

# The Army Air Forces in World War II

## Vol. VI:

### Men and Planes

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FORWARD  
to the New  
Imprint

IN March 1942, President Franklin D. Roosevelt wrote to the Director of the Bureau of the Budget ordering each war agency to prepare "an accurate and objective account" of that agency's war experience. Soon after, the Army Air Forces began hiring professional historians so that its history could, in the words of Brigadier General Laurence Kuter, "be recorded while it is hot and that personnel be selected and an agency set up for a clear historian's job without axe to grind or defense to prepare." An Historical Division was established in Headquarters Army Air Forces under Air Intelligence, in September 1942, and the modern Air Force historical program began.

With the end of the war, Headquarters approved a plan for writing and publishing a seven-volume history. In December 1945, Lieutenant General Ira C. Eaker, Deputy Commander of Army Air Forces, asked the Chancellor of the University of Chicago to "assume the responsibility for the publication" of the history, stressing that it must "meet the highest academic standards." Lieutenant Colonel Wesley Frank Craven of New York University and Major James Lea Cate of the University of Chicago, both of whom had been assigned to the historical program, were selected to be editors of the volumes. Between 1948 and 1958 seven were published. With publication of the last, the editors wrote that the Air Force had "fulfilled in letter and spirit" the promise of access to documents and complete freedom of historical interpretation. Like all history, The Army Air Forces in World War II reflects the era when it was conceived, researched, and written. The strategic bombing campaigns received the primary emphasis, not only because of a widely-shared belief in bombardment's contribution

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to victory, but also because of its importance in establishing the United States Air Force as a military service independent of the Army. The huge investment of men and machines and the effectiveness of the combined Anglo-American bomber offensive against Germany had not been subjected to the critical scrutiny they have since received. Nor, given the personalities involved and the immediacy of the events, did the authors question some of the command arrangements. In the tactical area, to give another example, the authors did not doubt the effect of aerial interdiction on

both the German withdrawal from Sicily and the allied landings at Anzio. Editors Craven and Cate insisted that the volumes present the war through the eyes of the major commanders, and be based on information available to them as important decisions were made. At the time, secrecy still shrouded the Allied code-breaking effort. While the link between decoded message traffic and combat action occasionally emerges from these pages, the authors lacked the knowledge to portray adequately the intelligence aspects of many operations, such as the interdiction in 1943 of Axis supply lines to Tunisia and the systematic bombardment, beginning in 1944, of the German oil industry. All historical works a generation old suffer such limitations. New information and altered perspective inevitably change the emphasis of an historical account. Some accounts in these volumes have been superseded by subsequent research and other portions will be superseded in the future. However, these books met the highest of contemporary professional standards of quality and comprehensiveness. They contain information and experience that are of great value to the Air Force today and to the public. Together they are the only comprehensive discussion of Army Air Forces activity in the largest air war this nation has ever waged. Until we summon the resources to take a fresh, comprehensive look at the Army Air Forces' experience in World War II, these seven volumes will continue to serve us as well for the next quarter century as they have for the last.

*RICHARD H. KOHN*  
*Chief, Office of Air Force History*

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## FOREWORD

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The five volumes of this series which have been published heretofore completed the story of the combat activities of the Army Air Forces in the several theaters, a story that began with Pearl Harbor and came to a victorious close within a few days after the atomic bombing of Hiroshima and Nagasaki. The present volume, VI, deals with the Zone of the Interior--with the development of an effective air organization, with the forging and distribution of weapons, with the recruiting and training of airmen.

It was not without much forethought and some misgivings that the editors relegated these vital activities to a separate volume, thus removing them from the immediate context of the combat operations which were their constant guide and indeed their very *raison d'être*. The alternative--and it was seriously considered--would have been to intersperse the combat narrative with isolated chapters dealing with concurrent developments within the United States. To follow that pattern, it seemed, would interrupt such continuity as the editors had been able to give to a very complex story of air operations conducted simultaneously on a number of fronts. Furthermore, the decision to divide the combat narrative into two parallel sets of volumes dealing with the war against the European Axis (Vols. I, II, III) and against Japan (Vols. 1, IV, V) would have made it difficult for readers interested primarily in organization, personnel, and materiel to have found all pertinent information without the formidable expenditure of time required to go through the whole set. So, for better or worse, the editors decided to sketch in a short analysis of the basic problems of the air arm and the solutions thereto in Volume I, and to refer briefly in proper context to such stateside matters of men and weapons as affected immediately the conduct of war in the several theaters, meanwhile reserving for the present volume a fuller elucidation of those

topics. Inevitably this has made for some duplication, but it is an enrichment rather than mere repetition. To borrow a simile from the teaching profession, the present volume bears somewhat the same relation to earlier scattered references as the advanced or graduate course in history does to the freshman survey, and the editors' occasional experience with a student who fancied he had absorbed all that was useful in tabloid form during his first semester has not altered their estimate of the importance and the interest of the expanded treatment presented herewith.

The three sections of this volume deal respectively with the organization and mission of the Army Air Forces; with the development, production, distribution, and servicing of equipment; and with the recruiting and training of airmen. While the emphasis is on the war years, there is for each topic a preliminary discussion that begins at some appropriate time in the 1930's, when the foundations for the AAF were being laid.

In the development of organization, the year 1935 proved to be a turning point. Under the influence of Billy Mitchell, aviation enthusiasts, military and civilian alike, had long fought for a separate air arm. The Baker Board, whose report of July 1934 was accepted as public policy, denied the existence of an independent air mission and, consequently, the need for an independent air force. Thereafter most airmen ceased to struggle for the separate organization, deriving such comfort as they might from a provision of the Baker report which when adopted in 1935 allowed them to concentrate all their tactical units under one command, the newly formed GHQ Air Force. Any hopes for immediate improvement were soon dissipated. The division of responsibilities for procurement and training, and for operations, between the Office, Chief of the Air Corps (OCAC) and the GMQ Air Force led to friction. Procurement of the modest increase of aircraft recommended by the Baker Board lagged far behind schedule. Especially galling to the airman was the War Department's negative attitude toward the big bomber, now available in the B-17, both in respect to procurement and to the development of doctrine.

Changes in that attitude, with attendant changes in the Air Corps' organization and mission, were forced by international crises abroad. It was the Munich crisis, and the obvious importance of the *Luftwaffe* in Hitler's diplomatic victory, that persuaded President Roosevelt of the need for an immediate and vast expansion of American air

power. His successful request in January 1939 for a large defense appropriation provided the necessary means, but it soon became apparent that the President, with his deep concern for the preservation of the nations of western Europe, was more interested in accelerating aircraft production than in the orderly building of all those elements which together constitute an air force.

The German blitz in the spring of 1940 furthered the transition toward the wartime air force. Expansion was no longer conceived in terms of planes alone, but as a rational program to provide the bases, pilots, mechanics, and equipment for a given number of tactical groups. The number of groups changed frequently under further threats from abroad--from 24 to 54 to 84 and eventually by further accretions to the ultimate 273-group program--but in spite of the constant shifting in estimates of the number and nature of the groups needed, the programs gave structure to the Air Corps in a period of expansion unprecedented in the short history of aviation.

There were increased pressures from outside the military establishment for an independent air arm with cabinet representation, but the threat of war made so radical an experiment dangerous. General Marshall, who became Chief of Staff in 1939, had become increasingly sympathetic toward the airman's view, though he preferred evolution to revolution as a means of effecting needed changes in the command structure; General Arnold, who had been named Chief of the Air Corps in the previous year, favored a more rapid transition but worked loyally with Marshall. A compromise solution reached in November 1940 proved disappointing and was scrapped on 20 June 1941 by Army Regulation 95-5, which established the Army Air Forces, whose Chief (Arnold) was to serve as Deputy Chief of Staff for Air. A comparable change had occurred at the level of civilian leadership. Henry L. Stimson had been named Secretary of War in June of 1940; soon afterward he brought into his office Robert A. Lovett, who in the following spring became Assistant Secretary of War for Air. This team of Stimson and Lovett, Marshall and Arnold was to hold together through the war; the ability of its several members to work harmoniously together was perhaps more important than any structural changes that were made.

From lessons learned from the Battle of Britain the Air Corps gained an increased responsibility in air defense of the United States, and from preliminary strategic agreements with Great Britain

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(ABC-1, March 1941) an offensive mission of its own. By spring of 1941 there had emerged four numbered air forces, each combining certain regional defense duties with a training mission. Under AR 95-9, Arnold was supposed to coordinate the activities of the various OCAC agencies and of the GHQ Air Force, now redesignated Air Force Combat Command. This proved difficult to do, and there were inevitably conflicts in authority between his office and GHQ, which had been activated in July 1940. Various proposals for improved command channels were made but none had been agreed on when war came to make an early solution imperative.

That solution came on 9 March 1942 and it was significant that the new directive was merely in the form of a War Department circular, a suggestion of impermanence that was ill founded since the arrangement made was to outlast the war. GHQ was abolished. To handle Zone of Interior duties three autonomous and coordinate commands were set up under the Chief of Staff: the Army Air Forces, Army Ground Forces, and Services of Supply (later Army Service Forces). The OCAC and the AFCC were abolished and the functions of the former were divided among an enlarged AAF staff.

Literally, this made of the AAF a subordinate command within the Army, with a Zone of Interior mission "to organize, train, and equip air units for assignment to combat theaters." But actually, if without official sanction, the AAF became an autonomous branch of the service, on a level with the Army and Navy rather than with AGF and ASF. In part this was occasioned by the necessary inclusion of an airman in all topside decisions on strategy, a need which was given formal sanction by the appointment of Arnold to the Joint Chiefs of Staff and the Combined Chiefs of Staff on an equal plane with Marshall, who was technically his superior in the War Department. Through his personal connections with AAF commanders in the several theaters Arnold was able also to affect significantly if indirectly the actual conduct of operations, so that both at home and abroad the activities of AAF Headquarters went far beyond a literal adherence to its stated mission.

In that headquarters there was throughout the war a willingness to experiment with administrative procedures and agencies; offices changed designations with a rapidity that was reflected in almost

each new Pentagon telephone directory, and in some instances the transformation may have seemed hardly more than finding new titles for

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familiar officers performing familiar tasks in familiar rooms. In part the experimental mood derived from the lack of any deeply entrenched traditions, in part from the liberal use by Arnold of civilian personnel and techniques in office management. The Air Staff had been established in 1941 along conventional military lines (with A's instead of G's), and on this pattern was superimposed for a while a system of directorates borrowed from the RAF. These latter were abolished in 1943 in the AAF's third successive spring housecleaning, one which in effect established the essential structure of the Washington headquarters for the duration of hostilities. Changes thereafter were in detail rather than in over-all design, the one important exception being an attempt to operate the Twentieth Air Force from the Pentagon with a special staff.

Changes at Washington were closely linked with changes among the operating agencies in the United States. Early in the war the pattern for combat units--squadron, group, wing--was set, though there was an appreciable variety as between different types of units at each level. As the air arm grew in size the wing lost some of its earlier importance as an administrative unit; the standard large-scale combat organization became the numbered air force, divided functionally into commands--bomber, fighter, air service, etc. The four such air forces permanently assigned to the United States continued to divide their energies between their defensive mission, which was regional, and their task of training combat crews and units, with a steady growth in the relative importance of training over defense after 1942.

In its other functions--individual training, development and procurement of materiel, air transport, weather, communications, etc.-- the AAF tried in turn several systems of control. Amid the frequent changes in detail, two general trends may be observed: one away from regional controls inherited from the Army in favor of functional structures, the other a move toward decentralization to relieve an overcrowded Washington. There emerged a number of commands (or comparable organizations such as the Army Airways Communications System), each with a field headquarters reporting directly to top-level echelons at Washington. Before the end of the war the Continental Air Forces was established as a coordinating agency between the numbered air forces and AAF Headquarters.

The evolution toward autonomy and toward a structure built along novel functional lines absorbed a considerable amount of the interest

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and energies of the higher AAF officers, but it was accomplished without serious detriment to the main issue of winning the war, and the accumulated experience of the war years was reflected in the total reorganization of the defense structure after victory came.

In its defense mission, the AAF was never tested except in antisubmarine activities, a role which it assumed adventitiously and by default. Although most arguments in favor of an enlarged air force in the period between the two wars had been couched in terms of defense, the emphasis was rather on antishipping than on anti-air activities. Thus in 1942 when threats of war and the improved performance of aircraft made bomber attacks against the United States a possibility, the Air Corps found itself long on offensive doctrine, short on plans for air defense. Fortunately air increasingly

close relations with Britain made available the expert advice of those men who were currently operating the world's most effective air defense. The activation of the Air Defense Command in February 1940 provided a small staff for coordination of information drawn from RAF visitors, from Air Corps observers of the Battle of Britain, and from Army maneuvers in the United States. From Britain came not only information concerning defense organization and tactics but invaluable scientific and technological secrets in the field of electronics. By the spring of 1941 the four numbered air forces, each with its interceptor command, had been made responsible for air defense within its respective area, with passive measures under control of the Office of Civilian Defense.

Shortage of qualified personnel and of equipment made it impossible to establish rapidly the elaborate system envisaged, with its radar stations, ground observers, and filter and control systems, its AA guns and fighters, its barrage balloons, smoke generators, and blackouts; tests late in 1941 showed up many flaws. The fact that war came with a surprise air attack on U.S. territory as distant from Tokyo as was our eastern seaboard from Germany put an abrupt end to any complacency, at least on the east and west coasts, which were immediately established as theaters of operations. The new concern for the safety of our shores brought a great increase in civilian volunteers, but it brought also from many communities demands for fighters and AA guns that could not be met. Fortunately defense leaders refused to yield to local pressures to the extent of parcelling out our very limited fighter strength among the many claimants. Improvements in

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organization and control and increases in available equipment eventually provided an adequate defense except against hit-and-run attacks. By spring of 1943 the JCS had approved a plan for calculated risks in defense and within a year most of the vast organizations had been dismantled or put on a stand-by basis. Actually the system had never been tried, the only serious attacks coming later in the form of incendiaries sent from Japan in free balloons; but the very considerable cost of the air defense organization had been justified by its strategic purpose of protecting our industrial centers, by its contribution to training in the AAF, and by the confidence it gave to our citizens.

As General Arnold pointed out on more than one occasion, an air force was made up of planes, flying and ground crews, and bases; an orderly expansion called for a balancing of needs in each of those categories. The air installations in active use when Air Corps expansion was authorized in 1939 were for the most part relics of World War I, though some were of more recent construction; in all they included seventeen air bases, four air depots, and six bombing and gunnery ranges. Some help was obtained from the WPA and CAA in building civil air fields that were a needed adjunct to those of the Air Corps. Methods employed in siting, acquiring, and building the military fields were speeded up; responsibility for construction passed from the Quartermaster Corps to the Corps of Engineers, and a general policy was adopted of using "permanent" materials (brick or concrete) only for technical buildings. The 54-group program was the basis of the development plan until Pearl Harbor; thereafter each new program through that calling for 273 groups brought an upward revision of housing needs for training and defense. Arnold tended to discourage the limitless demands from local communities for defense fields and to stress the prior need of training fields, where he demanded an adherence to "Spartan simplicity."

The tar-paper barracks housing cadets differed radically from the hotels, some of them famous resort hostelries, which were rented as quarters for various technical training programs. This device was a great time saver and not as costly in the long run as might have been expected, even in a highly publicized case where the hotel was bought outright and later resold. Before the end of 1943, AAF installations in the United States had reached a peak figure of 345 main bases, 116 subbases,

322 auxiliary fields, 12 air depots, 68 specialized depots and 480 bombing and gunnery ranges; thereafter, as additional units

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moved overseas and the training establishment shrank, contraction began with the closing of some fields, the transfer to the Navy of others, and the termination of some leases.

In planning the expenditure of over \$3 billion, the AAF and its building agencies made mistakes. Expansion in some categories continued after contraction had begun in others; some fields were in use only a short time and some were not ideally located; there was needless and expensive duplication with the Navy and a lack of sharing between the two air arms. But the training and defense programs were never seriously retarded by lack of facilities and the expenditures have not been judged exorbitant by wartime standards. Some satisfaction may be derived from the fact that though local pressures were exerted in favor of this or that location, the AAF suffered less on this score than earlier since the very multiplicity of pressures tended to weaken the power of any.

During the years 1939-45 the United States produced military aircraft and related equipment in such quantities as to be able to equip its own Army and Navy air forces and to extend material aid to other opponents of the Axis powers. The remarkable achievements in the development and production of air weapons were made possible by the collaboration of science, industry, labor, and the military establishment; here, appropriately, the emphasis has been directed toward the part played by the AAF without implying that it was the dominant factor in success.

When rearmament began in 1939, the Air Corps had little in the way of equipment and almost no modern planes. Except for the B-17, it had no aircraft type equal in performance to the best in England or Germany. National resources for aeronautical research and development were potentially rich but as yet not oriented toward the rapid creation of a first-line air force. In part this was the result of the small appropriations granted to the Air Corps in the period since World War I, but the lack of agreement as to the air mission was also a severe handicap since it prevented any long-range planning. This latter weakness was partially overcome by the report in June 1939 of the Kilner Board which by formulating the needs of the Air Corps in the various categories of combat planes provided a general guide for design competition within the aircraft industry.

That industry was pretty well concentrated in a handful of companies which had survived the depression, They had been kept alive

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only by virtue of government contracts for military planes, and that source of business was too erratic to encourage plant expansion or the adoption of elaborate production-line techniques. Early plans for industrial mobilization were inadequate and were based on an impractical idea of type freezing for quantity production, a concept incompatible with the rapid rate of improvement under the stress of war. Aircraft manufacturers were slow to expand facilities at their own expense for what might be only a brief period of enlarged sales, and it seemed impolitic to reopen recent debates over government ownership of factories. Fortunately, the dilemma was resolved by the great wave of British and French orders which helped finance plant expansion, although the foreign orders in turn were to constitute a serious threat to the immediate buildup of an American air force in being.



Because of the long time-lag between the original conception of a combat airplane and its quantity production, it was fortunate that the new emphasis on research and development came no later. As it was, some of the planes with which the AAF fought the war were developed before the Kilner report, and all were in production or under development before Pearl Harbor. Yet among the limited number of types that reached the production stage there were numerous changes which greatly enhanced performance in such categories as speed, altitude, range, firepower, and payload while adding various safety devices. Most of the various aircraft became familiar to the public through their official AAF designations or the more picturesque names given by their manufacturers, but it was only an expert who could recognize the successive models, each incorporating some significant improvement by which a fighter's range might be vastly extended or a medium bomber's useful load increased beyond the original capacity of the pre-Pearl Harbor heavy bomber.

The constant modifications were a vital necessity since at the beginning of the war some enemy planes were superior to our current models in certain significant characteristics. Before the war ended the United States had at least one airplane in each conventional class that was equal to the enemy's best and in some categories--such as the very heavy bomber and transport planes--AAF superiority was beyond any challenge. Because of the system of competitive bids used in developing new airplane types, in most categories there were two or more planes of roughly equal merit, with special merits and defects about balancing out. In some cases the balance was so even as to

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foster unending arguments between pilots and crews of rival planes--the B-17 versus the B-24, the P-47 versus the P-51. In other cases the contest was less equal: there was never a successful American rival to the C-47, the B-29, the B-25, or the AT-6. Where an American plane was superior to that of the enemy the margin might be slight or it might fluctuate with each succeeding model. The one respect in which US. planes were almost universally superior was in their heavy and rugged construction which insured a relatively high survival ratio of both plane and crew.

Since available resources were not unlimited--particularly in respect to scientists and technicians--there was an unending competition between programs for long-range research and development on the one hand and for improvement and production of existing models on the other. Inevitably the latter had priority during the early period of rearmament but eventually a happier balance was achieved. The first revision of the five-year program based on the Kilner report came as early as April 1940, and subsequently other changes were made in the over-all program and among its internal priorities. A better utilization of resources was achieved by a closer coordination between the Air Staff and Wright Field and the various contributing agencies, military and civilian alike. The exchange of information with the British was fruitful, too, particularly in the field of electronics. But the AAF still depended most heavily upon industry for research and development.

Perhaps this policy was in part responsible for the fact that in general the AAF was more successful during the war in improving existing weapons than in developing radically new ones. The B-29 was perhaps the most spectacular exception in that by a crash program of development and production the plane was put into operation early enough to play a decisive role in the Pacific war. To the development of the war's most spectacular weapon, the atomic bomb, the AAF contributed almost nothing. In two other radical innovations, jet planes and guided missiles, America lagged far behind Germany. Conversely, by various expedients the AAF was able to extend vastly the range of its fighters to remedy its most glaring pre-war omission, an escort for long-range bombers. In retrospect, the failure to produce a jet fighter seems most serious since the Germans might have

used their jets very effectively had their leadership been better, but in the pragmatic test of the air victory AAF policy seems to have been justified

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for that particular war, and the jet P-80 and the transcontinental B-36, both developed during the war, were to provide some security in the early post-war years.

In the production of conventional aircraft, where the US. record was much more impressive than in the development of radically new weapons, the Air Corps' part was chiefly advisory. With the beginning of rearmament in 1939, General Arnold and his staff assumed responsibility for an early and vast increase in the number of planes manufactured. Funds were provided to that end in such staggering sums as to be almost embarrassing to an air arm long nurtured on economy, but existing facilities in the aeronautical industry were unequal to the new demands, and in planning for expansion of production capacity air leaders had to compete with the needs of other military services. The steadily deteriorating international situation made for frequent upward revisions of the Air Corps' estimated needs and consequently of actual production schedules.

President Roosevelt's tendency to state objectives in huge round figures had a calculated effect on public opinion, but such estimates had to be translated into more precise military terms. Thus his call in May 1940 for 50,000 planes a year became the basis for the First Aviation Objective, the 54-group program. So long as we were at peace there was a reasonable question as to whether we were more interested in manufacturing a given number of planes (which would age rapidly) or in building up and maintaining productive capacity. The latter policy finally won out, largely because of the President's decision to give a high priority in the assignment of planes to those nations already fighting the Axis powers. This decision alleviated the danger that the equipping of U.S. combat units might result in the accumulation of a surplus of obsolescent planes.

In anticipation of an accelerating production rate, the AAF in March 1941 set its Second Aviation Objective at eighty-four groups. Then in August, when the President asked for an estimate of "overall production requirements" for victory over the Axis, the goal was sharply extended. In AWP/1, an air plan which with remarkable foresight provided a strategic and logistical blueprint for the imminent conflict, Arnold's staff asked for 239 groups, a figure not far from the actual maximum of 243 which were fully equipped in 1945. This plan, incorporated in the President's Victory Program and in Anglo-American agreements, was brought under review immediately after Pearl

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Harbor when the AAF extended its ultimate demands in AWP/4 and, consonant with Roosevelt's demands for 80,000 planes in 1942 and 125,000 in 1943, stepped up its more immediate requirements in a 115-group program.

The full mobilization of all military forces after Pearl Harbor threatened the high priority which the President's policies had given to aircraft production, and by August 1942 a realistic appreciation of production capacity and certain changes in military strategy demanded a review of the whole production picture. Arnold submitted a new plan, AWP/42, calling for a total output of 131,000 planes in 1943, of which the AAF's share would be used to equip 281 groups. This demand was sharply challenged by the Navy and by October the AAF (and the President) had accepted a

compromise figure of 107,000 planes for 1943. This marked the end of the overriding priority for aircraft among the various categories of munitions, but the AAF had little cause for complaint. Rather there was some danger that acceptances of aircraft might outrun the availability of combat crews or of shipping to support the planes in combat theaters and, while the AAF maintained an official position of standing pat on existing schedules, some leaders acknowledged privately that it might be necessary to reduce demands to accord with actual production records. It was realized that round-figure goals were deceiving; that the record could be, and in some cases actually was, padded out by the continuance of planes no longer considered first class. A far more revealing index was in terms of total airframe weight, and thus expressed, the production score became increasingly impressive with the trend toward heavier bombers and larger transports.

In any event, it was relatively easy to secure approval for a total of 120,00 planes for 1944, with the AAF adhering to a program of 273 groups. Peak strength was reached in March 1945 with 269¼ groups in being, of which 243 were fully equipped. Even before that, the AAF had begun plans for contraction. Each of these major changes in policy, and other factors as well, were reflected in the constant revision of the detailed production schedules, which attempted to reconcile the requests of the various users--AAF, Navy, and British--with production potentials. Scheduling was a responsibility, after January 1942, of the Aircraft Production Board, "virtually a separate organization within the WPB," acting through its executive agency, the Aircraft Resources Control Office.

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The conspicuous success of the production program was made possible only by bold planning and initial expansion in the period between the Battle of France and Pearl Harbor. Before 1940 airplanes were largely manufactured by handwork; by the end of 1942 the transition to mass production methods had occurred and the automotive industry was in a process of conversion to support the expanded aircraft factories.

Before 1938, M-day plans for mobilizing the aircraft industry were concerned with preventing competition only among US. military agencies; reflecting current concepts of the air mission, those plans were hopelessly inadequate to provide guidance for Roosevelt's startling demands. In 1939, some use was made of so-called "educational orders" as a means of encouraging and measuring the possibility of expansion of munitions factories, but the sums allocated for Air Corps use were insignificant. The real incentive to expand came from foreign orders, a type of business which had been under severe criticism in those years when all makers of arms were attacked as "merchants of death." Under the impetus of war in Europe, however, public opinion and government policy changed; the Neutrality Act was modified to allow sale of munitions by the "cash and carry" method and France and England began ordering U.S. aircraft. At first these were obsolescent planes, but in March 1940 the rules were liberalized, with full support of the Air Corps, to allow the export of more recent models. With the fall of France, Britain became the sole important foreign customer, greatly increasing her orders first on her own credit and after March 1941 through lend-lease, a program in which aircraft heavily outweighed all other munitions.

As constituted in 1939, the US. aircraft industry did not have the capacity to produce within acceptable time limits the planes wanted by foreign nations and our own Army and Navy. Expansion was necessary and four alternatives were considered: 1) government factories; 2) an increase of plant capacity by the aircraft industry itself; 3) more subcontracting by the major companies to smaller aircraft firms and to organizations outside the aircraft industry; and 4) conversion of other industries, especially the automotive. Of these methods, only the second was

acceptable to the large plane manufacturers and, recalling recent unpleasant experiences with overexpansion, they were anxious that the new facilities be provided without cost to themselves.

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Actually, plant expansion was begun on the basis of U.S. and foreign orders and speeded by Roosevelt's call for 50,000 planes. The aircraft manufacturers objected to the limits set on profits by the Vinson-Trammell Act and to the current rate of amortization allowed for tax purposes. During the summer of 1940 the industry almost came to a standstill while Congress debated the issues involved until, finally, with the President's support, the law was liberalized in both respects; even so, the industry preferred British orders, with no profit limits, to U.S. ones. In the building program, various methods of financing were used, all involving some subsidy or guarantee by the government. Expansion was accomplished more rapidly by the airframe companies than by engine factories or those producing propellers, instruments, and other equipment.

The increased emphasis on heavy bombers began a second wave of expansion in the autumn of 1940. Because of the great size and complexity of those planes, current methods of manufacture seemed inadequate. The solution to this problem was found in the pooling of the resources of several big firms, tried first when Consolidated, Douglas, and Ford cooperated on the B-24 program. This system was extended to the B-17 program, with Douglas and Vega aiding the parent Boeing firm, and later in a more complex form to the B-29. Further expansion came with the Victory Program of September 1941. Some of the new factories were located inland to lessen congestion along the two seaboard and to minimize the dangers of air attack, but this trend was not popular with the major companies.

None of the new factories were at work when war began and they were not in full production until 1943, but the rapid growth of facilities had gone forward without disturbing the automotive industry, long considered by some as a sort of ace in the hole. Under the impetus of war itself, further plant expansion of the big firms had been accompanied by a fuller use of the small firms. By the end of 1942, most of the factory space for airframes had been built and some excess capacity had appeared. Some plant expansion still continued for companies manufacturing engines and accessories. In 1944 there were some cutbacks and new expenditures were limited to retooling.

The conversion of the automotive industry, which helped make possible the remarkable production record during the war, came late. It was an obvious possibility that the industry which had developed assembly line methods could use its plants and tools and techniques to

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produce airplanes in great quantities. For sufficient reasons, both the aircraft and the automotive industry objected to such suggestions. The Reuther Plan for greater utilization of automotive plants for this purpose was debated widely after its publication in December 1940, but it was not accepted. It was through the manufacture of engines under license to other companies and in new plants that the automobile companies first entered the aircraft field. So long as it was possible to turn out cars and trucks for civilian as well as military use, the large companies continued to do so, and it was the government ban on civilian cars induced by the shortage of materials and labor rather than any desire of their own that turned them to the new task. The real conversion came in 1942. The most important contribution was in the manufacture of engines, in which task the automotive firms surpassed the regular aviation companies, and in making airframe subassemblies and parts. In the

assembly of airframes the record was less impressive, even in the highly publicized Ford plant at Willow Run.

The statistical record of aircraft production shows a remarkable growth between 1940 and the peak year of 1944: an increase of about 1,600 per cent in the number of military planes, of about 4,500 per cent in total airframe weight, and of about 2,700 per cent in total horsepower of the engines built. That these records were made with an increase in factory floor space of only 1,200 per cent and of manpower by about 1,600 per cent indicates an appreciable gain in efficiency of operations.

The most conspicuous improvement was the switch from handwork methods to those of mass production. Faced with the need for rapid acceleration of output in 1940, the aircraft industry had wished to freeze designs. In the face of rapid improvement of enemy planes under the impetus of combat, this policy was rejected by the AAF in favor of stabilizing the basic design of a relatively few standard airplanes and adding all subsequent improvements at an AAF modification center, of which ten were eventually in operation. With the degree of stability thus assured, the industry was able to utilize assembly lines in producing engines, airframe parts and subassemblies. Efforts to use the same methods in the production of the whole plane proved less satisfactory.

The prime contractors had not used before 1939 the system of purchasing parts and subassemblies, so common among other industries, and in general they had little liking for it. It was first used by

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some of the smaller aviation companies, and did not become widespread until the cutback in the manufacture of civilian goods made it more attractive for other industries to act as subcontractors. This system allowed the use of a pool of unskilled labor, including two groups that until then had been little used by heavy industry, women and Negroes, but it put a heavier burden on management and proved more difficult to schedule accurately than had previous methods.

Some problems the aircraft industry shared with other makers of munitions, others were more peculiarly its own. There was a continuing dearth of management and engineering personnel. An early shortage of machine tools was overcome by 1942. Some materials were in short supply, most importantly aluminum. This situation, blamed by WPB on poor management but by the industry and the AAF on the aluminum producers, persisted until the summer of 1943 and returned early in 1945 with the increase in munitions orders that followed the German Ardennes counteroffensive. Because of its early start in the rearmament program and the location of many new plants in nonindustrial communities, the aircraft industry never faced a comparably severe shortage of unskilled labor. Its labor problems--loss of workers to selective service, rapid turnover, absenteeism, and disputes with management--were all solved tolerably well, in many cases with the active support of the AAF.

The most serious fault with the whole aviation production program was the neglect to provide enough spare engines and parts, and here the AAF was at fault. The shortage stemmed originally from a mistaken use of funds provided in 1939, whereby all appropriations were expended in the purchase of whole planes. The original shortages thus created were magnified by the high priority given Britain in allocations before Pearl Harbor and by the heavy wear and tear on planes in combat, especially in primitive areas. Since quoted production figures were in terms of whole planes, aircraft manufacturers were loath to devote much effort to spare parts, and it required great pressure by the AAF, itself constantly needed by combat theater commands, to overcome the initial handicap.

In spite of errors, the aircraft industry with the aid of the, AAF compiled a magnificent record. Those interested in statistics may find them abundantly in this volume. It is sufficient to state here that in the peak month of March 1944, 9,113 military planes were built, a rate of 110,000 per year. If this fell short of the requirements listed in AWP/42, it was still a sharp rebuttal to those who had considered

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President Roosevelt's estimates fantastically impossible. Apparently the United States produced almost as many aircraft as did Britain, the U.S.S.R., Germany, and Japan together, and greatly exceeded them in total airframe weight. This was done by a happy combination of those factors that have made U.S. industry supreme; it is not to detract from the impressiveness of that achievement to remind ourselves that this country, unlike the others, worked out its industrial problems with no interruption from invasion or air bombardment. Such immunity would hardly occur in another war.

To provide logistical support for its combat units the AAF developed during the war a huge organization. The responsibilities of AAF Headquarters in these respects included the procurement, storage, and distribution of countless articles of supply in the United States, channeling those supplies to the combat theaters, and providing properly trained and equipped service units for overseas duty. Supply functions were shared with the Army Service Forces, which handled "common use" articles as the AAF handled articles peculiar to its own needs. Because of the uniqueness of its weapon, the Air Corps had very early taken a heavier logistical responsibility than other Army combat services; during the war, the quasi-autonomous status of the AAF was reflected in an increased power over its own supplies in such common use articles as fuel, ordnance, and communications equipment.

From 1926 until 1942, the Air Corps' logistical responsibilities were vested in the OCAC's Materiel Division, with headquarters at Wright Field and with four major depots distributed over the United States. Conflicts of authority occurred between the Materiel Division and the GHQ Air Force (after 1935) and its successor, the Air Force Combat Command. After much debate and some experimentation, a more unified structure was provided by the establishment in October 1941 of the Air Service Command, and the reorganization of the Army in March 1942 gave the AAF a clearer line of authority in logistical matters. During the first year of the war the ASC operated from Washington, then moved to Patterson Field, Ohio. Its regional structure, involving eventually 11 depots and 238 subdepots, went through a series of changes; after 1944, the system included a number of regional air technical service commands. To supervise the shipment of supplies overseas, the ASC maintained an Atlantic and a Pacific Overseas Air Service Command.

In theory, the AAF's logistical functions were divided between the

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Materiel Command, charged with research, development, and procurement; and the Air Service Command, charged with storage, distribution, and maintenance. Inevitably there were areas in which no clear line of jurisdiction could be drawn and after much study the two offices were combined into the Air Technical Service Command in September 1944. Other cases of overlapping authority occurred in relations with the ASF. In these instances it was usually the ASC which was the aggressor, attempting to secure control over certain types of supplies previously classified as

common use articles. Though not wholly successful in these efforts, the ASC made sufficient gains to make easier the transition to an independent air force in 1947.

The requirements for aircraft were set by AAF Headquarters in accordance with decisions of the Joint Chiefs of Staff. For other equipment and supplies, requirements were estimated by the ASC and after procurement distributed through channels, usually from factory to depot to subdepot to base, or factory to intransit depot for overseas shipment. Never during the war did the ASC devise an accurate system of calculating requirements. During the early months of the war many combat units suffered grave shortages because of failure to provide spare parts, loss of equipment to enemy action, and lack of transportation. When production and transportation improved, theater supply officers tended to play safe by overstocking and in many areas there were huge surpluses before the war's end. In addition to the normal desire not to get caught short again, other factors contributed to the wasteful handling of supplies. In spite of efforts to simplify stock recording, it was very difficult to keep an accurate inventory in the early part of the war, when there was a great deal of confused evacuation of supplies from the threatened west coast area, when the number of individual articles to be accounted for rose from 80,000 to 500,000, and when the rapidly accumulated stock had to be handled by inadequately trained personnel. It was 1943 before an accurate inventory for the depots existed, and in the meantime requirements were compiled on the basis of "educated guesses" of stock and consumption rates. It was only when production rates and AAF strength leveled off simultaneously in 1944 that the records could be straightened out.

In storage and distribution, the ASC found its facilities swamped at the beginning of the war. The establishment of new depots and subdepots was supplemented by setting up a number of storage depots

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near the factories, and eventually by specialized depots, handling only one property class or subclass. In providing organizational equipment, the ASC worked from a table of equipment standard for each type of unit. The issue of such equipment was attended by much confusion during the early months of the war; after experiment with issue at the station of activation and at the first training station, the ASC evolved a system of sending the equipment to the proper theater ahead of the unit, which received it only after arriving at station. After 1943 this system, though not perfect, proved generally satisfactory.

In providing maintenance supplies, the ASC first used a system of automatic supply, with "pack ups" containing the items estimated as required for a given period. Because of the lack of up-to-date stock reporting and the wide fluctuations in demand in an active theater, this method produced too many surpluses and shortages, and was abandoned in the fall of 1943 in favor of a system of specific requisitions which, if also imperfect, at least proved more flexible. War is a wasteful affair and Americans are wasteful people, and it seems doubtful that any economical system of supply could have been devised for so widespread and varied a logistics network.

Policies governing the allocation of aircraft were set at the highest governmental level, but Air Corps leaders served in an advisory capacity as policies were formed and helped administer the programs agreed on. When the fall of France made acute the problems determining the best division of a still-limited output of planes among the chief claimants--the AAF, the Navy, and Great Britain--it was the AAF that took the initiative in promoting the Joint Aircraft Committee, an Anglo-American body which allocated production resources rather than lanes. In deliberations of this body and in the ABC strategy conferences in March 1941, President Roosevelt's policy of favoring

British combat needs over AAF expansion was adhered to, though in the more pressing need for training planes the AAF had a higher priority, as well as a temporary advantage in heavy bombers, needed to bolster forces in the Pacific.

The extension of lend-lease to the U.S.S.R. in the summer of 1941 put further burdens on U.S. production which could not be solved by the type of informal agreements which had worked well enough between the Americans and British. Both before and after Pearl Harbor, allotments to the Soviets were recited in a series of "Russian protocols" which were considered binding to the extent that production

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allowed and were not subject to readjustment as were the Anglo-American agreements. In all, nearly 15,000 U.S.-built planes were delivered to the Soviets during the war, of which about 4,000 were from Britain's allocations. These aircraft, which included relatively few heavy bombers and large transports, consisted largely of light bombers and fighters, the latter including models which were less popular with American than with Soviet pilots.

When war came, the machinery for cooperation with Britain was elaborated along familiar lines. The Munitions Assignments Committee (Air), a subsidiary of the Munitions Assignments Board, framed schedules which were recommended to the Combined Chiefs of Staff for action. As between the AAF and the Navy, aircraft were allotted by the Joint Chiefs. As between the British and the AAF, the work was done in effect by Chief of Air Staff Sir Charles Portal and General Arnold. The Arnold-Portal agreement of 13 January 1942 was the first of a series of schedules, arrived at by what Arnold called "horse-trading," which attempted to provide the best possible distribution of available aircraft to implement accepted strategy. From Pearl Harbor on, Arnold fought for the principle that, where possible, U.S. planes should be manned by U.S. crews, but in the early part of the war he was forced by higher authority to accept compromise solutions in each agreement. He long maintained that the RAF kept a heavier reserve in planes than needed, but as production moved toward its peak, there was less difficulty in reaching an agreement. After V-E Day, when the AAF had begun to cut back orders to avoid surpluses, Arnold was against assigning to either Britain or Russia the long-range bombers or fighters currently used in the Pacific; the early surrender of Japan before redeployment had got under way avoided any serious debates. Actually, in spite of differences of interest between the using services, negotiations had been carried on in an amicable fashion.

Within the AAF, priorities were set by the A-3 office in Arnold's staff. Until 1944, the bulk of the planes went to equip new units; thereafter, the heaviest charge was for replacements. The normal process for distribution was for the Materiel Command to obtain planes from the factory, ASC to modify and store them, and ATC to ferry them in the various moves from factory to combat units. Of 230,000 planes accepted by the AAF between July 1940 and August 1945 about two-thirds were ferried to their destination, with a loss of

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594 in overseas flights and 417 within the United States. Some fighters were flown to Europe, but for the most part these had to be shipped and with the shortage of bottoms that existed through much of the war, delivery in this fashion was a constant problem. Various means were attempted: shipment of planes knocked down and crated in dry cargo ships; use of carriers on special



occasions; deck-loading in assembled form on the waist of a tanker; and finally, most satisfactory of all, the development of a specially modified Liberty ship called the ZEC.

In the procurement and training of men the Air Corps played a more important part than in the production of planes. Extensive use was made of such civilian facilities as were available for turning out the crews and technicians needed to man and support the vast number of combat aircraft built, but it was the Air Corps that set all standards of competence, that worked out schedules of classes, that trained or supervised instructors, and that in the final score provided most of the actual instruction--except in primary flight schools and for some technical specialties. The training program involved an expansion as spectacular as that of the production program, as the Air Corps grew from a strength of 20,196 in June 1938 to 2,372,293 in June 1944, and from 11 per cent of the total Army strength to 31 per cent. This growth was made possible by liberal procurement priorities and was marked by a change in training processes that can be compared aptly with the change in production methods from piecework to production line techniques, although in combat crews the variable human factors were too important to allow the breakdown of training into such minutely simplified processes as were basic to the production program.

The prewar training program was excellent if judged by the performance of the men it turned out, but they were carefully selected and highly motivated professionals whose schooling was accompanied by no unseemly rush for time. Pilot training was conducted at Randolph Field, where the largest class before 1939 numbered 246 graduates, and technical training was centered at Chanute Field; the only postgraduate work was at the Air Corps Tactical School at Maxwell Field. The approach of war, and especially the passage of the Selective Service Act in September 1940, changed the procurement basis and brought a severe competition for eligible pilot personnel from Navy and Marine Corps programs, but the Air Corps continued to

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enjoy a favorable position: as late as 1943 it was still getting 41 per cent of Army recruits in the two highest brackets as defined by the Army General Classification Test.

In procurement of flying personnel, programs were described in terms of pilots trained per year, a system usually coordinated with the combat group programs. Thus the 24-group program of 1939 called for a goal of 1,200 pilots (and 30,000 technicians) a year; the 41-group program of 1940, 7,000 pilots; the 54-group, 12,500 pilots; the 84-group program, 30,000 pilots and 100,000 technicians. In AWPD/1, which prescribed an ultimate pilot-training goal of 85,000 a year, it was estimated that 10 applicants and 2 school entrants would be required for each pilot who qualified, and that all needed bombardiers and navigators could be provided from eliminated trainees.

Realizing the limited clientele from which it could draw applicants meeting its very high requirements, the Air Force used such inducements as were feasible to attract potential cadets: removal of numerical restrictions and increased pay by Congressional action, use of waivers to bypass the strict physical qualifications, use of a limited number of enlisted men as pilots, training in grade for AUS officers, favorable treatment by draft boards of potential draftees, and help from civic organizations. In spite of pressures to the contrary, the Air Corps before the war held to its policy of requiring two years of college training for flying cadets, rather from the view that such preparation was valuable to the potential officer than necessary for the chauffeur of an airplane.

Recruiting of cadets was a duty of The Adjutant General, performed normally by the OCAC. As the Air Corps' expansion began, the source of supply for cadets was chiefly in the nation's colleges, and

methods--and success--varied from one corps area to another. Mobile examining boards proved a successful stimulus to enlistment as did the efforts of various civilian groups, and whatever errors in policy may have been committed, the flow of recruits generally kept up with declared training programs.

The problems of recruiting potential officers for nonrated categories were different. Earlier legal limits on the number of nonflying officers were relaxed, and some effort was made to recruit college-trained candidates for commissions in such fields as engineering, communications, armament, photography, and meteorology. But before the war, classes in those categories were small and, except where

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academic standards were unusually high, enough candidates were available from the pool of pilot washouts.

To a remarkable degree, the success of the whole Air Corps program was due to the available supply of reserve officers. Because of budgetary restrictions, only a small proportion of pilots trained at Randolph Field before 1940 had been commissioned in the Regular Army, and only gradually after each new emergency were the laws relaxed to allow for a greater use of those rated reservists who had been trained and commissioned there. The abundance of those officers (and of those trained in wartime) as compared with regulars may be seen in the statistics, which show that the AAF had an officer corps consisting of only 1.3 per cent regulars, as compared with 2.6 per cent for the ASF and 3.5 for the AGF. Conversely, the AAF made relatively little use of National Guard rated officers. The peak officer roll of the AAF of 388,295 included about 40,000 officers originally commissioned in other services. Its ratio of 156 officers to 1,000 enlisted men was appreciably higher than that of the ASF with 97 officers or the AGF with 54.

Traditionally the system for training pilots had been to divide the course into stages--primary, basic, and advanced at Randolph Field--followed by transition to a combat type of plane in a tactical unit. Faced with the problem of expansion in 1938, some Air Corps officers thought it possible simply to multiply the number of "Randolph Fields," but already General Arnold had accepted the idea of mass production and was advocating a plan for use of civilian schools for primary flying and technical training. Through his efforts, nine highly considered civilian schools were persuaded in 1939 to take over contract training at the primary flight level, and by successive increments the number was increased to forty-one by Pearl Harbor and to fifty-six at the peak in May 1943.

Financial arrangements for the training and housing of cadets at contract schools underwent some changes during the war, none radical, and the cost per trainee seems to have been reasonable enough by Air Corps standards. The length of training periods was reduced from an original 1939 schedule of twelve weeks to a 1942 schedule of nine weeks, but this was without prejudice to a continuing course of sixty hours flying time, the reduction resulting from a transfer of the bulk of the ground school work to preflight school. The chief problem in the primary schools was to maintain a supply of competent instructors,

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since the civilian pilots used, after refresher courses in Air Corps methods, were continuously subject to recruiting drives by the ATC and Navy and to the zealous attentions of local draft boards.

The use of civilian help for technical training proceeded somewhat more slowly, with seven schools under contract in 1939 and fifteen when war began, at which time there were about four students in AAF schools for each one under civilian tutelage. Thereafter expansion was more rapid as the AAF turned to the universities, airline companies, and factories for technical training of officer candidates and enlisted men. But the great bulk of trainees were taught by the AAF itself in schools established before and after the beginning of war. The new programs included more specialized training for such previously neglected crew members as bombardiers, navigators, and flexible gunners, though as war began there was still a deficiency in each of these categories. The great weakness in the whole training program was a lack of qualified instructors and of actual combat experience. The latter want was lessened somewhat by information supplied by the British and by AAF officers who had served as observers during the Battle of Britain. The organizational structure had been strengthened somewhat by the establishment of the Technical Training Command (March 1941) and the Flying Training Command (January 1942), and by a more precise allocation of duties among the continental air forces which gave to the First and Fourth a primary duty of national defense, to the Second and Third a primary duty of training.

The increased training rates for aircrew and ground specialists that were established after Pearl Harbor rendered inadequate previous methods of procurement. Standards for pilot trainees were liberalized somewhat, and an examination was substituted for the two years of college requirement. The number of cadet examining boards was increased to more than 200 and travelling boards in trailers toured outlying areas. To tap manpower sources as yet untouched by the draft, the minimum age was lowered from twenty to eighteen years. These procedures, accompanied by a great deal of publicity, greatly stimulated enlistment, and for several confused months those inducted as aviation cadets greatly exceeded accommodations. With the establishment of regular quotas to fill scheduled classes, some order was restored, but in the face of competition from other recruiting programs, particularly of the Navy and Marine Corps, the AAF felt it necessary

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to devise some method by which it could meet its rising needs and in the meantime maintain a pool of 50,000 candidates.

A solution was found in the Air Corps Enlisted Reserve (ACER), established in April 1942, which allowed a candidate to enlist with expectation of eventual call to duty as an aviation cadet, spending the interim as an enlisted man, or at his civilian job, or in college where he might be given a deferment. During the spring a concerted recruiting campaign was conducted which aimed especially at the colleges, and by fall the desired pool had been built up, with enlistments running about 3,000 a month over the 10,000 called up.

The ACER had provided for a small number of cadets to train for commissions in various ground specialties. The educational standards were higher than those for aircrew trainees and the physical requirements were lower; generally the examining boards misunderstood or failed to observe instructions and in most of these categories accepted too many candidates. There were other sources of supply than the ACER--aircrew eliminees, graduates of enlisted men's technical schools, and officers training in grade--and it became necessary to close enlistment in some specialties as early as September 1942 and in all by March 1944.

War Department policy required a maximum use of civilian workers in depots and subdepots, and the task of recruiting and training the 300,000 persons eventually so used added to the AAF's burdens. It was difficult to get and keep technicians of various sorts since better paying factory jobs

were plentiful. Several types of training were used for trainees retained on a minimum wage: civilian contract schools, government-operated "off reservation" schools, post schools, and factory schools. Increasing use of women in mechanical as well as clerical jobs brought their number to 46 per cent of the total force by June 1944. Estimates of their efficiency as compared to male employees have shown as wide a variance as might be expected in a battle of the sexes where few care to be neutral, but the arguments seem not wholly material since the women did a great deal of valuable work when there was no one else to call on. A smaller source of labor was found in the physically handicapped, who needed more careful assignment procedures but whose record on appropriate tasks--and they were surprisingly diversified--was most heartening.

A problem of special importance to the training program was to provide instructors for constantly growing classes. For AAF flying

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schools, instructors could be provided from graduates of the central instructors school, and the chief concerns were to maintain a proper ratio between instructors and students and to avoid excessive turnover of instructors through assignment to combat duty. There was more difficulty in the contract primary schools where civilian flying instructors were constantly lost to the Navy because of the War Department objection to granting direct commissions to civilians.

To take over ground-school instruction, once given by rated officers who could no longer be spared from more pressing duties, AAF schools depended at first on local resources--enlisted men, eliminees, civil service personnel, and men with some experience as teachers but little knowledge of the subject matter in question. In 1942 the training centers turned to the colleges with a program of direct commissions for qualified instructors. Some 500 college teachers were thus obtained by a board recruiting for the Gulf Coast Training Command and later 1,000 more were split between the three flying training commands. Promises of some of the recruiting officers were somewhat overoptimistic; this at any rate seems to be a judgment validated by the experience of a number of our authors and of one of the editors, and by the reminiscences of a wide sampling of the academic profession today. The subject matter assigned to many instructors was unfamiliar but simple enough to be superficially mastered in a short time and most schools had some sort of in-service training. By 1943 most ground-school instructors were in uniform, usually as officers, though in radio code there were some enlisted men and in the various Technical Training Command schools a great many.

As the manpower shortage became more severe, the AAF suffered two serious blows to its enlistment program: the lowering of the draft age to eighteen in November 1942 and the closing of voluntary enlistments in the following month. In theory this meant that the AAF would get its aircrew trainees from a quota established by the War Department, but the allotment of qualified candidates soon fell in arrears and it was only the ACER pool--long the object of outside criticism--that served as a protective cushion. The initial age for the ACER was reduced to seventeen years with much legal difficulty and without the anticipated results. Some easement in a tight situation was afforded by a system of voluntary induction and by increased use of enlisted men as potential cadets. By October 1943 the crisis was over; successive cutbacks in the pilot-training programs created long waiting

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lists, with consequent ill effects on morale, and at the same time allowed longer training periods. Early in 1944 the AAF ceased procurement of cadets from the AGF and ASF and from voluntary inductees, and after V-E Day pilot training was reduced to 1,000 a year; similar cuts had already been made in the bombardier and navigator programs.

Procurement of Negro airmen presented peculiar difficulties. Army policy was to use Negroes in the same proportion as they were found in the total U.S. population, a figure calculated at 10.6 per cent. Actually, this was never done. On the Army General Classification Test an inordinate number of Negroes scored in the two lowest categories, whereas by War Department policy the AAF had been given more than its share of men scoring in the two highest brackets; hence relatively few Negroes could qualify for flying or technical schools. Army policy was to use Negroes in segregated units with Negro officers "where possible," but whereas the 1944 troop basis for the AAF called for 156 officers per 1,000 men, Negro officers numbered only 110 per 1,000 colored troops. Relatively few Negroes received flying training and ratings. Most Negroes served in supporting or service units as "basics." A significantly smaller proportion of Negroes than of whites were sent to overseas stations.

The section on Negroes in this volume has been deliberately limited by the editors to a statement of the main problems and of attempted solutions. The whole subject of Negroes in the armed services is important enough to deserve a more careful study than seemed appropriate in a treatment of recruitment and training which was organized along functional lines that in theory at least had no connection with racial or ethnic considerations. From the summary account presented the editors have formed the opinion--which is not an official one--that the policy of segregation failed in its purpose of providing Negro units equal to similar white units; that there was some justification for the AAF's refusal during wartime to accept responsibility for a social reform not yet agreed on by the nation; and that the progress of integration since the war has shown that there was nothing peculiarly inherent in the airman's disposition that determined the AAF's policy between 1939 and 1945.

The whole history of recruitment during the war, indeed, merits further investigation. The conflict between the basic assumptions of selective service and the idea that volunteering was essential to an

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elite corps was inevitable, though generally it could be resolved by compromise between men of good sense and will. The different methods used by the several services to recruit officer material encouraged sharper competition than was good and the habit of holding large pools of potential officer material against some unpredictable emergency worked a handicap on some valuable but less highly publicized services, to say nothing of the frustration it brought to the individuals concerned.

To facilitate the transition from civilian to military life, the Army had long favored a brief period of orientation and of indoctrination in those attitudes and skills which were fundamental to soldiers of whatever arm or service. As the need for specialized training increased, the basic program was contracted during emergency periods, especially in the Air Corps where technical jobs were so numerous; but the use of a separate station for receiving, processing, training, and distributing recruits remained standard. This began soon after the adoption of selective service in 1940 with a single Air Corps reception center at Jefferson Barracks, Missouri; eventually the program grew to include, at peak strength, seven basic training centers. Without a clear directive or proper resources, the Jefferson Barracks staff worked out a four-week program that was later lengthened to eight

weeks, when it became an unofficial model for other schools. Much attention was given to physical conditioning, generally thought to have been well done, and to the School of the Soldier, done without arms and without great success by infantry standards. Eventually, as a result of complaints from combat theaters, more attention was given to the use of weapons and to survival training.

Classification began at the Army reception centers, where the recruit took certain tests and received his qualification card before being assigned to a particular service, and continued at the basic training center with more tests and interviews on the basis of which he was assigned to a job or, more frequently, to a school for further training. Aptitudes, as measured by the tests, and personal inclinations were consulted in making assignments, but the need to fill certain quotas at any given time was often the deciding factor, at least until mid-1943.

Testing for selection and classification of aircrew trainees had begun on an experimental basis in 1941 and was extended to cover all candidates immediately after war began. Three classification centers were established in the spring of 1942 to process, classify, and house

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cadets before their call to a class. There the qualifying test used in lieu of college credits was administered. Then the cadet received the "classification battery" of psychological and psychomotor tests designed to eliminate the unfit and determine the best position (pilot, bombardier, navigator) for the fit. The medical examination was stiff, though some waivers were allowed, and a psychiatric test proved a valuable time saver. All in all, the tests stood up well as predictors of success, eliminated many potential failures, and gave a useful guide for the assignment of cadets to the proper specialty, though both tests and personal inclinations sometimes had to bow before the inexorable logic of the quotas.

Individual training of aircrew members was carried on in the many airfields belonging to the three regional training centers and under the general supervision first of the Flying Training Command, then (from 1943) of the Training Command. For pilots the traditional three-stage system of prewar times was continued, but to compensate for accelerated programs designed for tremendous classes a preflight stage was added early in 1942, with four large schools, three of which were located adjacent to the classification center pools. Separate training for pilots and nonpilots was the rule until 1944, when all preflight work was concentrated at the San Antonio Aviation Cadet Center. The programs grew in length from an original four weeks to nine weeks in 1942 and ten in 1944. Originally the main stress was on military and physical training, but there was a general strengthening of the academic program designed to supplement the trainee's civilian education: curricula were improved and standardized, teaching aids devised, and the quality of teaching improved by the addition of instructors commissioned directly from the colleges. The aircrew college training program of 1943-44 was ostensibly designed to extend this preflight training into civilian schools, but its real purpose was to protect a pool of potential cadets, a ruse which was readily diagnosed and criticized by the Selective Service System and the War Manpower Commission. The college program was never successful in its training function; after its abolition, candidates awaiting assignment to the steadily diminishing preflight classes were held by assignment to on-the-job instruction in maintenance or even clerical jobs on airfields. This gradual approach to the status of enlisted men was hard on morale, and the high motivation that had characterized cadets at preflight schools in the first two years of the war fell appreciably.

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The three-stage (primary, basic, advanced) system of instruction at Randolph Field before the war had produced in twelve months excellent pilots who were also competent junior officers. In 1939, the period was cut to ten months and in 1940 to seven. After Pearl Harbor, classes at preflight and each subsequent stage ran nine weeks until 1944 when they were extended to ten. Successful candidates received commissions after graduation from advanced flying schools; later they underwent transition training in combat planes and learned to operate as a combat team. In all, the whole period of instruction before combat might be well over a year. As compared with the old prewar program, the course through advanced school had lost somewhat in the hours of actual flying, but the main saving in time was at the expense of the military training. Even under the accelerated program the American cadet got much more experience in the air than the German or Japanese, and toward the end of the war the very heavy advantage in that respect was graphically shown in the results of air combats.

Each successive stage of flying training was marked by the use of a more powerful aircraft and the performance of more complicated tasks. Usually the courses were divided into several set phases with performance checks at each. There was some experimentation with the use of different instructors for each phase but the "all through" system in which a single instructor carried a very few students through a complete stage was almost universal. There was a trend toward standardizing ground-school and flight training through the establishment of central instructors schools and the use of uniform manuals and training aids. In the matter of grading performance in the air, the judgment of instructors and supervisors unavoidably included many subjective elements which prohibited the establishment of uniform standards. Furthermore, directives of AAF Headquarters fluctuated between a stress on quality and on quantity of pilots according to the shifting strategic situation and the quota of cadets, and these changes in attitude were reflected in the standards for graduation. There were thus no fixed rates for eliminees but rather a proportion that varied with the quality of a particular class and instructor and with the current demand from Washington. Between July 1939 and August 1945 the advanced flying schools graduated 193,440 pilots. During the same time about 124,000 cadets, roughly two out of five matriculating, had washed out, most of them in primary and fewest in advanced.

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The Air Corps had had less experience in training bombardiers and navigators in the prewar years; such instruction as had been offered was informal, on-the-job teaching of individuals. Separate schools with regularized instruction for the two specialties were begun in 1941. The original twelve-week course at the bombardier schools was lengthened to eighteen weeks in 1943 and eventually to twenty-four. The ratio of ground to air instruction time was about four to one. The heavy use of pilot washouts in this specialty created morale problems which the AAF attempted to mitigate by a high-powered publicity campaign. Instruction for navigation cadets began in a contract school run by Pan American Airways and was extended to include four AAF schools. The instruction period grew by increments from fifteen to twenty weeks, with about 500 hours of ground school and 100 hours of flight. Generally, navigation cadets were better selected and more highly motivated than the bombardiers, but because of the stiffer requirements elimination rates for the former were about 20 per cent as against 12 per cent for the latter. In both courses improvement came as equipment grew more plentiful and as the central instructors school for each specialty made methods more nearly uniform. For a while some candidates were trained in both schools, usually with an abbreviated course in one or the other, to qualify as navigator-bombardiers.

There were other less common rated specialties for which schools had to be established--that for B-29 flight engineers, for example, or for radar observers. Enrollment in the seven flexible gunnery

schools was much heavier, for the six-week course they offered was required for other members of a bomber crew besides the "career gunners." Total graduates included 297,000, with a 12 per cent washout rate. Methods of instruction improved, but none of the many devices or techniques used could offer an apt simulation to combat situations, and complaints from the theaters on marksmanship continued throughout the war.

As the number of authorized combat units increased by successive increments, the old regular Air Corps units found themselves unable either to absorb the flow of graduates from the new flying schools or to provide sufficient cadres for the new units being formed. AAF observers brought back from Britain in 1941 enthusiastic reports of methods used by the RAF in forming and training new combat units and combat crews, and like so many other RAF procedures, those methods were borrowed and adapted to AAF conditions. The operational

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training unit (OTU) program involved the use of an oversized parent group to provide cadres for what were called, in a somewhat mixed metaphor, satellite groups. Graduates from the schools were used to man the satellites and to restore the parent after each loss of a cadre. The system, developed during the early months of the war, was in full swing by 1943. Cadre leaders were given an intensive thirty-day course at the AAF School of Applied Tactics at Orlando, after which they returned to direct the individual and unit training of the new group. Generally six months were required from the original assignment of the cadre to readiness for combat. Some additional training for local conditions might be required in the theater, but the OTU had made a combat team from a group of individuals assigned at random.

After May 1943 the continental air forces used also the replacement training unit (RTU), a substitute for the older custom of drawing replacements from organized units or instructional staffs in the United States. To train individual combat pilots or crews in larger teams, the RTU was formed as an overstrength group from which replacements were constantly transferred while new school graduates came in, or as a provisional group under a parent unit, the former being dissolved into a replacement pool at the end of training. By the end of 1943, when practically all groups except those for B-29's had been organized, the RTU replaced the OTU for all other types. Eventually the RTU's merged with their air base complements to form combat crew training stations, which provided a more realistic training for overseas assignments.

Although there was some diversification among the several continental air forces, in general the First and Fourth specialized in fighter training, the Second in heavy and very heavy bombardment and 1 Troop Carrier Command in transport. Because of the size of the crew, the complexity of the plane, and the nature of AAF doctrine, the most important of these programs was for heavy and very heavy bombers. The B-29 program was unique in being under the combined direction of AAF Headquarters, the Second Air Force, and Training Command. Most of its pilots (though not co-pilots) were men with hundreds of hours of flying in multiengine planes, and many crew members were experienced.

The OTU-RTU system was handicapped by the customary shortages in personnel and equipment and, until the reorganization of AAF

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Headquarters in March 1943, by too much interference by Washington. In reply to complaints from overseas, the continental air forces began specialized training for each theater, using in 1944 and 1945 small units on leave from the theater as a cadre for replacements assigned thereto. Special problems arose in training reconnaissance and troop carrier units, for which there was no substantial prewar experience.

Although the preparation of combat crews was the most eager concern of the training establishment, the training of ground technicians and service personnel was a heavier charge in terms of sheer numbers of graduates. In the AAF there were seven men on the ground for each one who flew and four of them were rated as technicians; 700,000 graduated from courses in maintenance alone during the period 1939-45. Chief responsibility for the vast and variegated programs lay with the Technical Training Command and its successor the Training Command; but the task was shared by ATC, the continental air forces, and the parent organization of members of Arms and Services with the AAF. Three types of schools were used: those run by the AAF, civilian-operated contract schools, and factory schools for specialists on articles produced by that company.

The basic airplane mechanics course, with a term of 112 days, soon became standardized. Some experiments in specializing on a particular kind of airplane were tried, then abandoned in favor of 76 days of general instruction and 36 of specialization on a single type. Besides this basic course, there were schools that carried the trainee on to become an expert mechanic on electric equipment, power plants, instruments, and hydraulic systems. Schools for auxiliary specialists included those for welders, machinists, sheet metal workers, and parachute riggers. In addition to these schools, most of whose graduates came under control of an engineering officer, there were various fields for which instruction was provided in both operation and maintenance: communications, radar, armament, aerial photography, weather, and aviation medicine. In most cases courses for enlisted men were given in AAF or contract schools, those leading toward a commission by contract with some college or university.

Complaints by General Arnold that instruction was too theoretical led to a radical experiment by the Technical Training Command in 1942. Classes were put on a seven-day-week, twenty-four-hour-day schedule. All lecturing, all reading, all written exams were to be

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abolished and all instruction was to be by demonstration and imitation. Whatever virtues the system may have had, it proved impossible to administer with the existing staff of instructors, though its main principle of strict adherence to the practical aspects of a subject was usually followed.

The ground echelons of combat units, made up of graduates of the various technical schools, were trained as teams under the supervision of the continental air forces and I Troop Carrier Command. The training was given at the OTU along with that of the flight echelon, and a cadre system was used similar to that for the flyers. Service and depot groups were put together by the ASC, sometimes on bases operated by the continental air forces, in which case there was often a wasteful duplication of men with both a permanent and a student unit existing at the same station.

In addition to the more or less standard schools training aircrews and ground technicians, the AAF provided training for a wide variety of other specialists. ATC, for instance, was faced with the need for pilots familiar with a wider variety of airplane types than was common among combat pilots. Originally ATC was able to enlist a number of civilian pilots, bring them up to the level of service pilots, and then commission them. Later the ATC had to depend on graduates of the regular schools,

and so in 1942 began the use of OTU's, of which there were eventually four. Responsibility was vested in the Ferrying Division and emphasis was placed on checking out the pilots on a wide variety of planes, but the course was intended for transport pilots as well as those delivering aircraft. By 1944 the courses had been lengthened to as much as eighteen weeks and had shown marked improvement with specialization for various plane types at the several OTU's, one being devoted exclusively to prospective crews for the Hump airline in India-China. To supplement the supply of male pilots available for ferrying, a project for using experienced women pilots was begun with the Women's Auxiliary Ferrying Squadron in September 1942. Shortly thereafter a more ambitious plan to train women pilots in greater numbers and for more diversified tasks resulted in the establishment of the Women Airforce Service Pilots. Instruction according to AAF methods with necessary modifications continued until the disbanding of the WASP's in late 1944. Whether under the existing manpower situation, realistically estimated, the results of this

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experiment justified the effort required to maintain the special training establishment might make an interesting topic for study.

To release as many rated officers as possible from routine administrative jobs, the Technical Training Command established an officers' candidate school at Miami Beach in February 1942. It was moved to San Antonio in June 1944 and again to Maxwell Field a year later. The school drew its candidates chiefly from eliminated flight cadets and enlisted personnel and, with a waiting list of each far greater than the quotas allowed, OCS might have selected a highly qualified student body but for errors in assignments. The school had a reputation for being "tough," apparently exaggerated because of incorrect rumors as to the rate of elimination. Other complaints were better founded. In the academic section too little was taught about too many subjects in too short a time (twelve weeks). The military phase, consisting almost entirely of close order drill and ceremonies, was stressed at the expense of the administrative training for which the school had been founded. An unsuccessful effort to imitate the West Point class system brought criticism, especially from adult officer candidates who had little liking for adolescent forms of hazing. Classroom instruction was uninspired. It was little better at the adjacent officers' training school where specialists commissioned directly from civilian life were given six weeks of military orientation. For the student officers, aged usually between thirty and forty-five years, the drill and physical training were less exacting, but the academic program was as superficial and as dull.

By contrast, the varied instruction given at the AAF School of Applied Tactics at Orlando drew heavily on the experience of men freshly returned from combat assignments who, whatever their pedagogical skill, had an impressive fund of useful information. The wide range of student ranks--from major generals to enlisted men--and the deliberate slighting of the more formal aspects of military courtesy must have contributed as much to the unique character of AAFSAT as did the unconventional nature of the tactical problems studied and taught there. Finally, it should be recalled that the AAF trained in its flying or technical schools a great number of foreign nationals. Some 31 nations were represented among the 21,000 foreign students who enrolled in AAF schools, but more than half were British and they, with the French, Chinese, Brazilians, Netherlanders, and Mexicans--in that

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order--made up all but a handful of trainees. In some cases the service rendered was for diplomatic rather than military reasons and indeed, except in the case of a few of the countries that sent large quotas, the immediate results could hardly have repaid the not inconsiderable efforts involved.

The length of the section of this volume devoted to the training program is a reliable index of the importance assigned thereto by the editors and contributors. It is possible that they have here exhibited a more critical attitude than in dealing with other stateside activities of the AAF. If so, it has been because of their own professional training as teachers and their wartime experiences in schools which differed so sharply from their civilian colleges in curricula, methods, and standards. Probably the AAF schools would have been improved by a more liberal use of experienced educators at key administrative positions (as they were used for instructors) rather than depending on a random assignment of reserve officers who in civilian life had been lawyers, insurance agents, or car salesmen. Yet in last analysis most of the obvious faults in the schools were those that stemmed from an over-rapid growth and were hardly avoidable. On the positive side, the chapters in question show that the AAF did recruit and train the world's largest air force; the over-all soundness of the methods used may be seen in the air victory.

Before Pearl Harbor, both German and Japanese pilots were receiving more training before assignment to units than were those of the U.S. Air Corps. In the last year of the war, when AAF pilots were showing a marked superiority over their Luftwaffe opponents, the training of the Americans included an average of about 360 flying hours; of the Germans, about 110 . In terms of training in combat models, the discrepancy was even greater. In the same period, the Japanese were committing *kamikaze* pilots to combat with as little as 70 flying hours. Some idea of the fashion in which the AAF average of 360 hours was accumulated may be derived from the present volume, supplemented by sections from the pertinent combat narratives that deal with theater training programs. The editors have thought it useful to give here an account of one pilot's career, drawn from his 201 File, to document the AAF's emphasis on thorough and on-going flying training. To illustrate as many phases of the program as possible, the editors present the case of Capt. Frederick C. Bock,\* whose

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\* For Captain Bock's part in the atomic bombing of Nagasaki, see Vol. V, [719-20](#).

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period of service was about coterminous with the war training program.

Frederick C. Bock, born 1918, was graduated from the University of Chicago in the spring of 1939. He stayed on for a year of graduate work in philosophy, then went to work in a wholesale grocery. In March 1941 he applied for an appointment as aviation cadet and was accepted by a traveling flying cadet examining board at Grand Rapids, Michigan. This gave him deferment from the draft and Bock returned to his university to await his call from the Air Corps, meanwhile receiving some flight instruction--enough to have soloed--from the CAA. He was enlisted at Fort Custer, Michigan, on 10 July 1941 and sent to Fort Ord, California, for his final physical check. He did his primary training at a contract school at Santa Maria, California, and his basic at Moffett Field, where he returned from his last solo flight on 7 December to learn of the Japanese attack on Pearl Harbor. Each stage had lasted ten weeks, but in the emergency his class in the advanced school at Stockton Air Base was accelerated, so that 2d Lt. Bock received his wings and commission on 23 February 1942, almost a year from the date his application was accepted. In the meanwhile, he had amassed

about 200 hours of flying time--60 hours in a PT-13 at primary, 70 in a BT-13 at basic, and 75 in an AT-6 at advanced.

There being as yet no OTU's, Bock was assigned to the AFCC and sent to Pendleton Field, Oregon, where he received transition training in a B-17 and was rated as co-pilot in the 34th Bombardment Group (H); his operations officer was Maj. Curtis E. Le May. After six weeks Bock went to Morrison Field, Florida, and thence to Karachi, India, where he arrived on 5 May 1942 and was assigned as a replacement to the 7th Bombardment Group (H). There was more training, mostly in B-17's and then in B-24's as the 7th Group was reequipped about October. When he flew with his 436th Squadron in the first China strike with heavy bombers, on the 21st, Bock had flown in training and ferrying between 450 and 500 hours, well over half of the time in combat planes. He was rated first pilot in December.

After eleven months of combat, Bock was rotated to the States, being assigned in September 1943 to the 9th Bombardment Group (H) at AAFTAC, where his unit was engaged in developing and teaching bombardment tactics. This assignment lasted until February 1944

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when he volunteered for the B-29 program and was transferred to the Second Air Force, then in charge of VHB training. When he began his transition to the B-29 in April, he had a total of over 1,150 flying hours. The new training went slowly for want of sufficient B-29's, but his squadron, the 393d Bombardment (VHB), had almost completed the normal OTU program when in September it was chosen as the atomic-bomb unit and moved from Fairmount Air Field, Nebraska, to Wendover Field, Utah. The intensive training that followed omitted some of the regular features but included a tour of temporary duty at Batista Field, Cuba, whence long overwater simulated missions were flown, and bombardment practice in Utah, with bombs having ballistics characteristics similar to those of the atomic bomb.

In June 1945 the 393d flew its specially modified B-29's to Tinian. There Bock and his crew, with others in the squadron, took a seven-day theater orientation course and then three weeks of combat flight training which included half-a-dozen practice missions with some bombing of by-passed Japanese islands. Then occurred several strikes against targets in the main islands with 10,000-pound bombs; these were regular combat missions carried out by small flights of two or three planes, but their purpose was further training for the real mission rather than to accomplish any significant destruction. The payoff came on 9 August when Bock piloted one of the B-29's on the atomic strike against Nagasaki. His last mission was another go with a 10,000-pounder on the 14th; he learned of the cessation of hostilities that day, as he had of their beginning, on his return from a flight which was essentially a part of a training program, though conducted under very different circumstances. In November, Captain Bock was relieved from duty with his squadron at Roswell Air Field, New Mexico. He then had logged 1,863 hours in flight and in spite of his having had two very active tours of combat duty, well more than half of that time had been devoted to training, either of himself and his crew or of others.

The chapters on training in this volume have been written by Thomas H. Greer and Arthur R. Kooker, both of whom were actively identified with the AAF training program during the war. Alfred Goldberg has brought to his study of equipment and logistical services a long experience with air service organizations in the European

Theater of Operations. Frank Futrell's experience as historical officer included assignments both to the AAF School of Applied Tactics and to the Far East Air Forces. William A. Goss had a long tour of duty with the Fourth Air Force during the war, and after the termination of hostilities he was reassigned to AAF Headquarters. P. Alan Bliss undertook his study of air defense while a member of the AAF Historical Division.

The editors began their work on this volume at a time when Col. Wilfred J. Paul continued to serve, as he had for several years past, as Director of the Research Studies Institute. They regret that the work could not be completed before Colonel Paul's retirement from active duty on 31 August 1954, for they have come to regard each published volume in this series as being in some measure an acknowledgment of his very great help in making possible a history of the AAF. That the series now requires only one more volume for completion is largely owing to the genial and ever helpful guidance he has given the project from its beginning.

We are happy to acknowledge the many courtesies of his successor, Brig. Gen. Clinton W. Davies, Director of the Research Studies Institute, Air University. Among the members of General Davies' staff we are most heavily indebted to Dr. Albert F. Simpson, Chief of the USAF Historical Division, and to Lt. Col. Eldon W. Downs and Mr. Joseph W. Angell, Jr.; Dr. Ernest S. Gohn, Lt. Paul S. Guinn, Jr., Dr. Edward C. Williamson, and Mr. James L. Daniels, Jr., have been especially helpful in the editorial assistance they have provided. Lieutenant Guinn has prepared the glossary and the index. Mrs. Juliette A. Hennessy compiled the appendix listing the wartime assignments of key AAF personnel. The charts have been done by Mr. Z. F. Shelton, Jr. Donald L. Zoll, on loan from the Directorate of Intelligence, contributed importantly to the collection of the information on which Section II is based. Footnotes and other references in the text carry individual acknowledgment of our indebtedness to those who have so generously permitted us to draw upon their wartime experience for the purpose of clearing up obscurities in the records. For a variety of helpful acts our thanks go also to other members of the USAF Historical Division, and especially to Miss Marguerite K. Kennedy and her associates in the Archives Branch; Miss Sara Venable, Mrs. Molly O. Keever, and Mrs. Margie McCardel,

who ably handled the task of typing the manuscripts of the several chapters; Dr. Victor H. Cohen, who resolved a number of problems on training; and Capt. Donald R. Smith, Executive Officer of the Division. Mr. Arthur K. Marmor of the Historical Division's Liaison Office and Col. William S. Vollandt (USAF, ret.) were of material assistance in the preparation of Section II of this volume.

Once more, the pictures have been made available through the courtesy of the Photographic Records and Services Division, Headquarters, USAF. And once again, all of us are indebted for the friendliest cooperation of Dr. Kent Roberts Greenfield and his colleagues of the Army's historical division.

WESLEY FRANK CRAVEN  
JAMES LEA CATE

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Maj. General Henry H. Arnold, Chief of the Army Air Forces and Staff, 1941

Left to right: Lt. Col. Edgar P. Sorenson, Lt. Col. Harold L. George Brig. Gen. Carl Spaatz. Maj.  
Gen. Arnold, Maj. Haywood S. Hansell, Jr., Brig. Gen Martin F. Scanlon, Lt. Col. Arthur W.  
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