

CHAPTER 3

THE SECOND WORLD WAR 1939-45



MAP MODIFIED FROM ATLAS OF WARFARE: NATKIEL & PIMLOTT

In the First World War, the aeroplane was in its infancy and, for all the strides made in development, it remained an ancillary of land and sea operations. The Second World War, however, brought air power to its maturity; the aeroplane became a decisive weapon and the outcome of both land and sea battles depended upon air superiority.

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Between 1939-45 the RAF was in the forefront of the exercise of air power; it prevented an invasion of Britain; it supported British Armies in North Africa, Italy, NW Europe and the Far East; it fought continuously over the seas around Britain, over the North Atlantic and the Mediterranean and over the Indian Ocean; and it played a major role (together with the US Army Air Force) in the strategic bombing offensive against Germany. Of the major air forces of the Second World War, the German, Italian, Japanese and Russian were organized and equipped primarily to support their respective armies on the ground; only the RAF and US Army Air Force had well-developed plans for the independent use of air power in maritime and strategic bombing offensive roles.

THE LUFTWAFFE

From the first to the last day of the war in Europe, the major opponent of the RAF was the German Luftwaffe. Since the RAF and the Luftwaffe were locked in combat for so long, it is worth looking briefly at their plans for an air war at the start of the Second World War. The Luftwaffe had been reborn even before Hitler came to power. The civilian airline Lufthansa provided a shadow organization, pilots were trained in Russia, and industrial capacity for aircraft production was kept alive by firms such as Junkers, Heinkel and Messerschmitt. When he came to power, Hitler found it easy to expand the Luftwaffe to the impressive numerical superiority over the RAF it achieved by 1939. It was, moreover, a Luftwaffe with a special function. Ideas for a revolution in warfare by combining the fire power and speed of tank and aeroplane had been put forward between the wars, notably by British military writers like J F C Fuller and Basil Liddell Hart. This concept of manoeuvre warfare was readily adopted in Germany (though largely ignored in Britain) so that the Luftwaffe became an essential part of the German "Blitzkrieg". The Luftwaffe was organised and equipped to support the German Army directly on the battlefield, which it did with conspicuous success in Poland in September 1939, and in Norway, Denmark, Holland, Belgium and France in the spring of 1940.

THE ROYAL AIR FORCE

The RAF had considerable experience of operations in India and the Middle East but devoted little effort to cooperation with the Army or Navy at home since not until the mid-1930s was a war in Europe contemplated. The strategic offensive dominated RAF plans until fighters and the other elements of air defence began to be built up to meet the now obvious German threat in the last couple of years before the War. It was ironic that the aeroplane, the offensive weapon, should win its first and greatest battle as a defender. In reality, the bomber force in September 1939 had little by way of aircraft, bombs or experience to execute its plans. While the bombers and fighters dominated at the start of the War, the demands of the War and the

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realisation that air power was vital in all operations gradually forced the RAF into large-scale co-operation with the Army (tactical air forces) and the Navy (coastal or maritime air forces) as well as into air supply and the transport of men and equipment. This expansion of roles demonstrated the flexibility inherent in the practice of air power by the RAF; because the Luftwaffe remained inflexible, it suffered defeat. By examining separately the major roles of air defence, strategic bombing, maritime operations, tactical support of ground forces, and airborne and transport operations, a very clear picture of the RAF's contribution to final victory can be seen.



Lysanders of Army Co-Op, Sunderland of 210 Squadron over convoy 1940, Troops on Hudson, British Para training drop May 1941, Lancaster departing for Ruhr 26 March 1943, Army Co-Op June 1942, Refueling and Rearming 19 Squadron Spitfire September 1940

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Junkers Ju 87 'Stuka' dive bomber dropping bombs

The fortunes of the RAF in the Second World War paralleled those of the nation as might be expected and the RAF's roles must be seen in the context of the overall course of events. After the German advances and the collapse of France in June 1940, Britain was entirely on the defensive and alone, until June 1941 when the USSR entered the War, followed 6 months later by the USA. This defensive period was the critical time encompassing the Battle of Britain and German success in North Africa and the Atlantic. The turning point of the War is generally regarded as being the winter of 1942-43. Then the German momentum came to an end and Britain and her Allies (now fighting Germany and Italy in Europe and Japan in the Far East) moved to the offensive: on the land in North Africa and Italy, at sea with the start of success in the campaign against the U-boats, and in the air with the greatly increased strategic bombing offensive against the heart of Germany and the use of tactical air power on a large scale. Offensive action continued to increase both against Germany and Japan throughout 1944 until the final victories of the Allies in 1945.

THE BATTLE OF FRANCE

The close support of the British Armies on the ground had been the major task of the RFC and the RAF in the First World War. From reconnaissance, the role expanded into bombing and strafing the enemy supply areas and front-line trenches. Air superiority over the battlefield had been the main priority of Trenchard and Haig. While the theory

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may have remained firm in the interwar years, the practice was forgotten. Unlike the Germans, British military leaders did little to develop close cooperation between air and ground forces. The Army was also slow to grasp the implications of the firepower and mobility that tanks and aeroplanes could bring to the battlefield. It was not until the British Government chose to send a large Field Force to the continent, instead of the small BEF contingent, that the RAF recognised that it would have to take army support much more seriously.



France in 1940: Pilot Officer prepares for a sortie, Fairey Battle aircrew, Riggers in snow covered trench, RAF guards on duty, Aircraft dispersal

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As well as the Advanced Air Striking Force (AASF) of light and medium bombers (Battles and Blenheims), the RAF sent the Air Component of the British Expeditionary Force (BEF) to France in September 1939; Blenheims and Lysanders for reconnaissance and photographic work, and some Hurricanes for fighter support.



No 73 Squadron Hurricanes on patrol over France, 1940

But it was all very reminiscent of 1914 when a small and poorly equipped RFC went to France with another BEF. Even the mood was the same and the Press sought to revive the so-called age of chivalry in the air and promote the image of the new breed of air aces.



Scramble France 1940

The rapid German advance through the Low Countries and France in 1940 soon changed the public's perception.

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Low level Battle attack on enemy column

Although displaying courage and determination in the face of this onslaught, the Air Component was unable to cope with the strength of the Luftwaffe.



615 Squadron Gladiators and crews France, January 1940

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Nowhere was the gallantry of the AASF more clearly demonstrated than in the desperate series of attacks mounted by RAF Battle and Blenheim light bombers on the German bridgeheads over the River Meuse.



Battles return from a raid

On 12 May 1940, a particularly determined attack pressed home by 6 Battles of 12 Squadron resulted in the award of the first VCs to the RAF. These were won posthumously by Flying Officer Donald Garland and his Observer (navigator) Sergeant Thomas Gray.



Flying Officer Donald Garland VC and Sergeant Thomas Gray VC

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The Army Commanders complained bitterly that they had no protection against the low-level bombing and fighter attacks of the Luftwaffe. Lack of air support and failure on the ground contrasted vividly with the success of the Ju 87s (Stukas) and the Me 109s in their support of the panzer divisions of the German blitzkrieg. In spite of individual acts of courage, British tactical air power was an ad hoc arrangement of unsuitable equipment, inadequate preparation and a general lack of understanding between air and ground commanders as to how tactical air forces should be employed.

In the Battle of France from mid-May to early June 1940, the RAF losses had been appalling; nearly 1,000 aircraft destroyed, 320 pilots killed or missing and 115 pilots taken prisoners of war. Considerable ground equipment was also abandoned as the AASF and the Air Component evacuated from France. At this time, there was a growing public misconception that there was an 'absence' of significant air power supporting the British troops on and near the beaches. However, the RAF's Battles and Blenheims were engaged heavily in conducting bombing offensives deep into enemy territory - tasks that were not so overt to the British public.



RAF ground crew on a ship during evacuation from France, June 1940

During the Dunkirk evacuation, RAF Fighter Command together with elements of Coastal Command sought to protect the troops massed on the beaches below them. Between 26 May and 4 June 1940, Fighter Command alone lost 106 aircraft and somewhere between 75-80 pilots in the efforts to defend the BEF. Although unrecognised and unappreciated by many on the ground, the RAF's efforts were heralded by the Prime Minister when he said that 'There was a victory inside this deliverance. It was gained by the Royal Air Force'. By agreeing with

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the Navy that their ships should arrive at Dunkirk around dusk and depart before dawn and then applying maximum fighter coverage at those times, sufficient local control of the air was achieved to prevent the Luftwaffe from interfering decisively with the evacuation.



A Hudson inbound to Dunkirk, June 1940

The destruction of 2 more Fighter Command squadrons during the disastrous defence of Norway in April and May 1940 exacerbated the shortage of aircraft and pilots. While many of those aircraft were obsolescent Battles and Gladiators, 250 Hurricanes alone were lost between 8-18 May and Air Chief Marshal Sir Hugh Dowding, the AOC-in-C of Fighter Command refused to send any more fighters to France. Yet Hitler and his staff feared to put into motion an invasion of England immediately after the British Army had been evacuated from Dunkirk at the beginning of June. Hitler felt, with some justification, that Britain's position was so hopeless that she was bound to come to terms without being invaded - with Britain out of the War, he would be able to attack Russia without the worry of a war on two fronts. However, by the time direct orders were given at the beginning of August for an invasion to be carried out - Operation Sealion - the RAF had replaced much of the losses. The balance sheet was still so much in favour of the Luftwaffe that neither Hitler, nor Goering, the Luftwaffe's Commander, had any reason to doubt that the RAF could be destroyed and the invasion undertaken.

FIGHTER COMMAND



THE BATTLE OF BRITAIN

In mid-June 1940, at the conclusion of his most famous wartime speech, the Prime Minister, Winston Churchill said: 'The Battle of France is over ... the Battle of Britain is about to begin' ... let us therefore brace ourselves to our duties, and so bear ourselves that, if the British Empire and its Commonwealth last for a thousand years, men will say, 'This was their finest hour'.

At that time Britain stood alone against the power of Nazi Germany which had overrun much of Europe; only Britain, of the European nations who had declared war on Germany in September 1939, still remained unconquered. Thus, Britain came to play a vital part in world history.

From bases in Norway, the Low Countries and France, the Luftwaffe ringed Britain with 3 massive air fleets - bombers, dive-bombers, single-engined and twin-engine fighters, reconnaissance aircraft - about 3,500 in all, of which about two-thirds would normally be serviceable on any given day. Fighter Command had 60 squadrons with 700 operational aircraft. Of these, just over 600 were Hurricanes and Spitfires (400 of the former, 200 of the latter); the rest were Blenheims, Defiants and Gladiators which were no match for the Me 109s. In May 1940, Churchill appointed the newspaper owner, Lord Beaverbrook, to be Minister of Aircraft Production. Beaverbrook was a dynamic individual who used unorthodox methods that did not endear him to civil servants or the aircraft industry. His flair for publicity campaigns, such as 'Saucepans into Spitfires', made sure that fighter aircraft production continued apace. Credit should also be given to Air Chief Marshal Sir Wilfrid Freeman and Lord Swinton, the Secretary of State for Air 1935-38, who had the foresight to set up 'shadow' factories before the war with the intention that they could be used for increased aircraft production should war commence.

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Wing Commander Stanford Tuck in cockpit, Refueling and rearming a Hurricane, Squadron Leader Townsend and Squadron Leader Hull as 43 Squadron Flight Commanders.

Behind the front-line aircraft of Fighter Command, however, was the system of air defence and its commander, Sir Hugh Dowding. Dowding was an austere and aloof man whose manner and style had little in common with that of his fighter pilots. He had been AOC-in-C of Fighter Command since its inception in 1936. Before that he had been Air Member for Research and Development at the Air Ministry. Thus the twin pillars of the integrated air defence system - radar and the eight-gun fighters - had been nurtured by him from its drawing board and laboratory beginnings into an effective air defence system. Integrated into that system, too, were the ack-ack guns of the Army, the Observer Corps, the barrage balloons and the air-sea rescue service.



High speed search and rescue launches April 1941

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Barrage balloons over London

It can be said that Dowding's enduring achievement was his air defence system rather than any charismatic leadership. But that is not to say that he undervalued his men in any way. On 2nd June 1940, as the Battle of France came to its disastrous end, Dowding wrote to his squadrons from his Headquarters at RAF Bentley Priory:

"My Dear Fighter Boys,

I don't send out many congratulatory letters and signals, but I feel that I must take this occasion, when the intensive fighting in Northern France is for the time being over, to tell you how proud I am of you and the way in which you have fought since the "Blitzkrieg" started.

I wish I could have spent my time visiting you and hearing your accounts of the fighting, but I have occupied myself working for you in other ways. I want you to know that my thoughts are always with you, and that it is you and your fighting spirit which will crack the morale of the German Air Force, and preserve our Country through the trials which yet lie ahead.

Good Luck to you.

*H.C.T.Dowding
Air Chief Marshal"*

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19 Squadron Spitfires in formation

Although there was considerable preliminary skirmishing over the Channel and the south coast from the middle of July, the Luftwaffe's all-out assault Adler Tag (Eagle Day) did not start until 13 August (it should have started on 10 August but was delayed by bad weather). That first day cost the Luftwaffe 45 aircraft - 39 to the fighters - while Fighter Command lost 13 aircraft, but only 7 pilots. It was a pattern to be repeated almost daily as the Luftwaffe attacked fighter airfields and aircraft factories, but, surprisingly, left alone the radar sites after the first couple of days since Goering's intelligence staff discounted their importance

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Defiant 2 seat fighter formation. These aircraft were designed with a rear turret but no forward firing guns.



87 Squadron 'Scramble'



9 Squadron nightfighter aircrew and dachshund.

The scale of operations built up. The most active day of the entire Battle of Britain was 15 August 1940 when all 3 of the German air fleets were involved, flying 1,786 sorties against Britain. Fighter Command flew 974 sorties in a battle that raged from the north-east of England to the south coast, inland as well as out to sea. The true losses that day were 75 Luftwaffe and 34 RAF, although at the time claims were exaggerated to over double the actual figures. On 16 August, Pilot Officer Billy Fiske became the first American citizen to die while serving with the RAF and Flight Lieutenant J B Nicolson won the only Victoria Cross to be awarded to a fighter pilot in the Battle of Britain.

The pressure on Fighter Command reached its peak in the last week of August and the first week of September, when the Luftwaffe concentrated its efforts almost exclusively on the airfields and sector stations of No 11 Group covering the south-east of England and London.

Biggin Hill, Debden, Hornchurch, North Weald and Tangmere - the famous Battle of Britain airfields of No 11 Group - were constantly under attack and Fighter Command's losses in pilots exceeded the supply from the training schools. Daily in that fortnight the Luftwaffe sent over 1,000 aircraft against Fighter Command, which had now reached the point of exhaustion. In the two-week period, 295 Spitfires and Hurricanes were lost, 171 severely damaged, and 231 pilots were killed or wounded. At that rate, Dowding would very soon have had no Fighter Command. This was the critical moment in the Battle.

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Pilot Officer Fiske's Memorial Tablet



222 Squadron Spitfire wreckage after Hornchurch was bombed 31 August

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The strain of command during the Battle of Britain - 23 year old OC 19 Squadron, Squadron Leader Sandy Lane (facing) with Flying Officer Lawson and Flight Sergeant Unwin

THE BOMBING OF LONDON

With Fighter Command near to exhaustion, Hitler and Goering made their most serious error; the Luftwaffe's focus of attention was switched away from engaging Fighter Command towards large-scale bombing raids against London.



London's burning

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On 24-25 August 1940, German aircraft had bombed London in error; the target had been the Thameshaven oil refineries but the bombs fell on the City of London instead. In response, Churchill ordered Bomber Command to attack Berlin on 25-26 August with a force of Wellingtons, Whitleys and Hampdens. Although the damage to Berlin was small, the bombing came at a time when Goering was boasting to the German people that the RAF had been 'eliminated'.



London firefighters

Luftwaffe intelligence was poor and some senior commanders thought that one final blow against London would prove decisive. Others, however, felt that Fighter Command still had plenty of fight left in it and they wished to continue the campaign against Britain's air defence system. Goering and Hitler were both attracted to the grand gesture of delivering a 'final blow' to London and so the advocates of bombing London won the day. On the afternoon of Saturday, 7 September 1940, the first full-scale bombing attack on London was made by over 300 bombers (Ju 88s, Heinkel 111s, Dornier 17s) escorted by 600 fighters (Me 109s and 110s). The following week saw more raids on London, but the switch of attack away from Fighter Command's airfields and the ground elements of the air defence system gave Dowding the breathing space needed to regroup and recover.

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A Luftwaffe Heinkel 111 over Wapping

By Sunday, 15 September, when Goering launched the attack which he claimed would destroy the RAF once and for all, Fighter Command had recovered and was using new tactics. Spitfires took on the escorting fighters; Hurricanes engaged the bombers. The official account at the time called 15 September “The Greatest Day” and claimed 185 German aircraft destroyed. Post-war research concluded that only 60 German aircraft were lost to 26 RAF aircraft. The significance, however, is not in the numbers. The Germans had lost one quarter of their bomber force despite the protection of nearly 5 escort fighters for each bomber. Clearly the Luftwaffe had not achieved control of the air over Britain and could not continue to accept such losses; on 17 September Hitler postponed his invasion plan.



A German raid over London

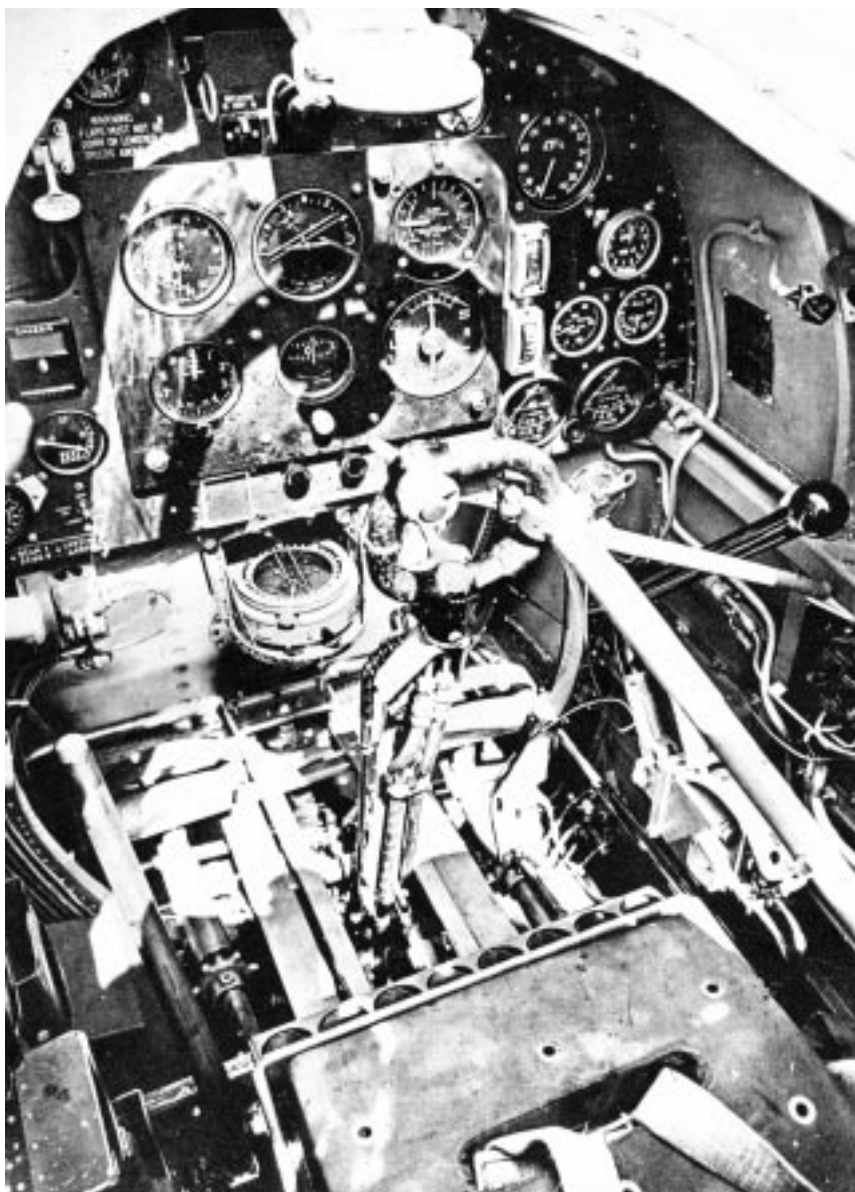
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While German bombers continued to attack throughout the winter of 1940-41, in The Blitz on London and other cities, the Battle of Britain had been won by the middle of September although no one realized it at the time. Without that victory, the Second World War would have taken a different course; with control of the air, the German Army could have invaded and the odds are that it would have succeeded as the British Army had not yet recovered after the Dunkirk evacuation. If Britain had been occupied, it could not have been the base subsequently used for either the Allied air offensive against Germany or the Normandy landings that led to the liberation of Europe in 1944-45. The Battle of Britain was, therefore, not just a local, territorial success over the south of England in the summer of 1940, but one of the most significant conflicts of the Second World War and the only major, self-contained and absolutely decisive air battle in history.

The Battle was won because the Luftwaffe had no heavy bomber or the strategy to go with it and because of Goering's weak leadership and the costly tactical errors that he made. Conversely, the efficiency of the air defence system that Dowding had built rather than any individual part of it, like radar or the Spitfire; and the skill and courage of the RAF fighter pilots - men like Malan, Bader, Tuck and Deere - who maintained their fighting morale in the face of tremendous odds, saved Britain. While 'The Few' are rightly enshrined in history by Churchill's oft-quoted words, the architects of victory, Dowding and Park (AOC No 11 Group), received scant thanks at the time. Dowding was replaced in November 1940, never given another operational command and never promoted to Marshal of the RAF, although he did later get a peerage; Park was moved to a flying training post but later emerged to hold important commands in Malta and South-East Asia.



Air Vice Marshal Park



A Spitfire cockpit

BOMBER COMMAND



THE STRATEGIC BOMBING OFFENSIVE

At the start of the War, Bomber Command's main plan was to attack key points in the German war machine, such as oil refineries, railways and power stations. Very quickly it was realized that major operations against Germany in daylight were impossible since the Wellingtons and Hampdens could not survive against the German air defences, especially the fighters. So attacks were switched to night bombing. In Autumn 1941 the Butt Report on the effectiveness of the bombing of Germany stated that only about one third of aircraft claiming to have reached their targets actually did so and the proportion of aircraft actually dropping their bombs on the target was very much less. Precision bombing was impossible, and the Report shocked the Air Staff. Inadequacies in equipment and techniques meant that Bomber Command had no alternative (if it was to keep its strategic offensive going and nobody suggested that it should not) but to concentrate on the bombing of major German cities (which contained the majority of war industries) by night - thus area bombing was formally recognized as the basis of policy. The bomber offensive was the only means of striking at Germany, it was vital to show both America and Russia that Britain was still capable of fighting back.



A Whitley V of 102 Squadron, March 1940

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From the costly operations of the first 2 years of war, which almost appeared to undermine the entire concept of strategic bombing, came the great Bomber Command offensives of 1942-45, masterminded by a new leader of single-minded determination, Air Chief Marshal Sir Arthur Harris.



Air Chief Marshal Sir Arthur Harris

The Bomber Command of the last years of the War was barely recognizable as the weak force that had existed in 1939. There was new equipment in the heavy 4-engined bombers - the Stirling, Halifax and especially the Lancaster. This comprised new navigational and bombing devices like GEE (a radar navigational aid using ground transmitters and an airborne receiver), OBOE (a blind bombing device using ground controlled radar) (the range of GEE and OBOE was limited to 350-400 miles because of the dependence on ground stations) and H2S (an airborne radar that gave a picture of the ground on a cathode ray tube) which greatly improved the efficiency of the operations. Also, new operational techniques such as the Pathfinder Force to find, illuminate and mark the targets were introduced.

The 4-engined bomber originally specified by the Air Staff entered service as the Short Stirling but proved disappointing because it could not fly high enough to avoid the German ack-ack guns. The most successful of all heavy bombers was undoubtedly the Avro Lancaster that was developed under the stress of operational experience from the twin-engine Manchester.

Whilst 1943 marked a steady increase in the ability of Bomber Command to mount heavy and increasingly accurate raids over Germany, as a prelude to the major offensives of 1944, it is the 'Dams Raid' of the nights of 16/17 May 1943 that most people are aware of. Of the 19 Lancasters of 617 Squadron that attacked the Mohne, Eder, Sorpe and Ennepe Dams, 8 failed to return. Many modern commentators now decry the raid as failure to achieve the strategic successes prophesied. However, whilst that had been the

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aspiration in 1938 it was recognised by 1943 that that was not likely. The Mohne and Eder were breached and the swift German repairs to industry and infrastructure, utilising the Todt Organisation inside Germany for the first time, were only achieved at great expense to other projects such as the Atlantic Wall. Canal, and hence coal, traffic on which the Ruhr industries depended was disrupted and steel production reduced. Furthermore, a Division's-worth of manpower, plus AAA guns and barrage balloons, were swiftly deployed to defend other dams from potential attack. Finally, the raid had positive morale effects not only upon the other crews of Bomber Command but also upon the UK and allied populations.



Mohne Dam



XV Squadron Stirling MacRobert's Reply



Lancaster bombing Abergyn Bridge March 1945

Another highly successful aircraft was the twin-engined all wooden Mosquito, this time in its role as a light bomber. This aircraft, the majority of which arrived on squadrons in 1942, could carry 4 x 500lb bombs and relied on speed for safety. In its capacity as a bomber, the Mosquito went on to be used in famous precision attacks on Gestapo HQs in Norway and France. A modified version was capable of delivering a 4000lb bomb on Berlin. On the night of 2/3rd May 1945 it was Mosquitoes of 608 Squadron which conducted the last attack of Bomber Command against Germany.

Harris was a firm believer in the Trenchard doctrine of a strategic bombing offensive independent of land or sea operations. He inherited the area bombing policy and became its staunchest advocate; he believed that Bomber Command could bring Germany to her knees by the destruction of industrial cities and the demoralization of the civilian population. In particular, he considered that Berlin should be bombed 'until the heart of Nazi Germany ceases to beat'. He found a ready ally and supporter in Winston Churchill who had said that bombers alone provided the means of victory. Harris, of course, carried out the Air Staff's policy, but his outspoken defence of area bombing and dislike for 'panacea' targets - such as oil plants and ball-bearing factories - led to sharp differences of opinion with colleagues and Allies alike. He was most reluctant to accept any policy that diverted his forces away from the main task of inflicting the severest material destruction on German industrial cities.

BOMBER COMMAND'S SCALE OF OPERATIONS - THE COST

The scale of operations and the cost to Bomber Command were both enormous. For example, 4 months of the Battle of Berlin (November 1943-March 1944) cost Bomber

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Command the equivalent of its whole front-line force, mostly to German fighters; in one raid on Nuremburg in March 1944, Bomber Command suffered more aircrew casualties than Fighter Command did in the entire Battle of Britain. The German air defences, especially the Ju 88 and Me 110 night fighters, were so well organized that Bomber Command's casualties could not be endured. Having taken to night attacks to escape the German fighters, Bomber Command discovered that the targets were difficult to find and that the bombers had to be so concentrated together if there was to be any chance of achieving decisive results that the night fighters were given even better chances of finding and destroying the bomber force. Despite the effort and sacrifice involved, by early 1944 it was clear that the bombing offensive had not then achieved the decisive results hoped for. Over 1,000 Bomber Command groundcrew lost their lives through pneumonia and other ailments while working on bombers in Britain's bitter winter conditions.



Groundcrew with improvised hut



Burial of a British airman by Germans

THE SCALES ARE TIPPED



A badly damaged B-17 Flying Fortress from the 414th Squadron, 97th Bomb Group after its aft fuselage had been practically cut in half by an out of control Me-109.

This aircraft continued to fly for an hour and a half.

Photo: Flying Fortress E Jablonski

The bombing offensive could not achieve decisive results until command of the air had been won. Around the clock bombing was achieved with a combination of daylight (American) and night time (RAF) sorties. This combination made a significant contribution to the battle for air superiority. The Americans, like the RAF, had developed the doctrine of the bomber offensive against precision targets, but had found to their surprise in 1943 that the close formations of B-17s and B-24s could not defend themselves against the German day fighters. Daylight operations against targets in Germany were therefore impossible without unacceptable casualties until a long-range escort fighter arrived.



Mustangs defending a bomber formation, May 1943

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The P-51 Mustang filled that role with distinction. With its Rolls-Royce Merlin engine, built under licence by Packard in the United States, it was superior in performance to the best German fighters, the Me 109 and the Focke-Wulf 190, and could escort the bombers on the long flights all the way to Berlin and back. The US Strategic Air Forces in Europe began a sustained daylight offensive in February 1944 aimed at destroying the Luftwaffe, on the ground by attacking the German aircraft industry and in the air by combat. With escort all the way to the target, fewer bombers were lost while at the same time the Luftwaffe suffered increasingly heavy losses to the escort fighters.



A classic target - marshalling yard

The winning of air superiority was crucial. It meant the end of the Luftwaffe as a decisive fighting force and ensured that the Allied invasion force could be safely landed in Normandy in June 1944 without significant interference from the air. It also enabled the combined strategic bombing offensive against Germany by Bomber Command and the US Strategic Air Forces, operating to what was known as the 'Pointblank Directive', to achieve, during the last year of the war, the level of result long contemplated. Germany was thrown onto the defensive in the air; fighters and the dual role anti-aircraft guns (which could also be used against tanks) had to be deployed to cover vital targets and could not be used at the battle fronts against the Allied invasion forces. About three quarters of a million men were needed to man the German air defences alone. With greatly improved navigation and bombing accuracy, the combined bombing effort could now be directed against more specific targets, especially the transport system and the oil industry, as well as area targets.

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The destruction of the German oil industry and its transport system finally paralysed both the Luftwaffe and the German Army and greatly assisted the Allied advance from Normandy to Germany. Bomber Command by night was able to equal, if not surpass, the precision bombing accuracy of the Americans by day. Although it is claimed that USAAF daylight bombing with the Norden bomb sight was precise as opposed to area bombing, this was not the case; only the lead aircraft's bombs were aimed, the rest of the formation dropped on the leader's call so most of the bombs released were based on radio instructions rather than aiming. Above all, there was dramatic growth in both the size of the forces and the tonnage of bombs dropped. In October-December 1944, Bomber Command dropped 163,000 tons of bombs compared with the 40,000 and 8,000 tons which it had dropped respectively in the same period in 1943 and 1942. Against Duisburg alone, Bomber Command dropped as great a weight of bombs in 24 hours as the Germans dropped on London during the entire war.



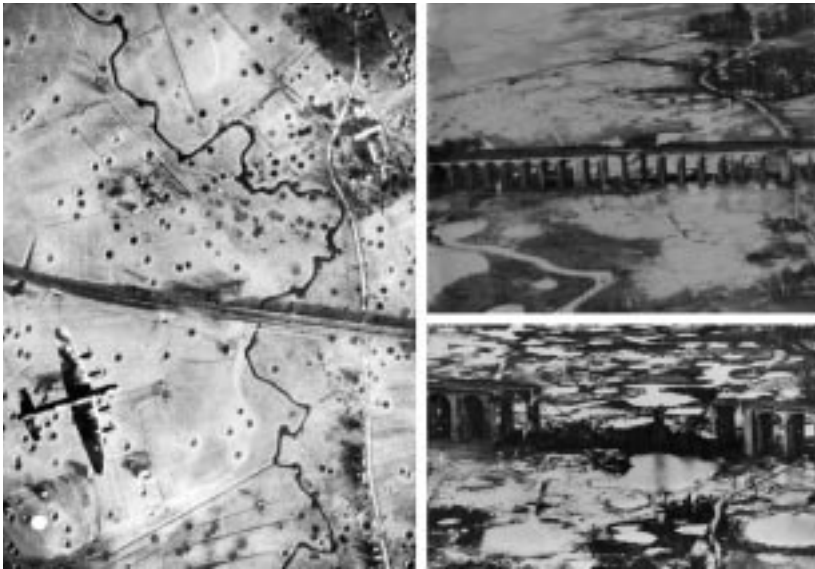
Wrecked rolling stock Hamm marshalling yard

While now numerically inferior to the US Air Forces, Bomber Command's particular contribution was in the weight of bombs delivered on target; the Lancasters and Halifaxes were weight-carriers first and foremost. Although the Bielfeld Viaduct in the Rhur was attacked numerous times by the USAAF and Bomber Command it took the "Tallboys" (12,000lb bombs) - delivered by 617 Squadron - to bring it down. The RAF's largest bomb was the "Grand Slam" weighing 22,000 lb. Harris had always argued that, given sufficient bomb tonnages, the German industrial capacity could be destroyed.

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Grand Slam



Bielefeld Viaduct attack February 1945, Bielefeld Viaduct still standing March 1945,
Bielefeld destroyed by 617 Squadron 14 March 1945

After D-Day, the outstanding feature of the remainder of the war in the West was Allied air supremacy. The absence of the Luftwaffe on many critical occasions made it possible

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for the Allied Air Forces, Strategic and Tactical, to undertake their tasks with great freedom. However, there was considerable debate about what those tasks should be, particularly the nature of the strategic bombing targets themselves. Harris and General Spaatz, commander of the US Strategic Air Forces, argued that attacks should be concentrated on German oil production. Although no one doubted the importance of hitting the German oil industry, many believed that the effects would take too long to be seen and the Army needed immediate help to consolidate its position on the ground. An alternative option was advocated, known as the 'Transportation Plan', that would produce a degree of disruption and immobility to German land forces by carrying out precise attacks on the railway infrastructure. This option was supported by Tedder and Montgomery. Although there was much concern about the risk of causing heavy casualties among French civilians by bombing densely populated railway centres, the military arguments outweighed the humanity considerations and the 'Transportation Plan' was adopted. The campaign began with Bomber Command's highly successful attack on the railway yards at Trappes, south-west of Paris, on 6 March. Further attacks followed and, although French casualties appeared to be fewer than expected, there was still much criticism of the area bombing of highly populated areas.

Arguments about the effectiveness of area bombing against precision attacks may never be resolved. Critics may suggest that the results were not worth the enormous effort put into the bomber force and better results could have been obtained by devoting the air potential to the maritime war or the land battle. While other horrors of the Second World War, such as the treatment of prisoners-of-war by the Japanese or the German concentration camps offend more, the morality of strategic bombing is still capable of provoking strong feelings. Nonetheless, it remains true that the war would have continued for longer and eventual victory would have been achieved at an even higher price had the Allied bomber offensive not been mounted. Albert Speer, the German Armaments Minister, summed up the effects of the Allied bomber offensive:

"The real importance of the air war consisted in the fact that it opened a second front long before the invasion of Europe. That front was the skies over Germany...every square metre of the territory we controlled was a kind of front line. Defence against air attacks required the production of thousands of anti-aircraft guns, the stockpiling of tremendous quantities of ammunition all over the country, and holding in readiness hundreds of thousands of soldiers, who in addition had to stay in position by their guns, often totally inactive, for months at a time".

In addition, Bomber Command destroyed a high percentage of the German Navy's capital ships in the latter stages of the War. In the last 18 months of the War, Bomber

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Command sunk or irreparably damaged the German battleships and cruisers Tirpitz, Scheer, Lutzow, Gneisenau, Hipper, Prinz Eugen and the Emden. Bomber Command also damaged the cruiser Koln in Oslo Fjord so that she was forced to return to Wilhelmshaven in Germany where she was sunk by bombers of the USAAF 8th Air Force. Manufacture of U-boats was also severely disrupted forcing dispersal of production and dislocation of their transportation to ports.



The German battleship Tirpitz in camouflage Aas Fjord February 1942, Photo reconnaissance at 200ft confirmed Tirpitz position on 12 November 1944



Upturned hull of Tirpitz following 9 and 617 Squadron's attack with 12,000lb Tall Boy bombs.

Finally, it should be appreciated that in the bomber offensive the RAF made its biggest effort of the War in terms of logistics, aircraft, personnel and casualties. Of the total of 70,253 officers, NCOs and airmen killed and missing in all RAF operations from September 1939 to August 1945, 47,293 were from Bomber Command. The numbers

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include the Commonwealth and other Allied Forces (not American) operating with the RAF, but do not include those killed or wounded in flying accidents and those who became prisoners-of-war.



Bomber crews leave briefing May 1941

From the first to the last day of the war, Bomber Command was in action continuously. It was as Harris himself said “the longest battle in history”. Bomber Command had come a long way since 1939 and the small force “not trained or equipped either to penetrate into enemy territory by day or to find its target areas, let alone targets, by night”. The Official History, which exhaustively and objectively examined the entire campaign, sums up succinctly: “Strategic bombing ... made a contribution to victory that was decisive. Those who claim that the Bomber Command contribution was less than this are factually in error”.

The men and women of Bomber Command were highly decorated for their feats of bravery. The first VC of 19 VCs to be awarded to aircrew of Bomber Command was awarded to Flight Lieutenant R A B ‘Babe’ Learoyd of 49 Squadron for gallantry during an attack by Hampdens on the Dortmund-Ems Canal on the night of 12 August 1940.



Flight Lieutenant Babe Learoyd August 1940

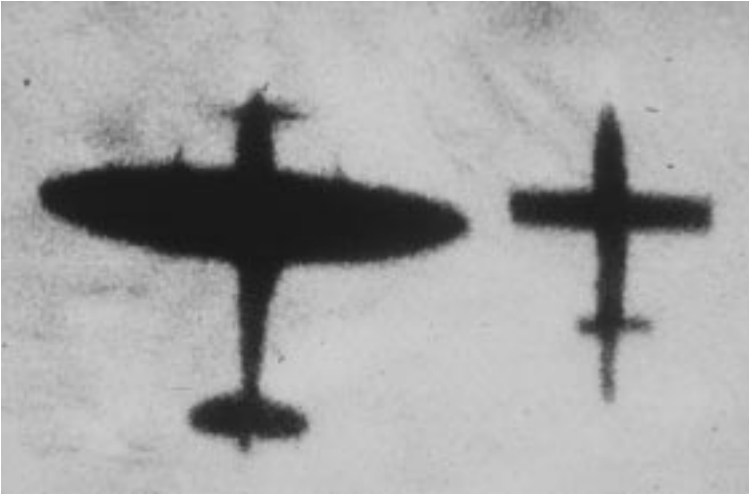
The citation for this award stated that ‘The high courage, skill and determination, which this officer has invariably displayed on many occasions in the face of the enemy sets an example which is unsurpassed’.

THE V-1 MISSILE THREAT

On 13 June 1944, only 7 days after D-Day, Hitler unleashed his pilotless, jet-propelled 400mph V-1 missiles carrying nearly a ton of high explosives each from bases in the Pas de Calais against the South of England. By 11 July, 2,754 of these missiles had reached England of which 1,280 fell in the London area causing 2,752 deaths and 8,000 casualties. These ‘flying bombs’ or “doodlebugs” as Britons called them, flew at low altitude and were powered by petrol and compressed air. They were steered by a gyroscope and were fitted with a fuel system that was designed to be cut off after a designated flying time after which the V-1s would dive to the ground and explode on impact. In response, the first priority in air operations became attacks against V-weapon sites, an activity known as CROSSBOW. During the next 2 months, half of Bomber Command’s operations were against V-1 sites. The sites were difficult and elusive targets and some 3,000 Allied aircrew lost their lives in CROSSBOW operations. The Tempest and Meteor fighters played a distinguished part in intercepting V-1s. RAF fighter pilots attempted to shoot the V-1s down and in time adopted the tactic of closely formatting onto the V-1 to then tip its wing to throw the missile off course. It was a Meteor pilot, Flying Officer Dean, who, on 4 August, succeeded in tipping a V-1 into a

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dive to the ground with a flick of his own wing tip. A barrage of 2,015 ballons was also effective against the V-1s but the best weapon proved to be anti-aircraft guns of all types, using the new proximity fuse, that were moved to the South Coast.



A Spitfire formates on a V-1 to tip its wing



The RAF's World War 2 bombs from smallest to largest

COASTAL COMMAND



MARITIME AIR OPERATIONS

In December 1937 the AOCinC Coastal Command Air Marshal Sir Fredrick Bowhill, was told that the primary role would be “trade protection, reconnaissance and co-operation with the Royal Navy”. The Navy was confident that, with its ASDIC (an underwater detecting device using sound waves named after the Allied Submarine Detection Investigation Committee) capability, it could deal with the submarine threat and therefore would only require limited air support in the anti-submarine role. However, the Navy did feel threatened by the possibility of German commerce raiders (pocket battle ships and battle cruisers) breaking out from Baltic ports, via the North Sea, into the Atlantic to harass the sea lanes.



Sister ship of the Bismark, the Tirpitz prior to the 617 Squadron attack

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Coastal Command's primary task was reconnaissance over the North Sea. However, this changed as the submarine menace quickly became apparent. In the first month of war, September 1939, the German U-Boats sank 41 ships, British, Allied and neutral. In August, before the War had even begun, the Germans had deployed 14 of their 42 operational U-Boats into the Atlantic. They had slipped out while the Royal Navy was engaged on its last pre-war combined exercise of air and sea assets.



U-Boat on surface

THE BATTLE OF THE ATLANTIC

During the First World War, Britain came perilously close to being starved into defeat in 1917 by the unrestricted German submarine campaign. It is one of the ironies of history that the campaign that brought the Germans so near to victory had in it the seeds of their defeat - the entry of the USA into the war. It is surprising, therefore, that in 1939 neither the Royal Navy nor the RAF had any clear idea of how they would deal with unrestricted submarine warfare should it occur again. RAF cooperation with the Navy had been overshadowed for too long by the argument over who should control the Fleet Air Arm. So little had been done that in an exercise in 1939 one 100lb anti-submarine bomb bounced off one of our own submarines with only the most minor damage. The Navy

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Blenheim MK IV, Avro Anson, Coastal Hudson

ignored the lessons of the First World War and little attention was paid to the protection of slow merchant convoys or how the air might be used; the Navy had put its faith in ASDIC.

Germany began unrestricted submarine warfare on the first day of the Second World War and the first 3 years were a time of great frustration for Coastal Command, responsible for cooperation with the Royal Navy in the protection of shipping around the coasts and out in the Atlantic Ocean. Insufficient numbers, inadequate equipment and weakness in the organization of the cooperation with the Navy led to great frustration and, more importantly, extremely high losses of British merchant shipping. In September 1939, the 230 aircraft of Coastal Command lacked the range and the bomb load to have any effect upon enemy shipping or the U-boats. Some Blenheims, the 10 squadrons of Ansons and a few American made Hudsons (the only really modern aircraft) were spread very thinly just to provide protection for coastal shipping, let alone out in the Atlantic.

The inadequate numbers of Sunderland flying boats (only 3 squadrons) could not provide sufficient cover for Atlantic shipping although a Sunderland shared in the first U-Boat kill on 30 January 1940.

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210 Squadron Sunderland 1940

Such a force was unable to deal with the German air threat or get to grips with the U-boats. The presence of the Hudson was perhaps the only light in those depressing early days when the U-boats were very much on top. A Hudson of 224 Squadron claimed the first German aircraft to be shot down when it brought down a Dornier 18 flying boat on 8 October 1939. Since the USA was still neutral, the Hudsons were flown from their American manufacturer to the Canadian border and then towed by a team of horses to Canadian soil from where they were flown to Coastal Command bases.



Shot down Dornier 18 Seaplane

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The Hudson was superior to the Anson, which it gradually replaced, and it was a Hudson of No 269 Squadron that on 27 August 1941 achieved the notable first ever surrender of a U-boat to an aircraft.

Until early 1943 the U-boats were winning the Battle of the Atlantic. Merchant shipping losses remained alarmingly high, especially in late 1942-early 1943 (the worst losses were in November 1942: 800,000 tons sunk). Greater priority had to be given to Coastal Command if the U-boats were not to cut off completely the economic and military lifeline between the USA and Britain.



Britain's lifeline - a convoy, November 1942

A few squadrons of Bomber Command Wellingtons were transferred to Coastal Command in 1941 and the Catalinas ordered from America entered squadron service in March of that year. Bomber Command itself devoted 44% of its effort in 1942 to the war at sea by mine laying and bombing German ports and U-boat bases.



Consolidated Catalina, 311 (Polish) Squadron Wellingtons in flight

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In fact, mine laying by both Coastal and Bomber Commands accounted in all for the sinking of 738,000 tons of German shipping for the loss of 515 aircraft - an expensive but crucial contribution. Coastal Command's first major success was in establishing a relatively free U-boat area 350 miles around the coasts. By moving on to the offensive against the U-boats instead of being tied to close air escort of the merchant convoys, it was able to push the U-boats out further into the Atlantic. This was only a short-lived success, however, because the U-boats in turn, hunting in wolf packs out beyond the range of aircraft, achieved their greatest successes in mid-Atlantic.

Coastal Command played a crucial role in the hunt for the Bismarck, the largest battleship afloat which, in May 1943, broke out into the Atlantic sinking HMS Hood, the pride of the Royal Navy, on the way. Bismarck, in company with the Prinz Eugen, a heavy cruiser, posed the most serious surface threat to convoys yet faced. Ships of the Royal Navy chased the Bismarck for several days but lost contact on 25 May. Air Chief Marshal Bowhill himself redirected the air search for Bismarck on to a south-easterly course. He was rewarded when a Catalina of 209 Squadron piloted by Pilot Officer D A Briggs found the Bismarck on 26 May enabling the Royal Navy to attack and sink her.



Recently promoted Flying Officer D A Briggs, the pilot who found Bismarck, May 1941

THE TIDE TURNS

Coastal Command had 3 problems; first, to cover the gap in mid-Atlantic where there was no air cover from shore-based aircraft operating from either British or American bases; second, to detect the U-boats on the surface at night when they were recharging batteries and were most vulnerable to attack; and third, to find a weapon capable of destroying the U-boats when an attack could be made.

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502 Squadron Whitley crew during flight 1942

These 3 sum up the daily task of the crews of Coastal Command; patrol, detect, attack. Over the vast bleakness of the Atlantic, they faced long, monotonous hours of flying in all weathers in which danger was never far away.



Meal on patrol and washing up on 210 Squadron Sunderland August 1940

The solutions to the 3 problems came slowly and painfully, but by mid-1943 the tide had begun to turn in favour of the Allies against the U-boats. While the Sunderland flying boats did sterling service, the need for a very long range (VLR) aircraft was not met until the B-24 Liberator joined Coastal Command in strength.



The Liberator

With the Liberator's ability to patrol for 3 hours 1,100 miles out into the Atlantic (compared to the 2hrs/600 mile endurance of the Sunderland and 2 hrs/800 miles of the Catalina) together with the use of the Azores and Iceland as bases, the mid-Atlantic gap was closed and the convoys to West and South Africa were given complete air cover.

Coastal Command complained, with justification, that in spite of the urgency of its needs, it usually got the aircraft no longer used by Bomber Command. The Wellington came to Coastal Command when it was replaced by the 4-engined heavy bombers in Bomber Command and became the mainstay of the maritime force for a long time.

Solutions to the second and third problems came directly from scientific research. Indeed, operational research probably had a greater influence in winning the Battle of the Atlantic than in any other campaign. Air-to-surface vessel (ASV) radar and the Leigh Searchlight made possible the detection of the U-boats on the surface at night. The Leigh Light, invented by Squadron Leader H de V Leigh, was an ASV detection radar set combined with a searchlight beam operated from within the aircraft. Once the ASV had located the U-boat and tracked it to contact, the searchlight then revealed the U-boat and an attack could be made. It was introduced in 1940 and developed over the next 18 months; in July 1942 a Wellington destroyed the first U-boat at night using the Leigh Light.



U Boat destroyed in Leigh Lights

The U-Boats were now denied the shelter of night. The aerial depth-charge replaced the delayed action bomb and a low-level bombsight gave the accuracy needed to destroy the enemy. After the mid-Atlantic gap had been closed, the U-boats were withdrawn to the Bay of Biscay. The successes of the Leigh Light and ASV radar forced the U-boats to surface by day and then attempt to fight it out using anti-aircraft gunfire against the Wellingtons. There was some initial success but soon the Bay of Biscay became something of a graveyard for the U-boat. Losses of British shipping dropped to 130,000 tons per month in late 1943 and U-boat losses increased or, to put it another way, the average merchant shipping tonnage sunk for every U-boat loss fell from 40,000 to 6,000 tons between the beginning and end of 1943.

THE SCHNORKEL EQUIPPED U-BOAT

The immediate effect of the success in the Battle of the Atlantic in late 1943 was that the build-up of US forces and materiel for the Allied invasion of Europe could take place and that German U-boats were unable to interfere in any significant way with the Normandy landings. But the German U-boats still had one final card to play; the new high-speed U-boat using the schnorkel device which allowed it to breathe without coming to the surface had been developed. The first Schnorkel-equipped U-boats appeared in mid-1944 and for a short time merchant shipping losses around British coasts were on a scale not seen since 1940. The Schnorkel, however, came too late to alter the main battle. There remains though the clear possibility that had the invasion of Europe not taken place to deny bases in France to German U-boats, and had the air bombardment of German shipyards and U-boat pens not achieved its cumulative effect, then the Battle of the Atlantic could have taken another turn and the disasters of 1942 and early 1943 might have been repeated.

ANTI-SHIPPING STRIKES



Beaufighters attack trawler

In the last year of the war, Coastal Command developed to its full potential the tactic of striking at enemy shipping around the coast, attacking ports and harbours, as well as bringing to a high pitch the photographic reconnaissance and air-sea rescue units for which it was responsible.



Beaufighter Mk X



Beaufighter attack off Royan

The anti shipping strike force of Beaufighters, equipped as bombers or torpedo-bombers, and Mosquitos did much damage to the dwindling merchant shipping resources and the ships of the German Navy trying to beat the blockade established by the Royal Navy and Coastal Command in the Channel and the North Sea. In particular, they disrupted coastal traffic from Norway right down to the Bay of Biscay, interrupting vital shipments of iron ore which were sent

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down from Sweden to the Norwegian port of Narvik. But beyond all other activities, the major contribution made by the RAF to winning the war at sea was the success achieved by RAF maritime patrol aircraft against the U-boat. During the war, RAF aircraft sank 188 U-boats; yet it was a joint victory for the Royal Navy and the RAF. Cooperation between the 2 Services was essential; they were in fact mutually dependent and the U-boat could not have been defeated without both Services working together in a way considered to be impossible in the 1930s.



Beaufort crew March 1941

TACTICAL AIR FORCES



Coningham and Tedder

THE DESERT AIR FORCE (DAF)

After Dunkirk, the British Army was face to face with the Italian and German forces only in the Middle East and it was here, particularly in the North African deserts between 1940-43, that tactical air power was gradually forged into a most effective weapon. Early British success on the ground and in the air against the Italian forces (the Italian Regia Aeronautica was equipped with much the same type of vintage fighters and bombers as the RAF) brought German forces into North Africa in strength. Rommel's Afrika Korps and the Luftwaffe were a different matter altogether. The land battle between the Afrika Korps and the British Eighth Army seasawed to and fro in the desert from 1941-43. The Eighth Army and its tactical air force, the Desert Air Force (DAF), were often thinly spread as other campaigns in Greece, Crete and Syria demanded resources in 1941. The year 1942 was a crisis year at sea and in the desert. German forces were at the gates of Egypt and throughout the Mediterranean, which was, with the exception of embattled Malta, virtually under total German control - effectively a German lake. However, the DAF had achieved a degree of air superiority, which it never relinquished.



Tomahawk

By the middle of 1942, the DAF had become a greatly expanded force; American-built Tomahawks, Kittyhawks and Maryland bombers were added to the Hurricanes and Wellingtons.

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'Bombing-up' Maryland in the Western desert, Recce Maryland Western desert

When Mediterranean convoys could not get through to Egypt, aircraft had to be delivered by a torturous route from West African ports, across central Africa to the Sudan and then north to Egypt, or by the long, slow journey around the Cape of Good Hope and East Africa. Additionally, the method of employing this air power had changed. Instead of constant fighter patrols above (now known as combat air patrols (CAPs)), the Army recognized that their best protection lay in the offensive sweeps and attacks on enemy airfields by the DAF since this would eventually achieve air superiority. Cooperation between the Army and the RAF became complete under the shrewd guidance of Air Chief Marshal Tedder, the Middle East Air Force commander, and his DAF commander, Air Vice-Marshall Coningham.



Desert Kittyhawk bomber

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Western Desert ops room

The effectiveness of the tactical air force was clear by mid-1942 when the Eighth Army was being pushed back towards Egypt. As the Eighth Army rallied, held and then drove Rommel back from El Alamein, the DAF was joined by the first American units with B-24 Liberators and B-25 Mitchells to strengthen the bombing force.



RAF groundcrew service a Spitfire with a captured German Me109 in the background



Blenheim bombers with fighter escort en route to target

An ever-increasing force of fighters, fighter-bombers and bombers was now concentrated against the stores and supply dumps of the enemy, his shipping in the Mediterranean, his airfields and his retreating armies. Supply was, in fact, the crux of the desert battle. Ensuring your own supply routes was the only path to victory. Rommel's Afrika Korps was halted by lack of fuel as much as by anything else.



Crews briefing in the desert

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After the Allied landings in Morocco and Algeria in November 1942 (Operation Torch), all Allied air forces in the Mediterranean and North Africa were put under the unified command of Tedder to apply the final blow to the German forces which were now caught in a pincer of 2 advancing armies, the British Eighth Army under Montgomery and the American-British force under Eisenhower. In the final battles in Tunisia, the Allied air forces destroyed the last attempt by the Germans to reinforce their ground forces by air from Sicily and, in turn, prevented the evacuation of those forces. In 3 weeks in April 1943, 432 enemy transport aircraft were destroyed for the loss of 35 fighters.



Junkers 52 troop carrier

In May, it was all over; the German and Italian armies surrendered. Allied air power had achieved an overwhelming victory that had paved the way for the similarly overwhelming victory on the ground. Tedder's words to the air and ground crews of the Allied air forces were: 'You have shown the World the unity and strength of air power'.



Weapons and equipment landed Op TORCH

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Night fighter pilots in the desert, 37 Squadron Wellingtons in the desert skies,
Coningham December 1941, Pilot's quarters -
Western desert, Rain in Libya bailing out sleeping quarters

The force of 1941 was but a pathetic thing compared to numerical and tactical superiority of the one Tedder commanded early in 1943. Yet the cost of victory had been high; the DAF in 1941-42 suffered higher casualties than any other tactical air force. Yet the experience, both through the difficult days and the days of plenty, proved so valuable that the DAF became the model for all future Allied tactical air forces. Subsequently, in Sicily, Italy and in NW Europe, the organization, tactics and leaders were all the products of the Desert War.



Air Marshal Tedder, Air Chief Marshal Portal, Air Vice Marshal Broadhurst
and Air Marshal Coningham

2ND TACTICAL AIR FORCE (TAF) - EUROPE

Great Britain's Second Tactical Air Force (2 TAF) had grown out of initiatives in mid-1943 to structure a 'Composite Group' to support the invasion of Europe. In January 1944, Air Marshal Sir Arthur Coningham took command of 2 TAF and a few months later took on the additional duties as commander of the Advanced Allied Expeditionary Air Force (AAEAF). Britain's 2 TAF consisted of four groups: No 2 Group, No 83 Group, No 84 Group, and No 85 Group. Of these four, only the first three groups were available for the air-land battle in Normandy (No 85 Group was under the temporary operational control of No 11 Group involved in homeland air defence). No 2 Group consisted of four wings of Boston, Mitchell and Mosquito light and heavy bombers; No 83 Group consisted of one Mustang wing, four Spitfire wings, four Typhoon wings, a reconnaissance wing and some light aircraft for artillery spotting; and, No 84 Group consisted of one Mustang wing, five Spitfire wings, three Typhoon wings and a reconnaissance and spotting wing. The subordinate units of 2 TAF directly supported the units of the 21ST Army Group. The British Second Army could rely on No 83 Group, while No 84 Group supported the First Canadian Army.

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On the eve of D-Day for the Allied invasion of Normandy, the Supreme Commander, General Eisenhower, could say with near certainty to the troops about to embark on what he called the great crusade: “You needn’t worry about the air. If you see a plane it will be ours”. And he could go on saying that until the final surrender of Germany in May 1945, for, with only rare exceptions, Allied air superiority over the battlefield was complete. The Luftwaffe was unable to interfere with the Normandy invasion, the breakout from the beaches, the advance across France, or the crossing of the Rhine and the move into Germany itself. Those elements of the Luftwaffe that were still operational were brought closer to home to fight off the Allied bombers over Germany.



Mechanics at work on a Typhoon, Mustang Squadron aircrew in France 1944



A wet day in Normandy August 1944

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Allied airfield post-attack 1 January 1945

The final effort, en masse, of the Luftwaffe to influence the land battle was made on New Year's Day 1945 when about 800 aircraft made a spectacular sweep against Allied airfields, destroying 144 British aircraft alone. Like the German Ardennes offensive on the ground in December 1944, it taught the complacent Allies a lesson, but could not halt the tide of the Allied advance. Thereafter, the Allied tactical air forces with complete air superiority brought their great numbers and awesome power to bear upon the battlefield. RAF Spitfires, Mustangs, Mosquitos, Typhoons and Tempests, USAAF A-20 Havocs, B-25 Mitchells, B-26 Marauders, P-38 Lightnings and P-47 Thunderbolts combined to destroy airfields, radar sites, bridges and roads as well as German troop concentrations, artillery installations and tanks. Even the heavy bomber forces were switched to support the tactical air forces, so flexible had the exercise of air power become.



USAAF Marauder over train, Mosquito nose showing cannon, 2 TAF Mitchells queue for take-off February 1945, original Typhoon in flight

RAF & ARMY CO-OPERATION



RAF and Army man visual contact point Normandy July 1944

The mobility of the tactical air forces in providing the close air support for the armies was best shown by the system originally used in Tunisia for the ground control of fighters; the fighter controller (now known as the Forward Air Controller (FAC)) rode in the leading tank or armoured car and then, by using VHF radio telephone, he directed aircraft forming a “cab rank” above to whatever target appeared most suitable.



Squadron Leader R A Sutherland & Major D Gray mobile fighter controllers

Planning for every battle was a joint ground-air effort. The system of such close co-operation, first used in the Desert Air Force, was refined and perfected in Italy, Normandy and across France and Germany. The Army and the RAF had become one in defeating the German Army and its Luftwaffe.

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AIR WAR IN THE MEDITERRANEAN

In June 1940, when Italy entered the War there were less than 300 front-line RAF aircraft in service throughout the Mediterranean and Middle East. British forces suffered a series of early defeats starting with the invasion of Greece in April 1941 and Crete the following month. Although RAF forces fought valiantly against the Germans and Italians, the RAF was heavily outnumbered and was soon forced to withdraw to Egypt to regroup.



Men of the new RAF Regiment in battle dress

The strategically important island of Malta also came in for sustained bombardment by the Italian and then German Air Forces.



Malta ration August 1942

Once again meagre RAF resources were faced with overwhelming odds but at Malta the enemy was eventually deterred from invading by a handful of fighters and the resolute

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determination and courage of the island's population. Their heroism during the siege and bombardment of their island prompted King George VI to award Malta the George Cross, Britain's highest civilian decoration for bravery. Malta remained a critical staging post throughout the war.



Maltese civilians repair airfield August 1942

The war that saved Malta was fought in the air and on and under the sea. In the early stages of the conflict in Malta, Spitfires and Hurricanes were flown off aircraft carriers (with varying degrees of success) in the Western Mediterranean to reinforce the island's air defence force of 3 ageing Gladiator biplanes. These had been purloined from the Fleet Air Arm who had left them crated up on the island for "collection later". Faith, Hope and Charity, as the 3 Gladiators were known, became legends and a symbol of the spirit of defiance exhibit by Servicemen and women and civilians alike on the beleaguered Island.



SS Ohio limps into Grand Harbour, 15 August 1942 with essential stores and aviation fuel on board

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Subsequently Malta served as the base for a concerted assault by RAF and Fleet Air Arm aircraft and Royal Navy submarines against the Axis supply lines across the Mediterranean from Italy to North Africa.



Beaufighter departs for an anti-shipping strike July 1942

These attacks played an important part in hampering Rommel's forces in North Africa and greatly assisted General Montgomery in his final drive for victory which began at El Alamein in October 1942. It was from Malta that reconnaissance sorties were flown which led to the destruction of the Italian Fleet at Taranto by the Fleet Air Arm.



Taranto after attack 11 November

FORMATION OF THE RAF REGIMENT

The German parachute and glider assault on RAF airfields in Crete had a lasting effect in that it started developments that led to the creation of the RAF Regiment. The fall of Crete combined with the invasion of Norway and Greece, made it clear that the Army, with its resources stretched severely, could not cope with the added burden of defending RAF airfields and installations. Churchill advised that theatre airfields should be the “stronghold of fighting air-ground men, and not.....protected by detachments of soldiers” and it was decided to create a new corps to specialise in airfield defence. On 1 February 1942 the Corps of the RAF Regiment was officially formed by Royal Warrant from King George VI. Initially, the RAF Regiment’s task was essentially defensive but as the war progressed, the Regiment adopted a more aggressive role. On 15 September 1943, RAF Regiment squadrons were air transported to Cos and Southern Italy. Squadrons were also landed at Salerno and later became involved in the battle for Monte Cassino. In the European theatre, the Regiment landed squadrons on Juno Beach in the early hours of D Day + 1.

By the end of the war, the RAF Regiment had seen service in North Africa, the Middle and Far East, the Mediterranean and Europe and had a fighting force of over 85,000 men.



RAF Regiment defending a captured airfield Italy July 1944

SICILY, ITALY AND THE BALKANS



Airfield bombed Sicily July 1943

Once North Africa had been secured, the Allies turned their attention to the invasion of Italy. Sicily was the first step and the RAF played a major role in achieving air superiority over the island before covering the airborne and amphibious assault known as Operation HUSKY in July 1943. A combination of bad weather, navigational problems and friendly fire disrupted the airborne phase of the operation, but the RAF and USAAF were able to paralyse the German and Italian air forces to enable a rapid Allied occupation of Sicily.



Airborne troops by Waco glider prior to invasion of Sicily

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The invasion of the Italian mainland in September 1943 was preceded by bombing raidson military and transportation targets throughout Italy. After Italy's surrender the German forces continued to resist the Allied advance through Italy, however, the Germans were continually harried by RAF and USAAF fighters and bombers. Thousands of air interdiction missions were flown which had a cumulative effect on the ability of the German Army to manoeuvre and redeploy its forces. The air/land cooperation system that had worked so well in North Africa was adapted for use in Italy leading to the more efficient use of air power resources. As the Allied advance through Italy allowed the RAF to occupy enemy airfields, attention was turned to the Balkans. An international force, known as the Balkan Air Force, was set up under the command of the Mediterranean Allied Air Forces and included airmen from Britain and the Commonwealth, the USA, Greece, Italy, Poland, Russia and Yugoslavia. From its new bases in Italy the RAF attacked Axis forces in Yugoslavia, Bulgaria, Albania and Greece. RAF transport aircraft flew supplies to the Yugoslav Partisan Army and, during the Warsaw Uprising of August and September 1944, RAF and Commonwealth aircrews suffered heavy losses while attempting to resupply the Polish underground army. There is no doubt that Allied air power contributed significantly to ultimate victory in Italy and the Mediterranean. Many of the air lessons learned at some cost in these theatres were later applied during the invasion of Northern Europe.



Supply air drop for Yugoslavian partisans, Partisans medevaced on a Dakota,
Partisan flare path Topusko 1944

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THE FAR EAST

The Japanese attack on the British colonies in the Far East in December 1941 once more found the RAF forces in the region ill-equipped to face the threat. Priorities in Europe and North Africa meant that few front-line aircraft could be spared for the Far East and only 181 serviceable RAF aircraft of all types were available in theatre on 7 December 1941.



Brewster Buffalo



100 Squadron Vildebeests refuel at Kuala Lumpur,
100 Squadron Vildebeest drops torpedo

The pitifully few squadrons of Hurricane and Buffalo fighters put up a fierce struggle against the attackers, while ancient Vildebeest biplanes and more modern Blenheims and Hudsons attempted to torpedo and bomb Japanese shipping to little avail.



Bombing the Burma Thai railway

Within a matter of a few weeks the RAF units in Malaya and Singapore were decimated and the survivors withdrawn to Burma and India in the face of a relentless Japanese pursuit. The rebuilding of RAF strength in India was a slow and difficult process and was only possible initially through the delivery of a large number of US-built aircraft like the Curtis Mohawk, Vultee Vengeance, Consolidated Liberator and the Douglas Dakota. Gradually, as RAF strength increased and more modern types were introduced, the balance began to swing in favour of the British and American forces and the Japanese found themselves under air attack from all sides. By March 1945 Air Command South-East Asia consisted of no less than 71 RAF squadrons including modern types such as Spitfires, Thunderbolts, Liberators and Mosquitos.

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Thunderbolt and Hurricane in Burma

As in North Africa and later in Italy and Northern Europe, cooperation between air and ground forces was critical to success and air supply was probably more vital in this theatre than in any other.



Beaufighter attack on a Japanese train in Burma

TRANSPORT OPERATIONS



THE INTER-WAR YEARS

In the inter-war years, the RAF had a limited chance to develop some expertise in the air transport role for both men and freight with the Cairo-Baghdad mail service and in moving small numbers of troops into troubled areas as part of the system of air control. But it was very limited for the aircraft available were dual-purpose bomber-transporters like the Victoria and the Bombay.



Troops emplane at Victoria

British civil aviation lagged behind its American counterpart in the development of passenger-carrying aircraft and so could not provide the manufacturing base from which the RAF could develop its operations.

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Vernons used on Cairo-Baghdad run

FERRY COMMAND



Nerve centre of Ferry Command

The first major impetus to develop air transport was the need to get American-built aircraft to Britain in the early years of the war. Flying the Atlantic then was not a daily occurrence, but it soon had to become so.

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Liberator about to depart for an Atlantic crossing

With the direct help of the Canadian Government and using experienced British Overseas Airways Corporation (BOAC) pilots, including D C T Bennett, who later commanded the Pathfinders, the Atlantic Ferry Organization began and, in turn, became RAF Ferry Command in July 1941. The first Hudsons for Coastal Command came online in November 1940; passengers crossed the Atlantic lying on mattresses in the bomb bays of converted B-24 Liberator bombers. But the supply route had been proved and established; indeed, over 9,000 operational aircraft were ferried across the Atlantic between 1941-45. In turn, it was to lead to a network of regular services on strategic air routes to the Middle East and India, and the ferrying of aircraft delivered from America to all overseas operational theatres by RAF Transport Command which was formed in March 1943.



In a flight to Canada, the Duke of Kent became the first member of the Royal Family to fly across the Atlantic.

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While the ferry route across the Atlantic was providing valuable experience of long-distance flying, the transport role was still limited by the lack of a suitable aircraft.



Troops board Hudsons North Africa May 1943

Hudsons performed well in the Middle East flying passengers and freight into Malta and even supplied a Hurricane wing by air during the advance from El Alamein. Not until the Douglas DC-3 Dakota appeared could the specialized transport squadrons and the great use made by Allied forces of airborne troops and air supply become possible. The DC-3 became the workhorse of the air, the most successful of all transport aircraft of the piston-engine age both in its civil and military versions.



DC-3 Dakotas

AIRBORNE OPERATIONS



German paratrooper pre-drop Holland 1940, German paratrooper
and bike Holland 1940

The Germans had pioneered the use of airborne troops in their invasions of the Low Countries and Norway. Their last spectacular success with airborne forces was during their capture of Crete in 1941, but the Germans believed the cost in lives to be too high and never attempted another airborne operation. The Allies, on the other hand, created large airborne forces that were to be used in many of the major Allied campaigns.



British paratroopers emplane for a training drop May 1941

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The first British use of paratroops was in Operation COLOSSUS in February 1941. A small force was sent to attack an aqueduct in southern Italy which supplied drinking water to Taranto, Brindisi and Bari, ports that were being used as embarkation points for troops on their way to North Africa. The paras were flown from Malta by 51 Squadron in specially adapted Whitley bombers. All 6 of the aircraft carrying troops reached the dropping zone (DZ) and dropped successfully. Although the attack was successful in that the aqueduct was blown up, all the paratroopers were captured on their way to the pick up point.

Another airborne assault was made against the radar station at Bruneval in France in February 1942. Again 51 Squadron was involved dropping C Company of the 2nd Parachute Battalion. This time the attack was a complete success, the paratroopers being picked up by elements of the Royal Navy.



The Queen inspects Paras of Bruneval raid, March 1942,

The King with Major Frost, and the Queen with Wing Commander Pickard, March 1942

Both the British and the Americans used airborne troops in Operation TORCH, the Allied landings in Tunisia.

In Sicily, the Allied airborne operation was not a conspicuous success. American C-47s (Dakotas) and RAF Albemarle and Halifaxes towed in the American Wacos and the 25-seater British Horsa gliders. Some American gliders touched down in the wrong place, many ended up in the sea and others became lost; the RAF, however, was rather

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more successful with nearly four-fifths of the force reaching the correct zone.

Things went better in the Allied invasion of Italy at the beginning of September 1943 and in Normandy in 1944, where air superiority was even more complete than in Sicily or Italy. Here the airborne forces were given the tasks of securing the flanks of the invading army and holding vital bridges. In Normandy, the problems of finding the correct dropping zone at precisely the right moment were still present - for example, only about 150 out of 600 men of the 9th Battalion Parachute Regiment were dropped close enough to the 4 German coastal guns, their allotted target, to be able to make an assault. But the successes outweighed the failures; the landing of 6 Horsa gliders, one of them within 50 yards, at the lift bridge (famed as Pegasus Bridge) across the Caen Canal, which was then seized, fulfilled one of the major tasks of the airborne troops. Altogether, Transport Command dispatched 264 aircraft and 344 glider combinations in support of the Allied invasion; just 7 aircraft and 22 gliders were lost. One of the lessons learnt was the importance of maintaining a steady course when near the dropping zone in face of anti-aircraft fire. The jinking action of aircraft to avoid anti-aircraft fire led to erratic despatch of troops and, in some cases, they completely missed the Drop Zone. This lesson was to be applied particularly in the next major Allied airborne operation at Arnhem in Operation MARKET GARDEN.



Dropping Paras from a Whitley, WAAF parachute packing for Paras, Stirling towing a Horsa crosses the Dutch coast en route Arnhem

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The air armada for Montgomery's bold plan of capturing the vital bridges over the Dutch rivers in September 1944 was vast: 3,887 aircraft and 500 gliders. But of that force, 1,240 were fighters and 1,113 bombers. With all the resources and effort available by that stage in the War, there were still too few transport aircraft available to carry in one lift all the troops needed for the task. The gallantry on the ground in this glorious failure was matched by that in the air. The Dakotas kept to their steady course through intense anti aircraft fire, some crews were still throwing out supplies to the doomed airborne troops as their Dakotas hit the ground and Flight Lieutenant David Lord, flying a Dakota, posthumously won Transport Command's only Victoria Cross.



Flight Lieutenant D S A Lord VC



Gliders for Arnhem

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Operation MARKET GARDEN Dakotas drop paratroops



Gliders in fields Holland September 1944



A Bridge Too Far Arnhem in Allied hands

The last major Allied airborne operation of the war in Europe - the crossing of the Rhine in March 1945, Op VARSITY - was a complete success for detailed planning and the use of air power. The full range of Allied air power dominated the battlefield and the dropping zones; medium and fighter bombers destroyed the German anti-aircraft defences, fighters provided escort for the transports carrying the parachute troops, and the bombers concentrated on preventing the movement of German forces by attacking railways, canals, roads and bridges. The lessons of Arnhem had been painfully learnt; the British and American airborne divisions were taken in one lift and the airborne supplies were dropped the same evening, 6 hours at the most after the first soldier had landed. The marking of the DZs and the landing of the gliders was extremely accurate; some gliders touched down within 20 or 30 yards of their objective. The Luftwaffe was powerless to intervene. Once over the Rhine, the Allied armies swept into the heart of Germany to final victory in May 1945.

MEDEVAC



Casualties waiting for an Air Ambulance, A packed Air Ambulance
North Africa May 1943

RAF transport aircraft also fulfilled a vital and effective role in evacuating casualties from the continent to the better-equipped hospitals in Britain. Altogether some 77,000 casualties were flown from strips and airfields in Europe to the UK, where fleets of ambulances were waiting to ferry them to hospital. This figure represents some 60 per cent of all British casualties in Northwest Europe. Some 42,000 casualties were flown from the battleground itself, either direct to Britain or to medical facilities further from the front. Apart from the obvious benefit in terms of rapid and improved medical treatment, this considerably enhanced morale. In the Far East, the achievement was even more impressive, with some 200,000 men flown out of Burma, mostly by the RAF, at a rate of some 600 a day, despite the often appalling weather conditions.

AIR SUPPLY IN THE FAR EAST

While the transport work of the RAF in Europe was centred on airborne operations, in the Far East the task of supplying, by air, the armies fighting the Japanese became more and more the dominant one. After the disasters in Malaya and Singapore and the retreat to the Burma-India border of a British Army often poorly equipped and frequently outflanked in the jungles, it became clear to General Slim, the British 14th Army Commander, that air supply could redress the balance in his favour. Given a measure of air superiority, which had been established over the Japanese air force by late 1943, Slim used air supply with more imagination than perhaps any other British general, both to stabilize his frontline and to launch the attack that would re-conquer Burma.

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Loading a Jeep on to a Dakota, in Burma July 1944

When Slim's commanders were surrounded by the Japanese, he told them to stay where they were and that they would be supplied by air. He used the air to move entire divisions of troops from one critical point to another.



Indian troops about to emplane in Burma July 1944

When Kohima and Imphal were surrounded and besieged for over 80 days in March-June 1944, a force of 155,000 men was maintained with an average of 250 tons of supplies per day solely by air. Only 2 Dakotas and one Wellington that were engaged on bringing supplies into the garrison were shot down. So impotent had the Japanese Air Force become against the combined forces of RAF Spitfires, Mosquitos and Thunderbolts and the American long-range Lightnings and Mustangs, which had put out of action the

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Japanese forward airfields and most of their aircraft.

The success at Imphal and its twin beleaguered fortress, Kohima, in the spring of 1944 broke the Japanese attempt to get into India and began the long road back for the 14th Army, the 'forgotten army'. In that advance from the Indian border to the complete reconquest of Burma (November 1944-May 1945) the 14th Army, more than 300,000 men, received most of its supplies by air. Air supply had become both normal and indispensable to the Burma campaign.



A Dakota takes off in a monsoon, India September 1944

The Dakota transport force operated into and out of the same forward airstrips as the Hurricanes, Spitfires, Thunderbolts, Lightnings and Mosquitos, which had established air supremacy over the Japanese air forces and thus allowed the freedom of movement of the transport force. The Burma success was an Allied one; the RAF and American transport and air supply squadrons were unified into a single organization, which produced an operational effort and a fighting spirit second to none.

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Measuring rice for air drop Burma July 1944, Parachute packing supply base
Burma July 1944, Sepoys of Air Supply Corps packing containers.

Another example of the most impressive work of the mainly Dakota-equipped transport force in Burma was in support of the 2 Chindit expeditions deep into enemy territory. The first expedition of Wingate's Chindits was in February 1943. The force operated for about 3 months behind Japanese lines completely supplied from the air; 178 sorties were flown and 303 tons of supplies dropped. The second Chindit expedition in March 1944 was a much larger operation. It was planned to put about 2 full divisions (12,000 men) behind the Japanese armies then attack at Kohima and Imphal. Of these, 10,000 were to be transported by air and the other 2,000 were to go on foot. In the end, mainly RAF and a few American Dakotas and gliders transported 9,052 men, 175 ponies, 1,183 mules and 227 tons of supplies 150 miles behind enemy lines to air strips hacked out of the jungle.

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RAF working with Chindits first wash for weeks, Loading a mule into a Dakota Burma July 1944.

The main body of the force touched down at a strip called Broadway (others were called Piccadilly, White City and Aberdeen). Air Marshal Baldwin, the Commander of the Tactical Air Force of SE Asia Command, who saw the operation for himself, wrote later: 'Nobody has seen a transport operation until he has stood at Broadway under the light of a Burma moon and watched Dakotas coming in and taking off in opposite directions on a single strip at the rate of one take-off or one landing every 3 minutes'. In addition to the supply work, the RAF had an officer with every Chindit column deep in the jungle. He controlled by radio the fighter-bombers on to their targets, marked new DZs and indicated where the small ambulance aircraft could land.



The RAF who called in the drops for the Chindits in the jungle

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This latter work was of particular importance in getting sick and wounded men out of the jungle - in the first Chindit expedition the severely wounded had been left behind to face both the jungle and the Japanese. Before the second expedition withdrew in August, it had accounted for over 5,000 enemy troops many miles behind the lines in an area which the Japanese had dominated for over 2 years.



Burma wounded loaded on a launch from a Sunderland in India, Chindit wounded.

The final contribution of the transport force in the Far East was flying in the food and medical supplies urgently needed by the thousands of Allied prisoners of war in the camps all over South-East Asia, and flying out those requiring the most urgent treatment. A vast armada of Dakotas, Liberators and Sunderlands engaged on this vital and humane task thus brought to a close the special role of air supply in the victories of the Allied armies fighting the Japanese in Burma and China.



POWs arrive at Rangoon from Bangkok September 1945, Allied POWs board a Dakota in Bangkok September 1945.

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So vast had been the growth of air transport that, by the end of the war, Transport Command was the largest of all Commands with 12 Groups, 58 Squadrons and over 3,000 aircraft. Airborne forces and air supply had become firmly established as an essential part of the successful Allied war effort. In the Far East, air supply had played a vital part in the final victory of the British forces in Burma. In Northwest Europe the transport forces flew vital supplies, including fuel and ammunition, into the theatre whilst flying casualties back out. When the Allies failed to capture a useable port quickly after D-Day and were forced to rely on the artificial 'Mulberry' harbour at Arromanches, air transport came into its own for the transport of high priority goods. Without air superiority, however, the scale of transport operations would have remained small; the decisive exploitation of air superiority is nowhere better illustrated than in the scale of transport operations by both the RAF and the American forces in all theatres of war.

THE RAF IN THE SECOND WORLD WAR IN RETROSPECT



105 Squadron Battles, NEW PHOTO Gladiator, (H2803) front close up over sea,
WAAF servicing an aero engine, RAF cadets carry out flying training in US with
PT-17, EATS trained pilots arrive in the UK

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The RAF had started the Second World War with 2,600 aircraft and 173,958 officers and airmen. By May 1945, its numbers had grown to 9,200 aircraft and 1,079,835 RAF, Dominion and Allied officers and airmen, of who 193,313 were aircrew. Women, too, played their part; in 1943 the Women's Auxiliary Air Force reached its peak strength of 181,909 (all ranks) in over 8 trades. The vast expansion was only part of the achievement; the other is that the highest technical and professional standards were consistently maintained both in the air and on the ground. Trenchard had laid down those standards in the 1920s - the foundation of an air force should be flying and engineering - and they were not lowered even under the pressures of wartime needs. Pride of place amongst the training schemes must be given to the Empire Air Training Scheme (EATS), later called the British Commonwealth Air Training Plan, which operated from May 1940 to March 1945. The Plan was implemented primarily in Canada, where there were over 300 training schools, but also in Australia, New Zealand, South Africa, Rhodesia (now called Zimbabwe) and the United Kingdom itself. In all, nearly 300,000 pilots and other aircrew were trained. Over 14,000 British aircrew also received their training in the USA.



Awaiting aircraft returning from sweep.

The standard of training in the RAF, both in the air and on the ground, remained high even with the expansion. Supporting the aircrew was a vast and highly skilled force of ground tradesmen - the flight mechanics, fitters, electricians, wireless and radio mechanics - most of whom served in the RAF only for the duration of the War. It was above all in the quality of its airmen that the RAF excelled over the other air forces, Allied and enemy, of the Second World War.

The aeroplane, too, played a decisive role in the Second World War. Whether on land or at sea, the establishment of air superiority became the essential pre-requisite of victory. The achievement of air superiority was one long and unremitting struggle. Tactical air superiority in the Battle of Britain in 1940 was not enough in itself; there could be no lasting victory until Allied air power (American, Russian and British) had

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established a general dominance in the air over the enemy whoever he was and wherever he was to be found - in North Africa, over the Atlantic, in Europe or in the Far East. Only when that had been achieved, as we have seen, was the full range of Allied air power with its flexibility, mobility, and destructive power brought to bear decisively against the enemy. Only then was the full range of the major roles of the aeroplane employed. If the RAF began the Second World War heavily committed to its bombers and fighters, the demands of the war broadened that commitment to an equal concern for its maritime, tactical and air transport forces. It had entered the war still using obsolete biplanes, yet, such is the technological catalyst of war that 5 years later it had received its first jet fighter, the Meteor. While the strategic offensive remained the linchpin of policy, the RAF was a much better balanced and therefore more flexible force in 1945 than it was in 1939. As such, it had played an indispensable part in the Allied victory over Germany, Italy and Japan.



122 Squadron ground crew await charges return, Open air workshop France 1940,
Halifax ground crews take a break, Mechanics work on vehicle snow France 1940,
Stirling support, Early Meteor jet fighter Spring 1945

WORLD WAR TWO - THE COMMANDERS

AIR CHIEF MARSHAL THE LORD DOWDING



Hugh Dowding was born in 1882 at Moffat. In 1913 he gained his wings at CFS before being placed on the RFC reserve. The outbreak of war saw him first at Farnborough and then with 6 and 9 Squadrons in France.

In the middle of 1915, he commanded 16 Squadron, whose main role was artillery observation. He spent much of 1916 in command of the Ninth (Headquarters) Wing during the Battle of the Somme, but owing to differences of opinion with Trenchard, he was sent to run the Southern Training Brigade at Salisbury where he remained for the rest of the war. Dowding was subsequently awarded his permanent RAF commission and his first major post at HQ 1 Group, Kenley, before serving at Chief Staff Officer as HQ Inland Area, Uxbridge.

In 1926 he moved to the Air Ministry to become Director of Training and went on to become Air Member for Supply and Research at the end of 1930. During the next six years he was to encourage the development of advanced fighter aircraft based on the experience gained in the Schneider Trophy, and it was largely on his initiative that the prototypes for the Hurricane and Spitfire were ordered in 1934. He was also

instrumental in the development of the world's first Integrated Air Defence System (IADS) which was in place just in time for the Battle of Britain. Dowding was seen by many to be the natural choice to become Commander-in-Chief of the new Fighter Command when it was set up in July 1936. He had at that time some expectations of succeeding Ellington as CAS but was disappointed when, in 1937, the decision went in favour of Newall. However, in the normal course of events, Dowding would have been due to retire at about this time. As it transpired, Dowding's task at Fighter Command was more suited to him, as he himself later recognised. Notwithstanding the greater priority accorded to fighter production from 1938 onwards, his fighter strength - as he regularly pointed out to higher authority - was far from adequate for the proper defence of the homeland. It was increasingly clear that when the Army went to France, some of his Hurricanes would have to go with it. Totally convinced that the security of the home base must come before all else, Dowding was not enamoured with the prospect of his Hurricanes being 'lost' in France. On 15 May 1940, after 5 days of intense fighting on the Continent, he urged the War Cabinet of the dire consequences should the present rate of wastage continue. The letter Dowding wrote the next day is one of the great documents in history and is now on display in RAF College Cranwell College Hall Library (see following pages). Nevertheless, serious as his losses were, they were not mortal. He had retained just enough of his aircraft to enable him in due course to fight the Luftwaffe in the one place where they could effectively be used, within the comprehensive air defence system he had built up in the United Kingdom. Maurice Dean recalls Dowding's visit to the Air Staff Secretariat at the time of the French collapse. His face shone as he spoke: 'Now we cannot lose'.

While it is indisputable that the immortal 'Few' - his chicks as Churchill called them - won the Battle using the organisation he had created, it is equally true that the Luftwaffe lost it through bad senior leadership, faulty tactics and mistaken target selection. However, Dowding, who saw his aim quite simply as to prevent a German invasion by denying them control of the air, did just that. At the age of 58, under formidable strain and increasingly remote from those he led, Dowding had his critics. At the Air Ministry, he was seen as a non-co-operator, a man with whom it was difficult to get on. Portal, who was 11 years his junior and had recently been appointed CAS felt that Dowding was not the type of commander needed to lead Fighter Command after the Battle of Britain.

Dowding finally retired in 1942, still an Air Chief Marshal. He died in 1970 and his remains were interred in Westminster Abbey. Delivering the address on this occasion, Denis Healey, the Secretary of State for Defence, summed him up as 'One of those great men whom this country miraculously produces in times of peril'.

THE SECOND WORLD WAR 1939-45

Telephone: 2. BIRLEY HEATHS 1661 (8 Lines).
BIRLEY HEATHS 1646 (4 Lines).

Teletype Address:
"AEROGRAPHIC STATION"

Reference: — PG/S.18048.

HEADQUARTERS, FIGHTER COMMAND,
ROYAL AIR FORCE,
BENTLEY PRIORY,
STANMORE,
MIDDLESEX.

SECRET.

16th May, 1940.

Sir,

I have the honour to refer to the very serious calls which have recently been made upon the Home Defence, Fighter Units in an attempt to stem the German invasion on the Continent.

2. I hope and believe that our Armies may yet be victorious in France and Belgium, but we have to face the possibility that they may be defeated.

3. In this case I presume that there is no-one who will deny that England should fight on, even though the remainder of the Continent of Europe is dominated by the Germans.

4. For this purpose it is necessary to retain some minimum fighter strength in this country and I must request that the Air Council will inform me what they consider this minimum strength to be, in order that I may make my dispositions accordingly.

5. I would remind the Air Council that the last estimate which they made as to the force necessary to defend this country was 52 Squadrons, and my strength has now been reduced to the equivalent of 36 Squadrons.

6. Once a decision has been reached as to the limit on which the Air Council and the Cabinet are prepared to stake the existence of the country, it should be made clear to the Allied Commanders on the Continent that not a single aeroplane from Fighter Command beyond the limit will be sent across the Channel, no matter how desperate the situation may become.

7. It will, of course, be remembered that the estimate of 52 Squadrons was based on the assumption that the attack would come from the eastwards except in so far as the defences might be outflanked in flight. We have now to face the possibility that attacks may come from Spain or even from the North coast of France. The result is that our line is very much extended at the same time as our resources are reduced.

8. I must point out that within the last few days the equivalent of 10 Squadrons have been sent to France, that the Hurricane Squadrons remaining in this country are seriously depleted, and that the more squadrons which are sent to France the higher will be the wastage and the more insistent the demands for reinforcements.

Under Secretary of State,
Air Ministry,
LONDON. W.C.2.

/I....

-2-

9. I must therefore request that as a matter of paramount urgency the Air Ministry will consider and decide what level of strength is to be left to the Fighter Command for the defence of this country, and will assure me that when this level has been reached, not one fighter will be sent across the Channel however urgent and insistent the appeals for help may be.

10. I believe that, if an adequate fighter force is kept in this country, if the fleet remains in being, and if Home Forces are suitably organized to resist invasion, we should be able to carry on the war single handed for some time, if not indefinitely. But, if the Home Defence Force is drained away in desperate attempts to remedy the situation in France, defeat in France will involve the final, complete and irremediable defeat of this country.

I have the honour to be,
Sir,
Your obedient Servant,

G.P.B.J. Dowding
Air Chief Marshal,
Air Officer Commanding-in-Chief,
Fighter Command, Royal Air Force.

One month before the start of the Battle of Britain - Dowding's letter to the Under Secretary of State at the Air Ministry outlining the potential perils of sending more fighters to France.

MARSHAL OF THE ROYAL AIR FORCE SIR ARTHUR HARRIS



Of all the high commanders in the RAF during the Second World War, the most widely known is probably Sir Arthur ‘Bomber’ Harris. Indeed, the mention of his name still evokes the deepest passions and arguments, since the strategic bombing offensive, which he so ably led, has caused more controversy than any other campaign that was waged against Germany. His reputation and his place in history are intrinsically linked to the role and achievements of Bomber Command under his direction. Harris was born in Cheltenham in 1892 and on the outbreak of war in 1914, he joined the 1st Rhodesia Regiment as a bugler. Two years later, he was accepted into the Royal Flying Corps and after completion of his pilot training, he joined 39 Squadron, flying against the Zeppelins.

Throughout the 1920’s Harris progressed through the commissioned ranks, commanding No 45 and No 58 Squadron, as well as serving as Senior Staff Officer to the AOC Middle East Command. In the 1930s, Harris worked for the Air Ministry as Deputy Director of Operations and later Deputy Director of Plans. During this period, he was involved in many policy issues including projects for new types of aircraft and various potential war plans. From 1937 onwards, there followed a series of short appointments including AOC 4 Group and AOC 5 Group (Bomber Command) from where he stayed until the end of 1940. Harris was brought back to the Air Ministry by Portal as Deputy Chief of the Air Staff so that he could oversee the build-up of the RAF - and not least Bomber Command.

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In February 1942, he was appointed as Commander-in-Chief Bomber Command, a post for which he was unquestionably suited. The policy of strategic bombing for which Harris will be best remembered originated in 1940 when Great Britain and the Commonwealth stood alone after the fall of France. The choice was simple. If Britain could not come to terms with Hitler, then either a defensive or offensive strategy was the way forward. By early 1942, it seemed to many critics that the offensive air campaign was achieving little in relation to the enormous efforts being devoted to it. What was needed was a man to lead and inspire the offensive, and Harris was given the task. Very quickly, by the force of his personality, Harris gave his men confidence in themselves, in the importance of the job they were doing and in the significance of their leadership. He also quickly demonstrated to Churchill and his colleagues that Bomber Command might well be able to do what its proponents had envisaged, which was taking the war to the enemy homeland on an ever-increasing scale.

The thousand bomber raids of 1942, the Battles of the Ruhr and Hamburg in 1943 and the Battle of Berlin in 1943/44 caused enormous damage to many of the cities and industries of Germany and forced the enemy to devote increasing resources to home defence and damage repair. His iron resolve coupled with a fertile mind enabled the command to absorb the new aircraft and equipment coming into service and to develop techniques and tactics, which turned it into a formidably effective force.

The strategic bomber offensive became a joint operation with the United States 8th Army Air Force and throughout the air campaign Harris gave his American colleagues every encouragement and assistance. In the summer of 1944 the allied heavy bombers provided crucial direct and indirect support to Operation OVERLORD. By 1945 the combined strategic bomber force proved capable of wreaking such destruction on the German transportation system and oil industry that the German war machine almost literally ground to a halt. The alliance between the 2 Air Forces, which Harris did so much to forge, has remained as important in the post-war years and must count as one of his greatest achievements.

When the war ended, he was aged 53 and decided to retire. He moved to America, to become the Managing Director of a new shipping line, the South African Marine Corporation, operating between the USA and South Africa. In his retirement, Harris always gave support to the Bomber Command Association, and the Aircrew Association - founded in 1977 - owed much to his inspiration as its first President. He also saw the Bomber Command Museum, whose opening he attended in April 1983 as a fitting memorial. He died a year later, aged almost 92. Harris was the last of the RAF's great captains and perhaps its greatest operational commander in the Second World War.

MARSHAL OF THE ROYAL AIR FORCE THE LORD TEDDER



After reading History at Magdalene College, Cambridge from 1909-1913, Arthur Tedder embarked on a career in the Colonial Service. He was in Fiji when World War I broke out but, determined to play his part, he returned home and was commissioned in the Dorset Regiment. However, a leg injury suffered during training barred him from the infantry and he spent a year persuading bureaucracy to let him join the Royal Flying Corps. Tedder eventually found his way into the RFC and completed his pilot training in time to fly operations in the Battle of the Somme. Within 6 weeks he was commanding 70 Squadron and ended the war commanding a training wing in Egypt.

With the war over, Tedder decided to stay in the RAF rather than rejoin the Colonial Service. During the inter-war years that followed, Tedder held a number of appointments that culminated in 1936 in Singapore as Air Officer Commanding Far East Air Force. Just prior to World War II, Tedder returned home and was given the task of taking charge of research and development under Sir Wilfrid Freeman. Tedder was closely involved in the planning and production of new types of aircraft and thus had a key role in the critical months before and after the beginning of World War II. In the summer of 1940, Tedder joined Beaverbrook's Ministry of Aircraft Production and subsequently was appointed as

Deputy Commander in Chief of the Middle East theatre. During the next three years, Tedder was to imprint himself on the history of the air war in the Mediterranean, first as Deputy to Sir Arthur Longmore at Middle East Command, then as his successor, and finally as Air Commander in Chief for the whole Mediterranean theatre. Tedder's insistence that the winning of the air battle must take precedence, and that the whole air, sea and land campaign must be run as a fully combined operation, was fundamental in the defeat of Rommel at El Alamein. By the end of 1942, Tedder was held in high regard and had the full confidence of Churchill.

When General Eisenhower was appointed as the Allied Theatre Commander in the Mediterranean in 1943, Tedder was the natural choice to be appointed Air Commander in Chief in charge of all the Allied Air Forces. Thus, throughout 1943, Tedder worked with Eisenhower, first during the Tunisian battles, next in the Sicilian invasion, and then during the early stages of the long Italian campaign. Under Tedders's command was a complete air force covering every major role of air power and he showed great skill in ensuring that air, sea and land worked in close harmony. Eisenhower had the highest opinion of tedder whose persuasive leadership was eminently suited to the task. When Eisenhower was chosen as Supreme Allied Commander for Operation Overlord, it was again the natural choice that Tedder was appointed to be his Deputy. Tedder's appointment meant that he directed all the air forces that were placed under Eisenhower's command, strategic as well as tactical. So, from the beginning of 1944, Tedder played the key role in the preparation of the air campaign for Overlord and the Transportation Plan by which the air forces would aim to cut German communications. Until the end of the war, Tedder retained responsibility for coordinating all Allied air operations. In May 1945, Tedder led the Western delegation to Berlin to sign with the Russians the ratification of the German surrender.

At the end of World War II, Tedder was aged 55 and soon to be promoted to Marshal of the Royal Air Force and raised to the peerage. He was recognised internationally as one of Britain's most distinguished wartime leaders and a brilliant exponent of air power. But a new challenge lay ahead and in January 1946 he was appointed Chief of the Air Staff. His task upon his appointment as CAS was daunting. On the one hand the RAF still had inescapable responsibilities extending across the world from Germany to the Mediterranean, the Middle East, India, Singapore and Hong Kong. On the other hand, most of its skilled and experienced personnel were anxious to return to civilian life, its aircraft were largely obsolescent, and financial pressures were becoming acute. Understandably, therefore, some of Tedder's biggest problems during his 4 years as CAS were on the manpower front. Indeed, in 1948 he warned that manning levels might in time dictate the order of battle, and he aroused the anger of the Secretary of State by not consulting him before making a widely reported speech at Halton that urged the necessity of increased recruiting. Fortunately, the introduction of the peacetime National Service scheme in 1949 did much to alleviate the situation.

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Many measures were also taken to improve the organisation of the Service during these years, not least the introduction of several new officer branches and the development of a new trade structure. At the same time much was done to enhance the RAF's operational capability; major aircraft projects included those for the Canberra and the V Force, and the decisions in 1948 to restore the UK radar, control and reporting system and in 1949 to double the size of Fighter Command were also of great significance.

Much of Tedder's work, however, was as Chairman of the Chiefs of Staff Committee, a role to which he was well suited except when it came to dealing with Montgomery, his Army colleague, who was temperamentally unsuited to committee work and had been highly critical of Tedder as Deputy Supreme Commander. Consequently, the Chiefs of Staff did not work together as well as they should have done during the immediate post-war years when faced by so many far-reaching issues. In the Far East there was continued strife in the Dutch East Indies; great problems arose from the decisions to grant Independence to India and then agree to partition; and 1948 saw the outbreak of the communist insurrection in Malaya. In the Middle East there were the events associated with the relinquishment of the Palestine mandate. In Europe there was the increasing Soviet domination of Eastern Europe, culminating in the Berlin Blockade, and the many negotiations that eventually led to the signing of the North Atlantic Treaty in 1949 with the formation of NATO.

In these and many more issues Tedder was heavily involved, and he showed particularly close interest both in the RAF's contribution to the Berlin Airlift and in the deployment of USAF strategic bombers to Europe and the allocation of RAF airfields for their use. Tedder handed over the duties of CAS at the end of 1949 and, due to his close connections with the American military leaders, he was appointed as Chairman of the Joint Services Mission in Washington, where he served until 1951. In retirement he served as Chairman of the Standard Motor Company and as a Governor of the BBC. He died in 1967.

MARSHAL OF THE ROYAL AIR FORCE THE VISCOUNT PORTAL



Charles Portal was at Oxford when the First World War broke out and curtailed his studies to enlist in the Royal Engineers. He flew as an observer before being awarded his pilot's wings in 1916. He then flew with 60 and 3 Squadrons before being appointed OC 16 Squadron where his leadership was recognised by the award of 2 DSOs.

Between the World Wars he held a succession of staff and command posts of increasing seniority and on the outbreak of the Second World War was Air Member for Personnel. After a brief period as C-in-C Bomber Command, he was appointed CAS on 25 October 1940 and was in Churchill's words 'The accepted star of the Air Force'. At 47, he was much younger than his Navy and Army counterparts on the Chiefs of Staff Committee. Yet he could combine a highly distinguished operational record in World War I with command experience at most levels, a full sequence of staff training, and service in several key posts in the Air Ministry. That career was now to be capped by 5 years spent leading his Service during the Second World War, and in playing his part in the determination of grand strategy. The range of his responsibilities was enormous, though inevitably he had to delegate much of the day-to-day work of running the Air Force to his deputies, in particular the wise and wily Sir Wilfrid Freeman, on whom he relied heavily for advice in the earlier years. It is possible here to touch on only 2 of the greatest RAF issues.

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The first was the relation of air power to the roles of the other 2 Services, neither of which was initially persuaded that the RAF, strongly convinced of the importance of strategic bombing, was sufficiently concerned about its needs. Within weeks of taking office, Portal had to withstand a strong bid for the Royal Navy to take over Coastal Command, an issue which, after threatening to resign, he eventually resolved with a sensible compromise which allowed the Navy operational control. Then in 1942, General Brooke, recently appointed Chief of the Imperial General Staff, urged the formation of an Army Air Arm as the only means of providing tactical air support for the land battle, and Portal had to argue very strongly for the maintenance of the unified Air Force, pointing out that splitting up the RAF, far from increasing the number of aircraft, would merely destroy the cohesion of the nation's growing air power. Fortunately, as the war progressed and the RAF grew in strength, the complaints of the sister Services largely disappeared, and Portal deserves his full share of credit for the close co-operation and understanding that developed between the 3 Services at all levels from the Chiefs of Staff downwards.

That the RAF played such major roles in the Battle of the Atlantic, in the Mediterranean and North West European campaigns, and in the Far Eastern war, owed much to his breadth of vision. The second major issue was the strategic bomber offensive, a campaign in which Portal strongly believed and without whom it would probably never have materialised. Convinced that it offered the one means in the early part of the war to strike directly at the enemy, but that time was needed to build up its potential, it was he that at times reinforced Churchill's determination to press on and at others allayed his doubts about what the offensive was capable of achieving. It was Portal who saw that area bombing offered the only way forward in 1942 and 1943, that Bomber Command required a new leader to inspire it, and then gave his choice, Sir Arthur Harris, the full support he needed. True, they had their differences, for example over the Pathfinder Force, the diversion of Bomber Command for Operation OVERLORD, and particularly the role of Bomber Command in the later stages of the war, when Portal was unable to persuade Harris of the overriding importance of the oil offensive. To say, however, as some have done, that Portal was indecisive and weak in not dismissing him over this issue, and cannot therefore be considered a great Commander, is totally unjustified. Portal realised that Harris's qualities far outweighed his defects, and bearing in mind Harris's prestige and the state of the war at that time, such a measure would have been totally inappropriate.

Reaching far beyond such essentially RAF issues were Portal's duties as a member of the Chiefs of Staff Committee. Meeting regularly, often under the Chairmanship of the Prime Minister himself, their main concerns were strategic planning and the overall direction of military operations. Here he more than held his own, not only with his older colleagues, but also with Churchill, whom he would always stand up to when necessary,

and with whom he had considerable influence. This was demonstrated in late March 1945 when Portal forced Churchill to withdraw one of his less felicitous wartime minutes in which he was highly critical of Harris' area bombing of Dresden.

Even before the United States entered the war, Portal had met General Arnold and other leaders of the United States Army Air Corps and had earned their confidence. His subsequent total support for the USAAF build-up in the United Kingdom, his backing of their daylight bombing policy which he realised would complement the RAF's night offensive, and his encouragement when things were going wrong, won him the unstinting admiration and respect of all the American airmen who knew him. Indeed, on occasions, it was his advocacy rather than General Arnold's that won the day in the top level debate about the mission of the Eighth Air Force. He earned similar high regard for his contribution to the combined Chiefs of Staff; when accompanying Churchill and his other British Colleagues to most of the great Allied planning conferences, it was often - as Eisenhower and others later testified - his quiet, dispassionate reasoning that would reconcile the differences and produce the mutually acceptable formula for agreement. This success with the Americans in what was essentially a coalition war was seen as one of Portal's great achievements.

As the conflict drew to an end in 1945, Portal, now the longest serving of the Chiefs of Staff was still only 52, and while the accolades poured in amongst the victory celebrations, he was preparing to hand over the reins as CAS. He relinquished his appointment on 31 December 1945 and was bestowed as Viscount Portal of Hungerford the following day.

After the War, the concept of a strategic nuclear deterrent was formulated and Portal, with his experience and understanding of the great issues, was appointed as the head of the new Atomic Energy organisation. Portal's prestige and ability at the political level were essential to the progress of the programme in those early days and by the time he retired from the post in 1951, great developments had been made in nuclear technology for both civil and military purposes. From 1952 to his ultimate retirement in 1969, it was the business world that claimed much of Portal's attention, particularly the British Aircraft Corporation of which he became Chairman in 1960. Lord Portal died in 1971 and four years later the statue that commemorates him in Whithall Gardens was unveiled.

**INVENTOR OF THE JET ENGINE,
AIR COMMODORE SIR FRANK WHITTLE**



Frank Whittle was born in Coventry on 1 June 1907, and educated at Earlsdon and Milverton Council Schools before winning a scholarship to Leamington College. Sir Frank's fascination with aviation and engineering led him to the RAF, and he first applied to become an apprentice in 1922 – only to be rejected due to his small stature. Refusing to accept this setback, Whittle embarked upon an exercise regime and diet laid down by a sympathetic RAF PT instructor, as a consequence of which he increased both his height and his chest measurement by some 3 inches. Circumventing regulations that prohibited the reconsideration of rejected candidates, Sir Frank submitted a second successful application to join the RAF in 1923, becoming a member of No 4 Apprentices Wing at RAF Cranwell in that year.

Although Sir Frank chafed against the strict discipline imposed during apprentice training, his ability, intelligence and determination to succeed stood him in good stead and in 1926 he graduated sixth of 600 apprentices in his entry. On graduating, Sir Frank was granted a cadetship to the RAF College, and between 1926 and 1928 he underwent officer and flying training. During his final year, he produced a thesis entitled 'Future Developments in Aircraft Design', in which he concluded that in order to achieve higher speeds and longer ranges it would be necessary for aircraft to be able to fly at altitudes greatly beyond those at which piston engines and propellers could operate; the concepts

discussed in this paper were to form the basis for much of his later work. In the summer of 1928 Sir Frank passed out second in his entry and was awarded the Abdy Gerrard Fellowes Memorial Prize for Aeronautical Sciences. His academic prowess at Cranwell was matched by his skill as a pilot; on graduating, Sir Frank's flying proficiency was rated 'Exceptional to above average' – although a reference to overconfidence was also included in his logbook.

Sir Frank began his flying career with No 111 (Fighter) Squadron at RAF Hornchurch, flying Armstrong Whitworth Siskin III fighters. Subsequently, in 1929 Sir Frank was posted on a flying instructor's course at the Central Flying School, RAF Wittering, and after completing the course he joined the staff of No 2 Flying Training School at RAF Digby as an instructor. In 1930, Sir Frank was one of 2 pilots from No 2 FTS to participate in a competition to select a team to perform the 'crazy flying' display at that year's RAF Air Display. During rehearsals, Sir Frank wrote off 2 aircraft in accidents in the space of 3 days, emerging unscathed on each occasion; after the second incident, he was confronted by an irate flight commander who demanded "Why don't you take all my bloody aeroplanes, and make a heap of them in the middle of the aerodrome and set fire to them – it's quicker"!

It was during his period at CFS that Sir Frank's ideas with regard to future methods of aircraft propulsion first began to take shape. Extrapolating from the conclusions of his Cranwell thesis, Sir Frank realised that the gas turbine offered a potential solution to the problem of high-speed flight at altitude. On 16 January 1930, he filed a patent describing a practical turbojet, and he continued to refine his ideas throughout the next decade.

Having established himself as an outstanding pilot, in 1931 Sir Frank was posted to the Marine Aircraft Experimental Establishment at Felixstowe as a floatplane test pilot, often being called upon to conduct the first catapult launch of aircraft under evaluation; he also served as the Establishment's armament officer. While at MAEE, Sir Frank was strongly recommended for engineering duties, and in 1932 he joined the Officers Engineering Course at RAF Henlow. In a preliminary examination sat by all new students on the course Sir Frank excelled, obtaining an aggregate score of 98 per cent in all subjects; on the strength of this result, he was allowed to take this 2-year course in 18 months. Although the Air Ministry had stopped sending selected officers from the Officers Engineering Course to Cambridge to complete the Mechanical Engineering Tripos, an exception was made for Sir Frank, and he became a member of Peterhouse College in July 1934, graduating with First Class Honours in 1936.

During his time at Cambridge, Sir Frank became totally engrossed in his concept of a gas turbine aero engine. Official scepticism prevented public funds being made available to fund jet development; nevertheless, the Air Ministry did maintain Sir Frank on the Special Duty List after graduation, thereby granting him time to work on the preliminary design of an experimental engine whilst continuing to serve in the RAF. In an effort to generate private funding, in 1936 Sir Frank and a group of 'believers'

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including Rolf Dudley-Williams (with whom Sir Frank had shared a hut while a Flight Cadet at Cranwell) and J C B Tinling formed Power Jets Ltd. British Thompson Houston (BTH) at Rugby contracted to construct the first Whittle jet engine, which was run for the first time on 12 April 1937.

In August 1939 the Ministry decided to construct an aircraft powered by a Whittle engine, and in February 1940 the Gloster Aircraft Company received a contract to design and build 2 aircraft to specification E28/39. The first E28/39 (unofficially dubbed 'Pioneer'), serial number W4041/G, made its maiden flight from Cranwell in the hands of Gloster test pilot P E G 'Jerry' Sayer on 15 May 1941.

Following this success, Gloster were authorised to develop a fighter powered by 2 jet engines; this would enter squadron service in 1944 as the Meteor – Britain's first jet combat aircraft. Sir Frank's company, Power Jets, continued to press ahead with jet engine development, although the need to produce engines in quantity led inevitably to the involvement of other companies more suited to large-scale manufacture (Rover, and later Rolls-Royce and de Havilland). Power Jets' role diminished, and the company was subsequently nationalised, being renamed Power Jets (Research and Development). Sir Frank resigned from the board of Power Jets in January 1946 and was appointed Technical Advisor on Engine Design and Production to the Controller of Supplies (Air) at the Ministry of Supply in June of that year. The immense pressure under which Sir Frank had been placed during the development of the jet engine led to his health deteriorating, and while on a lecture tour in the USA his health broke down; he retired from the RAF on medical grounds on 26 August 1946.

During May 1948, Sir Frank received an *ex gratia* award of £100,000 from the Royal Commission on Awards to Inventors in recognition of his enormous contribution to British aeronautical engineering, and he was knighted in July 1948 – becoming the first Old Cranwellian to receive this honour. Sir Frank went on to serve as honorary technical advisor to the British Overseas Airways Corporation between 1948 and 1952, and was later retained as a technical advisor by Shell. During the 1960s, Sir Frank worked with Bristol Siddeley Engines to develop a revolutionary oil drill – the Whittle Turbodrill. Sir Frank emigrated to the USA in 1976, and in the following year he joined the staff of the US Naval Academy. His second book – *Gas Turbine Thermodynamics* – was published in 1981. In 1986, Sir Frank was appointed a member of the Order of Merit. Sir Frank Whittle died on 9 August 1996, aged 89.