RESTRICTED

AIR PUBLICATION 3235

THE SECOND WORLD WAR

1939–1945

ROYAL AIR FORCE

AIR SUPPORT

ISSUED BY THE AIR MINISTRY (A.H.B.)

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INTRODUCTION

' Air support ', ' direct air support ', ' indirect air support ' and other terms which were standard in the Second World War are no longer in use in the United Kingdom and United States Air Forces. In this historical monograph these expressions have been retained, principally because they are the ones quoted in the contemporary documents on which this history is based, and also because of the difficulty and confusion which might arise in translating them into the present day equivalents[1] which may themselves be subject to alteration in future years.

Direct air support was ' intended to have an immediate effect on current land or sea operations '. It included defensive support to impede the enemy's ground and air offensive and offensive support to destroy the enemy's ground forces. It was divided into pre-planned (pre-arranged) and impromptu support. Close support was a form of direct support and was ' offensive air support in close proximity to our forward troops '.

Indirect air support was ' that support given to land or sea forces by air action against objectives other than enemy forces engaged in the tactical battle '. It included air action against land communications, base installations, etc., and was in fact air support directed against any target which had an effect, although not an immediate effect, on the battle between ground forces. Theoretically such support included operations by strategic air forces but in practice indirect air support only included operations in association with a particular army group or groups.

More space has been devoted to direct support because it was generally during direct support operations that new support methods were evolved. Those which were used in the course of indirect support operations, such as attacks on supply bases were frequently similar to methods employed by the strategic air forces.

The air war at sea has not been described, although, for example, considerable indirect support was given to the Eighth Army by the sinking of tankers in the Mediterranean during the North African Campaigns. For accounts of such support, the reader may be referred to the various operational narratives issued by the Air Historical Branch.

Air transport, glider and parachute troop operations and tactical reconnaissance are all forms of air support but developments in these spheres have only been included when they assumed main importance in a particular campaign because of the terrain or other reasons. Thus air transport is not described in any detail in the section dealing with the Western Desert Campaigns but its importance is stressed during the Reconquest of Burma.[2] Again, while

1 Details of terms in use at the time of publication of this monograph are contained in A.P. 3162 and A.P. 3218.

2 *See* Chapter 6. Also Appendix 12.

no history of the development of the Airborne Forces has been given—this subject has already been covered as an earlier work in this series[1]—Operation Varsity (the crossing of the Rhine in March 1945) has been described, since it was concerned with problems directly related to air support.

[1] A.P. 3231.

CHAPTER 1

PLANNING FOR WAR

Air Support Policy

Throughout the First World War the problem of handling large air forces in a major strategic role was never fully developed, and the principle of concentration was constantly infringed. This was largely because the Royal Air Force in the field had grown up on the basis of decentralisation to armies. This made it difficult to practise, and therefore to gain knowledge of the rewards of centralised control and concentration. It was only by subsequent study that the full significance of this principle was revealed. Air forces, of which bombers offer the best example, must be concentrated in the maximum possible force on whatever might be the decisive task at the time. The only legitimate limit to the application of this principle was that imposed by the requirement of security and diversion of enemy strength ; but the use of air forces for this purpose had to be kept to a minimum whilst the bulk of air effort was concentrated on the primary task. Air forces possessed quite unprecedented freedom of operational flexibility and therefore equally impressive powers of concentration of primary effort. Conversely, however, the effort could be readily dispersed and strength dissipated by lack of understanding of the principle of concentration and consequent mismanagement.

As the sub-allotment of bombers to ground forces would involve waste and inefficiency and could not be relied upon to provide effective support for the affiliated ground formations, the Air Staff maintained the principle, which was accepted by the Army, that the long range bombers should be kept under centralised control, but that the Commander-in-Chief in the field must be able to call upon the force to assist in the achievement of his aim.[1] Routine bombing tasks were not to be undertaken on an Army front as this would entail dispersion of effort on indecisive objectives, and if the armies were not engaged in decisive conflict the bombing effort was to be directed to more important tasks. This was also the view of the German Air Staff, who refused to give air support to any army formation which was not taking part in a decisive battle. On the other hand, if the Army was carrying out an operation such as a major offensive, as much of Bomber Command as necessary would be allotted for air support.

Many attacks on strategical targets in enemy country would also afford indirect support to ground operations. But more immediate assistance could be given by direct support action against enemy ground force targets such as base depots, dumps, supply columns, movements by road and rail, headquarters, rest and reserve billets, assembly points of reinforcements, forward elements of armed forces, and even forward troops deployed and in contact. This latter action was known as ' close support ' and entailed the active participation of aircraft in the ground battle, whether it were the assault or defence of lines in static warfare, or advanced or rearguard action in mobile warfare.

Experience of numerous instances during the First World War when aircraft, generally fighters, were employed in close support showed, however, that, except in certain special and rare circumstances, the results were disappointing

[1] A.H.B./IIH/97.

when compared with the losses sustained.[1] More favourable and important objectives could usually have been chosen. Nevertheless the Civil War in Spain had shown that aircraft could be used efficiently as battlefield weapons against troops who were undisciplined and ill-equipped with anti-aircraft guns. The success of the *Luftwaffe* in Poland was due largely to the fact that the Polish Air Force was virtually destroyed early in the campaign and that German bombers had disorganised communications in the rear of the Polish armies.[2] However, in the conditions of the battle for which we were preparing, all war experience seemed to prove that low-flying attack—which was the usual method of providing close support—on the battlefield against unbroken troops, deployed and in position, inevitably involved a very high rate of aircraft casualties. Whilst the Royal Air Force had never been unwilling to face heavy losses, it was realised that highly trained pilots could not be replaced with the same ease as infantry soldiers.

The normal requirements for the provision of close support included local air superiority, a lack of light anti-aircraft weapons with the opposing ground forces, a high standard of training and morale in the air, intelligent briefing, and an efficient organisation for the control of aircraft. Few of these conditions could be fulfilled and close support operations were therefore to be limited to exceptional circumstances which justified this method of support. These circumstances were defined by the Air Staff in a Memorandum dated 21 November 1939, as follows :—

(*a*) In defence, in a critical situation when the overriding consideration was to stop a hostile breakthrough ; to cover the withdrawal of our forward troops from untenable positions and to give time for the arrival of reserves. The use of aircraft at a terrible cost in casualties to avert a break-through west of Bapaume and the closing of the gap at Roye, during the retreat of Gough's Fifth Army in March 1918 served as an example.

(*b*) In the pursuit of an already broken enemy to turn a retreat into a rout, such as occurred after Megiddo in Palestine on 21 September 1918, when the Turkish Seventh and Eighth Armies were annihilated.

(*c*) On rare occassions in an attack on a highly organised defensive system when it might be justifiable to use aircraft ' temporarily ' against such objectives as artillery areas and the movements of the enemy's immediate reserves, to make sure of breaking the crust of the defence for the initial break-in. No justifiable examples existed of the use of aircraft in this manner, although there had been occasions when some benefit had been obtained ; but in all instances the effect would have been greater if the effort had been applied further back.

In brief, liberties could not be taken with these rules except when one side had complete air superiority and when the opposing army was ill-organised and inadequately equipped with anti-aircraft weapons. Close support could only, therefore, be considered a secondary role for aircraft and it was evident that specially designed aircraft or a specially designated and reserved force

1 A.H.B./IIH/97, Encl. 11.
2 Air Staff Memo., 21 November 1939.

could not be afforded for the task. The choice, when the occasion arose, would lie between available bomber, fighter and reconnaissance aircraft and would depend to some extent on the suitability of the aircraft for the job. Under certain conditions it was possible that more than one or even all types might be required.

It thus appeared that the use of aircraft in the forward battle zone was strictly limited and that attention would need to be focused upon objectives further back. In Poland, by far the most important contribution of the German Air Force was ' the devastating effect of their bombers against objectives far to the rear of the Polish forward troops. Command and direction was stunned and rendered deaf and dumb by the systematic bombardment of headquarters and signal communications ; counter attacks were killed at the source by bombing the movements of reserve formations to the threatened points ; the Polish Air Force was neutralised, not so much by bombing their aerodromes as by destroying the means of inter-communication by which they could receive information and orders ; road and rail comminucation, bridges, power stations and finally the armament and aircraft industry was ruthlessly and systematically bombed up to distances of 150 miles behind the lines '.[1]

There seemed no doubt that the true function of the bomber aircraft in support of an army was to isolate the battle-movement of reserves, and generally to create disorganisation and confusion behind the enemy front while the ground forces achieved their objectives. Road and rail communications were thought to be particularly susceptible to low-flying attack. Even a small effort at sensitive points could effect considerable delay or disorganisation. The fact that continuous attack in the artillery sense was not possible could be remedied by the selection of targets far enough back to enable accumulated effect to be obtained by repeated attacks. The object was delay rather than material damage, and low-flying tactics were advocated in view of the accuracy required. Medium or high altitude bombing could also be effective, but would probably require supplementary low-flying attacks. All targets would need to be readily 'locatable' and low-flying attacks would benefit from some measure of tactical surprise.

The choice of method to be used to bring about the desired effect would depend upon the extent to which the enemy had been allowed to complete his concentration before a battle. Owing to their greater vulnerability combined with their lack of flexibility as compared with road communications, rail systems seemed to offer better targets than other systems of communication. There were four main methods of attacking railway systems :—[2]

First there was the systematic and repeated cutting of railway lines along the open track at selected radial distances from the area to be isolated. Calculations showed, however, that the number of British bombers expected to be available in August 1939 could expect to make and maintain only nine breaches during the first three days of operations, and fifteen during the following four days. Furthermore it would rarely be possible to maintain the breaches for 24 hours a day. Secondly, attacks on bridges offered an alternative method

1 Air Staff Memo., Bomber Support for the Army.
2 A.F.C.(J)51, 73 and 95 (A.H.B./IIA/1/68).

but calculations, based on the costly but accurate shallow dive attack, showed that the whole British heavy bomber force could only put eleven bridges temporarily out of action during the first seventeen days of operations. The period of unserviceability was estimated to average about seven days. A third method was to attack traffic centres but this offered only intermittent delays and railways would only be vulnerable when they were either comparatively undeveloped systems or overloaded to a point near the limit of their capacity. Finally it was possible to subject railway systems to a long term attrition by the destruction of locomotives and rolling stock.

Alternative targets could be divided into two categories, Permanent and Fleeting. The former were those which could be foreseen sufficiently early for orders to be issued by normal means ; the latter required arrangements whereby at least a portion of the bomber force could be directed at short notice on to such objectives.

Bomber Plans

Sufficient agreement was reached during the 1939 Anglo-French Staff conversations to permit plans to be prepared for the support of the Allied armies in the field in the event of war with Germany. Pending Allied agreement on the desirability of attacking the Ruhr, two separate air plans were prepared.[1] The first was for the attack of columns and purely military objectives and was not subject to further governmental sanction : the second was for the attack of the Ruhr subject to the decision of the Government at the time. Later, in April 1940 the Supreme War Council agreed that in the event of an invasion of Belgium or Holland the light bombers and a limited number of heavy bombers would operate in direct support of the Allied armies advancing into the Low Countries[2] and that simultaneously the main heavy bomber effort would be used at night against troop concentrations, marshalling yards, communications, and oil refineries in the Ruhr. Should the situation become critical, the task of stemming a German invasion by direct attack on enemy armies and their supply services was to be the primary role of the whole Allied bomber force, in spite of the fact that the strength of this force made it inadvisable to rely too greatly on the results of air action.[3] In the initial stages, permanent objectives were to be attacked and lists were prepared of suitable targets along Belgian and Dutch roads. These consisted in general of those cross-roads, bridges and portions of towns, the attack of which was likely to impede the passage of enemy motorised divisions. In addition, lists were made of the most favourable railway objectives west of the Rhine for attack if important results appeared likely, from the short delays that might be achieved.

This policy for the provision of air support was not accepted without contest. False conclusions gained from recent campaigns, the lack of appreciation of the fundamental importance of concentration of air power, and insufficient understanding of the problem of providing and maintaining a large air force in the field were the principle factors leading to this dissent. However, during the discussions between the Air Ministry and War Office that continued throughout

1 W.P. (39) 118 II.
2 C.A.S. File, Air Policy, Pt. III.
3 A.F.C.21 (A.H.B./IIA/1/69).

the summer of 1939, the independence of the heavy bomber force, subject to a call from the Commander-in-Chief in the field to support his aim, was accepted.[1] We had not in the past attempted to match the German short range bomber force because it could not attack the United Kingdom owing to lack of range, and because previously we had no comparable army to require such a force for our own use. With a projected army of thirty-two divisions we were required to be able to provide substantially more support and the Air Ministry proposed to do this with a planned force of light bombers, which would have the dual role of strategic and direct support bombing. Suitable support training was to be provided, but the whole force was to remain under the A.O.C.-in-C. Bomber Command, who would thus be able to take a wide view and apply his efforts to tasks of vital importance. The Allied bomber force would not be large but the system to be adopted provided for collaboration of the force with the whole of the Allied armies, and was designed to enable it to concentrate wherever it was most urgently required.

The comparatively short range of the light and medium bombers made it essential that, in the event of a war between Germany on the one hand and the United Kingdom and France on the other, these forces should as far as possible be based forward on airfields in the Rheims area of France. The French were to provide airfields for a force of twenty squadrons. The first echelon of the Advanced Air Striking Force (A.A.S.F.) was to be composed of No. 1 Bomber Group, armed with Battle aircraft and this was to be followed about eighteen days later by No. 2 Group armed with Blenheims. The two Groups would then come under an established A.A.S.F. Headquarters. A Quick Despatch Scheme was prepared whereby Servicing Flight Sections would be flown to France in civil aircraft before the main body in order that the force could be ready to operate 24 hours after arrival. Bombs, ammunition, petrol and oil were to be laid down at the selected airfields prior to the outbreak of war and a French Air Company was to be installed at each to provide essential services pending the completion of the British administrative and supply organisation.

A fundamental development from the Anglo-French strategic situation was that the whole line from Scapa Flow to North Africa was one Allied front as far as the air strategy was concerned. Fighters and anti-aircraft ground weapons were the air equivalent to the Maginot Line, while bombers were comparable to the French *mass de manoeuvre*. On the cardinal principle of concentration at the decisive point at the right time, the Allied air forces had to be prepared to reinforce any particular sector of the one front at the expense of less important areas.[2] Furthermore, the fighter squadrons of the Metropolitan Air Force and the anti-aircraft units of the Air Defence of Great Britain could not be allowed to be immovably fixed in the United Kingdom, but should as far as practicable be available and organised to make concentration possible. But any movement from the United Kingdom of units additional to those already earmarked for France, was to depend upon the air situation in the United Kingdom at the time and be subject to Cabinet decision.[3]

It was evident that, in principle, a comparatively small section of the Allied armies, such as the British Field Force would be in the early stages of a cam-

1 A.H.B./IIH/97, Encl. 38.
2 A.H.B./IIH/97, Encl. 7.
3 A.H.B./IIH/97, Encl. 52.

paign, should not attempt to be self-contained in respect of fighters but on the other hand General Gamelin was pressing the British to undertake the air defence of all British forces in France and, in any case, to provide a strong enough force of fighters and ground defence weapons to enable the French to spare units to meet a possible threat from Spain or in Libya.[1] This problem was largely resolved when the British Field Force was allocated an area in the north-west of France which enabled the British to take over a sector for air defence, which not only gave the Royal Air Force direct responsibility for the air protection of the majority of British forces in France (the A.A.S.F. excepted), but was within reasonable distance of the United Kingdom. The Air Component fighters thus remained an assured part of the Royal Air Force and could be used either to co-operate with the French in the event of an attack through the Low Countries, or to deal with bombers coming from the north or being directed against southern England. Furthermore, the choice of the British Army for the sector to be defended by the Royal Air Force allowed co-ordination between British aircraft, guns and searchlights. General Gamelin's requirements were not met in full for no British fighter defence was, at the outset, provided for the A.A.S.F., which would have to rely upon French fighters for close air protection. On the other hand the first requisite of close defence was met by the provision of light A.A. and four high angle guns per airfield and a suitable complement of ground weapons for important isolated Royal Air Force establishments was also to be supplied.

The Army Viewpoint

The division of the British Air Forces in France into two separate Commands in order that the light bombers might remain part of the air striking force was not entirely satisfactory to the Army, which considered itself to be inadequately assured of prompt air support, and, furthermore, contended that the Royal Air Force did not possess aircraft suitable for close support.[2] It was suggested that an aircraft of simple construction should be specially designed for this role, that the Army should be directly responsible for the command and ultimately the training and maintenance of direct support air forces, and that pilots should be drawn predominantly from Army resources in order that they might be familiar with Army methods. It was also claimed that operations would be unnecessarily complicated by the practice of having independent commanders in the field whose headquarters were between one and three hundred miles apart, and that the need for the G.O.C.-in-C., B.E.F. to refer in certain circumstances to the Chiefs of Staff and eventually the War Office, was a further hindrance.[3] The War Office therefore pressed for an additional 250 specially designed first line aircraft suitable for close support, together with the necessary pilots and reserves, to be made available by the spring of 1940 and to act under Army orders. The claims in respect of command were similar to a proposal made earlier in the year for the Army to control all air forces in the field, including bomber, fighter, reconnaissance, communication and possibly transport aircraft.[4]

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1 A.F.C. 17 (A.H.B./IIA/1/69).
2 A.H.B./ID2/145.
3 War Cabinet Meeting, 8 November 1939.
4 C.O.S.924, 14 June 1939.

Such a proposal was tantamount to placing almost a third of the Royal Air Force under the Army and was resisted by the Air Ministry.[1] The existing basis of allotment of aircraft and the organisation for control had already been determined in consultation with the War Office and the Field Force had been substantially supplied with aircraft on the agreed scale, despite the fact that the air force lacked 30 per cent of its first line requirements for Home Defence fighters, that the bomber strength was seriously behind schedule, and that the forces of Coastal Command were far short of what was needed.[2] The decision earlier that year to double the size of the Army had inevitably affected the air programme. It was hoped to increase the production of Lysanders to 160 a month in order to be able to maintain the number of squadrons required on the existing allotment basis. The question of providing additional fighters and bombers was under discussion, and much effort was being made to produce light aircraft for improved application of artillery fire. There could be no hope, however, of providing an Air Component (reconnaissance and fighter aircraft) on the full scale for a force of 55 Divisions by the end of two years as had been proposed. To meet the Army demand for an additional new 250 first line direct support aircraft, together with the large number of reserves needed, by the spring of 1940, was therefore quite impossible unless the other Commands of the Royal Air Force were to be greatly reduced.

If large numbers of aircraft were produced which were only suitable for Army needs, an Army Air Force would in effect be established and this would clearly result in a dissipation of effort.[3] What the Army really required was as many good bombers as could quickly be provided. Air requirements could not be calculated on a divisional basis, but depended upon various other factors such as the length of front, the scale of attack, the enemy's strength and disposition, the nature of the terrain and communications behind the enemy's lines, the enemy fighter and ant-aircraft strength, and our own fighter strength for the support of bomber operations. Although the strength of ground forces affected the scale of air forces required, it was not necessarily in the sense that the more divisions we had the more air support was required.[4] The estimate of 250 first line bombers might be too great or too small, but on the whole was considered reasonable and was already met.[5] This force could be maintained on the existing programme until 1942 and would be given special training in the direct support role. In the meantime the development of prototypes for large scale production and complying as nearly as possible with the War Office requirements was to be continued, and it was decided by the War Cabinet that the whole of the Air Striking Force was to be made available for whatever the strategical situation might require and that subject to this, the Army was to have full assurances regarding air support.

British Air Forces in France

At the beginning of the war the Royal Air Force in France consisted of two entirely separate organisations both for operations and administration (except for a part of the maintenance organisation which was common to both) namely

1 A.M. File C.S.1480.
2 A.H.B./ID2/145
3 War Cabinet Meeting, 8 November 1939.
4 D.C.A.S. Note to General Ismay, 19 November 1939.
5 W.P.(39) 127, Annex I.

the Advanced Air Striking Force and the Air Component of the Field Force.[1] Three British Air Staff Missions were also established. In view of the operations expected in 1940, it was agreed at War Cabinet level on 8 December 1939 to form a Royal Air Force Command to co-ordinate the operations of all Royal Air Force Units in France. A proportion of suitable aircraft was to be allotted for work with the Army and was to be placed at the disposal of the G.O.C.-in-C. unless an emergency arose which made it necessary to use them for some other purpose.[2] The new formation was to be named British Air Forces in France (B.A.F.F.) and was to be commanded by an A.O.C.-in.C. whose position *vis-à-vis* his own Government was to be similar to that of the G.O.C.-in-C., B.E.F. He was not, however, to come under the orders of any French General. The command included all the bomber squadrons of the A.A.S.F. in France which were thus detached from Bomber Command, and they were to receive such special training in air support as was necessary. The Air Component of the B.E.F. was absorbed by the new Command but retained an A.O.C. who would continue to advise the G.O.C.-in-C., B.E.F. and remain under the latter's operational control. Tasks for the A.A.S.F. were to be allotted in accordance with the day-to-day needs of the whole Allied western front, but the A.O.C.-in-C., B.A.F.F. was to see that the G.O.C.-in-C. had at all times full assurances of air support and that bomber squadrons were placed at his disposal when necessary. Should it be required to place the A.A.S.F. or any part of it under the command of the A.O.C.-in-C. Bomber Command, the Chiefs of Staff were required to obtain War Cabinet sanction. This policy for a measure of decentralisation of the bomber force and the establishment of a single command in France was made effective from 15 January 1940, and Air Marshal Barratt was appointed Air Officer Commanding-in-Chief.[3]

As has been stated, the French had agreed to the allotment of airfields to the Royal Air Force but in fact these were insufficient and, in some cases either unsuitable or unserviceable during the winter. Maintenance and training and, above all, security and flexibility were prejudiced from the start but fortunately the enemy took no advantage of local congestion. However, the need for mobility with its demand for an organisation capable of constructing airfields rapidly and the ability of units to move quickly had been considerably clouded by the defensive and static conception of the opening phase of the war. Rapid movement was not foreseen and, when it became necessary in May 1940, our air forces were inadequately organised and ill-equipped for such manoeuvres.[4]

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1 Air Marshal Barratt's Report.
2 War Cabinet Meeting, 8 November 1939.
3 A.M. File S.3054, Appendix ' C ' to Air Marshal Barratt's Report.
4 Air Marshal Barratt's Report

CHAPTER 2

THE CAMPAIGN IN FRANCE, 1940

The German Offensive in France and the Low Countries

At 0215 hours on 9 May 1940 Air Marshal Barratt was informed that Germany had issued an ultimatum to Holland and in the early hours of 10 May the German attack in the west began. Military assaults against the frontiers of Holland, Belgium and Luxembourg were combined with air attacks against airfields and communications in these countries and in France. In Holland a full scale air invasion was also launched. The enemy advances on the first day were considerable and the British and French forces immediately began their pivotal movement on Mezieres in accordance with the preconceived plan. By 12 May the initial part of this move had been completed, enemy progress across the Albert Canal had been slowed and the French had taken position on the Gembloux line.

The enemy advance had been rapid but in general the application of the initial air plan was successful and the control organisation worked smoothly. The fighters of the Air Component however, had to meet extremely heavy demands and although in three days' operations 101 enemy aircraft were claimed to have been destroyed (mostly fighters) for a loss of 78 of our own, the Component fighter force was reduced to some 50 aircraft by 12 May.

The enemy's practice of establishing strong anti-aircraft defences, particularly in towns at which roads converged, detracted much from the ability of the air forces to impede his advance. However, during the week 10–15 May A.A.S.F. aircraft attacked mechanised columns approaching Luxembourg, although out of the 32 aircraft used in the initial attacks 12 were lost. A large section of the light bomber force also attacked enemy columns on the Maastricht-Tongres road and canal bridges west of Maastricht. On the Zundert-Breda road A.A.S.F. aircraft collapsed a factory in order to assist in the withdrawal of the French Seventh Army. Pontoon bridges on the Meuse and mechanical columns in the Sedan area were constantly attacked, in the course of which more than 40 Fairey Battle aircraft were lost out of a total of eighty. The tasks of the Blenheims of No. 2 Group were to attack the Dutch airfields at Waalhaven and Ypenburg, which were in enemy hands, troop concentrations near Eindhoven, Maastricht, Aachen and Maesyck and to disrupt the crossings of the Meuse. They were also to attack enemy communications in the Tilburg-Breda area and concentrations in the immediate approaches to the Dinant area.

Enemy fighter activity and ' flak ' concentrations hindered air reconnaissance and our losses were very great. During the short period 10 May to 4 June some 33 Lysanders and 38 Blenheims out of an initial force of 90 and 68 respectively were reported as having failed to return, been destroyed on the ground or so badly damaged as to be abandoned in the evacuation. In the case of the P.R. Spitfires, however, only two aircraft were lost in the same period.

On 15 May the Dutch Army laid down its arms and the French Seventh Army withdrew its advanced formations to the vicinity of Antwerp. The British front was holding the enemy attacks, but the French First Army had

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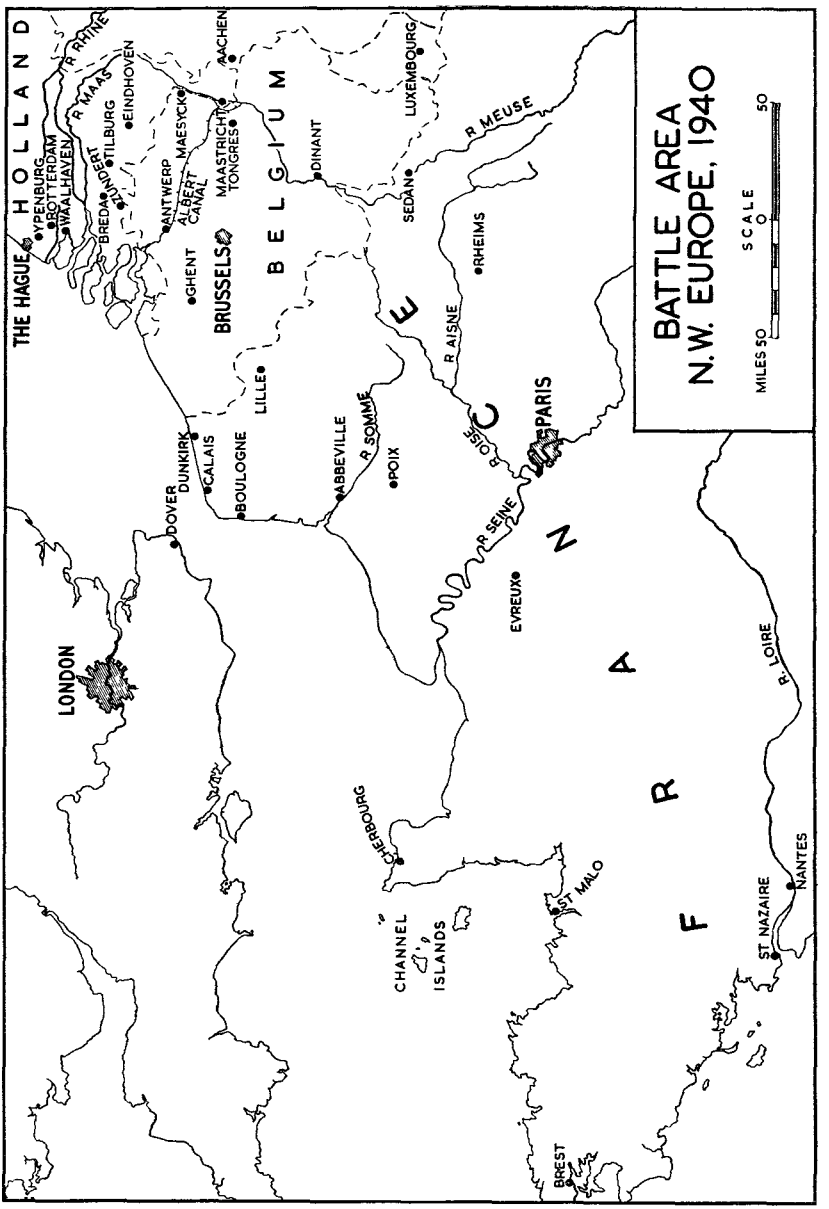
lost ground, and enemy bombing in the rear areas, together with the movement of refugees, was beginning to present a difficult problem. It was now evident that a further deterioration of the position in the south would force a withdrawal of the French First Army, the B.E.F. and the Belgian Army. It was planned to withdraw to the Escaut area where positions would be occupied in accordance with a pre-arranged plan and this retreat was completed by the afternoon of 17 May. In the south a gap of 20 miles now existed and three British divisions in the rear area were ordered to take up positions. On the 18th the bulk of the



A.A.S.F. moved from the Rheims area to central France, and the next morning the Air Component abandoned Poix and occupied airfields at Abbeville, which they evacuated the following evening. On the 19th a meeting had been called at the War Office to consider the problem of ' the hazardous (but unlikely) evacuation of very large Forces ' from the Continent.

From 21 May onwards all arrangements for air support for the B.E.F. were made by the War Office in conjunction with the Air Ministry at home, targets being selected in accordance with telephone or telegraphic requests from the B.E.F. as long as communications remained open. From 23 May to 4 June no Blenheim operations by No. 2 Group were requested by B.A.F.F., owing to the lack of communications and information and all tasks were allotted from the United Kingdom.

The situation had now deteriorated rapidly and it became apparent that the enemy advance would necessitate the evacuation of at least a part of the Allied forces. This created grave problems for the Royal Air Force since the choice of Dunkirk as the port of evacuation was far from ideal. Dunkirk was farther from the Royal Air Force bases than either Calais or Boulogne and this was important in view of the fighters' limited endurance. Secondly, if the B.E.F. were unable to hold a front to the east of a line Calais-Abbeville, all the fighter airfields in North-West France would have to be abandoned involving a considerable reduction in the amount of cover which could be provided for the area of withdrawal.[1] However, in the circumstances the Allies were given little choice. Fortunately the implications resulting from a French collapse had been foreseen and on 18 May orders were given to direct all fighter replacements to Fighter Command at the expense of the squadrons in France.[2]

At 1857 hours on 26 May the executive order for the evacuation from Dunkirk (Operation Dynamo) was given by the Admiralty. A detailed account of the operations of the Royal Air Force during the evacuation is outside the scope of this monograph but it may be noted that air support was generally effected in the following ways :—

(*a*) Day and night bombing attacks on communications in the enemy's rear.

(*b*) Reconnaissance flights which often entailed the diversion of precious fighters for escort duties.

(*c*) Anti-submarine and other patrols over the Channel areas.

(*d*) Fighter patrols over the evacuation area itself.

From 28 May the policy of sending fighter patrols over less frequently, but in greater strength was adopted, one patrol on 29 May being of 44 aircraft.[3] After 2 June the fact that German guns were now within range of the beaches at Dunkirk enforced the decision to evacuate by night only. This materially assisted Fighter Command who were thus able to step up the strength of the

1 A.H.B./IIH/133, Encl. 39A.

2 A.M. Signal O.224 18/5.

3 A.M. Signal X.268, 28/5. No. 11 Group O.R.B. Dunkirk was outside the range of controlled interception based on radar plots. It was therefore impossible to intercept specific enemy raids. (A.M. Footnote to Admi. Ramsay's Despatch A.M. File C.32101/46).

two main patrols at dawn and dusk and interference from the *Luftwaffe* was lessened. The deterioration in the weather and the ability of Fighter Command to operate in greater strength resulted in more effective interception and decreased enemy attacks until the evacuation was completed on 4 June. During the period 26 May to 4 June inclusive No. 11 Group fighters flew some 101 patrols totalling 4,822 flying hours and claimed the destruction of 262 enemy aircraft.[1]

After Dunkirk

The total Royal Air Force strength in France available (after reinforcement) for the battles on the Somme and the Aisne was represented by 96 bombers, 80 fighters and six P.R. Spitfires, although only about half this force was available when the enemy launched further heavy attacks on 5 June. A force of some 60 Blenheims gave support to the ground forces by day attacks on river crossings, enemy concentrations, road defiles and enemy columns close to the front line. Owing to range, fighter operations were limited to the north of France. Furthermore, the need to rest and re-equip after the fighting in support of Dunkirk, in order to prepare for the defence of Great Britain, the shortage of certain items of equipment such as V.H.F. R/T and incendiary ammunition, and the obvious need to conserve the force for the more profitable task of engaging the enemy within the Metropolitan air defence system, all emphasised the necessity of restricting rather than enlarging upon Fighter Command's commitments over France. Thus, although seventeen squadrons represented the force that could be spared for the operations in France, a total of 272 fighters may be added to the 80 eventually available to the A.A.S.F. Reconnaissance was provided by the detachment to France of a few aircraft at a time for a few days duty, and although several Blenheim squadrons existed only two were engaged in operations. The disposition of strengths in May showed a marked disparity between the Allies and the enemy.

United Kingdom	692	aircraft
R.A.F. in France	182	,,
French[2]	675	,,
Allied Total	1,549	,,
G.A.F. at 75 per cent of establishment	2,969	,,

The Allies were outnumbered by almost one and a half to one in fighters, two to one in reconnaissance and three to one in bomber aircraft.

The German offensive, which began on 5 June, with five major thrusts to the south, reached Paris by 14 June, and the French Government moved to Bordeaux. The B.E.F. was removed from French command, but continued to co-operate with the French forces with which it had been operating and preparations were begun for the evacuation of those elements which were not actually operating with the Tenth Army. The air forces were relieved from the duty of co-operating with the French and instructed to concentrate on pro-

[1] Adml. Ramsay's Despatch.

[2] Not including 100 fighters which were either night fighters or deployed for air defence against Italy.

tecting the B.E.F. withdrawal. Authorisation for complete evacuation was given on 17 June. In the south the Air Force contingent (Haddock Force) sailed from Marseilles on 18 June. The A.A.S.F. Bomber Force had already been ordered to return to the United Kingdom on 15 June in order to relieve the congestion on the few remaining airfields, and cover for the military evacuation was provided by the five fighter squadrons of which two were placed under South Component for the protection of Cherbourg and St. Malo, and three were to operate from Nantes under B.A.F.F. Headquarters for the protection of Nantes and St. Nazaire. The bulk of the ground personnel of the bomber wings sailed from Brest during the night of 16 June and the South Component with its two fighter squadrons moved to the Channel Islands on 17 June. Air support bombing operations ended with the attack of trains and transport in the Evreux district by the A.A.S.F. Battles during their return flight to the United Kingdom on 15 June and with a small operation by six home-based Blenheims against road movement near Cherbourg on the 18th. Pétain requested an armistice on the 17th and on 19 June South Component completed the evacuation of the British forces by leaving the Channel Islands.

Conclusions from the Campaign[1]

The advantage of having a single authority for the command and administration of all Royal Air Force formations in a theatre of war was clearly demonstrated and indicated the need for one supreme commander of all the air forces in one theatre with a fully representative headquarters. Owing to the fact that Headquarters B.A.A.F. had been formed as a policy headquarters for the control of two fully staffed air forces (Air Component and A.A.S.F.), it was established almost entirely with administrative services. This arrangement did not prove satisfactory when the subordinate commands became intensively engaged and the need for frequent movement arose.

The necessity for good communications was again illustrated and, except for short periods, Headquarters B.A.F.F. was in communication throughout the campaign with the Air Ministry, Headquarters A.A.S.F., South Component on the Seine and Haddock Force in the south of France. This was achieved by siting the principal headquarters on the lines of existing main truck cables, by the use of normal point to point W/T, by transmissions to the Air Ministry and Bomber Command via the Eiffel Tower and by means of two Heavy Mobile W/T Stations (Blue Trains) fitted for high power and high speed transmission. The principal example of failure was in respect of direct land line communication between Headquarters B.A.F.F. and the Air Component. This system broke down early in the battle.

In spite of an Air Ministry review of the transport establishment of the Royal Air Force in France and the local purchase of light vans, the force was some 600 vehicles short of a plan only designed to give semi-mobility when it faced the crisis in May. The group and wing transport of the Air Component was reorganised but the A.A.S.F. found itself in a most difficult predicament and had to rely largely on borrowed French vehicles.

[1] On 24 June 1940 Air Chief Marshal Sir Robert Brooke-Popham was appointed chairman of a committee to investigate air war experiences by interviewing members of representative ranks and different units who had had recent war experiences. The report was finished by 16 July and included the following points.

There is no doubt that operations by the Royal Air Force made a definite contribution to the successful withdrawal to Dunkirk and the final evacuation. But the greatest achievement was the survival from the unequal battle, of an air force strong enough to defend the British Isles against the large scale enemy air offensive during the summer and early autumn of 1940. More precisely, the experiences of the campaign gave a powerful impetus to the development of an air support organisation and resulted in the formation of Army Co-operation Command before the end of the year.

CHAPTER 3

THE UNITED KINGDOM : THE RE-ORGANISATION OF AIR SUPPORT, 1940-1943

The Importance of General Air Superiority

Experience during the first years of the war confirmed that success in a ground battle depended largely upon air superiority. No carefully balanced force of reconnaissance, bomber and fighter squadrons forming an integral part of each Corps and Army could ensure the success of the land campaign.[1] The essential need was for a high degree of air superiority and the size of the force necessary to obtain that superiority would vary, not in relation to the size of the ground forces engaged, but to the strength of the air forces which it opposed. It was necessary, therefore, to build up an air force of bombers and fighters large enough, after allowing for the security of bases and communications, to enable an air situation to be created in which the ground forces could operate freely, and reconnaissance aircraft would be unmolested. A specialised Army Support Force could only be provided at great expense to the growing power of the Royal Air Force for strategic action, and there seemed little prospect of defeating the enemy except by the development of a superior bomber force.[2] The most economical means to this end was considered to be the heavy bomber, and this implied that a maximum number of the bomber squadrons would only provide for a small fraction of the Army's specialised requirements.

The Army was less conscious than the Royal Air Force of the broad conception of the effect of air superiority and tended to place emphasis upon the need to employ air forces against targets closely related to the battlefield.[3] This widespread misconception of the root cause of German successes gave rise to a demand for dive bombers, but, as it seemed probable that in any future land battle more effective support would be provided by bomber action against other than close support targets, the Chief of Staff decided on 19 February 1941, with the agreement of the War Office, that ' no more dive bombers need be ordered.'[4] The success of the Luftwaffe in France and the Low Countries in 1940 was not primarily an example of well organised support but of the effects resulting from German air superiority. This vitally important point was not fully appreciated by the Army at the time but it was, and is, the cardinal factor in the application of any air support. It was therefore accepted that the Royal Air Force should expand and re-equip to the extent required for security in the first instance, the bomber offensive in the second, and finally for air support.

Army Co-operation Command

After the evacuation from Dunkirk, the Army was disorganised, and lacked clothing, equipment and, above all, guns. Invasion became an immediate threat and the Army asked for close support dive bombing on the German model. This request was resisted but certain light bomber squadrons were earmarked for decentralisation to Army Commands and a Central Combined

1 A.M. File S.7736.
2 A.M. File S.6162.
3 A.M. File S.6461.
4 A.M. File S.6162.

Operations Room (C.C.O.R.) was installed at G.H.Q. Home Forces.[1] Agreement was then obtained to centralise once more the control of bombers under Bomber Command. The C.C.O.R. was thus the instrument by which the C.-in-C. Home Forces was enabled to convey to the A.O.C.-in-C. Bomber Command his requirements for air bombardment in support of land forces in the event of invasion.[2] At each Army Command Headquarters there was a Combined Operations Room (C.O.R.) which was smaller but similar to the C.C.O.R. These C.O.Rs. were responsible for keeping the C.C.O.R. fully informed of the land situation with particular reference to Air Support, and the C.C.O.R. was to keep Bomber Command informed. At G.H.Q. Home Forces a small Air Staff was established under a Senior Air Staff Officer who acted as air adviser to the C.-in-C. A Deputy Directorate of the Director of Plans at the Air Ministry kept in close touch with the War Office and dealt with matters of policy in connection with the air requirements of the army. Finally the execution of policy in respect of all air forces under the operational control of the C.-in-C. Home Forces (army co-operation squadrons) and the organisation and administration of all army co-operation squadrons, schools and establishments was vested in the A.O.C. No. 22 Group. The squadrons were, however, controlled operationally by Army and Corps Commanders.

This organisation was in some respects an improvisation for the control of air forces which had been placed at the disposal of the C.-in-C. for defence against invasion, but it was not able to deal with matters of policy with regard to future development and training to meet the requirements of the Army both for Home Defence and operations overseas.[3] Progress in this important work was a secondary responsibility of a number of officials at the Ministries and, since the matter was urgent, the War Office advocated that this responsibility should become the primary charge of high ranking officers in the Army and Royal Air Force working in close co-operation. The setting up of an establishment which combined the appropriate Directorates of both the Air Ministry and the War Office still presented practical difficulties and the War Office therefore recommended the formation of a separate Army Co-operation Command. This was agreed and the new Command formed on 1 December 1940 with Air Marshal Sir Arthur S. Barratt as the Air Officer Commanding-in-Chief. At the same time a Directorate of Military Co-operation was formed at the Air Ministry and No. 22 Group was disbanded.

The Command was organised in two groups as follows :—

(*a*) No. 70 (Training) Group, which was to control the policy, training and administration of the units under its control.

(*b*) No. 71 (Operations) Group, comprising all the operational squadrons allotted to Home Forces. It had an Advanced Headquarters located with G.H.Q. Home Forces which consisted of the Air Intelligence Staffs of the Group from where the A.O.C. normally exercised command. The Group Commander was charged, in the capacity of A.O.C. of an Air Component, with advising the C.-in-C. on all matters relating to the Air Force, and with the responsibility for the administration and

[1] A.C.C./S.55/Air.
[2] No. 71 Group, A.S.I. No. 2 (A.H.B./IIL/15).
[3] A.M. File S.6461.

technical efficiency of the air forces in the Group.[1] He was to receive his orders regarding operations through the General Staff of G.H.Q. Home Forces, but he was to be responsible for the means employed to carry out these tasks.

The A.O.C.-in-C. was charged with the supervision of all air training in co-operation with the Army and with the development of the tactics and technique of Army Co-operation, including close support. A portion of the posts in the Command and Group Headquarters were filled by Army officers and the A.O.C.-in-C. was given a Brigadier as his Senior Air Staff Officer.

The anomalous position remained, however, in that the A.O.C.-in.C. had no operational responsibility and was excluded from discussions of policy in respect of such problems as the employment of bomber squadrons in close support of Home Forces. His task was to implement the training policy, and his subordinate was interposed as adviser to the C.-in-C. Home Forces. The reason for this arrangement was that, in the event of an invasion, Home Forces—charged with the defence of the United Kingdom—would have to make certain demands upon the other Royal Air Force Commanders-in-Chief, and the establishment of the A.O.C.-in.-C. Army Co-operation Command as adviser to the G.O.C.-in-C. Home Forces might well have provoked unnecessary difficulties. A four day home defence exercise known as ' Victor I ' revealed, however, that the A.O.C. No. 71 Group could not be expected to act as adviser to the C.-in-C. in addition to exercising command of his squadrons and, consequently, a Senior Air Staff Officer was re-established as adviser and principal liaison officer to the C.-in-C. Home Forces on all air matters and the No. 71 Group Staff was withdrawn from G.H.Q. Liaison officers were, however, retained at G.H.Q. in order to represent the A.O.C.-in-C. and the A.O.C. No. 71 Group and thus the G.O.C.-in-C. had links both to the Air Ministry and to Army Co-operation Command. This system again was not entirely satisfactory, and it gradually became clear that the Military Commander should have no more than one Air Staff represented at his Headquarters. In the circumstances the obvious choice was that this should be provided by Army Co-operation Command. The S.A.S.O., who had been provided by the Air Ministry, was therefore withdrawn in July 1941 and a strengthened Air Staff, known as Royal Air Force G.H.Q., was provided from Army Co-operation Command.[2]

In August 1941 No. 71 Group and the small Air Staffs at the Headquarters of Army Commands were abolished and were replaced by six Wing Headquarters which were allotted to each Army Command and were given the following responsibilities :—[3]

(*a*) To command the Army Co-operation (A.C.) squadrons with the Army.

(*b*) To command re-inforcing A.C. squadrons joining the Army in operations, including those A.C. squadrons provided for giving air support.

(*c*) To organise the movements of squadrons during operations.

(*d*) To man the air operations room at Army Headquarters. This was the link through which the Army Commander made requests on the air cell at G.H.Q., for assistance from Bomber and Fighter Commands, etc.

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[1] A.P.1300 Chap. XI, para. 7.
[2] A.M. File C.S.8277.
[3] A.C.C./S.50/3/Air and A.C.C./S.50/1/Air

(*e*) To act as a liaison line between the Army Commander and adjacent Royal Air Force groups in the event of any general breakdown in communications.

(*f*) To advise the Army Commander at all times on air matters.

Each Army Co-operation Wing was commanded by a Royal Air Force officer who had executive control under the Army Commander of all the A.C. squadrons within the Command, but the operational control by the Army Corps etc., of A.C. squadrons sub-allotted to them was not to be effected. The four Army Air Support Controls (A.S.S.C.) in existence were to be the medium for controlling Army Air Support, with the respective Wing Headquarters as the controlling Royal Air Force authority.[1]

The Development of Air Support Controls, 1940–1941

Following the campaigns in the Low Countries, France and Norway, attention was focused upon the need to find a way of co-ordinating and providing close support to meet the requirements of the Army, particularly of armoured formations.[2] The existing methods for the provision and control of direct support (excluding close support) were satisfactory, but, with the increasing mechanisation of ground forces, the outdistancing of artillery was likely to become a regular feature of army operations.

A study was therefore made of German methods and the experiences of recent campaigns, and extensive trials were carried out in Northern Ireland during September and October 1940 under the direction of Group Captain A. H. Wann and Lieutenant Colonel J. D. Woodhall with the active co-operation of No. 75 Wing and Army forces. Despite German success in the application of close support, it was clear that this form of assistance was still subject to tactical considerations and to certain basic limitations.[3] The enemy had made extensive use of direct support, but under conditions of almost complete air superiority and with negligible opposition from ground anti-aircraft weapons.[4] This had given him a freedom of choice in his methods of applying air support which was unlikely to be repeated for either side, and which enabled him to use the highly vulnerable Ju.87 dive bomber in a manner which with more evenly balanced forces would have proved disastrous. The object of the trials was to develop an organisation which would be capable of providing the necessary air support for future operations. The trials resulted in the issue early in December 1940 of an agreed policy for the organisation and methods of demanding and applying close support. The problems involved were carefully considered and a system was produced which was both flexible and yet maintained the necessary co-ordinated control.[5] The methods and the organisation for air support were carefully discussed and when agreement was reached between the Army and the Royal Air Force, the conclusions were published in the Army Training Instruction No. 6 which was issued on 31 October 1941.[6]

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1 Not necessarily applicable at the time to No. 2 Group.

2 A.M. File C.S.5943.

3 A.H.B./IIL/41, Encl. 36A.

4 Army Co-operation Command Directive on Close Support, Encl. 48A.

5 *See* Appendix 1.

6 *See* Appendix 2.

This instruction categorised the forms which air support would take, stated the responsibilities of the Royal Air Force for the provision of an Army Co-operation Force operating under Army control and for the provision of air support by air forces under separate Royal Air Force command, and broadly defined the means by which the Army was to assist the air forces in the field. The types of air reconnaissance and the level of control were recorded, the nature and methods of controlling were explained, and, in a note on the selection of targets, examples were given of targets which might be usefully attacked on the battlefield and the most vulnerable points in communications networks.

Close Support Bomber Controls (C.S.B.C.) were introduced in January 1941 for use in England and Northern Ireland and exercises were begun with the object of examining the methods of allotment of effort, the time factor, the selection of targets with reference to their suitability and tactical necessity for engagement by aircraft, the method of description, and the effect likely to be obtained from the effort available.[1] The limiting factor in this programme was, however, the heavy demand of current operations upon the light bomber force which made it necessary either to carry out the majority of the training by means of signals exercises alone, or with reconnaissance aircraft simulating the operations of bombers. Unfavourable weather also restricted the use of bombers and by the middle of March 1941 only 45 light bomber sorties had been flown on exercises. Furthermore, the Air Staff was strongly opposed to the use of bomber forces in a close support role during invasion and regarded the training as having little connection with preparations for home defence. It was considered unlikely that, during an invasion, the situation would lend itself to close support operations and it was argued that bombers would be of most service if employed to attack surface craft at their ports of departure and at sea, and enemy forces in the act of disembarkation or in a bridgehead. This conception did not get the unreserved acceptance of the War Office, and, unfortunately, the fact that exercises were to be directed towards the development of air support in the Field rather than for Home Defence was slow in percolating down to the air units involved. Nevertheless, useful experience was gained which revealed the need for a higher standard of formation flying by the bombers, a clearer appreciation of what constituted a proper bomber objective by the Army, situation reports by the airfields, and for a C.S.B.C. to be placed under No. 2 Group during exercises (the two C.S.B.C.s were in fact allotted to Nos. 70 and 71 Groups in Army Co-operation Command).[2]

Training in the close support with No. 2 Group bombers was not continued during the months of April, May and June owing to intensive operational commitments but in the meantime it was agreed that light bombers should be capable of acting during an invasion in quick response to a call for support through the medium of a C.S.B.C. attached to military headquarters. This met the requirement of the C.-in-C. Home Forces who argued that bombers should be prepared to attack defended nodal points, the crossings over obstacles such as rivers, artillery positions, the movements of reserves when concentrated, concentrations of transport, and enemy headquarters. The particular feature of these targets was not that they were either 'close' or 'direct' support objectives, but that their attack was designed to have an immediate or very

1 *See* Appendix 3.
2 A.M. File C.S.7807.

early effect on the battle, and that they were all capable of engagement through the C.S.B.C. The terms ' close ' and ' direct ' support were obviously misleading for, with regard to the method of control, the really important distinction between targets was the extent to which a rapid response was necessary. It was therefore decided to adopt the term ' Army Air Support ' to cover all targets engaged through the quick support medium of the C.S.B.C. and subsequently the C.S.B.C. itself was renamed the Army Air Support Control (A.A.S.C.).

The various Army Commands had already been affiliated and connected by land line and wireless to No. 2 Group stations and the early exercises had tested these communications and practised the operations and intelligence staffs of the Group Headquarters and stations. This arrangement was satisfactory for pre-arranged direct support but the problem was not to train the Royal Air Force in Army Air Support, the Army in the widest use of this support, and to perfect the organisation for the provision of support including the method of control. A series of exercises were therefore organised during July and August 1941, under the direction of the A.O.C.-in-C. Army Co-operation Command, in which the staff and squadrons of No. 2 Group gave full co-operation, and the squadrons completed their initial training in air support.

The C.S.B.C. was located at Corps Headquarters and training began at East Raynham where the organisation and the methods to be adopted were examined. Thereafter exercises were held to train all the No. 2 Group stations together with their affiliated corps, and particular attention was paid to quick briefing, the turn round of aircraft, the recognition of targets, the form of attack, the use of the C.S.B.C., and staff and signals procedure.

By the end of these exercises army air support had been effectively established as part of the role of the Royal Air Force during an invasion and when Exercise Bumper was held in the autumn of 1941 to study the employment of armoured/motorised corps and the delivery of a large scale counter offensive against hostile landings, the aim of the air side of the exercise was as follows :—[1]

(*a*) To study the employment of aircraft (including fighters) in Army Air Support of large military formations in offensive operations.

(*b*) To study the employment of army co-operation squadrons in their reconnaissance role when working with corps and armoured divisions.

By far the greatest difficulty during Bumper, was that caused by the very unsatisfactory performance of the communication system. The Army Air Support Control was rightly sited in a position from which it was intended to cover the whole front but this in turn increased the importance of adequate communications to the formations controlling reconnaissance and to forward elements. Owing to the decentralisation of reconnaissance to lower formations and the inadequacy of communications it was found that insufficient information reached army level to enable army air support to be directed to the best advantage and comparatively few requests for air support were received over the tentacles. But although the scarcity of information from this source could be attributed in part to a reduction in numbers of the tentacles (to less than the

[1] A.H.B./ID3/1745 Pt. 3 and A.H.B./IIL/16/12.

originally proposed complement of nine) and to the inadequacy of their range, it became evident that the most profitable source of targets would be from air reconnaissance by fighter reconnaissance aircraft and that the real weakness lay in the failure of such information to reach Army Headquarters. This necessitated a considerable improvement in communications, including the use of listening sets as air tentacles, in order that the results of reconnaissance might be made available at Army Headquarters and the A.A.S.C. In fact, the whole problem of providing sufficient information at the Army level was so urgent that it appeared likely that the solution would have to be met in part by the compromise measure of providing each army with more than one A.A.S.C., in order that effective control over the whole front might be directed from a lower level as necessary.

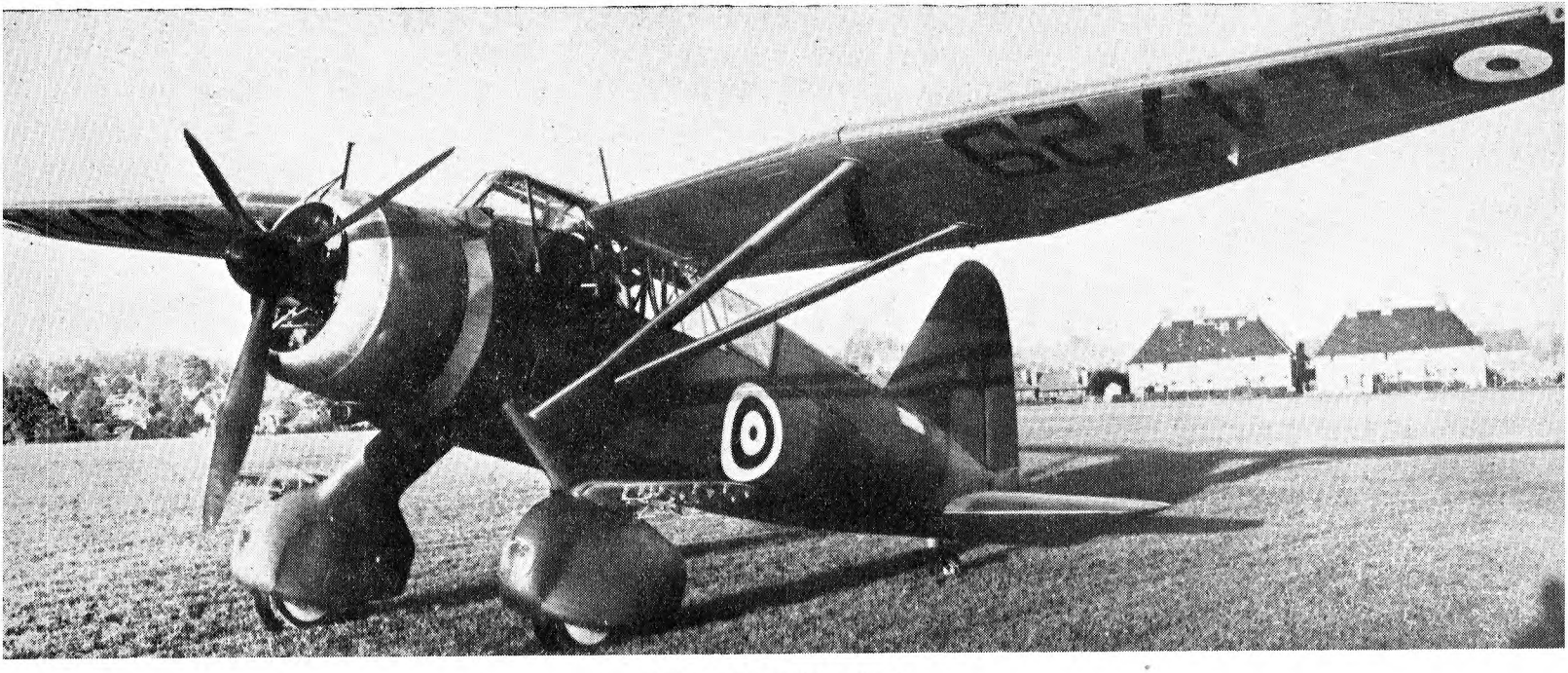
It also became apparent that the task devolving on the senior Royal Air Force Officer at the A.A.S.C. demanded personal qualities of a high order, since he was responsible for the direction during battle of all the squadrons placed in army air support. He required a full knowledge of the capabilities of fighters and bombers in this role and the necessary judgment on air matters to enable him to employ his resources to the best advantage in accordance with the military commanders' aim. The A.A.S.C. organisation provided an extremely flexible means of controlling aircraft in accordance with information received either from tentacles or from air reconnaissance. But wise judgment was needed in the allocation of effort and the selection of targets as it was very easy to dissipate the limited air effort by attacking objectives which, though attractive in themselves, might have no effect commensurate with the probable wastage of the battle as a whole. The need for a plan throughout the battle had therefore to be heavily stressed and arrangements made to ensure that the air effort was allotted and expended in the most profitable manner.

Tactical and Artillery Reconnaissance

Although in modern conditions tactical reconnaissance was often a matter for special missions rather than for continuous patrols the Lysander had shown itself to be quite unsuitable for such tasks. A faster and less vulnerable aircraft was required which would also be capable of carrying bombs in order to carry out ground attack under the direct orders of the Army formation to which the units were attached. From the point of view of economy it was also desirable that one aircraft should combine the two functions of support bombing and reconnaissance and continued efforts were therefore made to find a suitable replacement.[1]

Considerable changes had also occurred in artillery reconnaissance and spotting. The system hitherto employed was based on the experience of the 1914–1918 war in a situation of static warfare with masses of artillery on either side of a more or less stable line. Artillery, however, no longer consisted of isolated units of four or six guns. The Field Regiment, itself of 24 guns, was often able to shoot as one battery and simple methods of linking batteries graphically had reached a stage at which a single observation post, given good command, could switch and concentrate the fire of a mass of artillery with almost the ease which formerly could only be attained for a single battery. In

[1] *See* Appendix 4.



WESTLAND LYSANDER

addition to these advances, research had eliminated the need for many of the old and slow methods of ranging. It seemed probable, therefore, that an aircraft could act as a high observation post from which the battlefield could be seen and the fire of a mass of artillery could be controlled. Several types of aircraft had been tried before the war and a flight of Taylorcraft had flown to France in April 1940, but was withdrawn at the opening of the German offensive. These were the foundations of the Air Observation Post.[1]

The Composite Group

By the beginning of 1942 the War Office was becoming worried over the ability of the Royal Air Force to provide full assistance for a land compaign in Europe. Air superiority, reconnaissance, army air support, and air transportation were needed but, of these, the stated requirement for air transportation was completely beyond the realms of practicability and the provision being made for reconnaissance and Army Air Support was unsatisfactory, largely owing to the fact that army co-operation took third place in the provision of aircraft.[2] Furthermore, American resources were being diverted to other theatres and the United Kingdom was committed to sending two hundred aircraft to Russia each month.

By February 1942 the Air Ministry schedule to meet the Home Forces requirements in Army Co-operation aircraft by the provision of ten fighter reconnaissance and ten bomber reconnaissance squadrons, was being met by only fourteen squadrons and of the eight Tomahawk squadrons only thirty-five aircraft were serviceable.[3] Under the impact of fresh reverses in the Far East, the War Office now demanded an enlarged Army Co-operation Force totalling over four thousand aircraft of all types. The Air Staff could not possibly agree to this demand and it was again stressed that the primary need of the Army was for general air superiority, and that an army co-operation force would be backed by the full weight of the Metropolitan Air Force in Continental operations. It was proposed, however, to train and equip a number of fighter squadrons for Army Air Support in order to offset the tactical inadequacy of the light bomber, and a settlement was reached on 19 May 1942. No decision was reached as to whether or not light bombers (or fighters) were eventually to become part of a composite Army Co-operation Force, and the question of an airborne lift was left in abeyance.[4] Under the agreement :—

(*a*) The strength of Army Co-operation Command was to be built up to twenty squadrons by 1 September 1942.

(*b*) The light bomber Group (No. 2) was to be built up to twenty squadrons, organised and trained with the Army for Army Air Support, subject to overseas commitments and the fulfilment of American deliveries.

(*c*) Fifteen cannon-fighter squadrons were to be made available from Fighter Command to exercise and operate with the Army.

No organisation was specified either for training or operations although the possibility of opening a second front in Europe was being closely studied at the time. In June 1942, however, the C.I.G.S. presented a proposal, prepared by

1 *See* Appendix 4.
2 C.O.S., D.O.(42) 8 and 34.
3 A.H.B./ID3/1745.
4 C.O.S.(42) 155 and 208.

the S.A.S.O. at G.H.Q. Home Forces, for the formation of a new mobile Royal Air Force Army Air Support Group, on a Field Force basis within Army Co-operation Command, consisting of bomber and fighter types of aircraft specially designed for the attack of ground targets. This proposal possessed the special attraction of involving a comparatively small immediate commitment of aircraft, of probably closing the argument in favour of placing No. 2 Group under Army control, and of being able to satisfy the Army that a Royal Air Force organisation would be created whose attention would be entirely focused upon the problem of Army Air Support. The organisation would be gradually built up for active operations, and not hurriedly devised and assembled at the last moment. Training would be standardised, operations would be practised from advanced grounds, and an effective army air support weapon would be created. Furthermore, the War Office agreed that such a force should be employed in the main offensive until the beginning of land operations.

Owing to the unsuitability of the Blenheim or the Boston, owing to a high casualty rate from light 'flak' at low altitudes and inaccuracy in bombing at height, Army interest was partially withdrawn from No. 2 Group. It followed, from the limitations of the light bomber, that the fighter would become the primary support weapon, in which task it has already been proved extremely effective against thin skinned targets. The fighter, however, was still largely ineffective against armoured vehicles and it was also susceptible to light 'flak'. Experience of the Middle East campaign showed that fighters could be modified to give the pilots and vital aircraft parts greater protection and be more suitably armed for the attack of ground targets. Thus the standard fighter aircraft could be converted to an effective support weapon without incurring the risk of introducing a further specialised type with limited application.[1] In the Army view it was most desirable that this development and the necessary training should be effected under a Group organisation.

The proposed initial establishment for the Group consisting of 12 squadrons was readily accepted.[2] The total of 35 bomber and fighter squadrons which were not in Army Co-operation Command but which were to train and operate with the Army was to be correspondingly reduced, and the Group was to gain its operational experience by taking part in the main air offensive. The conception of the Group as a mobile formation for field operations was not contested, but the Air Staff conviction, that the initial phase of an invasion of the Continent, up to and including the securing of a lodgement area, could best be assisted by means of an extension of the fighter organisation of the United Kingdom, was in direct conflict with any proposal that might tend to perpetuate Army Co-operation Command or superimpose additional formations upon the otherwise uncomplicated fighter organisation.

The Air Staff plan of 21 July 1942, was based upon the assumption that there would be a Supreme Commander of all ground, sea and air forces engaged in an invasion of Europe and a single A.O.C.-in-C. of the British and United States Air Forces. The whole of the Metropolitan Air Force, apart from units of Coastal and Fighter Commands engaged in a security role, were to be employed

1 A.H.B./ID3/1745, Pt. 2.

2 Four squadrons of 40-mm. anti-tank fighters, four of 20-mm. fighters for the attack of thin skinned vehicles, and four of Bermuda bombers.

on Army Support in the widest sense, and the appointment of a single A.O.C.-in-C. was intended to ensure that the air forces were applied in the most effective manner possible. This arrangement also ensured that the Army Commander should have to deal with only one Air Commander since experience gained in the Middle East and during exercises in England had proved this to be an important factor in efficient liaison between the two services.[1]

The paramount consideration was to ensure air superiority over the area of land and sea operations but this depended upon the metropolitan fighter force being able to operate freely over the selected area without fear of having to be withdrawn for the defence of Great Britain. The status of Fighter Command when engaged in operations to effect a lodgement on the Continent was therefore established and it had been demonstrated, in active combined operations, and was subsequently proven in the Dieppe raid of 19 August 1942, that such expeditions could be successfully supported and protected by the normal Home Defence fighter organisation, assisted by forward direction through R/T in ships.[2] No. 11 Fighter Group Headquarters at Uxbridge and the sector organisation stretching from London to the coast provided a highly developed, well tried, and efficient organisation, specially designed and adapted for the control of air operations over the channel. No better system than this organisation, suitably expanded, and extended, could be provided for the control of the very large numbers of squadrons which would be involved in the initial assault. Twelve Army Air Support squadrons, of which eight were fighter squadrons were to be formed and, as Fighter Command had taken a keen interest in Army Air Support throughout the year, all 75 of the Commands squadrons had received some training in Army Air Support by September 1942, including control by an A.A.S.C.

The existing operational organisation in England which consisted of functional Bomber, Fighter, Coastal and Army Co-operation Commands was not fully reconcilable with the need for flexibility and rapidity of action which were necessary in order to ensure that the air effort could be applied to the support of any part of the Army front. Furthermore, it was necessary for the Army Commander to be able to select objectives and apportion effort for almost any number of supporting squadrons and these had to come under the control of one Air Force Commander in any one area, who could see the air situation as a whole and co-ordinate support, reconnaissance and fighter operation. This postulated a non-functional, composite organisation and it was apparent that Fighter Command offered the best basis upon which to build.[3] 'Army co-operation' had therefore moved from the restricted domain of a specialised service into the much wider field of the main fighter offensive. Air Support was no longer to depend upon limited resources but was to have the whole strength of Fighter Command behind it and the elimination of Army Co-operation Command therefore became a logical step in invasion, since it could not and would not be able to command sufficient resources. The Air Staff was therefore reluctant to establish a new Army Support Group within Army Co-operation Command or to commit themselves to any permanent allocation

1 See particularly Exercise Victor II, February 1942.
2 A.H.B./IIH4/1/2 Annex 7.
3 A.H.B./ID3/1745B.

to it of the twelve new squadrons. The most satisfactory solution appeared to be in reorganising No. 11 Group into a composite force within which, groups would be formed on the basis of one for each Army to be supported.

In July 1942 a completely new organisation was planned for the invasion of the continent in the following year. This was based upon the organisation of the *Luftwaffe* and developed from practical experience in North Africa, where the combined Allied air forces in the Middle East had been co-ordinated and used for army support where and when this was necessary.[1] It was proposed to form two air forces (corresponding to *Luftflotte*) under the A.O.C.-in-C., who, in addition to commanding all the air forces in support of ground operations was to be responsible for the Air Defence of Great Britain (A.D.G.B.). The Eastern Air Force consisting of fighters, light bombers, army support, and reconnaissance squadrons and organised into three composite groups (corresponding to *Fliegerkorps*), was to occupy No. 11 Group Headquarters, and the three eastern sectors of the Group area in order to cover the British armies. The Western Air Force (U.S.A.A.F.) was to be organised on similar lines to cover the front of the U.S. armies. In addition, all or part of the U.S. heavy bomber groups were to be employed under the direction of the A.O.C.-in-C. in conjunction with Bomber Command on such tasks as were required on either front.

In the initial stages, captured airfields were to be used as advanced landing grounds by squadrons based in England which were to be serviced on the Continent by Servicing Commandos, each Commando being capable of servicing any of the aircraft types in the groups. Operational control was to be exercised through advanced Headquarters of the groups but later, when sufficient ground was occupied, stations were to be established in France capable of maintaining three squadrons each. The necessary mobile signals and radar equipment required to extend the group communications and warning system into France, together with the appropriate sector control and A.A./searchlight organisation required for the air defence of the group area was also to be provided.

The Army Co-operation Wing was to be renamed the Army Support (A.S.) Wing and became the basic control organisation (using an extended A.A.S.C. for the purpose) through which the army commander was to control any squadron allotted to air support, including Army Support, light bombers, fighters, and reconnaissance aircraft. The Army Support Wing Headquarters was then to become the advanced headquarters of the groups concerned but, for more than a very limited effort, operations were to continue to be controlled by the Group Commander in the United Kingdom (experience in Libya had shown the necessity of the Group Commander retaining control). This was until a mobile operational headquarters could move forward in immediate contact with the appropriate army headquarters.

There was to be no separate Air Command similar to B.A.F.F. of 1940 and no Air Component or Army Support Group Headquarters was to be superimposed upon this organisation. It was intended however, to establish an

[1] C.O.S.(42) 351.

officer of air rank at G.H.Q., in place of an Army Co-operation Force Commander as Air Adviser to the G.O.C. and to supervise training and development from No. 11 Group Headquarters during the preparatory phase. The twelve new squadrons were to form in No. 11 Group as soon as aircraft and personnel became available; the light bomber squadrons of No. 2 Group were to be affiliated for training to the appropriate fighter sectors forthwith, and, at the end of September, No. 11 Group was to be re-constituted with three mixed groups as the Eastern Air Force.

This organisation which had been designed by the Air Staff, did not, however, satisfy the C.I.G.S., who argued that it was tied down to one particular operation (whereas it should cater for operations in general), that it was not sufficiently mobile and it did not insure continuous and intensive co-operation with the Army in training.[1] The fact that the command of Army Air Support during operations was not vested in a Royal Air Force headquarters having direct control with G.H.Q. throughout all stages of the operations[2] was stated to be a direct contradiction of the fundamental lesson that the military commanders on all levels should be able to deal with an executive Royal Air Force Commander. Furthermore, there was great reluctance to substitute the existing Army Co-operation Command organisation for one which would have dual responsibilities (A.D.G.B. and Army Co-operation in the Field) during the important training period prior to operations.

By the end of August 1942, however, Operation Round Up[3] had been postponed and arrangements had been made to send 17 of the 75 fighter squadrons, required during an invasion, to participate in the landings in North-West Africa.[4] The proposed re-organisation was therefore not immediately appropriate or necessary as the three armies which were to have been supported by three composite groups were now to remain dispersed over the United Kingdom. The rate of formation of the twelve Army Air Support squadrons was reduced (owing to the need to replace the lost fighter squadrons) to two immediately and to one a month from November 1942 onwards but it was still necessary to decide whether they were to form in Army Co-operation or Fighter Command. The Air Staff preferred the latter alternative and was prepared to provide a special staff under an Air Officer in Fighter Command for the purpose of organising and supervising training, tactics, and technique, not only of the twelve new squadrons but of all other squadrons in Fighter Command and No. 2 Group. This arrangement was in accordance with the organisation being considered for Operation Round Up and provided for the rapid development of technique and equipment (e.g. the mobile control, communications, and warning equipment) required to enable the operation to pass from the initial assault phase, when the existing Fighter Command system had to be relied upon, to the phase when a lodgement had been effected and a fully mobile independent system was needed.

The C.I.G.S. did not, however, agree to the transfer of responsibility to Fighter Command, which at any time might find its interests focused upon air defence rather than upon the development of the organisation for air support

1 C.O.S.(42) 364, 1 August 1942.

2 The proposal to use No. 11 Group Headquarters as the headquarters of the Eastern Air Force until it was possible to move on to the continent.

3 Liberation of North-West Europe.

4 A.H.B./ID3/1745B.

training and operations.[1] He also expressed misgivings with regard to the C.A.S.'s condition that with either alternative, the Army Air Support squadrons would be required to train and operate in a normal fighter defence role should the United Kingdom become subject to a renewed air threat while Fighter Command was below strength.

The C.I.G.S. asked for the twelve new squadrons to be formed in Army Co-operation Command under an Army Support Group as a training organisation and this was agreed by the C.A.S., without prejudice to the Air Staff proposals for the Round Up Organisation, in order that the formation of the squadrons should not be further delayed. The divergence of opinion with regard to the proposed Air Staff organisation for Round Up were however, considerable and far reaching and consequently the whole problem, including the question of the type of equipment and the organisation for training, was brought before the Prime Minister on 5 October 1942. The Air Staff plan for meeting the ' fifty-five ' squadron commitment allowed for an eventual force of 20 army co-operation squadrons, 12 army support squadrons, ten light bomber squadrons from No. 2 Group, and 13 fighter squadrons from Fighter Command. The decision to form the army support squadrons within Army Co-operation Command was confirmed without prejudice to the final decision and it was agreed that the air forces should be organised on the Libyan model in such a manner as to provide for the following phases :—[2]

(*a*) The training in co-operation before operations began.

(*b*) The move across the Channel.

(*c*) The establishment of a front in France.

The Prime Minister ruled that the whole of the air force was to be under the command of one A.O.C.-in-C. whose relationship to the Army C.-in-C. was to be laid down in his directive of 7 October 1941, in connection with the Middle East Campaign.[3] This ruled that when a battle was in prospect or in progress the A.O.C.-in-C. was to give the G.O.C.-in-C. all possible aid irrespective of other targets, however attractive. The organisation and employment of the Royal Air Force was to conform to that which had proved so successful in the Western Desert and the solution to the problem of organisation was therefore to be sought by first deciding what had to be achieved in France and then determining the method of execution for ' the spring across the channel '. The solution to this phase was expected to indicate the arrangements required for training in the initial phase.

By 14 November 1942, the War Office and the Air Ministry had studied the application of the Western Desert system to conditions when the Army would be established in France and had agreed upon the following main points :—[4]

(*a*) The Supreme Commander and the A.O.C.-in-C. of the combined air forces were to be established in immediate contact, either in the United Kingdom or France.[5] The bulk of the British and U.S. Bomber

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[1] A.H.B./ID3/1745B.
[2] C.O.S.(42) 138 and A.H.B./ID3/1745B.
[3] D.O.(I)17.
[4] *See* Appendix 5.
[5] A.H.B./ID3/1745B.

Commands and the fighter squadrons employed upon the protection of the United Kingdom and the line of communications across the Channel were to continue to operate from bases in the United Kingdom until the later stages of the third phase. It was unlikely that the main headquarters of the Supreme Commander and the A.O.C.-in-C. would be transferred to Europe until an advanced stage of the invasion of the Continent. Adequate communications would be provided between the A.O.C.-in-C. and the Headquarters of the two air forces in the field.

(*b*) The G.O.C.-in-C., British Army and the A.O.C. Eastern Air Force were to be established in immediate contact at a headquarters in the field.

(*c*) Mobile composite groups, each containing fighter, light bomber, army support, and reconnaissance wings were to have their respective headquarters in immediate contact with the headquarters of the armies in the field. Although under the A.O.C. in the field, they were to be subject to the general operational control of the A.O.C.-in-C. They were to be flexible units of no fixed strength, and one or more could be reinforced at the expense of others by the A.O.C. in the field, in consultation with the G.O.C.-in-C., according to the situation on any Army front. The organisation was to be capable of controlling both the formations which were permanently under the command of the A.O.C. in the field and those which would be allotted. Air support operations and reconnaissance by all aircraft were to be controlled by a specially trained Army Support Commander through an A.A.S.C. organisation at Group Headquarters.

The only major point of disagreement was whether or not the A.O.C.-in-C. was to have additional responsibilities, such as the Air Defence of Great Britain. The Air Staff held that neither the A.O.C.-in-C. nor the A.O.C. Eastern Air Force could disinterest themselves in the Air Defence of Great Britain or in the communications between the United Kingdom and forces in France and pointed out that during the preparation and initial stages of invasion when south-east England would be one vast air base and army concentration area, the fighter squadrons taking part in the preliminary offensive operations would also be responsible for defeating attacks made by the enemy on south-east England. Whilst admitting that, once the forces were well established on the Continent and were attacking Germany, new conditions would arise, it was considered that a division of the command of the air forces would reduce the flexibility with which they could be operated. The General Staff, however, did not accept this view and argued that the responsibility for determining the division of air forces between support for the Expeditionary Force and the defence of Great Britain should rest with the Chiefs of Staff. They were not content that the A.O.C.-in-C. should have to ' look over his shoulder ' instead of concentrating his whole attention on the battlefield and claimed that under these circumstances he would be unable to do his job properly.

On 3 December 1942, the Prime Minister stated in a personal minute that, having agreed upon the third phase, except for the above point, he would like to see a similar statement covering the second phase.[1] He considered that the

[1] A.H.B./ID3/1745B.

problem of the responsibilities of the A.O.C.-in-C., would solve itself when phases two and three were considered together. In his opinion, the A.O.C.-in-C., could not disinterest himself in the protection of his base, which would be the United Kingdom, but when the invasion had made considerable progress on the Continent, he though it quite possible that the A.O.C.-in-C., would not need to concern himself with anything farther to the rear than the French Channel ports.

The general form of the Composite Groups for mobile operations in the field was thus agreed and included the introduction of a new unit known as the Mobile Operations Room Unit (M.O.R.U.). Fighters, bombers, tactical support and reconnaissance aircraft were to be kept under central control and were to be interchangeable between airfields to allow for flexibility and reinforcement. Local control for a variety of types could not be achieved by specialised Wing Headquarters and so the M.O.R.U. was to be designed, staffed, and allocated on the basis of one for each four airfields. In considering the crossing of the Channel, however, it was also necessary to determine the most suitable method of change over from control by a well established organisation, which could be applied during the initial assault, to control on a basis of full field mobility as required for the third phase. This transition stage was to occur during the establishment of a firm lodgement on the Continent and it was necessary to ensure that the Corps/Army and Composite Groups Headquarters retained close contact throughout. Contact was to be effected by means of mobile advanced headquarters until the main headquarters had moved across. It remained to be decided whether the existing static organisation could be projected on a mobile basis in close contact with the Army or whether a new mobile field organisation should be created.[1] It was not, however, advisable to attempt to decide upon an organisation to provide for the conditions of phase two before some additional experience had been gained of the mobile Composite Group in action and it was therefore decided to postpone the submission of a plan to the Prime Minister until the organisation had been tested on a full scale.

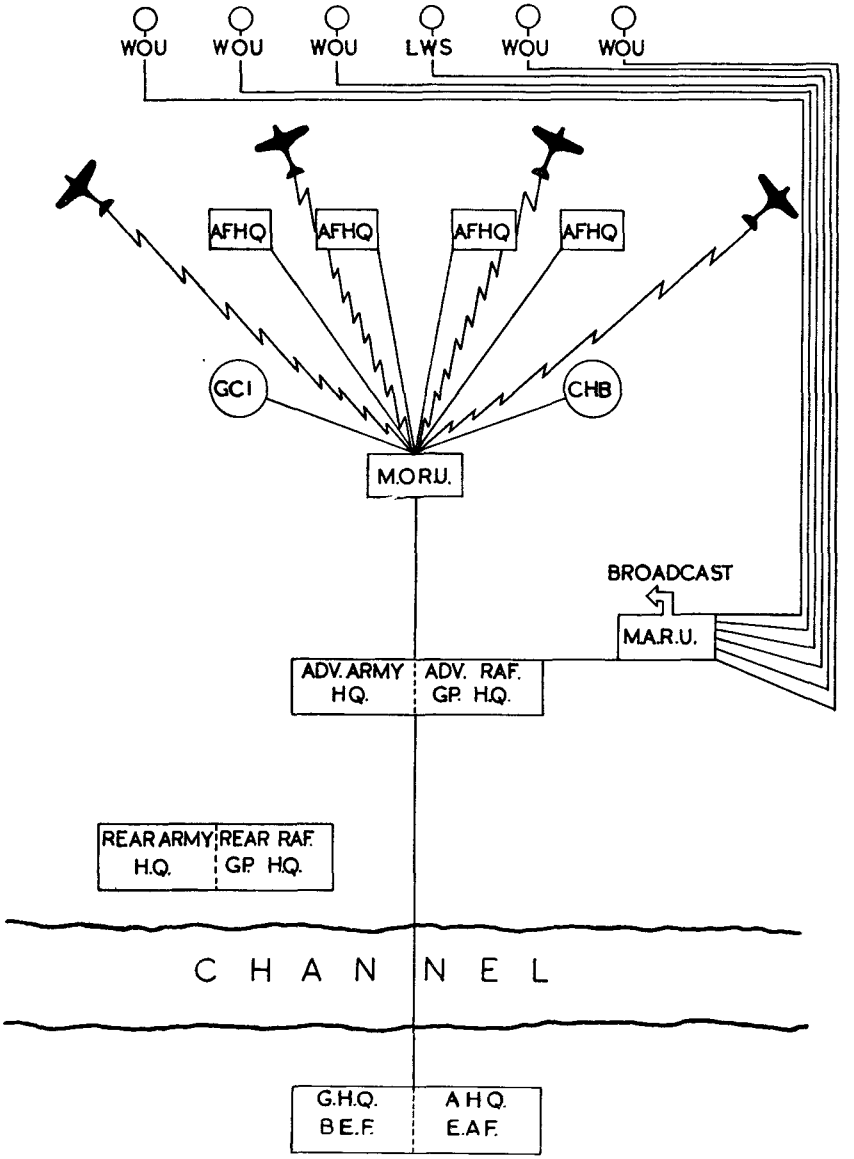
Exercise Spartan, March 1943

This conception of the Composite Group was tried out and found to be successful in exercise Spartan in the United Kingdom in March 1943.[2] The location of the Group and Army Commanders in joint or adjacent Headquarters was a means of ensuring that Army and Air Force resources were directed to the accomplishment of a common Army/Air task. The exercise dealt with the problems arising in an advance from an overseas bridgehead, practised the handling of mixed military forces, and exercised the control organisation of Air Forces operating with the Army. It was in fact a rehearsal for the liberation of North West Europe.

Air action was co-ordinated with the ground battle through the medium of two Composite Groups, one of which was allotted to the support of each of the two opposing Armies, each Group being composed of fighters, light bombers,

1 A.H.B./ID3/1745B.
2 A.M. File C.S.18704.

OPERATIONAL CONTROL FOR A COMPOSITE GROUP—N.W. EUROPE



L E G E N D

W.O.U. = WIRELESS OBSERVER UNIT
L.W.S. = LIGHT WARNING SET
A.F.H.Q. = AIRFIELD H.Q.
M.O.R.U. = MOBILE OPERATIONS ROOM UNIT
M.A.R.U. = MOBILE AIR REPORTING UNIT

tactical support fighters, and fighter reconnaissance aircraft.[1] The internal Royal Air Force organisation was deliberately experimental and was handicapped by limitations of the personnel available and inadequate knowledge and experience in the conduct of a combined ground/air battle.

In order that the Group Commander and his Headquarters could always be with the Army Commander and his Headquarters, the Group Headquarters was divided into two parts to conform to the Army Headquarters organisation. These were the Advanced (or operational) Group Headquarters and the Rear (or administrative) Group Headquarters. The principal units of the Group were as follows :—

(*a*) The Advanced Group Headquarters designed for mobility with no large administrative Staff. Operational control was exercised through the Mobile Operations Room Units.

(*b*) A self-administering M.O.R.U. It had ground to air communications for the control of aircraft and W/T or land-line communication to each of four airfields. Additional control facilities were to be provided by means of a Ground Control Interceptor (G.C.I.), directly associated with the M.O.R.U.[2]

(*c*) The Rear Group Headquarters which was transportable by means of the Group pool of vehicles. It maintained and administered all Royal Air Force units in the area. This organisation was not fully carried into effect for the exercise, some units being maintained by their static stations. Twelve ' British ' squadrons, however, were organised on a field force basis involving the provision of the following :—

(i) Airfield Headquarters. Each Airfield Headquarters was responsible for the operation, maintenance and administration of three squadrons of various types. Due to the assumption of a large measure of responsibility the Field Force Squadron was reduced to a very small mobile unit.

(ii) Two mobile Air Stores Parks were provided, each being responsible for supply to two airfields.

(iii) A Mobile Repair and Salvage Unit was responsible for the limited repair of aircraft and M.T. on site. In addition it carried a pool of maintenance personnel (Servicing Commando),

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1 ' Z ' Mobile Composite Group—British Forces.
(i) One Mobile Operations Room Unit.
(ii) Four airfield Headquarters.
(iii) Six Fighter Reconnaissance Squadrons.
(iv) Seven Fighter Squadrons.
(v) Four Tactical Support Fighter Squadrons.
(vi) Two light bomber Squadrons.
(vii) One Air Observation Post Squadron.
Total : Twenty Squadrons.

' X ' Mobile Composite Group—' German ' Forces.
(i) Five Fighter Reconnaissance Squadrons.
(ii) Seven Fighter Squadrons.
(iii) Two Tactical Support Fighter Squadrons.
(iv) Four Light Bomber Squadrons.
(v) Three Air Observation Post Squadrons.
Total : Twenty-one Squadrons.

2 Warning of enemy air raids was to be obtained through the medium of a Mobile Air Reporting Unit (M.A.R.U.) which broadcast information received from a chain of Wireless Observer Units (W.O.U.) and through a Radar Reporting Unit (C.H.B.) which was to be directly linked to the M.O.R.U.

which was at the call of airfields to assist in the first line maintenance of squadrons if required. The Commando was to move forward as soon as an airfield was ready and function as the maintenance element of the Airfield Headquarters until that headquarters arrived. When thus relieved it moved either to another Advanced Landing Ground or back to the R. and S.U.

(iv) A Motor Transport Company, under Group Headquarters, was provided to assist the move of units which were not themselves fully equipped with transport.

(v) A Supply and Transport Column under the Group Headquarters, was provided for the transport of supplies within a radius of forty miles. Beyond this radius, transport was provided by the Army.

The active operations during the exercise lasted nine days before which it was assumed than an ' Allied ' bridgehead had been established and preparations made for the advance therefrom. In this early period the ' Allies ' had gained a marked air superiority and a number of airfields had been captured and put into use by ' Z ' Group. The heavy bombers attacked centres of communications and bottlenecks, the ' Allies ' concentrating more on the rearward areas while the ' Germans ' were forced to lay emphasis on the more forward zone. A number of air attacks were made on targets reported by reconnaissance, but delays, in getting the details to aircraft resulted in many of the attacks arriving too late.

The Air Observation Post (A.O.P.) was especially useful after the ground forces had made contact and, as was becoming usual, the Auster aircraft was used also for local and contact reconnaissance, liaison and communications duties. The need for ample warning of projected moves was demonstrated when some aircraft had to be left behind temporarily during a night withdrawal, but the danger from being spotted by enemy aircraft was shown to be not as great as originally feared and properly camouflaged Air Landing Grounds (A.L.Gs.) also proved difficult to locate from the air. The capture and retention of airfields and the need for speed in movement were shown to be the primary factors affecting the operations of supporting air forces. Forward moves of 30 to 40 miles were practised by Royal Air Force units and two airfields were constructed by the Airfield Construction Groups of the Royal Engineers.

Exercise Spartan confirmed the view that the organisation of the Royal Air Force should be based primarily upon the predominant requirements of the third phase operations on the Continent, when support would be required for a full land campaign, and indicated some of the expedients which, though possibly necessary during the preceding phases, should be given temporary status only, within the basic organisation.[1] The conclusions which were reported by the A.O.C.-in-C. Army Co-operation Command were the outcome, not only of Spartan, but of the experiences in both the Western Desert and the United Kingdom.

[1] Air Marshal Barratt's Report on Spartan.

The aim was to provide for combined planning and operations, but this was not necessarily achieved merely by placing the Army and Air Headquarters in contact. The higher Army and Air Force Commanders had to plan well ahead but the former could only influence a battle that had been joined by the use of his reserves. The latter, however, commanded an inherently flexible force which required his constant attention. The fundamental difference in the pace of the air and ground battles had to be clearly understood by Staffs and the combining of the points of control and their communications had to be carefully considered so that the flexibility of air forces was not destroyed.

It was expected that the majority of targets attacked by fighter-bombers and light bombers would be found as the result of reconnaissance, and would be of a fleeting nature. Many of them would appear to be attractive from the narrow view point of a local commander whereas the results to be achieved might not justify the effort. It was considered of the greatest importance that air action should be concentrated on objectives vital to the ground operations and this could be achieved by careful selection based upon a clear air plan of campaign. The greatest limitation was likely to be the delay between a target being found and the attack being delivered and this could be reduced by means of improved methods.

As the heavy bomber resources available could make a powerful contribution to a campaign it was thought essential that commanders should look well ahead in studying the means whereby this effort could be used to provide a full measure of assistance. The co-ordination of these forces was to be effected at the highest level and it was essential that a request for assistance should state why it was needed and the results it was hoped to achieve in accordance with a single concerted plan.

The proposed organisation provided for the control of air forces to be centralised at the highest possible level but the needs for a measure of decentralisation were also evident.[1] The immediate recommendation did not go so far as to suggest a separate group organisation for fighter and light bomber types, but advocated a functional Wing organisation for reconnaissance and light bomber aircraft and a Wing or Group organisation for fighters and fighter-bombers depending upon the size of the force. This provided for the organisation of these functional forces under either a Composite Group or Command, again depending upon the size of the force.

The agreed lay-out for a Composite Group working with the Army at the time of Spartan envisaged the establishment of similar joint Army/Air Head-

1 (*a*) The defensive action of fighters could best be controlled at Wing or Group Headquarters within the terms of a general directive. The possible need for a static fighter organisation for the defence of the base area was foreseen.

(*b*) The offensive action of fighters and light bombers could be best provided by confining orders issued to an outline of the task and leaving the details to subordinate commanders. This method had been tried and proved in the Western Desert.

(*c*) Air reconnaissance was a normal requirement over the whole front and centralisation was desirable owing to the need to co-ordinate reconnaissance activities with other operations which would provide for the safety of our aircraft and in order to permit the use of resources. On the other hand the system had to provide for the reception of information by tactical military commanders with the minimum of delay and consequently a means had to be found for a measure of decentralisation for particular operations.

quarters at Army and Corps level.[1] The proposals for the organisation of the joint headquarters provided for it to function as follows :—

(*a*) *Planning and Policy.* The Army and Air Commanders and their principal Staff Officers should concentrate primarily on planning for future action and should delegate the responsibility for current operations to their Staffs.

(*b*) *Current Operations.* These should be dealt with by the Combined Operations Room Staff within the limits laid down by the Commanders.

(*c*) *Implementing decisions.* Separate executive operations rooms should be provided for the Army and Air Force, where action should be taken on the decisions made by the Combined Operations Room Staff.

The organisation of the Army Air Support Control as an independent mixed unit was shown to be partly redundant as the result of Spartan. The Mobile Operations Unit (later known as the Group Control Unit) had become the instrument by means of which the Commander of the Composite Group exercised control of his aircraft and this left the A.A.S.C. with a signals function only. It therefore became known as the Air Support Signals Unit (A.S.S.U.). As previously, a separate Army network of tentacles was provided for the rapid transmission of information affecting air action and requests for air support and reconnaissance. The communications from Air Force control points to airfields and aircraft became an integral part of the Royal Air Force group signals organisation. The system of broadcasting the results of centralised reconnaissance from Army/Group level was shown to require further study.

A more general conclusion which was drawn from the exercise, was that most of the units, which would comprise the ' Air Expeditionary Force ', needed considerably more experience in living and operating in the field.

Formation of a Tactical Air Force, 1 June 1943

The experience in the Middle East and the contemporary developments in the United Kingdom up to Exercise Spartan in March 1943 were of supreme importance in the build-up of the organisation methods and equipment, for the support of armies in the field. The superseding of the term ' close support ' by that of ' immediate support ' was followed by a new and broader conception of air support, in which the fighter, the ground attack fighter, the fighter reconnaissance aircraft, the light bomber and the heavy bomber were all to be harnessed for army support. This made the old idea obsolete, in which army co-operation was considered to be a specialised and limited form of air assistance.

The conception of the Air Component was now dead and had been replaced by the composite ' Air Contingent ', in which all aircraft were subject to centralised control under an Air Commander who enjoyed equal status to a parallel Army Commander. Both commanders had a common aim but the air commander was required to assist the Army with all means at his disposal from the moment a land battle was in prospect. The Army and Air Commanders therefore had to be able to deal ' face to face ' at all levels and air

1 That at Corps level was later dropped.

forces had to be organised in order to provide the necessary mobility and flexibility to make effective support possible during all phases of an operation. The organisation for ground operations against the Continent had therefore to be flexible enough to meet the requirements of the three operational phases which were now defined as follows :—[1]

(*a*) The sea crossing and landing during which the main support was to be carried out from England.

(*b*) The establishment of the bridgehead during which certain squadrons would operate from the Continent. The number of airfields available would be a limiting factor.

(*c*) The expansion of the bridgehead for which the most suitable organisation had to be evolved for the support of the full land campaign.

Exercise Spartan confirmed the view that the Royal Air Force organisation should be moulded to suit the predominant final phase and consequently the 'Z' Group Headquarters and certain Field Force units were kept in being after the exercise and used to form No. 83 Group within Fighter Command.[2]

The need for units of different wings to use the same airfields was seen to be a temporary requirement when airfields would be limited within the bridgehead, and it was therefore decided to organise operational units into functional wings in order to achieve concentration and economy of effort under the more effective control that could thereby be achieved. Furthermore, Spartan again demonstrated the extent to which bomber effort could be dissipated by sub-division and, as the fighter-bomber was the obvious weapon for day to day use on the comparatively narrow front of the Composite Group, it became clear that the light bomber force should be retained as a functional Group under the Headquarters of the Eastern Air Force.

It was now definitely accepted that the two vital factors in the organisation of air forces, which were to co-operate with ground forces, were mobility and close contact at corresponding Army and Air Force levels for planning, training and the conduct of operations. These conditions, together with the prospect of operations on the Continent during 1944, necessitated the early formation of a supporting British Air Force as a separate entity and making full use of all Fighter Command facilities for as long as possible. The new force—Tactical Air Force—was therefore to form and remain within Fighter Command until the appointment of a C.-in-C. Allied Expeditionary Force was announced. Responsibility for Home Defence was later resolved by the replacement of Fighter Command by a reconstituted Air Defence of Great Britain organisation.

The Chiefs of Staff were therefore informed on 10 March 1943, that a Tactical Air Force[3] was to be formed within Fighter Command with effect from 1 June 1943, and that, in consequence, Army Co-operation Command would cease to exist from that date.

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1 Air Marshal Barratt's Report on Spartan.

2 C.O.S. (43) 149(O) and A.H.B./ID3/1745B.

3 To be composed of the following formations and units :—

(*a*) No. 2 Group—to be transferred from Bomber Command.

(*b*) No. 83 Composite Group—then in Fighter Command.

(*c*) No. 84 Group—not yet formed.

(*d*) No. 38 Airborne Wing—then in Army Co-operation Command.

(*e*) No. 140 Photographic Reconnaissance Squadron—then in No. 35 Wing, which would continue to administer it.

The functions of Headquarters Tactical Air Force were to be as follows :—[1]

(*a*) To command the appropriate formations.

(*b*) To study the air aspects of Continental operations.

(*c*) To exercise with Army Group Headquarters.

(*d*) To train Composite Groups, including tactical reconnaissance squadrons, and to exercise them in actual operations.

(*e*) To train light bomber squadrons with fighters and fighter-bombers and to exercise them in actual operations.

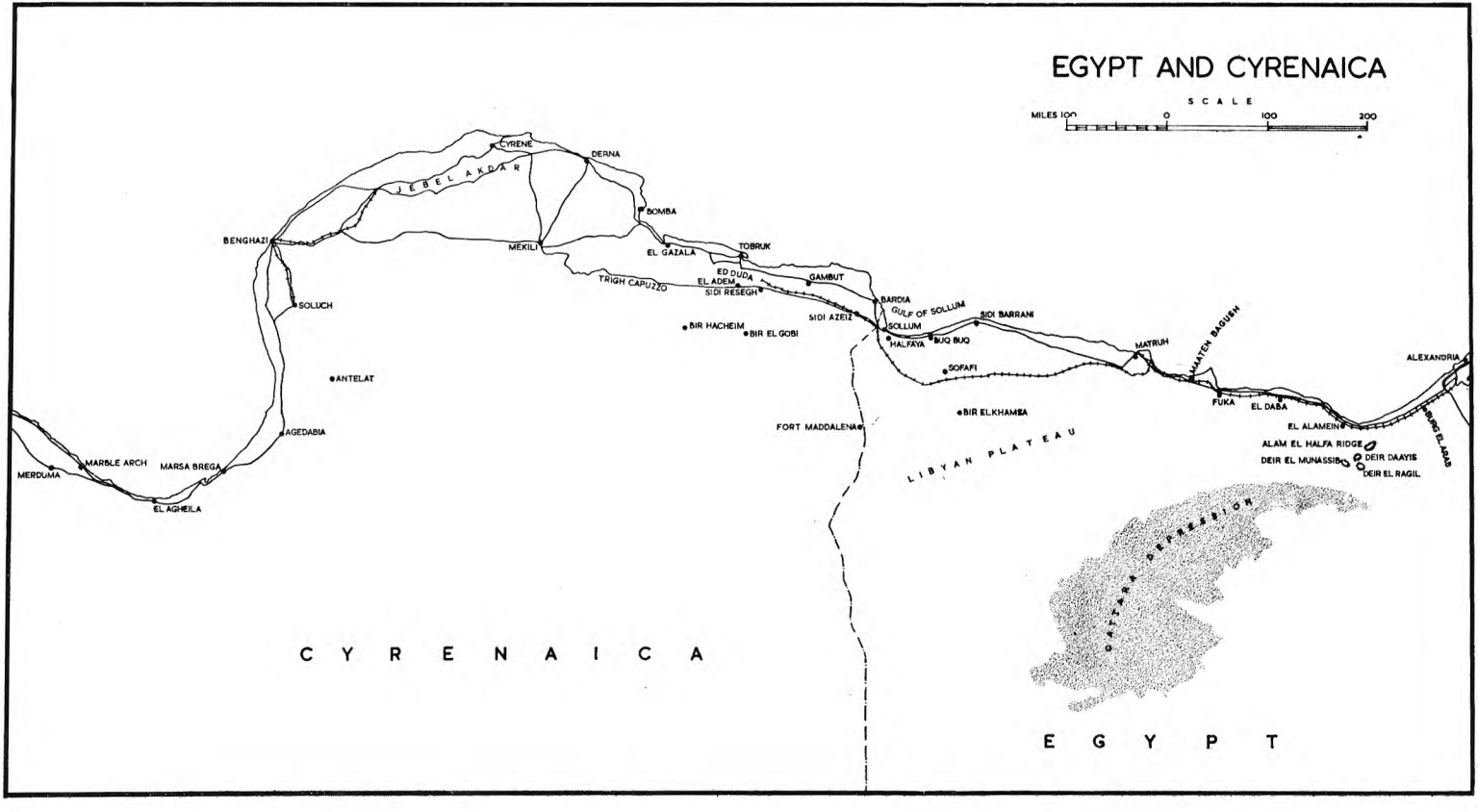
(*f*) To make detailed plans in conjunction with the G.O.C.-in-C. Expeditionary Force for Continental operations when the outline and cover plans had been issued.

(*g*) To meet requirements for strategical reconnaissance for Continental operations.

(*h*) To study the air aspect of the employment of airborne forces.

The arrangements concerning the organisation of the Royal Air Force for the support of cross channel operations and the appointment of Air Vice Marshal D'Albiac as Commander of the Tactical Air Force were notified to the Prime Minister by the Secretaries of State for War and Air on 10 June 1943.[2]

[1] A.H.B./ID3/1745C and A.M. File C.S.19336/43.
[2] A.H.B./ID3/1745C.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CHAPTER 4

CAMPAIGNS IN THE MEDITERRANEAN THEATRE

PART I

Egypt, Libya and Tunisia, 10 June 1940—13 May 1943

Preliminary Organisation and Early Experience

In the Operational Plans produced by Headquarters Middle East during 1939 it was stated that the method of employment, and the strength to be allotted for each role of the air forces was to be determined by the A.O.C.-in-C., but that the actual operations and choice of targets were to be the responsibility of A.O.C. Egypt Group (later No. 202 Group). The latter could meet requests from Military Commanders for close support, and, if the situation demanded, this support was to be given first priority for as long as necessary.[1]

The plans included specific instructions on co-operation with the Army. In the forward area, the Air Force supporting the Mobile Division was to consist of bomber and fighter squadrons under an Advanced Wing, as well as an Air Component with the Army under the operational control of the G.O.C. Mobile Division. The normal channel between the G.O.C. and the A.O.C. was to be through the Officer Commanding Advanced Wing. In order to facilitate close collaboration, it was intended that the latter should base his headquarters near that of the Mobile Division. To effect liaison between the G.O.C. and Officer Commanding Advanced Wing, it was proposed to attach a senior air staff officer to the Divisional Headquarters. This officer was to be informed of the ground and air situation so that he would be able to advise the G.O.C. at any time on what air support he could expect, and so that he could warn the Officer Commanding Advanced Wing of anticipated targets or vital areas requiring air defence. It was realised that this connecting link did not result in an ideal organisation, and it was therefore suggested that the Officer Commanding Advanced Wing should take every opportunity of personal contact with the G.O.C. Although the Army Co-operation Squadrons were to be under the direct control of the G.O.C., it was laid down that it was the responsibility of the Officer Commanding Advanced Wing to advise the G.O.C. on their employment. Equally the Officer Commanding Advanced Wing was to be at all times aware of the operations and plans of the Army Co-operation Squadrons, in order that the operations of his own squadrons could be co-ordinated with them. Shortly before the war, the A.O.C.-in-C. decided that the A.O.C. Egypt, should move forward his Headquarters (No. 202 Group) to combine with Advanced Wing, thus consolidating the air striking force.[2] This move eliminated one link in the chain of command, and made the Officer Commanding Advanced Wing available for whole-time liaison with the Mobile Division. On the outbreak of war, the Air Component with the Army consisted of one Army Co-operation and one fighter squadron, each with an Air Liaison Section.

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1 M.E. Operational Plans 1939.
2 No. 253 Wing O.R.B., Appendix B.

Both squadron commanders considered that it was essential to have their Headquarters within ten miles of the Divisional or Corps Headquarters with which they were working, and that direct telephone communication should be provided.[1]

On the opening of hostilities, the British Army in Egypt was in no position to launch an offensive, and it was expected that the enemy would make the first major move as soon as the weather became cooler and more favourable for campaigning. Air support consisted chiefly of reconnaissance, and the bombing in conjunction with attacks by ground troops of enemy strong points threatening a safe withdrawal of British forces from the frontier. With a threat of an Italian invasion of Egypt however, the conservation of air strength became more and more essential, and it was agreed between the Army and Air Force that the former should not call for air attacks on land targets unless it was clear that the enemy attack was imminent.[2]

At the start of the Italian offensive on 9 September 1940, the principal air effort, which contributed to the land battle, was attacks on motor transport groups. It had been appreciated earlier that the Western Desert Force could not prevent a limited enemy advance and by 20 September the enemy was establishing a line from Sidi Barrani to Sofafi. Although this was the extent of the enemy advance, it put the Royal Air Force at a grave disadvantage as it involved the loss of the group of forward landing grounds around Sidi Barrani, and reduced British air activity against objectives in Cyrenaica.

During September it had been decided in London to send reinforcements to the Western Desert.[3] In October 1940, however, the outbreak of war between Italy and Greece necessitated the despatch of certain air units to Greece and this both postponed the ground offensive in the Desert until early December and reduced the effort of the Royal Air Force in preliminary operations. Before the opening of General Wavell's offensive on 9 December 1940 however, efforts were made to cut the enemy's supply lines by air attacks, and immediately before the offensive, Air Commodore Collishaw continued to attack targets over a wide area in order to force the Italian fighter force onto the defensive. An important development during this period was the partial equipment of the Army Co-operation squadrons with fighters.[4] Experience in both France and the Middle East had shown that the Lysander required a strong fighter escort for reconnaissances of even very limited depth into enemy territory where enemy fighter opposition might be expected. The employment of Lysanders therefore tied up a larger proportion of the fighter force than the value of reconnaissance normally justified, and it had been principally the difficulty of allocating sufficient fighter protection that had prevented the Royal Air Force from meeting the full demands of the Army for reconnaissance. In August it had been agreed therefore, between the War Office and Air Ministry, to abandon the traditional methods of tactical reconnaissance and to employ the same type of aircraft for this as for close support, whenever fighter opposition was probable. By the

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1 A.H.B./IIJ6/49/6(1).
2 H.Q., R.A.F., M.E., O.R.B. Appendix 29.
3 A.H.B. Narrative, *The Campaigns in the Middle East, Vol.* 1.
4 A.H.B./IIJ1/183/138 Pt. ' A '.

beginning of the British offensive, the newly arrived Army Co-operation squadron, No. 3 R.A.A.F. Squadron, had been equipped with Gladiators instead of Lysanders, and No. 208 Squadron had been given some Hurricanes.[1]

On the day preceding the British offensive, fighters maintained offensive patrols over the forward area to protect the assembly of the ground forces, and during the initial attacks on the night 8/9 December, diversionary bomber attacks were made on enemy positions, with the result that complete surprise was achieved in the ground offensive. The preliminary operations had been carried out with due consideration for the conservation of aircraft for the battle period, and the Royal Air Force embarked on a full-scale offensive of increasing severity against enemy airfields, ports, supplies, troops and transport.[2] Despite inferiority in numbers, air superiority was attained at the outset, and nearly four hundred sorties were flown in the first week, for the loss of only six aircraft.

In this offensive, however, the difficulties involved in locating friendly ground forces quickly became apparent. During the period immediately following the first thrust the Army was exploiting its gains in the expectation of an enemy withdrawal in the face of increasingly heavy bombing attacks. The situation remained fluid, and it was difficult for the Air Headquarters to determine the exact position and movement of ground forces.[3] Army calls for help were, in fact, frequently the first indication of the position of Army formations. British fighters tried to intercept the enemy air attacks and with some success but their numbers were limited and constant patrols could not be maintained.

The assault on the heavily defended port of Bardia on 3 January was remarkable for a very close combination of the activities of all three Services.[4] Bombers delivered heavy attacks immediately ahead of the ground forces and during the initial attack Hurricanes and Gladiators maintained patrols over Bardia. A Lysander co-operated with the artillery and other Hurricanes were despatched every ten minutes to dive over Bardia for reconnaissance information.[5] Meanwhile the medium bomber force, having prepared the way for ground troops by sustained bombing, turned its attention to the enemy landing grounds to prevent the interference of the Italian Air Force. The bombers sustained considerable damage, however, and the dangers of operating them in daylight without cloud cover became very apparent.[6] The Air Force also played a similar part in the operations for the capture of Tobruk on 21 January, when bombing was particularly valuable in maintaining pressure whilst the heavy artillery was being brought up.[7]

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1 The A.O.C. later advised the employment of a greater number of fighters in squadrons under Army control, for duties which included close defence of ground troops from air attack, attacks on enemy ground forces retreating immediately ahead of British troops and escorts for Lysanders on artillery shoots if and when needed. This policy was never initiated, however, as it was superseded by the Air Support Control (A.S.C.) organization for close co-operation with the Army which was introduced for Operation Crusader in the autumn of 1941.

2 A.H.B. Narrative, *The Campaigns in the Middle East, Vol.* 1.

3 A.H.B./IIJ6/1.

4 The Navy carried out bombardments from the sea with capital ships as well as destroyers.

5 H.Q., R.A.F., M.E., O.R.B. 7 January 1941.

6 A.H.B./IIJ1/183/138 Pt. ' C '.

7 A.H.B./IIJ6/3.

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The experience of the first six months of the war in the desert could not easily be applied to the future, as it was not likely that the air superiority which had been maintained by the Royal Air Force owing to the comparative lack of enterprise of the much larger Italian Air Force, would persist.[1] There were, however, two particular lessons of importance which emerged from the operations.

The speed of desert warfare, both in advance and retreat, made it imperative that the ground staff of squadrons could move themselves and their equipment very rapidly from one airfield to another according to the requirements of the battle. It had been found that, except for the Army Co-operation Squadrons, units were insufficiently mobile, owing to their organisation on a semi-static basis. They had neither the transport nor the personnel to operate efficiently under the conditions of desert warfare. This drawback was only partially and temporarily overcome through the loan of transport from the Army and during the advance, through the use of vehicles captured from the enemy. Owing to the difficulty of identifying British troops from the air, the Royal Air Force wanted Army vehicles to carry some kind of identification mark.[2] The Commander of the Armoured Division considered this was impracticable because painted signs would quickly become covered with desert dust, and, unless they could be readily concealed vertical signs would give away the identity of formations to the enemy. Instead he advocated the provision of a Royal Air Force Liaison Officer at Divisional Headquarters, with his own wireless set, with which he could keep in touch with aircraft in the air and inform them of the movements of the armoured fighting vehicles.

In January 1941, German forces under Rommel entered the Mediterranean theatre and on 30 March the Axis forces began to advance from El Agheila. The heavily outnumbered British forces were forced to withdraw and by 10 April were back at the frontier. During the retreat through the Jebel Akdar ground units frequently lost contact both with each other and with the supporting air units. In this confused situation false deductions were twice made from air reconnaissance reports with grave results for the retreating forces, and these incidents pointed out once again the need of some more efficient form of air-to-ground recognition system.

Owing to the reduction early in the year, the Royal Air Force was inferior in numbers to the enemy air force during the withdrawal. This was not to say that the enemy held unchallenged air superiority. Although two British petrol supply columns were attacked and destroyed during the confused retreat through the Jebel Akdar, Royal Air Force fighter patrols prevented grave molestation of British units crowding through the narrow passes north of Benghazi. During the subsequent heavy assault on Tobruk on 13 and 14 April, the diarist of the German Afrika Corps in fact recorded that the air superiority of the Royal Air Force had had a profound effect upon the Axis forces.[3] On this occasion Royal Air Force bombers maintained constant attacks on the enemy's motorised infantry and its supply columns and it was evident that the enemy plan was adversely affected by the heavy casualties inflicted by low-level bombing.

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1 A.H.B./IIJ6/1 and A.H.B./IIJ6/49 (1) and (2).

2 *See* Appendix 6.

3 Air Commodore Brown's Comments on General Wavell's Despatch and A.H.B.6, G.A.C. Diary.

Battleaxe Offensive—14 June 1941

After the attack on Tobruk the Desert War reached a period of comparative inactivity. Rommel needed time to reinforce and supply his forces before resuming his offensive into Egypt, while the British forces were unable to do more than hold Tobruk and a defensive line at the frontier. During this period General Wavell had received reinforcements and a date was fixed (14 June 1941) for a British offensive to be known as Battleaxe. The chief interim task of the Air Force was to attack the enemy's lines of communication to prevent a build-up of enemy strength, whilst, at the same time, improving its own strength and serviceability which, at the end of the withdrawal, was very low. The return of some units from Crete and the arrival of reinforcements of fighters from the United Kingdom however enabled the A.O.C.-in-C. to put five fighter, three medium bomber and two reconnaissance squadrons into the field for operation. Such was the importance attached to Battleaxe that the Chiefs of Staff urged both Commanders-in-Chief to throw the full weight of their forces into the battle, even if this prejudiced future operations.

It was particularly desirable from the air point of view that the planning of the air role in the battle should be made with the full agreement of the Army, since there was a tendency in the United Kingdom to criticise unfavourably the existing methods of close support.[1] For example, it was generally thought that, when they were in difficulties, German troops immediately summoned aircraft to deal with the ground opposition, and it had been asked why the British did not have a similar arrangement. It had also been suggested that in the forthcoming battle the Air Force would pay too much attention to attacking enemy lines of communication and airfields in the rear, and not enough to dealing with anti-tank guns, tanks and artillery which might be in contact with our forward troops.

An offensive Air policy was straightforward so far as the bombers were concerned, but with regard to the fighters the A.O.C. was opposed by the G.O.C. Western Desert Force, who insisted on the fighter force providing an ' umbrella ' for the defence of the ground forces during the approach march to the battle area.[2] The continuity of patrols demanded by this plan meant that each patrol would have very few aircraft. Such a policy, if persisted in for any length of time, was certain to wear out the fighter force, expose it to engagements in which it was outnumbered, deny escorts to the bombers, leave the initiative largely in the hands of the enemy, and ultimately result in the loss of air superiority. The A.O.C.-in-C. was prepared to carry it out, however, since it was only requested for a short time, and since the ground forces, after the experience of Greece and Crete were extremely alive to the possibility of enemy air attacks.

The ' umbrella ' tactics, particularly on 15 and 16 June, were successful in that very few enemy aircraft penetrated the fighter screen to attack British ground troops. During the 15th the offensive air effort was confined to attacks against the enemy's forward lines of communications, and night, dawn and dusk attacks against enemy landing grounds. On the following day the

[1] A.H.B./IIJ1/183/137(A)–(B).
[2] A.H.B./IIJ6/2.

bomber force was ready to answer Army calls for support, but although ground units were in difficulties at the Halfaya Ridge, they did not avail themselves to this support as, despite pre-battle arrangements for signal communications between air and ground forces, they considered the enemy and British ground troops were too closely situated to each other for effective air intervention to be possible. British aircraft patrolling over friendly ground troops also failed to evoke reply to their recognition signals.

On 17 June, the flank of the main British column advancing from Sofafi to Sollum was threatened from the east by an enemy column and, at the request of the G.O.C. Western Desert Force, all available aircraft were engaged. The bombers, and the majority of the fighters attacked enemy armoured fighting vehicles, motorised troops and the communications and supply vehicles operating in the immediate neighbourhood of the enemy's advancing column. All these attacks were directed against enemy columns which were threatening to envelop British troops, but which were still well clear of them.[1] Closer support was given, however, later in the day when the situation had grown more urgent, by Marylands and Blenheims with 250 lb. bombs fused for instantaneous detonation. Several enemy armoured fighting vehicles received direct hits from bombs dropped from a height of few hundred feet and the G.O.C. considered these attacks played an important part in bringing the particular enemy column to a halt. The instantaneous fuse was employed to take advantage of the fragmentation of the bomb in close misses, as experience had shown that bomb splinters were quite likely to damage the tracks of tanks.[2]

Air Support Failures during Battleaxe

Although the air operations against ground troops in Battleaxe were made in agreement with the Army, both the General Officer Commanding-in-Chief and the Air Officer Commanding-in-Chief agreed that they were not a good example of effective ' Close Support '.[3] Air Marshal Tedder stated that as far as could be discovered, only one request for air support had been made by ground units in operation. This request was on 15 June, when a cannon Hurricane was sent to destroy an enemy artillery position at Halfaya. The mission was successful although the aircraft was shot down. Other Royal Air Force operations against ground troops during the battle were carried out with Army cognizance, but as a result of air reconnaissance, and were all against targets well clear of British troops. At Halfaya and elsewhere the Army did not ask for close support because of the proximity of enemy troops to the British.

The Army criticism of air action or the lack of it, showed very clearly the need for a better understanding of the essential character of air participation in a ground battle. For example General Wavell said that the Royal Air Force did not have sufficient air superiority to afford entire protection of the ground troops or to stop the enemy's movements, but that the British forces were

1 A.H.B./IIJ6/2 and A.H.B./ID3/734.

2 A moving tank was very difficult to hit with a bomb and it was thought probable that this method was more likely to bring tanks to a halt by damaging their unprotected parts by fragmentation. The 250 lb. bomb with instantaneous detonator and rod fixture was much employed in subsequent operations in the Desert against M.T. columns.

3 A.H.B./ID3/734.

neither trained nor organised for the type of air support employed by the enemy and, therefore, could not expect it. This view of air operations was severely criticised both by the Air Officer Commanding-in-Chief and by the Air Ministry and their criticisms were later endorsed by the Prime Minister in a directive to the Commanders-in-Chief. It was pointed out that the Royal Air Force had air superiority throughout the battle but that no superiority, unless it was complete, could stop enemy ground movement or ensure an impregnable defence against enemy attacks on ground troops, however careful the organisation and training of both air and ground forces. As it was, both the fighter defence and the offensive operations had proved very effective, as the Commander-in-Chief had himself admitted. Complete invulnerability provided by the Royal Air Force from either air or ground attack could not and should not be expected, and in any case the wisdom of providing the ' umbrella ' defence system was very questionable.

Other criticisms from the Army regarding Army/Air Co-operation included delay in both offensive and defensive support caused by the separation of the Army and Air Headquarters by roughly 100 miles, and poor tactical reconnaissance caused by the lack of direct communication between the pilots and Divisional Headquarters.[1] It was suggested that, in addition to signals improvements, co-operation might be improved by the provision of a senior air officer in the forward area who, with the knowledge of the immediate situation, could advise the staff at Air Headquarters what action would best help the ground forces. The A.O.C.-in-C. maintained that communications were the crux of the problem and submitted that the existing layout and organisation were inefficient and required a drastic overhaul. In his view there was no doubt that opportunities for giving air support were lost owing to the absence of accurate information from the Army and the failure of the recognition procedure. The fact that the Army Co-operation Squadron was weak and suffered many casualties had made it impossible to compensate for lack of position reports by additional tactical reconnaissance. The lack of information provided by the Army was caused to some extent by the breakdown of wireless communications, but also by the inefficiency of the signals system between ground and air forces when indicating the position of the mobile forward units. In some cases the Army had found it difficult to give even a bomb line. The A.O.C.-in-C. thought that lack of training, rather than lack of suitable equipment, was in fact the main cause for the breakdown in communications. His proposals for the future were to bring the existing Army Co-operation Wing up to the authorised establishment as quickly as possible, and to initiate investigation, development and training on the proper lines, with experienced instructors from the United Kingdom.

During the lull that followed Battleaxe when both sides were occupied in building up their strength for an offensive in the autumn, the Commander-in-Chief, Middle East made demands for an air component and stressed the importance of the air factor in such a way as to imply a triple control of the air forces.[2] He declared that the ' second essential ' for a successful Desert offensive (the first was armoured reinforcements) was ' adequate and suitably trained air components at the disposal of the Army for all its

[1] Western Desert Force ' G ' Staff Diary.
[2] C.O.S.(41) 417, Annex I.

needs, including fighters, medium bombers, tactical reconnaissance and close support on the battlefield'. The 'third essential' was separate air forces at the disposal of the Navy. Upon this, and in view of the recent experiences in air support, the Prime Minister made it clear to the G.O.C.-in-C. Middle East that, although the full power of the Air Force was to be directed to winning the land battle, this did not imply a local employment and control of the air forces. He wrote :—

> 'I feel that for all major operational purposes your (the Army's) plan must govern the employment of the whole Air Force through the Middle East, bearing in mind that the Air Force has its own dominant strategic role to play and must not be frittered away in providing small umbrellas for the Army as it seems to have been in the Sollum battle.'[1]

During the summer of 1941 the whole question of the employment of the air forces in support of the projected land offensive was discussed between the Prime Minister and the Chiefs of Staff, with the result that a directive was issued by the Prime Minister :—

> '250 Bofors are now being sent to General Auchinleck for him to use in the best possible way with all his columns and at all the assembly points of his troops or refuelling stations required in the course of operations. Never more must the ground troops expect, as a matter of course, to be protected from the air by aircraft. If this can be done it must only be as a happy make-weight and as a piece of good luck. Above all, the idea of keeping standing patrols of aircraft over moving columns should be abandoned. It is unsound to distribute aircraft in this way, and no air superiority will stand any large application of such a mischievous practice. Upon the military Commander-in-Chief announcing that a battle is in prospect, the A.O.C.-in-C. will give him all possible air support irrespective of other targets, however attractive. . . . The Army Commander-in-Chief will specify to the Air Officer Commanding-in-Chief the targets and tasks which he requires to be performed, both in the preparatory attack on the rearward installations of the enemy and for air action during the progress of the battle.
>
> 'It will be for the A.O.C.-in-C. to use his maximum force (against) these objects in the manner most effective. This applies not only to any squadrons assigned to Army Co-operation permanently, but also to the whole air forces available in the theatre . . . As the interests of the Cs.-in-C. are identical, it is not thought that any difficulty should arise. The A.O.C.in-C. would naturally lay aside any routine programmes and concentrate on bombing the rearward services of the enemy in the preparatory period. This he would do, not only by night, but by day attacks with fighter protection. In this process he will bring about a trial of strength with enemy fighters, and has the best chance of obtaining local command of the air. . . . What is true of the preparatory period applies with even greater force during the battle.'[2]

This directive formed the basis for the general policy which became the background to the planning of Army/Air Co-operation for the Crusader offensive in November 1941 and, indeed, for Air Support in general throughout

1 War Cabinet Hist. Series B.1 (Final).
2 A.H.B./III1/183/271 (A)–(B).

the rest of the war. Whilst confirming the independence of the Royal Air Force as a separate service on equal terms with the Army and Royal Navy, it also introduced principles of co-operation which could match the unity of purpose of the three Services, with a combined plan for operations.

Middle East (Army and R.A.F.) Directive on Direct Air Support

In July 1941 an Inter Service Committee of representatives of the Army and the Royal Air Force was formed to study the whole question of air support.[1] Experiments were carried out in August and an Air Support Conference was held in Cairo on 4 September ' to discuss the policy to be adopted in the Middle East for the provision of Air Support for the Army '.[2] As a result of this conference the Middle East Directive on Direct Air Support was issued on 30 September.[3] It was to be adhered to in principle in future operations but could be modified in detail to suit local conditions and special circumstances.

In the Directive, which was an important milestone in the development of Army/Air co-operation, Direct Air Support was defined as ' air action having an immediate effect on the action of our own ground forces in battle '. Such support could be prearranged or impromptu ; it was the latter which presented difficulties. The Directive defined the two basic aspects of direct support as :—

(*a*) Defensive support to impede or halt the enemy's ground offensive in general and to counter his dive-bombers in particular.

(*b*) Offensive support which aimed at the destruction of enemy ground forces, with the intention of facilitating the offensive of the military forces on the battlefield.

For defensive support against an enemy offensive, the most suitable targets were normally outside the range of ground observation, and had therefore to be selected by air reconnaissance. A tentacle system was necessary, however, so that commanders of leading brigades could rapidly communicate their requirements in air support. Effective air defence against dive-bombers could only be achieved by air supremacy since there was no time for fighters to be called up once an attack had started. As defence by the wasteful means of standing patrols was out of the question the best solution to this problem appeared to be in fighter sweeps arranged for the time when enemy bombing raids were most likely. The most constant protection would, accordingly, be provided by ground A.A. defences.

It was in offensive direct support, however, that the Royal Air Force was most likely to assist ground operations. Attacks by fighters with machine-gun or cannon corresponded to the German ' Stuka ' attacks but they could not normally be expected until a considerable degree of air superiority had been obtained. Fighter-bomber attacks were described as ' low-level or shallow-dive attacks, usually carried out at about eight hundred feet at high speed, the formation having previously dived down from a considerable altitude. Columns of M.T. or light A.F.V.s were considered the most suitable targets

1 A.H.B./IIJ1/6.

2 War Office File 43/R.A.F./640.

3 *See* Appendix 7.

for this form of attack. The initial bombing would halt the convoy and this would be followed by accuracte machine-gun attacks. Normal direct support would be given by medium bombers (later to be reclassified as light bombers).

The Directive pointed out that by means of direct air support bombing it was possible rapidly to produce a considerable volume of fire to assist formations which had outstripped their artillery. Bombing was not to be used, however, when other ground support such as artillery and mortars was sufficient. Unlike artillery, it would be generally impossible for direct air support aircraft to sustain their attack for a prolonged period, and air attack did not tend to become more accurate as it proceeded. The success of the attack would depend on the extent of the enemy ground and/or air opposition, good visibility and a target which could be clearly recognised from the air. To avoid the accidental bombing of our own troops, it was laid down that targets should never be within 500 yards of our forward positions.

Suitable targets for direct support bombing were concentrations of troops or vehicles which could be surprised in close formation and would have difficulty in dispersing ; Headquarters and Signals Centres, where these could be accurately located ; artillery positions in the open (the effect being more likely to kill or disperse gun crews rather than knock out guns) ; supply echelons and crossing points over obstacles. These targets were normally outside the range of ground observation and would usually be selected by air reconnaissance.

In order to ensure that the maximum effort was obtained from the available direct air support aircraft, an Air Support Control (A.S.C.) was to be used to meet, modify or reject reports for support received from various sources. The Headquarters of the Royal Air Force formations which might be called upon to give direct air support was to be organised with one or more mobile advanced headquarters, which combined with an Army element, was to be known as Air Support Control. The two elements would comprise :—[1]

Army. Two staff officers plus a small staff. A wireless organisation consisting of :—

(*a*) Seven forward links known as tentacles for communication with the Control Headquarters. The tentacles could be allotted to those lower formations which the higher commander decided should be given the means of calling for Air Support.

(*b*) Three wireless sets at the Control Headquarters for communicating with the tentacles.

Royal Air Force. The formation commander or his deputy, plus a small operational staff.

(*a*) Eight wireless sets known as Forward Air Support Links (F.A.S.Ls.) for controlling air support aircraft in the air and for listening to reconnaissance aircraft.

(*b*) Two wireless sets known as Rear Air Support Links (R.A.S.Ls.) for communicating directly to four landing grounds.

(*c*) Four wireless sets for use at four landing grounds.

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1 *See* Appendix 7.

It was the intention to provide A.S.Cs. on the basis of one to each Corps and one to the Armoured Division. For ' Crusader ', however, it was not intended to provide the Army element of an A.S.C. allotted to the Armoured Division, as all headquarters in such formations already had operational wireless channels which would be used for passing requests for air support. The headquarters of the A.S.C. would be established as part of the headquarters of the formation fighting the battle. This would normally be a Corps or Armoured Division Headquarters. Tentacles and F.A.S.Ls. were to be allotted to Brigades of Infantry Divisions to enable forward commanders to call for direct air support. Tentacles of F.A.S.Ls. for listening purposes were also to be allotted to the headquarters of Infantry Divisions.

The A.S.C. organisation thus allowed requests for air support to be received from :—

(*a*) Tactical Reconnaissance aircraft which happened to note suitable targets.

(*b*) A support reconnaissance aircraft specially sent up by A.S.C. Headquarters to look for suitable targets.

(*c*) Forward formation commanders by means of the tentacles allotted to them.

The selection of targets provided by air reconnaissance was to be made by the following method. The military commander indicated to the Royal Air Force formation commander probable areas for direct support targets and on this information, the Royal Air Force commander arranged the air reconnaissance. Requests for air support on selected targets was made by R/T by the support reconnaissance aircraft to A.S.C. Headquarters. The Control staff decided whether the request should be accepted or refused, and the aircraft and the appropriate ground formation were informed accordingly.

Requests from forward troops for air support were made by W/T from the tentacles. The messages were received at the A.S.C. Headquarters by the G.S.O.2. The Control staff again either accepted or refused the request according to the suitability of the target and availability of aircraft, and the formation which had originated the request was notified. If accepted, the request was passed by the Royal Air Force commander over the Royal Air Force signals system to the appropriate landing ground. A.S.C. informed the tentacle of the time of attack and the number of aircraft so that the ground commander could make any necessary adjustments in his plans.

In order to reduce to a minimum the time taken in transmitting calls for air support, standard types of messages were adopted. The target was described by means of the Reconnaissance Code and authorised abbreviations. The number of aircraft required was decided at Control Headquarters on the basis of the type of aircraft, availability of aircraft and other considerations. As the location of our own troops and the times at attack and rendezvous had to appear on the message, simple map references and time codes were used throughout. Such codes were to be originated by the Headquarters of the formation to which the A.S.C. was allocated. Furthermore, as medium, low-level and shallow-dive

attacks could not achieve results which were as accurate as those obtained by dive-bombing, it was necessary to stipulate a bombline, beyond which it was not safe to attack. Bomblines were to be expressed as ground features wherever possible and not as grid lines.

For the state of the readiness of aircraft, the system which was found to be most satisfactory in trials involved 50 per cent of aircraft at ' instant readiness '— 25 per cent ready within two hours and 25 per cent released. One hour after the return of a mission Wings were required to report to the A.S.C. the number of aircraft returned and the number available for further sorties. An interval of one hour was allowed for inspection, refuelling and rearmament.

The various ways of indicating the target to the support aircraft included the following :—

(*a*) The formation was met at the rendezvous by a reconnaissance aircraft and led to the target.

(*b*) It was directed from the ground by means of ground strips or R/T from a F.A.S.L.

(*c*) It was given the exact location before leaving the landing ground.

An efficient recognition system between aircraft and ground troops was essential. The system recommended was based on a flying height of 6,000 feet and included the use of coloured cartridges, Verey lights and ground signs.

Modifications of Air Support Control—Combined Army/Air Headquarters, 16 November 1941

Although the principles embodied in the Directive were adopted, certain modifications were made in the organisation as a result of further exercises by mutual consent of the G.O.C. Eighth Army (General Cunningham) and the A.O.C. Western Desert Air Force (Air Vice-Marshal Coningham). It was agreed that the local air superiority over the advance must be maintained and that the provision of direct support should never jeopardise this essential superiority. Moreover, it was necessary to anticipate an occasion when, according to the agreed Army/Air plan, the entire bomber force would be directed against a single target. It was decided, therefore, that the air support should be controlled centrally by the A.O.C. Western Desert aided by the Direct Support Section at Battle Headquarters. The function of the Corps Headquarters Unit was, therefore, to relay messages from aircraft and tentacles straight to Battle Headquarters and also warn the Wings so that pilots could be briefed pending the final decision by the A.O.C.[1]

In addition to the clarification of the policy and organisation of Air Support Control to remedy the weaknesses revealed during Operation Battleaxe and previous operations, steps were also taken to improve the mobility of the Western Desert Air Force. The main consideration was the necessity for maintaining uninterrupted air operations while the ground organisation moved backwards or forwards. ' To achieve this, every unit which in static conditions works as an indivisible entirety, must be made to walk. For this purpose two

[1] A.H.B./IIJ1/122/7(A).

SIGNAL DIAGRAM—AIR SUPPORT CONTROL

(Based on Diagram in Middle East Pamphlet No. 3A)

limbs are required, each of which can carry the weight of the body while the other is reaching forward. Therefore it is a fundamental principle in mobile warfare that every unit must be capable of division into separate entities.'

Although improvements had been made to increase mobility, it was evident that the provision of vehicles for the Air Force in the desert was far from adequate. However, the A.O.C.'s last-minute requirements were met to a considerable extent by the C.M.S.O.'s action in supplying 84 additional three-tonners and extra utility vehicles shortly before the opening of the offensive. The effort to render the Western Desert Air Force as mobile as possible is indicated by the fact that of the Royal Air Force vehicles used at the beginning of Crusader 802 were new.

In order to afford support to and cover the advance of our ground forces, it was necessary to prepare and safeguard a series of landing grounds which would allow our air force to keep the battle area within range. The general plan was for fighters, with their limited range, to progress by short strides to speedily prepared landing grounds on selected sites, and for the bombers to follow with longer strides to take over suitable landing grounds which had been vacated by the fighters.[1]

Finally, two days before the offensive opened, Advanced Air Headquarters Western Desert was set up alongside Army Battle Headquarters in the Khamsa area.[2] The Rear Air Headquarters under the A.O.A. Western Desert remained at Maaten Bagush.

Crusader Offensive—18 November 1941

The planning and execution of air operation before and during Crusader shaped the method of applying air power in support of a land campaign. It composed a battle for air superiority and attacks on enemy rear areas while the air forces designated for direct air support were being prepared for participation in the struggle on land. A maximum effort, from the evening before to the evening after the move forward of troops, was planned in order to use the superiority in providing the maximum support for the Army.

During the battle Wellington bombers flew 101 effective sorties by night, against concentrations of vehicles and other pin-point targets, in support of round-the-clock operations during the six day period preceding the relief of Tobruk. Over the battlefield itself, a force of specially equipped Wellingtons attempted to jam the R/T communications of the enemy armoured formations.

The light bomber and the fighter-bomber, with the assistance of fighters, were the primary means of providing support against ground targets engaged through the Air Support Control machinery, as the result of reconnaissance, or by

[1] A.H.B./IIJ6/7/4.

[2] To ensure unbroken control from Advanced Air Headquarters Western Desert, the most important operational channels—those to the fighter and bomber wings in the forward area—were duplicated. The channel to Rear Air Headquarters was also duplicated. Thus any operational signals to No. 205 Group, or other operational units not controlled by the Western Desert fighter or bomber wings, would be passed through Rear Air Headquarters.

means of offensive sweeps. The light bombers' first active operations took place on 18 November 1941, the opening day of the battle, when Blenheims and Marylands attacked A.F.V.s and transport which had been reported by reconnaissance as mud-bound in the Bir El Gobi area. These operations immediately indicated an appreciable improvement in the efficiency of the Blenheim force as the result of recent training, the take-off being effected within half an hour of the orders being issued. But on 20 November at Gabr Saleb and later at Gazala the operations of the light bombers were gravely restricted by the difficulty of identification of troops on the ground. In fact the problem of fixing a bomb-line or otherwise providing for the protection of friendly troops, was a restrictive influence throughout the campaign. Furthermore, as the requirements of impromptu support took precedence in respect of the light bomber force, much waiting for targets and loss of effort could not be avoided. Low cloud, rain, dust, unserviceability, diversions to contend with the enemy air transport force, the need to have fighters suitably based for the provision of escort, and the shortage of fuel and supplies in the area west of Tobruk, further reduced the effort against enemy land forces. During the three days 25 to 27 November, when the enemy penetrated to the Egyptian frontier, the light bomber effort averaged over 70 effective sorties per day on direct support. But at Gazala the light bomber effort was negligible, and for nine days in January the effort was stopped altogether. During the first month while fighting was most intense the light bombers flew almost 900 effective sorties of which about 90 per cent was against direct support targets, an average effort of about 30 effective sorties a day.

The effect of bombing decreased after the first week of operations as the enemy learned the lesson of dispersal, and, thereafter, the attack on direct support targets in the forward area was not on a sufficient scale to be a dominant factor in the land battle. Enemy movement was restricted and considerable casualties were inflicted upon thin-skinned vehicles and on certain occasions, such as from 24 to 27 November 1941, much help was given in checking Rommel's marauding columns and in assisting in the Sidi Resegh and El Duda areas. Again on 3 and 4 December air attack played a valuable part in turning back enemy columns, but Gazala was a disappointment and it was painfully obvious that until communications and the control of army forces were improved, the air force would be forced more than ever to strike the vulnerable enemy tail rather than to give more immediate assistance on the battlefield.

Both fighters and bombers proved effective against concentrations of thin-skinned vehicles, especially when these were caught in defiles from which dispersal was difficult. The fighter-bomber by means of high speed shallow dive tactics from about 800 feet after a descent from high altitude, was adept at stopping convoys as a preliminary to machine-gunning, but as soon as halted targets were engaged the task became more difficult owing to the increased A.A. opposition that was immediately encountered.

For the greater part of the offensive there was an average time-lag of two-and-a-half to three hours between the initiation of a call and the dropping of bombs but this was greatly reduced when bombers were able to operate from the advanced fighter landing grounds. The main causes of the time-lag were :—

(*a*) The delay caused by the relay of messages from A.S.C. at Corps to Battle Headquarters.

(*b*) The distance from the bomber airfields to the target—sometimes as much as 200 miles.

(*c*) The unavoidable delay caused by picking up fighter escorts at fighter airfields or at a rendezvous.

(*d*) The time taken to brief pilots on the new airfields once the advance had started.

(*e*) Difficulties of navigation and identification of targets in the featureless desert, particularly when M.T. had moved from their originally indicated positions. Moreover visibility was often poor.

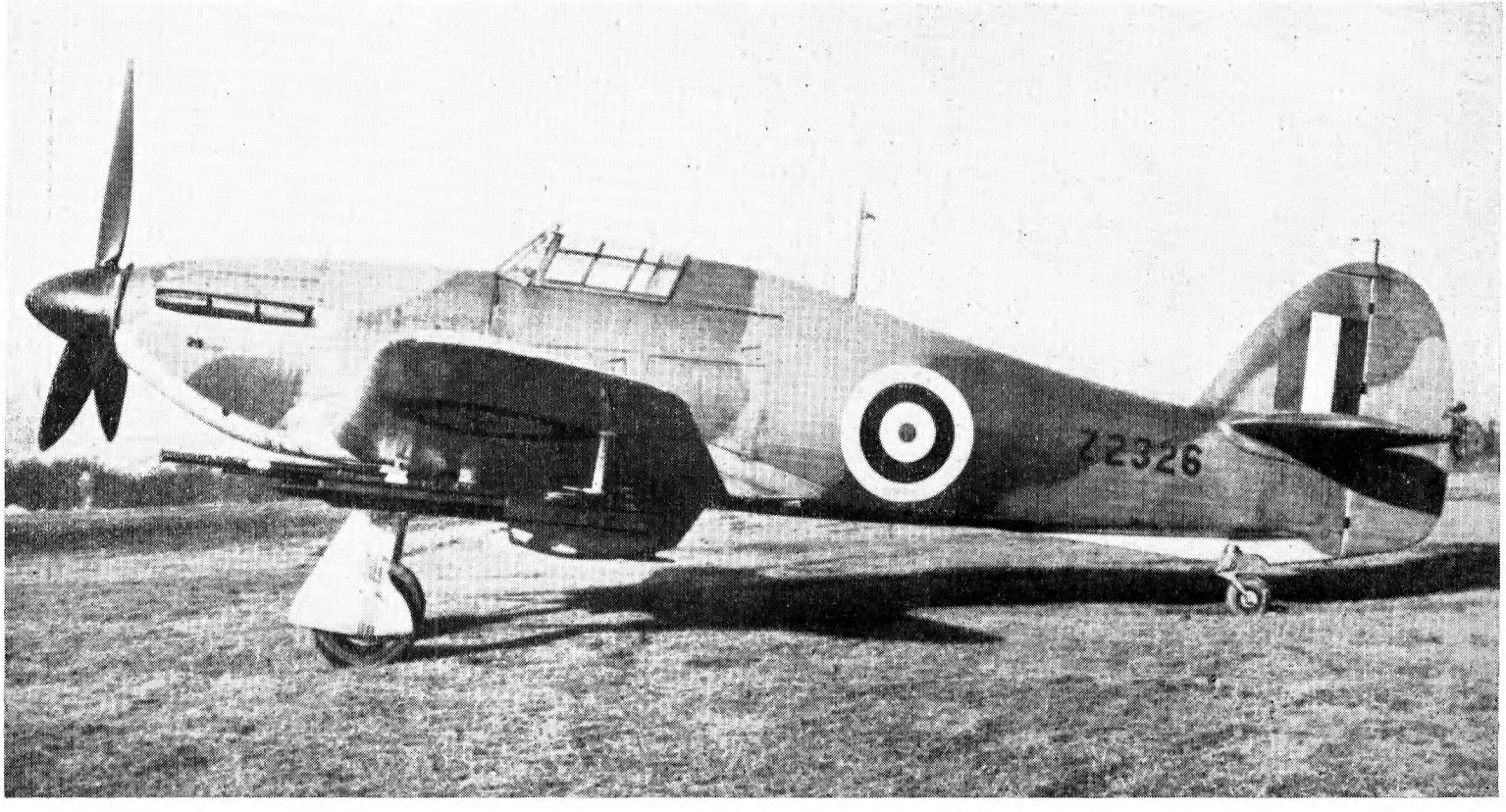
Before the offensive began it was realised that as large a proportion as possible of all supplies should be of general utility value, or a shortage of specific items would occur. It was decided therefore, that the standard bomb should be the 250 lb. G.P. which with its wide range of fuzing could be used effectively against all targets likely to be encountered.[1] An early form of ' carpet ' or ' pattern ' bombing was used in this offensive. Experiments had shown that on typical desert terrain of about six inches sand surface and limestone sub-soil, M.T. vehicles were set on fire at distances up to 40 yards from the nearest bomb and that adequate fragmentation was produced at 60 yards to render almost all vehicles temporarily immobile. Consequently, when desert convoys in leaguer were attacked, bomber units were instructed by the A.O.C. Western Desert Air Force to attempt a spacing both in line and range of 100 yards.

In general, the effect of our direct support bombing was greatest in the early stages of the campaign before the enemy learnt the lesson of full dispersal. In addition to the material effect of the bombing, the moral effect on our troops seeing the enemy bombed or seeing our fighter or escorted bomber formations *en route* to targets was again confirmed as being a most important factor. For our part better dispersal in the field was needed. Moreover, the A.A. defence of the Eighth Army was still inadequate compared with the enemy's.

Air Support During the Retreat from El Agheila

' On the 21st January,' General Auchinleck wrote, ' the improbable occurred, and without warning the enemy began to advance.' Although we had gained a timely victory it was incomplete. Appreciable enemy forces had escaped and the lack of lighters for unloading at Benghazi and the impracticability of hurriedly installing a defence of the port against air attack, made it impossible to obtain sufficient supplies either to maintain the advance or to hold the ground that had been won. The enemy on the other hand made a rapid recovery and counter attacked at El Agheila on 21 January 1942. Bad weather prevented full air co-operation in the form of reconnaissance, and on 22 January the enemy had pressed forward to seize Antelat. An effort was made to hold the advance, but February saw our forces pushed back as far as Gazala. Rommel was advancing without air support for his troops but in contrast W.D.A.F. fighter and to a lesser extent, light bomber squadrons kept up a continuous, although necessarily restricted effort. The main factors limiting

[1] A.H.B./IIJ1/122/7(A).



HAWKER HURRICANE

the scale of effort were bad weather at the beginning of February, when alternate rain and dust storms were common over the battle area ; the withdrawal of the Western Desert Air Force, owing to the enemy advance, which inevitably caused some disruption of effort ; and a depleted fighter force (seven squadrons had had to be withdrawn for lack of aircraft and, in some cases, for re-equipping). Difficulties were also experienced in fixing a bombline, in the lack of identification on our vehicles, in the great tactical superiority of the Me.109F and in the general weakness of the Eighth Army in A.A. gun defences which forced a heavy defensive burden on the Royal Air Force.

Nevertheless, in spite of the depletion of the Fighter Force and the disruption caused by the withdrawal, the air support given to the Army in its final withdrawal to the Gazala-Bir Hacheim line and the initial period of consolidation proved that the methods evolved to ensure the mobility and uninterrupted control of the Western Desert Air Force during the Crusader advance worked equally well in reverse.

A closer control of training, tactics and administration was, however, essential and the Fighter Force was therefore organised into Fighter Wings of four to six squadrons controlled by No. 211 (Fighter) Group which was reformed for this purpose. The main object was to divorce operational from administrative and maintenance control in order that the officer in charge of operations could devote all his time to operations and would be unhampered by administrative duties.[1] Orders for the day-to-day employment of the fighter force were to be issued by A.H.Q. Western Desert and would be based on a preconceived plan.

During March experiments were made with fitting Kittyhawks with bomb racks. This had been successful with Hurricanes, and during the Crusader offensive they carried eight 40 lb. bombs. These bombs, however, were not heavy enough to penetrate armoured vehicles, and could only be used successfully for low level attacks on enemy personnel and soft-skinned transport. One Hurricane squadron was therefore equipped to carry two 250 lb. bombs with extension rods and the first Kittyhawk which was fitted locally carried one 250 lb. bomb. Later issues of Kittyhawks arrived fully equipped to carry one 500 lb. American bomb.

The fighter-bomber, as developed by the Western Desert Air Force in the spring of 1942, was the answer to the German ' Stuka '. It had the additional advantage of being able to provide close support at a much reduced time interval than the bomber and it could also immediately revert to its primary role as a fighter once its bomb load had been released. Kittybombers were first used in the desert on 16 May, when six aircraft of No. 112 Squadron attacked an enemy camp east of the main road near Bomba.

The main modification to the system of Air Support Control for co-operation with the Army laid down in Directive No. 3 was the centralised control at the combined Army/Air Headquarters. In the phase of the campaign which terminated at Gazala, Air Support Control had been located at Corps Head-

[1] No. 211 Group O.R.B.

quarters, relaying calls for air support to Combined Headquarters for approval and simultaneously to Wings for preliminary briefing.[1] It became evident that if this Control was located at Combined Headquarters, in a position to represent the requests from forward tentacles direct to Army and Air Headquarters, more rapid executive action could be taken, within the framework of the Combined Plan. Air Support Control was therefore moved to Combined Headquarters and the change proved itself of much value in subsequent operations. Arising from this new location it was found that the G.S.O.2 Commanding the Air Support Control Unit was in a position to advise on the importance of targets from the Army aspect if higher authority was not immediately available and this procedure was also adopted with beneficial results.

To assist pilots to pin-point themselves in the featureless desert, all Army formations were prepared to put out landmarks by day or night at points selected by them and made known as a map reference to the Royal Air Force through Air Support Control. By day the landmarks took the form of letters of the alphabet 20 yards in length, and by night a ' V ' sign with sides 100 yards long constructed of lighted petrol tins 25 yards apart. These ground landmarks, when laid out, were of great assistance and enabled directed support to be given with a much greater degree of accuracy. Steps were also taken during the lull to improve the identification of vehicles. The white St. Andrew's Cross on a black background had been painted on the majority of vehicles. For various reasons this had not been satisfactory, and at a conference held on 5 March 1942, Wing Commander Finlayson suggested using the Royal Air Force roundel since it was ' a sign for which all fighter aircraft are on continual watch in the air.' The roundel was therefore recognised as the permanent marking for all vehicles, although owing to a shortage of the necessary materials it was some time before it came into general use.[2] Similarly, although the Desert Air Force had long advocated the use of coloured smoke as being the best means of identification of friendly troops, the system could not be adopted until an adequate supply of smoke candles and cartridges was obtainable in the Middle East.

A co-operative effort between Wellingtons and Fleet Air Arm Albacores had been tried out and proved on a small scale early in the campaign. It was subsequently introduced as a standard procedure to make the maximum use of night bomber effort and, through its development on an ever-increasing scale, was one of the main factors in stopping the advance of Rommel at El Alamein and in the defeat of the Afrika Korps at Alam el Halfa in late August.[3] During raids on airfields the F.A.A. Albacores arrived over the target fifteen minutes ahead of the Wellingtons and searched for and later illuminated the dispersal areas at a specific time when the Wellingtons would arrive. With their slow speed, good visibility and large flare-carrying capacity, the Albacore was most suitable for this task.

On 26 May 1942 Rommel began his advance and the Desert Air Force went into action in accordance with the agreed policy.[4] The fighters, abandoning for the time being the primary task of keeping air superiority, were used in the

[1] Report on Operations A.H.B./IIJ6/8.
[2] A.H.B./IIJ1/122/7(a).
[3] A.H.B./IIJ6/8.
[4] A.H.B./IIJ1/159/20.

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FAIREY ALBACORE

closest support of the Eighth Army, making low-level attacks on the advancing enemy and often without top cover. Enemy ground A.A. defences however, exacted a heavy toll and, in addition, the Western Desert Air Force fighters were often 'jumped' by higher flying enemy fighters. Some 200 enemy vehicles were claimed to have been destroyed, and the toll would have been much higher but for the lack of incendiary ammunition. Within four days, however, over 40 fighters were lost, and the high wastage in Kittyhawks and the gap in deliveries quickly swallowed up the reserve of these aircraft.[1] A decision was therefore made that fighters should operate on more normal lines. The casualty figures immediately dropped.

On 2 June, reorganised and under the cover of a two-day sand-storm, the enemy attacked Bir Hacheim. After an intense fight the strongpoint fell on 11 June and Rommel's forces were soon threatening the Western Desert Air Force's advanced landing grounds at Gambut. The plan which had been prepared by Air Marshal Coningham was put into effect and the withdrawal of Royal Air Force units to the frontier of Egypt and Cyrenaica began on 17 June 1942. It was this provision which enabled air operations during the retreat to be maintained on an undiminished scale. Stocks of fuel and bombs had been established at selected operational bases and these had been linked by telephone to A.A.H.Q. Western Desert, thus ensuring that control and direction were available for formations and units.[2]

The withdrawal of the Western Desert Air Force, first to Sidi Azeiz and then to Sidi Barrani, meant that the Tobruk garrison was denied an adequate measure of air support, even although long-range fuel tanks had been fitted to the fighters. This was unfortunate since the heavy enemy dive-bombing attacks played an important part in the garrison's surrender. After the fall of Tobruk, on 20 June, the enemy advance continued rapidly. The effort by the Western Desert Air Force was very great and there were instances of aircraft doing as many as seven and pilots as many as five sorties in one day.

The force available to the A.O.C.-in-C., Middle East Command, at the end of June 1942, comprised three main components. There was the tactical or field striking force of the Western Desert Air Force's fighters, fighter bombers and light bombers ; No. 205 Group's strategical force of medium bombers, supplemented by a small number of heavy bombers ; and No. 201 (Naval Co-operation) Group's mixed coastal force employed on shipping strikes, convoy escort and sea-reconnaissance work. There was also a small force under A.H.Q. Egypt for defensive duties.

During this period of crisis in the land battle, the three components tended to coalesce and were employed almost exclusively in direct support on the Eighth Army. For example, No. 205 Group's force of Wellingtons was switched from the bombing of ports to targets in the battle area. The two Fleet Air Arm Albacore squadrons, Nos. 821 and 826, were engaged on 'path-finder' duties with the Wellingtons, while the two coastal Beaufighter Squadrons, Nos. 252 and 272, were switched to attacks on enemy road convoys and

[1] A.H.B./IIJ1/159/20.
[2] A.H.B./IIM/A48/1.

airfields. This policy in which every available aircraft was concentrated in a systemmatic ' round-the-clock ' bombing of the enemy columns had a profound effect on the course of the fighting. Two extracts from enemy War Diaries read :—

21st Panzer Division

' Continued bombing attacks during the night 1/2 July) but otherwise no contact with the enemy. The supply columns have been scattered or dispersed.'

Afrika Korps

' In the night (1/2 July) continuous bombing attacks met with success and the supply columns were blown up ; there was no improvement in the supply position. An advance is intended after replenishment of fuel stocks. During the day there were once again heavy raids. Our own fighter defence was not nearly sufficient. Panzer Armee Afrika reports that, in the coming night, night fighters will be brought into action. The supply situation is again difficult ; ammunition is especially short.'

' In the night (2/3 July) British air activity has again been very intense. The continual raids by night and day are seriously hindering the troops ; our own fighter defence is not to be seen.'[1]

On 4 July 1942, Field Marshal Rommel made known his decision that the German-Italian Panzer Army must go over to the defensive. The invading army had been held only seventy miles from Alexandria.

One result of the long and speedy retreat—in 12 days the battle moved some 350 miles—was that the organisation for the necessary close co-operation between the army and the air force was gravely impaired, yet at no time had the Eighth Army's need for air support been more urgent. There was no lack of the spirit of co-operation : but the system had broken down under the strain and confusion of a retreat in which the army themselves had often lost track of the whereabouts of their own units.[2] Air Marshal Coningham therefore evolved a system whereby the reports brought back by pilots returning from operational missions were used for selecting targets. The Air information passed to military formations in this way was considerable. On one day 35 bomber and fighter reports were sent forward, in addition to routine tactical reconnaissance information.

There were approximately 248 requests for direct support during the May–July battle.[3] Of these, 187 were fed from tentacles and 61 were selected by Corps for air information. The time from origination of the request to the time of arrival over the target was 60 minutes, including an average flying time of 20 minutes. A few exceptional cases of 20 to 30 minutes occurred when demands from formations were forestalled by the Air Operations Room which

1 A.H.B.6 Translation.

2 A.H.B./IIJ6/8.

3 These fall roughly into three periods :—
(i) 26 May–17 June, between the Gazala Road and Sidi Resegh (138 requests).
(ii) 18 June–1 July, following the withdrawal (12 requests).
(iii) 2 July–26 July, El Alamein line (98 requests).
(Report on Visit to the Middle East by the A.O.C.-in-C. Army Co-operation Command).

had already acted as the result of air information. This was a great improvement over the time taken during Crusader which averaged more than three hours.

Co-operation between the Eighth Army and the Desert Air Force was hampered by the fact that the Eighth Army Tactical Headquarters was situated at a considerable distance from the Advanced Air Headquarters. When General Montgomery assumed command of the Eighth Army, Air Vice-Marshal Coningham represented to him the difficulties of working in separate localities and one of the first steps taken by the new G.O.C. Eighth Army was to move his headquarters back to Burg el Arab, where Advanced Air Headquarters was sited.

During August 1942, until Rommel launched his offensive on the 30th, there was a lull in the land fighting and during this period two reports were published which crystallised much of the experience gained in the field of army/air co-operation. One was the ' Memorandum on the Organisation of the Western Desert Air Force for Co-operation with Eighth Army ' by Air Commodore Elmhirst, A.O.A., Western Desert Air Force and the other was a ' Report on a Visit to the Middle East ' by Air Marshal Sir Arthur Barratt, A.O.C.-in-C. Army Co-operation Command.[1] The great importance of a combined Army/Air Headquarters and the necessity for all units (particularly headquarters and control units) to be as mobile as possible were again emphasised.

The Battle of Alam el Halfa—30 August to 6 September 1942

In many respects this little-known battle was the climax of army/air co-operation in the Western Desert and one in which, broadly speaking, the seal was set on the procedure and organisation for air support. The battle was a classic of its kind, exemplifying the use of air power on efficient and economical lines, when used in direct support of an army in the field. Field Marshal Rommel's plan envisaged an offensive by the German-Italian Panzer Army in the course of which the British army in the field would be destroyed at El Alamein, leaving the road open for full occupation of Egypt and an advance as far as the Suez Canal and the Red Sea.[2]

The Western Desert Air Force had now reached a high level of operational efficiency. Pilots were familiar with the terrain and the maximum possible force had been concentrated for action in the battle area.[3] These measures included switching squadrons from the defence of Egypt to more aggressive tasks with the field fighter force and employing the greater part of No. 205 Group's strategic bomber force on the night-bombing of tactical targets in the desert.

The Army plan, the keystone of which was the strong defensive position on the Alam el Halfa Ridge, was to force the enemy to fight on ground selected and prepared by the defenders. The air policy was an extension of the one pursued during the pre-battle ' softening-up ' ; the enemy forces were to be

1 *See* Appendix 8.
2 High level Reports and Directives, A.H.B.6 Translations.
3 A.H.B./IIJ1/12.

allowed no rest by day or night and the full weight of the bombing was to be concentrated in the south, where it was anticipated the enemy Commander would launch his main attack.[1] As a result of the A.O.C.-in-C.'s long-term policy to isolate the Axis forces from their sources of supply and reinforcement in Europe by attacks against the enemy line of communication, Rommel was faced with the task of launching a major offensive with only 20 per cent of the necessary fuel requirements.[2]

The Desert Air Force air offensive began nine days before the enemy attack, during which more than 450 tons of high explosives were dropped. On 30 August last light tactical reconnaissance reported enemy mechanised columns moving forward and a night raid by twenty-six medium bombers was quickly organised. Where possible the bombers made two sorties. These attacks, the unexpected strength of the minefield system in the south and the stubbornness of the Eighth Army defence delayed the enemy advance very considerably. Another fruitful cause of disorganisation to the enemy offensive, right at its inception, was a direct hit on the Headquarters of the German Afrika Korps by a night bomber, when the Commanding General was wounded and other members of his staff killed.[3]

By dawn on 31 August—such had been the initial difficulties—the enemy Commander-in-Chief had decided to go over to the defensive. However, after a conference with his Corps Commanders, he decided to continue the attack, but with the important difference that, instead of the ambitious project of an advance towards the east, the plan was modified in favour of a short hook to the coast. This was the form of attack for which the Eighth Army was best prepared, for it meant that the strongly fortified position at Alam el Halfa ran athwart the enemy's main line of advance. From this decision evolved the salient feature of the battle, for while the whole of the Eighth Army's heavy armour was committed to the static defence of this vital ridge, practically the whole burden of offensive operations against the enemy devolved on the air force. ' In effect the guns and armour of the Army made a ring and the air gave the punch inside the ring.'[4]

Bad weather prevented any large scale bombing effort on 31 August and the enemy offensive therefore began to get into its stride. In spite of opposition from the 7th Armoured Division, the main enemy striking force comprising the two armoured divisions and the Recce Group were operating some thirty miles behind the British mine-fields and, by working in a north-easterly direction, were soon challenging the 10th Armoured Division on Alam el Halfa Ridge, from the south. By last light, forward elements of the 15th Panzer Division had installed themselves at only about one thousand yards distance from

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[1] A.A.H.Q., W.D., War Diary.

[2] Afrika Korps War Diary. As late as 27 August Rommel was still unable to determine the actual day of attack owing to the shortage of fuel. When the final movement of the enemy armour to its assembly areas was taking place, the Panzer Divisions had only 2.5 units of fuel (one unit equals petrol for 100 kilometres) when their fuel requirement was in the region of 10 units. For a full account of Rommel's fuel situation see : A.H.B. Narrative *The Middle East Campaigns, Vol. IV, Part III, Chapters* 9 *and* 10.

[3] Afrika Korps War Diary, A.H.B.6 Translation.

[4] A.H.B./IIJ1/122/69.

22nd Armoured Brigade Headquarters and close to the 1st Regiment Royal Horse Artillery waggon line. Both enemy Divisions were also well-positioned for a resumption of their attacks on the following day.

That night, however, 31 August to 1 September, improved weather conditions permitted the night bombers to operate against the enemy concentrations in the battle area—mainly in the Deir el Ragel locality—which offered a series of magnificent targets. Over 90 tons of bombs were dropped by Wellington bombers, which had been guided to their targets by flare-dropping Albacores and almost half of the aircraft managed to carry out second sorties.[1] The German Reconnaissance Group suffered particularly severely in these raids.

On the morning of 1 September, the two German Panzer Divisions resumed their attacks on Alam el Halfa Ridge, but were beaten off, mainly by the efforts of 22nd Armoured Brigade. From first light—the weather now being more favourable for air operations—the light bombers of No. 3 (S.A.A.F.) Wing subjected the vast pool of enemy vehicles and armour in the Munassib-Daayis-Ragil area to intensive bombing attacks. These raids also had the effect of diverting many of the enemy's 88-mm. guns from use against the Eighth Army in their alternative role as anti-tank guns. On the afternoon of 1 September the enemy attacks on the Alam el Halfa Ridge were called off and the enemy forces were compelled to go over to the defensive.[2]

That night, 1/2 September, a total of 90 Wellingtons and Albacores between them dropped almost 112 tons of bombs on enemy vehicles and tank leaguers in the battle area, some of the night bombers operating from as low as 200 feet. Considerable loss and disorganisation were caused to the enemy who reported that : ' These enemy raids, intensified night after night, are an effective battle technique . . . The casualties and loss of equipment occasioned by these attacks necessitate an improvement in day and night defences.'

By dawn on 2 September, the Battle of Alam el Halfa, as a planned offensive carried out by the enemy, was virtually over and at 0750 hours Field Marshal Rommel issued orders for the Afrika Korps to withdraw towards the west, largely because of ' Enemy air superiority and the supply shortage, particularly of fuel '. On 2 September, with the land battle static and the weather good, the light bombers were able to deal their most crushing blow at the enemy, whose biggest concentrations of vehicles were mainly centred in the area of the Ragil Depression. A total of 112 tons of bombs was dropped by 176 aircraft. Eighth Army artillery, which had been very active by night and day throughout the battle, added to the enemy's confusion.

In the course of night operations 2/3 September, the medium bombers of No. 205 Group, helped by the Fleet Air Arm Albacores, dropped over 115 tons of bombs and enemy units found a large proportion of their vehicles unserviceable in the morning.[3] By dawn the next day, 3 September, it appeared

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[1] No. 205 Group O.R.B.
[2] Afrika Korps War Diary.
[3] No. 205 Group O.R.B. and Afrika Korps War Diary.

to air observers, from the general trend of vehicle movement, that the enemy force were in full retreat.[1] The light bombers then flew a total of 200 sorties and dropped 121 tons of bombs while the fighters flew nearly 600 sorties.[2] The best targets were found among the main enemy concentrations which were withdrawing from the Ragil Depression and to the south and west, between Munassib and Himeimat. The Eighth Army Commander was still undecided whether this was the start of a real retreat or merely a feint to entice the British armour into battle, and XIII Corps followed up with armoured cars only. However, by 0800 hours on 4 September, the Ragil Depression where enemy concentrations of vehicles had presented such a vulnerable series of targets throughout the battle, was declared free of the enemy.[3]

During the night of 4/5 September, the smallest force of medium bombers to operate over the battle area since the beginning of Rommel's offensive found what was described as ' their best target '. A massed concentration of enemy M.T. was located in a wadi in the Munassib area, to the south of the New Zealand positions. Thirty-six tons of bombs were dropped in the course of 23 sorties.

' The tremendous power of the air arm in co-operation with the land battle was well demonstrated in the operation ', wrote General Montgomery. ' The Army and Air Force worked to a combined plan, made possible because the Army and Air Commanders and their Staffs were working together at one Headquarters.' According to Rommel the offensive failed for three main reasons. One was the strength of the minefields in the south, another the shortage of petrol and lastly, ' the continuous and very heavy attacks of the Royal Air Force who were practically masters of the air, absolutely pinned my troops to the ground and made impossible any safe deployment or any advance according to schedule.'

From the air support point of view, the main features of the Battle of Alam el Halfa were the way in which the pre-battle air offensive, which ante-dated the land battle by nine days and disorganised the enemy's plans. The strategical bombing force had been used in a tactical role for the night bombing of the enemy leaguers and lines of communication in the battle area ; and the collaboration between the slow-flying F.A.A. Albacores and No. 205 Group Wellingtons was again very successful. There was no ' melee ' on the battle-field and in spite of a very concentrated bomber programme, there was not a single case of attacks being carried out on friendly troops. Finally and perhaps most important was the fact that, in addition to the round-the-clock bombing policy, attacks were concentrated. Once the main Army/Air plan had been agreed to, the main weight of our air attacks was delivered in the south, where the enemy's real drive was located ; and there was no deviation, however tempting other targets appeared.

In short, the Battle of Alam el Halfa fully vindicated the new air support organisation. In the course of operations it was proved that air action could and should form an essential part of the army plan and the battle stands out as a landmark in the development of air support organisation and technique during the war.

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[1] Squadron O.R.Bs.
[2] A.H.B./IIJ1/31/1.
[3] Eighth Army War Diary.

Immediately the defensive battle at Alam el Halfa was over, preparations were put in hand for the full-scale offensive which, it was intended should be the prelude to the final expulsion of the Axis forces from North Africa. ' D-Day ' was fixed for 23 October.

The air battle began four days before ' D-Day ' with an extensive programme of operations against enemy airfields to prevent any heavy scale of enemy air attack on the assembly area in the northern sector while the ground units were moving into position, and, as a subsidiary objective, to limit air reconnaissance. Apart from bombing raids, the peak of fighter achievement was reached on 23 October, when a continuous fighter patrol was maintained without challenge over the enemy's forward fighter airfields ; however it will be seen that this was not a true indication of the air situation in the days to come. After this preliminary effort, the remainder of the air operations in the battle were planned on a day-to-day and frequently an hour-to-hour basis, in conjunction with the development of the land situation and in concert with Army plans.

At 2140 hours on 23 October, the heaviest artillery barrage ever heard in Africa preceded the Eighth Army's attacks along the entire front twenty minutes later. In support of the attacking troops, and to supplement the artillery barrage, continuous bombing was carried out during the first night by 66 Wellingtons and 24 Albacores in the northern and southern sectors, in repetition of the technique so successfully applied some weeks earlier at Alam el Halfa.[1] Medium bomber operations continued each night without break and, as the pressure of the land forces increased day by day, the enemy was forced to concentrate and light bomber targets became available. No opportunity was lost of engaging targets with the light bomber force when they were presented and a scheme was in force for a code word to be sent back on R/T by bomber formations, describing the target immediately after the attack. In this way it was possible to judge immediately whether a further attack on the target was justifiable. On 28 October seven raids of eighteen aircraft were mounted against the German 21st Panzer Division within two and a half hours. The expected ground attack did not materialise.

In order to keep the enemy air force on the defensive, one, or a maximum of two raids per day were directed against airfields. Apart from these raids the bomber operations constituted an unrelenting pressure by day and night against objectives in the battle area and by day the light bombers operated in formations of eighteen aircraft as a normal maximum strength.

From 29 October to the evening of 1 November dispersal of the enemy's vehicles resulted in comparatively few targets in the battle area for the light bombers, but conditions were suitable for the fighter-bombers which successfully attacked vehicles, gun emplacements and encampments. The casualties inflicted on fresh formations which the enemy was endeavouring to bring into action were sufficient to reduce their capacity to withstand the subsequent land assault. Our ground forces launched strong attack on the night 1/2 November and after very heavy fighting on the 2nd, the enemy began to withdraw. On

[1] A.H.B./IIJ1/122/69.

3 November the coastal road from Ghazal to Fuka was packed with traffic moving west and the light bombers and fighter-bombers were presented with a series of excellent targets.

In the Battle of El Alamein the organisation for close co-operation between air and ground forces was again successful. This was partly due to the high degree of co-ordination maintained through the A.S.C. centre. Here, the Intelligence received through the normal tentacle and air reconnaissance channels was augmented by an intercept (J) service which had previously been worked by the A.S.C. on armoured division forward controls and was now expanded to include all G.Ops. and information passing on all corps and division wireless controls. With these sources of information, the G.S.O.1 Operations was able to keep in touch with the battle to an extent never before experienced.

During the battle there was little scope provided for the Hurricane IID anti-tank squadrons. The policy of employing them against selected objectives only was continued, the governing factor for the acceptance of a target being the scale of A.A. likely to be encountered. This could usually be assessed by the number of M.T. accompanying the tanks. Isolated tank groups without M.T. were considered ideal targets, while tanks with heavy M.T. escorts were not considered worth the risks of losses to the Hurricanes. During the battle anti-tank operations in the northern sector were restricted because of the proximity of the enemy armoured forces and because of the enemy's light A.A. defences. In addition to these restrictions it was also clear that although the attacks were generally successful, they would have been far more destructive if ammunition with an explosive charge could have been employed.

Air Support during the Pursuit to Tripoli

A month before the battle of El Alamein, Air Headquarters Western Desert circulated their Plan Buster for the ' Operation of the Western Desert Air Force in Support of an Advance into Cyrenaica and Tripolitania.' The plan was devoted to the problem of providing the Eighth Army with close support in the course of a swift pursuit in which it was anticipated that the outstanding difficulties would be of an administrative character.[1] Plan Buster postulated that ' in order to combine compactness with ability to overcome stiff opposition, the air forces directly supporting our advance must be maintained at full strength and must have no commitments outside direct support.' Furthermore, the point was stressed that, until Benghazi had been captured and was in operation as a port, it would only be possible to maintain the air force employed in direct support of the army, together with those squadrons required for the rotection of lines of communication further west than the Tobruk area.

For the purpose of the advance, therefore, the Western Desert Air Force was divided into two components. Force ' A ' would provide direct support for the Eighth Army whilst Force ' B ' would act as a reserve and sustain the fighting strength of Force ' A ' by the transfer of aircraft and personnel and the exchange of squadrons, as required. Force ' B ' would also be responsible for protecting the line of communication. Arrangements were also made for the

[1] A.H.B./IIJ1/122/69(B).

maintenance organisation to 'leapfrog' their way forward, so that the air support would be continuous. In order to ensure rapid movement of squadrons during the pursuit, an airfield reconnaissance party, with a W/T link to Advanced Air Headquarters, together with an airfield construction party, was positioned with the forward troops at the commencement of the battle, in readiness to move forward to the next group of landing grounds immediately the areas were safe. It would then report on and repair the landing grounds which were selected. Arrangements had also been made with the Chief Engineer Eighth Army for the Royal Engineers with the forward divisions to test for and clear, airfields of mines, as a matter of first priority.

Advanced ground parties of squadrons and control formations were at immediate readiness to move when confirmation reports from the reconnaissance parties were received, and these were to be followed by the air parties when the ground parties were installed. Supply columns were held in forward areas to take petrol and ammunition to the forward airfields.

On 6 and 7 November, the advance was severely hampered by heavy rains which flooded the airfields and rendered all movement on desert routes impossible. These conditions caused grave dislocation to both the Eighth Army and Western Desert Air Force offensives and virtually gave the enemy a forty-eight hour start. The fact that certain army units were working well ahead of the main Eighth Army formations, harrying the enemy's rear and lines of communication, meant that for a time the bombline position was obscure and air attacks, especially for the light bombers, were curtailed.[1] Nevertheless, by day and particularly by night when the enemy's main movement took place, a heavy toll of the enemy was taken by bombing, supported by low-flying fighter attacks. In the area between the Fuka escarpment and Daba and later in the Halfaya area the destruction of the enemy's transport was considerable.

In order to harass rearward columns retreating south on the road from Benghazi to Agheila, the A.O.C. Western Desert Air Force Air Vice-Marshal Coningham, on 13 November, while still maintaining fighter pressure against the main forces of the enemy in the Jebel area, ordered two Hurricane squadrons to a landing ground in the desert, 180 miles due east of Agedabia.[2] Essential squadron ground staffs and supplies were transported by air and the first sorties were carried out the same afternoon. The unexpected appearance of our fighters in the Agedabia-Agheila area, while the main body of the retreating enemy was still east of Benghazi, took the enemy completely by surprise. The pilots claimed nearly 300 vehicles destroyed or damaged. When the surprise element had been lost the squadrons were withdrawn by air on 16 November.

The withdrawal of the enemy to the Marsa Brega and Agheila positions meant that the Western Desert Air Force was soon faced with an acute problem of supply. In general the air force may be said to have outrun the army supply organisation at this time and although the port of Benghazi was quickly opened by the Royal Navy and worked to a capacity far in excess of anticipation it was clear that the deployment of the air force must be delayed if entire reliance was placed on the standard supply system.

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1 A.H.B./IIJ1/122/68(B).

2 A.H.B. Narrative. *The Campaigns in the Middle East, Vol. IV, Part IV, Chapter* 14.

The alternative was the use of an air transport fleet such as had helped the enemy so materially throughout the campaign, but for which the transport aircraft available to the Western Desert Air Force had been quite inadequate. It was therefore most fortunate that early in December 1942, three squadrons of the 316th Troop Carrier Group of the Ninth U.S.A.A.F. (a total of 39 aircraft) were placed at the disposal of A.H.Q. Western Desert. These Dakota aircraft were first used to supplement the work of the Supply and Transport Columns in carrying petrol. Some 72,000 gallons were laid down at Agedabia in this way and the procedure which was repeated at successive landing grounds, proved of value in keeping the forward fighter wings supplied during the advance to Tripoli. Later, the maintenance personnel of a whole wing (No. 239 Wing) and its four squadrons were moved to new landing grounds, together with sufficient supplies to enable squadrons to operate for at least two days independently of supply by road.

Second only to the supply difficulties during the advance was the problem of providing adequate landing ground facilities without which the field striking force would be unable to give the Eighth Army air support. In spite of the machinery set up in Plan Buster which operated so well during the early stages of the pursuit, the enemy policy of extensive mining and ploughing of their airfields set a problem for which the existing L.G. construction parties proved quite inadequate and it was only by the full co-operation of Eighth Army troops that airfields could be constructed in time.

When the Merduma and Marble Arch landing grounds had been secured by 17 December, it was found that they had been heavily mined and littered with a profusion of ingenious booby traps. However, the Royal Engineers worked in moonlight throughout the night and by 0800 hours the next morning were able to report that the Marble Arch landing ground was clear. The landing ground had been sown with more than 2,000 mines, in addition to booby traps, and the Sappers suffered considerable casualties. Within two hours fighter and transport aircraft began to arrive, and that afternoon five sorties at squadron strength were carried out against enemy M.T. which until that time, had been quite out of range.[1] Work on the landing ground sites selected in the Hamreit area was made doubly difficult because they were covered with an enormous number of stones. In order to assist the Royal Engineers Landing Ground Construction Parties, the New Zealanders detailed a thousand fighting troops to pick up stones.

As the advance progressed intensive study was made of the effects of air attack on enemy transport. Allowing for the fact that the enemy salvaged every vehicle capable of being put in tow, inspection of the roads between Agedabia and Marble Arch led to the conclusion that, on the whole, the fighter-bombing had had disappointing results. Advantage was therefore taken of lulls in operations—especially when shortage of supplies or the lack of new landing grounds forced the pace of the advance to slacken to concentrate on fighter-bombing training with practice bombs. This policy of constant training, even in the midst of active operations, proved of great value when the concentrated low-level fighter bomber attacks at Mareth began.

[1] This was the move of No. 239 Wing referred to above. D.C.3 transport aircraft were used and on their return flight to base evacuated casualties.

Reorganisation after the Fall of Tripoli

With the capture of Tripoli on 23 January 1943 the enemy was forced back into Tunisia and the opportunity was taken for revising the system of command of air forces in North Africa. On 23 February 1943, the Western Desert Air Force was placed under the operational command of the North-West African Tactical Air Force. It remained, however, under the Middle East for administration, supply and maintenance.[1]

During March 1943, a favourable opportunity was given to No. 6 Squadron for action against the kind of target for which its specialist Hurricane IID aircraft, fitted with 40-mm. cannon were best adapted. A force of Fighting French, under General le Clerc, after treking from Lake Chad across the Sahara Desert, had established themselves at Kasr Rhilane, some 50 miles to the south of the Eighth Army positions. After their long march they were, however, weak in artillery and anti-tank weapons and Rommel, anticipating an easy success, despatched a strong column of tanks, armoured cars and artillery with the intention of annihilating them. On 10 March 1943, a Tac/R aircraft located the enemy column moving towards Kasr Rhilane and shortly afterwards urgent calls for help were received from the Fighting French force which by that time was being attacked from both the ground and the air. Orders were therefore given to No. 6 Squadron to attack the enemy columns, while strong patrols of Spitfires covered the Hurricanes and protected the French from dive bombers and low flying attacks.

The Hurricanes caught the enemy in the open and claimed to have destroyed or put out of action two-thirds of his vehicles. An emergency relieving force was next located by Tac/R and dealt with by fighter-bombers of No. 239 Wing who caused so much damage that the enemy abandoned any further attempt to capture Kasr Rhilane.

Recent operations had shown the need to improve the existing methods of forming up and approaching the target. A system for the rendezvous of bombers and escorting fighters was therefore adopted which ensured that a minimum time was spent circling the rendezvous point and at a height which did not register on the enemy's radar system, the final climb towards the target being delayed until the last possible moment. It was thus possible to reduce the fighter escort to a minimum and so increase the number of fighters available for use as fighter-bombers and on offensive sweeps.

The method adopted was to select an easily recognised rendezvous point, well clear of fighter or bomber aerodromes. The bombers took off and formed up below 500 feet at a subsidiary point visible from the main rendezvous. Similarly, fighters followed the same process at a third rendezvous point. The bomber formation then flew over the main rendezvous, as near as possible to the precise ' zero ' time, and immediately set course for the target while the fighter escort slipped into position. The 5 minute rule was introduced so that should rendezvous be missed at zero hour, the bombers would again cross the rendezvous point at zero plus 5, zero plus 10 and zero plus 15, after which, if no

[1] A.H.B./IIJ15/4. For a full account of the reorganisation of the Air Forces in the Mediterranean, see below under section *North West Africa.*

rendezvous was made, they would return to base.[1] Apart from other considerations the procedure avoided the necessity for breaking R/T or W/T silence. The system had an important effect on direct support technique as it served to lessen the time-lag between the initial call for air support and the arrival of the aircraft over the target.

The Battles of the Mareth Line, 20–27 March 1943

By the beginning of March 1943, preparations for the general offensive against the Mareth line, which was planned to take place during the next moon period, were well under way.[2]

The Eighth Army plan was to deliver a frontal attack on the night 20/21 March against the enemy left or eastern flank with the object of breaking into the Mareth position ; to roll it up from the east and north and to destroy the enemy holding troops ; and subsequently to advance and capture Gabes. Meanwhile the New Zealand Corps was to make a turning movement round the enemy's western flank, and then advance northwards and establish itself astride the Gabes–Matmata Road so as to cut the enemy's line of escape. The capture of Sfax was to be the final objective.

After four days of heavy fighting it was clear that the fronted attack on the Mareth positions had failed and General Montgomery decided not to renew it. Instead it was intended to make the main thrust towards the Gabes gap via El Hamma, and to switch all available air effort away from the Mareth front to support this thrust.

General Freyburg, commanding the New Zealand Corps, reported that the nature of the country was such that he did not consider a frontal assault feasible. There were, however, obvious objections to delaying the thrust towards Gabes by employing outflanking movements and after consideration it was decided to stage an unusually concentrated air bombardment. It was hoped that this would temporarily paralyse the enemy forces, during which time the Army would attempt to drive an armoured force through to El Hamma. When this was done we could then deploy greatly superior armoured and infantry forces against the enemy in open country.

In preparation for the attack the whole bomber force including No. 205 Group was turned on to night work with the object of destroying enemy transport and telephone communications in the El Hamma area and of depriving his troops of rest. In all 322 sorties were flown on the night of 24/25 and 25/26 March. For the attack itself it was decided to concentrate the maximum number of aircraft that could reasonably operate over the area throughout the period agreed to by the Army, which was two and a quarter hours. It was also important to surprise the enemy, and mainly on this account, the attack was timed to start in daylight.

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1 During the campaign from El Alamein to Tunis not a single bomber was shot down by enemy fighters. Record of Operations of the W.D.A.F. A.H.B./IIJ/15/4.

2 A.H.B./IIJ15/4.

At 1530 hours on 26 March, three formations of light and medium bombers launched a simultaneous pattern-bombing attack on the main enemy positions. The intention was to create disorganisation and particularly to disrupt telephone communications. This attack made a low and evasive approach and met no air opposition. Immediately afterwards, the first relay of fighter-bombers entered the area and began to bomb and machine gun from the lowest possible heights. A strength of two and half squadrons was maintained in the area, fresh relays arriving at quarter hour intervals. Pilots were briefed to bomb specific targets and then to attack gun positions with the object of killing the crews, particularly of those guns which were in a position to hold up our armour. Hurricane ' Tank Busters ' also attacked and broke up enemy tank concentrations. A Spitfire patrol of one squadron strength was maintained over the area to protect the fighter bombers, while at the same time light bombers under the control of N.A.T.A.F. attacked enemy air forces as a diversion. The enemy were effectively surprised and no air opposition was encountered over the battle area.

As the country was difficult for navigation, a scheme of identification was used consisting of a large land mark cut into the ground against which red and blue smoke was burned throughout the period of the air attack, while at the same time our forward troops burned yellow smoke. In addition lorries were arranged in the form of letters to act as ground strips at selected pin-points. During the first five minutes of the air attack British artillery shelled the most important enemy strong points with smoke shells. In spite of a thick haze, these indicators worked well.

Half-an-hour after the air offensive opened, infantry attacked under cover of a heavy barrage creeping forward at the rate of 100 feet a minute, thus automatically defining the bomb line. Aircraft bombed and attacked continually in front of this line and became, in fact, part of the barrage. The enemy defences were completely overwhelmed and this most difficult position was taken with relatively light loss, and our armour was enabled to break through. The Western Desert Air Force made 412 sorties during the two and a quarter hour period at a cost of eleven pilots missing.

Evidence both from prisoners and from the quantity of men and material left behind by the enemy testified to the morale and material effect caused by the air attack. It introduced no novel features, but it caught the enemy without well prepared A.A. defences and on an occasion when the Royal Air Force enjoyed almost complete air supremacy. It was emphasised that such results could not be achieved unless the control of air forces was centralised in the Air Commander working in close co-ordination with the Army Group Commander concerned. Success was due principally to long training, experience and good leadership. An interesting feature of the operations, and one in itself illustrating the strong degree of inter-dependence of the Eighth Army and Desert Air Force was the readiness of the Eighth Army to modify their plans at short notice in order to fit in with what was considered to be the most effective method of employing the air forces.

After the battle of the Mareth line the Air Forces, operating against the enemy's retreating columns, achieved considerable success against motor transport targets, which increased in number as the withdrawal continued.[1]

[1] A.H.B./IIJ15/4.

The Eighth Army's advance had been so rapid, however, that there was now difficulty in keeping the enemy within range. In the final battle at Enfidaville, the light and medium bombers of the Western Desert Air Force together with those of the other tactical groups in North Africa combined in a concentrated attack against enemy troops ahead of the axis of the ground advance. This heavy attack proved most successful and after hard fighting enemy resistance rapidly crumbled. Scattered units continued to resist for some time but by 13 May 1943 Axis resistance in North Africa was over.

Summary of Air Support Developments during the Western Desert Campaigns

Following the collapse of France in June 1940 the British and Commonwealth forces in the Western Desert were the only Army units actively engaged with the enemy and it was therefore in the Desert that new methods for air support came to be evolved. Some experience had, necessarily, been gained in France in 1940 but the campaign there was too short to allow the results of this experience to be put into effect. During Wavell's first Desert offensive in December 1940 both the importance of mobility of squadrons and the difficulties of air to ground identification were fully appreciated. Various steps were taken to effect improvements in these aspects but it was not until much later in the war that the problems were at least partially solved. For a long time shortage of motor transport prevented the Desert Air Force from being sufficiently mobile. The difficulty of identifying ground troops from the air was never completely overcome, even in North-West Europe, although the introduction of smoke, ground markers, fluorescent panels, A.A. bursts and radio aids helped to mitigate the problem.

During the Battleaxe Offensive in June 1941 the Royal Air Force was subjected to criticism for not providing adequate air support and the discussion which followed had two important results. The Prime Minister issued a directive forbidding 'air umbrellas'; A.A. weapons were to be the Army's normal defence against enemy air attack. The Air Force had its own dominant strategic role to play but when a battle was in prospect, the A.O.C.-in-C. was instructed to give the ground commander all possible aid, irrespective of other targets, however attractive these might be.[1] This directive formed the basis of the general policy for air support throughout the rest of the war. Secondly, as a result of an Air Support Conference held in Cairo, the 'Middle East (Army and R.A.F.) Directive on Direct Air Support' was issued on 30 September 1941.[2] The directive was an important milestone in Army/Air co-operation. The experience from the first years of Desert war was summarised and a complete Air Support Control organisation was described. The importance of joint Army/Air planning was also stressed and two days before the Crusader Offensive a combined Army/Air Headquarters was established on 16 November 1941.

It was in the Western Desert that the fighter-bomber was first developed in the Second World War.[3] Before the Crusader Offensive experiments had been carried out in fitting Hurricanes with eight 40 lb. bombs. During the fighting, however, it was found that these bombs were not heavy enough to penetrate

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1 A.H.B./IIJ1/183/271(A)–(B).

2 *See* Appendix 7.

3 Fighter-bombers were employed in the First World War from 1917 onwards.

armoured vehicles. One Hurricane squadron was therefore equipped to carry two 250 lb. bombs and Kittyhawks were fitted locally to carry one 250 lb. bomb. Later issues of Kittyhawks arrived fully equipped to carry one 500 lb. American bomb. The fighter-bomber, as it was developed by the Desert Air Force in the spring of 1942, proved to be a most effective weapon and it was continually improved throughout the war. It was in fact the answer to the German 'Stuka' and its great versatility allowed it to be used with equal success in Italy, Burma and North-West Europe.

After successive improvements particularly in communications, the Air Support Control organisation was able to function smoothly and by the spring of 1942, and in spite of the disorganisation caused by the long and speedy retreat from El Agheila, the average time taken to answer an Army request for support was 60 minutes. This included the time taken to hand in the message to the tentacle and an average flying time of 20 minutes, and was a great improvement on the time taken to answer requests during Crusader.

Another development which was used with great success in 1942, was the use of Fleet Air Arm Albacores as pathfinders to Wellingtons. During night raids on airfields or M.T. concentrations the Albacores arrived over the target fifteen minutes ahead of the Wellingtons and searched for and later illuminated targets with flares when the Wellingtons arrived. With its slow speed, good visibility and large flare-carrying capacity the Albacore was found to be the most suitable aircraft for this task.

The Battle of Alam el Halfa thoroughly tested the new air support organisation and demonstrated the use of air power in a ground action on efficient and economical lines. It stands out as a landmark in the development of air support during the war.

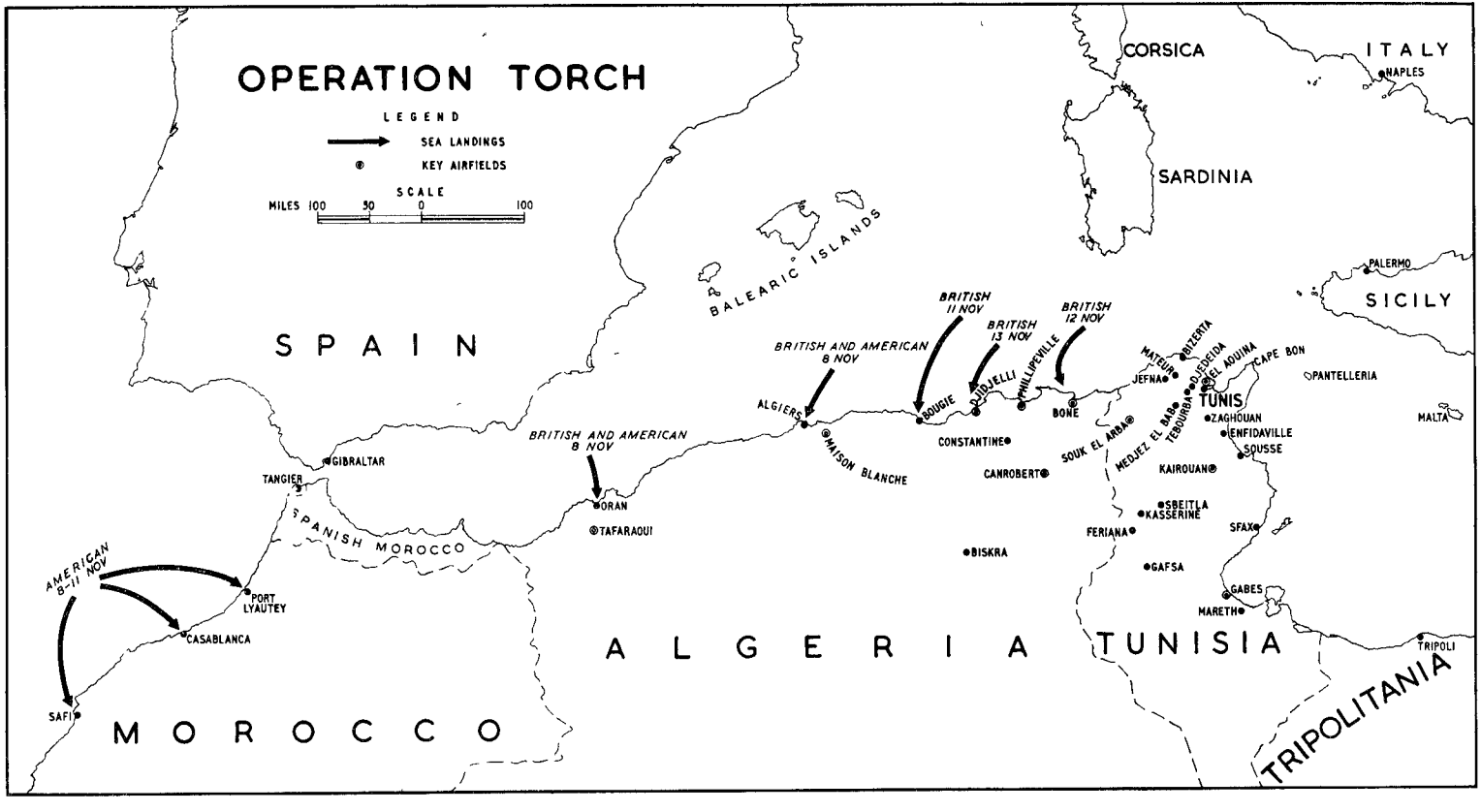
The assault of the Mareth line on 26 March 1943 was characterised by a heavy, concentrated medium, light and fighter-bomber bombardment which, in the result was largely responsible for the success of the subsequent ground attack. As the Allied air forces grew in stature this form of attack was developed and it was frequently used in Italy and North-West Europe. The weight and the effectiveness of this form of air action are clear indications of the growth in the methods and organisation of air support which had taken place since the outbreak of war, when the Air Component with the Army in the Desert consisted of only one Army Co-operation and one fighter squadron.

North-West Africa 8 November 1942–13 May 1943[1]

Air Support Organisation during the Assault and Initial Operations

Air support during the assault phases of the landings in North-West Africa (Torch) was provided by aircraft operating from carriers. At the Algiers landing H.M.S. *Argus* and H.M.S. *Avenger* provided the air cover with aircraft of the two fleet carriers, *Formidable* and *Victorious* available to assist if necessary.

[1] The information in this section is drawn from the A.H.B. Narrative *The North African Campaign, November* 1942 *to May* 1943 unless otherwise indicated.


OPERATION TORCH
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SEA LANDINGS
KEY AIRFIELDS
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MILES 100 50 0 100
CORSICA
ITALY
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BALEARIC ISLANDS
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MATEUR
BIZERTA
DJEDEIDA
EL AOUINA
CAPE BON
PANTELLERIA
JEFNA
DJIDJELLI
PHILIPPEVILLE
BONE
ALGIERS
BOUGIE
TUNIS
ZAGHOUAN
MALTA
ENFIDAVILLE
SOUSSE
TEBOURBA
MEDJEZ EL BAB
SOUK EL ARBA
CONSTANTINE
MAISON BLANCHE
CANROBERT
KAIROUAN
SBEITLA
KASSERINE
FERIANA
SFAX
BISKRA
GAFSA
GABES
MARETH
TRIPOLI
TRIPOLITANIA
GIBRALTAR
TANGIER
BRITISH AND AMERICAN 8 NOV
ORAN
TAFARAOUI
SPANISH MOROCCO
AMERICAN 8-11 NOV
PORT LYAUTEY
CASABLANCA
SAFI
MOROCCO
ALGERIA
TUNISIA

At Casablanca the aircraft were provided by the Air Group of U.S. Naval Task Force 34. The duties of both the Fleet Air Arm and the United States Naval Air Service was, until relieved by the U.S.A.A.F. and the Royal Air Force to protect the convoys and assault forces and to provide air support for the armies.

During ' D-Day ' both these tasks were fulfilled. They included patrols over the various beaches, tactical reconnaissance for the Army and the dive-bombing of selected targets which were holding up the advance of the Allied assault forces. On ' D-Day ', No. 43 Squadron (Hurricane) and Nos. 81 and 154 (Spitfire) Squadrons arrived at Maison Blanche airfield, adjacent to Algiers. In the afternoon, 24 Spitfires of Nos. 308 and 309 Squadrons of the 31st Fighter Group arrived at Tafaraoui near Oran. The following day, the Royal Air Force and U.S.A.A.F. assumed responsibility for air support. At Casablanca, however, the squadrons of the United States Naval Air Service continued to give air support to the Western Task Force for a further two days in the hard fought battle for Casablanca and Port Lyautey. Following the occupation of Algiers and Bougie, the First Army pressed forward in an endeavour to seize Bizerta and Tunis before the enemy could build up sufficient strength to intervene. The Germans were however not slow to react both on the ground and in the air and it was not long before the First Army Command post was complaining of the enemy's ' continual dive bombing of very tired troops '.

By mid-December the greater part of the Royal Air Force fighter strength (six squadrons) was concentrated at Souk el Arba. There was one squadron at Djidjelli, one at Philippeville and three at Bone. The airfield at Souk el Arba was unsatisfactory, as it was liable to become unserviceable at very short notice after rain. The maintenance of aircraft was difficult, as the squadrons were still operating without their regular ground crews. The whole position was in fact extremely unsatisfactory. The policy at that time seems to have been to attempt to provide continuous fighter cover over any forward area which was being dive bombed. Thus protective patrols were constantly maintained over Algiers, Djidjelli, Philippeville and Bone. Originally, Hurricanes on tactical reconnaissance had been sent out unescorted, but this had led to such heavy losses that the practice had grown up of providing Spitfire escorts in ever increasing numbers—with the result that very few tactical reconnaissances could be flown.

The four Bisley bomber squadrons were concentrated at Canrobert and were largely employed in flying tactical reconnaissance for the Army. The procedure was for the aircraft to fly from Canrobert to the landing ground at Souk el Arba and, from there, to proceed, often heavily escorted by Spitfires, on their various tasks. Their bombing targets were enemy columns on the road between Mateur and Jefna, the railway junction at Djedeida and the village of Tebourba. By night small attacks were made on the docks at Tunis and Bizerta. By the end of 1942. No. 18 Squadron was virtually wiped out ; nor were the other three squadrons in any better shape. The number of aircraft serviceable steadily dropped until, in the case of No. 13 Squadron, the average was never higher than six aircraft a day available for operations. On 6 January there were only 12 aircraft serviceable in the whole Wing and thereafter the efforts of No. 326 (Light Bomber) Wing were limited to moonlit nights.

During the First Army's advance, the American bomber effort was directed against a number of enemy airfields in Tunisia in an attempt to cripple the growing strength of the *Luftwaffe* in Tunisia. B.17 (Fortress) Groups attacked Aouina, while the 15th Light Bombardment Squadron (Marauder) of the 319th (U.S.) Group bombed, in addition to Aouina, the airfields at Kairouan and Gabes. The efforts of the bomber force of the Twelfth Air Force was also diverted against the Tunisian ports in Axis hands in an attempt to curtail the Axis build up. During December and January, XII Bomber Command confined itself largely to the harbours at Tunis and Bizerta, although making strikes against Sousse and Sfax whenever weather or unusual enemy activity especially favoured them as targets. Daylight attacks on Tunis and Bizerta were left almost exlusively to the heavy bombers, although light bombers occasionally attacked Aouina or the docks at Bizerta when the B.17's were there to saturate the defences.

Establishment of the Luftwaffe in Tunisia

Although the Allied landings in North-West Africa had caught the Axis forces off balance their recovery from the initial surprise, was rapid and within the four weeks immediately succeeding the landing the enemy had disposed a considerable force in Sardinia, Sicily, and Tunisia. By 20 November the *Fliegerfuhrer* Tunisia, the commander of the *Luftwaffe* in Tunisia, had the following aircraft at his disposal :—

Type	*Strength*	*Serviceable*
F.W. 190	43	39
Ju. 87	33	30
Me. 109	101	55
	177	124

Numerically this force was inferior to the Allied air forces, but it had immense tactical advantages. Enemy airfields were close to the battle area, and their main bases at Tunis and Bizerta remained serviceable in all weathers. In the early days of the campaign the enemy were hampered by administrative difficulties, but within three weeks their effort had risen to a daily effort of 120 sorties.

Thus by the end of 1942, the position of the German forces in North Africa had been relatively stabilised, although the German High Command was still faced with the major problem of supply, and it had been forced to reinforce the Mediterranean theatre on a scale which adversely affected its broad strategic planning. But by vigorous measure it had recovered from the first shock of the Allied landings, and had established an unexpectedly strong defensive position. In the west the initial Allied thrust towards Tunis and Bizerta had failed, and the Allies were faced with the problem of building up a ground organisation in unfavourable terrain with inadequate communications. This problem was only gradually overcome, and in the meantime, the *Luftwaffe*, which had shown considerable energy and capacity in developing airfields and ground organisation in Tunisia, was able to hold its own against numerically superior forces, particularly as the tardy Allied decision to release the latest

types of Spitfire—contrasted with the immediate allocation of the F.W.190 from the Channel area—gave the Germans the advantage of technical superiority for a considerable period.

The halt of the Allied advance towards the end of December gave the Axis a respite, which they put to particularly good use. The air forces which had hitherto been divided between Tripolitania and Tunisia were thoroughly reorganised and the two separate commands were placed under a single operational command, known as the *Fliegerkorps* Tunisia. This change permitted greater flexibility in the employment of air forces on either flank as circumstances required, and undoubtedly contributed to the success of the *Luftwaffe* in the face of a superior enemy. Its effectiveness became evident in mid-February, when the possibility of an Allied break through from central Tunisia towards Sfax, threatening to divide the armies of Rommel and von Arnim, compelled the German command to launch a counter attack to widen the Gafsa–Sfax bottleneck. In support of this operation a considerable *Luftwaffe* force moved down to the Kairouan area, and on 14 February some 375 sorties were flown in support of the successful German thrust towards Feriana and Sbeitla.

Meanwhile, however, the German Command energetically exploited its success in central Tunisia by opening an offensive against the Allied First Army in the north. Here, also, in spite of its notable contribution towards the thrust towards Sbeitla, the *Luftwaffe* provided effective support with the small forces available, averaging some 150 close support sorties per twenty-four hours for the first four days of the operation.

Reorganisation of the Air Forces in the Mediterranean—Mediterranean Air Command

In the same way as the Axis had found that the most efficient use of their air forces was to concentrate them under a single command, the Allies adopted a similar solution to their problem. The need for the complete reorganisation of the Allied air forces in the Mediterranean had been realised for some time. The command arrangement in the Algerian/Tunisian sphere of operations had never functioned satisfactorily and this was most evident in the provision of air support for the land battle. Investigations, later conducted by Mediterranean Air Command, into the method of operations and their control explain the shortcomings of the system. Fighters were frittered away in penny packets to give close cover, while bombers and their fighter escorts were used for attacking relatively unimportant targets—all on the orders of the local army commanders. Under such conditions aircraft losses were high. The *Luftwaffe* had been 'aggressive and impudent' despite inferior numbers, and in consequence effective Allied air support for the land battle had not been forthcoming on the scale, which should have been possible with the forces available to the Allies. The basic remedy for efficient and effective air support was, in Air Chief Marshal Tedder's opinion, 'proper organisation and control'. Other factors had militated to the same end. At the Casablanca conference in January 1943, the Combined Chiefs of Staff decided that one officer should control all the air forces in the Mediterranean, and that he would assume his duties, when the Western Desert forces crossed the Tunisian/Tripolitanian border. The command was to be known as Mediterranean Air Command.

On 17 February 1943, the Mediterranean Air Command formed with its Headquarters in Algiers. Air Chief Marshal Sir Arthur Tedder was appointed Air Commander-in-Chief, Mediterranean, his deputy being Air Vice-Marshal E. P. Wigglesworth. Brigadier-General H. R. Craig was his Chief of Staff and Air Vice-Marshal G. G. Dawson his Director of Maintenance and Supply. The Command comprised the Middle East Air Command, Royal Air Force, Malta Air Command and the North-West African Air Forces.

The North-West African Air Forces were at the time organised as follows :—

(*a*) An Air Headquarters at Constantine comprised of an amalgamation of the personnel of the Headquarters Unit of Eastern Air Command and the Headquarters Squadron of Twelfth Air Force.

(*b*) The North-West African Tactical Air Force (N.A.T.A.F.), under Air Vice-Marshal Sir Arthur Coningham, comprised Headquarters Allied Air Support Command, the XII Air Support Command, No. 242 Group, Royal Air Force and, later, the Western Desert Force.

(*c*) The North West African Strategic Air Force (N.A.S.A.F.), under the command of Major General James H. Doolittle.

(*d*) The North West African Coastal Air Force (N.A.C.A.F.) under the command of Group Captain G. G. Barrett.

(*e*) The North West African Training Command, under the command of Brigadier General John K. Cannon.

(*f*) The North-West African Air Service Command, under the command of Brigadier-General Dalman H. Dunton.

(*g*) The North-West African Photographic Reconnaissance Wing, under the command of Lieutenant Colonel Elliott Roosevelt.

The A.O.C.-in-C. had his offices in the Allied Forces Headquarters and was in immediate touch with the Supreme Commander, the Naval C.-in-C. and with General Alexander on the occasions when he visited Allied Forces Headquarters. In so far as North-West Africa was concerned, Air Chief Marshal Tedder had a dual role. On one hand he was a commander with authority outside the North-West African area who decided on the allocation of air forces and the co-ordination of air operations between two theatres of war. On the other hand in the position of local A.O.C.-in-C. he issued operational directives to the Commanding General, North-West African Air Forces, prepared after consultation with the Naval C.-in-C. and the Allied Commander-in-Chief.

Headquarters Mediterranean Air Command dealt primarily with major policy and the A.O.C.-in-C. stressed the importance of adhering strictly to the delegation of responsibilities laid down in the Chain of Command. The Headquarters had no administrative function in North-West Africa and only dealt with administrative matters affecting the Mediterranean theatre as a whole. The staff was composed of both British and American officers.

The Role of the North-West African Tactical Air Force

Headquarters N.A.T.A.F. was closely linked with the Headquarters of Eighteenth Army Group and shared the same camp. The role of the Tactical Air Force was operational co-ordination of air operations in support of the

armies in the field by formulating policy, planning and the issue of operational guidance by means of directives to subordinate formations. The only administrative problems dealt with at this Headquarters were those which affected operations which were the particular concern of the A.O.C. As N.A.T.A.F. consisted of British and American formations, the Headquarters had a mixed staff of British and American officers and an American deputy A.O.C.

The A.O.C.-in-C.'s intentions were converted into action by three air force formations, each closely identified with a military Headquarters—No. 262 Group with the First Army, the Western Desert Air Force with the Eighth Army and XII Air Support Command with II U.S. Corps. At this level the fusion of British and American forces had not been adopted as in principle the forces had been organised on a national basis. There were, however, some American squadrons in the Western Desert Air Force under the command of Air Vice-Marshal Broadhurst and American liaison officers were employed at Western Desert Air Force Headquarters.

The A.O.C. N.A.T.A.F. had been given a broad instruction by the Commanding General, North African Air Force, ' To provide maximum air support for land operations '. This objective, as the A.O.C. pointed out in his first directive on 2 March, could only be attained by first obtaining air supremacy in the theatre of operations. After this had been achieved it would be possible for land forces to operate practically unhindered by enemy air attack and the Allied air forces would be able to operate with increased freedom in the battle area and against objectives in the rear of the enemy. He therefore ordered his commanders both to train and to operate their air forces with this end in view.

He proposed to initiate a continual air offensive against the enemy in the air and to combine this with sustained attacks on enemy main airfields. For the offensive, increased means of obtaining warning of enemy air activity would be required in the forward areas and measures were therefore to be undertaken to increase the radar facilities and improve signal communications in all areas in the command. For the attacks on the main enemy airfields it was intended to employ light and medium bombers in escorted raids by day. At night, light bombers would be directed against enemy airfields and these operations would be supported by the Strategic Air Force acting independently but in conjunction with the N.A.T.A.F. plan.

It was realised that, on a front extending for 250 miles, operations would be restricted to areas within ranges of aircraft from their bases. Commanders were, therefore, ordered to plan the movement of units from one sector to another and to be prepared to implement their plans at short notice. Training was to be undertaken immediately and fighter units were ordered to institute shadow flying pactices. The importance of sound tactical plans both for wings and smaller formations and good markmanship were also emphasised.

In his directive the A.O.C., stressed the disadvantages of employing large fighter formations where the enemy was encountered only in small numbers. He much preferred a greater number of small but well trained formations. The necessity of communications between the fighter and bomber leaders in escorted raids was pointed out and it was to be the responsibility of the fighter leader to decide as to the desirability of abandoning the sortie, whether as a

result of the weakening of the fighter escort after an engagement or because of unsuitable weather conditions. All light bombers should be capable of operating by night, as much Army movement, particularly supplies, was covered by darkness and it was during this period that decisive blows might be delivered. Moreover, night bombers could undertake dusk and dawn attacks when the enemy would be likely to be concentrated and unprepared for attack. Squadron Commanders were made reponsible for the training of their own replacement crews and for making the decision as to what aircrews were considered fit to take part in operations.

Summary of Air Support in the Tunisian Campaign

The first phase of the campaign, from 18 February to 15 March 1943, as far as the North-West Tactical Air Force was concerned, was primarily one of preparation for offensive action and the repulse of enemy counter-attacks. Operations were governed by the need to conserve resources and to train units and consequently the force only worked under pressure when a critical ground situation required it. The Western Desert Air Force was not at first faced with any critical ground situation, but, the German thrust through the Kasserine Pass was threatening very large Army supply dumps. The German advance was halted on 21 February. XII Air Support Command supported by the Strategic Air Force continued to operate at high intensity, and the Western Desert Air Force attempted a diversion by large scale action against landing grounds and positions in the Mareth Line. From 26 February into March the maximum Spitfire, Hurribomber and Boston effort of No. 242 Group was unleashed against an enemy attempt to capture the Medjez el Bab Salient—the fighters were given permission to attack any moving target—and after severe fighting the attack was held. On 6 March the Afrika Corps attacked the Eighth Army. But enemy air attacks were successfully dealt with, while the Strategic Air Force bombed enemy airfields, and by 7 March, the Afrika Corps after being trapped in an exceptionally heavy concentration of gunpower, was defeated on the ground and in the air, and the Western Desert Air Force turned to the offensive against his retreating columns.

The second phase, from 15 March to 6 April 1943 was centred upon the Eighth Army's attack and successful outflanking movement at Mareth.

The third phase, from 7 April to 16 April, featured the headlong retreat of the enemy to Enfidaville, under the convincing threat of air forces which, subject to weather, could make the roads leading north untenable. All available aircraft from the Western Desert Air Force and XII Air Support Command attacked enemy columns with considerable effect on 7 April ; the Western Desert Air Force continued alone on 8 April owing to the Tunisian forces being grounded by weather ; and No. 242 Group, XII Air Support Command and the Tactical Bomber Force continued the attack with fighters, fighter-bombers, light and medium bombers from then until 16 April—during which time the Western Desert Air Force was unable to keep within range.[1] Throughout the whole of this period the enemy air force was disorganised and did not operate in any strength in the battle area.

[1] In view of experience in the Western Desert and in current operations the A.O.C. N.A.T.A.F. decided to place all his British and American light and medium bombers (except those belonging to the W.D.A.F.) in a separate group under his immediate control. This enabled him to employ them on whichever portion of the front the situation demanded.

The fourth and final phase, from 17 April to 13 May, was the attack on Tunis and Bizerta and the collapse of the Axis forces. Following the withdrawal of the enemy to the Enfidaville position the Air Forces moved forward to a position where they could operate over the Cape Bon Peninsula and Tunis. The two night Bisley squadrons, however, remained back with the French night bomber unit at Biskra. No. 242 Group with its Headquarters alongside the First Army was the main control on this front with XII Air Support Command and the Tactical Bomber Force working in close co-operation. The Desert Air Force continued to operate on the Eighth Army Front. Nos. 242 and 211 Group Controls (main and forward as applicable) were responsible for the control of all aircraft in the battle area. A division of territory was agreed between No. 242 Group and the Western Desert Air Force using the Mejerda River, running south-west from Tunis, as the common boundary. Apart from giving maximum support to the Army during its final drive, it was hoped that the Tactical Air Force would employ every available aircraft to attack shipping or air transport if the enemy attempted a ' Dunkirk '.

The air offensive against occupied landing grounds were continued from 17 to 21 April, by the whole Tactical Air Force—less that part of the Western Desert Air Force employed against air transport, and supplemented by the Strategic Air Force whose Fortresses attacked the heavy ' flak ' defended airfields at Tunis and Bizerta. From 22 April onwards the German Air Force withdrew from North Africa with the Ju.87's in the van of the retreat. Except for isolated operations from Sicily and a light scale of attack by fighter bombers from forward landing grounds in Africa, the G.A.F. ceased to play any serious part in the battle, and 6 May, when the enemy lost 20 fighters in three hours, was the last occasion on which any enemy aircraft appeared. On 8 May, 120 light and medium bombers and 96 P.38's attacked the landing ground and air installations on Pantelleria and their attack seems to have been decisive in denying this base to the *Luftwaffe.*

From 28 April until the final surrender, fighter-bombers were available for anti-shipping strikes. A striking force was held at readiness for this attack on shipping sighted by air reconnaissance, which was flown continuously and left little opportunity for shipping to get through unseen. Armed reconnaissance, looking for air transport, had shipping as a secondary object and attempts to move shipping by night were frustrated by the Navy. During the period some 43 craft ranging from destroyers and 3,000 ton M.Vs. to small boats were destroyed or damaged by the Tactical Air Force.

At all stages of the Tunisian Campaign, air transport was a necessary line of supply for the enemy, especially when shipping losses increased and the supply position of the Axis armies became strained by continuous battle expenditure. A full scale mass attack by the Strategic and Tactical Air Forces, on 23 March, had been made against transport landing grounds in Sicily, Italy and North Africa while P.38's and Spitfires from Malta had flown sweeps to intercept transports and enemy fighters in the air. Thereafter, the accumulative effect of attacks had substantially reduced the enemy air transport effort and forced the enemy to provide heavy fighter escort for each convoy. From 12 April, however, the enemy air transport in use had begun to increase again and the

Me.323, with a capacity four times that of the Ju.52, had come into extensive use in large convoys with short range fighter escort provided from both ends of the route. But from 16 April the Western Desert Air Force was located on forward landing grounds north of Sousse and was able to operate the whole Spitfire and P.40 force over the Gulf of Tunis. Consequently the intensified enemy air transport effort was short-lived. Sweeps were flown with never less than three squadrons of P.40's and one squadron of Spitfires as top cover and on 18 April fifty-two Ju.52's were destroyed out of a force of about 80 and practically the whole of the remainder crash-landed on the beaches of the Cape Bon Peninsula. On 20 April a further 12 transports were destroyed and on 22 April twenty-one Me.323's were intercepted and all destroyed. The enemy was now convinced that an effective air blockade was in being and no further attempt was made to use air transport in daylight hours.

From 17 April, attempts were made to break through the German defensive line with the assistance of full air support but, by 29 April, it was clear that only an attack in strength directly on Tunis, could succeed. This was to be supported by the maximum air power available.

Air attack began on the evening of 5 May with preliminary bombing in the Zaghouan Area to soften positions on the ground preparatory to the assault. The following day, starting at first light, a moving barrage of air support on the axis Medjez–Tunis successfully blasted through enemy positions for the first time in any war by laying a four miles by one thousand yards 'carpet' of bombs. This was done at small loss with over 2,000 aircraft sorties.[1]

By the afternoon, 6 May, the advance was ahead of schedule and consequently the Air Force was waiting for Army calls which somewhat lessened the scale of air attack. By the evening the battle for Tunis had been won, with the help of 2,154 direct support sorties during the day, and on 7 May, Tunis and Bizerta were entered.

The ground situation was now changing too rapidly for support calls to be awaited or acted upon and the air forces were directed to disrupt the movement of the enemy's already disorganised forces. The last of the enemy between Tunis and Bizerta surrendered on 10 May ; those attempting to reach the Cape Bon Peninsula were surrounded the same day. The air force maintained pressure until the final surrender on 13 May.

During the campaign from 18 February until 11 May 1943 Tactical Air Force units completed 59,000 sorties and claimed the destruction of 573 enemy aircraft, more than 500 motor transport vehicles, 23 miscellaneous ships, and during the last stages, provided the largest weight of air attack ever undertaken in support of a ground battle to that date.

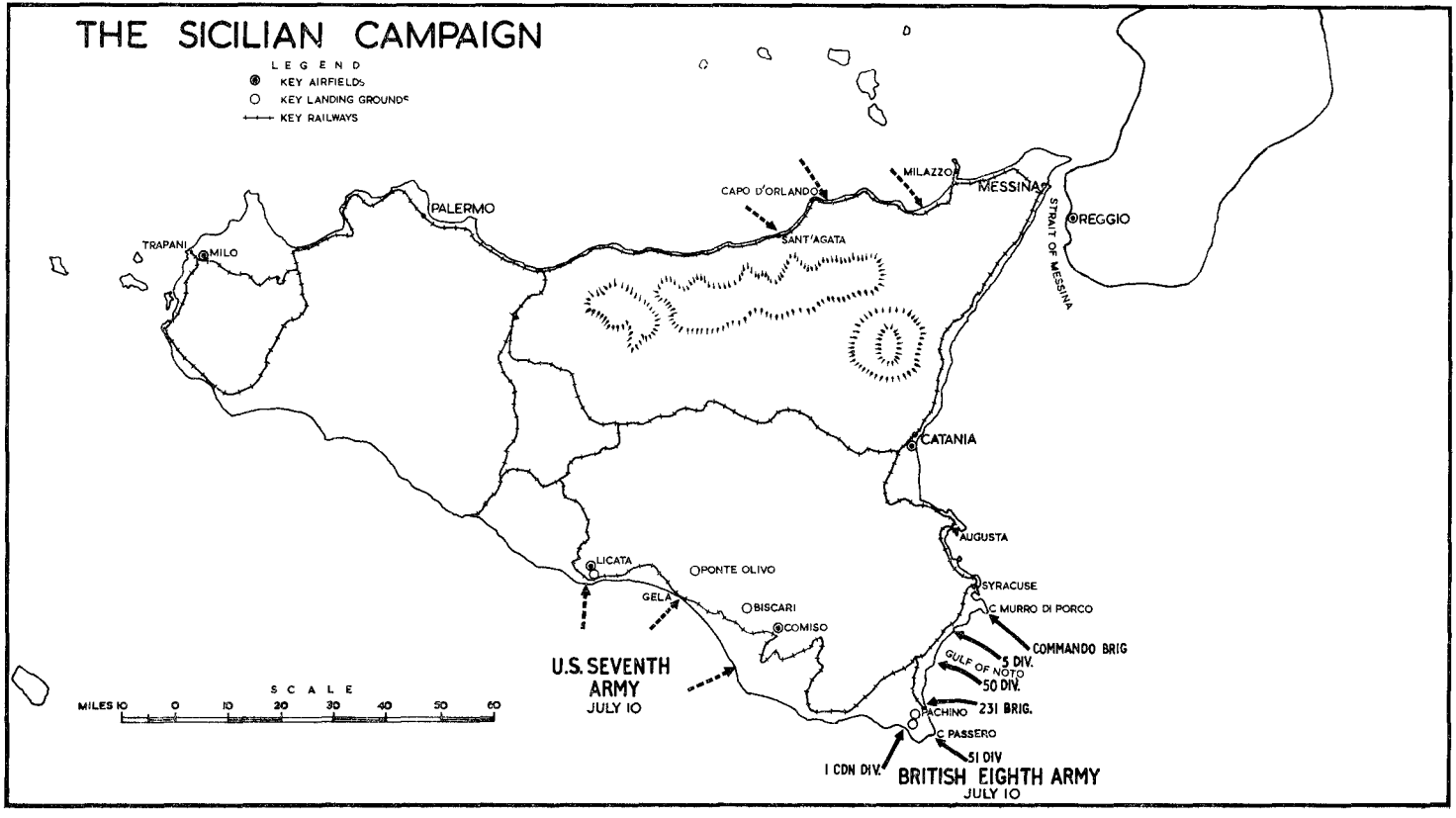
The campaign showed once again that the fighter-bomber with experienced pilots was a most versatile weapon but that specialist 'tank-busting' aircraft were uneconomical. The Squadron (No. 6) with the Western Desert Air Force

[1] Later, in Italy the technique was developed (under the code name of Timothy), as a carefully timed and co-ordinated ground and air attack. *See* Chapter 5.

travelled some 2,000 miles in four months, yet it only operated for about a week, during which damage to aircraft was very heavy. The standard of G.A.F. airfields was much lower than that required by the Allies. Sommerfeld Tracking and Pierced Steel Plank required a foundation such as sandy soil, that would not be unduly softened by rain and, in any case, considerable maintenance was required on a tracked field in constant use. A measure of control at Tactical Headquarters was therefore required over the Airfield Construction units. Ground signs displayed by the ground forces were again of great help during close support bombing and the use of ' pathfinders ' much increased the efficiency of night bombing. Finally, the American fragmentation cluster bomb proved itself to be a most effective weapon.

Perhaps the best tribute to the effectiveness of the air support given to the land forces in the Tunisian campaign is contained in a German report, written in 1944. ' The Anglo-American air forces played a decisive part in the enemy operational successes, which led to the destruction of the German-Italian bridgehead in Tunisia. They took part in the ground fighting to an extent never before attempted, thus increasing the pressure of the advancing attacking land forces, and putting the defensive powers of the German and Italian troops to the severest of tests.'[1]

[1] A.H.B.6. The Course of the War in the Med. Theatre, Vol. 8, p. 18.


THE SICILIAN CAMPAIGN
LEGEND
KEY AIRFIELDS
KEY LANDING GROUNDS
KEY RAILWAYS
PALERMO
TRAPANI
MILO
CAPO D'ORLANDO
MILAZZO
MESSINA
REGGIO
STRAIT OF MESSINA
SANT'AGATA
CATANIA
AUGUSTA
SYRACUSE
C MURRO DI PORCO
LICATA
PONTE OLIVO
GELA
BISCARI
COMISO
U.S. SEVENTH ARMY
JULY 10
COMMANDO BRIG
5 DIV.
GULF OF NOTO
50 DIV.
231 BRIG.
PACHINO
C PASSERO
51 DIV
1 CDN DIV.
BRITISH EIGHTH ARMY
JULY 10
SCALE
MILES 10 0 10 20 30 40 50 60

CHAPTER 5

CAMPAIGNS IN THE MEDITERRANEAN THEATRE

PART II

Sicily, 10 July–17 August 1943[1]

The invasion of Sicily conceived at the Combined Chiefs of Staff Conference at Casablanca in January 1943 and known as Operation Husky was carried out by the American Seventh and British Eighth Armies. Direct support for the land operation was supplied by the Desert Air Force, XII (U.S.) Air Support Command and Royal Air Force, Malta, assisted by the Strategic and Coastal Air Forces under the overall direction of the Air C.-in-C. Mediterranean Air Command. The subordinate Commands (Tactical, Strategic, Coastal and Troop Carrier) set up Command Posts, adjacent to the Air C.-in-C's. Headquarters thus virtually establishing one large Headquarters at La Marsa, near Tunis. The Air Support Control was at Malta, in the Royal Air Force War Room, together with the representatives of Headquarters Eighth Army and with Advanced Headquarters Desert Air Force, which at that time was in Malta prior to moving to Sicily.[2]

The Strategic Air Force maintained spasmodic attacks on ports and airfields in Sicily from the close of the Tunisian campaign but the scale of attack was increased from 20 June 1943. The Ninth (U.S.) Air Force in Cyrenaica assisted with occasional attacks and Malta provided escort for bombers of both formations as the occasion demanded. From 3 July Tactical Bomber Force added its weight to the attack by day and also, with the aid of Wellingtons, harassed enemy airfields on an increasing scale by night. In addition, two new United States A.36 Groups gained valuable experience and a knowledge of Sicily (that was later to prove extremely valuable) by attacking selected objectives such as road and rail movement, radar stations and camps.

From 8 July onwards the protection of assault convoys was a heavy Air Force responsibility but the anticipated large scale enemy air effort did not materialise and the convoys were entirely unmolested by air attack. The weather and the state of the sea suddenly deteriorated on the morning of 8 July but died down in the evening and the landings were begun as planned, at 0245 hours on the 10 July. Tactical surprise was achieved and very slight opposition was encountered from coastal batteries. The ports of Syracuse and Licata and the airfields at Pachino and Licata were captured ; on 11 July the port of Augusta and the airfields at Comiso and Ponte Olivo were taken ; and by 13 July an advance was in progress in all sectors.

In anticipation of a full enemy air offensive upon shipping and beaches on ' D-Day,' continuous patrols were flown over two beaches throughout the hours of daylight and over all landing grounds for the first two hours, from 1030 to

1 A.H.B./IIJ5/8. Report on Amphibious Operation in the Mediterranean. July–September 1943.

2 A.H.B./IIJ5/92. Report on Ops. of N.A.T.A.F. in Capture of Sicily.

1230 hours, 1600 to 1730 hours, and for the last one and a half hours of daylight. One Wing was also retained at readiness to reinforce any area as occasion demanded. Although the anticipated high scale of enemy air effort did not materialise in full, attacks by day on 11 and 12 July involved a large number of enemy aircraft and much air fighting. By last light, 10 July, only 12 out of about 2,000 ships had been damaged by air attack and, from 11 July, the enemy concentrated mainly upon a day fighter-bomber effort and a night effort. To counter this night effort, three Ground Control Interception Units (G.C.Is.) had been mounted in Tank Landing Ships (L.S.Ts.) for employment off 'Joss', 'Bark' and 'Acid' beaches, where they were to act as forward controls for Malta G.C.I., and Beaufighters, Hurricanes and Mosquitoes were provided from Malta, with the result that 45 enemy aircraft were claimed as destroyed during the six nights beginning 10/11 July.

Airborne landings employing about 350 aircraft under the control of Troop Carrier Command were synchronised with the seaborne assaults. Mainly glider-borne landings were made in the Syracuse area and paratroops were dropped in the Ponte Olivo area. The former were adversely affected by a strong wind from the northwest and poor navigation, which resulted in a proportion landing in the sea or just on shore. Diversionary attacks in the Catania area and in the vicinity of the dropping zones were carried out by the Tactical Bomber Force and searchlights along the routes and in the dropping zones, were attacked by Hurricanes from Malta. The Tactical Bomber force also provided navigation markers by dropping incendiary bombs in the paratroops' sector. This was the largest airborne operation so far attempted by the Allies and bearing in mind the limited experience of the crews of the transport aircraft the result was satisfactory, if 'not emphatically successful'.

The two (U.S.) A.36 groups, reinforced by the two P.38 Fighter Bomber groups flew formations of twelve aircraft throughout the day, beginning 10 July, against traffic on the routes leading to the beachhead. At the outset, targets were scarce but traffic tended to increase as the day wore on and a considerable number of M.T. were claimed destroyed. Under this scale of attack, traffic was not allowed to develop and road and rail movement was quickly reduced to small proportions. During the subsequent days the attack spread over the whole island and resulted in much dislocation of enemy movement.

The control of the air forces during amphibious operations catered for day and night fighter cover over the assault convoys and beaches, tactical reconnaissance, intruder, fighter-bomber and air/sea rescue operations, light, medium and heavy bombers and photo reconnaissance and air transport.[1] All aircraft had to operate from the launching territories until airfields could be secured in the assaulted territory for the priority use of fighters. Headquarters and control centres had also to be located in the launching territory. The basis of this control was as follows :—[2]

[1] A.H.B./IIJ5/8.

[2] The control system described applied in principle to both Sicily and Salerno with a few exceptions which are noted.

(*a*) *On launching territory*

(i) An Air Command Post for the overall direction of air operations and subordinate headquarters for the control of tactical operations, and to arrange and provide assistance by bomber, photo reconnaissance and transport aircraft.

(ii) A radar organisation and a broadcast system.

(iii) A central fighter operations room or despatching agency for the control of day and night fighters, tactical reconnaissance, intruder, fighter-bomber and air/sea rescue operations.

(*b*) *Afloat*

(i) Short range radar on cruisers, monitors and A.A. ships, long-range radar on naval Fighter Directing ships and on certain American Headquarters ships, and G.C.Is. mounted in Tank Landing ships (L.S.Ts.).

(ii) Headquarters ships for each assault area (and one stand-by Headquarters ship) fitted to accommodate Headquarters staffs and to operate as Forward Fighter Controls using information received from broadcasts and, when fitted, from their own radar.

(iii) A naval Fighter Directing ship with each main Headquarters ship to provide information from its long range radar, but not to control (except in the case of the control of the Fleet Air Arm carrier-borne aircraft at Salerno). It was considered necessary to limit the function of control to Headquarters ships as the naval controllers on the Fighter Directing ships were not sufficiently briefed to be certain of keeping the few available fighters within the most important patrol areas. In retrospect, however, it was evident that there was no basic reason why controllers and Headquarters staffs should continue to be crowded together on the one ship, with an over-complicated communications system, and, consequently the provision of separate Air Force Fighter Directing ships was recommended.[1]

(iv) Three seaborne G.C.Is. were used at Sicily for the control of night fighters.[2]

(*c*) *Ashore on assaulted territory*

(i) On 'D-Day' Operation Husky the Royal Air Force Forward Fighter Controls with a G.C.I., two light warning sets and a skeleton wireless unit (W.U.) of five posts in jeeps went ashore on each of three assault beaches ; a similar U.S.A.A.F. organisation consisting of an advanced section of main fighter control went

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[1] *See* Chapter 7.

[2] This was reduced to two at Salerno.

ashore on a fourth beach ; a fifth beach had no control landed ashore on ' D-Day '. The purpose of these controls was to relieve the Headquarters ships.[1]

(ii) On D plus 3 Operation Husky, Headquarters, No. 211 Group went ashore to centralise the control of fighters ashore, and, on the same day additional G.C.I./C.O.Ls., L.W.Ss. and W.Us. were landed. It transpired, however, that the Forward Fighter Control had been unable efficiently to relieve the Headquarters ships and, consequently, it was recommended that a main fighter control complete with operations room, radar, W.Us. and a ' Y ' services (Royal Air Force Group Headquarters ; United States Wing Headquarters or a M.O.R.U.) should land on ' D-Day ' in subsequent operations. It was intended that Forward Fighter Controls should be landed at the same time on the other beaches in order to guard against the loss of the main control.[2]

By 13 July the enemy operational air bases were in the Toe and Heel of Italy and only small numbers of aircraft were using the remaining airfields in Sicily as advanced landing grounds. As a background to Tactical Air Force operations the Strategic Air Force continued to attack airfields and communications targets in southern Italy, ports either side of the Strait of Messina, and medium bombers attacked static objectives in the rear of the battle area.

The continuous operation of Kittybombers from Malta was difficult while the Spitfires still remained there, and it was therefore essential that the Spitfires should be based in Sicily (and the Kittybombers in Malta) as soon as possible. These squadrons were to operate on both Army fronts until the fighter-bombers of XII (U.S.) Air Support Command could move from Tunisia to Sicily. Adequate resources for airfield construction had been arranged in planning. Twenty-one strips were in operation by the end of July and altogether about 40 squadrons were in Sicily by 25 July 1943.

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1 The Forward Fighter Control consisted of the following :—
(i) A Chain Overseas Low (C.O.L.) Station.
(ii) A Light Warning Set (L.W.S.)—radar.
(iii) A V.H.F. R/T Station.
(iv) W/T channel to the main fighter control centre.
(v) W/T channel for reception of plots from the G.C.I. or M.R.U. Station.
(vi) Trailer Operations Room.

Squadrons were sent out under the Fighter Control Centre and then called ' Free from Control ' by R/T. The function of informing close support aircraft and bombers of changes in the position of the target was the duty of the Forward Control Post and Visual Control Post or ' Rover ' (*q.v.*).

The Control Centre at Group embraced the Intelligence Staff, Mobile Gun Operations Room, Controller, ' Y ' Officer, Forward Bomber Control, Operations staff, and H/F receiving cabins all housed in four vehicles. Information received was plotted direct on to the table and tracks were selected by the Controller. Bomber missions were co-ordinated with fighters and controlled through the Forward Bomber Control which was in touch with the bomber formation. This was, in effect, the working equivalent of the Mobile Operations Room Unit (M.O.R.U.) formed in the United Kingdom in October 1942. The unit eventually became the Group Control Centre used in the liberation of North-West Europe. The original No. 1 M.O.R.U. arrived in Sicily between 19 and 24 July 1943 and a Gun Operations Room and Bomber Operations Room were added to it. A.H.B./IIJ1/22/53 and A.H.B./IIJ5/83/127.)

2 The policy was followed, later, at Salerno of putting in a full Fighter Control Organisation right away without first landing a nucleus organisation. The first G.C.I. was landed on D plus 1 and Headquarters 64th Fighter Wing was landed on D plus 3. Two G.C.Is. and four L.W.Ss. were ashore by D plus 3, but no reserve control organisation was provided.

The whole of the Tactical Bomber Force remained in the Cape Bon Peninsula until 21 July, when two wings and a group moved to Malta to replace the fighter-bombers that had moved out. This brought the whole of the Tactical Bomber Force within operational range of the battle by day or by night. The bombers on Malta were placed under A.O.C. Desert Air Force and operated through a Forward Bomber Control at Desert Air Force Headquarters back to Advanced Headquarters Tactical Bomber Force on Malta. The bombers in Tunisia were placed under the Commanding General Headquarters XII Air Support Command and operated through a similar Forward Bomber Control at Headquarters XII Air Support Command back to Main Headquarters Tactical Bomber Force. Those in Tunisia moved to Sicily on 4 August and were joined by those from Malta so that by 12 August the whole of the Tactical Bomber Force was in Sicily and again united.

The enemy had begun to withdraw from Sicily early in August, thinning out his resources prior to his final exit, and making use of favourable ground, mining and demolitions for delaying tactics that prevented pressure by ground forces. He built up a tremendous concentration of 'flak' on both sides of the narrow Strait of Messina and thus restricted the Allied air effort against ports and shipping; and he operated an intense traffic by night across the narrow strait (into which the Allied Navy could not penetrate) and thus offered few targets by day.

Probably the most outstanding feature of operation Husky was the success which attended the attacks on enemy airfields and did much to ensure immunity from an attack to the seaborne assault. The results substantiated the conclusions from the Tunisian Campaign—that an airfield can be so damaged by air action as to be rendered unfit for flying. In at least two cases, Milo and Biscari, the damage caused by heavy bomber attacks was so extensive that no effort was made to repair them. Other airfields were frequently made unserviceable for periods of from 12 to 48 hours. Fragmentation bombs caused severe losses to enemy aircraft on the ground, even when in pens.

Perhaps the second most useful lesson learned in Husky, was the value of the G.C.I. mounted on a L.S.T. and located off the assault beaches. The introduction of this advanced control station enabled night fighters to operate with a high degree of efficiency. In consequence the losses caused to shipping by enemy night attacks were negligible.

The control of A.A. gunfire by warships, landing craft and merchant vessels proved far from satisfactory, despite elaborate regulations and a number of our own aircraft were shot down. It was therefore recommended 'that when aircraft are forced to be routed over shipping in the assault area that all A.A. fire be prohibited at certain fixed times when aircraft are due to pass; this particularly applies to transport aircraft used in airborne operations'.

In order to assess the scale of protection required over the beaches and to avoid the undue employment of fighters in a defensive role over a long period, it was recommended that a senior air force officer in each main assault area be briefed to render a short situation report to Tactical Air Force Headquarters at least twice a day.

The main role of the fighter-bomber force was to paralyse enemy movement toward the assault area and this was achieved by using formations of twelve aircraft at the beginning when good targets were found and by using formations of eight and four aircraft as targets became smaller and more scattered. The number of vehicles destroyed was small but road movement was practically brought to a standstill. Similarly, owing to the simplicity of the Sicilian rail-road system, the object of stopping rail traffic was soon achieved and attacks finally had to be discontinued in order to avoid further damage to a means of transportation that would later be required by the Allies.

Operations by the Tactical Bomber Force showed that such a force must be equally well prepared to undertake day or night operations. Initially, during the moon period and when fighter escort was difficult, the Tactical Bomber Force was used principally against road movement by night, as a complement to the day effort. It was only during the later stages of Husky, that it was employed mainly in the role of supporting ground operations by day.

Air force units were transferred quickly from their pre-assault bases to air-fields in Sicily by air transport. Units were usually called forward at short notice and frequently at times which did not exactly follow those anticipated in the planned build-up. This was to be expected and, in order to keep air trans-port formations fully briefed as to events and requirements, Troop Carrier Command and No. 216 Group had a Command Post alongside Headquarters Tactical Air Force.

The provision of an officer with operational flying experience for liaison duties with the airfield construction groups was proved to be essential. Unless the Engineer Officer in charge of airfield construction could obtain immediate advice as to the operational suitability of any sites selected, there was bound to be delay in commencing construction and a risk in starting work on fields which were unsuitable for operations. The Air Force commander had to be informed at the earliest possible moment that sites had been found, and that these were likely to be ready by a certain date, and it was suggested that the best means of obtaining this information was from the Air Force Liaison Officer, using Army channels of communication.

Plans for the invasion of Sicily provided for the issue of luminous triangles to individual men, red panels surmounted by a white star to platoons, and special pennants to A.F.Vs. and thereafter, particularly in set-piece ground attacks, a combination of all the systems was used. By mid-1944 the coloured ' Fluores-cent ' Panel was in use in combination with other methods, in all theatres, and in the majority of close support operations ; it largely solved the problem of air/ground recognition of A.F.Vs. and was far in advance of any similar device.

Italy, 3 September 1943–5 May 1945

Salerno, 9 September–1 October 1943

Operation Avalanche[1] was the amphibious assault by the Fifth U.S. Army, mounted from North Africa and Sicily, against the Italian mainland with the primary object of establishing air forces at Montecorvino and neighbouring

1 Report on Avalanche by M.A.T.A.F.

airfields, of seizing Naples, and of developing a base from which operations could be conducted against the remainder of Italy. It was preceded on 3 September 1943 by an Eighth Army assault across the Strait of Messina (Operation Baytown).

Up to D minus 1 the Tactical Air Force assisted the Strategic Air Force to neutralise the enemy air forces in southern Italy and to impose the maximum interference upon the movement of forces and supplies towards the assault area. These tasks were continued on D minus 1 when additional assistance was given to the Coastal Air Force in the protection of convoys and from ' D-Day ' (9 September) onwards, the role of the Tactical Air Force became the protection of shipping and beaches, the prevention of enemy movement in or to the assault area, and the attack of military targets.

The various elements of the Tactical Air Force were given the following responsibilities :—

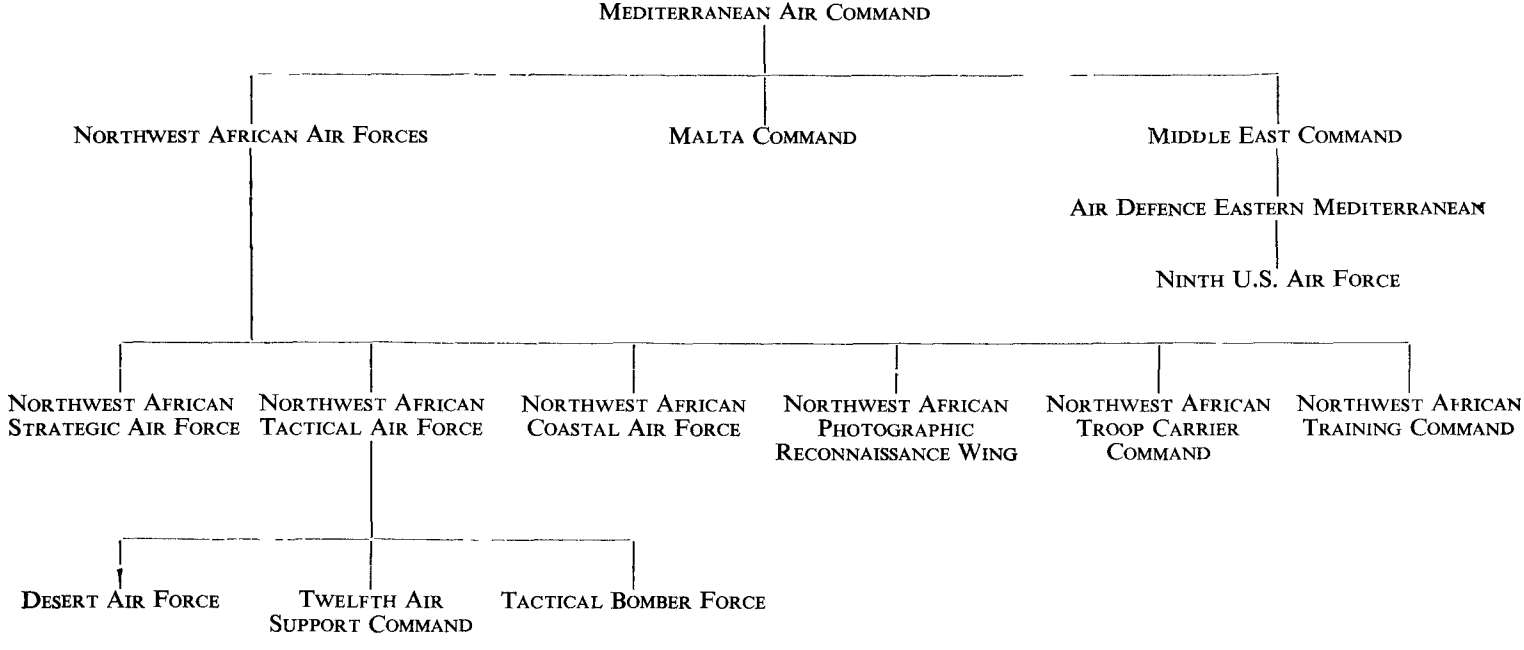
(*a*) Desert Air Force (D.A.F.) was responsible for the air effort in support of Eighth Army's crossing of the Strait of Messina and exercised operational control over the Tactical Bomber Force from D minus 8 to ' D-Day '. Thereafter it retained control of six light bomber squadrons.

(*b*) XII (U.S.) Air Support Command was reponsible for the operational control of all fighters and fighter-bombers from D minus 7 onwards but up to ' D-Day ' all fighters in north-east Sicily were controlled by D.A.F. through No. 1 M.O.R.U. From ' D-Day ' onwards XII Air Support Command operated a despatching agency for fighters and fighter-bombers and these were controlled in the assault area by a Headquarters ship, until the 64th Fighter Wing was established ashore on D plus 3.

(*c*) Headquarters Tactical Bomber Force therefore played no commanding role in the operation. It was under D.A.F. until ' D-Day ', and thereafter was divided between D.A.F. and XII Air Support Command, while operating against tactical targets. Small advanced headquarters were located alongside Advanced XII Air Support Command and Advanced D.A.F. Headquarters, where requests for support were initiated and fighter escort was arranged.

(*d*) Air Transport was provided by No. 216 Group alone up to ' D-Day ' but Troop Carrier Command undertook to meet additional tactical requirements for the transport and maintenance of airborne forces thereafter. Transport operations in the forward area were undertaken only at the request of the Commanding General XII Air Support Command, or the A.O.C., Desert Air Force, who co-ordinated all demands and provided routes and protection. Conflicting demands were referred by No. 216 Group to the Tactical Air Force for decision in consultation with the Fifteenth Army Group. Airborne operations were carried out on the nights of 13/14 and 14/15 September when part of the 82nd Airborne Division was dropped in a threatened zone of the beachhead and part behind the enemy lines.

AIR ORGANISATION AND CHAIN OF COMMAND OF FORCES ENGAGED IN INVASION OF ITALY, 3 SEPTEMBER 1943



At first light on 3 September, troops of the Eighth Army crossed the Strait of Messina and entered Reggio. The following day Commandos landed at Bagnara and linked up with the advancing troops ; on 7 September, Rosarno was captured ; and on 8 September another bridgehead was established at Pizzo.

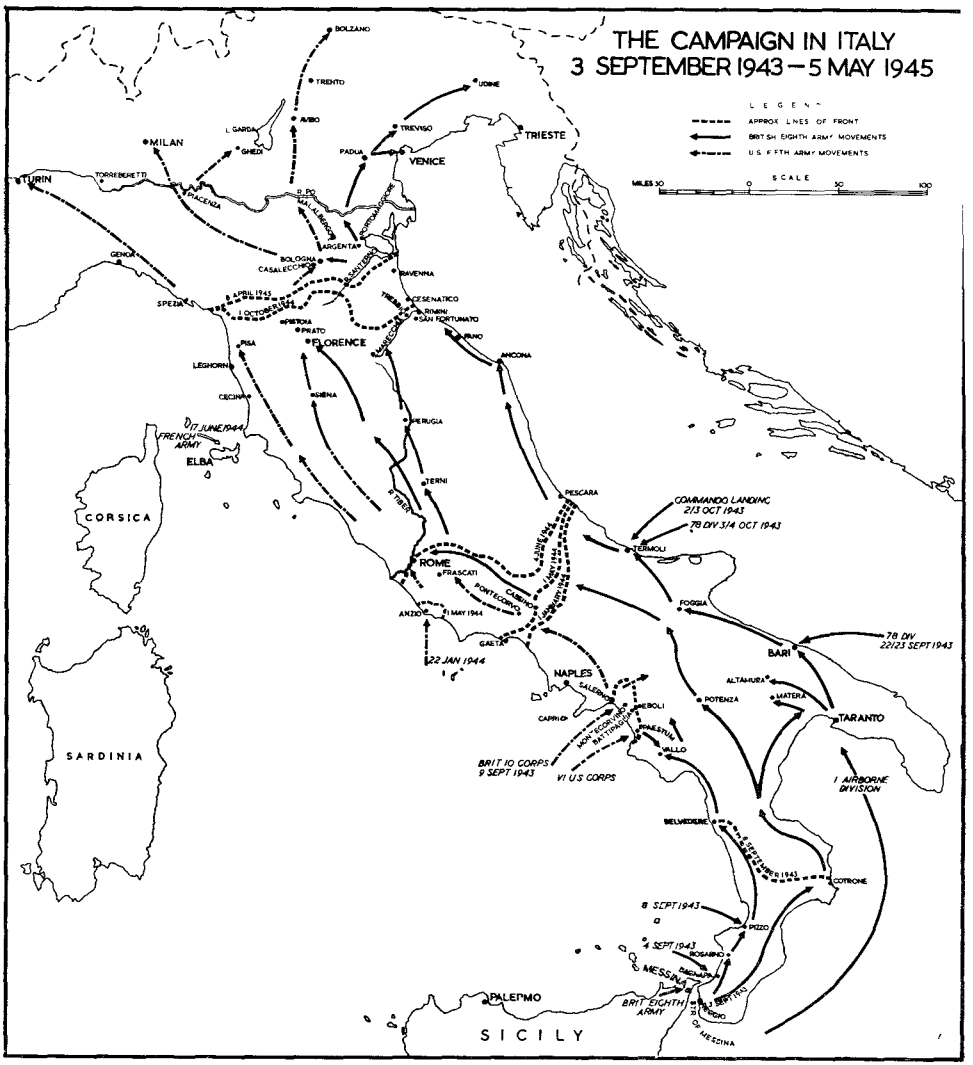
Operation Avalanche took place as planned at 0330 hours 9 September 1943, and the assault stage lasted until 17 September when the bridgehead was secured and the German counter-attack of 13 September was finally liquidated. The advance of the Eighth Army up the centre and east of Italy and the vigorous Fifth Army attack on 17 September caused the enemy to withdraw from the right flank of the Salerno beachhead, and by 21 September, a line was formed from Salerno to Bari. The rugged hill country covering the Naples Plain was crossed by 28 September, the first elements of the Fifth Army entered Naples on 1 October, and the simultaneous consolidation of positions stretching across Italy, to include the landing grounds at Foggia, concluded Operations Avalanche and Baytown.

A valuable contribution to the beach patrol system at Salerno was made by Fleet Air Arm aircraft operating from five Royal Navy escort carriers—H.M. Ships *Unicorn*, *Attacker*, *Stalker*, *Battler* and *Hunter*—until Sicily-based fighters moved on to beachhead strips. The margin of Allied air superiority rendered it possible for the Carrier Force V to function for three and a half days. Control of its Seafires was delegated to H.M.S. *Ulster Queen*, which was linked with XII Tactical Air Support Command in the Headquarters ship U.S.S. *Ancon*. When the latter was damaged by a near-miss from a German bomb, U.S.S. *Palomares* took her place until she returned as standby ship. Cover was maintained on ' D-Day ' over the beaches and the area south and west of Capri. When the latter proved redundant, the aircraft concerned joined the high beach patrols. As aircraft were ship-based in the vicinity, they could remain on patrol for 80 minutes, as against the Lighnings' 60 minutes and the Spitfires' 25 minutes. They served not only as an almost unbroken deterrent to enemy air attacks (although the fighter screen as a whole failed to prevent a number of damaging enemy air attacks) but as stopgaps in the dawn and dusk intervals left open by aircraft operating at long range from Sicily. Furthermore, on D plus 2, when one-half of the Lightning patrol failed to report and enemy aircraft were inflicting serious damage on our shipping, their value was manifest. The daily sortie totals—265, 232, 160 and 56—represented a not unimpressive percentage of the total patrol effort. The whole carrier programme was an interesting experiment.

Although handicapped by inadequate training, unsuitable equipment, crowded communications, aircraft somewhat inferior in performance to the German fighters and a high accident rate, the force carried a step further the development of carrier participation in land operations begun at Madagascar and North-West Africa. Lessons were learned on such problems as control, manoeuvring, training and equipment. When Force V retired on 13 September, the twenty-six Seafires still serviceable flew back to Paestum airstrip in the U.S. beachhead to continue patrolling until relieved by Spitfires.

Sufficient airfields had been constructed in Sicily in time to accommodate the whole of the Tactical Air Force for the operation ; thus bringing the fighter force within operational range of the beachhead. Although the primary task

was the securing of airfields in the Montecorvino area, it was in this important respect that the assault was a disappointment, for Montecorvino was not captured as planned, on ' D-Day '. Even when it finally fell, the airfield remained for several days under German shellfire. The need for new construction had been anticipated by the inclusion of airfield construction personnel in the ' D-Day ' landing parties and mechanical equipment followed on D plus 1. Engineers were nearly always within enemy artillery range but most of the work was restricted to the laying of ' prepared landing strip ' and the first airfield was ready by 11 September and nine were in use by the end of the month.



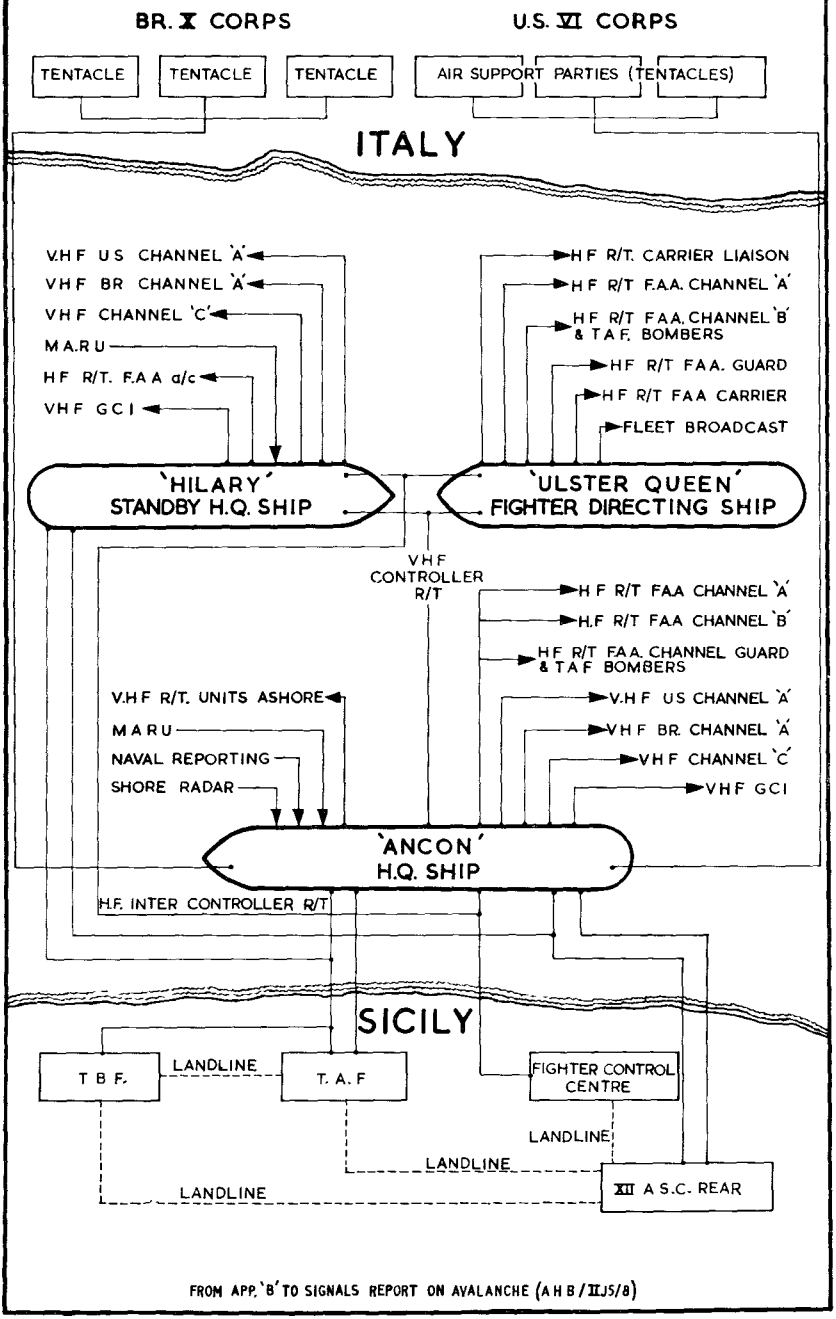
The Strategic Air Force had been attacking airfields and lines of communication in Italy throughout the summer of 1943 and these attacks were concentrated at the end of August against those areas from which the enemy was expected to oppose the Salerno landings. At the same time, 31 August to 8 September, the operations of the Tactical Bomber Force, in support of the Eighth Army,

were being co-ordinated with those of the Strategic Air Force and airfields, marshalling yards, bridges, and road and rail bottlenecks were bombed. On 8 September, 131 Fortresses attacked the German Headquarters at Frascati and from 9 to 17 September the whole bombardment effort was devoted to the support of Fifth Army. For five days the effort was applied against railway junctions, communication bottlenecks and lines of supply, but during the crisis of 14 to 15 September, the targets were the towns and nearby roads of Battipaglia and Eboli, directly in front of the Allied troops. The encouragement and assistance thus given to the ground forces was largely responsible for the success of the Allied counter-attacks of 17 September and, thereafter, the bomber effort reverted to the attack of communications and airfields off the battlefield.

Enemy fighter opposition to the pre-' D-Day ' bomber operations was slight and indicated that the *Luftwaffe's* limited resources were being conserved for an inevitable clash somewhere in the area of Naples. The nearest Allied airfields were 150 miles away from the beachhead but, by using long range tanks, Spitfires were able to patrol for up to twenty-five minutes each at 16–20,000 feet while American P.38 Lightnings and A.36 Mustang Invaders patrolling for one hour, provided the medium and low cover respectively. The Headquarters Control ship, U.S.S. *Ancon*, was unable to pass much useful information to fighters, but night fighters found the seaborne G.C.I. to be most accurate. The enemy resorted to low-flying attacks whereby fighter-bombers were able to take advantage of the mountainous character of the country to avoid being detected by radar. It was therefore recommended that, for similar conditions, a visual fighter control with V.H.F. and a controller should be made available and sited on a suitable point of observation, probably alongside a W.U. post. Two land G.C.U./C.O.Ls. went ashore on ' D-Day ' and the control of fighter aircraft was handed over to Headquarters 64th Fighter Wing on 12 September. Comparatively little G.A.F. activity was encountered on the first day (9 September) but resistance increased thereafter with the main effort being directed against shipping and a lesser effort against ground forces. The enemy would not fight in the air unless forced to but during the first nine days, when some 30 ships were damaged, the Tactical Air Force destroyed an estimated 69 aircraft for a loss of thirty-four. From 17 September the German effort was in the decline and, as the *Luftwaffe* was forced back to more distant airfields, finally dwindled to negligible proportions.

The first five fighter squadrons were ashore by 12 September and the number had increased to twenty-three by 16 September (including one reconnaissance and one fighter-bomber squadron). Headquarters Fifth Army, Advanced XII Air Support Command and Fifth Army Air Support Control were carried on board the headquarters ship U.S.S. *Ancon*, and, by the evening of ' D-Day ', five tentacles on land were in good communication with control. Owing to the complete commitment of fighters to defensive tasks and the consequent lack of escort by bombing operations, no close support day bombing was possible during the first five days. But the provision of the Air Support net was fully justified by its use for the regular passing of Tac/R results and changes of bomblines. The Tac/R aircraft called *Ancon* when returning from their missions and detailed results were passed by wireless from XII Air Support

H.Q. SHIP COMMUNICATIONS AT SALERNO



FROM APP. 'B' TO SIGNALS REPORT ON AVALANCHE (A.H.B./IIJ5/8)

Command Rear Headquarters in Sicily to *Ancon* after the aircraft had landed. Requests for Tac/R were also received over the Air Support Control net and on certain occasions the system was used for passing administrative messages.

The Army and Air Headquarters and the Air Support Control went ashore on 12 September and the British system of operating the Air Support Control organisation was put into effect. Demands for support and changes of bomb-line were submitted to G.3 Army for decision and agreement and were passed to A.3, XII Air Support Command for action direct with bomber wing groups. On 14 and 15 September, a large Strategical and Tactical Bomber effort was concentrated on the Battipaglia and Eboli areas and long range P.38's were used to search out opportunity targets near the bomb line. The Air Support Control network was used to pass the results of pre-arranged effort, bombline changes and the results of Tac R but until fighter-bombers were based on the mainland, on 16 September, it was impossible to accept opportunity targets. Thereafter it was possible to accept opportunity targets according to the number of aircraft available and with the beginning of regular Tac R broadcasts from reconnaissance squadrons it became less necessary to pass the results of reconnaissance over the tentacle net to the tentacles (which could now receive the broadcast). An air support programme for the following day was agreed at an Army Air S.C. meeting each evening (when the telephoned requests of Corps were considered), and the intentions, together with as much detail as possible, were subsequently sent in cipher to Corps over the Air Support channels.

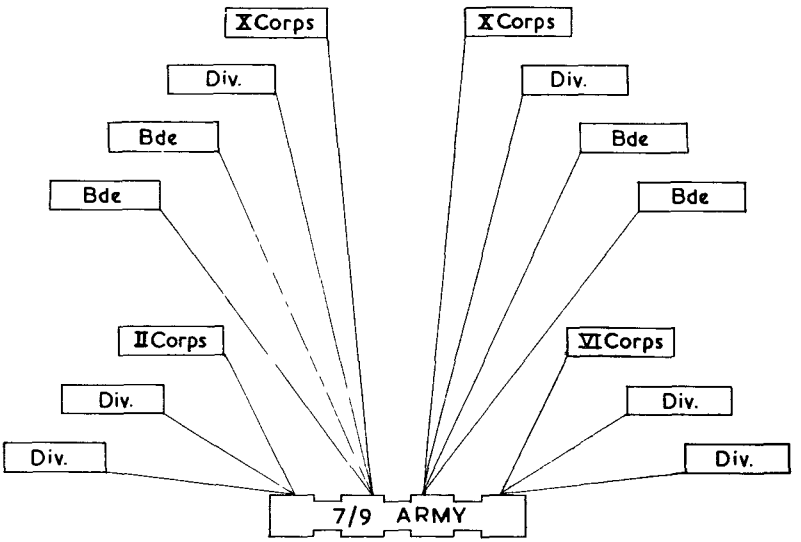
As a result of the successful operation of the British system, XII Air Support Command agreed to accept rear links and A.L.Os. at all XII Air Support Command formations in order that the results of missions might be received more quickly and in more detail.

On 10 October 1943, the control of all tactical bombers reverted to the Tactical Bomber Force, but the Desert Air Force and XII Air Support Command continued to make requests direct to Headquarters Tactical Bomber Force and were each given a temporary allocation of bomber effort in order that they would have prior knowledge of their resources and escort commitment, irrespective of faulty communications.

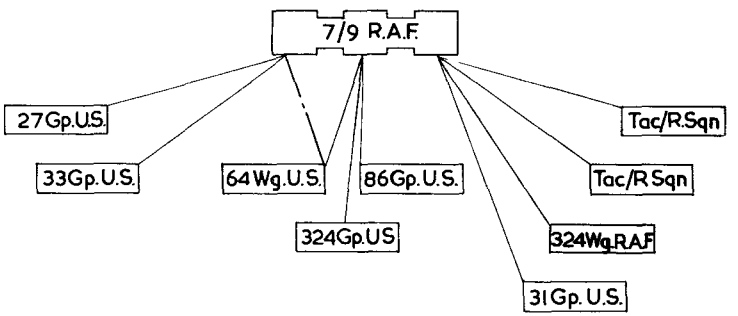
In order to avoid as far as possible abortive raids due to misunderstandings and mistimings at rendezvous a new procedure was laid down on 7 November 1943 between fighter escorts and bomber formations. It was decided that the fighter escort leader should be in charge of the rendezvous and the combined formation at the rendezvous. He would lead the formation away only when satisfied that all bomber formations had sufficient escort. To do this he would form the aircraft on the starboard wing of the bomber leader, rock his wings and remain in position until the bomber leader set course for the target, returning to his escort position when course was set. If it were necessary to cancel the mission after the combined formation had set course, the fighter leader would turn back the formation by flying in front of the bomber leader, rocking his wings and turning off towards base.

Adherence was emphasised to the strictest punctuality in rendezvous times and it was emphasised too that heights should only be varied when there were clouds—bombers flying 1,000 feet below the cloud base at rendezvous to give

No. 7/9 A.AIR S.C. OPERATING AT H.Q. 5TH ARMY/XII A.S.C. 15 NOVEMBER 1943



A. AIR S.C.



NOTES:-

(a) - - - - - Listening Watch only

(b) By this time American tentacles (Air Support Parties) were double banking VI and II Corps and their Divisions

(c) Taken from Appendix 'A' to MATAF report on Avalanche (A.H.B./II.J11/48/1)

the escort sufficient height. The escort in the rendezvous area would fly 500 feet above the bombers and over the fighter box of six so as to help the fighter leader in identifying escorts with their squadrons in large formations. Second boxes of bombers would fly the closest possible formation on the leading box, particularly in the rendezvous area, and if the boxes split in the target area only the leading box would be escorted by the fighters when the escort was less than eight in number—formations flew in boxes of six up to a normal maximum of 24 aircraft.

Cassino—15 February and 15 March 1944

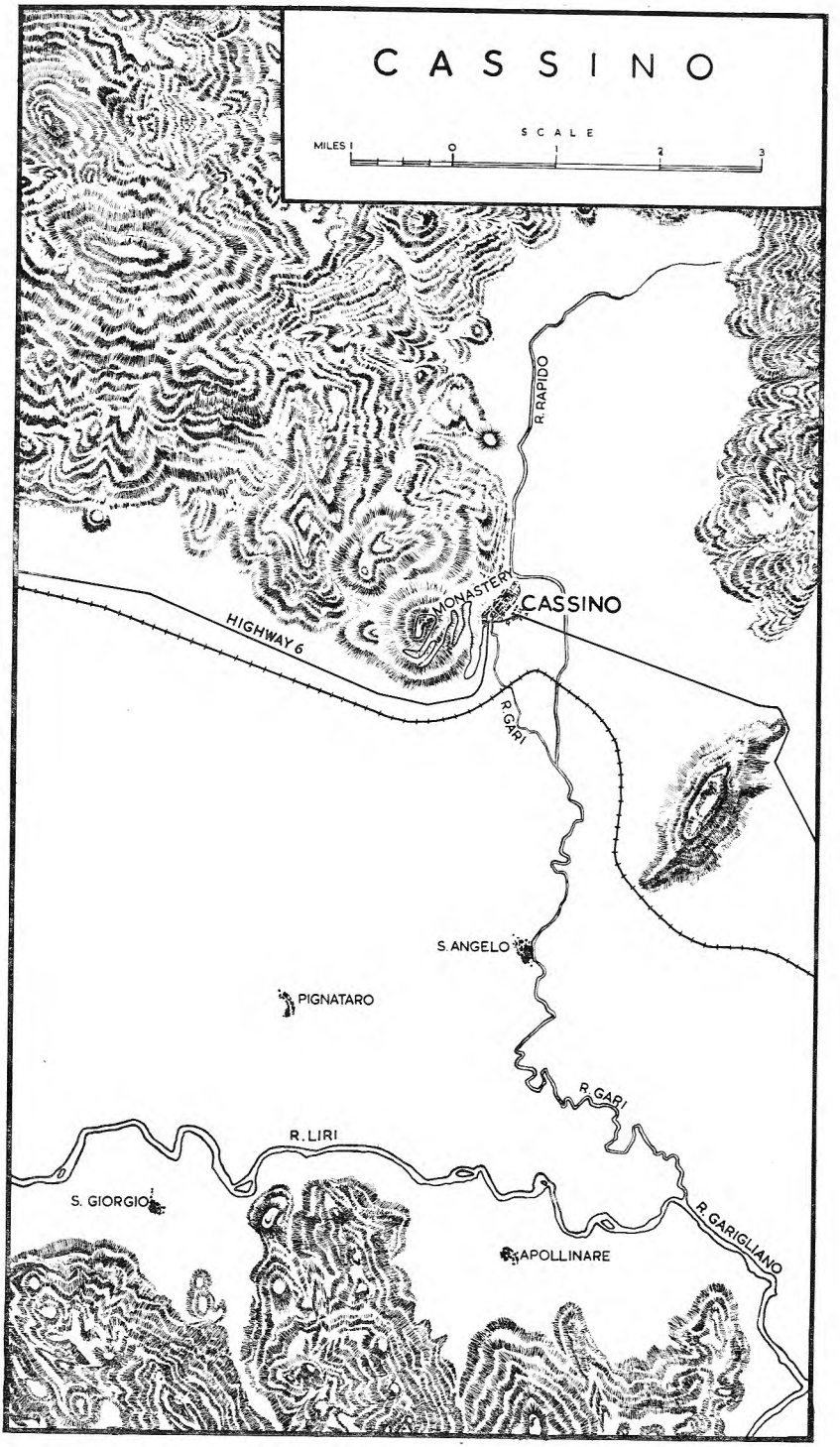
In January 1944 the Allies in Italy were held south of the *Führer* or Hitler Line of which the stretch covering the Cassino Area and main front was known as the Gustav Line. There were only two routes to Rome—by sea and up the Liri Valley, and the Allies chose to take both. The bastion of Monte Cassino stood at the entrance to the Liri Valley. Its 'Keep' was a monastery and most of its acreage was protected by high thick stone walls. Before the war the Italians had considered Monte Cassino to be almost impregnable, even without any artificial works, and the Germans had been developing and fortifying it for the past four months. The monastery overlooked and dominated the strongly fortified town of Cassino, extensive field works covered the slopes and a wide area of the hills summit, two further features to the west were also strong points, and the whole constituted an intricate system of defences from which accurate cross fire from several points could be brought to bear on any line of approach.[1]

The first attempt to force an entrance into the Liri Valley was begun in January. Gains were made in all sectors and by 6 February leading troops were on the outskirts of Cassino and within 300 yards of Monastery Hill. The offensive did not however, go according to plan ; the defensive network was too strong ; and on 11 February the last attack had failed.

The second battle for Cassino was preceded by air attack. It had been possible to give little direct support while the Anzio beachhead was being secured and consolidated and, until the second battle, the main weight of air effort affecting the main and Anzio fronts fell on communication targets. The Commander 4th Indian division, who was detailed to capture Monastery Hill and Cassino from the west represented an urgent need for heavy bombs to breach the Monastery walls which rose sheer from the face of the rock. On 15 February 1944, nearly 450 tons of bombs were dropped on the buildings standing 1,700 feet above Cassino town by 135 Fortresses, 47 Mitchells and 40 Marauders. 4th Indian Division did not receive sufficient warning of the attack to allow it to withdraw to safe positions but fortunately the bombing was so accurate that few casualties were incurred. The ground attack followed that night but was brought to a halt by the enemy cross-fire. It can be safely assumed that the defenders had filtered back to their defensive position from the underground tunnels which ran through the hill and town.

Anzio was absorbing almost the whole available air effort but on 16 and 17 February, the heap of rubble that now comprised the Monastery was attacked by 40 and 51 fighter-bombers respectively in order to drive the Germans to

[1] A.H.B. Narrative. *The Italian Campaign, Vol. I*


CASSINO
SCALE
MILES 1 0 1 2 3
R. RAPIDO
MONASTERY
CASSINO
HIGHWAY 6
R. GARI
S. ANGELO
PIGNATARO
R. GARI
R. LIRI
S. GIORGIO
APOLLINARE
R. GARIGLIANO

cover in advance of ground attacks that again followed by night. Neither of these assaults was successful and only the New Zealanders attack on Cassino town from the south made appreciable progress before being halted.

In view of the strongly held theory that air bombardment might function in an artillery role on occasions of offensive action, the Army Commanders suggested a mass air and artillery bombardment of Cassino followed by an infantry attack and a secondary tank operation. It was clear that bomb craters and rubble would obstruct the passage of tanks but armour was intended only for the ' third ' phase breakthrough into the Liri Valley and General Freyberg was content that bulldozers should clear the way. The ground attack failed and the unarmed bulldozers and the bridge engineers, working on the Rapido crossings, came under such continuous fire that the passage remained blocked and no tanks got through.

Contrary to general belief, the obstruction of tanks was of only minor concern. The agreement that an attempt should be made to surprise the enemy by an intense and concentrated air bombardment, followed by a heavy artillery concentration, is understandable. It was hoped, so to stupefy and demoralise the defenders that ground forces would be able to attack successfully against the enemy's superior observation system, with a minimum of loss.

It was agreed that the Allied troops should withdraw about 1,000 yards before dawn on ' D-Day ' and that they should advance into Cassino, under cover of an intense rolling barrage, immediately after the air bombardment ceased at 1205 hours. Eleven heavy groups of MASAF and five medium groups of MATAF were to attack between 0830 and 1200 hours and no bombing was to take place after 1205 hours. The object was the complete reduction of Cassino town and no bombs of less than 1,000 lb. or with long delay fuses were to be used. Operating heights were 15,000 to 16,000 feet for heavy bombers and 7,000 to 9,000 feet for medium bombers. On the other hand the axes of attack were all perpendicular to the front, briefing was thorough and carried out with the help of photographs, and a radio link was established between the bombing aircraft and a XII A.S.C. ground control.

No specific aiming points were assigned but the target area was divided into two halves which were to be attacked alternatively at 15 minute intervals—a timing which was calculated to allow for manoeuvring and for dust to clear from the limited target. The mediums maintained close formation and attacks were generally punctual, concentrated and accurate but the heavies were reported as being ' all over the sky ' and attacks were frequently unpunctual, dispersed and inaccurate. One group failed to find the target, 13 Liberators dropped 40 bombs in friendly territory causing some 105 military casualties and at least 60 civilian casualties, the spacing of attacks varied from one to forty-one minutes, smoke interfered, and out of a total of 988 tons of bombs dropped, only about 300 tons fell in the target area. This was followed by artillery fire from 890 guns of all calibres, of which 144 twenty-five pounders provided a rolling barrage for about two hours, and by several accurate fighter-bomber attacks against specific targets.

Cassino was reduced from an area of broken buildings, few of which could afford adequate cover for either men or equipment, to a scorched weal over which clouds of smoke and dust hovered for many hours. Nevertheless, neither the German's resistance nor morale was greatly reduced. Machine guns, mortars, and artillery were only partially neutralised and the heavily fortified area of the defending artillery was not cleared. Furthermore, all traffic routes were blocked and the rain that followed that night, filled in the craters and reduced the debris to a consistency that made removal practically impossible.

The air bombardment had destroyed Cassino as planned and by dusk 15 March the infantry were only a little behind schedule. Complete success and consolidation were prevented however, largely by the lack of weight in the attack. The Germans were also allowed time to recover from the shock and the torrential rain during the night ruined any chance of success.

The struggle went on for another eight days but despite the intervention of tanks and fighter-bombers only slow progress was made against stiffening resistance. On 23 March, after long deliberation, the attack was abandoned and the fortress did not fall until two months later when it was by-passed and isolated before capture. The scale of bombing in support of the third attack on Cassino was subsequently shown to have been heavier than necessary ; allowance might have been made for the previous damage in the town and, added to the massive artillery fire, the air effort caused greater material destruction than was desirable from the ground force point of view. The defenders were not destroyed owing to the solid nature of their shelter system, enemy morale remained high.

From the experience of operations at Cassino it was concluded that the bombing of an enemy strongpoint should be followed as quickly as possible by a determined ground attack. Bombing cannot flatten a point or seriously affect an enemy protected by deep shelters. It was only a means to an end and would inevitably create impediments to the advance of troops and tanks.

Anti-Communications Operations Strangle and Diadem, 19 March–4 August 1944

On 15 March 1944 the Army was directed to accept a switch of emphasis from direct support to anti-communications operations.[1] Operation Strangle began on 19 March, as an intensification of the anti-communications war but was later referred to as the introductory stage of the offensive against Rome, which opened on 11 May 1944. Operation Diadem lasted from 11 May to 4 August 1944. It was estimated (and the figure is sound enough for practical purposes) that only five per cent of the normal rail traffic was required for purely military needs and to be effective all rail lines had to be cut quickly and simultaneously. In October and November 1943 the XII (U.S.) Bomber Command carried out a first attempt to establish a line of interdiction across Italy, north of Rome, by cutting bridges. Three major rail lines down Italy were successfully cut but two minor ones were left open. The effects were not decisive and the Germans continued to get their necessary 2,100 tons of supplies daily.

[1] A.H.B. Narrative. *The Italian Campaign, Vol. I.*

The northern Italian railway system was vulnerable to interdiction but the system of repair facilities, rail centres and rolling-stock bases was too extensive to be put out and kept out of action by air attack. Furthermore the Germans had an ample call on rolling stock to meet their minimum requirements and the locomotive position was comfortable. It was believed, however, that if the weight of air pressure on communications could be maintained, and an Allied attack could be made on the whole length of front, the German commitments would increase to such an extent that he would be so short of fuel that a crisis would result.

The main plan for operation Strangle concerned the Tactical Air Force, which was to interdict the rail system south of Pisa-Rimini. Whenever possible, main lines were to be cut at points more than 100 miles from the Anzio area in order to impose a maximum strain on motor transport and all lines across Italy had to be cut in order to prevent the diversion of traffic. Medium bombers were to attack bridges, marshalling yards and repair shops, and fighter-bombers were to attack active trains, troops, major bridges under repair, and secondary bridges. In addition, fighter and night bombers were to operate constantly over the whole road-net of central Italy with the object of destroying motor transport and disrupting movement by day and by night.

Operation Diadem was a logical continuation of Strangle and was planned with a major frontal attack in view. The enemy was not to be allowed to create, or retire to, a defensive line but was to be destroyed on a field of the Allies own choosing. The frontal assault was to provoke an expenditure of enemy supplies in excess of that trickling through the interdicted transport system. The role of the Tactical Air Force was to maintain the destruction and disruption already caused to land and sea communications and counter enemy air force operations during the main offensive. It was also to isolate the immediate battle area on the Fifth Army Front and neutralise the gun positions commanding the crossings over the Rapido River, on the Eighth Army Front. An attack on the German Army Headquarters was planned for 'D-Day' 11 May 1944.

The land offensive began on 11 May 1944 and Fifth Army crossed the Garigliano River two days later. On 17 May Highway 6 was cut and the next day Monte Cassino, now isolated, was taken. On 23 May a breach was effected in the enemy line at Pontecorvo, two days later the Anzio and main Fifth Army forces met, and, on 4 June Rome fell. The Eighth Army then advanced towards Perugia and the Fifth Army towards Siena, which fell on 20 June and 3 July respectively, and on 4 August Florence was entered. Heavy and medium bomber attacks on headquarters had been reasonably successful in causing disorganisation behind the enemy's lines and for the first three days the medium and fighter-bombers had concentrated upon such targets as command posts, strong points, gun positions, main towns on the road net, bridges and defiles. One medium bomber wing was again employed against road junctions from 21 to 25 May but otherwise the two bombardment wings of the Tactical Air Force were employed from 15 May onwards against rail bridges in central Italy. The fighters and bombers kept up a steady offensive against gun positions, roads, road bridges, railway tracks, towns and bivouac areas. Once

the break-through had been accomplished the fighter-bombers began armed reconnaissance mainly against M.T. and troop concentrations and the light bombers began to attack dumps. The German Tenth Army was, in fact, subjected to a pulverisation from the air such as had never yet been experienced by a well organised army.

The Tactical Air Force effort against lines of communication was closely co-ordinated with a Strategic Air Force effort against marshalling yards north of the Apennines. By the end of March the average number of cuts in the railway lines was 25 per day and during May the average rose to 71 per day.[1] Photographic cover of every line was attempted every forty-eight hours (so that each block could be cut again as soon as it showed signs of repair) but the enemy, after neglecting a damaged area for days, could be very quick in effecting the simultaneous repair of several multiple cuts—and no stretch of line was completely abandoned until the opening of the offensive in May. Furthermore, the Germans devised ingenious systems of transhipment whereby motor and animal transport was impressed to carry goods from one train to another—on the side of a break—and to supplement rail transport. As the shuttling from trains to M.T. fell off, the road movement increased in sympathy but owing to Allied air attacks and bombing the supplementary traffic (road and sea) had to travel as much as possible in darkness and the four Royal Air Force light bomber squadrons that were employed by night, were hard pressed to maintain a 24 hour schedule of air attack. On the whole, it is probable that the Germans suffered no serious shortages during the static phase before Diadem.

On ' D-Day ', 11 May, all rail traffic was blocked north of the line Cecina–Fano and in the first week no rail traffic approached closer than fifty miles from Rome. By the end of May the only route from the Po Valley was via the east coast to Fano and thence inland by a branch line on which transhipment was probably necessary at some points. On 1 June 1944 there were 124 cuts north of Rome of which 47 were major bridge cuts and until the middle of June, the situation remained very satisfactory. The operations of Tactical Air Force were extended when it became evident that the Germans would attempt to hold the Spezia-Rimini line and, consequently, the medium bombers cut all the rail and road lines across the Po river from Piacenza to the sea. These cuts were extended so that there were about 90 rail cuts north of a line through Florence by 4 August when the city was entered. Railway interdiction was absolute. No more than two or three road bridges remained across the Po east of Torreberetti, and the road system was disastrously disorganised.

Strangle and Diadem were never expected to secure a withdrawal of enemy ground troops but were so designed to weaken the enemy that the forthcoming ground operation would be materially facilitated.[2] So long as the front remained static the enemy's supply situation was probably not highly critical but long before ' D-Day ' he was short of food and clothing, and both fuel and certain types of heavy ammunition were severely rationed. Stocks of ammunition still remained however. Food was made up at the expense of the Italian

[1] A.H.B. Narrative. *The Italian Campaign, Vol. I.*
[2] M.A.A.F. Report on Diadem, Vol. VIII.

population, and considerable tonnages of material were moved forward by M.T., horse drawn vehicles and small coastal craft. With the opening of the ground offensive it was ironically, the dependence upon M.T. that appears to have been the cardinal factor in the collapse of the enemy supply system. The progressive withdrawal of transport from the forward communication zone made it impossible to supply the front line troops—and, once the lines of communication had shifted from rail to road, the intermediate supply depots and convoys became the principal tactical targets.

The fighter-bombers were switched from mainly close support missions to enemy communications and quickly proved their worth in the new type of operations. ' On a number of days over 100 track cuts were created by their effort alone, and throughout the period they averaged over 30 cuts per day . . . No less valuable was the ability of fighter-bombers to continue operating during periods when the medium bombers were grounded by weather. This ensured that traffic would remain frozen even though a major block created by medium bombers might be repaired during a period of enforced inactivity . . . In addition the fighter-bombers further restricted enemy supply by virtually stopping all road movement by day on the roads, and on the railways before complete interdiction had been achieved. They were in fact an essential complement to the medium bomber without which it would have been impossible to bring rail movement to a standstill.'[1]

The Strategic Air Force was used only sporadically, usually when weather prevented their attacks against higher priority targets. Its efforts showed that : ' Attacks caused temporary inconvenience to enemy communications in the Po Valley but accomplished no reduction in the flow of supplies to the battle area other than the destruction of the relatively few cars that happened to contain military supplies at the time of attack '. In 16 attacks on bridges and viaducts 12 targets were rendered unserviceable and the tracks of all 16 were cratered. In each case, at least temporary interdiction was accomplished and in two-thirds of the attacks interdiction was accomplished which lasted 10 to 25 times longer than the average four hours interdiction period following on an attack on marshalling yards.

The most difficult problem was to prevent enemy movement by night durin Strangle. Whereas by day as many as six groups of medium bombers and an equal number of fighter-bombers were concentrating almost their entire effort on the interdiction of enemy communications, the same task had to be accomplished at night by two squadrons of Bostons and two of Baltimores. The night harassing effort was inadequate, although the four squadrons contributed an essential part to the success of the operation.

The main conclusions, stated at the time, from Strangle and Diadem were that :—

(*a*) Air Power could not by itself defeat a highly organised and disciplined army even when that army was virtually without air support of its own ; enforce a withdrawal by drying up the flow of essential supplies when the enemy was not being forced to expend his supplies at a high rate ;

[1] M.A.A.F. Report on Diadem, Vol. VII.

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entirely prevent the movement of reserve or other troops, or, in short, absolutely isolate the battlefield from enemy supply and reinforcement. It also could not guarantee the immunity of forward formations or back areas against occasional air attack or reconnaissance.

(*b*) Air Power could make it impossible for the most highly organised and disciplined army to offer prolonged resistance to a determined offensive on the ground. It could turn an orderly retreat into a rout and could virtually eliminate an entire army as an effective fighting force.

(*c*) The theory that, as a long term policy, the most vulnerable railway targets for attack were large railway centres which contained important repair facilities and large concentrations of locomotives and rolling-stock was accepted. But complete interdiction of the railway systems leading to the front line was essential in order to cut into the minimum flow of supplies required to maintain an army in battle. This could be achieved only by actually cutting and keeping cut the railway lines themselves and M.A.A.F. concluded that the most effective method of producing continuous interdiction was the complete destruction of selected bridges and viaducts with long spans.

(*d*) Furthermore, the attack on all routes should be continuous throughout the twenty-four hours and, for the night effort, against land and sea routes, a strong night bomber force was required.

Developments of the Doctrine of Tactical Air Support—May 1944

In the meantime, the experiences of the period were being collated and considered by Allied Force Headquarters who decided to integrate the lessons learned to date for the benefit of all concerned. On 6 May 1944, they issued an Operation Memorandum on the ' Employment of Bombers and Fighter-Bombers in Co-operation with the Army.'[1] While warning not to overrate the effect of our air superiority and that standing patrols were uneconomical, it pointed out, as no similar document had done until that date, the need for the closest integration in air/ground planning. So that air and ground operations could interact to the best advantage, it might be necessary to adapt both timing and location of ground operations to assist and take full advantage of operations in the air. In the section on tactical air attacks on communications, the need for pressure on the enemy's reserves of stores was insisted on.

Development of Rover Controls in Italy, 1943–1945

Rover was a creation of the Army Air Support Control system and developed throughout its life and that of its successor, the Air Support Signals Unit, which was formed on 31 October 1944. Rover was operated either as a Visual Control Post, or, as was the general rule in the later stages of the campaign, as a Forward (blind) Control Post from which aircraft could be briefed and assisted to the attack of targets close to the front line. The aircraft were fighter-bombers and carried H.E. fragmentation bombs, fire bombs or rockets as dictated by the tactical situation.

Rover began in Italy as a normal armoured tentacle carrying a Royal Air Force controller, an A.L.O. and V.H.F. R/T for communicating with aircraft. It was sited on a height overlooking the battle area and the controller, by means

1 *See* Appendix 9.

of visual observation and a knowledge of the positions of forward troops (obtained by the A.L.O. by wireless from the Air Support Control) was in a position to contact aircraft and to brief them to attack fleeting targets, which he could observe on the battlefield.[1] But this he did without regard to the tactical situation and, sometimes, he could order the attack of only the most obvious targets for fear of confusion in briefing. A large-scale map, overprinted with a small grid, helped to clear the situation to some extent but the cockpit got cluttered up and the problem of briefing was not really solved until a handy sized gridded photo-mosaic was produced. Nevertheless, with additional communications the British 'Rover David' was able to play an important role in the fighting before the Gustav Line.

A fundamental part of the organisation was the provision of a 'Cab-rank' of aircraft timed to arrive in the area at regular intervals of about 30 minutes. These aircraft would be briefed at their airfields to attack pre-selected targets but, for a period of about 20 minutes before the attack, they would be required to orbit close to the forward line in order to give Rover an opportunity to call and brief them for the attack of priority 'fleeting' targets. If no call was received the aircraft would attack their original targets and return to base.

The American 'Rover Joe' was of a similar pattern to its British counterpart and, likewise, was able to act as a Visual Control Post in static warfare and mountainous country. It consisted of radio and telephonic communications from the supported units to the 'Rover Joe' personnel and of radio communications from 'Rover Joe' to the aircraft making the attack. Constant voice communication with the regiments making the main effort was provided by means of three or four radio jeeps and over and above this voice net, a carrier wave net was maintained with Air Support Control at Fifth Army and the Divisions and Corps. Squadron C.Os. took turns as controllers for a period of ten days and each took an experienced pilot as an assistant. Army liaison, technical assistance and administration were provided by ground personnel.

Missions were requested by the ground units and were referred by the liaison officer to the controller who, with the help of maps, photographs and a knowledge of the location of friendly troops, decided whether to refuse or accept the target. If the target were accepted, the A.L.O. would notify the ground unit of the expected time of attack and keep it posted on changes in plan, and the controller would decide how to guide the attacking aircraft in relation to landmarks. If necessary, he would ask for artillery smoke to indicate or bracket the target at the time when aircraft would be ready to attack. Aircraft were normally available every half hour and, when the pilots reported to the controller, they were notified of the target to be attacked. The flight leader was given the co-ordination of the target, its nature, checkpoints and advice on any special characteristics of the terrain or target, and informed of any smoke signals that were to be displayed. The controller would do his best to ensure positive identification of the target by the flight leader but, even when direct observation was possible, he had normally to rely in the end upon the pilot's ability. When all worked satisfactorily, calls for support could be answered by bombing in as little as seven minutes. The flight leader then reported the observed results to the controller and supplementary information was obtained by interrogation after landing and by ground reports.

[1] M.A.T.A.F. Bulletin, March 1945.

The British ' Rover David '[1] when used as a Visual Control Post and provided with communications to Corps, Divisions, the nearest field battery for ordering indication smoke, and to A.O.Ps., was ideal for the first stage of a set piece battle and sometimes in the slow exploitation of success. It was, however, a large-staffed unit, normally sited in a large building, and consequently some modifications of procedure and organisation was necessary to cope with mobile warfare which develops in comparatively flat country. Under these conditions good sites for observation and within a reasonable distance of Corps were likely to be scarce and consequently Rover had to be prepared to operate as a Forward Control Post rather than as a Visual Control Post.

Fortunately, the gridded photo-mosaic on a scale of 1/30,000 proved of great value for ' blind control ' and during the advance in the Po Valley, where good observation posts were rarely found, it was possible to brief pilots with precision working entirely from a photograph. During one day's heavy fighting a Rover Control working in the dim interior of a cornstore, directed aircraft on enemy strong points sometimes only 200 yards from our forward troops, chased many tanks to death, and broke up at least one heavy, unexpected counter-attack. The controller was kept fully in the battle picture by his senior A.L.O. in touch with Corps and Divisions and with the local tactical situation through forward troops, A.O.P. and Tac/R.

Further mobility was required, however, to deal with a highly fluid and mobile ground situation and for this purpose Contact tanks and Contact cars were developed and consideration was given to control from light aircraft. Two Sherman tanks had their six-pounder guns replaced by dummy guns and were each fitted with V.H.F. R/T and an Army No. 19 R/T set. One acted as the control unit and carried a Royal Air Force Controller, the senior A.L.O., a Royal Air Force wireless operator and two Army drivers, one of whom acted as an R/T operator. The other, the ' Tentacle Tank ', was fitted with an additional Cdre No. 9 W/T set on the normal Air Support net and carried an A.L.O., a Signals N.C.O., two operators and a driver. The No. 19 sets were on the armoured regimental net and their component ' B ' sets were used for communication between tanks.

The first trial of these tanks in battle was a failure. However, in conjunction with No. 1 Mobile Operations Room Unit, further training of personnel and tests of communications were carried out in January 1945. A demonstration on 31 January which was attended by representatives from Army Group, Corps and the Air Forces, showed tanks controlling aircraft both while the tanks were stationary and on the move, and was highly successful. Contact tanks had a limited role and the war ended before they could be thoroughly tried in Italy. They were not intended as a substitute for the normal sited Rover but were expected to be of use ' In support of an armoured breakthrough where the intention was one of rapid exploitation with little, if any, regard to flanking formations ; or in support of an armoured attack, e.g. an Armoured Brigade with limited objectives where a definite allotment of air effort (had) been placed in support.'

[1] And its identical partner ' Rover Paddy ' (for a short period known as ' Rover Jimmy ')

The Contact Car as used in North-West Europe was not developed in Italy until late in the campaign. It consisted of a White Scout car (half-tracked) fitted with V.H.F. R/T, an Army No. 19 set and a Cdre No. 9 W/T set. It carried a Controller, an A.L.O. three operators and a driver and was intended to provide support during a rapid and extensive pursuit when little determined opposition was to be expected. It was to be detached, as necessary, from the normal 'Rover' and could operate as a self-contained Forward or Visual Control Post. It was to be in touch with 'column cover' of fighter-bombers or with Tac/R. aircraft working ahead of the column and was to use its Army sets to keep contact with the pursuit armour and with the Army. The practice became to allot two contact cars in support of the 'Rover David' (F.C.P.) at Corps, deploying them as necessary to brigades, and during the final pursuit the contact car was, in fact, used in its intended role. Aircraft were allotted to the contact cars by the F.C.P. as necessary, but in general the contact car was limited to the function of a forward observation post or leap-frog unit for the V.C.P., which was the lowest level to which aircraft and briefing could normally be de-centralised economically.

The Horsefly system of placing a Rover control in a light aircraft was not generally favoured. It offered the advantages of visual observation but briefing was extremely difficult from a moving platform and the facilities for quiet study and consultation with the A.L.O. were not available. In any case the controller on the ground could at any time call for the assistance of, or be given targets by an A.O.P. aircraft and this information could be passed on to the fighter-bombers if desired.

The British 'Rover Frank' was an extra Forward Control Post situated alongside the Counter Battery Officer A.G.R.A. for the purpose of re-directing aircraft engaged on the attack of enemy gun sites.[1] Guns were not good targets for bombs of 500 lb. or over and it was not always possible to use the more effective anti-personnel bombs. On the other hand, the mere presence of aircraft in a hostile role was known to have kept down the enemy heavy artillery sufficiently to enable infantry to attack. In northern Italy the enemy's usual reaction to air attack was to change his sites overnight and, consequently, it was necessary to devise a system whereby pre-planned air attacks did not need to be held up while the changes were being analysed. 'Rover Frank' was the answer to this problem and all that was necessary was for the pilots of aircraft to inform the controller of their intended targets, whereupon the Counter Battery Officer would either 'confirm' or allot new targets.

The method of employment was in five stages. First, the Counter Battery officers at the A.G.R.A. furnished the Army Air Support Control with the most up-to-date list of enemy heavy batteries which could be produced by 2359 hours each night: secondly, missions were briefed to attack one of these batteries: thirdly, they were briefed to 'call in' on 'Rover Frank' on their way to the target: fourthly, they reported to 'Rover Frank' the gun they were briefed to attack: fifthly, 'Rover Frank' checked to ensure that the guns were still active and, if they were, the mission carried out the

1 A.G.R.A. Army Group Royal Artillery—normally a unit operating a collection of medium guns for counter battery work. All artillery not under control of a division was grouped into A.G.R.As. under control of Army Headquarters.

attack ; if not, or if some other battery had become particularly troublesome, ' Rover Frank ' cancelled the initial target and rebriefed the mission in the air from photographs. This helped to ensure that the batteries attacked by our fighter-bombers, were the batteries which were troubling our troops.

The American Midnight Rover was not a Rover in the usual sense but was an aircraft equipped for night photography and backed by a quick ground system of development, interpretation and diversion of aircraft to targets so found. A small detachment of one A.20, three B.25's, and photo interpreters from No. 3 P.R. Group and No. 3 Photographic Technical Squadron was operated from an advance base. The A.20 operated from 1,500 to 3,000 feet using an Edgerton Flash unit and the B.25's operated from 7,500 feet with magnesium flash bombs and a photo-electric shutter control. Photographs were taken of pontoon bridges, ferry sites, marshalling yards and other possible choke points and the films were developed and interpreted (no printing at this stage) immediately the aircraft landed or, in the event of bad weather, the exposed film was dropped in an illuminated carrier on the airfield. Any important targets found by the interpreters were passed to the Tactical Control Centre (equivalent to M.O.R.U.), which in turn called XXII T.A.C. and D.A.F. to have subsequent night bomber/fighter sorties diverted, and called the Sector Controller (equivalent to Forward Direct Post) by radio to have airborne aircraft vectored to the target. The P.R. aircraft could also call the Sector Controller by radio should visual sightings be obtained.

At the end of 1944 each Corps was allotted a Rover and a certain number of ' Cab-rank ' sections according to the demand of G.2 (Air) at Corps Headquarters. If the Corps required further ' Cab-ranks ' it applied to G.2 (Air) who in turn referred to G.1 (Air) at Army Headquarters who arranged it with the Air Force Headquarters.

Formation of No. 1 Air Support Signals Unit[1]

In autumn 1944 it was decided to centralise the control of all operational aircraft at Advanced Air Headquarters (in this sense Headquarters No. 211 Group and No. 1 M.O.R.U. were a part of Air Headquarters) and then to place the Air Support Control alongside Battle/Advanced Air Headquarters. This changed the function of the Air Support Control. The real control, thereafter, was Operations staffs at Army/Air Headquarters. The Air Support Control quickly came to be regarded and used primarily as a specialist communication network which notified Army/Air Headquarters of calls for air support and distributed certain intelligence information. It was not used as a control.

On 31 October 1944, No. 2/5 Army Air Support Control was disbanded and in its place was formed the ' G ' (Air) Branch of Headquarters Eighth Army with under its operational command, No. 1 A.S.S.U. Instead of a composite Army/R.A.F. unit it became an integral part of the ' G ' Branch at Army Headquarters and the signals element a completely Army Signals unit. This A.S.S.U. was designed for deployment to an Army of two Corps. Throughout

1 Cabinet Hist. Section/1002/4C/202. *See* also Chap. 3 ' Exercise Spartan '. A.S.S.Us. had existed in the United Kingdom for more than a year.

this period of the campaign it was always possible to deploy tentacles on the basis of three per division in the line and one F.C.P. per Corps with contact cars as required.

Air Support During the Battle of San Fortunato, 17–21 September 1944[1]

The battle of San Fortunato, which amounted to the battle for Rimini, occasioned some of the fiercest fighting during the campaign to that date. The battle was one of a series of offensive operations launched by the Eighth Army in order to breach the line of enemy defences, known as the Gothic Line. Heavy air attacks on the Fortunato Ridge began on 11 September and (apart from the 15th when weather conditions were very poor) continued until the 17 September. Weakened though the enemy was by the joint bombing and bombardment, the allies had so far failed to dislodge him and were suffering grievous casualties themselves.

On 17 September, both the forward and reverse slopes of Fortunato Ridge were attacked by 132 fighter-bombers. First the forward slopes, then the summit and then the reverse slopes were bombed, while coloured smoke bomblines were laid by aircraft. On 18 September the Tactical and Desert air forces succeeded in putting up 804 sorties between them. The first phase against the ridge was carried out by three entire Wings of fighter-bombers, between 0600 and 0700 hours. It took the form of synchronised attacks on both the forward and reverse slopes. Spitbombers flying at ten-minute intervals, edged a course between Kittyhawks and Mustangs. The second phase from 0700 to 0745 saw a change of tactics. While a very heavy artillery concentration was laid down on the forward slopes, air attack was confined to the reverse slopes, now playing a significant role in German tactics. During the day the weather worsened but by the end of the day the Army had established a firm foothold on the ridge.

It was on 18 September that the first ' Rover Frank ' attacks were carried out on the Canadian Corps front. Enemy gun positions in the Trebbio-Marecchia Valley were giving particular trouble to advanced Canadian troops and 11 heavy batteries were engaged at quarter of an hour intervals between 1500 and 1800 hours. There seems no doubt whatever that they were definitely a success and reduced considerably enemy shelling on the army front.

Another refinement in air/ground co-operation at this time was the discovery by some army corps that, by attaching a Forward Observation Officer (F.O.O.) to the ' Rover David ' team, Superior Support could be provided, since the F.O.O. could take on, with his artillery, targets which the Rover turned down either because they were too close to our own forward troops or in some other way unsuited for air attack. The F.O.O. could lay smoke to indicate a difficult target to the fighter-bombers with the minimum delay. Programmes combining bombing with shelling could by this method be easily laid on : it was, for example frequently effective to shell a target a few minutes after a bombing attack, just as the enemy was emerging from his slit trenches.

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[1] A.H.B. Narrative *The Italian Campaign, Vol. II.*

Operation Timothy, 12 November 1944[1]

After the innovation of the Rover controls, the greatest step forward in air/ground co-operation was, in Allied air circles in Italy, considered to be what came to be a household word among all forward Army formations as Timothy. It originated on 11 November 1944 with a request by the ' G ' (Air) Branch at V Corps for what was a novel (in so far as the Italian theatre was concerned) form of close support for the 12th Brigade of the 4th British Division. The technique of this type of attack was, briefly, the ' blitzing ' of a selected area in front of our own troops by fighter-bombers, co-ordinated with an attack on the ground at the same time or immediately afterwards. The air attack was usually pre-arranged the day before and was given a code name or letter by which it was known. Operation Timothy itself took place on 12 November in the form of an attack on a limited area on either side of the brigade's axis of advance, to a depth of about 1,000 yards, in front of a smoke bombline. Three attacks, pre-arranged, at hourly intervals, were so successful that the attacks were repeated. An advance of 2,000 yards was made on this day, in consequence, by our forward troops and 106 prisoners of war taken at a cost of only 13 casualties to our own troops. The Brigade Commander was very enthusiastic about the accuracy and closeness of the air support and confirmed his casualties as the lightest for such an occasion in his experience. The essential features of Timothy were, firstly, it had to be tied-in with a ground offensive ; secondly, the ground formations had to furnish explicit information on positions, targets and timing and thirdly, two safety factors had to be observed. The first was that the local Rover controlled the operations, in that he gave the word for the smoke-bombline to be laid after the aircraft had announced that they were in the area, that he gave permission for the attack to proceed and that he could contact the aircraft and order the attack to cease. The second was that pilots were briefed that no attack was to be made unless both the smoke bombline had been laid according to plan and express permission had been given by the Rover.

The four main points of interest which emerged from Timothy were, its elasticity, the success of individual pilot selection of targets under leaders' guidance, the decision that twelve was the maximum safe number of aircraft in any formation and the damage effected on the enemy by denying him recovery time by ten minutes ground attack after bombing. The most important of these, from a tactical viewpoint was the elasticity. Even when, through unexpectedly heavy opposition, the estimated rate of ground advance did not conform with plan, aircraft could still directly support the infantry.

On 12 November each attack was originally timed to ' tie-in ' with the opening of an infantry attack phase but subsequently it was found that the aircraft could be used with equal efficacy at pre-arranged intervals, irrespective of the line reached by forward troops. This was possible because the smoke bomb safety line—the main factor as far as pilots were concerned—could be put down to conform with the ground situation at any given time. It might even be put down diagonally to the axis of advance ; pilots were briefed for this eventuality. Should an infantry commander, during a Timothy, want any particularly

[1] A.H.B./IIJ1/176/72 Annexure ' B '.

troublesome strongpoint singled out for attack, ' Rover Paddy ', the by now semi-mobile control unit, could arrange this at short notice. Two other developments—Pig[1] and Toby[2]—also belong to this winter period.[3]

Development of Ground to Air Recognition Signals Operation Wowser, 9–19 April 1945

During operation Wowser, which included the effort of medium, light and fighter-bombers, the Strategic Air Force flew six major day attacks to assist the Eighth Army to cross the Rivers Senio and Santerno, to facilitate the subsequent advance of the Fifth Army on the left, and to close the enemy escape routes.[4] Two of these heavy bomber attacks were against targets on the Eighth Army front and four on the Fifth Army Front—three rail diversion bridges north and north-east of Venice, and the ammunition factory and stores at Ghedi (15 miles south-west of Lake Garda). In addition, Liberators (of No. 205 Group Royal Air Force) made possible round-the-clock strategy by operating on seven nights against areas containing front line military targets and against the communication centres with the object of closing the escape route through the Argenta Gap and with interfering with movement on the Fifth Army Front.

All day bombing was by visual means and on 15 April the Fifteenth (U.S.) Air Force put up the largest force in its history—when 98.6 per cent of all the heavy bombers in Italy were airborne. Area bombing was adopted on the Eighth Army Front where precise targets could not be identified from high altitudes ; specific tactical target areas were adopted on the Fifth Army Front where the objectives were of a more confined nature ; and all but one of the close support missions were limited to a duration of ninety minutes. The minimum bombing altitude of 18,000 feet imposed the greatest need for safety precautions and navigational assistance and bombers were required to open their bomb doors while over the sea. Axes of attack were made perpendicular to the front line, initial points were selected at Cesenatico (Eighth Army) and Pistoia and Prato (Fifth Army) ; and a safety margin of 3,000 yards was left between the targets and the Allied forward positions. Artillery was turned on the enemy forward gun positions to reduce the expected ' flak ' curtain ; visual aids and radio aids were employed on an unprecedented scale ; lead bombardiers and navigators were flown over the course once or twice (in modified P.38 ' droop-snoots ') before the operation and given first hand experience of locating the initial point, course markers and target ; and pilots were trained in making use of the radio aids at high altitudes.

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1 On 14 December, forward troops of First Canadian Division requested a Timothy when weather conditions did not permit bombing. A strafing attack was agreed to by the Desert Air Force and was carried out by three squadrons of fighters. The code name for this operation was Pig. It was similar in all details to a Timothy, except that the aircraft did not carry bombs.

2 The air equivalent of an accepted artillery practice. Toby targets with code names were pre-arranged targets along a divisional thrust line. On the receipt of a code name and time of attack aircraft could attack within 1¼ hours.

3 At first it was usual to lay smoke down 500 to 800 yards ahead of forward troops but interrogation of prisoners of war showed that ' in the great majority of such cases bombing and strafing of our aircraft was done up to 400 yards behind the enemy main line of resistance.' The smoke bombline was therefore ordered to be as close to our own troops as was safe.

4 Report on Wowser by Fifteenth Air Force. *See* also Appendix 10.

Visual aids varied in details but were similar in principle on each front. The following aids were available on the Eighth Army front :—

(*a*) Heavy concentrations of white smoke at a pinpoint adjacent to the initial point, beginning fifteen minutes before the operation.

(*b*) Three sets of ground markers comprised of white bars with white smoke downwind along the bomb run. The first had one bar the second two bars and the third three bars.

(*c*) White ' T ' letters 100 yards long and 1,000 yards apart marked the front line along the whole of area ' Apple ', as close to the Senio River as possible, and supplemented by yellow smoke cannisters along the line of the ' T ' letters.

(*d*) Small red fluorescent panels in front of areas ' Apricot ' and ' Apple '.

(*e*) Indication Ack Ack bursts along the Faenza–Bagnacavallo highway—three lots of four bursts 300 yards apart opposite each target area (salvo at each end and one in the middle). The shell bursts in each salvo were at 30 seconds interval and at 15,000 feet above sea level.

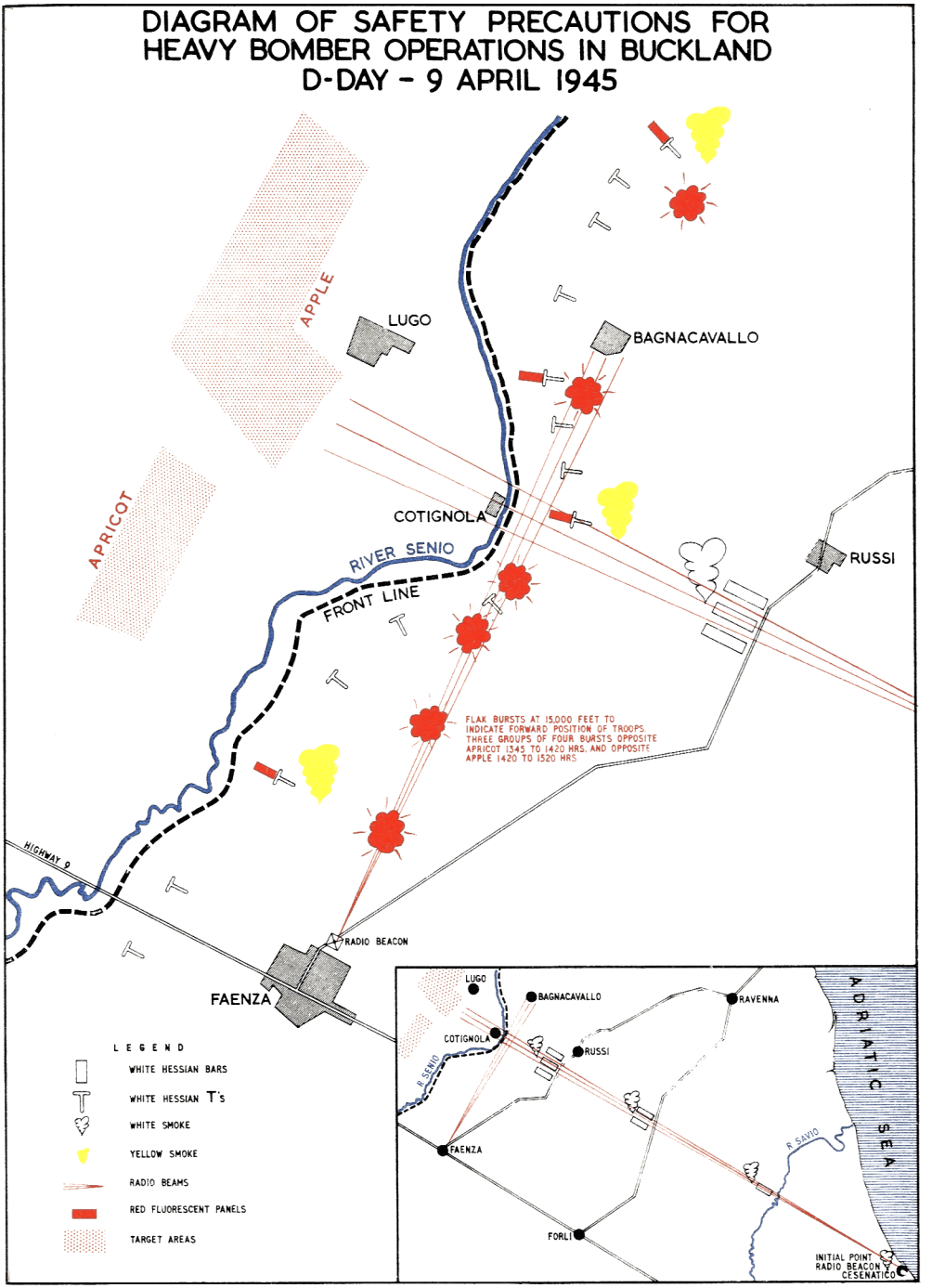
(*f*) If necessary, ' flak ' bursts in the form of an ' X ' at 15,000 feet above the initial point were to have been used to indicate cancellation of the operation.

Additional methods were used during the subsequent pursuit and instances of the bombing of friendly troops were due to human errors rather than to any intrinsic fault in the system adopted. When time was available to plan a set piece attack the arrangements were very effective but following the break-through, the fluid nature of the battle and the use of captured German vehicles by the Allies made the pilots' task one of great difficulty.

Radio aids comprised SCR.299 point to point communications between Headquarters Fifteenth Air Force, M.A.T.A.F. and a Command Post at Loiana ; V.H.F. R/T at Desert Air Force and XXII Tactical Air Command Headquarters for the recall of bombers if necessary, and three MRN-1 vans (runway localisers) on each front. These provided beams on both the east and west target approach lines on each front and also gave a bomb line by transmitting a beam along the line of the visual bomb line markers.

The overall results of the Strategic Air Force attacks on tactical targets were excellent, especially with regard to effects on gun positions, personnel, supply dumps, troop concentrations, maintenance installations and communications. Bomb craters from 9 to 14 feet in diamater and 3 to 6 feet deep rendered communications wholly useless, in many cases gun positions received direct hits, many occupied buildings and strong points were destroyed, and dug-in troops were buried or became casualties. The 20 lb. fragmentation bombs rendered useless all supplies, vehicles, and lightly protected equipment in the area of attack ; in many instances heavier guns and motorised equipment had to be abandoned ; wire communications were cut and disorganised ; and enemy movement was thrown into confusion by the blocking of roads. The lack of resistance in the air was discouraging to the enemy and, in addition to the casualty effect of the attacks, the bombardment had a powerful effect on enemy morale which in some instances led to surrender without a struggle. The

DIAGRAM OF SAFETY PRECAUTIONS FOR HEAVY BOMBER OPERATIONS IN BUCKLAND D-DAY - 9 APRIL 1945



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enemy's ability to withstand the Allied ground forces, which advanced immediately after bombs ceased to fall, was destroyed and only scattered and ineffective resistance was met.

During the seven night attacks between 9 and 19 April, 507 heavy bombers dropped 1,402 tons of bombs, including 2,000 lb., 1,000 lb., 500 lb., and 500 lb. incendiary clusters. On each occasion approximately eight Liberators were used for illuminating and marking the target but on the first attack at 0400 hours 10 April (prior to the crossing of the Santerno) the army marked the centre of each area with red marker shells. The duration of attack was from two to eight minutes and all subsequent attacks took place shortly after 2100 hours. The results were good to excellent, the escape route through Argenta was blocked with rubble and craters, the bridge at Casalecchio was destroyed and communications through the town disrupted. The escape route through Porto Maggiore was blocked by rubble, craters and broken bridges, and the destruction at Malalbergo was sufficient to end its value as a communication centre. On the whole, the enemy was denied the possibility of regrouping after the day attacks and could not make large scale movements under the cover of night. The cutting of his escape routes added to the congestion and made the enemy more than ever vulnerable to daylight attack.

All the safety aids were effective. The red fluorescent panels stood out well but these were secondary in importance compared with the white panels along the approach line and the ' T 's along the front line.[1] The yellow and white smoke markers successfully attracted attention to the panels and ' T 's and the A.A. line and radio beams were useful, but not fully used owing to the good visibility at the time. In spite of all precautions, however, there were two accidents. One wave of 18 bombers bombed short killing 40 and wounding 120 forward troops ; three bombers bombed short and caused a further 50 casualties. The reasons for these mistakes were obscure but the incidents again demonstrated that hazards must be accepted if heavy bombers were to operate in close support.

Summary of Air Support Developments in the Italian Campaign

The foundations of the air support organisation with the Allied armies in Italy were laid during the campaigns in North Africa. No new principles were evolved but certain techniques were developed which were peculiar to the Italian theatre. Perhaps the most important of these was the development of Rover Controls. Rover began as a part of the Army Air Support Control and was operated either as a Visual Control Post or (particularly during the final stages of the campaign) as a Forward (blind) control Post. There followed several variations including Rover David, Rover Paddy, Rover Frank and the American Rover Joe. Experiments were carried out with an airborne Rover known as Horsefly but this was found to possess few advantages over the normal ground Rover. A fundamental part of the Rover organisation was the provision of a ' Cab-rank ' of aircraft.[2]

Another feature of the Italian campaign was the use of heavy bombers in close support operations. The use of these at Cassino was far from satisfactory. In spite of a very heavy air bombardment the enemy was not dislodged from his

1 M.A.T.A.F. Monthly Air Intelligence and Operation Bulletin for April 1945.

2 Now known as ' Air Alert Mission ' (May 1952). *See* Introduction.

positions and our ground attack was halted. Moreover bombs were dropped in friendly territory causing 105 military and at least 60 civilian casualties. The causes of the failure appeared to be twofold. The army did not follow up the air bombarment with a major ground attack quickly enough, so that the enemy was given time to recover and secondly, the pilots, navigators and bomb aimers were not sufficiently highly trained to bomb with the necessary accuracy. However, various remedies were applied and Operation Wowser was judged to have been very successful. Many safety precautions were taken on this occasion to define the bombline including the use of radio beams but in spite of these the Army reported 210 casualties amongst our own troops.

Throughout the campaign there was the promblem of mixed Army and Royal Air Force staffs controlling close support air operations and for a time it was undecided whether the best system was for joint staffs to use a joint Battle Room or for separate staffs to work in separate operations rooms which were in close proximity.

The hilly and often thickly wooded countryside in Italy played an important part in determining the kind of air support methods that could be used and developed. A good example is afforded by the Battle of San Fortunato when air bombing and ground attack was confined to the reverse slopes of the Fortunato Ridge which our troops were attacking. This had played a significant role in German tactics and the air effort was perhaps the decisive part in our successful attack on the Ridge.

In an assessment of air support in Italy it is important to bear in mind the scale of enemy air opposition. This was never very great and in the later stages of the campaign was almost negligible. But this decline was paralleled by the build up of the enemy anti-aircraft defences and in 1944 casualties due to 'flak' were considerable. In some cases air support operations were cancelled as the risk from 'flak' was considered to be too great.

At the close of the campaign the Desert Air Force, in the month of April 1945, flew approximately 21,500 sorties on close support alone ; fighter-bombers under Rover Control were frequently engaging targets between 200 and 1,000 yards ahead of our forward troops.

CHAPTER 6

THE CAMPAIGN IN BURMA, 1941-1945

There was little systematic or organised air support with the army during the First Burma campaign in 1942, although during the autumn of 1941 steps had been taken to prepare a suitable organisation in the Far East, in accordance with instructions received from England, and some training on these lines had taken place.[1] In January 1942, two army co-operation squadrons, No. 28 (A.C.) Squadron and No. 1 Indian (A.C.) Squadron, equipped with Lysanders, arrived in Burma. Both units were well trained in army co-operation duties based on the system in force before the war, but for various reasons, the nature of the jungle terrain and the lack of ground to air communication, they were not able to carry out their normal duties and were employed in a light bomber role. Both squadrons returned to India for re-equipment at the end of February.

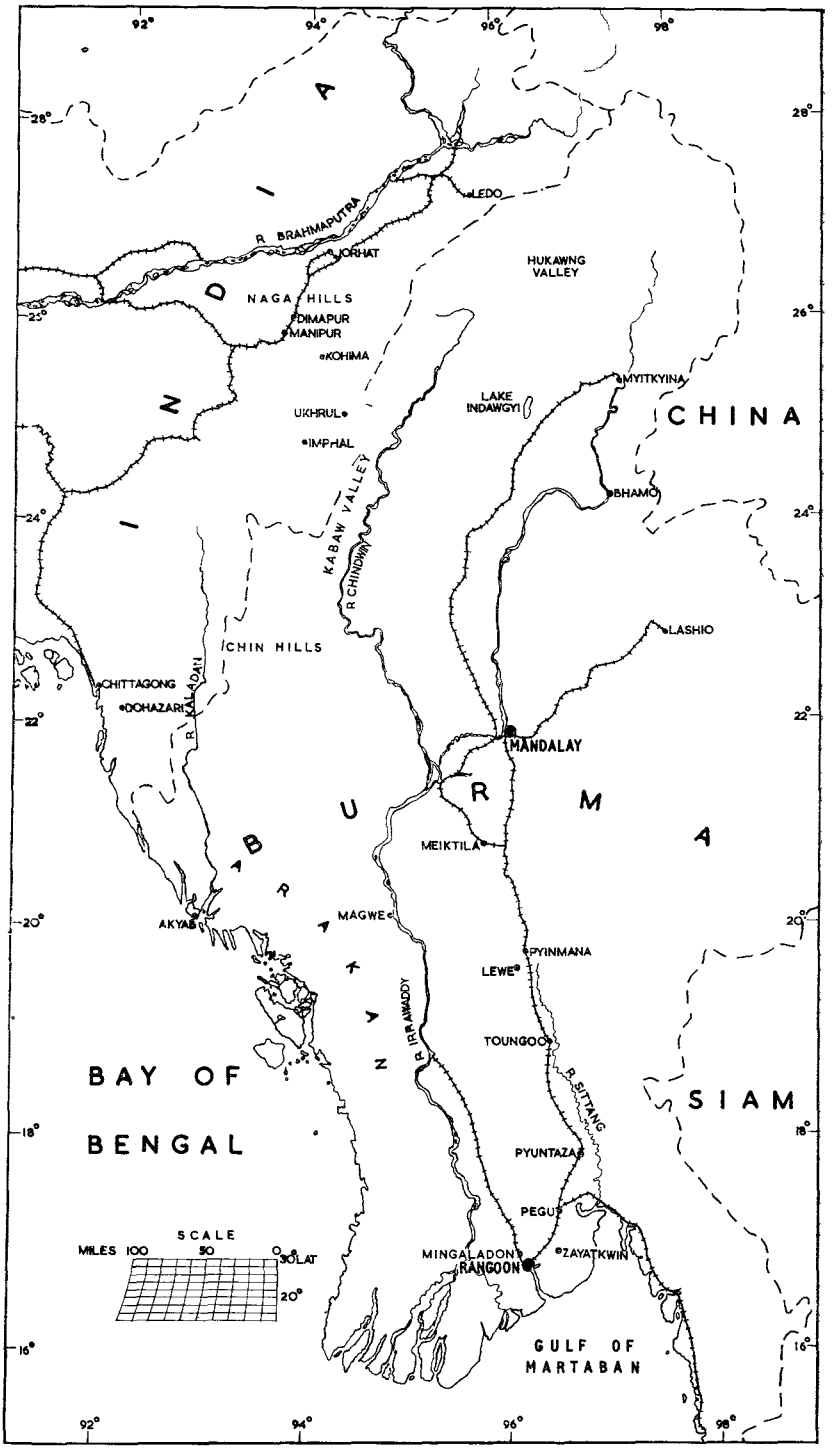
It was in the closing stages of the campaign, however, that the tremendous possibilities of transport aircraft for army support in Burma were first visualised. From the time when it was decided that Rangoon must be surrendered, a large proportion of Royal Air Force ground personnel was evacuated by No. 31 Squadron, a flight of which operated two or three D.C.2's on a daily shuttle service from Akyab to Mingaladon. Later when more aircraft were available, supply dropping from the air to the columns of refugees moving to India and flying back wounded from north Burma were undertaken. From the beginning of March to the end of May 1942, about 8,616 persons, including 2,600 wounded, were flown out of Burma, and 109,652 pounds (about 49 tons) of supplies were dropped to troops, refugees and isolated garrisons.

The Beginnings of Air Support in Burma. November 1942–October 1943

For some months following the withdrawal of the Allied forces from Burma in May 1942, the air forces in India were in a poor state. Fortunately, however, the monsoon rains gave the Allies a time in which to re-organise, train and establish a proper operational command and control on the India–Burma frontier. Thus when the campaigning season of 1942–43 opened in November 1942, the outlines of an effective air force organisation were taking shape and plans and preparations for an Allied offensive were under way. The origin of joint air/ground warfare on the India-Burma frontier may therefore be traced to the first Arakan campaign, an unsuccessful venture which lasted from December 1942 until May in the following year. The control of tactical aircraft for close support was vested in the Army Air Support Control (A.A.S.C.) which operated alongside the Divisional Headquarters and appears to have functioned satisfactorily.

Targets were, however, often invisible to aircrews and were generally indicated either by pin-point positions, by bearing and distance from a given object (usually a prominent landmark) or by smoke shells fired by the artillery. All close support bombing had to be undertaken by Blenheim squadrons and it was impossible for this type of aircraft to obtain the degree of accuracy

[1] A.H.B./IIJ50/41/3.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AKYAB
MAGWE
R IRRAWADDY
PYINMANA
LEWE
TOUNGOO
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necessary to obliterate enemy dug-in positions which were the stumbling block of our ground forces. The number of aircraft available never exceeded one squadron at a time and an attack by eight aircraft was considered to be a fairly heavy one.

Greater success was achieved by the Hurricanes in the sphere of indirect support. The nature of the country forced the enemy to rely to a large extent upon the waterways and rivercraft. Within a short period, enemy movement by day (or in moonlight) by water, or along the better defined land routes was seriously curtailed and the Japanese were forced to move by night, in non-flying weather or in the thickest jungle.

Air Support during the Second Arakan Campaign. December 1943–May 1944

With the opening of the campaigning season of 1943–44 changes in the operational chain of command and control of the Allied air forces in India took place. Air Headquarters, India was replaced by Air Command, South-East Asia and the British and American air forces were integrated, operationally, under a new headquarters known as Eastern Air Command, which controlled all air operations on the India-Burma frontier. In the central sector No. 221 Group co-operated with the British IV Corps, while in Arakan No. 224 Group worked with XV Corps. In addition, Wingate's Special Force, destined to operate behind enemy lines in Burma, was controlled directly by Fourteenth Army through its supporting air formation, the First Air Commando Force, which virtually operated independently.[1]

In spite of the close alignment of the military and air headquarters, however, the principle of a combined army/air headquarters had not emerged. Operations were conducted through the Army Air Support Controls located alongside each corps headquarters. The organisation in the Special Force and the Air Commando was somewhat unorthodox but in effect constitutes the beginnings of Visual Control Posts in Burma and R/T communication for the control of tactical aircraft.

As in the first Arakan campaign No. 224 Group again supported the ground forces on the coastal sector of the front. The group was now equipped with Vengeance dive-bombers and bomb-carrying Hurricanes for close support tasks. Though these aircraft were a great advance upon the Blenheims, which a year earlier had been responsible for all tactical bombing, they could hardly be regarded as modern weapons. In the 1943–44 campaign there was certainly better co-ordination between ground and air forces but the position was still far from ideal. No. 224 Group Headquarters was nearly 100 miles from the Headquarters of XV Corps and communications were by no means good. As a result, the Group's tactical squadrons were less flexible than they might otherwise have been. In view of its operational commitments. the Group had not only to carry out many close support tasks but had also, with the same aircraft, to perform escort duties and to mount attacks upon enemy lines of communication. It was thus difficult to strike a reasonable balance between operations in the battle area and those further afield.[2]

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[1] A.H.B. Narrative, *The Campaign in the Far East, Vol. IV, Chapter* 1.
[2] A.H.B./IIJ50/47/34 pp. 306–308.

The results of tactical bombing, particularly by aircraft of the Strategic Air Force, were generally disappointing, and on many occasions when our troops reached enemy strongholds it was found that air bombardment had inflicted little damage. The main reason was the depth of Japanese fox-holes, and the terrain, consisting of jungle so thick that at first our air reconnaissance failed to pin-point accurately vulnerable enemy positions.[1] The enemy's capacity of absorbing punishment from the air and of camouflaging himself was countered by the application to his positions of a fire-power or bomb load of such a magnitude as would seem in other theatres to be out of all proportion to the object it was hoped to achieve. Such a concentration of bombs over any area held by the enemy could ensure that enemy troops were at least held down while our own forces launched an assault.[2]

The problem presented by the strength and depth of the many enemy bunker positions was never properly solved during the Arakan campaign. The bombs carried by light bombers and fighters did little damage unless they made direct hits and the use of heavy or medium bombers for the task was, of necessity, restricted. The resources in heavy bombers were small and the great distances and difficult terrain combined to make effective close support bombing by heavy aircraft a problem of considerable complexity. It was as if Bomber Command were asked, in conjunction with Second T.A.F. (but with bad signals communications) to attack, at the right moment before a ground assault, trenches occupied by a few hundred stout hearted men in the closely wooded foothills of the Swiss alps.[3] What advantage the heavy and medium bombers had in the weight of their blow was offset by their greater margin of error, which forced our troops to start their assault at a greater distance from the objective. Thus the problem remained of bringing the bomb line near enough to our own troops for them to take advantage of the temporary paralysis which accurate bombing could inflict upon the enemy. As the campaign progressed, however, pilots of light and fighter-bombers gained an intimate knowledge of the country over which they operated and of Japanese concealment tactics. These factors led to an improvement in the effectiveness of close support bombing, particularly after the introduction of dummy attacks (following the bombing of enemy positions) which kept the enemy underground while our troops made a closely co-ordinated assault.

For target identification, artillery smoke shells were at first used. These were effective until the enemy began to put down diversionary smoke. The answer to this was found, later, in the use of coloured smoke shells. The real solution, however, lay in the development of good R/T communication between the ground and the air and, towards the end of the Arakan campaign, R/T was used to inform aircraft of the precise moment when smoke shells were put down.

Long Range Penetration. March–June 1944

Air support during the operations of Wingate's Long Range Penetration Brigades behind enemy lines was in many ways unique, for the Americans had equipped Wingate with the First Air Commando. This unusual and indepen-

[1] *See* Appendix 11.
[2] A.H.B./IIJ54/10.
[3] A.H.B./IIJ50/47/34 pp. 150–151.

dent air unit, whose organisation was never committed to paper, comprised P.51 fighters, B.25 medium bombers, L.1 and L.5 light aircraft, C.47 transports, a few helicopters and a number of gliders. Although in theory the Air Commando operated under Third Tactical Air Force it was, for all practicable purposes, an independent formation created solely for the purpose of supporting Wingate's Special Force. The tactical aircraft of the Air Commando (P.51's and B.25's) made up an assault force capable of almost any type of attack. The B.25's carried a 75-mm. gun in addition to six 0.5 calibre machine guns in the nose, which made it effective for ground attack, as well as a bomber. Versatile use was also made of the P.51's which could carry $2 \times 1{,}000$ lb. bombs (twice normal capacity) or three rocket projectiles under each wing, in addition to its normal fighter fire power.

In the first Wingate expedition in 1943 the Long Range Penetration (L.R.P.) groups had become exhausted by the long and arduous jungle approach marches into their operational area. In 1944 the position was very different since the glider element of the Air Commando Force enabled combat troops and American engineers to be deposited in jungle clearings behind enemy lines. Impromptu airstrips were then quickly prepared and Dakota aircraft, during March and April 1944, flew into Burma four army brigades. These troops operated against the communications of the enemy forces opposing the advance of Stilwell's Chinese and American forces towards Myitkyina. The Special Force were dependent upon airborne supplies for their maintenance, while all casualties were evacuated by light aircraft and Dakotas.

As in the first Wingate expedition, Royal Air Force sections accompanied the L.R.P. columns but with the essential difference that their radio equipment was more suitable for the control of tactical aircraft in respect to selected targets. This development was a necessity, since the passing of close support demands through an orthodox Army Air Support Control (as practised concurrently in Arakan and Manipur), could not meet the situation. The Special Force operated 250 miles from our air bases and the ground situation was apt to change between the time the request for air support originated and the arrival of the aircraft over the target area. This limiting factor of distance was aggravated by the fact that much of the flight from the base airfield lay over the formidable Chin Hills, which rise to a height of 7,000 feet in places, and were not notable for constant weather. The quickest air support possible, therefore, involved a delay of some hours. The fact that the aircraft of the Air Commando Force could talk to ground troops by R/T, however, gave them a tremendous advantage, particularly since the Royal Air Force officers accompanying the ground forces knew both the battle situation and the capabilities and limitations of the aircraft employed.[1]

Direct air support during the operations of Wingate's Special Force was used in defence, attack and the bombing of observed targets beyond the range of our forward troops. In defence, the procedure was usually as follows. A message would be sent in plain language, except for the map reference and time which would be in code, and an estimated time of arrival would subsequently be received. A mortar would be detailed to provide smoke, although on

[1] A.H.B./IIJ50/47/27.

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occasions 25 pounder smoke would be used. When the pilot of the leading aircraft was approaching the target area he would call up the Royal Air Force officer on the ground by R/T. The target, usually a Japanese force dug in close to our positions, would be identified for the aircraft which would then be told the exact moment when the smoke was put down. If the enemy imitated our own smoke the pilot could be informed of this by R/T and re-briefed accordingly. In any case all pilots carried gridded large scale photographs on which the position of friendly troops were clearly marked.[1]

In attack the procedure and equipment for air support were more or less the same—an observation post with a No. 22 set, R/T communication and gridded photographs. In attack, however, it was necessary for an officer to be well forward with the troops to see the targets, arrange for smoke with the mortars and contact the observation post. The latter had to be fairly static owing to the difficulties of moving the R/T set too frequently and the need for good observation.

It was considered that the best bomb in defence was the depth charge and in attack the 250 or 500 lb. bomb. In defence the attacking enemy was in the open and if caught thus he seldom had a chance to dig in, so that a depth charge with little penetration but with great lateral blast, was effective for a radius of 50 yards or so against men even if they were lying flat. In attack, where the defending enemy was well dug in, a direct hit from a bomb with good penetration was the only answer. Ground attack in both cases was effective.

The targets beyond the range of our own troops were located by patrols or seen and clearly defined by observers. In the close jungle country the identification of targets by ground observation was the only method by which targets, other than the few permanent installations, could be bombed with any certainty and accuracy and the results observed.

A word or two may be said here about the effects of air attack on the Japanese soldier. The lowest private in the Japanese Imperial Army considered himself invincible on the ground, and there is no doubt that during the war he proved himself to be an excellent soldier. But at the back of his mind there was a steadily growing fear of air power. The scarcity of his own and the super-abundance of Allied aircraft kept driving this home.[2] Diaries of Japanese troops tell of this fear engendered by air attack. A Japanese was prepared to die for his Emperor provided his nerve was not broken first. The latter could be achieved by a combination of ground and air attack but he seldom fled from a ground attack alone.

Operations in Manipur. March–June 1944

As in the case of No. 224 Group, air support on the central sector of the front was conducted through an Army Air Support Control. On this front too, direct air support was largely the province of Vengeance dive-bombers and Hurricanes, though on occasion medium and heavy bombers of the Strategic Air Force also participated. Few operations of any importance occurred in

[1] A.H.B./IIJ50/47/88.
[2] A.H.B./IIJ50/47/28.

Manipur until March 1944 when the Japanese mounted a major offensive aimed at capturing the Imphal plain and Kohima. By the end of March the infiltrating flood of Japanese troops had isolated IV Corps on the plain of Imphal and henceforth they became solely dependent upon airborne supplies for their survival.

Meanwhile defensive measures were taken, on which the Japanese had not reckoned. A parachute brigade was flown in to Imphal and shortly after its arrival fought a stiff rearguard action to the north-east of the Imphal plain, holding up the Japanese advance on this sector while leading elements of the 5th Division, which were flown up from Arakan, concentrated at Imphal. At a critical time the 5th Division was thus enabled to cut the Imphal–Ukhrul track north-east of the plain. The division was transported in about a quarter of the time it would have taken to reach its destination had the overland route been open. When, in early April, the Japanese completed what they doubtless considered their investment of Imphal, they were faced, not by the demoralised force they had expected, but by four divisions in fighting trim being supplied from the air. To the north XXXIII Corps opened its Headquarters at Dimapur and prepared to relieve the besieged garrison at Kohima. During the first week of April the 7th Division, formerly in action on the Arakan front, moved by air and surface transport to Imphal and Dimapur, one brigade being flown complete into the Imphal plain. An Army Air Support Control was likewise taken by air from western India and a brigade was similarly flown from western Bengal to Jorhat for service with XXXIII Corps. Aircraft taking reinforcement troops and supplies to the Imphal garrison, brought out casualties and other troops not needed for active combat on the return trips, thereby easing the supply problem.

On and around the Imphal plain tactical operations provided an illustration of a close association, not always elsewhere practicable, between the two services. It was by no means unusual for pilots of tactical squadrons to visit the brigade about to mount an attack, consult the commander and study from advanced positions the lie of the target which they would attack the following morning.[1]

The problems which confronted the tactical squadrons of No. 221 Group during the Manipur campaign were similar to those encountered in Arakan. The principle of a combined army/air headquarters had not yet been adopted. During the battles which raged around the plain of Imphal and Kohima in the spring of 1944, No. 221 Group controlled all tactical squadrons operating on the front and needed to co-operate with both XXXIII Corps and IV Corps at Dimapur and Imphal respectively. Consequently the control of aircraft for close support had to be decentralised and was, of necessity, placed largely in the hands of the senior Royal Air Force officer attached to each corps headquarters. Yet despite the obvious disadvantages which accrued it has been said that the enemy's efforts to deploy in the Imphal plain during May 1944 were decisively defeated by the impromptu attacks by Hurricanes and Vengeances. Moreover, the constant attacks upon the enemy's lines of communication prevented him from concentrating his full potential strength about the perimeter of the Imphal plain.

[1] A.H.B./IIJ50/47/42.

Throughout June and July 1944 the tactical squadrons maintained a constant pressure on the enemy. The period of defence and attrition was over, and No. 221 Group could look forward to destroying an enemy in retreat. Positive results were hard to achieve against an enemy with such a high standard of camouflage and concealment who, when on the offensive, moved in small groups with little impedimenta. No army could maintain its standard of camouflage in retreat, however, and the air forces in Manipur proved again that an enemy experiencing overwhelming pressure from advancing ground forces provided the best targets for air attack.[1]

Message Dropping, Contact Reconnaissance and Artillery Observation

Lines of communication from bases to forward areas were generally poor on the Burma front and thus fighter reconnaissance squadrons were often employed to drop messages, photographs, small quantities of urgently required medical supplies and even newspapers to forward troops. No special technique was adopted, the pilot merely stowing in his cockpit the package to be dropped and throwing it out when the dropping zone had been located. Perhaps one of the most important aspects of this work was the dropping of photographs which were needed quickly by forward troops in anticipation of an immediate assault on enemy positions.

Contact reconnaissance was another function of the fighter reconnaissance aircraft which in Burma probably assumed a wider importance than in other theatres. In Arakan its scope was limited but elsewhere on the Burma front it assumed greater importance since troops advancing into jungle country were soon out of touch with their bases. Many contacts were made with forward troops to provide supply dropping Dakotas with up to date information and also to enable commanders to keep their fingers on the pulse of their formations. Various means of recognition were adopted so that troops could make themselves seen in the jungle. The most common sign was an orange coloured umbrella that was hoisted to the level of the tree tops and which could be clearly seen by our aircraft. No communications other than visual ones were used and the sorties were confined solely to contracting land formations. Along jungle paths and in close hilly country a surprisingly high number of contacts were made and where previous liaison had been possible with the formation to be contacted, success was usually ensured.

Until the advent of an Auster (A.O.P.) squadron in January 1944, fighter reconnaissance aircraft performed the task of artillery observation. Air to ground communication was the first problem to be solved and the following method was invariably employed. The fighter reconnaissance squadron sent forward a Royal Air Force officer and air liaison officer (A.L.O.) in a jeep or 15 cwt. truck equipped with V.H.F. R/T and H.F. W/T to the division or brigade with whom it was to co-operate. During operations it was the practice for the A.L.O. to call aircraft on the H.F. W/T without any recourse to otherwise unreliable communications and there was thus no time lag other than that taken for the aircraft to reach the target area. Close liaison was maintained with the Gunners and consequently nearly all shoots were carried out with the procedure agreed upon beforehand or explained to the battery commanders by the Royal Air Force officer or A.L.O.

[1] A.H.B./IIJ54/10.

In the dense country usually found on the Burma front, high explosive shells were not easy to locate unless the pilot knew exactly, or to within about a hundred yards, where to look for them. Smoke shells were therefore used on all ranging shots. In hill country shots often disappeared over a narrow ledge and were lost in the valley below, and so a ' creeping ' procedure was adopted which, though a little more costly in ammunition, in the end produced results with no greater expenditure than would have occurred had shots been lost. Once the ranging rounds had been clearly fixed, no further difficulty was experienced in directing the fire and producing very satisfactory results within 10–12 minutes of the commencement of the shoot. Very few impromptu shoots were tried owing to the inability of the pilots to see any target worth engaging. On occasion, however, opportunity targets were reported on the H.F. link to the squadron and sometimes aircraft were called up and briefed whilst over the target.[1]

Re-equipping of Squadrons—September 1944

In June 1944 the air forces, having just completed a period of intensive operations were envisaging some retrenchment and an extensive programme of re-equipment was in train. The relative scarcity of all-weather airfields in the forward areas entailed the withdrawal of many squadrons to bases in India for conversion, and the monsoon campaign was undertaken with a total of seventeen squadrons. The air component conducting tactical operations, was, however, a moderate well-balanced force of experienced squadrons ; it was versed in the ready identification of jungle targets and trained in close co-operation with the formations which it was supporting. Operations by the squadrons of No. 221 Group in support of XXXIII Corps were inevitably affected by the monsoon. Nevertheless, Vengeance and Hurricane bombers continued the task of providing air support while heavy bombers and fighters maintained their offensive against lines of communication in the battle area and beyond during the disastrous Japanese retreat to the Chindwin.

In September 1944 the Vengeance squadrons were withdrawn and were re-equipped with Mosquito light bombers. Some of the Hurricane squadrons also moved back into India and acquired Thunderbolt aircraft although the backbone of close support during the 1944–45 campaign was still to be provided by the Hurricanes. Thus at the end of the monsoon the Royal Air Force tactical force comprised Mosquitos, Thunderbolts, Hurricanes and Spitfires. The Tenth U.S. Air Force at the end of the monsoon had tactical squadrons equipped with P.47, P.38 and B.25 aircraft.

Organisation for Air Support—Combined Army/Air Headquarters

During the autumn of 1944 there was a general reorganisation of the major headquarters in north-eastern India and this affected the chain of tactical air control. In December 1944, Third Tactical Air Force was disbanded on the move of the Fourteenth Army to Imphal and the three major tactical formations on the Burma front—Nos. 221 and 224 Groups, Royal Air Force and the Tenth U.S. Air Force—thereafter operated directly under Eastern Command. The principle of a combined headquarters was at least regarded as an essential

[1] A.H.B./IIJ50/47/34 pp. 377–382.

element in successful co-operation and by the end of December 1944 two had been established—XV Corps/No. 224 Group and Fourteenth Army/No. 221 Group.[1] The advantages of combined headquarters had of course been fully recognised in the Western Desert for some years.

In the campaign in central Burma all the aircraft engaged in close support were controlled by No. 221 Group which was faced with several difficult problems. Its wings and squadrons operated from bases covering a front of some 200 miles, which also had an equal depth. By the end of April this had expanded to some 600 miles, from the Mosquito Wing at Kumbhigram to the fighter squadrons on forward strips near Toungoo. Most squadrons were on a highly mobile basis with personnel reduced to a minimum. They were organised on a servicing echelon basis, administration and most of the first-line maintenance becoming the responsibility of the Wing Headquarters. Fighter squadrons moved forward in pace with the advancing front as quickly as airfields and transport aircraft could be made available for them, a system that was a feature of the campaigns in the Middle East and North-West Europe. The squadrons of No. 906 Wing, for instance, were operating from airfields near Ye-U by the middle of January and before the end of April no less than nine squadrons had reached Toungoo (captured on the 22nd) and another four at Magwe which had fallen on 18 April 1945.

Unlike the Western Desert Air Force the Mobile Operations Reporting Unit were not employed in South-East Asia until 1945. At this stage a mobile control centre became necessary owing to the speed of the advance and a Group Control Centre was formed on the European model and deployed at Meiktila and Toungoo.[2] A Visual Control Post H/F ground network was organised in the 17th Division, connecting the V.C.Ps. with brigades to a master V.C.P. at Divisional Headquarters. This was also in contact with the 'offensive readiness flight' at Meiktila by land-line or H.F. A direct link was also established on the Army Support Signals Unit network at advanced Headquarters No. 221 Group. It was considered that as a result of this planning for the offensive, the organisation was sufficiently flexible to deal fully with all requirements including, where advisable, the decentralisation of air support to the corps and divisions. This decentralisation, however, was to function only as an emergency and not as a normal procedure. It also ensured the most efficient use of the aircraft available to the whole Army front, and the Combined Headquarters accordingly fully endorsed the principle of centralised control.

Visual Control Posts

During the operations in north Burma in 1944 it was found that the Visual Control Post (V.C.P.) could solve many of the problems of close support in jungle country. At the end of 1944 the Army Air Support Controls were therefore replaced by Air Support Signals Units (A.S.S.U.) with V.C.Ps. attached. Air advisers were also provided for both corps and divisional headquarters. A combined army/air training school for V.C.P. personnel was set up at Ranchi and it was soon found that the greatest difficulty in the

[1] A.H.B./IIJ54/10.
[2] A.H.B./IIJ50/47/57.

establishment of V.C.P.s was the provision of personnel, particularly controllers, who it was agreed should be chosen from experienced junior officers of the general duties branch, preferably from pilots with operational experience.

After the Squadron Leader Liaison Officers at divisional headquarters had been supplied with man-pack V.H.F. R/T sets, exercises with heavy, medium and fighter-bombers demonstrated the usefulness of the V.C.Ps. and an establishment of one per brigade was approved. By the end of 1944 ten teams were in operation and this was increased to thirty-four early in May 1945. The V.C.P. comprised an army element with a liaison officer, signals personnel and a H.F. set on the brigade net ; and a Royal Air Force element which at first consisted of a Flight Lieutenent G.D. controller, a wireless mechanic, two operators, a jeep and V.H.F. and H.F. sets mounted in a jeep trailer. The trailer, however, proved too cumbersome, so the signals equipment was eventually transferred to the jeep and the trailer used for kit and spares. Towards the end of 1944 it was decided to adopt the name ' Contact Car (Air) ' and to limit the Royal Air Force teams to one G.D. officer, one wireless operator/mechanic, one member of the Royal Air Force Regiment who was to drive and service the vehicle, and R/T equipment consisting of one Type 1143 set and one Type 22 set. Anything required in support of this unit was to be an army responsibility.

The inaccuracies and possible counterfeiting of smoke indication, to which reference has already been made, were obviated by the V.C.P., which was both flexible and accurate, and made smoke largely unnecessary except for targets which were invisible from the air and not determinable in relation to any obvious landmark. The main purpose of the V.C.P. was to assist pilots to find and destroy targets or to prevent enemy attacks. The range of functions was briefly as follows :—

(*a*) To assist aircraft to identify targets for which they had been briefed on the ground, or to adjust the target.

(*b*) To cancel or delay operations as necessary.

(*c*) To direct aircraft on to secondary targets for which they had previously been briefed.[1]

(*d*) To direct aircraft from ' Cab-rank ' and to re-direct aircraft on to a new target as necessary.[1]

(*e*) To co-ordinate and control heavy bomber operations.

Light aircraft were used successfully to assist the V.C.P. to direct aircraft to a target, particularly when the V.C.P. controller was unable to find a satiafactory observation post on the ground. In these circumstances the light aircraft spoke to the V.C.P. over H.F. R/T, and the controller, using the information, thus supplied, directed the aircraft by V.H.F. From this it was but a further step to making the V.C.P. airborne and two such V.C.Ps. were in operation at the end of the campaign.[3]

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1 A.H.B./IIJ54/10.
2 A.H.B./IIJ50/47/57.

The V.C.P. system proved a success from both the air and ground points of view. It provided facilities for close and efficient co-operation between ground and air forces. During heavy bomber or combined attacks it was only used to give permission to late aircraft to attack if the target was still open. It led to the use of ' Cab-ranks ', in which aircraft patrolled continuously over selected areas in constant touch with the V.C.P., there awaiting instructions to attack opportunity targets. This system was very popular with our own troops as the continued presence of our own air support aircraft overhead had an excellent moral effect, and air support was available at a moments notice. It was, however, wasteful of flying hours and petrol stocks and it diminished the weight of air attack since in order to maintain a continuous patrol the aircraft could seldom operate in more than pairs. Thus ' Cab-ranks ' could only be regarded as a secondary alternative and then only when the aircraft involved were based on airfields situated closely behind the front lines.

Close Support of Fourteenth Army

As already mentioned Royal Air Force Thunderbolts began operations in September 1944 and the Vengeance squadrons were replaced by Mosquito units. Thunderbolts had already been in use for some time with the Tenth U.S. Air Force which had also occasionally employed its P.38 (Lightnings) in close support work. As the new campaign developed and it became clear that the enemy was in no position to seriously challenge Allied air superiority, Spitfires were increasingly diverted to the ground-attack role, particularly in the Arakan sector.[1] The back-bone of air support, however, was always provided by the Hurricane, with or without bombs. The Hurribomber had already proved its worth in the 1943–44 campaigns and some of the Hurribomber squadrons enjoyed a reputation for their accurate pin-pointing of targets close to our own troops. Their value in this form of attack was particularly evident during the period of mountain warfare that ended at the beginning of December 1944, and subsequently in the interval of semi-static fighting that was marked by the battle of the bridgeheads across the Irrawaddy in late January and February 1945. Both in conjunction with fighter-bombers and independently, ground-attack fighters also frequently operated in close support, doing particularly effective work in attacks upon gun sites and patrols over areas in which enemy artillery was suspected.

Heavy aircraft were also taken into service in support of ground attacks. B.25's had already been employed for this purpose in the 1943–44 campaigns, but four squadrons of the Twelfth Bombardment Group were withdrawn from the Strategic Air Force and placed under the operational control first of No. 224 Group and later of No. 221 Group, so that their work might be more simply dovetailed into the general tactical pattern. In close support and in conjunction with fighter-bombers they added greatly to the weight and effectiveness of large scale close support operations. The term ' Earthquake ' which was ultimately used to describe these concerted attacks upon Japanese bunker positions, originated among the Mitchell (B.25) squadrons. Heavy bombers of the Strategic Air Force were also employed on Earthquake operations from time to time, though prior to January 1945 very little use was made of them. In January and February 1945, however, heavy bombers were used

[1] At the beginning of 1945 Spitfires of No. 224 Group were also used as fighter-bombers.

in support of the Fourteenth Army during the battle for the bridgeheads and they continued to be used throughout the remainder of the campaign. Well-marked targets suitable for their employment were relatively few, until the enemy began to withdraw ; but when more open country had been reached, situations arose which made their use much more effective.

Earthquake strikes were designed to clear some particular area immediately prior to a ground attack.[1] Heavy bombardment did not always neutralise an area but it confused the enemy by blast and concussion. If the ground forces quickly took advantage of the enemy's stunned condition, they were usually successful in taking a position. The principle of the earthquake was a relatively heavy bombing attack followed by fighter-bombers, directed against the target in sections, receding as the ground forces advanced, and finishing with dummy attacks. Many of the difficulties that had been discovered during trials in 1944 were overcome with increased success in the following year. Conferences were held at least 36 hours before an operation was due to take place, the degree of concentration was increased to between 0.3 and 0.5 lb. of bombs per square yard, and the safety limits were modified to 800 yards for Liberators, 700 for Mitchells, 300 for Thunderbolts and 200 yards for Hurricanes. It was found that a bombardment which produced 20 per cent casualties was sufficiently demoralising to the remaining 80 per cent to permit the attacking troops, if they went in immediately afterwards, to mop up the position with very little opposition. In practice, six to eight minutes were allowed for four Mitchell squadrons to attack and three minutes for each fighter-bomber squadron.[2] At the conclusion of the bombing, the fighter-bombers were employed as necessary on ground attack across the front just ahead of the advance. The Liberator and Mitchell attacks were planned to provide the degree of saturation required and the fighter-bombers, under V.C.P. control if necessary, were employed against specific targets. There were three main types of targets for which the Army could request concentrated bombing.[3]

An outstanding Earthquake operation was the air contribution to the combined army and air attack directed on 10 January 1945 against the enemy stronghold in the Kabaw valley, where an extensive and well-defended system of bunkers and gun emplacements was holding up the advance of IV Corps in its important thrust southwards.[4] Four B.25 squadrons took part in this

1 A.H.B./IIJ50/47/57.

2 A.H.B./IIJ50/16.

3 These were :—

(*a*) Organised defensive positions astride the only road axis through hilly country covering some tactical feature. These were combinations of fox-hole and bunker positions protected by wire, well camouflaged and hidden from the air and difficult to locate even from the ground.

(*b*) Organised defensive positions covering important road or rail communications in open country and at the crossing of major rivers. The defended locality was again of the bunker and fox-hole type, with wire protection and all timber construction. They lay within an area of about 4000 × 3000 yards and would probably be held by one regiment.

(*c*) Organised defensive positions in towns and built up communications centres, where the outer fringe of the defences was invariably formed by very strong bunkers, with overhead cover, that necessitated heavy bombs and a short delay fuse. They lay in areas of up to 8000 × 8000 yards and held up to one division. (A.H.B./IIJ50/47/12).

4 A.H.B./IIJ54/10.

operation, together with 34 Hurribombers, defensive cover being supplied by Spitfires and Thunderbolts. Within 90 minutes of the commencement of the bombardment five out of six Japanese positions were in Allied hands. The subsequent withdrawal of the enemy from the whole neighbourhood during the next few days was attributed by IV Corps in great measure due to a lowering of the enemy's morale as a result of the air attack. But the participation of so large a number of aircraft in a single operation was not usual, and as the campaign continued it was realised that B.25's operating in numbers as low as two or three could do effective work in accurately driving out small enemy parties from their positions.

The swift drive southwards through Burma by IV Corps had isolated a great many Japanese troops west of the railway corridor and in May and June 1945 the Allied Tactical air forces carried out many attacks aimed at destroying enemy troops and animals. In July the enemy attempted to create a diversion to assist the planned break-out of their trapped forces by mounting an offensive west of the Sittang river. This offensive was broken with the assistance of intensive air support. Spitfires and Thunderbolts operated under V.C.P. control in ' Cab-ranks ' against gun positions, troop concentrations and river craft. As the month advanced Spitfires, Thunderbolts and Mosquitos were guided by ground indicators and flags, to large concentrations of troops which were reported by W/T equipment operated by guerilla bands. On 21 July the remnants of the Japanese army in Burma began their attempt to break-out from the Pegu Yomas. All available air support was switched to this area and in the course of nine days the enemy lost about 10,000 troops killed, of which 2,000 were directly attributable to air attacks by squadrons of No. 221 Group.

This was the last major battle of the war in south-east Asia. By the beginning of August 1945 virtually all Japanese resistance in Burma—with the exception of isolated groups—had been overcome, and two weeks later the war against Japan was over.

Summary of Air Support during the Campaigns in Burma

In 1942 and 1943, air superiority had not been definitely established but from 1944 onwards Allied air supremacy moulded the progress of all operations on the Burma front. The battle for air superiority was only fitfully contested by the Japanese, but it is precisely for that reason that the factor of the virtually unchallenged Allied air superiority is not always given due prominence when the war on the Burma front is studied. Without such supremacy, the defensive battles in Arakan and Imphal could not have been sustained, nor could our offensives into Burma have been launched.

Another matter which must be emphasised is the nature of the terrain over which the battles were being fought. Much of Burma is densely wooded or covered with thick undergrowth, so that the recognition of targets presented to even the most experienced pilots a problem of considerable complexity ; and the overwhelming difficulty which faced all air units along the Burma front was the dearth of worthwhile targets. The India-Burma frontier must be flown over to appreciate the lack of anything that could be regarded as an adequate target. From the air, the mantle of jungle resembles a cauliflower, but dark green in

colour. Rarely was any movement discernable on the ground and there were few fixed installations that could be regarded as permanent. Lines of communications were deduced rather than observed. To the nature of the country may be added the characteristics of the enemy as a fighter on the ground. He had tremendous tenacity and stamina which enabled him to take great punishment from the air without losing the will to fight. He was adept at camouflage and this made it difficult to locate his positions from the air or from the ground. Finally, he had a beaver-like propensity for digging himself into the ground by excavations that ranged from a number of shallow fox-holes to hold one or two men, to an elaborate system of bunkers which could not be destroyed except by direct hits from bombs or shells. Indeed the terrain and the Japanese soldier were highly suited to each other.

Royal Air Force pilots overcame the problems of difficult terrain and skilful camouflage largely by gaining an intimate knowledge of the country over which they operated and pilots were sometimes given targets that in other theatres would probably have been regarded as too difficult for identification. This familiarity with the country served adequately while the war was confined to the India-Burma frontier but when the battle moved further afield, as during the operations of Wingate's Special Force in 1944, it was found that the use of enlarged vertical photographs was essential. An identification of targets by six figure map references—in an area where maps were not always reliable—was shown to be insufficient. In fact three conditions had to be fulfilled if close support was to be effective. The first essential requirement was good air-to-ground communication, preferably with an air force officer on the ground directing aircraft overhead. Smoke mortar bombs were necessary for precise target identification and complete photographic coverage in advance was needed with enlarged pictures for briefing purposes.

The nature of the relationship in the joint air/ground effort in Burma was controlled largely by the circumstances of the campaigns. The system of Tactical Air Control thus fell into two well defined phases. Until the middle of 1944, the system of Army Air Support Controls, operating alongside the senior army formation in the field, functioned more or less satisfactory. But the organisation was put to no test during 1943 since the Allies were unable to initiate a sustained offensive. Consequently, close support work did not constitute the primary obligation of the tactical air forces on the Burma front. Towards the end of 1943 and during the early months of 1944, however, demands for direct air contribution to the ground operations began to increase. This was evidenced by the defensive Arakan and Manipur campaigns and the advance of Stilwell's forces from Ledo down the Hukawng Valley. These operations illustrated the need for a revised form of tactical air control. By the middle of 1944, both Nos. 221 and 224 Groups, aided by the lessons which emerged from the operations of Wingate's Special Force, had gained enough experience in close support to frame an organisation and to establish methods of effective co-ordination between ground and air forces. Thus when the campaigning season of 1944–45 opened, the Army Air Support Control organisation had given way to Army Support Signals Units and Visual Control Posts. The development of tactical air control during 1944 solved the pressing problem of bringing the bomb line near enough to our own troops to take advantage of the effects of air bombardment.

One of the major difficulties of assessing the work of the air forces in Burma is the impracticability of drawing up a full balance sheet which will give in detail the full results of air action. A detailed examination of enemy documents cannot at present be made, and it is necessary to rely upon the disjointed accounts of the ground forces, the reports of agents and photographic reconnaissance for an assessment. Nevertheless, it may safely be assumed that close support air action formed the spearhead of all ground advances in Burma.

There were times when a belief was current that our close support squadrons did not operate to full advantage owing to the lack of experience on the part of the army commanders as to the relative efficacy of certain types of air attack against varied objectives. It was suggested, for example, that a more scientific application of fire-power afforded by ground-attack aircraft might have led to an economy of effort. Whether an attack by a dozen aircraft against a small fox-hole is justifiable must remain a moot point. It is not difficult in a staff study to deduce that the effort is unprofitable, but the same point of view may not be held by the troops making the assault. The results of the air bombardment may be just what is needed to make the action successful and it is certain that the high degree of accuracy developed by the tactical squadrons in Burma during the 1944-45 campaign had an enormous effect upon enemy resistance. The low incidence of casualties during assaults by our own troops also bears this out, as do the unvarying tributes paid by battalions and divisions to the work of the squadrons who supported them.

During the 1943–44 campaigns, the heavy bomber was tried but did not prove to be effective against an enemy entrenched in bunker positions, since, apart from the inaccuracy of the attack, our troops often could not advance sufficiently rapidly to take advantage of the bombardment. But the fighter-bomber proved flexible and effective for close support operations. For example, it could be employed against targets in valleys hemmed in by cloud, conditions which demanded a high degree of manoeuvrability if the target was to be reached at all. Thus in close jungle and mountainous terrain, occasions for the use of heavy aircraft were relatively few. But as the enemy began to withdraw from the India-Burma frontier in 1944–45, situations arose which made it advisable to use heavy equipment, particularly when the battle moved into the more open country of central Burma. It is probably true to say, however, that the use of the heavy bomber against tactical targets was most effective when used in conjunction with medium and fighter-bombers.

The campaign in Burma can bear no comparison with the even more mobile campaign in the Western Desert where airstrips could be hurriedly constructed in the desert, nor to the Pacific theatre, where large numbers of aircraft operated from naval carriers. Nevertheless, the re-conquest of Burma was a period of continual movement and the tactical air forces had to keep pace with the rapidly moving columns of the Fourteenth Army. By using glider borne engineers, airfields were in fact opened close enough to the forward troops to enable short ranged aircraft to protect and support them. In 1945, however, the monsoon rains began somewhat earlier than usual and the airfields at Toungoo, needed to support the final thrust to Rangoon, were rendered unserviceable. In order to provide some measure of close support for IV Corps,

the Thunderbolt squadrons based in central Burma had now to be flown at extreme range while a U.S. medium bomber group was brought into central Burma to provide additional support. As events turned out the lack of forward airfields did not matter greatly since no enemy opposition was encountered in the Rangoon area.

The use of air transport in the prosecution of the war in south-east Asia was impressed time and again by the impact of military necessity.[1] Even under the most favourable circumstances, Allied troops did not possess the mobility which years of warfare in China taught the Japanese soldier and it was air transport that provided the weapon by which the Allies exploited their economic and technical superiority to overcome this handicap. Topographical difficulties further emphasised this need and to a large extent dictated the expansion and development of air transport. From India the railway penetrated only the northern fringe of Burma, striking north-east to Ledo and south-east to Chittagong and Dohazari. Thereafter extensive mountain ranges stood as a barrier to central Burma, isolating Chindwin and Irrawaddy river valleys. All land communications in Burma ran from Rangoon in the south northwards until they petered out in the foothills of vast mountains. Whoever held Rangoon retained the only strategic key to the control of the whole country and thus an overland conquest of Burma from the north had always been regarded as being a military impossibility. However, it was not until 1944 that the enormous potentialities of air transport were realised and it was 1945 before they were fully developed.

The swift and un-coordinated growth of the air transport organisation in south-east Asia did not allow a full appreciation by either the army or the air forces of the importance of the ancillary services necessary to promote the full effectiveness of the machine. But as the campaign advanced, this tendency was progressively eliminated and at the end of the war, only lack of resources prevented the air transport organisation from incorporating all the experience which had been gained from earlier campaigns. This does not apply to the air transport organisation that developed within the Tenth U.S. Air Force where a realisation of the importance of a firm backing to the supply system was evident from the outset and resulted in a very high standard of operating efficiency.

[1] *See* Appendix 12.

CHAPTER 7

THE LIBERATION OF NORTH-WEST EUROPE

Air Support Organisation and Operations before the Assault

The appointment of General Eisenhower as Supreme Commander Allied Expeditionary Force (S.C.A.E.F.) became official on 12 February 1944, when he was directed to ' enter the continent of Europe and, in conjunction with the other United Nations, undertake operations aimed at the heart of Germany and the destruction of her armed forces.'[1] Such an operation called for certain changes in the control and disposition of the forces to be used, and major changes were made affecting the air forces in England. The most important was the formation of an Allied Expeditionary Air Force (A.E.A.F.) closely linked with the armies it would support. Both the American and British Strategic air forces were excluded from this arrangement, with the exceptions that it was agreed that they should come under direction and command of the Supreme Commander—instead of joint Anglo-U.S. control—for a period preceding, during and subsequent to the actual assault. Furthermore the Commander was allowed to state in what way the efforts of the Mediterranean Air Command could best be interlocked with those of the United Kingdom.

In the early stages of planning and preparations there was a C.-in-C. air forces and a C.-in-C. naval forces, each with integrated Staffs, but the Army had no equivalent commander and was under the direction of the Chief of Staff to the Supreme Allied Commander (C.O.S.S.A.C.). In February 1944 the C.-in-C., Twenty-first Army Group was appointed to co-ordinate the planning and execution of the assault for both the American and the British Army groups, and was thus raised to the level of the C.-in-C. land forces. He naturally used the Staff of Headquarters Twenty-first Army Group but the staff of S.H.A.E.F. still continued to exercise direction of land operations from the point of view of general policy and to effect co-ordination with the Navy and Air Force at the higher levels. The C.-in-C. land forces and his staff had therefore to work on two levels with two large Army Staffs. The situation was further complicated by the geographical situation of the headquarters concerned with the planning of the operation, housed as they were in London, Bushey Park, Portsmouth and Stanmore. An Advanced Headquarters Allied Expeditionary Air Force was established at Uxbridge alongside the Headquarters of the American and British Tactical air forces in order to direct and co-ordinate the operations of these forces and to form a convenient link on a tactical level with the C.-in-C. land forces during the initial phases of the assault.

Briefly, the whole of the available strength of the Allies in the air, apart from aircraft operating remote from the theatre, was available for the assault although due to other considerations such as the launching of the German flying bomb offensive, careful consideration had to be given to the priority of targets and the best use of the aircraft available. The great weight of the Strategic air

[1] Despatch by Air Chief Marshal Leigh-Mallory and Report on Air Operations by Air Staff S.H.A.E.F.

forces of Britain and America, as has already been said, was at the disposal of the Supreme Commander if he considered that their use would materially assist in the achievement of any particular objective and the American day and the British night bombers were employed on more than one occasion in a purely tactical role. The fighters of Air Defence of Great Britain were also available to protect the bases in the United Kingdom and, later, the shipping in the Channel and off the French coast or to act as escorts of other Commands. The aircraft most intimately connected with the invasion were those of the British and American Tactical air forces (2nd T.A.F. and U.S. Ninth Air Force and 1st Tactical Air Force). The British element was assigned to work with the Twenty-first British Army Group and included No. 2 Group's light/medium day and night bombers, No. 85 Group operating day and night fighters, No. 34 Strategic Reconnaissance Wing, and two day fighter groups, namely No. 83 Group consisting of fighters and fighter-bombers to work with the British Second Army, and No. 84 Group to work with the Canadian First Army. The aircraft of the United States and the First Free French Air Force were assigned to work with the ground forces of their respective nationalities.

The landings on the Continent can be roughly divided into three phases ; the preparatory phase which lasted for about three months ; the actual assault on the beaches on ' D-Day ' ; and the follow-up period from ' D-Day ' to D plus 11. The assault and operations up to D plus 4 were known as Operation Neptune. Before the preparatory phases strategic operations against the German Air Force were launched (Operation Pointblank) ; but in March 1944 these gave place in priority to Operation Overlord, the code name for the overall strategic plan designed to bring about the defeat of Germany. In addition, as early as 5 December 1943, Operation Crossbow had been initiated as a counter-measure against the attacks by flying bombs and rockets against London and the south coast. The launching of this enemy offensive might have been a real threat to the preparations and it was essential that strong measures be taken to prove it ineffective.

Reconnaissance

One of the first air tasks before the landings was that of photographic reconnaissance.[1] Coverage was required, and obtained, of the whole of the enemy coast line from Holland to the frontier of Spain. Vertical and oblique photographs had to be made showing beach gradients, beach obstacles, coastal defences and batteries. In some cases obliques were taken at wave-top height at varying distances from the beach to provide low-level views of the shore for the use of the incoming assault crews and troops. Further coverage of the hinterland was also made for the use of troops striking inwards from the shore. In addition, coverage was required for the selection of airfield sites, of bridging points for the Army Engineers and of likely dropping points for the Airborne Divisions. The flooding areas of the Low Countries and France were not neglected in this last work, the extent of which may be judged by the fact that in the two weeks before ' D-Day ' one Royal Air Force Mobile Field Photographic Section alone made more than 120,000 prints for Army requirements. The photographic sorties were by no means all flown for the Army ; the special requirements of the other two Services had to be studied and catered for. So great was the demand for air reconnaissance that the Central Recon-

[1] Air Chief Marshal Leigh-Mallory's Despatch. Para. 139.

naissance Committee was set up at S.H.A.E.F. in the spring of 1944 to co-ordinate and allot the tasks.[1] During the period 1 April 1944 to 5 June 1944, aircraft of the A.E.A.F. flew 3,215 sorties, whilst aircraft of other Commands, including the U.S. Eighth Air Force flew a total of 1,519 sorties during the same period on photographic missions. As a result, the Allied Command was given a comprehensive and up-to-date picture of the ground they had to assault and attack over, and a fair idea of the enemy's resources available to resist them, together with his dispositions.

Attacks on Communications

A carefully worked-out plan was made to disrupt the enemy's communication system. A total of 80 rail targets of primary importance was scheduled for attack by the A.E.A.F., Bomber Command and the U.S. Eighth Air Force.[2] By ' D-Day ' 51 of the 80 were damaged to such an extent that no further attacks were deemed necessary until repairs had been effected ; 25 were severely damaged, but with certain vital installations still intact, thus necessitating further attack, while the remaining four had received little or no damage.[3] In addition to the damage done to the actual rail targets, rolling stock was attacked by fighters and fighter-bombers, 3,932 sorties being flown between 19 May and ' D-Day '. The result of this effort was to deny to the enemy his capacity to move his reinforcements quickly and decisively in the build up against the invaders.[4] A further feature of this plan to isolate the battlefield was a series of attacks against bridges across the Seine and Loire of which the first began on 21 April 1944. These attacks were made both by fighter and medium bombers and it was discovered that the 1,000 lb. bomb carried by a fighter-bomber (usually a Thunderbolt) was the most suitable destructive agent. Attacks were also made by British aircraft carrying rocket projectiles, but these only caused damage of a very temporary nature. The tempo of attacks increased with the approach of ' D-Day ' and by that date twelve rail and road bridges across the Seine had been made impassable. A number of other vital bridges in northern France were also destroyed.

Other tasks which fell to the air forces prior to the launching of the attack may be briefly tabulated as follows :—[5]

(*a*) Protection of the assault craft assembling at United Kingdom bases.

(*b*) Destruction and dislocation of the enemy's detection devices so that the approach to the beaches could achieve the maximum surprise.

(*c*) Protection of the invasion fleet as it crossed the Channel and the movements of shipping after ' D-Day '.

(*d*) Neutralisation of the enemy's coastal batteries.

(*e*) Dislocation of the enemy's communications system in order to obstruct the German Staff in their appreciation of the situation and in mobilising and moving in reinforcements.

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1 S.H.A.E.F., O.R.B. Op. Memo. No. 19 (A.H.B./IIM/A49/LYY).

2 Air Chief Marshal Leigh-Mallory's Despatch. Para. 57.

3 During the period that this rail plan was in operation, that is from 9 February to ' D-Day ', a total of 21,949 aircraft dropped a weight of 66,517 tons of bombs on the targets selected.

4 Air Chief Marshal Leigh-Mallory's Despatch. Para. 86.

5 Air Chief Marshal Leigh-Mallory's Despatch. No. 11 Group Ops. Order.

(*f*) The landing of airborne forces in the neighbourhood of the battle area.

(*g*) Attacks on G.A.F. airfields in the vicinity of the beachhead.

A number of these tasks can barely be described as taking the form of an Air Support commitment except in so far as almost all operations during the spring of 1944 were in the nature of support for the Army on whom had to fall the final and critical responsibility of storming the enemy beaches and establishing a bridgehead. The day of the attack was provisionally decided but on that day the weather was not as good as had been hoped for. Finally, after a twenty-four hour postponement due to the weather, the Supreme Commander made what was probably the most responsible and far-reaching decision of the campaign and gave the executive order for the attack to be launched.

The Assault, 6 June 1944

Before the assault force of five divisions left its various anchorages and sailed towards the Normandy coast certain preliminary operations, apart from those already briefly mentioned, were initiated to prepare the ground for the main attack. One of the most important of these was the neutralisation, or at any rate the disorganisation of ten heavy coastal batteries whose fire could interfere considerably with the approach of the invasion fleet. This task fell to the aircraft of Bomber Command, who were to make the attacks so timed that the bombardment would have finished at dawn. A second operation was the dropping of certain airborne units on the flanks of the assault area. This was successfully achieved and the flanks held.[1] At the same time the presence of airborne troops added to the confusion of the enemy and hampered his efforts to bring in reinforcements. Two important tasks of the British Airborne troops were the elimination of a heavy battery at Merville, and the seizing of bridges over the river Orne. Both these operations were successful.

The attacks on the batteries by Bomber Command were immediately followed by a very heavy attack by Liberators and Fortresses of the Eighth U.S. Air Force. Their object was to saturate the beach defences with bombs when the landing craft were making their approach. The remainder of this force was to create blocks and choke points on the roads leading to the battle area. In the first attack over 1,300 aircraft were involved. Weather conditions did not permit a visual attack and the ruling was that all bombing was to be concluded ten minutes before the assault. The main point of impact was to be not less than 1,000 yards from the forward wave of the assault forces. As an additional precaution, bombs were fuzed with instantaneous fuzes in order to prevent cratering of the landing beaches. The strict observance of these safety conditions resulted in a large proportion of the bombs falling well behind the beaches. There is, however, no doubt that the enemy was greatly demoralised by this concentrated attack while the assault troops were stimulated by such a large scale demonstration of air power.

The beach itself was divided into five sections under the code names Utah, Omaha, (American) and Gold, Juno and Sword (British) which would, as the lodgement areas increased, eventually link up one with another to form a

[1] A.H.B./IIS/76, p. 40.

continuous bridge-head of sufficient length and depth to allow the build up and grouping of the forces required for the thrust into France. Not only had air cover to be provided at both high and low levels over the beaches, but arrangements had also to be made to provide cover for the stream of shipping moving back and forth between England and France and for those vessels standing off the French coast. This was no mean commitment, for more than 2,000 ships and landing craft were used to lift the initial assault force and their equipment supported by a task force of over 100 warships and escort vessels.[1] Coastal Command was responsible for protecting the flanks of the shipping lanes from attacks by submarines. The defensive patrols which were planned had to cater for a possible effort by the German Air Force—whose strength it was considered had been husbanded during the preceding months—of anything up to a 1,000 sorties per day. In fact the reaction of the enemy air forces was unexpectedly and gratifyingly meagre. Nevertheless it might well have proved fatal to the whole expedition to have planned on such an optimistic basis.

The major operations in support of the Army were the attacking of pre-arranged and opportunity targets in the assault area, reconnaissance of the enemy's reactions, the prevention of movement of enemy reinforcements and spotting for the naval heavy calibre guns, whose duty it was to bombard those coastal defences which had not been neutralised by aerial attack. Fifteen American and 18 British fighter-bomber squadrons were available to provide immediate support against either pre-arranged or opportunity targets which might present themselves as the battle progressed.[2] Where the target was pre-arranged the squadrons detailed for close support in the actual assault area were controlled by the Headquarters Ship of the force assaulting that part of the coast where the target was situated. When, however, the target was an opportunity one, the aircraft were controlled by the Headquarters Ship which had initiated the request. Each Headquarters Ship, which acted as Flagship to the Naval Commander of the assault force concerned, accommodated the Military Commander of the assault Division and his Staff and also an Air Staff Officer representing the Commander, Advanced A.E.A.F. In addition to this Officer, who was a Group Captain, a Wing Commander and a Squadron Leader Signals Liaison were also on board. The duties of this small Royal Air Force Staff were briefly as follows :—[3]

(*a*) To keep the Commander, Advanced A.E.F. informed of the Naval and Military Commanders' intentions and requirements.

(*b*) To give advice to both the other Commanders regarding calls for immediate air support or tactical reconnaissance received over the Army Support Channel from tentacles ashore, or on any other relevant air matters such as the use of smoke over the anchorage at night and the control of A.A. fire by day.

(*c*) To receive R/T reports on behalf of the Military Commander from aircraft.

(*d*) To represent to the co-ordinating Fighter Direction Tender, the adequacy or inadequacy of the fighter cover provided.

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1 Air Chief Marshal Leigh-Mallory's Despatch. Para. 154.

2 No. 11 Group Summary for June. App. ' G '.

3 A.H.B./IIS/89/1. Reports on Operation Neptune by Air Staff Officers of Headquarters Ships and Fighter Direction Tenders.

(*e*) To direct fighters by visual control as required on instructions from the Fighter Direction Tender.

(*f*) To maintain an R/T listening watch for Naval Bombarment spotting aircraft and to issue instructions to such aircraft if they were unable to contact the bombarding ship for which they were detailed to spot.

(*g*) To inform the Naval Commander of the Force of any special requirements for Air/Sea Rescue Services from naval vessels.

(*h*) To re-brief or to re-direct if necessary, aircraft which arrived in response to calls for immediate support, and to maintain an R/T listening watch for support aircraft arriving over the area.

To ensure that the striking force was employed to the best advantage against opportunity targets, requests for action against them were passed by one of these five Headquarters Ships to Headquarters Advanced A.E.A.F. who decided the scale of effort to be provided in the light of forces available, and the tasks on hand or envisaged. The Combined Control Centre at Uxbridge was then instructed to pass the executive order to the squadrons detailed to carry out the mission. In addition squadrons were available to be detailed for duties on ' D-Day ' and subsequently as required in the neighbourhood of the assault area. These Air Alert Squadrons were also under the control of the appropriate Headquarters Ships which could pass R/T instructions to attack opportunity targets as required. To cater for any change in the situation which might occur between briefing and arrival at the assault area, each formation leader reported to the Headquarters Ship on his arrival in the area and again when leaving it. Opportunity targets which might arise, but not of such urgency as would necessitate action by the Air Alert Squadrons, were catered for by a number of Readiness Squadrons, which could be brought quickly into the battle area to deliver attacks against the selected targets.

Control of all fighters in the area was through the Fighter Direction Tenders. These were Tank Landing Craft which had been suitably modified to accommodate the special staff on board. They were also equipped with the specialised equipment required for the maintenance of communications between themselves, shore stations and the aircraft they were controlling. The control of fighters was not exercised in any way by the Headquarters Ships, although these were in a position to request additional fighter cover if more was required. Both systems worked well, the only drawback being that some six hours after the attack had begun the Military Commander and his Senior Staff Officers naturally went ashore to keep in closer touch with the developments of operations. This meant that there was no Senior Army Officer left on board to represent the Divisional Commander, whereas the Royal Air Force Officer, tied as he was to his communications equipment, could not move ashore with the Army Staff.

Daylight operations by aircraft under the Combined Control Centre began at 0430 hours, an hour and a half before the divisions began to disembark. The security measures, diversionary raids and destruction or confusion of the enemy's radar had been effective in ensuring a far greater measure of surprise than might have been anticipated in the circumstances, for little serious resistance was offered during the initial phases of the landing either in the air or on

the ground. During the morning some enemy reconnaissance sorties were flown, but it was not till 1500 hours that small formations of F.W.190 fighters and fighter-bombers appeared in the assault area. These were attacked by allied fighters protecting the troops on beach cover patrol, and four of twelve Ju. 88's and Ju. 188's were destroyed.

With the withdrawal of the heavy bombers, the fighters and fighter-bombers took over the area in and around the bridgehead. The plan called for what was virtually an air umbrella stretching from England to the beaches. Such a plan envisaged the employment of six squadrons of Spitfires on low cover, and three squadrons of P.47's on high cover throughout the hours of daylight. This commitment embraced the whole of the area of the five beaches and the area five miles inland and fifteen miles seaward. Patrols of the area were necessarily limited to fifty minutes for the low cover squadrons and an hour for the high cover squadrons.

Throughout the day attacks were made on enemy batteries, defended localities and enemy tanks and vehicles. Rocket firing Typhoons were successful in attacking a German radar unit between Le Havre and Cap De La Hague which had been ranging guns on the coastal forces. Typical of the targets attacked were a pocket gun position at Meuvaines by Typhoons carrying bombs or rockets ; defended localities in the Caen area, and thin-skinned vehicles on the roads out of Caen. Armed reconnaissance flights were also carried out in the area immediately beyond the beaches. Results of the attacks were, in the main, good, and numbers of tanks, M.T. and horse drawn vehicles were destroyed or damaged. As the battle progressed further, numbers of armed reconnaissance flights were flown and successful strikes were accomplished on enemy vehicles moving into the battle area. Casualties to aircraft of 2nd T.A.F. and A.D.G.B. on these missions amounted to only eight aircraft.

On the following day enemy air activity increased, although it was confined mainly to defensive patrols covering enemy forces moving up to the assault area. The number of enemy aircraft sighted over the beach-head was only fifty-nine. Our aircraft continued their support operations although a number of missions were abortive due to bad weather conditions. On 8 June claims were made for the destruction of at least 12 tanks and 40 M.T. vehicles, in addition to the damage to a number of vehicles in moving columns which were raked with cannon fire. By nightfall a rapid deterioration in the weather was forecast and, on 9 June, air operations were virtually brought to a standstill from dawn onwards owing to 10/10 cloud at an average height of 600 feet over United Kingdom bases. Nevertheless 158 sorties were flown, of which 27 were offensive operations.

One feature of the air operations in support of the assault was the frequency of attacks on British and U.S. aircraft by Allied anti-aircraft gunners, mainly from the Royal Navy and the Merchant Navy. During the first seven days of the operation five aircraft were lost in this manner by 2nd T.A.F. and Air Defence Great Britain, while the Ninth Air Force lost six aircraft. A ban was, therefore, placed on all anti-aircraft fire up to 5,000 yards to the front, except when aircraft were actually committing a hostile act. Thereafter,

although accidents did not continue at such a high rate, the problem of identifying Allied aircraft was never satisfactorily solved and aircraft of 2nd T.A.F., in particular the night-flying Mosquitos, continued to be shot down.

Airstrips within the Bridgehead Area

By 8 June two emergency landing strips had already been prepared in the Assault Area. On 10 June No. 144 Wing took off from its base in the United Kingdom but returned to the emergency landing strip. This fighter sweep was repeated at 1637 hours before the aircraft returned to base in England. No. 144 Wing (Nos. 441, 442, 443 R.C.A.F. Squadrons) was, therefore, the first Royal Air Force Unit to operate from French soil in the campaign.[1] By 9 June No. 83 Group Main Headquarters had been set up at Villiers Le Ece but the congestion in the restricted area of the bridgehead made it difficult to find the ten airfields required to accommodate the Group. However, by 30 June 11 airfields had been completed and work begun on a further two. But it was not until the first week of August that No. 84 Group found it possible to move across to Normandy owing to the restricted nature of the beach-head. It was fortunate that the Air Forces already installed on the Continent proved sufficient to deal with the effort made by the G.A.F. Had the latter been more effective the position in the narrow beachhead might well have become serious.

The preparation and use of landing grounds on the Continent was a major consideration since much of the effective range of aircraft was unproductively utilised in flying to and from their home bases on the other side of the Channel. This flying seriously curtailed the period during which they could be usefully employed in the battle area, or beyond it. In this respect the technique between American aircraft and British differed. From the time of take off American aircraft were in close touch with the ground and were vectored on to the target by the ground control. The combat operations planning staffs ordered the aircraft into the air and briefed crews for their missions afterwards. This method was made possible by the greater endurance of fuel of the aircraft employed and by an extremely elaborate control system. Such a policy could not be pursued by the Royal Air Force owing to the comparatively short range of the British aircraft. Each mission had to be planned carefully and tasks allotted as specifically as possible. It was not normally possible to keep a ' Cab-rank ' formation in the target area for more than twenty minutes, after which time an alternative target was attacked. ' Cab-ranks ' were only used when it was clear that a rapid concentration of aircraft was needed for a restricted period in order to assist the Army either in an attack or in repelling an enemy counter-attack.

An additional advantage brought about by the rapid preparation of the airfields in the lodgement area was the ability to fly in transport aircraft. This made the Royal Air Force independent of the Army for the provision of urgent and specialised equipment which might have become lost or delayed in transit and which the Army, who were primarily concerned with the unloading of their own stores, could not supply from their own resources. Another important feature of the air supply organisation was the ability, at an early stage in the battle, to evacuate casualties direct from the fighting line and move them rapidly and in comparative comfort to hospitals which had the staffs, equipment and other appropriate facilities.

[1] 2nd T.A.F. O.R.B. (Admin.).

There were, however, objections to transport aircraft using advanced landing grounds particularly in the course of a swift advance by the ground forces such as from the Seine to Antwerp and later in the campaign from the Rhine to the Elbe. A phase of mobile warfare was usually a time when tactical aircraft were required well forward so as to give cover to the spearheads while at the same time supplies (fuel and ammunition) were urgently required by ground and air forces to maintain progress. This was particularly noticeable in the cramped British sector where there was a lack of airfields compared to the American zone.

By the middle of June, under cover of Allied air support, the invading armies were firmly established in the lodgement area and the continued harrying of the enemy's communications and reinforcements had made the preliminary move in the liberation of Europe the success it had been planned to be. The beach-heads were firmly linked on a front of over fifty miles, varying in depth from eight to twelve miles. The port of Cherbourg was isolated and surrendered to the U.S. First Army on 27 June and the Allied armies were then ready to break out of the bridgehead.

The Air Commanders were, however, far from satisfied since the Army had not won for them the open country south of Caen where they hoped to construct airfields. The deployment of the remaining groups of 2nd T.A.F. on the Continent could not, therefore, be completed. Thus, when the Second British Army were planning to capture Caen in the first week of July the Air Commander-in-Chief, although perhaps sceptical as to the results, agreed to the employment of the heavy bombers to put down a large concentration of bombs before the ground attack began.

Operation Goodwood 18 July 1944

So far in the campaign there had been two daylight heavy bomber attacks in direct support of the ground forces. They were directed against troop and armour concentrations and proved to be successful. On the other hand it was believed that heavy bombers were not fitted to the role of close support and that such problems as the selection of proper targets, types of bombs and fuses, the movement of troops across cratered ground had not yet reached a solution. Moreover the unsuccessful air attack at Cassino had taken place only that spring.

On the evening of 7 July a force of 467 heavy bombers of Bomber Command attacked a rectangular strip measuring 4,000 × 1,500 yards on the northern outskirts of Caen at a distance of 6,000 yards from the nearest troops.[1] The attack was extremely accurate but the target area indicated by Headquarters Second Army to the Air Commanders did not contain any of the enemy's defensive positions which were in fact much closer to the British line. It did, however, disrupt communications and isolate the forward enemy positions, although the ground forces experienced great difficulty in making their way through the rubble. It was realised that in subsequent heavy bomber operations the target area would have to be much closer to the front line and more careful planning would be required. The attack was in effect a large scale trial of the methods which were to be used in Operation Goodwood.

1 Operation Charnwood.

The object of the ground forces during Operation Goodwood was to break out of the southern flank of the Orne bridgehead with a view to occupying the high ground south and south-west of Caen, so that subsequently it might be possible to break-through into the Caen-Falaise plain and initiate an armoured thrust in the direction of Falaise. As a result of these operations it was hoped that a maximum number of enemy armoured formations would be drawn into the Caen sector and thereby relieve the pressure on the American front. The main break-through was the task of VIII Corps, which consisted of three armoured divisions, but attacks were also to be delivered by XII Corps on the two nights preceding the operation. There were three major factors which affected the plans of VIII Corps. First, three armoured divisions had to be moved across the crowded bridgehead from west to east without being detected by the enemy, and without interfering with the operations and maintenance of the rest of the Army. The area available east of the river was only large enough to hold one of these Divisions at a time. Since the enemy had observation of part of this area, the arrival of the armour had to be delayed until as late as possible. Secondly, the ground was very much in favour of the defence and was ideal for the siting of the enemy's artillery, both field and anti-tank. The break-through, moreover, could only be achieved after a long advance on a narrow front. Thirdly, the operation was dependent upon air support, which in its turn was dependent upon the weather, and that was far from settled. A final decision on whether aircraft could operate could only be made a few hours before the battle was due to start. It was not possible to delay the concentration of armour until this decision was given. This meant that plans had to be made to conceal the large troop concentrations so that the element of surprise, upon which success so largely depended, would not be sacrificed in the event of postponement. It was firmly laid down that if their plans could not be put into effect, the attack was to be postponed.

Assurance was given that there would be no troops within 2,000 yards of H.E. bomb targets, within 2,500 yards of areas for fragmentation bombing, and that there would be no troops not dug-in within 3,000 yards of any target area. This complicated the accommodation problem in the bridgehead area as it necessitated a slight withdrawal of our Forward Defence lines, but this had to be accepted.

The advance was to be preceded by an air effort on a larger scale than any previous operation staged in direct support of ground forces. The plan to employ such a large force was not, in the first place, generally approved. However, both Air Chief Marshal Tedder and Air Marshal Coningham gave full support to the plan in the hope that a break-through would bring them the airfields they so badly needed. The Army maintained that in view of the considerable opposition likely to be met from enemy artillery both in front of and on the flanks of the advance and the long distance which had to be covered quickly if a break-out was to be achieved, the operation could not take place at all unless maximum air support could be given.

The main features of the air plan, which was made at Second Army/No. 83 Group level, were heavy bombing on the flanks of the Corps advance, fragmentation bombing in the parth of the armoured divisions and the neutralisation

of certain located enemy gun areas out of range of our own artillery. The plan called for great accuracy both in timing and bombing, since it was so closely related to the movements and positions of the attacking troops.

VIII Corps was compelled to advance down a narrow corridor, the sides of which were held by the enemy. It was, therefore, essential that the enemy positions in and along the sides of this corridor were neutralised. Cratering of these targets was not only acceptable, but desirable ; but in the line of the attacking armour it was important that the advance should not be so obstructed. Targets were, therefore, allotted to the heavy bombers, medium bombers and the aircraft of No. 83 Group in accordance with the requirements above as follows :—

Area 'A'.[1] Royal Air Force Bomber Command. Main target 1,000 acres, containing the steel factory at Colombelles, which was believed to contain a strong enemy mortar position. Cratering was acceptable. Attack to be completed by 0630 hours, or 0700 hours according to the wind speed.

Area 'H'. Royal Air Force Bomber Command. Approximately 940 acres, containing four villages which were believed to be strong points with important formations of enemy troops. Cratering was acceptable. Time of attack as for Area 'A'.

Area 'M'. Royal Air Force Bomber Command. Approximately 340 acres containing enemy strong points in and around Cagny. Cratering to be held to a minimum. Time of attack as for Area 'A'.

The above targets were to be marked by Mosquitos with full Pathfinder marking, and the main force squadrons were to bomb from heights of 6,000 feet to 10,000 feet. All aircraft were to carry maximum bomb load, mainly 1,000 lb. G.P. and M.C. with some 500 lb. G.P. and M.C. bombs. Fuses over areas 'A' and 'H' were to be 0.025 seconds delay and on area 'M' 70 per cent nose instantaneous and 30 per cent No. 44 pistol.[2]

Area 'I'. U.S. Eighth Air Force. A strip of 500 acres west of Troarn which was believed to contain a number of gun positions. Cratering was acceptable. Time of attack 0730 hours and, after concentration was achieved, at intervals till 0930 hours.

Area 'P'. U.S. Eighth Air Force. 1,940 acres of open country through which the advance was to be made. Three villages were believed to hold enemy gun positions. Catering was not acceptable. Time of attack from 0900 hours to 0930 hours.

Area 'Q'. U.S. Eighth Air Force. A smaller open country area of 540 acres to the east of Area 'P' with gun positions near Frenouville. Cratering was not acceptable.

Areas 'C', 'D', 'E', 'F' and 'G'. These were target areas for the medium bombers of the Ninth Air Force and were in the main path of the advance. Cratering was not acceptable in any area except 'G'. Bombs

1 A.H.B./IIF2/45/80 and A.H.B./IIB/9.

2 Pressure-operated pistol designed to function slightly above ground level.

to be used were 500 lb. G.P. for the two defended towns and 260 lb. fragmentation in the three open country areas. The attack was timed for 0730 hours to 0815 hours.

The importance of accurate bombing was stressed, with instructions that if markers became obscured by smoke, crews were not to drop their bombs within the smoke area, but to aim carefully at the southern edge of the main smoke concentration. Finally, crews were not to release their bombs unless they could see the markers or positively identify the smoke concentration as being in the correct place, and in no case were crews to aim their bombs on markers which might fall north or west of the canal between Caen and the sea.

Aircraft of No. 83 Group were to attack the remaining targets shown on the map, while the other attacks were going in.[1] Their other tasks included maximum interference with any enemy movement into the battle area, with particular attention to the area south of St. Andre Sur Orne and the area between the rivers Orne and Laize around Clinchamps Sur Orne. The Air Support Signals Unit (A.S.S.U.) was deployed with tentacles, in certain cases, down to Brigades. The intention was to use a Visual Control Post which would move with Headquarters 29th Armoured Brigade but, in the event, the Royal Air Force Controller was wounded in the early stages of the action and, due to the inexpereince of the A.L.O. the Visual Control Post was not able to function as intended.

The Visual Control Posts were originally designed to control strike aircraft on to their targets by visual means, but in practice it was found that there were few occasions when it could function in this manner and, accordingly, it tended to be used more as an A.S.S.U. tentacle when it was referred to as a Contact Car or Contact Tank. These vehicles moved forward with the armoured spearheads and kept the Army formations and F.C.P. or G.C.C.[2] informed as to their positions as well as acting as a channel through which air support could be requested and, when controllers were included in their crews as in this particular case, as posts from which aircraft could be controlled.

Communications between contact vehicles and Army formations, G.C.C. and F.C.P. was by R/T, and between them and aircraft by V.H.F. R/T. The entire briefing of crews for this form of concentrated support was done by the V.H.F. R/T channel and, if the F.C.P. Controller—in consultation with his A.L.O.—considered that a Contact Vehicle was in a better position to control a mission, the aircraft could be handed over to the Contact Vehicle. Similar handing over could also take place if the F.C.P. became overloaded with targets. Such a hand-over was carried out by R/T on normal A.S.S.U. channels and reports on the results of missions would similarly be passed by R/T from Contact Vehicles to the F.C.P. and from F.C.P. to G.C.C.

Fighter cover for the operation was to be provided by 90 Spitfires of No. 11 Group, who encountered no enemy opposition during the battle. In addition a comprehensive fire plan from Army and Naval guns was co-ordinated with the air attack.

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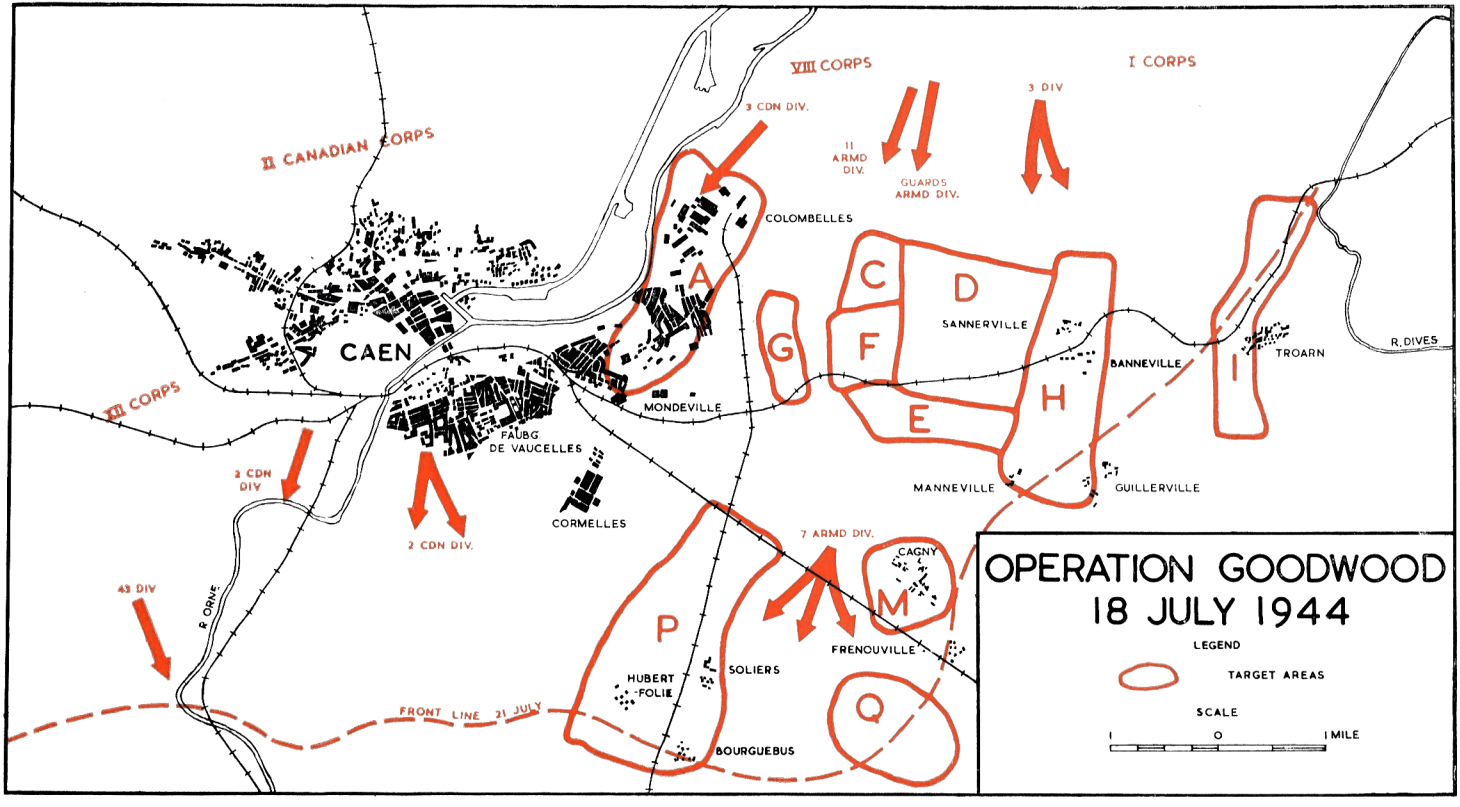
1 A.H.B./IIL/24/1.

2 Forward Control Post and Group Control Centre.


II CANADIAN CORPS
VIII CORPS
I CORPS
3 CDN DIV.
11 ARMD DIV.
GUARDS ARMD DIV.
3 DIV
COLOMBELLES
CAEN
XII CORPS
MONDEVILLE
FAUBG. DE VAUCELLES
2 CDN DIV
2 CDN DIV.
CORMELLES
43 DIV
R. ORNE
FRONT LINE 21 JULY
7 ARMD DIV.
CAGNY
FRENOUVILLE
HUBERT FOLIE
SOLIERS
BOURGUEBUS
SANNERVILLE
BANNEVILLE
TROARN
R. DIVES
MANNEVILLE
GUILLERVILLE
A
C
D
F
G
E
H
I
M
P
Q
OPERATION GOODWOOD
18 JULY 1944
LEGEND
TARGET AREAS
SCALE
1 0 1 MILE

The weather was perfect on the morning of 18 July and the assault was initiated by Mosquitos of No. 8 P.F.F. Group dropping red target indicators.[1] These indicators were released on 'Oboe' from heights of 22,000 to 30,000 feet. Master or Deputy Master Bombers were also employed to identify the aiming points visually. The marking was corrected visually where necessary by yellow markers released by the Master Bomber or his Deputy, which in turn were backed by P.F.F. Lancasters dropping further yellow markers.

The Bomber Command aircraft flew in streams with random but fairly even spacing, each aircraft bombing individually. The Americans bombed in boxes of eighteen aircraft. Nearly 2,000 aircraft were over the target area during the period of the attack and over 7,000 tons of bombs were dropped on the various targets. The scale of effort and the appropriate data are tabulated below :—

Target	Time	No. of Aircraft Attacking	Height in ft.	Short Tons of H.E.	No. of Markers	Mean Tonnage per acre
Bomber Command[2]						
'A' Colombelles	0536/0604	233	6,500/9,500	1,306	56	1·4
Mondeville	0559/0617	230	6,500/10,000	1,228	48	
'H' Sannerville	0541/0557	234	5,000/9,000	1,217	56	2·1
Manneville	0559/0617	229	6,500/10,000	1,261	39	
'M' Cagny	0615/0625	102	6,000/10,000	608	52	0·7
Eighth U.S.A.A.F.						
'I' Troarn	0730/0930	571	14,000/18,000	353	—	0·08
'P' Soliers	0900/0930			640	—	0·09
'Q' Frenouville	0900/0930			333	—	0·23
Ninth U.S.A.A.F.						
C, D, E, F, G		318	10,800/13,000	621	—	
Totals		1,917		7,567	251	

A large escort of fighters accompanied the heavy bombers but there was no enemy air opposition ; the following losses were, however, sustained from enemy 'flak' :—

Bomber Command	..	6 Bombers
Eighth U.S.A.A.F.	..	1 Bomber

The effects of this unprecedented bombardment may be briefly summarised as follows :—[3]

Area 'A'. Conditions were clear with some haze. The markers were well placed and the bombing was well concentrated. The target could be described by any reasonable standards of bombing as 'perfectly bombed'. Roads were blocked in many places and buildings were demolished to such an extent that movement of armoured vehicles would have been difficult or impossible.

[1] A.H.B./IIB/9.
[2] A.H.B./IIF2/45/80.
[3] A.H.B./II/69/120 and A.H.B./IIF2/45/80.

Area 'H'. The weather was cloudless with excellent visibility and again markers were well placed and an excellent concentration of bombing achieved. Roads in Manneville and Guillerville were completely blocked and buildings demolished preventing any movement of armoured vehicles. General examination revealed the remains of considerable German forces, including tanks, supply vehicles and mortar positions.

Area 'M'. The early markers slighly overshot the aiming point, but the Master Bomber instructed crews to bomb on others which fell very near. The target soon became obscured by smoke and dust. Demolition of buildings and road blocks was not as great as for the other areas. One battery of 88-mm. guns did not appear damaged and artillery fire from this area later proved an obstacle to the attacking troops.

Areas 'I' and 'P'. Bombing was somewhat scattered and extended over an area much greater than the target assigned, Area 'I' being hit by only 18 per cent of the intended bombs and Area 'P' by 40 per cent. In Area 'I' road blocks were not affected, but in Area 'P' some were made by craters which were easily passed.

Area 'Q'. This area received a better concentration, and there were some possible road blocks, but in general there were easy detours through fields.

Area 'G'. Two road blocks were caused by a 'spill' from Area 'A'.

Areas 'C', 'D', 'E' and 'F'. Although large tracts of these areas were untouched, a good percentage of the bombs fell in the assigned target areas. Little obstruction, even in the fields, was caused by fragmentation bombs. Tracks were later seen to have run right across the marks of the bomb bursts. Enemy communications were cut and troops lost contact with their officers and were often badly shocked, many being deaf for the following twenty-four hours. Enemy morale suffered greatly.[1]

There is no doubt that the attacks by Bomber Command on Areas 'A', 'H' and 'M' were highly satisfactory and were far more accurate than those of the American air forces, although it must not be forgotten that Bomber Command had the advantage of operating during the best part of the day and before dust and smoke had begun to obscure the battlefield. The destructive effect of high explosive bombs was experienced by a company of the 21st Panzer Division which had laagered in farm buildings around the village of Guillerville. This proved to be the centre of the bomb pattern in Area 'H'. After the bombardment, this company virtually ceased to exist and fifteen tanks were put out of action. The density of bomb strikes was 13.4 per acre and it would have been quite impossible for any armoured vehicle to move in or out of the affected area. In one particular orchard there were over 100 craters with diameters greater than 26 feet and 16 craters over 45 feet in diameter.[2]

At 0745 hours VIII Corps, with one armoured division up, attacked southwards with infantry of II Canadian Corps and I Corps attacking on each flank.[3] The armoured division moved very fast, and was followed rapidly by two more.

[1] P.O.W. Reports.
[2] B.A.U. Report No. 22.
[3] A.H.B./IIL/24.

By midday strong armoured formations of VIII Corps had advanced nearly seven miles to the south and had broken through the main German defences. During the afternoon, however, the rapid advance of the morning was slowed up by stiffening enemy opposition and the need for moving forward of infantry units to assist the armour. The enemy began counter-attacks with infantry and tanks and the armoured thrust in the direction of Vimont was held.

Throughout the day 2nd T.A.F. and the Ninth Air Force gave support to the advancing troops attacking gun positions and movement around the battle area. The Typhoons, armed with rocket projectiles, were especially useful, flying both pre-arranged and impromptu missions against gun positions, strong points and bridges. The Typhoons made nine attacks on tanks and pilots claimed to have destroyed or damaged twelve of them. Other fighter bombers ringed the area with armed reconnaissance missions whilst further afield the Ninth Air Force attacked enemy airfields to keep the G.A.F. from interfering over the battle area.

On 19 July enemy resistance slowed down still more the progress of the Allied advance, and enemy anti-tank guns and tanks in carefully selected ground resulted in slow progress by the armoured formations. By 21 July enemy resistance and counter-attacks were such that the projected sweep-through from the bridgehead had been slowed down to a halt.

There is no doubt that the heavy bombardment from aircraft, ships and artillery had a decisive effect on the morale of the enemy as well as, in a large measure, heartening the Allied troops. The effect can best be measured by reference to the remarks addressed to Hitler by Von Kluge who had taken over command in Normandy after Rommel had been injured when his car was wrecked by fighter-bombers. He states : ' my conference with the commanders of the units at Caen, forced me to the conclusion that in our present position—considering the material at our disposal—there is absolutely no way in which we could do battle with the all-powerful enemy air forces, to counter their present destructive activities, without being forced to surrender territory. Whole armoured units . . . were attacked by terrific numbers of aircraft dropping carpets of bombs, so that they emerged from the churned-up earth with the greatest difficulty, sometimes only with the aid of tractors. The psychological effect on the fighting forces, especially the infantry, of such a mass of bombs, raining down on them with all the force of elemental nature, is a factor which must be given serious consideration. It is not in the least important whether such a carpet of bombs is dropped on good or bad troops. They are more or less annihilated by it, and above all their equipment is ruined. It only needs this to happen a few times and the power of resistance of these troops is put to the severest test. It becomes paralysed, dies ; what is left is not equal to the demands of the situation. Consequently the troops have the impression that they are battling against an enemy who carries all before him. This must make itself felt to an increasing extent . . . In spite of all endeavours, the moment is fast approaching when this overtaxed front line is bound to break up. And when the enemy once reaches the open country a properly co-ordinated command will be almost impossible, because of the insufficient

mobility of our troops. I consider it is my duty as the responsible commander on this front, to bring these developments to your notice in good time, my *Führer*.'[1]

However, although some ground was gained and the armoured forces of the enemy were drawn into action, the main objective of the attack, as understood by the Air Commanders, was not achieved.[2] The enemy, on the whole survived this shattering air bombardment, because he was given time to recover, from the cessation of the air attack until the moment when he became engaged with the leading elements of the ground forces. Resistance stiffened as the Allied troops moved on to those areas beyond the bombing targets, or in places where it had proved impossible to neutralise his defence positions, as at Cagny. It appears that the Corps Commander had wanted a second air attack at approximately 1500 hours that afternoon when it was hoped that his armour would be in a position to move to its final objectives. However, this request never seems to have made its way to the appropriate authority.

Another explanation of the increased resistance will be found in a study of the effects of the bombing which took place later in the morning. The feature of Bourguebus (Area 'P'), regarded by the enemy as a key point and bristling with anti-tank weapons, did not experience such a great weight of bombs as fell in the Colombelles area. Only one third of the planned tonnage fell in the former area, together with Areas 'I' and 'Q'. It should be added that only fragmentation bombs were used here. A number of Army officers felt that a smaller weight of bombs might have been put down on targets nearer the start line and the effort thus saved could have been directed against the Bourguebus ridge, whose defences eventually halted the British advance.[3]

The objection to a series of phased attacks on selected areas ahead of our own troops was the difficulty of manoeuvring a large force of heavy aircraft so as to enable it to throw its weight of explosives into the battle at the critical moment. A heavy attack on an area some distance ahead of the advancing troops was ineffective if the assault was delayed at the start, and it was virtually impossible to apply the 'Cab-rank' technique to a strategic bomber formation. While operation Goodwood was a considerable advance on previous air-ground operations in which heavy bombers took part, it was obvious that there was much to be learned. In the first place, much closer co-operation was required between air and army officers in the battle area to ensure that the correct proportions of effort were directed against the target area. Secondly, it was clear that however great the air bombardment might be, the ground forces must follow up at once and exploit the momentary confusion. This implied that there should be a narrower margin between the target area and the safety line.

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1 A.H.B.6 Translation VII/73.

2 The Army contend that there was no intention of breaking through to Falaise. On 17 July, Second Army Commander ordered the armoured divisions of VIII Corps to form a base in the areas Vimont, Garcelles—Secqueville, Hubert—Folie—Verrieres and that a major advance to the south should not be made without referring to him. (Second Army Order 17 July 1944).

3 A.H.B./IIF2/45/80.

Subsequent Heavy Bomber Support Operations July–September 1944

The essence of Allied strategy throughout July was to try and draw off the enemy's armour from west to east so that the American First and the newly formed Third Army, under General Patton, could break out in the area of St. Lo towards Avranches. Once the advance had got under way, General Bradley was to take command of these two U.S. armies, to be known collectively as Twelfth Army Group. At the same time the First Canadian Army took its place in the British line at Caen. As in Operation Goodwood, heavy bombers were to be used to support the U.S. ground forces and as the Eighth Air Force necessarily required visual conditions, the operation had to wait for fine weather which, during the third week of July, was far from promising. After a false start on the previous day, the attack was made on 25 July. The bombing differed from Operation Goodwood in that the target area did not consist of a number of selected points but was a long rectangular strip of about 3,600 acres alongside the St. Lo–Periers highway.

Three divisions of heavy bombers were involved and the attack thoroughly disorganised the German positions, in particular the crack Panzer Lehr Divisions. On the other hand, a number of aircraft dropped their bomb loads among their own troops and caused a high number of casualties. There is little doubt that this air attack was in no small measure responsible for the swift break through of the ground forces and, within six days, American troops had reached Avranches. The route into the interior of France now lay open.

By 6 August the Americans had reached a line, Domfront–Mayennes–Laval. It was then intended that they should occupy the Le Mans–Alencon area and converge on the Seine in order to prevent the enemy escaping through the Paris–Orleans gap. The British were to advance through Argentan and reach the Seine below Mantes. This wide enveloping movement was narrowed when, on 11 August, the Third U.S. Army was ordered to change direction and advance northwards towards Alencon and Argentan, while the British and Canadians pressed on towards Falaise. The German Army was thus threatened with an encirclement between the towns of Mortain and Argentan.

It was essential, in order to close the gap, that Falaise should be taken as quickly as possible. On two occasions, on 8 and 14 August, the Strategic air forces were called upon to assist the Army to break through the strong German defences astride the main road north of the town. The first attack (Operation Totalise) was made by both Bomber Command and Eighth Air Force. In order to confuse the enemy the first bombing was made at night with infantry in armoured carriers following up simultaneously to exploit the confusion. This novel method of attack was a success, although the second wave of troops experienced the familiar difficulties of mopping up pockets of the enemy who had recovered from the shock of the bombing. On the following day (9 August) the Eighth Air Force bombed four areas in the line of the Canadian advance. This part of the operation was marred by ill fortune, for the American aircraft detailed for the first attack were dispersed by ' flak ' on the approach to the target area and little more than half the force found their objectives. Aircraft detailed to another target area were unable to discover it and dropped their bombs behind the Allied lines and inflicted a large number of

casualties upon the British troops. As the enemy continued to resist fiercely, an attack on the German position astride the Caen–Falaise road was made by Bomber Command on 14 August. The attack began with great accuracy but was abandoned because a number of aircraft, mistaking identification signals for target indicators dropped their bombs on Allied territory and once again killed and injured Allied troops. In both these air-ground operations, 2nd T.A.F. proved its worth in many close support sorties against enemy positions, transport and armour, which also included medium bomber attacks on gun positions.

During the period 5–28 September Bomber Command bombed the defences of the towns of Le Havre, Boulogne and Calais. These attacks undoubtedly prevented many Army casualties and enabled artillery to be moved to more important sectors of the front. On more than one occasion, however, the friendly civilian population suffered many casualties. Henceforward there was a marked tendency for the Army to call upon heavy bomber support, particularly as the war weariness of the troops who had fought throughout the summer increased.

Mortain and Falaise, August 1944

The enemy's reaction to the American armoured columns probing into France was an attempt to cut the Allies tenuous line of communication at Avranches on the west coast. In the first week of August preparations were made to concentrate the best of the German armour for a break-through in the hilly countryside around Mortain east of Avranches. This stroke was, however, doomed to failure because when the concentration was complete, the Americans had already begun to encircle the Seventh Army and the Fifth Panzer Army. Secondly, the weather, which was unpropitious all through July towards air operations, cleared at last and enabled the Tactical air forces to give close support to their armies on a maximum scale.

The enemy forces concentrated at Mortain were composed of the 1st S.S., 2nd S.S. and 116th Panzer Divisions, elements of the 17th S.S. Panzer Grenadier Division together with supporting infantry. The G.A.F. withdrew its long range bombers from their almost sole task of minelaying and also assembled a force of some 300 fighter aircraft to give cover over the battle area. Although Allied air reconnaissance had identified an eastward movement of German armour, it would appear that the attack had not been anticipated by the Allied Commanders. Moreover enemy movement was cloaked by the thick summer mist which did not normally clear before midday. The Germans doubtless believed that this would enable them to gain much headway before they were spotted from the air.

Operation Luttich, which had been ordered by Hitler, was launched in the early hours of 7 August. The rugged district of Mortain was held by no more than two divisions of the VII U.S. Corps, one of which had just arrived in the area. This was a situation which called for support from the Tactical air forces with their ability to concentrate rapidly at a given point. The Commander of the Ninth Air Force called upon the rocket carrying Typhoons of 2nd T.A.F. to stop the Panzer advance and squadrons of No. 83 Group were

at once directed to Mortain. These attacks began shortly after 1200 hours when the summer mist and haze had cleared. Had poor weather grounded the air forces the enemy might well have succeeded in his intention of reaching the coast. Whilst the British fighter-bombers harried the German armour, the Ninth Air Force held off the G.A.F. so successfully that the latter's intervention was impossible and General Speidel, Chief of Staff to Von Kluge, later admitted that the armoured operation was completely wrecked, entirely by the Allied air forces, supported by a highly trained R/T organisation. Another feature conducive to the success of this battle was the close proximity of the British and U.S. Tactical Air Headquarters in Normandy. It is worth while remarking that during this battle British pilots were unfamiliar with the close countryside of Mortain and the Americans for their part were not cognizant of the Royal Air Force technique of close support. Although both the ground forces were often interlocked in combat, there was only one mistake in identification from the air.

On 7 August, there were 19 squadrons of Typhoons operating from French airfields. During the day these squadrons carried out 69 missions of 458 sorties, of which 294 were in the Mortain area, firing 2,088 rockets and dropping 80 tons of bombs. Claims were made for a large number of A.F.Vs. destroyed and damaged, as well as M.T. vehicles, at a cost of five aircraft lost. The thrust was maintained by the enemy during the period 7 to 11 August, when the number of missions rose to 298 involving 2,193 sorties ; 9,850 rocket projectiles and 398 tons of bombs were aimed at enemy targets inflicting further casualties on his armour and transport. After the Typhoon attacks on the first day the fighter-bombers of the U.S.A.A.F. took over the responsibility of the Mortain area, accounting for many more enemy vehicles and flying some 3,500 sorties between 6 and 12 August. The fine weather contributed effectively to the outstanding success of the air forces and it may well be that the enemy was relying on a continuation of the previous bad weather which had done so much to restrict air operations. By this effort the Allied air forces broke up and partly destroyed the enemy concentration and, although a number of spearheads did penetrate westwards they were effectively dealt with after bitter and heavy fighting by the ground forces. In spite of the reinforcements which the enemy brought up the advance was held and persistent efforts to break through to Avranches were prevented.

On 10 August it was decided to exploit the opportunity for encirclement which the enemy tactics had offered.[1] Le Mans had already been captured on 9 August by XV Corps, which was now pushing north according to plan ; Angers had fallen to XX Corps on the 10th, and by the night of 12 August the U.S. 5th Armoured Division was in the outskirts of Argentan. Thus, with the Canadians at Falaise and the Third Army forces at Argentan the stage was set for the Battle of the Pocket, soon to develop into a rout whilst the enemy struggled to keep open the narrowing gap through which to withdraw his forces from the west. This withdrawal was under way by the 13 August. Allied aircraft grasped this opportunity. On that morning, for example, 37 pilots of the U.S. 36th Group found 800 to 1,000 enemy vehicles of all types

1 Report by S.C.A.E.F.

milling about in the pocket west of Argentan.[1] Within an hour the Thunderbolts claimed to have blown up or burnt out between 400 and 500 enemy vehicles. On that day the American XIX T.A.C. fighter-bombers claimed to have accounted for more than 1,000 road and rail vehicles, 45 A.F.Vs. and 12 locomotives. Inside the pocket they reduced ten enemy strong points to heaps of rubble. The effect of the air attack had made its mark on the enemy. On 13 August Von Kluge stated in his report : ' If the widely spread front line remains as it is at present, with its critical lack of resources, it will be broken through and surrounded by the enemy, with his superiority in men and materials, and his mastery of the air, and our units could not fight their way out.'[2] The situation report for that week (8 to 14 August) went on to say, ' The question of supplying the fighting front in all areas has become more difficult as a result of increased enemy air activity. The lack of mobility is becoming increasingly awkward.'

On 16 August, Falaise, the pivot of the German defence system fell to the Canadians. On the south side of the pocket the First U.S. Army had reached Argentan and the Third U.S. Army was advancing rapidly towards the Seine during which it was able to seize the main German supply bases. The enemy was, therefore, limited to one escape route—the gap between Falaise and Argentan—through which he could reach the Seine north of Paris. He fought desparately to keep open the gap whilst his transport streamed eastwards along the roads, bumper to bumper and often two and three abreast. This was an ideal opportunity for the Tactical Air Forces, in particular the fighter-bomber force of 2nd T.A.F. The air attacks culminated on 18 August after the enemy trapped in the Pocket had made a final attempt to escape in daylight. Scores of armoured vehicles and transport formed a block in the narrow lanes outside the village of Vimoutiers and were subjected to a series of devastating attacks by fighter-bombers until nightfall.

On 19 August American troops linked up with the Polish Armoured Division at Chambois and the mouth of the net was drawn tight. There was now little left to be done except to mop up what remained of the demoralised enemy after the ten days slaughter. By that date the German forces in Normandy had lost all cohesion ; divisions were hopelessly jumbled together and commanders were able to control no more than their own battle groups. The absence of the G.A.F. over the battlefields must have been particularly bitter to the German soldier. Congestion on the road continued and Allied pilots were presented with targets that were probably never paralleled later in the campaign. The inability of the enemy to move eastwards was, in a large measure, due to the Allied air attacks. The German Situation Report for the week 15 and 21 August confirms this by the statement that ' enemy air activity rose to immense proportions this week, and in many cases rendered it impossible for us to move our troops.[2] For a brief period supplies could only be brought to the troops with fighter escorts. Our inferior mobility is hampering our tactical decisions.' The report concludes with the significant sentence, ' Our own losses have not yet been assessed.'

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1 Effectiveness of Third Phase Tactical Air Ops. in the European Theatre.
2 A.H.B.6 Translation VII/73.

In the air operations of August, and complementary to the attacks of the fighter-bombers, were sorties of the light and medium bombers against the enemy's supply routes. Mosquitos of 2nd T.A.F. operated by night against the Seine crossings and harassed movement on the roads east of the pocket causing much disorganisation. By daylight the medium bombers of the Ninth Air Force bombed bridges over the rivers between the pocket and the Seine. The enemy was thus starved of food, ammunition and above all, petrol. The most frequent complaint in the German Seventh Army diary at this stage was the lack of fuel. As the focal point of the battle moved towards the Seine the medium bombers proved their value in breaking up troop concentrations. No. 2 Group and U.S. medium bombers caused havoc on the south bank of the Seine at Rouen where a large convoy was drawn up waiting to cross the river on 26 August.

The tactical and photographic reconnaissance aircraft (Spitfires and Mustangs flying by day and Wellingtons and Mosquitos at night) played a significant part in the battle. Fighter-bombers were often despatched to break up troop and vehicle concentrations on the receipt of orders from the pilots of these aircraft. Photographic and visual reconnaissances at night provided a check on entraining and detraining points in the enemy's rear areas.

With the advent of mobile operations in Normandy the contact car was used for the first time in this campaign. In this procedure a White scout car went forward with the leading reconnaissance elements of the ground force while maintaining contact with a Tactical Reconnaissance aircraft. This aircraft sent back information concerning enemy troops or other obstacles in the path of the advance. The information was passed on to the local ground commander and thus saved unnecessary deployment of troops. The contact car was also used as a Visual Control Post and was responsible for guiding close support aircraft onto their targets. The procedure was used extensively during the remainder of the campaign.

The employment of heavy bombers to block the enemy's routes of withdrawal was a subject of discussion during this period. The Twenty-First Army Group Commander, supported by the 2nd Tactical Air Force Commander, was in favour of using the Strategic Air Forces in this role and both the Eighth Air Force and Bomber Command in fact bombed roads and road junctions west of the Seine. The value of such attacks, however, lay open to question. The Air Commander-in-Chief believed that with the enemy in retreat the most suitable targets for heavy bombers were industrial and transportation targets in Germany. He therefore stopped this type of operation maintaining that the fighter-bomber was the most suitable type of aircraft for close support in mobile operations, while the Mosquitos and Mitchells of No. 2 Group could harass the enemy's routes of withdrawal by night.[1]

It was inevitable, as the struggle grew daily more confused, that cases arose of Allied pilots attacking their own troops. To guard againt this danger the Army Commanders fixed bomb-lines with such margins of safety that they severely restricted attacks in close support of the ground forces.[2] Many

[1] Mitchells were used for flare dropping.
[2] Leigh-Mallory Despatch.

excellent targets were thus denied to the fighter-bombers. In spite of repeated requests for the revision of these bomb-lines in order to allow more freedom to aircraft to operate closer to the fighting, the Army Commanders maintained their caution. This was understandable but there is no doubt that their restrictions allowed a great deal of enemy material and personnel to make good their escape to the east, which would otherwise have been subjected to the same battering as the less fortunate remainder. As it was, the enemy pulled out as much of his precious armour as was possible, and left the infantry to their fate. The countryside west of Argentan thus became the graveyard of the army which had looked with confidence to the smashing of the Allied invasion, and what was left of the Seventh and Fifth Panzer Armies was in full retreat towards the Seine with the Allied columns racing after them. Mantes, on the Seine, was reached by the Third U.S. Army on 20 August, and by 26 August crossings were in progress on all Allied Army fronts.

There should be no doubt that the defeat of the German Army in Normandy came as a result of a combined effort by ground and air forces. The former blocked the more distant exits from the battlefield leaving the air to concentrate on the one and only escape route. It is impossible to show by statistics the effect of constant air attacks upon the enemy. Reports by prisoners of war show vividly that from the moment of entering the battlefield they became obsessed with the need to take cover from Allied aircraft and at the same time all confidence was lost in the ability of the G.A.F. to provide cover overhead.

Walcheren Island, October–November 1944

The forward thrust of the Allied armies had made it imperative that the long lines of communication should be shortened by opening up the Port of Antwerp for their use.[1] The Northern Group of armies was, therefore, instructed to undertake the operation as a matter of first priority. The mouth of the Scheldt, however, was guarded by an enemy force of some 10,000 troops including anti-aircraft guns and at least 26 coastal defence batteries, garrisoned on the island of Walcheren at the northern entrance to the estuary. The continued existence of such a force could deny the use of Antwerp to the Allies and, as winter approached, the reduction of the garrison became a matter of urgency.

The first preliminary operation was the isolation of the island by air bombing, and the second was the neutralisation of the coastal defence batteries to allow naval vessels to sweep the approaches clear of mines.[2] It was felt that the task could be greatly simplified if it were possible to breach the dykes in order to allow the sea to flood the island, much of which was below sea leavel. It was hoped that this would force the enemy to concentrate his forces, making them easier to attack ; impose serious administrative difficulties on the enemy and immobilise his reserves ; and finally, put a proportion of his defences out of action while creating a means of entry for our own amphibious vehicles.

On 1 September S.H.A.E.F. gave approval for the flooding plan and, as the task called for an effort by heavy bombers beyond the capacity of 2nd T.A.F., discussions were immediately begun with Headquarters, Bomber Command.[3]

1 A.H.B./IIS1/13(A), Encl. 4A.
2 A.H.B./IIS1/13(A), Encl. 12A.
3 A.H.B./IIS1/13(A), Encl. 11A.

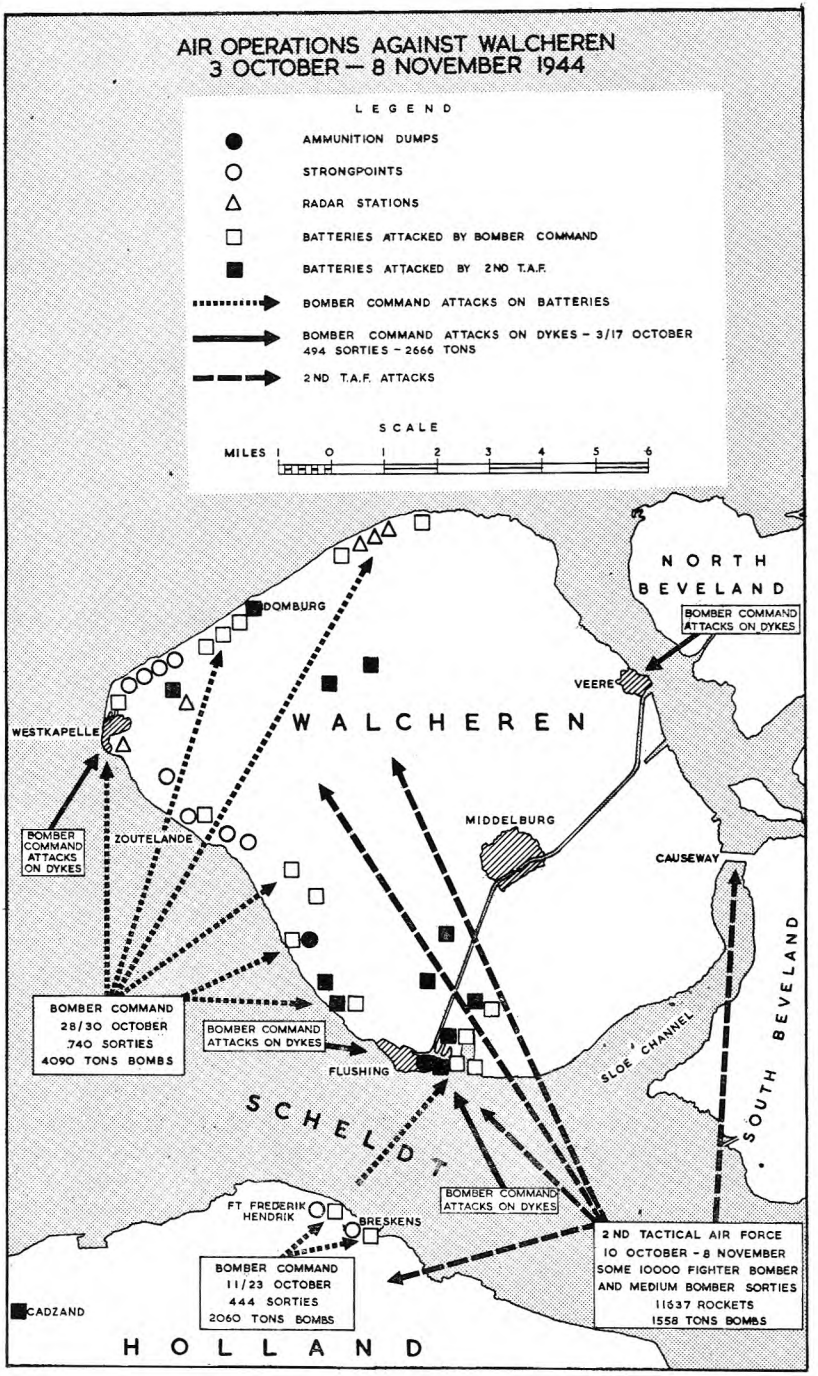
The Dutch were warned by broadcast and leaflets of the impending operation, and on the next day, 3 October, a force of 259 heavy bombers attacking in waves, dropped 1,270 tons of explosives on the dyke. Within an hour a breach was effected in the sea wall, which was approximately 250 feet thick at its base and 60 feet wide at its top. The immediate effect was to inundate four gun emplacements and surround seven other batteries with water. Two further attacks were made on 7 October to the west and east of Flushing with 348 and 384 tons of bombs respectively, with the result that additional breaches were made in the sea wall. Sixty-three heavy bombers made another attack on 11 October dropping 374 tons of bombs, and a final attack of 290 tons was made on 17 October. This effort was effective in flooding all the low-lying parts of the island, and the heavy bombers then turned to the task of attacking the gun emplacements. Bad weather prevented these operations being continued right up to the time of the assault. Between 28 October and 30 October 740 sorties were made and 4,090 tons of bombs were dropped on these targets. On 31 October (D minus 1 of Operation Infatuate) flying operations had to be abandoned by both Strategic and Tactical air forces owing to the weather. This gave the enemy valuable respite.

Attacks on the defences in the Scheldt by 2nd T.A.F. began in the second week of September and attempts were made to block the causeways linking Walcheren and South Beveland. They were unsuccessful owing to the heavy 'flak' concentrated at these points. Later in the month and during October fighter-bombers sought to destroy gun positions, 'flak' positions and radar stations, and strong points. But the major part of October was devoted to supporting Army operations south of the Scheldt.[1] Air activity against Walcheren was intensified from 28–30 October when 796 fighter-bomber sorties were flown against the island's defences.

The final assault on Walcheren took place at first light on 1 November, and was in two simultaneous operations known as Infatuate I and Infatuate II; the former being the attack on Westkapelle and the latter that on Flushing. The Army and Naval Commanders responsible for Infatuate I decided to make the assault on Westkapelle, although at the time it was certain that weather would be unfit for air action. The weather, in actual fact, on the night immediately before the operation, was as bad as could be expected. Cloud was 7/10 to 10/10 at 800 feet and rain and drizzle reduced the visibility at times to less than 1,000 yards. Nevertheless both operations proceeded from the Breskens area as planned.

Flushing was subjected to attacks in thirty-seven sorties by Mosquitos from last light on D minus 1 to 0530 hours on 'D-Day'. Here the plan was that there should be no air support until the ground forces were established ashore and air support could be called for in the normal manner through the Air Support Signals Unit. Owing to weather conditions at base this did not

[1] A new technique of close support was evolved in the flat, featureless countryside of the Netherlands. The ground forces found it difficult to locate the position of guns and strong points whereas in Normandy they could pin point such targets due for attack from the air by firing red smoke shells onto them. Instead, a smoke screen was laid along the forward positions extending up to about 2,000 or 3,000 yards. In front of this line the fighter-bombers could attack targets of their own choice. This method of support was found to be effective on a number of occasions.


AIR OPERATIONS AGAINST WALCHEREN
3 OCTOBER — 8 NOVEMBER 1944
LEGEND
AMMUNITION DUMPS
STRONGPOINTS
RADAR STATIONS
BATTERIES ATTACKED BY BOMBER COMMAND
BATTERIES ATTACKED BY 2ND T.A.F.
BOMBER COMMAND ATTACKS ON BATTERIES
BOMBER COMMAND ATTACKS ON DYKES – 3/17 OCTOBER
494 SORTIES – 2666 TONS
2ND T.A.F. ATTACKS
SCALE
MILES 1 0 1 2 3 4 5 6
NORTH BEVELAND
BOMBER COMMAND ATTACKS ON DYKES
DOMBURG
VEERE
WALCHEREN
WESTKAPELLE
BOMBER COMMAND ATTACKS ON DYKES
ZOUTELANDE
MIDDELBURG
CAUSEWAY
BOMBER COMMAND 28/30 OCTOBER 740 SORTIES 4090 TONS BOMBS
BOMBER COMMAND ATTACKS ON DYKES
FLUSHING
SLOE CHANNEL
SOUTH BEVELAND
SCHELDT
BOMBER COMMAND ATTACKS ON DYKES
FT FREDERIK HENDRIK
BRESKENS
2ND TACTICAL AIR FORCE 10 OCTOBER – 8 NOVEMBER SOME 10000 FIGHTER BOMBER AND MEDIUM BOMBER SORTIES 11637 ROCKETS 1558 TONS BOMBS
BOMBER COMMAND 11/23 OCTOBER 444 SORTIES 2060 TONS BOMBS
CADZAND
HOLLAND

materialise until 1100 hours, but subsequently nearly 200 sorties were flown during the day in extremely bad weather against various targets in the area. A heavy bomber programme against the dock area at Flushing, scheduled to take place shortly before the attack, was cancelled due to bad weather.

The plan for the assault on Westkapelle, unlike that on Flushing, had taken into account the provision that air support would be provided but, although the A.O.C. No. 84 Group recommended that the operation be suspended for twenty-four hours due to the flying conditions that were expected, the Naval and Army Commanders on the spot decided to press forward with the assault. The importance of the operation, however, justified the risk since, after that date, the operation would have been impossible from a naval point of view owing to the state of the tides and the prospects of rougher weather.

By dawn the rain had ceased off the Walcheren coast, the cloud base was as high as 2,500 feet, visibility was good and there was little swell on the sea. The Air Staff Officer on board the Headquarters Ship signalled to the Air Officer Commanding No. 84 Group that conditions were favourable for close support operations and the Force Commander decided to go ahead with the assault. On the mainland, however, No. 84 Group was grounded by low cloud and rain and the pre-arranged support before ' H ' Hour did not arrive. The naval support squadron went into the attack but soon came under heavy fire from coastal guns. Casualties began to mount up and when the Commandos began to land only seven out of 23 craft of the support squadron were capable of further action. The enemy directed his fire against these craft and allowed the Commandos to close to the shore. It was at this crucial stage that the Typhoons, due to make the pre-arranged attacks immediately before ' H ' Hour, arrived on the scene. They had taken off in the most adverse conditions (10/10ths cloud and 1,100 yards visibility). The rocket firing surface craft were ordered to cease fire and the Typhoons at once attacked the guns firing on the naval craft with cannon and rocket projectiles. As the Commandos advanced inland the Typhoons attacked targets further ahead.

During this phase the Headquarters Ship requested No. 84 Group Control Centre to scramble all available fighters for close support.[1] This was done and fighter-bombers and R.P. Typhoons provided the maximum close support possible in the prevailing weather conditions.

Information about the suitability of targets and the position of forward troops was passed to the Group Control Centre either through the fighter aircraft or naval inter-ship communications direct to the Forward Control Post (F.C.P.). This information was used to brief crews for subsequent attacks until the Air Support Signals Unit began to function. Fighter-bombers were kept on ' Cab-rank ' under the F.C.P. with instructions to search for suitable targets outside certain pre-determined bomb-lines. These were supplementary to precise targets given by the F.C.P.

It had also been planned to screen the assault force from the Domburg batteries during the touch-down by smoke laid by Bostons, but weather at base prevented this operation. Similar conditions prevented the Spitfires from

[1] A.H.B./IIS1/1, Sect. 6.

HAWKER TYPHOON

taking off from their United Kingdom bases for spotting duties, though bases in Belgium, from which spotting aircraft could have operated, were clear.[1] Air O.Ps. had been arranged at short notice as an alternative, but due to poor communications the results were ' most disappointing ' and the naval bombardment was carried out by direct observation. This absence of spotting aircraft during the forenoon of ' D-Day ' severely reduced the efficiency of the heavy ship bombardment. When the aircraft did eventually arrive all the ships were able to give effective support.

Too much reliance had been placed by the surface forces on the effect of the heavy bomber attack on the coastal batteries and the naval support force was subjected to heavier attack than they had anticipated. The absence of spotting aircraft for the heavy ships' guns or close support aircraft at the time of the assault enabled these batteries to inflict severe punishment on the attackers. This situation was materially relieved when the weather improved and aircraft were able to become airborne.

In the event, four separate items of air support were either not forthcoming or delayed due to bad weather, etc. :—

(a) Smoke laying by Bostons. (Cancelled).

(*b*) F/R Spotting by Spitfires. (Delayed).

(*c*) Close Support by R.P. Typhoons. (Delayed).

(*d*) Attacks by heavies on Flushing Docks. (Cancelled).

Although the C.-in-C. 2nd T.A.F. expressed the opinion that the operation by No. 2 Group on D minus 1, and by No. 84 Group on ' D-Day ' ' gave one of the most effective examples of air support under the existing conditions which had occurred since ' D-Day ' of Operation Overlord,' the operations were criticised by the Navy whose fire was rendered ineffective for a vital part of the operation, and by the Army in whose opinion it was ' obvious that the bombing effort placed on the various batteries covering the approaches to Westkapelle, failed to achieve the expected and desired result.'[2] The enemy was given a forty-eight hour respite because of bad weather and this was exactly the time when an intensive aerial bombardment should have been made. Investigations after the battle proved that in fact considerable damage had been inflicted by bombs and even rockets on guns in open emplacements but as most of the guns were destroyed by the enemy before surrender it was difficult to ascertain precisely how many guns were put out of action as a result of air attack.

As in Normandy the moral and stunning effects of an air attack were underestimated and in all the operations against strongly defended areas those positions which had not been subjected to air attack took twice as long to capture. The action of the Typhoons at Westkapelle also showed that even rockets and cannon fire could temporarily silence very strong defences whilst the ground forces were making their approach.

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1 A.H.B./IIS1/13/(c) Sect. 4, para. 28.
2 A.H.B./IIS1/13B, Encl. 54A.

Although the clearing of Walcheren, which was completed by 9 November—netting some 10,000 prisoners—had opened the Port of Antwerp for the use of the Allies, the long line of the attacking troops who had raced across France at an unprecedented speed offered a tempting opportunity to the enemy. If he could be successful in driving a wedge between the Allied armies and striking right through to the coast, he could cut his attackers in two and deny them the use of their newly acquired port. It will be remembered that the Germans had attempted a similar drive in France in an effort to cut General Patton's lines of communication by driving a spearhead through to Avranches. That attempt had ended in the disastrous Falaise pocket.

The Ardennes Offensive. 16 December 1944

Like the previous attack in France just referred to, a drive through the Ardennes towards Antwerp had been anticipated by the Allies as a possibility, but the probability of such an attack through the difficult terrain in the winter months had, as before, been discounted.[1] In order to provide troops for attack elsewhere, and because of this premise, this portion of the battle front was very thinly held by the Americans.

From early in November Allied Intelligence knew that the German armoured reserve, the Sixth S.S. Panzer Army, was being moved from northern Germany to west of the Rhine in the Cologne–Dusseldorf sector. The Allied commanders believed that if the Germans were going to attack at all that winter their blow would fall opposite to the Ruhr where most Allied pressure was being exerted. This, indeed, was exactly what German Supreme Command had hoped for and their armour was quietly shifted to the Eifel under cover of the persistent bad weather during the beginning of December. A clue to the attack had been provided by the gradual assembly by Field Marshal Von Runstedt of six infantry divisions in this quiet sector. This was a larger number than was required for reasonable security, but use had been made over many months of this area for the preliminary seasoning of new troops. In spite of this concentration it was still felt that no offensive operations in this area were likely and, in any case, could be dealt with effectively if they occurred. Nevertheless the attack was launched and achieved some initial success, although it failed in its objective of reaching Antwerp.

The enemy attack began at 0530 hours on the morning of 16 December, and bad weather prior to the attack materially assisted the Germans, as even routine reconnaissance had been impossible for Allied aircraft. The assault was preceded by a short artillery preparation and a powerful attack was launched against the Allied line between Monschau and Trier. Parachutists were dropped behind Allied lines to disrupt communications and hamper the movement of reinforcements and the initial break-through was followed up by units equipped with American tanks and uniforms whose task it was to seize key points such as bridges and road junctions. Behind these followed the armoured spearheads of the Fifth and Sixth Panzer armies. In the early stages Allied ground resistance was weak and the enemy moved so swiftly that no definite plan of counter-attack was evolved. The situation from the Allied point of view became fluid and confused; communications were disrupted and

[1] Report by S.C.A.E.F.

commands split. From the air point of view it is of interest to note that the Supreme Commander made use of the troop carrier aircraft at his disposal to increase his reserves and brought in by air the 17th U.S. Airborne Division from the United Kingdom to concentration area near Rheims. This operation was completed in eleven days.

The initial rate of movement of the enemy was of the order of about 20 kilometres a day, which was maintained until 23 December.[1] On the 24th it was slowed down, and on Christmas Day it ceased altogther. It is significant that there was no sudden change in resistance on the ground to account for this abrupt halt to the advance, whereas the timing of the air efforts fits the sequence of events perfectly. Evidence indicated that the indirect air support was a decisive factor, whereas the close support was of less importance. For instance, detailed examination immediately after the offensive showed that the destruction of enemy armour was insignificant, whereas the advance ceased two days after really heavy bombing in the rear areas, and one day after fighter-bombers had resumed their activity on the lines of communication nearer the front. At the beginning of the attack the Allied air effort had to be diverted to combating the attacks of the G.A.F. which flew some 600 to 700 sorties on 17 December.[1] On that day the U.S. Ninth Air Force put up more than 1,100 fighters and fighter-bombers and claimed to have destroyed 96 out of 300 enemy aircraft attacked. 2nd T.A.F. claimed 11 out of 100 intercepted.

Bad weather still hampered air operations, but on the night of 17/18 December Bomber Command attacked four centres important to the enemy's communications. On the 18th the U.S. Eighth Air Force put nearly 500 bombers on to the marshalling yards and the Tactical air forces flew 1,400 fighter and fighter-bomber sorties.[2]

The following four days saw a period of fog both at the bases and over the battle area, and plans for further attacks on communications had to be cancelled, only 1,500 sorties of all types being flown on 19 December and twenty on 20 December. On 21 December 284 were flown of which 112 were flown by Bomber Command. From 20–22 December the Tactical air forces were completely grounded and not until the 23rd were they able to operate on an extensive scale.

The British and American Tactical Air Force Commanders quickly appreciated the danger of the enemy thrust and the close co-operation that existed between the two air forces proved its worth. On 17 December, three days before General Eisenhower reorganised the command of the affected front, 2nd T.A.F. agreed to support the Ninth Air Force during the crisis leaving behind the minimum number to protect the British sector. The U.S. aircraft were to provide close support to their own armies while the British maintained cover over the battle area. During the hours of darkness Mosquitos of No. 2 Group attacked communications in the Eifel area, and generally behind the enemy's forward area as far south at Coblenz. These harassing operations were to prove of great value.

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1 2nd T.A.F. O.R.S. Report No. 19.
2 Report by S.C.A.E.F.

On the night of 21/22 December, Bomber Command attacked Bonn and Cologne with over 200 aircraft and, during the day of the 22 December 2nd T.A.F. were able to operate 256 sorties.[1] Plans to fly supplies to the Allied forces isolated in the Bastogne area had to be cancelled due to the prevailing bad weather conditions. On the 23rd however, conditions improved and there were 929 heavy bomber sorties and 837 sorties by medium bombers. More than 3,000 tons of bombs were dropped on the enemy's lines of communication. Sorties by fighters and fighter-bombers rose to 2,700, whilst no less than 1,150 enemy sightings were reported during the day. It became evident from such a show of strength on the part of the G.A.F. that, in order that the Allied air forces could give the defending ground troops the maximum support, it was essential to restrict the activities of the G.A.F., even if this meant temporarily drawing off aircraft. Accordingly, on 24 December, 2,400 heavy bombers attacked airfields and air force control stations, dropping more than 4,200 tons of bombs on these targets. A further 738 sorties by medium bombers increased the tonnage by another 2,600 tons. Fighters and fighter-bombers flew more than 4,000 sorties destroying 125 enemy aircraft and dropping 500 tons of bombs. Transport aircraft were also enabled to fly in supplies to the Bastogne area where the U.S. forces were still encircled. In all, over 7,500 offensive sorties were flown on 24 December.

By Christmas Day the farthest spearhead to the west, that of the 2nd Panzer Division, was caught at Celles, immobilised through lack of petrol, and here it was deciseively smashed.[2] The support given by the air arm had effectively cut the life blood from the advancing Germans, and the attack petered out through sheer lack of supplies which it was impossible to bring up in the face of the devastating bombardment and ground attack from the air. On this day the enemy advance towards the Meuse was also halted.

A useful contribution towards breaking up the enemy's concentrations in Alsace, where Von Runstedt staged a small diversionary offensive, was also made by Bomber Command. On 13 and 14 January the heavy bombers dropped 2,000 tons of H.E. on three marshalling yards in the Saarbrucken area which were at that time only fifteen miles from the front and very active. Signs of enemy activity were also noted along the Maas, which was very weakly held by First Canadian Army, and in the enemy occupied islands north of the Scheldt. Here 2nd T.A.F. was able to remedy the lack of troops on the ground by intensifying the interdiction of railways leading into south-west Holland, bombing bridges, headquarters and carrying out tactical reconnaissances.

Operations Plunder and Varsity. 23 and 24 March 1945

On 15 March, after having gained their objectives along the Rhine, north of Moselle, the Allies opened their major offensive south of the Moselle. The Third U.S. Army struck south-eastwards across the Moselle in conjunction with a Seventh U.S. Army thrust northwards through the Siegfried Line and, by the end of the month all organised resistance west of the river had come to an end. In addition, two sizeable bridgeheads at Remagen (First U.S. Army) and near Mainz (Third U.S. Army) had been obtained.

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1 Report on Air Operations.
2 Report by S.C.A.E.F.

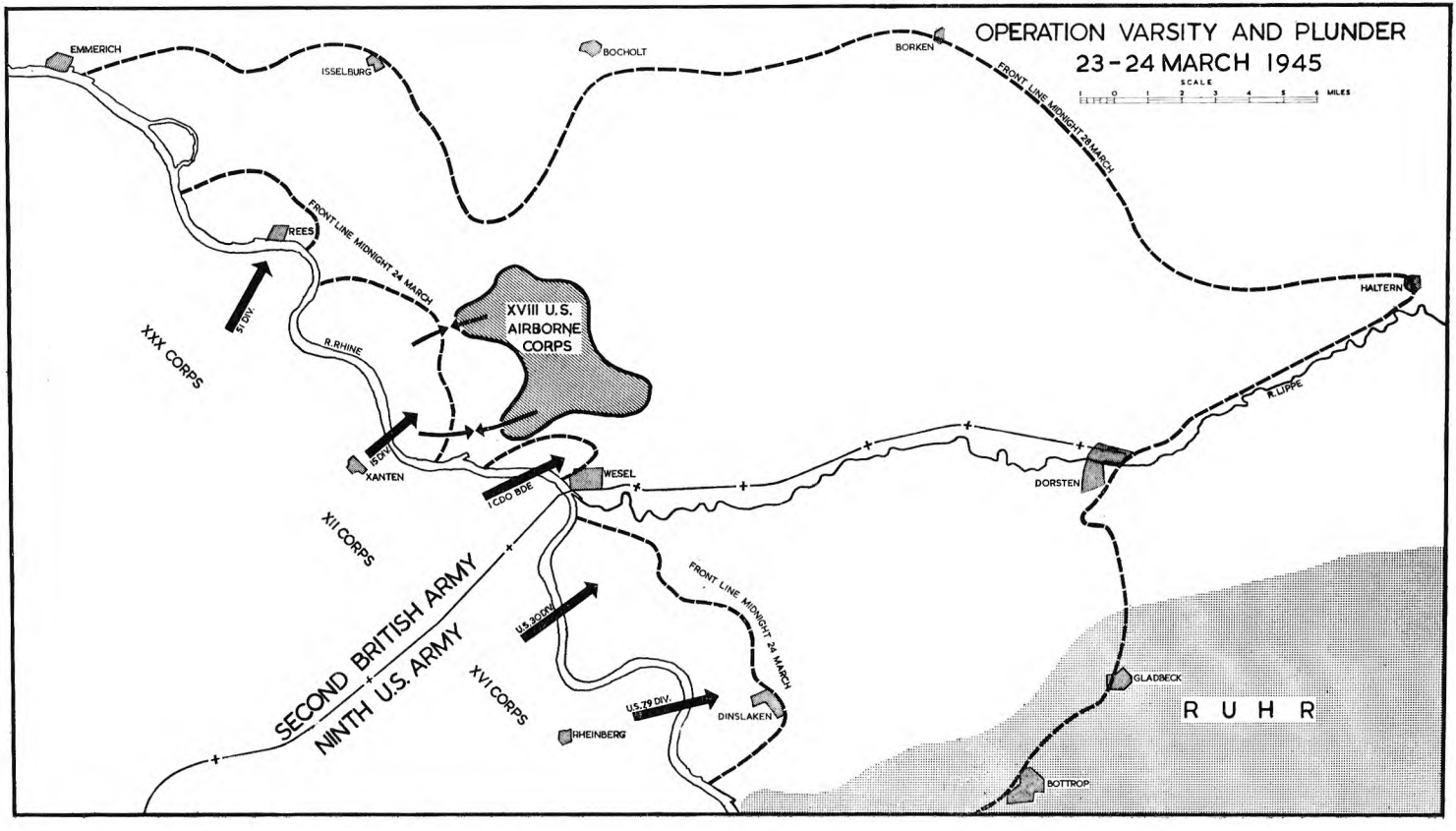
The crossing of the Rhine by the ground forces during the latter half of March was known by the code name of Plunder, whilst the airborne operation which supported the crossing was called Varsity.[1] As the two operations were complementary they may be described together.

The enemy at this time was in an unenviable position. As the Allies had hoped, he had elected to stand and fight west of the Rhine, and the result had been disastrous for him. His losses in battle had been crippling, morale was low, and the front which his troops held was too long for his shrunken numbers, facing as they were almost four million Allied troops. The fundamental feature of the campaign now was the launching of the main attack to the north of the Ruhr, supported by strong secondary thrusts from bridgeheads in the Frankfurt area. The plan of Operation Plunder, the great assault across the Rhine which was to constitute the main effort, involved the use of three armies. Under the command of Field Marshal Montgomery the U.S. Ninth Army and the British Second Army were to attack on the river between Rheinberg and Rees. They were to capture the communications centre of Wesel and then to expand their lodgement area on the east bank south and north. The Ninth Army's assault was to be launched south of Wesel with its main bridging area at Rheinberg, and its principal initial task was to protect the Army Group's right flank.[2] The Second Army was to assault north of Wesel and to concentrate first on the capture of that town in order that the Ninth Army might commence bridging there. The Second Army was also to bridge the river at Xanten and Rees.

To assist the advance of the Second Army, the First Allied Airborne Army was to drop XVIII Airborne Corps (comprising the U.S. 17th and the British 6th Airborne Divisions) north and north-west of Wesel to seize the key terrain in that area.[3] This airborne operation—known by the code name Varsity—was timed to follow the commencement of the ground assault, it being hoped thereby to achieve an additional element of surprise and to ensure a quick link-up with the ground forces.

From the nature of these operations, the cutting of communications from the Ruhr was a matter of first importance in facilitating the establishment of a bridgehead on the east bank of the Rhine, north of the industrial area. In accomplishing this the Allied air forces were to play a major part. The plan entailed that the north-western area of Germany should be cut off from the central and southern regions by the drawing of a line of interdiction running in a rough curve southward from Bremen to the Rhine at Coblenz. This embraced 18 rail bridges and rail viaducts, the destruction of which would, it was considered, cut every main line leading out of the Ruhr to the west of Germany. There were three lines of paramount importance, namely those running through Bielefeld, Altenbeken and Arnsberg, whose traffic, it was calculated, amounted to about half that to and from the Ruhr. Previous damage to a number of these targets had been energetically repaired by the enemy ; for their importance had increased due to the successful attacks upon

1 Report by S.C.A.E.F. and A.H.B./IIS/54. *See* also Appendix 13.
2 A.H.B./IIS/76.
3 A.H.B./IIS/82.


OPERATION VARSITY AND PLUNDER
23-24 MARCH 1945
SCALE
MILES
EMMERICH
ISSELBURG
BOCHOLT
BORKEN
FRONT LINE MIDNIGHT 28 MARCH
REES
FRONT LINE MIDNIGHT 24 MARCH
5 DIV.
XXX CORPS
R. RHINE
XVIII U.S. AIRBORNE CORPS
HALTERN
R. LIPPE
15 DIV.
XANTEN
1 CDO BDE
WESEL
DORSTEN
XII CORPS
SECOND BRITISH ARMY
NINTH U.S. ARMY
FRONT LINE MIDNIGHT 24 MARCH
U.S. 30 DIV.
XVI CORPS
U.S. 79 DIV.
DINSLAKEN
GLADBECK
RHEINBERG
RUHR
BOTTROP

the waterways connecting the Ruhr and the increased traffic they now had to carry since the Silesian coalfields and industrial centres had been lost to the advancing Russians. The isolation of this area and the disruption of its rail centres would not only assist the assault crossing by hampering the ability of the enemy to deploy his ground forces in his rear areas, but would also deny much of its war production to the remainder of the enemy forces resisting the Allied pressure on other fronts.

On 21 February a series of attacks was initiated against the rail bridges and viaducts. All types of aircraft were involved in this interdiction programme. The greater part of the bridges were within range of medium bombers whilst the heavy bombers attacked bridges farther afield, for example, at Bremen and the great viaducts at Altenbeken, Bielefeld and Arnsberg. Meanwhile fighter-bombers continued to harass railway traffic around the Ruhr—a task that had been maintained with little interruption since the autumn. During this period 42 attacks by medium and heavy bombers were made on these bridges and viaducts by aircraft of the U.S. Ninth and Eighth Air Forces and by Bomber Command. A summary of the effort made and the losses involved against what were frequently heavily defended targets is tabled below :—

	No. of Attacks	*Effective Sorties*	*Tons of Bombs Dropped*[1]	*Aircraft Lost*
Royal Air Force, Bomber Command ..	14	308	2,270	6
U.S. Eighth Air Force ..	8	702	2,023	—
U.S. Ninth Air Force ..	20	875	1,530	31
Total	42	1,885	5,823	37

By 24 March, ten had been destroyed, one partly destroyed, and three were so damaged as to be impassable. A further two were suspended from air attack as by that time they were within range of the artillery of the Remagen bridgehead area. Only two therefore remained as possibly passable, and their importance had been lessened by other cuts along the lines which served them. During March, within the area and westward to the battle line, a tremendous onslaught was made against every nodal point on the rail system—some 158 heavy attacks being carried out in the first three weeks of the month.

The experience which had then been gained at Arnhem—that the local Tactical Air Commander should be responsible for controlling all air operations in support of an airborne assault—was tested for the first time in Operation Plunder/Varsity. The Air Officer Commanding-in-Chief 2nd T.A.F. was responsible for drawing up a plan of cover and support to Operation Varsity by both Strategic and Tactical air forces.[2] Air Marshal Coningham in turn made the Air Officer Commanding No. 83 Group responsible for co-ordinating the fighter cover west of the Rhine and the anti-' flak ' operations of 2nd T.A.F.

1 In these attacks the R.A.F. for the first time made use of bombs of 22,000 lb., with considerable success.

2 It should be noted that attacks on airfields were made by the Strategic Air Force in connection with the airborne operation but that the heavy bomber operations supporting the ground assault (Plunder) were arranged and controlled by S.H.A.E.F. (Air) according to normal practice.

and XXIX Tactical Air Command in assistance of the airborne operation. The first task included the cover of an area stretching fifty miles east of the landing/dropping zones. The details of close support to the ground forces were worked out by No. 83 Group in conjunction with Headquarters, Second Army.

The Supreme Commander directed that the highest priority should be given to air operations in support of Operation Plunder/Varsity and the tasks of the air forces may be summarised as follows :—

(*a*) The establishment and maintenance of air superiority over the assault areas and dropping/landing zones.

(*b*) The neutralisation of ' flak '.

(*c*) Fighter protection of the troop carrier aircraft.

(*d*) Close support of the ground and airborne forces.

(*e*) The prevention of movement into and towards the battle area.

Bomber Command and the Eighth Air Force were active during the three days before the battle bombing marshalling yards around the Ruhr and bridges east of this area. A heavy attack was made by the U.S. heavy bombers on camps and barracks. Both British and U.S. medium bombers attacked defended towns and communication centres. Altogether 43 separate attacks were made during which 3,471 effective sorties were flown and more than 8,500 tons of bombs dropped. Fighter-bombers also intensified their attacks on enemy movements in the 72 hour period preceding the assault. More than 3,000 sorties were flown by day and night against targets in the area, and claims were made that included 318 M.T. vehicles, 80 locomotives and 2,383 railroad cars destroyed and 215 railcuts made. Not only was it essential to disrupt the communications and movements of the enemy in the area, but it was also imperative to subject his defences to a series of attacks in order to facilitate the assault of ground troops and to minimise the interference from ' flak ' and fighters to the airborne operations. Accordingly, in the three days prior to the crossing no less than 56 attacks were made on defence, artillery and ' flak ' positions, and more than 6,600 tons of bombs were dropped upon them. Rocket firing aircraft were especially successful in several attacks on buildings believed to house Headquarters Staffs. G.A.F. bases, particularly those from which jet fighters operated, were heavily and successfully attacked in order to neutralise these fields during the vital period of the assault.

The ground offensive (Operation Plunder) began at 2000 hours on 23 March with a great artillery barrage of an hour's duration directed against the east bank of the Rhine and extending through the zone where the airborne forces were to be dropped and landed the next day. At 2100 hours the barrage lifted and British troops began to cross the Rhine at Rees on the left flank of the assault area. The most important objective was Wesel—a key communication centre on the Rhine and a Commando brigade was ordered to seize it. The town's defences were subdued by two heavy attacks by Bomber Command. The first took place during the afternoon on 23 March and bombing was effected by means of radar ; the second was a visual attack made at 2235 hours that night after the Commandos had crossed the Rhine and were waiting on

the east bank at a distance of 1,500 yards from the target area.[1] Both attacks were made with great accuracy and the Commandos were able to enter the town before midnight having sustained only 36 casualties.

The initial crossings, largely owing to the weight of the preparatory artillery fire and bombing were generally made against only slight opposition and firm footholds were gained on the far bank of the river. The airborne landings (Operation Varsity), began just before 1000 hours on 24 March. The plan provided for the paradrop and glider-tug aircraft operating from the United Kingdom to set off shortly before 0800 hours, and for the train, which was an hour long, to converge with the train from the French bases. This latter train of aircraft and gliders was to be two and a half hours long. From a turning point near Brussels the two trains were to fly parallel courses to Weeze, whence they were to turn into four dropping and six landing zones.

The whole operation was carried through almost exactly as planned. The parachute forces led both the American and the British trains. The British forces were carried in the 243 aircraft of the U.S. IX Troop Carrier Command, operating from the United Kingdom, with No. 38 Group, Royal Air Force. All of these forces and the U.S. glider forces flew at 1,500 feet M.S.L. decreasing height to 600 feet above ground level at the dropping and landing zones. The British glider forces flew at 2,500 feet M.S.L. for the whole outward journey. At the completion of the drop the British 6th Airborne Division turned left about and the U.S. 17th Airborne Division turned right about.

Enemy air resistance to the operation was negligible, and only fifteen to twenty sightings were reported. The losses sustained were almost all due to light 'flak' and small arms fire, of which the train which turned left encountered the heaviest concentration. It is significant that the U.S. forces, which sustained the higher percentage of losses, operated at the lower altitude of 600 feet.

During the morning of the 24th attacks on 'flak' positions were intensified and further attacks were made on towns and the sites of gun and mortar batteries, while heavy bombers of the U.S. Eighth Air Force attacked G.A.F. bases.[2] Bomber Command carried out a heavy diversionary raid on the rail centre of Sterkrade, close to the flank of the assault. The U.S. Fifteenth Air Force, based on the Mediterranean, made a deep penetration to attack a tank factory in the Berlin area, thus drawing off the G.A.F. fighter forces based in central Germany. In all, the Allied forces operating in the west flew 7,704 sorties on the 24th excluding troop carrying and supply aircraft missions.

The air support given by 2nd T.A.F. to the Army also worked effectively. A standing patrol or 'cab-rank' of four aircraft was maintained by No. 83 Group over the advanced Group Control Centre on the west bank of the Rhine and two squadrons were kept at readiness on the ground. On the east bank one contact car operated with each of the two assaulting divisions. A further two were flown in with the airborne divisions without mishap. Immediate support requests from the assault area were filtered at the advanced Group

[1] The radar equipment used was Gee-H, a developed form of Gee.
[2] A.H.B./IIS/76.

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Control Centre and, on being accepted, were passed on the contact car concerned. In the case of requests from airborne troops, the Air Support Signals Unit was rarely used and requests were passed to the Advanced Group Control Centre over the ground to ground V.H.F. R/T link.

Features of close support operations on 24 March were attacks on headquarters at first light, the bombing of strong points, troop concentrations and gun positions. Medium bombers dealt with these targets, in addition to the fighter-bombers and were directed on to their objectives by Mobile Radar Control Posts. The success of the airborne operation was largely dependent on the neutralisation of 'flak' positions in the battle area. Investigations after the battle showed that Allied Intelligence had over-estimated the number of A.A. guns east of Wesel and certain positions were in fact empty at the time of their attack. Whilst the medium bombers of No. 2 Group may claim to have silenced two batteries, fighter-bombers experienced difficulty in identifying such small targets in the dust and smoke of the battle and little physical damage was done. It was noticeable that 'flak' did not slacken until the airborne troops had actually captured positions. Nevertheless the low-flying tactics of the fighter-bombers and the persistence of their attacks must have lowered the morale of the enemy gunners and whilst it is true that only a small proportion of the glider force escaped damage, losses would otherwise have been far higher.

It was not until the following day, when the enemy began to withdraw, that pilots on armed reconnaissances began to claim the destruction of large numbers of vehicles. Artillery contact and photographic reconnaissances were extremely valuable to the Army and at the same time information of enemy troop movements were passed back to the Group Control Centre with the result that fighter-bombers on armed reconnaissance were at once directed against them.

Characteristics of Air Support Operations in North West Europe 1944–1945

In the latter stages of the war the enemy found it increasingly difficult to maintain his forces with sufficient fuel for mobile operations. In the campaign of north-west Europe the disruption of communications was therefore probably the most effective form of support to the Allied ground forces. Owing to the shortage of petrol the enemy tended to rely on the railways to bring supplies as close as possible to the forward areas. He was aided by the complex railway network of northern France, north-west Germany and Holland, which proved to be an ideal target for the Allied air forces. The experience which had been gained from air attacks on communications in Sicily and Italy were applied in the western Theatre on an increased scale. Once the Air Force had paralysed the communication system, the issue of a battle was never in doubt. The enemy was forced to rely on road transport which often had a long distance to travel and this had the effect of both eating up fuel and increasing the wear and tear to vehicles. Moreover, excellent targets, in the shape of motor convoys to and from the front were provided for fighter-bombers by day and for light bombers by night. Both the cutting of railways and the shortage of fuel drove the enemy to use the canals of Holland and north-west Germany. These in turn together with barges and installations such as lock gates and bridges were subjected to air attack. Coastal shipping along the German and

Dutch shores was not neglected and air strikes reached a climax in the last days of the campaign, when in April–May 1945 large concentrations of shipping, including ocean going vessels, were attacked by 2nd T.A.F. in the Baltic.

The numerous river lines in Europe formed natural barriers.[1] These were the Seine and Loire in Normandy ; the Rhine and Mosel on the frontiers of Germany, and rivers such as the Weser and Siegen east of the Ruhr. It was possible, by destroying bridges and by harrassing ferries and crossing places, to delay movement into or away from the battle area, but the air forces found it impossible to stop traffic crossing by night or in bad weather. This could only be achieved by an enveloping movement of the ground forces. But the difficulties of an advance on the ground, and the rigid boundaries laid down to prevent the intermingling of units, allowed the enemy to withdraw the bulk of his forces both from Normandy and the Ardennes where they had been isolated in a pocket. Only in the last phase, when the Ruhr was encircled by two U.S. armies and an effective line of interdiction had been established previously, east of the Ruhr, did the air and ground forces succeed in forcing the surrender of large numbers of enemy troops.

In close terrain, particularly in the ' bocage ' country of Normandy it was not always easy to give full air support. Targets were hard to identify, especially in cases where, as in Normandy and later in the Ardennes and Rhineland, forces of two Allies were fighting on either side of a pocket, and recognition from the air was difficult. Attacks on ground targets were frequently made by a Tactical Air Force in support of its Army Group which was often separated only by a few miles of close country from the forces of another Allied army. Thus there was a serious risk of aircraft attacking friendly troops in the course of giving support to one or other of these converging thrusts and it was also possible for clashes in the air between two Tactical air forces to take place. In the heat of battle these were not infrequent. The problem was partially solved by a mutual arrangement between the British and U.S. Tactical Air Commanders that air-ground attacks would only be made under the direction of contact cars. The crews of these vehicles maintained an R/T link with the pilots and were able to direct them against appropriate targets. When a unified system of control of the Tactical air forces was possible (i.e. during the battles of the Ardennes and the Rhineland) the Commander of 2nd T.A.F. defined zones of responsibility to the British and U.S. air units under his command.

Perhaps the greatest handicap to air operations lay in the fact that the Allies were operating over friendly territory until they reached the German border in the autumn of 1944. Even at that stage, it was necessary to operate constantly over enemy-occupied Holland. The problem of avoiding harm to the civilian population was, therefore, always present in the planning of air operation . Whilst it is undoubtedly true that the losses to Army personnel were greatly reduced when heavy bombers attacked such towns as Caen, St. Lo, Le Havre, Boulogne and Calais, the number of civilians killed and injured was consider-

[1] Rivers were equally as serious a problem to the Allied Commanders and it became necessary as the ground forces advanced, for example, after the break-out in Normandy, to place a ban on bridge destruction.

able. Whenever possible these heavy air bombardments were preceded by fighter-bomber attacks which could give some warning of what was to come. However, it is debatable whether in all cases these large scale operations justified the extensive damage.

The suitability of the weather for flying operations was an all important factor in determinimg the outcome of a battle and had considerable importance in operations throughout the campaign. The clearing of the summer mists at Mortain, for example, when the enemy was assembling his armour for a break-through to Avranches, enabled the British Typhoon forces to operate with decisive results. Equally momentous was the spell of fine weather during the German thrust in the Ardennes when the combined effort of Strategic and Tactical air forces against communications halted the German advance on the Meuse. Conversely, the foggy weather at the start of this battle caused air bases, both in the United Kingdom and on the Continent to be closed down for operations. Other examples of weather permitting air support may be found in the actions at Walcheren and the Falaise Gap.

The G.A.F. was not strong enough to operate powerfully against the Allied armies or their installations. Thus the need for extensive protection of the rear areas from the air became redundant early in the campaign and a large proportion of fighters and fighter-bombers, operating at the fullest extent of their range, were employed on armed reconnaissance and interdiction. It was the object of the Tactical Air Force to weaken the enemy before he was in contact with Allied ground forces and to delay or prevent supplies arriving at the front. These activities stopped the enemy from moving at will by day and forced his fighter aircraft into taking defensive action well away from the land battle. The Allied ground force was, therefore, afforded almost complete immunity from air attack and the Air Force could operate over the battlefield without being challenged by the G.A.F.[1] During the hours of darkness, light bombers (Mosquitos) harassed communications along the bomb line and in the enemy's rear. As the majority of enemy moves had to be made at night, these attacks were often very fruitful. It should be noted that there was no equivalent of this type of air operation in the U.S. sectors.

The main task of aircraft engaged on armed reconnaissance was to attack and destroy road, rail and canal traffic. Each Composite Group was given an area and, within it, every sortie was carefully planned so that the total effort was extended over the hours of daylight and routine runs were prevented. This system was found to be more efficient than acting on the information of tactical reconnaissance aircraft which was not always comprehensive and did not always arrive in sufficient time. Railway interdiction consisted of severing the enemy's railway lines at vulnerable points such as embankments and cuttings. The policy was to make at least three cuts in each section of the line chosen for attack, so as to prevent the enemy repair organisation from reaching the central cut. After bombing the lines, fighter-bombers completed their sorties by carrying out normal armed reconnaissance tasks.

[1] An example of the latter kind of security was that transport aircraft were able to fly into the forward areas without escort.

Normal close support sorties such as attacks on troop concentrations, strong points, gun positions, bridges and headquarters did not differ from other theatres of war. In the course of such operations material damage was inflicted and the morale of the enemy troops frequently broken but certain disadvantages became apparent. Rapid concentration of aircraft and accuracy of timing (e.g. when an air attack had to be co-ordinated with an artillery barrage) was not easy, particularly if the airfields of the Composite Group were situated at a distance of 100 miles from the battle area, as they were during the Scheldt operations. Secondly, air attacks, unlike artillery bombardment, did not tend to become more accurate with successive strikes. Thirdly, there was the problem, already mentioned, of locating the position to be attacked. Thus it would appear that the most valuable targets for tactical bombing lay well ahead of the main advance where fighters and fighter-bombers could be employed on an interdiction programme. Attacks of this nature interrupted enemy movement more effectively and helped to maintain the forward momentum of the Allied ground forces. They proved more profitable than expending a large effort on small and unsuitable targets near the front line.

The campaign was remarkable for the development in the technique of heavy bomber attacks in support of the ground forces. Four different types of attack were used :—

(*a*) The bombing of an area in front of the ground forces before an advance, with the object of destroying or paralysing communications up to a depth of two thousand yards.

(*b*) The bombing of areas behind the forward defensive system so as to isolate forward troops and destroy communications.

(*c*) The bombing of defended areas on the flanks of an advance thus allowing an ' avenue ' down which the ground force might pass.

(*d*) The destruction of supply dumps, concentration areas, headquarters, etc.

There has been some controversy as to the usefulness of such large scale attacks. Briefly the effects were as follows. Enemy troops who were in the target areas were frequently demoralised and were stunned and dazed by the weight of bombs. An additional factor for the decline in morale was that the heavy bombers were always able to accomplish their mission without any interference from the G.A.F. Secondly, bombing prevented and delayed movement and disrupted communications. There were occasions when the destruction of troops, vehicles and guns was achieved but because of the degree of dispersion in a modern battlefield and in view of the fact that troops were usually dug in, the chances of dealing with a target decisively were not great.

On the Allied side the sight of large formations of aircraft delivering such an attack was a great stimulant to the morale of the soldier and the operation was often worth while even when the material effects of the bombing were not great. The value of the operations lay in the ability of the ground forces to exploit the confusion which followed immediately after the air attacks.

The planning of this type of operation obviously could not be done at short notice nor was it easy, when heavy bombers were engaged, to call off or re-arrange an attack. The principle adopted by the Tactical Air Force Commanders when requesting air support outside their own resources was simply to state the targets to be bombed and the object of the attack. This inevitably led at times to a misapplication of effort. It was essential that the planners should have some knowledge of the artillery plan so that they could apportion the air effort accordingly. On the Army side due allowance had to be made in the artillery plan for counter action against 'flak' batteries, which might easily upset an air attack. Two other factors which had to be taken into account were the weather (an alternative plan had to be made if the air support was cancelled) and the need to continue air attacks to prevent the enemy reforming outside the bombed area. Medium and fighter-bombers were the most suitable type of aircraft to fulfil this role.

The most difficult problem connected with this form of attack was recognition of the ground forces by high flying formations—a difficulty with which low flying tactical aircraft also had to contend. The Air Force could never guarantee that no bombs would fall within Allied lines during a heavy bomber attack. Safety measures such as yellow personnel indicators, vehicles marked with the five pointed white star, smoke generators emitting coloured smoke and coloured artillery bursts were on occasion found to be inadequate. However, the most practical developments, apart from radar aids, were the firing of coloured anti-aircraft bursts over the front line at a pre-planned time and height and, secondly, the use of a wireless beam.[1]

In assessing the value of tactical bombing by Strategic Air Forces and by medium bombers of the Tactical Air Forces, their missions against road and railway targets in the battle area are apt to be overlooked. The heavy and medium bombers were used to make choke points at road junctions in both offensive and defensive operations. An example of the former was the bombing of road centres around the beach-head in Normandy and later the bombing of roads leading away from the Falaise–Argentan gap; whilst an excellent example of the latter were the heavy bomber attacks in the Ardennes. Disadvantages of this type of bombing were that, on occasion, it impeded the progress of Allied troops until bulldozers were brought up to clear a path. In open country and when the weather was dry, making cross-country movement feasible, the enemy could by-pass such obstacles and in any case he tended to avoid prominent junctions usually marked by a town. The hilly country of the Ardennes where the road system was poor and where defiles could be blocked provided more suitable targets. Investigations after the battle recommended that these attacks might have been more valuable if the roads leading to a choke point had been blocked rather than inflicting severe damage on friendly towns situated in the centre of a road network. The bombing of railway centres delayed the movement of enemy troops in the Normandy battle and during the operations in the Ardennes when the railway system along and west of the Rhine between Cologne and Coblenz was paralysed.

The principle that the best form of air support was that directed against the enemy's rear areas seemed from the evidence of the campaign to be a sound one.

[1] The American blind landing equipment S.C.S.51, was used to provide a radio 'bomb-line'.

Nevertheless, it was frequently contested by Army Commanders, and until the morale factor both of our own and enemy troops can be more accurately assessed, it would be unwise to state any definite conclusion.

SUMMARY AND GENERAL CONCLUSIONS

A close study of the use and mis-use of air forces during and after the 1914–18 war revealed the need to emphasise the importance of the principle of concentration and of the method of applying air power in support of armies, known as ' isolation of the battlefield '. If an air force were to be able to obtain air superiority and to use this in providing the maximum degree of air support, it had to be centrally controlled and free to operate essentially on the offensive. Only by this means could the air effort be concentrated upon one task at a time and the foremost of these tasks (in air support) was to exclude the enemy's supplies and reinforcements from the battle area.

Unfortunately in Europe in 1940, the Allied armies were hopelessly outclassed by the Germans and the Royal Air Force was so outnumbered and the task so great that its only victories were scored at Dunkirk and over England where the narrowness of the battle area and the backing of an efficient control organisation made possible an effective concentration of effort. The German Army and Air Force were expressly designed for a *Blitzkrieg* on land (at the purposeful sacrifice of a strategic air force) and, when faced with this closely integrated combination, the British soldier not unnaturally looked to the Royal Air Force to provide the air counterpart.

Britain of the late 1930's was obsessed with the need to provide against a knock-out blow from the air and during the late summer of 1940 she was well pleased to have a strong air defence. On the other hand, the Allies took the field with only a sketchy organisation for air support and it was owing to the disruption of the British Army in the field, that England was left largely dependent upon her Air Force and Navy for defence against threatened invasion. The exclusive priority accorded to security and offensive air operations was justifiable so long as Britain was prepared to stand behind the English Channel. It was a different matter when the British Army took to the field, for to do so without an adequate organisation by air support was to court disaster.

Furthermore, views were conflicting on the method of employing the heavy bomber force. The Air Staff wanted to get on with the strategic air war against oil targets and marshalling yards within Germany (particularly in the Ruhr), which was one means of applying indirect support. On the other hand, the Army was keen that the effect of bombing should produce more immediate results and argued in favour of direct air support. For this purpose a light bomber force was already available and in accordance with the current view could be directed against even ' close ' support targets should a critical situation, a pursuit of the enemy or an Allied ground attack, demand such action. In 1940, on the Continent almost the whole of the light bomber effort by day was directed against targets within forty miles of the front line and to this was added about twenty-five per cent of the heavy bomber effort. But beyond this distance the heavy bombers were divided almost equally between communica-

tion and strategic targets with the result that an already inadequate force was divided in its purpose. The first principle of war (maintenance of the aim) appears to have been broken and this fact should not be obscured by the argument that in any case the available air forces were inadequate for the occasion.

With the Army committed to battle the War Office was quite justified in demanding air support and the onus for the provision of this fell on the Air Ministry which was required to organise the limited resources of the Royal Air Force so as to meet all justified demands. The Army wanted a specific allotment of aircraft, including a bomber specifically to provide ' close ' support, but the Air Ministry was adamant on its purpose of resisting any suggestion that would prejudice the concentration of the force (by breaking the Air Force down into ' penny packets ' or by unjustified specialisation). To achieve concentration, the air force had to be under centralised control and had to be as flexible as possible and it was correctly stated that existing types of aircraft would be able to provide all the support necessary provided a suitable control organisation was evolved. Furthermore, the German dive bomber was a success only so long as it was able to operate in an atmosphere of almost complete air superiority (with few opposing A.A. guns) and such an air situation was rarely to be achieved.

Most of the operations of the Royal Air Force in support of the Army took place behind the enemy lines, well removed from the sight of the soldier on the ground. Consequently in times of stress, the soldier was inclined to the belief that he was being asked to shoulder more than his just share of the burden. This erroneous belief was due to lack of knowledge of air methods and operations, and it was not until late 1941, that the demands for additional protection (and if possible a special allotment aircraft under army control) were quashed by the Prime Minister.[1] His directive then fixed the relationship between the two services and placed on the Army the onus for its own protection (by A.A.) against attacks by enemy aircraft.

The term ' Air Component ' became obsolete with the Prime Minister's ruling of October 1941 that the Air Commander should primarily concern himself with strategic operations until a ground battle was in prospect and that he should then turn his attention to the furtherance of the Army Commanders intentions. The narrow term ' Army Co-operation ' gave place to the broad term ' Air Support ', provided by all kinds of fighter, bomber, transport, coastal and reconnaissance aircraft. Every conceivable and economic means of air power was made available to the Army and this was made possible by the retention, under the Air Commander-in-Chief, of the whole available Air Force. In addition to Area, Strategic and Functional Commands the policy was adopted of controlling tactical operations through Tactical Headquarters situated alongside the appropriate Military headquarters.

In France, in 1940, there was no thorough integration of the national forces or of their staffs and the debacle was followed by a demand for a guaranteed allotment of aircraft for air support ; but the provision of air support in the

[1] A.H.B./IIJ1/183/271(A)-(B).

Middle East was less obscured by the long term fruits of a strategic air war and the joint Commanders were more readily able to focus their attention upon the immediate requirements of the battles on land. It was in fact during the Campaigns in Egypt and Libya that the foundations of an efficient air support organisation were laid. The recurrent problems of Ground/Air Identification and Mobility were studied and experiments carried out which resulted in considerable improvements. Perhaps one of the most important landmarks was the setting up of a Combined Army/Air Headquarters. This took place on 16 November 1941 immediately before the opening of the Crusader Offensive.[1]

The attack of shipping in the Mediterranean and bridges in Italy and North-West Europe was of decisive importance when coupled with attacks upon ports, base installations and dumps, railway lines and rail and road movement, and when the Army was prepared to force the issue by strong offensive action on land. Shipping, river and coastal craft were attacked mainly by light bombers and fighters whilst bridges, ports, bases and dumps were attacked mainly by medium, light and fighter-bombers. Railways forward of bridge damage were subjected to effective interdiction by fighter-bombers which made series of cuts in the lines themselves and rail and road movement was attacked by fighters by day and by light bombers by night. The railway repair organisation, rolling stock and locomotives at railway centres were attacked by medium and heavy bombers. The attack of railway targets at rail centres was fundamentally a long term project designed (with the overall effect of damage to railway equipment) eventually to paralyse the railway communications system.

The attack of headquarters and signals centres was an effective means of disrupting the enemy control organisation just prior to or during a ground battle ; and the bombing of battery sites and the attack of coastal radar stations by bombs, R.P. and cannon were effective ways of neutralising a considerable portion of the enemy defence system prior to an assault landing. A more difficult problem was that of meeting the requirement for support against targets on the battlefield for although the artillery was the primary bombardment weapon close to the front line there were occasions when an air effort was indispensable. This could occur in defensive or offensive operations when insufficient artillery power was available to take on the numerous targets offered, or when targets were beyond the reach of artillery owing to intervening features such as hills ; or when artillery was out-distanced during a pursuit. In all these instances it was essential to provide a means whereby forward ground forces could notify their requirements to a central control, and to provide a means of ground recognition whereby the attacking aircraft could engage close objectives without unnecessarily endangering the troops.

The first requirement was met by the Air Support Control and later the Air Support Signals Unit. With these systems the forward Army formation passed their requests for support over an army ' tentacle ' net to Army/Air Headquarters where the necessary executive action was taken through a detached Control Centre. This Control Centre was located near the fighter, fighter-bomber and reconnaissance airfields and was therefore able to maintain good

[1] *See* Chapter 4.

communications for the control of aircraft. It also co-ordinated the plots received from radar stations and wireless units, provided information for a Gun Operations Room, and operated the advanced radar stations as forward fighter controls or forward director posts. On the other hand, it had no intrinsic means of assisting support aircraft to their objectives until late 1944, when the Mobile Radar Control Post was first introduced into the Royal Air Force.

The second requirement, for a means to assist in the location and recognition of ground targets had therefore to be met by additional expedients. The basis of these systems comprised the notification of a bombline which indicated to all concerned the expected position of forward troops two hours in advance, and of special bomblines for specified occasions. This was done over the Air S.C./A.S.S.U. net and in general it catered satisfactorily for attacks made as a result of air reconnaissance. Furthermore, recognition in mobile warfare was assisted by the marking of Allied vehicles with Royal Air Force roundels or the American five-pointed star. It did not, however, cater for attacks against close support targets in difficult country or by forces, such as the strategic air forces, which were either not specifically trained for the type of operation or flew too high to be able to recognise their targets.

In the case of tactical air forces operating over difficult country or well in advance during a pursuit, the basis of control against targets reported from the ground consisted of the Visual Control Post or Contact Car or Tank. These operated as combined tentacles and Visual Control Posts, which could take up positions on a good observation point in suitable country and could, if necessary, control a whole ' cab-rank ' of fighter-bomber aircraft on to a target. When vantage points were not available, control could be exercised ' blind ' by the use of gridded mosaics and maps and under these circumstances the control post was known in North-West Europe as a Forward Control Post. In Italy the Forward and Visual Control Posts were known as Rovers.

Rover, however, was not developed until the autumn of 1943 and before and after that date much reliance had to be placed on visual signals displayed from the ground. These included ground strips, ' V ' indicators formed by tins of burning petrol, smoke and smoke shells. Fluorescent panels, radio beams and finally radio aids such as Shoran were also developed, and the majority of these devices were employed during the crossing of the Senio River in northern Italy, when large heavy bomber forces took part.[1] In addition the aircrews of the heavy bombers were given special training and experience over the route and target area, but, even then, a number of casualties were inflicted on friendly ground troops.

The use of all the available aircraft to save a critical position on the ground was not questioned and during the German Ardennes Offensive the intervention of heavy bombers was most successful. However, in a ground offensive, the heavy bombers could be usefully employed on the battlefield only if the ground forces would remain sufficiently far forward and, after the bombing, attack in sufficient strength to overcome the objective before the defenders had time to recover from the numbing effect of the bombardment. The joint task was not easy to achieve for although the Air Force could normally guarantee to do all

[1] *See* Chapter 5.

that was expected of it, the Army was by no means always able to complete its share of the task. In Italy and North-West Europe the most distressing instances of failure occurred at Cassino and Caen and in both cases the ultimate break-through was eventually achieved by flanking rather than frontal attacks. This state of affairs was partly relieved by the success of operations at Senio and against the Channel Ports but, in success or failure, the massed air attack on built up areas resulted in untold devastation and suffering, often to a friendly populace.

A third requirement, that was first encountered on a large scale during the North African landings, was for the provision of an organisation capable of supporting a combined assault across water. The technique was developed for the invasions of Sicily, Italy and Normandy and involved the provision of good intelligence about the forces to be overrun and the practicability of obtaining or constructing airfields on captured ground. Bases from which fighters could cover the assault convoy and beaches, and an organisation for the forward control of fighters from the sea and then from assaulted territory were also necessary. In addition to the above tasks the Air Force was responsible for the interruption of enemy communications, the provision of a high degree of air superiority (for security), the neutralisation of coastal defences and the launching of airborne operations.

Special features of the organisations were a central despatching agency for fighters, headquarters ships, fighter directing ships, seaborne radar, seaborne G.C.I for the control of night fighters over the assault area and a control centre with radar and wireless units to be landed as soon as possible to take over control ashore. The most difficult problem was that of limiting the fire of friendly anti-aircraft guns in order to provide safe heights and lanes for friendly aircraft.

The organisation for control provided for precise application of effort when and where it was required but it was also necessary to make the force mobile and flexible. To these ends rapid airfield construction was provided by the Army, units were organised to move on a two-party basis and were equipped with vehicles, squadrons were established on a servicing echelon basis, and technical developments increased the scope of aircraft. In particular the fighter, fitted with bombs or R.P. became a weapon of very great versatility and of foremost use for the provision of impromptu support. It was the most accurate of all air weapons and was effective against the smallest of targets, including the immobilisation of tanks and the destruction of bridges. Whilst, however, it was natural to use aircraft which had a high performance at low altitudes—such as the Mustang or the Typhoon—for direct air support operations, it was found to be uneconomical to develop a specialised aircraft for such duties. During the advance from El Alamein, No. 6 Squadron, which was equipped with Hurricanes fitted with 40-mm. cannons, travelled some 2,000 miles in four months. Yet the squadron only operated for about a week during which the damage to aircraft was very heavy.

It is unnecessary to emphasise here the importance of securing general air superiority (so that local air superiority may be easily achieved) to ensure the success of support operations but it is perhaps interesting to note that this

factor was appreciated as early as 1911.[1] The principles which govern the use of air power such as concentration and flexibility may also of course be applied to air support. Air Support, however, has its own peculiar problems some of which have as yet been incompletely analysed or resolved.

In particular there is the question of morale. It was frequently asserted by Army Commanders that continuous or concentrated bombing resulted in a low morale in enemy troops, even when such bombing was judged to be uneconomical in terms of material destruction of the enemy's fighting equipment. To some extent at least this claim is substantiated by the captured diaries of enemy units and soldiers. It was also held that this bombing, particularly when it was carried out in daylight and in view of our own troops, resulted in a corresponding rise in morale of our own troops. It is impossible to assess the importance of morale with the same precision which may be afforded in the case of material losses but it is certain that low morale gravely impairs the efficiency of fighting troops and that air action was often responsible for such a lowering of morale.[2]

Both the terrain and the weather could easily prejudice the success of air support. The dense jungle country in Burma, for example, made it exceedingly difficult for pilots to find their targets. At the same time it was often the terrain which caused new support tactics to be developed, as when the reverse sides of hills (from the point of view of our own troops) were attacked during the battle of San Fortunato.[3]

The development of air support during the war was partly a matter of technical progress. The greatly increased standards of performance of aircraft, the development of radio aids of all kinds, the introduction of cannons and later rocket projectiles—these things improved the effectiveness of the air support organisation as they benefited the Royal Air Force as a whole. But the increased co-operation between the Army and the Royal Air Force was equally important. This was achieved not only by very much better liaison between the two services but also by a better understanding of the particular part the Royal Air Force could play in joint air and ground operations.

1 Captain Bertram Dickson's memorandum to a sub-committee of the Committee of Imperial Defence 1911. Quoted Walter Raleigh. *The War in the Air, Vol. I*, pp. 175–176.
2 A.H.B.6 Translation VII/73. *See also* A.H.B./IIJ1/90/246, Appendix 'H'.
3 *See* Chapter 5.

APPENDIX 1

THE CONTROL OF AIR SUPPORT [1]

The results of the trials held in Northern Ireland during the autumn of 1940 are set out below.

Support

Two forms of bombing were to be used to give direct assistance to Armies in the field, and were defined as follows :—[2]

(*a*) *Direct Support.* The isolation of the battlefield by air forces.

(*b*) *Close Support.* The intervention of air forces in the battlefield itself—no distinction was drawn between action in the battlefield as applied to the ' defence ' and action off the battlefield but within the zone of active operations as applied to the ' attack and pursuit '.

It was foreseen that in practice there might be no clear dividing line between the two types of support, and that both would probably have to be provided by the same force of bomber aircraft. The broad distinction, however, existed that direct support could be planned before the battle and applied as the result of reconnaissance behind the enemy's lines, whereas targets for close support would probably have to be indicated by forward troops who alone would often know what should be attacked from the air. The forward elements, therefore, had to have a means of indicating targets and the air forces had to be so organised as to be able to respond quickly and effectively.

The right applications of close support therefore required a clear understanding of the characteristics of bombers, which were described as follows :—

(*a*) *Flexibility.* It was possible for the whole bomber effort to be concentrated at short notice on a particular portion of the front. To make the best use of this flexibility some form of centralised control was desirable.

(*b*) *Form of attack.* As had been demonstrated repeatedly in attacks employing dive-bombers against objectives within a strong and well organised fighter and ground defence system, the attacker had suffered heavy casualties owing to the inherent vulnerability of the Ju.87. For this reason it was unlikely that steep dive-bombing tactics would always be the best method for close support. The shallow dive or level attack might prove to be more effective and the type of aircraft envisaged for the close support role would therefore be capable of carrying out either type of attack. It was also to be suitable for medium distance bombing which, as a corollary, indicated that squadrons employed in medium distance bombing (or direct support) could give close support if necessary.

(*c*) *Range.* The support from aircraft would need to be generally reserved for employment on targets which could not be effectively engaged by artillery. For this reason close support was to be mainly in support of armoured and mobile Divisions, combined operations and highly mobile operations.

(*d*) *Accuracy.* The accuracy was less sure than that of artillery, neither did it increase as the bombardment proceeded.

(*e*) *Vulnerability.* Since aircraft were more vulnerable and less easily replaced than artillery, economy in their use against well-defended positions had to be exercised. This did not mean economy in numbers applied to the objective, but economy by application to the right targets at the right time.

(*f*) *Element of doubt.* Support which had been ordered, could not always be guaranteed as it could be interrupted by weather and a number of other factors.

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[1] A.M. Files C.S. 5943, Encl. 48a and S. 7106, Encl. 20a

[2] The extensive use of front gun fighters was not yet feasible and rocket projectiles were as yet unknown.

(*g*) *State of readiness.* It was uneconomical, as well as impracticable, to keep all aircraft constantly in a state of readiness to take off. It was estimated that not more than an average of one third of the bombing aircraft could be immediately ready to take off, except for a pre-arranged initial effort. In order to reduce the time spent in bombing up, it was recommended that only one, and not more than two, normal bomb loads be used for other than pre-arranged operations.

(*h*) *Fluctuating effort.* The bomber effort would decrease as casualties occurred, and vary according to the interval which elapsed between the engagement of one target and the time aircraft became available to engage the next. Although, therefore, the bomber support available could be assessed with some accuracy on the basis of the first sortie of each aircraft, the support available for further sorties would be initially an unknown factor.

(*i*) *Protection.* The organisation had to provide a means for getting protection at short notice for bombers carrying out close support roles.

(*j*) *Uncertainty as to Time.* Unlike artillery there could be no absolute certainty of the time when aircraft support would be given. Various factors might cause delays. On the other hand it was most undesirable that aircraft should circle over a target waiting for ' zero hour ', and it followed that close support had to be given within admissible time limits.

(*k*) *Weight of attack.* Unlike artillery in which volume can be obtained largely by ammunition expenditure, the weight of a bombing attack depended upon the number of aircraft employed. Centralised control was therefore essential in order to develop an adequate weight of attack to overcome the more serious obstacles.

(*l*) *Effect of bombardment.* It was desirable that commanders should have some ' yardstick ' whereby the effect of air bombardment might be measured in artillery terms. This would come as a result of experience and could not be laid down precisely. Again, weather, strength of defence, type of bomb, target and bomb load were influencing factors. As a very rough guide, subject to revision, it was reasonable to assume in the case of aircraft carrying a bomb load of 16–40 lb. bombs, that the effort of one attack by a single aircraft might be equivalent to four salvoes from an eight gun battery of 25 pdrs., and that attacks from a flight and a squadron might be the equivalent of battery concentrations of five and ten minutes respectively. The effect on morale of consistent bombing attacks was known to be great, particularly if the enemy had already been shaken, or if the attack was closely followed by other forms of attack. Similarly the effect on morale of the attacker was increased by the knowledge that air assistance could be obtained rapidly and surely.

The characteristics of the weapon being thus described, it was next necessary to consider the basic requirements of the Army which the system should aim to satisfy. These were as follows :—

(*a*) The interval between calling for and obtaining support had to be reduced to a minimum.

(*b*) The local commander calling for support had to know as soon as possible if and when it would be forthcoming.

(*c*) It was desirable that the local commander should know in advance whether his demands were likely to be met.

(*d*) As local commanders would always want the maximum support available and could not know the general air situation, the scheme had to ensure that, as far as possible, demands were limited to the minimum vital need.

(*e*) When support was given the concentration had to be adequate.

(*f*) It was unlikely that any headquarters in rear of Brigades would be in a position to detail actual targets to be engaged at short notice, and the scheme therefore had to be designed primarily to deal with the requirements of lower formations.

The simple solution to direct allotment of specific squadrons to forward Brigades was clearly unacceptable and some form of centralised bomber control between forward units and airfields was therefore essential for the control and allocation of tasks to the squadrons involved. It was proposed to meet these requirements as follows :—

(*a*) The close support aircraft would probably be placed under a Close Support Group Headquarters. (This later became the Tactical Group embodying fighters, fighter-bombers and reconnaissance aircraft).

(*b*) The Group Headquarters was to have the means of sending forward mobile equipment and personnel for one or more mobile advanced combined headquarters known as ' Close Support Bomber Control ' (to become later a distinct Royal Air Force control unit known as the Group Control Centre). Later developments were off-shoots of the Control such as Forward Director Posts and Mobile Radar Control Posts.

(*c*) In the initial plan it would therefore be necessary to decide whether to :—

(i) Keep the Close Support Control adjacent to the higher headquarters, allotting the bomber effort in weight of support rather than by squadrons.

(ii) Allot the whole effort to a subordinate formation, in which case the control would be established adjacent to the headquarters of that formation.

(iii) Divide the bomber effort by squadrons and to establish two such controls.

(iv) Allot the bomber effort by weight of support as in (i), but to establish a single control adjacent to the subordinate formation most affected.

(*d*) Signals communications were to be provided as follows :—

(i) *By the Royal Air Force.* Direct wireless links between the Control and each airfield with which it dealt, on the basis of one set at Control for each three airfields controlled.

(ii) *By the Army.* One set with each forward formation to which, for an operation, it was decided to sub-allot authority to call for air support. These forward sets were to be known as ' tentacles ' and the Control was to have one set for every three tentacles. It was decided that when an Army formation was in direct touch with an airfield it would provide both ends of the signals link.

(*e*) At each Control there was to be an Army Staff Officer who would, in emergency, represent the Army Commander at Control when direct touch was lost with his headquarters.

(*f*) Tentacles were to be sub-allotted in bulk to lower formations for a given operation and could be further sub-allotted as necessary. This sub-allotment was not normally to be below Brigades of infantry or Regiments of the Royal Armoured Corps.

(*g*) It was not expected that one Control could handle more than nine tentacles and six airfields.

The essence of the problem was clearly a matter of speed and certainty in the provision of close support. Certain factors, such as visibility, enemy defences and recognition could be more readily appreciated than countered, but nevertheless it was possible to devise a workable system providing adequate communications, airfields, and aircraft were available.

Basing aircraft close behind the front line would reduce the distance between forward and rearward links and thus make communications less difficult. The Wann-Woodhall report suggested a minimum range of 50 miles for the tentacle wireless and 75 miles for the airfield wireless. All W/T equipment was to be fully mobile and it was recommended that airfields should be provided with a minimum of two channels of communication. Line communications were to be provided wherever possible

from Control to Group Headquarters and to the military commander fighting the battle. This was later simplified by siting the Group and Army Headquarters alongside. The intention was to introduce V.H.F. R/T communication between Control and close support aircraft as soon as the equipment became available.

The siting of airfields well forward would also reduce the time taken in flying to the chosen targets, and from the wireless ranges contemplated it may be assumed that the maximum distance considered was in the order of 100 miles. Trials had disclosed that at this range the time lapse between the time of origin of a request for assistance and the time of arrival of the aircraft would be in the order of an hour and a half. Another advantage of keeping the airfield well forward would be that aircrew would be well aware of the operations in progress and could thus be expected to locate and identify targets more easily.

In these circumstances, however, operational bases were often likely to be hastily prepared grounds of limited size where the facilities for maintenance and handling aircraft would be somewhat rudimentary. Aircraft would therefore need to be such that they could be operated in these conditions without difficulty.

The application of this system incorporated simplicity and variability to meet particular requirements. The first responsibility was naturally that of the higher commander in deciding the allotment of bomber effort to any particular sphere of operations and the subsequent readjustment of this allocation as necessary. The provision of fighter cover was to be a function of the Group Headquarters Staff, but a need was foreseen for the final executive order to be issued from the Control direct to the fighter airfields.[1]

The lower formations to which tentacles were allotted were to indicate their requirements to control by brief signals including the following information :—

(*a*) *Estimate of sorties required.* This required knowledge of the type of aircraft and the weight and type of bomb load.

(*b*) *Target.* Brief description and map reference.

(*c*) *Time.* A period of time was normally to be stated within which support was needed and after which aircraft were not to bomb.

(*d*) *Bomb line.*

As a general rule the only targets selected were to be those on which bombing would have a definite effect on the battle and which could not be adequately engaged by other means. Concentrated and relatively stationary targets were most suitable and dispersed or rapidly moving columns were not. The recognition of targets had to be easy from either high or low level under the prevailing conditions of visibility and enemy defences, and a margin for the security of our own troops had to be allowed in fixing a ' bomb line ' behind which bombing was not to take place. A suggested system for trials was the placing of white cloth arrows fifteen feet in length with bars each indicating 500 yards to point out targets and indicate our own positions.

A first requirement of the Control was that it should make certain that, as far as possible, tentacles were not left in doubt as to the availability and extent of support on which they might call. Furthermore, discretion would have to be exercised on occasion in responding to or rejecting demands, and it was for this reason that the Control was given a combined Staff and was best located adjacent to the headquarters of the Army formation most concerned with the battle. In either case, a request from a tentacle was to be answered at once as to whether or not support would be sent. The acceptance of a request was to be followed by the issue of executive orders to the airfields selected for the task and the remainder of the responsibility then rested with the airfield concerned except for any amendment to the order and the provision of

[1] Simplified later by the inclusion of both fighters and fighter-bombers in the Tactical Group of which the precursor was the Composite Group combining fighters, bombers and reconnaissance aircraft.

fighters. Any tendency to regard the Control as an Air Intelligence centre was to be deprecated and drastically discouraged, for the Staff and communications system would be fully engaged with the receipt and issue of requests and orders. Consequently air intelligence from airfields was to be passed direct to Group Headquarters from whence it would be passed to Control when the line facilities allowed.

At airfields, briefing was best carried out in the operations room close to which the aircrews were at readiness in their rest room. Maps most suitable were those of the same scale and marked with the same grid as those in use by the Army formations. It was considered that R/T or telephone briefing to dispersal points was considered unsatisfactory owing to the delay and misunderstanding which might arise.

This system was clearly adaptable to several other methods of supplying air support which could be brought into force to meet special circumstances such as might occur if ground formations were experiencing difficulty in defining centres of opposition or when special assistance was needed for the operation of armoured formations. These variations were foreseen as follows :—

(*a*) *Bombing by judgement.* This form of bomber support might afford timely and valuable assistance, but it carried the risk of misapplication and therefore had to be based on a directive from higher headquarters. The Control would indicate to airfields the aim to be achieved, the target area, and the period of attack and the objectives would then be found by bombers and attacked.

(*b*) *Bombing as a result of air reconnaissance.* Air reconnaissance ahead of leading columns was to be provided whenever possible and the results were to be passed by normal means (or perhaps by wireless) from the air to forward formations. The leading formations to which tentacles were allotted would therefore be able to make full use of this information and could make it the basis of requests for air support. If the information available should prove insufficient on which to direct bombing it was suggested that the Control might then arrange for additional reconnaissance and order close support bombing as a result of the further information obtained.

(*c*) *Bombing as a result of R/T instructions received in the air.* This system had to await the provision of V.H.F. R/T, but it was forseen that aircraft might then be ordered off the ground to rendezvous by pre-arrangement in anticipation of precise orders being transmitted from either the tentacles or the Control.[1]

A further variation of the organisation was proposed for the special support of armoured formations in which a composite force of bombers, fighters and reconnaissance aircraft was to be employed. Control was to be exercised from a small mobile operations room, the equivalent of the Close Support Bomber Control, which was to move forward with the commander of the armoured Division conducting the battle, but would incorporate in its normal tasks the close co-ordination of fighter, bomber and reconnaissance aircraft.[2]

1 Later developments included a mobile Visual Control Post for this purpose.

2 Later developed as a Forward Director Post, a forward auxiliary of the Group Control Centre.

APPENDIX 2

ARMY TRAINING INSTRUCTION No. 6

This instruction, issued on 31 October 1941, set out the methods and organisation for air support that had been developed and agreed to that date. The forms of air support were categorised in the following order :—

(*a*) General air superiority was vital as it provided the conditions essential to free observation of the enemy, secrecy in our own preparations, and the prevention of enemy air forces from taking action which would adversely effect the course of a land operation.

(*b*) Provision of information whose value was in proportion of the speed with which it could be delivered to the military commander concerned.

(*c*) Attacks by bomber and fighter aircraft against strategical targets having a long-term effect on the campaign as a whole, and against tactical targets more closely connected with land operations, in addition to attacks on targets in pursuance of the policy of obtaining air superiority. These air support targets included the following :—

(i) Strategical : Docks, shipping, base installations, factories, and distant communications.

(ii) Tactical : Troops, vehicles, war materials, defiles, defended localities, headquarters, and communications ; all of which might be engaged either on a deliberate plan or in quick response to the requirements at any one time.

(*d*) Fighter cover for special operations when air superiority was not absolute.

(*e*) Airborne operations with gliders and transport aircraft for the carriage of troops, equipment and stores, and for the dropping of troops and/or supplies.

The responsibility of the Royal Air Force was visualised as including the provision of assistance by means of air formations placed under the Army and of formations operating under Royal Air Force control. The force under Army control was to be known as an Army Co-operation Force, which was normally expected to consist of aircraft of the fighter reconnaissance or bomber reconnaissance type. Thus provision was made for the Army to be supported by an air force under command which could provide reconnaissance together with Army air support, local fighter cover in an emergency, and assistance to the air forces not under Army control when not needed for military operations. A number of squadrons with their commanding officers acting as advisers, were likely to be allotted to Corps and armoured Divisions for tactical and artillery reconnaissance, while the remainder were expected to be organised into Wings or Groups to provide army air support.

The squadrons provided by the Royal Air Force outside the Army Co-operation Force were not necessarily to be expected to have practised attacks on fleeting targets near our own troops or to have trained with the Army, but would usually have been trained to operate on more deliberate methods involving the use of a carefully organised communications system, which inferred that their use against close tactical targets would need to be closely regulated. In addition to operations undertaken to further the campaign as a whole, it was to be expected, however, that these forces would be employed to assist the Army in the following ways :—

(*a*) By fighting for general air superiority in the theatre of military operations.

(*b*) By the attack of strategical targets prior to the battle.

(*c*) By the attack of permanent targets during the battle regardless of their location in accordance with a general joint army/air plan for a particular operation.

(*d*) By the provision in emergency of reinforcements for the Army Co-operation Force : in which case they would be placed under the operational control of the Military commander concerned—the operational communications being the responsibility of the Army Co-operation Force.

In any active theatre of war the Army contribution towards assisting the air forces in the performance of their tasks included the provision of secure bases from which to operate, information regarding the progress of the land battle, and all land lines and certain W/T communications between military headquarters and the R.A.F. Stations.

Visual and photographic reconnaissance by day and night were all possible requirements within the three main categories of reconnaissance :—

(*a*) Strategical reconnaissance under the control of G.H.Q. or Army Headquarters was normally to be carried out by long range fighters equipped with cameras in clear weather and by bomber types at night or under cover of cloud.

(*b*) Tactical reconnaissance under the control of Corps or armoured Divisions would, if the enemy opposition were strong, be restricted to short mission flights to obtain one or two definite items of information.

(*c*) Artillery reconnaissance was to be undertaken by Air Observation Posts as far as this was practicable. That which was beyond their powers was to be undertaken by the reconnaissance squadrons allotted to Corps and armoured Divisions.

Targets fell into three main categories, although no clear-cut distinction could be made and no comprehensive list could be given. Those of a ' strategical nature ' were not necessarily to be expected to affect the military operations immediately, and were normally to be engaged by the main air force on the orders of the A.O.C.-in-C. in accordance with the strategical plan of campaign. ' Tactical targets of a permanent nature ' either on or off the battlefield were to be attacked deliberately according to a pre-arranged military/air force plan, normally by the main air force but also by squadrons of the Army Co-operation Force if this could be done without prejudice to the engagement of opportunity targets. The military situations thought likely to benefit from the attack of permanent tactical targets were as follows :—

(*a*) In the initial stages of a deliberate attack when adequate close support could be provided by the artillery, the air effort was to be used to isolate the battlefield by the attack of such targets as headquarters, reserves and concentrations beyond artillery range.

(*b*) In defence, to cut the enemy off from further reinforcements and to attack ammunition dumps and stores in order to delay and hinder his offensive.

(*c*) During an orderly withdrawal in order to prevent the repair of engineer demolition.

The third category was the opportunity target which was intimately connected with the operations in progress and was to be attacked by aircraft of the Army Co-operation force, or by squadrons of the main air force detailed to provide army air support and was to be selected during the course of the battle at the A.A.S.C. The types of military situation thought likely to require this form of assistance were as follows :—

(*a*) An attack against hastily organised defences when the effect on enemy morale might be decisive and when A.A. opposition might not be serious.

(*b*) During the break-through, after an initial land attack, when artillery fire was outdistanced by the advancing troops and air support would be invaluable. Reserves were to be kept for this purpose.

(*c*) During a pursuit, against defiles, villages (to block roads), and enemy columns especially where they were congested owing to road blocks.

(*d*) During an enemy break-through or a hasty withdrawal of our own troops when it might become advisable to intervene within close proximity of our own troops in order to provide material and morale assistance, rather than to concentrate upon the wider and normally more effective task of attacking more distant targets.

The headquarters of the Army Co-operation Force was to be adjacent to G.H.Q. and provided with land lines to subordinate formations during static operations. For mobile operations one or more A.A.S.Cs. were to be available to accompany the headquarters of the formation to which squadrons were allotted. It was the duty of the A.A.S.C. to implement the decisions of the military formation commander in respect of air effort, the allocation of air effort to a sector, and the phasing of the air action. Air attacks ordered by the A.A.S.C. against suitable targets revealed by special reconnaissance, normal reconnaissance, military sources, or tentacles, were to be as heavy as reserves would permit and were to be repeated and sustained, if necessary, until the desired effect was achieved. The decision to use fighters or bombers depended upon the nature of the target as, for instance, in the case of troops dug in or in buildings which were more likely to be vulnerable to bombs than machine guns, troops or M.T. on the road which were generally more vulnerable to attack by fighters, and deployed A.F.Vs. which could only be expected to succumb to cannon fire.

The use of special reconnaissance and normal reconnaissance as a means of selecting opportunity targets depended upon the quick receipt by the A.A.S.C. of the information obtained, and for this purpose a listening set at the A.A.S.C. and line communications through Corps to the reconnaissance control set were to be provided. By means of suitable wireless communications between air support aircraft and the A.A.S.C. or tentacles it was also thought possible to brief pilots in flight, amend or confirm orders and thus reduce time-lag.

Considerable agreement had also been reached on the nature of targets which could usefully be attacked either on or off the battlefield. Those on the battlefield were now tabulated as follows :—

(*a*) Headquarters and signals offices.

(*b*) Defended points such as villages and woods.

(*c*) Crossing points of obstacles, bridges, bottlenecks.

(*d*) Concentrations of transport and A.F.Vs. especially at bottlenecks where diversion was difficult.

(*e*) Movements of reserves.

(*f*) Artillery positions.

The attack of more distant targets with the object of isolating the battlefield included all forms of communications and had to be co-ordinated and based on the enemy's system of supply, so far as it was known. Some considerations on the vulnerable points in communications were shown as follows :—

(*a*) *Headquarters and signal communications.* To obtain useful results it is necessary to attack the centres of communications. Effective attack on both distant and near headquarters may paralyse the enemy's activity and, if co-ordinated with the land attack, may have decisive results on the operations.

(*b*) *Rail communications.* The greatest dislocation is secured by attacking vital junctions every few days. Railways are not an easy target and attacks must be made in sufficient strength to ensure that damage is inflicted. This is applicable to the period prior to active operations, provided the targets attacked do not disclose the area in which the offensive is being prepared.

(*c*) *Road communications.* Generally speaking these are not good targets being hard to hit and diversions can be made. When travelling at a low density M.T. offers a poor target to the bomber. Low flying fighters may

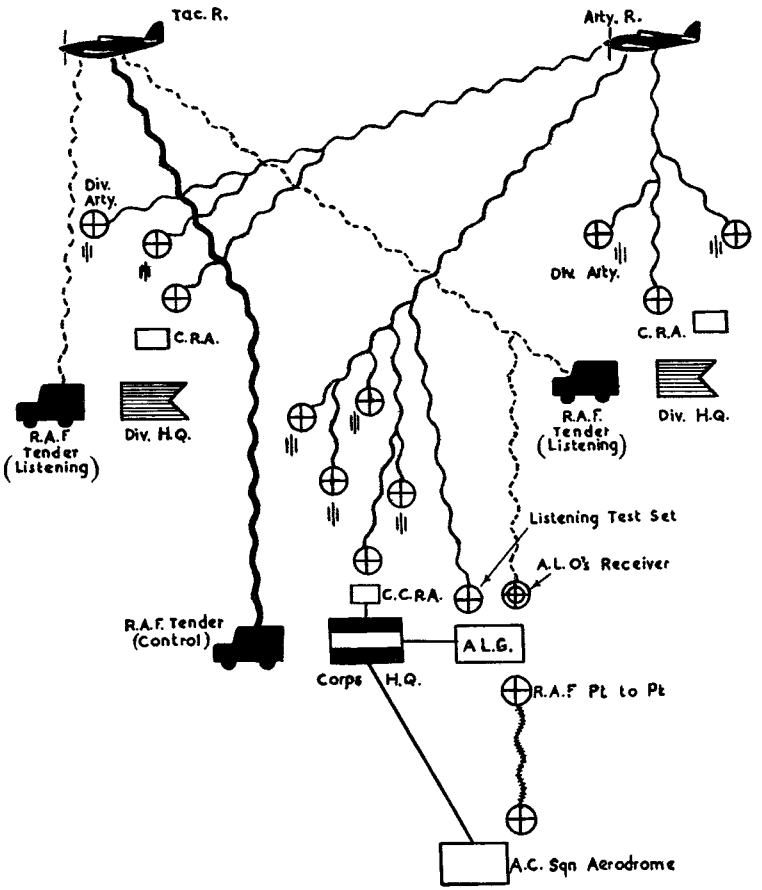
prove effective, but their employment on this role must be weighed against other demands they may have to meet. The point selected for attack should be a stretch of road where repair is difficult and detour facilities poor. Bridges are the most favourable targets from this point of view, but it must be expected that enemy anti-aircraft defence will be at its most effective at such vulnerable places. When all main routes in an area are filled to capacity the attack on roads in towns which form bottlenecks will be the best means of dislocating road movement. Hits on houses bordering the road will cause rubble to obstruct the road and delay traffic without the necessity of obtaining a direct hit on the road. The plan should aim at causing a number of blocks simultaneously so that diverted traffic becomes congested on the routes that remain open. Attacks may then be made on the traffic itself and, if the air situation permits, machine-gun attacks by fighters can prove most effective.

(*d*) *Water communications.* Air action against water transport, whether by sea or land, is most effectively directed against docks and other points of transhipment. These targets are well suited to night attack.

(*e*) *Air communications.* The main responsibility for harassing air communications rests with fighter aircraft which can attack transport in the air and on the ground. Bomber attack on aerodromes which form the terminus of an air transport system is usually unprofitable unless there are no alternative landing grounds. If the enemy is limited to a few aerodromes it may be possible to render them temporarily unserviceable and to damage aircraft without undue bomber effort but usually the effort will be more usefully employed against other targets. Machine gun and cannon fire are more effective against dispersed aircraft than bombing.

The transfer of tentacles between formations during battle was rarely desirable and consequently the initial allotment either had to allow for a reserve or had to be on a basis that would not require re-adjustment. This allotment was normally on a scale of one tentacle to a Brigade of infantry, and, in the case of armoured Divisions which had better internal W/T communications, on the basis of one 'active' tentacle at Divisional Headquarters. When not being used for their primary tasks tentacles could be used for passing information provided no message exceeded five minutes, as otherwise a demand for air support from one of the other tentacles on the same frequency might be delayed unduly.

A.T.I.6 DIAGRAM TO ILLUSTRATE RECONNAISSANCE CHANNELS OF INTERCOMMUNICATION BETWEEN CORPS AND R.A.F.



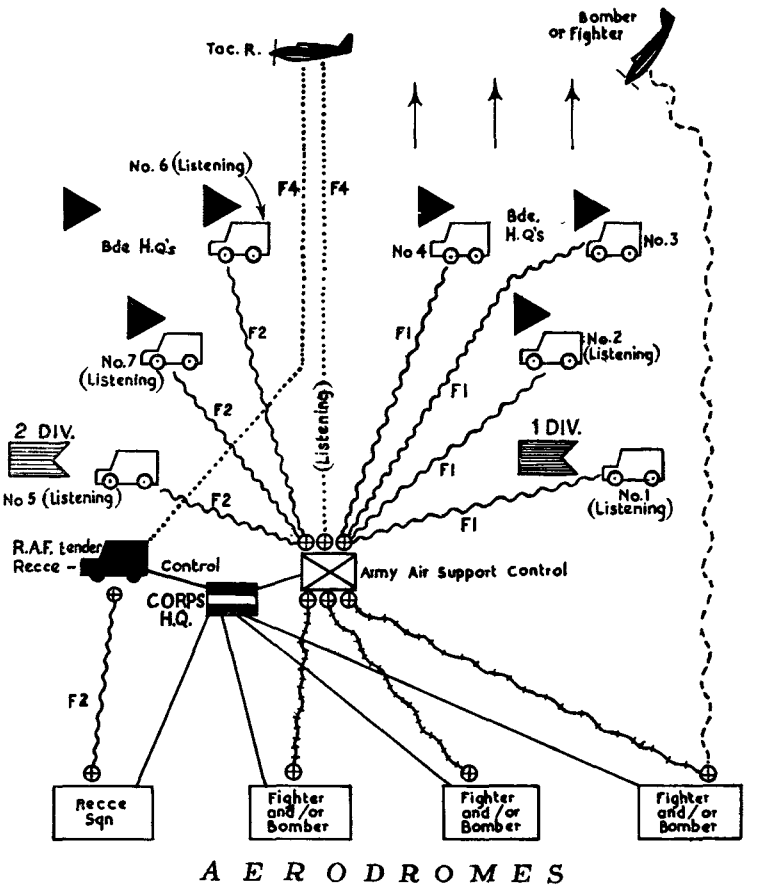
L E G E N D

TWO WAY R/T.	
ONE WAY R/T.(AIRCRAFT TO LISTENING SETS)	
ONE WAY W/T.(AIRCRAFT TO BTY GROUND STAS)	
R.A.F. PT TO PT W/T. OR R/T.	
LINE (USUALLY LAID BY CORPS SIGS.)	

NOTES :—

1. LISTENING TENDERS ARE NOT NECESSARILY ALLOTTED TO DIVISIONS.
2. ONLY ARTILLERY DETAILED TO ANSWER AIR CALLS (BY FIRE) WILL BE LISTENING TO ART-Y 'R'.
3. A.L G. ESTABLISHED ONLY IF AERODROME TOO FAR FROM CORPS H.Q. FOR RAPID INTERCOMMUNICATION AND VISITS.

A.T.I.6 DIAGRAM TO ILLUSTRATE ARMY AIR SUPPORT CONTROL CHANNELS OF INTERCOMMUNICATION



LEGEND

TWO WAY R/T OR W/T ARMY	
TAC.R AIRCRAFT TO GROUND	
BOMBER OR FIGHTER AIR TO GROUND	
TWO WAY R/T OR W/T RAF	
LINE (ARMY SIGS)	
FREQUENCY	F1, F2 ETC.
TENTACLE TENDER	No.1 ETC

NOTES :—

1. SEVEN TENTACLES SHOWN.
2. MAIN AIR ATTACK ALLOTTED ON 1st DIVISION FRONT AND ONLY Nos. 3 AND 4 TENTACLES ARE ACTIVE.
3. NORMAL ARMY COMMUNICATIONS AND TAC. R.A.F. TENDERS (LISTENING) ARE NOT SHOWN.
4. FUTURE EQUIPMENT MAY ALLOW FOR R/T FROM BOMBER OR FIGHTER AIRCRAFT TO A.A.S.C.

APPENDIX 3

THE PROTOTYPE CLOSE SUPPORT BOMBER CONTROL[1]

The Prototype Close Support Bomber Control which was introduced in January 1941, was provided with the following communications :—

(*a*) By the Royal Air Force

(i) Two W/T channels from Control to bomber airfields.

(ii) One V.H.F. R/T channel from Control to Bomber aircraft (to be provided later).

(iii) One W/T channel from Control to Fighter Group Headquarters.

(*b*) By the Army

(i) Three W/T channels from Control to nine tentacles (range about 35 miles).

(ii) One landline channel to Bomber Group Headquarters and one to military Headquarters whenever possible.

The layout of the signals equipment at Control was governed by the factors of mobility, rapid communications between wireless receivers and the operations room, and vulnerability from the air (size and number of vehicles were reduced to a minimum and items were to be dispersed to provide protection against aircraft and to avoid interference between transmitters and receivers). All vehicles were therefore prime movers, receivers were placed in the operations room vehicle, and transmitters (placed a quarter of a mile away) were remotely controlled from the receiver positions. In addition a petrol-electric generating set (7.K.V.A.) was placed in a three ton tender two hundred yards away from the operations room for the provision of 230 volt lighting and heating, and charging facilities.

The operations room consisted of a converted thirty-two seat coach fitted with accommodation for the army staff officers, the Royal Air Force Commander, a clerk, a signals officer and signals personnel. A telephone exchange switchboard was fitted so that land lines could be run from adjoining military and Royal Air Force formations ; and a large sloping mapboard, a blackboard, cupboards (overhead) and drawers were provided. In all, the personnel (including drivers, etc.) and vehicles required to run the communication system at Control consisted of :—

(*a*) *Army.* One signals officer, 26 other ranks, five trucks and five motorcycles.

(*b*) *Royal Air Force.* One signals officer, 27 other ranks, and six vehicles.

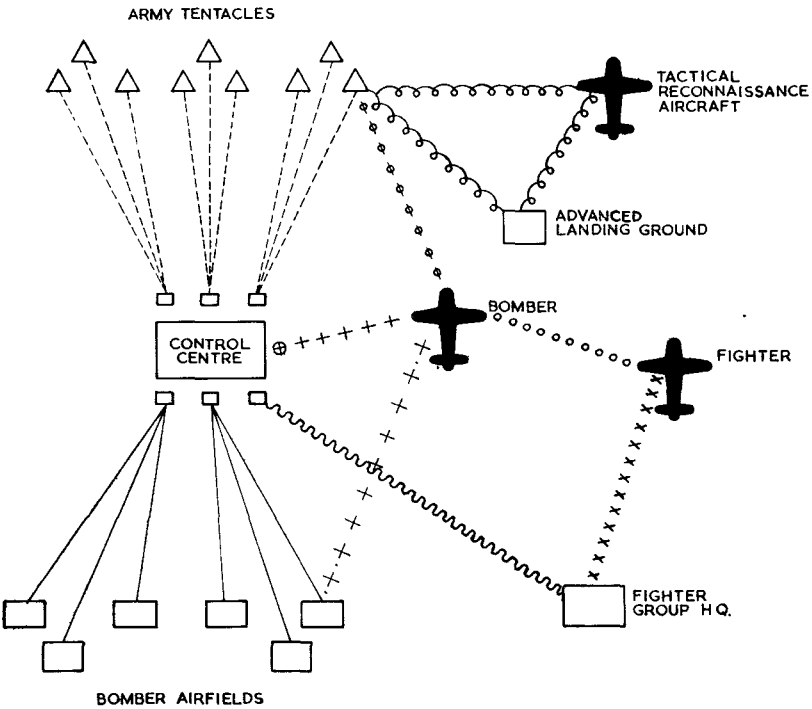
In addition provision was made for seven army detachments each of three other ranks and one truck was added. The total therefore became two signals officers, 74 other ranks, 12 main vehicles and five motorcycles exclusive of the Control staff and the V.H.F. equipment which was to be added later.

The Army was responsible for all forward W/T communications and all landline communications between the operations room and Army or Royal Air Force Headquarters. The Royal Air Force was responsible for all rearward W/T and R/T communications to aircraft, all equipment in the operations room (except for army receivers) and for the power vehicle.

[1] A.M. File S.7106, Encls. 28B and 43A.

ATTACHMENT 'A' TO APPENDIX 3

COMMUNICATIONS FOR CLOSE SUPPORT



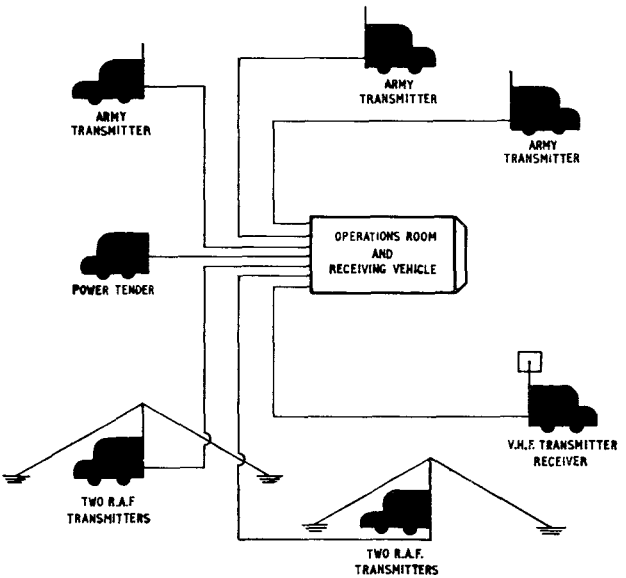
L E G E N D

(A) POINT TO POINT W/T.
- ARMY TENTACLES ------
- R.A.F. TO AIRFIELDS ——————
- R.A.F. TO FIGHTER GROUP H.Q. ∿∿∿∿∿

(B) AIRCRAFT COMMUNICATIONS V.H.F. R/T
- AIRFIELD TO BOMBER ·+·+·
- CONTROL TO BOMBER + + +
- ARMY FORWARD H.Q. TO BOMBER -o-o-o-
- FIGHTER TO BOMBER o o o o o
- FIGHTER GROUP H.Q. TO FIGHTER X X X X

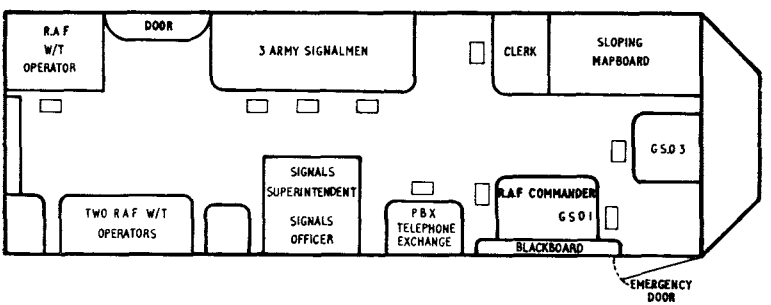
(REFERENCE :—A.M. FILE S.7106, ENCL. 28B)

SIGNALS LAYOUT OF THE CLOSE SUPPORT BOMBER CONTROL—1941



ALL VEHICLES 400 YARDS FROM OPERATIONS ROOM

LAYOUT OF OPERATIONS ROOM AND RECEIVING VEHICLE



NOTE :—THREE SUCH CONTROLS WERE FORMED EARLY IN 1941. TWO WERE FOR USE IN ENGLAND AND THE THIRD IN NORTHERN IRELAND. LATER IN THE YEAR A FURTHER TWO WERE PROVIDED.

(A.M. FILES C.S.5943, ENCL. 49A AND S.6512, ENCL. 64A.)

APPENDIX 4

TACTICAL AND ARTILLERY RECONNAISSANCE, 1941–1944

The unsuitability and vulnerability of the Lysander made it essential for a replacement aircraft to be found. As an interim measure it was proposed to supplement Lysander squadrons with fighter types for areas where Lysanders would be too vulnerable, but directly after 1940 there was little prospect of obtaining fighter types in sufficient numbers for the purpose. Consequently it was decided to re-equip the Army Co-operation squadrons with the American Vengeance and Bermuda dive bomber type aircraft which were no longer required as support bombers.[1] It soon transpired, however, that these types could not be obtained in early 1941 owing to low production in the U.S.A. and attention was switched to a quantity of Tomahawks which had originally been ordered to serve as fighters. Re-equipment with Tomahawks was therefore begun in 1941 and as an essential measure of economy the number of squadrons in the United Kingdom was provisionally limited to 14, mainly with an aircraft establishment of 12 and a proportionally reduced pilot strength. The basis of allotment was retained at one squadron per Corps or Armoured Division and the role of bombing, and later ground attack, remained as a secondary task to the primary function of tactical reconnaissance. By July 1943 the Tomahawk was completely superseded in all theatres and the Mustang at home and the Hurribomber abroad became the established aircraft. The Spitfire became the next tactical reconnaissance aircraft, and for the remainder of the war operated alongside the Mustang in the Metropolitan Air Force (including 2nd T.A.F.) and replaced the Hurricane in the Middle East. No change was made from the Hurricane in South East Asia.

It is noteworthy that the number of tactical reconnaissance squadrons reached a peak of some 30 squadrons in 1942 and 1943, of which some 18 were in the Metropolitan Air Force, and that thereafter the number decreased to 17 and less, of which only eight, and later five, were at home or in 2nd T.A.F. This change of policy was a reflection of the increased amount of information that was at this time obtainable as a result of the increasing scale of fighter and bomber operations, and of the adoption of centralised control for reconnaissance units. The pooling of specialised tactical reconnaissance resources into Wings was then found to be a satisfactory organisation for providing the remainder of the required information and, with the development of the Air Observation Post the amount of artillery reconnaissance flown was likewise limited.

Artillery reconnaissance remained, as previously, a function of army co-operation or tactical reconnaissance squadrons, the main difference being in the replacement of the Lysander by faster aircraft, the introduction of air observation by artillery methods on 15 July 1941 whereby the pilot corrected the fire with reference to the line between the battery and the target instead of plotting the fall of the shot by the old clock code method and, finally, by the subsequent introduction of two-way R/T.[2] The Royal Artillery concept of the flying Observation Post was that of a light aircraft provided by the Royal Air Force but manned by the Royal Artillery on a probable basis of one to each artillery Regiment. The light aircraft was intended to operate at a low height over our own and not over enemy territory, and to supplement the functions of the normal Regimental Observation Post on the ground in observing the enemy's disposition and directing fire. Security was to be obtained against enemy fighters by its low speed, low height and its manoeuvrability and in its short time in the air at irregular intervals. This latter was of some concern to the Royal Air Force as all trials had been carried out in peaceful conditions and it was doubted whether the A.O.P. could operate effectively in the face of the enemy. There was also the problem of providing the equipment and personnel to form and maintain the units required and there was risk that the A.O.P. aircraft on forward landing grounds might have to be abandoned to the enemy in the event of a sudden tactical move being undertaken by night or in

[1] A.M. File S. 6162, Encls. 68A, 71B and 81A also A.M. File S. 7736, Encls. 4A and 6A.
[2] A.A.C./S.82/Air.

bad weather. On the whole, therefore, the case against the Air Observation Post from the Air Force point of view seemed practically conclusive, but since no satisfactory alternative existed, trials were continued.

A.O.P. squadrons were not regarded as substitutes for the orthodox direction of fire by aircraft flying deep into the enemy zone, but were intended to provide aircraft to supplement eyes on the ground limited for want of height. They would also to some extent reduce the tasks which had to be given to normal air observation, but their essential quality was to increase artillery power and not to reduce calls on the air. They began to form in the United Kingdom in the latter half of 1941. By July 1944 there was a total of 12½ Auster squadrons, this having been found the most suitable aircraft. Of these squadrons four and a half were in the Mediterranean Allied Air Forces and one in South East Asia, and by May of the following year the total had been increased to 16½ squadrons.

AGREED STATEMENT SUBMITTED TO THE PRIME MINISTER BY THE SECRETARY OF STATE FOR WAR ON 14 NOVEMBER 1942

Organisation of Air Support for the Army in Continental Operations

The organisation of the R.A.F. Western Desert (A.V.M. Coningham's force) is as follows :—

(*a*) When a land battle is in prospect or in progress, the sole responsibility of the A.O.C., R.A.F. Western Desert is the support of the Eighth Army. The air defence of the Nile Delta is the responsibility of the A.O.C.-in-C.

(*b*) The organisation is capable of expansion. Medium bombers are allotted by the A.O.C.-in-C., Middle East, to the A.O.C. Western Desert ; the numbers vary with the requirements of the situation ; they may even include Fleet Air Arm aircraft. On 31 August 1942, for example, the A.O.C.-in-C., Middle East, placed the whole of the medium bombers at the disposal of the A.O.C., Western Desert.

(*c*) Mobility. In the Western Desert Air Force all operational units, including A.H.Q. Group and Wing H.Q., are fully mobile.

(*d*) It is a composite force of fighters, light bombers and reconnaissance formations, whose Headquarters and units are trained in Army Air Support.

(*e*) The A.O.C. is permanently in personal touch with the Commander, Eighth Army, and his organisation and training has been evolved so as to facilitate his control over all the air forces which are operating in direct support of the land forces.

(*f*) The operational control of light bombers and the fighter groups, and also of such medium bombers as are allotted to the A.O.C., is centralised. They are disposed for their tasks on the following day as a result of a personal conference between the Army and R.A.F. Commanders.

(*g*) The control of air support is exercised from a joint Advanced Army and Air Headquarters.

The arrangements described below are those in use in the Western Desert, with the modifications necessary to meet the different conditions of major operations against the Continent of Europe. These different conditions are :—

(*a*) The fact that the operations envisaged will be a joint Anglo-American operation in which virtually the whole of the Metropolitan Air Force and the U.S. Air Forces in U.K. will be engaged.

(*b*) The existence of a Supreme Commander over all the Allied Air, Land and Sea forces engaged, having under him a single A.O.C.-in-C., one of whose principal tasks will be the control, under the direction of the Supreme Commander, of the strategic air reserve represented by the Heavy and Medium Bombers of the British and VIII U.S. Bomber Commands.
Note :—If the operation were entirely British, neither (*a*) nor (*b*) above would arise and the difference from the Western Desert would be merely one of scale.

Assuming that (*a*) and (*b*) above are applicable there would be in Europe a higher level, represented by the Supreme Commander and the A.O.C.-in-C., which does not exist in the Western Desert. But both on this level, and on the lower level represented by the G.O.C.-in-C., British Army and the A.O.C. Eastern Air Force on the one hand, and the Commanding Generals U.S. Field Army and Eighth Air Force on the other, the governing principle is exactly the same as in the Western Desert. This is that the whole Air Force available in the theatre will afford the Army all possible support

irrespective of other targets, the tasks and objectives being indicated by the Army Commander (or the Supreme Commander as the case may be) and dealt with by the Air Force Commander (or the A.O.C.-in-C.) with his maximum force in the manner most effective.

Thus when the Army is established in France and the necessary aerodromes and other air facilities are available,

(*a*) The Supreme Commander and the A.O.C.-in-C., of the Combined Air Force will be established in immediate contact, either in the U.K. or in France. For reasons of aerodrome accommodation, administration and supply, the bulk of both British and U.S. Bomber Commands must continue (until a stage later than it is necessary to consider in this Paper) to operate from bases in the U.K., as must the fighter Squadrons employed in the protection of the U.K. and the Line of Communications across the Channel. It seems unlikely that the main H.Q. of the Supreme Commander and the A.O.C.-in-C., will transfer to France until an advanced stage of the invasion of the Continent. But adequate communications will be provided between the A.O.C.-in-C. and the H.Q. of the two Air Forces in the Field.

(*b*) The G.O.C.-in-C., British Army and the A.O.C. Eastern Air Force will be established in immediate contact at a H.Q. in the Field.

(*c*) Mobile composite groups, each containing fighter, light bomber, army support and reconnaissance wings, and each corresponding exactly to the Organisation in the Western Desert, will have their respective H.Qs. in immediate contact with the H.Qs. of the Armies in the Field. They will be under the command of the A.O.C. in the Field, subject of course, to the general operational control of the A.O.C.-in-C. They will be flexible formations of no fixed strength, and one or more can be reinforced at the expense of others by the A.O.C. in the Field, in consultation with the G.O.C.-in-C., according to the situation on any army front. Their basic organisation will thus be such as to be capable not only of controlling the formations permanently under command, but also those which are allotted. Close support operations and reconnaissance by all classes of aircraft will be controlled, as in the Western Desert, by a specially trained Army Support Commander through the Army Air Support Control Organisation at Group Headquarters.

APPENDIX 6

DEVELOPMENT OF GROUND TO AIR IDENTIFICATION 1940–1943

The Wann-Woodhall report of late 1940 recommended that each tentacle should be supplied with a stock of simple signs in the form of a white cloth arrow fifteen feet in length.[1] This was to be pointed towards the target and bars were to be placed across the arrow to indicate a distance of 500 yards. In September 1941 the first issue of Middle East Training Pamphlet No. 3 indicated that simple map references and time codes would be used for the location of forward troops and that bomb lines would be expressed in terms of ground features and not grid lines. Formations of aircraft were to be met by a recce aircraft at a pre-arranged rendezvous and guided to the target, at the same time being directed by R/T and ground strips. Recognition between ground and air was to be based upon a flying height of 6,000 feet and included the use of coloured Verey lights and ground signals. Aircraft had to announce their presence by visual signal and the Army had to indicate the position of ground signs by the display of light or smoke signals in return. On 29 October 1941, an instruction was issued, on the subject of ground/air recognition, which combined all the systems so far tried in the Middle East. Illuminating cartridges, smoke bombs or cannisters, large 'T' ground strips, 'V' direction indicators and Code words were included. Nevertheless, with aircraft flying at 6,000 feet or more above ill-defined country, smoke proved to be the only really effective ground signal and, under certain conditions, the day bombers could not give support nearer than five miles from the forward troops. In a fluid battle, and at lower altitudes, the recognition of closely enmeshed vehicles was a constant source of concern. Red and yellow paint on the tops of A.F.Vs. had failed to produce the answer in the Desert battles of 1940 and thereafter the use, by the enemy, of captured British vehicles served greatly to complicate this problem. Four-foot black flags, surmounted by a white 'T' were issued to A.F.V.s during Crusader but the quantities issued were insufficient and, in any case, when in battle the tank crew could neither see nor hear an approaching aircraft and were naturally disinclined to stop in order to tie on the flag in accordance with instructions.

Lack of definite information from the Army with regard to friendly troops had prevented the full use being made of the day bomber force. The methods in use for recognition and target indication were not encouraging and early in 1942, Air Marshal Tedder wrote: 'The Army fully realise the difficulties, but the solution depends on better control of land forces, which depends on better communications and training, and better recognition methods'. The system of detailing bomb lines, which followed salient ground features and defined the forward limits of safe bombing, had not been able to contend with the confusion and fluidity of the Crusader operations but, during the subsequent lull, a more satisfactory scheme was introduced whereby movements in the forward area were to be forecast two hours ahead and sent hourly through the Air S.C.[2]

It was also decided that ground indication should be increased in size and that both indicators and ground strips should be issued on a more extensive scale. An artificial 'V' sign with sides 100 yards long, constructed of lighted petrol tins 25 yards apart, was introduced for use by night (and proved of great assistance in helping fighters to fix their positions) and the enemy's extensive use of coloured smoke by day brought the conviction that this device should also be introduced. The use of smoke shells for target indication met with some opposition on the basis that targets within artillery range should normally be engaged by the artillery but, nevertheless, white smoke was being used by July 1942 and 'V' target indications, illuminated by red smoke generators, were officially introduced a month later.

The use of canvas strips, 1½ feet by 15 feet and painted red and white in three sections, continued in use for some time for the marking of the vehicles of the Long Range Desert Group but a white St. Andrew's Cross on a black background was painted on

[1] Chief reference. School of Land/Air Warfare. Study No. 9.
[2] A.H.B. Narrative. *The Middle East Campaigns. Vol. II.*

the majority of Eighth Army vehicles during the lull at Gazala. In the meantime the Royal Air Force continued to use the Roundel and this in turn, gradually replaced the St. Andrew Cross on all British vehicles. Vehicle making continued for the remainder of the war but by this time the Roundel was to some extent replaced by the American five-pointed star. With mounting air superiority the advantage to be gained by this method of recognising friendly vehicles was invaluable and the possibility of a few captured Allied vehicles being thus able to escape from air attack was of minor importance.

The provision of a continuous up-to-date expected line of forward troops—in the form of a bomb line—continued as the basis of ground recognition but, in the period leading up to the battle of El Alamein, the forementioned methods were put to a more comprehensive use and artillery smoke came to be accepted as the most efficient method of marking close support targets. In addition, forward defence lines were marked by smoke candles, Aldis lamps and ' T ' panels pointing towards the enemy ; and night navigation was improved by the use of magnesium flares, vertical searchlights, and a variety of letters constructed of lighted petrol tins ; and, during the advance through Tripolitania large ' V 's were bulldozed in the ground and strips of road were painted alternately black and white. At El Hamma and Mareth, in the spring of 1943, large and well defined landmarks in the forward area were marked by red and blue smoke and, simultaneously, the front line was marked by yellow smoke. Important enemy strong points were marked by artillery smoke and, as the advance began, the bombline was automatically defined by a creeping barrage consisting of high explosive and a small proportion of smoke and moving at a rate of 100 feet per minute.[1]

[1] It is interesting to note that instructions were issued on 26 May 1916 (before the Battles of the Somme) for attacking infantry to indicate their progress to aircraft by lighting flares and carrying mirrors on their backs. Smoke was also generally used for this purpose throughout the 1914–1918 war. (H. A. Jones : *The War in the Air. Vol. II, pp.* 179–180.)

APPENDIX 7

MIDDLE EAST (ARMY & R.A.F.) DIRECTIVE ON DIRECT AIR SUPPORT

issued by

G.H.Q. M.E.F. and H.Q. R.A.F. M.E.[1]
(30 September 1941)

1. Action by the R.A.F. in conjunction with the army will be known as Air Support. The use of the term ' close support ' is leading to confusion owing to the impossibility of defining its limitations ; the term will therefore not be used. Air Support can be sub-divided into Indirect Air Support and Direct Air Support.

2. *Indirect Air Support* included air action against the approaches to a theatre of war such as sea communications and ports, land communications, base installations, etc., within a land theatre of war. It is in fact strategic air support directed against any target which has an effect, though not an immediate effect, on the battle between ground forces.

3. *Direct Air Support* implies air action having an immediate effect on the action of our own ground forces in battle. It can be divided into :—

(*a*) Pre-arranged support.

(*b*) Impromptu support.

4. *Pre-Arranged Support* does not present any particular difficulties. Targets and target areas can be selected before the action starts and the timing of attacks on them can be settled beforehand.

5. *Impromptu Support* presents a far more difficult problem, especially in fluid operations and particularly in support of armoured formations.

6. *Air Superiority.* It cannot be too strongly stressed that the general air situation will affect the possibility of giving direct air support to the action of ground forces, in that aircraft detailed for air support are particularly susceptible to attack by enemy fighters and a high degree of protection against enemy air attack must be provided.

7. *Protection of Land Forces against Air Attack.* The Germans, who have perfected the means of giving air support, did not neglect to study the counter measures available to defeat air support if used against themselves.

Consequently a very high degree of protection in the shape of anti-aircraft guns of all sorts is provided in the German Army to those units and formations which are likely to present suitable targets, and consequently it must be taken into account, that the casualties likely to be suffered by our own aircraft when attacking the Germans, will amount to considerably more than would be the case if a similar attack was carried out on our own forces. There is a real need for a careful study of defence against air attacks and of the provision of suitable weapons and personnel to make such attacks costly.

8. *Morale.* The importance of the moral aspect of air attack on ground troops needs stressing. For troops in defensive positions it is not of vital importance, but its effects on troops in the open can scarcely be exaggerated. It must be borne in mind that the weight of air attack will usually not be very heavy and the accuracy of the attack will depend on the degree of opposition which the enemy are able to put up, whether by means of fighter defence or fire from the ground. The main effect of air support is therefore likely to be moral rather than material, and air support not only destroys the morale of the enemy, but, also raises that of our own troops. It is the experience of those who have been subjected to serious air attack, that there is scarcely

[1] A.H.B./IIJ1/53.

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anything better calculated to raise the morale of the troops than seeing our own aircraft in the air, and most of all seeing enemy aircraft shot down. It is a matter which has a very direct bearing on troops in battle, the moral effect being out of all proportion to the material effect produced.

Aspects of Direct Air Support

9. **Direct Air Support** includes :—

(*a*) *Defensive Support* to impede or halt the enemy's ground offensive in general and to counter his dive bombers in particular.

(*b*) *Offensive Support* aiming at the destruction of enemy ground forces with the intention of facilitating the offensive of the military forces on the battlefield.

Defensive Support

10. *Against Enemy Ground Offensives.* The principle should be that the available air support is employed against the most suitable and vulnerable targets. These targets will normally be outside the range of ground observation. They should therefore be selected by the R.A.F. by observation from the air. A tentacle system is, however, needed as a second means whereby commanders of leading brigades can rapidly communicate to the air their wants in Air Support. But the main responsibility for deciding on the employment of the available air support resources must depend on a joint plan of the military and air commanders.

11. *Against Enemy Dive Bombers.* In its biggest aspect, this is achieved by maintaining complete air superiority. Complete protection in any lesser degree than this is difficult to attain. It is obviously useless, however perfect the available intercommunication resources, for the Army to expect that they can get fighter support in time, by calling for this support after a hostile attack has started. By the time the fighters arrive, the enemy dive bombing attack will have finished. The only alternative is the provision of standing fighter patrols, but these must of necessity be so uneconomical as to be out of the question. One solution is to have fighter sweeps in the air during the periods when enemy bombing attack appears likely. The German is prone to be regular in his habits ; for instance, experience in France, in Crete and in Greece shows that he nearly always employs dive bombers immediately after first light. Complete fighter protection against dive bombers cannot be expected, but it should be possible, by the judicious employment of our fighters, often to have fighter cover at times when hostile dive bombers are operating. More than this we cannot expect ; our energies should be employed in perfecting our ground A.A. defences and in the art of concealment, camouflage and deception.

Offensive Support

12. It is in this sphere that the R.A.F. are able mostly to assist ground operations, but it must be recognised that we do not possess suitable aircraft for dive bombing.

13. *Fighter Attack.* In this type of attack, something akin to dive attack on the German pattern is possible. Suitable targets and their relative positions on the battlefield are similar, with minor exceptions, to those for bombers considered below. The exceptions are that attack on A.F.Vs. by fighters with cannon are sometimes 'worth while', and fighters can attack by ground strafing methods targets nearer to our leading ground elements.

It is difficult to assess the relative value of this type of attack probably has the greater moral effect. But the fighter is the main weapon in the battle for air superiority, and to employ fighters against ground targets in a direct support role must inevitably be drawing them off from the main issue. Thus, though direct support by fighter aircraft is probably more effective than that by bomber aircraft, this type of direct support, however desirable it may be, cannot normally be expected until a considerable degree of air superiority has already been attained.

14. **Bomber Attack** will normally take the form of :—

(*a*) *Level bombing from medium altitude* (6–8,000 *ft.*).
In this form of attack, sticks of bombs falling at predetermined intervals are released automatically, the bomb-aimer of the leading aircraft sighting for the whole formation. Aircraft are above light A.A. fire at this height.

(*b*) *Shallow dive attack.*
Aircraft dive from medium altitudes to approximately 2,000 ft., level out and carry out stick bombing as in (*a*) above. The pilot or bomb-aimer in the leading aircraft can sight in this attack, aircraft bombing in formation or singly according to the situation.

(*c*) *Low Level Attack* (1,000–3,000 *ft.*).
Aircraft maintain constant height at low altitude during the approach, actual bombing, and 'get-away'. The pilot normally aims and releases bombs, aircraft attacking individually. This form of attack is only carried out when ground opposition is expected to be small.

(*d*) *Ground Level Attack* (*below* 50 *ft.*)
Aircraft never climb above 50 ft. throughout the entire raid. The object is to obtain complete surprise, and every use must be made of topographical features in the approach. Unless the exact position of the target is known, and the target itself is clearly discernible from low level, this form of attack is useless. Furthermore, unless complete surprise is achieved, casualties may be expected to be very high. Generally, ground level attack is unsuitable for direct air support targets.

15. **Bombs and Fuzes**

In Direct Air Support Bombardment, the effect on morale is as important as material effect, and therefore, a 250 lb. bomb will produce better results than an equal weight of 40 lb. or 20 lb. bombs. The majority of targets in Direct Air Support call for a heavy type of bomb, the 40 lb. bomb only being of use agsinst concentrations of troops and vehicles, and in these days of air attack, troops are learning to avoid such concentrations.

It is considered that the 250 lb. G.P. Bomb fuzed Instantaneous is the most suitable for Direct Air Support Bombardment, except for ground level bombing, where an 11 seconds delay fuze must be used.

16. The Characteristics of Direct Air Support Bombing must be fully appreciated if maximum use is to be made of this type of support.

(*a*) It is possible with Direct Air Support Aircraft to develop suddenly a very considerable volume of fire to assist formations who have outdistanced their artillery.

(*b*) As there will normally be targets in excess of the capacity of the available aircraft, the latter should not be used when other support, such as artillery and mortars, are sufficient for the purpose.

(*c*) Unlike artillery, it will generally be impossible for Direct Air Support aircraft to sustain their attack for any length of time ; neither does the attack tend to become more accurate as it proceeds.

(*d*) The accuracy of the attack will depend on a number of factors, of which the chief are :—

(i) Absence of enemy opposition both from the ground and in the air.

(ii) Good visibility.

(iii) A Target which can be Clearly Recognised by the Airman.

In general, except when there is little or no enemy opposition to the aircraft, and except in the case of ground level attacks, accuracy will be of a considerably lower order than that attained by artillery. In these conditions aircraft cannot be expected

successfully to engage targets in close contact with out leading troops, nor, in fact, is it here that the best targets are likely to be found

Selection of Targets for Direct Air Support

17. The selection of targets will be governed by one or more of the following factors :—

(*a*) The degree of natural or artificial cover of which the enemy is making use.

(*b*) The amount of dispersion which it has been possible to achieve.

(*c*) Whether destruction of personnel or material is desired.

(*d*) The distance of the target from our own leading troops. If accidental bombardment of our own troops is to be avoided, targets selected should not be within 500 yards of them.

(*e*) The extent to which ground fire can be directed into enemy targets.

(*f*) The ease of locating the target from the air. It must have some distinctive feature by which it can be recognised from the air. In the face of enemy opposition either ground defences or fighters, it is impossible for the pilot to cruise round until he finds it.

18. Generally speaking the larger the target which presents itself, the easier it is to attack it effectively, and at the same time the farther it is likely to be from our own troops. It must therefore be expected that the target will be found in areas not actually in contact with our leading troops, because land forces tend to become more and more dispersed the nearer they get to the enemy.

19. No comprehensive list of targets can be laid down, any more than they can be laid down for artillery, but the commander who is allotted aircraft to assist him, will be entitled to use those aircraft on targets which he considers will enable him to achieve his object, provided always that the target is one which is suitable for air attack.

20. **Suitable Targets for Direct Air Support** aircraft will include :—

(*a*) Any concentration of troops or vehicles which can be surprised in close formation and which would have difficulty in dispersing. Concentrations can be caused by the blocking of suitable defiles.

(*b*) Headquarters and Signal Centres where these can be accurately located and are not under cover.

(*c*) Artillery positions in the open. The effect will probably be only to kill or temporarily disperse the personnel and not to damage the guns to any extent.

(*d*) Supply echelons, particularly petrol and rations, without which vehicles cannot continue to function and men cannot continue to fight.

(*e*) Crossing points over obstacles.

Such targets will normally be outside the range of ground observation, in which case they must usually be selected by air observation.

21. **The following Targets are not suitable** for air attack :—

(*a*) Dispersed Infantry or vehicles.

(*b*) Any troops, guns, etc., which are well protected either by the nature of the country, or by the protective works which the enemy has been able to provide.

(*c*) Columns on the L. of C. which can rapidly disperse and maintain considerable distance between vehicles.

The Air Support Control System

22. Owing to the flexibility of air power, the proportion of effort devoted to Indirect and Direct Air Support will never be constant, but will vary in accordance with the plans of the higher command during the progress of any battle. Before an operation, a plan for air support to assist the land forces is made. This plan will envisage a proportion of the air effort being employed during a given period in a Direct Air Support role.

23. In order to ensure that the maximum effort is obtained from the available Direct Support aircraft, an Air Support Control is used to meet, modify or reject the requests for support received from various sources.

24. It may be argued that it would be better to simplify Direct Air Support by allotting Squadrons or Flights to Brigades or Battalions in the same way as Batteries are allotted. This system would inevitably lead to such a wide dispersal of air forces that the small number of aircraft available for each particular mission would accomplish little or nothing.

25. Air Support to be effective requires the employment of concentrations of aircraft ; such concentrations can only be achieved by some form of control.

Organisation of an Air Support Control

26. Headquarters or R.A.F. formations which may be called upon to give Direct Air Support will be organised with one or more mobile advanced Headquarters, which combined with an Army element will be known as Air Support Controls (Air S.C.). The two elements will comprise :—

(*a*) *Army*. Two staff officers plus a small staff.

A wireless organisation which consists of :—

(i) Seven forward links known as Tentacles for communication to the Control H.Q. The Tentacles can be allotted to those lower formations which the higher commander decides should be given the means of calling for Air Support.

(ii) Three wireless sets at the Control H.Q. for communication to Tentacles.

(*b*) *Royal Air Force*. The Formation Commander or his deputy, plus a small operational staff.

A Wireless organisation consists of :—

(i) Eight sets known as Forward Air Support Links (F.A.S.Ls.) for controlling Air Support Aircraft in the air and for listening to Reconnaissance Aircraft.

(ii) Two wireless sets known as Rear Air Support Links (R.A.S.Ls.) for communicating directly to four Landing Grounds.

(iii) Four wireless sets for use at four Landing Grounds.

27. A diagramatic layout of an Air Support Control is attached at Annexure ' A '.

28. In addition to the R.A.F. Formation Commander or his deputy, two operations officers working watch and watch are sufficient to maintain the records and until such time as the state of readiness board. Until such time as the Air Support Control is put into operation, they will normally be employed in the Operations Room of the R.A.F. Formation H.Q.

Allotment of Air Support Controls

29. It is the intention in the Middle East to provide Air Support Controls on the basis of one to each Corps and one to each Armoured Division. For the present, it is not intended to provide the Army element of an Air Support Control allotted to an Armoured Division since all H.Qs. in such formations already have suitable operational wireless channels, which can be used for passing requests for Air Support.

The H.Q. of the Air Support Control will be established adjacent to, in fact as part of, the H.Q. of the formation which is fighting the battle ; this will normally be a Corps H.Q. or an Armoured Division H.Q.

Allotment of Tentacles and F.A.S.Ls.

30. Tentacles and F.A.S.Ls. will be allotted to Brigades of Infantry Divisions to enable forward commanders to call for Direct Air Support. Experience has shown that there are serious difficulties in moving tentacles from formation to formation during continuous operations ; reserve brigades should therefore receive their tentacles before operations start as far as the number of tentacles will allow.

31. Tentacles and F.A.S.Ls. for listening purposes should also be allotted to Infantry Division H.Qs.

Operation of the Air Support Control

32. The organisation of an Air Support Control allows requests for Air Support to be received from :—

(*a*) A Tactical Reconnaissance Aircraft which may happen to observe a suitable target during a normal reconnaissance.

(*b*) A Support Reconnaissance Aircraft—i.e. an aircraft sent out on orders from the Air Support Control H.Q. to look for suitable Air Support targets.

(*c*) Forward Formation Commanders by means of Tentacles allotted to them.

33. It appears, from the reasons given earlier, that better and more numerous targets are likely to be seen by reconnaissance aircraft than by forward troops. Whereas the procedure described in the following paragraphs may therefore be more normal, it is essential to have in addition the organisation by which forward troops can call for Direct Air Support when required.

Selection of Targets by Air Reconniassance

34. The military commander will explain to the R.A.F. formation commander, or his deputy at the Air Support Control H.Q., the enemy's dispositions, his own plan and the probable trend of events ; and will indicate to him the likely areas for Direct Air Support targets.

35. Acting on this information, the R.A.F. Commander will arrange for air reconnaissance of these areas to be carried out with the object of locating suitable Air Support Targets. As the operation progresses, the military commander will be able to supplement the original information, and to indicate new areas for reconnaissance.

36. Requests for Air Support on selected targets will be made by R/T by the Support Reconnaissance aircraft to the Air Support Control H.Q. The Control Staff decide whether the request shall be accepted or refused, and the aircraft is informed accordingly. Control H.Q. will also inform a formation if action is being taken against targets on its front. This should be considered the normal method of applying Direct Air Support.

Selection of Targets by Forward Troops

37. Requests from Forward Troops for Air Support will be made by W/T from Tentacles. These messages will be received at the Air Support Control H.Q. by the G.S.O.2 who is the representative of the Commander fighting the battle.

38. The Control Staff accepts or refuses the request according to the suitability of the target for air attack and the availability of aircraft. The formation originating the request is notified.

39. In cases of acceptance, the requests are passed directly by the R.A.F. Commander over the R.A.F. signal system to the landing ground selected for the task.

Allocation of Effort

40. It can be seen that requests for air support against a large variety of targets will be received from a number of sources at Air Support Control H.Q. It is essential therefore, that the Commander should indicate very clearly the principles of which the priority of targets is to be decided, and that the Control Staff should adhere to these principles closely.

41. In addition to allocating effort by exercising judgement at the Air Support Control H.Q., there is the method of pre-allotting a proportion of the total effort to Support Reconnaissance sorties and to lower formations, so that each sortie and each formation to which a tentacle has been given, knows in advance how many Air Support sorties are at its disposal.

42. In theory, this method can readily be applied, since it is but a matter of the higher commander promulgating in his orders as a result of the plan the number of sorties or proportion of the available effort sub-allotted. Then, if the Air Support Control H.Q. knows in terms of sorties the allotment to reconnaissance aircraft and tentacles, it can, provided the total number allotted does not exceed the number of first sorties available, ensure, subject to weather and enemy action, that demands are met.

43. In practice, however, it has been found that this method presents many difficulties, since not only is it extremely difficult to forecast what lower formations may require as the battle proceeds, but it is also impossible to allot in advance any but those first sorties at immediate readiness. As the situation develops, the needs of forward formations change, and the aircraft available fluctuate, thus it will be necessary to adjust allotment. It will often be impossible to make this adjustment in sufficient time to be effective.

44. In these circumstances, the Air Support Control H.Q. will have to exercise discretion in responding to or rejecting demands, and it is for this reason that the Air Support Control H.Q. should be located as shown in para. 29 and must contain a representative staff officer.

State of Readiness

45. The problem of state of Readiness for Direct Air Support aircraft differs in some respect from that of Fighters. Whereas a fighter squadron has to be ready to meet any emergency day in, day out, Direct Air Support Squadrons are required to operate at maximum intensity only over certain periods of time, which may vary from day to day. The necessity for developing maximum intensity at a stated time may well have priority over emergency calls.

46. Any system of readiness devised must be flexible. A system which has been satisfactory in trials consists of having 50 per cent of aircraft at Instant Readiness, 25 per cent at 2 hours and 25 per cent released, unserviceable aircraft being included in the percentage of released aircraft. Aircraft at instant readiness despatched on a mission are replaced, in so far as the number permits, by bringing up to instant readiness the aircraft at 2 hours notice.

47. The period of two hours as a state of readiness is an arbitrary figure, but experience in operations has shown that anything less than 2 hours virtually amounts to Instant Readiness.

This period allows certain essential maintenance inspections to be carried out.

48. The State of Readiness described above should be allotted to aerodromes or Wings, and to Squadrons. This allows a certain amount of flexibility in the Wing organisation, as the state of Readiness can be varied between Squadrons. It also simplifies procedure at the Control H.Q. dealing in Wings rather than Squadrons, for keeping the record of available aircraft.

Availability of Aircraft

49. Direct Air Support requirements will probably entail more than one sortie for each serviceable aircraft each day. Some system is therefore necessary to enable the Control to know at any time, the number of aircraft available at Instant Readiness and at two hours notice.

50. Wings or Aerodromes will report, one hour after the return of a mission, the number of aircraft that have returned and are available for further sorties. The interval of one hour is allowed for inspection, refuelling and re-arming.

51. The signal to the Control H.Q. can be very brief, and need contain only the reference number of the Control H.Qs. signal ordering the mission, followed by the number of aircraft that are available for a further mission—i.e. ' Five stop Eight aircraft '. It is understood that available aircraft reported also include crews. On receipt of this signal the Control H.Q. can readily determine from its records the numbers at Instant and Two Hours Readiness.

Form of Message Requesting Air Support

52. In order to reduce to a minimum the time taken in transmitting calls for air support, a standard type of message will be used.

53. The number of aircraft required for any task will not be inserted in the message at the Tentacle. This figure is decided at the Control H.Q. and is dependant on the type of target, availability of aircraft and other demands.

54. The target will be described by means of the Reconnaissance Code and authorised abbreviations.

55. **Map Reference and Time Codes**

As the location of our troops and the time of attacks and times of meeting at R.Vs. must appear on the message, it is necessary to use simple map reference and time codes throughout. Such codes will be originated by the H.Q. of the formation to which the Air Support Control is allotted. Owing to the form in which figures are sent in the message, these codes must be figures codes as opposed to letter codes.

56. **Bombline**

It has been stated earlier that medium, low level and shallow dive attacks cannot produce results as accurate as those obtainable from dive bombing attacks. It is therefore necessary to lay down a bombline beyond which it is safe to bomb. Bomb-lines will be expressed as ground features whenever possible, and not as Gridlines.

57. **Information Required by Tentacles**

The minimum time taken between support being demanded by a Reconnaissance Aircraft or a Tentacle, and Air Support Aircraft being over the target will depend on a number of factors, and will vary with local conditions. The minimum prevailing time must be known to Tentacles.

When an Air Support Control accepts a request for support from a Tentacle, it will inform that Tentacle of the time at which support can be expected and of the number of aircraft that will carry out the attack ; the commander on the ground can then adjust his plan accordingly.

58. **Briefing of Crews**

Briefing of crews must be simple and quick. Without further experience it is not possible to lay down any particular method as being the best ; one of the methods given in Annexure ' B ' should be used.

Indicating the Target to Support Aircraft

59. The various methods of indicating the target to Support Aircraft are :—

(*a*) They can be met at a R.V. by a Reconnaissance Aircraft and led to the target.

(*b*) They can be directed from the ground by :—

(i) Ground Strips.

(ii) R/T from a F.A.S.L.

(*c*) They can be given the target location before leaving the Landing Ground and receive no further aid.

60. R.V. Method

When a Reconnaissance aircraft is to lead Support Aircraft from a R.V., the location and height of the R.V. will be arranged before the Reconnaissance aircraft leaves on the sortie.

61. The Control H.Q., on accepting the request for Air Support from a Reconnaissance aircraft, will arrange the time at the R.V. and insert it on the message form. Control H.Q. will, at the same time, inform the Reconnaissance aircraft by R/T that his request has been accepted.

62. There may be occasions when the Reconnaissance aircraft selects a target towards the end of a sortie and when he has not sufficient endurance to wait and lead the Support Aircraft to the target. In such a case, Control H.Q. will decide whether the description of the target and its location are sufficient information for the Support Aircraft, or whether the Reconnaissance aircraft should land and refuel before leading the attack.

63. Indication of Target by Ground Strips

Signals displayed by our own troops to indicate the position of the target are of great value when operating against an enemy whose defences are not strong. Against fighter opposition or strong defences, it may not be possible to reconnoitre for such signals.

64. Leading troops will indicate a target to Support Aircraft by displaying ground strips in the form of a ' V ' pointing to the target, with bars beneath to indicate distance. A ' V ' will only be displayed on orders from the formation or units controlling the Tentacle from which a call for support has originated. Therefore, only one ' V ' will be displayed on any Brigade front at any one time. Details of the procedure are given in Annexure ' C '.

65. Indication of Target by R/T from F.A.S.L.

In addition to ground strips, assistance in guiding Support Aircraft to a target can be given by R/T from a F.A.S.L., preferably in view of the target. Direction can be given in the form of bearing and distance from ground strips or ground features.

Recognition Signals

66. An efficient recognition system between aircraft and ground forces is essential for the satisfactory working of direct Air Support. The system given is based on a flying height of 6,000 feet. The principle of the system is that both aircraft and ground forces must attract the other party's attention to the area in which a recognition signal will eventually be displayed, by showing a bright light. Once observation has been drawn to the correct area, it will be possible to see less visible signals. Details of the system are contained in Annexure ' C '.

67. Aircraft calling for signals from ground forces in a certain area will make the necessary signals at a distance of 4–5 miles from the area. Every effort must be made

by ground forces to make answering signals as quickly as possible and before the aircraft have arrived immediately overhead ; thus aircraft will avoid having to circle the area in search of ground signals.

68. It is necessary for aircraft and ground forces to repeat light signals at short intervals to ensure that the signals are seen.

69. Ground Indicators will be carried by all H.Q. down to and including Unit H.Q. These indicators will be the same shapes as those now in use, but will be increased in size and will have a black background.

70. Ground Strips will be issued in sets of five to sub-unit H.Q. down to R.A.C. Tps., Inf. Coys., Motor Platoons. They will be 12 ft. by 2 ft. 6 ins. and have a black background.

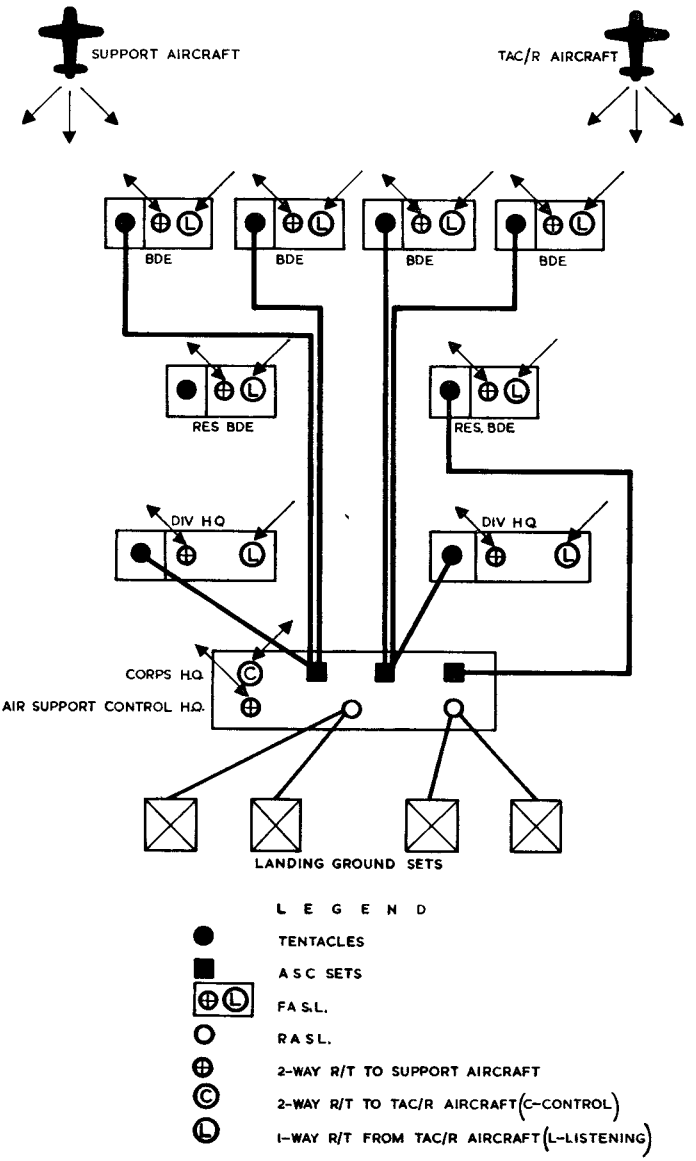
71. The R.A.F. Signal Manual Part V (Ground Signal Codes) with strips and discs will be retained in addition to the above ground signs for use as required.

72. **Air Sentries**

All H.Q. down to Companies and equivalent sub-units will have an Air Sentry on permanent duty during operations. Air Sentries with dismounted units will be responsible for carrying and exhibiting the ground strips ; they will be armed with a revolver in place of a rifle.

ANNEXURE 'A' TO APPENDIX 7

COMMUNICATIONS FOR AIR SUPPORT CONTROL



ANNEXURE 'B'

Briefing of Crews

1. It is not intended to lay down any one method for briefing crews until further experience has been gained. One of the methods given below should be used.

2. Crews of aircraft at instant readiness can be kept standing by near the Operations Room and be briefed there. Transport should be available to take crews to dispersal points immediately after briefing.

3. In certain circumstances it may be possible for crews to receive a preliminary briefing in anticipation of the receipt of a call for support. Crews can then be sent to dispersal points and stand by at the aircraft.

When the call for support is received, aircraft can be warned by a signal from the Operations Room. While aircraft are warming up, final instructions (a copy of the pro-forma) can be sent to crews now in the aircraft by written message.

4. The briefing of crews by R/T in their aircraft or by telephone at dispersal points is not recommended since misunderstandings tend to occur calling for lengthy explanations, which can be shortened when the Operations Officer and crews can study points together over one map.

ANNEXURE 'C'

Recognition Signals

1. Air to Ground Signals

(*a*) An aircraft calling for a Formation or Unit H.Q. to disclose its position will fire :—

(i) A cartridge illuminating—to attract attention.

(ii) A two star cartridge giving the same two colours (Red Red or Green Green).

(*b*) An aircraft calling for forward troops (including Sqn./Coy. H.Q.) to identify themselves will fire :—

(i) A cartridge illuminating—to attract attention.

(ii) A two star cartridge giving two different colours (Red White or Green White).

(*c*) These signals will be repeated until a reply is received from the ground.

2. Ground to Air Signals

(*a*) *Formation and Unit Headquarters.*

(i) Formation and Unit H.Q. will answer a call from an aircraft by :—

(*a*) Firing a White cartridge illuminating—to attract attention.

(*b*) Showing a ground indicator.

(ii) Visual signals will be repeated every minute for three minutes.

(*b*) *Forward Troops.*

(i) R.A.C. Sqn. and Tp. H.Q. and Inf. H.Q. will answer a call from an aircraft by :—

(*a*) Firing a White cartridge illuminating—to attract attention.

(*b*) Firing a Verey light of the odd colour of the three (Red, White, Green) that has not been fired by the aircraft.

(*c*) Displaying a 'T' ground sign with the cross piece of the 'T' nearest the enemy and parallel to the front.

Aircraft will assume that the forward line of troops is not more than 500 yards distant from the line of 'T' ground strips.

Light signals will be repeated every minute for three minutes.

(ii) Foremost line of troops will flash tin discs.

Note.—It is intended to produce a cartridge illuminating ('I') giving an effect similar to the R.A.F. catridge illuminating ($1\frac{1}{2}$"). Pending the production of this cartridge, Ground Flares will be used at forward H.Q. in conjunction with Ground strips.

3. **Indication of Targets**

A forward H.Q. wishing to indicate a target to an aircraft will display a ' V ' ground sign as an arrow pointing to the target in place of a ' T '. Three extra strips will be supplied to be placed as bars beneath the arrow, indicating distance in accordance with a pre-arranged code. Bars will be placed three feet apart.

A ' V ' ground sign will only be displayed by a forward H.Q. on orders from the formation which originated the call for support. Thus only one ' V ' will be visible in an area among a number of ' T 's. A ground flare will be displayed at the ' V ' to assist in attracting the pilot's attention.

4. **Acknowledgement by Aircraft**

An aircraft will look for signals when flying straight or on a left hand turn. An aircraft will acknowledge signals when the situation allows, by flying on a right hand turn.

5. Ground Indicators will be the same shape as those laid down in

(*a*) Employment of Air Forces with the Army in the Field ;

(*b*) R.A.F. Manual of Army Co-operation ;

(*c*) R.A.F. Signal Manual Part V (Ground Signal Codes).

They will have minimum dimensions of 12 ft. by 2 ft. 6 ins. and will have a black border of 2 ft.

6. Ground Strips will be issued in sets of five to :—

H.Q. of R.A.C. Sqns. and Tps.
H.Q. of Motor Coys. and Pls.
H.Q. of Inf. Coys.

Strips will be 12 ft. by 2 ft. 6 ins. and have a black border of 2 ft.

APPENDIX 8

AIR SUPPORT FOR THE EIGHTH ARMY[1]

Advanced A.H.Q. and Rear A.H.Q. Organisation

In order to obtain the closest co-ordination of both Military and Air plans, the A.O.C. Western Desert and the G.O.C. Eighth Army were located in the same camp. Further, in order that the A.O.C. Western Desert could exercise immediate and direct control over the operations of the Bomber and Fighter Groups, it was desirable that the location of Air H.Q. should be within reasonable distance of forward operational landing grounds and adjacent to a landing ground for his own use. The siting of the Advanced Army and Air H.Q. was therefore a compromise to suit both. Signals, both Army and Air, were always consulted before the final decision was made in order that the best line facilities could be made available.

Experience showed that it was quite impossible to have a camp in the forward area combining the total staffs of both Army and Air H.Q. Such a camp, properly dispersed, would have occupied some 3-4 square miles and, with all the signal vehicles and masts, would be unmistakable, and be a target for the enemy. Accordingly, the splitting of Army and Air H.Q. into Advanced and Rear H.Q. became a necessity. Provided direct telephone lines between Advanced and Rear functioned well, few administrative difficulties occurred. Rear Air H.Q. were situated, wherever possible, close to Rear Army H.Q.

Forward Operational Units—Composition and Organisation

Fighter Group H.Q. directly controlled the operations of four Fighter Wings, organised bomber and Tac.R. escorts and supervised and plotted the information received from the A.M.E.S. and Observer screens allotted to it.

The Fighter Group was fully mobile, conducting its operations from three vehicles from all of which the Operations table could be overlooked. In addition to the Main Control there was a small Forward Control sited as near to the Army front line as possible. The Group H.Q. main control was always located in a central position in the Fighter Wing aerodrome area . . . Aircraft would be controlled in the air either from Main or Forward Control positions. Experience showed that a Fighter Group with three to four Fighter Wings could cover an army front line of some 40 to 50 miles in breadth. With such a front line the Group would need two Forward Controls, each to be sited as far forward as possible, on either flank of the front line.

Fighter Group had an additional 'Controller' vehicle supplied so that in mobile warfare it could be sent ahead ready to control fighters in the air, whilst the Main Control was on the move. Forward Controls remained located with front line Army units whether advancing or retiring.

Fighter Group had operational control of Fighter Wings and Squadrons, but not administrative control except that recommendations for promotions of Flight, Squadron and Wing Commanders and recommendations for honours and awards coming from Wings and Squadrons had to be submitted to the Group Commander before passing to the A.O.C.

Fighter Wings consisted of 3, 4 or 5 Fighter Squadrons where possible equipped with the same type of aircraft and based on the same aerodrome. Fighter Wing H.Q. was usually established a mile clear of the aerodrome boundary. It was entirely mobile and, in the same manner as Advanced A.H.Q. and the Fighter Group, was organised into 'A' and 'B' parties. On orders to move, the 'A' party moved to the new site and was in a position to take control before the 'B' party moved away from the old site.

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[1] Notes compiled from :—
Air Commodore Elmhirst, A.O.A., W.D.A.F.
Memorandum on the Organisation of the Western Desert Air Force for Co-operation with Eighth Army.
Air Marshal Sir Arthur Barratt, A.O.C.-in-C.
Army Co-operation Command : Report on a Visit to the Middle East.

Fighter Squadrons were organised into ' A ' and ' B ' parties such that either could maintain squadron aircraft engaged on full operations for a period of 2 to 3 days, while the other party was on the move.

Bomber Wing H.Q. was divided into two parties, Advanced and Rear. The Advanced H.Q. was sited in the vicinity of the Advanced Bomber Squadron's landing ground in the forward area, close to the Fighter Wing aerodromes. The Rear H.Q. was located in the neighbourhood of the Bomber Squadron base aerodromes in the Rear area.

As a result of the experience of the first six months of 1942, a Reconnaissance Wing under the immediate control of A.H.Q. was formed and came into operation in mid-July. The function of the Wing was to co-ordinate all Reconnaissance and Photographic sorties and to ensure that the results obtained were interpreted promptly and distributed to all units concerned.

Liaison with the Eighth Army

(*a*) The A.O.C. Western Desert and the G.O.C. Eighth Army shared the same Mess.

(*b*) Army ' G ' Operations Room and Air Operations Room were always sited adjacent and there was continuous liaison between B.G.S. on the one hand and S.A.S.O. on the other.

(*c*) Army liaison officers were appointed to A.H.Q. Ops. Room and all Group and Wing Operations Rooms.

(*d*) Two Tactical Reconnaissance Squadrons were available for use by each Army Corps.

(*e*) R.A.F. officers were appointed as liaison officers with Armoured Divisions until these units became experienced in the Air Support procedure.

(*f*) An Air Support Unit (with R.A.F. component) was located at the Combined Army and Air H.Q. and formed a minute-to-minute link on the operations side between forward troops and A.H.Q. Operations.

(*g*) A.O.A., Advanced A.H.Q. and A.Q.M.G. Eighth Army shared the same mess.

(*h*) Senior Equipment Staff Officers at Rear H.Q. maintained a constant liaison with ' Q ' at Rear Army.

Mobility

The importance of all units in a force such as the Western Desert Air Force being completely mobile when operating with an Army in open warfare was stressed very strongly. Whether advancing or retiring, units had to be able to go into action with the minimum of delay. A cardinal principal learnt was that vehicles should be established on a basis of $\frac{3}{4}$ load.

Advance and Retreat Organisation

Administrative plans for both advance and retreat were drawn up prior to the battle by the Air and Administrative Staff at Advanced Air H.Q. In general the Air Staff selected the next set of aerodromes to be used and gave the orders to the ' A ' parties of Operational units to commence the move. Likewise the ' B ' parties, when the ' A ' parties were known to have arrived at their destination.

Airfield Construction

Airfield construction was carried out by an Army R.E. Detachment. The H.Q. of this Detachment was located in the vicinity of Rear H.Q. A forward post was maintained in the vicinity of Fighter Group H.Q. On the staff of the Fighter Group was a Squadron Leader (G.D.) for aerodrome duties. This officer was supplied with a small communications type aeroplane.

Air Staff at A.H.Q. decided the policy for new landing ground sites. This policy was passed to Fighter Group for action in the area, or to Rear A.H.Q. if new sites were required in the rear area.

Personnel

To a very great extent the efficiency of the Western Desert Air Force rested on the absolute power delegated by the A.O.C.-in-C. to the A.O.C. Western Desert to choose his own Unit Commanders and H.Q. Staff and of promoting his own choice to fill vacancies within establishment. All Wing, Squadron and Flight Commanders were personally selected by the A.O.C.

APPENDIX 9

THE EMPLOYMENT OF BOMBERS AND FIGHTER-BOMBERS IN CO-OPERATION WITH THE ARMY

(Operation Memo. 54, 6 May 1944)

Introduction

1. The object of this memorandum is to summarise the experience of combined air and land operations in Italy during the past six months, and to set out certain principles which are to be accepted as the basis for planning and execution of such operations in the Mediterranean theatre. It deals principally with the activities of the Tactical Air Forces, whose primary function is co-operation with the Armies ; it must be remembered, however, that they constitute only one arm of the Allied Air Forces in this as in other theatres. The Strategic and Coastal Air Forces and the squadrons engaged in special operations all have their own part in the major strategic scheme ; but units from each of them are called upon from time to time to support the Tactical Air Force in its operations with the Army.

Air Superiority

2. A very high degree of air superiority has been attained in this theatre, and it goes without saying that this must be maintained. The subject will not be dealt with in this memorandum further than to make two points :—

(*a*) The enemy have proved that a determined and efficient Army can fight well in defence, even when the air is almost completely dominated by the enemy. The effect of such superiority, in itself, should therefore not be over-rated.

(*b*) A situation in which adequate air defence can be provided only by a system of standing patrols is extremely uneconomical in air effort and diverts aircraft from other urgent tasks. The early provision of advanced landing strips and radar facilities is therefore, a matter of urgent importance and should always be borne in mind in forward planning.

Planning and selection of objectives

3. It is the duty of the Army Commander to indicate to the Air Force Commander the effect he wants achieved to further the operations on the land forces, and when he wants that effect achieved. The method of achieving it in the actual selection of targets is the responsibility of the Air Force Commander, who will make appropriate use of the available expert advice and information from ground forces and other intelligence sources. Success in a modern battle on land, however, involves a combined land air plan. Army and Air Force Commanders therefore must work in the closest consultation throughout all stages of the formulation and execution of the plan, to ensure that the land and air operations interact to the best advantage ; to this end it may be necessary to adapt both the timing and location of operations on the ground to assist and take full advantage of operations in the air.

Air Attack on communications.

General

4. The main function of all classes of bomber aircraft in a land campaign is to interfere with the movement of enemy forces and their supplies. This involves :—

(*a*) Sustained attack on the communications, rail, road and sea, between the enemy's sources of supply and his forward areas ; and

(*b*) During the active stages of the land battle, whether in attack or defence, the isolation of the battlefield from enemy reinforcement and supply.

5. Action against the three main means of transportation is complementary, and its efficacy can be made cumulative by careful planning. The railway as the biggest carrier is the most important objective. But action against railways has an indirect effect on road transportation since it throws an added load on the enemy's M.T. resources which, in itself, leads to increased consumption of one critical item of supply, i.e. fuel. Action against railways and roads makes sea supply more important and thus creates favourable targets for aircraft and light naval forces.

Railways

6. The selection of objectives in a railway system will vary with the circumstances, the density and vulnerability of the system and the time by which the action is required to take effect. In general, there are two main courses of action :—

(*a*) For long-term lasting effect, the destruction of major rail centres which contain not only important marshalling yards—and hence sometimes important concentrations of loaded wagons—but also the main loco and rolling stock repair facilities, workshops and servicing sheds, and centres of traffic control and inter-communication. These objectives will frequently be beyond the range of medium bombers and they are usually very suitable for attack by heavies. They may sometimes profitably be attacked at night.
It is sometimes possible to select objectives in this class on which successful attack will also temporarily block the current flow of supplies—as at Verona and Padua which are on the main line of supply from Germany to the Italian front. But at least one through line can always be cleared in a large railway centre, and the object of attack on these objectives is not to block the current flow but to effect long-term disruption and dislocation of the whole system ; for short-term effect, therefore, it can only be supplementary to :

(*b*) Sustained attacks against vulnerable points on all the railway lines between rearward depots and railheads, such as those recently executed against the railways south of the Pisa–Rimini line, aimed at cutting or blocking the lines. This course has the incidental effect of causing a congestion of traffic in the marshalling yards further back and thus creating profitable targets. But its main object is to reduce the supply of the day to day requirements of the armies to a point where they are compelled to withdraw or at least are unable to offer prolonged resistance to an offensive on the ground.
Objectives in the class, which are at relatively short range and call for a high degree of accuracy, are suitable for medium, light and fighter-bombers. They are not normally suitable for night attack.

7. Attacks under 6(*b*) above should be supplemented by intruders and light bombers at night attacking trains on the move. Suitable targets may also sometimes be found in the form of minor marshalling yards where bombing will not only cut the tracks but also destroy loaded wagons and dislocate servicing facilities, the signalling system, and so on. But the principal method of attack in this category is to make and maintain definite breaches in the railroad, where the enemy must unload the train, transfer the load to M.T. and by-pass the breach. The enemy can be relied upon to work at high pressure to repair these breaches, and the most suitable points for attack are therefore those where repair will be most difficult and will take longest. From this point of view junctions and marshalling yards are the least suitable for attack, by far the best being bridges, which recent experience has shown can be effectively cut by medium bombers at normal altitudes and by fighter-bombers flying low. The aim should be to achieve complete interdiction of all the railway lines leading to the front. The cuts nearest to the front should be made sufficiently near railheads to make it not worth while reloading on to trains forward of the cut, and sufficiently far back to throw the heaviest possible strain on the enemy's M.T. Each line should be cut in several places suitably selected in depth, so that the enemy is faced with the alternatives of taking the whole load on his road transportation or of organising a number of road by-passes on each line—either of which will involve a very serious strain on his M.T. vehicles, fuel, labour and time. M.T. vehicles employed on these road by-passes present suitable targets for light bombers and intruders at night, as well as for fighter-bombers by day.

8. The proportion of the total potential capacity of a railway system—even of such a relatively sparse system as that in Central Italy—which is needed to supply the essential needs of a substantial German army such as that now holding the line south of Rome, is small. One day's supplies for such an army and its supporting forces can be carried in a few train loads. It is therefore essential not only to cut all the railways but to keep them cut for the length of time required to achieve the object stated in paragraph 6 above. Cuts must be kept under constant observation and either attacks must be renewed when repairs are approaching completion or a fresh cut effected elsewhere.

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9. It follows that this form of attack on communications is particularly susceptible to weather conditions. A spell of bad weather may enable the enemy to get through sufficient trains to build up his reserve stocks of all kinds with the troops and in forward depots, and thus to nullify the effects of prolonged and perhaps costly activity by the Tactical Air Force. It is in this connection that fighter-bombers are of particular value in maintaining the pressure, since they can operate in weather which would be quite impossible for the mediums. This raises two points of great importance which must always be borne in mind :—

(*a*) The daily tonnage of all supplies, except rations and fodder, required to support an army and to maintain its reserve stocks at a safe level is directly dependent upon the intensity of the operations in which that army is engaged. An army on the defensive which is not being subjected to any pressure uses only a fraction of the supplies which it must expend if it is fighting intensively, and the effect of air action against its communications is proportionately less serious. During an air offensive of this nature, therefore, the Army must whenever possible support the Air Force by maintaining pressure on the enemy, thus forcing him to expend fuel, ammunition, engineer stores, etc., while the Air Force is preventing him from replenishing his supplies.

(*b*) It is not always possible, when the number of available divisions is limited, for the Army to be constantly on the offensive with the object of forcing the enemy to expend supplies. At the same time the Air Force cannot be expected to sustain this very intensive form of operations indefinitely, involving as it does a high rate of attrition in aircraft and crews. When therefore a period of comparative inactivity on the ground becomes necessary—as for training and regrouping before an offensive—the timing of the air offensive against communications is a matter for the nicest judgement. The balance must be struck between, on the one hand, allowing the enemy to build up reserves in the forward areas to a point which will make the object of the air offensive almost impossible to achieve, and, on the other, exhausting the Tactical Air Force to an extent which will weaken its capacity to meet the exacting demands of support for the ground offensive when it is launched.

Roads

10. Whereas in attack on railways the main target is the railroad itself rather than the traffic using it, on the roads the reverse is true. Except for medium and large bridges and viaducts on important highways, which are often targets of the first importance, roads are difficult to cut or block for any length of time. It is generally true to say that (again excepting large main road bridges) attacks on roads themselves are only profitable as bottlenecks, such as in villages, when the resultant temporary barrier may create useful targets in the form of a block of vehicles. On the other hand the destruction of M.T. vehicles using the roads is an essential supplement to action against rail communications. The enemy is known to be short of M.T., and the more effective our attacks on his railways the more vital will be his dependence on road transportation. We have conclusive evidence that fighter-bombers by day with cannon and bombs, supplemented by intruders and light bombers by night, can impose a rate of wastage of destruction and damage of M.T. vehicles that is a factor of real importance in any offensive against communications.

11. Opportunities seldom present themselves for attack on formed bodies of troops on roads, except occasionally in the forward areas actually during a battle. But the movement of important reserves over appreciable distances is usually done by M.T. at night, and may form a profitable objective for light bombers in the critical stages of a battle when the enemy may be expected to be moving his reserves.

Seaborne Supply

12. Experience in Italy has shown that, when the enemy feels the pinch on his rail and road communications, he turns increasingly to seaborne supply in light craft of all types, using every available port of any size and even unloading over beaches. This, of course, can never be a substitute for rail or road transportation particularly anywhere near the front, but it does constitute a useful supplement to land communications. This form of seaborne supply is very difficult to stop. The movement

of enemy shipping can be, and has been, stopped almost completely by air attack during the hours of daylight. But aircraft cannot be relied upon to stop small vessels moving at night, and even when sufficient light naval forces of a suitagle type (including minesweepers) can be made available, a certain amount of shipping will always get through. The use of medium bombers at night for mining harbour approaches and inland waterways will sometimes be effective in dislocating waterborne supply.

13. Harbours are not normally good bomber objectives. Ships can be sunk in harbour, port facilities destroyed and approach roads and railways blocked, but it is almost impossible to prevent the use of a harbour and thus cut a line of sea supply in the same way as a line of rail supply can be cut by destroying a bridge. Nevertheless, this seaborne supply may be so important, especially when the enemy is working to a fine margin, that his ports cannot be ignored. Action against his ships at sea must, therefore, be supplemented by bombing the ports where they load and discharge. Unloading is done to a considerable extent at night, and harassing attack by night bombers, in addition to destroying a certain amount of supplies, will cause delay and dislocation in the unloading and turn round of ships and thus reduce the volume of supply that can reach the armies by this means.

The employment of bombers on the battlefield

14. From the foregoing certain principles emerge affecting the employment of bombers during a land battle :—

(*a*) The proper function of bombers of all classes is to prevent or interfere with movement : of reserves, fuel, ammunition, rations and warlike stores generally.

(*b*) This movement can mostly be found and can most effectively be dealt with in the enemy's rear areas and on his lines of communication, beyond the range of artillery. On the battlefield itself movement is too dispersed to present a favourable target for bombers, and in any event interferences with it will normally be too late to affect operations.

(*c*) Except to retrieve a critical situation in defence, when it is vital to use every available means to stop enemy movement on the battlefield, heavy and medium bombers should very rarely be used on the battlefield itself.

(*d*) In the attack, our aim being to move ourselves, the use of heavy or medium bombers on the battlefield, so far from being a help to the land forces, is definitely liable to be a hindrance. By demolishing buildings, blocking roads with debris and making deep craters, air bombardment tends to create obstacles to movement by our infantry or tanks—obstacles which are still suitable for defence by determined infantry and anti-tank gunners.

(*e*) Even light and fighter-bombers will usually afford more valuable assistance to the advance of the land forces if they are used in the enemy's back areas, beyond the range of our artillery. There may be rare occasions, in terrain approximating to that of the North African desert, when lack of cover enables fighter-bombers to take advantage of targets of opportunity in the enemy's forward areas. And in the crisis of the land battle there will be some targets, such as key artillery positions in ground dead to direct observation and fire, which will be of sufficient importance to justify the use of fighter-bombers even within the range of our artillery. But as a general rule they should not be used against gun positions, strong points or fighting troops on the battlefield which can be engaged by artillery. Even in the actual assault, therefore, calls for close battlefield support by fighter-bombers should be reduced to the absolute essential minimum, so that they may be concentrated at the critical time against enemy movement where it is important—in his immediate back areas where reserves and supplies may be expected to move.

(*f*) In periods of inactivity on the ground, armies must do without close air support altogether in order that every available aircraft may be employed on the offensive against enemy communications.

(*g*) When fighter-bombers are used against battlefield targets it is usually advisable to give them as free a hand as possible, briefing them clearly on the effect they are required to achieve but not tying them down too closely with preconceived orders designed to meet a situation which may have changed by the time they get into action.

15. On the very rare occasions when it may be considered necessary to use medium bombers to supplement the artillery preparation for an attack—which should only be when it is considered that the available artillery is inadequate for the task—it is important that all concerned should be fully aware of the implications.

16. The bomb has a far higher charge/weight ratio, and hence greater blast effect, than a shell of equivalent size ; a concentrated air bombardment will therefore bring to bear a weight of explosive in a very short space of time which would take much longer if fired by a concentration of artillery. But, apart from a greater blast effect, the eventual result will be substantially the same. Neither form of bombardment can be expected to eliminate all resistance and enable the land forces to advance without opposition ; dug-outs and other underground shelters will afford at least a measure of immunity from either, and neither will reduce stone buildings to a condition in which they will not serve as cover for stout-hearted defenders when the bombardment ceases. Moreover, as pointed out above, heavy bombs will reduce houses to piles of rubble that will block streets and make them impassable for tanks and difficult even for infantry, and, especially in country where the water level is close to the surface, they will make craters that become very effective anti-tank obstacles and require bridging before they are passable to vehicles of any description. In weighing the use of pattern bombing on the battlefield as against communication targets, it must also be remembered that, though one bomb may hit a strong point or gun position, the remainder of the pattern may be entirely wasted. Against a target like a railway junction or marshalling yard, on the other hand, almost every bomb of an accurately-laid pattern can be relied upon to do damage.

17. Nevertheless, there may be rare occasions when these disadvantages are considered acceptable and heavy air bombardment included in the fire plan for the assault. The effect of such bombardment as the climax of an artillery preparation may be very demoralising, but it will be fleeting. On such occasions, therefore, the initial assault must be timed to go in immediately the bombardment stops so as to catch the surviving defenders while they may be expected still to be somewhat dazed by the effect of the bombardment, and it must be in sufficient strength to make sure of smothering the defenders. Where the position is highly organised, mopping up must be carfully planned ; and if the conditions are such that the bombardment is likely to produce obstacles to free movement, infantry must form the bulk of the assaulting force.

18. Normally, however, all classes of bomber will contribute best to the success of an offensive on the ground if they are used :—

(*a*) to keep open the cuts that have been made in the enemy's rear communications during the preparatory stage ; so that when the time comes when he is forced to expend fuel and ammunition in a big way, he is given no relief or opportunity to replace that expenditure from his rear depots ; and

(*b*) during, and for a short period prior to the attack on the ground, which may vary from a few hours to a few days depending on the situation and particularly on the value in that particular situation of the factor of surprise, to destroy the enemy's power of movement close behind the battlefield ; to smash his headquarters and signal system, communication bottlenecks, dumps of fuel and ammunition, tank and M.T. repair shops, M.T. parks and forward railheads ; in fact, to create a situation in which his capacity to move reserves of all kind to meet the needs of the battle will be paralysed.

By command of GENERAL WILSON :

J. A. H. GAMMELL,
Lieutenant General, Chief of Staff

EARL H. DEFORD,
Brigadier General United States Army
Air Corps

APPENDIX 10

OPERATION WOWSER—1945

Target	*Date*	*Time of Start*	*Duration in Minutes*	*Effective Heavy Bomber Sorties*	*Tons of Bombs*	*Results*
Tactical targets in area Apricot and Apple about 9 miles by 1–2 miles and parallel to Santerno and and Senio Rivers	9 April	1342 (just prior to opening of Eighth Army Offensive	92	825	1,692 (mainly frag.)	Excellent
Tactical targets in area Baker and Charlie along Santerno River	10 April	1100	60	848	1,792 (frag.)	Excellent
Nineteen specific tactical target areas on Fifth Army front south and south east of Bologna	15 April	1257	91	830	1,577	Excellent on eighteen areas
Three rail diversion bridges, ammunition factory and stores	15 April	1200	108	312	797	Good
Tactical targets south of Bologna	16 April	1321	39	98	216 (G.P.)	One good concentration but 692 aircraft failed to attack owing to weather
Twenty-one specific tactical target areas south of Bologna	17 April	1254	125	751	1,607 (G.P.)	Good on twenty targets
Thirteen specific tactical target areas south of Bologna	18 April	1548	61	473	1,091 (frag. RDX)[1]	Heavy concentration on areas

On the average each effective heavy bomber dropped 2.2 tons of bombs. Non-effective sorties were normally only about 5% of the force despatched but the over-all effectiveness was reduced to 86% owing to bad weather conditions on 16 April. Losses amounted to $\frac{3}{10}$ of 1%.

[1] A new type of powerful high explosive.

APPENDIX 11

TACTICAL RECONNAISSANCE IN BURMA

Fighter Reconnaissance

From June 1942 a detachment of Lysander aircraft performed tactical reconnaissance tasks for IV Corps on the Manipur front and from September in the same year another Lysander flight operated from Chittagong. In January 1943 the Lysanders were withdrawn and in Arakan were replaced by Hurricanes. A similar change over occurred in Manipur in March 1943. Thereafter and for the remainder of the war in Burma, Hurricanes fulfilled the role of tactical reconnaissance. One Royal Air Force Tac/R squadron operated on the Burma front until November 1943 when an Indian Air Force squadron moved into Arakan. This enabled the Royal Air Force squadron to concentrate all its aircraft at Imphal. In March 1944 another Indian Air Force squadron was brought into the Manipur area, making two in all on this front. In July 1944 the Royal Air Force squadron was withdrawn.

In the course of time it was found that the handbooks and manuals of army co-operation could only form a basis for the tactics actually employed in the Burma theatre since the difficult nature of the country, long distances between forward troops and forward airfields and other factors differed greatly from conditions found elsewhere. Tactical reconnaissance was the chief function of fighter reconnaissance squadrons and in the period 1942–1944, two distinct areas were covered. The first in Arakan and the second from Imphal as far east as Bhamo and as far south as Mandalay. The two differed so considerably that they must be dealt with separately

Fighter reconnaissance aircraft in Arakan were the most advanced elements of the air forces on this front. They were only a few miles behind the forward troops and had a comparatively small area to cover. This extended roughly south to Akyab and east to the Kaladan river. The terrain to the south along the coast is flat and the lines of communication were mainly down broad river valleys fairly easily followed, while to the east the densely covered hills of the Arakan Yomas presented a vastly different picture. Here tracks were almost completely hidden for long stretches and a high standard of map reading and navigation was required to obtain any results. Sorties were flown at about 50 feet in the open country and at 100–150 feet over thick jungle. From any greater height nothing of value could be seen.

The Japanese ground forces were extremely air conscious and it was only by complete tactical surprise that any troops could be caught out in the open by day. If seen, the enemy would immediately take cover in the dense jungle at the side of the roads or in slit trenches which they built everywhere. Complete surprise was however obtained by flying at 50 feet and in this way aircraft could often confirm the presence of enemy troops in certain areas. Possibly the greatest effect of the tactical reconnaissance aircraft was to deter the enemy from using his lines of communication during the day and to report activity in villages and the use of roads. At first sorties were flown singly, primarily to conserve aircraft and secondly because there was little enemy opposition. Flying over dense jungle was later to be regarded as trying on the nerves of pilots and from January 1943 onwards sections were employed on all operations. The second aircraft would usually weave slightly behind and to one side of the leader. Very little M.T. was used by the enemy and when spotted was usually returning to harbour at first light. Dawn sorties therefore proved more profitable and the occasional night sorties usually caught one or two vehicles. Japanese camouflage was almost perfect and pilots had therefore to develop the art of looking ' into' the jungle rather that at it. This was difficult for new pilots but after several sorties the ability to spot activity in jungle country could be developed.

In the period 1942–43 very little activity on either side took place around Imphal. Fighter reconnaissance was used to a large extent in a strategic role and sorties were flown far and wide over the enemy's lines of communication. Tactics on this front differed only slightly from those adopted in Arakan. Aircraft again flew in pairs the duration of sorties being 2½ to 4 hours for which long range tanks were used.

Tactical Photographic Reconnaissance

At all times on the Burma front photographic reconnaissance played an important part in the work of fighter reconnaissance squadrons. Cameras used were F.24 with 5 in. and 8 in. lenses, one oblique and one vertical camera usually being carried. But the photographic equipment carried by fighter reconnaissance Hurricanes was very much out of date and this also applied to the ground equipment. A dilapidated Brownhall trailer served one squadron for nearly three years and the deficiency in photographic equipment greatly affected this form of reconnaissance. Topographical information was grossly inadequate and inaccurate and the air forces were therefore required to provide large numbers of oblique and vertical photographs of the battle areas. These photographs had to be modern since streams and rivers were apt to change course at frequent intervals and warlike activity often altered the appearance of tracks and villages from the air. The demand for photographs was far in excess of what could be provided by the aircraft available. It thus became necessary for Third T.A.F. to enlist the aid of the Photographic Reconnaissance Force but this too had serious drawbacks. All the facilities of the Photographic Reconnaissance Force were situated at Calcutta and by the time the photographs had been processed, interpreted and flown back to units in the forward areas, a minimum of eighteen hours had elapsed.

Photographic sorties were flown at varying heights from 2,500 to 6,000 feet save for the low level oblique photographs. By fitting each aircraft of a section with cameras double results were achieved on sorties, each aircraft taking photographs in turn while the other acted as look out and cover. Here again map reading had to be of the highest standard for the approach to target areas as mosaics were frequently rendered difficult by the absence of suitable landmarks and no successful method was evolved by which the second aircraft could direct his leader on to the correct photographic run. Success therefore depended largely upon the experience of the pilots.

APPENDIX 12

AIR TRANSPORT DURING THE RE-CONQUEST OF BURMA

The re-conquest of Burma proved that once air superiority had been achieved, the air maintenance of forces in the field was governed primarily by the availability of airfields and of transport aircraft. The supply of an army engaged in intensive and mobile operations, together with a tactical air force in support, is a major problem even under the most favourable conditions. In Burma supply bases were 250 miles distant and the intervening country comprised vast stretches of almost impenetrable jungle and a formidable mountain barrier rising up to 10,000 feet. In addition, weather conditions were by no means favourable. Yet despite these many difficulties the air supply operations in the Burma campaign met with great success. It was, in fact, a decisive factor of the land campaign. Mistakes occurred, sometimes due to miscalculation and sometimes due to unforeseen contingencies but the air supply operations in Burma will probably rank as one of the major air supply achievements of the war. For ninety per cent of the requirements of two army corps and the advanced elements of a tactical air force were met by British and American transport squadrons operating at sustained rates. Air supply reached its peak in Burma in March 1945 when approximately 85,000 tons of supplies were transported by air to the Allied forces in Burma.

Air transport support was not, however, confined to the supply of forces in the field since the use of American glider-borne engineers to build and repair airstrips for the reception of landed supplies and troops down the railway corridor was an integral part of the plan for IV Corps' dash towards Rangoon during April 1945. Before this a small, though vital, airborne operation took place to consolidate the capture of Meiktila. As soon as the rapidly moving brigade of IV Corps had captured the airfield, which was being fiercely attacked on all sides by the enemy, transport aircraft, on 27 February, began to fly-in reinforcements under fire. In less than five days 655 landings were made on this airfield during which time 4,000 troops, together with vast stores of petrol, ammunition and rations were landed. On 3 March organised resistance in Meiktila town had ceased. A captured Japanese staff officer assessed the Meiktila operation as the turning point in the battle for Burma. The difficulties for the transport aircraft had not yet been overcome, however, since Meiktila airfield was still within range of Japanese guns. After three weeks bitter fighting the enemy shelling continued so persistently that aircraft were obliged to resort to supply dropping. It was not until early in April that Japanese resistance weakened and the whole of Meiktila was secured as a vital base. But for the effort kept up by air transport, it seems resonable to conclude that the struggle might well have been even more bitter and the outcome less fortunate for the Allies.

Preparations were immediately commenced to build up stocks at Meiktila to maintain the Fourteenth Army in their thrust southwards. By 20 April the leading elements of IV Corps had cleared Pyinmana and the nearby airfield of Lewe. Here British and American engineers prepared the strip for the reception of the gliders then at readiness at Meiktila and on 21 April the fly-in commenced. The gliders carried a variety of loads including runway equipment, bulldozers, jeeps, food and water. As the finishing touches were being put to Lewe airfield, IV Corps troops had reached Toungoo and on 23 April, six gliders from Meiktila were released over Tennant airfield (Toungoo), all landing safely with loads similar to those delivered to Lewe. The airborne engineers immediately set to work and made the strip serviceable. On 24 April 56 transport aircraft landed.

Another part of the original air lift plan was to lift a battalion group to the Pegu area, about 50 miles north of Rangoon. This was necessary to cut the Japanese escape route to the east. On 29 April the plan was put into effect when 28 transport aircraft conveyed troops to Pyuntaza airfield, north of Pegu, together with a considerable variety of stores. On the morning of 1 May there remained 159 trips to complete the Pegu operation. Although planned to be completed in four days, this time-limit was cut by half, in an attempt to prevent delays due to weather and field

conditions. To the south of Pegu bad weather had slowed the advance but by 4 May airborne engineers had reached Zayatkwin airfield to which gliders were towed from Toungoo. Other gliders were towed there from Lewe on 8 May with miscellaneous loads. This ended the last special transport operation in support of IV Corps' advance on Rangoon.

It should be noted that all these glider operations in support of IV Corps were carried out by U.S. aircraft and that the airborne engineers were members of American units of which the Royal Air Force had no counterpart. The fact that the Japanese were rapidly withdrawing down the railway corridor undoubtedly facilitated the operations as a whole ; moreover, apart from a light enemy air raid at Lewe, there was no interference from Japanese aircraft. The system of transport support to the land forces as represented by the glider operations was in many ways a model of inter-service organisation and co-operation. It would appear by the results to have been well planned and efficiently executed ; but these results, however, should not be analysed, except against a background of freedom from enemy opposition both in the air and, with certain exceptions, on the ground.

The problem of mantaining army units by air during the monsoon was no new one but its significance was greatest in 1945 owing to the considerable increase in commitments. The port of Rangoon, though now in Allied hands, could not handle the required tonnage of supplies needed, while communications difficulties rendered the movement of supplies northwards from Rangoon uncertain. Hence the need for a continued high rate of transport effort during the monsoon. Owing to various factors there was a short fall in supplies transported during June 1945 but in various ways the problems presented by waterlogged base airfields, the attrition caused by the intensive operations during the advance through Burma, the withdrawal of U.S. transport aircraft from the theatre, were overcome.[1] In July 1945 when only Royal Air Force transport aircraft operated, the number of hours flown and the tonnages delivered were proportionately greater than had been achieved before.

Throughout 1944 and 1945, the saving of lives and the mobility of our ground forces was materially assisted by the work of light aircraft and transport aircraft flying out sick and wounded from the battle areas. A formidable total of men were thus saved from avoidable pain and suffering, from many days' journey by sampan, mule and ambulance, and from dying for lack of hospital facilities. The flexibility of air power was illustrated by a unique operation carried out by Sunderland flying boats in 1944, when 537 wounded men of the Special Force were flown out from Lake Indawgyi behind enemy lines. This operation was, however, exceptional. The normal procedure was for light aircraft to bring sick and wounded from extemporised landing strips to airfields where transport were discharging their cargoes from where they could be flown to base hospitals.

[1] A.H.B./IIJ 50/47/6.

APPENDIX 13

OPERATION VARSITY, 24 MARCH 1945

	Aircraft Despatched	*Gliders Despatched*	*Effective Sorties (aircraft)*	*Effective Sorties (gliders)*	*Aircraft Losses*	*Aircraft Losses as Percentage of Effort*
U.S. IX T.C.C.						
From French Bases	906	897	897	889	40	4.41
From English Bases	243	—	243	—	5	2.06
Total American	1,149	897	1,140	889	45	3.91
Royal Air Force						
No. 38 Group	320	320	298	298	6	1.87
No. 46 Group	120	120	118	118	1	0.83
Total British	440	440	416	416	7	1.84
Combined Airborne Total	1,589	1,337	1,556	1,305	52	3.28
U.S. Eighth A.F. Supply Dropping	240	—	239	—	16	6.66
Grand Total	1,829	1,337	1,795	1,305	68	3.71

Summary of Loads Carried in the Initial Drop

Troops	14,365
Ammunition and Explosives	109 tons
Vehicles	695
Artillery Weapons	113
Equipment and Supplies	765 pieces

APPENDIX 14

DEVELOPMENT OF THE GERMAN GROUND ATTACK ARM AND PRINCIPLES GOVERNING ITS OPERATIONS UP TO THE END OF 1944[1]

A Study prepared by the German Air Historical Branch (*8th Abteilung*) and dated 1 December 1944. Translated by Air Ministry A.H.B.6. Translation No. VII/14. Revised 18 February 1952.

CONTENTS

I. The Formation of the Ground Attack Arm and its Development before and during the War

In the course of the war, the ground attack aircraft has gained ever growing significance as an important factor on the battlefield. Whereas before, and at the beginning of this war, only a small number of ground attack formations was available, there has during the course of the war, been a steady extension of this arm of the service.

Among the enemy powers, there was contention as to whether ground attack units should be regarded as a special branch of the service, or whether their tasks should be taken over by fighters and bombers. In this connection, the development of the ' attack ' aircraft, as carried out in America particularly, is worthy of attention. In other countries, light bombers or multi-purpose aircraft had been developed for the tasks of ground attack aircraft.

The experiences of this war, however, have shown that the ground attack aircraft is a weapon which can no longer be ignored. In the operation of modernly equipped forces, the ground attack aircraft plays a part as important as that of the bomber, fighter, reconnaissance aircraft and tank.

The importance of the moral and material effect of low flying aircraft was recognised during the Battle of the Somme in 1916. Single so-called ' Infantry aircraft ' (aircraft attached to divisions for battle tasks of all kinds) were employed for the recognition of our advanced positions or for the purpose of supplying isolated groups, with ammunition, food and equipment. These aircraft attacked enemy machine gun positions, reserves, and batteries from low level with machine gun fire and bombs.

Not until the Battle of Flanders, however, were organisational and tactical deductions drawn from these individual results. In an attack on the coast in the 4th Army area on 10 July 1917, an independent *Staffel* of Bomber *Geschwader* 1, which was in the process of re-equipping, escorted our own attacking troops for the first time.

The effect on friend and foe alike was recognised as exceptionally great. In consequence, the *Schutzstaffeln* (i.e. the escort aircraft attached to divisions for battle tasks as independent *Staffeln*), were gradually renamed *Schlachtfliegerstaffeln* or *Schlachtstaffelgruppen* (a Gruppe of 4–6 *Staffeln*) by March 1918, and were re-equipped.

[1] The L.D.V. and D(Luft)g series which are quoted in this study were German Air Ministry Publications corresponding approximately to our Air Publications. The L.D.V. series was mainly concerned with administrative and organisational matters, while the D(Luft)g series, classified Secret, dealt with tactical, operational, and technical subjects.

The question of whether a light, fast and easily manoeuvrable aircraft or a heavy, armoured type should be introduced, was settled in favour of a light aircraft at a meeting of *Schlachtstaffel* pilots held in the late autumn of 1917. (*Halberstadter* CL IV and *Hannoveraner* CL V, single strut bi-planes with 160 h.p. Mercedes, 3 hour duration, speed of 190 km. hour approx.)

Strongly armoured twin-seater AEG aircraft were also used, from which the observer attacked ground targets in the main battlefield with a movable 2 cm. (Becker) cannon or small 1 kg. fragmentation bombs (known as *Fliegermaus*).

These very vulnerable types were later replaced by a Junkers all-metal aircraft with an armament of :—2 fixed machine guns for the pilot, 1 movable machine gun for the gunner, 6–8 bombs (10 kg.) with highly sensitive fuses and occasionally mortar bombs. Up to March 1918 a total of 38 such ground attack *Staffeln* were formed. A special ground attack school trained the flying personnel, which consisted of N.C.Os. and O.Rs. up to and including the *Staffel* leader.

In the fighting early in the year during the great battle in France and particularly in the last offensive and defensive battles from June to autumn 1918, these formations were used successfully in attack and defence, particularly in the heavy fighting during the attempted break-through near St. Quentin on 21 March, and subsequently against enemy reserves, supplies and columns on the Roman road, and against the Somme and canal bridges near Noyon, Ham, Chauny and Peronne, bridges on the Aisne and Veille and against airfields around Soissons.

The ground attack *Staffeln* thus developed into an extremely effective and mobile reserve weapon for attack and defence.

* * * *

The Versailles Treaty had destroyed German air power, and in the reconstruction of the Air Force in 1935 no plans were made for the formation of ground attack units. The main emphasis was placed on the creation of bomber and fighter units.

As regards Army-Air Force co-operation, it was laid down that in decisive battles the Air Force must give support to the Army (para. 120, L.Dv.16, 1935). To this end the bomber forces should operate behind the enemy's operational area. In the battle area itself, there were no suitable targets for the bomber forces (para. 125, L.Dv.16, 1935). The results obtainable by bomber forces were not considered to be worth the outlay. When available, fighter and reconnaissance aircraft were at that time considered more suitable for operations over the battle area.

Nevertheless, these special requirements were kept in mind during the course of technical development, and the light dive-bomber was included in the specifications made at that time. The first type produced was the Hs.123, which was developed on the lines of the Curtis ' Helldiver '.

L.Dv.16 (1937) refers to the possibilities of employing ground attack aircraft over the battle area, but the traditional conception of these aircraft dating from World War I had not yet changed. In the new edition of L.Dv.16 (1937/40), dealing with Army co-operation, the principle was expounded, that the operations of the Air Force generally have an indirect effect on the military operations of the other Armed Services (para. 120, L.Dv.16 (1940)).

For army co-operation, the use of reconnaissance aircraft, ' flak ' Artillery and aircraft reporting companies was foreseen ; also that of fighters when the ground situation demanded it, and the situation of the entire war permitted (paras. 120 and 121, L.Dv.16 (1940)).

Paragraphs 129 and 130 of L.Dv.16 (1940) then proposed the use of bombers near to the front line. Mass attacks, mainly at low-level, against reserves or movements in the rear and against the retreating enemy were also discussed here, and these were credited with striking results, particularly as regards their effect on morale.

These principles show that the employment of the Air Force in close support of the Army had to be expected. The creation of units exclusively for this purpose had not yet been considered and the conception of ground attack units as such was still lacking. These principles may also have been influenced by the belief that air attacks against scattered formations in frontal areas or against troops in reinforced positions had in general little effect (para. 130, L.Dv.16 (1940)).

At this time the great military powers were concentrating on the development of the so-called strategical Air Force with which it was intended to induce quick decisions. These aircraft were, and still are, unsuitable for regular employment in close support of the Army.

Development of ground attack units was particularly advanced in the U.S.A. ; in other countries opinion was divided and consequently no special type of aircraft was developed. The types of aircraft which might have been used for intensive ground attack work were unable to give the necessary support to the ground troops because of their low pay-load, light armament and extreme vulnerability.

Modern tactics and technique for the employment of ground attack units had to be developed. Their possibilities had not yet been fully studied or confirmed, and this state of affairs probably led to the failure to recognise the ground attack units as an important aid to land warfare. The same ideas evidently predominated in the camp of our present enemies. This can only be explained by the fact that little or nothing had been done to develop the ground attack arm after the end of World War I, in which our enemies were victorious.

* * * *

With the Spanish Civil War came a reversal of previous conceptions regarding the employment of the Air Force in direct support of the Army with units specially equipped and trained for the task. The ' Condor ' Legion, which successfully experimented with ground attack sorties, acquired much valuable experience. It is an interesting fact that this result was brought about indirectly.

At the beginning of 1937 the ' Condor ' Legion had at its disposal one fighter *Gruppe* equipped with He. 51's. It now transpired that this aircraft was no match for the opposing fighters, which had appeared at the same time as the ' Rata ' and ' Curtiss ' types, both of which were superior to the He. 51 in speed and armament. As a result of this, and of consequent losses, the German Command had the choice of either withdrawing the He. 51 from the battle, or of employing it in another way. The solution was found—to employ the He. 51 fighter *Staffeln* as low-level ground attack aircraft.

In co-operation with the ground troops and our own reconnaissance formations, these *Staffeln* were now used in direct support of the Army on the battlefield. Methods and tactics were quickly improved and offensive and defensive operations were soon carried out by Franco's troops solely with the assistance of the ground attack units. The ground attack aircraft thus played a decisive part in these operations. Fully appreciating the importance of this innovation, the High Command of the Spanish Air Force formed its own additional ground attack units.

The importance of the support given by the ground attack aircraft to the troops in the Spanish Civil War can be judged from the high German and Spanish decorations awarded to the commanders of the ground attack units after the end of the war. The importance of the ground attack unit had already been recognised by the General Staff of the German Air Force during the Civil War.

As the possibility of a war had to be considered in 1938 before the occupation of the Sudetenland, the immediate formation of 5 ground attack *Gruppen* (at that time, *Gruppen* 10, 20, 30, 40 and 50) was ordered. Between 1st July and 1st September, previously untrained pilots had to be trained as operational ground attack pilots. Four of these five *Gruppen* were re-equipped with Ju. 87's after November 1938 and joined existing dive-bomber *Gruppen.*

Technical research led to the development of the twin-engined F.W. 189 with armour-plated cabin. This type fell short of expectations ; it was consequently not employed as a low-level aircraft, but was used later for close range reconnaissance operations.

At first, the Ju. 87 formations did not belong to the ground attack units and therefore only one ground attack *Gruppe* was available at the outbreak of war in 1939. (II *Schlact*/Training *Geschwader* 2 (Hs. 123's) was formed from *Schlactgruppe* 20 on 1 November 1938.) The Ju.87 formations were neither bomber nor ground attack units, but formed an independent arm in the German Air Force as dive-bombers. Their task did not consist in close support of the Army but was the attacking of strategic targets within their range.

D(Luft)g. 1911 of September 1940 states : ' The main task of dive-bombers is to attack small static enemy positions of vital military importance. The manoeuvrability of the dive-bomber and its armament made it suitable for attacks on living and mobile targets, e.g. railway trains, tanks and mechanised supply columns, warships and merchant ships of all kinds, troop concentrations and columns on the march, particularly when in narrow confines '.

The campaign in the west, however, had caused a considerable change in duties, and in the meantime close support of the Army had become as important as attacks on the targets specified in D(Luft)g. 1911 ; during the subsequent course of the war close support of the Army proved to be the main task of the dive-bombers.

Although the Ju.87 formations appear under the designation of ' dive-bombers ' up to 1943, they must, nevertheless, like the Hs.123, Hs.129 and Me.110 formations, be regarded as ground attack units.

The renaming of dive-bombers as ground attack aircraft began on 5 October 1943. Up to that time there was no Air Officer in charge. Had there been one, he would surely have introduced a uniform designation for all formations. It was partly on account of this that the designation ' Stukas ' continued to be used for so long ; in addition, this work had become universally known by the great successes of the units. In Poland and in the Western campaign, ' Stuka ' was to our enemies synonymous with destruction, death, fear and panic.

A noteworthy event in the further development of the ground attack arm was the alteration effected in the Me.109 fighter and the Me.110 long range fighter or heavy fighter. The Me.109 was converted to carry a 250 or 500 kg. bomb, thus creating a new and controversial class of aircraft—fighter-bomber (' Jabo ') added to fighters or bombers.

The Me.110 was likewise equipped with bombs, and was employed on low-level attacks on ground targets with its very effective fixed armament, that is it was used in fact as a ground attack aircraft.

The lack of a uniform organisation was, however, prejudicial to the ground attack arm in the course of the war. Whilst the Hs.123, Hs.129, Me.109, Me.110 and F.W.190 formations were, as ground attack aircraft, fighter-bombers and high speed bombers, under the control of the A.O. for Fighters (Air Inspectorate 3), the Ju.87 formations were under the A.O. for Bombers (Air Inspectorate 2).

The ground attack arm, which had proved to be increasingly important during the course of the war, thus had two heads, a situation the disadvantages of which were not however obvious until 1942. Up to that time no particular tactical or technical difficulties arose, partly because we had air superiority on all fronts.

It is clear, however, that a separate Air Officer would have looked after the interests of the ground attack arm quite differently and with much more vigour than two Air Officers who still had to contend with their main tasks—the fighter arm in one case and the bomber arm in the other. In the course of the war these officers were so much concerned with the development of their own special arm that the interests of ground attack (especially as represented by the Me.109 fighter-bomber and Me.110) could only be considered to a very small extent.

The development of the war, however, demanded another solution. In view of the difficulties under which the ground attack formations had to fight in all theatres of war, particularly in the south, the ever increasing enemy defences, the specialisation of day and night operations and the special tactics against tanks, new technical developments and the replacement of obsolete aircraft became essential.

The constantly changing situation led to a multiplication of armament. For example the *Waffenbombe* (so-called *Giesskanne*—' watering-can ') with a number of fixed machine guns enclosed obliquely near the bottom was introduced. Me.109's, Me.110's and Ju.87's were also equipped with 2 kg. fragmentation bombs. The installation of the 3 cm. machine cannon 101 in the Me.110, which had exceptional success in attacks on tanks, must also be mentioned here.

Direction by a separate Air Officer therefore became still more necessary. On 7 September 1943 the post of A.O. for Close Support was created, embracing all ground attack formations, and on 7 October 1943 was designated A.O. for Ground Attack.

The Stuka (Ju.87), ground attack (F.W.190), high speed bomber (F.W.190) and tank buster (Hs.129 and Ju.87) were included under the new designation—' Ground attack, tank buster and night ground attack formations '. The Me.110 formations, however, remained as heavy fighters with the A.O. Fighters.

Uniformity as regards both tactics and training of cadets resulted from this time onwards. The interests of the ground attack arm, particularly in the field of tactical and technical development, were followed with the greatest care and energy.

The units provided for ground attack operations were equipped with Hs.123's and Ju.87's before the war, and they also entered the war with these types. The Ju.87 is still used in a few units today as a front-line aircraft, and during the war has been continually improved in different series. The performance, however, was much inferior to that of enemy fighters whose strength and superior armament first became noticeable in 1942 in Malta and Africa.

From then onwards, operations with Ju.87's demanded strong fighter escorts. As a result of the general air situation and withdrawal of fighters from other fronts for the defence of the Reich—still less forces were available for fighter escorts, and the conversion of the Ju.87 formations became essential. It was planned for all day ground attack formations, and this has already been carried out in most units. The Ju.87 has been replaced by the F.W.190.

The Hs.123 units, already obsolete before the beginning of the war had, as a result of their losses in the course of the war, also to be re-equipped with Me.190's and Hs.129's at first, and later with F.W.190's.

The tank buster units are equipped with Hs.129's and Ju.87's. Two F.W.190 *Staffeln* are operating with *Panzerschreck* and 3–4 others are being re-equipped, while the use of F.W.190's with *Panzerblitz* is planned.

Various bombs up to 1800 kg. (Ju.87) are used and 250 and 500 kg. bombs are normally carried in the fuselage, while 50 and 70 kg. bombs are loaded under the wings. Jettisonable containers of SD1, SD2, SD10 and more recently of SD4 HL (hollow charge) bombs are being used in ever increasing numbers for attacks on tanks.

The calibre of aircraft armament has also developed during the war. The M.G.15 and 17 came into use at the outbreak of war, but the former has now been replaced by the M.G.81 and the M.G.131 and 151, and 2 cm. cannons have been introduced in place of the M.G.17 as fixed aircraft armament. The 3 cm. (Me.110 and Hs.129) and 3.7 cm. (Ju.87) cannons are being introduced as special weapons for tank combats (the 3.7 cm. cannon was used in Me.110's). One Hs.129 B-3 *Staffel* is also operating with 7.5 cm. cannons (7.5 cm. anti-tank cannon 40).

Before, and at the beginning of the war, radio equipment consisted of the Fu.Ge.7,. which was later replaced by the 7c, while Fu.Ge.16 came into operation in the F.W.190. In the course of the war, Peil-G.4 was first used by Ju.87 units in Africa. F.W.190's are equipped with Fu.Ge.16ZS (homing equipment—ground attack), ZVG 16 (homing and sensing equipment) for homing after visual contact. Some were equipped later with Fu.Ge.25a (I.F.F. radar) for special operations (radar fighter and bomber control).

One ground attack *Gruppe* (Hs.123's), one *Geschwaderstab* and 9 *Gruppen* with Ju.87's were available at the outbreak of war. (Data taken from operation reports of Q.M.G. 6th *Abteilung*). In August 1943, 2 *Geschwaderstabe* each with 2 *Gruppen* of 4 *Staffeln* each were in operation with the Air Officer for Fighters as ground attack units (this includes the old Hs.123 *Gruppe*).

The strength of the Ju.87 formations in August 1943 was 4 *Geschwaderstabe* of 3 *Gruppen* each and one independent *Gruppe*, and during the course of the war 3 new *Geschwaderstabe* and 4 new *Gruppen* have been formed.

The concentration of all ground attack units under the Air Officer for Ground Attack gave the following strengths :—

6 *Geschwaderstabe* with a total of 17 *Gruppen*

1 independent *Gruppe*

1 tank buster *Gruppe*

4 tank buster *Staffeln* attached to 4 *Geschwadern*.

The night ground attack units came into operation at the end of 1942 for the first time, and up to August 1943 two *Gruppenstabe* and 13 operational *Staffeln* were available. Meanwhile the night ground attack arm had increased to 9 *Gruppenstabe* and 26 *Staffeln*.

The training of cadets was carried out by the units themselves until the beginning of the war, when the task had to be transferred from them on operational grounds. This led to the formation of reserve training *Staffeln* with the *Geschwadern* and of an independent *Gruppe* for the training of aircrew. At first they only trained cadets for their own units, but owing to heavy losses suffered by front-line units, transfers and weather conditions, these *Staffeln* could not always supply the necessary personnel, and it often became necessary to supply them from other reserve training *Staffeln*.

All Ju.87 reserve training *Staffeln* were embodied in one training unit in 1943 and after the appointment of the Air Officer for Ground Attack, all training units of ground attack formations were concentrated into one Ju.87 reserve training *Geschwader* and one F.W.190 ground attack reserve training *Gruppe*. With the conversion of F.W.190's a further concentration of all reserve training units for day and night ground attack into ground attack *Geschwader* 151 was carried out in May 1944. Training is now uniformly organised and presents no difficulties.

At the same time the necessity of equipping ground attack units with aircraft and arms developed for their special tasks becomes still more apparent, as converted aircraft of other branches of the service can at the best only be considered as temporary expedients.

II. Tasks, Organisation, Equipment and Tactics of the Ground Attack Units

The tasks and possible uses of ground attack aircraft were originally specified in D(Luft) 1911 of September 1940. The varied and many experiences of actual war have led to a development of more fundamental principles together with a deeper and more specialised knowledge of the individual problems arising from them. Furthermore, completely new objectives have evolved from them.

The tactics of the ground attack units, like those of other branches of the service, are subject to continuous development, and new changes will also appear in the future. It will always be the task of the High Command and even more so that of the unit commanders to adapt tactics to actual conditions and possibilities so that the greatest possible effect will be achieved with the smallest possible losses.

These tactics will have to be adapted to our own objectives and to the enemy's situation (particularly the air situation), to the technical position of both sides at the time to the enemy's mode of fighting, and to the geographical and climatic conditions of individual theatres of war.

Below are enumerated some of the principal changes in ground attack tactics :—

(*a*) No difficulties were experienced in operations by *Schwarmen* (4–5 aircraft) and *Staffeln* as long as we had air superiority, but with the growth of enemy fighter defences, these attacks became of necessity impossible unless carried out in bad weather conditions. The provision of a strengthened fighter escort also became necessary.

(*b*) The air superiority gained by the enemy made it impossible to operate ground attack formation on isolated fronts, because there were insufficient fighters available for escort duties.

(*c*) For the same reason it was urgently necessary to accelerate the conversion of units equipped with obsolete types of aircraft.

(*d*) Bombing attacks on tanks were very unsatisfactory, which led to the creation of special formations—tank-busters.

(*e*) Armour plating became necessary with the increase in armament of enemy fighters.

(*f*) Co-operation with the Army produced many improvements during the course of the war. Before the war only ground signalling strips were available as a means of communication, but since then several improvements in the recognition service have resulted in closer and quicker co-operation with the Army. Ground signals were improved and smoke puffs and signal cartridges introduced. Ground attack control officers (*Fliegerleitoffiziere* (*Schlacht*)) are employed with troops fighting at the main point of attack. By means of R/T communications it is possible to indicate targets and changes in the front line and targets during the approach, and to give reports on the weather and enemy fighters direct to the aircraft from the front.

(*g*) The introduction of the F.W.190 as a ground attack aircraft at first made the provision of fighter escorts unnecessary but subsequently its operation became impossible without fighter escort on some fronts owing to enemy air superiority.

The above mentioned examples show clearly how much tactics are subject to changes due to various factors, and technical development of aircraft, armament and armour-plating must keep pace with these developments.

At present the employment of ground attack formations is governed by the following principles :—

Ground attack units support the troops on the battlefield and the efficacy of this support can decisively influence the operations of the three Services. In direct support of the Army, the attacking of enemy troops in the field is exclusively the task of ground attack formations and only in an emergency should fighter and heavy fighter formations be drawn into these tasks.

Ground attack operations are directed against such targets on the battlefield (up to 30 km. behind the front line) which cannot be seen or destroyed by ground troops or which lie out of range of their heavy artillery. Targets which can be attacked by the Army, particularly with artillery fire, should not be attacked by ground attack units.

Ground attack operations take the form of repeated attacks on concentrations of weapons, troop movements, heavy guns, H.Qs. and supplies on the battlefield ; they weaken the enemy's morale and oblige him to conduct both his offensive and defensive operations from concealed positions. The ground attack units thus save lives among our own ground troops and facilitate airborne troop movements.

Indirect support of the ground troops can also be carried out in special circumstances by means of operations in the tactical area (up to 100 km. behind the front), in which case the targets are troop concentrations, traffic routes and headquarters installations. By this means the enemy can be surprised and weakened, often to such an extent that his operations are hindered or considerably delayed. Operations of this nature, however, are dependent as much on the enemy's ground and air situation as on our own strength.

Support of our own airborne undertakings as well as the destruction of enemy airborne troops is a task for ground attack aircraft and operations of this kind are of great importance.

Naval support operations prepare the way for our own landings and attack those of the enemy ; in this connection, the main target of the ground attack aircraft is to attack enemy landing units as early as possible. The beginning of landing operations is, according to our experience, generally delayed until night time, and consequently the attacks fall on ships running up to the coast. Ground attack formations are thus unable to counter-attack until after the landings and supply ships with personnel and equipment remain the target until the ground situation and the demands of our Army and Navy necessitate support operations. An effective attack on enemy landing can only be carried out with a strong fighter escort and a concentration of all available forces, as landings take place under cover of strong enemy fighter formations.

The actual task in hand will thus determine the choice of the most suitable means of attack. Sizes and types of bombs will have to be chosen according to the target, and it must also be decided whether bombs or cannons are to be used. Rocket projectiles as used by the enemy for low-level attacks demand special attention.

In a similar way, the type of attack (low-level, glide, dive or high-level) must be correctly chosen and applied according to the location and type of the target. The enemy's development of ricochet-bombing for attacking dug-outs can be taken as an example of how ground attack aircraft can be successfully employed where other methods of attack have failed.

The ground attack formations consist of ground attack, tank-buster and night ground attack units. Ground attack formations usually comprise *Geschwader* of 3 *Gruppen* each, with 3 *Staffeln.* Hs.129 tank-busters form one *Gruppe* and four Ju.87 tank-buster units are attached to ground attack *Geschwadern* as the 10th *Staffel.* Night ground attack aircraft are formed into *Gruppen* of 2–4 *Staffeln,* which can be employed independently at any time as the situation demands.

The ground attack units are mainly equipped with F.W.190's ; only a few Ju.87 formations are still in use, and their conversion to F.W.190's is planned. (Position at August 1944 : two Ju.87 *Gruppen* still operating—2 *Gruppen* being converted). The F.W.190, originally built as a fighter has kept its speed and manoeuvrability and has effective fixed armament and a bomb load of up to 500 kg. The performance of the Ju.87 ground attack aircraft is very much inferior to that of enemy fighters ; its main advantage is its heavy bomb load.

Ju.87G's and Hs.129's are used as tank-busters ; both of these aircraft are very slow due to their weight and to the unfavourable installation from the aerodynamic point of view of their special anti-tank armament. (This does not apply to the Hs.129B2 with machine cannon 103.) Their special armament is very successful against enemy armoured forces. In areas where there is danger from enemy fighters, they can be used with success with fighter cover.

Ju.87's and F.W.190's are being used more and more as night ground attack aircraft while a few efficient captured types are also coming into operation.

The ground attack aircraft's principal weapon is the bomb, and much importance has been attached to the jettisonable container with small fragmentation and hollow charge bombs. In addition to the material effect of the weapons, the moral effect is particularly great. The release of large containers full of small fragmentation bombs is very effective, as is also, although to a lesser extent, that of incendiary and smoke bombs.

Because of the varied nature of their duties it is necessary for ground attack personnel to be proficient in the use of all weapons suitable for their attacks.

Ground attack aircraft are equipped with normal and heavy guns and 2 cm. cannons according to types. The guns are fixed or movable and are effective against troops and vehicles. Anti-tank guns up to 3.7 cm. are the main equipment of tank-busters, and with special ammunition they have great success against enemy tanks and armoured vehicles.

In low-level operations with heavy bombs, the danger to our ground attack aircraft must not be under-estimated. If fuzes with long delays (to avoid endangering our own aircraft) are used, accuracy is reduced because unless sticky bombs can be used, the bomb will often bounce. Attention is also drawn to the penetrating capacity of the bombs (angle of impact and speed), which is greatly reduced in low-level attacks.

Direct Army support operations take the ground attack aircraft into the critical areas of the ground fighting, and such support is only completely successful if by means of close co-operation between the Army and Air Force, immediate advantage is taken by the Army of the effect of the air attack.

During days of heavy fighting operations are carried out without a pause. New operational orders must be ready when the formation lands, so that the time required for servicing the aircraft can be utilised for briefing the crews. In the case of heavy operations being sustained over a long period, a rest of 12 or 14 hours must be ordered from time to time by the Command, in order to prevent a decline in efficiency and technical serviceability.

The situation on the battlefield determines the course of possible ground attack operations, and the enemy's ground and air situation in relation to the strength of our available forces and types of aircraft, the weather situation and the terrain must be taken into consideration. On account of its great inferiority the Ju.87 cannot operate during the daytime without a fighter escort.

The fast F.W.190 has so far been able to carry out its tasks on the Eastern Front without fighter escort, and because of its high performance can also if necessary perform the duties of an escort fighter for Ju.87 formations. With air supremacy in the hands of the enemy, the provision of fighter escorts is also necessary for F.W.190's because during the target approach, in climbing and on account of their bomb-load, they are inferior in speed and manoeuvrability to the great number of enemy fighters employed. In addition to strong fighter escorts, the overwhelming enemy air superiority experienced in all enemy landings up to now demands the concentration of all available ground attack and fighter units for one task, if success on the battlefield is to be won.

The fighter escort is a decisive factor in the success of ground attack operations. The strength of the escort is dependent on the situation and the type of aircraft employed and it should be remembered that if F.W.190's have to act as fighter escort the efficacy of these *Gruppen* as ground attack units will be reduced.

During training it should be borne in mind that every ground attack pilot may have to perform fighter escort duties. It is desirable to keep the same fighter and ground attack formations together for a long time, as personal friendships between unit commanders and crews make for better co-operation and reduced friction. The rendezvous between the units usually takes place over the fighter aerodrome, but the enemy's great air superiority in heavy ground attacks sometimes makes it necessary for our ground attack formations to meet at any rate part of the fighters over their own aerodromes.

Ground attack operations usually take the aircraft over enemy strong-points, which are protected by strong fighter and ' flak ' forces. Light and medium quick-firing rocket projectors as well as A.A. machine guns are the most dangerous. Concentrated heavy ' flak ' forces the ground attack formation to greater heights during the target approach, rendering identification of target and co-operation with the ground troops (aircraft recognition service) more difficult. To reduce the effect of enemy defences we must use the following tactics :—approach from the sun, utilise cloud cover, attack simultaneously from different directions, and make simultaneous attacks on the ground defences by elements of the ground attack formation, Army weapons or our own ' flak ' artillery.

The great manoeuvrability of the night ground attack aircraft reduces the success of the enemy night fighter defences and their ceiling enables them to escape the light weapons of the ground defences. Targets protected by searchlights should wherever possible be avoided.

The minimum weather conditions for the operation of modern ground attack aircraft are considered to be a cloud base of 300 m. and visibility of 2–3 km. Formation attacks on targets heavily defended by A.A. are impossible with 10/10 cloud under 2,000 m. and in these conditions only small formations with specially trained crews can operate. A cloudless sky renders a surprise approach more difficult whereas medium, broken cloudiness of 3–5 tenths, which enables an approach to be made under cover, is particularly favourable for the attack.

The terrain has a decisive influence on operations. Poorly defended strips of land such as marshy areas, lakes and woods are very suitable for the purpose of rallying and target approach and departure. Low-level approaches will be made on sectors of the front protected by radar.

The closest co-operation with the ground troops is necessary if full advantage is to be taken of the operation and if mistaken attacks on our own troops are to be avoided. Recognition of our troops, particularly in the front line, and the use of signal cartridges are essential conditions in this connection. Amicable exchanges of experiences regarding recognition problems have frequently taken place with the Army, and numerous innovations and improvements resulted.

In the framework of Army-Air Force co-operation Control Officers (Ground Attack) were introduced by the Air Force Operational Commands in ground units employed at key points of the ground fighting. They were equipped with armoured vehicles and wireless sets, as used by the flying units. The Control Officer has the task of directing the formations to their target by R/T, informing them of local changes in the target and front line during the flight and warning them of the weather and air and ground defences ; he is not, however, entitled to issue orders.

In the course of the war the following current operational principles have been proved.

The great success of the ground attack operations is due to the effect of this concentrated form of attack. Attacks should therefore generally be carried out in *Gruppe* strength (20–30 aircraft) and only in exceptional cases in *Staffel* strength (8–10 aircraft). With suitable training, smaller units can carry out bad weather attacks in *Rotte* (2–3 aircraft) or *Schwarm* (4–5 aircraft) strength.

Centres of resistance such as infantry strong-points, anti-tank and artillery emplacements, tanks, etc., which do not always justify operations in *Gruppe* strength are often found in the path of our offensive. These targets are repeatedly attacked by *Rotten* and *Schwarme*. The commanders of these units must possess considerable tactical skill. Operations of this kind are not practicable in the face of enemy air superiority.

In mobile warfare the ground attack pilots seek out their own targets where fighting is heaviest. They ensure the rapid elimination of enemy defences and the protection of our offensive movements and withdrawals and also carry out tactical operations in the vicinity of the front.

The recognition of targets is facilitated by co-operation with the Ground Attack Control Officers and by the use of signal cartridges by the Army.

Given air superiority, several successive bomb and machine gun attacks can be made during the same operation. In the face of enemy air superiority, formations of obsolete aircraft (Ju.87) will generally make a single bombing attack and use their machine guns while leaving the target, whereas formations of modern aircraft (F.W.190) will be able to remain over the battlefield for a longer time. If the enemy has overwhelming air superiority, even the F.W.190 will only be able to make a single attack.

Tank-buster attacks, usually made by 2–4 aircraft, are particularly directed against tanks and armoured vehicles which have broken through. They can usefully be employed simultaneously with ground attack aircraft, which neutralise the enemy ground defences by bombing and machine gun attacks, while the tank-busters destroy their objectives with their special weapons.

Tank-busters are not suitable for attacks on tank assembly positions as the strong fighter and ' flak ' defences usually found in the vicinity cause heavy losses to these special aircraft. Tank assembly positions and tanks in battle should therefore be attacked by massed ground attack formations with large H.E. and fragmentation bombs. Considerably greater successes have recently been achieved by the use of jettisonable containers filled with SD 4 hollow charge bombs.

On account of the increased defences, it is necessary to approach the tank assembly positions at an altitude above 3,000 metres. Formations are forbidden to make prolonged searches for the target, and position, size and defences must be ascertained before the operation.

It is necessary to have the target pictures before attacking artillery positions because visual recognition of a site from the air is not practicable unless it is firing. If several batteries are attacked simultaneously a dispersal of effect will result, with a consequent reduction in destruction. 8–10 aircraft per battery should be allowed.

Attacks on centres of resistance and strong-points necessitate careful briefing and the use of aerial photographs and large scale maps. In addition, last minute instructions are transmitted through the Ground Attack Control Officer, and the firing of signal cartridges also facilitates the locating of the target when conditions are suitable ; the dropping of the first bombs by the leader of the formation can be a useful guide. Heavy bombs are the most effective against well-fortified emplacements, while large numbers of small bombs have the best effect against dispersed field positions.

Ground attack operations against railways seldom cause any permanent damage and these attacks should be left to heavy bomber formations. On the other hand, ground attacks with bombs and machine guns against trains and loading and unloading installations are often of value.

By means of sustained bombing attacks spread over the entire night, the night ground attack aircraft weaken the enemy's physical and moral powers of resistance. Additional losses in men and material are also inflicted on the enemy by the bombing of ' flak ' and artillery sites and of garrison towns and villages.

Ground attack aircraft will in general only operate against shipping during landing undertakings. When possible the aircraft fly in from the sea in order to achieve the maximum surprise effect. It will then also be possible for damaged aircraft to reach land. With these tactics the increased danger of being fired on by our troops should be remembered. Only H.E. and fragmentation bombs are likely to prove successful against armoured ships and landing craft. Aerial torpedoes (BT), the destructive effect of whose detonation under the keel is great, may be used against larger shipping targets.

In favourable conditions
1 BT 400 (weight—400 kgs., explosive—200 kgs.) can sink a freighter of up to 500 GRT.
1 BT 700 (weight—700 kgs., explosive—350 kgs.) can sink a cruiser, and
1 BT 1400 (weight—1,400 kgs., explosive—1,100 kgs.) can sink a battleship.

The required accuracy and angle of immersion can be achieved by means of a special bombsight. The use of small fragmentation bombs is only recommended against lighter ships. AB-SD-4 hollow charge bombs can be used against tank landing craft, and small vessels can be heavily attacked with cannon fire.

As enemy landings are covered by very large fighter forces, air ground attack operations can only be successful if adequate fighter protection is available, and Ju.87's cannot be used for these operations. Ju.87 and Hs.129 tank-busters can be successfully used against small landing craft in poorly defended sea and swamp areas, rivers, etc.

Uniformity of maps and of reporting methods are essential conditions for successful co-operation with the Army.

Ground attack pilots generally use 1: 500,000 and 1: 300,000 maps for approaching and leaving the target, but for target location the 1 : 100,000 map is necessary. Particular importance is attached to aerial photographs because on static fronts they usually provide valuable information for mapping purposes.

Ground attack formations must establish and maintain close contact with reconnaissance units in their operational vicinity. Such co-operation ensures the most rapid exchange of aerial photographs and reconnaissance reports.

Reliable signals communications within the formation and from the formation to Command, as well as R/T link with the Ground Attack Control Officers, are necessary in every ground attack operation. Line and radio communications must also be available in order to permit transmission of orders and reports should signals communications be severed.

As regards R/T, ground attack formations and their fighter escort should if possible work on the same frequency, ensuring the best possible co-operation. High security conciousness is an essential condition.

The operational aerodromes of the ground attack formations lie close behind the front, but enemy air superiority will often make it necessary to use airfields lying further back. Camouflage measures should be taken and shelter and reserve runways constructed in order to restore serviceability quickly and avoid unnecessary losses in the event of enemy air attack.

III. Present Possibilities for Ground Attack Operations

The air superiority of the enemy and our own fuel position are the sole factors determining the extent and possibilities of future ground attack operations. Surprise attacks carried out under particularly favourable weather conditions or at dusk have become very much more difficult owing to the enemy's highly developed aircraft reporting service in which radar is being used to an increasing extent.

Up to 1941 we possessed air supremacy in every theatre of war ; from then onwards the position in the air began to change to Germany's disadvantage, at first slowly, but later with increasing speed.

Before 1941 every new campaign began with the most ruthless raids on the enemy air force and ground organisation. These large scale operations in which a number of ground attack aircraft always took part either eliminated a part of the enemy air forces altogether or severely undermined their striking power.

Our air supremacy at this time made it possible for the ground attack units to operate successfully with only a small fighter escort, thus helping to achieve our great victories in the various campaigns in spite of the fact that the aircraft of these ground strafer units were even at the beginning of the war greatly inferior to the enemy fighters.

The first difficulties in ground attack operations were felt in Africa in 1942. The overwhelming enemy air superiority encountered in this theatre forced us to send as many as 30 Me.109's out to escort a force of between 8 and 12 Ju.87's.

The effects of steadily increasing and now completely unhindered Allied aircraft production are becoming more and more noticeable.

The first F.W.190 ground attack units to operate in Africa also required a fighter escort although they had originally been used because it was hoped that owing to their high performance they would not require a fighter escort, and the small available fighter forces would thus be freed for other missions. Enemy air superiority was however so overwhelming that this hope was never realised.

The British and American air forces were meanwhile becoming steadily stronger. Units of Ju.87's suffered heavy losses in every operation on the Anglo-American fronts, and were consequently moved to other theatres of war.

Owing to the steadily increasing strength of the enemy air forces the FW.190 ground attack units had to be given stronger and stronger fighter escorts. There was, however, a shortage of fighter aircraft in Italy in the spring of 1944, and also later during the invasion of Normandy, and a decline in operations was therefore inevitable.

Ground attack aircraft invariably met extremely heavy enemy fighter opposition ; they no longer afforded any decisive support to the land forces, and the heavy losses incurred rose ultimately to a level out of all proportion to the successes achieved.

The transfer of fighter units for the defence of the Reich led to a drastic weakening of the other battle fronts, despite the fact that the situation on these fronts demanded more and more fighter aircraft for defensive operations. In Italy, the necessary fighter escort could only be provided for an average of one ground attack sortie per day.

These circumstances, due to the air supremacy of the enemy, eventually made all ground attack operations impossible. With the exception of the night ground attack units, all ground attack aircraft were withdrawn from the Southern and Western fronts and transferrred to the Eastern Front.

Ground attack formations can operate without difficulty against the Russians. Even Ju.87 formations can operate by day, given a sufficient fighter escort, at all points except where the Russians have set up a concentrated fighter defence. F.W.190 formations can also operate with a fighter escort.

We are still in a position to repel the Russian fighter attacks, although their aircraft are now numerically superior to the German fighter force.

It must however not be forgotten that the Russian aircraft are rapidly developing and will soon reach the standard of the German and Anglo-American types.

The conversion of the last Ju.87 units to F.W.190 had been planned for the summer of 1944. It was however not fully realised because the critical position on the Eastern Front demanded the use of every available aircraft and crew. Circumstances were therefore not propitious for the withdrawal of the Ju.87 units for conversion to F.W.190's.

As soon as the Eastern Front had been stabilised a new problem arose which again prevented the intended conversion. Supplies of C.3, the aircraft fuel used by the F.W.190's, was very limited, whereas B.4 (for the Ju.87's) was available in substantially greater quantities. The last of the Ju.87 units therefore remained in use.

Thanks to the conversion of F.W.190's, the Ju.87's which had been withdrawn from the front could now be placed at the disposal of the night ground attack units, who thus acquired an aircraft with a greater pay-load and better armament than they had had before.

The Ju.87 has a further advanatage over all other aircraft models used for night ground strafing in its suitability for precision bombing. This has brought far greater successes against the enemy, and these were further increased by improved training courses and improved operational tactics. The planned conversion to F.W.190's and the development of new bombing methods even in difficult weather conditions are both proceeding rapidly. Night ground attack will thus remain an effective fighting weapon.

The severe shortage of aircraft fuel has also an effect on the ground attack units. Priority is given to fighters and owing to the fuel shortage only such operations as are essential for the land battles can be contemplated at present.

New developments in enemy aircraft reporting service and especially the greater use of radar have also added to our difficulties.

It has been noticed both in Italy and on the invasion front that the enemy fighter screens over the centre of the battle, in themselves strong enough to oppose our attacks, are further reinforced by ' emergency ' fighters taking off as soon as our target has been ascertained. This has very often led to our ground attack formations and their fighter escort being intercepted before reaching their objective.

No details are so far available concerning the use of radar on the Eastern Front.

IV. Lessons Learnt from the Course of Past Operations and Prospects for the Future

The lessons learnt from ground attack operations up to the present time have resulted in new principles of warfare. To these may be added some further general remarks.

After the first World War the German Air Force was the first to recognise the great importance of ground attack aircraft. Independent units were set up and successfully employed during the war.

Our enemies also recognised the successes and possibilities of ground attack and consequently began to form units of their own. The Allies thus modelled their organisation and operations on the German pattern.

Compared with those of the Allies the German ground attack units have been but little expanded during the war. On 1 June 1944 the Soviets had an estimated total of 5,120 ground attack aircraft ; a month later the Allies had a total of 7,270 close support aircraft in England, France and the Mediterranean, while Germany at that time had a total of 1,005 ground attack aircraft at her disposal (from a OKL report).

During the course of the war both sides have learnt that real successes can only be achieved when air supremacy has been won. It is then possible, apart from direct army support operations, to make tactical sorties with or without fighter escort.

These operations became considerably more difficult when the enemy is in possession of air supremacy. A stronger fighter escort is necessary, small units are practically unable to operate, and the time our aircraft can remain over the front, the number of sorties, and consequently the effect on the enemy, are greatly reduced.

Overwhelming enemy air supremacy may necessitate the use of airfields far behind the lines and make it impossible for several bombing runs to be made during a single raid.

Furthermore, unless we have a sufficiently strong fighter force at our disposal overwhelming enemy air supremacy may prevent air operations in certain frontal sectors. This is the state of affairs on the Western and Southern Fronts, but even in these areas we must attempt to carry out ground attack sorties in support of the hard-pressed land forces. This can only be achieved if the enemy fighter strength can be reduced and that of the *Luftwaffe* increased on all fronts. First of all our fighter units must be equipped with new aircraft types superior to the enemy's.

However justified is the demand made by the Air Officer for Ground Attack for Do.335's, its fulfilment would hinder the attainment of our primary aim—the breaking of enemy air supremacy. Once a reinforced German fighter force has levelled out the disparity between the opposing air forces, or even achieved German air supremacy, the flying speed of the Do.335 ground attack aircraft will be of secondary importance. With the fighter escort which will then be available F.W.190's will be able to carry out ground attack operations on all fronts.

At present ground attack operations are possible only on the Eastern Front. Should the Russians reinforce their radar stations behind the front, and should, as is by no means impossible, American and English fighter units be transferred to the Eastern theatre of war, operations on this front may also become impossible for as long as the present shortage of fighter aircraft persists.

Owing to the present air situation we may therefore decide to incorporate at any rate the F.W.190 ground attack units into the fighter units with a view to the strengthening of our fighter defences.

Certain considerations speak against such a move :—

(*a*) While our lines in the east are weak, the ground attack formations are our only weapons of attack, and one, which thanks to its speed and manoeuvrability, can be successfully employed against surprise attacks and breakthrough.

(*b*) The cessation of all ground attack sorties by day would inevitably have an effect on the spirit and the morale of the army. We must remember that since 1939 the German Army has never fought a major offensive or defensive battle without air support, and that enemy ground attack activity is increasing. Without direct air support both offensive and long-term defensive operations are inconceivable.

(*c*) It is therefore essential to maintain a solid nucleus of ground attack units. As regards future prospects, the following possibilities should be considered :—

(i) As soon as the land fighting and the aircraft fuel position permit, the conversion of the remaining Ju.87 units to F.W.190's would be of considerable value. F.W.190 formations could then operate in the east without fighter escort and the fighter forces hitherto employed on escort duties could be freed for other tasks. The Ju.87's thus made available could be used for night ground attack operations.

(ii) Since Russia is evidently increasing her fighter strength and undertaking the conversion of units to more modern aircraft, the possibility of increased attacks on the Eastern Front must also be reckoned with. Such an emergency can best be met by intensified training among the reserve fighter units.

(iii) The strict operational limitations now imposed on anti-tank aircraft will have to be remedied by new tactical and technical devices. The new F.W.190's equipped with *Panzerschreck* and *Panzerblitz* which are at the moment undergoing successful tests will soon be ready for operational use. The possibilities of rocket projectiles and ricochet methods must be studied and, should they promise a reasonable element of success, they must be developed and personnel trained in their use.
Should operational results prove satisfactory the Ju.87's and Hs.129's could be withdrawn, and all day ground attack units would then be uniformly armed and equipped.

(iv) The already strengthened night ground attack units will have to be developed to an even greater degree of efficacy. This can be achieved by supplying them with more Ju.87's. Their present dependence on weather conditions must be eliminated and in this connection the use of the ' Egon ' RDF instrument, facilitating operations in bad weather conditions and target location, offers great possibilities.

(v) As the shortage of aircraft fuel is likely to continue for some time ground attack operations also remain on a limited scale. During this period of relative inactivity our commanders and the ground attack units will have to watch closely enemy ground attack tactics so that any new developments can be speedily observed, tested and employed should the opportunity arise.

The varied nature of ground attack operations demands extensive training and equipment. We must, however, never diverge from the fundamental principle that ground attack is, and must remain, the instrument of the Air Force, its main purpose being the purely tactical support of any major land operation.

Army Commanders must not expect ground attack aircraft to be placed at their disposal in unlimited numbers, nor that the Air Force will undertake tasks which could equally well be carried out by the Army itself with the possible aid of air observation.