~~SECRET~~
SECURITY INFORMATION
CONFIDENTIAL

Copy No. 1

U. S. Air Force Historical Study No. 119
(Formerly Army Air Forces Reference History No. 19)
(Short Title – AAFRH-19)

THE Combined BOMBER OFFENSIVE
APRIL THROUGH DECEMBER 1943

CONFIDENTIAL
Classification changed to .....
By auth. of DIRECTOR, R&I, AG
7 OCT 1953

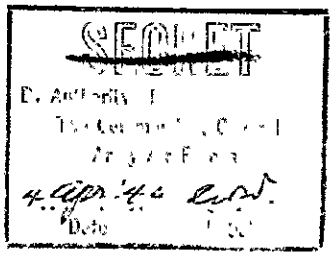
Classification Cancelled
By Authority of Director,
Research & Intelligence
By _____
Date _____

PREPARED BY
AAF HISTORICAL OFFICE
HEADQUARTERS, ARMY AIR FORCES

CONFIDENTIAL
~~SECRET~~

CONFIDENTIAL

REFERENCE HISTORY



THE COMBINED BOMBER OFFENSIVE

April through December 1943

(Short Title: AAFRH-19)

AAF Historical Office
Headquarters, Army Air Forces
March 1946

F O R E W O R D

This study was prepared during the summer of 1945 by Captain John W. Stormont, whose services were lost to the AAF Historical Office immediately after the study was completed. It does not incorporate, therefore, the results of such more recently released materials as the final over-all report of the U. S. Strategic Bombing Survey.

The present study is preceded by AAFRH-18: The Early Operations of the Eighth Air Force and the Origins of the Combined Bomber Offensive and will be followed by a study dealing with the CBO after December 1943. In order that the reader may understand without recourse to AAFRH-18 the developments narrated here, Captain Stormont has presented in Chapter I and part of Chapter II a summary analysis of materials which will be found treated in greater detail in the study covering the earlier period.

The study is subject to revision, and additional information or suggested corrections will be welcomed.

C O N T E N T S

The Combined Bomber Offensive, April through December 1943

Chapter I

TARGET SELECTION FOR THE COMBINED BOMBER OFFENSIVE

Early Planning: 1941-1942

The history of the combined bomber offensive (CBO) in Europe is, in the main, an account of strategic air warfare. In a letter written to the Commanding General of the Army Air Forces in January 1943, Maj. Gen. Ira C. Eaker, Commanding General of the United States component of the CBO forces, made a significant distinction between two of the most important military applications of air power. In the course of a comment on the enemy he said:[1]

> The Germans never had an Air Force. They had a great Air Support Command. Goering designed and built their airplanes to support ground armies in continental conquest. They never had an Air Force of long range bombers with a defensive fire power to carry destruction outside the continent. . . . They had not the means, perhaps, to build the overpowering Air Force and the overpowering Air Support Command. Quite rightly, therefore, by their lights, they built the latter . . . .

War Department doctrine on the employment of air power makes the same distinctions of mission and composition in more conventional terms. According to this doctrine the over-all mission of a strategic air force is the defeat of the enemy nation, the implication being that such a force can wage war on an enemy independent of the action of other forces. The strategic air force comprises bombardment, fighter, and photographic aviation, but heavy bombardment aircraft constitute its backbone. Its objectives are to be found in the vital centers of the enemy's communication lines and his economic system. The tactical

air force, on the other hand, lacks the emphasis on heavy bombardment aircraft and normally functions in a theater where ground forces are operating. Its missions are principally to gain air superiority within the theater, to prevent movement of hostile troops and supplies, and to participate with the ground forces in a combined effort to gain objectives on the immediate front.[2]

The joint and separate U. S. and British planning for the defeat of Germany contemplated from 1941 forward the strategic application of air power as one of the means of bringing that end about. The British-United States Staff Conversations held in the first quarter of 1941 and reported on 27 March of that year proposed "a sustained air offensive against the German homeland and all territories under her control" as one of the measures against Axis Europe.[3] The War Department plan, RAINBOW NO. 5, which followed these staff conversations and provided for the defense of the Western Hemisphere and action in the Pacific and European theaters, proposed the conduct of "offensive air operations from bases in the British Isles . . . against German military power at its source."[4]

The AAF plan AWPD-1, drafted in August 1941 in pursuance of a presidential directive dated 9 July and in consonance with the United States-British Staff Conversations of 1941 and RAINBOW NO. 5, stated clearly a strategic doctrine for the defeat of Germany in these words: "The center of the Axis system is Germany . . . . The basic conception on which this plan is based lies in the application of air power for the breakdown of the industrial and economic structure of Germany."[5]

CONFIDENTIAL INFORMATION

The purpose was further elaborated in a "Plan for Initiation of U. S. Army Bombardment Operations in the British Isles," 20 March 1942, which stated that after our bombardment force had been built up sufficiently it would "commence operations against the strategic objectives, facilities and establishments which support the operations of enemy forces and the enemy national, economic, and industrial structure."[6]

The air plan known as AWPD-42, dated 9 September 1942 and prepared by the Army Air Forces in compliance with a letter directive from the President to the Chief of Staff, declared that our air force must deplete the German Air Force and undermine the economic structure that supported the surface forces of the enemy. The accomplishment of these tasks was to be through the combined efforts of the U. S. AAF and the British RAF. The AAF would conduct precision bombing in daylight and the RAF would make mass area attacks at night for the purpose of cutting down production and weakening morale.[7]

It is thus quite evident that the strategic air force mission was understood and clearly stated well in advance of the drawing up of the final Combined Bomber Offensive Plan.

Strategic warfare with heavy bombardment aviation involves three phases: the preoperational or planning phase, operations and attack, and the assessment of results. The planning phase is considerably different from that for other types of warfare and even unlike that required for other applications of air power. The strategic plan calls for two essential steps--the selection of targets and the calculation of the

CONFIDENTIAL
SECURITY INFORMATION

force necessary to destroy these targets. It is primarily in the selection of targets that planning for strategic air war differs most from other types of war planning. Since the strategic force aims to destroy the economic sources of military power, the selection of target systems is of paramount importance. Their selection requires a kind of intelligence of the enemy and a type of personnel different from other military preparations.

The air planning for war against Germany that preceded the CBO Plan paid a great deal of attention to the matter of target selection. AWPD-1, mentioned above, selected a set of industrial systems for destruction and arranged them in order of priority. The plan called for:

a. disruption of the German electric power system
b. disruption of the German transportation system
c. destruction of German oil and petroleum supplies
d. undermining morale by attacks on centers of population

To aid in the accomplishment of these objectives it would be necessary to neutralize the German Air Force by attacks on

a. its bases
b. engine and airframe factories
c. aluminum and magnesium factories[8]

The Plan for Initiation of Air Force Bombardment Operations in the British Isles selected some 144 targets within four categories in the following order of priority:

a. Munitions industry
b. Electric and water-power industry
c. Petroleum and fuel industry
d. Rail and water transportation[9]

AWPD-42, mentioned above, went into considerable detail in selection of systems and individual targets, and in the calculation of the forces

SECURITY INFORMATION

and munitions necessary for achieving the destruction of these targets. The size of the forces planned was based upon the bombardment accuracy that had been observed in early Eighth Air Force operations. The plan provided seven target systems for the attention of the Eighth while the RAF bombers were to be engaged in mass area attacks. The systems for the AAF bombers included:[10]

a. First priority, the facilities supporting the GAF--including eleven fighter factories, fifteen bomber factories, and seventeen engine plants.
b. Second priority, twenty submarine building yards.
c. Third priority, transportation system--Individual targets (36) were to be found among building shops, repair works, marshalling yards, and canals.
d. Fourth priority, electric power--including some thirty-seven major plants.
e. Fifth priority, oil--which required destruction of twenty-three plants.
f. Sixth priority, fourteen aluminum plants.
g. Seventh priority, rubber--The destruction of the two principal plants was called for.

The whole plan required the destruction of 177 targets by 66,145 heavy bomber sorties dropping two tons per sortie.

Since during the course of 1942 the German submarine had become a serious threat to our successful waging of the war, the facilities supporting underseas craft were moved to top priority in a list of target categories given to the U. S. Eighth Air Force by the theater commander in October 1942:

a. First priority, five submarine bases
b. Second priority, aircraft factories and fields
c. Third priority, twelve railroad marshalling yards[11]

The Casablanca Conference

From the above it seems quite evident that definite progress had been made in the sphere of target selection in the planning prior to the

drawing of the final blueprint for the combined bomber offensive in 1943. It was true, nevertheless, that certain things were lacking in the preparations for the air offensive against the Western Axis. No directive emanating from the top policy levels had been issued to control the combined operations of the two Allied air forces that were operating against Germany; no directive of sufficient clearness and definiteness had been given to the U. S. Eighth Air Force; and no unified analysis of enemy economy had been made that was sufficiently thorough to serve as a basis for the best target selection.[12]

Two of these defects in strategic planning were eliminated by the work of the Casablanca Conference in January 1943: a directive was issued by the Combined Chiefs of Staff, and this directive proved to be quite clear and definite. There had apparently never been any disposition on the part of the Combined Chiefs to depart from the intention to use strategic air power as one of the primary offensive measures against Germany, but there had been some pressure exerted to have the U. S. Eighth abandon daylight precision bombing and join with the British in night bombing.[13]

The Commanding General of the Eighth was called to Casablanca and given opportunity to defend the United States doctrine of day bombing. His defense emphasized the greater accuracy of this type of operation which permitted small targets like factories to be found, seen, and hit. Day bombing, he declared, was more economical in the employment of forces, for a smaller number of bombers could destroy a given target.

This meant reduced exposure to enemy action and consequent lower losses for a given result. Also, day attack was more economical because all forces could carry bombs, whereas at night large numbers of pathfinders and target illuminators were required. It was stated, in addition, that day bombing used in conjunction with British night bombing would heavily tax German defenses by allowing no rest during the daylight hours, and would prevent congestion and provide more economical use of English airdromes. The general's defense of precision bombing likewise stressed the fact that American training and equipment would require modification if successful night operation was to be possible, for American crews would need a long period of additional training to make them capable of coping with English weather at night and U. S. planes would have to be flame dampened, thus reducing their power and range. Furthermore, the point was made that day bombing provided an excellent means of cooperating with the RAF night effort, in that the AAF bombers could find difficult targets and mark them by setting fires, whereupon the RAF could complete the job of destruction at night. Moreover, day bombing would permit the destruction of the enemy's day fighters, thus causing the greatest reduction of his air force. Finally, it would (as a complement to night bombing) result in the greatest havoc to the enemy's industrial system.[14]

General Eaker spent an hour with the British Prime Minister at Casablanca and was assured by the latter that he would be given an opportunity to prove his case.[15]

The Casablanca directive that was issued by the Combined Chiefs

of Staff on 21 January 1943 is noteworthy because it governed the operations of both U. S. and British bomber commands in the United Kingdom, because of its excellent statement of the mission of strategic bombardment, and because of the target systems that were selected for attack.

The mission of the bomber offensive from the United Kingdom was "the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to the point where their capacity for armed resistance is fatally weakened."

The target systems to be attacked in the accomplishment of this mission were in five categories in the following order of priority:

a. German submarine construction yards
b. The German aircraft industry
c. Transportation
d. Oil plants
e. Other targets in enemy war industry

The directive stated that strategical developments might vary the order of the five categories and that there were other targets of military and political importance, such as submarine operating bases on the Biscay coast and the city of Berlin, which were worthy of attention. Attacks were to be made in the Mediterranean theater when the occasion demanded, and the units of the German fleet were to be hit when opportune. Daylight attacks were to be pressed against targets within Germany in order to maintain continuous pressure on German fighters, and to take enemy fighter pressure away from the Soviet and Mediterranean theaters.[16]

CONFIDENTIAL

SECURITY INFORMATION

The Report of the Committee of Operations Analysts

The target selection in the Casablanca directive was not, however, much different from nor perhaps any better than that in the earlier planning. The thing that had been lacking in all this planning was a thorough study of the enemy economy by a single agency, such a unified analysis being necessary for the proper selection of strategic objectives. This phase of planning had developed its own principles and techniques, which involved a detailed knowledge of the enemy's productive system and a careful balancing of economic and military factors; but no agency had been created to apply these techniques in preparing a comprehensive report.

Not all of the intelligence of the enemy necessary for target selection can be obtained directly by an air force or a bomber command. Such intelligence is obtained by many regular and special governmental agencies and by a variety of individual experts. Its sources are as varied as its collectors. Aerial reconnaissance photographs, ground reports, captured weapons, interrogations of refugees and prisoners of war, current and prewar enemy technical publications, the prewar experience of Allied technical experts abroad, our own production practices, and Allied data on bombing effectiveness are but some of the sources used in making a selection of targets for strategic bombing.

Before industrial systems can be ranked in target priority a number of economic and military criteria must be applied. Most important, perhaps, is the military use of the products of a system. Some of the economic factors which must be considered are the depth of an industry

SECURITY INFORMATION

(measured by the time required to get products from industry to the front line), the cushion (idle capacity that can be brought into production), the reserve stocks, the attrition rate, the existence of substitutes, the possibility of exercising economies, and the ability of an industry to recuperate.

Military factors relating to the vulnerability of targets and the capabilities of the attacking air force must be applied. The structural characteristics and concentration of buildings, their susceptibility to various types of munitions, the dispersal of plants, and distances from bases all govern the possible destruction of a telling fraction of an industry by an air force.[17]

The appointment of a body to make the analysis of German economy that was necessary before further progress in target selection could be achieved was made on 9 December 1943 by the Commanding General of the Army Air Forces. This body, known as the Committee of Operations Analysts (COA) and placed under the direction of the Assistant Chief of the Air Staff, Management Control, was instructed to submit a report which would show the rate of deterioration of the German war effort that would result from air operations and which would indicate an approximate date when invasion of the Continent would be possible.[18] This was the body that filled the gap that had existed in the strategical planning before 1943 by making a thorough-going study of German economy upon which a dependable choice of target systems might rest.

The first meeting of the Committee of Operations Analysts was held on 10 December, and it immediately went to work with the appointment

of subcommittees to study enemy industrial systems.[19]

Although it was desired that the committee submit a report before the Casablanca Conference, that could not be accomplished in the time available. An interim report was submitted on 23 December 1943 in which the committee's methods and sources of intelligence were described and in which the principle of concentration of effort was stated thus: ". . . it is better to cause a high degree of destruction in a few really essential industries or services than to cause a small degree of destruction in many industries."[20]

The next few months were spent in the study of various target systems. Assistance was given by A-3, G-2, the Board of Economic Warfare, the Office of Strategic Services, the War Production Board, and certain other government agencies and experts in private industry. Certain members of the committee went to England where methods and materials were reviewed with the Eighth Air Force, the Royal Air Force, the Air Ministry, and the Ministry of Economic Warfare.

The final report of the COA was submitted on 8 March 1943. The over-all results of the researches of the various subcommittees were presented in a bound volume which summarized data on 19 different German industrial systems--all that appeared to have bombardment significance. Under a separate tab the various production units in each system were listed. The distance of each unit from London and its percentage of total axis production were set forth. For security reasons the committee did not rank the 19 systems[21] in order of priority, but it did announce a set of principles of strategic selection which concurrently constitute

one of its chief contributions to the planning phase of this type of warfare.

Although the COA did not recommend definite target priorities or find it possible at the time of the 6 March report to forecast a date on which invasion would be possible, it did arrive at two important conclusions:[23]

a. The destruction and continued neutralization of some sixty targets would gravely impair and might paralyze the Western Axis war effort.

b. In view of the ability of adequate and properly utilized air power to impair the industrial sources of the enemy's military strength, only the most vital considerations should be permitted to delay or divert the application of an adequate striking force to this task.

The Combined Bomber Offensive Plan and Directive

The report of the COA was taken to England, where a committee composed of Brig. Gen. Haywood S. Hansell, Jr., Brig. Gen. Orvil A. Anderson, and plans personnel of USSTAF, the Royal Air Force, and the Eighth Air Force was set up under General Eaker for the purpose of drawing up an operating plan to accomplish the desired result. The committee had as its task the establishment of target priorities and the calculation of the size of U. S. forces necessary to accomplish the purpose of the COA.[25]

This committee completed its work in April 1943. The finished plan restated the mission of the strategic air forces as defined in the Casablanca directive[24] and recommended the destruction of 76 specific targets that were to be found in the following systems:

a. Submarine construction yards and bases
b. German aircraft industry

c. Ball bearings
d. Oil
e. Synthetic rubber and tires
f. Military transport vehicles

It further stated that the destruction of the selected individual targets within those systems would achieve the elimination of commanding fractions of enemy production within the affected industries:

a. Destruction of the selected submarine yards would reduce German construction by 89%.
b. German fighter capacity would be reduced by 43% and bomber capacity by 65%.
c. Ball-bearing capacity would be reduced by 78%.
d. Destruction of Ploesti refineries and German synthetic oil plants would reduce production by 49%.
e. Destruction of 50% of synthetic rubber production and nearly all of that for tires would be accomplished.
f. Destruction of seven plants producing motor vehicles would fatally weaken the capacity of the German people for armed resistance.

The German aircraft industry was placed second in the priority list of target systems, but the plan stated that German fighter strength was an intermediate objective of the bomber offensive second to none. That is to say that the German fighter force had to be destroyed before the combined bomber offensive, especially the American part of it, could be successful. It was pointed out in this connection that German fighter production had increased 4[illegible]% and fighter strength on the Western front had nearly doubled since the entry of the United States into the war.

The plan emphasized the fact that the bomber offensive was an integrated RAF and USAAF effort, and that the capabilities of the two forces were complementary.

A time schedule was worked out calling for [illegible] RAF missions against a certain number of targets within certain systems in each of

four three-month phases. The first phase was scheduled to run to 30 June, the second to 30 September, the third to the end of 1943, and the fourth to go into the early months of 1944. The specific targets for the Eighth during the first three phases were set forth in charts by category, and the distance from bases and the productive importance of each was shown. The RAF was given a certain definite assignment of cities in each phase for attack. In general, these coincided with the location of the USAAF targets. The precision targets of the Eighth and the area targets of the RAF were shown on maps by different symbols.

The Eighth Air Force penetrations of enemy territory were to become deeper as the offensive progressed. First-phase operations were to be relatively shallow and were to be concentrated against the submarine yards and bases along the coast. Second-phase range was to increase to approximately 400 miles, and about three-quarters of the effort was to be concentrated against German fighter aircraft factories and other German Air Force facilities. The third phase was to see attacks against all the principal objectives with continued effort to neutralize those previously attacked but capable of repair. Fourth phase was to witness the continuation of these operations with provision made for attacks against installations associated with a cross-channel invasion.

The calculation of the size of U. S. forces needed was based upon the experience of the Eighth in operating in the theater. It was stated in the plan that this force had conducted about 80 missions in the three-month period from January to April 1943, and that approximately 12 of

[redacted]
SECURITY INFORMATION

these missions had been successful. It was stated also that the average number of aircraft dispatched by the Eighth was 86. It was assumed, therefore, that a force of about 100 bombers would be sufficient to destroy a target about 1,000 feet in radius, and that about two-thirds of the missions could be expected to reach and strike their objectives. It was further assumed on the basis of Eighth Air Force experience that about 37.5% of the airplanes in the theater could be dispatched on missions at any one time. An percentage made allowance for airplanes in reserve, in depot repair, and being modified. Contemplating about 18 important operations during each three-month phase, of which 12 were expected to be successful, the heavy bomber force build-up for the U. S. continent called for in the plan was:

a.	At the end of the first phase, 30 June 1943	944
b.	End of the second phase, 30 September 1943	1192
c.	End of third phase, 31 December 1943	1746
d.	By 31 March 1944	2702

The plan also called for the build-up of the U. S. forces in medium bombers which were to be used in attacks on German airdromes and to aid in the heavy bomber raids by missions designed to divert enemy fighters. It was pointed out that medium bombers would also be required to support combined operations in 1944. The build-up program for the mediums was set at:

a.	By the end of the first phase	300
b.	End of second phase	400
c.	End of third phase	600
d.	By 31 March 1944	800

The plan did not provide a schedule for the build-up of fighter forces. It did, however, call attention to the need for extensive U. S.

fighter strength both to protect the bombers and to help reduce the German fighter strength. It also called attention to the necessity for the creation of a tactical air force in the European theater in order to be ready for combined operations in 1944.

This rather complete air plan, which restated the strategic air mission with respect to Germany, listed target priorities, contained a detailed schedule of operations by phases, and provided for the build-up of United States heavy and medium bombers, received the approval of the U. S. Army Commanding General of the European Theater of Operations and of the Chief of the British Air Staff.[25] The plan was taken to Washington by the Commanding General of the Eighth Air Force and presented to the Combined Chiefs of Staff, who granted approval in May. The Combined Bomber Offensive directive based upon it was issued through the British Air Staff to the Eighth Air Force and to RAF Bomber Command and Fighter Command on 10 June 1943.[26] The directive reaffirmed the strategic air mission as it had been given in the Casablanca directive; it listed target priorities in the light of the then existing strategical situation; it assigned tasks to the British Fighter Command and to the American fighter forces, and provided for coordination of British and U. S. efforts.

Target priorities were assigned to the Eighth under three heads: intermediate, primary, and secondary objectives. The intermediate objective was stated to be the German fighter strength. Calling this an intermediate objective implied that it was something that had to be accomplished before the rest of the offensive could be effectively concluded. It was pointed out that any delay in the attack on German fighters

would make the prosecution of the rest of the task progressively more difficult. Enemy fighter strength was to be cut down by attacks on airframe, engine, components, and ball-bearing factories; by area disorganization attacks; by strikes against repair depots and storage parks; and by the destruction of fighters in the air and on the ground.

Primary objectives of the heavy bombers were to be:

a. German submarine yards and bases
b. Facilities supporting the German air forces other than fighters
c. Ball bearings
d. Oil

It was directed that the German submarine yards and bases receive maximum effort whenever tactical and weather conditions precluded attacks on German fighter objectives. The offensive against oil was stated to be contingent upon attacks against Ploesti from the Mediterranean.

Secondary objectives of the bomber offensive were to be:

a. Synthetic rubber and tires
b. Military transport vehicles[27]

The directive called for the British Bomber Command to be employed in the general disorganization of German industry, with all action designed as far as practicable to be complementary to that of the Eighth.

Judgments Concerning the Selection of Targets

Before proceeding with the account of operations in pursuance of the Combined Bomber Offensive directive, it might be well to examine tentatively, in the light of the strategical situation and the intelligence of the enemy available in 1943, some of the questions that have been raised concerning the wisdom of the target selection in that plan.

Basing a judgment upon subsequent events, the giving of high priority to submarine yards and bases as primary objectives might be questioned. We now have the testimony of Grand Admiral Doenitz to the effect that the bombing of these facilities was not very damaging. He declared that the U-boat assembly places were never hit until 1945 and that the turn-around time in the pens was not increased by bombing.[28] Eighth Air Force studies made in late 1942 and early 1943 concerning the effectiveness of bombing submarine installations had already indicated that such action was none too effective. There was great doubt about the vulnerability of submarine pens; in fact a study made by VIII Bomber Command on 5 December 1942 expressed the opinion that none of the U. S. bombs available at the time were capable of penetrating the roofs of the pens from any practical bombing height.[29] Another study on the target value of submarines concluded that because of the cushion of excess productive capacity an attack on components would have at best only a very long-term effect. Submarine yards, moreover, were not considered profitable targets unless the then current sinking rate by air and surface craft could be doubled. "Even total destruction of all yards would produce no decrease in the number of submarines operating in the Atlantic for the 12 months succeeding the destruction.[30] The OSA report of 8 March 1945 evidenced this lag in military results with the statement that the number of submarines undergoing trials and nearing completion was sufficient to make good the sinking rate at the time. This report also said that there was no conclusive evidence that the bombing of bases would substantially reduce the number of submarines operating at any one time.[31]

It seems, therefore, that neither submarine yards nor bases met the tests of a good target for strategic bombing. One must conclude, however, that the U-boat was such a menace in early 1943 that any method that offered any promise at all should have been used. Fortunately, the strategic bombardment of yards and bases was but one of the methods employed against this enemy weapon.

The inclusion of the aircraft industry in high-priority target position is not open to so much questioning. It is true that testimony of German prisoners of war has indicated that our bombing was not nearly so damaging as we believed it would be or thought it was at the time. The reason seems to have been found in the ability of the enemy to effect dispersal of the industry.[32] Of course, the degree of effectiveness of the bombing as it developed did not to any great extent invalidate the wisdom of selecting the aircraft industry as a target system in 1943. One of the fundamental tasks of an air force is the destruction of hostile air forces by attacks in the air, on the ground, and against all installations which support air power. The aircraft industry met the economic and military criteria for a target system in 1943 and it would have been a violation of fundamental principles of air warfare not to have given it high priority. Moreover, the effects were by no means negligible.

The ball-bearing industry was accorded third priority among primary objectives of the bomber offensive, immediately after submarines and aircraft. Some of the testimony by German prisoners of war seems to minimize the effectiveness of the bombing of this industry also. That its effect was not more marked was due to several factors: the dispersal that was

achieved, the ability of the enemy to cut down on the delivery time of the finished product from the factory to the consumer, the fact that in the aircraft industry ball bearings could be replaced by other appliances, and that the German army had accumulated in the vicinity of Magdeburg several months' supply for emergency purposes.[33] Allied information on the ball-bearing industry rated it an excellent target system from both the economic and military standpoints. On the basis of American and British knowledge and practice it was believed impracticable for the Germans to have accumulated any great stock of bearings. Nearly half the German supply was turned out in three plants around the one city of Schweinfurt, and 10% of the product came from two plants near Paris. The damaging of the ball-bearing industry would be crippling to all other industry which used high-speed moving parts.[34] The bearing industry was too valuable to the German war effort not to have accorded it high priority in 1943.

The information concerning the effect of Allied strategic bombing in Europe that has been obtained from the German prisoners of war indicates that attacks on oil and transportation did more damage to German effort than any other bombing. The target priority list which according to Hermann Goering would have been most effective reads as follows:[35]

a. Synthetic oil
b. Communications
c. Aero-engine factories
d. Airframe factories
e. Ball-bearing factories
f. Airfields

Albert Speer, former German Minister of Armaments and War Production, ranked

objectives in order of relative importance from the point of view of armament production. His first two categories were:

a. Key points in the basic industries or supplies.
b. Transport and communications, although the effect of attacks on these was long delayed because of the density of the transport network.

Speer said that the attacks on the chemical industry were the most difficult to deal with, and he included synthetic oil production in the chemical industry. The former Minister of Armaments even went so far as to say that the attack on the chemical industry, without the impact of other military events, would have rendered Germany defenseless.[36]

Field Marshal William Keitel rated the destruction of transportation as the most decisive influence in the defeat of Germany, and the demoralization of the Wehrmacht and the nation as of second greatest influence.[37]

General Galland rated the bombing of transport facilities and oil targets in first and second places in his scale of effectiveness. He ranked transportation facilities first because of their direct importance to military operations and war production, oil targets second because of their relation to the function of air and armored forces and military and industrial transport.[38]

There is slight point in introducing further evidence concerning German opinion on the ranking of target systems. Oil and transportation run like a chorus through a considerable portion of their testimony. This raises two questions: why oil was not given higher priority, and why transportation was not included among primary or secondary objectives of the Combined Bomber Offensive Plan. As far as oil is concerned, this amounts

to asking why it was not ranked above ball bearings. The oil industry (synthetic and natural) aside from Ploesti was much more dispersed than was the bearing industry. Synthetic production, which accounted for about 31% of Axis output, was scattered among some 13 plants. Only two of these plants were estimated to turn out as much as 5% each of the total Axis product. One was at Leuna (5%), 570 miles from London, and the other at Poelitz (6%), which was 640 miles from London. It was recognized in 1943 that the German oil position was serious,[39] but it was also known that such a large portion of the Axis requirement was supplied by the refineries located about Ploesti that an attack on this complex would be necessary before attacks on the dispersed synthetic producers would show telling results.

The question of the exclusion of transportation targets from the early phases of the combined bomber offensive is relatively simple. It will be recalled that AWPD-1 (Plan for Bomber and Constituent Units to Arrive in the United Kingdom in 1942), AWPD-42 (the target directive given to the Eighth Air Force in October 1942), and the Casablanca directive all placed transportation in relatively high priority. Transportation had never been forgotten in strategic planning, nor was it neglected in the Combined Bomber Offensive Plan. One of the chief ends of the strategic mission was to weaken Germany to such an extent that successful cross-channel landing operations could be undertaken by the Allies. It was just before and during such operations that attack on transportation would be most profitable. In the early stages of the CBO before the force was built up and before the timing would help ground forces, the transporta-

tion system did not present a telling target. Limited and scattered attacks would do little good because of the ease of repair. There was no small number of points whose destruction would prove decisive. It would be necessary to hit a great many targets within a relatively short time in order to do the enemy the same harm as an attack on one of his other systems would accomplish. The wiser course in regard to this category was to wait until the air offensive was well advanced and combined cross-channel operations were at hand.[40]

Questions concerning the judgment to be made of the target selection for the CEO call for examination of several other systems. One, a question of exclusion, involves electric power. It will be recalled that the 1941 and 1942 target planning included this in high priority. It was not included in the directive of 10 June 1943. Field Marshal Goering, in his interview of 29 June 1945, stated that an attack on electric power had been feared. He also declared that the Germans had planned attacks on 21 power plants in the U.S.S.R.[41] Field Marshal Keitel has stated that an attack on electric power plants, while dangerous, would not have stopped transportation on electric railroads because of the possibility of the switch to steam locomotives.[42] The key to the thinking back of the exclusion of this category from the CEO targets may be found in the COA Report of 8 March 1943. This stated that while German industry as a whole was in large measure dependent on electrical energy for continued operation, in almost no instance was a single industry dependent upon a single generating plant. It rather depended upon a network which pooled the electrical power within an area. As a bombing problem, then, an

SECURITY INFORMATION

attack on electric power resolved itself into the deprivation of a given region rather than an assault upon the whole industry, which was too big and too dispersed to be entirely destroyed. There was also some doubt about the vulnerability of electric power plants.[43]

The wisdom of the inclusion as target systems of industries manufacturing rubber, tires, and motor vehicles is evident upon examination of some of the data collected about them in 1943. The German position in rubber at that time was thought to be precarious, since one-third of her supplies was provided by blockade running and the reclamation of scrap, and the other two-thirds by synthetic production. Nearly one-half of the synthetic rubber was turned out by two plants at Huls and Schkopau, and these plants were responsible for an even larger fraction of the synthetic suitable for tires.

Tire-manufacturing plants, particularly those for manufacturing airplane tires, presented a fine target system from the standpoint of concentration and vulnerability. Four plants located in Hanau, Hannover (2), and Milan produced practically all the aircraft tires. The destruction of six other plants (Aachen, Wuppertal, Montlucon, Harburg, Clermont-Ferrand, and Munich) was deemed sufficient to deprive Germany of more than 50% of all tires (truck, passenger vehicle, aircraft, etc.). Rubber-tire plants were believed to be especially susceptible to incendiary attack. All these factors made the rubber and tire industry too lucrative a target system to be neglected.[44]

The motor vehicle industry well met the tests of military significance, concentration, and vulnerability. Furthermore, attrition was

supposed during the winter of 1943-43 to have been twice as great as production. The German vehicle position was such that it was assured that scarcely any vehicles could have been withdrawn from industrial and other uses for the military service. Although there were about 35 truck-assembly and manufacturing plants, it was believed that above 35% of the total truck output was concentrated in seven plants (Ford-Cologne; Opel-Brandenburg; Daimler-Benz, Stuttgart; Matford-Paris; Matford-Bourges; Citroen-Clichy; and Fiat-Turin) four of which were less than 450 miles from London.[45]

On the face of the thing; it would appear that any attempt to undermine the economy of a modern industrial nation would involve attacks upon the very foundations of that economy, namely, iron and steel, coke, and machine tools. The conclusions of the USA on these industries as strategic targets are pertinent.

Concerning the steel industry the conclusion was that the Western Axis position was strong and the destruction of one-half the plants would not produce much military effect for more than a year. Moreover, because of their ruggedness of construction the vulnerability of steel plants was not high. The Western Axis was thought to be more vulnerable in high-grade alloy steels, but even here the result of attacks was considered questionable because of the existence of a number of alternate facilities.[46]

Coke ovens were considered vulnerable to air attack, but their number was so great that they did not represent a profitable target for achieving decisive results in the crippling of the German military machine.[47]

The OCA conclusion in regard to machine tools was that the industry did not constitute a high-priority target because it lay too deep in the industrial process. There was, however, a recommendation that the plants making machine tools for a particular industry should have a high priority in order to prevent reconversion when that industry was successfully attacked.[43]

Chapter II

THE FIRST PHASE OF THE COMBINED BOMBER OFFENSIVE, APRIL-JUNE 1943

Size of the United States Forces

The basic measure of strategic bombardment has been the unit weight of bombs on target. The chief vehicles employed by the Eighth Air Force in carrying bombs to enemy targets were the B-17 and B-24 heavy bombers. The carrying capacity of these aircraft changed somewhat during the course of the 20-odd months the Eighth operated in the European theater, and the number of trips per unit time (sortie rate) also changed, but the quantity of bombs delivered always depended in a definite way on the size of the force of heavy bombers and upon the crews available to fly them.

Behind the sortie rate of the operational aircraft are very many highly important factors which are beyond the scope of this examination of the forces available to the Eighth Air Force for conducting the combined bomber offensive. Here the concern is to be primarily with the size of the force in terms of combat groups, aircraft, and crews--that is, with the effective operating strength. The important matter of providing service units in support of combat units is too large for treatment at this time. The aim is to set forth the effective combat strength available to the Eighth during the first three months of the combined bomber offensive, and to make a brief inquiry as to why it was not larger.

The Eighth Air Force had been sent to the United Kingdom in the spring of 1942 as a part of the so-called "BOLERO Task Force." BOLERO was the plan for the build-up of a force in the British Isles which was to launch

an invasion of the Continent. This invasion was to be preceded by an air offensive designed to gain the necessary degree of air superiority. After that was accomplished, air forces were to disrupt the German industrial machine by strategic bombardment and to operate in conjunction with ground forces.[1] As long as the invasion of the Continent was planned for the summer of 1943,[2] the Eighth had a definite mission. But a change in plans occurred in July of 1942 when the decision was made to invade North Africa (TORCH project).[3] The Eighth was, in consequence, left without a clear-cut mission for some time, or perhaps it is better to say, with its mission postponed for an indefinite time. Nevertheless, it continued to carry the fight to the enemy as best it could.

The size of the force available was, of course, adversely affected by the strategical decision. During the last five months of 1942 the Eighth really served as "a giant replacement pool" for the Twelfth Air Force in North Africa. During that time the Eighth dispatched to the new air force more than 1,000 aircraft, practically all its organizational equipment, and huge quantities of supplies.[4] It supplied three P-38 fighter groups (1st, 31st, and 82d) in October, one heavy bomb group (97th) in November, and two in December (301st and 93d). In addition it provided training for other Twelfth Air Force groups.[5]

During these last months of 1942 the Eighth never had more than seven heavy bomber groups operating at any one time, and after September it had but one fighter group (Spitfire). Its average number of operational heavy bomber aircraft was less than 100 during every month except December; its average number of heavy crews available was never much

above 100; and its greatest average effective heavy bomber strength, attained in December, was only 114.[6] The Commanding General of the Eighth was not exaggerating when he described his command at this period as "our piddling force of Fortresses."[7]

The U. S. air arm in the British Isles had its mission restated in clear-cut terms at the Casablanca Conference in January 1943, but that did not immediately raise the size of the effective forces. During the first quarter of that year there were operational no more than six heavy bomb groups, one fighter group, and one photo-reconnaissance group.[8] The effective heavy bomber strength was even lower than it had been during the last quarter of 1942.[9]

The failure of the Eighth Air Force to build up to greater strength was not due to lack of planning by the Army Air Forces. Back of our air strength in Great Britain there was planning of two general types. In the first place, such over-all plans as AWPD-1 (1941) and AWPD-42 had made theoretical calculations of the size of forces necessary to do a certain kind of strategical job against Germany.[10] In the second place, considerable attention was given to the very practical matter of allocating what was available among the various theaters and charting the rate of flow of units and replacements. The Arnold-Towers-Portal Agreement of June 1942 specified a definite build-up plan for the Eighth to be achieved by the first of April 1943.[11] In September of 1942 the so-called Peacock Flow Chart set forth a rate of build-up for the air forces in the United Kingdom as well as in other theaters.[12]

A variety of other factors governed the flow of aircraft and crews

to the Mighty. Over-all strategical decisions, as that to invade North Africa before Western Europe, continued to affect the build-up of force, and demands of the Mediterranean and other theaters were again to draw strength from the United Kingdom. As important as any other factor was the rate of production of aircraft and equipment, and closely parallel to this was the state of training of combat and service units. The limitations of shipping, moreover, were constantly threatening to upset any planned flow of units and materiel to a theater.[13]

Despite these difficulties there was an understandable demand from the European theater for definite commitments. The British wanted a reliable plan for the flow of new units in order that they might prepare the airdromes and accommodations for their reception.[14] The air force commander wanted a chart of the arrival of new units in order that he might plan his operations accordingly.[15] His forces sank to such a low point in February 1943, that he pleaded for just the air echelons of groups even though there was no shipping available for ground echelons.[16] He needed to know the rate at which replacements, particularly crews, would arrive, for these determined the rate at which the old units could conduct operations.[17] The theater commander needed to know the dates on which units and certain types of equipment would be ready in order that he might properly assign shipping priorities.

The AAF expended great effort in the preparation of flow charts for the United Kingdom, both to meet the needs of the European theater and to aid in the planning of allocations to all theaters. Some of the flow charts were sent to the British and some to the Eighth Air Force. During

the first quarter of 1943, and even thereafter, they were produced in quantity, but all were subject to change without notice and none could be carried out on schedule.

At the Casablanca Conference of January 1943 General Arnold gave to Air Vice Marshal J. M. Slessor, RAF Director of Plans, a table showing the build-up of the VIII Bomber Command for 1943. It had a goal of 33 heavy groups with unit equipment (U.E.) of 3,135 aircraft and 10 medium groups with unit equipment of 770 aircraft, and indicated that the command would be maintained at this strength during 1944.[18] Later in January Air Vice Marshal Foster received from Maj. Gen. George E. Strategeyer, U. S. Chief on Air Staff, another chart which forecast the rate of build-up of the VIIIth in all types of combat aircraft, but projected the expansion to 30 June 1943, at which time the heavy bomber strength was to reach 45 groups; medium bomber, 11 groups; and fighter, 35 groups. Strength was also forecast for 30 June 1943, and 31 December 1943. According to this chart, heavy bomb groups were to have 48 aircraft per group; medium groups, 6- ; and fighters, 100.[19] Air Vice Marshal Foster received a revision of this schedule about a month later in a letter from General Arnold which stated that changing circumstances made it impracticable to forecast the flow of aircraft with any degree of accuracy. The Commanding General of the AAF explained that the situation in the Mediterranean theater had occasioned the revisions of the Strategyer program of January.[20]

General Eaker complained on 1 March to General Arnold that he was greatly embarrassed in his conferences with the British Chief of the Air

Staff by not having accurate figures on the proposed build-up of his air force. General Arnold replied on the 24th with another chart that forecast the flow of all types of aircraft as of 30 June and 31 December 1943, and 30 June 1944. He told the commander of the Eighth, however, that the figures were not sufficiently reliable to be used as definite commitments. They were simply the best estimate that could be made at the time on the basis of the training and activation schedule and the expected availability of aircraft.[21] That was all that any flow chart could be because it was impossible to predict with exactness the rate at which men and airplanes would arrive in any theater.

Another flow chart taken to Europe in April by the Chief of Air Staff, and called in the theater the Stratemeyer Flow Plan, seems to have had more significance during the first phase of operations than any of the others. It evidently was the basis for planning on both sides of the Atlantic until it was amended by the Bradley Plan in May.[22]

The latter plan, named for Inspector General of the Army Air Forces, Maj. Gen. Follett Bradley, was the most significant step taken in the build-up of the Eighth Air Force and deserves somewhat detailed consideration. It had much greater scope than simply the charting of the flow of units or aircraft to the United Kingdom. It made recommendations for fundamental organizational changes in the strategic air force, provided for the organization of a tactical air force, and set up a troop basis for both of them. It had a difficult time in the War Department and was finally approved only after it was out of date. It did, however, serve the theater, the AAF, and the War Department as a basis for planning and

therein lies its significance.

The Combined Bomber Offensive Plan which was drawn up in the theater in April 1943 and approved by the Combined Chiefs of Staff in May, provided for the build-up of heavy and medium bomber forces by three-month intervals beginning with 30 June 1943.[23] There was drawn up at the same time by General Eaker's staff a troop basis incorporating the combat and service units for the strategic air force as well as for the tactical air force which was to support the invasion. All the units included in the troop basis were standard War Department units designed to operate in any theater. This troop basis was not accepted because it was believed that in a stabilized theater where bases were located in a highly industrialized nation a considerable saving in manpower could be effected by organizing certain units under manning tables.[24] General Arnold realized that the air build-up plans for the United Kingdom current in April of 1943 called for more personnel (681,051) than could ever be shipped or than would ever be approved by the War Department. On 14 April he sent a cable to General Eaker directing that he initiate a study with the purpose of determining what economies could be exercised and telling him that he was sending General Bradley and two other officers to the theater for the investigation of the same problems.[25]

Somewhat later in the month the Commanding General of the AAF gave definite instructions to General Bradley for his important assignment. The Air Inspector was to: (1) find whether the ultimate planned strength of 120 groups for the United Kingdom could be operated and maintained with no more than 540,000 personnel, and if that could not be done, to determine

what strength could be operated with that number; (2) study certain proposed adjustments in organization and maintenance with the view of incorporating them in other theaters; (3) make an estimate of the operational saturation point of RAF and USAAF numbers in the theater; (4) obtain the preferences of the theater commander concerning the ratio of AAF ground to combat troops; and (5) collaborate with Generals Andrews and Baker in preparing a troop basis to implement the plan for the bomber offensive.[26]

General Bradley conferred with General Baker, who had come to Washington with the AAF Plan, before leaving the country and arrived in the United Kingdom on 8 May, accompanied by Col. Hugh J. Kerr, then chief of the Control Division of the Air Service Command, and other officers. The committee of officers went at once to its task, which it viewed as the determination of the most economical personnel requirements for the theater and the balancing of these against available shipping.[27]

The Bradley Committee visited a number of typical RAF and AAF installations, interviewed the agencies concerned, and on 23 May made its recommendations which were based upon the following assumptions: (1) that since strategic bombardment was the mission of the Eighth during 1943 and 1944, rapid build-up of the bomber command was necessary to success; (2) that there was to be a separate tactical air force to operate initially from fixed bases in England and eventually from the Continent; (3) that both tactical and service units on a station should be under the group commander, who was to have the assistance of competent air and ground executives; (4) that a proved method by which technical control of service functions by the Air Service Command could be accomplished was through the

[redacted]

establishment of control areas to operate subdepots on tactical stations.

Important recommendations were made concerning the organization of the bomber command and the air service command, a troop basis and rate of build-up were set forth for both strategic and tactical air forces, and manning tables were drawn up for a variety of units in order to effect the saving in manpower that had been directed by AAF Headquarters.

The most important organizational recommendation for VIII Bomber Command was that there be activated the administrative units known as air divisions. A recommendation for such units had already been made by the Commanding General of the Eighth Air Force.[23] This departure from the conventional AAF organization was based partly upon the RAF Bomber Command model, partly on the signals arrangements of British airdromes, and partly upon the need for some decentralization in the administration of so large an organization as the VIII Bomber Command was destined to become. The air division was to consist of five or six combat wings, each of which in turn would be composed of three heavy groups. A heavy bomb group, made up of four squadrons, would occupy a single airdrome. The combat wing was not to have administrative functions but was to be entirely a tactical organization. Thus the VIII Bomber Command was to be counterpart of the RAF where the bomber command is divided into groups, each composed of a series of bases, each base controlling three (3) stations with two (2) squadrons on each station with an I.E. [Initial equipment] of twenty-four (24) aircraft each."[24]

Other organizational recommendations affecting tactical units were (1) that there be air and ground executives at each station responsible to the station commander who would normally be the tactical group

[redacted]

commander, and (2) that station complement organizations (for housekeeping functions) and guard organizations be provided for each station.[30]

Important recommendations of the Bradley Committee also affected the VIII Air Force Service Command. The details of this matter cannot be covered here and need not be since the history of the Service Command is available. The significant recommendation was that decentralization should be achieved in the operation of this command through the creation of subdivisions known as control areas. There was to be a Base Air Depot Area to control the base air depots,[31] an Air Service Strategical Control Area for advance air depots serving the heavy bombardment stations, and Air Service Tactical Control Area to supervise the units serving tactical aviation.[32]

The Bradley Committee recommended that troop allocation for the air forces in the United Kingdom should eventually be:

Strategic air force	354,996
Tactical air force	230,447
Total	485,843

It was intended that the air force strength should grow during 1943 at the following rate:[33]

Total by 30 June	110,000
Added during third quarter	82,000
Added during fourth quarter	68,000
Total by end of 1943	260,000

Strategic air force units were given priority over tactical units in the planned build-up, which was envisaged during 1943 as:[34]

	June	September	December
Heavy bomber groups	15 3/4	25	38
Medium " "	4	7	9
Light and dive "	--	1	3

	June	September	December
Fighter groups	6	9	16
Night fighter groups	--	--	1/4
Photo Recon. groups	--	1/2	1/2
Troop carrier groups	1/2	4 1/2	7 1/2
Observation "	1	1	3

The so-called Bradley Plan was favorably indorsed by the Commanding General of the Eighth Air Force on 28 May, and by Lt. Gen. Jacob L. Devers, Commanding General of ETOUSA, on 8 June 1943.[35] The plan was promptly approved by AAF Headquarters, and after much study, by the War Department, tentatively on 18 August, and finally on 8 November 1943. The over-all troop basis as finally approved was cut to 407,853.[36]

The Commanding General of the Eighth stated that the Bradley Plan met the organizational and personnel problems of both the strategic and tactical air forces. He felt that the rate of build-up and the flow of replacement crews and aircraft would permit six to eight maximum missions per month which would enable the Eighth to carry out the task set for it in the COS Plan. He pointed out that the rate of operations was controlled by the flow of replacements, especially of crew replacements.[37] This was to remain the controlling factor until fairly late in 1943, for the Eighth's position with respect to operational heavy bombers was better than that for available crews until December of that year.[38]

Headquarters AAF set about fulfilling the requirements of the Bradley Plan in June of 1943, some months before it was finally approved by the War Department, and this plan thus became the principal guide for the build-up of the air forces in the United Kingdom, even during the summer of 1943.[39]

CONFIDENTIAL

The fact that the Army Air Forces and the theater had a build-up plan did not mean that unit and replacement flow would follow it automatically. The same matters of intertheater competition, training and activation schedules, production of equipment, and shipping were still to govern. The question of balance between training and production was very troublesome. In fact, the deficiency of the Eighth in replacement combat crews became so serious before the first phase of the bomber offensive was over that it was to slow down the arrival of new units because AAF Headquarters set a goal of 2 1/2 crews per aircraft unit equipment in order to be sure that groups could operate at full strength.[40]

The demands of the Mediterranean theater, which had so depleted the strength of the Eighth in 1942, were again to make inroads during the first phase. Planned in that theater were two important operations which required more heavy bombardment than was there available. These were the invasion of Sicily (operation HUSKY) and the attack on the Ploesti oil refineries (operation SOAPSUDS). Although they were not to be undertaken until later in the summer, the presence of the aircraft and crews was required for training. Consequently, the War Department ordered the 389th Bomb Group (H), which was scheduled for the United Kingdom, diverted to North Africa,[41] and the 93d and 44th Groups sent from the United Kingdom. The 93d Group set out on 23 June with 39 B-24's aircraft, and the 44th departed on 27 June with 38 B-24's.[42]

Despite the drain of heavy group strength at the end of June, the Eighth had more than doubled its unit strength during the first phase of

the bomber offensive. In the matter of operational groups the growth experienced was indicated by the total on hand at the end of each month:[43]

	31 March	30 April	31 May	30 June
Heavy bomb groups	6	6	13	13
Fighter "	1	3	3	3

The effective combat strength in terms of bombardment aircraft and crews was not so great, however, as the increase in units might indicate:[44]

Daily Av. by Month	Aircraft (HE) In Inc. Units	Aircraft (HE) Fully Oprl. in Inc. Units	Crews Asgd.	Crews Avail.	Effective Strength for Combat
March	190	112	151	87	87
April	331	153	187	140	140
May	340	200	318	178	178
June	459	237	419	222	222

An examination of the above table makes it at once evident that the controlling factor in effective strength during all the first phase was the availability of crews and not the maintenance of aircraft. The wide difference between assigned and available crews is explained by the fact that most of the crews arriving in the theater had to undergo a considerable period of training before they were ready for combat.

The growth in personnel during the first three-month phase was more than 150%, the total climbing from 40,280 on 31 March to 101,349 on 30 June.[45] It will be recalled that the Bradley Plan troop basis forecast the growth of the Eighth to reach 110,000 by 30 June.

General Nature of First-Phase Operations

The combined bomber offensive was a joint undertaking of the United States and British air forces. The plan for the offensive that was drawn

up in the theater in April 1943 and presented to the Combined Chiefs of Staff stated that the capabilities of the two forces were complementary. The Eighth Air Force was the rapier attacking precision targets by daylight. The RAF was the bludgeon destroying German materiel facilities and undermining the morale of the German worker.[46] The coordination of the two forces was not left to chance. Moreover, the problem was not simply one of coordinating the efforts of two bomber commands. Much of the fighter support provided for the U. S. heavy bombers during the first phase (April-May-June 1943) was by the RAF Fighter Command.[47] It was necessary to assure the closest cooperation among bomber and fighter commands of both forces and with RAF Coastal Command in connection with air-sea rescue.[48]

The chief agency for coordinating the efforts of the forces involved was called the Combined Operational Planning Committee (COPC). It was established about April 1943, shortly after the VIII Fighter Command put three groups of P-47's into operation.[49] This committee was composed of representatives of VIII Bomber Command, VIII Fighter Command, RAF Bomber Command, and RAF Fighter Command. After 15 October 1943 the Ninth Air Force representative was included. The committe was charged with the function of planning the operations against major targets. The plans, after completion, were submitted to the commanders concerned, and after approval by the Eighth Air Force Commander, they were given code names and filed at each operating headquarters against future need. When the VIII Bomber Commander, at his daily operational conference, selected one of these targets for attack, the code name was immediately passed to all

[redacted]

related commands and the operational plans previously prepared was put into effect."[50]

The COBC received the sanction of the Combined Chiefs of Staff in the directive of 10 June 1943. Certain terms of reference under which this committee was to operate were set forth in an inclosure to this directive which formally launched the combined bomber offensive. Not only was the COBC given a planning function; it was instructed to "observe critically the tactical execution of these plans and to report to their Commanders [of the four commands concerned]."[51]

The operations of the combined bomber offensive made full use of the scientific method in the application of air power to destruction, and this subject merits consideration. Air warfare, employing so many of the products of scientific research, might have been quite unscientific in its operations had these operations been controlled merely by the opinions of commanding officers, even though the latter possessed great experience. The Eighth Air Force agency for the scientific study of all phases of air operations was known as the Operational Research Section (ORS). There were, of course, agencies in the United States which made valuable studies of the tactics of air warfare. The AAF School of Applied Tactics made many contributions to the solution of the problems of the Eighth and other air forces, but the Operational Research Section functioned in the field, secured its data at the sources, and drew its conclusions on the facts as they were found. As General Arnold's report later pointed out, "Operational research was originated in the VIII Bomber Command . . . . It is composed of a group of scientists who study every phase of our operations and of

enemy reaction, catalogue results and draw conclusions. It has now been definitely demonstrated that the studies of this organization are invaluable to air force commanders and that operational research has a staff function and staff agency in modern aerial warfare and fills a requirement not supplied by any other staff section."[52] The results of some of the studies of OAS will presently be examined.

The scale of Eighth Air Force operations during the first phase does not now seem consequential. During the eight months prior to April 1943, General Eaker's "middling force of Fortresses" had engaged in 45 missions, flown 3,387 sorties, and dropped 4,715.7 tons of bombs on targets. April, May, and June were to see that eight-month record beaten badly on the sortie and tonnage counts. It took but 33 missions (two of these were wholly recalled) during these months to pile up 4,367 sorties and drop 6,435.4 tons on targets. Yet that first-phase effort was itself "middling" when compared with the over-all achievement of the Eighth during its 33 months of operations against Germany. The operations of this phase accounted for less than 1% of the total tonnage dropped by the Eighth in Europe, and for correspondingly small proportions of the other factors which indicate the magnitude of strategic air warfare.[53] Yet, even though this effort of the second quarter of 1943 was small when compared with what was to follow, it did constitute the first experience with an expanding force and it did help to make succeeding efforts more effective.

April 1943 was a slack month for VIII Bomber Command, its operations falling considerably short of the record piled up in March.[54] The reasons were two. It has already been noted how small were the effective forces;

CONFIDENTIAL

furthermore, the conduct of operations was greatly hampered by bad weather.[55] During this month there were but four missions flown by the heavy bombers; and on only one of the four (17 April, Bremen) were there as many as 100 aircraft reported attacking the target.[56] The four April operations cost 38 heavy bombers against claims of 146 enemy aircraft destroyed, 41 probably destroyed, and 31 damaged.[57]

Reasonably good bombing weather and the expansion of the force combined to make May the best month the VIII Bomber Command had ever seen. The heavy bombers were out nine days during the month and dropped approximately 2,800 tons of bombs on 18 different targets.[58] Three of these were attacked by more than 100 bombers each. The last operation in May (on the 29th) saw the Eighth break all its previous records, for a single day as well as for a month, dispatching 979 heavies of which 930 actually attacked.[59] The May operations cost 68 heavy bombers against claims of 369 enemy aircraft destroyed.[60]

The month of May witnessed also the initial experimental operations of the medium bombers of the Eighth Air Force. The Combined Bomber Offensive Plan had provided for medium bombers as necessary adjuncts to heavy bombers and as a vital factor in the support of combined operations scheduled for 1944.[61]

The first U. S. medium bomb group to become operational in the United Kingdom was the 322d, which had arrived in the theater on 6 March. Before its May effort it was given eight weeks of training in low-level operations.[62] This type of training indicated the tactics that were contemplated to capitalize on the speed and ruggedness of the B-26. Since these tactics

were changed after but two missions, it is approprl to to inquire into the reasons for their adoption. In the first place, since mediums were to be used to support surface operations, low-level tactics would be needed, and training in them would be of great value. In the second place, the B-26's were not equipped with bombsights for medium-altitude attack. Furthermore, it was desirable to learn whether a well trained force could utilize the element of surprise on an important objective.[63]

The strategical directives for the Eighth Air Force were delivered through the British Air Ministry, so in March when the commander of the Eighth was planning the operations of the mediums, he wrote to Air Chief Marshal Sir Charles Portal and asked that certain targets in occupied Europe be cleared for attack. These targets required very shallow penetrations of the Continent and included airdromes as first priority, marshalling yards, power stations, and port facilities in France, Belgium, and Holland. Mediums were also to be used in Germany on targets within 200 miles of bases.[64]

Air Marshal Portal's reply suggested that the most important matter to consider in planning the operations of the medium bombers was to see that their activities were coordinated with other daylight operations. It was his idea that the Eighth's mediums should give first priority to transportation targets rather than to airdromes. This was the policy of the RAF light bombers, and was in accord with the directives of the Combined Chiefs of Staff. (In March the bomber offensive was functioning under the Casablanca directive which placed transportation targets in third priority) The change to airdromes as first priority for mediums, in his opinion,

might prove profitable later if it were decided to shift the main effort of the entire bomber attack to the German Air Force.[65]

Eventually, during the first week in May when the 322d Group was well advanced in its low-level training, certain industrial installations were cleared as "freshman targets" for the 3d Wing which contained this medium bomb group.[66]

The objective actually selected for the initial medium mission of 14 May was the power station at Ijmuiden, Holland. The same objective was hit three days later on the ill-fated second operation that finally convinced the Eighth Air Force commander that the low-level technique was not feasible in Western Europe.[67] One intelligence officer of the 3d Bombardment Wing had been convinced of this for many months before the attack. This officer, Major Von Holnitz, had advised the commander of the 3d Wing in December 1942 that in his opinion low-level attacks on heavily defended targets would be disastrous. Between the 14 May and 17 May missions the same officer made strong representations to the commander of the 322d Group about the dangers of the operation. It certainly would seem, however, that the first attack on Ijmuiden was not a fair test of the ability of the B-26 to surprise the defense, for the RAF had hit it on the 2d and 6th of May.[68]

On the 14 May mission, 18 B-26's had taken off and 11 of them dropped 10.75 tons of high-explosive bombs from an altitude of between 200 and 500 feet. The bombs employed had 30-minute delayed-action fuzes. Apparently very little damage was done to the power station. The one medium that failed to bomb had an engine shot out by flak as it crossed the enemy

CONFIDENTIAL

coast and was forced to return to base. No enemy fighters were encountered, but nine of the bombers were damaged by flak. One ship crash-landed at its base and killed the pilot after the remainder of the crew had bailed out.[69] Since this test was inconclusive, the second attempt was made three days later. Twelve B-26's set out on the 17th, and again one turned back, this time because of engine failure. The attack was again made from minimum altitude employing 30-minute delayed-action fuses. Of the 11 attacking, not one returned, although one of them, badly shot up, was abandoned by the crew near its base.[70] The remainder were lost to flak, ground fire, collision, and unknown causes. This was enough to convince the Commanding General of the Eighth that a change in policy for mediums was required:[71]

> The simple truth appears to be that worthwhile targets on the coast of Western Europe are too heavily defended to make low-level attack feasible and economic . . . .I am now convinced that we must discontinue low-level attack except for that against surface vessels. We have a plan to get some training and experience of the latter category. I am going to put the medium bombers in the Air Support Command and give them maximum training as part of the tactical air force to support any ground forces invading the Continent. Their crews will get their fighting experience by medium altitude attacks heavily defended by fighter aviation. This will necessitate the installation of some bomb sights, at least for lead aircraft.

The 323d Group was removed from operations, and the mediums got no more action against the enemy until July.[72]

June operations by the Eighth fell somewhat short of the record achieved in May, for the weather kept both the USAAF and the RAF grounded during the first 10 days of the month. The first mission, run on 11 June, saw 333 heavies dispatched and 318 of them attack two targets. Including this mission of the 11th, the last two-thirds of June saw the Eighth

operational on nine days, but on two of these days (15th and 23d) the missions had to be abandoned because of weather.[73] The seven successful missions piled up 3,154 sorties and dropped 3,610 tons of bombs. The cost in heavy bombers missing in action was 65 against claims of 230 enemy aircraft destroyed.[74]

The geographical pattern of the Eighth Air Force operations during the first phase of the bomber offensive calls attention to what has been one of the great tragedies of World War II--the necessity of fighting over and destroying so much in territory belonging to peoples who were enemies of the Axis powers. Of the 6,436.4 tons of bombs dropped by United Kingdom-based U. S. heavy bombers during the second quarter of 1943, just slightly more than half (51.4%) fell on Germany. France received 37.3%, Belgium slightly more than 10%, and Holland the remainder.[75]

Bombardment policy in Allied or neutral territory occupied by the enemy was carefully regulated. Only military objectives (these were narrowly defined) were to be bombed and such bombing was subject to certain principles. The bombing of civilian populations as such was forbidden. The military objective had to be clearly identified and the attack made with reasonable care to avoid undue loss of life to civilians in the vicinity of the target. If doubt existed as to the possibility of accurate bombing, the attack was to be withheld. All Red Cross conventions were observed.[76] Despite the fact that both RAF and AAF took every possible precaution to reduce the risks to civilian populations in occupied countries to a minimum, casualties could not be avoided. The protests of the subject peoples and their representatives to the Allied powers did not

make the tasks of the air leaders any easier. They were faced with the fact that many of the facilities in occupied countries were contributing to German war effort, and they had no choice but to attempt to destroy them.

The efficiency of daylight precision bombardment is difficult to assess, but one can hardly study the operational side without becoming aware of the tremendous effort necessary to achieve even a small result. Some notice has already been given to the size of the forces available to the Eighth during the first phase of the bomber offensive, but it must be remembered that only the planes in commission can engage in operations. During April, May, and June more than two-fifths of the heavy bombers were unserviceable because they were undergoing repair, being modified, or awaiting parts.[77] In May of 1943, the average serviceability was only 38%. Planes in commission, even planes airborne on operations, are of slight offensive account unless they can get over the target. Out of 4,337 sorties flown in April, May, and June, only 60% actually accomplished the mission assigned (effective sorties) of dropping bombs in the target area. The question as to the accuracy of the bombing is very difficult, particularly in the early period of operations. First-phase bombing accuracy by the Eighth has been estimated at 15% of bombs within 1,000 feet and 30% within 3,000 feet of the mean point of impact. This measure tells more about the pattern of the bomb fall than about accuracy with respect to the aiming points in assigned targets. The scant evidence available indicates that first-phase daylight bombing accuracy was low, even lower than during the first quarter of 1943. This may have been due in part

SECURITY INFORMATION

to the lower level of experience resulting from the sudden expansion of Will Bomber Command in May.[78]

The Defense of the Day Bomber

Presently the effectiveness of first-phase bombardment is to be examined from another point of view, but first one of the most important problems of first-phase operations deserves some attention. As a statement from an Eighth Air Force intelligence report indicated, the U. S. heavy day bomber posed a formidable problem to the German Air Force:[79]

> The first operations of Flying Fortress formations in high altitude daylight precision bombing attacks over Europe opened a new chapter in the oldest conflict in warfare. That conflict is the perpetual struggle between offensive and defensive technique. Our Fortresses, as used here, were a new offensive weapon.
>
> Against them the Germans confidently pitted the three-fold mechanism of defence which aerial bombing has itself generated: Radar detection and counter attack by both flak and highly maneuverable, heavily armed fighter planes. This defensive technique as developed by both Germans and British was believed to have precluded large scale daylight bombing in this theater forever.
>
> But the Fortress brought to its work two unique features. The first was its ability to operate effectively above the maximum effectiveness of light flak. The second was its formidable armament of .50 caliber machine guns, which, compounded by the mutual support of close formation flying, provided withering fire power against conventional fighter plane attack.

It is true that the countermeasures taken against the Fortresses and the Liberators threatened to restore the balance between the offense and the defense which the first operations had upset. The complete redress of the balance would have nullified the bomber offensive. Our air leaders were forced to great efforts in the defense of the day bombers to keep the offensive going. It is necessary to note some of these efforts as

CONFIDENTIAL

they developed during the first phase.

The simplest statement of the problem is presented in the loss and unsave figures for the heavy bombers. The operations of the last five months of 1942 cost 81 heavies missing in action, 33 attributed to enemy aircraft and 8 to flak or a combination of flak and enemy aircraft; and the first quarter of 1943 saw 59 of our bombers lost on operations. During the first month of the period under review, April 1943, 36 heavies were lost; in May there were 68, and in June 85, giving a total of 161 for this first phase of the CBO. Of these losses, 89 were due to the action of enemy aircraft, 32 to flak or a combination of flak and enemy aircraft, and the remainder to accidents and unknown causes.

The rate of loss is more revealing than the absolute loss. Taking those planes that were lost due to combat (lost in action or to operational salvage) as a percentage of planes attacking (completing effective sorties) we find the following:[89]

Last five months of 1942	4.5%
First quarter, 1943	7.1%
Second quarter, 1943	7.6%

Another side of the bomber loss problem is seen in the attrition rate. This considers all kinds of lost aircraft (operational and nonoperational) as a percentage of unit equipment. During 1942 the attrition rate for the B-17's was 5.3% and for B-24's was 2.1%. For the first quarter of 1943 for both types of heavy bombers it was above 7.3%. That the attrition rate turned sharply upward for B-17's is evident from the figures for April, May, and June. It is to be remembered that the Fortresses constituted the bulk of the bomber force during this period. Attrition as

a percentage of unit equipment was:[81]

	B-17	B-24
April	11.7	5.3
May	16.3	7.3
June	15.9	---

Another measure of the severity of the opposition encountered by the day bombers is found in the amount of battle damage sustained by aircraft which were able to return from missions. During the 1942 operations, 27% of heavy bombers completing "credit sorties" (that is, sorties entering areas where enemy action was normally anticipated) were damaged in varying degrees of severity; in the first quarter of 1943 the rate was 51%; and for April, May, and June it was approximately 30.7%. That meant that three out of every 10 heavy bombers entering enemy territory were damaged.[82]

Loss and damage figures can be interpreted in various ways. "The Statistical Summary of Eighth Air Force Operations in the European Theater, 17 August 1942-8 May 1945" and various studies by the Operational Research Section are excellent sources for these figures. The interest here is in what these data tell about the intensity of enemy opposition. The evidence indicates that the effectiveness of that opposition was increasing during the first phase of the bomber offensive.

It is evident also that the defensive problems presented by this severe opposition were recognized by AAF leaders[83] and that energetic steps were taken to overcome the formidable efforts of the Germans to halt the day bomber offensive.

It has been noted that the three principal German defenses were the

radar installations for detecting the approach of hostile forces, the German fighter force with its elaborate control system, and antiaircraft artillery (flak). Since the principal defensive efforts of the Eighth during the first phase were concerned with fighters and antiaircraft fire, those measures will be considered here. Radar countermeasures are treated in connection with the third phase when they were first used.

The plan for the bomber offensive which was drawn up in the European theater in April called attention to the growth of the German fighter force and the changes that had taken place in the disposition of that force. The GAF was increasing its fighters at the expense of other types, and it was concentrating these on the Western Front at the expense of other theaters. Both these trends were to continue for many months.[64]

The German fighter force was not only increasing its numbers and concentrating them against the bomber offensive; it was improving its standard pursuit tactics and even adding some rather startling tactical innovations. Two of these innovations began to appear during the first half of 1943. The first was air-to-air bombing, both dive and level, by individual planes and in formation. Apparently the first use of this tactic against the Eighth's heavy bombers was on 16 February 1943, in a mission against St. Nazaire. Reports of its use were made in March, and the four April heavy missions encountered it. Air-to-air bombing was met on at least nine missions in May and several times in June. This German measure was never successful because of the great difficulty of insuring the detonation of a projectile at just the right instant sufficiently near a rapidly moving target. Undoubtedly the reason for its use was that the size of the

lethal burst of a bomb was very great--perhaps six times as large as that of the best flak.[85]

The other new tactic of the German fighters which was initiated during the first phase was the employment of 21-cm. rockets by both FW-190's and Me-109's. Their use was first reported positively[86] on 21 May 1943 during the raid on Wilhelmshaven, but there is some evidence that they were used earlier.[87] The danger to the heavy bombers from the rocket projectiles lay in the fact that the rocket gun could be carried to 35,000 feet by either of the enemy's two best single-engine fighters, and once at that altitude could fire an 80-pound shell very accurately at ranges well beyond those of the .50-caliber machine guns carried by U. S. bombers. Another great danger from the rocket projectile lay in the fact that it had a lethal burst of 100 feet and its detonation could be well controlled.[88]

The greatest damage from enemy fighters during the first phase was not due to these innovations, however, but to improved pursuit tactics and to the fact that more German fighters were armed with larger caliber guns. During the 1943 operations, there were 40 cannon hits for every 100 machine-gun hits on damaged bombers; but during the first half of 1943, there were 77 cannon hits for every 100 machine-gun hits. The hits by heavier guns help to explain the increased loss rate of bombers to fighter action.[89] The damage rate due to enemy fighters became particularly formidable during the first two months of expanded VIII Bomber Command operations (May-June 1943) when more than 10% of the bombers crossing into enemy territory were damaged by fighters. This was approximately one and one-quarter times the rate for all operations prior to May.[90]

An indirect product of damage from enemy aircraft was self-inflicted damage to the heavy bombers. This was caused both by the guns on the damaged planes and by guns on friendly planes in the same or near-by formations. This category of battle damage became prominent first in May 1943. On missions 25 through 60, carried out between 13 and 21 May, 24 of 125 aircraft damaged by machine-gun fire were reported damaged by their own guns. Other cases of self-inflicted battle damage came from empty shell cases falling from higher planes. Most of the self-inflicted machine-gun fire damage occurred to B-17's and was caused by waist gunners firing into the horizontal stabilizers and elevators on their own ships.[91]

The other German weapon for combating the day bomber was flak. Although the damage rate from flak was higher than from enemy fighters, the damage from the former was generally less severe. It was often true, however, that flak damage was a contributing factor in many cases of aircraft reported lost to enemy aircraft, for an initial hit by antiaircraft frequently caused a bomber to straggle behind its formation and made it easy prey for fighters. All important German targets were heavily defended by flak; these included the submarine yards and aircraft that were the particular targets during the first phase of the offensive. In France, the most heavily defended areas were around Paris and St. Nazaire, both of which were attacked by the Eighth during the second quarter of 1943.[92]

Defense of the day bomber involved both material and tactical developments. Two of the more outstanding material problems that demanded attention during the first phase were the modification of the heavy bomber to increase fire power and the development of escort for the bomber formations.

SECRET INFORMATION

During the early months of the bomber offensive certain complaints were voiced against the armament of the heavy bombers. The most serious was that the forward fire power was entirely inadequate.[93] B-17D's and E's came to the European theater with a single hand-held .30-caliber center nose gun or with no center nose gun at all. B-17D's had no side nose guns and some E's had two hand-held side nose guns. B-24D's generally had one .30-caliber gun in the nose.[94] Such armament was not a sufficient deterrent to the German fighter armed with 20-mm. cannon.

When Marshal Goering was interviewed as a prisoner of war, he said that tail attacks on the day bombers were preferred to head-on attacks because the closing-in speed involved in the latter allowed too short a firing time.[95] Tail attacks were the rule during the period from August 1942 to November 1943, but head-on attacks predominated in December 1943, and during the whole first half of 1943. The evidence is quite clear, and it was recognized in the theater at the time.[96]

Modifications were performed on the heavies throughout the first half of 1943 in order to increase their forward fire power. On the B-17's either one or two .30-caliber guns with ring-and-post sights were installed in the center nose section. On B-24's an additional .30-caliber nose gun was mounted.[97]

These hand-held guns were the best answer the Eighth found to the problem during the first phase. They were recognized as a temporary measure, for the manufacturers of the B-17 were working on a power-driven chin turret for the aircraft. Turrets possessed several advantages over

hand-held guns in field of fire, accuracy, and fire power per gunner. Since the chin turret was not expected until late in 1943, another temporary experiment in the form of a reworked Bendix lower turret was tried out during the first phase. In airplane with one of these experimental turrets arrived in the theater on 27 June and was given thorough tests.[98] The preliminary results indicated some superiority over the hand-held guns, but combat tests proved the latter better. The reworked turret would not react quickly enough on simultaneous attacks from several directions.[99] Orders were given from Headquarters, AAF to stop installation of the makeshift lower turret and to continue with the development of the regular chin turret.[100] This one was known to be satisfactory because of experiments with it on the YB-40's which will be noticed presently. Meanwhile it should be remembered that the chief dependence for forward fire power by heavy bombers during the first phase was upon the hand-held .50-caliber gun provided with direct sighting. Other armament modifications were performed on the heavies, but those designed to increase forward fire power seem most significant.

Coupled closely with the effort to increase the fire power of the bomb-carrying heavies was the attempt to convert a bomber to an escort cruiser by substituting fire power and armor for bomb-carrying capacity. In the spring of 1942, Maj. Gen. Carl A. Spaatz had speculated on the possibilities of such an aircraft: "Auxiliary (expendable) tanks offer the only immediate solution for extending the range of fighters, unless it can be developed that the bomber, with its fire-power, can substitute

[redacted]

ammunition for bomb-load and act as an accompanying fighter."[101] The escort cruiser which was developed--a heavily armed and armored B-17--was designated the XB-40, later the YB-40. This craft had the chin turret, upper turret, ball turret, direct-sighting power-boosted twin .50's on each side of the waist, twin .50's in a Martin electric upper turret in the radio compartment, and twin .50's in a power-boosted tail gun mount with reflector sights. It carried 40,000 rounds of ammunition. General Baker was quite interested in the development and in mid-March 1943 expressed a desire to try it out against the Germans, but at the same time voiced doubt about the economy of taking bombers that did not carry bombs on combat missions. In the operating groups there was more enthusiasm for the escort airplane, particularly for the chin turret which was one of its most promising features.[102]

In mid-April, when the German fighters were concentrating on the lead formations of his bomber forces, the Eighth's commander became very anxious to get some of the YB-40's as quickly as possible.[103] He was told that 13 YB-40's were to be sent to the United Kingdom just as soon as the crews had completed their gunnery training.[104]

These heavy cruisers arrived in the theater in the first part of May and most of them were assigned to the 92d Bomb Group (H). After additional training and modification they embarked on their first mission on 29 May, when seven were dispatched to St. Nazaire.[105] The initial experience dictated the necessity for modification of waist and tail gun feeds and ammunition supplies, and indicated the basic defect of the craft, which was its inability to keep up with normal B-17's--especially

after the latter had dropped their bombs. Modifications were complete by 15 June, and YB-40's took part in five missions during the last half of the month. On the 22 June raid on Huls, 11 were dispatched and one was lost. On the 25th, only four of the seven dispatched were able to accompany the formations to Northwest Germany. Five took off on the 26th, but not one was able to complete the attack. Their record was better against St. Nazaire on the 28th, when all six dispatched completed the mission. The mission to Le Mans on 29 June found the two that were dispatched abortive.[106]

Although the YB-40's were to see further action in the theater, the June experience was sufficient for the Eighth's commander to form an adverse judgment on this version of the escort cruiser. His report condemned it because it had different flight characteristics (it was tail-heavy) and was so much heavier than the normal B-17 that it could not fly formation with them. The 40's had been tried in their own formations and on either side of the lead ship in a combat wing, but in neither case were they successful. The crews of the YB-40's did not like the planes because they had to occupy the hot spots in the formation and because they carried no bombs. General Eaker was strongly sold on one feature of the YB-40--the chin turret--which was presently to be placed on all operating heavies. He did not entirely condemn the whole idea of such an escort, but the June experience convinced him that such a craft required two features that the 40's did not have: the ability to carry bombs and the same flight characteristics as other bombers.[107]

At the same time that the development of the heavy escort was taking

place, attention was given to the build-up of a fighter force and the extension of the range of our fighter craft for escort purposes.

The fighter situation in the Eighth Air Force during the first quarter of 1943 was untenable. It has been noticed that three P-38-equipped groups had been sent from the Eighth to the Twelfth Air Force in October 1942. Four additional fighter groups were trained by the Eighth for the North African theater during the last part of 1942.[109] There was but one operational group left to the Eighth and that was the 4th ("Eagle") Fighter Group, equipped with Spitfires. This situation prevailed until 8 April 1943, when three groups became operational. These three (4th, 78th, and 56th) were all using the P-47 Thunderbolt at the time. The 4th first had had some P-47's assigned to it in January, and was converted to this craft in March. The 78th came to the theater equipped with P-38's but was presently reequipped with the P-47. The 56th came to the United Kingdom on 13 January 1943, already out-fitted with the Thunderbolt.[109] The tardiness in getting the P-47 into operation was due partly to radio and mechanical difficulties in the aircraft and to the necessity for 'selling' it to the pilots. Moreover, the Fighter Command had to proceed cautiously, for it did not want to run the risk of a serious setback in making a new airplane operational.[110]

Three operational groups of fighters were all the Eighth had during the first phase of the bomber offensive. Although the 353d Group arrived in the theater in June, it did not become operational until August.[111]

Inquiry as to why VIII Fighter Command was no better off in the early part of 1943 is not very profitable. Intertheater competition

drained the groups away and there seems to have been some weight of opinion that the B-17 could carry out daylight operations without escort. The AWPD Plan had provided no build-up rate for fighters as it had for bombers, although it had called attention to the need for the latter craft.[112] General Bradley, chief author of the build-up and troop basis for the Eighth, had made the assumption that strategic bombing would generally be unsupported by fighters because of the fighters' deficiency of range.[113] Whatever the reason, VIII Fighter Command was sadly lacking in planes all during the first phase.

The realization that they were needed, however, became strongly impressed upon the minds of the air force leaders on both sides of the Atlantic. The attrition and damage figures were easy to read. In April the Commanding General of VIII Fighter Command expressed the need for 30 groups and the opinion that opposition to the bomber offensive would grow heavier unless the German fighters were neutralized by an American fighter force.[114] The German fighter tactics of concentrating against the bombers during the bombing run made it clear that protection would have to go all the way to the target.[115] This was set forth by Assistant Secretary of War for Air Robert A. Lovett after a trip to the United Kingdom in June. He declared, "The greatest single factor differentiating the 8th AF operations from those in other theaters is the extremely high proportion of battle damage resulting from combat with the best German fighters . . . . There is an immediate need for long range fighters. This may be met by tanks for P-47's but ultimately P-38's and P-51's will be needed."[116]

The story of increasing fighter range by use of expendable tanks is

well covered in the histories of VIII Fighter Command and VIII Air Force Service Command. Here all that is necessary is to note the progress that was made in this development during the first phase of the bomber offensive. Expendable tanks were not a development of the European theater, but had been used for some time for ferrying purposes. One of the first tanks used by the P-47 was a 200-gallon-capacity paper ferry tank. The tests which were made on this tank in March 1943 were only partially satisfactory because fuel could not be extracted above 30,000 feet. Moreover, its structure was such that it was not capable of pressurization, and it was not good aerodynamically. However, the range of the Thunderbolt could be extended by using fuel from this tank while climbing to altitude. Such tanks were employed on the first escort mission in which VIII Fighter Com. and used droppable tanks. This event did not take place until 28 July.[117]

Besides the tests on the 200-gallon ferry tanks, there were two other developments in the expendable tank problem during the first phase. One was the testing and provision for procurement of a smaller paper tank of British design. VIII Air Force Service Command's maintenance division designed a steel tank which was approved by Fighter Com. and on 29 May. British agencies were asked to manufacture these, but because of production difficulties, the British proposed the substitution of 108-gallon paper tanks which could be pressurized and which had been successfully used on the Mustang. Tests were run on the tank and it was officially approved by the Fighter Com. and on 26 June. The British began delivery of this tank on 12 July.[118] The third development in the range-extension

problem was experimentation with a variety of metal tanks ranging in capacity from 75 to 150 gallons. All these were capable of leak-proofing and pressurization but required the installation of certain fixtures on the P-47.[119] Although the solution to the fighter range problem was not reached during the first phase, the need for extending the range was thoroughly realized and progress in design and production was made on both sides of the Atlantic.[120]

The fighter protection given to the heavy bomber operations during the first phase was provided by both RAF Fighter Command and VIII Fighter Command. As a matter of fact, the latter was under the control of RAF Sector Controller until 30 June 1943.[121] All four of the April missions of VIII Bomber Command were given fighter support by Spitfires of the RAF.[122]

The first escort of heavy bombers by P-47 Thunderbolts was furnished on 4 May during the mission against the Ford and General Motors plants at Antwerp. On this mission six squadrons of P-47's and six of RAF Spitfires were used. The Bomber Command described the support as excellent and attributed the mediocre enemy fighter opposition to the presence of the P-47.[123] During May and June the Thunderbolts escorted the day bombers on at least five other occasions. The other operations of VIII Fighter Command consisted of sweeps, or forays into enemy territory, and diversions designed to give indirect support to the heavies. The P-47's flew 4,727 sorties in 31 operational days during the first phase and about 30 of them were in support of heavy bombers.[124]

Defense against enemy fighters involved tactical deployment of

bombers as well as material developments. Principal tactics were the use of the formation, the diversion, and the feint.

The formation as a defensive measure witnessed much experimentation and development in the MTO in 1943. In the early operations bombing was done by elements of three aircraft in formation and later by squadrons of six. The intensity of enemy fighter attacks forced the bringing together of more aircraft to secure mutual fire support. From January to April 1943 the formations flown were boxes of 12 to 24 aircraft rather widely spaced. The formations were generally loosely flown, for individual evasive action was encouraged. After May the basic group formation was a combat box of 18 to 21 aircraft flown much more tightly than in the earlier period. Such a box ideally flown would occupy 350 feet in altitude, 900 feet in breadth, and 600 feet in trail. Actually it was always much larger in breadth and trail. Two or three combat boxes stacked together constituted the combat wing. Experience indicated that three groups was the maximum number that could be practically flown together in a defensive formation. The combat wing was not maintained during the bombing run, since bombing was done by groups. After bomb release the combat boxes would reassemble for support on the route to base.[139]

Formation flying required great skill on the part of the pilots, and the Eighth constantly emphasized the necessity for better training in this specialty at operating altitude. The use of group bombing also influenced another aircrew position. One or two bombardiers in a group became very important because generally all planes released bombs on one sighting operation, that of the bombardier in the lead aircraft. Others

simply toggled their bombs out on his signal.[125]

The diversion as a defensive tactic was employed by both fighters and bombers. The chief defensive value of the diversion lay in its proper timing to attract enemy fighter action to itself from the main bombing effort of the day. The diversionary force was at times dispatched ahead of the main effort in order to arouse the enemy ahead of time, have him use up his fuel, and so find his fighters grounded when the main attack was delivered. It was also dispatched after the main effort had gone out in order to lessen enemy pressure on a withdrawing force. The diversion was employed at least five times by VIII Bomber Command and several times by VIII Fighter Command during April, May, and June. During the raid on the Me109 aircraft plant at Antwerp on 5 April, a force of 35 B-24's conducted a diversionary sweep over the North Sea and toward the French and Belgian coasts.[127] This measure brought up no fighter opposition, but a similar venture on 4 May was highly successful. On that occasion the bombing objectives were the Ford and General Motors plants at Antwerp. Seventy-nine B-17's were dispatched on the main effort and 20 B-17's and 13 B-24's were dispatched on a diversionary feint toward the French coast. The diversion as well as the main effort was provided with fighter cover. The feint aroused more than 100 fighters (about half the Germans had in the region) and kept many of them airborne so long that they could not attack the main effort. The principal force encountered but 30 enemy aircraft.[128]

VIII Fighter Command engaged in diversionary indirect support of heavies even before it undertook direct close support. On the 17 April

raid against Bremen, 76 P-47's carried out a sweep of the Holland coast while the bombardment mission was in progress.[129]

The diversion not only had defensive value; it gave excellent training to participating air crews. The bomber diversion was but a variation of what has been called the "split-target" technique. This involved the dispatch of strong forces to several different objectives at the same time, thus causing the enemy to disperse his forces. Although practiced during the first phase, the best use of the tactic had to await the build-up of the Eighth to greater strength.

Another defensive variation of the diversion was the feint or fake by the main attack force toward one target with a sharp turn toward the intended objective at the last moment. Route to and from the target was not left to the groups but was carefully prescribed by higher headquarters.[130]

Except for radar countermeasures, the defensive tactics against flak were fairly well developed by the time of the first phase. These involved selection of operating altitude and route, reduction of bombing run, control of spacing of groups and number of groups bombing together, and evasive action. Further protection from flak was provided by armor plate and the development of special flak curtains and flak suits for crews.

Bombing altitude of heavy bombers during the first phase was generally above 20,000 feet. The lowest reported bombing altitude was 19,000 feet on the Le Mans mission of 20 June, and the greatest, 27,500 feet on the 25 June raid against northwest Germany. Although it is not possible to strike an average, it is safe to say that most of the day bombing was from about 23,000 feet.[131] This was high enough to take the planes out of

the range of the enemy's light flak. Bombing altitude, as is the case with many other operational policies, was a compromise. Much better bombing accuracy could have been achieved and many operational problems could have been eased at lower levels. On the other hand, the damage from heavy flak could have been greatly decreased by operating at greater altitudes. The Commanding General of the Eighth stated that the reasons for not going higher were that above 25,000 feet increasing difficulties were experienced with oxygen equipment and with propeller and supercharger action.[132] Operations above 30,000 feet brought to the Eighth a host of problems connected with oxygen, electrically heated flying suits, machine guns, and the functioning of internal combustion engines. Many of the complaints in the United Kingdom about the lack of training of new crews and replacements were due to the altitudes to which the enemy forced operations.[133]

Intelligence and antiaircraft officers played a prominent part in the plotting of routes designed to avoid as much flak as possible. With the enemy's chief emplacements known, not only the best route from base to target could be selected but the best angle of final approach could be charted. Angles of approach and departure were determined by calculating the effectiveness of all possible AA batteries along each 30-degree direction about the target. Charting of such courses became a very important and exacting portion of mission planning. Likelihood of flak damage was also diminished by making the turn along the predetermined axis of attack at the last point and the production of the bombing run to the shortest possible time commensurate with accurate bombing.[134]

The common methods of AA fire control used by the Germans were the predicted barrage and the continuous-following method. In the predicted barrage each gun fires at a particular spot in the sky through which the formation is due to pass; hence the Allies could get protection from barrage fire by increasing the spread of the entire formation in altitude and breadth. Protection from continuous-following fire control was secured by closing up the units in trail and thus saturating the enemy's flak defense at a particular time. Both tactic reduced the risk to any single unit.

Various types of evasive action were taken by the bombers to reduce the likelihood of hits by flak. One was a change of altitude by at least 1,000 feet on the approach to the bombing run or after bombs were released. Another was the making of irregular changes in course of at least 30 degrees every 30 to 60 seconds except on the bomb run. Such tactics gave protection because of the tracking time necessary in continuous-following fire control and because of the time required for a projectile to reach operating altitude.[135]

In addition to protection offered by armor plate, further protection was given to air crewmen by the development of flak suits and flak curtains which were capable of stopping low-velocity projectiles. In the autumn of 1943, an analysis of the wounds to crew members on combat missions had shown that 70% were due to missiles of relatively low velocity. The Surgeon of the Eighth Air Force, Col. Malcolm Grow, was of the opinion that many of these wounds could be prevented by body armor. As a result of researches by the medical department and by the British, the Surgeon had

the Wilkinson Sword Company of London made up suitable suits of body armor. "These were made of laminated (20 gauge) manganese steel plates [1/16 inch in thickness], approximately two inches square, which overlapped 3/8" on all sides. This armored suit covered the vital parts of the trunk, and was designed with a quick release mechanism to facilitate removal in case the wearer was required to abandon the aircraft."[136] The armor as used formed a loose fitting outer garment which weighed about 20 pounds. By the end of May enough of these were being manufactured in the theater to outfit some 300 Heavy crews, and orders were to be placed in the United States for additional quantities.[137]

Defensive measures and devices constantly called for the best efforts of air leaders. That these efforts brought forth both makeshift and very clever contrivances is already evident. Subsequent defensive developments will be taken up as they appeared in later phases of the offensive.

Day Operations in Accordance with 1943 Target Systems

During most of the second quarter of 1943 the bomber offensive was conducted under the Casablanca directive of 21 January 1943. This had made submarine construction yards the first-priority target system. The directive had also called for experimental attacks on submarine operating bases on the Biscay coast in order that an assessment of their effectiveness might be made. The January directive made the German aircraft industry second priority, transportation third, oil plants fourth, and other war industries fifth.[138]

After 10 June 1943 the Eighth Air Force operated under the Combined Bomber Offensive directive issued on that date. As has been noted above,

this had given submarine yards and bases first priority [illegible]; ordinary objectives; but another target system, consisting of the German fighter forces and their supporting installations, was given even higher rating by calling these an intermediate objective of first importance. After the German fighter force installations and submarine yards and bases, the 10 June directive called for attacks on the remainder of the aircraft industry and on production of ball bearings, oil, synthetic rubber and tires, and military motor transport, in that order.[139]

It was the policy of the Eighth Air Force, commanded by General Eaker, and of VIII Bomber Command, under Brig. Gen. Newton Longfellow until the end of the first phase (1 July 1943), to attack CBO targets at every opportunity.[140] The working out of this policy was controlled to a considerable degree by weather conditions, particularly those prevailing in target areas. When Bomber Command was ready to run a mission, the first step called for a check on Continental weather to determine the areas available for operations. When known, the highest priority target or targets were selected within the open regions. This decision was usually reached the afternoon preceding the day set for the operation. The commanders of wings (later called divisions) were notified of the operational decision and told target designations by code numbers. Bomber Command then issued the field order, which usually reached the wings in the early evening. The field order left some details to be filled in by the wing commanders. These were supplied by their orders to group commanders. The groups kept a file of target folders (each target designated by a code number) in which all pertinent information was kept up to date. Using

this information and that supplied by the field order, the antiaircraft, intelligence, weather, and other staff officers could immediately make final preparations for briefing the participating crews before the take-off next morning.[141] All the dramatic details of briefing, take-off, assembly, flight to target, return, and interrogation have been told and pictured too many times to need attention here.

Submarine Installations. The fight was not expected to make deep penetrations into enemy territory during the first phase. More than half of the German submarine construction was done in yards that were more than 400 miles from British bases, but about 38% of building capacity located at Emden, Bremen, Wilhelmshaven, and Bremerhaven could be reached by flights of less than 400 miles. Hamburg and Kiel, two of the most important German cities in the German U-boat industry, were both outside that range, as were Flensburg and Lubeck, cities of lesser importance.

Of the principal operating bases on the Bay of Biscay, Bordeaux at 470 miles and La Pallice at 450 involved more than a 400-mile range. St. Nazaire, L'Orient, and Brest could be reached by shorter flights of 390 to 370 miles.[142]

Submarine yards and bases absorbed more than 30% of the AAF effort during the first quarter of 1943, but during April, May, and June only slightly more than one-half the tonnage of bombs dropped fell on these installations.[143] This second-quarter war on the submarines involved about a score of raids carried out on 11 operational days. Twelve of the raids and seven operational days fell in May.[144]

In general, high-explosive bombs were used against yards, bases, and port areas. However, some incendiary bombs were employed against building yards. The most commonly used high-explosive bomb against yards was the 500-pound variety, although some 1,000-pound missiles were used. The bases with their thick concrete pens called for heavier munitions. Two-thousand-pound bombs were employed against St. Nazaire and La Pallice and 1,000-pounders against L'Orient, but 500-pound projectiles were used at Bordeaux.[145]

In April there were two small-scale attacks made on French ports, L'Orient and Brest, both on the 16th of the month. Fifty-nine out of 63 Fortresses dispatched raided L'Orient, doing some damage to a power station and other facilities. Liberators were used in the attack on the port area of Brest. This small force (36 dispatched--19 bombed), which served as a diversion for the main operation of the day, was hindered in its bombing by a very effective smoke screen. The B-24's were escorted by RAF Spitfires on both penetration and withdrawal. The bombers encountered from 10 to 15 single-engine enemy fighters and the escort about 20. The B-17's on the L'Orient raid encountered 20 to 25 fighters, some of which attempted air-to-air bombing.[146]

During the first half of May two attacks on U-boat installations were achieved, a small-scale raid against St. Nazaire on 1 May in heavy clouds and a much bigger mission against the Krupp Germania yards at Kiel on the 14th. The latter raid combined Fortresses and Liberators (195 attacked) in the deepest penetration American bombers had made up to that time. The long trip (1,430 miles) to Kiel was completed without escort

and aroused intense fighter opposition both to and from the target. The enemy attacked the bombers from all directions with machine-gun and cannon fire and tried aerial parachute bombing. These enemy aircraft and moderate to intense flak brought down nine heavies, five of them B-24's. The weather conditions were excellent, and the bombing was the most successful accomplished by the Eighth to that date despite the strong resistance.[147]

The last half of May saw the bomber war on the submarine increase in size and weight. On 17 May good weather in western France enabled the heavies to strike hard blows against L'Orient and Bordeaux. This was the first American raid on the latter, more distant French port. The L'Orient mission was carried out by 118 B-17's of the 1st and 4th Wings. Eighty 1st Wing craft concentrated on the submarine pens and 38 4th Wing planes put the north power station out of action. The Bordeaux raid was carried out by a small force (34 bombed) of B-24's which went in on the port from the sea to achieve complete surprise. The lock gates to the U-boat basin were badly damaged.[148]

On 19 May good weather in North Germany permitted 101 B-17's to return to Kiel and a smaller force (51) to hit the U-boat building yards at Flensburg just south of the border of Denmark. The Kiel raid was not as satisfactory as the one on 14 May, and there is some doubt about which of the three yards (Germania Werft, Kriegsmarinewerft, or Deutsche Werke) at Kiel was the target on the 19th,[149] but the smaller force achieved excellent results at the Flensburg yards.[150]

During the final 10 days in May five submarine targets, including two yards in Germany and three bases in France, were attacked on two

operational days. The German yards at Emden and Wilhelmshaven were raided with indifferent success on 21 May by medium-sized forces. On 29 May the Eighth dispatched 273 heavies against a naval storage depot at Rennes, the base at La Pallice, and oft-bombed St. Nazaire. The latter target called for the big effort of the day with 140 B-17's dropping 277 of the 2,000-pound bombs on locks to the U-boat basin, workshops, and various dockside buildings. The results were described as fair. Seven YB-40's completed the St. Nazaire mission and withdrawal cover against fighters was supplied by 10 Spitfire and three P-47 squadrons.[141]

During June the U-boat construction facilities were attacked on the 11th and 13th. A big force of B-17's (167) hit the Marinewerft at Wilhelmshaven on the 11th, while a smaller force (30) was delivering a blow to the port area of Cuxhaven. Two days later on 13 June, a two-pronged attack was delivered at Bremen and Kiel. Bremen's Deschimag U-boat yards called for the bigger effort (102 B-17's dropped 224 tons) and the Deutsche Werke at Kiel received about 85 tons. The cost of the raids was in inverse proportion to their size, for the Kiel raid stirred up the strongest fighter opposition the Eighth had ever met.[142]

The first-phase attack on submarines was completed, appropriately enough, by the 25 June raid on the St. Nazaire base. A large force (133) of B-17's in two waves dropped 300 ton-size bombs in an effort to destroy the one serviceable lock entrance to the U-boat basin. Strike photographs indicated that the mission was successful.[143]

Oil Facilities. Eighth Air Force operations against German Air Force facilities are thoroughly covered by another AFHRA Reference Study, The

...r Against the Luftwaffe, April 1942-June 1944, and these operations are considered here only briefly as an integral part of the first-phase of the CBO. Missions against GAF installations absorbed about one-fifth (21%) of the entire first-phase bomb tonnage dropped by the Eighth and involved attacks on nine operational days. Assembly plants, engine works, repair facilities, and airdromes were included among the GAF objectives.[154]

During April two attacks were delivered, one against the Erla aircraft and engine repair works at Antwerp on the 5th, and the other against the Focke-Wulf assembly plant at Bremen on the 17th. In the Antwerp mission 64 B-17's dropped 245 tons on the Erla works and stirred up a hornets' nest of enemy fighters (50-75) which pressed their attacks halfway across the Channel on the route home.[155]

The enemy fighter reaction to the important Bremen mission was twice as severe (100 encounters) and cost 16 heavy bombers, four times as many as the Antwerp operation. The Bremen mission was one of the most important of the first phase. The Focke-Wulf assembly plant at this city was estimated at the time as the producer of better than 15% of all enemy single-engine fighters and 30% of all the FW-190's.[156] Marshal Goering still remembered the raid in his interview as a prisoner of war in June 1945.[157] The attack was made by 107 B-17's dropping 326 tons of 1,000-pound high-explosive bombs. The Fortresses met a prepared defense that seemed to indicate the enemy had advance warning. German fighters concentrated on the bombing run and the ferocity of the air battle is attested by the loss of 16 of the B-17's to fighters (one was lost to flak). The bombers, however, claimed 63 fighters destroyed, 15 probably destroyed, and 17

damaged. The bombing of the assembly plant was considered successful.[158]

The first operation against GAF facilities in May was a coordinated two-pronged attack on the Potez airframe factory, really a German repair depot, in Meaulte, and on the St. Omer-Longuesse airdrome. The Meaulte target had been attacked inconclusively three times by the Eighth during 1942, but this 13 May attack seemed to achieve a good concentration of 218 tons of bombs and to do much damage to shops and storage facilities. The airdrome that was bombed the same day was not much hurt by the first efforts of new groups. The Courtrai airdrome was attacked next day (14 May) with no better results.[159]

The June attack on the facilities of the GAF was not impressive, and it did not develop until late in the month. An airdrome and repair depot at Villacoublay were attacked in adverse weather conditions by a handful (10-10) B-17's on the 20th, and a somewhat larger force (39) hit at the Triqueville airdrome the same day. Bomber Command reported the results negative. Somewhat better results were achieved two days later on the Beaumont-le-Roger airdrome. Next day, 23 June, only 76 of 330 dispatched B-17's were able to bomb the Gnome and Rhone aero-engine works at Le Mans. The low percentage attacking was due to heavy cloud over the target. Most of the bombs that were dropped did little or no damage.[160]

Rubber. There was but one operation by the Eighth during the first phase on the synthetic-rubber production, the 22 June attack on Huls near Recklenhausen in northwest Germany. The plant at this city was one of the two most important synthetic producers and was the source of a

considerable portion (17%) of Axis supply.[161] Its selection was probably dictated by its distance from bomber bases (280 miles), which was much less than that of the Schkopau plant (430 miles).

The Huls attack was, for the time, a large-scale effort. It involved 11 operating groups dispatching 235 B-17's of which 170 actually dropped bombs on Huls. Eleven of the planes participating in the mission were YB-40's, one of which was lost to flak. Although the Huls raid was the main show for 22 June, the Eighth dispatched two other missions on the same day, one to hit Antwerp and a diversion over the North Sea. The RAF contributed another small diversionary attack on Rotterdam. The diversions, which were strongly supported by AAF and RAF escort, contributed greatly to the success of the main effort by disorganizing the enemy opposition and drawing off a number of his fighters estimated at 150.[162]

The Huls mission was considered a success despite the loss of 16 heavies. It prompted RAF Fighter Commander Sir Trafford Leigh-Mallory to say it opened "a new chapter in aerial warfare."[163]

Motor Vehicles. The Axis industry producing military motor vehicles was right after the production of rubber and tires on the target-systems list in the directive of 10 June 1943. Most of the first-phase effort against motor vehicles took place prior to the issuance of the CBO directive, but it was justified under the Casablanca directive which, although it did not specifically name the vehicle industry as a target category, did call for attacks on industries supporting the Axis war effort.[164]

The first blows against motor vehicles were small to medium-sized efforts against plants in occupied countries. The mission of 4 April

against the Renault-Billancourt works two miles southeast of Paris was the most important. It involved 88 attacking B-17's, which aroused 75 German fighters to vigorous resistance and the use of aerial dive bombing. This technique did not destroy any bombers, but other tactics brought down four. The 351 tons placed on the Renault works did severe damage to this facility.[165]

The May operations against motor vehicles were carried out on the 4th and 11th of the month against the Ford and General Motors truck plants at Antwerp. The first of these involved 65 attacking B-17's dropping 161 tons of bombs and was the main effort of 4 May. The small-scale second mission (43 B-17's) was but one of the attacks delivered on 14 May, which also saw raids on Kiel, the Courtrai airdrome, and the first B-26 mission of the Eighth against Ijmuiden in Holland.[166]

On 22 June, 39 B-17's were used to bomb the Antwerp Ford and General Motors plants and to divert enemy fighters away from the main effort of the day, which was the bombing of synthetic rubber at Huls. Four days later six B-17's dropped 13.25 tons on a motor transport plant at Folssy to wind up the first-phase attack on motor vehicles.[167]

There were no first-phase attacks by the Eighth on either oil or ball bearings, both of which were high on the priority list. Already noted are the facts that more than half the weight of bombs during the second quarter of 1943 was on submarine facilities and 21% on GAF supporting installations. Rubber received 7% and motor vehicles 9%. Only a little more than 10% of the effort was dissipated on other than GAF targets.[168]

Even this small diversion was due to circumstances beyond the control of the leaders of the Eighth. A mission aimed at Lübeck on 15 May was so hindered by cloud that most of the participating planes bombed targets of opportunity in northwest Germany. Cloudy weather was also responsible for failure to bomb G&O targets on 11 June, and again on the 25th. On the latter date when the submarine facilities at Bremen and Emsburg were scheduled objectives, the bombers' crews showed great persistence in seeking targets and provoking battles with enemy fighters. Their bombs were dropped on half a dozen towns in northwest Germany and on two convoys. The fight they sought was provided by 100 to 150 enemy aircraft and the score was 18 heavies lost against claims of 62 enemy fighters destroyed, 11 probably destroyed, and 40 damaged.[109]

The USAAF part of the combined bomber offensive was small during this period, and it neglected two important target systems entirely. Nevertheless it did exhibit a strong adherence to its cardinal principle of "maintenance of the aim."

The RAF Attack on the Ruhr

RAF Bomber Command operations during the second quarter of 1943 were on a far larger scale than those of the Eighth Air Force. While the Eighth was dropping 6,455.7 tons the RAF bombers, particularly the Halifax and Lancaster heavies, unloaded more than 30,000 long tons (33 pounds 1.12 U. S. tons) of bombs of which 26,731 long tons (41,123.7 short tons) hit Germany. Relatively small fractions of the effort were devoted to targets in France and other occupied countries. Main great RAF attack

was delivered at a cost of 811 aircraft, and 718 of these were lost over Germany.[170]

The RAF bombardment of Germany was facilitated by the use of new navigational aids which allowed reasonably accurate bombing in weather which formerly would have stormed operations. The conquest of weather obstacles made the battle much easier against German night fighters, which found it difficult to operate on some of the nights chosen by the RAF for attacks.[171]

RAF Bomber Command's air war on Germany was particularly concentrated against three types of objectives in the Ruhr and Rhineland:[172]

1. The industrial centers of the Ruhr valley--Essen, Dortmund, Bochum, Duisburg, and their satellites.
2. The great Rhineland centers of commerce--Dusseldorf and Cologne.
3. Subsidiary targets not primarily concerned with heavy industry but important for the production and transport of other badly needed war materials. Münster, Barmen, Elberfeld, and Krefeld were in this category, as was the important synthetic-rubber works at Huls.

The RAF leveled three strong attacks against Essen during April and May which were designed to finish the destruction that had been started in that city in March 1943. Dortmund, industrial and transport center, suffered two heavy attacks in May, which involved nearly 1,500 attacking bombers and which caused such damage that Bomber Command's Quarterly Review for April, May, and June 1943 said that it was virtually eliminated; "indeed, for a short time these two attacks probably made Dortmund the most heavily wrecked city in the Reich."[173]

Bochum, a coal-producing center northwest of Essen, was attacked once in May (night of 13-14) and once in June (night of 12-13) by more than 800 aircraft dropping more than 2,000 long tons of high-explosive

and incendiary bombs. Its extensive coke, gas, benzol, iron, and steel plants were concurrently damaged.

Duisburg, at the junction of the Ruhr and Rhine rivers, suffered three raids in April and one in May. Oberhausen, east of Duisburg, and Mülheim, on the Ruhr River and just south of Oberhausen, were attacked once each during June.

One of the most spectacular accomplishments of RAF Bomber Command during the first phase was the breaching of the Möhne and Eder dams on the night of 16 May by 19 Lancasters equipped with special mines. The Möhne dam controlled the level of the Ruhr River, and the Eder dam helped to control the waters of the Weser. The breaching of these dams was a severe blow to the water supplies of many Ruhr towns.[174]

Düsseldorf and Cologne, the great cities of the Rhine, were both attacked twice during the second quarter of 1943. The first attack on Düsseldorf (22-23 May) employed blind-bombing methods and was not successful. The second (11-12 June) used visual methods and achieved good concentration. The two June attacks against Cologne were made to destroy the progress achieved by the Germans in their attempt to rehabilitate the city since the 1,000-plane raid of May 1942 and to round out the RAF Bomber Command's campaign against the Ruhr.

Other towns in this important industrial region attacked during this phase were Wuppertal (twice), Krefeld, and Münster. The attack on the last named was small, but the other two received large-scale raids and the devastation in both towns was widespread.[175]

[redacted]

Outside the Ruhr and the Rhineland regions the RAF war on Germany included large-scale attacks on Kiel, Frankfurt, Stuttgart, and Stettin in April. Smaller forces hit Rostock and Mannheim during the same month. The Kiel and Frankfurt attacks did not do great harm, but Stettin suffered heavily. Both of the two smaller attacks (Rostock and Mannheim) were quite successful. The Mannheim raid was made as a diversion for a heavier blow which was designed against the Skoda works in Pilsen, Czechoslovakia, on the night of 16 April. This attack on Pilsen and another on the night of 13 May did little damage.[176]

Only twice during May and June did any large force hit targets outside the Ruhr. Le Creusot, reported to have recuperated from a daylight attack which had been delivered against it back in October 1942, was again put out of action by a heavy blow on the night of 19 June. On the next night a formation of Lancasters successfully attacked Friedrichshafen on the way to North Africa and then hit Spezia on the return trip. Berlin underwent a series of nuisance raids and was attacked 12 times by Mosquitoes.[177]

The Tentative Results of First-Phase Attacks

The assessment of so small a segment of the combined bomber offensive as was encompassed in the second quarter of 1943 can have very little value in the measurement of the part played by strategic bombing in the victory over Germany. An assessment that was made at the time does have value in an operational story, however, for it tells something about what the air leaders who were doing the strategic job believed their efforts were accomplishing.

The best strictly first-phase assessment of the bomber offensive, made shortly after the close of that period, was the work of the British War Cabinet Joint Intelligence Committee, 'Effects of Bombing Offensive on German War Effort,' dated 22 July 1943. Given here is a brief summary of the effects reported.[178]

The bombing offensive had forced Germany to adopt a defensive air strategy. That strategy involved strong efforts to increase the fighter force and to so distribute it that more than half was employed on the Western Front at the expense of the Mediterranean and U.S.S.R. fronts.

German aircraft and maintenance facilities suffered very little damage from first-phase attacks. The Eighth Air Force raid on Bremen in April seems to have been partially nullified by a previously effected dispersal.

The judgment of the effectiveness of U-boat yard-bombing was uncertain, but it was estimated that the Germans had been deprived of 12 to 13 submarines, which would show up in decreased output between September 1943 and March 1944.

It was believed that the bombing of submarine bases had caused delay in the sailing of submarines from the Biscay ports, and that valuable stores of ammunition and other supplies had been destroyed. The towns and docks of L'Orient and St. Nazaire had been severely damaged, but it was not believed that their concrete-covered submarine pens had been put out of action.

The examination of the results of the attack on the synthetic rubber plant at Huls led to the belief that it had been put out of action for

several months. This meant a further tightening of an already difficult situation for the Western Axis.

The bombing of Axis motor-vehicle production may have deprived the German armed forces of an output of between 3,000 and 5,000 motor trucks. This was equivalent to the full motor-transport establishment of three to four infantry divisions.

The RAF heavy attacks on the Ruhr had caused grave effects in the production of solid fuels, iron and steel, and alloy steels. Evidence of falling off in deliveries of Ruhr coal to Italy, to North German ports, and to Berlin was found. Rate of operations in the Ruhr iron and steel industry had been curtailed by the second-quarter bombings. Steel production at the end of June in that region was estimated at 30% of capacity as contrasted with 8[illegible]% at the start of 1943. It was not clear in July that the shortage of steel had affected the armament industry.

The effects of bombing of rail transportation appeared to have caused the enemy to step up his locomotive construction program. This meant a diversion of some resources from the production of armaments.

Diversion or dislocation of effort was believed to have been one of the very important results of bombing. Prominent examples of diversion were the removal of skilled manpower from other jobs to improve radar and fighter defenses. It was also necessary to keep men from other employment part of the time in order to maintain air-raid protection and fire services at a high level of efficiency.

It was judged that the destruction of housing had caused some decrease in the willingness of the people in heavily bombed areas to hold out. This same kind of destruction was believed responsible for some deterioration

in the morale of the armed forces.

This summation of the results of the first-phase offensive is intended to do no more than to describe the estimate of those results as they appeared at the time. There was enough evidence available of "the softening" of Germany to warrant the continuance of the effort and to step up the rate of strategic operations.

Chapter III

THE SECOND PHASE OF THE COMBINED BOMBER OFFENSIVE,
JULY-SEPTEMBER 1943

Organizational and Build-Up Problems

In the preceding chapter it was stated that the principal guide for the build-up and organization of the strategic and tactical air forces in the United Kingdom was the Bradley Plan. This plan had been drawn up primarily to achieve the maximum economy in the utilization of manpower in the U. S. air forces in the ETO. The plan was promptly approved by the theater commander and by the Commanding General of the Army Air Forces. It was given conditional approval by the War Department in the third week of August 1943 and did not receive complete approval until 3 November, after the end of the second phase of the bomber offensive.[1]

The reason the Bradley Plan failed to secure immediate and complete approval by the War Department was that it was believed the plan did not accomplish the purpose for which it was drawn--the cutting down of air force personnel to the smallest number with which the offensive could be carried out. The War Department and the Army Air Forces manpower position was such that no single force and no single unit of air force could be augmented without taking from some other force or some other unit.

Specifically the chief conditions set up by the War Department for its approval of the Bradley Plan were:

1. The theater was to requisition only standard Table of Organization units, which were somewhat different from the Bradley Table units

provided for in the Bradley Plan. The difference between the two was to be supplied by shipping technically trained "fillers" to the theater, where they were to be incorporated into the proper units, which would be reorganized in the theater and reported to The Adjutant General.

2. Certain overhead organizations provided for in the plan were to be eliminated. General Marshall thought that the Eighth Air Force was top-heavy with headquarters. Especially did he object to certain features of VIII Air Force Service Command organization--namely, the area commands through which the command aimed to decentralize its operations. Under the Headquarters of the Service Command were the Base Air Depot Area Command for controlling the three base air depots (Warton, Burtonwood, and Langford Lodge), the Strategic Air Depot Area Command for supervising the depots serving heavy bomber stations, and the Tactical Air Service Area Command for control of installations serving the tactical air force. The War Department believed that the base air depots and the strategic depots could be supervised from the VIII Air Force Service Command headquarters. Only the Tactical Air Service Area Command was approved at first, probably because this organization was designed to become the service command for the tactical air force when it assumed its separate existence.

3. The troop strength figure of 485,843 set up in the plan was accepted for planning purposes only. The War Department did not commit itself to this figure but rather reserved judgment in order to determine whether it could be whittled down.

Theater dissatisfaction with conditions laid down by the War Department was strongly expressed. The organization of the various area

commands had already been set up as provided by the Bradley Plan without waiting for War Department approval. The recommendation for the elimination of certain parts of the zoning organization was resented as unnecessary by persons who were too far removed to understand the problem. The Commanding General of the European Theater cabled the War Department that the qualified approval of the Bradley Plan actually nullified it, for it was regarded as an "integrated whole." It was felt in the theater that the elimination of the strategic and base depot control areas was unsound, for there was as much reason for them as for the tactical control areas which was approved. The opinion in the VIII Air Force Service Command was that the failure to secure unconditional approval definitely hindered the improvement of its maintenance and supply functions.[3]

Eventually the air forces got its way in the matter of the service command organization. The control areas, which were not strictly geographical regions but really functional subdivisions, had been provisionally activated on 1 August, and were somewhat more formally launched on 4 September, after General Marshall had stated that the War Department accepted the Bradley Plan as an "integrated whole." In the theater this statement was taken to mean that the earlier conditions were withdrawn. Although this theater interpretation of the statement of the Chief of Staff went somewhat beyond his intentions, apparently no further objections were raised and the control area commands carried out their supervisory functions long before they were finally sanctioned in November.[4]

The functional organization of VIII Air Force Service Command was but one of the problems in the implementation of the Bradley Plan. One

of the important parts of that program was a schedule of the flow of combat and service units into the United Kingdom. This schedule proved impossible of fulfillment in either category.

In the matter of combat units it was found necessary during the third quarter of 1943 to postpone the sending of four heavy groups and six medium groups because the AAF training program could not meet both the demand for replacement combat crews and the scheduled flow of new units. Some attention was already been given to the problem of replacement crews. Shortage of these constituted the chief limiting factor on the rate of heavy bombardment operations during most of 1943. During the phase under review in this chapter the problem was met principally by two measures. The crews of about six groups in the United States that had been trained in the B-26 were converted to heavy bombers, and four new heavy groups scheduled for the United Kingdom during the summer were withheld in order that their crews might be sent as replacements for groups already in the theater. In July the AAF goal for heavy crews had been set at two per unit equipment airplane assigned to the groups, with a sufficient flow of replacements to care for a 2[illegible] attrition rate per month. Meeting this goal was such a difficult task that the scheduled flow of new heavy units could not be met until after 1 October.[5]

The problem of meeting the Bradley schedule of service units was even more difficult than that pertaining to combat units and replacement crews. It was the opinion in the War Department that the build-up plan called for an excessive number of service units. It seemed also that these generally arrived in the theater in the wrong order. Air echelons of

combat units would arrive first, and somewhat after them would come the service elements designed for their support. This practice placed a very heavy burden on the service forces already in the theater, for they had to do double duty. The build-up of service units had lagged so far behind schedule in August 1943 that General Marshall's office made it the subject of a special memorandum for the Commanding General of the Army Air Forces. The latter was told: "It is desired that positive and immediate action be taken to eliminate this deficit and bring into balance the AAF program for Tactical Service units and combat units. If this cannot be accomplished by other means at your disposal, the activation of additional combat units will be deferred until the structure of the AAF is balanced."[6]

The lack of balance between service and combat units was due to a variety of factors. Shortage of personnel and training equipment slowed down the training program and shortage of shipping delayed the dispatch to the theater. Combat units usually had higher priority on the shipping lists than service units and consequently arrived in the theater first. Even when supporting units were not available or when there was no shipping to transport them, leaders in the theaters were reluctant to stop the flow of combat units simply to preserve balance. They preferred to have their forces increase as rapidly as possible and to resort to improvisations to support them.[7]

In the Eighth Air Force the unbalance was due in part to the great variety of units (especially nonstandard units) that was required. Before the end of the third quarter of 1943 it became evident that the AAF could not meet the requirements for many of the units. Rather than delay

the build-up too much, the decision was made to ship large numbers of individuals in various stages of training to the theater as 'fillers' with the understanding that certain units would there be activated. These fillers were charged against the troop allotment as set up in the Bradley Plan. The procedure placed an added burden on the forces in the theater, but it seemed to be the wisest solution of a difficult problem. This was one of the most important decisions made in the build-up of the air forces in the United Kingdom. General Marshall's proposal to the theater commander is worth quoting:[8]

> Our suggestion is that you reconsider your air organization effecting every economy you can, particularly in special units and service organizations. Special units that you need must be activated in the theater. If you approve, we will again send you trained personnel above your priority assignments for fillers and replacements but within the percentage assigned to the overall Air Force shipping allotment. Here you may use to organize provisionally mobile repair and reclamation squadrons and other special units for which there is no provision but here to train by the target date. As these units are provisionally organized, such as you request formal constitution and activation. We will do all possible to send these trained men and grant authority for your activation within existing policies. Units so activated will be charged against the Bradley Plan.

In accepting this proposal the theater commander indicated a purpose to work on the following basis:[9]

> The Bradley Plan will be used as the overall guide and organization will be set up as provided therein. Maximum will be saved wherever possible in all Echelons of Command and Staff but the overall organizational framework will be implemented as provided in that plan.
>
> You will advise us what organizations can be dispatched as units. You will dispatch all other personnel as individuals and we shall first provisionally organize and activate, and later request formal constitution and activation authority from you.
>
> The principle which it is urged be followed in this connection is that wherever personnel cuts are necessary, we be allowed to indicate in what units the cut will be taken. In the organization

programmes it will be carefully studied and any Headquarters or unit found to be unnecessary will be promptly inactivated.

This basic decision in the carrying out of the build-up plan required the services in the theater of a commission of officers from Washington to explain the personnel situation as it existed in the United States and to discuss War Department and AAF intentions in meeting the programs. The work of this commission, headed by an air officer, Col. J. W. Taylor, of the European Section, OCAC, belongs to the account of the next phase of the bomber offensive.[10]

The third quarter of 1943 saw certain progress made in the organization of the U. S. tactical air force in the United Kingdom and some discussion by U. S. and British leaders of the organizational setup under which that air force was to function in support of a Continental invasion. The first commander of that force, Maj. Gen. L. H. Brereton, was selected and groomed, the beginnings of a service command organization were made in the activation of the Tactical Air Service Area Command (later Tactical Air Depot Area), and General Arnold exchanged views with Air Chief Marshal Portal on the subject of a directive to the commander in chief of Allied Expeditionary Air Forces, who was to have operational control of the U. S. tactical air force.[11]

The U. S. strategic air force also experienced some important command and organizational changes during the third quarter of 1943. On 1 July Brig. Gen. Newton Longfellow was replaced by Brig. Gen. Fred L. Anderson as Commanding General of VIII Bomber Command, and VIII Fighter Command received a new commander on 29 August when Maj. Gen. W. E. Kepner succeeded

Brig. Gen. Frank O'D. Hunter. The Eighth Air Force pressed for and received authorization for the creation of the air divisions and combat wings that had been recommended in the Bradley Plan. The authority was granted by the Adjutant General on 30 August, and formal activation was accomplished shortly thereafter.[12]

This brief account of some of the more significant build-up and organizational problems met by the U. S. Air forces based in the United Kingdom has intentionally refrained from detailed discussion of the problems mentioned and has ignored many others that are also quite important but more appropriate to the administrative history of an air force. It is also necessary to examine certain aspects of the operations that constituted the second phase of the combined bomber offensive.

Magnitude and Rate of Operations

In the third quarter of 1943 the Eighth Air Force operated at a rate well above that achieved during the April-May-June period. July, August, and September missions accounted for 20,000 sorties (dispatched aircraft) by all units and more than three-fourths of these were effective sorties--that is, they reached and bombed targets or accomplished other purposes set for them. The numbers of sorties and effective sorties were more than double the corresponding figures recorded for the second quarter, while in the weight of bombs, the 1 July-30 September interval saw the Eighth drop 18,000 tons, or more than three times the figure established during the previous quarter a year.[13]

The increased rate of operations was due in part to somewhat better

weather conditions and in part to the expansion of available forces. VIII Bomber Command had 33 daylight operations between 1 July and 30 September as compared with 30 for the quarter ending 30 June. On the latter date there had been but 13 heavy bombardment groups in the command; on 31 July there were 15, and by 30 September there were 20 3/4. Of these 16 3/4 were equipped with B-17 aircraft and four had B-24's.[14]

The Eighth had been required at the close of June 1943 to send its two B-24-equipped groups to the North African theater, while the 389th scheduled for UK was diverted temporarily to the Mediterranean. There these units had operated from 9 to 19 July in support of the Sicilian campaign. On 1 August they had engaged in the attack on the oil refineries in the Ploesti region, and between 13 and 31 August they took part in certain other operations. One of the most important of these August missions was an attack on an aircraft factory in Wiener Neustadt in Austria, further discussed later in this chapter. During the July and August operations the three Eighth Air Force B-24 groups (44th, 93d, and 389th) flew nearly a thousand sorties and dropped 3,733.3 tons of bombs.[15]

The North African theater attempted during July to secure additional Eighth Air Force strength--medium bombers, heavy bombers, and fighters--but this was strongly resisted by the commanders of both the European theater and the Eighth Air Force. When General Eisenhower requested four additional heavy bomb groups, Lt. Gen. Jacob L. Devers (CG, NATO) so strongly defended the necessity of implementing the OVERLORD from the United Kingdom to the fullest possible extent that the Chief of Staff suggested as a compromise measure that four medium groups be sent from England to

the Mediterranean. General Eisenhower's reaction to this suggestion was that while mediums were no substitute for heavies, the mediums were better than nothing and could be used effectively. General Devers countered with another statement of the significance of operations in his own theater and stressed the important part the mediums could play in the CBO. He said that their diversion would cut down attacks on enemy airfields, increase heavy bomber losses, reduce the pressure that the Eighth was applying to the GAF, and reduce the air support for operation STARKEY (an experimental landing on the French coast). The outcome of this intertheater contest was that General Marshall in August sided with MTO, and there was no further diversion of air strength to the Mediterranean at that time.[16]

Not only did the MTO strongly resist the diversion of additional strength to the Mediterranean, but it pressed for the return of the three groups that it had previously dispatched to that theater. General Eisenhower wanted to keep these as long as possible and made a strong case for their retention. The United Kingdom forces won again, for the Combined Chiefs of Staff directed that the B-24's be returned to MTO because of the critical struggle the Eighth was having with the GAF. The three groups returned in August, and by 8 September the U. S. forces had four B-24 groups (44th, 93d, 389th, plus the 492d) operational.[17]

But this return of the borrowed B-24's did not end the diversion of heavy bomber strength from the United Kingdom. By the middle of September, the American Fifth Army was in serious trouble on the Salerno beachhead and there was not sufficient air power to properly support this

operation. On 14 September, General Eisenhower told the CC/S that there were possibilities of a serious reverse and that his tactical and strategic air forces were being badly overworked, with each unit attempting to execute two missions daily. On the 15th, he reported that the situation was precarious and urged that long-range bombers from the United Kingdom operate against German lines of communication in North Italy and that the three B-24 groups which had been in his theater be returned without a moment's delay. This plea was not denied. The Joint Chiefs of Staff in Washington told General Devers to approach the British Chiefs of Staff about the dispatch of the groups, and if concurrence were secured, to start the movement at once. General Devers acted with the promptness demanded by the critical situation and by 16 September the 93d, 389th, and 44th groups, with approximately 20 aircraft each, were on their way back to Africa. The long-range support from the United Kingdom came on the night of 16 September when five B-17's operated with 340 aircraft of RAF Bomber Command to bomb the marshalling yards at Modane in southeastern France in an effort to close the northern end of the Mont Cenis tunnel to Italy.[18]

All told, the eighth dispatched 80 airplanes, 98 combat crews, and 446 noncombatant personnel to the Mediterranean for the support of the Fifth Army in the Salerno battle. Between 21 September and the first of October this force flew 191 sorties, dropped 406.6 tons of bombs, claimed 50 enemy aircraft destroyed, and lost 11 heavy bombers in combat. General Eisenhower assured the Chief of Staff that the force would be returned as soon as it could be spared; by 24 September General Marshall was told

that the crisis had passed, and that it was safe to release the planes. They participated in a second raid on Siener Neustadt on the 1st of October before returning to the United Kingdom bases which they reached on the 4th. Of the 60 heavies sent out, 63 returned to England.[19]

The intertheater contest for B-24 groups has been recounted to show some of the difficulties experienced by the Eighth in building and keeping its forces. In addition to the heavy groups in VIII Bomber Command, VIII Air Support Command had four groups operational with B-26 mediums during a portion of July and throughout August and September. VIII Fighter Command doubled its operational groups during the third quarter. There had been three P-47 groups at the close of June, but at the end of September there were six.[20]

Aircraft and crew strength are much more important indexes of striking power than the number of groups. Daily average heavy bomber strength in operational aircraft, available crews, and effective strength during the third quarter of 1943 were:[21]

	A/C Fully Cpnl. with Tac. Units	Avail. Crews	Effective Strength
July	378	315	279
August	406	341	331
September	461	409	373

The figures make it evident that VIII Bomber Command was better off with respect to operational aircraft than available crews during this period, but it is worthy of note that the effective strength was less than the number of available crews seems to indicate it should have been. The reason for this condition was that the group was the operational unit.

Effective strength on a given day was not represented by either the aggregate number of fully operational aircraft or that of available crews in the bomber command, but by the sums of the operational aircraft or available crews assigned to the groups.[32]

Heavy bomber strength was about 30% short of the goal that had been set up by the CBO Plan. This had called for 1,192 heavy bombers to be in the theater by 30 September. Actually, on the 23th of that month there were 931, and the average figure for the whole of September was only 831.[33]

The CBO Plan had assumed that about three-eighths (37.5) of the heavy bombers assigned to the theater would actually be available at any one time for dispatch on missions. This assumption had been made upon the basis of Eighth Air Force experience prior to April 1943, and second-phase operations were about in line with this experience. In the table below are shown the average number of assigned heavy bombers and the average number dispatched on missions for the three-month period:[34]

	Avg. No. A/C Asgd. to Air Force	Avg. No. Dispd. on Day Opns.
July	800	283
August	761	283
September	831	323

The average number of aircraft dispatched on operations was obtained by dividing the total dispatched aircraft on daylight missions for the month by the number of daylight operations. Night operations, involving very few aircraft, were excluded. There were 10 operational days during July, and on each of nine days VIII Bomber Command dispatched more than 200 aircraft. On five out of the nine more than 300 heavy bombers were sent

out. The only operational day in July when fewer than 200 heavy bombers were sent out was the 30th, and that was probably due to the fact that the command had been operational six of the seven days ending with the 30th.[35]

August had but eight operational days, and on seven of them more than 300 heavy bombers were dispatched. Four of the seven saw more than 350 sent out, and the well-known 17 August raid on Schweinfurt and Regensburg found 315 attacking aircraft out of the 376 dispatched.[36]

The month of September saw the Eighth attain the figure of 300 dispatched bombers five times; and on one occasion, 6 September, some 407 were sent out. The top second-phase figure for attacking aircraft was not attained on this date, but came two days later on the 9th, when 330 out of 377 dispatched bombers hit a number of airfields in occupied countries.[37]

In general the Air Bomber Command was able to utilize its effective strength in excellent fashion. This is evident when figures for effective strength and average number of aircraft dispatched on operations are compared:[38]

	Avg. Daily Effective HB Strength	Avg. No. A/C Disp. Day Ops.
July	279	233
August	291	283
September	373	333

It has been seen already that the utilization of all heavy bombardment aircraft assigned to the theater was not nearly so satisfactory. This is further emphasized by an examination of the sortie rates for the period

under review:[29]

	No. of Sorties per Unit Equipment Aircraft	No. of Sorties per Effective-Strength Manned Aircraft
Heavy Bombers		
July	3.9	10.1
August	2.8	7.3
September	3.4	9.2
		27.1

When it is recalled that there were but 29 operational days during the second phase of the bomber offensive, it is clear that effective strength was quite well used inasmuch as the heavy bombers ready for operations were used at a rate of about 93% (27.1/29) of capacity.* However, the sortie rate for unit equipment aircraft (column 1 in above table) shows that VIII Bomber Command was not making such effective use of the planes assigned to units. In no month was the average bomber assigned to a group able to fly as many as four sorties per month. The sortie rate per heavy bomber, considering all aircraft assigned to the theater (that is, including those unassigned to combat units), was naturally even lower.

This unsatisfactory operational rate was recognized in AAF Headquarters and in the theater at the time, and great efforts were expended to improve the situation.[30] The operational rate for heavy bombers was held down by two factors: (1) Repairs necessitated by battle damage and repairs and overhaul required after a certain amount of flying time; and (2) the replacement rate for crews and equipment. Although it was possible to improve the maintenance and repair situation considerably, the other factor, replacement flow, still operated to keep down rate of operations, for a greater operational rate would have carried losses above replacements

* This conclusion is based on the premises that no bomber flew more or was expected to fly more than one sortie on any one operational day.

and thus resulted in a diminution of the latter strength.[31]

Problems of Defense and Bombing Accuracy

The examination of the loss and damage figures for first-phase heavy bomber operations led to the conclusion that enemy opposition was becoming more intense during April, May, and June. The effect of that opposition seems to have continued to be very great during July and August, but it lightened perceptibly in September. There were 109 heavy bombers lost in action in July, 107 in August, and 60 in September. Of this total of 333 lost in combat, 107 (nearly 30%) were lost to enemy aircraft; 47 (nearly 14%) were lost to flak or a combination of flak and enemy aircraft; 20 (6.0%) were lost to accidents; and 139 (42%) were lost to other causes. In addition to the 333 lost in action there were 24 so badly damaged that they could not be economically repaired; consequently the loss due to combat was 353 heavy bombers for the second phase of the offensive. When this loss due to combat is translated into a percentage of credit sorties, it becomes a measure of the severity of enemy opposition. It was more meaningful to calculate loss as a percentage of credit sorties than as a percentage of dispatched planes, for some dispatched planes never were in a position where they could be attacked by the enemy. Losses due to combat computed as a percentage of credit sorties for the three months of this second phase were:

July	5.8%
August	6.0
September	3.6%
Entire second phase	5.0%

This is to say that during the third quarter of 1943, of every 20 bombers

flying into positions where contact with the enemy was possible, one was lost due to combat.[32]

Battle damage to aircraft that returned from operations showed the same trends during the second phase as the combat loss rates. Considering damaged heavy bombers as a percentage of credit sorties, the following is observed:

	No. Damaged	% of Credit Sorties
July	1,035	43.9
August	869	42.2
September	745	33.2

July and August rates were high. The reasons for the low loss and damage rates in September were probably found in the nature of the operations for this month. Only two of the September operations were over German targets--a mission against Stuttgart and targets of opportunity on the 6th and the mission against Kiel on the 27th. The former was made on a cloudy day which did not favor German fighter operations, and the latter was also made under cloud conditions and employed blind bombing aids for sighting--the first time they were used by the Eighth Air Force. Many of the September operations were made against airfields during the STARKEY exercise and against other targets which required relatively shallow penetrations. Less than half the September sorties were flown against GAF targets. Hence it seems to have been due to the kind of operations conducted rather than to improved bomber defense or lessened enemy effort that loss and damage rates declined in September.[33]

Throughout the three months of the second phase the German Air Force continued to exhibit the same trends that had become evident during the

first half of 1943. Fighter aircraft production, particularly of single-engine types, was emphasized at the expense of other craft, and the existing fighter force was so distributed to meet the bomber offensive that the Western Front gained in strength both absolutely (from an estimated 1,180 in June to about 1,360 in September) and in relation to the Eastern and Mediterranean fronts.[34]

GAF tactical developments during the third quarter saw just one innovation--the flying of captured B-17's in or near the formations of VIII Bomber Command. The use of B-17's by the Germans was first reported during the early part of July, and the reports caused considerable agitation in AAF Headquarters.[35] The German purposes in using the repaired B-17's that had crashed in enemy territory seem to have been to obtain performance data on Fortress formations, to confuse U. S. crewmen, and perhaps to transmit fire-control data to rocket-carrying and aerial-bombing aircraft. U. S. countermeasures included distinctive markings for each mission and orders to train guns on strange craft not properly identified as part of our forces.[36]

German fighters continued to make some use of air-to-air bombing during the second phase of the offensive, but this tactic was never developed to the point where it constituted a real threat to the day bombers.[37] As noted earlier, the Germans began the use of fighter-mounted rocket guns in April 1943. Apparently they were used throughout July, August, and September but not on a very extensive scale. The mission reports did not begin to identify positively the use of rockets until the latter part of the period under review, but there seems to be little

doubt that they were used before Bomber Command was completely aware of this enemy weapon. There were probably a dozen cases of rocket employment against the day bombers during the period July-September, and quite certainly there were some losses to this tactic. The first proved success of the weapon occurred on 28 July during the mission to Kassel and Oschersleben.[38]

In the heavy bomber battle with the German fighter force there was continual development of defensive techniques. That was perhaps the most important offensive measure adopted by the bombers--the increase in the size of attacking forces--also worked to the advantage of their defense. The Operational Research Section of VIII Bomber Command made a study of loss and damage suffered by heavy bombers during July-September and reached the conclusion that the amount of loss and damage suffered varied directly with the number of enemy fighters that were mounted. The concentration of a certain number of fighters by the enemy on a small force or the spreading out of the same number of his attacks in time and space against a large force caused approximately the same amount of damage to bombardment aircraft. The lesson for VIII Bomber Command from this study was clear--increase the size of the attacking force and lower the rate of loss, and at the same time, lessen the probability that any one plane or group would be successfully attacked.[39] It has been seen that the average number of heavy bombers dispatched on daylight missions was 388 during July and August and was increased to 633 for September.[40]

The increased forces of day bombers made possible the use of the diversion and the effective employment of the 'split target' technique.

In the course of the 10 daylight operations in July, approximately 75 different targets were hit, or nearly three per mission. The August record was not quite so high: eight operations days saw about 18 targets attacked. September, with 11 daylight operations, saw the day bombers attack about four targets per operation.[41] Strangely enough, however, the two best examples of the employment of the "split target" technique during the second phase were days of extremely high losses. On the anniversary mission of 17 August 1943, some 376 bombers were dispatched against the Schweinfurt ball-bearing plants and the Regensburg aircraft factory. At Schweinfurt, 183 actually attacked, while 176 bombed Regensburg. The losses for both raids totaled 60--16% of aircraft dispatched and 19.4% of the number attacking. On the 6th of September 407 bombers were dispatched and 323 actually bombed at least 10 different targets. Losses were 47 (45 missing in action and 2 battle salvage) or 11.5% of the number dispatched and 14.6% of the number attacking. These two operations (17 August and 6 September) were the most costly during the entire third quarter of 1943, both absolutely and in relation to the numbers dispatched. The chief explanations for the losses on the Schweinfurt-Regensburg mission probably were the importance of the targets and the depth of penetration; for the 6 September mission some of the loss seems to have been due to fuel shortage.[42]

The effective strength of the Eighth Air Force was augmented and the German fighter forces were spread still further by the use of B-26 medium bombers during the second phase of the bomber offensive. After a disastrous introduction to the European theater with low-level tactics

in May, the B-26's were removed from operations and transferred to VIII Air Support Command. After a period of training, during which the number of aircraft available was increased considerably, the mediums resumed operations on 16 July with an attack on the Abbeville marshalling yards.[43] The two-engine bombers were now employed at medium altitudes (10,000-12,000 feet) and generally had the benefit of fighter escort. They were used to attack near-by industrial targets and airfields and to run diversions for both the heavy and their own missions. There was always the closest coordination between medium and heavy attacks run on the same day in order that the maximum results in harassing enemy fighters might be obtained. Operations by medium bombers were on a small scale in July (233 sorties) but increased in size and importance in August (1,190 sorties) and September (3,033 sorties). In the latter month mediums dropped nearly three-fifths as great a weight of bombs as did the heavies.[44]

VIII Bomber Command continued to study and experiment with the problem of the formation. Formation flying was primarily a defensive tactic, but it had very important offensive implications, for the accuracy of bombing was very closely related to the type of formation flown during the bombing run. There was considerable criticism by AAF Headquarters of the Eighth's heavy formations during the second phase because of losses incurred and because of the poor accuracy attained on some missions.[45] General Arnold passed on to the Eighth Air Force an extensive report (including photographs by Hal Roach) from the School of Applied Tactics dealing with heavy formations, in an effort to improve both defense techniques and bombing patterns by the United Kingdom forces. The basic group

CONFIDENTIAL

formation used during the second phase continued to be the 18- to 21-plane combat box. This unit was kept intact during the bombing run and the way in which it was flown determined, in great measure, the bombing pattern achieved. Except on the bombing run, the combat wing, consisting of two or three combat boxes stacked together for mutual fire support, was still the defensive unit. It was the opinion of the Commanding General of the Eighth that the deficiencies in the defensive tactics of the heavy formations lay in the faulty techniques of the pilots rather than in improper planning or false conceptions of the theory of the formation.[48] There was constant emphasis on the fact that pilots arriving in the theater were not properly trained in formation flying, and efforts were made to supply this deficiency in the theater before crews were sent into combat.[49]

Although bombing accuracy is definitely an offensive characteristic of operations, it is so closely related to defensive problems, particularly to formation flying, that it is appropriate to discuss it at this point. There are more data available from the missions of the third quarter than from those of the second quarter of 1943, but the assessment of the bombing accuracy for any period in these early stages of the offensive is never entirely satisfactory. Many missions attacked targets of opportunity without pre-assigned aiming points, and often on these, as well as on more successful missions, photographic coverage was not at all satisfactory. All figures on bombing accuracy of VIII Bomber Command have to be considered very cautiously, for they are never based upon the whole effort of the command, but upon a fraction of it--necessarily upon the most successful fraction.

[redacted]

Examination of bombing accuracy by the three-month phases of the bomber offensive is not necessarily the most satisfactory approach. "The Statistical Summary of Eighth Air Force Operations" reports bombing accuracy by quarter years, but the best OR3 study on the subject for the 1943 operations uses somewhat different time intervals.[48] "The Statistical Summary" reports the "average percent of bombs which fell within 1000 ft. and 2000 ft. of pre-assigned MPI [Mean Point of Impact] on visual missions of good to fair visibility" for the third quarter of 1943 as follows:[49]

Within 1,000 feet			Within 2,000 feet		
1st Div.	3d Div.	8th AF	1st Div.	3d Div.	8th AF
13	19	16	31	48	38

The expression "pre-assigned MPI" is meaningless, and what is probably meant is the pre-assigned aiming point. Whatever the reference point, it would seem that day bombing accuracy was on the upgrade during the third quarter, for it will be recalled that but 12% of the bombs were reported within 1,000 feet of the MPI during the second quarter of 1943. Other evidence from OR3 studies also indicates improvement. The accuracy achieved by the entire air force and by divisions for each of the three months in the third quarter was reported as follows:[50]

Avg. % of Bombs Which Fell Within 1,000 and 2,000 Feet of Aiming Point

	1,000 feet			2,000 feet		
	July	Aug.	Sep.	July	Aug.	Sep.
8th Air Force	13.7	21.7	16.3	38.7	47.5	43.1
1st Bomb Div.	8.9	20.9	13.4	29.6	41.3	33.5
3d Bomb Div.	20.9	22.5	18.9	36.0	54.5	51.0
2d Bomb Div.			4.4			21.5

The reason for no report on the 3d Division in both July and August was the absence of most of the aircraft of that organization from the United Kingdom during these two months. The reason for the smaller figures in the September column for 1st and 3d Divisions and for the entire air force is probably to be found in the nature of the operations for that month--during the first nine days of which sorties were flown in connection with CADILLAC (presently to be discussed), several missions were carried out in heavy cloud conditions, and several missions were devoted to targets at the request of the Admiralty.[31] A monthly average of the accuracies given in the table immediately above will not give the true figure for the quarter unless the figures for the months are weighted in proportion to the relative value of operations. Despite limited data it seems reasonable to conclude that Eighth Air Force accuracy, while improving during the second phase of the bomber offensive, was not outstanding. As a matter of fact, according to General Arnold's grading standards, Eighth Air Force bombing was poor. During August Headquarters AAF sent a grading system to all air force commanders for the purpose of standardizing reporting of bombing results. Certain adjectives were designated to go with certain percentages of bombs within 1,000 feet of designated aiming points:

50% or more	excellent
40%	good
30%	fair
20%	poor
15%	unsatisfactory

General Eaker thought that such a scale might be satisfactory for peacetime training, but not good for wartime measurement because it did not take into account the destruction of the target, the amount of enemy opposition,

or the prevailing weather conditions.[52]

Loss and damage figures already examined have indicated something about the severity of enemy opposition to the daylight attack. The other side of the picture, seen in claims of enemy aircraft destroyed and damaged, is a measure of the ability of the bombardment aircraft to defend themselves.[53] The heavy bombers claimed the destruction of 549 enemy aircraft in July, 440 in August, and 273 in September. Medium bomber claims for the same months were 3, 4, and 13 respectively. Thus the total number of enemy aircraft destroyed by day bombers during the second phase was 1,278, if the claims represented the true results of the air battle. An additional 206 were reported as probably destroyed and 673 as damaged during the three months of operations.[54] It is very difficult to assess these claims accurately. They were recorded only after very rigid examination which attempted to eliminate all duplications. There is no fault to find with the standards set up for the various categories of combat claims, yet it seems that the toll of enemy aircraft claimed by the bombers might have been greater than the actual waste experienced by the German Air Force.[55]

One of the difficulties involved in accepting claims of the Eighth's heavy bombers is the constant criticism of the combat-crew gunnery. One example, typical of many, is worth citing. The Commanding General of the European Theater of Operations on 3 July 1943, reported to General Arnold: "Your bombardiers can do their job with a high degree of proficiency, but your gunners need training and more training, particularly at high altitudes. It is the most important existing deficiency."[56]

The British Air Ministry estimates of German wastage (total combat and noncombat losses) were generally considerably short of Eighth Air Force claims of enemy aircraft destroyed. These estimates were made upon the basis of combat sorties by the RAF during a given period, and losses for different types of aircraft were computed on the basis of British experience with comparable types. In the following table British Air Ministry wastage figures, together with VIII Bomber Command claims (medium bomber included) of enemy aircraft destroyed, and total claims by both the Eighth and the RAF for July, August, and September on the Western front are shown in parallel columns:[57]

	Western Front		
	RAF Net Wastage	VIII BC Claims (H & MB)	Total RAF and 8 AF Claims
July	313	445	685
August	305	441	773
September	328	286	494

The following quotation from an OSS study presents an excellent statement of the problem:[58]

> The wide divergence between claims and Air Ministry wastage and the failure of the RAF to use claims in any way in computing wastage, implies that the Air Ministry believes claims to be worthless. This is disconcerting in view of the care with which it is reported that fliers' claims are scrutinized. Aircraft claimed to be destroyed are recorded according to time, altitude, distance, and angle, and checked against the time, altitude, distance, and angle of planes claimed by other gunners. If there is even roughly coincidence of two or more claims, only one is allowed . . . . Because the chances of inflation of claims is so obvious, it is said that those responsible for evaluation of gunners' reports lean backwards in an attempt to be conservative. Furthermore, no planes are credited to lost aircraft. When as many as sixty bombers fail to return from a single mission, and are presumably those entering the heaviest defenses, it is would seem to provide a more than adequate margin against overstatement.

> Captured records of GAF squadrons reveal that the volume of non-combat losses is frequently as high as or higher than the volume of combat losses, and this is broadly confirmed by Allied experience. Thus, even if gunners' claims are discounted by 50 percent, the implied total loss figure is still well above the Air Ministry's estimate.

A complete and accurate account of the matter will probably have to wait for a careful analysis of GAF operational records.

The defensive power of the heavy bombers was great, but the opposition of the fighter forces of the enemy was so determined and his rocket guns were so menacing that it was well known that the only solution of the defensive problem lay in the development of fighter escort all the way to the target. The urgency of the matter was great during the second phase of the bomber offensive, and it can be understood even more easily from the words of Air Force leaders than from the statistics of operations. A memorandum drawn up on 1 July by Maj. Gen. B. M. Giles for General Arnold said, "The 8th Air Force now has insufficient fighters to conduct escort for the strategic bombers and counter-antiaircraft artillery operations. A minimum of one fighter group to two heavy bomber groups for escort must be established in the UK at the earliest possible date."[59] At that time the ratio of fighter groups to heavy groups was less than 1 to 4.[60] After a visit to the Eighth Air Force in England, Maj. D. J. Munson of the AAF Proving Ground Command reported in August to the Assistant Chief of Air Staff, Operations, Commitments, and Requirements: "The only real answer to protection against enemy air-to-air bombing and rockets is fighter protection. The fighters must be able to accompany our bomber formations on the entire mission if they are to render

efficient protection.[81] The same idea was stated by General Anderson, the commander of VIII Bomber Command: "It is obvious that the ideal fighter protection is that which can accompany the bombers from enemy territory to target. Failing that, the greater the escorted penetration the better.[82] Again in September General Anderson said: ". . . the most likely solution for the problem of long range, high caliber gun fire, as well as rocket projectiles from enemy fighters, is the extension and improvement of fighter escort.[83]

Toward the end of September the need became so strong that General Arnold wrote to Air Chief Marshal Portal, "The increasingly strong enemy fighter opposition to the Army Air Forces bomber offensive over continental Europe requires an immediate strengthening of our fighter escort forces." The Commanding General of the AAF thought the need was so great that he requested that the RAF place certain Mosquito squadrons under the control of the Eighth Air Force and release some of the same type to AAF fighter squadrons.[84]

Other evidence of the desperate need for solution of the escort problem is to be found in a suggestion from AAF Headquarters at the beginning of the second phase that some of the B-29's be used as escort destroyers for the heavy bombers,[85] and by the continued efforts to make something of the YB-40 after its disappointing showing during the second quarter of 1943. As to the suggestion that B-29's be used for escort, someone made the obvious reply with the query as to what should then be used to escort the Superfortresses. Although a few B-29's took part in eight of the July missions, and although some additional work was done on the program in the United States, the theater air force was more than glad

to receive bombardment airplanes instead of additional YB-40's and to convert those on hand to training uses.[66]

The account of the development of the fighter escort during the first phase has called attention to the facts that VIII Fighter Command had successfully introduced the P-47 Thunderbolt into the European theater, that it had begun the escort of heavy bombers within very limited ranges, and that it had made progress in solving the problem of range extension by experimentation with various kinds of expendable tanks. The work on the droppable tank was probably the most important development in the history of VIII Fighter Command during the third quarter of 1943, and was one of the most important single developments in the history of the whole Eighth Air Force.

It has been noted that the first droppable tanks to be used with the Thunderbolt were paper ferry tanks of 90-gallon capacity. These were employed on the 28 and 29 July escort operations and on some missions in August. Since the supply in the theater was small it did not last long. No efforts were made to procure more of these tanks, for they were not capable of pressurization and had to be dropped at about 7,000 feet because fuel could not be extracted above that altitude. These tanks would give the P-47 a range of about 225 miles if dropped as soon as the plane had climbed to the critical altitude, and a little above 300 miles if the climb to altitude were delayed until the fuel capacity of the tanks had been fully utilized.[67]

A 108-gallon paper tank was designed by the British for VIII Fighter Command and initial small scale deliveries were made in July.[68] This

tank was capable of pressurization and promised to be quite satisfactory in extending the radius of action of the P-47 to about 300 miles.[69] British agencies at first were asked to take care of all Fighter Command requirements for expendable tanks after the end of September, but this proved to be impossible, and the problem was solved only by demanding a considerable percentage on U. S. production. Some steel tanks of 100 and 150-gallon capacity were also manufactured in the United Kingdom. An effort to expand the capacity of the 108-gallon paper tank to 150 gallons proved unsatisfactory from an aerodynamic standpoint.[70]

Besides the limited number of 300-gallon paper tanks and tanks of British manufacture, Fighter Command used regular 75 and 150-gallon ferry tanks. These required a considerable quantity of expendable plumbing in order to make possible the withdrawal of fuel during flight, and supplies for this purpose were obtained from the United States. The small tanks were suspended from both fuselage and wings. Shackles for this purpose presented a troublesome difficulty. Even and the whole droppable tank problem was not worked out until the last quarter of 1943. However, by the end of the year there were between 2,000 and 3,000 jettisonable tanks available at each of the eighth's fighter stations, and approximately 1,100 at each fighter station of the tactical air force.[71]

While the P-47 was an excellent airplane for escorting bombers to the extent of its limited range, it had certain other deficiencies for work in the European theater. Its acceleration and rate of climb were poor, and it could not compete on even terms with the best enemy fighters below 25,000 feet. To improve acceleration and rate of climb considerable

experimental work was performed during the second phase on a new paddle propeller and a water injection system designed to give the Thunderbolt more emergency power. Even with these improvements it was felt that the European theater demanded more than one type fighter for the varied tasks that had to be performed. Even with drop tanks the P-47 did not have the range desired for the deepest penetrations. To supplement the Republic fighter the Eighth Air Force wanted both the P-38 and P-51, especially the latter--because of both its range and its performance characteristics at medium altitudes.[72] But the state of aircraft production did not permit the Eighth any fighters except the P-47 for second-phase operations. There were, it is true, two P-38-equipped groups in the United Kingdom by 15 September (20th and 55th), but it was 15 October before one of them (the 55th) was placed on operations. VIII Fighter Command had only six operational groups by the end of the second phase. The ratio of fighter groups to heavy bombardment groups was about 1:3.5 at the time.[73]

VIII Fighter Command became independent of RAF operational control on 30 June 1943, at which time all groups were placed under the operational control of the 65th Fighter Wing. VIII Fighter Command grew during the third quarter of 1943 from an average effective strength of 171 for July to 374 for September,[74] but in contrast to VIII Bomber Command, it found its effective strength limited by aircraft rather than crews.[75]

Although none of the heavy-bomber escort work was performed by the RAF (support for medium bombers was practically all furnished by the RAF), the U. S. P-47's took over the major share of this task. Thunderbolts

executed several indecisive forays into the Continent, but most of their second-phase work was in heavy bomber support: but of the July sorties, 6[illegible] of August sorties, and 6[illegible] of September sorties were flown on such missions.[76]

The testimony of VIII Bomber Command leaders makes very clear the reward that was felt for the escort that was furnished. It enabled more planes to get to the target, it allowed greater accuracy on the bombing run, and it brought more heavies back. An OKW study of second-phase operations showed that loss and damage from enemy aircraft was about four times as great on unescorted missions as when escort was all the way to the target. During July, August, and September 8th Fighters flew some 7,751 sorties on 81 operational days, claimed 186 enemy aircraft destroyed, 13 probably destroyed, and 61 damaged, at a cost of 35 P-47's missing in action.[77]

Pattern of Bomb-Dropping Operations

The major portion (7[illegible]) of the bomb tonnage dropped during the second three months of the CBO fell on targets in occupied countries. Germany received only about 27 of the total tonnage of both heavy and medium bombers and coordinately 73 of that dropped by heavies alone. Targets in France were objectives for nearly 63 of third-quarter tonnage (both heavies and mediums) and the remainder fell on Belgian, Dutch, and Norwegian targets, and on enemy shipping. During July, Germany received slightly more than half (51[illegible]) of Eighth Air Force bombs, in August less than one-third, but in September only 14.7 . The heavy weight of bombs falling in France during the second phase is accounted for by the large number of raids made on airfields, especially by the medium bombers.[78]

Although the weight of bombs dropped during the second phase of the bomber offensive was considerably greater than that of the first phase, the second-phase effort showed less tendency to keep to the target pattern that had been prescribed by the CBO Plan. As facilities supporting the German fighter force still constituted first priority for the Eighth, 43% of the tonnage dropped by the heavies was used against aircraft targets. Only 7.5% fell on aircraft construction facilities, for German repair and storage depots received slightly more than 10% and airfields received about 25% of heavy bomber tonnage. A major fraction of the medium bomber effort was directed against the latter type of target. Submarine yards and bases (second-priority target system) received 8.[illegible]% of heavy bomb tonnage during July, August, and September, and port facilities nearly [illegible]%. Ball bearings accounted for 4.9%, coastal defenses and other military installations 4%, light metals [illegible].1%, oil 1.[illegible]%, and rubber 1.[illegible]%. Transportation, general industrial areas, and targets of opportunity received nearly 1[illegible]% of the tonnage dropped by the heavy bombers.[79]

Bombs used during the second phase were principally of the 500-pound high-explosive type, but something more than 1,[illegible]0 tons of incendiaries were used during the period. The Eighth began to employ fragmentation bombs on airfields in August, dropping about 81 tons in that month and [illegible]33 tons in September.[80]

Aircraft Facilities. The most important strategic attacks during the second phase were those delivered between 2[illegible] July and 18 August on

German fighter production. These attacks were made on five operational days against seven separate targets, all lying deep inside Germany, as follows:[1]

Date	Place	Factory	AC Attacking
23 July	Kassel--Fieseler Flugzeugbau (FW-190)		49 B-17
28 July	Oschersleben--Ago Flugzeugwerke (FW-190)		28 B-17
29 July	Warnemunde--Ernst Heinkel Flugzeugwerke (FW-190)		64 B-17
30 July	Kassel--Fieseler Flugzeugbau (Bettenhausen) (FW-190)		34 B-17
30 July	Kassel--Fieseler Flugzeugbau (Waldau) (FW-190)		57 B-17
14 Aug.	Wiener Neustadt--Steyer Arado (Me-109)		61 B-24
17 Aug.	Regensburg--Messerschmitt AG (Me-109)		130 B-17

The 28 July raids on the Focke-Wulf factories at Kassel (components) and Oschersleben (assembly) were made in very difficult weather conditions which cut the size of the attacking forces badly. The bombing at Kassel was not very accurate, for a considerable portion of the bombs (60 tons of high explosive and 81 tons incendiaries) fell south of the aircraft factory and covered an important textile factory and several other plants. Bombing at Oschersleben by the very small attacking force seems to have been more accurate than at Kassel. These missions of 28 July constitute one of the landmarks in United States Air Force history, for this was the first time P-47's employed belly tanks in escort work. The fighters did not go all the way to the targets (Kassel was 300 miles from coast and Oschersleben at 400 miles was the deepest penetration made by heavy bombers at the time), but the bombers returning from Kassel were picked up by another force of fighters in the vicinity of Cleve on the German border. The 30th of July was also the first day on which heavy bombers were lost to enemy rocket fire.[2]

The Ernest Heinkel factory at Warnemunde, thought to produce about 25% of all He-177's, was hit on the 28th. Next day the Rottenhausen Fieseler Flugzeugbau (components) in the Kassel area was hit for the second time, and a Focke-Wulf assembly plant near-by (Waldau) was bombed by a small force of 37 B-17's. Expendable tanks were again employed by the P-47's which furnished withdrawal support for this 30 July mission.[83]

The two August raids on German fighter production involved very-long-range missions, one by the B-24's on loan to the Mediterranean theater against Wiener Neustadt on the 14th, and the other against the Messerschmitt factory at Regensburg on the 17th. The Messerschmitt factory at Regensburg was a very important unit, for it currently turned out 30% of all Me-109 production. This Regensburg operation was part of the first anniversary mission of the Eighth Air Force (the other part went to Schweinfurt), and was the first occasion of shuttle bombing from the United Kingdom. After the attack, which was reported as excellent, the heavy bombers went on to bases in North Africa. This deepest penetration cost 24 heavy bombers to very vicious opposition, which crews reported was continuous from Antwerp to the Alps.[84]

These daylight attacks on aircraft factories were given credit for cutting down German single-engine fighter production from slightly above 600 in July to about 475 for September. Without these raids it was estimated that single-engine production would have been approximately 900 aircraft in September. They constituted a severe blow against the highest priority item in the GAF production program and were bitterly resisted.[85]

The German Air Force utilized a number of facilities in occupied countries for repair of damaged aircraft and for storage of reserves.

There were about eight such major facilities in France and Belgium and a very large number of secondary importance located in these two countries and in Holland. Several of these, as the following table indicates, were second-phase targets for the Eighth Air Force in its war on the GAF:

Date	Place	Target	A/C	Attacking	Tons
4 July	Le Mans	Gnome and Rhone Aero Engine Works	103	B-17	254.5
4 July	Nantes	SNCA de L'Ouest	58	B-17	145.00
14 July	Paris	Le Bourget	52	B-17	122.85
14 July	Villacoublay	SNCA du Nord	96	B-17	202.5
16 Aug.	Paris	Le Bourget	168	B-17	397.35
24 Aug.	Villacoublay	SNCA du Nord	86	B-17	257.20
24 Aug.	Bordeaux	SNCA du Sud Ouest	57	B-17	141.75
3 Sep.	Romilly-sur-Seine		100	B-17	294.25
3 Sep.	Meulan-les-Mureaux		38	B-17	113.5
3 Sep.	Paris	Soc. Caudron Renault	20	B-17	60.0
7 Sep.	Brussels	Evere Repair Depot	104	B-17	310.75
9 Sep.	Paris	Soc. Caudron Renault	20	B-17	58.0
15 Sep.	Paris	Soc. Caudron Renault	40	B-17	118.75
15 Sep.	Paris	Hispano-Suiza Bois Colombes	78	B-17	229.0
15 Sep.	Romilly-sur-Seine		87	B-17	235.5

Of the facilities listed as targets in the above table, Romilly-sur-Seine, Villacoublay, Le Bourget, and Brussels-Evere were rated as major repair depots. Of the attacks, two are particularly worthy of attention: the 16 August raid on Le Bourget in Paris because of its size and because it was escorted all the way to target by P-47's using drop tanks; and the 24 August attack on Bordeaux because it was a shuttle mission performed by bombers on the way from North Africa to English bases.[86]

It is not possible to state quantitatively the effect on the GAF of the bombing of storage and repair facilities. Such raids destroyed stored aircraft, lengthened the repair time, and lessened enemy air force mobility. Repair facilities constituted reasonably profitable targets at relatively short distances from United Kingdom bases.[87]

In the attack on the German Air Force the VIII Bomber Command and VIII Air Support Command (medium bombers) made a total many raids on the airfields in occupied countries. It has already been noticed that approximately 80% of the tonnage dropped by the heavy bombers was directed at airfields. A much greater fraction of the medium effort was delivered to like targets. The reasons for the heavy attention to airfields were that such targets were frequently seen when weather did not permit the heavy bombers to go to Germany, the main were within reach of the medium bombers, and airdrome attacks increased the attrition of the German air fighter force and reduced its mobility.[68]

Submarine Yards, Bases, and Port Facilities. There were two attacks on submarine bases and four on building yards during July:[69]

Date	Target	A/C Attacking	Tons of Bombs
4 July	La Pallice	71 B-17	137.5
24 July	Trondheim	41 B-17	81.0
25 July	Kiel	69 B-17	113.0
26 July	Kiel	67 B-17	163.3
28 July	Wilhelmshaven	52 B-17	128.2
29 July	Kiel	91 B-17	207.9

La Pallice, according to the Key of Victory, was one of three targets struck by VIII Bomber Command on the 4th of July. The other submarine bases attacked in the month of July involved a 1,500-mile round trip to Trondheim, Norway. The attacking force on this mission, though small, achieved good results.[70]

The Army Air attacked on two successive days in close coordination with the RAF, which managed in each instance to completely destroy Germany's greatest port in the period between 24 July and 3 August. The precision targets for the Eighth's heavy threat were the Blohm und Voss building

yards on 25 July and the Howaldtswerke on the 28th, but the bombs apparently damaged a number of other plants as well.[91]

The building yards at Kiel were also subjected to two attacks during the last week in July. On the 28th the Deutsche Werke and Kriegsmarine werft were the targets, and on the 30th a somewhat larger force hit the Howaldtswerke and the Deutsche Werke a second time. The B-17's at Kiel dropped propaganda as well as bombs, for some 767,000 U. S. 6-8 leaflets were released over the city.[92]

The great improvement in the submarine situation after July prompted the British Admiralty to agree that the 8th should shift its attention to more decisive targets. No raids against submarine installations were made during August, but B-26 medium did attack Le Trait shipbuilding yards with a small force (23 bombed) on the 4th of the month.[93]

There were six September raids on submarine bases and port facilities:[94]

Date	Place	A/C attacking	Tons
11 Sep.	Le Trait Shipyards	15 B-26	37
16 Sep.	Nantes Port Area	73 B-17	238.6
18 Sep.	La Pallice	72 B-17	179.3
23 Sep. (a.m.)	Nantes Port Area	43 B-17	134.3
23 Sep. (p.m.)	" " "	61 B-17	174.0
27 Sep.	Emden	178 B-17	505.5

Port installations and shipping at Nantes were considerably damaged by the three raids during the last half of September. This French west-coast town, located close to the mouth of the Loire, was the principal target for both the morning and afternoon missions that were run on 23 September.[95]

The Emden mission on 27 September was an outstanding event in the history of daylight bombing, for it marked the first use of H2S blind-bombing equipment* by day bombers in the European theater. Three pathfinder airplanes led two air task forces to the port city which was covered by 9/10 cloud and a smoke screen. The target was designated by the dropping of British marker bombs, fused to start burning when 1,500 feet below the airplane and designed to burn for four minutes and drop 500 feet per minute. The first air task force composed of three combat wings was led by two pathfinder airplanes. The first combat wing bombed on the pathfinder marker bomb release, the second bombed on the markers, but the third could not see the markers and bombed targets of opportunity. The second air task force, also composed of three combat wings, was led by one pathfinder B-17. The first wing in this force dropped with the pathfinder, the second wing found a break in the cloud and bombed visually, and the third could not see the markers and bombed targets of opportunity.[56]

The Emden mission is noteworthy for another reason: it was the first attack in Germany for which P-47's provided cover all the way. Emden was chosen for the first test of the blind-bombing technique by day bombers because its position on the coast made it suitable for location by H2S, because this port had assumed increased importance for the enemy after the July destruction of Hamburg by the RAF, because Emden was an important submarine assembly point, and because Emden provided a true precision target less than one-half mile in diameter. The results of this first blind-bombing raid were doubtful, for assessment by photographic

* For a discussion of the development of this technique, see Chapter IV below.

reconnaissance was not obtained until after a second attack was made on 8 October.[97]

The reaction of AAF Headquarters to the Ploesti mission is interesting. In a message to General Eaker, combining congratulation with exhortation, General Arnold declared this use of the Pathfinder force against a distant, cloud-covered objective and the long-range escort provided by the P-47's constituted another stride toward winning the air war. He questioned, however, whether the Eighth was using pathfinders on a sufficiently large scale, and expressed a desire to see a whole series of raids on a scale even larger than the Ploesti mission of 1 August that would so thoroughly smash German airplane factories that the enemy would find it easier to build new ones than to repair the damage. In conclusion, he urged: "Let's get on with the war in a bigger and better way."[98]

There is slight point in attempting to assess the effects on the bombardment of submarine yards and bases during the second phase of the bomber offensive. Other methods of dealing with the undersea craft had been far more effective. The Atlantic fleet of U-boats reached a very low point in October 1943, not because of strategic bombardment but because of losses inflicted at sea and the withdrawal of submarines from sea duty for major repairs and addition to their anti-aircraft armament.[99]

Aircraft Industries. The only significant attack on the German aircraft industry during the second phase was the now-famous deep penetration (650 miles from bases) to Schweinfurt on 17 August 1943, the date of the first anniversary of Eighth Air Force operations. The 17th of August also saw the equally well-known subsequent attack on the single-

engine fighter industry. At Schweinfurt there were three plants responsible for nearly half of all Western Axis production of ball and roller bearings and for approximately three-fourths of all those bearings used by the German military machine. The strength of the attacks on the three plants were:[100]

Plant	A/C Attacking	Bombs Dropped	A/C Missing in Action
Kugelfischer	84	113	9
VKF No. 1	78	165	4
VKF No. 2	61	127.2	23
Schweinfurt Totals	183	405.2	36

The Bomber Command narrative of operations recorded the Schweinfurt bombing results as "very good." The AAF intelligence assessment estimated that the raid cost the Fischer plant a loss equivalent to about 11 days' output and the VKF (Vereinigte Kugellager Fabriken) plants 4 3/4 days' output.[101]

The German reaction to the mission was strong and vicious. Over 300 enemy aircraft were encountered by the bombers. Escort was provided by P-47's as far as Liege, and the bombers were picked up at that same place on return by Thunderbolts which subsequently were relieved by RAF Spitfires. Fighter attacks were severe and costly to both sides. U. S. bombers claimed 186 destroyed, 18 probables, and 43 damaged. The escorting P-47's claims were 33-4-3, and the Spits claimed 1. U. S. bomber losses were very unevenly distributed. The smallest force (51) attacking the VKF No. 2 plant lost 23 of the planes bombing. The 91st Group, which lost but 2 planes over the target, lost all of these in addition to 1 lost before reaching the target, and the 381st Group lost 11 of 13

attacking planes. Besides the 30 heavy bombers that were lost in action, 3 were said to be salvaged, and 32 others were severely damaged.[102]

Another raid on ball bearings was made on 15 September when the SKF Ball Bearing Works at Furth was hit at the same time as the Eisemann-Gulcher repair plant. As noted above, 78 B-17's dropped 333 tons of bombs, but it is not possible to tell what fraction was devoted to the bearing works.[103]

Oil. The B-24's on loan from the Eighth participated with other bombers in the Mediterranean theater in the 1 August raid on the oil refineries located in the Ploesti region of Rumania. It was estimated that this raid damaged the Rumanian refineries to such an extent that the total crude refining capacity was reduced from 9,230,000 tons to 6,310,000 tons annually. This destruction of 3,075,000 tons of refining capacity removed the excess in that region and left capacity approximately equal to crude production. This operation met the condition laid down in the OAD Plan for successful attack on other Axis oil production.[104]

The Eighth dispatched a heavy mission to attack synthetic oil production at Gelsenkirchen in the Ruhr on 12 August, but heavy cloud and very effective smoke screen prevented all but two bombs from bombing the objective. The operational narrative reported that results could not be observed, but accurately they were not great.[105]

Miscellaneous Enemy Operations. Six B-17 attacks were made during the second phase on facilities contained in two other OAD target systems. On 28 July two planes of the Continental Motor (Hannover), producer

of a large fraction of German aircraft tires, were attacked by 91 B-17's carrying 214 tons of bombs. The tire plant and surrounding installations were badly damaged. It was estimated that this raid cost the Germans 25,000 aircraft tires and 90,000 for other vehicles.[106] The Renault Motor Vehicle Armament Works at Paris (Billancourt) was hit by a small force (21 B-17's) on 15 September with excellent results reported.[107]

One of the most remarkable of the Eighth's second-phase missions was the 24 July raid on a newly constructed magnesium, aluminum, and nitrate works at Heroya, 70 miles southwest of Oslo, Norway. The "Bi-Monthly Report of Bombing Results" reported tremendous destruction "among installations vital in the operations of the works," but more remarkable was the execution of the large-scale mission in very difficult weather conditions. Some 324 heavy bombers made practically blind take-offs, climbed through solid overcast, and assembled over splasher beacons. All but 15 of those taking off made the rendezvous on time and, with superb navigation, arrived over their appointed distant targets. In addition to the 167 B-17's which dropped 414.3 tons of bombs at Heroya, 41 bombed the submarine base at Trondheim, and a third force, finding its target cloud-covered, returned to base with its bombs. Many of these planes made a round trip of 1,900 miles, yet only one failed to return. The Norwegian mission was executed because of the importance of the targets and because weather over Europe did not permit a mission to Germany that day, but primarily to encourage a dispersion of German fighter defenses.[108]

Marshalling yards were targets for a dozen medium missions and one heavy attack during July, August, and September. The initial B-26 operation at medium altitude was against the Abbeville/Marshalling yards on

16 July, and this target was attacked a second time by the 36's on 15 August. Other railroad targets for the mediums, hit as a part of the STARKEY exercise, included Lille (2 raids), Courtrai (2), St. Pol (3), Ghent, Rouen, Amiens, and Serqueux. Fifty-one B-17's hit the Offenburg yards on 6 September. Two or three other times during the period very small numbers of heavies dropped bombs on railroad targets when primary objectives could not be located.[109]

Other miscellaneous targets for B-26's included coking plants, an ammonia plant, power stations, and ammunition dumps. Heavy bombers made many raids on the Ruhr industrial area and on other German cities as targets of opportunity when first-choice objectives could not be located. Enemy convoys were attacked at least once in July and three times in September.[110]

Operation STARKEY

STARKEY was the code name for a combined operation designed to deceive the enemy and to give Allied forces experience for later operations. Troops and vehicles were actually loaded into assault craft and naval vessels were maneuvered to simulate a landing on the French coast in the Calais region. The air aims of the operation were to compel the GAF to fight battles of attrition at times and places advantageous to Allied air forces with the objects of destroying the maximum number of enemy aircraft both in the air and on the ground and of building up sufficient air superiority over the Luftwaffe to facilitate subsequent operations against the Continent.[111]

The air targets for STARKEY were in two main classes: prearranged targets such as airfields, marshalling yards, industrial targets, ammunition dumps, oil stores, beach defenses, gun emplacements, and roads; and second, targets of opportunity such as troop concentrations, mobile headquarters, shipping, and emergency airfields.

The operation was executed in three phases: a preliminary phase from 16 to 24 August, a preparatory phase from 25 August to 8 September, and a culmination phase on 8 and 9 September. D-day was originally scheduled for 8 September, but had to be postponed to the 9th because of weather. During the preliminary phase air operations were directed almost entirely against enemy airfields. During the first part of the preparatory phase (to 3 September) intensive attacks on airfields were continued; and from 4 to 8 September the attack was shifted to marshalling yards. In the final days there were heavy attacks on the beach defenses, large gun emplacements, and airfields.[112]

The attacks on the beach defenses and special construction sites in the coastal region during this exercise were forerunners of many such raids which aircraft based in the United Kingdom were to make in an attempt to neutralize enemy preparations for launching new weapons against the British Isles. The principal STARKEY missions against beach defenses and construction sites were:[113]

27 Aug.	Watten	186 B-17	369 tons
30 Aug.	Watten	34 B-26	49
7 Sep.	Watten	58 B-17	116
8 Sep.	Boulogne	68 B-26	100
9 Sep.	Boulogne	202 B-26	336

Eighth Air Force participation in SHAEF involved the Bomber Command, Fighter Command, and Air Support Command.[114]

	Sorties			
	Preliminary	Preparatory	Final	Total
VIII Air Support Command--Bombers	554	1,196	231	2,031
Fighters	---	16	21	37
VIII Fighter Command	513	975	308	1,796
VIII Bomber Command	505	1,001	335	1,841

All participating forces claimed 341 enemy aircraft destroyed, 69 probably destroyed, and 163 damaged.

The anticipated large-scale air battle with the GAF did not materialize. Operations were greatly impeded by weather, but the Germans did not react as if they thought a Channel landing was imminent. Some air reinforcements were sent into the area, but the enemy air activity was quite reserved. Aerial reconnaissance was neglected. The chief concern of the German fighters seemed to be the prevention of deep penetrations by the heavy bombers. It was quite evident that the enemy was at no time deceived into thinking that a serious invasion landing was intended.[115]

Night Operations of the Eighth Air Force

Six times during September small numbers of specially equipped heavy bombers belonging to the 422d Squadron of the 305th Bombardment Group (H) participated in night operations with RAF aircraft. The first of these was on the night of 8 September, just prior to D-day in the SHAEF exercise. The targets for this first night mission were coastal defenses in the Boulogne area. Targets for other missions were the Montlucon

Dunlop tire factory (night of 15-16 Sept.), Modane marshalling yards (16-17), Hannover (22-23 and 27-28), and Mannheim ([illegible]). A total of [illegible]0 B-17's were dispatched on night missions, and all but two of the dispatched aircraft actually completed the planned attacks.[116]

RAF Bomber Command Operations

RAF Bomber Command dispatched 17,502 night bombing sorties and dropped 54,701 tons of bombs during the third quarter of 1943. About 55% of the RAF effort was devoted to German targets, and the remainder was divided between Italy and France. Slightly more than half (51.6%) of the night bomber tonnage was dropped on light industry, nearly one-fifth (19.7%) on ports and submarine yards, and approximately 11% on heavy industry. Rubber (4.6%), railroads (3.6%), chemicals (3.6%), and various miscellaneous targets (6.6%) absorbed the balance.[117]

The destruction of the great port of Hamburg was quickly accomplished by four large-scale RAF missions, assisted by the two much smaller ones run by the Eighth Air Force on 25 and 26 July which have already been recounted. The night attacks on Hamburg occurred during the last week in July and the first week of August:[118]

Date	A/C Attacking	Long Tons	A/C Missing
24-25 July	740	2,337	12
27-28 July	739	2,417	17
29-30 July	726	2,382	28
2-3 August	425	1,486	30
	2,630	8,622	87

Germany's greatest maritime city was a commercial center and was also quite important in the ship and submarine building industries.

photographic reconnaissance showed that 74% (6,300 out of 8,350 acres) of the built-up area of the city was heavily damaged by the great weight of bombs that it received.[119]

The RAF attack on Ruhr and Rhineland industry begun during the second quarter of 1943 was continued throughout July, August, and September. The aims were to complete the destruction of industry in this region, to prevent the removal of defenses to other threatened areas, and to discourage attempts at reconstruction. Cologne was hit twice (3-4 and 8-9 July), and the Krupp works at Essen were badly damaged by an outstanding attack on the night of 25-26 July.

Aachen, on the night of 13 July, and Remscheid, on 30-31 July, were thought to be virtually wiped out by single attacks. Somewhat less complete destruction was wrought at the textile center of Munchen Gladbach on 30-31 August, and less satisfactory damage was done to Gelsenkirchen (9-10 July), Leverkusen (2 -23 August), and Bochum (29-30 September).[120]

Three raids on Berlin in August and September were quite costly (8.9% of attacking aircraft lost) but caused extensive physical damage and were thought to be even more damaging to German morale:[121]

Date	A/C Attacking	Tons	A/C Missing
23-24 August	625	1,773.1	57
31 Aug.-1 Sep.	613	1,[illegible]47.0	47
3-4 Sep.	[illegible]	[illegible]	22
	1,453	4,219.4	126

Mannheim, in southwestern Germany, was attacked once in August (9-10) and twice in September. The raid of 5-6 September was made in excellent weather and was considered highly successful. Four nights

Air Force B-17's participated in the mission of 26-27 September to this important transportation center.[122]

Nuernberg was attacked twice in August (10-11 and 27-28) by large forces which did some damage to housing and industry. Munich railroad communications received considerable damage from a raid on the night of 4-5 September.

Fairly heavy destruction of manufacturing buildings and living quarters was achieved in the 17-18 August mission to the experimental station at Peenemünde northwest of Stettin on the Baltic coast. The attack was made in full moon conditions, and the RAF inflicted heavy losses (40 aircraft of 571 attacking) on night fighters brought up from Berlin and the Ruhr to intercept the bombers on the return trip.[123]

The relatively ineffective missions were those in September (27-28 and 27-28) against Hannover in north central Germany. U. S. B-17's participated in each of these missions.

Outside Germany, the RAF attacked targets at Turin, Leghorn, Milan, and Genoa in Italy during July and August. Great damage was done to the transportation system in Milan and to one of the Fiat works in Turin.

Three small-scale raids were made on French targets during July and August and three of larger proportions in September. U. S. aircraft participated in the all but one of the September missions. The first of these (6-8) was against coastal defenses in the Boulogne area in connection with DRAGOON, the second (15-16) severely damaged the Dunlop tire factory at Montluçon in central France, and the other (16-17) was designed to block the northern end of the Mont Cenis tunnel at Modane and thus hinder the flow of supplies to German armies in Italy.[124]

Chapter IV

THE THIRD PHASE OF THE COMBINED BOMBER OFFENSIVE, OCTOBER-DECEMBER 1943

Organizational Developments

The third phase of the combined bomber offensive was coincident with the fourth quarter of 1943. This three-month period saw some very important decisions affecting not only strategic bombing but the whole course of the war in the European theater. The build-up plan for the United States air forces in England was completed and approved by the War Department, and the Ninth Air Force assumed its separate role in the United Kingdom. A new strategic air force was set up in the Mediterranean theater, a directive was issued for the Allied Expeditionary Air Forces' support of the planned Continental invasion, and a whole new slate of commanders was selected for many important roles in the European air drama.

The preceding chapter gave some attention to the difficulties experienced in working out the build-up and organizational problems in the most economical manner possible. The inability of the Army Air Forces to train on time the variety of special units required by the Eighth Air Force had been the cause of the basic decision to send a considerable portion of the air force troop strength to the theater as fillers rather than as units. It has been seen that this important decision necessitated the sending of a new commission from Washington to the theater to rework the organizational setup, the flow schedule for units and fillers, and

the troop basis. This Baylor Commission finished its work by 17 October and succeeded in effecting a considerable saving in manpower. The revised build-up plan was to take care of both the strategic and tactical air forces in the United Kingdom, the latter having by that time assumed an existence separate and distinct from the Eighth. The War Department formally approved the revised plan on 8 November 1943, and the Bradley Plan tag which had identified the air force build-up plan for six months was formally dropped.[1]

During the second and third quarters of 1943 the Eighth Air Force had undertaken to perform two principal tasks. One was to bomb CBO targets and the other to build up a tactical air force. The latter task was at least partially completed on 15 October 1943 when the Ninth Air Force was established in the United Kingdom. The Ninth had, of course, quite a long record before 15 October, for it had been activated in the Middle East and had fought Rommel across the African desert. By the time the Germans had been expelled from North Africa and Sicily most of the Ninth's men and equipment had been absorbed by the Northwest African Air Forces, and in September 1943 Commanding General Louis H. Brereton took a skeleton organization to England to be reconstructed and to fight the Axis in a new theater.[2]

What happened in England on 15 October was that the Ninth Air Force assumed command over most of what had been the VIII Air Support Command and the Tactical Air Service Area Command. The organizational work in the Ninth progressed rapidly in October and November, and medium bombers and fighters of that air force were active in support of the CBO and

in preparation for combined operations to come.[3]

Thus the Ninth Air Force became the tactical force that had been contemplated in the build-up plans for U. S. air power in the British Isles. Now that there were two air forces in the United Kingdom, a higher headquarters was necessary to exercise supervision and to provide coordination. This need was met by the creation of the United States Army Air Forces in the United Kingdom (USAAFUK), which was established the same day (15 October) as the Ninth. This superior headquarters was commanded by Lt. Gen. Ira C. Eaker, the commander of the Eighth; its general staff was identical with that of the Eighth, and its special staff practically the same as the special staff of VIII Air Force Service Command.[4]

The medium bombers that had belonged to VIII Air Support Command came under the jurisdiction of IX Bomber Command, and Generals Eaker and Brereton worked out an allocation of fighter strength between the strategic and tactical air forces about the middle of November. According to this agreement, the Eighth kept 10 groups of P-47's and five groups of P-38's. All other groups and types, including the P-51's, went to the Ninth but with the understanding that Ninth's fighters were to be used to support the heavy bombers until the invasion of the Continent was imminent.[5] Operational control of the Ninth remained with USAAFUK until 15 December 1943, when it passed to the Allied Expeditionary Air Forces.[6]

A week after the Ninth was set up, the Combined Chiefs of Staff approved a directive for the establishment of a second United States

strategic air force to take part in the combined bomber offensive against the Western Axis. On 23 October General Eisenhower, in the Mediterranean theater, was informed that the Fifteenth Air Force was to be established under his command effective 1 November 1943. This force was initially to consist of the six heavy bombardment groups and two long-range fighter groups that were assigned to the Twelfth Air Force at the time. The scheduled growth of the Fifteenth in combat groups was forecast as follows:

	Heavy Bomb Groups	Long-Range Ftr. Groups
By 31 December 1943	12	4
By 31 March 1944	21	7

General Eisenhower was directed to use the Fifteenth primarily against targets of the CBO, and to insure the close coordination between the Eighth Air Force and the Fifteenth against such targets.[7]

For the Eighth this development meant another diversion of its strength to the Mediterranean. The same message that announced the directive to General Eisenhower forecast the augmentation of Eighth Air Force heavy groups to the end of June 1944 as follows:[8]

	Heavy Bomb Groups
By 31 December 1943	28
By 31 March 1944	34
By 30 June 1944	41

This ultimate strength of 41 heavy bombardment groups was 13 or 14 short of the goal established before the constitution of the Fifteenth. Preparations had been made by U. S. and British leaders in the United Kingdom to accommodate 54 or 55 heavy groups by the summer of 1944. The

reduction in planned strength consequently necessitated some revision and curtailment of the airdrone construction program.[9]

To the commander of the Eighth the new Mediterranean diversion was not pleasing. Such diversions had been resisted by him throughout his connection with the Eighth, and this latest was no exception. General Eaker felt that the bomber offensive would be weakened and that Continental invasion would be jeopardized by the new deployment of heavy bomb groups. He made strong efforts to show General Arnold that the move was unwise, and to convince him that heavy bombers could operate at a satisfactory rate during the winter months from bases in the United Kingdom.[10]

Air Chief Marshal Portal criticised the directive creating the Fifteenth Air Force on the ground that it meant a reduction of the total number of heavy groups to be used against Germany, that bases available in Italy during the winter of 1943-44 could accommodate very little more than the six heavy groups that were already in the Mediterranean, that the Eighth would lose during the last six months of 1943 six groups for which preparations had already been made, and that weather in Italy gave no promise of great advantage over that in the British Isles.[11] General Arnold reported to Eisenhower that the British Chiefs of Staff challenged the wisdom of sending additional heavy groups to Italy and that they contended the groups could not be based, maintained, and operated there as efficiently as in the United Kingdom.[12]

The decision to create the second U. S. strategic air force in Europe seems to have been made by the U. S. Chiefs of Staff, and in

this decision General Arnold's influence was evidently very great. He informed Eisenhower that the reasons for the move were two. The bases in Italy provided a better point of take-off for (1) reduction of German ability to continue to wage war and (2) forcing the dispersion of German fighter and other defense agencies.[13]

To comply with the Combined Chiefs of Staff directive for coordinating the two strategic forces, a conference was held on 8 and 9 November at Gibraltar with Marshal Tedder and Generals Spaatz, Baker, and Doolittle (the last named of whom had been given command of the Fifteenth at its activation on 1 November) in attendance. The conference arranged for: (1) allocation of targets to the two forces, (2) procedure for combined operations, and (3) liaison officers at each headquarters to insure rapid interchange of operational experience and intelligence data. Radio communications between the two headquarters were pronounced satisfactory. It was stated that full exploitation of the bomber effort was dependent upon an adequate supply of blind-bombing equipment for both forces. Organizational experience, operational technique, and technical data were discussed and agreement was reached for prompt and continuous interchange of ideas and experience.[14]

A further step in the coordination of the efforts of the U. S. forces engaged in the strategic bombardment of Europe was the creation of the United States Strategic Air Forces (USSTAF) in January 1944 with Spaatz commanding. This over-all air command was to function under the Supreme Allied Commander in Europe and was to be concerned exclusively with the combined bomber offensive. Its history falls, however, outside the

period covered by this study.[15]

Tactical air coordination for operation OVERLORD (Continental invasion) was to be secured through still another headquarters, the Allied Expeditionary Air Forces (AEAF). The directive for this organization was approved on 5 November by the Combined Chiefs of Staff and announced to the Commanding General of the European Theater on the 18th. The directive, which was to be issued through the Chief of Staff, Supreme Allied Command, provided: (1) under the Supreme Allied Commander, a British air officer with the title Air Commander, AEAF, was designated to exercise command; (2) the Allied Expeditionary Air Forces would comprise the RAF Tactical Air Force, the Ninth Air Force, and such formations as were allotted to the air defense of Great Britain; and (3) the U. S. Ninth Air Force was to pass to the operational control of the Air Commander, AEAF on 15 December 1943.[16]

All these organizational changes necessarily involved a shifting of air officers in preparation for the year 1944. On 18 December 1943, General Arnold sent to Air Chief Marshal Portal a cable which gave the American slate of air officers for top commands in Europe:

Allied Air Forces in Mediterranean theater	Lt. Gen. Ira C. Eaker
Twelfth Air Force	Maj. Gen. J. K. Cannon
Fifteenth Air Force	Maj. Gen. N. F. Twining
U. S. Strategic Air Forces	Lt. Gen. Carl A. Spaatz
Eighth Air Force	Maj. Gen. James H. Doolittle
Ninth Air Force	Maj. Gen. L. H. Brereton

It was General Arnold's opinion that this American setup was the most satisfactory that could be secured.[17]

After this brief review of changes in organization and command, it

is appropriate to examine certain characteristics of third-phase strategic operations.

Magnitude and Rate of Third-Phase Operations from the United Kingdom

In the account of second-phase operations given above in Chapter III it was noted that VIII Bomber Command ended the month of September with 20-3/4 heavy bombardment groups operational. That number was not changed during nearly two-thirds of the third phase, for throughout October and practically all of November the operational heavy group status remained at 20-3/4. On the 25th of the latter month the 401st Group became operational with B-17's. On the 14th of December three B-24 groups (445th, 446th, and 448th) were declared operational, and on the 24th another B-17 group (447th) reached operational status.[18] VIII Bomber Command therefore ended 1943 with 25-3/4 heavy groups operational--18-3/4 equipped with Fortresses and 7 with Liberators.[19]

The Combined Bomber Offensive Plan had contemplated a heavy bomber strength of 1,746 in the theater by 31 December 1943, assuming that this number of aircraft would provide a striking force of 655 at the end of the period and that there would be a third-phase average striking force of 550.[20] The last weekly status report for Eighth Air Force in December (as of the 28th) indicated that there were 1,636 heavy bombers assigned (1,309 B-17's and 327 B-24's), and that 908 were operational with tactical commands. At the same time there were 1,937 heavy bomber crews assigned to the Eighth. Therefore, the Eighth had attained about 93% of the assigned heavy bomber strength called for by the CBO Plan.[21]

Even the figures for the average number of assigned heavy bombers and crews are quite formidable for the entire fourth quarter of 1943:[22]

Daily Average by Month	Heavy Bombers Assigned to Air Force	Crews Assigned
October 1943	1,000	820
November	1,254	1,085
December	1,503	1,556

The position of the Eighth Air Force in regard to effective strength for combat was actually better than the planning of April and May had anticipated. It was in December that for the first time the number of available heavy bomber crews was greater than the number of fully operational aircraft.[23]

Daily Average by Month	Heavy Bombers on hand, Opnl. Tac. Units	Fully Opnl. in Opnl. Tac. Units	Heavy Bomber Crews Avail.	Effective Str. for Combat
October 1943	763	535	479	417
November	902	705	636	578
December	1,057	752	949	723

VIII Bomber Command was able to perform 7 daylight missions in October, 11 in November, and 10 in December, a total of 28 during the last quarter of 1943, only one less than for the third quarter. In October, the average number of heavy bombers dispatched on daylight missions was 346; the largest number sent out during this month was 399 (on the 8 October Bremen mission); and on only one daylight mission during the month (20 October) were there fewer than 300 bombers dispatched. The October average for attacking bombers, 273, was pulled down considerably by the failure of blind-bombing equipment to function on the 20 October operation against Duren.[24] Bad weather reduced the average attacking

force on November missions to 225, and a number of small operations pulled down the average dispatched per daylight operation to 349, about the same as October. There were, however, three occasions in November when VIII Bomber Command was able to send out more than 500 bombers and once (3 November, Wilhelmshaven) 539 actually bombed on a single day.[25] In December the 10 daylight missions dispatched 5,898 sorties for an average of practically 590. The bombing average for the month (469) was spoiled on 5 December when only three out of 546 taking off were able to bomb targets in occupied France because of the weather. Three times in December the Eighth was able to dispatch more than 700 heavy bombers, and on six other days more than 500. The record mission for the quarter and for the year was on 24 December, when 722 B-17's and B-24's were dispatched and 670 actually bombed special construction sites for launching rocket weapons (CROSSBOW or NOBALL targets) in the Calais region. This Christmas Eve mission became even more impressive because it was conducted without the loss of a single heavy bomber.[26]

During the fourth quarter there were 34 night operations by the heavy bombers of the Eighth. These were small missions involving from one to seven aircraft each and were run chiefly for the purpose of dropping leaflets. Six of the night operations took place in October, 14 in November, and a like number in December.[27]

The rate of VIII Bomber Command's operations was never satisfactory to AAF Headquarters. Just before the start of the third phase, General Arnold sent a cable to General Eaker in which he said that since German air power appeared to be at a critical stage, it was necessary to send

the maximum number of planes against the enemy. "We are under constant pressure," he added, "to explain why we do not use massive flights of aircraft against a target now that we have planes and pilots to put over 500 planes in the air."[28] Some days later, near the middle of October, in a letter to Sir Charles Portal he said, ". . . we are not employing our forces in adequate numbers against the German Air Force in being, as well as its facilities and sources. On my part, I am pressing Eaker to get a much higher proportion of his force off the ground and put them where they will hurt the enemy."[29]

The explanation of what AAF Headquarters considered an unsatisfactory rate of operations was to be found partly in weather conditions and partly in the fact that the bomber forces were organized by groups for operations. As was noted above, during most of the third phase there were only 20-3/4 heavy groups operational and each group had an authorized establishment of but 35 aircraft (not counting reserve).[30] Nevertheless, a comparison of effective bomber strength and average number of aircraft dispatched on missions makes it appear that some of the criticism of the operational rate was justified.[31]

	Avg. Effective Heavy Bomber Strength	Avg. No. Heavy Bombers Dispd. on Daylight Missions
October 1943	417	346
November	578	349
December	723	590

Despite a somewhat unsatisfactory scale of operations, the third phase of the bomber offensive saw all units of the Eighth Air Force complete 27,283 sorties (about half of these were heavy bomber sorties)

and drop 23,470.4 tons of bombs on targets. This was a 41% greater tonnage than in the previous phase and was more than 47% of the total weight dropped during the entire year 1943.[32]

Defensive Side of Third-Phase Operations

Third-phase United States operations from British bases cost 431 heavy bombers missing in action, 44.4% of the total such loss in 1943. Enemy aircraft alone accounted for 115, flak and enemy aircraft together for 44, accidents for 15, and other causes for 258. October was the most costly month of the fourth quarter with 176 lost in combat; November had 93; and December, 163. The heavy battle loss in October is explained by that month's deep penetrations into Germany, including the famous Schweinfurt raid on the 14th which cost 60 planes. That loss represented nearly one-fifth of the number dispatched and more than one-fourth (26.2%) of the number actually dropping bombs on that mission. Three other October missions (on the 8th to Bremen and Weser, the 9th to Anklam and Marienburg, and the 10th the Münster and other targets) were also very costly, with 88 bombers lost in combat. These three plus the Schweinfurt operation cost more heavy bombers than were lost in any other entire month during 1943 save December.[33]

Total heavy bomber loss during the third phase, counting both combat and nonoperational salvage as well as missing in action, was 550, or the equivalent of the initial equipment of nearly 16 heavy groups at 35 aircraft per group. When this loss is translated into an attrition rate calculated on the basis of unit equipment, the following is observed:

	Total Loss	Unit Equip. at End of Month	Attrition Rate as % of Unit Equip.
October 1943	214	996	21.4%
November	119	1,044	11.9
December	217	1,236	17.5

October had the highest heavy bomber attrition rate for the quarter and for the whole of 1943 as well, due principally to the four extremely costly missions already mentioned.[34]

Heavy bomber battle damage during the third phase showed 2,825 damaged in all categories, distributed by months as follows:

	Number Damaged	Credit Sorties	Damaged as % of Credit Sorties
October 1943	900	2,159	41.7%
November	649	2,916	22.2
December	1,276	5,618	22.7
Third Phase	2,825	10,693	26.4

The damage rate for the last quarter was not so high as for the entire year 1943 (30.9%), but October's 41.7% was well above the annual figure and was surpassed only by January, July, and August.[35]

Heavy bomber claims of enemy aircraft destroyed for the last quarter were 1,151, probably destroyed 266, and damaged 562. Nearly one-third (32.6%) of all claims of aircraft destroyed by bombers during 1943 were made during the third phase; October alone accounted for 68.6% of the claims for this phase and 22.4% of those for all of 1943. The four October missions noticed in connection with high loss rates were also responsible for great numbers of the enemy destroyed:[36]

Date	Targets	Claims
8 October	Bremen and Vegesack	167--32--35
9 October	Anklam, Marienburg, and Polish targets	122-29--61

Date	Targets	Claims
10 October	Münster	183--21--51
14 October	Schweinfurt	186--37--89
Total for four October missions		658--99--286

The loss of 60 bombers in combat and the bomber claims of 186 enemy aircraft destroyed marked the Schweinfurt mission in October as the year's outstanding air battle. The cabled report [37] of the battle by the Commanding General of the Eighth to General Arnold contains a graphic description of the fight and proceeds to analyze the third-phase defensive program. The report begins: "Yesterday the Hun sprang his trap. He fully revealed his final counter measures to our daylight bombing." General Eaker's account declared, however, that these countermeasures were not unexpected, for many of them had been exhibited in previous air battles as the enemy experimented and trained with them. The Schweinfurt battle was but the culmination of these previously tried tactics executed with perfect timing.

The report stated that the first enemy manouver was to attack from the front at very close range with a screen of single-engine fighters firing 20-mm. cannon and machine guns. Following this screen were numbers of twin-engine fighters in formation, firing rockets from projectors suspended under the wings. The rocket-firing craft began their attacks at a distance and did not come in nearly so close as the single-engine fighters. The Fortress formations were subjected to great numbers of the rocket projectiles.

After the single-engine fighters had made their initial assault, they refueled and returned to the battle, this time attacking from all

directions in an attempt to confuse the gunners in the heavy bombers. Then followed the second effort of the enemy twin-engine fighters, which attacked principally from the front and rear.

The rocket-firing craft seemed to concentrate upon a single combat wing until their ammunition was exhausted. After these maneuvers, all enemy fighters centered their attention on the bombers that had been crippled by the organized attacks. All told, more than 300 enemy aircraft participated in the battle and these made above 700 separate attacks on the bombers during the principal fight.

General Eaker's report did not minimize the losses at Schweinfurt. He said that one combat wing was practically wiped out and that the total loss amounted to 60 bombers. It was his opinion that all the losses had been to enemy fighters rather than to flak. He believed, also, that the effect of the rockets had been to damage rather than to immediately destroy the bombers. The rocket-damaged heavies were forced to fall out of formation where they were finished off by single-engine fighters.

After an excellent description of the air battle over Schweinfurt, the Eighth's commander continued his report with an appraisal and a program. "This does not constitute disaster," he declared; "it does indicate that the air battle has reached its climax." The measures which the air force was to take in its future campaigns were stated in clear and positive terms. They were four in number:

1. It was proposed to use more fighter cover at longer range. General Eaker was satisfied with the Thunderbolt to the limit of its

range, which was 350 miles with a 110-gallon droppable tank. But for longer ranges, he intended to use the P-38 and the P-51 as rapidly as these types became available.

2. In the second place, it was planned to use an expanding force to saturate the enemy defenses with multiple attacks. The employment of seven or eight combat wings against widely dispersed targets might result in heavy damage to one or two formations, but the others would escape with minor damage.

3. The third measure involved an emphasis on operations directed against the facilities supporting the German Air Force. All possible airfields were to be attacked with mediums and the heavies were to strike hard at repair and storage establishments.

4. Full advantage would be taken of blind-bombing equipment which would permit strikes on cloudy days when enemy fighters would find it difficult to operate.

After stating his operational program, General Eaker in this report presented a plea for the help he needed from the United States. He asked for replacement bombers and crews to be sent as rapidly as possible. He wanted the number of replacements to be larger than his losses in order that the air force might grow in striking power. In the second place, he asked for every available fighter, and he emphasized his need for Lightnings and Mustangs. Finally, he asked for large numbers of 110- and 150-gallon expendable tanks and a monthly shipping schedule for this equipment that would keep up with his rate of operations.

The Schweinfurt battle report concluded with a note of optimism.

"We must show the enemy we can replace our losses. . . . We must continue the battle with unrelenting fury. There is no discouragement here."

The lower loss and damage rates for heavy bombers experienced during the last two months of 1943 were no doubt due considerably to the way in which the measures proposed in General Baker's report were carried out. The number of fighters for escort was increased, the range of escort was lengthened by a better supply of droppable tanks, the greater size of the bomber forces dispersed the enemy defenses, and blind-bombing techniques were frequently employed.

There was one defensive measure not mentioned in the Schweinfurt battle report. That development, the use of radio-countermeasures, became important during the last quarter of 1943. The two most important devices in this category were generally known by the names "Window" and "Carpet," and were first employed in October after RAF experience and U. S. tests had demonstrated their effectiveness. During the fourth quarter the Eighth made much greater use of Carpet (airborne jamming transmitter) than of Window (metal foil discharged from aircraft to upset German radar). An ORS study of 18 operations conducted between 8 October and 30 December indicated that Carpet was a definite protection against flak, for the average losses of unprotected groups attacking the same targets were 83% higher on the first 14 missions and 31% higher over the entire 18 missions that formed the basis for the study. There was not sufficient fourth-quarter use made of Window to determine its protective value.[38]

At the beginning of December, Eighth Air Force representatives held a conference with interested British agencies for the discussion of radio countermeasures and for the constitution of a special organization to be called Radio Counter Measure Unit. Both United States and British forces were to contribute 12 specially equipped B-17 airplanes and crews each to this unit, which was to operate in support of night bombers and day bombers without discrimination. Authority was received from Washington for this project and on 28 December the VIII Bomber Command was charged with the building and training of the organization.[39]

Blind Bombing Initiated by the Eighth Air Force

Blind or overcast bombing by daylight is an important offensive technique in that it allows operations on days that would otherwise see the force grounded or, at best, unable to strike the most desirable target. According to an ORS report, weather studies in the European theater stretching back over eight years prior to 1943 showed a need for some device which would allow bombing through heavy cloud; for, throughout the year, there were on the average fewer than six days per month suitable for high-level visual bombing of typical European targets. During the months from November to February suitable weather was to be anticipated only two or three days per month.[40]

Overcast bombing is also a defensive technique, for it allows bombardment forces to operate under conditions much less advantageous to the enemy than those found in visual bombing.

The need for blind-bombing devices was recognized quite early in the war, and in the first part of 1942 experimentation was under way

with several types of equipment. Two of these showed more promise than any others and were given special attention. Both employed the "phenomenon of pulse radiation giving highly directional radio waves." They are best known by their code names--OBOE and H2S. Both were largely British developments, but an American version of H2S, called H2X, was a considerable improvement of the British model. OBOE employed ground-sending stations and a receiver in an aircraft. The aircraft was guided to the target by a technical expert at one of the stations and told when to drop bombs. OBOE, dependent as it was upon airborne reception of radiation emanating from the ground stations, had a very limited range. H2S and H2X were completely airborne units involving no ground stations and consequently had at least the same range as the aircraft in which they were carried. They had the property of making a representation of the terrain over which the aircraft was passing by reception of reflected microwaves. In the early stages of development H2S was useful only for area bombing. The American H2X made possible a representation of land-marks in much sharper outline.[41]

Ideal conditions would have allowed blind-bombing equipment for several aircraft in each group, but because the sets were so scarce and production and training facilities so limited, it was determined to place all equipment and trained crews into a single unit known as a "pathfinder force." This force was modeled after a similar unit in the Royal Air Force which began to use the blind-bombing devices some months ahead of the Eighth Air Force.[42]

General Baker presented the plan for the organization of a pathfinder force to General Bradley in May 1943, when the latter was in the United Kingdom working on air force build-up problems. At that time there was a small force of about one squadron set aside for radar work. General Baker had drawn up a manning table for his proposed organization and he asked that it be approved. On 1 June, a special request for the approval of the pathfinder force manning table was sent to the Commanding General of the Army Air Forces through Headquarters, ETOUSA. It was explained that the force would be made up of highly trained personnel and would be put in possession of the latest target-finding devices. The hope was expressed that the pathfinder unit would be ready to function about the first of October.[43]

The pathfinder force manning table was approved by General Arnold by 11 July, and by the War Department on 19 July. The 482d Bomb Group (H), which contained the radar equipment and crews, was activated on 20 August and became operational 10 days later. This pathfinder group contained three squadrons and furnished the overcast bombing leaders throughout 1943. It continued operations until March of 1944, when it became essentially a training unit.[44]

One squadron of the 482d Group was formed in the theater and fitted out with British equipment--GEE and H2S. The other two were formed in the United States from replacement crews destined for the Eighth Air Force. Their planes were equipped with H2X. One of these American-trained squadrons arrived in the theater about 1 October, and the other some months later.[45]

The first use of pathfinder (PFF) planes to lead daylight bombers was on 27 September, in a mission to Emden. This operation was guided by the squadron that had been outfitted in the theater with British equipment. H2S-fitted planes were used on this Emden raid and on most of the other blind-bombing missions of the third quarter. OBOE was first used by the Eighth Air Force on 20 October in an operation against Duren. The pathfinder force might have participated in combat operations earlier in the year but Air Chief Marshal Sir Charles Portal objected to the possibility of the compromise of radar target-finding equipment. The RAF used H2S on night missions during the summer of 1943, but on very fast Mosquito bombers which ran much less chance of being shot down than United States pathfinders, which necessarily had to occupy the dangerous lead positions.[46]

Pathfinders were usedon about 18 missions from 27 September to the end of the year. Many of these were run against port cities because places on the seacoast were much easier to identify than inland targets. Without the pathfinders November would have been a very poor month for VIII Bomber Command, as eight of the 10 daylight missions made use of planes equipped for blind bombing. Altogether, the first PFF operation in September and those of the last quarter of 1943 dropped 13,781 tons of bombs. The third-phase proportion of bombs dropped by the heavies with the aid of PFF was:[47]

	Tons Dropped with Pathfinder Aid	% of Total Tons
October 1943	1,169.4	24.9%
November	4,395.1	68.3
December	7,467.6	62.6

[redacted]

The PFF experience during the third phase definitely demonstrated the defensive advantage of blind bombing. Losses to enemy aircraft on blind-bombing missions were about one-third the figure for visual missions against similar targets. Flak damage was considerably less on the blind-bombing missions, and damage to bombers by enemy fighters occurred three to four times as often on visual as on blind-bombing raids. The lower rates of loss in November and December, mentioned earlier in this chapter, were due in considerable measure to the fact that most of the bombing was done with PFF. An ORS study on losses and battle damages lists three factors in explanation of the November-December rates: "Our loss rates are primarily attributable to the use of fighter escort, to our failure to get near enough to targets to come within flak range, and especially in December, to the advantage derived from the dispatch of a total force large enough to begin to saturate enemy fighter defenses in the zones penetrated."[48] The phrase "failure to get near enough to targets to come within flak range" does not, however, give blind-bombing credit for much offensive value. In this connection, another statement from the above-quoted ORS report is in point: "However, our offensive record to date [the report covered the period from 17 August 1942 through 31 December 1943] indicates that blind-bombing results have been far from as accurate as visual bombing, with many targets missed altogether. Accordingly, even though losses seem to be cut to approximately 1/3, a balance in favor of blind-bombing technique requires that its offensive effectiveness be more than 1/3 as great as visual bombing."[49] The implication seems to be that third-phase bombing

experience left the offensive balance in favor of visual sighting, but it must be remembered that the operations of this period were beginning efforts with a new and complicated technique. These initial efforts aided the daylight bombers to much more effective use of radar target-finding devices in subsequent months of the offensive.

The first mission on which PFF aircraft led has been discussed in its proper chronological order in the account of the second phase (Chapter III). Third-phase blind-bombing missions are now to be considered along with visual missions in an examination of operations from the standpoint of target systems.

Pattern of Third-Phase Daylight Operations

The major portion (78%) of third-phase bomb tonnage dropped by the Eighth Air Force fell on German targets. Objectives in occupied countries--France (14%), Norway (4%), Holland, and Poland--received proportionately less attention than in preceding phases of the offensive. The Fifteenth Air Force hit targets in Italy, the Balkans, Austria, and southern France, with Italian targets getting most attention.[50]

The Combined Bomber Offensive Plan had anticipated that third-phase attacks should include all the principal target systems on the priority list and that repeat operations would be performed against installations previously neutralized. The German fighter-force facilities still had top priority in the fourth quarter of 1943, but submarine targets were of less consequence than they had been when the CBO Plan was drawn. Nevertheless, the Eighth Air Force hit German port cities where submarine

construction yards were located with greater tonnage than was allocated any other target category. Attention has been given to the fact that much of the Eighth's third-phase bombing was done with pathfinders and that these found coastal points much easier to locate than objectives in the interior. Both the Eighth and the Fifteenth gave some attention to aircraft construction, airfields, ball bearings, synthetic oil, and railroad transportation. There were no attacks on production of rubber or rubber tires and none of consequence on production facilities for motor transport vehicles. The Eighth made one big attack on German construction sites where preparations were being made to launch new weapons, but much of its effort was directed to miscellaneous industrial targets of opportunity, because of failure of pathfinder equipment and difficult weather conditions. The performance of both of the U. S. strategic air forces during the fourth quarter of 1943 presented, in general, a disappointing demonstration of strategic bombardment.[81]

It is scarcely possible to make a valid general statement about the accuracy of third-phase bombardment because of the small proportion of attacks made by visual sighting. It does not appear to be worth while to examine statistically the accuracy achieved on blind-bombing missions, for in many cases there is no assurance that bombs fell even close to the target. What data there is on Eighth Air Force visual accuracy shows an improvement over the first and second phases, but the fourth quarter compilations are made on returns from very few missions. The "Statistical Summary of Eighth Air Force Operations" gives the average percentage of

bombs dropped which fell within 1,000 feet of pre-assigned MPI's under conditions of good to fair visibility:

1st Div	2d Div	3d Div	8th AF
25%	32%	27%	27%

and within 2,000 feet:

1st Div	2d Div	3d Div	8th AF
46%	58%	47%	48%

Several missions during the period achieved outstanding accuracy and deserve special consideration. The most remarkable job of precision bombing in 1943 was the attack on the fighter factory at Marienburg on 9 October. On that mission 58% of the bombs fell within 1,000 feet of the aiming point and 83% within 2,000 feet. The photographs taken after the raid show what seems to be almost perfect coverage with scarcely any bursts outside the target area. The raid on the factory at Anklam the same day achieved 28% within 1,000 feet and 52.5% within 2,000 feet of the aiming point. The relatively low bombing altitudes at Marienburg (from 11,000 to 13,500 feet) and at Anklam (from 12,200 to 14,500 feet) probably explain the better-than-average accuracy on 9 October. Other missions achieving accuracy above the average Eighth Air Force fourth-quarter accuracy were:

Date	Target	% within 1,000 Feet	% within 2,000 Feet
16 Nov.	Knaben (Norway)	35	57
24 Dec.	NOBALL	35	56
31 Dec.	Paris (power station)	39	76
31 Dec.	Paris (ball-bearing plant)	40	82
31 Dec.	St. Jean D'Angley	50	77
31 Dec.	Cognac	28	58

[redacted]

SECUR[redacted]

The famous 14 October Schweinfurt raid under very strong opposition got 35% of the bombs within 1,000 feet and 51% within 2,000 feet of the aiming points.[52]

Aircraft Facilities. The Eighth Air Force made several important attacks on German fighter and components factories in October:[53]

Date	Target	Bombers Attacking	Tons
4 Oct.	Frankfurt--Vereinigte Deutsche (metal propellers and other A/C components)	77	216.3
8 Oct.	Bremen--Weser Flugzeubau (airframe factory)	33	81.0
9 Oct.	Anklam--Arado Components Factory	106	185.5
9 Oct.	Marienburg--Fw Assembly Plant	96	217.2

In addition to these operations, the B-24 aircraft sent in September to the Mediterranean from the Eighth Air Force participated shortly before their return to British bases in a raid at Wiener Neustadt on 1 October which saw 157 tons of bombs dropped on one of the Me-109 plants at that place. The Fifteenth Air Force dispatched 139 B-17's and B-24's against Wiener Neustadt on 2 November, and 112 of the heavies dropped 327 tons of bombs with excellent results reported.[54]

All these attacks on manufacturing facilities were accomplished by visual sighting, and except for the first Wiener Neustadt mission, achieved good success considering the small size of the attacking forces. As noted above, the Marienburg raid was outstanding.

The Assistant Chief of Air Staff, Intelligence made an assessment of the results of strategic bombardment as of 15 November 1943. It was estimated in this assessment that the attacks on aircraft construction

[redacted]

by that date had cut into German single-engine fighter production by about 21.5% for the period which would extend from August 1943 through April 1944:[55]

Production anticipated without bomb damage	8,940
Estimated production after bombings	7,015
Production loss due to bombing	1,925

The results of the attacks do not seem to have been exaggerated, for the estimates of production loss were somewhat more conservative than those of the British Air Ministry.[56]

Eighth Air Force B-24's made a medium-sized raid (302 tons) on two engine-repair factories and an airframe-repair installation at Oslo, Norway, on 18 November, and B-24's of the Fifteenth dropped 86 tons on an Me-109 plant at Augsburg on 19 December.[57] Other attacks on GAF facilities during the third phase were confined chiefly to airfields. The Eighth made at least three such attacks in October and seven in December. The Fifteenth made at least seven airdrome attacks in November and nine in December. The mediums of the Ninth Air Force contributed more than a score of airfield attacks during the fourth quarter of 1943.[58]

Port Cities, Submarine and Ship Building. Emden and Bremen were favored targets of VIII Bomber Command during the October-December portion of the strategic offensive. Emden was attacked twice:

Date	Sighting	Attacking A/C	Tons Dropped
2 Oct.	PFF	337	950
(8 Oct. 1 B-17 dropped bombs on Emden as target of opportunity.)			
11 Dec.	Visual	523	1,431

There is no certainty about what portion of the city was hit on the blind-bombing 2 October raid; the December attack did some damage to port and harbor facilities, but the operation probably should be classified as a general industrial area attack, for a railway station, a meat packing plant, and built-up areas of the city were hit.[59]

The city of Bremen was a target seven times:

Date	Sighting	Bombers Attacking	Tons Dropped
8 Oct.	Visual	241	602
13 Nov.	PFF failed to function	114	262
26 Nov.	PFF	422	1,205
29 Nov.	PFF	138	410
13 Dec.	PFF	174	457.2
16 Dec.	PFF	528	1,520.0
20 Dec.	PFF and Visual	465	1,099.5

On 8 October a small portion of the force (44 B-17's) hit one of the submarine and warship building yards, and the balance of the force (197 B-17's) bombed the city of Bremen and its port facilities. The 13 November mission was ruined by failure of all PFF equipment; the raid of 26 November was really an area raid of the city and not a precision attack; and the operation of the 29th was of the same type. Somewhat better success attended the December raids on oft-bombed Bremen, largely because of the better functioning of PFF aircraft.[60]

Other port-city operations by the Eighth Air Force during the fourth quarter of 1943 were:

Date	Target	Sighting	HB Attacking	Tons Dropped
8 Oct.	Vegesack	Visual	48	142.5
9 Oct.	Gdynia	Visual	127	308.0
9 Oct.	Danzig	Visual	23	50.3
3 Nov.	Wilhelmshaven	PFF	539	1,450.3
13 Dec.	Kiel	PFF	355	881.75
13 Dec.	Hamburg	PFF	116	264.85

The mission to the Baltic ports on 9 October was noteworthy at the time for the distance covered, and the Wilhelmshaven raid on 3 November for the size of the attacking force, but the accomplishments of these operations do not appear to have been great.[61]

The submarine base at Toulon was hit by 108 Fifteenth Air Force B-17's on 24 November, the Marseilles pens were bombed by Fifteenth formations (118 planes attacked) on 2 December, and on the 5th of the latter month, two Eighth Air Force B-17's bombed St. Nazaire.[62]

Antifriction Bearings. The third-phase daylight assault on the Western Axis ball-bearing industry was distributed over the three months and engaged both U. S. strategic air forces. The Eighth contributed one raid in October and one in December, and the Fifteenth struck four times in November and once in December.[63]

Air Force	Date	Target	Attacking A/C	Tons Dropped
8th	14 Oct.	Schweinfurt	228	483
15th	8 Nov.	Turin	81	183
15th	9 Nov.	Villar Perosa	20	60
15th	10 Nov.	Villar Perosa	22	66
15th	11 Nov.	Annecy	13	39
15th	1 Dec.	Turin	118	354
8th	31 Dec.	Paris	121	350

The Schweinfurt mission of 14 October by the 1st and 3d Heavy Bombardment Divisions of the Eighth Air Force was the most important and the most damaging to the German war effort. On the three bearing factories at Schweinfurt the Eighth Air Force effort was distributed as follows:[64]

Factory	Type Bombs		Total Tons
	High Explosive	Incendiary	
Kugelfischer Werke	165.7	--	165.7
Vereinigte Kugellager Fabriken No. 1	63.0	74.1	137.1

Factory	Type Bombs High Explosive	Type Bombs Incendiary	Total Tons
Vereinigte Kugellager Fabriken No. 2	166.5	13.5	180.0
Total Weight of Bombs Dropped			482.8

The Kugelfischer Werke, which was thought to employ about 12,000 workers at the time and to turn out about one-quarter of Germany's ball and roller bearings, was apparently heavily damaged by hits on assembly and machine shops. The VKF plants, estimated to employ about the same number of laborers as Kugelfischer, were likewise heavily damaged. An intelligence assessment of the raid made a month later calculated the loss in production in the two plants at:[65]

	Pre-Raid Production--Units per Day	Estimated Loss of Output--Units
Kugelfischer	100,000	1,275,000
VKF	100,000	8,250,000
Totals	200,000	9,525,000

The Schweinfurt raid damaged a motorcycle factory, a bearing-cage plant, a malt factory, railroad buildings and rolling stock, and barracks buildings in addition to the three main bearing plants.[66] Despite the heavy loss of bombers (60 missing in action, 26.5% of the number attacking), the operation called forth hearty congratulations to the Eighth from the Secretary of War, the Chief of Staff, the Commanding General of the Army Air Forces, Air Chief Marshal Portal, the British Air Staff, and the Royal Air Force.[67]

It was thought that the destruction wrought at Schweinfurt had occasioned great concern to the Germans and caused efforts to increase output and to bolster the defenses at Turin in Italy.[68] The Fifteenth

Air Force operation against the latter plant on 8 November achieved good concentration and caused considerable damage, and the 1 December mission was thought to have produced good results. The raids on the Villar Perosa and Annecy plants seem to have had very slight effect.[69]

The Eighth Air Force attack on the last day of 1943 wrought damage to the CAM bearing plants at Bois Colombes and Ivry (Paris) and seems to have hurt the Hispano-Suiza aero-engine works as well.[70]

Oil. The German oil industry was not much damaged by United States strategic air forces during the last three months of 1943. Two Eighth Air Force raids may have affected this target category slightly. On 5 November 328 B-17's, including 5 pathfinders equipped with "GEE," dropped bombs on Gelsenkirchen. Despite the presence of PFF, the sighting seems to have been visual on this raid, for the weather was reported clear with some industrial haze present. The majority of the Fortresses apparently attacked marshalling yards, but 96 of the bombers dropped about 238 tons on the Hydrier Werke Scholven A.G. and Gelsenkirchener Bergwerks synthetic oil plants. The first plant was damaged but the second seems to have been missed. On 19 November Gelsenkirchen was a first-priority objective for a pathfinder mission, but the equipment functioned imperfectly and other targets were hit.[71] A large-scale raid on Ludwigshaven (653 attacking bombers), aimed at the I.G. Farbenindustrie chemical works and other installations, on 30 December may have caused some damage to synthetic oil production. The target was completely cloud covered and bombing was done with the aid of pathfinders.[72]

Miscellaneous Operations. A relatively large number of the fourth-quarter operations were completed against targets that were not on the POINTBLANK priority list. Railroad marshalling yards were Eighth Air Force objectives on four days for fairly large forces and on a number of other days for smaller numbers of bombers. The most important third-phase raids on marshalling yards were:[73]

Date	Sighting	Target	Attacking A/C	Tons Dropped
10 Oct.	Visual	Münster	138	351
5 Nov.	PFF and Visual	Gelsenkirchen	229	495
5 Nov.	PFF and Visual	Münster	104	283
11 Nov.	PFF	Münster	58	122
22 Dec.	PFF	Osnabruck	219	543
22 Dec.	PFF	Münster	197	438

The Fifteenth Air Force conducted nearly half of its November and December missions against railroads, bridges, and marshalling yards in Italy and the Balkans.[74]

An Eighth Air Force mission to Norway on 16 November hit a molybdenum flotation plant at Knaben and power and hydrogen plants at Rjukan, two days before the aircraft repair facilities were attacked at Oslo. The electrolysis hydrogen plant, reported the largest of its kind in the world, was a subsidiary of I. G. Farben. The Norway operation was a fine demonstration of airmanship and navigation against a very distant target.[75]

Many of the operations performed by the United Kingdom-based U. S. strategic bombers are best classified as area raids of industrial towns. These missions were frequently performed under adverse weather conditions with the aid of pathfinder aircraft. On both PFF and visual operations targets of opportunity were hit when the primary objectives were not

located. Principal industrial area raids involving more than 20 attacking heavy bombers were:[76]

Date	Target	Attacking A/C	Tons Dropped
4 Oct.	Frankfurt (city)	37	88
4 Oct.	Saarlautern	67	169
4 Oct.	Saarguemines	47	98
10 Oct.	Targets of opportunity	30	89
10 Oct.	Coesfeld	68	187
20 Oct.	Duren	96	209
7 Nov.	Duren	38	84
7 Nov.	Wesel	54	125
7 Nov.	Randerath	20	48
19 Nov.	Ruhr targets of opportunity	130	281
30 Nov.	Solingen	78	221
1 Dec.	Solingen	261	702
22 Dec.	Targets of opportunity	23	65

Special construction sites which the Germans were preparing for the purpose of launching pilotless aircraft against England became targets of great importance in the last quarter of 1943. The British Chief of the Air Staff asked that medium bombers of the Ninth Air Force be used to attack these objectives, and after it became apparent that the number of sites was large and the enemy was pushing their completion with maximum effort, it was decided to use heavy bombers on them when the weather was suitable in coastal areas and unsuitable for attack on fighter factories. The B-26's completed many raids against such targets and on 24 December, VIII Bomber Command dropped 1,745 tons of bombs on 23 sites from 478 B-17's and 192 B-24's. The bombing on this occasion was done by squadrons using individual sightings. By the end of December 83 construction sites had been discovered and photographed, and at 70 of them the work was believed to be 50% complete. There were at the same time 82 other locations where suspicious activity had been reported. Since it was

believed that if the Germans were left unmolested they would be able to launch the equivalent of a 1,000-ton raid on England by February, the "Ski" sites, as they were called, had become high-priority targets.[77]

Night Missions by the Eighth Air Force

The Eighth Air Force engaged in 34 night operations during October, November, and December. These missions involved three kinds of activity--participating in RAF Bomber Command attacks, dropping of propaganda leaflets, and the testing of special equipment. In October there were two bombing and four leaflet missions. Seven and one-half tons of bombs were dropped over Munich and Frankfurt and 2,293,548 leaflets were dropped in France and Germany. In November there were 12 leaflet and two special photographic and instrument-testing missions. The 12 propaganda missions dropped 16,167,500 leaflets in France, Belgium, Holland, and Germany. The 14 night missions in December beat this record slightly with 17,886,300 leaflets on targets in these countries.[78]

RAF Operations, Fourth Quarter 1943

During the last quarter of 1943 the RAF Bomber Command carried out a series of very difficult operations against distant German targets, including eight attacks on the Reich's capital city. These operations were made successful by the use of new tactics and countermeasures designed to reduce losses and by improvements in navigation and night target-marking designed to secure better bombing concentrations. Nearly all (94.7%) of the 40,070 long tons of bombs dropped by the RAF during the last three months of 1943 fell on German targets. This fourth-quarter

tonnage was slightly more than one-fourth (25.3%) of the total effort of Bomber Command for 1943, which saw 157,434 long tons dropped.[79]

The German capital had been attacked three times in force during the third quarter of 1943, but the month of November marked the real beginning of the Battle of Berlin. Fourth-quarter major raids on Berlin involved more than 3,600 attacking aircraft and dropped 14,000 long tons of bombs.

Date	Attacking A/C	Total Tons	A/C Missing
18-19 Nov.	402	1,594	9
22-23 Nov.	670	2,465	26
23-24 Nov.	332	1,335	20
26-27 Nov.	407	1,576	28
2-3 Dec.	401	1,686	40
16-17 Dec.	450	1,815	25
23-24 Dec.	338	1,288	15
29-30 Dec.	656	2,315	20
	3,646	14,074	183

The Berlin operations of November and December did very heavy damage to the industry of that great city. Electrical concerns, plants making aero and other type engines, machine tool factories, and a variety of other plants were heavily damaged. Commercial concerns and railway services were also seriously affected. Public utilities and public buildings in great number were destroyed or damaged, and certain military installations were badly hurt. The Berlin raids accounted for more than one-third of the entire fourth-quarter effort expended by Bomber Command.[80]

Hannover was attacked twice in October by fairly large forces:

Date	Attacking A/C	Total Tons	A/C Missing
8-9 Oct.	457	1,782	26
18-19 Oct.	349	1,697	17
	806	3,479	43

The first attack seemed to have been more important than the second and did effective damage to business and residential property and to public buildings around the central portion of the city.[81]

One raid was made in October and one in December against the important commercial city of Leipzig in southern Germany:

Date	A/C Attacking	Tons Dropped	A/C Missing
20-21 Oct.	285	1,085	16
2-3 Dec.	451	1,451	24
	736	2,536	40

The December raid was the more successful and caused tremendous damage to the most important business districts of the city. Railroads, aircraft engine manufacturing concerns, and other industrial plants were also hurt badly.[82]

Two of the most successful RAF attacks were made on the important manufacturing city of Kassel:

Date	A/C Attacking	Total Tons	A/C Missing
3-4 Oct.	501	1,616	24
22-23 Oct.	486	1,824	43
	987	3,440	67

These October raids damaged the three great Henschel locomotive factories at Kassel which were reported responsible for approximately one-third of the total German output.[83]

Germany's third largest inland port, Düsseldorf, was the objective for a very successful mission on the night of 3-4 November when 527 aircraft dropped 2,193 tons of bombs at a cost of 16 planes missing. Some 21 identified factories were damaged and the devastation was so great that the city was no longer regarded a first-priority target.[84]

One medium and three small raids were made against the Mannheim-Ludwigshaven area in western Germany largely for the purpose of preventing recovery from damage caused on previous missions:[85]

Date	A/C Attacking	Total Tons	A/C Missing
4-5 Oct.	57	235	--
17-18 Nov.	75	308	1
18-19 Nov.	325	852	23
20-21 Dec.	62	223	--
	579	1,618	24

The great city of Frankfurt was attacked three times during the fourth quarter, once in each month:

Date	A/C Attacking	Total Tons	A/C Missing
4-5 Oct.	357	1,105	10
25-26 Nov.	237	646	12
20-21 Dec.	576	2,281	40
	1,170	4,032	62

The October raid was quite damaging to the east side of the city. The subsequent raids, while larger, were less successful; but they did considerable damage to business and industrial property.[86]

Other major RAF Bomber Command fourth-quarter attacks included two raids on Stuttgart in southwestern Germany and one each against Hagen in the Ruhr, Munich in south Germany, and Modane in southern France:

Date	Target	A/C Attacking	Total Tons	A/C Missing
1-2 Oct.	Hagen	240	1,150	1
2-3 Oct.	Munich	273	1,015	8
7-8 Oct.	Stuttgart	314	1,257	4
10-11 Nov.	Modane	301	1,121	--
26-27 Nov.	Stuttgart	162	446	6

Hagen in the Ruhr, important in the manufacture of submarine components, was damaged quite heavily. Scattered damage was done to an I. G. Farbenindustrie instrument factory, other industrial plants, and

military installations in Munich. Business and residential property and about 40 concerns in Stuttgart suffered in the two fourth-quarter attacks, and the November mission to Modane in France produced an excellent concentration on transportation facilities.[87]

The major RAF attacks during the last quarter of 1943 were well calculated to serve the aims of the bomber offensive. The heavy weight of explosives dropped on Berlin contributed to both the destruction of German industry and the undermining of German morale. Hannover had been designated as a third-phase RAF objective and was the seat of important rubber-tire plants and other industries. Kassel and Stuttgart had also been assigned in the CBO Plan as third-phase targets and both possessed important production facilities in the aircraft industry. One of the outstanding features of 1943 RAF operations was the campaign against the Ruhr-Rhine industrial region. The missions to Düsseldorf and Hagen were a continuation of that campaign. The strike on Modane in France was designed to cripple transportation facilities supplying the German forces in Italy. Frankfurt, Mannheim, and Munich were important transportation targets in Germany.

Besides the major attacks of Bomber Command, well over 100 minor raids were made on a variety of targets. These operations were important in themselves and in many cases were of great assistance to the conduct of major raids. In addition to the dropping of explosives and incendiaries the RAF distributed 143 million propaganda leaflets during the quarter.[88]

CONCLUSION

The first three phases of the combined bomber offensive were, for the United States Army Air Forces, more important in the preparations they made for future action than for the operations they witnessed. Developments during the last three quarters of 1943--the organizational changes, the materiel and personnel build-up attained, the plans made for future growth of forces, and the tactical and technical improvements achieved--all made possible the tremendous assault on the Western Axis in 1944 and after.

Of the preparations made for future strategic aerial warfare, three developments of 1943 seem to be of outstanding importance.

1. The build-up of the Eighth Air Force to formidable striking proportions and the organization of the Fifteenth Strategic Air Force for the utilization of Italian bases appear as achievements of first magnitude in the European air war.

2. The need for fighter and radio defenses to aid the heavy bomber in the accomplishment of its task was recognized, and progress was made in the build-up of the fighter forces with a variety of types, in the extension of the fighter range with expendable tanks, and in the use of countermeasures against German radar.

3. The offensive capabilities of the strategic air force were augmented by the experimentation with blind-bombing techniques during the fourth quarter of 1943.

On the operational side, the 1943 effort of the United States

strategic air forces seems to have had telling consequences on two chief target categories.

1. The German aircraft industry, or specifically the planned single-engine fighter production program, was delayed by approximately three months by strategic attacks on FW-190 and Me-109 assembly plants in July, August, and October. Acceptances of the Me-109 single-engine fighter were cut from 725 in July to a low of 357 in December. Acceptances of FW-190's were reduced from 325 in July to 203 in December 1943. Some of the reduction for both types was due, in part, to the fact that bad weather hindered acceptance flights; furthermore, aircraft acceptances were not necessarily the same as production figures. Nevertheless, the results of the 1943 air attacks on fighter production facilities had an important bearing on the defeat of the GAF in 1944.[1]

2. The center of the German antifriction bearing industry was very badly damaged by the important August and October missions of the Eighth Air Force to Schweinfurt. The heavy losses incurred on these raids strongly reinforced the lesson that other deep penetrations had taught--the heavy bomber had to have fighter help on long missions over Germany if it was to accomplish its purpose. The intervals between raids may have hindered the accomplishment of the strategical aim for this target category because of the time given the enemy to effect dispersal.[2]

The relatively large proportion of Eighth Air Force 1943 effort devoted to submarine yards and bases and port cities, reinforced as it was by RAF area raids, particularly those on Kiel and Hamburg, seems to have had slight effect on Germany's U-boat output. It has been pointed

out elsewhere that the battle against the submarine was won at sea and not in the yards and bases.[3]

Operations against other CBO target categories during 1943 now seem of relatively small importance. The August raid against the Ploesti oil refineries apparently had only a temporary effect;[4] other attacks on this category gave only slight results. Of the U. S. attacks on the rubber industry, the 22 June Eighth Air Force mission to Huls was the only one of real significance. This one raid apparently closed the entire plant for a month and caused such damage that full production was not regained for seven months.[5] The output of motor vehicles does not seem to have been seriously affected by the raids on plants in occupied countries.[6]

The enemy's efforts to develop new aerial weapons and his determined construction of sites for launching them gave the USAAF a new target category that did not exist when the CBO Plan was drawn, but one that was to become of great importance in 1944.

Of the 1943 accomplishments of the RAF, the Ruhr campaign aimed especially at the German steel industry seems most significant. Loss in enemy steel production because of the direct and indirect effects of bombing during all of 1943 was something above 13% of actual output. So great was the impact of the air attack on Ruhr industry that the section was never able, after the middle of 1943, to match the steel output that had been achieved at the beginning of the year.[7] RAF area raids did tremendous damage to a number of German cities during 1943; the outstanding example here was the terrible destruction wrought on Hamburg in July and August. So great was the havoc that this city never recovered

its productive capacity. The same thing can be said, however, of Düsseldorf, Bochum, and other cities in the Ruhr.[8]

The total loss of German armament production from air raids has been estimated by the United States Strategic Bombing Survey at from 3 to 5% for 1943. It appears that the indirect effects of the 1943 attack may have been greater than the direct. That is to say, the enemy lost more production because of shifts and dispersal than he did from bomb damage.[9]

In a sense, this 1943 preparatory, experimental period made the subsequent phases of the bomber offensive more difficult because of this dispersal and because of the time given to the enemy to improve his aerial defenses. That was unavoidable, however, for strategic air power in Europe could not, like Pallas Athene on Lake Triton, spring into being fully armed and ready for tremendous action. It had to grow slowly and learn operational lessons as it grew.

[redacted]

GLOSSARY

AAG	Air Adjutant General
AEAF	Allied Expeditionary Air Forces
AFAEP	Plans Division, Hq., AAF
A.P.W.I.D.	Air Prisoner of War Interrogation Detachment
ASC	Air Service Command
Asgd.	Assigned
Avg.	Average
BAM	British Air Ministry
BCNO	Bomber Command Narrative of Operations
CBO	Combined Bomber Offensive
CCS	Combined Chiefs of Staff
COA	Committee of Operations Analysts
COPC	Combined Operational Planning Committee
C/S	Chief of Staff
DC/AS	Deputy Chief of Air Staff
Desd.	Destroyed
Dispd.	Dispatched
ETOUSA	European Theater of Operations, U. S. Army
Exh.	Exhibit
GAF	German Air Force
MID	Military Intelligence Division, WDGS
MPI	Mean Point of Impact
MTO	Mediterranean Theater of Operations
OAS	Operational Analysis Section
Opnl.	Operational
ORS	Operational Research Section
RAF	Royal Air Force
Str.	Strength
USAAFUK	U. S. Army Air Forces in the United Kingdom

NOTES

Chapter 1

1. Ltr., Eaker to Arnold, 11 Jan. 1943, in Eighth Air Force Evaluations, K-14347, in A-2 Lib.

2. FM 100-20, Command and Employment of Air Power, 21 July 1943, pp. 8-9.

3. United States-British Staff Conversations, 1941.

4. Ibid., p. 5.

5. Memo for C/S, 20 Aug. 1941, in AFAEP files.

6. "Plan for Bomber Command and Constituent Units to Arrive in U. K. in 1943," in AFAEP files.

7. AWPD-42, 9 Sep. 1942.

8. Memo for C/S, 20 Aug. 1941.

9. "Plan for Bomber Command and Constituent Units to Arrive in U. K. in 1942."

10. AWPD-42, 9 Sep. 1942.

11. "Objectives for Operations Eighth Air Force," 20 Oct. 1942, Exh. 2, in Plans Annex, Report of Lt. Gen. Ira C. Eaker, U. S. Army Air Forces Activities in United Kingdom covering period from February 20, 1942, to December 31, 1943 [Eaker's Report], dated 31 Dec. 1943.

12. Eaker's Report, p. 7.

13. Ibid.

14. Ibid., Exh. 3, Plans Annex.

15. Ibid., p. 7.

16. Ibid., Exh. 4, Plans Annex, CCS 166/1/D, 21 Jan. 1943, "Casablanca Directive."

17. The principles of target selection are discussed in Report of the COA, 8 March 1943, in AFSHO; "Strategic Air Objectives, May 1944, an OSS Presentation," K-60360, in A-2 Lib.; and in "Target Selection Principles Developed by the Eighth Air Force," Exh. 11 in Plans Annex to Eaker's Report.

18. Ltr., Hq AAF to AC/AS Management Control, 9 Dec. 1942, in COA general correspondence file, AFSHO.

19. Notes from "History of the Organization and Operations of the COA," in Misc. file, AFSHO.

20. Memo for Gen. Arnold, 23 Dec. 1943, in COA general correspondence file.

21. The 19 target systems were aircraft, antitank and antiaircraft artillery, ball bearings, chemicals, coke, electric power, electrical equipment, food, grinding wheels and abrasives, iron and steel, machine tools, military transport vehicles, nitrogen, nonferrous metals, optical precision instruments, petroleum, submarines, synthetic rubber and rubber tires, and transportation. COA Report, 8 March 1943.

22. Ibid. The 8 March report was signed by the following committee members: Edward M. Earle, Special Consultant, AAF; Fowler Hamilton, Board of Economic Warfare; Thomas W. Lamont, Special Consultant, AAF; Edward S. Mason, Office of Strategic Services; Elihu Root, Jr., Special Consultant, AAF; Col. Edgar P. Sorensen, AC/AS, A-2, Lt. Col. Malcolm W. Moss, AC (A-2); Lt. Col. Thomas G. Lanphier, AC (G-2); Lt. Col. W. Barton Leach, AC; Col. Guido R. Perera, AC; and approved by Col. Byron E. Gates, AC/AS, Management Control.

23. Baker's Report, Plans Annex, pp. 3-4.

24. CC/S 217, 14 May 1943.

25. Baker's Report, p. 4.

26. Ibid., p. 8; Plans Annex, p. 4, and Exh. 8.

27. Ibid., Directive of 10 June 1943, Exn. 8 in Plans Annex.

28. U. S. Strategic Bombing Survey, Interview No. 59, 28 June 1945, KO-18987.

29. Eighth Air Force Evaluations, K-11995, in A-2 Lib.

30. "An Appreciation of the Air Effort Against Submarines," 16 Jan. 1943, in Eighth Air Force Evaluations, K-11995.

31. COA Report, 8 March 1943, Tab 7.

32. Cf. U. S. Strategic Bombing Survey, Interview No. 56, Reichsmarsnal Hermann Goering, 29 June 1945 (KO-18990); Generalleutnant Galland (A.O.C. Fighters), 17 May 1945 (KO-11423); Testimony of a GAF Field Marshal received in Britain 3 June 1945 (KO-18735); and others.

33. Cf. KO-18936, KO-15385 (K numbers of P/W interrogations).

34. COA Report, 8 March 1943.

35. Pt. IV, Interrogation Report on Hermann Goering, 1 June 1945, by Air Prisoner of War Interrogation Det., 9th Air Force, Adv.

36. Report on Albert Speer from Captured Personnel and Material Br. issued by MID, U. S. War Department, 11 July 1945, KO-21120.

37. U. S. Strategic Bombing Survey, Field Marshal William Keitel, 27 June 1945, KO-18391.

38. KO-11423. See also note 32 above.

39. Tab 3, Report of COA, 8 March 1943.

40. COA Report, 8 March 1943.

41. U. S. Strategic Bombing Survey, Interview No. 56, KO-18990.

42. U. S. Strategic Bombing Survey, 27 June 1945, KO-18991.

43. COA Report, 8 March 1943, Tab 13.

44. Ibid., Tab 6.

45. Ibid., Tab 8.

46. Ibid., Tab 11.

47. Ibid., Tab 10.

48. Ibid., Tab 12.

[redacted] SECURITY INFORMATION

Chapter II

1. Baker's Report, Opns. Annex, p. 1.
2. Biennial Report of the Chief of Staff of the United States Army, 1943-1945, to the Secretary of War.
3. Ibid.
4. Report, WD Office of Inspector General to DC/S, Survey of Organization and Operations of 8th AF, 5 Aug. 1943, in AAG 380-A.
5. Statistical Summary of Eighth Air Force Operations, 17 Aug. 1942-8 May 1945 [Stat Sum of Opns.].
6. Ibid.
7. Ltr., Baker to Arnold, 11 Jan. 1943, in K-14347, A-2 Lib.
8. Stat Sum of Opns.
9. Ibid.
10. "Munitions Requirements of the Army Air Forces for the Defeat of Our Potential Enemies," short title, AWPD/1; memo for C/S, 12 Aug. 1941, in AWPD-42, 9 Sep. 42.
11. AAFRH-2, p. 33.
12. History of VIII Air Force Service Command, Chap. IV, section on "Flow," p. 5.
13. Ibid., pp. 20-29.
14. Ltr., Portal to Arnold, 20 Feb. 1943, in WP III A-2, Great Britain, AFAEP.
15. Ltr., Baker to Stratemeyer, 2 Jan. 1943, ibid.
16. Ltr., Baker to Stratemeyer, 26 Feb. 1943, in AAG 312.1-D.
17. Ltr., Baker to Stratemeyer, 18 Feb. 1943, ibid. Ltr., Baker to Stratemeyer, 2 March 1943, in WP III A-2, Great Britain, AFAEP.
18. Ltr., Portal to Arnold, 20 Feb. 1943, ibid.
19. Ltr., Stratemeyer to Air Vice Marshal Foster, 29 Jan. 1943, ibid.
20. Ltr., Arnold to Foster, 4 March 1943, in III B-1, AFAEP.

21. Ltr., Arnold to Eaker, 24 March 1943, Misc. file, AFSEO.

22. History of VIII AFSC, Chap. IV, "Flow," p. 2.

23. CG/S 217, 14 May 1943.

24. Eaker's Report, Opns. Annex, p. 13.

25. History of VIII AFSC, Chap. IV, "Flow," p. 10.

26. Ltr., Arnold to Bradley, 22 April 1943, in AAG 320.2-F.

27. History of VIII AFSC, Chap. IV, "Flow," p. 11.

28. Ltr., Bradley to CG AAF, thru CG 8th AF and ETOUSA in turn, 28 May 1943, in III B-1, AFAEP.

29. Eaker's Report, p. 2.

30. Ltr., Bradley to CG AAF, 28 May 1943, in III B-I, AFAEP.

31. Base air depots performed modification and overhaul for both strategic and tactical aircraft.

32. Ltr., Bradley to CG AAF, 28 May 1943, in III B-I, AFAEP.

33. Ibid., and incl. entitled "Proposed Air Force Program in Relation to Shipping and Ground and SOS Troop Basis." Organization tables for various units prepared under direction of the Bradley Committee are in file entitled "Bradley Plan" in AFAEP: also in AAG files.

34. History of VIII AFSC, Chap. IV, "Flow," p. 5.

35. 1st and 2d Ind. to ltr., Bradley to CG AAF, 28 May 1943. General Devers had succeeded General Andrews as CG, ETOUSA, upon the death of the latter.

36. Eaker's Report, Opns. Annex, p. 15.

37. Ltr., Eaker to Bradley, 28 May 1943, in AAG 323-G.

38. Stat Sum of Opns.

39. Memo from AC/AS, Plans to AC/AS, Management Control, 20 June 1943, "Analysis of Army Air Force Programs," in WP III A-2, AFAEP.

40. CM-OUT-5882, 15 June 43, Arnold to Eaker.

41. CM-OUT-2138, 7 June 43.

42. CM-IN-17138, 27 June 43, London to War.

43. Stat Sum of Opns.

44. Ibid.

45. Ibid. There are many figures available for the strength of the Eighth Air Force. The Statistical Summary is used throughout this study for the sake of consistency.

46. 8th AF, Bi-Monthly Report of Bombing Results [Bimonthly Rpt.], 1-15 July 1943; CC/S 217, 14 May 1943.

47. VIII Bomber Command Narratives of Operations [VIII BCNO], April-June 1943.

48. Eaker's Report, p. 12.

49. "Operations of the 8th Air Force, " in AAFSAT Intel. Rpts. K-35373, A-2 Lib.

50. Eaker's Report, p. 13.

51. Ibid., Exh. 10, Plans Annex.

52. Ibid., p. 13.

53. Stat Sum of Opns.

54. Ibid.

55. Bimonthly Rpt., 15-30 April 1943.

56. VIII BCNO, April 1943.

57. Stat Sum of Opns.

58. Bimonthly Rpt., 1-15 and 16-30 May 1943.

59. Ibid.

60. Stat Sum of Opns.

61. CC/S 217, 14 May 1943.

62. AAF Historical Studies: No. 32, Ninth Air Force in the ETO, p. 121.

63. Ltr., Eaker to Giles, 28 May 1943, in AAG 312.1-F.

64. Ltr., Eaker to Portal, 4 March 1943, and incl. (list of targets), Exh. 5, Plans Annex to Eaker's Report.

65. Ltr., Portal to Eaker, 10 March 1943, Exh. 6, Plans Annex to Eaker's Report.

66. 8th AF, "Freshman Targets for 3rd Wing," 3 May 1943.

67. Ltr., Eaker to Giles, 28 May 1943.

68. Ninth Air Force in the ETO, pp. 121-123.

69. VIII BCHO, 14 May 1943.

70. CM-IN-18992, 29 May 43, USAWW London to WAR.

71. Ltr., Eaker to Giles, 28 May 1943. The initial operations of the medium bombers from United Kingdom are fully discussed in Ninth Air Force in the ETO, pp. 122-125.

72. Stat Sum of Opns.

73. VIII BCHO, 11-29 June 1943.

74. Stat Sum of Opns.

75. Ibid.

76. "Bombardment Policy," Exh. 1, Plans Annex to Eaker's Report.

77. History of VIII AFSC, Chap. V, chart preceding p. 108.

78. Stat Sum of Opns. These figures have little meaning, for they are based on scant data. There is a study by Operational Research Section entitled "Analysis of VIII Bomber Command Operations from the Point of view of Bombing Accuracy, 1 January-15 October 1943." This study summarizes accuracies for different time periods thus:

	% of HE Bombs Which Fell Within	
	1,000 ft. of AP	2,000 ft. of AP
All Missions		
Jan. 1--May 15, 1943	11.3	24.6
May 15--Aug. 1, 1943	6.3	17.6

79. Hq 8th AF, AC/S, A-2, Special Rpt. #83, 28 Aug. 1943, in AAG 319.1.

80. Hq 8th AF, Operational Analysis Sec., "An Evaluation of Defensive Measures Taken to Protect Heavy Bombers from Loss and Damage," ["Eval. of Defensive Measures"] Nov. 1944.

81. Stat Sum of Opns. The B-24's in the United Kingdom departed for MTO the latter part of June. Tactical unit equipment of B-24's was 96 for April and May. Tactical unit equipment of B-17's was 240 at the end of April, 480 end of May, and 624 end of June.

82. Ibid.

83. Memo for CG AAF from Robert A. Lovett, 19 June 1943, in AAG 380-A; memo, Report on Trip to England, by Maj. Edward Elliot, Jr., 21 June 1943, in WP III A-2, AFAEP.

84. CC/S 217, 14 May 1943.

85. Hq 8th AF, AC/S A-2, Special Rpt. #83.

86. Ibid.

87. Memo by AC/S A-2, 8th AF, 19 July 1943, in AAG 312.1-J.

88. 8th AF, AC/S A-2, Special Rpt. #83.

89. "Eval. of Defensive Measures."

90. VIII Bomber Command, ORS, "Battle Damage and Losses Connected with Enemy Fighter Activity," 4 Oct. 1943, K-3618, in A-2 Lib.

91. VIII Bomber Command, "Self Inflicted Battle Damage," 5 June 1943, K-35143, in A-2 Lib.

92. VIII Bomber Command, ORS report, 30 Sep. 1943, K-36317 in A-2 Lib.

93. History of VIII AFSC, Chap. V, p. 118; AAF Materiel Center, Memo Report on Trip to United Kingdom, 17 March 1943, in AAG 380-A.

94. "Eval. of Defensive Measures."

95. Pt. II, Hermann Goering, 1 June 1945, A.P.W.I.D. (9th AF Adv.), 65/1945.

96. "Eval. of Defensive Measures"; ltr., Baker to Stratemeyer, 2 Jan. 1943, in AAG 312.1-C; History of VIII AFSC, Chap. V, p. 118.

97. "Eval. of Defensive Measures."

98. Ltr., Stratemeyer to Baker, 17 Feb. 1943, in AAG 312.1-C; CM-OUT (?), 19 June 43, Hq AAF to CG 8th AF; ltr., Baker to Giles, 29 June 1943, in AAG 312.1-H.

99. CM-IN-917, 2 July 43, USAWW London to WAR; CM-IN-12575, 18 July 43, London to WAR.

100. CM-OUT-7952, 20 July 43, Hq AAF to CG 8th AF.

101. History, VIII Fighter Command, p. 211.

102. Memo Report on Trip to UK, 17 March 1943; "Eval. of Defensive Measures."

103. CM-IN-7811, 14 April 43, USFOR London to WAR; ltr., Baker to Giles, 17 April 1943, in AAG 312.1-E.

104. CM-OUT-6308, 16 April 43, Hq AAF to CG 8th AF.

105. CM-IN-9346, 15 June 43, USAWW to WAR.

106. VIII BCMO, June 1943.

107. Ltr., Baker to Giles, 29 June 1943, in AAG 312.1-H.

108. Report of VIII Fighter Command by Maj. Gen. W. E. Kepner, 31 Oct. 1943, in AAG 312.1-N.

109. History, VIII Fighter Command, p. 110.

110. VIII Fighter Command Report, 8 Aug. 1943, K-33473, in A-2 Lib.

111. History, VIII Fighter Command, p. 367; Stat Sum of Opns.

112. CG/S, 217, 14 May 1943.

113. Bradley to CG AAF, 28 May 1943, in III B-I, AFAEP.

114. Ltr., Hq. VIII Fighter Command, Estimated Fighter Requirements, 17 April 1943, in WP III A-2, AFAEP. See also ltr., CG 5th Bomb Wing to CG XII Bomber Command, about 14 June 1943, and attached ltrs. from Maj. Gen. Stratemeyer and Brig. Gen. Kuter.

115. CM-IN-14323, 24 April 43, USAWW to WAR.

116. Memo for CG AAF, Items Restricting Operations in 8th AF, from Robert A. Lovett, 19 June 1943, in AAG 380-A.

117. CM-IN-21332, 30 July 43, 8th AF to WAR.

118. History of VIII AFSC, Chap. V, p. 44; CM-IN-6982, 11 June 43, USAWW to CG AAF.

119. Ltr., Air Technical Sec., Hq. VIII Fighter Command to Col. Mark E. Bradley, Wright Field, 10 July 1943, in AAG 400-A; ltr., Maj. O. P. Echols to Gen. Baker, 2 July 1943, in AAG 312.1-H.

[redacted] SECURITY INFORMATION

120. Ltr., Baker to Giles, 13 May 1943, in AAG 312.1-F; CM-IN-6982, 11 June 43, USAWW to CG AAF.

121. Chronological Record of VIII Fighter Command to 10 Oct. 1944.

122. VIII BCNO, April 1943.

123. VIII BCNO, 4 May 1943. Chronological Record of VIII Fighter Command to 10 Oct. 1944; CM-IN-3768, 6 May 43, London to WAR.

124. VIII BCNO, May-June 1943, Stat Sum of Opns.

125. "Eval. of Defensive Measures."

126. Ltrs., Anderson to Baker, 13 Sep. 1943, and Baker to Arnold, 30 Aug. 1943, in AAG 312.1-K; interview with Brig. Gen. H. S. Hansell, 9 Aug. 1943, K-30972, in A-2 Lib.

127. VIII BCNO, 4 April 1943.

128. Ibid., 4 May 1943.

129. Command Informational Intelligence Series, #43-6, 3 May 1943, in AAG 300-A.

130. Interview with Lt. Col. Snavely, 27 July 1943, K-29946, in A-2 Lib.

131. VIII BCNO, April-June 1943.

132. Memo Report on Trip to UK, 17 March 1943.

133. Hq. VIII Bomber Command, 14 April 1943, Anti-Aircraft Memo #1, in Report of Lt. Col. John T. McCall to AC/AS, Intel., 21 July 1943, K-45463, in A-2 Lib.

134. Baker's Report, Opns. Annex, p. 4.

135. "Eval. of Defensive Measures."

136. Baker's Report, Personnel Annex, p. 6; History of VIII AFSC, Chap. V, p. 69.

137. Memo Report of Trip to UK, 17 March 1943; ltr., Baker to Bradley, 28 May 1943, in AAG 322-G.

138. Baker's Report, Exh. 4, Plans Annex.

139. Ibid., Exh. 8, Directive of 10 June 1943.

SECURITY INFORMATION

140. Ibid., Opns. Annex, p. 6; ltr., Baker to Arnold, 8 June 1943, in AAG 312.1-G.

141. Interview with Brig. Gen. H. S. Hansell.

142. CC/S, 217, 14 May 1943.

143. AC/AS, Intel., "The Strategic Aerial Bombardment of Europe: Accomplishments and Potentialities," 10 Dec. 1943; "Effects of Bombing Offensive on German War Effort," report by Joint Intelligence Com., 22 July 1943, Tab K, Bi-monthly Rpt., 16-31 July 1943.

144. VIII BCNO, April-June 1943.

145. Ibid.

146. Ibid., 16 April 1943.

147. Ibid., 14 May 1943; 8th AF Bi-monthly Rpt., 1-15 May 1943.

148. VIII BCNO, 17 May 1943; Bi-monthly Rpt., 16-31 May 1943.

149. 8th AF Target Summary gives the Fried Krupp Germania Werft while VIII BCNO says that 101 B-17's bombed Kiel Deutsche Werft and one bombed Kriegsmarinewerft.

150. VIII BCNO, 17 May 1943. Bi-monthly Rpt., 16-31 May 1943.

151. Ibid.

152. Ibid.; 8th AF Target Summary.

153. Ibid.

154. "The Strategic Aerial Bombardment of Europe"; VIII BCNO, April-June 1943.

155. Ibid., 5 April 1943; CM-IN-3702, 7 April 43, London to WAR.

156. Bi-monthly Rpt., 15-30 April 1943.

157. A.P.W.I.D. (9th AF Adv.), 65/1945.

158. VIII BCNO, 17 April 1943; CM-IN-12237, 20 April 43, London to WAR; Bi-monthly Rpt., 15-30 April 1943.

159. Ibid., 1-15 May 1943; CM-IN-9971, 16 May 43, London to WAR: VIII BCNO, 13 and 14 May 1943.

[redacted]

160. Ibid., 26-27 June 1943; Bi-monthly Rpt., 16-30 June 1943.

161. Report of CCA, 8 March 1943.

162. VIII BCNO, 22 June 1943; CM-IN-14358, 23 June 43, 8th AF to WAR.

163. Ibid.

164. Baker's Report, Exhs. 4 and 8, Plans Annex.

165. 8th AF Target Summary; VIII BCNO, 4 April 1943.

166. Ibid., 4 and 14 May 1943.

167. Ibid., 22 and 26 June 1943.

168. "The Strategic Aerial Bombardment of Europe."

169. VIII BCNO, 15 May, 11 and 25 June 1943; CM-IN-16767, 26 June 43, London to WAR.

170. Air Ministry War Room Manual of Bomber Command Operations, 1939-1945, Foreign Statistics Div., Statistical Control.

171. RAF, Bomber Command Quarterly Review, April-June 1943, #5, in A-2 Lib.

172. Ibid.

173. Ibid.

174. Ibid.

175. Ibid.

176. Ibid.

177. Ibid.

178. Document in Bi-monthly Rpt., 16-31 July 1943.

CONFIDENTIAL

Chapter III

1. CM-OUT-6951 (18 Aug. 43), Hq AAF to CG ETO, #1973, 17 Aug. 43; CM-OUT-520 (2 Oct. 43), WDGS to CG ETO, #3799, 29 Sep. 43.

2. CM-OUT-4007 (11 Aug. 43), WDGS to CG ETO, #R1720, 10 Aug. 43; CM-OUT-6097 (15 Aug. 43), WDGS to CG ETO, #1906, 15 Aug. 43; CM-OUT (18 Aug. 43), Hq AAF to CG ETO, #1973, 17 Aug. 43.

3. Ltr., Baker to Arnold, 15 Aug. 1943, in AAG 312.1-J; CM-IN-32260 (29 Aug. 43), London to WAR, #W3745, 29 Aug. 43; History of VIII AFSC, Chap. 4, "Flow," p. 15.

4. Ibid., Chap. 2, p. 68; CM-OUT-1636 (3 Sep. 43), WDGS to CG ETO, #R2637, 1 Sep. 43; CM-IN-5572 (7 Sep. 43), London to WAR, #W4179, 7 Sep. 43; CM-OUT-520 (2 Oct. 43), WDGS to CG ETO, #3799, 29 Sep. 43.

5. CM-OUT-191 (1 July 43), AC/AS, OCR to CG 8 AF, #A2788, 1 July 43; CM-OUT-1000 (3 July 43), AS/W for Air to CG USFOR, #R230, 2 July 43; CM-OUT-543 (2 July 43), AC/AS OCR to CG 8 AF, #A2796, 30 June 43; CM-IN-2432 (4 July 43), London to WAR, #1443, 3 July 43; memo for C/S, Inspector General's Report on 8th AF, 16 Sep. 1943 by Brig. Gen. Edwin Perin, DC/AS, in AAG 380-A; CM-OUT-520 (2 Oct. 43), WDGS to CG ETO, #3799, 29 Sep. 43; CM-OUT-1121 (2 Oct. 43), London to WAR, #W5195, 2 Oct. 43.

6. Memo for CG AAF from C/S, Tactical Service Units to Support Combat Units, 13 Aug. 1943, in AAG 380-A; ltr., Office of Inspector General to DC/S, 5 Aug. 1943, Survey of Organization and Operation of 8th AF (ETOUSA), in AAG 380-A.

7. Memo for C/S, Inspector General's Report on 8th AF, 16 Sep. 1943, in AAG 380-A.

8. CM-OUT-1636 (3 Sep. 43), WDGS to CG ETO, #R2637, 1 Sep. 43.

9. CM-IN-5572 (7 Sep. 43), London to WAR, #W4179, 7 Sep. 43.

10. CM-OUT-12787 (28 Sep. 43), WDGS to CG USFOR, #R3620, 27 Sep. 43; ltr., Brig. Gen. J. A. Craig, AC/AS OCR to Maj. Gen. Baker, 15 Sep. 1943, in AAG 312.1.

11. These subjects are completely discussed in the study entitled Ninth Air Force in ETO. CM-IN-15881 (22 July 43), London to WAR, #W2241, 22 July 43; CM-IN-2430 (4 Aug. 43), Cairo to AGWAR, #AHS HEAF 1901, 4 Aug. 43; ltrs., Arnold to Portal, 6 Sep. 1943, and Portal to Arnold, 9 Sep. 1943, in WP III A-2, AFHAP; History of VIII AFSC, Chap. II, p. 78.

12. Baker's Report, Personnel Annex, pp. 8-9; CM-IN-15939 (21 Aug. 43), London to WAR, #W3425, 20 Aug. 43; CM-OUT-477 (1 Sep. 43), Hq AAF to CG 8th AF, #3426, 1 Sep. 43.

SECURITY INFORMATION

13. Statistical Summary of Eighth Air Force Operations, European Theater, 17 Aug. 1942-8 May 1945 /Stat Sum of Opns./.

14. Ibid.

15. Ibid.

16. CM-IN-8429 (12 July 43), London to WAR, #W1843, 12 July 43; CM-OUT-5152 (13 July 43), AC/AS Plans to CG 8 AF, #A2891; CM-OUT-8200 (20 July 43), CC/S to CG Freedom Algiers; CM-IN-20257 (28 July 43), Algiers to AGWAR, #W5915/5144, 28 July 43; CM-IN-21175 (29 July 43), London to WAR, #W2530; CM-IN-21774 (30 July 43), Algiers to WAR, #W6099, 30 July 43; CM-OUT-12421 (31 July 43), WDGS to CG ETO, #R1331, 31 July 43; CM-IN-986 (2 Aug. 43), London to WAR, #W2687, 2 Aug. 43; CM-OUT-323 (2 Aug. 43), CC/S to CG Freedom Algiers, #R1381, 2 Aug. 43; CM-IN-1739 (3 Aug. 43), Algiers to WAR, #W6411, 3 Aug. 43; CM-OUT-1137 (4 Aug. 43), Opns. Div to CG NATO Freedom, #4160, 4 Aug. 43.

17. CM-IN-10280 (14 Aug. 43), London to WAR, #W3160, 14 Aug. 43; CM-IN-12549 (17 Aug. 43), AF Hq in NATO to WAR, #W7544, 17 Aug. 43; CM-IN-14807 (20 Aug. 43), Quebec to WAR, #88W40, 19 Aug. 43.

18. CM-IN-11026 (14 Sep. 43), Algiers to WAR, #471, 14 Sep. 43; CM-IN-11726 (15 Sep. 43), Algiers to WAR, #476, AAF 371, 15 Sep. 43; CM-OUT-7196 (15 Sep. 43), JCS to CG ETO, #R3145, 15 Sep. 43; CM-IN-12128, 16 Sep. 43, London to WAR, #W4528, 16 Sep. 43; VIII BCMO, 16-17 Sep. 1943.

19. CM-IN-14863 (20 Sep. 43), London to WAR, #W4732, 19 Sep. 43; CM-OUT-10324 (22 Sep. 43), WDGS to CG NATO, #8365, 22 Sep. 43; Stat Sum of Opns.; ltr., Eaker to Arnold, 1 Oct. 1943, in WP III A-2, AFAHP.

20. Stat Sum of Opns.

21. Ibid.

22. Ibid.

23. CM-IN-258 (1 Oct. 43), 8th AF to WAR, #D1221, 30 Sep. 43; Stat Sum of Opns.; CC/S 217, 14 May 1943.

24. VIII BCMO, July-Sep. 1943; Stat Sum of Opns.

25. VIII BCMO, July 1943.

26. Ibid., Aug. 1943.

27. Ibid., Sep. 1943.

28. Ibid., July-Sep. 1943; Stat Sum of Opns.

SECURITY INFORMATION

29. Ibid.

30. CM-OUT-9784 (24 July 43), Hq AAF to CG 8th AF, #A3014, 24 July 43; CM-IN-22645 (24 July 43), USFOR to WAR.

31. "Maximum Sortie Rates in United Kingdom," incl. to ltr., Brig. Gen. Byron E. Gates to Lt. Gen. Eaker, 4 Nov. 1943, in AAG 312.1-M.

32. Stat Sum of Opns.

33. Ibid.; Hq VIII Bomber Command, "September 1943 Effort of VIII Bomber Command," 2 Oct. 1943, in WP III A-2, AFAEP.

34. AC/AS, Intel., "The Strategic Aerial Bombardment of Europe," 10 Dec. 1943; interview with Air Commodore Sharp and Wing Commander Robinson, 10 Aug. 1943, K-44217, in A-2 Lib.; ltr., Col. L. P. Wercker to CG 8th AF, 9 Dec. 1943, in WP III D-8, Germany, AFAEP.

35. CM-OUT-11575 (29 July 43), CG AAF to CG ETO, #R1236, 29 July 43.

36. CM-IN-2549 (4 Aug. 43), London to WAR, #D1715, 4 Aug. 43; ltr., Eaker to Arnold, 30 Aug. 1943, in AAG 312.1-K.

37. Hq 8th AF, AC/S A-2, Special Report #83, 28 Aug. 1943, in AAG 319.1, Great Britain.

38. Ibid.; AAF Proving Ground Command, Personal Report on Mission to England, by Maj. D. J. Munson, Aug. 1943, in AAG 300-A, British Isles; CM-IN-3264 (4 Sep. 43), London to WAR, #W4044, 4 Sep. 43; A-2 Special Report #83; VIII BCMO, July-Sep. 1943.

39. Hq VIII Bomber Command, ORS, "Analysis of Enemy Fighter Activity as Related to Losses and Damage Suffered by Heavy Bombers on 39 Missions During July, August, and September 1943," K-42401, in A-2 Lib.

40. VIII BCMO, July-Sep. 1943.

41. Ibid.

42. Ibid., 17 Aug. and 6 Sep. 1943.

43. Hq 3d Bomb Wing (M), Summary of Mission #1, 16 July 1943, in A-2 Lib.

44. Hq 3d Bomb Wing (M), Mission Summaries. Stat Sum of Opns.; Medium Bomber Operations are discussed in the study, Ninth Air Force in ETO.

45. Ltrs., Arnold to Eaker, 1 Aug. 1943, and Eaker to Arnold, 30 Aug. 1943, in AAG 312.1.

46. Ibid.

SECURITY INFORMATION

47. CM-IN-15978 (22 July 43), London to WAR, #W2215, 22 July 43.

48. Hq VIII Bomber Command, ORS, "Analysis of VIII Bomber Command Operations from the Point of View of Bombing Accuracy, January-15 October 1943."

	All Missions % of HE Bombs Which Fell Within	
	1,000 feet of AP	2,000 feet of AP
1 Jan-15 May 1943	11.3	24.6
15 May-1 Aug 1943	6.3	17.6
1 Aug-15 Oct 1943	13.0	28.7

49. Stat Sum of Opns.

50. ORS, "Bombing Accuracy of 8th AF Bomb Divisions, Combat Wings, and Groups," (n.d.), in Research and Analysis Br., Office of Statistical Control.

51. Hq VIII Bomber Command, "September 1943 Effort of VIII Bomber Command," 2 Oct. 1943, in WP III A-2, AFAEP.

52. Ltr., Baker to Giles, 15 Sep. 1943, in AAG 312.1-K.

53. Certain standards were established for reporting enemy airplane losses:
Enemy aircraft in flight considered destroyed when:
1. Seen to crash.
2. Seen to disintegrate in the air or to be enveloped in flames.
3. Seen to descend on friendly territory and be captured.
4. Pilot and entire crew seen to bail out.

Probably destroyed: While in flight the enemy airplane is seen to break off combat under circumstances which lead to the conclusion that it must have been a loss, although it is not seen to crash.
Damaged: Enemy aircraft considered damaged when so injured that it requires repair before beginning another mission, but had better than even chance of continuing its flight.
Stat Sum of Opns.

54. Ibid.

55. Office of Strategic Services, "A Critical Review of Statistics on the German Air Position," 29 Nov. 1943.

56. CM-IN-1956 (3 July 43), USFOR to WAR, #W1410, 3 July 43.

57. OSS, "A Critical Review of Statistics on the German Air Position"; Stat Sum of Opns.

[redacted]

58. OSS, "A Critical Review of Statistics on the German Air Position."

59. Memo for Gen. Arnold, Fighter Requirements in UK, 1 July 1943, in WP III A-2, Great Britain, AFAEP.

60. Stat Sum of Opns.

61. AAF Proving Ground Command, Personal Report on Mission to England, Aug. 1943, in AAG 300-A, British Isles.

62. Ltr., Brig. Gen. F. L. Anderson to VIII Fighter Command, 8 Aug. 1943, K-33473, in A-2 Lib.

63. Ltr., Anderson to Baker, 13 Sep. 1943, in AAG 312.1.

64. Ltr., Arnold to Portal, 25 Sep. 1943, in WP III A-2, Great Britain, AFAEP.

65. CM-OUT-543 (2 July 43), AC/AS OCR to CG 8th AF, #A2796, 30 June 43; ltr., Baker to Giles, 18 July 1943, in AAG 312.1-H.

66. CM-IN-9113 (12 Sep. 43), London to WAR, #D1063, 11 Sep. 43.

67. Memo for Gen. Giles, Escort of Bombers by Fighters, UK, 17 June 1943, in WP III A-2, AFAEP; CM-IN-21332 (30 July 43), London to WAR, #D1663, 29 July 43; ltr., Lt. Col. Cass S. Hough, Air Technical Sec., VIII Fighter Command to Col. Mark E. Bradley, Wright Field, 10 July 1943, in AAG 400-A, British Isles.

68. CM-IN-21332 (30 July 43), London to WAR, #D1663, 29 July 43.

69. VIII Fighter Command Report [VIII FC Rpt.], 8 Aug. 1943, K-33473, in A-2 Lib.

70. History of VIII AFSC, Chap. V, p. 45; VIII FC Rpt. WD-PF-640, 15 Sep. 1943, London to CG AAF, #45372,15 Sep. 43.

71. History of VIII AFSC, Chap. V, p. 45; ltr., Kepner to Giles, 7 Sep. 1943, in AAG 312.1-K.

72. VIII FC Rpt.; ltr., Kepner to Giles, 7 Sep. 1943.

73. History, VIII Fighter Command, p.113; Stat Sum of Opns.

74. History, VIII Fighter Command, p. 114; Stat Sum of Opns.

75. Ibid.

76. Ibid.; VIII BCNO, July-Sep. 1943.

77. Ltr., Brig. Gen. F. L. Anderson to VIII Fighter Command, 8 Aug. 1943, K-33473, in A-2 Lib.; Stat Sum of Opns.; ORS Report, 12 Feb. 1944, K-55563, in A-2 Lib.

78. Stat Sum of Opns.; "The Strategic Aerial Bombardment of Europe."

79. Ibid.

80. Stat Sum of Opns.

81. VIII BCNO, July and August 1943; CM-IN-11401 (15 Aug. 43), Cairo to WAR, #AMSME 7432, 15 Aug. 43. For a complete discussion of the attack on GAF facilities, see AAFRH-10.

82. VIII BCNO, 28 July 1943; CM-IN-1711 (1 Aug. 43), London to WAR, #W2624, 31 July 43. 8th AF, "Bi-Monthly Report of Bombing Results," 16-31 July 1943.

83. VIII BCNO, 29 and 30 July 1943; CM-IN-836 (2 Aug. 43), London to WAR, #W2676, 1 Aug. 43.

84. CM-IN-11401 (15 Aug. 43), Cairo to WAR, #AMSME 7432, 15 Aug. 43; VIII BCNO, 17 Aug. 1943; 8th AF, "Semi-Monthly Report of Bombing Results" [Semimonthly Rpt.], 16-31 Aug. 1943.

85. "The Strategic Aerial Bombardment of Europe."

86. CM-IN-9832 (16 Oct. 43), London to WAR, #1410, 16 Oct. 43; VIII BCNO, July-Sep. 1943; 8th AF Target Summary; Semimonthly Rpt., July-Sep.1943.

87. "The Strategic Aerial Bombardment of Europe."

88. Ibid.; VIII BCNO, July-Sep. 1943.

89. VIII BCNO, July 1943; 8th AF Target Summary.

90. VIII BCNO, 4 and 24 July 1943; CM-IN-18104 (25 July 43), London to WAR, #W2370, 25 July 43.

91. VIII BCNO, 25 and 26 July 1943; Semimonthly Rpt., 16-31 July 1943.

92. VIII BCNO, 25 and 29 July 1943.

93. CM-IN-6499 (9 Aug. 43), London to WAR, #D1754, 9 Aug. 43; Semimonthly Rpt., 1-15 Aug. 1943.

94. VIII BCNO, Sep. 1943.

95. Ibid., 23 Sep. 1943.

SECURITY INFORMATION

96. CM-IN-19909 (28 Sep. 43), London to WAR, #W5010, 28 Sep. 43; VIII BCNO, 27 Sep. 1943. The cable story of the mission followed in this account is slightly different from the report in the Narrative of Operations. The cable account seems to be the clearer report.

97. Semimonthly Rpt., 16-30 Sep. 1943.

98. CM-OUT-13686 (29 Sep. 43), CG AAF to CG 8th AF, #A3767, 29 Sep. 43.

99. "The Strategic Aerial Bombardment of Europe."

100. 8th AF Target Summary; VIII BCNO, 17 Aug. 1943; Semimonthly Rpt., 16-31 Aug. 1943.

101. VIII BCNO, 17 Aug. 1943; "The Strategic Aerial Bombardment of Europe."

102. VIII BCNO, 17 Aug. 1943; CM-IN-14256 (19 Aug. 43), London to WAR, #W3382, 19 Aug. 43.

103. 8th AF Target Summary.

104. "The Strategic Aerial Bombardment of Europe"; CC/S 217, 14 May 1943.

105. VIII BCNO, 12 Aug. 1943; CM-IN-9368 (13 Aug. 43), London to WAR, #W3128, 12 Aug. 43; CM-IN-9546 (13 Aug. 43), London to WAR, #D1790, 13 Aug. 43.

106. VIII BCNO, 26 July 1943; "Strategic Aerial Bombardment of Europe."

107. VIII BCNO, 15 Sep. 1943.

108. Ibid.,24 July 1943; CM-IN-18104,(25 July 43), London to WAR, #W2370, 25 July 43; CM-IN-18061 (25 July 43), London to WAR, #2362, 24 July 43.

109. Semimonthly Rpt., July-Sep. 1943; VIII BCNO, July-Sep. 1943.

110. Ibid.

111. VIII Air Support Command, Report of Operation STARKEY, 30 Sep. 1943, K-44667, in A-2 Lib.

112. Ibid.

113. VIII BCNO, Aug. and Sep. 1943; 8th AF Target Summary; Semimonthly Rpt., 16-31 Aug. and 1-15 Sep. 1943.

114. VIII Air Support Command, Report of Operation STARKEY.

115. Ibid.

116. VIII BCNO, Sep. 1943.

SECURITY INFORMATION

117. RAF Bomber Command, Quarterly Review, July-Sep. 1943; "The Strategic Aerial Bombardment of Europe."

118. RAF Bomber Command Quarterly Review, July-Sep. 1943.

119. Ibid.

120. Ibid.

121. Ibid.

122. Ibid.

123. Ibid.

124. Ibid.

CONFIDENTIAL

Chapter IV

1. CM-IN-13750 (23 Oct. 43), Devers to Marshall for Arnold and Craig, #W6099, 22 Oct. 43. AAF Ltr. 55-1, 4 Dec. 1943, Discontinuance of the Term Bradley Plan (AAG 371 D, Theater of Operations), read:
"1. It is directed that the term "Bradley Plan" be discontinued effective at once.
"2. The plan for the augmentation of the Army Air Forces in the European Theater of Operations is contained in a letter dated 8 Nov 43, file AG 320.2 (3 Nov 43) OP-I-E-M, to the Commanding General, European Theater of Operations, subject: Troop Basis for Air Forces, European Theater of Operations (Less IBC)."

2. CM-IN-5119 (7 Sep. 43), Arnold to Marshall, #W4139, 7 Sep. 43; CM-OUT-6400 (14 Sep. 43), Arnold to Royce, #6774, 13 Sep. 43; "Organization for the Air Offensive," Air Forces General Information Bulletin, Jan. 1944; Ninth Air Force in ETO.

3. History of VIII AFSC, Chap. I, p. 25; Hq 9th AF, GO 101, 16 Oct. 1943; CM-OUT-686 (2 Nov. 43), TAG to CG ETO, #R5206, 2 Nov. 43; CM-IN-157 (1 Dec. 43), London to WAR, #W7899, 27 Nov. 43.

4. History of VIII AFSC, Chap. I, p. 22, and Chap. II, p. 27.

5. WDTC-70 (17 Nov. 43), Teletype Conference between Gen. Giles and Gen. Baker, 17 Nov. 43.

6. History of VIII AFSC, Chap. II, p. 77.

7. CM-OUT-9934 and 9935 (22 Oct. 43), CC/S to CG Freedom Algiers, #698, and to Brit COS, #4757.

8. Ibid.

9. History of VIII AFSC, Chap. IV, p. 17; ltr., Baker to Devers, 25 Oct. 1943, AFSHO Misc file.

10. Ibid.; ltr., Baker to Arnold, 1 Oct. 1943, in WP III A-2, Great Britain, AFAEP.

11. Ltr., Portal to Baker, 24 Oct. 1943, in Misc. file, AFSHO.

12. CM-OUT-14208 (31 Oct. 43), Hq AAF to CG Freedom Algiers, #1420, 31 Oct. 43.

13. Ibid.

14. CM-IN-5620 (9 Nov. 43), Algiers to WAR, #W4779, 9 Nov. 43.

CONFIDENTIAL

15. Memo for Baker from Spaatz, 5 Jan. 1944, in History ASC, USSTAF.

16. CM-OUT-7211 (18 Nov. 43), WDGS to CG USFOR, #R5874, 17 Nov. 43.

17. CM-OUT-7103 (18 Dec. 43), CG AAF to CG ETO, #R7076, 18 Dec. 43.

18. CM-IN-12161 (19 Dec. 43), London to WAR, #W8685, 19 Dec. 43;
CM-IN-12615 (20 Dec. 43), London to WAR, #W8720, 20 Dec. 43;
CM-OUT-7695 (20 Dec. 43), CG AAF to CG 8th AF, #A4989, 20 Dec. 43.

19. Stat Sum of Opns.

20. CC/S 217, 14 May 1943.

21. CM-IN-19355 (31 Dec. 43), London to WAR, #D1302, 30 Dec. 43; CM-IN-169 (1 Jan. 44), London to WAR, #D1318, 31 Dec. 43.

22. Stat Sum of Opns.

23. Ibid.

24. VIII BCHO, Oct.-Dec. 1943.

25. Ibid., Nov. 1943.

26. Ibid., 24 Dec. 1943.

27. Ibid., Oct.-Dec. 1943.

28. CM-OUT-12058 (25 Sep. 43), CG AAF to CG ETO, #R3580, 25 Sep. 43.

29. Ltr., Arnold to Portal, 14 Oct. 1943, in WP III A-2, Great Britain.

30. Ltr., Anderson to Giles, 17 Nov. 1943, in AAG 312.1-M; ltr., Air Marshal W. L. Welsh to Arnold, 14 Dec. 1943, in WP III A-2, Great Britain.

31. VIII BCHO, Oct.-Dec. 1943. The Statistical Summary of Eighth Air Force Operations shows sorties per operational day as follows:

October	384.3
November	408.2
December	633.7

but this obviously includes all types of heavy bomber sorties (night leaflet, participation with RAF, and daylight) divided by the number of operational days per month.

32. Stat Sum of Opns. Bomb totals include 396 tons by mediums in October, 16.8 tons by fighter bombers in November, and 10.5 tons by fighter bombers in December.

CONFIDENTIAL

33. Stat Sum of Opns.; VIII BCMO, Oct. 1943.

34. Stat Sum of Opns.

35. Ibid.

36. Ibid.; VIII BCMO, Oct. 1943.

37. CM-IN-8967 (15 Oct. 43), 8th AF London to WAR, #D1383, 15 Oct. 43.

38. ORS Report, Reduction of Losses and Battle Damage, 12 Feb. 1944, K-55563, in A-2 Lib.; History of VIII AFSC, Chap. V, p. 74.

39. CM-IN-1946 (3 Dec. 43), London to WAR, #W8044/497, 2 Dec. 43; ltr., Hq USAAF in UK, Radio Counter Measures Unit, 28 Dec. 1943, K-43218, in A-2 Lib.

40. ORS Report, 17 Aug. 1943, K-38458, in A-2 Lib.

41. Baker's Report, Opns. Annex, p. 9; History of VIII AFSC, Chap. V, p. 72; memo for C/AS, British Night Bombing, dated about 1 Dec. 1943, in AAG 300-A, British Isles.

42. Baker's Report, Opns. Annex, p. 9.

43. Ltr., Baker to Bradley, 28 May 1943, in AAG 322-G;ltr., Hq 8th AF to CG AAF, Washington, thru CG EFOUSA, 1 June 1943, Manning Table for Pathfinder Force, in "The Bradley Plan" file, AFAEP.

44. CM-OUT-4757 (11 July 43), Hq AAF to CG 8th AF, #A3879, 11 July 43; CM-IN-17109 (23 Aug. 43), London to WAR, #L3463, 21 Aug. 43; Stat Sum of Opns.

45. R&R, AC/AS OCR to AC/AS Plans, Tab: Status of Bradley Plan and Pathfinder Force, 9 July 1943, Balanced AAF Program, in III B-I, AFAEP; CM-IN-1751 (3 Oct. 43), 8th AF to WAR, #D1257, 3 Oct. 43.

46. History of VIII AFSC, Chap. V, p. 73; ltr., Baker to Arnold, 20 July 1943, in AAG 312.1; CM-IN-306 (1 Oct. 43), London to WAR, #D1230, 1 Oct. 43; CM-IN-12848 (21 Oct. 43), London to WAR, #D1460, 21 Oct. 43.

47. ORS Report, Reduction of Losses and Battle Damage, 12 Feb. 1944; Stat Sum of Opns.; VIII BCMO, Oct.-Dec. 1943.

48. ORS Report, Reduction of Losses and Battle Damage.

49. Ibid.

50. Stat Sum of Opns.; Targets of 15th AF, Nov. and Dec. 1943, in AFSnO.

51. CC/S 217, 14 May 1943; VIII BCNO, Oct.-Dec. 1943; Targets of 15th AF, Nov. and Dec. 1943.

52. ORS, "Bombing Accuracy of 8th AF Bomb Divisions, Combat Wings, and Groups," (n.d.), in Research and Analysis Br., Office of Statistical Control.

53. VIII BCNO, Oct. 1943; 8th AF Target Sum.

54. AC/AS, Intel., "The Strategic Aerial Bombardment of Europe," 10 Dec. 1943; Hq NASAF, Intops Sum #105, 4 Nov. 1943.

55. "The Strategic Aerial Bombardment of Europe."

56. USSTAF Semi-Monthly Report of Bombing Results, 16-31 Jan. 1943.

57. VIII BCNO, 18 Nov. 1943; Targets of 15th AF, Dec. 1943.

58. VIII BCNO, Oct.-Dec. 1943; Targets of 15th AF, Nov. and Dec. 1943; Hq 9th AF, 9th AF Missions, 18 Oct.-31 Dec. 1943.

59. VIII BCNO, 2 and 8 Oct., and 11 Dec. 1943; 8th AF Target Sum.

60. VIII BCNO, Oct.-Dec. 1943.

61. Ibid.; 8th AF Target Sum.

62. VIII BCNO, Nov. and Dec. 1943; Hq Northwest African Air Forces A-2 Sec., Air Intelligence Weekly Sum #55, 6 Dec. 1943, K-40816, in A-2 Lib.

63. VIII BCNO, Oct.-Dec. 1943; Hq NASAF, Intops Sum., Nov. and Dec. 1943; Hq MAAF A-2 Sec., Air Intelligence Weekly Sum. #52, 15 Nov. 1943.

64. 8th AF Target Sum.

65. "The Strategic Aerial Bombardment of Europe"; Semimonthly Rpt., 1-15 Oct. 1943.

66. VIII BCNO, 14 Oct. 1943.

67. CM-OUT-7052 (16 Oct. 43), Sec. WDGS to Gen. Eaker, #A3967, 16 Oct. 43; CM-OUT-6647 (15 Oct. 43), C/S to Lt. Gen. Devers, #R4442, 15 Oct. 43; CM-IN-9492 (16 Oct. 43), London to WAR, #D1397, 16 Oct. 43; CM-OUT-6846 (16 Oct. 43), AC/AS Plans to CG 8th AF, #A3957, 15 Oct. 43.

68. CM-OUT-11382 (26 Oct. 43), CG AAF to CG MATO.

SECURITY INFORMATION

69. Hq NASAF, Intops Sum., Nov. and Dec. 1943.

70. VIII BCMO, 31 Dec. 1943.

71. Ibid., 5 and 19 Nov. 1943; 8th AF Target Sum.

72. VIII BCMO, 30 Dec. 1943.

73. Ibid., Oct.-Dec. 1943; 8th AF Target Sum.

74. Hq NASAF, Intops Sum., Nov. and Dec. 1943.

75. VIII BCMO, 16 Nov. 1943; Semimonthly Rpt., 16-30 Nov. 1943.

76. Ibid., Oct.-Dec. 1943; VIII BCMO, Oct.-Dec. 1943; 8th AF Target Sum.

77. CM-IN-17047 (28 Dec. 43), London to WAR, #D1273, 27 Dec. 43; CM-IN-16085 (26 Dec. 43), London to WAR, #D1242, 25 Dec. 43; VIII BCMO, 24 Dec. 1943; 9th AF Hq, 9th AF Missions, 18 Oct.-31 Dec. 1943.

78. VIII BCMO, Oct.-Dec. 1943; Hq VIII Bomber Command, Tactical Mission Reports, Summary of Night Operations from 20/21 Oct. through 30 Nov./ 1 Dec. 1943, K-45934, in A-2 Lib.; Hq VIII Bomber Command, Summary of Night Leaflet Operations During the Month of Dec. 1943, K-47437, in A-2 Lib.

79. RAF Bomber Command Quarterly Review, Oct.-Dec. 1943.

80. Ibid.

81. Ibid.

82. Ibid.

83. Ibid.

84. Ibid.

85. Ibid.

86. Ibid.

87. Ibid.

88. Ibid.

Conclusion

1. The United States Strategic Bombing Survey: Over-all Report (European War), 30 Sep. 1943, pp. 16-17.
2. Ibid., pp. 26 and 29.
3. Ibid., p. 70.
4. Ibid., p. 41
5. Ibid., p. 46.
6. Ibid., p. 65.
7. Ibid., p. 78.
8. Ibid., p. 73.
9. Ibid., p. 37.

A P P E N D I X E S

(The source of all data in these Appendixes is: "Statistical Summary of Eighth Air Force Operations, European Theater, 17 Aug 1942-8 May 1945.")

Appendix 1

Eighth Air Force 1943 Order of Battle
Heavy Bombardment Groups Operational at End of Each Month

		Total Operational
Jan 1943	B-17 Groups: 92d (Tr only), 306th, 91st, 303d, 305th B-24 Groups: 93d, 44th	6
Feb 1943	B-17 Groups: 92d (Tr only), 306th, 91st, 303d, 305th B-24 Groups: 93d, 44th	6
March 1943	B-17 Groups: 92d (Tr only), 306th, 91st, 303d, 305th B-24 Groups: 93d, 44th	6
April 1943	B-17 Groups: 92d (Tr only), 306th, 91st, 303d, 305th B-24 Groups: 93d, 44th	6
May 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th B-24 Groups: 93d, 44th	12
June 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th, 100th, 381st, 384th B-24 Groups dispatched to Mediterranean	13
July 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th, 100th, 381st, 384th, 385th, 388th No B-24 groups operational	15
Aug 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th, 100th, 381st, 384th, 385th, 388th, 390th, 482d (3 sqdns PFF) No B-24 groups operational	16-3/4

		Total Operational
Sep 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th, 100th, 381st, 384th, 385th, 388th, 390th, 482d (3 sqdns, PFF) B-24 Groups: 93d, 44th, 389th, 392d	20-3/4
Oct 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th, 100th, 381st, 384th, 385th, 388th, 390th, 482d (3 sqdns, PFF) B-24 Groups: 93d, 44th, 389th, 392d	20-3/4
Nov 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th, 100th, 381st, 384th, 385th, 388th, 390th, 482d (3 sqdns, PFF), 401st B-24 Groups: 93d, 44th, 389th, 392d	21-3/4
Dec 1943	B-17 Groups: 92d, 306th, 91st, 303d, 305th, 95th, 96th, 351st, 94th, 379th, 100th, 381st, 384th, 385th, 389th, 390th, 482d (3 sqdns, PFF), 401st, 447th B-24 Groups: 93d, 44th, 389th, 392d, 445th, 446th, 448th	25-3/4

CONFIDENTIAL SECURITY INFORMATION

Appendix 2

Eighth Air Force
1943 Personnel Strength by Months

Strength as of Last Day of Each Month of 1943	Officers Assigned	Enlisted Men Assigned	Total Assigned
Jan 31	4,525	31,716	36,241
Feb 28	4,608	31,990	36,598
March 31	5,169	35,111	40,280
April 30	6,499	37,984	44,483
May 31	8,981	65,567	74,548
June 30	11,664	89,685	101,349
July 31	11,966	87,366	99,332#
Aug 31	14,761	115,213	129,974
Sep 30	16,780	129,747	146,527
Oct 31	16,792	127,289	144,081##
Nov 30	21,845	151,312	173,157
Dec 31	22,945	173,382	196,327

July drop in assigned strength due to Mediterranean diversion.

October drop in assigned strength due to loss of personnel to Ninth Air Force, which was established 15 Oct in United Kingdom.

CONFIDENTIAL

Appendix 3

Eighth Air Force
Aircraft and Crew Strength
Daily Average by Month--1st Line Tactical Aircraft
Heavy Bombers

Month 1943	Aircraft			Crews		
	Asgd to Air Force	On Hand in Opnl Tac Units	Fully Opnl in Opnl Tac Units	Crews Asgd	Crews Avail	Effective Strength for Combat
Jan	225	155	80	147	85	80
Feb	209	146	84	143	74	74
March	257	190	112	151	87	87
April	337	231	153	187	140	140
May	547	340	200	318	178	178
June	775	459	287	419	222	222
July	800	589	378	464	315	279
Aug	761	582	406	509	341	291
Sep	881	656	461	661	409	373
Oct	1000	763	535	820	479	417
Nov	1254	902	705	1085	636	578
Dec	1503	1057	752	1556	949	723

Appendix 4

Eighth Air Force
1943 Bombing Operations

Month 1943	Days Operations Carried Out	Total Sorties	Credit Sorties	Effective Sorties	Tons of Bombs on Targets Visual	Tons of Bombs on Targets PFF
Jan	4	358	279	263	665.6	
Feb	5	526	298	250	636.6	
March	9	956	716	610	1662.5	
April	4	450	373	353	962.5	
May	9	1640	1340	1217	2851.8	
May M/B		23	23	11	10.7	
June	7	2154	1447	1128	2610.4	
July	10	2828	2334	1609	3698.2	
July M/B		283	245	184	193.4	
Aug	8	2267	2058	1653	3570.5	
Aug M/B		1190	996	679	908.4	
Sep	11	3419	2561	2088	4728.6	748.9
Sep M/B		3033	2344	1897	2777.0	
Oct	7	2690	2159	1911	3528.5	1169.4
Oct M/B		579	485	266	396.0	
Nov	11	4490	2916	2483	2030.4	4395.1
Dec	10	6337	5618	4730	4456.1	7467.6
Total 1943	95	33223	26192	21332	35687.2	13781.0

First PFF Bombing Mission 27 Sep 1943

Appendix 5

Eighth Air Force
Types of Bombs Dropped by Heavy Bombers

1943 Months	High Explosive	Fragmentation	Incendiary	Total Tons
Jan	665.6			665.6
Feb	636.6			636.6
March	1662.5			1662.5
April	962.5			962.5
May	2727.3		124.5	2851.8
June	2610.4			2610.4
July	3186.1		512.1	3698.2
Aug	3140.4	80.7	349.4	3570.5
Sep	4810.7	318.4	348.4	5477.5
Oct	3405.3		1292.6	4697.9
Nov	4042.6		2382.9	6425.5
Dec	7734.1		4189.6	11923.7
1943 Totals	35,584.1	399.1	9199.5	45182.7

Appendix 6

Eighth Air Force
Bomb Tonnage by Country
Bombers and Fighters

Month 1943	Germany	France	Belgium	Holland	Norway	Poland	Shipping and Other	Total
Jan	202.0	463.6						665.6
Feb	259.3	377.0					.3	636.6
March	532.0	961.5		169.0				1662.5
April	267.0	450.0	245.5					962.5
May	1294.0	1232.0	325.8	10.7				2862.5
June	1748.8	721.1	95.5				45.0	2610.4
July	1987.3	1268.6	14.6	80.2	495.3		45.6	3891.6
Aug	1335.9	2633.8	32.3	474.4			2.5	4478.9
Sep	1215.1	6538.1	448.7	12.0			39.9	8253.8
Oct	4023.9	291.8		420.6		358.3		5094.6
Nov	5385.0	16.8		32.0	1001.3		7.2	6442.3
Dec	8901.2	3022.5		10.5				11934.2
1943 Totals	27151.5	17976.8	1162.4	1209.4	1496.6	358.3	140.5	49495.5

CONFIDENTIAL
SECURITY INFORMATION

Appendix 7

Eighth Air Force
1943 Heavy Bomber Loss Rates on Combat Operations

Month 1943	Combat Unit Credit Sorties	A/C Lost MIA, and Cat E	Losses as % of Credit Sorties
January	279	21	7.5
February	298	24	8.1
March	716	23	3.2
April	373	29	7.8
May	1340	73	5.4
June	1447	93	6.4
July	2334	128	5.5
August	2058	124	6.0
September	2561	101	3.9
October	2159	198	9.2
November	2916	114	3.9
December	5618	200	3.6
Totals 1943	22099	1128	5.1

MIA--Missing in Action.

Category E--Damaged beyond economical repair.

[redacted] SECURITY INFORMATION

Appendix 8

Eighth Air Force
1943 Bomber Command Units Missing in Action and Claims

Month 1943	Bombers MIA	Enemy Aircraft Claims		
		Destroyed	Probably Destroyed	Damaged
Jan	18	40	42	26
Feb	22	71	24	12
March	19	147	41	53
April	28	148	41	31
May	68	389	82	175
May M/B	10	--	--	--
June	85	300	81	146
July	109	542	155	325
July M/B	2	3	2	2
Aug	107	440	56	162
Aug M/B	4	4	2	3
Sep	84	273	45	125
Sep M/B	7	13	6	6
Oct	176	790	131	348
Nov	93	134	46	81
Dec	163	227	89	133
1943 Totals	995	3521	843	1628

Appendix 9

Eighth Air Force
Heavy Bombers Missing in Action by Cause

1943 Months	Enemy A/C	Flak or Flak & E/A	Accident	Other and Unknown Cause	Total
Jan	11	3	2	2	18
Feb	12	4	2	4	22
March	14	-	-	5	19
April	18	1	-	9	28
May	25	14	1	28	68
June	46	7	1	31	85
July	41	22	8	38	109
Aug	50	13	7	37	107
Sep	16	12	5	51	84
Oct	71	11	1	93	176
Nov	14	8	10	61	93
Dec	30	25	4	104	163
1943 Totals	348	120	41	463	972

Appendix 10

Eighth Air Force
1943 Heavy Bomber Battle Damage by Category

Month 1943	Combat Unit Credit Sorties	Category of Damage A	AC	B	E	Total Heavy Bombers Damaged Number	% of Credit Sorties
Jan	279	110	20	2	3	135	48.4
Feb	298	100	10	1	2	113	37.9
March	716	127	15	1	4	147	20.5
April	373	67	19	0	1	87	23.3
May	1340	304	100	4	5	413	30.8
June	1447	391	66	8	8	473	32.7
July	2334	876	126	4	19	1025	43.9
Aug	2058	756	90	6	17	869	42.2
Sep	2561	669	59	3	17	748	29.2
Oct	2159	770	95	13	22	900	41.7
Nov	2916	540	83	5	21	649	22.2
Dec	5618	1005	222	12	37	1276	22.7
1943 Totals	22099	5715	905	59	156	6835	30.9

Cat A--An airplane which, by nature of the damage, may be repaired within 36 hours, and is repairable by a combat unit.
Cat AC-An airplane which, by nature of the damage, requires 36 or more hours to repair, and is repairable by a subdepot or service sq.
Cat B--An airplane which, by nature of the damage, is repairable by a repair depot activity or establishment, regardless of whether the work is done on site or in a depot.
Cat E--An airplane damaged beyond economical repair while in performance of an operational mission.

INDEX

SECURITY INFORMATION

SECURITY INFORMATION