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THE GENERAL BOARD

United States Forces, European Theater

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AIR POWER IN THE EUROPEAN THEATER OF OPERATIONS

MISSION: Prepare Report and Recommendations on the Command and
Employment of Air Power in a Theater of Operations.

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AIR POWER IN THE EUROPEAN THEATER OF OPERATIONS

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R E S T R I C T E D
REPORT

ON

AIR POWER IN THE EUROPEAN THEATER OF OPERATIONS

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AIR POWER IN THE EUROPEAN THEATER OF OPERATIONS

FOREWORD

This report will portray in brief the accomplishments of the Air Forces (Strategical and Tactical) in the European Theater of Operations. Full reports of the operations and the analysis of results of the efforts of the Air Forces may be found in a report entitled "The Contribution of Air Power to the Defeat of Germany" prepared by the Commanding General, United States Air Forces in Europe, and being completed by Headquarters Army Air Forces in Washington.

It is difficult to classify the efforts of the Strategic and Tactical Air Forces into Strategic and Tactical air operations. Consequently some discussions in this report will cover action by both strategic and tactical air units.

In reviewing strategical air operations it should be remembered that the operations of the Eighth Air Force (European Theater) and the Fifteenth Air Force (Mediterranean Theater) were controlled by the Commanding General, United States Strategic Air Forces in Europe. This was necessary due to the proximity of the two theaters, the range of the strategic aircraft and the common interest in targets.

In this report, the participation of the Tactical Air Forces in the battle area in close cooperation with the Ground Force will not be stressed. A report "The Tactical Air Force in the European Theater of Operations," the Theater General Board, USFET, 31 December 1945, deals more thoroughly with that phase of air power.

A detailed study and analysis of the operating technique of a Strategic Air Force may be found in a report by the Eighth Air Force to the Commanding General, Army Air Forces, entitled "Eighth Air Force Tactical Development, August 1942 - May 1945."

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AIR POWER IN THE EUROPEAN THEATER OF OPERATIONS

CHAPTER 1

ORGANIZATION AND CONTROL

SECTION 1

INTRODUCTION

1. Due to the nature of the forces available and the objectives to be gained, the organization and control of the air Forces in the campaign against Germany were rather complex. To clarify the discussion of the mission and accomplishment of the air Forces in this report, there follows a brief description of the forces employed, their location, some data on strength of personnel and aircraft and chain of command and control.

SECTION 2

FORCES AVAILABLE

2. General. By far the majority of air units employed were distributed in the Allied Strategic Air Forces and Tactical Air Forces. There were other important air arms, but due to the limited requirement for their activities, their size was relatively small.

3. Strategic Air Forces.

a. U.S. Eighth Air Force - a composite heavy bomber and long range fighter force, commanded by Lieutenant General J. H. Doolittle and forming part of the United States Strategic Air Forces under command of General Carl Spaatz. This force was based in the United Kingdom, but beginning in December 1944 two groups of fighters used advanced fields on the Continent from which, when not engaged in escorting bomber forces, they operated as tactical fighters with U.S. Ninth Air Force.

b. R.A.F. Bomber Command - a force of heavy and medium bombers under command of Air Chief Marshal Sir Arthur T. Harris. This force, primarily a heavy night bomber force, also operated on many daylight missions in the final phases of the war. It was based throughout on airfields in the United Kingdom. In addition to its bomber aircraft, it operated radio countermeasure aircraft.

c. Mediterranean Allied Strategic Air Force - a composite of U.S. and British forces. It consisted of the U.S. Fifteenth Air Force under command of Lieutenant General Nathan F. Twining, and an R.A.F. unit No. 205 Group under command of Brigadier J. T. Durrant, South Africa Air Force.

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The Fifteenth Air Force, which operated both heavy bombers and long range fighters, formed part of the United States Strategic Air Forces commanded by General Carl Spaatz. The R.A.F. component was primarily a heavy night bomber force. This force was based in the Mediterranean theater.¹

4. Tactical Air Forces.

a. United States Ninth Air Force - commanded initially by Lieutenant General Lewis H. Brereton and later by Lieutenant General Hoyt S. Vandenberg. It comprised a strong medium bomber force, the 9th Bombardment Division commanded by Major General Samuel E. Anderson; IX Tactical Air Command under Major General Elwood R. Quesada until the middle of April, 1945, and from then till the end of the period, under Brigadier General Ralph F. Stearley, a force of fighters and fighter bombers designated to cooperate with the First U.S. Army; XIX Tactical Air Command under Major General Otto P. Weyland, a force of fighters and fighter bombers designated to cooperate with the Third U.S. Army; XXIX Tactical Air Command under Brigadier General Richard E. Nugent, a force of fighters and fighter bombers designated to cooperate with the Ninth U.S. Army; and appropriate Air Service, Aviation Engineer, and Air Defense Commands. All of these forces were based initially in the United Kingdom and rapidly moved to the Continent as soon as adequate facilities became available.

b. R.A.F. Second Tactical Air Force - commanded by Air Marshal Sir Arthur Coningham. It comprised a day and night medium bomber force, No. 2 Group R.A.F. Commanded by Air Vice Marshal B. E. Embry; No. 83 Group R.A.F. under command of Air Vice Marshal H. Broadhurst, a force of fighters and fighter bombers assigned to cooperate with Second British Army; No. 84 Group R.A.F. under command of Air Vice Marshal E. C. Huddleston, a force of fighters and fighter bombers assigned to cooperate with First Canadian Army; No. 85 Group R.A.F. under command of Air Vice Marshal C. R. Steel, a base defense group operating fighters and night fighters; appropriate maintenance and ancillary forces. All these forces were based initially in the United Kingdom and moved to the Continent as soon as adequate facilities were available.

c. United States First Tactical Air Force (Provisional) - formed 1 November 1944 and commanded by Major General Ralph Royce until the end of January, 1945, from then until early in March by Brigadier General Gordon P. Saville, and from then until the end of the period under review by Major General Robert M. Webster. This Air Force was composed of the U.S. 42nd Bomb Wing, a medium bomber force under command of Brigadier General John P. Doyle; U.S. XII Tactical Air Command under Brigadier General Gordon P. Saville until the end of January, 1945, and from then until the end of the period under review by Brigadier General Glenn O. Barcus, a fighter and fighter bomber force designated to cooperate with U.S. Seventh Army; First French Air Force, under command of Brigadier General Paul Gerardot, a composite force having some medium bombers and a fighter and fighter bomber component assigned to cooperate with First French Army; Western French Air Force commanded by Colonel C. Millinior, a small force employed against German garrisons on the Atlantic coast; and appropriate Air Service formations. These forces were based on the Continent.¹

5. Other Air Forces.

a. R.A.F. Coastal Command - a force of long range patrol aircraft and torpedo and rocket firing aircraft. It was based principally in the United Kingdom with some coastal reconnaissance units on Continental airfields. Air Chief Marshal Sir Sholto Douglas, commanded this force.

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b. R.A.F. Fighter Command - a day and night fighter force based in the United Kingdom and commanded by Air Marshal Sir Roderic W. Hill. Its chief function was the aerial defense of the Allied U.K. base; it also provided strike aircraft and fighter escort for the daylight missions of R.A.F. Bomber Command and R.A.F. Coastal Command.

c. Troop Carrier Forces. The IX Troop Carrier Command commanded by Major General Paul L. Williams; No's 46 and 38 Groups R.A.F. commanded by Air Commodore L. Darvel and Air Vice Marshal J. R. Scarlett Streatfield, respectively, and appropriate air service, maintenance and ancillary units were initially assigned to the Tactical Air Forces. Shortly after D-Day the IX Troop Carrier Command was assigned to the First Allied Airborne Army, commanded by Lieutenant General Lewis H. Brereton; the 38 Group and 46 Group R.A.F. were never assigned to the Army, but were made available for the airborne operations. Besides troop carrying operations, these units carried emergency supplies for both air and ground units to forward airfields under the auspices of a Combined Air Transport Operations Room set up in the G-3 section of SNAEF.¹

Section III

CONTROL OF AIR FORCES

6. Strategic Air Forces. The general direction of all the operations of the Air Forces in the West was exercised for the Supreme Commander by the Deputy Supreme Commander, Air Chief Marshal Sir Arthur Tedder. The control of the Strategic Air Forces was vested in the Combined Chiefs of Staff and General H. H. Arnold, Commanding General, Army Air Forces, for the American forces and Marshal of the Royal Air Force Sir Charles Portal, British Chief of Air Staff, Royal Air Force, for the British forces respectively. These authorities and their respective force Commanders were responsible for carrying out the agreed bombing policy for major attacks on the German war potential and also for implementing the requests of the Supreme Commander for assistance in the land and sea campaigns. They were assisted in their effort by the Combined Strategic Targets Committee which studied the suitability of, and recommended targets for bombing within the various target systems requested for attack.¹

7. Tactical Air Forces. The control of the Tactical Air Forces was exercised by the Air Commander-in-Chief, Allied Expeditionary Air Force, until the disbandment of that organization on 15 October 1944, when control passed to the Supreme Commander, Allied Expeditionary Forces. The Deputy Supreme Commander exercised control for the Supreme Commander. He was assisted by an Air Staff, headed by Air Marshal Sir J. M. Robb.¹

Section IV

STRENGTH OF AIR FORCES

8. Aircraft. The strength of the American and British Air Forces for the campaign against Germany was built up to its maximum in early 1944 and remained fairly constant through V-E Day. Following is a tabulation of the average daily number of serviceable aircraft for each air force as of 30 April 1945.

<u>Air Force</u>	<u>Fighters</u>	<u>Bombers</u>
Eighth Air Force	1180	2103
R.A.F. Bomber and Fighter Commands	490	1723
Fifteenth Air Force	557	897
Ninth Air Force	1249	639
First Tactical Air Force (Prov)	540	234
Second Tactical Air Force (R.A.F.)	926	218
Total	4942	5814

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9. Personnel. The Allied Air Forces employed against Germany in the West (including the U.S. Fifteenth Air Force, but excluding Air Transport Commands and the R.A.F. Coastal Command) totaled over 800,000 officers and enlisted men. During the months of March and April 1945, the last two full months of warfare in Europe, the Allied Air Forces flew 307,893 sorties. This effort involved the employment of an average of 21,270 air crewmen per day in actual contact with the enemy.¹

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CHAPTER 2

THE MISSION OF THE AIR FORCES

SECTION 1

GENERAL

10. Field Service Regulations Fm 100-20, "Command and Employment of Air Power" was the guide, followed exactly, throughout the European War.

In the early days of the war, Ground Forces were not engaged; therefore the bulk of the fighting, and the implementing of strategic plans fell to the Air Forces.²

11. The missions of the Strategic Air Forces are:

a. "The aim of the Strategic Air Force is the defeat of the enemy nation."

b. "The gaining of air supremacy is the first requirement for the success of any major land operation."

c. "Objectives may be found in the vital centers in the enemy's line of communication and important establishments in the economic system of the hostile country."

12. The missions of the Tactical Air Forces are:

a. "To gain the necessary degree of air superiority."

b. "To prevent the movement of hostile troops and supplies into the theater of operations or within the theater."

c. "To participate in a combined effort of the air and ground forces, in the battle area, to gain objectives in the immediate front of the ground forces." (Note: This participation cannot, of course, occur in the early stages of a war before the ground forces have joined.)

13. The above are extracts from Fm 100-20 "Command and Employment of Air Power." These, briefly, cover the tasks of Strategic and Tactical Air Forces. These missions are not at variance with the Casablanca directive--"...the progressive destruction and dislocation of the German military, industrial and economic systems..."

SECTION 2

DISCUSSION

14. Air Superiority. The task of defeating the German Air Force was welded into a well coordinated plan designed to accomplish the task with the Strategic and Tactical Air Forces which could be made available from other commitments. The plan had to be flexible to cope with the indicated changes in the plans and activities of the German Air Force. In early 1944 progress in aircraft and engine production indicated that German Air Force production facilities should be attacked. All attacks against the oil industry and storage plants would tend to deprive the German Air Force of aviation fuel which was essential to operations. When the enemy conserved his air forces and resources for short concerted efforts as he did just prior to the Ardennes counteroffensive, or when in early 1945 the threat of jet propelled aircraft was becoming serious, attacks against German Air Force air bases was the best countermeasure. Throughout the campaign the Allied Air Forces sought air combat as a means of reducing the strength of the operational aircraft and experienced crews of the German Air Force.²

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15. Attacks against German Economy. It was never easy to determine which target system or systems should be attacked by strategic air power in order to produce the most serious effect on the German war potential and attain the quickest and best results in the progressive destruction and dislocation of the German military, industrial, and economic systems. Relative priorities had to be decided upon from time to time for such target systems as the oil industry, aircraft production, rail and motor transportation, ball bearing production, tank production, armament production, submarine production, steel and other miscellaneous production. These priorities were varied by tactical and other requirements existing at the time. It was estimated that by such attacks, strategic air power could make its best contribution to the ground campaign and the final defeat of Germany. None of the target systems were bombed continuously. Many factors prevented such continuous attack. In general, each system was attacked when increasing production began to constitute a potential menace to the Allied forces.¹

16. Isolation of the Battle Area. The German fortress of Europe contained a network of well organized railroads, highways and inland waterways. Attack against the large communications centers, active marshalling yards and choke points in the canal system would not only prevent the movement of vital supplies to the battle areas, but also make a decisive contribution to the disintegration of German economy. Continuous attacks by fighter bombers on railroad rolling stock and other rail facilities would prevent the movement of enemy supplies, troops, and weapons into or within the battle area. There were times when the location of the battle area with respect to the rail and road network available to the enemy presented an excellent opportunity for Allied air power completely to ring the enemy portion of the area with a series of bridge cuts in all principle railroads and highways. Heavy bombers, medium bombers and fighter bombers were committed to such operations around the Normandy beach area, the Ardennes and Eifel during the German counteroffensive and subsequent withdrawal, the Remagen bridgehead, and the Ruhr.^{1,2}

17. Direct Participation in the Ground Battle. Both the tactical and strategic air forces were available at various times for direct assault on the battlefield. The tactical air forces were organized to perform promptly certain close cooperative missions such as air attacks on defended localities, strong gun positions, enemy headquarters, transport, lines of communications, troop concentrations, local counterattacks, and withdrawals. They were specially equipped and trained to perform missions involving armored column cover, artillery adjustment, as well as visual, photographic and weather reconnaissance. The terms of the Casablanca directive prescribed that the strategic air forces in addition to "the progressive destruction and dislocation of German industrial and economic systems", would have an additional task; "...and when needed, the direct support of land and naval forces." The need for this added air power was apparent in many critical battles. In such battles as the landing operations on the Normandy beaches and in Southern France, breakthrough operations at Caen and St. Lo, river crossings of the Roer and Rhine, the enemy counteroffensive in the Ardennes, and the assault operations against the fortifications of Brest, West Wall of the Aachen area and Metz, the full weight of Allied air power was thrown against the enemy in the battle to break his resistance and to advance the Allied ground armies.²

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ACHIEVEMENTS OF THE AIR FORCES

SECTION 1

GENERAL

18. Main Accomplishments. There were three main accomplishments of air power, fundamental to all other results and which when understood throw the air campaign into clear perspective. These accomplishments were:

- a. The gaining of air superiority.
- b. The denying to the enemy of mobility on the ground.
- c. The destruction of the enemy's economic system.

All three of these accomplishments are closely inter-related.²

19. Gaining Air Supremacy. It is a matter of record that the early diplomatic as well as military victories of Nazi Germany were accomplished under the threat and actuality of complete air supremacy. The German Army went nowhere without the unopposed support of the Luftwaffe. It was, however, the outstanding limitation of the German Air Force that although it played a prominent part in early German victories, and although independently organized, it was in fact almost exclusively an army weapon. It was never planned or equipped for truly independent operation of its own. Fully aware of the importance of the role of the Luftwaffe in all previous military operations of the Wehrmacht, America and Britain realized that the first responsibility of air power was to destroy the Luftwaffe as a capable fighting force. By spring of 1944 this indispensable pre-requisite for full scale air attack on Germany and indeed for invasion itself had been achieved. The Luftwaffe had been beaten and Allied air forces completely dominated the European skies. The victory had been won by a combination of three measures; an attack, unprecedented in scale and inclusiveness, on the enemy's aircraft production industry; the harrying, disruption and destruction of his operational bases including aircraft on the ground and forward repair facilities; and overwhelming pressure of combat in the skies. From the defeat of the spring of 1944, the Luftwaffe never recovered.²

20. Denying mobility to the German Army and Economy. The net result of the diverse and widespread operations of Allied air power, whether they were tactical or strategic in the accepted sense of these words, came ultimately to one overall end. That end was the denial of mobility to the enemy. The once highly-mechanized and swift-moving German army had, by June of 1944, been reduced to fighting a defensive war. Where her armies were dug in, in favorable terrain and in good positions, the Germans fought skillfully and well. Once the battle became fluid, however, they were hopelessly outclassed and beaten. The reason lay primarily in the fact that Allied air supremacy had denied the German armies the mobility which was the basis of their former victories.

The attack on mobility took many forms. Basic to all was the virtual destruction of her motor and aviation fuel industry. Continued heavy attack, by an accumulated process of attrition, completely disrupted the rail network of occupied countries and of the Reich itself.

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Attacks on motor transport and tank production seriously affected the weapons of mobility. Complete domination of the battle area and its approaches by Allied tactical air power almost completely denied to the enemy the use of roads by day, and often by night. Many thousands of vehicles were destroyed both in transit to the front and in attempts to carry out their missions in the battle.

At the same time this air power insured the mobility of Allied ground and sea forces, both night and day, by denying to the enemy air forces access to the area over front lines and zones of communication.

It was only when weather and terrain interfered that air power was unable to give the Allied ground forces the decisive margin of mobility which was the key to their most spectacular successes. In Normandy before the breakthrough, in the Atlantic ports; in the Siegfried Line; amid the canals of Holland; in the winter snow and mud on the German border; - in these places the battle became static until weather cleared sufficiently for air power to provide the extra margin of power which enabled the Allied armies to break through the turn the battle into one of motion. The enemy's only major counteroffensive, that in the Ardennes, was planned and carried out as a bad weather campaign; when the weather unexpectedly broke and Allied aircraft swarmed over the battle area and to the rear, there was no longer any doubt as to the outcome. It was unquestionably in good part superior mobility which gave the Allies their ground victories. The foundation for Allied superior mobility was laid on the enemy roads leading to the battles; in a rail system reduced to chaos, in roads littered with burning tanks and trucks, in crippled tank factories, and in shattered oil refineries deep within the Reich.²

21. Destruction and Dislocation of the German Industrial and Economic Systems. In a series of attacks from bases in the United Kingdom and Italy by day and by night, Allied heavy bombers struck deep within the Reich at German industry and transportation which fed the armies in the field. At the same time that these long range bombers were also devoting a considerable portion of their total effort in direct cooperation with land and naval forces, they were carrying out a program defined by the Casablanca directive as "the progressive destruction and dislocation of the German military, industrial and economic systems." The notable results achieved were the virtual destruction of the enemy's oil and chemical industries; the considerable reduction of enemy armaments production; the wrecking of her rail and water communications network, and the tying up of coal in the Ruhr.²

SECTION 2

DISCUSSION

AIR SUPERIORITY

22. General. The Allied air power won virtually complete control of the skies over Europe prior to the invasion of the Continent and maintained it to the end of the war. It destroyed aviation fuel (motor fuel as well), airplane factories, engine plants, airfields, aircraft in the air and on the ground. General Keller last Chief of the General Staff of the German Air Force noted in his diary of 7 May 1945 (prior to his capture) the reasons for Germany's defeat. His words are as follows: "There are many reasons which caused Germany to lose the war, reasons brought about by our own mistakes in political, economic and military matters. None of these reasons were singularly decisive; nor were they collectively decisive. However, the loss of air superiority (without considering the other mistakes whose avoidance could have brought about a more favorable overall situation) was alone decisive."

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This achievement, the gaining of air superiority, resulted from a well planned campaign against the German Air Force in which each type of attack was designed to play a part in bringing about complete Allied air domination. The principal features of this campaign are discussed below.

23. The Attack on Aircraft Production. At the beginning of 1944 the German aircraft industry still comprised a relatively small number of plants, most of them organized into smoothly integrated complexes using mass production techniques. Some of these had been heavily hit in the attacks of 1943, but for the most part they had recovered. A program of removing production from the more vulnerable western parts of the Reich had been started and it was thought that most of it was fairly safe from air attack - at least from concentrated and frequent attack. Plans also had been laid for greatly increased fighter production and some progress had been achieved by the turn of the year. After initial attacks in January 1944, a series of heavy precision attacks was carried out in five days of February 1944 which all but saturated the assembly plant system. Subsequent attacks through to the middle of the year affected a very large proportion of the entire industry, including aircraft engine production. From these attacks, the German aircraft industry never fully recovered.

The results of these attacks were highly significant although perhaps not as far reaching as first supposed. Actually production, after an immediate and short decline following the initial onslaught, recovered rapidly and total production continued to increase through July of 1944. Production of single-engine fighters reached a peak in September. Total production started downward in August, as did single-engine fighter production in October. The increase in production during the spring and summer of 1944 was accomplished by prodigious effort and organization. It did represent an increase over past output, but it was nevertheless very substantially below the production quotas called for by elaborate German plans to regain air supremacy. Indicative of the spread between plans and performance are German figures showing a quota of 5,800 aircraft for October 1944 against production of some 3,500 of all types. Thus, the attack against the aircraft industry frustrated these plans for expansion of the German Air Force.

Forced now into a program of extreme dispersal in order to avoid attack, production also was decentralized and spread out among hundreds of small plants. Mass production techniques had to be modified. The supply of skilled supervisory labor was inadequate to staff fully all these plants. The time for producing each finished plane was increased and time of delivery of finished parts for use was also increased. And above all, dispersal meant that the industry became extremely vulnerable to transportation breakdowns which eventually affected the entire German economy.

Finally, it is highly significant that, from 1942 on, the Germans failed to put into mass production any new aircraft which had material effect on the course of the air battle. Numerous models reached the experimental stage. Such aircraft as the me-410 did come into combat in numbers. But the burden of the air war was carried by the FW-190 and the me-109 in their various modifications. With experiment and research harassed by bombing, with production centers smashed and eventually widely dispersed, the German aircraft industry could not keep pace with the times. The result was that by the autumn of 1944, German conventional fighters were outclassed and the attempt to change over to mass production of jet planes came too late.²

24. The Attacks on Air Bases. The general overall effect of these attacks was to deny to the enemy free use of his forward bases. At some points during the war, the Luftwaffe was forced to operate almost entirely from bases as far from the front as 150 to 160 miles. Thus his fighter and ground attack aircraft arrived at the battle area, if indeed they managed to arrive at all through the Allied fighter screen, with a very limited amount of fuel and combat time. During invasion and even before, during the "little blitz," Germany's so-called long range bombers were based so far back that they were forced to use advanced landing grounds in order to reach their target areas. So intense was the bombing of airfields in France, and so devastating was the attack of Allied strafing fighters and fighter bombers that the Germans could not rest and refit their units without returning them deep into Germany.

Pushing the German Air Force back from forward bases was a general result. There are certain specific accomplishments which deserve mention. Prior to invasion in Normandy, French fields were reduced to chaos, and incoming reinforcements were chased from base to base and hurried into a state of such inefficiency that the total effort which came up to meet Allied aircraft was considerably less than would have been expected from the strength sent to the west. In fact, the failure of the Luftwaffe throughout the latter stages of the war to put up an effort commensurate with its Order of Battle may well be attributed not only to the general policy of conservation, but also in material degree on special occasions, to the harrying of their bases. During the Ardennes offensive a series of concentrated attacks on fields in the Frankfurt area is believed to have reduced materially the overall German air effort during that campaign. At the time of the Rhine crossing at Wesel, another concentrated attack on the few fields in Germany suitable for jet aircraft operations was so effective that except for one reconnaissance aircraft not one jet aircraft sortie is credited to the German Air Force during the assault. Added to these specific effects of the attack on Luftwaffe operations must be the quantities of aircraft of all kinds destroyed on the ground by Allied strafing and dive bombing fighters. Largely attributable to these attacks is the spectacle, as Allied planes approached, of German planes taking off not to join combat, but in fugitive flights to escape destruction on the ground. In the final stages of the war, another spectacle was that of jet aircraft, with their bases overrun or bombed into unserviceability forced in desperation to use Autobahn strips for runways.

In sum, the attack on airfields destroyed vast quantities of stores, installations and facilities; demanded considerable labor and energy for repairs; forced the development of operationally inefficient dispersal arrangements; chased units from field to field; destroyed numerous aircraft on the ground; contributed directly to the failure of the Luftwaffe on certain important occasions; and generally forced short range aircraft back to fields so distant from their targets that their effectiveness in operations was materially impaired.²

25. The Attack in the Air. Detailed figures on Luftwaffe combat losses on the various fronts are not available and therefore no exact comparison with Allied losses is possible. It is known, however, that total Luftwaffe operational losses of all aircraft on all fronts between 1 January 1944 and 10 January 1945 were 15,775 aircraft destroyed and written off, and another 7,713 damaged. This represents an average of something over 1,300 aircraft destroyed in operations during each of the twelve months. In June and August the totals during each month climbed to more than 2,000. Even if, however, specific figures were available on Luftwaffe combat losses it would be impossible to make an accurate comparison since the exact cause of all Allied losses could never be determined accurately. Thus it will never be known what actual Allied losses to enemy aircraft were.

The fact is, however, that Allied fighters and well escorted bomber formations were more than a match for anything the Germans put in the air, except the extremely scarce Me-262 jet fighters. Even against Me-262s, Allied aircraft did well on the whole. The largest number of bomber losses attributed to these fighters on any one mission occurred on 10 April 1945 when, out of a total of 1,200 bombers escorted in relays by a total of 764 P-51s, ten bombers were shot down. German records show a total of 55 Me-262 sorties, of which 48 engaged in combat. Of these 48, 27 were listed as lost or missing and the pilots of 19 were killed or missing. Losses in aircraft thus amounted to 49 per cent and losses in pilots to 34 per cent. German records of 16 Me-262 missions show aircraft losses averaging 13 per cent and pilots, since they were over the Reich, 8.8 per cent. The fact was that wastage was high and could not be continued over a long period.²

26. The Attack on Aviation Fuel. In March of 1944 Germany produced 196,000 metric tons of aviation fuel. In December, that figure had decreased to 26,000 tons and from then on it shrank to a negligible amount. German reports state that in the summer of 1944 fuel allotments for pilot training were reduced at first by 20 per cent. A few weeks later this allotment was further cut to 50 per cent of normal. The serious shortage of adequately trained pilots which faced the Luftwaffe in the autumn is attributable in large part to the lack of aviation gasoline.

The greatest impact which the fuel shortage had on the Luftwaffe was, of course, on actual operational capabilities. Starting as early as June 1944 and increasing steadily until the end of the war, lack of gasoline was one of the major limiting factors placed on the German Air Force. Sorties per day, with only occasional departures, decreased gradually until indeed the German Air Force was virtually grounded. Since the Luftwaffe had a considerable number of planes, and many calls to fight, the main and perhaps at times the only reason for inactivity was lack of fuel. The difficulties of the situation were outlined by Speer who said "In the Luftwaffe the shortage of liquid fuel became insupportable from September 1944 onwards, since as from that date the allocation was cut down to 30,000 tons a month, whereas the monthly requirements amounted to between 160,000 and 180,000 tons". The shortage of fuel had become an absolute and inescapable prohibition against operations of the German Air Forces.²

ISOLATION OF THE BATTLE AREA

27. General. Another major task of Air Power is the cutting of lines of communication, and this is sometimes referred to as "the isolation of the battle area". This might be misleading since the "battle area" is often considered to have a limiting depth--ten or twenty miles. Lines of communication disrupted well back from the battle area favorably affect our ground action and hamper the enemy in the movement of oil, manufactured articles, troops, etc. In this war there were established "the first line of interdiction," "the second line of interdiction," etc., as our advance progressed. Allied air power exerted large scale efforts on these operations for which there are no adequate statistics. Heavy, medium and fighter bombers flew many thousands of sorties and dropped hundreds of thousands of tons of bombs on the enemy's rail, road and water transportation systems; in addition to which thousands of fighters and fighter bombers machinegunned all military movement and types of transport. The heavy bombers alone devoted nearly a third of their total 1944/1945 effort, some 240,000 tons, to the enemy rail system, from the Brest Peninsula to the Black Sea and from the Baltic to the Adriatic. Most of this vast effort was carried out to influence directly the course of the battle, although eventually its effects accumulated and by constant attrition virtually paralyzed the entire German economic system.^{2,3}

28. Normandy Beachheads. The cutting of lines of communication to the Normandy Beachheads is a classic. To reach the Normandy coast one of three routes was open to the enemy. Coming from the northeast he was required to cross the Seine River; approaching from the south, he was required to cross the Loire River which formed a barrier from the coast to approximately 125 miles inland; finally from the east it was necessary to pass through the "Gap" between Paris and Orleans. The road and rail bridges over the rivers were knocked out and kept out. Bridges, fills and critical points in the "Gap" were attacked and communication lines were destroyed--and then attacked again if the enemy made repairs. The enemy ferried troops and supplies across the rivers and reloaded. To stop or at least retard this a thorough scheme of rail cutting was adopted. Many cuts were made on all lines for a distance of 25 to 80 miles. It was usually necessary for the enemy to repair certain cuts to get at others. In this way the delay was cumulative. Captured German generals described the area Seine--Loire-Gap area as a "traffic desert". Reconnaissance pilots reported that the country appeared to be a "dead area". There was little movement of trains, motor transport, or ox carts during daylight hours. There was more movement at night, but the nights were very short and that small movement was harassed by night bombers. Opposed to this our motor transport to the north was moving bumper to bumper--day and night.

Of 14 enemy divisions which carried out at least a portion of their journey to the Allied beachhead by rail, only four were able to move by rail inside the area Seine--Loire-Gap, and one of these had already been in Normandy prior to the invasion. Having detrained, combat units attempting to reach the battle were forced to move mainly by night. Units arrived in the area lacking essential equipment, and were often too late or too weary for effective participation in the battle. Attempts to overcome delays led to frequent changes in orders and to desperate "last-ditch" efforts to move units and supplies during daylight. This procedure resulted in almost prohibitive losses from fighter bomber attacks. The delays resulted in a lengthening spread between the arrival of the first elements of a formation and the final assembly of the unit in the battle zone. The Germans were consequently forced to commit their forces piecemeal, further increasing their losses and sacrificing much of their effectiveness.^{2,3}

29. The Retreat Across France. Early in this campaign, which lasted from the end of July until the middle of September, attacks were continued against rail bridges across the Seine and Loire Rivers and in the "Gap" between Paris and Orleans. Meanwhile additional cuts on the same lines were made to disrupt further communications inside the Seine-Loire-"Gap" barrier, until practically every stream crossing from Le Mans east to Paris had been bombed. Later in the period a series of attacks were also executed against bridges across the Oise River and in a 75 mile arc stretching to the east and southeast of Paris.

Although the scale of air effort against road targets was high during the course of this campaign, the majority of operations constituted direct participation in the fighting rather than isolation of the battle area. It was not until the second half of August, after the closing of the Falaise Pocket, that a serious attempt was made to delay the enemy's retreat by bombardment of road junctions. Even then the larger share of fighter bomber effort was directed toward the support of Allied armored columns and the destruction of enemy troops attempting to withdraw.

Reduction of the mobility of enemy units trapped in the Falaise area, and denial of the transport facilities required for the retreat of those units which escaped the trap, led to the destruction or capture of a large portion of the German divisions which a short time before had rushed toward the Normandy Coast to strengthen the enemy's defenses. At the same time severe damage inflicted on the enemy's railroads made it virtually impossible for him to salvage any appreciable portion of the vast stores accumulated in France. It was estimated by Von Rundstedt's Staff Officer for Railroad Transport that not more than five per cent of these were saved, and at that the selection was haphazard in the extreme.

The large scale enemy losses in personnel, supplies and equipment suffered during the retreat from Normandy, together with the chaotic condition of his communications, was the controlling factor in his decision to abandon plans for establishing a line of defense along the World War I line of the Aisne and Marne Rivers.²

30. Ardennes Counter Offensive. The bringing of supplies to advance railheads for the Ardennes offensive was controlled by lines west of the Rhine crossing bridges or embankments at Euskirchen, Ahrweiler, Mayen, Eller, Bullay, Trier and Konz Karthaus. The use of rails to the greatest possible extent was imperative in view of the relatively sparse road net of the district, as well as the rate of fuel consumption necessitated by extensive armored operations.

Practically no operations were carried out by our air forces for the first week of the counter offensive because of weather. However, on the night of 22/23 December conditions improved and operations were possible beginning with the morning of the 23rd. All available effort was employed, with fighter bombers concentrating against armored spearheads and supply lines, while medium and heavy bombers hit bridges and marshalling areas along the Rhine, bridges on the lines leading west from the Rhine, and key choke points in the road network. In that period of good weather, from 23 December to the first of the year, practically all rail movements west of a line Euskirchen, Ahrweiler, Mayen and north of the Moselle was stopped. Railheads were forced back even beyond this line, and detraining took place on both the east and west banks of the Rhine.

Prisoner of War accounts, particularly of the movement by rail of small formations during the last week of December and early in January, are filled with stories of delays, casualties, loss of equipment and extensive night travel. Although exact figures are impossible, there is no question but that road capacity was substantially reduced. Numerous detours, one way passages and rough stretches of filled in craters resulted in the failure of supplies of fuel, ammunition and food to reach the front line in quantity and in time. This depletion of fuel supplies was related in part to the general fuel shortage, but even the limited quantities available for this offensive were largely immobilized by the intensive attack on transportation facilities. The German Commander in Chief, West, stated that destruction of his lines of communication was the principle reason for his defeat, and that additional divisions would have complicated rather than relieved the situation.

While the most important Allied objective in isolating the Ardennes Salient had been to cut the flow of German supplies below the level of their essential requirements, the same policy also contributed to the size of the enemy's losses during the course of his subsequent withdrawal. In particular, the bombardment of bridges across the Our River resulted in large traffic concentrations on the west bank which constituted excellent targets for attacks by fighter bombers.²

31. Remagen Bridgehead. When the Remagen Bridge was captured intact on 7 March the Germans were faced with the problem of rushing reserves and supplies to the critical area, a problem complicated by difficult local terrain. For this movement, and in order to provide supplies for the battle, the enemy was largely dependent upon rail lines leading south from Cologne, west from the Siegen-Wetzlar area and northwest from Frankfurt.

Allied air effort contributing toward the isolation of the Remagen bridgehead between 7 and 22 March was extensive. During the course of the month 55,000 tons of bombs were dropped on rail targets behind the Western front and 40,000 fighter bomber sorties were flown in which rail claims were made. While only a minor portion of this effort was directed against rail installations directly serving the Remagen area, most of the important ones were hit, and the remaining attacks resulted in a general disorganization of rail traffic which contributed to the enemy's difficulties in moving troops and supplies toward Remagen.

Between 7 and 22 March, in spite of bad weather, some 285 attacks were carried out against all types of road targets in the Cologne-Biegen-Koblenz area surrounding the Remagen bridgehead. The majority of these operations were against fleeting targets, and where road intersections were bombed, the primary objective was to produce additional traffic concentrations for air attacks. On the Western front approximately half of the fighter bomber claims against fleeting targets during this period were scored in the middle Rhine area, which included Remagen.

Although the roads and railroads immediately behind the new Allied bridgehead were not completely blocked, damage inflicted on transportation facilities in Western Germany, together with attacks on columns moving westward toward Remagen, seriously impaired the enemy's chances of eliminating the Allied foothold across the Rhine. The 11th Panzer Division, which on 10 March constituted the first large reinforcements to reach the area, was able to employ rail transport for only 30 miles of its trip from Dusseldorf, and no major infantry units arrived until five days after the bridge had been captured. Ten additional divisions had joined the battle by 17 March, but these were committed piecemeal and the bridgehead continued to expand.²

32. Isolation of the Ruhr. Outstanding among the achievements of Allied air power was the total isolation of the Ruhr in March 1945. The operation was unique in that it was the one major rail cutting program of the war designed primarily to affect the enemy's economy rather than his ability to bring men and supplies to or from the battle, although the latter was an important by-product of the plan as executed.

During February 1945, the plan was evolved to complete this interdiction by cutting a series of 17 bridges and viaducts which were in an arc east of the Ruhr running through Bremen, the lower Weser, Minden to Neuwied, above Koblenz. On 21 February, a series of attacks was begun on the 17 selected targets. Between that date and 24 March, the date of the assault crossing of the Rhine in the North, 42 attacks by medium and heavy bombers of the Ninth and Eighth US Air Forces and the R.A.F. Bomber Command were made on these bridges and viaducts. The action of the medium bombers of the Ninth US Air Force is notable in this operation. This Force made 20 of the above mentioned 42 attacks and destroyed or rendered impassable over one half of the 17 targets. To supplement the cuts at these bridges, as well as for attritional effect, a series of attacks were instituted on those routes which carried a substantial portion of the Ruhr traffic and on those major centers through which most of the Ruhr traffic was canalized. These heavy bomber attacks were supplemented by numerous fighter bomber attacks on lines leading into the Ruhr.

By 24 March complete isolation of the Ruhr had become an accomplished fact. One or more spans were down on 14 of the main line of interdiction bridges and two back-up bridges while tracks were cut at the other three main lines of interdiction. By the same date 20 out of 25 marshalling yards on the periphery of the Ruhr, handling virtually all traffic originating in that area had been so heavily damaged as to prevent either through running or marshalling. Photographic reconnaissance on 23 and 24 March revealed an almost complete absence of railway movement to the north and northwest of the Ruhr as far as the River Weser, while traffic in the Ruhr itself, was to all intents and purposes at a standstill. In consequence of this unique achievement, the crisis already existing in the German economy became catastrophic.²

DIRECT PARTICIPATION IN THE GROUND BATTLE

33. General. In addition to daily participation of the tactical air forces in the battle there were certain operations in which the long range bombers brought their tremendous bomb loads to bear in purely tactical situations in cooperation with the medium and fighter bombers. These operations were carefully planned and carried out in conjunction with a major ground move. Actually 12.3 per cent of the total 1944/1945 heavy bomber tonnage was devoted to army cooperation attacks.

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There was virtually no type of ground operation in which air power did not play a part, sometimes it was, owing to weather or the type of targets, with only moderate success, but often the part produced decisive results. Air power was used to pave the way for landing operations, to reduce enemy defenses prior to a planned breakthrough, to exploit enemy retreats, to smash enemy attempted counter attacks, to assault permanent fortifications, to support airborne operations, and to aid in numerous other situations. In the Ardennes and Mortain offensives aircraft was used as anti-tank weapons, in the assault on Metz, Brest, and other similar fortifications air power functioned as heavy and light artillery, and in the many instances of close column support aircraft provided the equivalent of small arms fire. Bombing attacks by heavy and medium bombers were carried out with increasing success through the various campaigns, providing a bombardment in depth and intensity more devastating than the heaviest artillery barrage. Everywhere, air power provided the tactical reconnaissance which gave the armies the eyes which conversely allied air power denied to the enemy.

Selected examples of the use of air power are presented as illustrative of the scope and character of battle participation operations. In considering these examples, it must be borne in mind that they represent the unusual, and that the day in and day out armed reconnaissance and army cooperation operations were fully as important and, weather permitting, took place every day.²

34. Landing Operations.

a. Normandy - 6 June 1944. The German Forces were not engaged in any part of France by allied forces on the ground but there were strong concentrations of troops in the Pas de Calais area where Allied landings were expected. Although German divisions elsewhere along the coast were thinly deployed, the coast line bristled with permanent fortifications, beach defenses, and underwater obstacles. Radar installations were effectively distributed to give warning of approaching aircraft.

In April an air campaign to reduce the enemy's fixed coastal defenses, to neutralize radar installations, and to destroy Seine crossings by which enemy units could be moved into the landing areas from the Pas de Calais was begun. A major feature of the air campaign was deceptive bombing of the Pas de Calais area. This caused the enemy to maintain large forces in the Pas de Calais throughout the period of the landings and during a good part of the battle to secure the beachheads.

Aside from attacks on communication targets for isolation of the battle area, the pre-D-Day bombing involved over 9,000 heavy and medium bomber sorties and the dropping of nearly 30,000 tons of high explosives. On D-Day itself more than 2,500 heavy and medium bombers participated, bombing the landing area itself. Fighter bombers added to the total effort with emphasis on troop concentrations and headquarters.

One of the chief contributions of air power to the initial success of the operation again was in preserving the element of surprise. In addition to shielding the selected landing areas, air power put out of action by D-Day, 82 per cent of radar installations.

Attacks on gun positions in the assault areas were not highly successful, due in part to weather conditions which, immediately prior to the landings, made pin point bombing virtually impossible. Failure to achieve more important results, however, was compensated for in part by serious damage to enemy communications especially some distance behind the first line of defense. Attacks in this area on headquarters, troop concentrations and enemy movements by road were also successful in preventing the enemy from organizing quickly for an effective counter attack.^{2,3}

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b. Southern France - 15 August 1944. By the middle of August, the German Nineteenth Army in the south had been weakened by transfers of some of its best equipped divisions to the Normandy front. The remaining forces, including only one Panzer division in the Toulouse area, were strung out along the whole Riviera. By contrast with the Normandy front, the enemy was unprepared to put up a defense of this area in strength.

The landings in Southern France, like those in the north, were preceded by heavy air attacks on fixed defenses, coastal batteries, aircraft warning devices and communications, and by a deceptive plan of bombing which concealed from the enemy the precise points of the landing. The full scale softening-up process against gun positions, radar installations and various types of defended localities began on 11 August and continued through 14 August with more than 3,000 sorties dropping nearly 3,000 tons of bombs in the target areas. From D-Day onward, the scale of effort was reduced sharply, and entirely discontinued for these types of targets by 2 September.

The entire operation was so successful that all the heavy bomber effort and a large part of the medium bombers were discontinued by D plus one. The major task of the air forces thereafter consisted in pursuit of the retreating German forces and maintenance of the interdiction ring around the battle area. The pre-D-Day attacks against radar installations were not, however, as successful as in Normandy. Only some seven or eight of the twenty-two sites were rendered unserviceable. Severe damage was inflicted on at least 50 per cent of the principal gun positions, and there is ample evidence that many of the remaining positions were abandoned after the first wave of air attack. Effort against coastal batteries were generally more successful than in Normandy, and attacks on beach obstructions and light artillery positions proved effective.²

35. Breakthrough Operations.

a. St. Lo, with Carpet Bombing. The main breakthrough at St. Lo was preceded by heavy bomber attacks on 24 and 25 July. Unfavorable weather over the target area precluded successful completion of the attack begun on 24 July and the operation was postponed until the following day when nearly 1,500 heavy bombers dropped 3,400 tons in the target area. Medium bombers cooperated in attacking strong points. The enemy again caught the full force of an attack which paralyzed his communications, neutralized his artillery and anti-aircraft defenses and immobilized armored units. Although permanent casualties among troops were not excessively high, abundance of testimony by prisoners indicates that the demoralization was widespread and contributed very materially to the spectacular success of this operation.

General Bayerlein, Commanding General of the famous Panzer Lehr Division, gives eloquent expression to the effectiveness of the St. Lo carpet bombing, with its follow-up attacks by the fighter bombers on his mobile armor and supply columns. Following are pertinent excerpts from Bayerlein's interrogation:

"On the morning of 25 July, General Bayerlein was at his rear CP at Quibou, just southeast of Canisy. He had an advanced CP at Le Mesnil Aley, with artillery and some reserves just north of this point. His forward line was anchored on its right at the bend of the Vire northwest of St. Lo. It made an arc westward, crossing the St. Lo-Periers road and due west to Le Mesnil Eury. Just north of Canisy was his heavy artillery and flak. The Division supply and reserve area was from Corisy la Salle along a line east and south toward Percy. It was a somewhat overcast day, but the clouds were high. Just before 0900 hours, he saw waves of four-motored aircraft come over.

"His divisional flak opened up, but they had 'scarcely opened their mouths,' as he puts it, when the rain of bombs began to fall, and half of his AA guns (which consisted of three batteries, six guns each, 8.8) were immediately knocked out. Their commanding officer ordered the rest to cease firing.

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"Every living person immediately went for whatever cover he could find, and stayed there. The waves of planes kept coming "like a conveyor belt," seemingly without end. He heard the bomb carpets come down, now before him, now on the right, now on the left, rolling forward relentlessly. He felt certain now that a big attack was coming and that he must contact his forward positions. From 0930 hours on, he was completely out of communication with all levels, even by radio. About 1000 hours or 1030 hours he mounted the pillion of a motorcycle and set out for Le Mesnil Amey by inconspicuous paths he had previously learned. The CP itself was not damaged, but the fields all about were burning and smouldering. Here in an observation post in a heavy stone tower two meters thick, he watched the next wave of attack. He could see Amigny, on the US side of the lines, and could watch the bomb carpets rolling in great rectangles. By 1200 hours nothing could be seen at all in any direction so thick were the smoke, dust, and murk. Being entirely out of communication, he sent runners to his regiments, and then for the first time noticed that there was also heavy artillery fire.

"His front lines, he describes as a Mondlandschaft - a landscape on the surface of the moon, all craters and death. At least 70 per cent of the personnel were out of action, either dead, wounded, crazed or dazed. The 30 - 40 tanks he had in the front line were all knocked out, some turned over on their backs, some unable to climb out of craters. On a farm he found the whole CP of his 90th regiment completely destroyed right in the center of a bomb carpet."

On the whole this operation was highly successful. Certain lessons were evident. Carpet bombing must be followed immediately by infantry in order to take advantage of the shock effect created by the great weight of bombs in a confined area. It was also evident that the foxholes and bunkers widely used in all attack areas were little affected by anything less than direct hits. Moreover, the enemy was apparently able to anticipate the sequence of successively deeper "carpets," thus enabling evacuation in the zone immediately behind the one receiving the greatest weight of bombing.²

Another lesson learned was that positive measures should be taken to lessen or eliminate the probability of dropping bombs on friendly troops. During subsequent similar operations several methods of front line identification were developed and tried. The more successful were colored smoke lines placed in the air above the front lines by anti-aircraft artillery, barrage balloons just above an overcast, colored smoke on the ground and radio bancher and homing beacons located at known positions near the front lines.

b. North of the Ruhr Without Carpet Bombing. The encirclement of the Ruhr industrial area was accomplished concurrently by the American Ninth and First Armies' drives operating north and south of the area respectively. During the latter part of March, Allied forces which had been gathering on the Rhine, crossed in great strength at numerous places between Wesel and Oppenheim. The Remagen bridgehead, meanwhile, was being expanded both in length and depth. On the night of 23 - 24 March, after extensive preparations, and assisted by the dropping of airborne units in the Wesel area, a massive assault was launched north of Orsey and Rees. The bridgehead thus gained was expanded between 24 and 29 March and on the next three days, the Ninth Army in a series of quick thrusts to the east joined with units of the First Army advancing from the south. Thus, by 1 April, they had completed the encirclement of the Ruhr and trapped 350,000 enemy troops in an operation begun little more than a week earlier.

The participation of air power in this operation was also preponderantly close cooperation by fighter bombers and softening of centers of resistance by medium bombers. The greater portion of the missions were flown as armored column cover. Although weather hampered air operations considerably, close and highly effective cooperation was afforded during the establishment of the bridgehead and throughout the rapid advances of the encircling spearheads.

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Fighter bombers were employed successfully in this operation both as column cover and as armed reconnaissance. In the former role they assisted attacking elements in the reduction of road blocks and strong points, prevented armored counter attacks and precluded the enemy from organizing effective resistance to the thrusts of the advancing columns. Armed reconnaissance contributed significantly by locating and attacking enemy troops and armor in a position to resist the advance of our forces and by preventing the orderly withdrawal of enemy forces to the defense of local objectives in the path of the Allied advance.²

36. Enemy Counter-Offensive, The Ardennes. On the morning of 16 December 1944, in a plan long premeditated, the German High Command in the West issued the order which threw 22 divisions into an offensive against the Allied armies in an attempt to seize Brussels and Antwerp and thereby encircle some 28 Allied divisions, themselves poised for a major attack against the Ruhr. The serious weakness in the German situation was that of supplies and mobility, its chief vulnerability the lack of assured air supremacy. This was the first time a German army had launched an offensive without superiority in the air.

Operating in virtually completely overcast weather until the skies cleared on the sixth day of the offensive, and then given one week of good flying weather, Allied aircraft flew an enormous number of sorties. During the 30 day period 16 December - 16 January, almost 74,000 sorties were flown and 111,005 tons of bombs dropped by Allied aircraft in an all-out effort to stem the German drive. Fighters and fighter bombers concentrated their effort in the actual battle areas and along supply lines close to the front, while mediums and heavies, for the most part, attacked rail and road communications farther behind the front lines.

Despite weather conditions which, during nearly the entire period, were unfavorable for flying, the contribution of tactical air power through the wholesale destruction of enemy mobile equipment was severe. Initially the effect of these successful air operations was to contain the enemy spearheads and later to contribute decisively to his overall disorganization. The loss of equipment which he was unable to extract from the salient must have been felt throughout the remainder of the campaign.

It is felt, however, that air power, for the first time assigned a task of great importance under battle conditions selected by the enemy and favorable to him, made a decisive contribution to a critical Allied victory.^{1,2}

37. Assault on Permanent Fortifications, Fortress Cities and Heavily Defended Localities.

a. West Wall Defenses in the Aachen area. By 15 September the First U.S. Army had reached the Siegfried Line in the Aachen area, where it had been forced to halt for regrouping and resupply. This halt gave the enemy time to strengthen his defenses behind the Siegfried Line, both in the strongly defended city of Aachen and in Heerlen to the north. To the south of Aachen enemy opposition, aided by Siegfried defenses and by difficult terrain, especially in the Hurtgen Forest, was also heavy.

In addition to the routine armed reconnaissance and close cooperation, one large scale medium bomber operation was conducted on 2 October against the numerous defensive positions in the Heerlen area, consisting mainly of pill box type fortifications. The force assigned to this operation comprised five and a half groups of medium bombers. Fighter bombers were assigned specific targets consisting mainly of forward pill boxes. In the Hurtgen forest area no extraordinary effort was made.

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In the Heerlen area effort a clear choice was not made between the bombing of selected pin-point objectives and the saturation of the area. The force employed proved insufficient for the effective accomplishment of either objective, and air attacks in general failed to achieve their desired result. The fighter bomber attacks on the pill boxes also failed, probably because of the special incendiary bombs employed. The chief contribution of the air forces in the Heerlen area was the density of the air cover provided by fighter bombers on armed reconnaissance, and general close cooperation.²

1 b. Fortress City of Metz - September to November 1944. The capture of Metz was a protracted operation involving close coordination of ground and air attacks on an extensive scale. This historic city, which controlled the entrance to the Saar valley, occupied a terrain admirably situated for the construction of a formidable system of inner and outer defenses. Situated on the east bank of the Moselle, surrounding hills provided natural barriers to attacks on all quarters. Permanent forts and field fortifications commanding the high ground were individually capable of firing in all directions. The Germans had strengthened the original French fortifications by the addition of reinforced concrete structures. The defending garrison was efficiently trained and adequately provided with an extensive supply and communication system.

Between 17 September and the end of the first week in November, a series of limited object attacks were carried out with close fighter bomber cooperation and with the aid of heavy bombardment from medium and heavy bombers. These attacks were only partially successful, however, and indicated the high degree of impregnability of the concrete fortifications. The final plan, which resulted in the capture of the city, involved its encirclement and was put into operation on 9 November with a closely coordinated series of aerial attacks against supply and communication lines.

In this final effort, medium and heavy bombers were employed to neutralize enemy fire from the fortified positions while ground forces outflanked them. A force of 726 heavy bombers attacked a series of key forts in the line of the planned advance, while 500 others attacked communication targets in the battle area. More than 500 medium bombers were assigned to attack fortified positions but, because of cloud conditions, only 74 were able to carry out their missions. Fighter bombers, in addition to providing protective cover for advancing infantry units, also attacked the heavy concrete fortifications.

The most decisive effect of air participation in the capture of Metz was achieved through the combined effort of the medium and heavy bombers on 9 November. The ground troops in their speedy follow up on these attacks found the enemy unable to offer sustained resistance and major forts were by-passed without heavy casualties. Enemy troops forming for counter attacks were repeatedly disorganized by fighter bomber attacks and outlying gun positions were neutralized.²

c. Foret de Haye, 10 - 14 September 1944. The Foret de Haye was a heavily defended wooded area on hilly terrain guarding the approaches to the city of Nancy. Its reduction was essential to the capture of the city. It contained a network of well defended roads and a highly organized system of fully manned strong points and the density of the woods provided excellent concealment. Reconnaissance parties approaching the fringe of the woods met heavy and determined opposition and found the enemy capable of shifting heavy reserves to meet attacks. According to reliable intelligence reports, heavy tank reinforcements were being moved into the area.

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On 10 September, a force of 151 medium bombers carrying 100 lb. and 500 lb. G.P. bombs and 100 lb. fragmentation bombs, attacked strong points and ammunition dumps in the area, simultaneously with artillery fire from one battalion. Mediums again attacked the forest on 12 September, with more than 100 aircraft dropping high explosive and fragmentation bombs. Throughout the period 9 - 15 September, fighter bombers provided persistent close cooperation in the form of armed reconnaissance and column cover.

The medium bomber attacks on 10 and 12 September were decisive in forcing the enemy to abandon his defended positions. Fighter bombers were relatively ineffective in the attack on the forest itself, owing to the concealment afforded by the trees. One fighter group, however, succeeded in destroying a concentration of 15 tanks by strafing. Probably due to the success of the medium bomber operations, an infantry regiment, immediately following the first attack, succeeded in clearing the area west of the Moselle from Leverdun to Belleville. Again, the task force which surrounded the forest on 13 September sent patrols for distances of a mile into the forest without meeting resistance. Reports of ground force units entering the woods stated that many of the enemy, not found dead or wounded, were too dazed to offer resistance.

38. Cooperation with Airborne Landings. Air effort against flak positions and enemy troop concentrations, and diversionary operations contributed to Allied success in effecting successful drops in the three situations cited below, namely, Normandy, Arnhem and Wesel. The most successful of these operations was that at Wesel, where losses either from enemy ground action or anti-aircraft fire were relatively light. Armed reconnaissance attacks on enemy troops at Normandy and Wesel reduced initial opposition, while strikes on flak positions, particularly in the Normandy operation, reduced anticipated losses from this quarter. Air attacks against enemy troop units in the Arnhem drop had little effect on the rapid deployment of German forces which succeeded in encircling Allied paratroopers across the lower Rhine before Allied ground units approached the battle area, although other drops in the operation undoubtedly were materially aided.

a. The Normandy Drop. Airborne troops in support of the Normandy landings comprised two divisions dropped in six pre-determined zones astride road and rail lines, cutting Montburg and Carenten, and one division in the Orne river area, astride the road northeast of Caen.

Air cooperation with these drops involved preliminary reconnaissance and pre-d-drop attacks on gun positions, anti-aircraft artillery batteries, defended localities and communications.

Medium and heavy bombers participated in the pre-assault bombing of selected targets in the drop zones, but, later, cooperation was executed by fighter bombers, on pre-arranged armed reconnaissance routes and against selected pin-points, chiefly communication centers and bridges.

Preparations for the drop were accomplished without sacrificing tactical surprise. Anti-flak attacks prior to airborne attacks reduced anticipated losses from anti-aircraft artillery fire. In addition, the bombing of communication centers and bridges in the drop zones retarded the enemy's reaction to the landings. St. Martin Barreville was completely neutralized and easily taken. The 17 SS Panzer Grenadier Division was delayed by casualties and losses of equipment following armed reconnaissance attacks.²

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b. The Arnhem Drop. The airborne operations in the Arnhem area in Holland were executed on 17 September 1944 to facilitate an Allied thrust toward enemy positions north of the Siegfried Line. Air cooperation with this airborne landing involved a pre-assault attack on AAA installations followed by continuous area cover and armed reconnaissance on pre-assigned routes to provide necessary patrols of the perimeter of the area and strafing attacks on enemy units threatening the airborne troops.

A force of 853 bombers attacked 122 AAA installations and nearly 700 fighter bomber sorties were made in providing cover support for the landings.

The landings were made successfully. The troops made progress initially and seized the southern end of the Arnhem bridge on the night of 17 - 18 September. Bitter fighting ensued, however, and pressure by two Panzer divisions in the area awaiting the airborne forces proved excessive. After the initial stages of the operation, air cooperation practically ceased. Bad weather prevented even the normal armed reconnaissance of the area.²

c. The Wesel Drop. The airborne operation at Wesel was an important part of the major assault on 23 - 24 March, over the Rhine to the north of the Ruhr industrial area. This operation proceeded successfully and with considerable rapidity, meeting only light resistance during the first 12 hours of attack. The outskirts of Dinslaken were promptly reached and further to the north a substantial bridgehead was established.

Air cooperation was carefully coordinated with the airborne landings. Special attention was directed toward suppression of flak by combined bomber attacks and artillery fire on flak positions. Medium bombers accounted for 23 gun positions. Fighter bombers were also used in these anti-flak operations. Diversionary missions deep into Germany were flown to draw off enemy fire, and an isolation program was carried out to protect the landing zone from enemy reinforcements. Armed reconnaissance was flown continuously and in force until the airborne divisions had completed their task of assembling in the area.

Employment of air power at Wesel was particularly successful in facilitating the airborne landings. The most successful feature of the air operations were the attacks against gun positions which reduced measurably the opposition experienced from enemy ground fire.^{1,2}

ATTACKS AGAINST GERMAN ECONOMY

39. General. German industry by the beginning of 1944 had been mobilized for war purposes to a far greater degree than it had been in the comparatively quiet years when land fighting was confined largely to Africa and the Eastern front. The upward trend in war output carried the index of armament production to a wartime high at the beginning of 1944. It was in the face of an expanding and flourishing German war economy that the 1944 air campaign began.

During the last 28 months of the war, starting in January of 1943 some 1,584,000 tons were dropped on German targets related to or affecting industry. It was not until the 21st month that the half-way mark in this tonnage had been achieved. At mid 1944 only 37 per cent of the total bombs had fallen.

It was at this point, in August of 1944 when slightly more than a third of the total 1943 - 1945 tonnage had been dropped, that the index of armament production started on its downward course. The remaining two-thirds added to the cumulative effect and accelerated the rate of decline.

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When finally the factors of strength were dissipated the decline was hastened by the inherent weaknesses of the German economy: critical deficiencies in some raw materials; concentration of basic industries which could not be dispersed in vulnerable areas; critical labor shortages; continued failure to mobilize fully; bottlenecks in certain highly specialized machine tools; and Nazi Party interference with industry.

Thus, in the last quarter of 1944 the cumulative tonnage of bombs dropped on industrial targets produced disaster from which industry could not recover. The strain caused by dispersal, loss of man hours through diversion to repair of homes and industrial facilities and to manning anti-aircraft weapons, added to effects of bombing of plant facilities, put German industry in a position in the winter of 1944 where it could no longer furnish the Wehrmacht with the weapons necessary for carrying on the struggle.²

Following are some of the highlights in the application of air power against German industry. The attacks against aircraft production and the isolation of the Ruhr though equally important, have been discussed in paragraphs 23 and 32 respectively of this report and will not be repeated.

40. Attacks Against Oil. The air attack on Germany's oil production and transportation system stands out as the one clear cut fulfillment of the theory of precision "strategic" attack. It was carried out relentlessly and continuously until a vast and complex industry vital to virtually every branch of German industry and to agriculture as well lay all but prostrate. Attacks on other target systems disrupted industry and imposed handicaps on the enemy's conduct of the war. Here an industry was destroyed and in its destruction the whole fabric of Germany's war effort was vitally affected. In its most fundamental aspect the attack was the principal underlying cause of the Wehrmacht's lack of mobility. From the battle line back through the entire economy of Nazi Germany, the attack had its effects in a critical reduction of motor transport deliveries, in loss of chemical by-products for agriculture and industry and in man power allocated to rebuild damaged plants. Not the least among the effects was the ultimate drying up of all operations. The Allied air effort against oil production started in May 1944 but before it was finished 285,000 tons, or some 14 per cent of the total Allied effort for 1944-1945 had been dropped on it. The net result was that from a high of 927,000 metric tons produced for March 1944 it fell to an estimated 70,000 tons in April of 1945. As the ground forces overran the refineries beginning with the Russian capture of Ploesti in the summer of 1944, they found them either destroyed or operating at a fraction of their normal capacity. In the end virtually every major German refinery had been severely damaged and was out of action.

On the front, local oil shortages had been severely felt as early as the battle for Caen in July of 1944, and the subsequent battle of the Falaise gap. Despite carefully hoarded resources prior to the Ardennes offensive, oil shortages played a large part in its failure. The resistance in the Ruhr pocket was shortened considerably by the lack of motor fuel. According to Reichsminister Speer, some 1,500 tanks were available to contain the final Russian bridgehead at Saranovo on the Eastern front, but could not be used for lack of fuel. The ultimate collapse of Army Group "G" on the Southern front was undoubtedly due to complete lack of mobility. Behind the front fuel shortages were felt severely in tank training programs and equipment testing; both men and tanks arrived at the front unprepared for the responsibilities they had to meet. High Nazi officers have consistently stated that the rapid collapse on all fronts can be attributed largely to the immobilization of the armies.

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The effect of the attack on the German Air Force was truly catastrophic. The pilot training program was drastically curtailed; the long range bomber force first ceased to operate and was then abandoned; air transport was gradually eliminated, except for most critical emergencies; all non-operational flying was quickly discontinued, and gradually actual operations were limited to sheer necessity under "favorable conditions". By September 1944 allocations of aviation fuel were reduced to 30,000 tons from a minimum requirement of 160,000 tons. According to Saur no more aircraft gasoline was produced after December of 1944. By spring of 1945 the German Air Force was virtually grounded for lack of fuel.

Within the German economy and in civilian life by the end of 1944 there were virtually no civilian vehicles using liquid fuels. Speer had summed up the result of this attack in saying: "The planned assault on the oil industry----was the most decisive factor in hastening the end of the war".²

41. Attacks against Rail and Water Transport. The target system to receive the greatest weight of attack of all was the enemy's vast and intricate rail and water transport net. How extensive and flexible this net was may be seen in the fact that whereas the United States had 8.3 miles of rail lines per 100 square miles of territory, Germany had 20.8 rail miles per 100 square miles. Against this net and those in occupied territories nearly one third of the Allied heavy bomber effort was directed in 1944-45. Most of this effort was carried out to influence the course of the ground battle by isolation of the battle areas. A substantial tonnage, however, was dropped with the purpose of disrupting enemy communications and thereby to interfere with German economic traffic. Whatever the purpose, the net result was that the half million tons dropped by the heavy bombers alone, plus the thousands of tons dropped by tactical aircraft, had a cumulative effect which ended in inflicting so heavy a rate of attrition that large sections of the communications net were virtually paralyzed. No single attack is believed to have affected rail communications critically but the effects of repeated attacks against rail centers, bridges, embankments, rolling stock, signals equipment, and water ways mounted to create a problem which all German ingenuity and energy could not solve.

Speer in one interrogation reviewed concisely the effects of rail attack. The following sentences are excerpts from this interrogation.

"Concern over industrial production was first felt following attacks on communications in the Ruhr in May 1944; this threat grew from month to month and gave rise to a most serious crisis from the autumn of 1944 onwards, and to a final catastrophe from January 1945 onwards."

"Every industry was effected by the insufficiency of winter stocks of coal for power plants and gas works from November 1944 onwards and by the lack of transport space for the July deliveries."

The failure of the Reichsbahn under the impact of Allied bombing was reflected in numerous critically important parts of the German economic system, but the best indication is probably in coal production and movements. Coal, in fact, was the basis of virtually every major section of German industry. In June 1944 stocks at the pit-heads started a precipitous rise which continued even after production began to fall in August. Using the monthly average of 1944 as equal to 100, stocks of hard coal had by December risen to approximately 150, while hard coal production had slumped to 85, and the production of all coal had fallen to below 75. The downward trend continued, so that by February 1945 the production of all coal had fallen to below 50. The isolating of the Ruhr in March made impossible the continuation of heavy industrial output.

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In the armament industry, according to many German statements, it was the attack on transport ahead of the bombing of industry itself that caused its slow death. The whole armament industry had been widely decentralized in order to minimize the effect of air attacks on it. No one factory was the sole manufacturer of all the components of any single weapon or piece of equipment. On such a system lack of transportation had a disastrous effect. Eventually it became possible to transport only what was necessary for the completion of equipment already partly assembled. Raw materials remained where they were. And the same difficulties which attended the delivery of raw materials and sub-assemblies to the factories worked upon the dispatch of the finished products from them.

The dispersal of industry generally, which had been carried out as protection from air attack, in the end proved a fatal weakness. Often dispersal was planned without consideration of the rail facilities of the area to which dispersal was made. Goering's estimate of the results of bombing on the aircraft industry was: "The disruption of our communication lines has done more harm than the destruction of our factories."²

42. Attacks against Tanks and Motor Transport. At the start of 1944, both tanks and motor transport are known to have been far short of Table of Organization authorizations, and the Tables of Organization themselves were reduced during the course of the year. The supply of tanks and vehicles was extremely tight and any reduction in output would have been expected to have serious effects in Germany itself and on all fronts.

The air effort against this target system was comparatively small. The total weight of heavy bomber attacks amounted to some 39,000 tons or 2.2 per cent of the total dropped in 1944 and 1945. Of this total 2.2 per cent, slightly less than half was dropped on tank assembly components, and engine plants, and the balance on motor transport plants and ordnance depots. The heaviest attacks were carried out in the autumn of 1944 when the enemy was seeking to recover after the disastrous losses suffered during the retreat from France. Very substantial weight was contributed in the spring of 1945 when Allied armies were well into Germany and the end almost in sight.

As a result of the autumn attacks on production of tanks, (in terms of value of the monthly rate) output fell 15 per cent. The enemy's most formidable armament, the Tiger tank, was most seriously affected with production cut by two thirds over a period of six months. Even on the basis of the theoretical table of organization at the beginning of 1944, the tanks thus "lost" would have equipped eight full panzer divisions.

Motor transport vehicles are likewise believed to have been reduced to 40 per cent in the last six as compared with the first six months of 1944. No firm estimates are available as to the quantity of small arms, engineering tools, etc., destroyed in attacks on ordnance plants, but direct evidence from prisoner of war reports confirms amply the increasing shortage of all these items on the fronts.

Nowhere is the extreme difficulty and complexity in assessing the exact results of bombing attacks better illustrated than in this field. The statements of prisoners of war, the evidence of reduced table of organization, the use of horse-drawn vehicles, the inability of the enemy to move, to group, to bring forward supplies and to counter-attack, all testify to a disastrous shortage of tanks and motor transport. So numerous and complex, however, are the factors which, in addition to the bombing of production, contributed to this shortage at the front and elsewhere, that no precise estimate is now available on what any one factor contributed to the overall shortage. Inability to bring equipment forward on a shattered rail system; destruction by air attack of vehicles and tanks in action; breakdown of repair installations under

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attack by tactical aircraft; shortage of spare parts possibly due to their being assembled into finished vehicles in order to keep up production figures; diversion of a substantial part of capacity of V-weapon production; the indirect effect of attack on other target systems which produced component shortages such as needle bearings, and above all a steady drying up of motor fuel; all these factors make it impossible to assess with accuracy the results of the attacks on tanks and motor transport. Suffice it to say that there were serious shortages at the fighting fronts of these vital war materials.²

SECTION 3

CONCLUSIONS

43. The war against Germany was not won by any single branch or arm of the service; Army, Navy or Air. The team work, a product of the coordinated, combined efforts of the three forces defeated a great military machine.

44. In this war, air power made a substantial if not decisive contribution to the defeat of the enemy.

45. The fundamental principles and doctrine of the command and employment of air power, as set forth in FM 100-20 were adhered to in the European Theater and were proved to be sound.

SECTION 4

RECOMMENDATIONS

46. It is recommended:

- a. That air power continue to have two striking forces; the Strategic Air Force and the Tactical Air Force.
- b. That command and employment of air power continue to follow the principles and doctrine prescribed in FM 100-20.
- c. That in a theater of operations there be one Supreme Commander; that the Supreme Commander of the theater have under him, three commanders, each commanding one of the three forces, Ground, Naval and Air.

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