

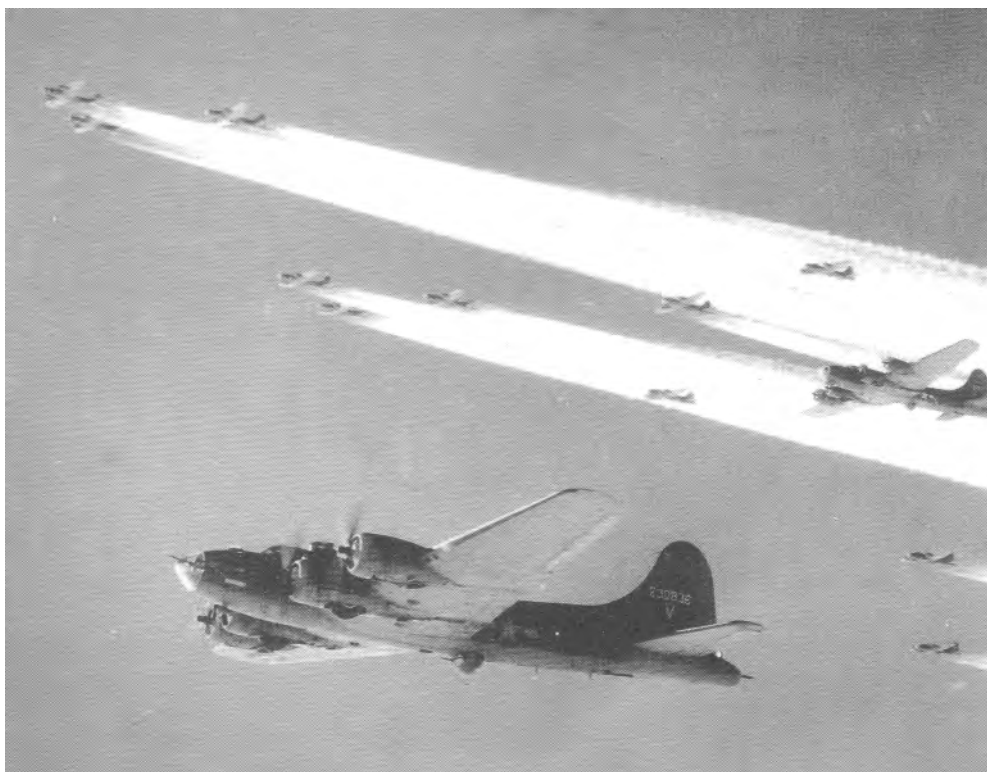


WITH COURAGE
The U.S. Army Air Forces in World War II



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The U.S. Army Air Forces in World War II



Air Force
History &
Museums
Program

Washington, DC

Bernard C. Nalty
John F. Shiner
George M. Watson

1994



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Page 215

Correct:

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To:

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Page 218

Correct Lieutenant Hughes

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Page 357

Correct Hughes, Lloyd D., 215, 218

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Foreword

In the last decade of the twentieth century, the United States Air Force commemorates two significant benchmarks in its heritage. The first is the occasion for the publication of this book, a tribute to the men and women who served in the U.S. Army Air Forces during World War II. The four years between 1991 and 1995 mark the fiftieth anniversary cycle of events in which the nation raised and trained an air armada and committed it to operations on a scale unknown to that time. *With Courage: U.S. Army Air Forces in World War II* retells the story of sacrifice, valor, and achievements in air campaigns against tough, determined adversaries. It describes the development of a uniquely American doctrine for the application of air power against an opponent's key industries and centers of national life, a doctrine whose legacy today is the *Global Reach — Global Power* strategic planning framework of the modern U.S. Air Force. The narrative integrates aspects of strategic intelligence, logistics, technology, and leadership to offer a full yet concise account of the contributions of American air power to victory in that war.

A second commemoration in September 1997 marks the fiftieth birthday of the United States Air Force as a separate military institution. From its origins in 1907 until it achieved independence on September 18, 1947, the Air Force was, under several different names, a subordinate branch of the United States Army. The combat achievements and the incomparable growth of air power capabilities and thought in World War II made the Air Force's separation from the Army both desirable and inevitable afterward. In the early years of the Cold War that followed, the Air Force was the principal arm of American strategic deterrent policy. It has continued to develop as the most flexible military instrument of American policy. After World War II, the Air Force deployed units in three major conflicts and in a succession of crises. It revealed an increasing reach in humanitarian missions as well. In 1991, the U.S. Air Force fielded an overwhelming presence in the Persian Gulf to defeat the forces of a predatory local regime. For the first time in history, global and precise air power was the decisive element in bringing a hostile government and its ground forces to terms.

As the Cold War recedes into history, it leaves in its wake ancient and new ethnic grievances, resurgent nationalism, and contending militant religious beliefs to complicate international relations. In this charged and

Preface

When separate regional conflicts in the Far East and Europe merged into global combat in 1939, popular usage immediately referred to the new conflagration as a second world war, coming as it did a bare twenty years after the first general war of the age. In the years between 1941 and 1945, the United States of America joined the fray after a surprise attack on its Pacific fleet anchorage in Hawaii. The cataclysm involved all the major powers of the earth, took an estimated sixty million military and non-combatant lives, and became one of the defining events of the century. Over eight million American veterans of the conflict are still alive today to commemorate their part in what they came to regard as a great crusade.

Among the most evident trends of the time were new military technologies. The rise of air power as an indispensable adjunct to ground and naval forces was one of the hallmarks of the era. Aircraft had shown their potential in World War I, but in the twenty years following that conflict, new theory and doctrine arose on their employment in war. World War II vastly expanded this thinking as events rewrote the orderly theory that had prevailed in the prewar Army Air Corps. America's industrial base, in feats of its own, gave U.S. and allied air forces the wherewithal to overcome the aerial might of the Axis. In an intelligence coup only revealed some thirty years after the end of the war, American and allied governments broke the most guarded communications codes of the enemy, an untold advantage in aerial and other operations. Perhaps the greatest achievement was in molding a citizen-soldiery into a fighting host. Of the twelve million men and women mobilized for the war, some two and a half million served in the Army Air Forces. Many gave the last measure of service; to these especially this history is dedicated.

No history of such scale is the labor of a single individual. This one is the work of many hands. Special recognition is due the three authors who wrote the text of this volume. Mr. Bernard C. Nalty is a veteran of several official defense historical programs; he has specialized in analyses of U.S. Air Force operations in Southeast Asia and has produced a respected history of the African-American military experience. Mr. Nalty crafted the narrative on aerial combat operations appearing in this book. Col. John F. Shiner, who retired in 1991, completed the chapter that became the

introduction to this volume. Dr. George M. Watson, Jr., author of an official study on the evolution of the office of the secretary of the Air Force, completed the segment on the home front and industrial production. I am indebted to them for creating the heart of this book. My role was to edit the volume, conceive its design, obtain photographs and other illustrations, and complete the photographic essays.

Executing the finished design would have been impossible without the cooperation of many others. Mr. William Phillips readily agreed to our using his image, *Alone No More*, for the cover of the volume. Permission for this was arranged by Ms. Jennifer Oakes of the Greenwich Workshop, Inc., Shelton, Connecticut, which owns the copyright for the original art and has prints of it available. Ms. Lori Crane and Ms. Protean Gibril integrated Mr. Phillips's artwork into the cover design. Ms. Crane also produced all of the interior art in the book; the six aircraft vignettes that grace the text pages were her creations. Mrs. Michelle Smith compiled the book's index. Mr. Larry Bowring, Bowring Cartographics, Arlington, Virginia, created the two multicolor fold-out maps.

A number of unsung professionals helped us acquire the images in the photographic essays. Mr. Timothy Cronen, National Air and Space Museum, Smithsonian Institution, was especially gracious in meeting our many demands. Mr. Robert Mikesh, a former Smithsonian staffer, assisted with photos of Japanese aircraft that proved elusive during our search. Ms. Mary Beth Straight, U.S. Naval Institute photo-archivist, offered similar assistance. Retired Air Force Col. Richard Cole provided a copy of a portrait of Brig. Gen. Harold H. George for our use. Mr. Charles Haberlein and Mr. Edwin Finney, Jr., Center for Naval History, were another indispensable source of valuable pictures. Special thanks is also due Mr. James A. Longo, Prudential Insurance Company, for assistance in obtaining a portrait of Mr. Franklin D'Olier.

Within the Center for Air Force History, I am indebted to several professionals who reviewed this work as it progressed. Dr. Richard G. Davis provided valuable comments on World War II aerial operations in Europe. Mr. Herman Wolk oversaw the entire production through its many and complicated stages. Dr. Richard P. Hallion further advanced the cause with his detailed suggestions and editorial assistance. To Mrs. Anna Barbara Wittig, I owe much for her special acumen and continued encouragement; to Mrs. Karen Fleming-Michael goes my gratitude as well for her willing support in reading photo-essay copy and her generosity in sharing images.

ALFRED M. BECK

January 1994

unpredictable atmosphere, the Air Force has a demonstrated ability to reach points of tension around the world within hours, delivering decisive, precise force against any opponent. It is an unparalleled strategic instrument for a period of particularly volatile international relationships. As the Air Force meets the demands of the future, it is well to honor those who were present during its gestation and birth. We dedicate this volume, with respect and affection, to the men and women of the Army Air Forces of the Second World War.

RICHARD P. HALLION
Air Force Historian

January 1994

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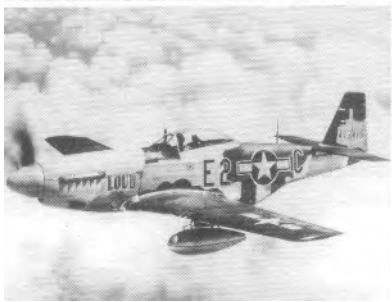
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Alfred M. Beck
chief editor

In peace there's nothing so becomes a man
As modest stillness and humility:
But when the blast of war blows in our ears,
Then imitate the action of the tiger;
Stiffen the sinews, summon up the blood,
Disguise fair nature with hard favor'd rage;
Then lend the eye a fearful aspect.

WILLIAM SHAKESPEARE, *Henry V*
Act III, scene 1

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1

A Weapon and an Idea

In the searing experience of World War I, the scale of combat and the technical instruments in the arsenals of the contending alliances gave the war an entirely new character. Governments improvised mass mobilizations of manpower and industry to meet the always increasing demands of what turned into a four-year slogging match. At the outset, German armies advanced to battle on the western front on meticulously planned railroad timetables in executing a strategy that was supposed to give them a rapid victory. On both western and eastern fronts on the European continent, military commanders controlled forces over immense distances in battles of monumental scope; advances in radio and field telephone communications needed to direct these efforts had to keep pace. Senior commanders, whose careers in many cases had spanned the introduction of steam power and wireless communication to military operations, by necessity harnessed other technology still new to field armies in their search for a combination of weapons that might break the deadlock that characterized the fighting front. The war marked the first wholesale use of the internal combustion engine in combat theaters. In wheeled and tracked vehicles, motors vied with horseflesh in increasing the speed and maneuver range of ground armies. Combined with an airfoil, the internal combustion engine supplied motive power for another maturing weapon.

Already in experimental military use by the first decade of the twentieth century, aircraft introduced a third dimension to warfare. Operating at altitude above the toiling armies and at speeds exceeding those of the cavalry horse and the steam locomotive, aviation added new ways to observe and attack an enemy and to thwart his thrusts against friendly forces. Consistent aerial observation virtually eliminated the meeting engagement, that phenome-

non in ground warfare in which two groping enemy bodies with imperfect intelligence about each other's location collided in disarray. Attempts by aviators to challenge an opponent's aerial reconnaissance soon led to combat aloft and the subsequent production of aircraft specifically designed to fight other aircraft. These same machines were also used in close air support of engaged troops on the ground, often with disastrous results; aircraft were an obvious means of putting more ordnance in the enemy's midst, but their losses in low-level flights along trench lines were unacceptably high where infantry could mass rifle fire against machine and pilot. Strategic bombing attacks on enemy homelands and industrial targets far behind the front lines using zeppelins and equally fragile multiengine bombers were spectacular in spreading terror among urban civilian populations but were militarily ineffective. No application of strategic or tactical aircraft followed any agreed-upon general doctrine during the war and proponents of air power were free to advocate war-winning projects that were far beyond the capability of their aircraft. One proposal for an air drop of an entire American infantry division behind enemy lines near the end of the war could not have given serious thought to the aircraft needed for the initial attack or the logistical requirements for resupplying such a force by air. Nevertheless, the most hidebound traditionalists never argued the point that the airplane had arrived as an instrument of war. Primitive as the mechanical technologies of World War I were, they opened an interplay of new strategic and tactical ideas afterward. Though developments in land fighting vehicles were slow and relatively invisible, the airplane's evolution in the twenty-year interwar period was far more public; nothing, in fact, seemed to promise immediate decision in any future war as much as did air power.

The period between the two wars in the United States, as elsewhere, was one of almost ceaseless ferment over the claims and aspirations of the proponents of aviation and defense establishments that attempted to integrate air weapons into traditional military and naval forces. This tension shaped U.S. War Department organization, fighting doctrine, interservice agreements, and interwar politics—especially the competition for military appropriations in a peacetime America beset by economic troubles through the late 1930s. Vast advances in aircraft design and aerial weapons technology in these twenty years and the construction of modern air fleets by former allies and potential enemies alike also influenced the debate as it became ever more apparent that aviation would figure heavily in any impending war.

The peace treaties ending World War I had not yet taken effect when American officers who had served in Europe with the Air

Service of the American Expeditionary Forces (AEF) began designing the course of things to come for their combat arm. Most of them had lived through the separation of the air arm from the Signal Corps, where it had resided since 1907. Acting upon their experiences in the war, many of these men such as Brig. Gen. William Mitchell, Lt. Col. Benjamin Foulois, Maj. Carl A. Spaatz, and Maj. William Sherman returned to the postwar Regular Army to proselytize for military aviation in a much diminished American force structure.

Reduced in number to a mere two hundred air officers of all grades, the officers of the AEF Air Service had been exposed in some degree to events or thinking during the war that recognized air power as independent and coequal with ground and naval establishments. Mitchell had pursued a professional relationship with Maj. Gen. Hugh Trenchard in which he absorbed British thinking on operations and an independent aerial combat arm controlled from the highest headquarters of the field army. Spurred by German air raids over England, the British Committee of Imperial Defense organized a separate Royal Air Force under Trenchard's command in 1917, an organizational development that was a constant in Mitchell's later pronouncements. Less definite was the impact of ideas from the Italian air force of the time. Sherman, who had been Chief of Staff for the U.S. First Army Air Service, associated only occasionally with Gianni Caproni, the Italian aircraft manufacturer, and Mitchell met the industrialist at least once, with unreported results. It therefore remains unclear what practical or theoretical influences the American fliers at this stage might have found in Caproni's disciple, Giulio Douhet.

The author of the earliest coherent statements on strategic bombardment, Douhet was an Italian Army artilleryman turned aviator. He presented his theories on air power in a book first published in 1921 and later translated into English as *The Command of the Air*. The Italian argued for an independent air force, separate from an army or a navy. He proposed a fleet of battle planes to first wrest control of the skies from an enemy air force and a bomber force that would then exact a decisive if indiscriminate toll of an enemy's war production and industrial workers. In this heavily offensive use of air power was a willingness to make war against civilians, but its appeal lay in the notion that it might avoid the deadlock and fruitless bloodletting of the trenches in World War I; some even saw such a new mode of warfare as humane since it would make future wars gratifyingly short, producing a decision in weeks or months instead of years.

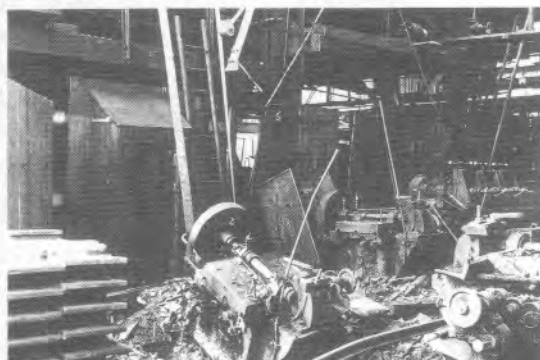
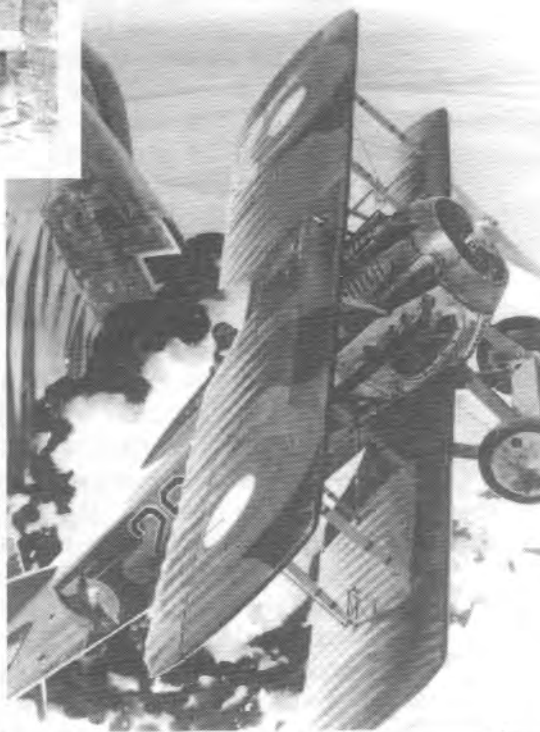


American airmen arriving in France after the American declaration of war against Germany in April 1917 were the first of only 1,200 fliers and ground crews then serving the control of the Army Signal Corps. With 250 aircraft and five balloons, they relied on their British and French allies for more advanced aircraft. At the time of the Armistice in November 1918, their number had swelled to 190,000, of which around 76,000 were overseas in the American Expeditionary Forces under General John J. Pershing. American aviators trained at French bases and began operating French-designed Nieuport, Breguet, Salmson, and Spad aircraft against the enemy.

In Europe, Pershing separated the Air Service from the Signal Corps and placed his West Point classmate, Maj. Gen. Mason M. Patrick, in command of all American air elements of the American Expeditionary Forces. The various functions of observation, pursuit, and bombardment were attached to AEF ground elements, usually at the corps or division level, a command structure that also governed the organization of American air elements after the war.

In battles that celebrated the knights of the air,

AEF Air Service pilots made their mark, but air operations left other imprints on American thinking about the uses of military aviation. Capt. Eddie Rickenbacker (*above*) scored twenty-six aerial victories to become the leading American ace. Ground crewmen (*above, opposite*) set crude bomb fuses at an airfield near Amanty, France, in 1918. Two canvasses by American artist Merv Corning capture the intensity of combat: the crew of a Breguet from the American 96th Aero Squadron fights off German ace Ernst Udet (*far right, above*), and *Arizona Balloon Buster* depicts the exploits of Frank Luke (*opposite, right*). One of the more feared German adversaries of the war was the superbly aerobatic Fokker DVII (*opposite, near right*). The scenes of destruction after an air raid on machine shops at Esch and Dudelange in Luxembourg in early September 1918 (*opposite, below*) contain the manifestation of an idea that would influence American and other airpower theorists through the next twenty years: the application of strategic air power against an enemy's warmaking industry would have more effect than air battles over a land front or attacks against fortified positions.



A semblance of this still ill-defined idea propelled American aviators and civilian authorities seeking a more eminent position for a weapon that had proved workable in the war. The public reacted enthusiastically if uncritically to the new wonder apparent in American skies, but the electorate and its political leaders responded equally against the prospects of a new war and a strong military. The country retreated from the ills of Europe after World War I. The U.S. Senate refused to endorse American membership in the postwar League of Nations, which struck many as a European collective security arrangement that would only entangle the United States in new foreign arguments. For the U. S. Army, national defense centered on a mobilization strategy with only a small regular force in being to protect borders and coasts. More ambitious undertakings would require at least a partial mobilization and the incorporation of reserve and National Guard forces into a federalized army. Regular army garrisons with a few attached aircraft were deployed for the protection of island bastions in Hawaii and the Philippines or in the Panama isthmus with its vital canal. Duties in these distant posts were more constabulary in nature for most of the interwar period. There seemed little need for an air force with even limited strategic striking power for a country with tractable neighbors north and south and vast ocean buffers east and west. By the mid-1930s, as dictatorships stalked their neighbors in Europe and Asia, the U.S. Congress began enacting a series of neutrality acts designed to isolate America from any conflict and even to keep American commercial interests from delivering munitions to distant combatants. Money, the always limiting factor for the interwar defense establishment, was in short supply for the diminished American Army until the new crisis loomed.

Aviation remained part of that Army. Legislation, War Department policy, and a series of decisions on organizational structure determined the position, the employment, and the funding of the air arm within the existing military establishment. A War Department investigating commission's recommendations and two bills introduced before Congress in 1919 aimed at transferring responsibility for aviation to a separate cabinet-level department. This was to incorporate all military and naval aviation and the development of all civilian air services. Representing the War Department's opposition to this in the name of Secretary Newton D. Baker was the first postwar Director of the Air Service, Maj. Gen. Charles T. Menoher, a former artilleryman. Menoher's committee returned findings that influenced the congressional hearings in favor of a more restricted notion: if the infantry loses, the entire army loses; therefore aviation's chief role was in support of the ground army,

not in attacking targets beyond a horizon. From this proceeded the Army's conviction that it must control its own aircraft to insure their proper application against an enemy. The resulting National Defense Act of 1920 reorganized the Army for peacetime existence, prescribing the Air Service as another combat arm with the Infantry, the Cavalry, and the Artillery, but under law still subordinate to the War Department. The field command structure of the interwar Army within the continental United States consisted of nine Corps Areas, actually administrative regions rather than formal military units. Within each Corps Area, a military commander controlled all attached military units including aviation and the installations on which they were based. The aviators were left to add their voices to the continuing debate on the issue of the employment of aircraft, which ran unchecked across the next two decades.

No voice in this polemic compared to that of Brig. Gen. William Mitchell. In the words of one historian, this former signal officer was "the sleepless and extraordinarily vocal propagandist for air power." The chief of the Air Service for the U.S. First Army in World War I, he returned from France in 1919 eventually to become Menoher's assistant chief of the Air Service in the War Department. Mitchell openly sought to harness public opinion to the cause of aviation as he defined it, a not unlikely goal, given the romance that soon surrounded barnstorming military and civilian pilots who made airplanes real to gaping crowds at county fairs through the 1920s. He was among the principal advocates of a governmental aviation department for all air matters including civil aviation and admitted to an approved biographer that he had himself in mind as head of it. For some influential Army officers like former AEF commander General John J. "Black Jack" Pershing, he behaved like a "bolshevik," but Mitchell was above all a publicist. He authored books and numerous popular magazine articles, all timed to sway legislative and appropriations hearings in the Congress. In July 1921, during a series of experiments employing aerial bombs against armored warships, he led the 1st Provisional Bombardment Wing from Langley Airfield in Virginia in the much-publicized sinking of a moored German prize-of-war, the *Ostfriesland*, off the Virginia capes to demonstrate the potential of aviation against capital ships.

Mitchell's demonstration hastened the departure of General Menoher as Chief of the Army's Air Service. Succeeding to that office in October 1921 was a guiding spirit that took the Service through the next rounds in the saga of American military aviation. Maj. Gen. Mason M. Patrick, a military engineer who had run the headquarters of the AEF Air Service in France and later earned



Mason Patrick



From October 1921 to December 1927, Maj. Gen. Mason M. Patrick presided over aviation within the U.S. Army. Patrick, a West Point classmate of General John Pershing in 1886, had a full career as a civil and military engineer officer before Pershing picked him to head the AEF's Air Service in World War I. He was a decided contrast to his assistant chief of the Air Service, Billy Mitchell, and worked quietly and skillfully to achieve funding for training, new aircraft, and an experimental testing program for new designs. Patrick promoted Mitchell's ideas for a round-the-world flight by four Army planes in 1924 and endorsed the entry of Army fliers in air meets of the day. Regarded by some of his younger charges as antiquated, he counterbalanced admirably the often flamboyant fliers stridently declaiming the merits of air power, yet shepherded the Air Corps Act of 1926 through the complex process of acceptance by the Army and the Congress. At the age of fifty-nine, he placed himself in the hands of one of his subordinates, who taught him to fly.

his wings at the advanced age of 59, was a less disputatious but nevertheless effective, experienced, and even-handed champion for the aviators in the Army. Speaking from more aviation experience, Patrick was also able to better rein in or at least channel Mitchell. To counter some of his subordinate's notoriety, Patrick sent Mitchell on diplomatic and observer assignments outside Washington. For the years between 1921 and 1927, Patrick also pushed for an air element that had the same relationship to the War Department as the Marine Corps had to the Navy. Later he advocated just as strongly an independent air element within a Defense Department comprising an Army, a Navy, and an Air Force.

In tactical organization, General Patrick applied the concept of a General Headquarters, or GHQ, mentioned in the National Defense Act of 1920. Meant to emulate the command structure of the AEF of World War I, the GHQ would be the mobilized field command of an American Army in time of war controlling operations to defend the country or to go overseas again. The GHQ concept could also serve admirably as a means of command for a highly mobile air force that would deploy to any threatened point for use as a striking force, either in concert with troops on the ground or operating alone. In Patrick's plan, only observation aircraft would be left under the direct control of ground commanders, and he favored placing observation units at the Army corps level rather than at lower headquarters. Striking forces of bombardment, attack, or pursuit planes would be controlled solely by an air officer from the level of the GHQ Reserve. At the time, his proposals challenged the prevailing command structure for aviation that was centered in the Corps Area commands. Patrick thus anticipated the principle of controlling air elements from a theater-level command, an arrangement that became commonplace in the latter stages of World War II.

These ideas, cogently presented in terms that the Army could accept as improvements in the operation of aircraft within its ranks, came before a new Army board on aviation established in early 1923 under Maj. Gen. William Lassiter. The Lassiter Board returned recommendations for the assignment of airplanes to Army units down to division level, but at least took seriously the idea of locating the control of air elements at the GHQ organization in wartime and recommended a ten-year program to give the Army enough aircraft to do the job. Undaunted, Patrick continued promoting arguments for a single commander for military aviation answering to the Secretary of War, another portent of developments in World War II.

As important were Patrick's attempts to apportion roles for

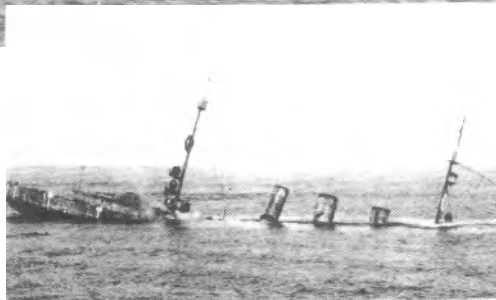
aviation with the U.S. Navy. Already in possession of an aircraft carrier by 1922, the Navy too had a vocal proponent for aviation, Rear Adm. William Moffett, chief of its Bureau of Aeronautics. Without the close-range enemies that influenced the character of the emerging air forces in Europe, U.S. Army aviators sought to define responsibilities of seaborne and land-based aviation in any aggression against the shores of the United States. The obvious solution was to use the water's edge as a demarcation line dividing the areas of operations for the two services, leaving the Navy everything to seaward and the Army, especially its Coast Artillery and the Air Service, responsible for countering hostile landing operations that penetrated the Navy's first line of defense. The difficulties of making rigid assignments of roles in this case were equally obvious. Army aviators clearly needed the operational flexibility to range over the ocean if their intervention would help defeat a theoretical invader, and likewise the Navy should have been accorded similar leave to assist in a land battle and to operate aircraft from its air stations ashore. Billy Mitchell, with the *Ostfriesland* and several subsequent bombing tests with the decommissioned USS *Alabama* in mind, sought to have the demarcation line in any future war moved two hundred miles offshore, making Army aviation responsible for the area from the shore to the boundary and confining naval aircraft to operations in support of the fleet. The issue of areas of responsibility clouded Army-Navy relations through the interwar period, despite the resonance that other aspects of Mitchell's crusade found even among some naval officers.

By early 1925, Mitchell had made himself a virtual outcast in Washington. His seniors, with Patrick's reluctant concurrence, reduced him to his permanent rank of colonel and dispatched him to Texas as air officer of the Army's Eighth Corps Area. He was replaced as Assistant Chief of the Air Service by Lt. Col. James Fechet. Later that year, with the disastrous crash of the Navy dirigible *Shenandoah*, the exiled Mitchell accused senior War and Navy Department officials of "incompetency and criminal negligence and almost treasonable administration of our national defense." Even his friends thought this a deliberate provocation. President Calvin Coolidge, a man of definite ideas about the decorum of his administration, took a personal interest in the charges drawn up against the former Air Service assistant chief. Mitchell's ensuing seven-week trial for insubordination became an open forum on the merits of aviation in national defense and aroused a popular storm. The court martial deliberated only on the issue of insubordination, found him guilty on all counts in December 1925, and sentenced him to five years suspension from



The Billy Mitchell Era

The most vocal spokesman for an aviation arm separate from the Army in the 1920s was Brig. Gen. William Mitchell. Born in 1879, Mitchell began a career in the U.S. Army as a signalman. Moving into aviation, then still under the Signal Corps, he rose to become chief of the Air Service of the American First Army in France in World War I. In July 1921, he gave a practical demonstration of the effectiveness of aerial bombs against armored naval vessels. A test culminated in an attack against a war-prize, the ex-German battleship *Ostfriesland*. Mitchell led the 1st Provisional Air Brigade, which sank the ship in the climax of two days of experiment. A 300-pound bomb explodes alongside the ship (above); underwater damage from 2,000-pounders dropped by Mitchell's pilots sent her to the bottom (inset, right) next day.



Mitchell's incessant crusade made him a thorn to his superiors, but endeared him to younger Army flying officers. His court-martial late in 1925 (below, left) caused a public furor, but his resignation from the Army permitted him full rein in his campaign for an adequate and independent air arm until his death in 1936. His junior officer-protegés promoted his ideas and developed offensive air doctrine, especially strategic bombing, to defeat potential enemies.



active duty. Mitchell proffered a resignation hastily accepted by the War Department the following February. He had given his name to an era in the Air Service and left behind a cadre of younger men who carried on as he pursued his campaign for air power as a civilian until his death a decade later. If he had staked too much on the capability of the aircraft of the time, this single-minded crusader had also made the American public sensitive to the potential of aircraft in war. It was a promise that seemed increasingly fulfilled in the coming years.

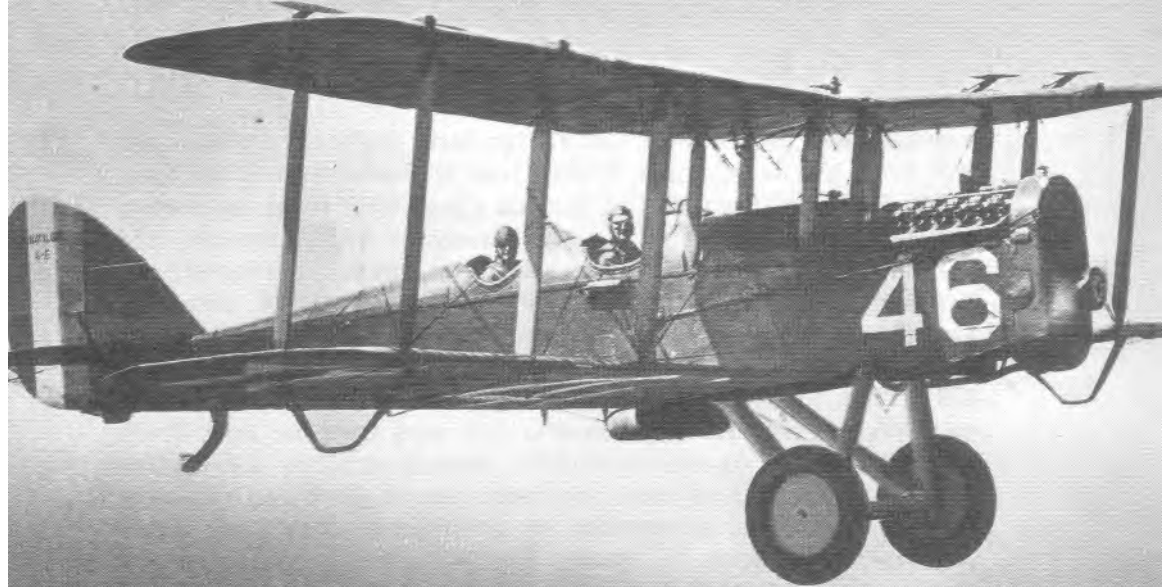
Even as Mitchell's case moved to a predictable conclusion, two competing bodies again met to influence the fate of military and naval air power. One, a congressional committee under Florian Lampert, pursued an extended—even leisurely—survey of the Lassiter findings with a parade of conflicting witnesses. Seeking to head off what might have been political embarrassment at the Lampert committee's direction, President Coolidge called upon an old friend, banker Dwight Morrow, to head a board to make new recommendations on aviation in the national defense. Morrow beat the Lampert committee to the punch and the accumulated advice from all quarters coalesced in the Air Corps Act of July 1926. The Act renamed the Air Service the Air Corps, increased the presence of air officers on the Army General Staff, and established an Assistant Secretary of War for Air. F. Trubee Davison, a New York lawyer, assumed the assistant secretaryship in July 1926 and served until late 1932. The Act also specified a five-year program for the expansion of military aviation, but again left its control firmly under the War Department. The Air Corps could expand "educational" Air Corps orders to the American aviation industry for newer and better aircraft prototypes in limited numbers and coincidentally to encourage a burgeoning industry that was already gaining a world-wide reputation.

The improvements for military aviation specified in the law came in fits and starts. The 1926 Act authorized enlarging the number of air officers from 919 to 1,650 (a 79 percent increase). The enlisted force was to increase from 8,725 to 15,000 (up 72 percent). Aircraft strength was to rise from 1,254 to 1,800, all over a period of five years. The War Department figured the cost at \$31 million a year for the five-year plan and \$26 million a year thereafter to maintain the force in a modernized and ready state. This would have more than doubled the \$14.9 million directly expended on the Air Corps in 1926 out of a \$267.2 million War Department budget for the year. Many Army regulars looked askance at these proposals when they realized that a single combat arm was to be so heavily favored with new equipment and rapid promotions in an era when company grade infantry officers

(captains and below) were often over forty years of age and had little hope of advancement. When General Patrick turned the reins of the Office of the Chief of the Air Corps over to his successor, now-Maj. Gen. James Fechet, in November 1927, however, the five-year plan was in trouble. With no money appropriations attached to the 1926 Act, the authorized numbers of personnel and planes fell prey to annual budget politics. The Air Corps appropriations actually dropped in 1927, but rose precipitously to \$28 million by 1930 and to \$38 million the following year, as the nation coped with financial disaster following the New York Stock Market collapse of October 1929. Annual requests for supplemental appropriations were routinely turned down, and existing funding was often impounded by presidential command as the economic depression deepened. The Air Corps consistently got about half its annual budget request in these years, but it also regularly outspent the rest of the Army except the Finance Corps, responsible for Army pay, and the Quartermaster Corps, in charge of Army subsistence and housing, including construction.

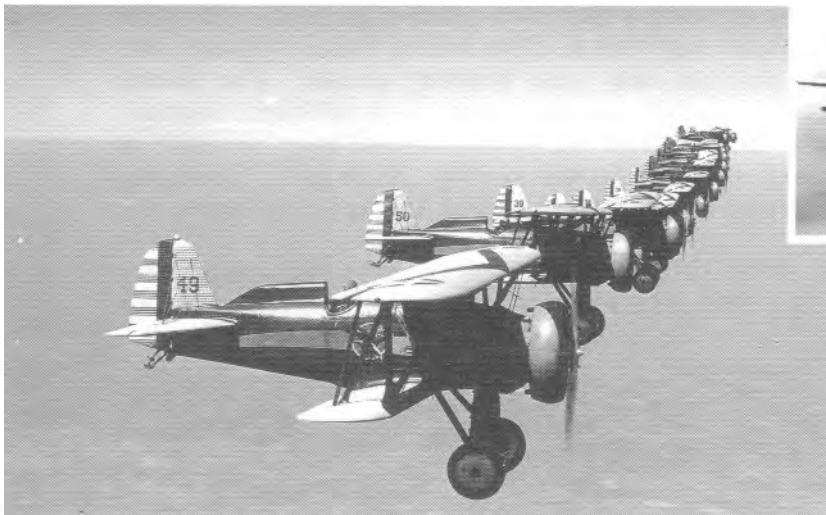
Between the mid-1920s and the beginnings of an Army mobilization in the late 1930s, the Air Corps managed to field increasingly capable aircraft devised for specific roles. The result of advancing aviation technology and an American aircraft industry that became an acknowledged world leader, this trend gave the Army myriad new prototypes. Army fliers throughout the interwar period pushed the frontiers of manned flight. At Mitchell's prompting in 1924, Army crews completed a four-plane, round-the-world flight that took five months and a logistical miracle. Flying officers and enlisted men participated in a series of races, transcontinental flights, and the first aerial navigation from the west coast to Hawaii. In 1929, Army aviators undertook to discover how long an aircraft could stay aloft. In a Fokker twin-engine craft named the *Question Mark* to signify their quest, they experimented with the transfer of gasoline from one craft to another in midair. The crew carried off this attempt at aerial refueling and landed after more than 151 hours airborne. Based on such heralded feats and experimentation in the service and in the industry, the Air Corps continued refining its requirements for the types of aircraft specified as observation, attack, pursuit, and bombardment through the first postwar decade. The design developments that most affected American military aviation, however, were in the field of bombardment and mirrored its perceived superiority over pursuit aircraft. A gradually coalescing doctrine of strategic bombardment was the main influence for this.

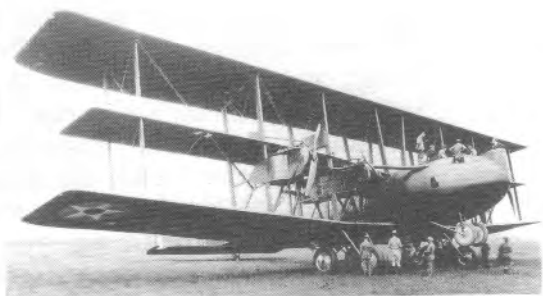
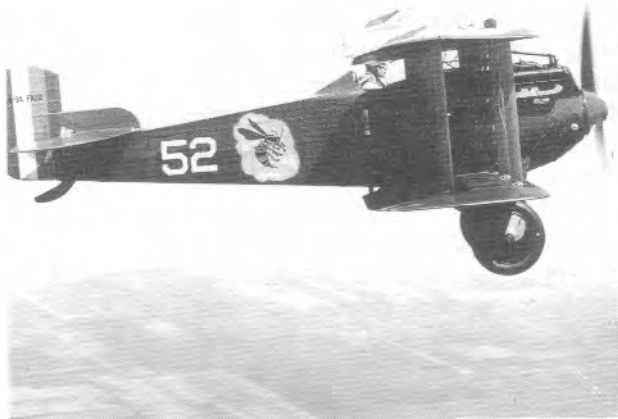
The years after 1926 were marked by what has since been termed the "Air Force idea." More than a continuation of Mason



American Aviation in the 1920s

American military aviation entered the post-World War I period with the Air Service in possession of thousands of aging De Havilland DH-4s (*above*), the only military aircraft manufactured in the United States during the war. Between 1921 and 1923, extensive tests and experimental work sought the shape of future pursuit and bombing aircraft. For the next decade and a half, nearly all the models developed were biplanes. By 1923, all Air Service pursuit units flew the MB-3 (*above, right*), a Thomas-Morse design eventually built in numbers by Boeing. Thereafter, the Boeing and Curtiss companies entered spirited competition in a series of biplane designs that advanced the quality of pursuits through the decade. The PW-8 (*right*) represents one in a succession of Curtiss variants collectively known as *Hawks*, which became the Army's standard fighter aircraft in 1926. The PW-8 offered a top speed of 178 miles per hour, a margin of performance better than that of any of the bombers of the era. At the end of the decade, Boeing surged ahead in the design rivalry with the radial-engined P-12 (*inset, below*), which became the standard pursuit of the early 1930s. The P-12F (*below*) approached 200 miles an hour at full throttle; the Boeing design, still fabric covered, also became a test airframe for supercharged engines. Army aviators and aircraft entered competitions of the time and advanced aviation technology with their experiments.





Bombers through the decade did not advance much past the fabric-covered, twin-engine biplanes of World War I. American models showed the influence of the Italian Caproni or English Handley-Page bombers of the late conflict. On the right of the page (top to bottom) are some principal American designs of the day. The Martin MB-2, also designated the NBS-1, was in service from 1921 to 1928 and was the mainstay of Billy Mitchell's provisional brigade when it sank a former German battleship as a climax to a demonstration of July 1921. The Barling (XNLB-1) was the largest American bomber of the decade, but its short range, limited useful load, and high cost made it a disappointment. The Keystone series of bombers, represented here by the B-3A, was the standard from 1928 to 1932. Most of these carried a four-man crew, with gunners in the nose and amidships, and could manage speeds just over 100 miles an hour; bomb loads varied with the amount of onboard fuel, for increasing one reduced the weight that could be allowed for the other. The Curtiss B-2 Condor competed with the Keystone models through the end of the decade, but did not offer marked advantages over earlier models.

Patrick's program for concentrating offensive air power in a theater level command, the Air Corps began emphasizing doctrine that reflected the broad tenets of Giulio Douhet, but with subtle differences. Relocated from Langley Field in Virginia to Maxwell Field outside Montgomery, Alabama, in 1931, the Air Corps Tactical School began developing strategic bombing theory that focused on attacks against an enemy's vital centers as the heart and soul of offensive air operations. The ultimate objective was not an opposing field army, but the destruction of civilian morale by the methodical elimination of the life threads of a modern society. A bombing force would defeat an enemy within his own homeland, breaking down the fragile web of interconnected services and communication necessary to sustain that society's every function. The likely targets would be transportation nets, munitions and other factories supplying a war effort, oil and electricity supplies, communications installations, and raw material stocks and sources. Behind the theorizing on such long-range strikes at an enemy's economic heartland lay the further implication that the bombing force would operate independently from any army or navy. That the designated targets would be surrounded by civilian habitation also implied the acceptance of casualties among noncombatants, war workers or not. Offsetting this grim reality was a continued emphasis on ways of hitting only desired objectives with greater precision, another focus of American operations in the coming war.

Consistent with this, contracts for new aircraft by 1930 centered heavily on a modern bomber. The first of these, the Boeing Y1B-9, was the first departure from the wire-braced, fabric-covered biplanes common during the late 1920s. A streamlined twin-engine, low-wing monoplane with a top speed of 186 miles per hour, 50 miles per hour faster than any of its predecessors, it still had an uncomfortable open cockpit. The metal skin on its elongated fuselage wrinkled so noticeably in flight that the plane earned the nickname "tissue-paper bomber." The next prototype, capable of speeds in excess of 200 miles an hour, the Martin B-10 became the standard Air Corps bomber of the mid-1930s. In 1934, Lt. Col. Henry H. "Hap" Arnold led a squadron of these planes on a successful mass flight from Bolling Field in the nation's capital to Alaska and back. The same aircraft served as a test bed for an instrument that was to contribute to the American approach to strategic warfare.

Through the interwar period, aviators continued to search for an aiming mechanism that would improve the accuracy of ordnance delivered by bombers. Two concerns, the Sperry Gyroscope Company and a Swiss-trained inventor named Carl Norden

produced optical bombsights that, coupled to an automatic pilot, could produce unprecedented accuracy. With the new sights, the Air Corps could think in terms of daylight precision bombing by comparatively few aircraft in tight formation instead of massive but inaccurate raids. The Norden sight, produced in prototype as early as 1923, was tested by two of Col. Henry Arnold's B-10 groups on the west coast in 1935, with heartening, if sometimes overstated, results. Stories were soon circulating that the Norden sight could put a bomb in a pickle barrel from 10,000 feet, but as tests in the Mojave Desert of California showed, inexperienced bombardiers still missed targets by wide margins. Because good visibility was necessary for precision attacks, the bombers were to operate during daylight, flying at high altitude to escape anti-aircraft fire and maintaining a compact formation to mass their mutually reinforcing defensive fire against enemy interceptors. Long-range fighter escort seemed unnecessary because of the firepower built into the bombers; moreover, it seemed technologically impossible to build a fighter that could carry the fuel necessary to escort the bombers and still be nimble enough to fight off defending interceptors.

The emphasis on long-range aviation and its accuracy, in fact, underpinned a dangerous assumption in the early 1930s. B-10s consistently outflew the best Army pursuit plane of its time, the Boeing P-26, itself an all-metal monoplane that represented a transition in fighter design. At full throttle the P-26 could make 234 miles an hour, too small a margin to permit it to chase approaching B-10s. The smaller fuel capacity of fighters also limited their ability to loiter in the sky and search for a stream of oncoming bombers; with only primitive location and target plotting methods available, finding the attackers in the air was alone a formidable job. After air maneuvers in 1933, Brig. Gen. Oscar Westover, then Assistant Chief of the Air Corps, wanted to eliminate pursuits from the Air Corps entirely because they could not consistently intercept the bombers. His report mirrored the common belief of the time that the bomber would always get through any defense. The 1934 exercises at March Field in California reconfirmed this judgment in a summary report written by Colonel Arnold. Technical developments in defensive warning—the early promise of radio detection and ranging, or *radar*—and the introduction of faster pursuit aircraft had challenged these convictions by 1937, but the leadership of the Air Corps—typified by men such as Henry Arnold, Frank Andrews, Carl Spaatz, and Kenneth Walker—shared the belief that long-range bombardment was the most important task of aerial warfare. They seemed justified in this when bomber design took another long step

forward with the arrival of what was for almost a decade the premier American aerial weapon, the Boeing B-17.

In mid-1933, Maj. Gen. Benjamin D. Foulois, then chief of the Air Corps, asked the War Department for funds for a bomber able to carry a ton of bombs 5,000 miles at a speed of 200 miles per hour. The War Department approved money for two new designs. In one of the marked advances of the era, the Boeing Aircraft Company completely outclassed all other design concepts with a four-engine model designated the XB-15. This basic design also produced Boeing's slightly smaller Model 299, eventually redesignated the B-17. The plane carried the descriptive nickname first applied to the B-15: Flying Fortress. In August 1935, a prototype flew 2,100 miles nonstop from the Boeing plant in Seattle, Washington, to Wright Field for design competition at an average speed of 232 miles an hour. This performance gave the B-17 a long advantage in the flight competitions scheduled for the fall. Then disaster struck. On October 30 the prototype crashed when a pilot attempted to take off without disengaging the rudder and elevator locks. Structural failure had not caused the accident, but the B-17 was excluded from competition because the crash occurred before it could be fully evaluated. The twin-engine Douglas B-18 was the eventual winner, and the Army ordered ninety of these less capable planes.

All was not lost. Foulois endorsed the recommendation of one of his field commanders to procure at least a few of the B-17s for an operating squadron to conduct advanced aeronautical tests. The War Department approved an Air Corps contract with Boeing in January 1936 for thirteen of the aircraft fitted with superchargers and other equipment for high-altitude flight. The first was delivered a year later, and the last of the initial group entered service in August 1937. The Army Air Corps had gained its first truly long-range bomber, the virtual symbol of American air power over Europe during World War II.

Even as the Air Corps hosted the "fly-offs" between the B-17 and its competitors in 1935, developments on the institutional front finally realized General Patrick's goal of a theater-level peacetime command to cover all existing air forces other than observation. With the expansion directed by the Air Corps Act of 1926, Army doctrinal thinking on air forces in war had moved to a clear division of aviation into a centrally controlled element of offensive air separate from observation elements left with the ground units. Spelled out in Army Regulation 95-10, *Air Corps: Air Corps Troops*, of March 1928, this principle would go into effect, however, only on commencement of hostilities. Between 1931 and 1935, the arguments of the Air Corps slowly bore fruit

Benjamin Foulois



Benjamin D. Foulois left a family plumbing business in Connecticut in 1898 to enlist as an engineer in the war against Spain. Never a polished speaker or skilled political intermediary, he remained to the end of his more than thirty-seven-year career a seat-of-the-pants administrator who nevertheless influenced the course of the interwar Army Air Corps. Commissioned in 1902, Foulois entered Signal Corps service in 1906, sought detail to the Corps' fledgling aeronautical division, and became one of the first Army aviators. In 1916, he headed the 1st Aero Squadron, comprising eight aircraft and eleven pilots that were the reconnaissance eyes of General Pershing's Punitive Expedition into Mexico.

Foulois went to France in 1917 as chief of the Air Service of the AEF, but Foulois's rivalry with Billy Mitchell led Pershing to appoint Maj. Gen. Mason Patrick to the post instead; Foulois remained as assistant chief. After a variety of postwar field commands, he became assistant chief of the Air Corps in 1927 and acceded to the top position of Air Corps Chief in December 1931 with the rank of major general. He continually advocated an independent air force coequal to the Army and the Navy. Anxious to prove the Air Corps' flexibility, he volunteered Army fliers to move the nation's air mail when the president cancelled commercial airline contracts. The results were disastrous, and twelve military pilots were lost. Despite this setback, Foulois's campaign led the Army to establish a General Headquarters, Air Force element that was a substitute for the autonomy the airmen wanted and the last major reorganization for air elements until the initiation of the Army Air Forces five years later.

Pictured above, Foulois is in the pilot's seat of a Wright Flyer. At right is his formal portrait as Chief of the Air Corps. Even in this exalted position he preferred to fly his Chief's aircraft, a Douglas observation ship, himself.



as the Army itself revised its peacetime structure to meet the possibility of combat operations.

When he became Chief of Staff of the Army, General Douglas MacArthur directed wholesale change in the readiness planning for American ground forces. During his tenure as Chief, he initiated a series of so-called protective mobilization plans designed to position within the country four field armies that could be committed to immediate operations while reserve and National Guard mobilizations progressed in planned phases and corresponding industrial mobilization swung into gear for any large-scale or long-term war. This planning reduced the corps area administrative structures to mere housekeeping commands in wartime, and General Foulois pointed out repeatedly to the War Department that the existence of a Four-Army Plan for guaranteeing readiness implied a similar centralized command structure for air forces, whose employment in war was to be under single command. The continued decentralized control of air forces among the nine corps area commanders further eroded the Air Corps' ability to train effectively for any centralized wartime role. MacArthur went so far as to designate the assistant chief of the Air Corps the acting commander of the GHQ's air force in war and to prepare for this role in peacetime. By late 1933 a nucleus of the command existed in the reactivated Headquarters, 1st Bombardment Brigade from Langley Field, which transferred to Bolling Field in Washington to be named Headquarters, GHQ Air Force in February 1934 with MacArthur's approval. A War Department board under General Hugh Drum endorsed the new arrangement with claims that the Army had fully concurred in it for years as a wartime organization. At this point, congressional interest in the air arm had again surfaced in the wake of its disastrous attempt to carry the mails in 1934 in which twelve pilots had been lost. Secretary of War George Dern named Newton Baker, who had served in Dern's capacity during World War I, to head a new panel on Army aviation. The Baker Board did not depart much from the Army General Staff's position when it recommended an immediate establishment of a formally designated GHQ, Air Force. The board resolved the control problems of the air establishment by leaving the maintenance of airfields and installations the responsibility of the corps area commanders, but gave GHQ Air Force jurisdiction over all questions relating to organization of units, maintenance of aircraft and operation of technical equipment, maneuvers, and training. The Chief of the Air Corps, Foulois, retained responsibility for supply and procurement and for developing all doctrine affecting the employment of air elements. Foulois had expected to command the new headquarters, but this

new responsibility fell to Brig. Gen. Frank Andrews, a bomber enthusiast and advocate of an independent air force, who established the command at Langley Field, near Norfolk, Virginia, on March 1, 1935. The Air Corps had achieved unified command over its combat units in the last major alteration in its command relationship to the Army General Staff until the series of reorganizations preceding the American entry into World War II. The Army did not activate its own GHQ during the interwar period until the large-scale maneuvers of July 1940.

Funding for the Air Corps during the Roosevelt administration's first two terms seemed erratic. In the Depression-bound budget for Fiscal Year 1934, Congress included a direct appropriation of \$30 million for the Air Corps, an increase of \$6 million from the preceding year, but Roosevelt authorized the Air Corps to spend only \$11.5 million. In trying to create jobs and prime the sick economy, the President took money from military aviation with one hand only to give it back with the other, making \$7.5 million available to the Air Corps expressly to buy airplanes and inject life into a faltering aircraft industry. With the infusion of funds from New Deal agencies, the air arm was able to purchase ninety-two aircraft at a time when an order for even a dozen airplanes might enable a manufacturer to stave off bankruptcy. In a widespread program of municipal airport construction with attendant navigational equipment under Roosevelt's economic policies, military aviation benefitted indirectly. The following year Congress approved almost \$30 million.

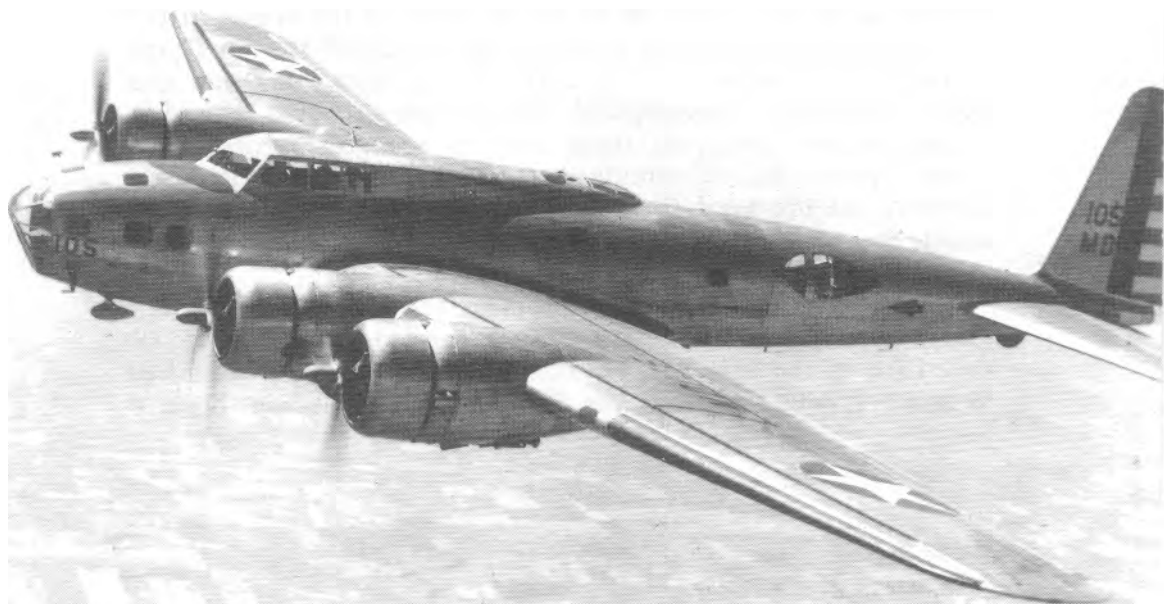
In the mid-1930s, the Army General Staff made a concerted effort to obtain larger appropriations for the Army air arm. This brought some improvement, for Congress appropriated more than \$45 million for military aviation in fiscal 1936. Yet, the irregular funding in previous years continued to take its toll, for larger numbers of aging airplanes had to be scrapped. The inventory of aircraft in the Air Corps fell to 855 in 1936. At the urging of the War Department, Congress in June 1936 authorized the Air Corps to increase its strength to the 2,320 aircraft that the Drum and Baker Boards had recommended, but the administration refused to budget enough money in fiscal 1937 to begin the process. Air Corps appropriations continued to climb annually from 1936 onward, but not until fiscal 1939 was there sufficient money to enable the Air Corps to reach the total number of aircraft that the Baker Board had approved five years earlier.

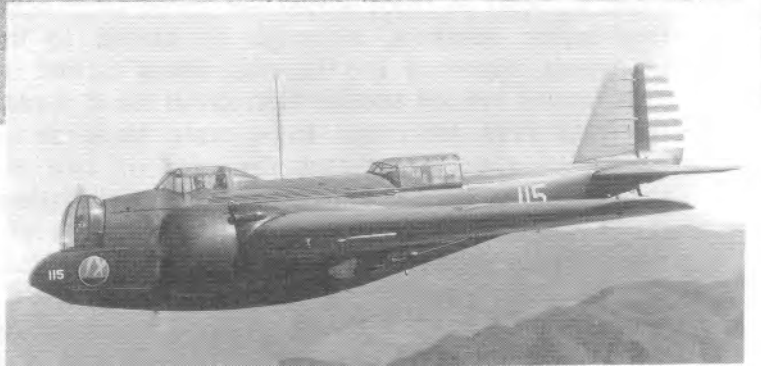
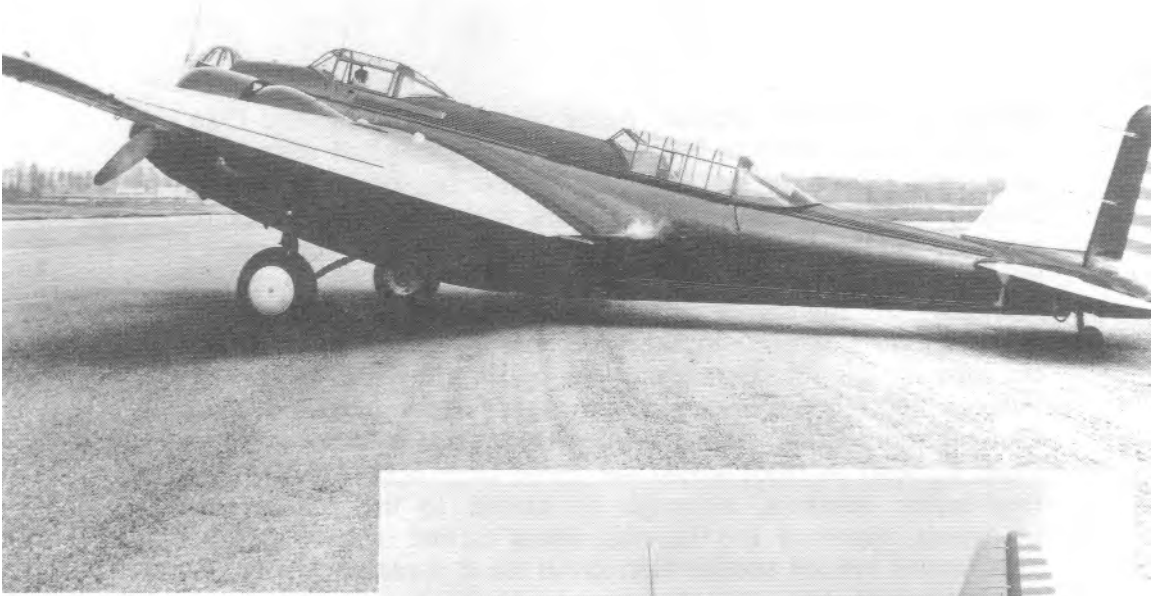
Manpower was as much a problem as equipment. The Air Corps by 1933 had almost attained the enlisted strength of 15,000 called for by the 1926 law, but commissioned strength, which had grown only slightly during the first half of the decade, hovered



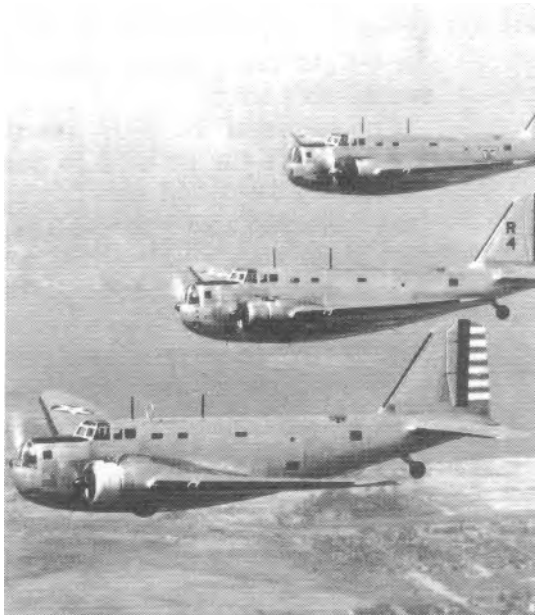
Evolution of the Bomber

With the introduction of the Boeing Y1B-9 (*above*) in April 1931, Army bombardment aviation entered a new era. The all-metal, low-wing craft equipped with two engines became the basis for designs that American airmen flew in the next global conflict. The B-9's semiretractable landing gear permitted speeds that now matched those of pursuit aircraft of the period, which complicated the problems of a defense, since the bomber could outlast its opponents in the sky. Within two years, the Martin Company had developed the B-10 (*opposite, above*), which improved yet again on the performance of bombardment aviation. The B-10 flew 35 miles an hour faster than the 171-mile-an-hour top speed of the older ship. The B-12 variant (*opposite, inset*), with newer engines, made 212 miles an hour with a one-ton bomb load. By 1934, Boeing had leaped ahead of all previous designs with the B-15 (*right*), with four engines and a range of over 3,000 miles, developed almost simultaneously with Boeing's Model 299, the forerunner of the B-17 Flying Fortress. Twenty B-17Cs, (*below*) flew missions with the Royal Air Force before American involvement in the war.





By 1941, a Douglas aircraft exceeded the size, speed, and range of Boeing and Martin designs. The B-18 (*below, right*) shows the influence of airliner layouts of the time. It was purchased in large numbers as a strategic bomber replacing the B-10, though the Air Corps preferred the B-17. The B-19 (*below, left*), only one of which was built, featured a 212-foot wingspan and the first powered turrets in any American bomber. Its size was not surpassed until the production of new, postwar designs with intercontinental range.



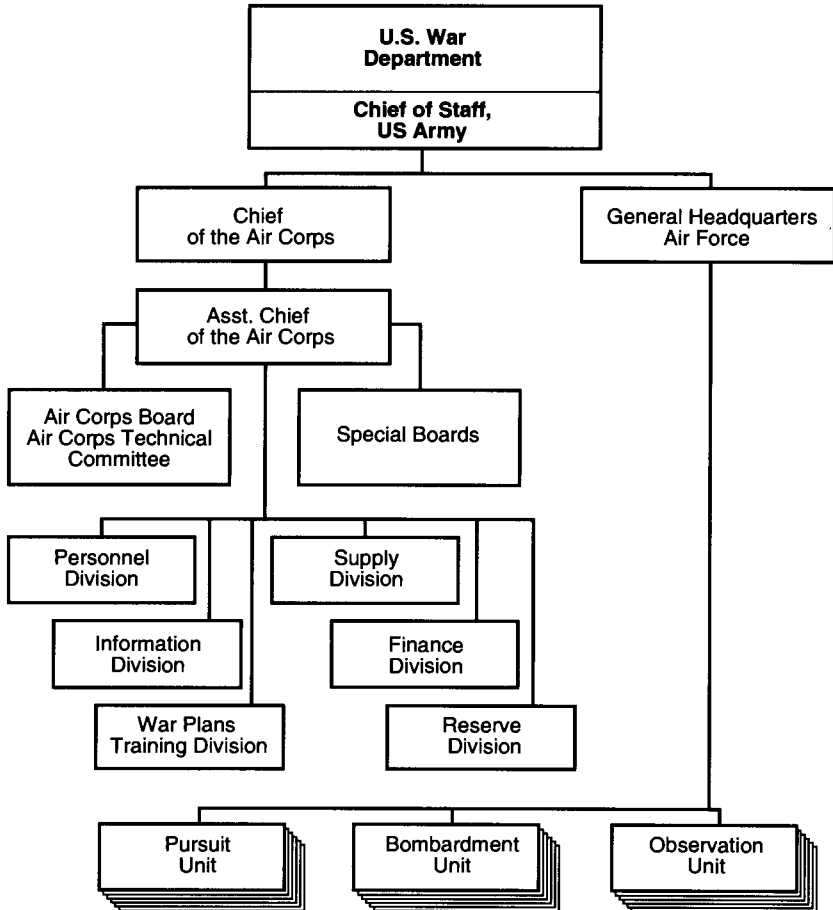
around 1,500 with Regular Army commissions in mid-1936. Congress finally acted in 1935 to ease the shortage of officers by giving the Secretary of War the authority to grant regular commissions to some reserve officers and to retain others on extended active duty. Handicapped by a chronic shortage of money, the Air Corps could not make full use of this authority until 1939, shortly before the outbreak of war in Europe.

Foreign developments by this time were prompting more outlays on defense, but the demands of the entire army had to be met. Heavily involved in a basic restructuring of Army units after 1936, General Malin Craig, who succeeded Douglas MacArthur as Army Chief of Staff in 1935, would not spend large sums for expensive four-engine bombers, although he agreed to the purchase of twenty-six improved B-17Bs with funds carried over from fiscal 1938 and to include another thirteen of the B models in the budget for fiscal 1939. He would do no more, since the amount spent on one B-17 roughly equaled the cost of two B-18s, and this twin-engine aircraft could perform the two missions approved for the Air Corps, coast defense and the support of ground operations. From Craig's point of view, to allow the Air Corps to acquire large numbers of four-engine bombers would merely encourage its promotion of strategic bombing, which remained untested and of dubious value. The General Staff also had to re-equip entirely its ground forces with such modern basics as semiautomatic rifles and standard vehicles.

International tensions nevertheless promoted a five-year program of aircraft procurement that would begin in 1940. Secretary of War Harry Woodring intended to provide a systematic means of at last expanding the Air Corps beyond 2,320 airplanes now agreed upon as a minimum force for the Army. Presented in March 1938, the Woodring program called for the purchase of 144 four-engine bombers, 266 twin-engine bombers, 259 attack aircraft, and 425 pursuits. The Secretary of War authorized the Air Corps to buy sixty-seven of the four-engine aircraft in fiscal 1940, forty-eight more in the following fiscal year, and the remaining twenty-nine later.

The future of the B-17 was still far from assured at this point. By July 1938 the decision to purchase some five squadrons of the aircraft in 1940 had been reversed. The change resulted in part from an unrelated proposal by Westover to begin developing a new long-range bomber that would ultimately replace the B-17. This move called attention to two subjects that the General Staff still questioned: the B-17 and research and development for the Air Corps. Given a chance to reconsider, the War Department decided that the funds earmarked in the Woodring program for

**Aviation Establishment
U.S. War Department**
November 1935



The War Department in 1935 realized some of the aspirations of aviators for a separate organization for attack aviation, which included pursuit and bomber aircraft. The initiation of a separate chain of command under a General Headquarters, Air Force established a centralized control of offensive air units, allowed them to train realistically for war, and placed command in the hands of an airman located at an elevated position in the structure. The various field units could be concentrated rapidly to meet foreign threats or to send units overseas. At the same time, the reorganization divided authority in the Air Corps by placing support and procurement functions under the Chief of the Air Corps and the flying and operating elements under the commanding general of the GHQ Air Force.

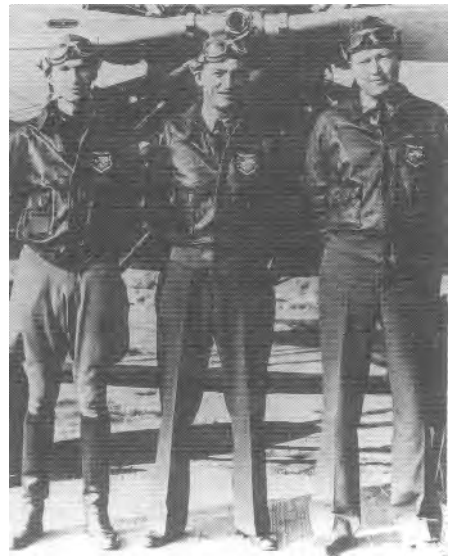
the purchase of the first sixty-seven B-17s could buy as many as 300 attack aircraft, which Craig and the General Staff considered more valuable than the big bombers to an Army that was being rebuilt literally from the ground up. Consequently the purchase of B-17Cs, improved models of the B-17Bs already on order, was postponed beyond June 1940. The War Department similarly delayed the start of research and development on a new four-engine bomber, decreeing that such spending in fiscal 1939 and 1940 be “restricted to that class of aviation designed for the close support of ground troops and the protection of that type of aircraft”—in effect attack aircraft, fighters, and twin-engine bombers.

Andrews resolved on a publicity stunt to enlist public support for the large bombers. On May 12, 1938, in what was described as a routine coast defense exercise, he staged the interception at sea of the Italian ocean liner *Rex* by three Army B-17s. The commander of the GHQ Air Force sought to demonstrate that bombers could locate and attack a hostile fleet far from American shores. With the cooperation of the steamship line and prearranged press notice and live radio coverage from one of the planes, the general launched his small force from Mitchel Field, New York. The three aircraft intercepted the liner seven hundred miles out. This dramatic incident nearly backfired when the Navy, stung by the intrusion of land-based aircraft so far into its domain, demanded that the Army restrict Air Corps flights to within 100 miles of shore, something honored for less than six months.

Aviation in the interwar period had maintained a steady visibility in the affairs of nations now facing another world conflict. Benito Mussolini, who formed Europe’s first Fascist government in 1922, named Giulio Douhet his first minister of aeronautics. The Italian *Regia Aeronautica* was an independent air arm that sponsored some spectacular aerial feats through the 1930s, but could not overcome the country’s lack of oil and other raw materials necessary to sustain a completely modern and evolving air force. It remained inadequate for aerial warfare against another major European nation. For France, reliance on regional alliances and the League of Nations-sponsored disarmament initiatives during the period proved fruitless. French military honor found something cowardly in systematized attacks on civilian industry and cities. “Douhet has no partisans in France,” said one senior French general on the very eve of a new European war. France’s *Armée de l’Air* never reached fighting trim during the period because of spartan defense budgets. An independent force, in wartime its commander would still report to a supreme



The disparate experience of American air elements in World War I prompted the establishment of a school system after the war that was to advance the professional education of Army airmen. Beginning in 1920 as the Air Service Field Officers' School at Langley, Virginia, the institution became the Air Corps Tactical School in 1926 and moved to Maxwell Field, Alabama, in 1931. Here the school functioned until it closed in 1942. Counted among its students and instructors were most of the air leaders of the Army Air Forces in World War II. More than a practical flying academy, the school was the intellectual focus of developing American theories of airpower, especially those of precision, strategic bombardment, that characterized U.S. Army Air Forces operations from 1941 to 1945. Pictured above is the Maxwell headquarters as it appeared in the 1930s. A school-sponsored flying demonstration team, "Three Men on a Flying Trapeze," featured (left to right) Captains Haywood Hansell, Claire Chennault, and J. H. Williamson in the mid-1930s. Students (below) puzzle over a map problem in Tactical School class. A total of 1,092 men, 916 of them air officers, graduated from the school during its twenty-two-year existence.



commander drawn from the army. For a time, the Soviet Union displayed an interest in long-range bombers, but military aviation remained an integral part of the Red Army. Before the 1930s ended, the senior officers who had directed the bomber program fell victim to Joseph Stalin, the Soviet dictator, who had them executed in a wide purge of senior officers in the armed forces. Any commitment to strategic aerial warfare apparently died with them, for Russian aviation acted primarily as airborne artillery thereafter. The defeated Germany, essentially disarmed after World War I, was not permitted an air arm, either subordinate to or independent of the 100,000-man *Reichswehr* left to it in the Versailles Treaty that imposed the conditions of peace in 1920. The leadership of that truncated army pursued new doctrine and tactics under secret agreements and tested ground and aviation equipment at clandestine bases inside the Soviet Union. In Japan, both the army and the navy developed air arms. Embroiled in China from 1931 on, Japan sought to erect in the Far East an economic sphere geared to sustaining itself as a great power. With only a small Chinese industrial base in being, attacking Japanese airmen found few factories. Separated by vast distances from truly strategic targets, the Japanese showed little interest in long-range bombers, although they developed large seaplanes for maritime reconnaissance. As events proved, Japan learned to make at least limited strategic use of carrier-based aircraft instead of the kind of long-range landplanes being developed elsewhere. The British came closest to realizing Douhet's early ideal under Maj. Gen. Hugh Trenchard, who commanded the independent Royal Air Force. In Trenchard's words, the RAF was to break down the enemy's resistance by attacks on means of communication, transportation, and factories producing everything from "boots to battleships." Consistent with this, the RAF until 1937 concentrated on building bombers, and Bomber Command was its cutting edge.

On January 30, 1933, Adolf Hitler brought to power the National Socialist German Workers Party, with a strong nationalistic and anti-Semitic agenda. As the nation's chancellor, he consolidated a dictatorship within six weeks and started a rearmament that would underpin his program of German predominance on the Continent. In March 1935, he announced the reintroduction of military conscription and revealed the existence of a German air force known as the *Luftwaffe*. Expanding German military strength predisposed a certain acquiescence among the victors of World War I as Hitler proceeded to a succession of diplomatic coups that reversed the Versailles peace settlement. In March 1936, he sent a few battalions to reoccupy the demilitarized German Rhineland area; the French Army stayed in its barracks.

In mid-1936, he sent aid to Spain, chiefly in the form of air elements in a unit known as the Condor Legion, to assist the forces of the Spanish military insurgent, Francisco Franco. The Italian and Japanese governments in the same year signed a pact directed against the Communist International, sponsored by the Soviet government, forming the basis for what was known as the Axis during World War II. In early 1938, Hitler dispatched motorized elements of the German Army on a triumphal march to Vienna that marked the assimilation of independent Austria into his so-called Third Reich. Through the fall of 1938, he advanced German demands on Czechoslovakia by threat of war; at a last-minute conference in Munich to broker the issue, fearful and militarily unprepared France and Britain appeased the German dictator by requiring the Czechs, not invited to the meeting, to cede large tracts of their borderlands containing German minorities to neighboring Germany. Hitler foreswore any further territorial claims in Europe, but within six months, Germany swallowed the weakened Czech state, and Poland seemed the next obvious victim. Widely advertised German accomplishments in aircraft design and production and the record of German aviation during the Spanish Civil War underscored Hitler's predatory policy.

In the worsening international climate, President Franklin Roosevelt realized the importance of military aviation as a weapon of war and a symbol of power. The President now turned to the airplane as a visible sign of American resolve. Roosevelt outlined his program for aerial expansion at a secret meeting in the White House on November 14, 1938, six weeks after the Munich surrender of Czech territory. Attending were Maj. Gen. Henry Arnold, who had become Chief of the Air Corps upon Oscar Westover's death in a crash in 1938, General Malin Craig, Army Chief of Staff, Maj. Gen. George C. Marshall, the new Deputy Chief of Staff, and a few other officials. The President surprised his audience by describing an Air Corps of 20,000 planes and an industry capable of producing 24,000 planes a year. Conceding that Congress probably would not approve an Air Corps of more than 10,000 planes, Roosevelt established as his immediate goal 7,500 combat aircraft and 2,500 trainers that, he believed, would serve notice to Hitler. Arnold later described the President's call for expansion of the air arm as the most important event in the history of the Air Corps, a "Magna Carta" for air power. Congress seemed sufficiently alarmed by events in Europe to vote the money for expansion beyond the numbers contemplated in legislation to that time. Roosevelt's program, by no means a blank check, promised rapid growth based on military realities, with the



A President Faces a War



Elected to the first of four terms in 1932, Democratic President Franklin D. Roosevelt offered the depression-bound United States domestic programs that slowly improved the economic ills of the nation. Abroad, Roosevelt opposed an expansionist Japan, already heavily involved after 1931 in China, and a resurgent Germany in Europe. Militarily, Roosevelt had little available to counter the aspirations of these powers, who were deterred neither by international moral outrage nor by American statecraft. Even when the German, Italian, and Japanese governments forged a formal alliance, the American national mood preferred isolation from outside conflicts. As assistant secretary of the Navy during World War I, the president knew the effect of naval power. Early in his presidency, he came increasingly to value the potential of land-based air power. Above, he congratulates Army Air Corps Capt. Albert F. Hegenberger, who won the 1935 Collier Trophy for his landmark work on instrument flying. At the far left (*behind trophy*) is Sen. William G. McAdoo of California, the influential head of the National Aeronautic Association. Mrs. Hegenberger and Brig. Gen. Oscar Westover, then Assistant Chief of the Air Corps, attended. In late 1938, responding to Germany's annexation of neighboring Czechoslovak borderlands, Roosevelt resolutely called for an American aircraft production rate of 20,000 a year. A seeming impossibility at the time, this astounding goal was a statement of political purpose and a forecast of the nature of the looming conflict.

Air Corps assuming a prominent position within the American defense establishment.

Arnold immediately saw the flaws in the new plan. An Air Corps of 10,000 airplanes (actually some 8,000 new ones added to 2,000-odd already authorized) would make for a credible air force, but it would mean little unless the aircraft were accompanied by increased pilot training, more support personnel, and more airfields. The President, however, seemed concerned only with numbers, assuming that once aircraft production increased, the Air Corps would somehow absorb the new equipment. Actually, in proposing the 20,000 planes, the President was merely testing the political waters. Arnold helped draft legislation that would have expanded the Air Corps to a more realistic 10,000 aircraft. When the President presented the new program to Congress on January 12, 1939, he asked for only 6,000 airplanes, 4,000 fewer than the first figure he had proposed in the secret meeting eight weeks earlier. The revised figure included the current inventory, excluding obsolete aircraft and those already authorized for purchase but not yet delivered—an aggregate of about 2,500 airplanes. As a result, new orders would total some 3,000 units and enlarge the Air Corps to 5,500 aircraft. The lesser number allowed for a more orderly development of an institutional structure for Army aviation. The President agreed that slightly more than half of the \$300 million that Congress made available for the Air Corps be used to purchase aircraft. The total actually spent for this purpose, \$186 million, bought 3,251 airplanes, increasing the Air Corps' inventory to 5,500. The balance of the appropriation was devoted to overcoming the most serious obstacles to expansion: a lack of men to operate and maintain the new equipment, a shortage of training facilities, and a need for more operating bases. The addition of these airplanes was just a start, however; Roosevelt had not abandoned his goal of 20,000 aircraft specified in November 1938, but would approach it in a series of comparatively small increments, if necessary.

Air Corps planners worked feverishly in the winter of 1938-1939 to plan for orderly expansion. Arnold transferred to his headquarters several experienced officers, including Lieutenant Colonels Carl Spaatz, Joseph McNarney, and Ira Eaker, and Capt. Laurence S. Kuter, who would play leading roles in the aerial campaigns of World War II, and Maj. Muir Fairchild, a leading staff officer during the war. Since the acquisition of manpower had to parallel the expansion to 5,500 airplanes, the planners decided that the enlarged Air Corps should consist by June 1941 of 48,000 officers and men, with an appropriate number of airfields, maintenance depots, and training centers. Arnold



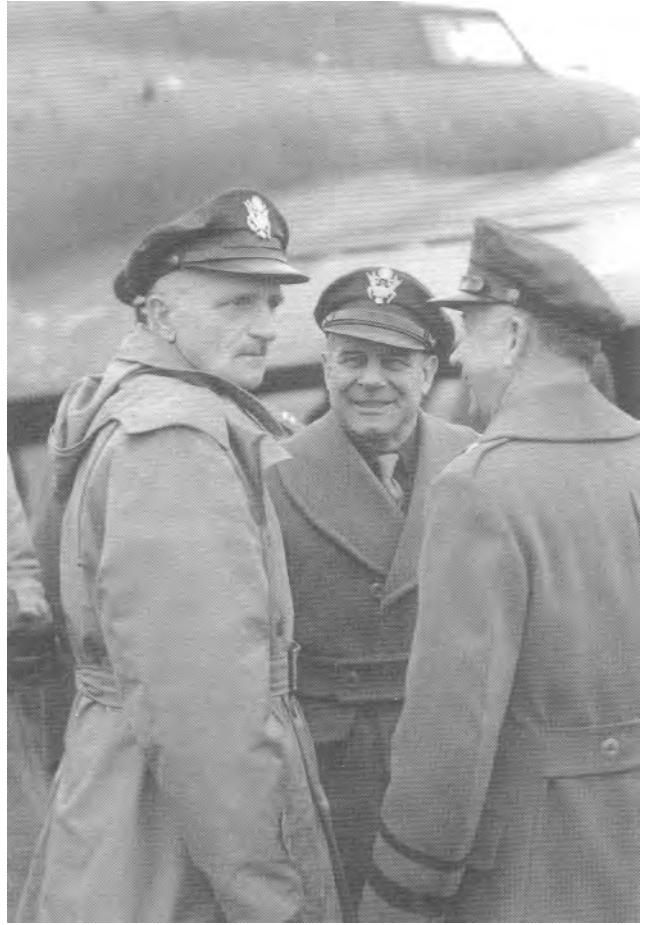
As the Army Air Forces faced the probability of active hostilities, its officer corps represented something of a cross section of American society, but with some obviously unique characteristics. Air Corps officers were members of a closed brotherhood. Observers of a later day might note that they were all white, male, and politically conservative, factors that were not especially noteworthy among their contemporaries; no military or naval branch at home or abroad looked much different. They were usually men who had shared the often deprived experiences of interwar Army officers. Their assignments were to flying fields largely isolated from American society at large, and they became a self-perceived elite within the Army.

The Air Corps by its nature was a youthful arm. The average age of its higher leadership during the war was forty-two. Its focus was technological and its manpower chosen according to exacting physical standards. Officers from other branches attracted to flying could not win easy transfer because of these standards and the limitations on flight ratings. The air arm was also an officers' domain. This sin-

gular fraternity insisted on commissioned rank for its pilots, a requirement institutionalized in the National Defense Act of 1920. This act also stipulated that 90 percent of all air officers be rated fliers, balloonists, or observers. Financial constraints in the 1920s and 1930s often led to a pilot's transfer to the reserve at the end of his active flying career, approximately at the time he reached the rank of major. By 1941, this combination of law and tradition led to a paucity of senior air officers in the Army, but a heavy concentration of airmen in the lower ranks. Air Corps captains comprised 21 percent of all men of that grade in the Army in 1941; for majors, the figure was 16 percent. At the level of colonel, however, only 3 percent were airmen and 4 percent of the lieutenant colonels were Air Corps members.



Some airmen, George Kenney among them, had seen combat in World War I, something even Arnold had not experienced. Kenney's novel approach to air warfare in the island-hopping



campaigns of the southwest Pacific would impress his theater commander, Douglas MacArthur, with the flexibility of aviation in the theater.

Others combined a mastery of air command with a style that endeared them to their men. John Cannon, who commanded Twelfth Air Force in the Mediterranean, was always "Uncle Joe" to his colleagues. James H. Doolittle, sometimes too famous for his habit of fraternizing with his men, was never-



theless legendary for his piloting skills and an advanced degree in aerodynamics from the Massachusetts Institute of Technology. He was a natural to lead the war's first daring counterstroke.



Ira C. Eaker was the Air Corps' premier publicist in the interwar period. He and Arnold coauthored three books on American aviation. Eaker served under Carl Spaatz, pictured above right, in the Eighth



Air Force, then commanded Allied air forces in Africa. The pragmatic, taciturn Spaatz was the leading American aviation commander during the war. He was the senior airman present at the surrender ceremonies of both principal Axis partners.

Hoyt Vandenberg, nephew of an influential senator, commanded Ninth Air Force in one of the great interdiction campaigns in the history of air power. Dour, hard-driving Curtis E. LeMay was the scourge of Japanese cities in the final months of the war. Both became luminaries in the postwar independent Air Force.



All these men shared near-absolute faith in a decisive capacity of air power, the efficacy of strategic bombing, and the hope for the eventual independence of the air arm from the Army. An unwritten agreement between Arnold and Army Chief of Staff General George Marshall postponed the realization of this aspiration until the end of hostilities with the Axis.

promptly initiated an intensive recruiting program and began offering tours of extended active duty to reserve pilots. Halfway to its goal by September 1939, the Air Corps then consisted of 2,058 Regular officers, 669 reserve officers, and 23,779 enlisted men.

The rapid increase in personnel necessitated a radical overhaul of the training process. Between 1919 and 1939 the largest number of pilot training graduates in one year had been 246. With the expansion, the Air Corps would need 1,200 new pilots annually. Arnold realized existing facilities would be inadequate for such large numbers and arranged contracts with nine of the best civilian flying schools to provide primary flight training beginning in mid-1939. The Air Corps supplied the aircraft and a cadre of supervisors; but all the instructors were civilians. Trainees who completed the 12-week primary program went on to Randolph Field for basic flight training and then to Kelly Field for advanced training. Despite the specialized skills required for long-range bombers like the B-17, the air arm made no move until 1941 to establish schools to train navigators or bombardiers; in 1939, these skills were learned through on-the-job training in GHQ Air Force units.

To handle the large influx of new enlisted men, the Air Corps changed its technical training program. All such training had formerly taken place at Chanute Field, Illinois. Beginning in late 1939, new recruits completed a basic course at Scott Field, Illinois, before going on to specialized instruction at either Chanute or the recently completed Lowry Field in Colorado. Supplementing the work of these three installations, the Air Corps arranged in 1939 for some enlisted men to be trained as mechanics at civilian technical schools and aircraft factories. As it had during World War I, this approach helped ease the training burden at a time when the Army air arm was woefully short of facilities. Even though the Air Corps was building new training bases as quickly as possible, it not only retained the civilian-operated training programs, but expanded them.

In the presence of a lingering isolationist impulse in American politics, American defense policy and war planning still emphasized the protection of the United States and the Western Hemisphere. A genuine threat had appeared in South America, where German aviation interests raised the possibility of economic penetration followed by political subversion. German and Italian airlines had established themselves in South America in the 1920s, and one German air terminus at Baranquilla, Colombia, lay within three hundred miles of the eastern end of the Panama Canal. In 1938, Arnold called for an Air Corps Board, to be located at

Maxwell Field, to determine how military aviation could best offset these influences. A month after Arnold became Chief of the Air Corps, the Board's hurriedly prepared study led him to call for a force of long-range heavy bombers for the defense of the hemisphere.

With Congress in 1939 approving the expansion of the air arm, Secretary Woodring appointed Arnold head of a larger War Department board to investigate of using aircraft for hemispheric defense. Arnold's group elaborated on the work of the Air Corps Board that went even further than the Air Corps Board. The War Department panel concluded that long-range heavy bombers were essential to defend the hemisphere effectively and that the Air Corps needed outlying bases to extend its radius of action. In one of his first acts upon becoming Chief of Staff of the Army on September 1, 1939, Marshall endorsed the conclusions of this study, noting that it established "for the first time" a specific mission for the Air Corps that was wholly consistent with American hemispheric defense policy. With General Marshall's full endorsement, the Air Corps now had a mission requiring the purchase of large numbers of B-17s and a greater investment in the development of improved bombers for the future.

Letting contracts for new airplanes proved to be easier than having them actually roll from the factory. Aircraft manufacturers needed time to prepare for sustained production. In September 1939, the Air Corps had only twenty-three B-17s, with about 100 more on order. To avoid the mistake made during World War I of fixing too soon on a few designs, the War Department early in 1939 authorized Arnold to find a second source of long-range bombers, and he asked the Consolidated Aircraft Company to begin work on the XB-24, prototype of the wartime Liberator bomber.

The primacy of the strategic bomber in Air Corps thinking affected the design of the pursuit planes acquired as a result of the 1939 expansion program. By 1939, the 300-mile-an-hour P-36 had become the mainstay of the Army's pursuit aviation, but it lacked a supercharger for high altitudes, was lightly armed and poorly armored, and tottered at the edge of obsolescence. The Air Corps, however, had already let contracts for the Bell P-39, of which only the prototype was supercharged; the Curtiss P-40, basically a P-36 with an often troublesome liquid-cooled engine; and the Lockheed P-38, intended as a high-altitude interceptor. As money for expansion became available, the Air Corps quickly ordered 524 P-40s (in addition to 200 already being purchased out of regular appropriations for fiscal 1939), along with thirteen YP-38s and 12 YP-39s—the Y prefix indicating that these aircraft, like the Y1B-9

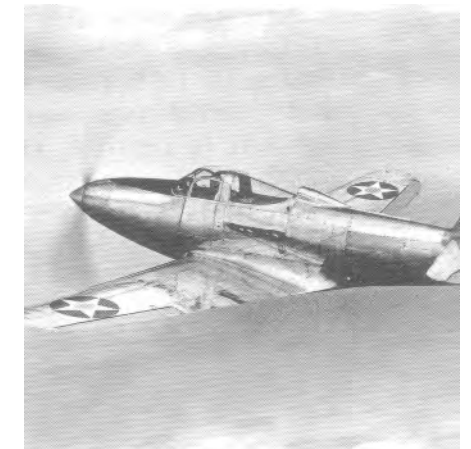
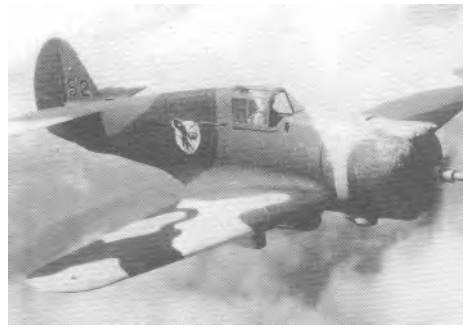
Pursuit and Attack Aviation



Monoplane cantilevered wing construction, enclosed cockpits, and retractable landing gear became standard for military aircraft by the mid-1930s. A series of attack and pursuit designs vastly exceeded the performance of the biplanes of the day. Over the course of the decade, they also incorporated variable-pitch propellers, wing flaps for better control in takeoffs and landings, and supercharged engines employing higher-octane fuels. Among the first Army aircraft with some of these characteristics was the Curtiss A-8 Shrike (*shown above in later variant, the A-12*), the first all-metal Army attack craft that set the trend for models after it, though it improved little on the top speed of the later biplanes. Further developments brought into regular service by November 1935 the standard two-place attack plane of the late 1930s, the Northrop A-17 (*below, right*). As first delivered, it retained the fixed landing gear of earlier models, but was immediately outfitted in the A-17A with retractable gear to accompany its wing flaps and enclosed crew compartment. The Douglas A-20 (*below, left*) reflected European, especially German, developments in its twin-engine approach; it was also the first American plane to use tricycle landing gear. French and British air forces eagerly purchased this model with its nearly 350-mile-an-hour top speed, one-ton bomb load, and heavy offensive and defensive armament.

Pursuit, or fighter, development paralleled that of attack aviation. Designs (*shown clockwise from above, right*) quickly went beyond that of the first all-metal pursuit, the diminutive Boeing P-26, the last Army aircraft to combine an open cockpit, fixed gear, and external wire bracing for the wings. The winner of an Air Corps pursuit competition in 1936, the Seversky P-35 combined American and European designs between 1937 and 1





1939, when civil versions won the Bendix Air Races. Competing with the P-35, the Curtiss P-36 (above, far right), latest in a line of Hawks, was the first American aircraft to defeat German fighters in Europe. In formation flight, a Lockheed P-38 Lightning, a Bell P-39 Airacobra, a Curtiss P-40 Warhawk, and Republic P-43 Lancer show the basic lines of American fighters on the eve of the war. The twin-boom P-38's bold design offered the safety of two engines, both supercharged for high-altitude flight, and a daunting armament when .50-caliber machine guns were added to the nose. The P-39's layout was unique in having the engine behind the pilot and, eventually, a heavy 37-millimeter cannon firing through the propeller hub. The Curtiss P-40 evolved from the P-36 by the adoption of an in-line engine and improved earlier performance by the first use of flush riveting. The Curtiss model clearly shows the cowl-mounted guns common at the time.

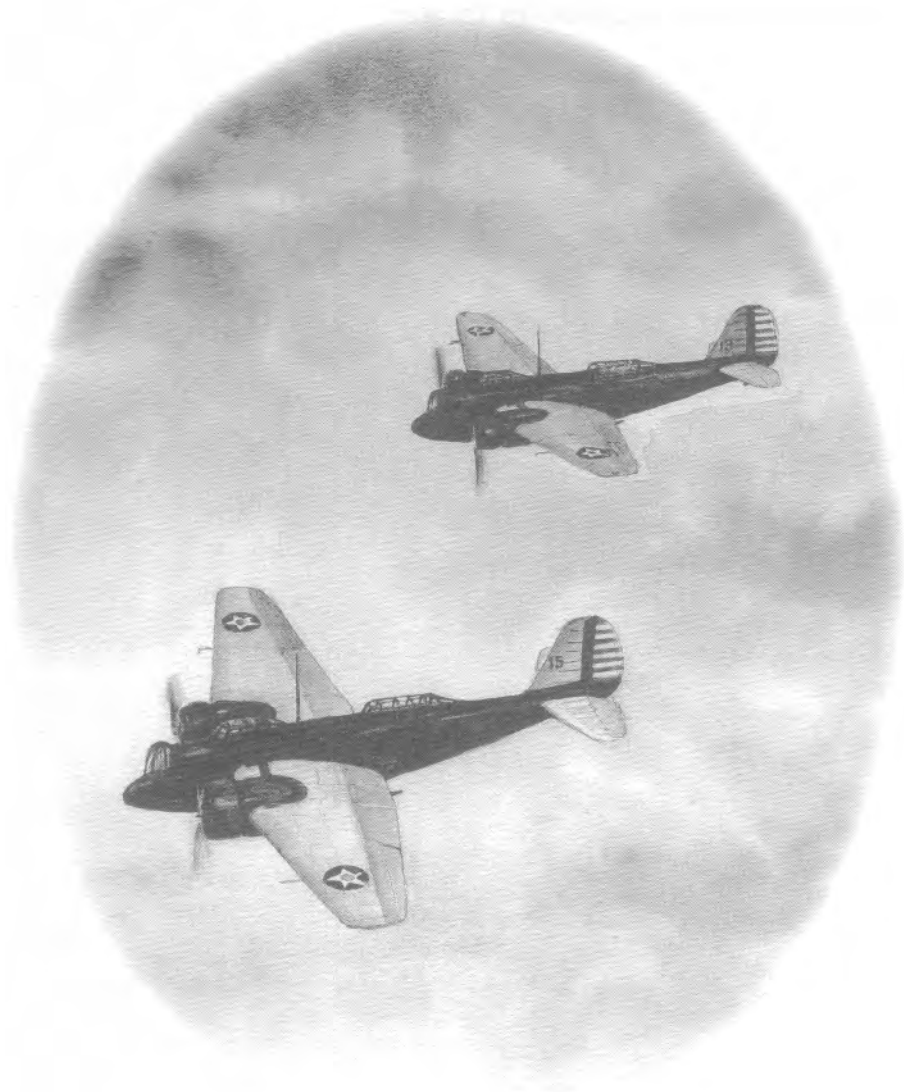


and Y1B-17 before them, were for operational testing. Only the P-38, with its two supercharged engines, came close to matching the performance of the latest German and Japanese fighters, although the P-39 and P-40 performed well at low and medium altitudes. Since it had become an article of faith that formations of bombers could protect themselves against interceptors, none of the three fighters had the range necessary to escort the new B-17s and B-24s, although the addition of external fuel tanks soon enabled the P-38 to fly escort missions. Basically, the American pursuits of this era were designed to gain air superiority in combat at low or medium altitude and to support ground troops. The Air Corps meanwhile contracted for test models of the North American B-25 and Martin B-26, creating a class of aircraft designed to fill the void between the high-altitude, long-range strategic bombers and the low-altitude attack types. Production contracts were signed for 183 B-25s and 201 B-26s in fiscal year 1940, before either plane was flying.

As the decade ended, a rapidly expanding Air Corps still tended toward the view that strategic bombing was a predominant role for air power. Although a few dissenters challenged the invulnerability of the new four-engine bombers, the skeptics did not prevail. Unlike Great Britain, bombed during World War I and within easy striking distance of continental Europe, the United States had never experienced aerial attack. Whereas Britain's vulnerability compelled the Royal Air Force to invest in air defense, developing new interceptors and establishing a radar screen, the U.S. Army Air Corps looked to the big bombers to intercept an invasion force approaching by sea, if necessary basing them in the Panama Canal Zone, in Hawaii, Latin America, or the Philippines. While aircraft like the B-17 carried the war to the attacker, American fighters were expected to function generally as they had in the previous war—gaining control of the skies over the battlefield (perhaps a hostile beachhead in the Western Hemisphere or in some overseas possession), harrying the enemy's troops, and conducting reconnaissance. Given the degree of confidence in the strategic bomber, its accuracy, and its capacity for self-defense, there was no reason to believe that pursuit aviation would have to do otherwise.

Although expanding rapidly, the Army Air Corps was small compared to the major European air forces that went to war in September 1939. General Arnold commanded some 26,000 officers and enlisted men equipped with about 800 first-line combat aircraft. In contrast, Germany's *Luftwaffe* had grown to about 3,600 comparable aircraft, the British to almost 2,000, and the French to more than 1,700. Despite the recent advances in

American aviation technology that had produced airplanes like the B-17, despite centralization of the aerial striking force in the GHQ Air Force, and despite the President's obvious interest in military aviation, the U.S. Army Air Corps was not yet the equal of the air forces of Europe; its fighters were much inferior to British and German designs. Independence from the Army remained a distant ideal for American military airmen who subordinated their aspirations to feverish preparations for war.



2

Europe in Flames

While the Air Corps expansion of 1939 was beginning, Europe went to war. After annexing the remainder of Czechoslovakia in the spring of the year, Hitler fomented the next European crisis on the issue of the Polish Corridor, a strip of land that had given otherwise landlocked Poland access to the sea. Though Poland had French and British guarantees of her borders, past inaction by the European democracies persuaded Soviet dictator Joseph Stalin that the Poles could expect no help. On the strength of this, he accepted a nonaggression pact with Germany. Negotiated in a single day by German Foreign Minister Joachim von Ribbentrop and Vyacheslav M. Molotov, the Soviet Commissar for Foreign Affairs, the treaty gave Germany a free hand. Secret protocols to the agreement left the Baltic states in a Soviet sphere of interest and ceded a segment of eastern Poland to Stalin. Diplomacy had thus removed the danger of Soviet intervention on behalf of his intended victim, and Hitler attacked Poland on September 1.

Much to the surprise of both dictators, France and Great Britain declared war against Germany within two days of the onslaught. The conflict did not take the expected form, for bombs did not fall mercilessly on London, Paris, or Berlin, as predicted. A form of mutual deterrence gripped western Europe, rooted in both the technological limitations of the bomber and the real, if exaggerated, fear of its effectiveness. Most of the bombers of 1939 lacked the range, durability, firepower, and navigational equipment to reach distant and defended targets. Moreover, fear of air attack had spurred the European democracies to renewed defensive measures. After the Czech crisis of 1938, all the principal powers set up civil defense organizations, designated bomb shelters, emplaced anti-aircraft guns, and deployed fighters. The British, who had suffered air attack in World War I, issued gas



Hitler Ascendant



A succession of political crises brought the right-wing, anti-Semitic National Socialist movement of Adolf Hitler (left) to power in Germany on January 30, 1933. Among the Nazi regime's first acts was the establishment of a Reich Air Ministry to develop German aviation, both civil airlines and a military program that had been pursued in secret with the Soviet Union since 1923. Hermann Goering (above, left), a World War I ace and early Nazi Party member, headed the ministry and the *Luftwaffe*, the German air arm whose existence was announced to the world on March 9, 1935. Preoccupied with several party and government offices, indolent, and increasingly drug-dependent, Goering left affairs to a capable former airline manager, Erhard Milch (above, right), whose executive skill expanded the German aircraft industry fivefold by 1937 despite shortages of basic resources such as aluminum. Between the two and several others who promoted the *Luftwaffe* as a feared instrument of German diplomacy, bitter rivalry reigned, a commonplace in the Nazi hierarchy. Before the war, German aviation (clockwise from above, opposite) appeared supreme on the Continent. The Junkers Ju 89 was among early German strategic bombers, a concept all but abandoned by the *Luftwaffe*. Willy Messerschmitt, one of Germany's premier aircraft designers, congratulates his test pilot, who has just set a world speed record with a modified Bf 109, the B-2 model of which is also shown in *Luftwaffe* markings. The B-2 reached series production by 1937. The Dornier Do 17, first conceived as an airliner, became one of the *Luftwaffe's* principal medium bombers. Among combat aircraft considered obsolescent by the outbreak of the war (small insets, right) were the Henschel Hs 123 biplane and the Heinkel He 100. The Henschel had an unexpected success in the Polish campaign of 1939. The Heinkel He 100D, also billed as the Heinkel He 113, was built to establish new speed records as a propaganda ploy; nine of these aircraft were repainted extensively with various unit insignia in 1940 as a hoax intended to simulate more flying squadrons than Germany possessed. The administrative confusion and contention among German aviation authorities and the competing demands of expanding German ground forces resulted in a technically remarkable *Luftwaffe*, but one with a decided tactical emphasis and no consistent or sustained capacity for strategic bombardment.



masks to civilians, allocated hospital space for expected casualties in the thousands, and prepared to evacuate children from the cities. The fear that motivated such preparations proved groundless, for the anticipated waves of bombers did not appear over the capitals of western Europe, at least during the early months of the conflict. The governments of France and Great Britain shared a dread of the effect of aerial bombing on their own urban populations that caused them to abstain from initiating air attacks on German cities during the fall of 1939. Not until the British had made some ineffectual strikes against German warships did the *Luftwaffe* retaliate against the same kind of targets; damage on either side was negligible.

In the opening months of what was to become World War II, German air power concentrated almost exclusively on Poland. Hitler's *Luftwaffe* used its aircraft as planned, mainly in support of advancing armored and infantry forces. *Luftwaffe* doctrine, based partly on experience in the Spanish Civil War, called for aviation to cooperate closely with ground forces. A key element in these tactics was the Messerschmitt Bf 109 fighter, with its top speed of 350 miles per hour and armament consisting of one or two 20-mm cannon and a pair of machineguns. This small, maneuverable airplane was to gain aerial superiority so that bombers could destroy not only defensive positions on the battlefield but also the airfields, supply depots, transportation hubs, and factories capable of sustaining resistance to the German advance. The fighters operated in pairs, the individual aircraft so spaced that they could maneuver either in unison to mass their fire or separately to protect each other. Two such teams worked together, flying close enough for mutual support but far enough apart for independent action. A decade earlier Claire Chennault, then a captain in the U.S. Army Air Corps, experimented briefly with a formation of six fighters in three mutually supporting pairs—but this four-plane German formation became the model for air forces throughout the world. Hitler's airmen destroyed more than three-fourths of the combat aircraft of the ill-equipped Polish air force. Once the German fighters had mastery of the skies, aircraft like the Junkers Ju 87B dive bomber attacked centers of resistance. German bombers gutted the center of Warsaw, the Polish capital, to extinguish the last spark of resistance to German ground forces and but also to demonstrate their aerial might to the French and the British. The air campaign proved costly to the aggressors, however, with the Germans claiming only some fifty Polish aircraft more than the *Luftwaffe* lost to fighters, antiaircraft fire, and accidents. Nonetheless, the Polish campaign served Nazi propaganda as a model of coopera-

tion between military aviation and ground forces, an example of *blitzkrieg*, or lightning war, as Germany overwhelmed its much weaker eastern neighbor in five weeks. Not three weeks after the German assault started, the Soviet Union attacked from the east, seizing the share of Polish territory allotted it in the secret protocol to the Soviet-German Nonaggression Pact.

The swift and apparently cheap victory concealed serious weaknesses that soon would trouble the *Luftwaffe*. Production planning remained geared to a short war, fought with the basic kinds of fighters and bombers already were rolling from the assembly line. In such a conflict, neither numbers nor obsolescence would pose a problem, and there seemed no need to expand the manufacture of aircraft or radically improve the existing models. Although Germany turned out some 8,000 planes during 1939, compared to 7,000 in the United Kingdom, the monthly rate of German production by year's end had fallen behind that of the British. The *Luftwaffe* never developed a long-range heavy bomber. When Hitler first began thinking seriously of a war in Europe, the ability of mechanized forces to advance rapidly seemed likely to place medium bombers like the Heinkel He 111 or the Dornier Do 17 within striking distance of most worthwhile targets, whether tactical or strategic.

In April, German forces attacked two neutrals, Denmark and Norway, as Hitler secured his northern flank before striking to the west. The invasion of Denmark scarcely taxed German aviation, for the small nation was overrun in a matter of hours, but even with the treason of Norwegian Nazis, the German conquest of Norway was hard-fought, requiring close coordination among air, ground, and naval forces. The *Luftwaffe* surprised and destroyed the small Norwegian air force. In conjunction with seaborne landings at Norwegian ports, German parachute troops seized key airfields so trimotor Junkers Ju 52 transports could land men to capture nearby objectives. The Allies responded by landing British, French, and Polish troops at various places on the Norwegian coast; only at Narvik in the far North did they establish a solid but ineffective foothold in Scandinavia.

On May 10, as Allied forces were trying to maintain their bridgehead, German troops struck westward. They invaded neutral Holland and routed French forces that had deployed into Belgium. Against the French, the *Luftwaffe* gained control of the air and then served mainly as aerial artillery as it had in Poland. French aviation tended to live up to the prewar estimates of its commander, General Joseph Vuillemin, who expected to lose two-thirds of his force in the first sixty days of sustained fighting. So complete was German mastery of the air that antiaircraft fire and

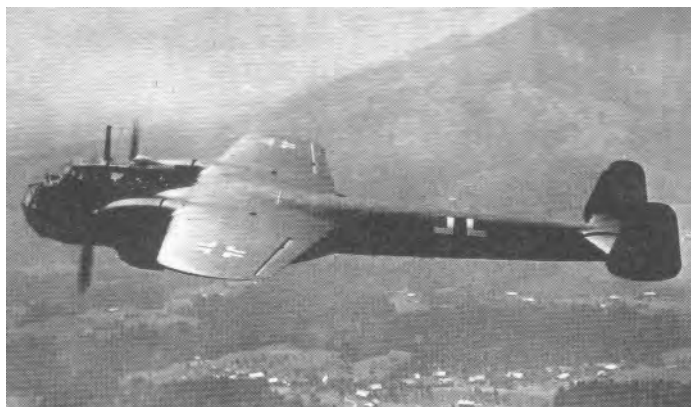
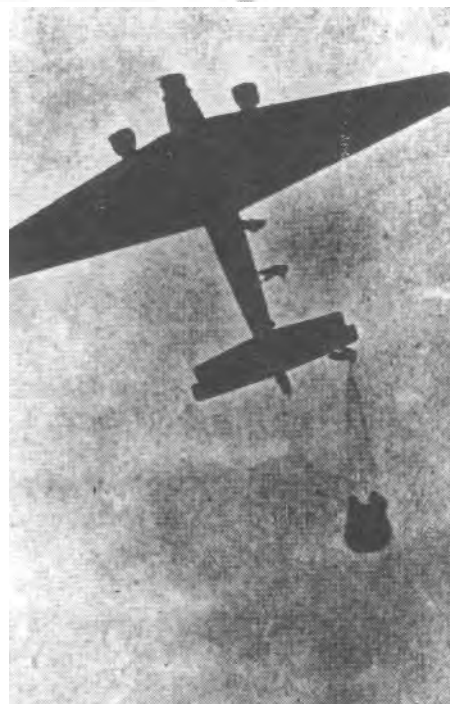
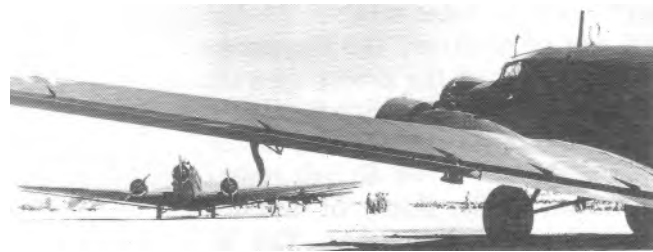
Luftwaffe Campaigns



German military conquests from 1939 through the end of 1941 had an almost irresistible character. Spearheaded by armored forces and the *Luftwaffe*, Hitler's legions quickly overran Poland in September 1939, turned to Scandinavia in April 1940, then opened a classic war of movement in France and the Low Countries in western Europe. In each of these campaigns, aircraft were among the most visible instruments of the German advance. The Ju 87B Stuka (clockwise from above) was the key to *Luftwaffe* close air support. Introduced in 1937 and used in German operations in the Spanish Civil War, the aircraft was obsolescent, large, and ungainly, but, when protected by German fighters, was highly effective.

Much of their impact was psychological; the Germans equipped the Stuka with a siren that moaned ominously as the craft dove on its target, releasing bombs as large as 500 kilograms with alarming accuracy. A grainy combat image shows a Ju 52 transport (far right, opposite), nicknamed "Iron Annie" and "Auntie Yu," spilling paratroops over the Dutch airfield at Waalhaven on May 10, 1940. Heinkel He 111s line up with a 2,000-kilogram bomb on a French field in 1940. The Dornier Do 215B-1, a heavily redesigned version of the Do 17 airframe, operated in reconnaissance and bombardment roles over Norway and France. Ju 52s on a makeshift field in North Africa; the aircraft had served as a bomber during the German intervention in Spain and was the rugged mainstay of the German transport fleet and a central component of the *Luftwaffe's* training establishment until 1942. The twin-engine Bf 110 *Zerstörer* was conceived as a multipurpose machine designed to clear an aerial path for main force bombardment aircraft and to engage enemy ground formations as well. Never entirely satisfactory in its many roles, it was nevertheless a formidable ground attack vehicle during the *blitzkrieg* campaigns in the west. In the inset above, the beneficiaries of *Luftwaffe* ground support doctrine, a German mortar crew sets up at a French railroad embankment during the 1940 campaign.





fighters shot down at least forty obsolescent Royal Air Force light bombers of the seventy-one that made unsuccessful attacks against the pontoon bridges carrying German armor across the Meuse River to exploit the breakthrough at Sedan. Elsewhere the Germans combined ingenuity with boldness, using gliders in Belgium to place engineer assault troops atop Fort Eben Emael, capturing that redoubt and, as in Norway, employing parachute troops and airborne infantry to seize airfields in Holland. Elements of the Dutch air force challenged the troop-carrying Ju 52s, shooting down several before Bf 109s could intervene, demonstrating that airborne forces, however much they might fire the imagination, were not invulnerable. Despite the stubborn gallantry of the Dutch, resistance collapsed after the invader destroyed the central part of Rotterdam, duplicating the earlier bombardment of Warsaw.

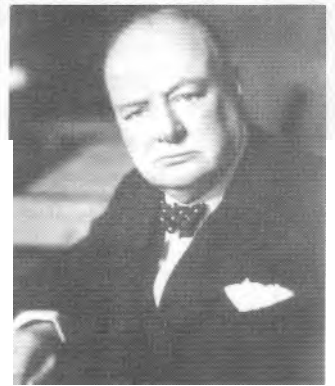
The German combined arms of air, infantry, and armor, with accompanying support troops, overwhelmed the opposition on the continent of Europe. On June 4, 1940, the last British troops withdrew from France, escaping by sea from Dunkirk under cover of Royal Air Force fighters. Within the week, the Allies had also re-embarked their expedition left at Narvik. Benito Mussolini, the Italian dictator tied to German fortunes by the so-called Pact of Steel since 1939, attacked France on June 8 in what Franklin Roosevelt called a dagger thrust into the back of a neighbor. France accepted surrender terms on June 22, and the resulting armistice left Hitler the master of western Europe from Norway's North Cape to the Franco-Spanish border. German divisions stood poised at the English Channel, awaiting the order to invade the British Isles. England stood alone and in dire peril.

Though not obvious at the time, German air forces faced more of an even contest than first met the eye. Before Hitler could launch an invasion, the *Luftwaffe* had to seize control of the skies. This would involve an aerial war of attrition. The Germans, who had greatly underestimated the capacity of the British aircraft industry to replace losses, now tried to lure the Spitfires and Hurricanes of the Royal Air Force Fighter Command into battle against numerically superior forces and wear down British resistance. In this struggle, popularly known as the Battle of Britain, the *Luftwaffe's* principal fighters had severe limitations. The Bf 109 lacked the range to escort bombers over the more distant targets in the United Kingdom and engage in aerial combat on these missions if necessary; the twin-engine Messerschmitt Bf 110, which had the necessary range, lacked maneuverability. The Ju 87 Stuka, the quintessential divebomber supporting German ground troops, was helpless in the skies over England and disappeared

early from the battle. At the outset, Air Marshal Sir Hugh Dowding, Chief of the RAF Fighter Command, had only some 650 fighters with which to defend the British Isles, but technology provided him with the information he needed to employ his force to deadly effect. A British radar detection net emplaced just before the war tracked German aircraft as they formed up over the Continent. Control centers linked to the net could mass fighters to meet a threat. With this information, ground controllers could keep fighters on the ground until they were sure of the size and the object of the German raid. British fighters thus had the fuel to engage Germans that were beginning to run dry just as they approached the fight. Other crucial information came from ULTRA, a code-name for an intelligence system that intercepted, decoded, and translated radio messages encrypted on the standard German military enciphering machine. In the critical sector that embraced London, Dowding relied on radar and ULTRA to intercept the German raids with adequate strength, but no more, so that he could maintain a reserve of fighters. He made his pilots avoid massive dogfights with the escorting Messerschmitts and concentrate on the bombers before they reached their targets.

One of the climactic actions of the Battle of Britain was Eagle Day, August 15, 1940. The *Luftwaffe* dispatched over 1,700 bomber and fighter sorties to lure the Hurricanes and Spitfires aloft and destroy them, but the attackers lost more than three times as many aircraft as the defenders. Although the aerial attrition ran against the Germans after Eagle Day, they twice stumbled on tactics that were far more dangerous to Fighter Command than the campaign of attrition, but each time reverted to their original concept. Despite successful attacks on coastal radar installations in preparation for Eagle Day, the *Luftwaffe* failed to blind the British defenders; the 350-foot high antennas made conspicuous targets, but the slender masts, with their supporting guy wires, were difficult to hit and bring down. Then, beginning on August 30, the enemy feinted toward the cities and concentrated on Fighter Command's airfields, inflicting heavy losses in aircraft; but after September 7, since German intelligence concluded that the *Luftwaffe* had all but destroyed Dowding's force, the attacks shifted to London and other large cities. Attrition resumed with the additional goal of eroding British civilian morale.

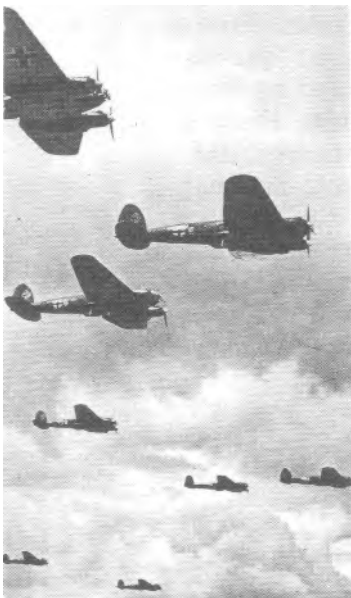
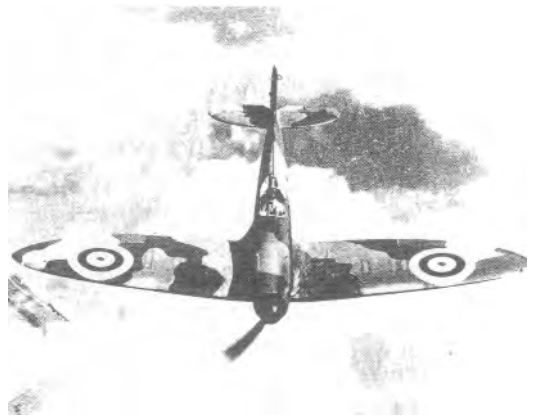
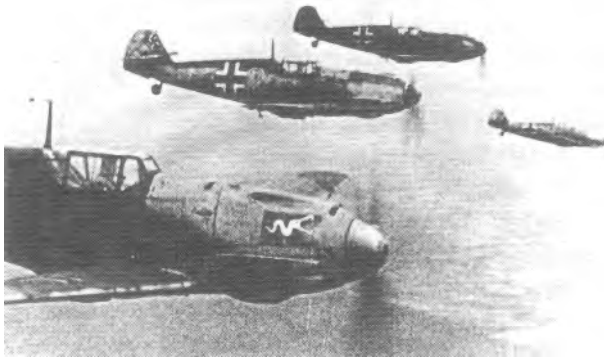
By the end of October, Fighter Command had prevailed, though by the narrowest of margins. The broad outlines of the aerial battle that went on until the end of the year were in place. The Germans had persisted in an ill-considered strategy despite the leisurely pace of their own aircraft manufacture. With the



Pushed off the Continent as the Germans subdued the Netherlands, Belgium, and France in June 1940, but with its Army intact and the Royal Air Force still in fighting trim, Great Britain faced the prospect of a German aerial onslaught in the summer of 1940. After desultory action over the English Channel in the month after the French campaign, the *Luftwaffe* began in earnest the German attempt by air operations alone to force the British government to sue for peace. On August 15, Eagle Day, *Luftwaffe* commander Hermann Goering opened the campaign with attacks on RAF airfields that came near to reaching their purpose over the next three weeks. The defense of the island remained in the hands of just over 900 overworked British pilots who fought one of the classic battles of air superiority against three German air fleets. The British defense had the advantage of a radar net that gave full warning of German raids forming over their home fields in France and allowed ground controllers to direct the battle with economy and effect.

In a fateful decision based on his need to retaliate for ineffectual British bombing attacks on Berlin, Hitler intervened in the conduct of the battle in early September to demand the redirection of the attacks from the British airfields to English cities. Though they usually aimed at military targets, the Germans only stiffened British resolve with these assaults on civilian centers. Smoke covers the London docks (*above*) on September 7 as the *Luftwaffe* adopted the new tactics. Pilots race to their Hurricanes (*above, far right*) as an RAF fighter squadron scrambles to meet the next *Luftwaffe* raid. The evenly matched Bf 109Es and Supermarine Spitfires (*opposite, middle*) were often adversaries, but the German model lacked the range to escort German bombers or to stay for prolonged combat in the English skies. Heinkel 111 bombers (*opposite, below left*) carried much of the German effort. The RAF's prowess in the defense is evident in the severed tail section of a dismembered Heinkel (*opposite, below right*) lying below the chalk cliffs of Dover. The battle gradually subsided by late 1940, when German forces made ready for operations in Russia in mid-1941. By the end of the contest, British aircraft output was exceeding the losses suffered, while the German production rate actually declined. The very essence of British spirit and defiance in appearance and speech, especially during the Battle of Britain, Prime Minister Winston S. Churchill (*above, inset*) was later called the man who mobilized the English language and sent it into battle.

Battle of Britain



combined effect of radar, ULTRA, modern fighters, and aggressive pilots, the British shot down twice as many airplanes as they lost. Aircraft production in the British Isles actually accelerated during the battle to the point that Fighter Command had more serviceable aircraft on hand when it ended than when it began. The loss of highly trained pilots was most damaging for both sides; but here, too, the defenders had the advantage. Since the fiercest action took place over the United Kingdom, most of the Fighter Command pilots who parachuted or crash landed returned to duty. Germans who bailed out of stricken aircraft parachuted into British captivity. So important were trained pilots that both air forces set up rescue services to retrieve men from the waters of the channel; indeed, with the approval of Prime Minister Winston Churchill, the British ignored the red cross insignia to fire on the white-painted German seaplanes engaged in rescue work. Determined to recover as many as possible of its highly trained airmen, the *Luftwaffe* camouflaged its rescue aircraft and provided fighter escort.

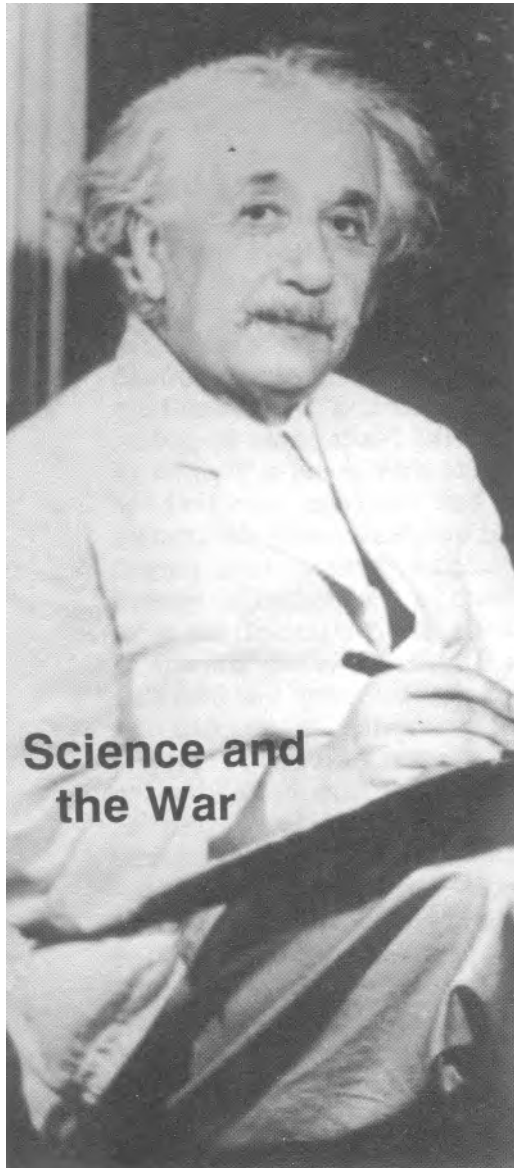
On September 17, ULTRA revealed that Hitler had postponed the invasion of England. The *Luftwaffe* had failed to gain the necessary control of the air and shifted its strategy to bombing cities by night. Since the weakened German fighter force could no longer protect the lightly armed bombers in daylight, the enemy had to resort to unescorted nighttime raids, but the bombers were too few and carried loads too small to force Britain out of the war. Although they caused heavy damage and spectacular fires in British populated centers, the night attacks achieved nothing decisive against British industry or morale. Their intensity peaked by the end of 1940. By the following spring, Hitler had turned his attention elsewhere. He sent a German force to North Africa in February, overran Yugoslavia in March, defeating a British expeditionary force in Greece and advancing into Egypt in April. On June 22, 1941, he began his most grandiose enterprise to that time by invading the Soviet Union.

Hitler's successes aroused opinion in the United States. President Franklin D. Roosevelt reacted to the onslaught against Poland by proclaiming neutrality, but as the threat posed by Nazi Germany grew, the nation increasingly sympathized with Hitler's enemies. In 1939, however, neutrality had seemed appropriate, and the Chief Executive merely declared a limited national emergency and issued an executive order calling for modest increases in the strength of the Army and the Navy. Further action was unnecessary at the moment, for as early as the Czechoslovakian crisis of 1938, the President had anticipated the outbreak of war in Europe and taken certain basic precautions, such as

asking Congress for funds to expand the Air Corps. By the summer of 1941, his earliest proposals had been enacted, and money was available to increase the Air Corps from the 1,600 aircraft on hand in 1938 to 5,500 and from fewer than 20,000 officers and men to more than 48,000.

More remote for the moment but with great portent for incipient American air power was a scientific breakthrough brought to Roosevelt's attention. Leo Szilard, a Hungarian-born physicist who had fled Germany when the Nazis came to power, sought to alert him to the possibility of developing a weapon of untold power. Szilard's experiments had convinced him that the energy within the uranium atom could be released with devastating force, and he feared that German science, even without purged Jewish members, could produce such a weapon. He warned Roosevelt about this danger in a letter and persuaded the most eminent scientist of the day, Albert Einstein, a Nobel laureate in physics, to sign it. The note explained that Germany was hoarding uranium mined in Czechoslovakia, but when it reached the President some six weeks after the invasion of Poland, its dry, scientific tone aroused more curiosity than alarm. Without a science adviser to clarify the possibilities, Roosevelt let the topic of nuclear fission languish for seven months while an ad hoc uranium committee reviewed Szilard's proposals. The difficulty in harnessing the talents of busy civilian scientists to work on a military project of uncertain value helped persuade the President to establish an organization to manage scientific projects of this sort. At the urging of Vannevar Bush, a mathematician and engineer, Roosevelt invoked a law passed on the eve of World War I and created the National Defense Research Committee in the spring of 1940. Under the direction of Bush, the committee, absorbed during the following year into the Office of Scientific Research and Development, marshalled the resources of American science for the war effort. Research on the atomic bomb, entrusted to the overall direction of the Army, in 1945 produced a weapon that multiplied the destructive power of the strategic bomber a thousand times. Before the bomb was produced, however, the Office of Scientific Research and Development participated in a number of less spectacular projects, especially in electronics and armaments, that proved of great importance to the Army Air Forces.

In the autumn of 1939, the aircraft of the U.S. Army Air Corps compared unfavorably with those of the air forces of Europe. Only the B-17 Flying Fortress remained unequalled as a high-altitude daylight bomber. The Army had, for example, no fighter that could match the British Spitfire or the German Bf 109 in high-altitude performance. The P-38 Lightning with its super-

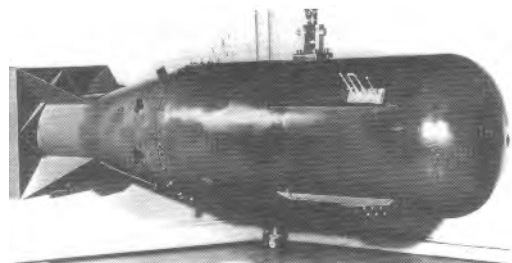
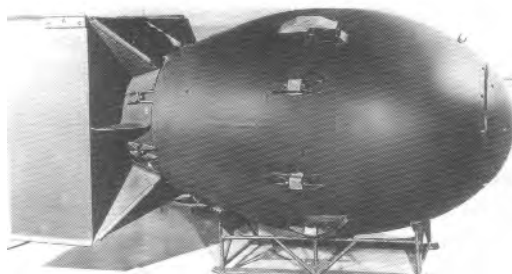


Science and the War



In another of the events characteristic of World War II, nations harnessed science in a measure untold to that time. In pursuing and financing the development of new weaponry in this way, governments set precedents for the postwar world in the control and direction of theoretical research. Albert Einstein (*above, left*), the world's leading abstract physicist who had fled Nazi persecution in Europe, advised President Roosevelt in 1939 of the feasibility of a radically new weapon based on atomic fission. The Army initiated the two-billion dollar MANHATTAN Project to derive the materials necessary to construct fission bombs. Scientists at a remote laboratory established at Los Alamos, New Mexico, proposed two possible means of manufacturing a workable atomic device. They pursued both solutions to insure success with either; both worked. The highly secret, nationwide program isolated an isotope of uranium at a plant at Hanford, Washington, and also produced plutonium at Oak Ridge, Tennessee. The elements were unknown in nature, and plutonium is highly toxic. On July 16, 1945, a new age began with the world's first nuclear explosion in a test at Alamogordo, New Mexico. At Los Alamos, scientists fashioned two bombs, *Little Boy* (*left*), with uranium elements, and *Fat Man* (*left, below*), using plutonium as its fissionable core.

In another secret endeavor, British and American experts broke Axis communications codes. By 1940, U.S. Army and Navy cryptanalysts succeeded in cracking Japanese diplomatic codes in a project called MAGIC. Simultaneously, much of Britain's mathematical brainpower was concentrated at Bletchley Park (*above, right*), a manor fifty miles northwest of London and the home of the Government Code and Cypher School. This aggregate concentrated on the messages encrypted by the German Enigma machine (*opposite, left above*). The intercepts of German radio traffic

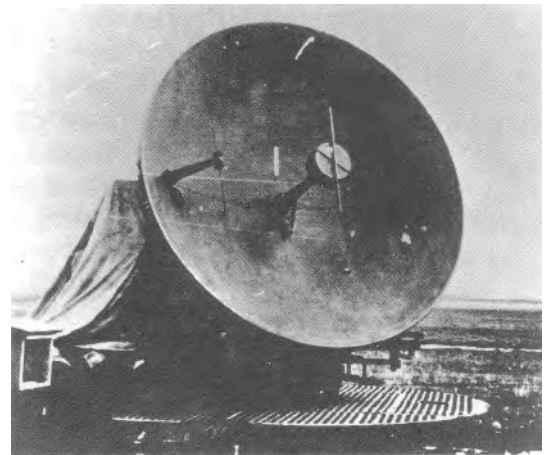
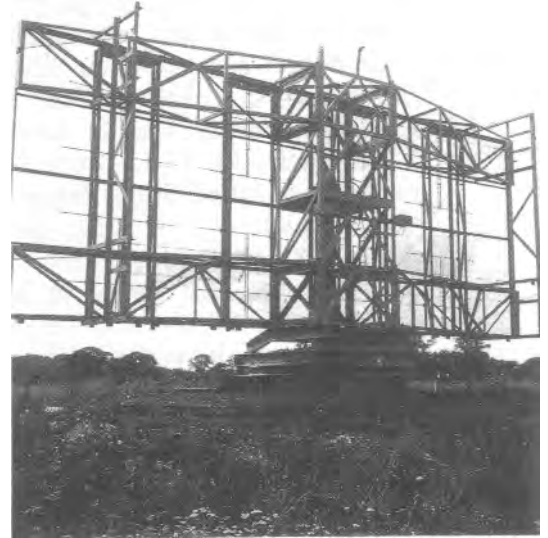




sent in the Enigma cyphers took the combined efforts of Bletchley's complement to decipher and required prodigious mathematical calculation; this work advanced the design and construction of some of the earliest prototypical computers, then known as *bombes*. The whole program and the delicately confidential intercepts it provided went under the code name ULTRA. Its existence revealed only some thirty years after the war, the system gave the Allies invaluable intelligence on German plans, strengths, and losses.

The Army Air Forces fielded much perfected models of the Norden optical bombsight, often credited with enough accuracy to put a bomb in a pickle barrel. With their aircraft operating at ever-greater altitudes, bombardiers needed a means of correcting for drift while keeping a constant speed and altitude. The Norden Mark XV was a maze of 2,000 gears and lenses connected to an autopilot that controlled the plane during the critical seconds of the bomb run. Above, right, a bombardier approaching a release point over Germany hunches over the instrument.

Radar came of age during the war in several applications. Employing the echo of a radio pulse that bounces off a moving or stationary object, the device could pinpoint incoming aircraft and help determine their range, speed, and course. Britain deployed a CHAIN HOME system (*right*) without which England could not have prevailed in the Battle of Britain. The German Würzburg (*right, midpage*) and other receivers soon proved better than British models. Transceivers were also improved and shrunk for use in aircraft; the RAF's Coastal Command exacted a deadly toll of the German U-boat arm with the use of airborne radar in 1944. By then Allied bombers were also using H2X radar sets to find targets through overcast. The domes replacing the ball turrets in B-17s (*below*) house the microwave antennae of the radars.



charged engines could climb as high as the European types, but lacked their maneuverability; and the lack of a supercharger restricted the ceilings of both the P-39 and the P-40.

Despite the work with superchargers, such as those installed in the P-38 and the B-17, neither the Air Corps nor the American aviation industry had made progress toward the development of a turbine engine for aircraft. Engineers at Wright Field, Ohio, the center of prewar research and development, had tried gearing a supercharger to the drive shaft of a piston engine, using the exhaust to help turn the propeller blades and increase power, but nothing came of this experiment until the appearance the so-called "compound engine" after World War II. In the absence of any challenge from the United States, Germany and the United Kingdom took the lead in developing jet aircraft.

Although the U.S. Navy had pioneered the development of radar, the United States lagged behind Britain in tactical applications. As late as 1941, Maj. Gen. Henry H. Arnold, Chief of U.S. Army Air Forces, denounced the American product as "no good" and recommended trying to purchase radar from Great Britain. Granted that the American sets had definite weaknesses and were susceptible to jamming, the greatest advantage of foreign radar may have been the skilled operators rather than the sets themselves. In any event, production continued in the United States, and by the end of November 1941 the Army was sufficiently confident of the equipment to begin installing it on both coasts and in Panama, Hawaii, and the Philippines.

The failure of the Air Corps to become involved in the prewar development of radar or jet engines could not be attributed to General Arnold, who had an abiding interest in technology and often solicited the help of prominent scientists. In 1939, for instance, he became aware of rocket experiments in the United States and recruited Theodore von Kármán, a Hungarian-born specialist in aerodynamics at the California Institute of Technology, to head a project designed to develop rockets capable of helping heavily laden bombers take off from short runways. The team headed by von Kármán produced solid-propellant rockets that could be attached to an airplane and ignited by the pilot to help hurl the craft into the sky. This technique of jet-assisted takeoff underwent a successful test in the summer of 1941. Some three years later, Arnold selected von Kármán to conduct a survey of the status of German aviation and determine the development projects needed to make the United States dominant in the skies after the war had ended. The air arm embraced von Kármán but ignored Robert Goddard, who had proposed a long-range missile with a warhead for attacking distant targets. Brig. Gen. George H.

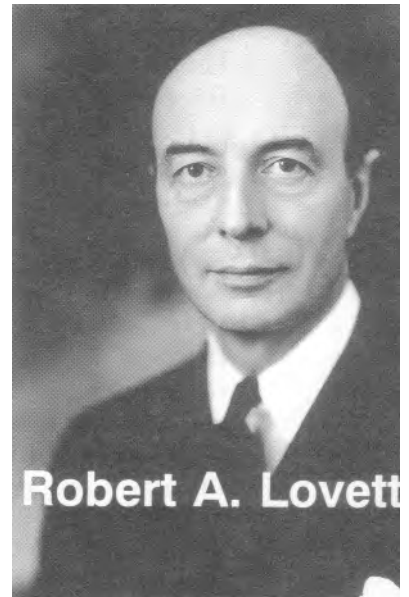
Brett, in charge of the Materiel Division at Wright Field, argued that such a one-shot weapon would prove less accurate and efficient than a bomber, which could fly a number of missions. The decision reflected the priorities of the time. The Air Corps remained so short of aircraft that any diversion of resources into missile development might well have proved a mistake.

The American production base had barely stirred. Still feeling the effects of economic depression, factories were operating at only 60 percent of capacity. On May 16, 1940, before the Battle of Britain had begun, and while German armies still were surging through France, President Roosevelt called for a force of 50,000 planes divided among the Army, the Navy, and the Marine Corps. In choosing this figure, he estimated as well the effect of requests for aircraft from the British and the French. The number, however, represented a dramatic gesture rather than a concrete goal, a rallying cry rather than a definite program. Aware of the true state of the nation's aircraft industry, which had barely begun to expand, Roosevelt called attention in his announcement to the need for greater manufacturing capacity to create and sustain so large an armada. The President's call to action resulted in immediate orders for 11,000 Army aircraft and plans for an air arm of fifty-four groups totaling more than 200,000 officers, air cadets, and enlisted men. The orders prompted by President Roosevelt's call at first went unfilled. As late as November 1940, six months after the Chief Executive established a general objective of 50,000 aircraft, an entire week's production of the American aviation industry amounted to fewer than fifty military aircraft, two combat types and the rest trainers. Obviously, the United States could not rearm and simultaneously supply the air forces battling the Axis powers without increasing production.

In the ragged beginnings of the American mobilization for war, some real statesmen arrived in positions of power and influence. Fortunately, a banker thoroughly familiar with airplane manufacturing would soon take the oath of office as Special Assistant for Aviation Matters to Secretary of War Henry L. Stimson. Robert A. Lovett, joined the War Department in 1940 and in March of the following year became Assistant Secretary of War for Air, a position Roosevelt had left vacant since 1933. Lovett immediately toured the American aircraft industry, comparing its techniques with those he had observed during recent visits to Europe, for production would be his main concern. As the fighting raged in Europe, President Roosevelt realized that the existing Army-Navy Munitions Board, even with the creation of a panel dealing with aircraft production, had such strong ties to the American military services that it could not divert warplanes to assist the Allies, a



The son of a railroad baron and Texas Republican jurist, Robert A. Lovett was among the several Wall Street names that served the Democratic Roosevelt administration in mobilizing American armed strength for the war. He was commissioned a Navy ensign in a flying unit formed among his classmates at Yale University in 1916. His aerial exploits during World War I included attacks against German U-boat bases in Holland, which left him with a lasting impression of the potential of strategic aviation and enduring acquaintanceships among interwar Army and Navy airmen. At forty-five years of age, Lovett answered the appeal of Secretary of War Henry Stimson and left his position as head of international affairs at a New York investment firm to become Assistant Secretary of War for Air on November 28, 1940. His sound business principles and organization on a national scale promoted the expansion of the Air Corps in men and matériel against competing demands and daunting conditions. He relied on his multiple contacts in business and finance, the law, and the press to help scale up aircraft output from 12,000 units a year in early 1941 to an annual figure of 96,000 by the end of 1943. Above, Lovett accompanies General Henry Arnold, Commanding General, Army Air Forces, and Brig. Gen. Grandison Gardner, commander of the Air Proving Ground at Eglin Field, Florida, in 1943 while inspecting some of the 2,300,000 airmen that made up Army Air Forces during World War II.



policy that he believed absolutely necessary. He solved the impasse by invoking a law passed during World War I and created the National Defense Advisory Commission, with himself as nominal chairman. Actually dominated by three men—William S. Knudsen, the president of General Motors; Sidney Hillman, an official of a major labor union, the Congress of Industrial Organizations; and Edward Stettinius, Jr., the chairman of the board of U.S. Steel—the commission became an industrial planning agency, through trial and error easing the impact of increased defense spending on the economy, especially the aircraft industry. Although far from infallible (it once questioned the feasibility of trying to mass-produce the B-17), the commission established workable priorities, arranged for distribution of critically needed raw materials, and successfully mobilized the resources of the automobile industry for aircraft production. Early in 1941, the commission was replaced by the Office of Production Management under Knudsen and by the War Production Board after the American entry into the war. General Arnold, who would appoint Knudsen a wartime lieutenant general in charge of materiel services for the Army Air Forces, later declared: “With his arrival in Washington, the Air Force production problems decreased as each day passed, and many of my headaches gradually disappeared.”

Chaos within the aircraft industry had barely begun to yield to order when new demands arose. Comparing the transfer of military equipment to the loan of a garden hose to help a neighbor put out a fire, Roosevelt in March 1941 persuaded Congress to pass the Lend-Lease Act. This legislation enabled the President to make weapons available to Great Britain, requiring only that any surviving items be returned after the war, an example of financial legerdemain that made it possible for the recipient to acquire weapons without using already depleted credit for outright purchases. China promptly became eligible to borrow war materials in this fashion, as did the Soviet Union after Hitler attacked in June 1941. By the time the war ended, Great Britain and its commonwealth had received some 26,000 airplanes through lend-lease, the Soviet Union 11,450, and China almost 1,400. An additional 4,000 went to other nations fighting the Axis powers.

As the volume of production increased, General Arnold would have fewer worries about competition for the military aircraft leaving the assembly line. Until that happened, however, lend-lease complicated production planning, for to Arnold’s dismay, executive arrangements with Great Britain, China, and the Soviet Union siphoned off equipment needed by the Army air arm. From 1939 through 1941, the number of military airplanes annually

emerging from American factories increased from 2,141 to more than 19,000; but the most spectacular growth, to a peak annual volume almost 45 times the 1939 rate, was yet to come.

Gradually the aircraft industry enlarged plant capacity and amassed the work force that would enable it to exceed the President's goal of 50,000 airplanes. Production gathered momentum, especially in 1941, so that between the outbreak of war in Europe and America's entry into the conflict, the number of aircraft available to the Army Air Forces increased from 2,500 to 12,000. Perhaps the most important contribution of the manufacturers during this period was a tenfold increase in training craft from 700 to almost 7,000. In 1939, the Army accepted a monthly average of fewer than 100 aircraft; during 1940, monthly acceptances rose from 250 in January to more than 800 in December; and in 1941, the number accepted soared from slightly more than 1,000 in January to 2,500 at year's end. The Army's inventory of combat aircraft, held in check by the need for trainers and the demands of lend-lease, nonetheless reflected the increasing tempo of production, for example, the number of B-17s rose from 22 in September 1939 to almost 200 when Japan attacked in December 1941. Fighter strength also increased during this period from not quite 500 to more than 1,600; of these first-line pursuits, fewer than 100 were P-38s, at least 300 were P-39s, and the rest were P-40s.

The growing force of aircraft had to be manned and maintained. General Arnold and his advisers faced the task of overseeing the frenzied expansion of a prewar air arm that numbered about 25,000, including reserve officers who participated to varying degrees in annual training exercises. The Air Corps of 1939 had operated 76 installations (including 21 major bases or depots), produced fewer than 1,000 graduates from flight training courses, and graduated about 1,500 enlisted men from technical schools. These figures represented a vast increase from the mid-1930s, but Army aviation had to expand still further in terms of both manpower and facilities to absorb its share of the increased American aircraft production.

The air arm needed equipment of every sort—bases, ranges, and men—and it needed them simultaneously. Civilian flight and technical training schools participated in the buildup. For example, the number of primary flight training schools under contract to the Army increased from nine in 1939 to twenty in 1940, to forty-one the following year, and to a maximum of fifty-six in 1943. Also, eight civilian institutions joined the technical training centers at Lowry Field, Colorado, and Chanute Field, Illinois, in producing technicians. Pan American Airways took part in the

training effort, providing instruction in meteorology and navigation until the Air Corps could set up schools of its own.

The number of air installations increased to a peak of 2,252 in 1943—what had been a cornfield or cotton patch in 1939 became a paved runway, while tracts of wilderness served as gunnery or bombing ranges. Included in this growth were the Army's flight training centers, which came to incorporate both new military airfields and existing civilian fields taken over during the national emergency. The expanded training facilities began offering courses of instruction for bombardiers and aerial gunners. The network of air installations within the United States, valued at a \$100 million in 1940, grew in five years to a complex worth 30 times that amount and covered land equal in area to the states of New Hampshire, Vermont, Massachusetts, and Connecticut combined. The expansion, moreover, absorbed almost 30 percent of the amount spent by the War Department during the period for domestic military construction.

Typical of the new training bases was Thunderbird Field near Phoenix, Arizona, an installation operated under contract to the Army by a firm headed by Leland Heyward, a theatrical producer, actor's agent, and private pilot, and John H. Connelly, who served in the Air Service during World War I and recently taught flying for the Civil Aeronautics Administration. Flight operations began in March 1941, three months after ground was broken for the project. The most substantial of the field's hurriedly built structures were the hangars, where mechanics—some of the less experienced earning only 75 cents an hour—worked by night to prepare the aircraft for the next day's flying. The first class at Thunderbird Field numbered 59 cadets; by the fall of 1945, when the last class graduated, some 20,000 pilots from 30 nations had trained at Thunderbird Field and two nearby airfields operated by the same firm.

Despite the excellent weather in Arizona, learning to fly was dangerous. One student, for example, overshot the runway on a solo flight, landing smoothly but somersaulting into a dry irrigation ditch. As the pilot hung head-down in his safety harness, a would-be rescuer asked if he was all right. He answered that he was unhurt, but wouldn't recommend the maneuver to any one else. Although this trainee survived uninjured and graduated, others were less fortunate, including one cadet who died because he set his altimeter incorrectly and plowed into the desert on a moonless night, the instrument showing that his airplane was at 1,000 feet.

Airfields and training courses meant nothing without technicians, students, instructors, and men to perform administrative

and housekeeping chores—all grouped in the general category of manpower. The personnel strength of the air arm kept pace with construction projects and aircraft purchases, reaching 43,000 at the end of 1939 and approaching 100,000 in 1940. By December 1941, almost 300,000 men wore the insignia of the Army Air Forces. The number of graduates from flight training increased by about 800 percent in 1940, reaching 8,000 during that year and 27,000 in 1941. The various technical training courses produced ten times as many specialists in 1940 as in 1939, almost 15,000, and about 42,000 the following year. Not only did greater training opportunities become available for enlisted men, in 1940 nonflying officers began to graduate from courses in engineering, administration, weather, photography, communications, and armaments. The vast majority of the new technicians enlisted for a specific term, which the government might extend, or received reserve commissions to serve during the emergency.

The reserve provided a means for rapidly enlarging an officer corps that, by the end of 1940, had an active-duty strength of approximately 6,000. Of this total, roughly 40 percent were Regulars, 40 percent were reservists, and the balance were officers on detail from other elements of the Army, such as the Quartermaster Corps. By July 1941, the Army Air Corps had mobilized all the reservists willing to volunteer for extended tours of duty and was beginning to call up the others. As the prewar pool of reservists shrank, civilians with needed skills, successful air cadets, and graduates of other Air Forces schools received commissions in the reserve, with orders to report immediately for active duty.

The nineteen observation squadrons that formed a part of the National Guard made a lesser contribution to national defense than did the reserve. In 1939, the Air Corps successfully resisted a congressional proposal to expand the aviation component of the National Guard, persuading legislators that it would be a mistake to divert resources from the expansion of the Regular air arm. Consequently, in September 1940, when President Roosevelt mobilized the National Guard, only 468 pilots responded to the call.

Despite its rapid expansion, the Air Corps tried to avoid increasing the number of noncommissioned pilots. During 1940, it retained about two dozen graduates of pilot training courses who had served on active duty as reserve officers and then agreed to stay on as enlisted men, primarily to fly transports. However, congressional pressure intensified for more enlisted pilots, largely to save money, and the War Department was urging a lowering of educational standards for flight school. By the summer of 1941, the Air Corps had decided to combine acceptance of additional

enlisted pilots with a change in educational requirements. Abandoning the policy that candidates for flight training either present proof that they had completed two years of college or pass an equivalent examination, the Army began accepting high school graduates, who trained as enlisted men and graduated as sergeant pilots. The program for noncommissioned pilots satisfied Congress and expanded the pool of potential flyers by lowering the required level of education.

The training of pilots, whether officers or sergeants, and of air crewmen, along with the need for specialists in totally new fields, overwhelmed the experienced cadre that had kept the Air Corps functioning during the 1930s. A shortage of instructors and the shift from professional education to training for service in a national emergency forced the Air Corps in 1940 to shut down its Tactical School at Maxwell Field, Alabama. Two years would pass before the Army Air Forces established a School of Applied Tactics at Orlando, Florida, to familiarize officers with staff duties and the managerial, as well as operational, aspects of air warfare.

Acquisition of large numbers of aircraft and trained men to fly and maintain them did not add up to real air power. The critical issue was whether the role of military aviation would ultimately be defined by ground officers or airmen. Fortunately, on the eve of war a ground officer became Chief of Staff who accepted the airplane as a strategic as well as tactical weapon and had confidence in the leadership of the air arm. The Army Air Forces might not have become a truly effective instrument of warfare except for the cooperation and mutual respect between Arnold and General George C. Marshall, the new Army Chief of Staff. The two officers struck an informal bargain: Arnold would not use American rearmament as a vehicle for obtaining independence from the Army and Marshall would see to it that aviation received the degree of autonomy within the Army that Arnold believed necessary for strategic as well as tactical operations against the enemy. Although a powerful advocate of the air arm, Marshall did not endorse the establishment of a separate air force in the midst of a national emergency, for he hoped to avoid any disruptive organizational changes. Military aviation was to remain a part of the Army, at least for the duration of the war, but the Chief of Staff intended that airmen enjoy sufficient freedom to function efficiently and imaginatively. Arnold, who respected the Chief of Staff and felt assured of Marshall's continuing cooperation, declined to take advantage of the interest in air power inspired by the success of the *Luftwaffe* and made no attempt to rally congressional support for independence. "Right at this

minute," the Air Corps chief conceded to a fellow officer in 1940, "it looks to me as if it might be a serious mistake to change the existing setup when we are using every facility available to take care of the present expansion of the Air Corps."

Even as he advised against seeking immediate independence, Arnold urged the Chief of Staff to grant aviation greater autonomy within the War Department. In brief, Arnold sought appointment as Deputy Chief of Staff for Air, one of three deputies responsible for ground forces, aviation, and services for the expanding Army. In this position, Arnold would continue to serve as Air Corps chief and have a deputy of his own to direct the GHQ Air Force. Although concerned that the plan might lead to the separation of the Air Corps from the rest of the Army, the General Staff did not reject it out of hand, for the appointment of Arnold as deputy for air, even though his authority would remain largely unchanged, should satisfy civilian critics, who complained that air power was not getting its due.

General Marshall tried to please both the General Staff, who tended to look on air power as another weapon for the commander on the ground, and the airmen, for whom aviation was decisive in its own right. In November 1940, the Chief of Staff installed Arnold, who remained Chief of the Air Corps, as his acting deputy for aviation, but reversed the policy adopted the previous year and removed the GHQ Air Force from Arnold's control. Instead of reporting to the Chief of the Army Air Corps, as it had for eighteen months, this aerial striking force now came under the authority of the Army's General Headquarters, reverting to the original chain of command for wartime described in the National Defense Act of 1920. When the GHQ Air Force began functioning in 1935, its basic mission had been to train in peacetime to fight during a future war as the air arm of the commanding general of the Army. In 1940, when an Army GHQ was organized, it faced neither an armed enemy nor the prospect of sending an expeditionary force overseas. Consequently, this operational headquarters became immersed in training and deployments and ran large-scale maneuvers, but duplicated much of the work of the War Department General Staff. In this role it also interposed itself between the GHQ Air Force and the Air Corps chief. Awkward though the arrangement was, the Army GHQ exercised control over the GHQ Air Force for more than a year. That such an organizational structure survived as long as it did reflected Arnold's willingness that "the present organization be given a chance to prove itself before any adjustments are made" and his harmonious relationship with Marshall.

Although they might be postponed for a time, changes to the

cumbersome system were inevitable. By the end of December 1940, Brett, now a major general and Acting Chief of the Air Corps, had revived Arnold's earlier proposal to reorganize the Army along functional lines, with deputy chiefs of staff for the air, ground, and service components. In March 1941, Marshall accepted the proposal, but only for aviation. He wanted one officer, General Arnold, to have complete responsibility for Army aviation, ending the informal arrangement whereby Arnold dealt with Marshall and the General Staff concerning plans, policy, and operations and Brett, as acting Chief of the Air Corps, assumed responsibility for research and development, manpower and administration, acquisition, and maintenance. In June 1941, the War Department adopted a regulation that reshaped military aviation as the Chief of Staff desired. Arnold became the Chief of the U.S. Army Air Forces, which consisted of two elements, the Air Corps and the Combat Command. The former continued to perform administrative and other support duties; the latter replaced the GHQ Air Force, which vanished into history. Both reported to Arnold, who made any interpretation of the boundary between support and operations. The new Chief of the U.S. Army Air Forces resembled a chief of staff for Army aviation, ultimately responsible for the functioning of the entire organization, including its contribution to the war plans and intelligence estimates adopted by the War Department.

In spite of this surface similarity between his role as Chief of the Army Air Forces and Marshall's as Army Chief of Staff, Arnold's authority was closely circumscribed; his writ did not extend beyond the Air Forces, and even here it was not absolute. For example, the Army GHQ remained athwart the lines of authority extending from Arnold's office to the Combat Command and to the Air Forces units overseas, which were controlled by the Army commander in the particular theater. Arnold, however, remained Marshall's deputy, the principal spokesman for air power in the highest councils of the Army and, as yet largely by invitation, the adviser to the President on military aviation.

In carrying out his duties, Arnold benefited from the assistance of a newly created Air Staff, formally organized to deal with the usual military specialties like operations, intelligence, and logistics. The Air Staff, a title borrowed from the British, in June 1941 replaced the varying number of advisers who, over the decades, had helped the Chief of the Air Service and the Chief of the Air Corps: As soon as the new agency began functioning, Lt. Col. Harold L. George of the Air War Plans Division spearheaded an effort to enhance the status of the Air Staff, particularly the status of his office. He proposed that his division formulate all plans



Though hardly the creation of any one man, the Army Air Forces in World War II was personified in Henry Harley Arnold. A native of Pennsylvania, "Hap" Arnold began a thirty-nine-year Army career as an Infantry officer after graduation with the Military Academy class of 1907. In April 1911, the Army detailed him to the Signal Corps and sent him to Dayton, Ohio, for two months of flight instruction with the Wright Brothers, which qualified him as an instructor for other Army pilots at the Army Signal Corps' flight school at College Park, Maryland. Arnold pushed the early Wright planes to their limits, setting an altitude record on June 1, 1912. He won the world's first Mackay Trophy in October of that year for a flight around a nonstop triangular course that carried him across the nation's capital from College Park to Fort Myer in Virginia and back. In a series of experiments at Fort Riley, Kansas, Arnold first employed airborne radio to report the fall

of field artillery rounds; in the photo above, Arnold (*right*) sits aboard a wireless-equipped Wright pusher with Lt. Follett Bradley at the controls. A brush with death in the same machine in November 1912 took Arnold out of aviation for eighteen months.

During World War I, Arnold organized military aviation in Panama and eventually became Assistant Director of the Office of Military Aeronautics. After a number of field commands through the 1920s, Arnold organized and led a flight of ten B-10 bombers from Washington, D.C., to Alaska and back in July and August 1934 (*left, in Alaska Flight leather jacket*), a feat that brought him a second Mackay Trophy.

In command of the 1st Wing of the General Headquarters, Air Force, at March Field, California, in February 1935, Arnold achieved his first star and within a year assignment to Washington as assistant chief of the Air Corps. At the untimely death of Maj. Gen. Oscar Westover, Arnold received a second

star and took over Westover's position as Chief of the Air Corps. In this capacity, he became Chief of Army Air Forces when that office was created on June 20, 1941. The country faced the distinct possibility of war with the Axis powers; German forces had just overrun France and a British Expeditionary Force had barely escaped destruction on the Continent.

dealing with military aviation, to make it, in effect, an aviation division of the War Department General Staff. The War Plans Division of the General Staff reacted by denying that the new Air Staff had any role whatsoever in War Department planning, but that interpretation did not prevail. A compromise was reached that defined the Air Staff as the staff of a commander, in this case Arnold, who was subordinate to the War Department, and guaranteed the right of the Air War Plans Division to submit its views to the War Plans Division of the General Staff. Once the United States had entered the conflict, the War Department encouraged the assignment of Air Forces officers to joint and Anglo-American planning groups, as well as to the Operations Division, as the General Staff's planning body came to be called.

While the Air Staff was finding a niche in the planning process, the two principal components of the Army Air Forces, the Combat Command and the Air Corps, undertook their assigned duties. As successor to the GHQ Air Force, the new Combat Command consisted of four regional air forces: the First at Mitchel Field, Long Island, New York; the Second at Salt Lake City, Utah; the Third at Tampa, Florida; and the Fourth at San Francisco, California. The First and Fourth Air Forces were to provide the nucleus for air defense in the event of war, and the other two would become combat training commands.

Meanwhile, the Office of Chief of the Air Corps became responsible for the Materiel Division and the Maintenance Command. The latter had been created in the spring of 1941 to take over the supply and maintenance activity formerly performed by components of the Materiel Division. In October, the Maintenance Command became the Air Service Command, but continued to concentrate on maintenance and supply and remained subject to the Office of Chief of the Air Corps until that agency disbanded in 1942. By the time the war ended, the Materiel Command (formerly Division) had consolidated with the Air Service Command to form the Air Technical Service Command, testimony to the difficulty in separating responsibility for such closely related matters as procurement, supply, and maintenance.

Another concern of the Office of Chief of the Air Corps was the training of aviators, crew members, and technicians. The inability of Randolph Field, Texas, to accommodate flight training for an expanding air arm led in 1940 to the establishment of three training centers, each serving a specific part of the nation, that produced navigators and bombardiers, as well as pilots. Supervision of the three regional centers shifted, following a 1942 reorganization, from the Office of Chief of the Air Corps to the new Flying Training Command. The Technical Training Com-

mand, set up in 1941, addressed the task of instructing technicians. Two years later it incorporated with the Flying Training Command to form the Army Air Forces Training Command.

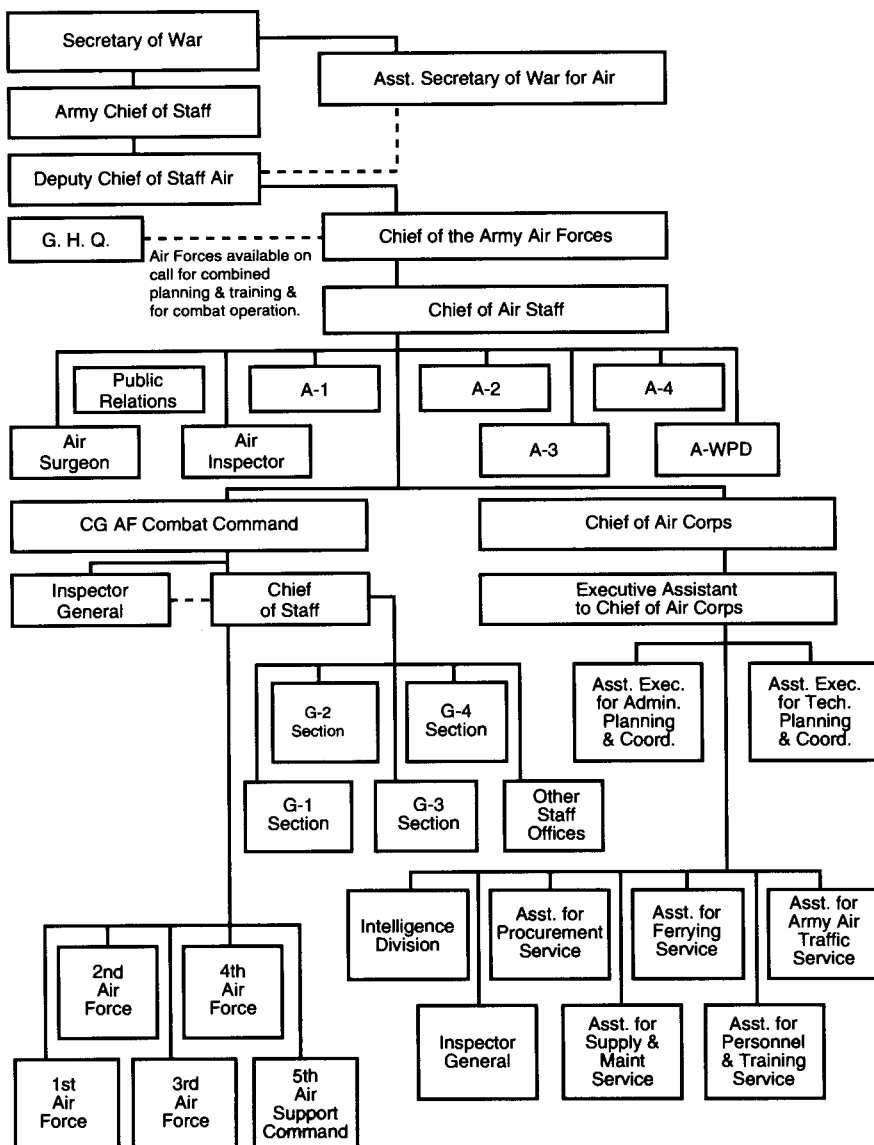
Unfortunately, flaws soon appeared in the arrangement that produced the Army Air Forces. The relationship between Arnold's Air Staff and the War Department General Staff was still being defined; and within the air arm, the distinction between combat and service components tended to blur. Although not fully satisfactory from the standpoint of either ground or air forces, the 1941 reforms ensured that the Chief of the Army Air Forces had continued access to General Marshall and, in advising the Chief of Staff, benefited from information gathered and processed by a staff of his own.

A further reform, effected in March 1942 after the United States was involved in the war, eliminated the Air Forces Combat Command and the Office of Chief of the Air Corps. It also made Arnold the Commanding General of the U.S. Army Air Forces, with full responsibility over aircraft development, procurement of men and machines, training, administration, and all forms of support not provided by the Army's technical services. The functional reorganization that Arnold had been advocating since 1940 also went into effect at that time. Acting on Air Corps recommendations from Maj. Gen. Joseph T. McNarney, the Army Chief of Staff established the Army Ground Forces and the Services of Supply (in 1943 redesignated the Army Services Forces), coequal with the Army Air Forces. This eliminated the Army GHQ, an administrative obstacle for the air element.

The Air Staff continued to function after the 1942 reorganization as it had since its creation the year before. As a matter of policy, General Arnold tried to bring to military specialties such as planning or intelligence the administrative techniques that he had come to admire in his dealings with the aircraft industry. The marriage of business efficiency and military staff work began in 1941 when Arnold sought to resolve contradictory statistics generated by various staff sections and speed the flow of accurate information throughout the headquarters. These early efforts led to the establishment of the wartime offices of organizational planning and statistical control, which cut across the functional boundaries of the Air Staff—personnel, logistics, and the like—gathered data from a variety of sources, resolved contradictions, and solved problems involving various staff agencies. In designing and manning these and other offices, Arnold called upon qualified civilians, visiting management consultants who evaluated his staff procedures and businessmen, lawyers, and public relations specialists commissioned in the reserve and assigned to jobs requiring their skills.

Army Air Forces Organization

After June 20, 1941



With its establishment in 1941, the position of Chief, Army Air Forces, was the center of coordination between combat and service elements of the air arm. Still evident, however, was the division of functions at the level of the new commanding general of the Air Forces Combat Command and the Chief of the Air Corps, some of whose functions overlapped those of the new Chief, Army Air Forces. Added to the new structure was an Air Staff, which mirrored the planning function of the War Department's General Staff for ground operations. The new Ferrying Service reflected the realities of international tensions and the necessity for flying American-built aircraft to transfer points where they could be turned over to foreign crews as part of Lend-Lease stocks made available to those allied against the Axis.

Before the emergence of the Army Air Forces and the Air Staff, military aviation played a minor role in American strategic planning. The Air Corps did not have suitable planning agencies, and its interests tended toward doctrine and equipment rather than war plans. For instance, in 1933, when General Douglas MacArthur, the Army Chief of Staff, asked Maj. Gen. Benjamin D. Foulois, the Chief of the Air Corps, to participate in war planning, Foulois used the occasion to plead for the modernization and expansion of military aviation, which he considered more important than drawing up plans to defeat a hypothetical enemy. As the 1930s drew to a close, individual airmen assigned to the War Department General Staff helped shape strategic concepts for the Army, but the Air Corps headquarters concerned itself almost exclusively with carrying out those elements of national strategy that involved the Army air arm, such as deploying heavy bombers in response to a threat to the Western Hemisphere.

Before the outbreak of war in Europe, the Joint Army and Navy Board, the predecessor of the Joint Chiefs of Staff, examined the existing national strategy in the light of Germany's growing military might and reports of increased German economic and diplomatic activity in Latin America, Italy's ambitions, and Japan's aggression in China. Shortly after the invasion of Poland, Army and Navy planners sought to revise the joint war plans to meet a changing threat. Each of the old plans had been directed at fighting a war against a single enemy and were designated by a color—ORANGE for Japan, RED for Great Britain, or BLACK for Germany—although a single document might deal with two enemies, as in the short-lived RED-ORANGE Plan. The replacements for the color series were called rainbow plans because they addressed a combination of enemies, the Axis powers of Germany, Italy, and Japan. The new plans varied in scope from RAINBOW 1, the defense by the United States, acting alone, of the Western Hemisphere and the outlying American possessions, to RAINBOW 5, which called for the United States and its Allies to defend the hemisphere, retain control of the Pacific in the face of aggression by Japan, and defeat Germany and Italy before launching a final offensive against the Japanese. By the summer of 1941, influenced by joint staff conversations held with British officers and strategists early in the year, RAINBOW 5 emerged as the basic statement of American strategy because it reflected the state of the world. Germany, with Italy as a junior partner, dominated Europe, and Japan was testing the declining strength of the colonial powers—Great Britain, the Netherlands, and France—that Germany was fighting or had defeated.

As the strategic consensus was taking shape, War Department

planners gave increasing thought to one aspect of RAINBOW 5, a coalition war in Europe, the kind of conflict that had been studied in Army schools since World War I. In planning for war in Europe, military aviation played an important role, for fighting there afforded opportunities not only to support the Army's ground forces but also to test the theory that an industrial nation like Germany could be bombed into submission. In contrast, the Army Air Forces figured scarcely at all in the kind of warfare that most interested the Navy, which had prepared for a battle to control the Atlantic, over which the Army would sail to fight in Europe, and for the final offensive against Japan. Conditioned by the history of World War I, naval planners anticipated a renewed threat from German submarines, but two decades of drawing up ORANGE plans for a war against Japan fought by battle fleets, aircraft carriers, and amphibious troops also conditioned their thinking.

The creation of the Air Staff gave Army aviation its first full-time planning agencies, but Air Forces planners made only a limited contribution to the initial work on the RAINBOW series. When it became apparent that Great Britain would be an ally if the United States became involved in the war, Anglo-American planners met at Washington from late January through early March 1941 to discuss the common strategy that underlay RAINBOW 5. Army airmen played a more important part in these talks with the British because Great Britain's Royal Air Force was a separate service, the equal of the Royal Army and the Royal Navy, and after the defeat of France air power became the sole means of carrying the war to Germany. Since aviation was the most available stick for belaboring Hitler, discussions with the British required the participation of a high-ranking American airman who could deal directly with the representatives of the Royal Air Force. As a result, McNarney, then a colonel assigned to the War Plans Division of the War Department General Staff, served in the American delegation during the conversations in the American capital with the British planning group. A self-styled "fire eater," McNarney believed that in the event of war, the Anglo-American alliance should immediately undertake operations aimed at "reducing the war-making capability of the Germans." The staff discussions, however, were not an appropriate forum to undertake a commitment for action, not even the loose collaboration—essentially basing Army bombers in the United Kingdom but under American control—that McNarney advocated. Lacking the authority to endorse a binding course of joint military action, the officers from the two nations could talk only in general terms, mainly about global strategy, and the conversations produced

agreements in principle rather than specific results. The two nations promised to exchange military missions and agreed that the British would have a priority claim on the aircraft produced at American factories, unless the United States entered the war. They also endorsed McNarney's proposal that, in the event the United States went to war against Germany, American bombers would operate from British bases under American command but in collaboration with the Royal Air Force Bomber Command. The conferees further recommended that Anglo-American strategy in any coalition war should be to concentrate on the defeat of Germany first and, only after Hitler's downfall, the defeat of his Allies.

The confidence of airmen like McNarney in daylight strategic bombing, which helped prompt the agreement concerning the employment of American bombers based in the British Isles, remained unshaken despite an evaluation by the Royal Air Force of *Fortress I*, a B-17C mounting seven hand-operated machine-guns and carrying the Sperry bombsight instead of the more accurate Norden. After twenty-two missions that began in May 1941—including strikes against Brest in France and Narvik in Norway—only twelve of the original twenty Fortresses survived, and these were transferred to Coastal Command for antisubmarine patrol. For the British, the results of this test confirmed a lesson they had learned earlier in the war: unescorted bombers could not survive by day against enemy fighters. Without a long-range escort, the Royal Air Force shifted to night operations, sacrificing bombing accuracy for survival. The fate of the *Fortress*, however, did not discourage Army Air Forces planners, who believed that the planes had gone into combat too few at a time to mass defensive fire or obtain a destructive bombing pattern.

The Army Air Forces, secure in its belief that the strategic bomber could carry the war to the enemy, began arranging to dispatch a military mission to the United Kingdom, as decided during the Anglo-American staff conversations. The War Department selected a veteran airman, Maj. Gen. James E. Chaney, to head a special observer group in Britain. General Chaney, who arrived in London in May 1941, seemed a logical choice because the first Army contingents likely to arrive in the British Isles would be aviation squadrons and because of the contacts he had made among the leaders of the Royal Air Force during his recent service in Britain. While an air observer in 1940, he had correctly interpreted the Battle of Britain as a triumph for the Royal Air Force and the key to British survival. In connection with his study of that struggle, he examined the air defenses of the United Kingdom, searching for techniques that Army airmen could use in

Observer Missions



The Army Air Corps evinced keen interest in the developing air battle over the Continent and the British Isles in 1940. A succession of informal observers journeyed to London to gain firsthand knowledge of the air defense of England. Among these was Air Corps Col.



Carl A. Spaatz, who spent July and August assessing British needs and chances in the battle. He departed in late summer just as Hitler turned the *Luftwaffe* to city attacks and conceded British air superiority in the struggle. Returning to his post in the Office of the Chief of the Air Corps, Spaatz was also convinced of England's continued viability in the war against Hitler. A similar assessment came from the man destined to represent American military forces as the head of a shadow theater staff, Maj. Gen. James E. Chaney (*left portrait*). Chaney confirmed in November 1940 that the British would hold out.

Following the combined staff conversations in Washington from January to March 1941, Chaney returned to London as the chief of the U.S. Army Special



Observer Group, with Brig. Gen. Joseph T. McNarney (*right portrait*) as his chief of staff. Chaney opened an office in the American Embassy in London, pictured in a contemporary photo, on May 19, 1941. He consulted with British military and political authorities on matters

as diverse as potential basing of larger American forces in the event of war to the allocation of Lend-Lease provisions, all in the face of the possibility that the United States would be involved in the European conflict. As Hitler attacked eastward and threatened the Soviet Union, Chaney went to Moscow in September to discuss aid to the Red Army and its air force.

Once an active combatant after Pearl Harbor, Chaney dropped his observer status to become the commanding general, U.S. Army Forces in the British Isles, a full-fledged theater of operations. It was no accident that an aviator led this Army command; U.S. war plans required the earliest American blows at Hitler's occupied domains to be air attacks launched from bases in England.

protecting the United States and its overseas outposts or, if the United States became Britain's ally, in helping defend the United Kingdom.

Aided by a small staff, Chaney devoted his second tour of duty in Britain to making tentative arrangements for bases that Army airmen could use, should the United States and the United Kingdom become allied in the fight against the Axis. In preparing a possible wartime command structure for American air forces, General Chaney unsuccessfully opposed Arnold's concept of a theater air force that combined fighter, bomber, and service elements under the centralized control of a single air officer responsible to the overall theater commander. More sensitive to advice from the British than to the views of his superiors, Chaney favored local autonomy and proposed organizing the air components geographically as well as functionally—an interceptor command in Northern Ireland, for example, and a bomber command in England—with the principal combat forces largely responsible for their own maintenance and other services.

President Roosevelt realized that the procurement of weapons for Britain and for American forces required the same careful attention devoted to overall military strategy. On July 9, 1941, not quite three weeks after Germany had invaded the Soviet Union, the President asked the Army and the Navy for estimates of the "overall production requirements needed to defeat our potential enemies." The War Plans Division of the General Staff received the task of framing the Army's response; and Clayton Bissell, a former aide to Mitchell and now a lieutenant colonel assigned to the War Plans Division, asked for help in preparing an Air Forces annex to the estimate. The Air War Plans Division requested, however, that it be allowed to prepare an Air Forces plan on its own. Arnold endorsed the proposal, and the War Plans Division, already working at capacity, agreed to delegate the task. Beginning on August 4, Lieutenant Colonel George, the chief of the Air War Plans Division, and three of his fellow officers—Lt. Col. Kenneth N. Walker, Maj. Haywood S. Hansell, Jr., and Maj. Laurence S. Kuter—drew up the division's first major plan, AWP/1, or Air War Plans Division plan number one. Drafted by advocates of strategic bombing, the document went far beyond estimating production requirements, offering nothing less than a plan for defeating Germany by means of aerial bombardment. This was the blueprint on which the Air Forces went to war.

The Army Air Forces planners accepted the basic "Germany first" strategy of RAINBOW 5. American air forces would contain the Japanese in the Pacific, the defense of the Western Hemisphere, and the defeat of Germany; but not until Germany had

been beaten would decisive operations begin against Japan. This basic strategy required an Army air arm of slightly more than two million men, about 135,000 pilots or members of air crews and the rest performing technical or administrative duties. The total number of aircraft envisioned in AWPDP/1 exceeded 63,000, with almost 7,500 heavy bombers, including the B-17 and B-24, the even larger Boeing B-29 and Consolidated B-32 (neither of which had yet flown), or a truly intercontinental type, still on the drawing boards, that emerged after the war as the Consolidated B-36.

George and his colleagues declared that 6,800 medium, heavy, and very heavy bombers based in Europe and North Africa could knock Germany out of the war by destroying 154 key industrial targets. Moreover, long-range bombers could strike at the heartland of Germany even though German forces dominated Europe and the Mediterranean and were knifing deep into the Soviet Union. The ability of the bomber to defy distance persuaded the Air Forces planners that Great Britain, instead of serving as the base for an invasion of the continent, might function more effectively as the site of the airfields from which bombers could destroy the industries on which the German war effort depended. Although firm believers in victory through strategic bombardment, the authors of AWPDP/1 did not rule out an invasion of Europe from the British Isles for two reasons. First, to do so would trigger a clash over doctrine that might prove fatal to the plan, since the War Department General Staff, which normally reviewed any document like AWPDP/1, remained committed to the principle that victory resulted from destroying an enemy's army and seizing his territory and not from leveling his industries. Second, the officers who prepared AWPDP/1, however confident they were that air power could prevent the bloodshed of a land campaign, had to concede that bombing would not bring the war to a swift conclusion because of the time needed to mass 6,800 bombers, especially since the largest were not yet in production. Consequently, the framers of the plan proposed that an interim force, consisting of 3,800 bombers, would carry the war to Germany while the striking force grew to its maximum size.

The Air War Plans Division realized that building even the interim force, let alone the full armada of 6,800 bombers, would require a mighty effort by the American aircraft industry, for in the summer of 1941 the Air Forces had on hand fewer than 700 bombers of all types—heavy, medium, and light. Assuming that the problems of production would be solved, as indeed they were, the planners felt that a growing force of American bombers could neutralize the German fighter force by destroying engine and



A Plan for Aerial War

Soon after Secretary of War Henry Stimson established the Army Air Forces as a distinct command in June 1941, the organization confronted a nearly impossible demand. As Hitler's legions were smashing the forward defenses of the Soviet Union a month later, President Roosevelt asked the War Plans Division of the War Department General Staff for a comprehensive plan that would guide the mobilization of the United States in the probable event of a war against the Axis. The second annex to the War Department's overall "Victory Plan" came from the still-forming Air War Plans Division. The Division, under Col. Harold L. George, had just seven days to forecast the entire military aviation force structure for such a war. Staff conversations with British officials had established the principle that the more dangerous German Reich would be the primary target, and Allied forces would remain on a strategic defensive in the Pacific pending an Axis collapse in Europe. Largely the brainchild of four men, Air War Plans Division 1, or AWPDP/1, as it was known thereafter, embodied the airpower ideas developed at the Air Corps Tactical School in the 1930s. George, Laurence Kuter, Haywood S. Hansell, and Kenneth Walker produced a scheme based squarely on a faith in precision strategic bombardment.

Major Hansell, shown above, believed that air power would be the chief instrument of victory. Aviation would vanquish an enemy well within the

same two years that the War Department plan required to build the armed might deemed necessary to defeat first the Germans in naval and ground campaigns and then be able to engage the Japanese. AWPDP/1 was a visionary call for 1,060 medium bombers (B-25s and B-26s), 3,740 heavy and very heavy bombers (B-17s, B-24s, and B-29s) and 2,000 fighters deployed against Germany on bases in England and Egypt. Another 3,740 intercontinental bombers would be required for missions against European targets flown directly from the United States; the aircraft for this, the Consolidated B-36 Peacemaker, was barely on the drawing boards. These forces would engage in six months of "intensive and undiluted" attacks against 154 specified German industrial targets. The principal targets were the German airframe assembly plants and associated metal production, some fifty electrical generating or switching stations, forty-seven key points in the German transportation network, and all of the twenty-seven synthetic petroleum plants in the country. All this would debilitate the German war economy and erode the German will to resist, topple the German state, if possible, and prepare for an invasion of the Continent, if that should be necessary. By early September 1941, General George Marshall, Army Chief of Staff, and Secretary Stimson accepted the plan as a whole. Its figures became the basis for new aircraft production and training schedules for the Army Air Forces.

airframe plants and shooting down interceptors in aerial combat, attack the nation's electrical power grid, considered a vital target because its generators served the entire economy, cripple the transportation network, and destroy the oil industry. Only when these war industries had been battered and Germany stood at the abyss of defeat, would the Americans engage in attacks to shatter civilian morale. AWPD/1 abandoned the principle rooted in Douhet's writing that civilian morale would collapse under heavy bombing, perhaps because of the continued resistance shown by the British populace despite the German bombardment. The plan proposed instead that attacks directed at morale serve as a *coup de grâce* for an enemy mortally wounded by the destruction of his industries.

Among all the systems of targets proposed in 1941, only the oil industry proved both vital and vulnerable to high-altitude strategic bombing. Given the belief in the pinpoint accuracy of daylight bombardment that prevailed among bombing enthusiasts when AWPD/1 was written, the power grid seemed a logical target, but events defied logic: the generating plants proved hard to locate and hit, transmission lines were among the first things repaired after an urban attack, and the large hydroelectric dams required special bombs that had to be dropped from a height of about fifty feet, bombs too bulky for B-17s or B-24s. Consequently, the power grid did not come under sustained attack. The offensive against German transportation proposed in AWPD/1 did not begin until late in the war when the advancing ground troops brought such targets within range of tactical aircraft and Allied dominance in the skies permitted heavy bombers to attack with greater accuracy from comparatively low altitude. As for German morale, which became a collateral target of the transportation campaign, the planners in 1941 were correct in emphasizing timing, for the civilian populace held up surprisingly well under aerial attack, at least as long as suffering and sacrifice seemed likely to bring victory or at least avoid a worse disaster than bombing. Not until hope had vanished did morale collapse.

In determining the force to be employed and the targets to be destroyed, the Air Forces planners reviewed the experience of the Royal Air Force in its brief attempt to bomb Germany by daylight and concluded that accuracy would prevail despite bad weather. Although acknowledging that only an average of five days per month would provide the cloudless skies needed for precision attacks, George and his fellow officers believed that German industry could nevertheless be leveled because 90 percent of the bombs directed at a particular factory on those clear days would explode within 1,250 feet of the aiming point, an unattainable

degree of accuracy. The planners did not foresee the use of the radar bombsight—far less precise than the optical kind, but necessary when weather obscured the target—that multiplied the number of bombing days but reduced accuracy. Other factors affecting the bombing pattern, besides weather and the need to use radar, included fighter opposition, antiaircraft fire, and the practice of having an entire formation drop its bombs when a designated bombardier released his. During the bomber offensive, crews undertook five or fewer missions from the United Kingdom against Germany during just six months out of thirty-two, a result of the increased use of radar, but even using the Norden sight under the best conditions of visibility, no more than 90 percent of the bombs directed at a target detonated within a mile of the aiming point, a pattern of dispersion four times as great as anticipated. A number of factors contributed to the lack of pinpoint accuracy—antiaircraft fire, winds, fighter opposition, and the practice of having a formation release its bombs simultaneously.

The framers of AWP/1 also erred in their assumption that German industry in the weeks following the invasion of the Soviet Union was already producing at full capacity; Hansell later described the German economy of that period as “presumably drawn taut” by the demands of a two-front war. Such was not the case. Despite his failure to subdue Britain, Hitler clung to the notion that his war against Stalin would be short and victorious. To avoid risking discontent among the populace by demanding sacrifices he believed unnecessary, the German dictator permitted production of civilian goods at the expense of weapons for his armed forces. The fatal weakness of the wartime German economy was not that it was overextended in 1941 but that it mobilized far too late in what proved to be a war for national survival.

Confident of the vulnerability of German industry and the accuracy of American bombing, the planners nevertheless feared—correctly as events would prove—that strategic bombers might be diverted from powerplants, oil refineries, and rail centers to attack less important targets. Because of unavoidable delays in marshaling a decisive force of bombers and the preferred strategy of the ground-oriented Army, an invasion of Europe might be undertaken, and such a campaign would inevitably require air support. To meet this need without shifting the B-17s and other bombers from their most rewarding targets, the Air War Plans Division proposed creating a force of light bombers, attack aircraft, and dive bombers to support the ground forces.

Although some General Staff officers considered strategic bombing, as set forth in AWP/1, to be an unproven theory and

possibly dangerous because it might interfere with the modernization and expansion of the ground forces, General Marshall decided the plan had merit. He therefore sent it out of channels to Secretary of War Stimson, a recent convert to air power, who endorsed its views. Circumstances, however, prevented the plan from reaching the President's desk. Shortly before the chief executive was to have a full explanation of AWPDP/1 and the aerial strategy behind it, the United States entered the war. Even without President Roosevelt's formal endorsement, the plan took effect because aerial bombardment was the chief means of carrying the war to Germany.

Until the United States entered the war and the Anglo-American alliance adopted the principles underlying AWPDP/1, the plan had no official status, even though Marshall and Stimson had given it a respectful hearing. Their attitude testified to the increasing importance of air power in a war against Hitler's Germany. A further acknowledgment of the vital role of military aviation was the presence of General Arnold at a meeting of the Anglo-American political and military leadership at Argentia, Newfoundland, in August 1941. As the Chief of the Army Air Forces, Arnold was rapidly becoming the voice of American air power in dealings with the British, functioning as the American counterpart of the Chief of the Air Staff, Royal Air Force, even though the American air arm was not yet independent and its chief was a subordinate of the Army Chief of Staff. Arnold's unique status enabled him to become a member of the wartime Combined Chiefs of Staff, the Anglo-American agency that provided strategic advice to President Roosevelt and Prime Minister Churchill. Arnold's place among the Combined Chiefs resulted from Marshall's belief in him and in the effectiveness of military aviation, as well as from the presence of a representative of the independent Royal Air Force. Because of Arnold's work with the Allied war council, when President Roosevelt in 1942 organized the Joint Chiefs of Staff to replace the Joint Army and Navy Board, the Commanding General of the Army Air Forces became a member, even though he was not, in the strict sense of the term, a chief of staff. His colleagues among the Joint Chiefs were Marshall, the Army Chief of Staff and Arnold's nominal superior; Admiral Ernest J. King, Commander in Chief, U.S. Fleet (and later Chief of Naval Operations as well); and Admiral William D. Leahy, Chief of Staff to the President.

At Argentia, where Arnold's transformation from Chief of the Army Air Forces to a peer of the Army Chief of Staff and Commander in Chief of the U.S. Fleet was just beginning, President Roosevelt and Prime Minister Churchill conferred with



Argentinia Conference



A mystified Hap Arnold listened to the Army Chief of Staff instructing him to gather current statistical data on the Army Air Forces and pack a heavy uniform for a trip. At sea two days later off Long Island, he learned the destination of the U.S. Navy ship he had boarded on August 3, 1941: an anchorage off Argentinia on Placentia Bay in Newfoundland for a conference involving Franklin Roosevelt and British Prime Minister Winston Churchill. Arnold later learned that he had been included to represent American aviation interests to British Air Vice Marshal R. W. Freeman, who had accompanied Churchill to the meeting to discuss Lend-Lease transfers of American aircraft. Diplomatic necessity thus added to Arnold's wartime role, for this meeting marked his arrival as a functioning and equal member of the Combined Chiefs of Staff in his capacity as commanding general of Army Air Forces.

The assembly for divine services on the fantail of HMS *Prince of Wales* (above) shows the president conferring with the prime minister. Behind Churchill are General George C. Marshall and Chief of Naval Operations Admiral Ernest King. On the far left at the ship's rail is General Arnold.

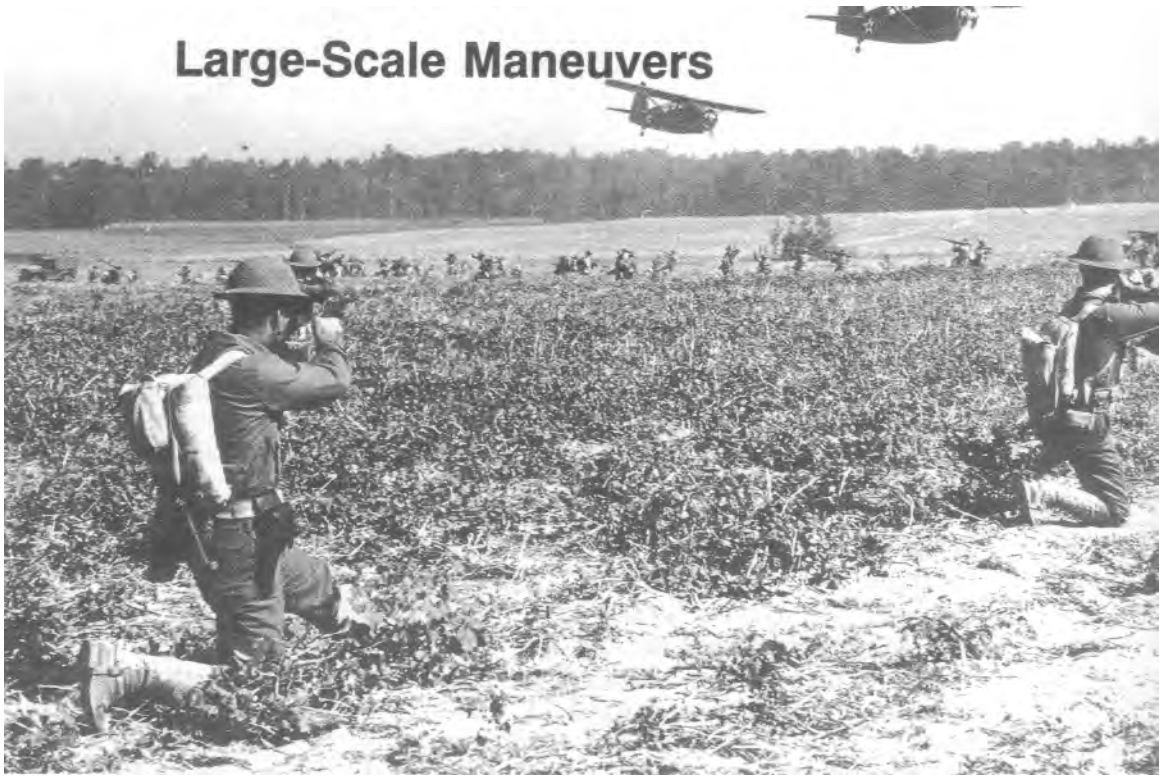
Exactly two years later, Arnold, now a regular at wartime planning conferences, appears (left) at the first Quebec conference in August 1943 with two Air Corps aides, Maj. Gen. Muir S. Fairchild, left, and Brig. Gen. Lawrence S. Kuter.

their principal military advisers, covering the concepts discussed earlier in the year at Washington by the group of Anglo-American planners that had included McNarney. The British outlined possible actions, such as driving the Germans and Italians from North Africa, in the event America became their ally; but the Americans carefully avoided making any clear-cut military commitment. Given the armament and state of training of the U.S. Army and the Army Air Forces, President Roosevelt's planners concluded that the United States could best help the British at this time by remaining a nonbelligerent and providing aircraft and other war materials. During the conference, Churchill referred to the new hard-hitting armored formations he hoped to employ in defeating the Germans. The British armed forces were attempting to apply lessons learned from Germany's earlier conquests. So, too, was the United States Army, which tried to emulate and enlarge upon *blitzkrieg* tactics.

The effort to keep pace with German tactical development included the issuance on April 15, 1940, of a new War Department field manual, FM 1-5, *Employment of Aviation of the Army*. The work of a board of air and ground officers headed by General Arnold, the publication covered a broad spectrum of air operations, declaring that strategic bombing could "deprive the enemy of essential war materiel" but also setting forth principles for tactical operations. When supporting ground forces, for example, aviation was most effective against the enemy's "rear areas;" troops on the battlefield presented a less profitable target, especially if dispersed or entrenched. The manual stated that, in general, control of aircraft supporting ground operations was to be centralized in the headquarters of the theater commander under an airman who advised the commander on the use of air power. If he believed it necessary, the theater commander could dedicate or attach aviation units to subordinate ground commanders, who would assign them missions. In brief, the manual endorsed strategic bombing, acknowledged that centralized control under an airman would increase efficiency, but left ground-oriented commanders ultimately responsible for employing Army aviation.

In an attempt to learn from recent German experience, the Army experimented, especially in the Louisiana and North Carolina maneuvers of 1941, with the use of aviation in cooperation with artillery, infantry, and armor. The maneuvers might conceivably have clarified the relationship of airmen to ground commanders, whether subordinates taking orders or equals collaborating on an agreed course of action, but the lack of aircraft and suitable radios prevented a real test of the precepts in FM 1-5. The greatest benefit of the maneuvers proved to be the opportunity for

Large-Scale Maneuvers



With the threat of war more insistent in the early 1940s, the United States Army engaged in increasingly comprehensive exercises to test the working relationships of all its separate arms. The results were often disheartening for the prospects of air support of ground forces. German victories in Europe in 1940 had emphasized the importance of close collaboration between rapidly advancing columns and supporting aircraft, and the principle of using air power as an extension of artillery governed the American large-scale maneuvers in the Carolinas in 1940 and across the southeastern states in 1941.

For the air elements involved, the wholesale deployment of maintenance and depot units for the first time revealed the Air Corps' inexperience in arranging transportation for even routine supply and aircraft spares; no one planned to move such matériel by air. Communication between units on the move or at dispersed locations suffered disastrous delays. New concepts of airbase defense and attack evolved from these exercises, but the greater focus was on air-ground interaction.

Ground troops had little training in defense against air attack or in cooperation with aircraft as they conducted attack and defense. In the photograph above, troops of the 13th Infantry, 8th Infantry Division, train their rifles on two Curtiss O-52 Owls, as the observation aircraft simulate a strafing run in the 1940 maneuvers. Some ground commanders tended to dismiss or downplay the ef-



fects of air attack, despite the presumed effects of an aerial delivery of pernicious gases against troops (*inset*). In the 1941 exercises, Brig. Gen. George S. Patton shouted down a maneuver umpire who declared a bridge destroyed by air attack just as tanks of his 2d Armored Division were crossing. The Army chief of staff thereupon wired instructions that anyone disputing such a decision would be

relieved. Ground commanders had no inkling what benefits aerial photography held for them.

Airmen were more disposed to apply their forces against targets behind the lines rather than in direct support of operations, as in the scene below. The differences over application would come to a head after the battles in North Africa a year hence.



a number of relatively junior officers to gain the experience with large units that paid off when they became wartime commanders or senior staff officers.

Besides influencing tactics, German success had inspired the basic policy of defending the United States by aiding Great Britain and, should war come, of concentrating first on the defeat of Hitler. The strategy of Germany first entailed a series of precautionary moves by air units to defend important outposts and installations, part of a general effort to safeguard the Western Hemisphere and the supply lines to Great Britain and the Soviet Union. The units assigned to protect the Panama Canal and its approaches formed the Caribbean Air Force (later the Sixth Air Force), which, following an exchange of base rights for old American destroyers, began establishing airfields on the British possessions of Jamaica, Antigua, St. Lucia, Guiana, and the Bahamas. In Alaska, preparations were less extensive, partly a result of the inhospitable climate. The recently established Air Field Forces, Alaska Defense Command (precursor of the Eleventh Air Force) possessed a handful of fighters and twin-engine bombers, most based near Anchorage. Work had begun on several new airfields, including those which would prove useful to deliver lend-lease aircraft for the Soviet Union to use against Hitler's forces.

To help protect the Atlantic sealanes that were necessary for Great Britain's survival, the Army sent a squadron of P-40s to Iceland, which had agreed in July 1941 to allow American marines and army troops to relieve the British occupation force. Ferried to the island aboard the aircraft carrier USS *Wasp*, the fighters arrived in August to assume responsibility for air defense. In addition, a few bombers flew maritime reconnaissance missions from Gander Lake, Newfoundland, searching the North Atlantic for German U-boats prowling restricted waters and for survivors from torpedoed ships. The principal activity in this region dealt, however, with the development of the air bases, weather stations, and communications facilities that would enable American-built bombers to reach the United Kingdom.

Although construction of the Greenland air bases had not yet begun in the summer of 1941, bombers manufactured in the United States began flying the Atlantic from Gander to Prestwick, Scotland, in 1940. However, until the passage of the Lend-Lease Act, a "cash-and-carry" policy governed military sales, so that British crews had to pick up aircraft at the factory. Late in May 1941, President Roosevelt directed Secretary of War Stimson to "take full responsibility for delivering other than PBYPs [naval patrol planes] to the point of ultimate takeoff." As a result, Army



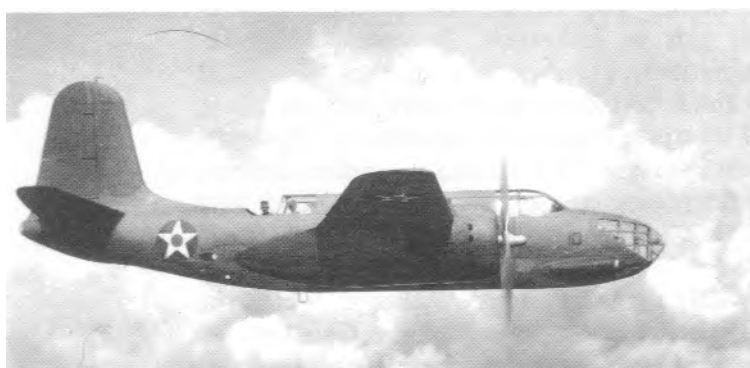
Torn between isolationist impulse and strategic realities, the United States government moved by 1940 from a position of adamant neutrality toward all warring parties in Europe to a willingness to sell matériel to the western Allies. French and British purchasing commissions had operated in the United States after 1938 and the death of a Frenchman in a crash at a Douglas factory became a near crisis.

Sales to the Allies were on a cash-and-carry basis through the end of the year. When the French capitulated after a six-week German campaign, England took over the French orders placed earlier. In dire plight, the British government faced food shortages, aerial onslaught, and the threat of imminent invasion. With the election of 1940 safely won, Roosevelt introduced legislation to aid England with what later was known as lend-lease. War supplies would be lent to British and later to Russian forces for the duration of the war, then returned or repaid later. Passed after acrimonious debate in March 1941, Lend-Lease fueled the armies reeling under Axis offensives. The system made the United States the arsenal of democracy for the worldwide crusade against the Axis.



P-40Cs (*above and inset*), dubbed Tomahawks by their new British owners, were not used in the Battle of Britain, but saw heavy service as tactical support aircraft in Egypt; almost 1,200 were transferred by August 1941. P-63 Kingcobras (*opposite, above*) at a Nome airfield in Alaska await transfer to Russian pilots; they already bear the star insignia of the Red Air Force. Clockwise opposite from far right, a spray painter converts a C-47 for Soviet use. The P-51 Mustang's development was spurred by British interest in 1940. The A-20, in its earlier DB-7 model, saw extensive British use as night fighters. Over \$7 billion in goods procured by the Air Forces went to Allied hands during the war. The British Empire and the Soviet Union were the principal recipients, but eventually aid went to all the nations fighting the Axis. This outpouring sustained the fighting forces eventually allied to the United States, but made nearly impossible an orderly expansion of American military air strength at the time. The United States gave other combatants

around the world a total of 43,021 aircraft of all types, 48,388 engines, and 56,981 propellers.



Air Forces crews began flying the planes from the place of manufacture to terminals where British airmen or American civilians took over for the transatlantic flight.

This change in policy served as the charter for the Army Air Forces Ferrying Command, which specialized in the delivery of aircraft. The new organization, forerunner of the wartime Air Transport Command, soon broadened its activity to include the operation of an airline that carried diplomatic mail and official passengers between the United States and Great Britain. Before 1941 ended, two Ferrying Command B-24s, their bomb bays converted into passenger compartments, had flown an American mission headed by W. Averell Harriman, a financier and diplomat, to Moscow via Newfoundland and Scotland. One of the aircraft returned by crossing Africa and the South Atlantic, but the other, piloted by Maj. Alva L. Harvey, continued around the world, arriving in the United States by way of Australia.

The ferry route across the North Atlantic could not have functioned without accurate weather forecasting and reliable communications. Beginning with a station at Gander Lake in March 1941, elements of the Army's Airways Communications System soon bounded across the ocean, establishing control centers and navigational aids in Labrador, Greenland, Iceland, and finally the United Kingdom. The Army Air Forces also called on its weather service, which employed some fifty persons along the route, to gather and interpret data and sometimes to fly long-range weather observation missions. British and Canadian meteorologists, and Danish meteorologists serving in Greenland and Iceland, gave the North Atlantic operation an international character.

Besides using the northerly route across the Atlantic, which the British nicknamed the Arnold Line in honor of the Chief of the Army Air Forces, passengers and lend-lease aircraft or other war materiel might travel from the United States to Natal, Brazil, span the Atlantic to the west coast of Africa, and cross that continent to the Sudan. Pan American Airways pioneered this South Atlantic route, which had barely commenced operation when the United States entered the war. In November 1941, following a variant of the South Atlantic line, the Ferrying Command initiated service to Cairo and surveyed a further extension to Basra on the Persian Gulf.

Although committed to maintaining the lifeline to Great Britain, American planners were well aware of the danger in the Far East. During the Washington conversations of early 1941, the British delegation had stressed the military, political, and psychological importance of Singapore, the port city at the tip of the Malay

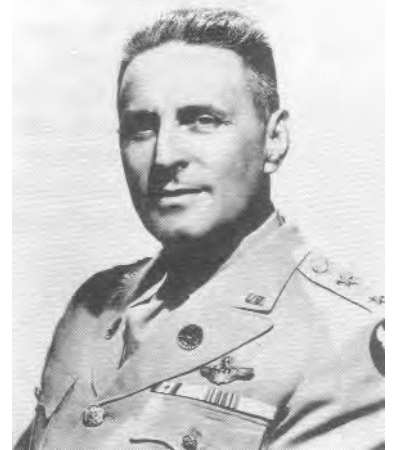


Air Transport Command

With its global commitments and the necessity for moving men and critical cargo rapidly, the Army Air Forces during World War II built and maintained the largest airline known to that time. The nucleus of this wartime organization existed in the air transport services established in 1931 at each of four air supply depots in the continental United States. In May 1941, a new Air Corps Ferrying Command took shape to deliver aircraft built in American factories to waiting Royal Air Force crews operating with the British Purchasing Commission in the United States. By July the command had inaugurated trans-Atlantic service using B-24 bombers. On June 20, 1942, the ferrying activity was redesignated the Air Transport Command to serve the War Department generally and came under Brig. Gen. Harold L. George, who rose to lieutenant general and ran the airline through the end of the war. Already stretched for pilots, the ATC relied heavily at first on the nation's air transport companies for contracted services; the president of American Airlines was commissioned a colonel and served as George's chief of staff. General George swept the ranks of private aircraft owners, barnstormers, and even crop dusters for pilots to be retrained in large, multiengine aircraft.

Beginning operations with 11,000 men in 1942 and expanding to over 200,000, the command controlled over 3,700 aircraft by war's end. The established routes took its planes all over the United States. Even before American involvement in hostilities, military transports ran south from airfields in Florida to Natal in Brazil, then across the Atlantic to Africa to the Persian Gulf and extended eventually along routes leading to China. In the Pacific, routes moved from the west coast to Hawaii, then southwest past the Solomon Islands to Australia.

Above, a Curtiss C-46 Commando labors over the Himalaya Range. Also shown (*right*) are the Douglas C-47 Skytrain, a derivative of the DC-3 airliner and the transport workhorse of the war, and the four-engine Douglas C-54 Skymaster, one of the mainstays of the postwar air fleet. Below is Maj. Gen. Harold L. George, who ran the command until November 1946. One of the leading proponents of strategic bombing before the war, George embodied the notion of strategic airlift during the conflict.



Peninsula. The United States, however, refused to shift any of the few warships of the Asiatic Fleet from the Philippines to strengthen the British base. The fate of Singapore, the Americans argued, depended ultimately on the survival of Great Britain. Thus did they affirm Admiral Harold R. Stark's aphorism that "if Britain wins decisively against Germany we could win everywhere; but that if she loses . . . while we may not lose everywhere, we might, possibly, not *win* anywhere." American eyes were fixed on Hitler in 1940 and 1941, and justifiably so, but the threat from Japan was not ignored.

The Japanese found themselves trapped in circumstances that made war with the United States an increasingly attractive gamble. Japan was committed to the subjugation of China, not necessarily occupying that vast country but eliminating effective resistance and exerting economic domination. The continuing war in China, even as it promised economic rewards, consumed scarce natural resources and forced Japan to look elsewhere for replenishment. The fall of France enabled Japan to employ political pressure on the French colony of Indochina, obtaining rice, coal, and rubber to sustain the fighting in China and acquiring access to ports and airfields. Whereas Hitler scored victories of sobering magnitude, the Japanese nibbled away at China and Indochina, occasionally killing Americans, as in the sinking of the gunboat *Panay* in 1937. Even though Japan always offered suitable apologies and expressed a desire for peace, the gradual southward expansion of the Japanese empire continued until, during July 1941, the economic exploitation of Indochina gave way to armed occupation. The Roosevelt administration reacted by imposing a freeze on Japanese assets in the United States, a course of action that Great Britain and the Dutch government-in-exile adopted. The impounding of funds prevented Japan from purchasing oil from the United States or from the Dutch colonies, and only such distant sources as Latin America and the Middle East seemed likely vendors of fuel for the war in China. In contrast, the oil of the poorly defended Netherlands East Indies lay near at hand, although any move in that direction would require the neutralization or conquest of the Philippines. That, in turn, could be assured only by the defeat of the American Pacific Fleet, which Roosevelt had shifted during 1940 from its usual home port of San Pedro, California, to Pearl Harbor, Hawaii, in order to deter Japanese aggression in the western Pacific. Instead of discouraging Japanese ambitions, the freeze of funds and resulting embargo on the sale of oil convinced the more militant of Japanese leaders that war with the United States was all but inevitable.

The Netherlands, Great Britain, and the United States had

frozen Japanese funds, and the territories of all three faced the danger of Japanese attack. As a result, American, British, and Dutch officers discussed common problems in defending the Philippines, Malaya, and the Netherlands East Indies. Aerial and naval resources were too slim and distances too formidable to permit the planning of combined operations. A party of American airmen visited Singapore and Java; but at most, the trip convinced the Americans to follow the example of Dutch veterans of German bombings in Europe and dig trenches for the protection of the men stationed at Clark Field, Luzon.

Located on the flank of a Japanese line of advance that seemed directed toward Malaya and the oil fields of the Netherlands East Indies, the Philippine Islands were in mortal peril. Since the initiative lay with Japan, the United States tried to make the best possible use of whatever time remained. "Due to the situation in the Far East," Secretary of War Stimson recommended, "all practical steps should be taken to increase the defensive strength of the Philippines." In carrying out Stimson's proposal, the Army Air Forces now reinforced the Philippines, while at the same time contributing to the defense of the Western Hemisphere and helping the British. "Early in 1941," General Arnold recalled, "the over-all policy on war defenses in the Pacific was fundamentally changed." Under the previous policy, "troops in the Philippines would hold out as long as they could on their own," but it seemed possible in mid-1941 that the islands "would not only be defended but reinforced." Transfers of men and equipment to the islands had to be weighed, however, against needs elsewhere, for the new policy sought to discourage Japanese aggression without causing serious disruption of American actions directed toward Europe.

Contributing to the decision to reinforce the islands was the apparent progress made by General MacArthur, the retired Army Chief of Staff, in creating a Philippine military establishment. The general believed that by 1946, when the commonwealth was scheduled to become independent of the United States, the Philippine armed forces would be strong enough to exact such a toll in lives and expenditures that "no Chancellory in the world, if it accepts the opinion of military and naval staffs, will ever . . . attack the Philippines." A key element in this future array would be a hundred fast bombers, able to cooperate with a flotilla of torpedo boats in opposing any invasion armada. MacArthur had a hundred trained pilots but only some forty obsolete aircraft for them to fly. In July 1941, the War Department sought to build on the foundation MacArthur had prepared by recalling him to active duty and placing him in command of

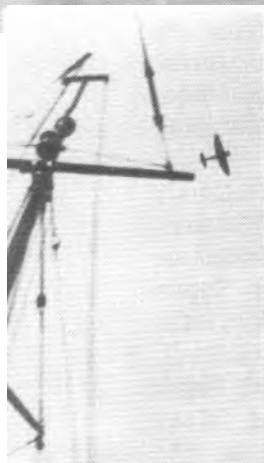
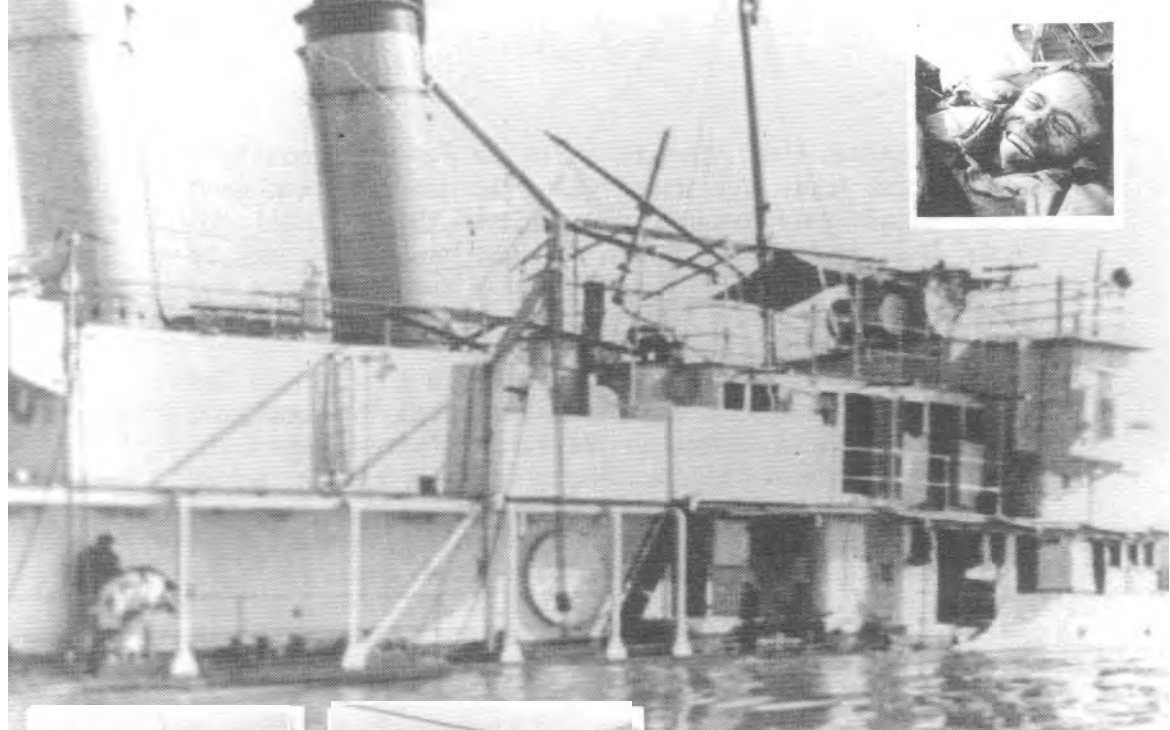
The Threat from the East



From the early 1930s Japanese and American interests were clearly on a collision course in the Far East. The inheritor of several former German Pacific colonies after World War I, Japan had great-power aspirations barely sustainable by its weak economy. Japan sought ever-greater control of affairs of its impotent Chinese neighbor and the eventual establishment in the region of what its leaders called a Greater East Asia Co-Prosperity Sphere. In 1931, Japan invaded Manchuria over vain American attempts to invoke long-standing principles guaranteeing China's territorial integrity. The war in China dragged on through 1945, producing some of the evocative images of the era: an infant (*left*) wails in the ruins of a bombed Chinese rail station in late 1937. A powerful military faction based on the Kwantung Army deployed in Manchuria increasingly influenced Japanese politics in a more truculent stance toward the United States. One of its leaders, General Hideki Tojo (*above, left*), became War Minister in 1940. The remote emperor, Hirohito (*above, right*), a studious and cautious man cast as a divine descendant of a sun goddess, seemed more carried along by events than in control of them.

Japanese operations in China drew continued western protest and risked damage to non-combatant commercial and naval vessels in Chinese waters. On December 12, 1937, Japanese ASM CLAUDES bombed and strafed the gunboat USS *Panay* (PR-5) in the Yangtze River near Nanking as she evacuated Americans from the combat zone. The ship was aground with decks awash (*opposite, above*) after a half-hour running battle. The inset photos show an attacking CLAUDE, an enlisted gunner at his battle station, and *Panay's* wounded skipper after the fight. Two crewmen and a civilian passenger died.

The remaining photos show military activity as Japanese forces fought for deep enclaves around larger ports in China and the city of Peking. Clockwise from midpage, *opposite*: Japanese pilots gauge their targets on a map before a raid in June 1938. An infantry squad advances on a rural road under the Rising Sun banner. Troops hail a victory outside Tsinan in January 1938. In June 1940, with Hitler's conquest of western Europe, Japan acquired administrative control of northern French Indochina, rich in foodstuffs and other resources of war lacking to the Japanese war machine. The American outpost in the Philippines now looked increasingly isolated.



the newly created U.S. Army Forces in the Far East, mobilizing the Philippine Army, and strengthening the American contingent in the islands. MacArthur's air element—initially called Air Forces, U.S. Army Forces in the Far East, and commanded by Brig. Gen. Henry B. Clagett—underwent a change of name and commander, in November 1941 becoming the Far East Air Forces under Maj. Gen. Lewis H. Brereton.

Critical to the defense of the Philippines, and the British and Dutch possessions as well, was the B-17. Indeed, the confidence shown by American airmen in the Flying Fortress, which the Royal Air Force had found so disappointing in Europe, helped persuade the War Department that the islands could be defended. Secretary Stimson maintained that a force of these bombers could form a cheap and effective deterrent to Japanese aggression in the region, a means by which the Philippines might become a "self-sustaining fortress capable of blockading the China Sea by air power." The hope also existed that, if the United States should go to war with Japan, the Soviet Union would permit American bombers to shuttle between Luzon and Vladivostok, attacking the Japanese home islands en route. No such agreement was forthcoming, however, from a nation reeling from the German onslaught and unwilling to risk a two-front war by antagonizing Japan.

With a ferry range in excess of 2,000 miles, the B-17 could fly to the Philippines and avoid the risk of travel by freighter through the Japanese Bonin group or the Carolines, Palaus, Marshalls, and Marianas—the former German colonies entrusted to Japan after World War I. On September 5, 1941, nine B-17Ds of the 14th Bombardment Squadron, led by Maj. Emmett O'Donnell, Jr., took off from Hickam Field, Hawaii, bound for Clark Field, near Manila. En route the planes landed at Midway Island, Wake Island, Port Moresby in New Guinea, and Darwin, Australia. The Wake Island-Port Moresby leg crossed the Japanese-controlled Caroline Islands, so the crews maintained radio silence, flying by night at 26,000 feet, an altitude believed beyond reach of Japan's fighters. During the final segment, Darwin to Clark Field, the weather turned bad, but the squadron reached its destination on September 12, Philippine time, landing safely in a driving rain. Another twenty-six B-17s, led by Lt. Col. Eugene Eubank, arrived in November to add to the striking power of Far East Air Forces. Meanwhile, to avoid flights over the Japanese-ruled islands, construction began on a South Pacific route from Hawaii to Christmas Island, Canton Island, Nandi in the Fiji group, Noumea on New Caledonia, and Townsville, Australia.

Reinforcement of the far Pacific could not, however, await

completion of the new route. On December 6, 1941, General Arnold visited Hamilton Field, California, where two flights of B-17s, led by Maj. Richard H. Carmichael and Maj. Truman H. Landon, were preparing to take off for the Philippines. Relations between the United States and Japan had deteriorated since the last trans-Pacific flight, causing concern for the safety of the aircraft as they passed over the Carolines. "I assembled the officers," the general recalled, "and told them they would probably run into trouble somewhere along the line." They did, but not where Arnold expected.

To protect the deterrent force of B-17s gathering in the Philippines, the War Department built up the defensive elements of the Far East Air Forces. By December 1, General Brereton had about a hundred P-40s, and sixty-eight obsolete Seversky P-35As and Boeing P-26As. A radar site at Iba Field and a web of ground observers fed information by telephone and telegraph to an interceptor command at nearby Nielson Field, which could launch fighters from any of the six airfields in the vicinity of Manila. The B-17s might derive further protection by operating from airstrips beyond the range of Japanese bombers based on Formosa (now Taiwan). Taking off from grass runways at Del Monte on the island of Mindanao, the Flying Fortresses could stage through Clark Field to attack an invasion fleet.

Reinforcement of the Philippines absorbed B-17s that might otherwise have strengthened the defenses of Pearl Harbor, where the Pacific Fleet stood by to discourage Japan's southward expansion. Since the principal mission of the Hawaiian Air Forces, commanded since November 1940 by Maj. Gen. Frederick L. Martin, was to protect the Pearl Harbor naval base, the Air Corps had been dispatching modern fighters to Hawaii. Shortly after General Martin arrived, Navy aircraft carriers began delivering P-36s and P-40s, so that by December 1941 the Hawaiian Air Forces had ninety-nine P-40s, along with thirty-nine of the older P-36s and fourteen of the obsolete P-26s. In addition, a small contingent of bombers operated from the island of Oahu—thirty-three obsolete B-18s, twelve modern Douglas A-20A attack aircraft, but only twelve B-17D heavy bombers.

Despite the arrival of the new fighters, General Martin had two concerns, dispersal and reconnaissance, that defied solution. The shortage of available land frustrated his plan to disperse the aircraft on small airstrips throughout the Hawaiian chain. A lack of long-range bombers or patrol craft prevented the execution of a joint search plan drawn up in collaboration with the naval air command. Based on the assumption that the "most likely and dangerous form of attack on Oahu would be an air attack," the

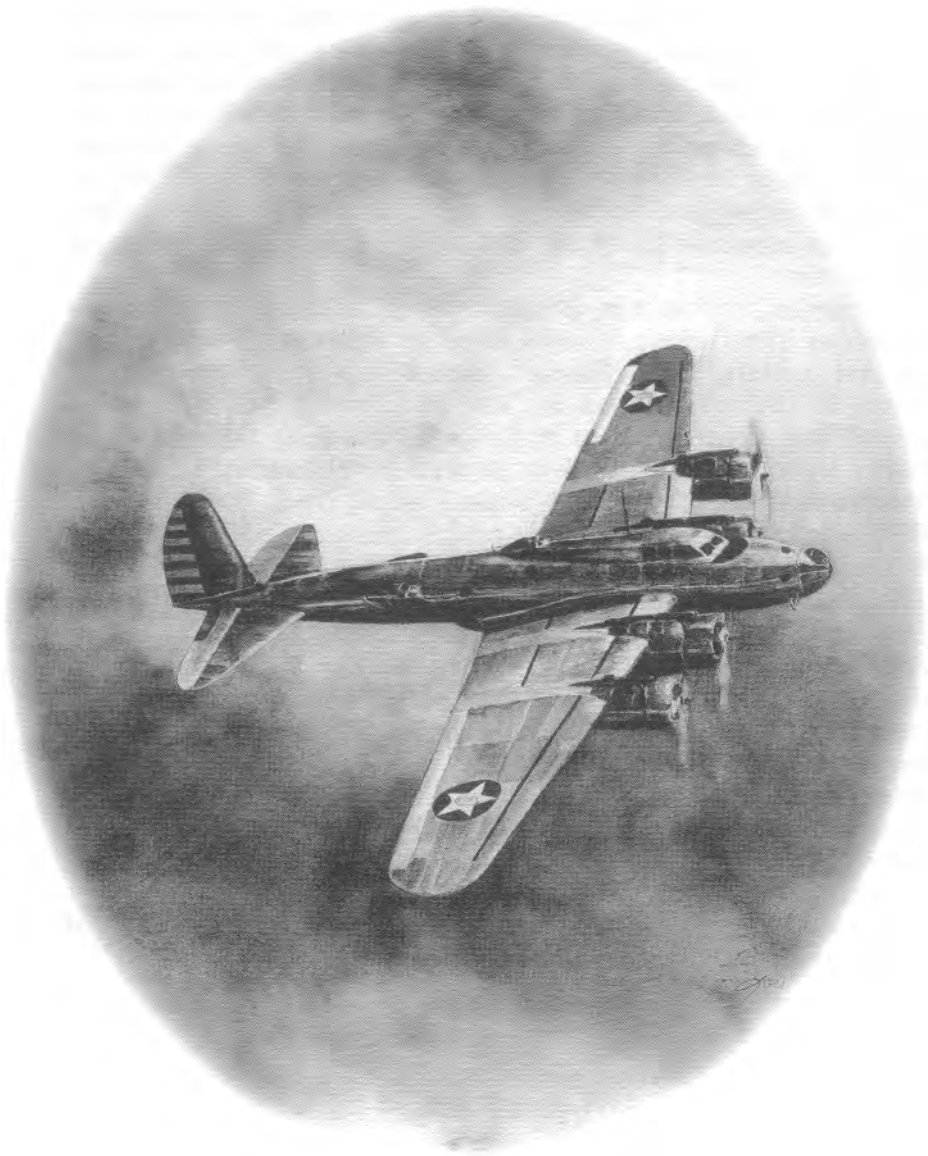
plan called for “daily patrols as far seaward as possible through 360 degrees,” a task that could not be carried out, except briefly during an emergency, with the aircraft available. Thus far Hawaii’s defenders perceived no immediate danger, save possibly from sabotage. Ironically, an alert against sabotage caused the Army to concentrate its aircraft at the main bases and park them together to ease the task of guarding them, instead of dispersing them and building revetments to reduce the danger from air attack. In preparing to thwart saboteurs, the garrison addressed an insignificant threat. The real danger lay in the skies, for Japan had decided to go to war if diplomacy failed to obtain American acceptance of Japanese hegemony throughout the Orient. Since the Americans made no concessions by the deadline that Japan had set, the fleet at Pearl Harbor became the main target.

During this period of heightening tension, American cryptanalysts were decoding Japanese diplomatic messages and charting the breakdown of peaceful relations between the two countries; and this intelligence, called MAGIC, provided evidence of the increased likelihood of war. Because the Japanese might attack the Philippines, Malaya, the Netherlands East Indies, or possibly the Soviet Union, already at war with Germany, the fighting could erupt almost anywhere in the Pacific. The distribution of MAGIC information was poorly coordinated—messages that might have sounded alarms in Hawaii failed to reach commanders there and warnings that did arrive were not shared between the Army and the Navy. One of the best informed of American officials, Secretary of War Stimson, later acknowledged that, although “not surprised, in one sense, that an attack would be made,” he had been worried about “the attack that was framing up in the southwestern Pacific” rather than the possibility of a blow to Pearl Harbor. The strike force destined for Hawaii steamed undetected toward its objective.

The Japanese carrier task force approaching Hawaii was intended to destroy the ability of the United States to wage strategic war in the Pacific until Japan had carved out an empire rich in the natural resources needed for modern warfare and created an impenetrable defensive perimeter to protect it. Without the Pacific Fleet, the American armed forces could neither reinforce the distant outposts of Guam, Wake, or the Philippines nor frustrate Japanese plans to seize the oil and other raw materials of the Netherlands East Indies and Malaya (now a part of Malaysia). Because of the vast distances of the Pacific, Japan used aircraft carriers to bring short-range bombers, fighters, and torpedo planes within striking distance of the target. For the Japanese, such an operation represented a desperate gamble: the carriers might be

detected before launching their aircraft, damage to the American fleet might prove superficial, and the United States had the resources and manpower to recover from even a successful strike. Already gathering momentum to supply the needs of Great Britain, the Soviet Union, and China, the American industrial juggernaut had the potential strength to overwhelm Japan before the riches of the conquered territory could be exploited. The few Japanese planners who thought the matter through realized the imbalance in potential strength, but even these succumbed to arguments of necessity—with oil imports restricted, Japan would never be stronger, only weaker—or to beliefs in racial or national superiority, which held that the Americans as a people lacked the courage to accept the loss of life necessary to break through Japan's outer defenses. Japanese survival thus depended on American determination, whether the United States would make use of its might or lose heart and accept Japan's domination of the Pacific.

Despite its advantage in industrial potential, the United States in December 1941 remained unprepared to fight an air war against the Axis powers. The Japanese homeland lay beyond the range of American bombers based in the Philippines, neither suitable aircraft nor airfields existed in China for attacking Japan, and the Soviet Union remained deaf to requests for the use of bases near Vladivostok. Of some 12,000 aircraft of all types, the Army Air Forces had sent just 913 combat models overseas—636 pursuits, 61 B-17s and B-24s, 157 medium bombers, and 59 light bombers. This total included some 300 warplanes based in the Philippines or en route there, another 200 in Hawaii, fewer than 40 in Alaska, and almost 250 in the vicinity of the Panama Canal, with the rest divided among Iceland, Greenland, and Newfoundland. Although American planners accepted the premise that Germany would be the main enemy if the United States went to war, not one Army bomber was based within range of any German city. The American forces already mobilized, trained, and deployed overseas merely foreshadowed the nation's vast resources in manpower, industrial capacity, and raw materials. Potential might, rather than existing strength, should have given pause to the leaders of Japan and the other Axis powers.



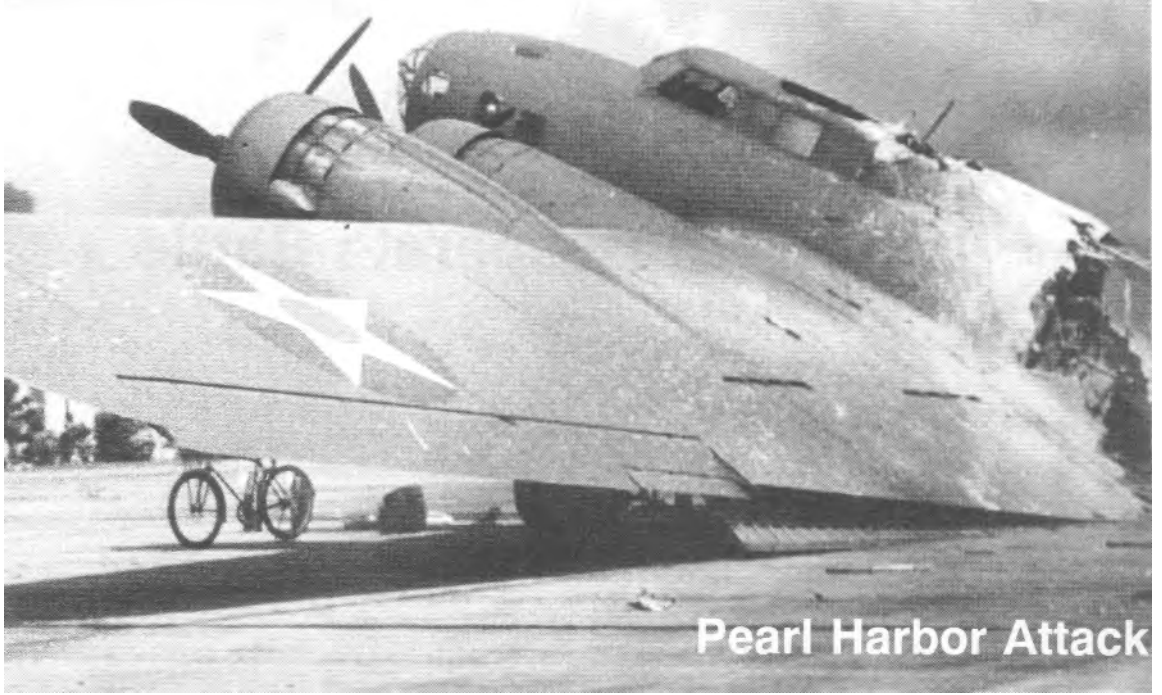
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In Desperate Battle

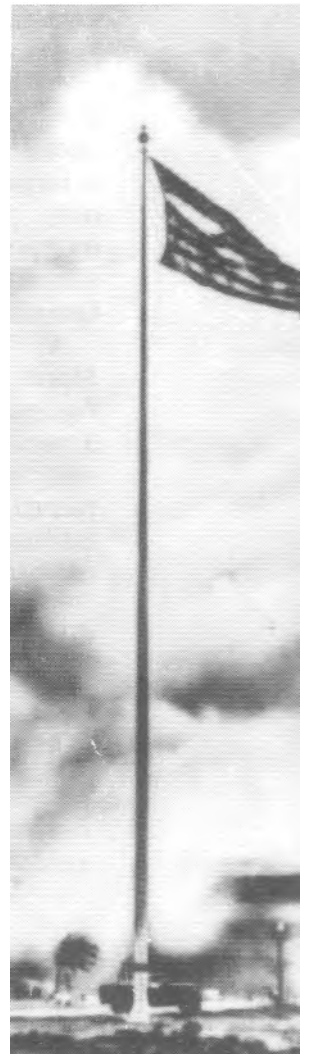
War came suddenly to the Pacific. At 7:55 on Sunday morning, December 7, 1941, the first wave of carrier-based Japanese aircraft attacked the Pearl Harbor Naval Base and other military installations on the island of Oahu, including Wheeler and Hickam Fields. Three of the six mobile radars on the island had been operating that morning, but two shut down on schedule, fifty-five minutes before the attack. At the remaining site, two Army operators, practicing after the normal surveillance period, detected a large formation of aircraft approaching Oahu. However, the only officer still on duty at the information center, which interpreted radar sightings, concluded that they were either Navy aircraft returning from American carriers at sea or the B-17s that General Arnold had seen off from California the previous night.

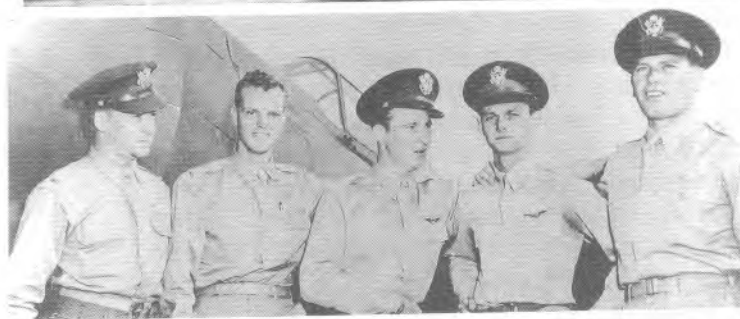
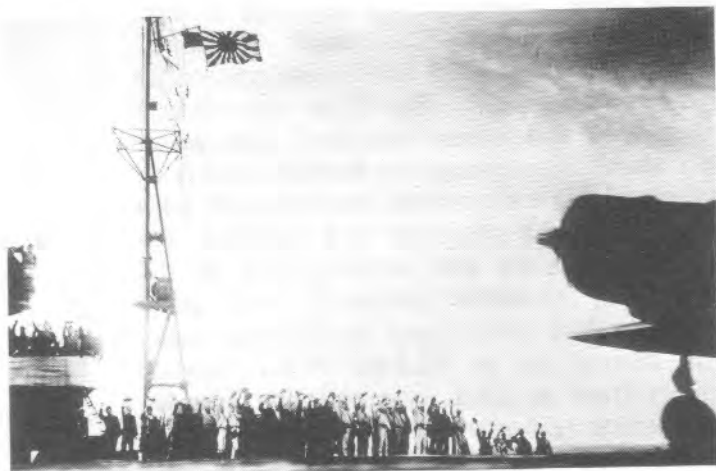
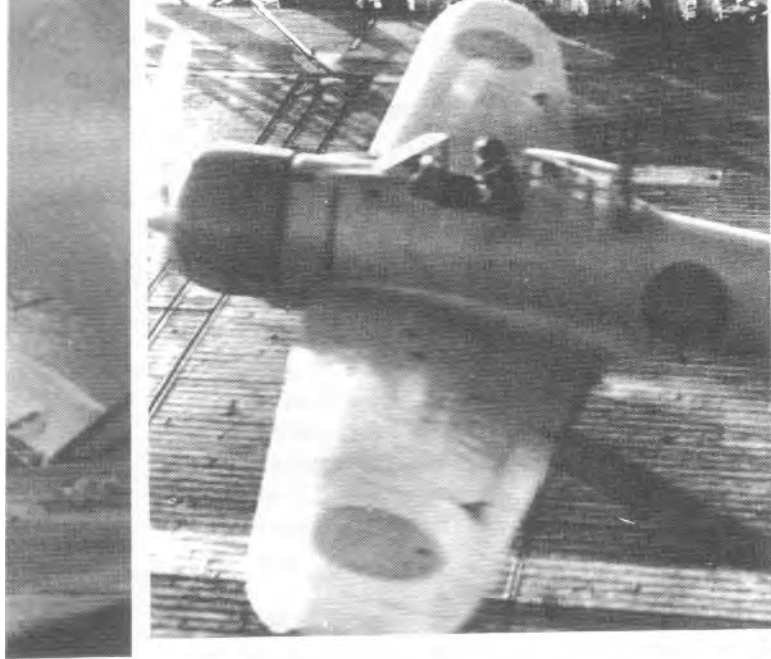
At Wheeler Field the commanding officer, Col. William J. Flood, had completed a hundred earthen revetments for his fighters, but because of an alert against possible sabotage by Japanese living in Hawaii, the airplanes were lined up in the open, wingtip-to-wingtip, when the enemy struck. The strafing fighters roared past so low that Flood claimed he could see the pilots smiling as they destroyed the American aircraft. Officers and enlisted men tried to push the least damaged of the P-36s and P-40s into the revetments before exploding gasoline tanks turned the entire apron into a sea of flame. Few of the fighters could be saved; Wheeler Field, Flood said later, was "a pitiful, unholy mess."

The second wave of attackers, which arrived not quite an hour after the first, encountered aerial opposition from a few Army fighter pilots. These included 2d Lt. George S. Welch, who, with five other pilots of the 47th Pursuit Squadron, drove to the auxiliary airstrip where their fighters were parked, took off, and



Tense diplomatic negotiations between Japan and the United States dragged on through the latter half of 1941 in vain American attempts to curb Japanese ambitions in the Far East. By late November, the Japanese government had resolved on war, and a six-carrier task force sallied from a desolate anchorage in the northern home islands to attack American installations on Oahu in the Hawaiian chain. The risky operation sought to neutralize America for six months while Japanese forces subdued an ocean empire in the western Pacific. The carriers launched their attack undetected 220 miles north of Hawaii. Just before eight o'clock on Sunday morning, December 7, 1941, their dive- and torpedo bombers, escorted by fighters, caught the American fleet and the U.S. Army's Hawaiian Air Force unawares in peacetime routine. Shown opposite, (*clockwise from midpage*), a Nakajima B5N KATE and an A6M2 ZEKE fighter head for Pearl Harbor to the *banzais* of flight deck crews. The cautious Admiral Chuichi Nagumo (*opposite, far right, above*) marshalled the next wave. In a frame taken from an incoming bomber at the opening of the attack, a Japanese plane wheels over Pearl Harbor's Battleship Row to the right of a plume marking the death blow delivered to USS *Oklahoma*. At Oahu's center, dense smoke from Wheeler Field's burning hangars and flight line aircraft (*lower half of page, right*) eventually concealed some of the parked planes from the next attack. A P-40's wreckage blocks the entrance to Hangar Number 3 at Wheeler afterwards. Debris bulldozed to clear an area for operations at the field stands in testimony to the effectiveness of the assault. Five airmen who rose from separate fields, Wheeler, Bellows (on Oahu's east coast), and Haleiwa (on the north coast) during the attack gather to contemplate their makeshift defense. Left to right are: 2d Lt. Harry W. Brown, 2d Lt. Philip M. Rasmussen, 2d Lt. Kenneth Taylor, 2d Lt. George S. Welch, and 1st Lt. Lewis Sanders. They straggled aloft in P-36s and P-40s to down nine attackers. A sixth man, 1st Lt. John Dains, probably shot down another, but lost his life to the fire of panicky defenders while landing. Another 19 enemy planes fell to anti-aircraft fire. Of 234 Army aircraft on hand when the attack started, only 83 were in commission later. Tattered but defiant, Old Glory (*right*) flies amid the ruin of Hickam Field, just west of the battleships whose sway in naval warfare was now over. American carriers, at sea on an exercise, escaped the disaster to take the war to the enemy.





climbed into a melee in which friendly anti-aircraft fire proved almost as dangerous as Japanese aircraft. Welch, flying a P-40, shot down four of the enemy, 2d Lt. Kenneth A. Taylor got two more, and P-36 pilots from Wheeler Field reported two other victims.

The B-17s en route from Hamilton Field to the Philippines flew into the midst of the air battle. The twelve aircraft—two of the original fourteen had turned back early in the flight—carried no ammunition; the weight saved had been invested in extra gasoline. To compensate for the additional fuel stored aft of the center of gravity, the armor had been removed from the crew positions and placed, along with the guns, forward in the fuselage, leaving the planes utterly defenseless. Despite enemy fighters, friendly anti-aircraft fire, and fatigue caused by the long flight, all the Flying Fortresses landed, one on a golf course, and only one was damaged beyond repair.

Within three hours after the first bombs fell on Pearl Harbor, the Japanese had sunk or badly damaged eight battleships of the Pacific Fleet and ten lesser ships. Intended as a deterrent to war, the naval concentration instead attracted the Japanese, who killed 2,335 American servicemen and wounded 1,143 at the cost of 29 aircraft and their crews. The Hawaiian Air Force had more than a third of its aircraft destroyed and others sustained damage in varying degrees, leaving about 80 airplanes in flyable condition. The death toll among General Martin's airmen exceeded 200 with more than 300 wounded. Although surprised and battered, the Americans had fought back. Sailors and soldiers fired at the Japanese with everything from .45-caliber pistols to 5-inch guns. Pilots like Welch and Taylor had knifed into the milling enemy aircraft; and amid the destruction at Hickam Field, General Martin, bleeding internally from an ulcer, was planning how his surviving airplanes might locate and attack the Japanese.

Word of the raid on Pearl Harbor had already reached Washington when Japanese emissaries delivered a note severing diplomatic relations. On December 8, the United States declared war on Japan; and three days later, both Germany and Italy entered the conflict as allies of the Japanese. The United States would fight the kind of war envisioned in RAINBOW 5, as a partner in a coalition arrayed against the three Axis powers Germany, Japan, and Italy with the defeat of Germany taking precedence. For the present, however, victory remained a distant goal. The American losses at Pearl Harbor cleared the way for the limited expansion that Japan desired, and the dramatic suddenness of the attack made even the West Coast of the United States seem vulnerable. At the same time, the threat of German submarines

along the East Coast revived concern for the security of the Panama Canal.

Instead of launching the kind of offensive operations described in AWPD/1, the Army Air Forces found itself fighting a series of desperate defensive actions. It had no usable airfields within striking distance of Japan and did not yet have the crews and aircraft to take advantage of the British bases within range of Germany and Italy. The authors of AWPD/1 had concluded that an interim force of 3,800 bombers—859 B-26s or B-25s, 1,600 B-29s or B-32s, and the rest B-17s or B-24s—would be needed to carry the war into Germany, while the Army Air Forces obtained and deployed the 6,800 bombers believed necessary to defeat Hitler. To wage a worldwide war against the Axis, the air arm had just 332 B-25s and B-26s on hand at the end of December 1941 and added only another 1,500 in all of 1942. The total number of B-17s and B-24s available on December 31, 1941 amounted to a mere 287, although an additional 1,900 were on hand a year later. Moreover, the prototypes of the B-29 and the B-32 did not fly until the summer of 1942. Aircraft production was increasing, but to assemble in Europe and North Africa a force of 6,800 or even 3,800 bombers for the defeat of Germany remained beyond the capacity of the air arm when the first year of fighting ended. The need for bombers to harry the advancing Japanese, patrol the sealanes, and complete the crew training necessary for sustained and effective aerial warfare further complicated the systematic concentration of air power against Germany.

The War Department moved swiftly to reinforce the Hawaiian Islands, the Air Forces sending forty-six B-17s in the weeks following the Japanese attack. Although General George C. Marshall, the Army Chief of Staff, and Admiral Harold R. Stark, the Chief of Naval Operations, agreed that the Navy should assume command over long-range reconnaissance from the islands, the Hawaiian Air Force (redesignated the Seventh Air Force in March 1942) retained eighteen of the bombers as a strike force to attack any Japanese task force that the reconnaissance craft might locate. The danger of a Japanese invasion of the islands seemed to have passed by the end of December, however, making men and matériel earmarked for the defense of Hawaii available to protect the supply line to Australia; and the urgency that had characterized the earlier reinforcement of the islands abated. Supposedly committed to maintaining a force of ninety-six heavy bombers in Hawaii, the War Department dragged its feet, apparently out of concern that the aircraft would be used exclusively for long-range reconnaissance. Not until the spring of 1942, when American intelligence detected a threat to Midway Island, some 1,100

nautical miles northwest of Hawaii, did any appreciable number of heavy bombers arrive in the region.

During the early months of 1942, the West Coast of the United States seemed even more vulnerable than Hawaii to a sudden Japanese raid. Erroneous reports of warships off California and recurring false radar sightings contributed to the uneasiness. Then, on the night of February 23, 1942, a Japanese submarine shelled an oil refinery near Santa Barbara, California. Concerned that the shelling was intended to divert attention from some more dangerous attack, the local commander held most of his aircraft in reserve and dispatched only three Army bombers, which conducted a search but failed to locate the submarine. Early on the morning of February 25, when radar indicated aircraft approaching Los Angeles, a blackout went into effect and, although no interceptors took off, searchlights and bursting shells illuminated the skies over the city, as antiaircraft batteries fired some 1,400 rounds. Rumors of flaming Japanese bombers crashing into the city proved groundless; the only damage was self-inflicted: shell fragments punctured roofs, traffic accidents occurred in the blacked-out streets, and the excitement contributed to at least one fatal heart attack. A subsequent investigation indicated that weather balloons released in the city and picked up by radar had caused the panic.

Despite the fierce barrage thrown up to meet the phantom raiders during this so-called Battle of Los Angeles, the defenses of the West Coast were extremely porous. When Arnold left March Field, California, for Washington, D.C., on the afternoon of December 7, he made sure that the squadrons based in the area were on wartime alert; indeed, he could do little else until he returned to his desk and began shifting reinforcements westward. In the days immediately after the attack on Pearl Harbor, the bases defending California, Oregon, and Washington had only fourteen B-17s (intended for the Philippines), some seventy-five medium bombers, and forty-five pursuits. Arnold concluded that the greatest immediate need was for fighters, and within three weeks, he sent an entire group of P-38s from Selfridge Field, Michigan. The buildup continued, and by the spring of 1942, more than 400 fighters and almost 300 bombers operated from airfields on the Pacific Coast.

Not only were aircraft scarce on the Pacific seaboard during the early months of the war, radar coverage of the region was inadequate, as demonstrated by the false alarm that triggered the barrage over Los Angeles. At the time of the Pearl Harbor attack, the radar network functioning on the West Coast consisted of just ten sites. Robert Watson-Watt, a British expert on radar, arrived

in the United States to study the nation's air defenses and found grave flaws in the coverage of the Pacific approaches. Some senior commanders, he reported, did not understand the value or the limitations of radar, either rejecting it as a gimmick or embracing it as the universal solution to all problems of defense. Furthermore, the coastline was long and difficult to cover, especially since no aircraft as yet carried radar capable of detecting ships on the surface of the sea. The equipment seemed crude by British standards and the operators inexperienced. The radar network on the East Coast shared these basic shortcomings, but both would improve.

The threat of aerial attack rapidly abated on both coasts; although in the fall of 1942, the Japanese submarine *I-25* twice launched a small float plane to drop incendiary bombs in the forests of Oregon, setting just one insignificant fire. The occasional attack by Japanese submarines on coastal shipping, scarcely comparable to the far deadlier German U-boat campaign, required only a few medium bombers. Ironically, in view of the hurried defensive measures following the attack on Pearl Harbor, the only Japanese aerial threat to the continental United States came in the last year of the war, well after training had replaced air defense as the principal concern at the Army airfields in the western United States. Between November of 1944 and May 1945, more than 9,000 hydrogen-filled paper balloons soared aloft from Honshu in Japan's home islands. The prevailing winds carried the balloons eastward to release high explosive or incendiary devices over American territory, but the offensive accomplished little. Of 285 balloons known to have reached the United States, most deposited their bombs in remote areas along the West Coast, though a few penetrated as far east as Nebraska, Iowa, and even Michigan. The only known casualties were six picnickers killed when they accidentally detonated a bomb that had landed near Bly, Oregon.

Germany's declaration of war brought the same sort of confusion and hectic reinforcement to the East Coast that the attack on Pearl Harbor caused on the West Coast. Arnold reinforced the air defenses on the Atlantic seaboard, although not to the extent that he did along the shores of the Pacific. Germany had no carrier task forces, but the danger existed, though laughably remote in retrospect, that German bombers might fly suicide missions across the ocean, mount small aerial raids from submarines, or that the pro-Nazi French colonial officials could send the aircraft carrier *Bearn*, anchored at Martinique, to launch its complement of American-built dive bombers against the cities of the eastern United States. Since the spring of 1941, the armed forces tried,

with increasing urgency, to create an air defense system along the Atlantic. By the time the nation went to war, the plotting rooms were ready, a few fighters stood by at airfields in the coastal states, and the first of several thousand spotters, mostly civilians, had received training and taken their places at observation posts. Although the entire system had undergone a few not very realistic exercises, it lacked two key elements: a radar warning net and a mechanism for coordinating anti-aircraft batteries with intercepting fighters. Fortunately, thirteen radar sites stood ready for occupancy when the war began, and within a month twenty-seven sets swept the skies along the coast.

As it began to take shape, the warning network produced an occasional false alarm. On December 9, for instance, P-40s took off from Mitchel Field to intercept raiders reportedly headed for New York City, and the schools there sent children home to find shelter from nonexistent bombs. Because air raid sirens had not yet been installed, most New Yorkers remained unaware of the supposed danger and no panic ensued. Over the months, the threat of aerial attack failed to materialize, and the emphasis shifted by 1943 from defense to training for combat overseas.

After learning of the Japanese attack on Pearl Harbor, Lt. Gen. Frank M. Andrews, the former chief of the GHQ Air Force and now the commanding general of the Caribbean Defense Command in Panama, alerted his forces and dispatched reconnaissance aircraft, then demonstrated both confidence in his troops and calmness in the midst of crisis by making sure that he was seen attending a motion picture on the first night of the war. On December 10, Andrews shifted twenty-five P-40s from Puerto Rico to Panama, and another eighty fighters arrived in the Canal Zone by the end of the month. The activation of additional radar sites contributed to the effectiveness of the planes, which were dispersed and camouflaged at the airfields on the isthmus. Mistaken reports of approaching Japanese ships caused momentary alarm, but no attack took place. Indeed, the only major action in the Caribbean area not involving submarines occurred in Puerto Rico, when a merchant ship unaware of the outbreak of war approached the island. The vessel's unannounced appearance—its radio was dead—and the accidental discharge of a rifle ashore convinced local authorities that the enemy was invading. Army planes took off from Borinquen Field and strafed what they thought were landing craft in the adjacent bay, and shore gunners also engaged the nonexistent assault force.

Unity of command had been a problem in Panama, where the same division of authority that contributed to the Pearl Harbor disaster prevailed on the eve of war. In the autumn of 1941,

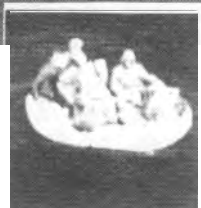
General Marshall had resolved to establish a command responsible for the overall defense of the Panama Canal and its approaches. Because aviation figured so prominently in plans to locate and destroy an attacker, the Army Chief of Staff wanted General Andrews, in whom he had special confidence, to take charge. The Navy did not agree, however, and the local naval district remained independent of the Army's Panama Department, with the commanders of the two organizations coordinating their defensive activity.

After the attack on Pearl Harbor revealed the inadequacy of such an arrangement, Secretary of War Stimson raised the issue at a cabinet meeting, and President Roosevelt promptly agreed that greater unity of command was necessary for the security of the canal. Taking a map of the existing Caribbean Command, the Chief Executive wrote "Army" over the Panama sector and "Navy" over the outer perimeter that stretched from Cuba through the West Indies. As a result of the President's decision, General Andrews, as commander of the Caribbean Command, exercised unified command over the Canal Zone, its western approaches, and the waters immediately to the east, while the Navy provided a commander for all forces in Jamaica and beyond.

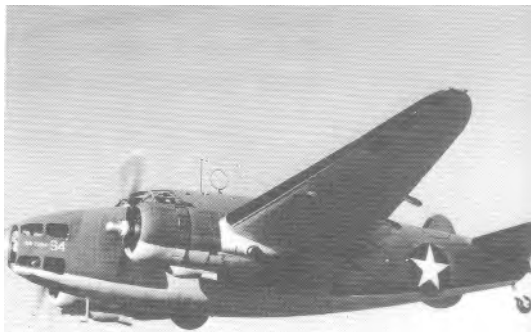
Whether in the Caribbean, on the Gulf Coast, or along the Atlantic seaboard, German submarines posed a deadly threat, at times sinking tankers or merchantmen within sight of shore. Essential though it was, the campaign against the U-boat bore no resemblance to the prewar interception of the *Rex*, a passenger liner that followed a prescribed course and schedule, or the attacks on surface warships that proponents of the GHQ Air Force had envisioned when they spoke in the mid-1930s of aerial coast defense. Rarely surfacing during daylight except to increase speed or recharge their batteries in an emergency, the submarines were essentially invisible given the technology of early 1942. All that the airmen knew for sure was that the raiders would try to attack individual ships or convoys in the shipping lanes used by merchant vessels. Until depth charges and radar became available, aircrews had to search the seas with binoculars while flying B-17s, B-18s, and even A-20s that carried general purpose bombs.

Initially the Army aircraft flew routine patrols in areas of U-boat activity, sometimes passing over a sector and then doubling back in the hope of catching any unwary captain who might have surfaced after the bomber passed. Beginning in May 1942, aircraft joined antisubmarine vessels in escorting coastal convoys. The Navy's long-range patrol bombers proved better suited than Army bombers for this role because of their lower cruising speed

The U-boat Menace



The Japanese attack on Pearl Harbor surprised German naval authorities as much as it did the American Navy and the Army Air Forces. Japanese submarines never seriously endangered the American western coast. Six weeks after Pearl Harbor, however, German undersea craft began taking their toll off the East and Gulf coasts. Germany could at first muster only five submarines for an assault on shipping in American waters. Neither the Navy nor the Air Forces had forces ready to meet the threat of the German *Unterseeboot*. By June 1942, U-boats had sunk 171 ships off American shores, a success rate influenced by confusion and rivalries in Air Forces and Navy command structures, an initial failure to convoy ships, and the refusal of ocean-side city governments to institute blackouts and prevent the U-boats from spotting targets against an illuminated shoreline. Army air patrols eventually covered the entire eastern seaboard, the Caribbean, the Bay of Biscay off France, the Mediterranean, and the waters off west Africa to counter the German undersea menace. Above, a B-24 puts charges on a U-boat's beam; a life raft with six of the boat's crew (*inset*) was seen two days later. Another aerial run places depth bombs astern of a raider (*left*) running at top speed. Below are shown a B-18 with magnetic anomaly detector gear in the long boom at the tail and a Lockheed A-29, a type which sank *U-701* in July 1942 in one of the few direct sinkings of a U-boat by aircraft. Aggressive aerial patrolling, the use of ULTRA intelligence, cooperation with Allied naval units, and telling attrition of the U-boat arm eventually defeated the Axis naval offensive.



and greater endurance. Antisubmarine missions, whether escort or patrol, sank few U-boats, but the aircraft harassed the enemy, forcing the boats to remain underwater during the day and, after the introduction and widespread use of airborne radar, to dive frequently at night also. When submerged, submarines traveled on battery power, which reduced speed, range, and the probability of finding and attacking Allied ships. Running beneath the sea added to the discomfort of the crews, whose members by the end of a cruise were scraping a layer of mold from their bread, and even the canned goods seemed to smell and taste of diesel oil. Although actual sinkings of German submarines by aircraft were rare, the unceasing threat of aerial attack reduced the effectiveness of the submarines.

During the critical spring of 1942, Army airmen fighting the war against German submarines operated under Navy control, receiving their assignments from the commanders of the Gulf, Eastern, or Caribbean Sea Frontiers. The arrangement proved awkward, however, for the naval staffs often were uncertain about the availability of Army Air Forces units, the training of the crews, or the condition of the aircraft. At last, in the spring of 1943, Admiral Ernest J. King reorganized the war against German submarines. King, who had become Commander in Chief, U.S. Fleet, in December 1941 and succeeded Stark as Chief of Naval Operations in March 1942, persuaded the Joint Chiefs of Staff to establish the Tenth Fleet, a command post located in the Navy Department that exercised centralized authority over the antisubmarine campaign. Naval officers retained control over Air Forces bombers, and the Air Forces assumed clearly defined responsibility not only for providing trained squadrons but for aircraft maintenance as well. This revised arrangement lasted but a few months, for it satisfied neither Arnold, who wanted to use Air Forces bombers to attack shipyards instead of individual submarines, nor King, who not only was seeking bombers of his own but disliked dealing on equal terms with the Commanding General of the Army Air Forces, whom he regarded as at best a satellite member of the Joint Chiefs of Staff. In mid-1943, Arnold and Maj. Gen. Joseph T. McNarney fashioned an agreement with Vice Adm. John S. McCain to remove Army heavy bombers from naval control. In effect, the Air Forces diverted new, radar-equipped B-24s to the Navy in return for the squadrons flying antisubmarine missions.

Improvisation characterized the Battle of the Atlantic, especially in its early months. Civilian pilots in privately owned light planes searched the coastal waters of the United States for submarines. In the hands of the Navy, strategic bombers designed for the Army

Air Forces became successful long-range patrol craft, helping drive the enemy from American shores, from the waters off Iceland and Greenland, and from the Bay of Biscay. The greatest piece of improvisation, however, was the escort carrier, a converted merchantman that, beginning in 1943, accompanied the transatlantic convoys into the most dangerous midocean areas, providing continuous air cover throughout the passage. Antisubmarine warfare profited, moreover, from the work of cryptanalysts who helped locate the German wolf packs and discover their plan of attack.

Securing the East Coast of the United States and protecting the Atlantic sealanes were tasks included in RAINBOW 5, the basic American war plan, which also called for essentially defensive operations in the Pacific, operations designed to contain Japan until the defeat of Germany. Even had the American planners decided otherwise, the disaster that befell the Pacific Fleet at Pearl Harbor would have forced the United States onto the defensive against Japan. American forces in the Pacific tried to relieve the garrison at Wake Island but turned back short of the objective; as the planners of the attack on Pearl Harbor had intended, the crippling of the Pacific Fleet cleared the way for a series of Japanese victories.

The Japanese blow to the Philippines proved as devastating to Army aviation as the attack on Pearl Harbor had been to the Navy's battleships, even though General Douglas MacArthur's headquarters at Manila knew of the raid on Oahu within an hour after the bombs started falling there. Precisely what happened on the morning of December 8 on the island of Luzon, across the international date line from Hawaii, remains concealed in the fog of war: the principals have died and key documents were destroyed during the Japanese conquest of the Philippines. On the one hand, Maj. Gen. Lewis H. Brereton, the air commander, insisted that he recommended an immediate strike against the airfields on Formosa (now Taiwan) with the eighteen B-17s at Clark Field, warning at the time that the bombers could be destroyed unless they went into action promptly. On the other, General MacArthur and his chief of staff, Maj. Gen. Richard K. Sutherland, denied that Brereton made any such request. In fact, both went further: MacArthur, five years after the fact, argued that an attack on Formosa would have been suicidal and Sutherland claimed that the bombers should not have been at Clark Field but at Del Monte on the island of Mindanao, beyond the reach of the enemy. What emerges is that an attack was proposed by someone, that Brereton supported the idea even if he did not

originate it, and that the operation was postponed to permit a last-minute reconnaissance to obtain aerial photographs that would supplement the inadequate charts of Formosa available to the American flyers. Also, if the attack had been delayed until the following day, some of the B-17s would have been shifted for the night to a nearby auxiliary airfield and brought back to Clark Field before dawn. Such a delay seemed likely at the time, for the bomber commander, Lt. Col. Eugene Eubank, did not receive orders for a photographic mission over Formosa until mid-morning of December 8, and by then the enemy was stirring.

Early morning fog paralyzed most of the Japanese squadrons based on Formosa, so that only a small formation of army aircraft could take off and bomb targets in the vicinity of Lingayen Gulf, some seventy-five miles north of Clark Field. The hundred-odd Japanese navy bombers scheduled to leave the ground at seven in the morning remained fog-bound until ten; and by then radio monitors on Formosa were picking up indications that Brereton was launching his bombers. The Flying Fortresses had indeed taken off, but only to avoid being caught on the ground during an attack on Clark Field. General Arnold recalled that before leaving the West Coast for Washington he had obtained access to the trans-Pacific telephone and cautioned Brereton against allowing the enemy to catch the American aircraft parked on the tarmac and destroy them, as had happened in Hawaii. At about eight, probably in reaction to the Japanese army bombers approaching the Lingayen Gulf rather than as a consequence of a call from Arnold, the two squadrons of B-17s roared aloft to remain out of harm's way for more than two hours. While the bombers were in the air, orders reached Clark Field for an attack on Formosa, photo reconnaissance or none, and the first of the B-17s began landing at about eleven o'clock to refuel and load bombs. Unfortunately, the Clark-based fighters that had taken off earlier when the Japanese formation passed Lingayen Gulf had also landed and were refueling.

By that time, the sun had burned away the fog over Formosa, enabling the main force of enemy aircraft to take off for an attack on Clark Field. Once the formation made its landfall, observers began reporting its progress toward the Manila area. The information center at Nielson Field realized that Clark Field was among the targets and issued a warning that arrived too late to save either the fighters or the bombers. When the raiders appeared, the P-40s were preparing to take off, while the B-17s remained parked on the apron. Two waves of Japanese bombers and one of strafing fighters wiped out the Flying Fortresses on the ground at Clark Field (the sole survivor was airborne on reconnaissance), and only

three of the P-40s managed to do battle, downing three or four hostile fighters. Iba Field also came under attack at this time, and there, too, the destruction was all but complete. During the first morning of the war, General Brereton's command lost roughly half its aircraft, including seventeen of thirty-five B-17s, at a cost to the Japanese of only seven fighters.

Had the prewar dispersal plan been carried out, all of the B-17s would have been based at Del Monte on Mindanao, safely out of range of the enemy on Formosa, until conditions permitted them to stage through Clark Field and take the offensive, but General Brereton had not taken this precaution. He later explained that, in anticipation of the arrival of the Flying Fortresses that had just set out from California (and encountered the Japanese over Pearl Harbor), he chose to base about half of his existing B-17s at Clark Field, which was better equipped than Del Monte and located near MacArthur's headquarters at Manila. The latest reinforcements would land at Del Monte and bring that primitive airfield to full operating capacity, accommodating two-thirds of his expanded force of B-17s. General Sutherland remembered things differently, however; he blamed Brereton for disobeying an order to concentrate the bombers on Mindanao, but no copy of such an order has survived and no disciplinary action was taken against the Air Forces officer, who later had important assignments in North Africa and Europe. In his memoir, *Global Mission*, written almost a decade after the attack on Clark Field, Arnold confessed that he had "never been able to get the real story of what happened in the Philippines."

The surviving bombers at Del Monte and elsewhere continued to fight, manned by crews and serviced by mechanics who subsisted on canned corned beef from quartermaster stores and pineapple grown on Mindanao. Until Clark Field became untenable, the B-17s staged through it, as three bombers did on December 10 to attack the Japanese invading northern Luzon. The pilot of one, Capt. Colin Kelly, became one of the first heroes of the air war against Japan. He remained at the controls of his B-17C while swarming enemy fighters shot it to pieces, sacrificing his life so that the surviving crew members could parachute from the doomed bomber. Kelly's crew erroneously received credit for sinking a battleship, but at best his bombardier, Cpl. Meyer Levin, may have scored near misses on a cruiser. A lack of training in ship identification, the combined fear and excitement of aerial combat, and utter confidence that the bomber could sink a battleship helped cause the error. Although the target probably escaped with little or no damage, Kelly's action saved the lives of six crew members; he was a hero at a time when the nation desperately needed heroes.

Philippines Defense



With tensions rising in the Pacific area and American-Japanese relations continuing to deteriorate through the summer of 1941, the U.S. War Department gave hasty but ineffectual attention to reinforcing the garrison in the Philippines. An American colonial possession since the turn of the century, the islands were threatened by Japanese designs in the region. War Plan ORANGE, the color-coded contingency blueprint for hostilities with Japan, called for a ground and air defense of the northernmost island of Luzon, with the archipelago's capital of Manila, while a U.S. Navy task force fought its way across the Pacific to lift the siege.

The center of preparations for air operations was at Clark Field, seventy miles north of Manila (above), a flat, poorly drained expanse within bomber range of Japanese targets on Formosa. Here, Brig. Gen. Harold H. George (right portrait), unrelated to the Air Transport Command's leader, commanded air units, and the flow of reinforcements as a member of General Douglas MacArthur's staff after May 1941. By late summer, the energetic George had influenced heavily the plans for potential air operations against Japan and received the first of 163 promised B-17Cs and -Ds (right, midpage). On October 15, 1941, Maj. Gen. Lewis H. Brereton (left portrait) arrived as commanding general, Far Eastern Air Force, headquartered in Manila.

In a still unexplained series of events, the Japanese caught most of the American bomber force on the ground on December 8, 1941, when they attacked the Philippines. Brereton left Manila on Christmas Day 1941 when Far Eastern Air Force transferred to Australia, then entered the losing battle for Java. General George directed the fighter defense of the embattled forces in Bataan and Corregidor Island. His inadequate fighter arm relied heavily on the P-40 Warhawk (bottom, right). He escaped the debacle with General MacArthur in 1942, only to perish in an air crash in Australia on April 29.



Abandoned as a permanent base for B-17s by the end of December, Del Monte served in January as the staging area for B-17s operating out of the Netherlands East Indies against targets in the Philippines. In April, within a month of the surrender of the American forces in the Philippines, a force of ten B-25s and three B-17s arrived at Del Monte from Port Darwin, Australia. One of the Flying Fortresses attacked Japanese-occupied Manila by night, but its bombs exploded harmlessly in the bay. The B-25s, however, were more successful in harassing Japanese coastal shipping off Mindanao; at best, this gallant mission did little more than annoy the enemy.

Although the defenders of the Philippines had adequate warning, Japanese air power had again destroyed a deterrent force, wiping out the B-17s at Clark Field as efficiently as it had crippled the battle fleet at Pearl Harbor. Before the war, one of the American fighter pilots at Clark Field, 2d Lt. Max Loux, had written his sister that "we are doomed from the start." He expected the small air force to which he was assigned to be overwhelmed by the Japanese, but he believed the islands could nevertheless hold out. "We know we are here for the duration," he told her on the eve of the conflict, "even if it be ten years, so we are anxious for it to start so it will be over sooner." On December 8, as the Japanese attacked the airfield, his P-40 had just cleared the runway when an incendiary bomb struck the aircraft, setting it on fire. He crashlanded successfully, but died when the canopy jammed, trapping him in the cockpit. The defense of the Philippines lasted only six months, instead of the ten years that Loux had suggested, and ended with an American surrender.

Despite the succession of victories—Pearl Harbor, Wake Island, Hong Kong, Singapore, the Philippines, and Burma (Myanmar)—Japan was fighting a limited war in terms of resources and strategic aims, making devastating use of its available manpower and material. Critically short of oil, steel, rubber, and aluminum, Japan invested what it had in a series of bold operations designed to capture what it needed so badly. For example, by using the forty-eight million barrels of oil husbanded as a reserve, Japan hoped to acquire a virtually limitless supply in the Netherlands East Indies. To effect its conquests, Japan had no aircraft capable of strategic bombing from bases on land. Even if these bombers had been available, the vastness of the Pacific would have protected the continental United States from aerial bombardment just as that same ocean now protected Japan from American wrath. Unable to achieve decisive results against the American

heartland, the Japanese had used the aircraft carrier to extend the range of their bombers and neutralize the Pacific Fleet at a single stroke. With the American fleet out of the war, at least temporarily, carrier forces and short-range army aircraft supported the succession of operations designed to gain for Japan the foodstuffs of the Philippines, the rubber and ore of Malaya, and the oil of the Netherlands East Indies and Burma. Having conquered all this, Japan intended to establish a defensive perimeter so strong that the United States would hammer away unsuccessfully until the American people lost heart and accepted the existence of this newly fashioned Japanese empire.

Such was the scenario of the Japanese militarists who dominated the government of Japan, breaking any political combination arrayed against them. To the most belligerent of these leaders, war with the United States entailed few risks, for they believed that the Japanese warrior spirit would prevail. This confidence reflected the combination of racism and nationalism that for a generation or more had disturbed relations between the United States and Japan. Whereas racists in the United States had considered the Japanese unfit to immigrate and incapable of being absorbed into American society, Japanese militarists staked the country's survival on a vaunted racial and national superiority. The Japanese fantasy failed to take into account American industrial capacity, which in 1941 dwarfed that of Japan; the leaders of the island nation had reduced war to a test of wills. Admiral Isoroku Yamamoto, who inspired the attack on Pearl Harbor, respected the industrial power of the United States, but he could not overcome the optimism of those who believed that Japan could defend its line of outposts until a disheartened America negotiated a peace giving the Japanese control of the oil and other essential resources they had conquered.

Just as most Japanese leaders tended to be contemptuous of the United States, many in the West were supremely confident of their own abilities and armaments, certain that Japan could neither produce first-rate weapons nor use them effectively. Yet, to the surprise of the Allies, the Japanese had developed thoroughly modern aircraft to carry out the strategy of limited war. British naval officers on board the *Repulse* and the *Prince of Wales* in December 1941 did not realize that the enemy possessed a land-based torpedo bomber until twin-engine Mitsubishi G3M2s skimmed the surface of the South China Sea to release the deadly missiles that helped sink these warships. Nor did American airmen heed Claire Chennault's warning of a deadly new Japanese naval fighter, the Mitsubishi A6M, also called the Zero fighter because of its designation of Zero-Sen or type 0. While flying for the

Chinese government, Chennault's American Volunteer Group, the Flying Tigers, encountered the fast, nimble, long-range airplane and discovered that designer Jiro Horikoshi had given it the ability to turn more tightly than any Allied aircraft. As the Flying Tigers discovered, and others soon learned, American pilots had to avoid dogfights and use their greater diving speed and overwhelming firepower to pounce on the Zero, which obtained its range and quickness by sacrificing armor, structural strength, and self-sealing fuel tanks.

When the battleship *Arizona* exploded and sank to the bottom of Pearl Harbor, Japanese flying schools produced about 2,000 pilots in a year, a total divided almost equally between the army and navy. In contrast, the U.S. Army Air Forces alone graduated some 11,000 pilots in 1941. At this time, Japan had about 2,700 modern aircraft, half with the army and half with the navy. This force was overwhelmingly superior to the few hundred planes, many obsolete, that the Allies in 1941 and 1942 could muster in the far Pacific; moreover, many Japanese pilots had honed their skills against the Chinese. As a result, Japan had a clear advantage in men and equipment at the outset. Japanese leaders, however, failed to anticipate the attrition in men and machines that war with the United States would bring and maintained production schedules and training programs geared to the desultory fighting in China, where the Japanese held the initiative, rather than to a defensive war across the breadth of the Pacific.

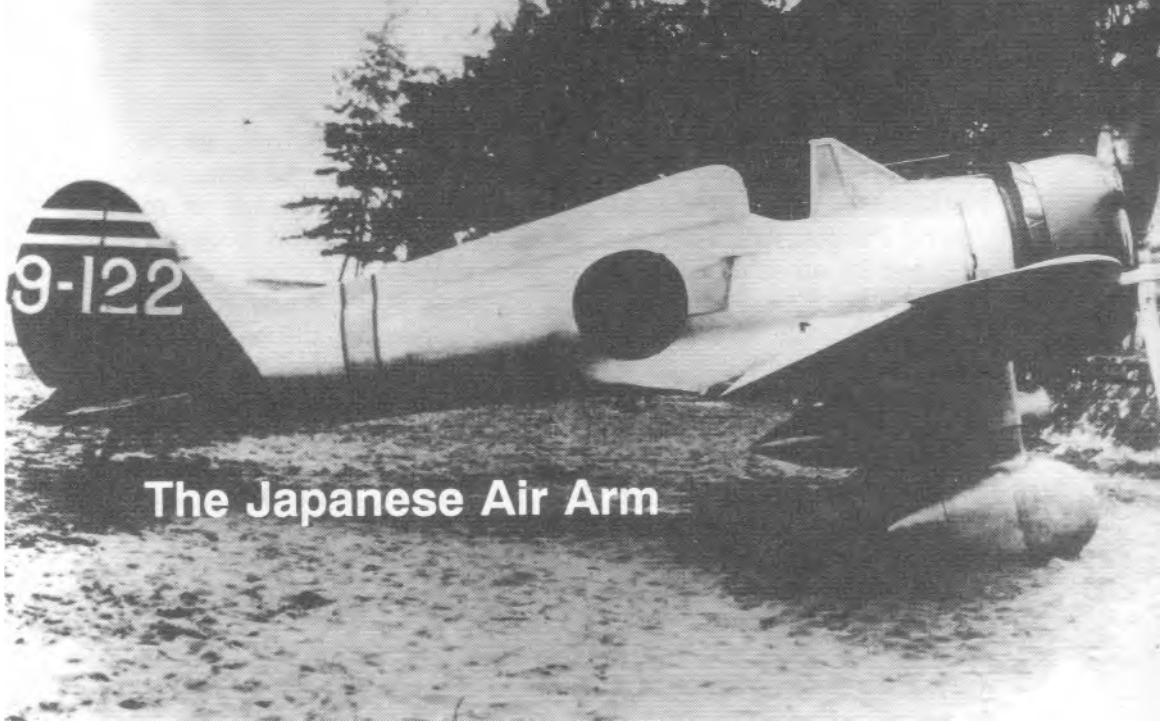
As Admiral Yamamoto realized, Japanese productive might did not approach that of the United States. During the last three years of peace in the Pacific, American aircraft production had more than quadrupled, from 6,000 units per year to more than 26,000, while Japan's annual output rose by a mere 600 aircraft to not quite 6,000. By 1944, the year of peak production for both countries, the United States turned out 96,000 airplanes, more than three times the Japanese total. The army and the Imperial Japanese Navy further hampered production by refusing to standardize aircraft components. The army, for instance, used a 24-volt electrical system throughout the war, but the navy did not follow suit until 1945. Both services developed a .50-caliber machinegun, but the two weapons used a different cartridge. The army and navy steadfastly refused to enter into joint development or production ventures, even though these would have conserved manpower, plant capacity, and scarce materials.

Ignoring the limited capacity for building aircraft and training pilots, Japan had risked its very existence in an attempt to wrest from Great Britain and the Netherlands those natural resources essential for modern warfare and then fight the United States to a

standstill. For a time the gamble seemed to pay off, as the Japanese carved out an empire that embraced Malaya, the Netherlands East Indies, the Philippines, and the islands of the central Pacific. Allied propaganda in that dismal period frequently depicted Japan as an octopus, its head at the home islands and its tentacles stretching toward Alaska, Hawaii, Australia, and India. The Allies could find few sources of consolation: the gallant but unsuccessful fight for Wake Island; the tenacious defense of Luzon, where a few American and Filipino airmen—men like Boyd D. Wagner, Russell Church, and Jesus Villamor—battled overwhelming odds, attacking shipping and airfields for as long as their aircraft survived and then fighting as infantrymen; and Burma, where Chennault's American Volunteer Group and their P-40Bs won heartening victories in the air, even though the Japanese triumphed on the ground. Wake Island surrendered in December 1941, however, and by mid-May the enemy had overrun Bataan peninsula and the island fortress of Corregidor, the last two outposts on Luzon, and had driven the Allies out of Burma.

From the doomed Philippines, Brereton and Brig. Gen. Henry B. Clagett flew to Australia, where until February 1942 they were the senior airmen trying to reorganize the remnants of the Far East Air Force. Maj. Gen. George S. Brett, in China on a tour of inspection, received orders to assume command of the American forces in Australia and almost immediately was promoted to lieutenant general. He had scarcely taken charge when he was appointed Deputy Supreme Commander of a new American-British-Dutch-Australian Command headed by a British general, Sir Archibald P. Wavell. In his capacity as Wavell's deputy, General Brett had no direct control over the employment of American troops. As a result, General Brereton, the senior American officer after Brett, temporarily became the U.S. Army commander in Australia, although he also acted as Deputy Chief of Air Staff for Wavell's command. In April 1942, after General MacArthur arrived in Australia from the Philippines and assumed command of the new Southwest Pacific Area, Brett became his air officer.

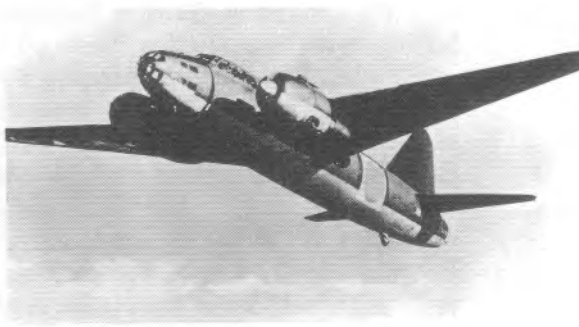
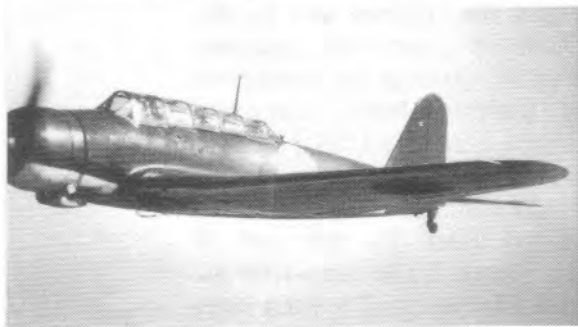
Airmen like Brett and Brereton had little to work with in trying to stop the Japanese advance. Typical of the problems they faced was the fate of the men and aircraft carried in a convoy originally bound for the Philippines but diverted to Brisbane, Australia, immediately after the attack on Pearl Harbor. The ships carried eighteen P-40s; fifty-two crated Douglas A-24s, the Army version of the Navy's SBD dive bomber; and the 8th Materiel Squadron, which formed the ground echelon of a B-17 group under orders to



The Japanese Air Arm

Japanese aircraft manufacturers of the late 1930s were dismissed in the West as being unsophisticated and given to copying foreign designs. The Imperial Navy especially promoted the development of modern designs influenced by Japan's maritime character. By the late 1930s, the Mitsubishi concern had supplied an all-metal monoplane in the A5M4 (*above*), code-named CLAUDE by U.S. Navy intelligence, for the Japanese Navy. Comparable in size and performance to the American Boeing P-26, it was a transitional design and the forerunner to the same company's A6M *Reisen* (*opposite, above*), shown in a captured late-war model. Coded as ZEKE, but forever known as the Zero, its successive variants dominated aerial combat in the Pacific until 1943. The Japanese also fielded a superior torpedo bomber in the Nakajima B5NJ, with the U.S. Navy code name KATE (*opposite midpage, left*). The Mitsubishi G4M medium bomber, coded as BETTY (*opposite midpage, right*), was the most widely used Japanese bombardment aircraft, though its unprotected fuel tanks were highly susceptible to battle damage and explosions. The Nakajima Ki 43 *Hayabusa*, known as OSCAR (*opposite below, right*), was built in larger numbers than any other Japanese fighter and matched the Zero's superb performance against Allied aircraft in the first half of the war. Also shown in the array opposite is the Kawanishi H8K (EMILY), the single best combat flying boat of the war; four of these machines carried out a mission against Hawaiian targets in March 1942, aborted only because weather obscured the objective. The Kawasaki Ki 61 *Hien* (TONY) was aerodynamically sound but suffered from the balkiness of its license-built Daimler Benz DB 601 engine, one of the few liquid-cooled motors in Japanese inventories. The original DB 601 powered the *Luftwaffe's* Bf 109.





proceed to the Philippines. Although trained to maintain the new B-17Es of the 7th Bombardment Group, which the outbreak of war had stranded en route to the Philippines, the matériel squadron helped assemble the fighters and dive bombers delivered by the convoy. Since the combat elements of the B-17 group were scattered from Hawaii to Java as reinforcements, the matériel squadron never rejoined its parent organization. The A-24s, moreover, were slow in getting into the fight for Java because the firing switches for the two forward-firing machineguns were missing, possibly destroyed with the crates in which the aircraft had arrived. In keeping with his style of management, General Arnold personally directed the shipment of replacements for the missing solenoids, which were available only in the United States. To make assurance triply sure, he shipped 312 of the switches, three times the number needed: 104 by air across the Pacific, another 104 by trans-Pacific sea convoy, and the final 104 by air across the south Atlantic and Africa.

Although Java-based B-17s did damage Japanese shipping anchored at Davao on the island of Mindanao, those bombers, the recently arrived A-24 dive bombers, and the fighters sent to the Netherlands East Indies were all unable to check the Japanese onslaught. In a daring, perhaps foolhardy, attempt to strengthen the Allied forces in the embattled Dutch colony, thirty-two precious P-40s were loaded as deck cargo onto the USS *Langley*, the former coal carrier that had been converted into the Navy's first aircraft carrier, but Japanese aircraft sank the ship as it tried to steam in daylight from Australia to Java. By the end of February 1942, defeat was certain. On March 2 the American air units withdrew from the Netherlands East Indies, and a week later the Dutch surrendered. The combined American-British-Dutch-Australian Command, responsible for the defense of the approaches to Australia, lacked the resources for its task.

When the Netherlands East Indies passed from Dutch to Japanese control, planning had already begun to avenge, at least symbolically, the defeat at Pearl Harbor. Two naval officers, Captains Francis S. Low and Donald B. Duncan, suggested attacking Tokyo with Army medium bombers launched from an aircraft carrier some 500 miles from the target, a proposal that General Arnold enthusiastically endorsed. Such a mission, however, presented grave danger not only for the bomber crews but also for the officers and men of the ships involved—the carrier *Hornet*, which would launch the strike; the *Enterprise*, whose air group would defend the task force; and the escorting warships. Coaxing a heavily loaded bomber from a rolling deck posed a challenge to the best of pilots, even though the aircraft carrier

would be steaming into the wind, reducing the required takeoff speed. Once airborne, the bombers would require precise navigation to locate the assigned targets and continue to designated airfields in China, where they would reinforce the American warplanes already operating in that country. Before the airmen faced these perils, the small naval task force would have to penetrate undetected through hostile seas, sailing where no American surface ship had dared to go since the outbreak of war and in the process risking two of the seven first-line aircraft carriers then in service. To lead the mission, General Arnold selected Lt. Col. James H. Doolittle, who gathered a force of sixteen B-25Bs and trained their crews.

En route to the launching point off Japan, the task force encountered Japanese patrol craft. The task force commander, Vice Adm. William F. Halsey, Jr., proposed to dispatch the bombers at once, and Doolittle agreed, even though the *Hornet* was more than a hundred miles farther from shore than planned. At an air base in Florida, Doolittle's pilots had practiced taking off from a runway marked to represent a carrier's flight deck; now they faced the real thing. On the morning of April 18, 1942, Doolittle released the brakes and sent the first B-25 thundering down the flight deck into a 40-mile-an-hour gale. His bomber clawed its way upward and led the force to Japan, where 13 of the raiders bombed Tokyo, while the other three attacked Kobe and Nagoya. After bombing Japan, the B-25s headed for China, but bad weather and the additional fuel consumed because of the early launch forced the crews to abandon or crashland all the planes but one, which touched down safely not in China as planned but at Vladivostok in the Soviet Union. Three of Doolittle's seventy-nine airmen died in crash landings or parachute jumps, and Japanese patrols took eight prisoner. Of those captured, three were executed by firing squad, another died in confinement, and the other four survived a brutal imprisonment.

Intended to satisfy President Roosevelt's desire to strike directly at Japan, thus boosting American morale and possibly shaking Japanese confidence, the raid inflicted trifling damage. It did demonstrate that the United States could deliver an occasional jab against the Japanese—as the Navy already had in raiding recently captured Wake Island, enemy bases in the Marshall group, and the enemy's beachhead in northeastern New Guinea—while gathering strength for a knockout blow against the Germans in Europe. Doolittle's attack had no effect on Anglo-American strategy, except to enable President Roosevelt to suggest that the bombing of Japan might have diverted Japanese naval forces from the Indian Ocean, where a foray had aroused British Prime Minister

Winston Churchill's unfounded concern about possible cooperation with Germany in the vicinity of Suez.

The boldness of the Doolittle raid stung the Japanese, who reacted in three ways. The army promptly organized air groups for the defense of Japan against future air attacks, and some 250 aircraft were dedicated to this role when the bombing of the home islands resumed in June 1944. The attack also ensured the army's enthusiastic participation in an attempt to extend the far-flung defensive perimeter by seizing Midway Island as the naval leadership had been demanding. Finally, Japanese troops in China mounted an offensive that soon overran the airfields where the B-25 crews had intended to land. The Chinese government at Chungking, headed by Generalissimo Chiang Kai-shek, may have foreseen such a reaction, for it had agreed only reluctantly to the Doolittle raid.

Shortly after Doolittle's flyers bombed Japan, Navy signal intelligence specialists decoded message traffic indicating an enemy move early in May against Port Moresby in southeastern New Guinea. As the time approached, the defenders shifted their aircraft carriers to meet the threat and sent Army bombers to search seaward. Some of these B-17s did detect a Japanese screening force and dropped a few bombs without effect, but land-based bombers took no part in the main action.

The Battle of the Coral Sea, fought on May 7 and 8, 1942, was a struggle between American and Japanese carrier aircraft. The U.S. Navy lost a large carrier, more than sixty planes, a destroyer, and a tanker; American naval aviators sank a light carrier and damaged a bigger one, depriving the enemy of the air cover necessary for the assault on Port Moresby, which the Japanese canceled. The Battle of the Coral Sea had scarcely ended before decoded Japanese radio traffic revealed an impending attack on Midway Island, an operation designed to draw out and destroy what remained of the U.S. Pacific Fleet, while at the same time extending the defensive belt protecting Japan and ensuring against repetition of the Doolittle raid. A carrier task force, trailed by a formation of battleships and an invasion group, approached Midway, while other Japanese naval units prepared to attack the Aleutian Islands, thus diverting attention from the main objective. Alerted by the decoded messages, Admiral Chester W. Nimitz, the Commander in Chief, Pacific, marshalled three carriers against the four that spearheaded the assault.

Since he was responsible for repelling the enemy thrust, the admiral exercised operational control over Maj. Gen. Clarence L. Tinker's Seventh Air Force, which had risen from the ashes of

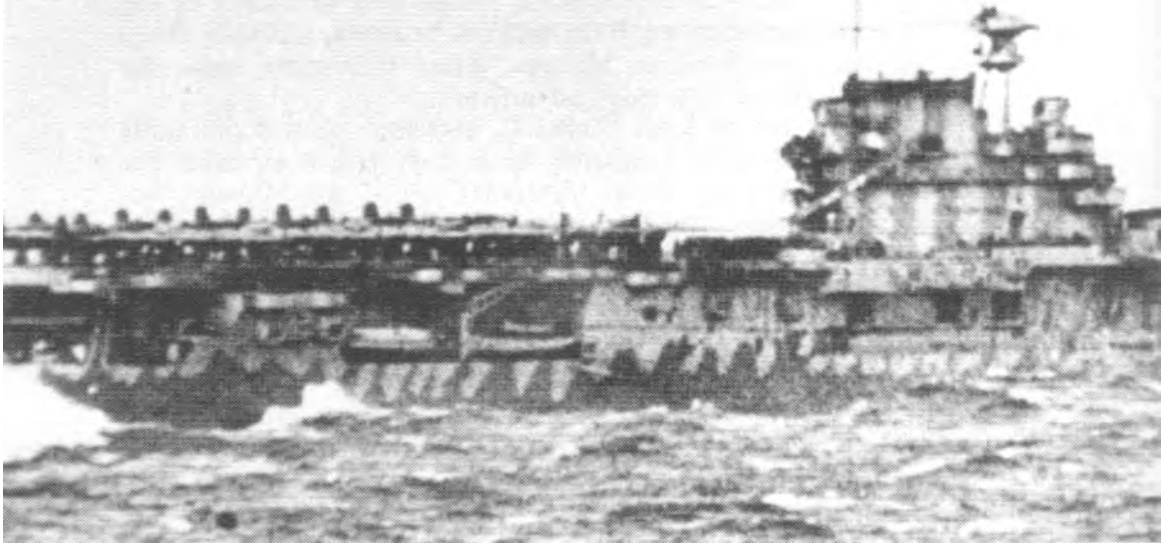
General Martin's Hawaiian Air Force. Tinker wanted to attack Wake Island, a likely staging area for the enemy, but his B-17Es lacked the range. Instead, Admiral Nimitz sent seventeen of the Flying Fortresses and four B-26 medium bombers, hurriedly fitted out to drop torpedoes, to Midway, where they came under the operational control of a Navy air officer.

The B-17s, led by Maj. Walter C. Sweeney, opened the battle on June 3, following a sighting by a Navy patrol aircraft. The bombers attacked the troop transports bound for Midway, but caused no damage. The next morning, after Navy flyers had located the enemy's carriers, the four B-26s attacked with torpedoes, losing two of their number to anti-aircraft fire but inflicting no damage on the warships. A formation of B-17s en route to attack the transports received orders to hit the carriers instead, but once again the bombs fell harmlessly into the sea. By the time the Battle of Midway ended on June 6, the B-17s had dropped some 300 bombs during 55 sorties, but failed to score a single hit, demonstrating that the strategic bomber, using conventional high-altitude tactics, posed little danger to warships under way.

A struggle between carrier task forces like the recent engagement in the Coral Sea, the Battle of Midway was a victory for the dive bomber. Navy aircraft of this type fatally damaged three Japanese aircraft carriers in a span of just three minutes on the morning of June 4. That afternoon they crippled the fourth carrier, which its crew had to scuttle on the following day; and on June 6, they sank a cruiser already damaged in a collision. The enemy, moreover, used dive bombers in conjunction with torpedo bombers to damage an American aircraft carrier, USS *Yorktown*, which finally succumbed to submarine attack. The American ship-building industry had the capability to replace the *Yorktown*, but Japanese shipyards lacked the capacity and the steel to restore to full strength the mobile striking force that had triumphed during the early months of the war. Besides the ships, the battle of Midway cost the Japanese navy its cadre of veteran pilots who had won victories from Pearl Harbor to the Indian Ocean; because of Japan's limited training establishment, this was a staggering loss.

Despite the success of the dive bomber at Midway (not to mention Germany's earlier use of the Ju 87 Stuka), this type of craft proved incompatible with General Arnold's vision of air power, even though he had reluctantly equipped one bombardment group with the very type used so successfully by the Navy in this battle. A misplaced confidence in the ability of the heavy bomber to sink warships from high altitude affected the general's judgment, but he had other and sounder reasons for preferring other types of aircraft. For short-range missions, the fighter could

Symbolic Strike at Japan



For five months after the attack on Pearl Harbor, the tide of war in the Pacific ran in favor of the Japanese. In early April 1942 the main body of American forces in the Philippines surrendered, leaving a doomed garrison on the island of Corregidor to fight on. About to be realized was a bold plan to strike Japan with Army bombers brought within range by a Navy aircraft carrier.

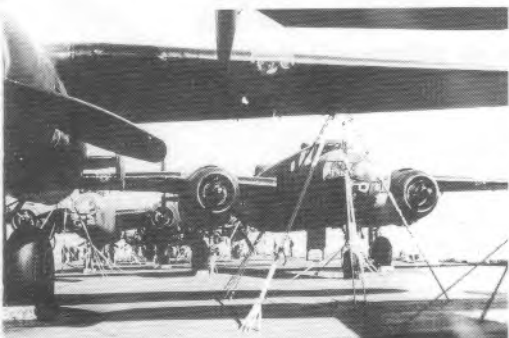
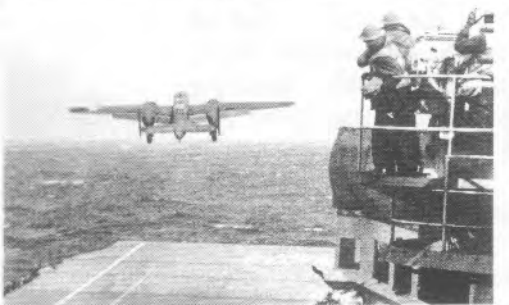
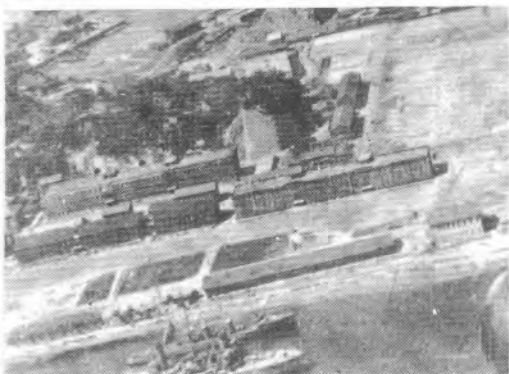
On April 18, a task force including the newly commissioned USS *Hornet* (CV-8) entered Japanese waters, the carrier steaming with sixteen B-25s lashed down on her deck. Eighty Army fliers under Lt. Col. James H. Doolittle prepared for the difficult takeoff from the ship 400 miles from their targets. An encounter with a Japanese trawler forced the planes off 650 miles from shore instead. Stripped of most defensive armament and equipped with additional internal fuel tanks, the B-25s also lost their heavy bombsights, replaced by two simple metal strips set in the bombers' glazed noses and calibrated for attacks from 1,500 feet. With three 500-pound bombs and an incendiary, each bomber strained off *Hornet's* bow and headed for targets in one of five cities: Tokyo, Kobe, Yokohama, Yokosuka, and Nagoya. Unable to return to the carrier, the B-25s were then to head for landings at Chuchow, in China. Doolittle buzzed

Tokyo three days after a local radio broadcast proclaiming that the capital would never be bombed. All sixteen planes were lost in the raid, one interned in the Soviet Union. Eight fliers fell into Japanese hands in China and three of these were executed by their captors; the Chinese who helped the American fliers suffered the more at the hands of their enemies. The Japanese obliterated Chuchow and murdered local Chinese mercilessly.

Doolittle's plane is first off the carrier in the photo above. In photos opposite, (clockwise from above, right) crews break out cases of .50-caliber ammunition. Capt. Marc A. Mitscher, *Hornet's* skipper, confers with Doolittle just before the raid. Lashed down bombers frequently ran up their engines. At full throttle, a B-25 claws for altitude after the dangerously short roll down the deck. A glimpse of the Japanese Naval Station at Yokosuka flashes under the



raiders' noses. Jimmy Doolittle, one of America's premier aviators, beams in the inset portrait. Anticipating the possibility of court-martial for losing his entire complement of bombers, he returned to the United States a hero. Though it had little military effect, his feat astounded the Japanese government, raised American morale immeasurably, and earned him the Congressional Medal of Honor and promotion to brigadier general.



double as bomber; besides being faster than a light bomber or dive bomber, the fighter-bomber could deal on equal terms with enemy fighters once it had dropped its bombs. For any sort of interdiction, range was a dominant consideration, since Army aircraft, unlike those of the Navy, operated from immobile bases, and the larger types could fly farther. Twin-engine types like the B-25 or A-20 had greater range, carried heavier loads of explosives, and possessed more formidable armament than the Navy's SBD dive bomber or its Army equivalent, the A-24; moreover, the second engine provided a margin of safety.

The American dive bombers had claimed the last of their victims in the seas beyond Midway, when four B-24s arrived at the island. These bombers, which had greater range than the B-17, enabled General Tinker to attempt an attack on Wake Island. Aside from the real possibility of interception by the Japanese, the flight itself was dangerous, requiring precise navigation, flawlessly operating engines, and careful husbanding of fuel. Fitted with extra gasoline tanks, the bombers took off on the night of June 6 for a dawn strike, flying westward beneath an overcast that prevented the navigators from using the stars to maintain course. The aircraft could not find the tiny atoll, and only three had enough fuel to return to Midway; the B-24 that disappeared into the Pacific carried General Tinker.

To divert attention from Midway and also to extend their defensive perimeter, the Japanese attacked the Aleutian Islands with an invasion force that included two aircraft carriers. Faced with this secondary threat, Admiral Nimitz placed Brig. Gen. William O. Butler's Eleventh Air Force under the control of Rear Adm. Robert A. Theobald, who incorporated the Army airmen into the task force charged with defending Alaska. On June 3 and 4, Japanese aircraft took off from the fog-enshrouded light carriers, but on both days found clear skies over the target, the American base at Dutch Harbor. A break in the weather enabled General Butler's aircraft to attack the carriers, but neither B-17s nor torpedo-carrying B-26s inflicted any damage. Besides bombing the American base at Dutch Harbor, the Japanese occupied two undefended islands, Kiska and Attu, but the hostile presence in the Aleutians proved short-lived. United States forces recaptured Attu in May 1943, and the enemy abandoned Kiska in July of that year.

Although described by the more imaginative military analysts as a spear aimed at the vitals of the Japanese octopus, the Aleutians remained a secondary theater of operations throughout the war, and with good reason. The weather proved sullen and given to unexpected rage, and the island chain afforded few good sites for

airfields. At Adak Island, Army engineers overcame problems typical of base construction in the Aleutians when they drained a bog, scraped down to the subsurface gravel, and managed to build a mile-long runway surfaced with pierced-steel planking. Drainage there remained a problem, however; a foot of water might collect on the metal surface so that aircraft often took off and landed in clouds of spray. At all the Aleutian airstrips the steel planking was vulnerable to fierce gales that could dislodge the interconnected strips and peel them back like the skin of a banana. In these circumstances, the air offensive from Alaska, far from being decisive, consisted mainly of harassing raids against Paramushiro, the Japanese naval base in the Kurile Islands.

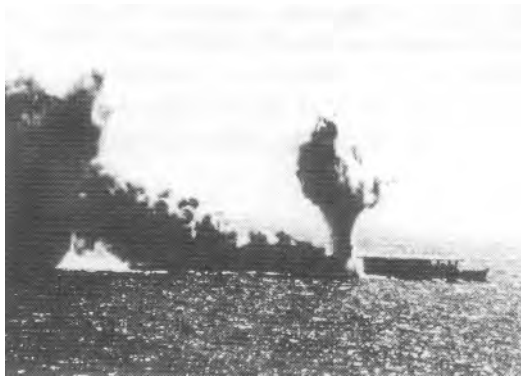
Despite the American victories in the Coral Sea and at Midway, the Japanese octopus seemed alive and menacing, with tentacles that might yet choke off the supply line to Australia and possibly enfold the continent in deadly embrace. The defense of Australia under General MacArthur therefore took on a critical importance. As MacArthur's air officer, General Brett attempted to create a supply and maintenance service to absorb the new squadrons being rushed into the Southwest Pacific Area while he simultaneously harried the Japanese advance across the Owen Stanley Mountains of New Guinea toward Port Moresby. The theater commander grew impatient with these efforts, however, and requested a replacement to take over the Allied Air Forces and also its American component. As Brett's replacement, Arnold chose Maj. Gen. George C. Kenney, who arrived in August 1942. Unlike the hard-pressed Brett, "George Kenney," in the words of a subordinate, ". . . was a real affable, convincing guy . . .; he was a born salesman." Apparently those were the qualities needed to get along with MacArthur. "Sometimes," wrote General Arnold, "we had to guard against the wrong mixture of human 'chemical,'" and the Brett-MacArthur compound obviously failed. In contrast, General Kenney gained the confidence of the theater commander, insisted on direct access to him, and remained MacArthur's air officer for the rest of the war.

The war in the Southwest Pacific proved frustrating for advocates of strategic bombardment like Brig. Gen. Kenneth Walker, who had helped shape prewar bombing doctrine at the Air Corps Tactical School and now headed Kenney's bomber command. Bombers were few, and thousands of miles of ocean separated their bases from the Japanese heartland. Instead of delivering massive blows against vital industrial targets to defeat Japan, the handful of B-17s available in the Southwest Pacific bombed heavily defended advance bases like Rabaul on the island of New Britain in the hope of disrupting shipping, destroying

Coral Sea, Midway Fleet Actions



Even as American fortunes in the Pacific war seemed at their lowest with the surrender of U.S. Army forces on Bataan in the Philippines, there came a dramatic reversal in the course of the conflict within the space of four weeks in the spring of 1942. In two climactic sea-air battles, the Japanese outward drive was halted. In early May the Japanese Combined Fleet made for Port Moresby on the south coast of New Guinea to consolidate a strong link in the defensive perimeter in the Pacific. Operating with carriers USS *Lexington* (CV-2) and USS *Yorktown* (CV-5), a patrolling American task force found the Japanese force of three flattops in the Coral Sea, due south of the Solomon Islands. In the world's first naval action in which the hostile surface units never sighted each other, aviation was the striking arm of both fleets. American fliers sank a smaller carrier on May 7 and heavily damaged a larger one the next day; the American fleet lost *Lexington* and nearly lost *Yorktown*. *Lexington* (above) lists to starboard as her crew abandons ship moments before explosions wracked and sank her. *Yorktown* (below, right) sits in a Pearl Harbor drydock where repairs, scheduled to take ninety days, were completed in three. In the last scene below, Japanese carrier *Shoho* is mortally wounded after an American aerial torpedo struck her starboard side. Her damaged sister, *Shokaku*, laid up a month, missed the next act at Midway. The Japanese abandoned forever their designs on Port Moresby and with them the possibility of threatening directly the north coast of Australia.





Turning to the mid-Pacific, the Japanese gathered a force of four aircraft carriers and a battleship element to seize Midway Island, 1,100 miles north of Hawaii, while a diversionary force moved against the Aleutian chain further north. An American naval task force with *Enterprise* (CV-6), *Hornet* (CV-8), and the patched-up *Yorktown*, fully apprised of the Japanese advance by the so-called MAGIC intercepts of Japanese coded message traffic, sailed to give battle. Aviators again tipped the balance. Early on June 4, Japanese planes had attacked the Midway defenses and were gassing up and rearming on three of their carriers for another strike when torpedo bombers from the American flattops bore in on them. Defending Zeros dove to destroy nearly every U.S. Navy torpedo plane, but left their fleet undefended from above. At that exact moment, American dive bombers entered the fray; in the five minutes after 10:24 in the morning, they sank all three carriers in the main Japanese force. The fourth went down next day in a stunning reversal for the Japanese cause; at one stroke, air power, with the advantage of superior intelligence, had placed the Japanese on the strategic defensive for the remainder of the war. Above, two Douglas SBD Dauntless dive bombers are ready to jump the remains of the Japanese fleet in the last phases of the battle on June 6. Stricken *Hiryu*, the last of the enemy carriers (right) burns before being scuttled. An Army Air Forces B-17 (bottom right) leaves a Midway airstrip to attack the Japanese. A B-26 Marauder crew (bottom left) counted over 500 holes in their ship after striking the enemy fleet. One B-26 attempted a torpedo run on enemy vessels, but dropped the missile from too high an altitude for any effect.



supplies, and downing fighters, all in an effort to check the Japanese advance. Determined to lead by example in these trying times, Walker insisted on flying on missions against Rabaul and was killed during one of the attacks. His sacrifice earned him the Medal of Honor.

Although long-range bombing could contribute little during the early months of the war against Japan, aerial reconnaissance proved especially important to the defense of Australia and its vulnerable supply line. Capt. Karl Polifka led a flight of F-4s (P-38Es stripped of armament and fitted with cameras and additional fuel tanks) that commenced operating from Australia in April 1942. At times the distances that had to be flown were too much even for the long-range F-4s; furthermore, an unarmed aircraft might not survive if intercepted by Japanese fighters over one of the more distant targets. As a result, fully armed B-17s and B-25s exchanged bombs for cameras on long-range flights that were likely to encounter enemy aircraft. For example, Flying Fortresses of the 40th Reconnaissance Squadron, later rechristened the 435th Bombardment Squadron, flew missions over Rabaul; and when the United States launched a counterthrust into the Solomon Islands, the unit's B-17s not only photographed the initial objective but also carried two officers of the assault force, the 1st Marine Division, on a personal reconnaissance flight.

In the Pacific, the United States checked the Japanese advance in the battles of the Coral Sea and Midway and gathered strength for limited offensive operations on the periphery of Japan's conquests. In the war against Germany, American forces adhered to a defensive strategy, fighting the U-boat, a weapon that had threatened to isolate the British Isles in 1917 and presented that threat again in 1942. At the same time, the United States shipped men and weapons to the United Kingdom in preparation for assaulting continental Europe. Since building an invasion force took time, air power, which could be mustered more quickly, would strike the first American blows against Germany. This aerial striking force, however, would inevitably have fewer bombers than the final objective of 6,800 or the interim goal of 3,800 set forth in AWPD/1, the blueprint for bombing Hitler into submission drafted in the summer of 1941.

The new Eighth Air Force drew the assignment of carrying the war to the enemy. In the hectic weeks after Pearl Harbor, Prime Minister Churchill, in casting about for a quick way of exerting pressure on Germany and Italy, had proposed occupying French Northwest Africa, and General Arnold created the Eighth Air Force to take part in the operation. A British defeat in the Libyan

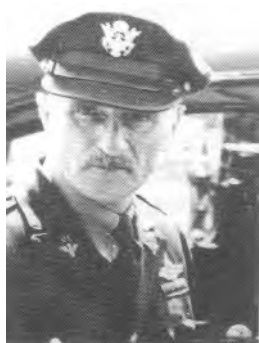
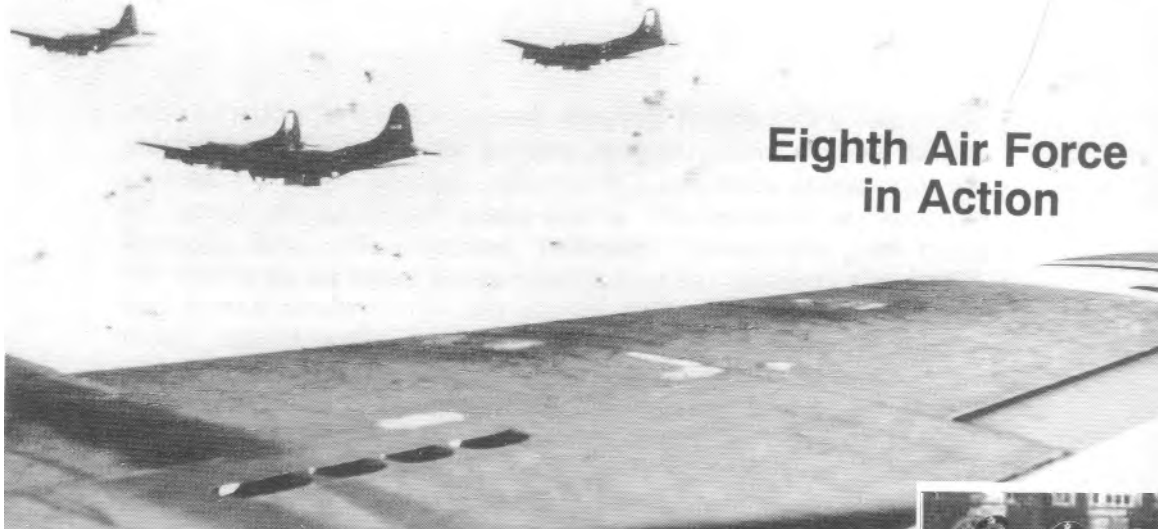
desert and a shortage of shipping doomed Churchill's plan to open up the western Mediterranean, making the new air force available for operations elsewhere. Meanwhile, Arnold rejected Chaney's proposal to organize the Britain-based American air forces by functional commands, separated geographically, and obtained Marshall's approval for centralized control under an air officer for the theater. Maj. Gen. Carl Spaatz, the officer whom Arnold had chosen to command the Army Air Forces in Great Britain, asked for the Eighth Air Force, and Arnold agreed.

Selected to lead Spaatz's bomber command in the British Isles, Brig. Gen. Ira C. Eaker established a headquarters at High Wycombe, a girls' school that had once been a manor house, completed the network of bomber bases General Chaney had begun, and set up a training program. Eaker tried insofar as possible to pattern his organization after the Royal Air Force Bomber Command, led by Air Marshal Sir Arthur Harris. Chaney argued, however, that Eaker should report to him, as the senior Army (and Army Air Forces) officer in the British Isles and in effect the acting theater commander. Chaney did not realize that the issues of organization and command were settled; his was a temporary assignment. Marshall had decided on Maj. Gen. Dwight D. Eisenhower to head the European theater, and the Chief of Staff had also approved Arnold's choice of Spaatz to command the theater air force.

With the fight against Germany initially an air war fought almost exclusively with bombers, Spaatz had the authority to deal directly with the leaders of the Royal Air Force. In this sense, the Eighth Air Force, although a component of the U.S. Army Air Forces, enjoyed a status comparable to Great Britain's independent air service, while Eaker's VIII Bomber Command resembled the Royal Air Force Bomber Command under Harris. As agreed a year earlier at the Argentia conference of August 1941, the two allies would cooperate in an aerial campaign designed to wear down Germany in preparation for the kind of cross-channel invasion that Marshall and Eisenhower believed necessary for victory. The American airmen proposed to bomb Germany by day in carrying out an overall aerial strategy decided by the Combined Chiefs of Staff and transmitted to Eighth Air Force headquarters by the Joint Chiefs of Staff. When Spaatz arrived, the VIII Bomber Command had not yet proved itself; the men, equipment, and tactics remained untested. Moreover, British airmen, because of their own lack of success in daylight bombing, tended to doubt that Americans could bomb Germany by day without incurring disastrous losses.

Daylight bombing was an integral part of Air Forces doctrine

Eighth Air Force in Action



The American strategic force in England was slow to expand into an effective striking arm. Eighth Air Force activated in late January 1942 under Maj. Gen. Carl A. Spaatz (*left portrait*), using the command echelons of the former Air Combat Command as a nucleus. Its subordinate VIII Bomber Command began deployments to England through the spring. The arrival of American air units hardly reached meaningful levels before June, and fields had to be found, expanded, or newly built for two incoming fighter groups, a troop carrier group and the 97th Bombardment Group. VIII Bomber Command concentrated in East Anglia, and American airmen found sometimes sumptuous accommodations, as the group portrait (*inset above*) on a manor house lawn indicates. Brig. Gen. Ira C. Eaker (*right portrait*) took over the Eighth when Spaatz left for North Africa in December and led the American aggregate in Britain until January 1944. Much of his strength went to fill out Twelfth Air Force for the Allied invasion of North Africa in November.

Douglas A-20 Havocs (*left, midpage*) flew the first Eighth Air Force runs over the Continent when six American A-20 crews observed Independence Day 1942 by joining a British medium bomber raid on German airfields in Holland. On August 17, the Eighth committed strategic bombers in their first precision strike over Europe. Twelve B-17s with Spitfire escorts struck the Rouen-Sotteville marshalling yards in northern France. Other objectives included the impenetrable concrete German submarine pens at Lorient, the target of the 500-pounders shown in the bottom photograph. Above, a flak curtain confronts American attackers as B-17s arrive over a target in occupied France.



and training, but Sir Charles Portal, Chief of Air Staff for the Royal Air Force, was eager to add the weight of American bombs to the deadly tonnage already raining down by night on Germany. When German defenses first compelled the Bomber Command to abandon daylight raids and seek the concealment of darkness, British airmen had tried to destroy oil refineries and other fairly compact targets, only to discover that the raiders seldom found their objectives. An examination of 600 photographs taken from individual bombers at the time they released their bombs revealed that only 10 percent dropped their loads within five miles of the assigned target. Since air crews could not find and attack a particular structure by night, Bomber Command had to find a different target for the heavy bombers. Navigators could find German cities and bombardiers could aim precisely enough to damage an urban area; consequently, industrial cities, rather than specific factories, became the target of British night attacks. In addition, Air Marshal Harris believed that "city-busting," or area bombing, could destroy the urban infrastructure of houses, shops, and utilities that supported the German war effort, satisfying Churchill's demand for results and possibly making an invasion unnecessary. Indeed, nighttime area bombing yielded impressive results, as Harris tried to "de-house" German workers by incinerating the industrial cities where they lived. Guided by new navigational beacons, his crews burned the north German towns of Lübeck and Rostock, and on May 30, 1942, he dispatched a thousand bombers to devastate Cologne. Both Harris and Portal believed that American crews could readily adopt British tactics of flying through the darkness in loose bomber streams, aiming at either flares or fires set by incendiary bombs instead of at features on the ground.

Neither the failure of British daylight raids nor the desolation being wrought by night shook the resolve of Arnold, Spaatz, and Eaker to bomb during the day. For them daylight precision bombing was an article of faith, and the same deep-seated belief influenced Chaney's analysis of the German nighttime bombing of Britain. His study concluded that from the fall of 1940 through the spring of 1941 the *Luftwaffe* had relied on small formations to make night attacks on sprawling urban targets, instead of massing its bombers by day against truly essential industries. The Americans, Chaney declared, could avoid Germany's mistakes by dispatching a succession of large formations that could fight their way through the fighter screen to destroy vital factories, bombing them accurately by day instead of merely dumping munitions at night. Losses would be greater in daylight than in darkness, but the improvement in accuracy would more than compensate for the

increased casualties. Rather than offering new insights, Chaney's report served as a capsule summary of Army Air Forces doctrine on strategic bombardment.

Although persuaded by their own bitter experience that daylight precision bombing could not succeed, the leaders of the Royal Air Force agreed that Spaatz should have the chance to prove them wrong. Sir Archibald Sinclair, Secretary of State for Air, summarized this view when he declared that, inasmuch as the Americans were determined to attack Germany, "It would be a tragedy if we were to frustrate them on the eve of this great experiment." Should daylight bombing somehow succeed, Sinclair envisioned an air war in which the British would "send a thousand bombers over Hamburg one night" and the Americans would "follow with 5 or 600 bombers the following day, and, if the weather is kind, for us to follow up with a large force of heavy bombers the next night—and then go on bombing one city after another in Germany on that scale." Even Sinclair had his doubts that the Eighth Air Force would prove successful, but Generals Spaatz and Eaker could be sure of an opportunity to demonstrate the soundness of prewar bombardment doctrine once the necessary men and planes were available.

Ships carrying ground elements of the Eighth Air Force began arriving in the United Kingdom in May 1942, and the first airplane, a B-17, landed in Scotland on July 1. The buildup encountered unavoidable delays, however. Shipping for the ground elements proved scarce, the transoceanic communications network had the teething problems of any new and complex technology, and bomber pilots needed extra training before they learned to watch fuel consumption and trust their navigators during an Atlantic crossing that used the new airfields in Greenland. A bomber shepherded each fighter formation, and when none of the big airplanes was available to navigate for a P-39 group, the pilots and ground crews sailed in one convoy, while the fighters waited for space in another.

Further delays occurred after the men and machines—accompanied by the first items in a mountain of spare parts and maintenance equipment—reached their destination. Rushed across the Atlantic though not yet ready for combat, bomber crews had to undergo additional training in such basic skills as gunnery, radio communication, and aerial navigation. Next they flew practice missions that taught them to fight at 25,000 feet, breathing oxygen and enduring biting cold while maintaining a tight defensive formation. As the bomber men sharpened their techniques under the leadership of Col. Frank A. Armstrong, Jr., fighter groups underwent indoctrination by the Royal Air Force.

The P-39 unit whose planes were waiting for shipment from the United States acquired British Spitfires and underwent a period of familiarization that delayed their entry into combat. Meanwhile, the Eagle Squadrons, three Royal Air Force squadrons made up of American volunteers, transferred to the U.S. Army Air Forces, temporarily retaining their Spitfires and becoming the 4th Fighter Group.

Among the first American aviation units to reach the British Isles was the 15th Bombardment Squadron (Light). Although trained as an attack unit for supporting ground forces, the squadron received orders to retrain, under the British, as a night-fighter outfit flying a version of the A-20 light bomber fitted with high-intensity searchlights. Technology improved, however, and radar replaced the searchlight, depriving the squadron of a mission. The Americans therefore resumed bombardment training in Douglas Boston III attack bombers, the equivalent of the American A-20A, borrowed from the British. On July 4, 1942, to commemorate the national holiday, six crews from this squadron took part with British airmen in an attack against German airfields in Holland. The first American raid mounted from the United Kingdom was scarcely a success, for only two of the Eighth Air Force Bostons managed to locate, bomb, and strafe the assigned target. The Americans, moreover, lost two planes to anti-aircraft fire and the British lost one, downed by the combined efforts of flak and German fighters.

More than a month passed before the VIII Bomber Command's B-17s were ready to deliver their first strike against Nazi-occupied Europe. On August 17, General Eaker flew one of the 12 Flying Fortresses that bombed the Sotteville marshaling yard at Rouen, France. Colonel Armstrong led the raid; his copilot that day was Maj. Paul W. Tibbets, an officer destined for a mission of far greater significance before the war ended. Although at most a small-scale demonstration of the destruction to come, the flawlessly executed attack produced heartening results. Only one German fighter slipped through the four squadrons of escorting Spitfires, and this lone aircraft caused no damage. The bombing proved accurate, and all twelve B-17s returned with, at worst, a few holes from shell fragments.

Admittedly a mere pinprick to the enemy, the Rouen attack symbolized American determination to join in the bombing offensive. As the advocates of daylight precision attack conceded, many more aircraft would be needed before formations large enough to defend themselves and inflict serious damage could penetrate far into Germany on a regular basis. As B-24s and additional B-17s arrived in England, they went into action against

rail centers and aircraft factories in France, Dutch shipyards, or the heavily defended submarine pens along the French coast.

Despite the important role assigned it in the air war, the Eighth Air Force did not drop the first American bombs on a target in Europe. That honor went to a detachment of B-24s led by Col. Harry A. Halverson. Halverson's group originally had the mission of bombing Japan; but the enemy, as a consequence of the Doolittle raid, overran the bases in China projected for the B-24s. The Halverson force therefore received orders to terminate its journey in Egypt and strike a blow to aid the Soviet Red Army, hard pressed by Hitler's invaders. The target of this ambitious raid was Ploesti, Rumania, where huge refineries supplied fuel for the German war machine. The attack, delivered by a dozen aircraft bombing through an overcast at dawn of June 10, 1942, proved ineffectual. The unsuccessful raid on Ploesti led, however, to one of the more ingenious escapes of World War II. A B-24 piloted by 1st Lt. Eugene L. Ziesel ran low on gasoline and landed at Ankara in neutral Turkey where authorities interned the crew. Ziesel convinced his captors that the bomber's engines had to be run up every few days to keep them from deteriorating. Each time he used less fuel than the amount the Turkish mechanics had put in the tanks, and when a large enough surplus had accumulated he took off and flew to an Allied air base. A week after returning to combat, Ziesel and his crew were killed during an attack on Naples, Italy.

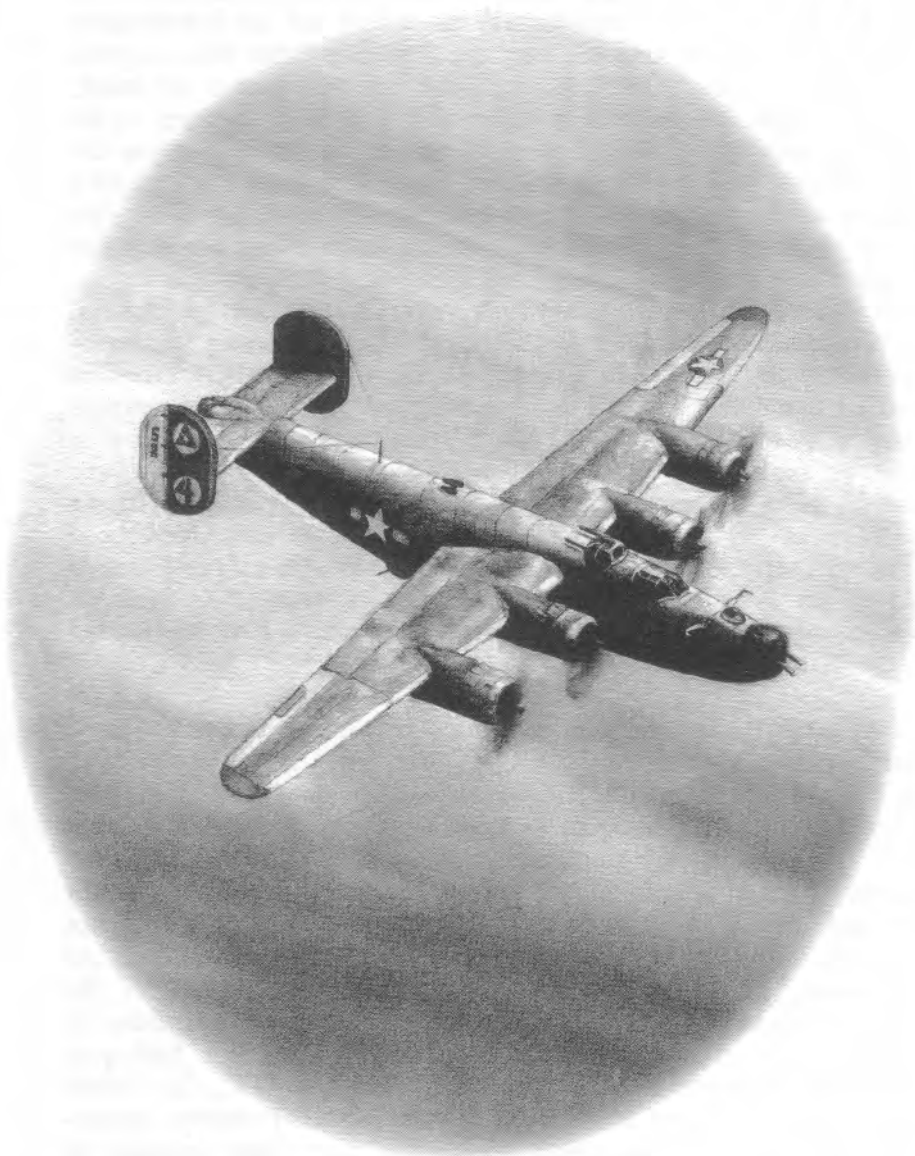
Even as Halverson's bombers were attacking Ploesti, German forces led by Field Marshal Erwin Rommel advanced on the Suez Canal. To help meet this emergency, these B-24s began bombing the Libyan ports of Tobruk and Benghazi in an effort to disrupt enemy supply lines. Aircraft bound for the China-Burma-India Theater by way of the Sudan joined the colonel's bombers to form the nucleus of a new command. Late in June 1942, General Brereton, who had been ordered to leave the Southwest Pacific and organize a bomber command in India, exchanged that assignment for command of a hurriedly assembled U.S. Army Middle East Air Force.

Except for the B-17s and B-24s, Brereton's squadrons were attached to the Western Desert Air Force, commanded by Air Vice Marshal Sir Arthur Coningham. Coningham's force helped check Rommel at El Alamein, Egypt, in July and hurled him back in October and November; but the American aircraft, not even 10 percent of the total, played only a minor role in the action. During the victory at El Alamein and the westward advance that followed, Coningham and the ground commander, General Bernard Law Montgomery, maintained a joint headquarters in which

aviation and ground elements had equal voices. The status of British tactical air power in North Africa as an equal of the ground force reflected the independence of the Royal Air Force but did not provide a satisfactory precedent for an independent American air force. Granted that the fighter-bomber was essential to victory on the battlefield, it could not win a war by itself, whereas American leadership expected the strategic bomber to do just that and provide an irrefutable argument for a postwar air arm coequal with the Army and the Navy. Although Coningham's success could not justify an independent American air force, his accomplishments did demonstrate that an independent air arm, the Royal Air Force, could cooperate effectively with ground forces.

In the western desert, cooperation was the watchword between Coningham and Montgomery, although the two strong personalities eventually clashed in France. At El Alamein, the air officer massed his Allied aircraft to the deadliest effect, hitting supply lines and airfields indeed, for a time maintaining almost a constant patrol over the bases used by an exhausted *Luftwaffe*—instead of tying his airplanes to the battlefield. Exposure to the cooperation between Coningham and Montgomery influenced General Brereton, whose command became the Ninth Air Force in November 1942. Within months, in fact, Coningham's methods would serve as a model for air-ground cooperation in the United States Army.

Three great battles marked, as events would prove, the limits of Axis success: Midway in June 1942, Stalingrad from August 1942 to February 1943, and the breakthrough associated with the second clash at El Alamein in late October and early November 1942. Decisive though they appear in retrospect, at the time they served at most as portents of eventual victory. "Now this is not the end," said Winston Churchill in November 1942. "It is not even the beginning of the end. But it is, perhaps, the end of the beginning." The defensive phase of the war had ended for the Allies. Although America's ability to produce vast quantities of weapons and recruit and train the men to use them had only begun to make itself felt on the battle fronts in 1942, the United States soon began to perform the function that President Roosevelt had proposed in 1940, becoming the "vast arsenal of democracy," turning out endless tons of arms and equipment for its expanded armed forces and those of its allies. Nowhere was the nation's genius for production and management more evident than in the wartime growth of the Army Air Forces in terms of both modern aircraft and trained manpower.



4

Building Air Power

The building of American air power, foreshadowed by President Franklin D. Roosevelt's response to the dismal end of the Czech crisis of 1938, involved several kinds of vigorous and sustained efforts. Aircraft had to be manufactured in massive numbers, designs improved, and new models developed as necessary. The Army Air Forces had to set up a worldwide logistics network to supply, maintain, and repair the vast aerial armada thus created. The service had to recruit and train manpower—a term that by the end of the war included women—and then had to take care of those who had been recruited, sustaining their morale and providing for their health and welfare.

The manufacture of airplanes, rather than the training of men and women, set the pace for the creation of American air power to fight World War II. Simply put, the air arm could neither train, nor deploy, nor fight without aircraft, and the inventory seemed unlikely to grow rapidly because of the sluggish rate of the nation's aircraft production. In 1939, when fighting broke out in Europe, firms in the United States produced just 2,195 airplanes of all types, about half of Japan's output, one-fourth of Germany's, two-thirds of France's, and one-third of Great Britain's. An obviously feeble American industry faced the challenge of providing not only the aircraft for American forces but also those needed by the nations arrayed against the Axis. Following the passage of lend-lease legislation in March 1941, aircraft production became even more important as the United States, following the President's vow of December 1940, turned itself into the great arsenal of democracy, sustaining the war against the Axis powers while at the same time rearming.

Of all the combatants in World War II, only the United States succeeded in building the numbers and kinds of aircraft necessary

to wage every form of aerial warfare—whether strategic, tactical, land- or carrier-based—and to supply the air services of its allies as well as those of its own armed forces. The Soviet Union, for example, had a labor force, raw materials, and plant capacity rivaling that of the United States; but the German invasion forced the displacement of factories out of the war zone, and Soviet authorities chose to concentrate on tactical aviation for support of the Red Army. America's other major ally, the United Kingdom, lacked the resources in workers, materials, and machines to produce an adequate number of aircraft for every purpose. Once the Battle of Britain had been won, the British increased the emphasis on bombers, enlisting science to help them find and destroy German targets. Among the Axis powers, Italy was handicapped by shortages of raw materials for the construction and operation of aircraft. Similarly, Japan failed to benefit from its early conquests; American submarine warfare and an unexpectedly rapid Allied counteroffensive overtook Japanese the war industry. Although not fully mobilized until February 1944, German industry demonstrated greater ingenuity, despite mounting Allied pressure, but could not overtake the United States except in such narrow specialties as jet and rocket propulsion and synthetic fuel. After overrunning western Europe and large tracts of the Soviet Union, Germany failed to integrate the resources of these regions, except for labor drafts either forced or voluntary, into the production effort. Hitler believed his people could have both guns and butter and refused to countenance multiple shifts or the presence of women workers in Germany's aviation industry. Late in the war a first-class organizer, Albert Speer, began to realize the potential of Germany's factories, but defeat overtook his efforts. President Roosevelt by contrast forced American firms to extend themselves, in part by establishing production goals that seemed unattainable even to him. In 1939 he had spoken boldly of turning out 10,000 aircraft per year, although he had to settle at the time for a third that amount in new construction; and in May of 1940 he announced a goal of 50,000 planes. In response to the Japanese attack on Pearl Harbor and the declarations of war by Germany and Italy, he demanded that the American aircraft industry build 60,000 airplanes in 1942 and 125,000 during 1943. The new Assistant Secretary of War for Air, Robert A. Lovett, could not believe that turning out 125,000 aircraft in a single year was a realistic objective. He compared this to "asking a hen to lay an ostrich egg." It was "unlikely you will get the egg, and the hen will never look the same," he said. Lt. Gen. Henry H. Arnold, as chief of the Army Air Forces, decided to accept the wear and tear on the hen. Roosevelt often settled for less than he demanded, but

American industry during the war eventually came within 30,000 aircraft of meeting his most ambitious goal, attaining a peak output of 96,000 aircraft in 1944.

Although he dealt with possibilities rather than realities in announcing his production goals, the President kept in close touch with the views of the military concerning their actual aircraft requirements. In the summer of 1941, this contact had resulted in AWP/1—Air War Plans Division plan number one—which proposed that the Army Air Forces expand in the event of war to 60,000 planes and 2,100,000 men. In August 1942, Roosevelt asked for a new estimate that reflected more accurately the needs of a coalition war against Germany, Japan, and Italy. Specifically, he wanted an estimate of “the number of combat aircraft by types that should be produced for the Army and our Allies . . . in 1943 in order to have complete air ascendancy over the enemy.” As in the case of the previous year’s presidential request for production requirements, the Air War Plans Division of the Air Staff undertook a response. Although wartime reassignments had broken up the team that had turned out AWP/1, Arnold summoned one of its members, Haywood Hansell, now a brigadier general, from England to take charge of the new study, called AWP/42. In answering the President’s question, General Hansell’s group called for the production of some 75,000 airplanes and 8,000 gliders, intended for an Army Air Forces numbering 2,700,000 men, along with 8,000 aircraft for America’s allies. Omitted from the list of aircraft was the intercontinental bomber proposed in AWP/1; instead of investing in the B-36, the Army Air Forces would use the B-17 and B-24 to carry the war to Hitler’s Germany, with the B-29 or B-32 appearing in time to batter Japan from bases in China or on the islands of the far Pacific.

Besides answering the basic question, Arnold’s Air Staff planners, as with AWP/1, used a presidential request for projections of aircraft production as the occasion for a statement of aerial strategy. For the most part, AWP/42 reaffirmed the earlier views on bombing Germany into submission. The list of critical targets increased by twenty-three to 177, an expansion that reflected the addition of three war industries—submarine construction, aluminum production, and the manufacture of synthetic rubber—to the “target systems” contained in AWP/1: electric power; transportation; oil; and the *Luftwaffe*, including fighters, bases, and aircraft factories. With the Battle of the Atlantic far from won, submarine construction ranked second in importance only to the neutralization of the *Luftwaffe*. If American airmen destroyed all 177 targets, Hansell’s group insisted, “the effect would be decisive and Germany would be unable to continue her

war effort." Enemy morale received scant mention, possibly because Air Marshal Sir Arthur Harris of the Royal Air Force's Bomber Command had laid claim to city busting, which combined the physical destruction of cities with the demoralization of their inhabitants.

In drafting AWPD/42, General Arnold's planners included an estimate of 33,000 aircraft manufactured for the Navy, a figure based on official projections rather than specific interservice coordination. Even more rashly, the Army airmen proposed a coastal command of their own, numbering 640 heavy and medium bombers, that would patrol the waters off North and South America, Iceland, and the Azores in search of submarines. Admiral Ernest J. King, the Chief of Naval Operations, found the idea of an Army Air Forces hemispheric patrol especially annoying, for he had just wrested from a reluctant Arnold a share of bomber production so that Navy airmen could fly long-range antisubmarine missions. Always sensitive to the fact that Arnold was not a true service chief like General George C. Marshall, Army Chief of Staff, and himself, King raised strong objections to the Air Forces' meddling in Navy matters and prevented the Joint Chiefs from formally adopting the plan, which nevertheless served as a statement of what the Army Air Forces saw as its needs and its strategy against Germany.

As befit an industrial giant whose strength lay in the mass production of durable goods, the United States was blessed with managers who could apply assembly-line techniques to huge bombers (though with mixed results) and even to ships. The automobile industry had its Henry Ford, his son Edsel, and William S. Knudsen, the General Motors executive who helped advise the President on issues of production and later became a lieutenant general in charge of materiel for the Air Forces. Men like J. H. "Dutch" Kindleberger of North American Aviation and Henry J. Kaiser in shipbuilding knew how to bring workers, raw materials, and finished components together in the proper place and sequence.

The civilian within the War Department who bore the greatest responsibility for aircraft purchases and production, Assistant Secretary Lovett, was a lawyer, however, rather than a manager. His legal work for the aviation industry gave him a familiarity with production methods, costs, and profits. His experience enabled him to judge the feasibility of production goals and harmonize the plans of the air arm with those being shaped for the entire Army by General Marshall and Under Secretary of War Robert P. Patterson, who did for the Army Ground Forces and Service Forces what Lovett did for the Air Forces.

The impressive production effort began in chaos. Scarcely had the fighting broken out in Europe when the Army air arm found itself competing with the British and French for new aircraft. The collapse of France in 1940 did not ease the situation, for Roosevelt subsequently agreed to assist China and the Soviet Union. General Arnold objected from the outset to sharing America's slender aerial resources, voicing his complaint so strenuously that President Roosevelt, according to Arnold's recollection, reminded the airman that "there were places to which officers who did not play ball could be sent, such as Guam." In a sense, the Air Corps profited from agreeing, however reluctantly, to the release of aircraft, for Britain and France provided data on combat performance that led to such improvements as increased firepower and armor. Nor did the diversion weaken the American air forces as much as Arnold had feared, for the best aircraft of 1940 or even 1941 were not necessarily the best in 1943 or 1944.

The President's desire to aid foreign nations had the greatest impact on the availability of fighters. The United States transferred more than 17,000 of these aircraft during the course of the war. The types diverted in the greatest numbers to the various Allies were P-39s and P-40s, adequate fighters when designed before the war but soon outperformed by more modern types. Similarly, General Arnold sacrificed some 7,000 light bombers or attack aircraft, half either A-20s intended for the Air Forces or versions of that successful airplane designated specifically for export. Included in the shipments to America's allies, however, were almost 3,000 aircraft for which the Army Air Forces had no plans: Lockheed's A-29 Hudson, Martin's A-30 Baltimore, and Vultee's A-31 Vengeance dive bomber (manufactured as the A-35). Thanks to mass production, these transfers, along with the shipment of some 2,000 B-24s and 3,000 C-47s, had little long-term effect, although early in the conflict, before huge numbers of aircraft began emerging from the assembly lines, the absence of the A-20s, P-39s, and P-40s may well have hampered the Air Forces in the early months of the war. On balance, however, American manufacturers met the needs of both lend-lease and the armed forces of the United States.

Although Roosevelt announced unrealistic goals for aircraft production, he took concrete action to increase productive capacity so that they might ultimately be reached. Beginning in 1940, his administration provided incentives for aircraft builders, minimizing the financial risk to the manufacturer. Since American firms had struggled for survival during the depression of the previous decade, they proved reluctant to invest in additional plant capacity that might not be needed if Great Britain collapsed or the

United States avoided involvement in the conflict. Roosevelt's answer was to build the factories at government expense and allow private corporations to operate them; by the end of the war, the Air Forces had used War Department funds appropriated for the purpose to contract for 34 major plants. Although nine contracts were either canceled or amended to incorporate other financing, the total investment by the government approached \$1.5 billion, some 20 times the amount spent on the entire Air Corps in 1939. Additional money, perhaps another \$1 billion, was spent on lesser facilities, tools and other equipment, and the expansion of existing plants. Thanks in large measure to federal expenditures, the amount of floor space devoted to the manufacture of airframes, engines, and propellers increased more than 13-fold from some 13 million square feet in 1940 to a maximum of about 175 million square feet in December 1943.

Besides building factories and leasing them to aircraft manufacturers, the Roosevelt administration persuaded Congress to ease restrictions on excess profits, to grant tax advantages to airplane builders, and to lift the ban on negotiated contracts that had caused Maj. Gen. Benjamin D. Foulois such embarrassment when he was Chief of the Air Corps in the 1930s. Congress enacted the reforms piecemeal during the wartime years. The substitution of negotiation for time-consuming competition and the awarding of tax breaks were obvious measures for meeting the demand for increased production. The subject of excess profits proved far more complex. Although profit was perhaps the strongest of incentives, some restrictions had to prevail, for war profiteering posed a real threat to the nation's sense of purpose and to its economy. A later congressional investigation revealed that one company, which owed its very existence to government loans and its success to military contracts, more than doubled the price to the Army and the Navy for an aircraft engine starter. The excess profits in this case found their way into bonuses for executives and welfare or morale programs for the workers. Abuses like this caused the government to insist on renegotiating contracts if profits seemed outrageous, but establishing a margin of profit applicable throughout the aircraft industry proved impossible. Such factors as the volume of manufacture, the availability of labor and material, the urgency with which a product was needed, and the extent of the government's investment in tools and buildings had to be considered before making accusations of profiteering. Thus it happened that Douglas Aircraft, when it first began operating plants owned by the government, could legally realize a profit in excess of 50 percent on its corporate investment, seven times the average by firms using company-owned plants and machinery.

The American government also harnessed the American automobile industry to aircraft production. It too expanded into new factories built by the government for the manufacture of aircraft or converting existing ones to take advantage of the techniques of mass production perfected by the auto builders. These practices proved more adaptable to the making of all-metal airplanes than they had to the handcrafting of the wood-and-linen products of an earlier generation. As an airplane manufacturer, the automobile industry concentrated on fabricating wings or other structural components for aircraft assembled by others. Only Ford and the Eastern Aircraft Division of General Motors participated on any large scale in the final assembly of airplanes, with Ford building Consolidated B-24s for the Army Air Forces and General Motors making Grumman aircraft for the Navy.

Ford's government-built plant at Willow Run, Michigan, applied the methods of mass production to building the entire airframe of the B-24 and installing the bomber's four engines. Ford production engineers planned to use dies to shape bomber parts from aluminum, just as automobile components were shaped from steel. Unfortunately, aluminum, unlike steel, tends to reassume its original shape after being stamped in a die and requires repeated stampings and more time to achieve a desired shape. Major components of the B-24, such as the vertical stabilizer, were changed to reflect experience in combat, and radical changes required the construction of new dies. Parts for an automobile's chassis and sheet metal skin might require only simple cosmetic adjustments during a production run of two or more years. The Willow Run plant became highly efficient measured by weight produced per worker, but actual numbers of finished aircraft remained disappointing. By March 1944, monthly production barely exceeded 400 bombers, roughly two-thirds capacity, but given the success at other factories and the progress on the battlefield, the projected manufacture of 600 bombers per month at Willow Run proved unnecessary.

The nation's auto builders had marked success in converting to the production of aircraft engines. Packard, which built Liberty engines in World War I, now manufactured under license the British Rolls Royce Merlin that powered the P-51 escort fighter. General Motors, Ford, and Nash built Pratt and Whitney products, while Dodge and Studebaker were licensed by Wright Aeronautical. Automobile firms turned out more than 40 percent of the engines built for American aircraft between July 1940 and August 1945.

The provision of labor for the industry was the last great area of aviation mobilization in the war. As the aircraft industry grew

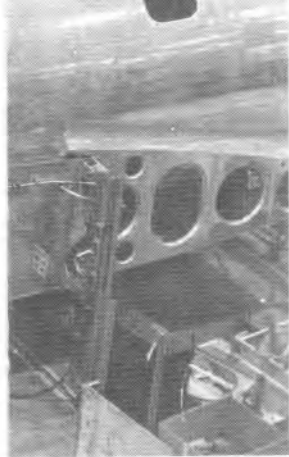


American production plants overcame monumental confusion and shortages through the course of the war to meet and exceed demands for aircraft, engines, fuel, propellers, and the equipment of aerial war. The production line at the Seattle Boeing plant (*above*) in 1942 shows in symmetrical array some of the 12,692 B-17s manufactured during the war. The industrial base poured out the necessities of all the armed forces and supplied much of the wherewithal for the Allies as well. Of 304,109 aircraft built in American factories from 1939 to 1945, 231,000 were bought by the Army Air Forces. The output for the Army and the Navy surged from a meager 921 in 1939 to 96,318 in the single year of 1944. The additional manufacture of 812,615 aircraft engines and nearly 714,000 propellers clarifies the extent of the American capacity.

The social impact of the war on American women is also clear in their prolific presence in the defense work force. Many had husbands overseas and young children at home while they held down their

factory jobs. In the left column opposite, a Martin worker finishes the nose bubble in a B-26 Marauder; a work crew stands aboard the wing of a trainer, and a young nursing student finishes metal collars on a grinding wheel.

Even relatively unskilled workers could be trained easily enough to operate the huge hydraulic presses (*far right, top*) that formed aluminum and steel parts for aircraft. Lacking in adequate numbers at the onset of the war were the tool and die makers that manufactured the presses themselves; a cause of alarm lay in the fact that many of these skilled craftsmen had German names. A Lockheed line assembles P-38 Lightnings (*midpage, opposite*). The B-24 Liberator (*opposite, below*), also produced as the C-87 transport, was among the craft assembled by the Ford Motor Company in an example of how the American automobile industry retooled for the production of airframes. As great an achievement was the rapid emplacement of an administrative structure for apportioning scarce resources, labor, and managerial talent.



larger, the nature of its work force changed. From 200,000 in 1940, most skilled craftsmen, the number of workers soared beyond 2,000,000 in 1944, declining the following year below 1,500,000 as a result of cutbacks in production that began even before the war ended. Most of the new workers were unskilled, though thoroughly trained in the repetitive work that contributed to the fabrication of an airplane, and many were women. The preponderance of unskilled (or at most semiskilled) labor reflected the triumph of the assembly line, on which much of the construction of the airplanes became a succession of simple procedures that required attention to detail rather than competence at metal working or some other craft. Although most of the workers had limited skills, workers with industrial experience were necessary to keep the production line moving. The Selective Service System sought to keep skilled aircraft technicians in the factories, and prevented their departure for the armed services. Persons holding essential jobs remained exempt from military service, and federal authorities urged workers about to enter the armed forces to remain at the plant for as long as possible. Since the work force had to be kept intact, the Army Air Forces saw to it that a new project was waiting when an existing contract ended. Industrial planners tried to avoid periods of idleness, even when a factory retooled for a different product. This policy sustained morale in the work force by providing continuity and reduced the tendency of employees to move from one firm to another and force the old employer to hire and train new workers before resuming production.

In an aircraft industry whose greatest strength (aside, perhaps, from its very size) was a unique capacity for mass production, the issue of quantity versus quality arose early in the war. Should the Army Air Forces settle for good or insist on the best? Was it better to turn out large numbers of adequate aircraft immediately or to accept the unavoidable delay in attaining the maximum volume of production in order to obtain a superior airplane? The Director of Requirements on the Air Staff, Maj. Gen. Davenport "Johnny" Johnson, commander of a pursuit group during World War I, endorsed quality: "Fifty 100 percent aircraft are of more value than a hundred 50 percent aircraft in actual combat." His words went unheeded, for in 1943 the Air Forces delayed the appearance of the Douglas A-26 light bomber to continue volume production of three similar, adequate, but less effective aircraft—the North American B-25, Martin B-26, and Douglas A-20. Similarly, Vultee's A-35 Vengeance dive bomber remained in production even though neither the Army Air Forces nor the Navy

had any plans for them; however, America's allies received the Vengeance through lend-lease, and it saw action with the British in Burma.

With a few admittedly important exceptions, the Air Forces relied throughout the war on variations of the types of aircraft on hand in December 1941 when the Japanese attacked Pearl Harbor. Some of the newer aircraft, moreover, evolved directly from earlier ones; for instance, the A-26 descended from the A-20, and Bell Aircraft's P-63 was a supercharged and more powerful variant of the P-39. Not so the B-29, for this four-engine giant was a daring departure, a truly revolutionary aircraft rushed into service with a minimum of testing. In retrospect, General Arnold termed the B-29 a \$3 billion gamble, but a gamble that paid off.

In the spring of 1940, after a design competition, Boeing and Lockheed received contracts for preliminary work on a very long-range bomber. Lockheed soon abandoned the project, but Boeing, the manufacturer of the XB-15 and B-17, produced an aircraft that, despite overheating and fires in its 2,200-horsepower radial engines, emerged as the most formidable bomber of World War II. Wright Aeronautical, the engine manufacturer, and Army Air Forces technicians at Wright Field collaborated in modifying the air flow in the engines and resolved the cooling problem. Nicknamed the Superfortress, the B-29 had a pressurized cabin and remotely controlled turrets blended smoothly with the cylindrical fuselage to yield minimum aerodynamic drag. Twice as heavy as the B-17, the Superfortress carried a crew of ten and up to ten tons of bombs, about two tons more than the maximum load of the latest B-17. A fuel capacity of some 9,500 gallons, compared to 3,600 gallons in a B-17 fitted with tanks in the bomb bay, gave the new bomber a ferry range in excess of 5,000 miles. Although B-29s based in India, heavily laden with fuel, once flew 4,000 miles to bomb a refinery on Sumatra and returned, a typical combat mission required a round-trip flight of no more than 3,200 miles. Work begun by Consolidated Aircraft, builder of the B-24 Liberator, on an alternative in the event the B-29 should fail produced the B-32 Dominator, which started as an enlarged Liberator with a pressurized cabin. With the success of the B-29 the Army Air Forces took delivery of some 3,700 of the Boeing product but only 118 B-32s.

Two new fighters entered service after Pearl Harbor and performed with deadly effect against the Germans and Japanese. The P-47 Thunderbolt made its debut in 1942, more than a year after the prototype had flown, a delay that stemmed from difficulties in linking a turbosupercharger to the 2,000-horsepower Pratt and Whitney radial engine. Until jettisonable auxiliary fuel

tanks became available, the P-47D suffered the handicap of short range. Few pilots complained, however, about its durability or firepower, for the six-ton Thunderbolt stood up well in combat and carried eight .50-caliber guns. The ability of the heavy airframe to withstand punishment and the augmentation of the machineguns with rocket launchers and bomb pylons converted later models into deadly weapons for ground attack. American factories turned out more than 15,500 of these aircraft for the Army Air Forces. The North American P-51 Mustang filled a need that most of the prewar Air Corps planners had not anticipated, becoming the premier long-range escort fighter of the war. With a normal loaded weight of about five tons, the Mustang weighed less than the P-47. The greatest asset of the P-51 was its ability to fly as far as Stettin or Munich in Germany or Prague in Czechoslovakia, fight off interceptors, and return to England. The addition of a large permanent fuel tank in the fuselage and jettisonable tanks under the wings gave the fighter its spectacular range. Originally designed for the British who wanted an improvement over the P-40, the airplane went into production in the spring of 1941 and at first attracted little attention, largely because of an Allison engine that lacked a supercharger for high altitude performance. Allied airmen became enthusiastic, however, after an American air attache in London called attention to the fighter's true potential. Maj. Thomas Hitchcock, a pilot in the Lafayette Escadrille during World War I and a horseman in civilian life, suggested "cross breeding" the P-51 with the Merlin engine that powered the Spitfire. When Rolls Royce engineers substituted their supercharged Merlin for the original Allison, they doubled the altitude at which the airplane could fight and increased its speed beyond 400 miles per hour. Armed with six .50-caliber guns, the Mustang could now do battle at high altitude over targets deep in Germany. Although production eventually exceeded 14,500 aircraft, the P-51 was not ready in time for the critical air battles over Germany during the summer and fall of 1943, a failure that General Arnold conceded was "the Air Force's own fault" for ignoring the possibilities inherent in this design.

Other new aircraft that appeared during war included the P-61 night fighter and C-46, C-54, and C-69 transports. Northrop built about 700 P-61 Black Widows—twin-engine, twin-boom aircraft—which replaced the P-70, a night-fighter version of the A-20. The radar-equipped Black Widow, comparable in size to a medium bomber, had the speed, endurance, and firepower—as many as eight 20-mm cannon and .50-caliber machine guns—needed in a night fighter. Curtiss-Wright manufactured some 3,000 C-46 Commandos, the heaviest and largest of the twin-

engine transports, but the C-46 saw only limited action before 1944 because of the tendency of its 2,000-horsepower Pratt and Whitney radial engines to overheat. Once this problem had been solved, another surfaced: the hydraulic system was vulnerable to fire from the ground. More successful were the thousand-odd Douglas C-54 Skymasters that the Air Transport Command used on transoceanic flights. The Lockheed C-69 Constellation, a four-engine aircraft like the Skymaster, showed great promise, but only 14 were built during the war.

Despite the late emergence of these successful aircraft, many of the types that helped contain the advancing Axis forces fought on until victory. The B-17 and the B-24 served throughout the conflict, with the Air Forces accepting some 12,600 Flying Fortresses and more than 18,000 Liberators. The Douglas A-20 remained in production into 1944; the government purchased more than 7,000 before Douglas began producing the improved A-26. The North American B-25 and Martin B-26 medium bombers entered the inventory as late as 1945; the Air Forces accepting almost 10,000 B-25s and slightly more than 5,000 B-26s. The Army bought the last of almost 10,000 Bell P-39s in 1944, turning then to the greatly improved P-63, also built by Bell, of which some 3,000 were accepted. A large proportion of the P-39s and P-63s were included in lend-lease deliveries. The final P-40 of more than 13,000 rolled from the Curtiss factory in 1944; and Lockheed ended P-38 production in 1945, with total acceptances approaching 10,000.

Emphasis on production diverted resources from research and development. Although useful concepts were tested—flying wings, wooden construction, and canard designs—the Air Forces, the National Advisory Committee for Aeronautics, and the aircraft industry concentrated on wringing the best performance from existing engines and airframes. An aerial gunner of 1945 might sit inside a power-operated plexiglas turret instead of battling the slipstream to manipulate his weapon as gunners did four years earlier. The metal bead-and-ring gunsight fixed on the cowling of a P-40B gave way in later models to a device that reflected the sight picture onto the windscreen. In trying to maximize production of proven types, the Army Air Forces and the aircraft manufacturers ignored the possibilities of the jet engine and set about perfecting the piston types, while others, primarily the British and Germans, examined this new means of propulsion. Once the British shared the fruits of their research, however, Bell turned out a test aircraft, the XP-59, thirteen months after signing a contract; and Lockheed designed and built the prototype for an operational jet fighter, the P-80, in an incredible 143 days.



American Classics

Wartime demand promoted hundreds of innovative designs for American combat aircraft, and modifications of existing models for war added to the inventive output that rolled from American factories. Of the many fighter designs, two were such standouts that they became legends. The North American P-51 Mustang began life as the company's NA-73X under a British order for a fighter superior to the P-40s being purchased in 1940. German-born chief designer Edgar Schmued leaves the cockpit of one of the earlier models at left. His conception blended an angular wing and tail with a new low-drag wing cross section pioneered in American research. First flown in May 1941, the aircraft was delivered to the RAF that November mounting four .50-caliber wing machine guns and capable of 390 miles an hour at 20,000 feet.

Over the objections of the British Air Ministry, Rolls Royce installed a Merlin 61 12-cylinder engine in a test-bed Mustang in October 1942. North American Aviation at the same time modified five P-51As at its California plant with a license-built Packard version of the same Rolls Royce engine. At one stroke, the addition of the new powerplant brought the Mustang's performance to gratifying levels. The redesignated P-51B had a service ceiling of 42,000 feet and attained an unmatched 441 miles an hour at 30,000 feet.

Continuing refinement with improved rearward vision for the pilot though the installation of the bubble canopy produced the P-51D, pictured above and at the lower left. It excelled as a high-level bomber escort, strafed ground targets, and could deliver bombs. The piston-engine fighters of the *Luftwaffe* could not match it above 20,000 feet. Alone, it was credited with destroying over 9,000 enemy aircraft, 4,950 in aerial combat. Several of these were the vaunted Me 262 turbojet fighter encountered after mid-1944.





The second compelling fighter design was Republic Aviation Corporation's P-47 Thunderbolt, conceived under Russian emigré engineer Alexander Kartveli (*right*). Stemming from the P-35 and the P-43 Lancer, the Thunderbolt was larger and heavier than any other fighter of the war; it became the premier fighter-bomber of the Army Air Forces. Originating as Republic's privately built AP-10, the P-47 was continually reworked as the requirements of the war in Europe prompted the addition of more armament, self-sealing fuel tanks, engine power, and speed. Kartveli designed the plane around a massive 2,000 horsepower Pratt & Whitney R 2800 radial engine, the last radial used in an Army fighter. He incorporated an unusual ducted turbosupercharger behind the pilot and vented the exhaust out the plane's belly just forward of the tailwheel. The first production model, the P-47B (*below, right*) flew in May 1941 with eight wing-mounted .50-caliber machine guns, the largest weapon array in any American single-engine fighter; it reached 412 miles an hour at 25,000 feet.

With additional engine and duct improvements, the D-model (*above*) added the bubble canopy to increase all-round visibility in mid-1943. Bomb, rocket, and fuel tank shackles were added to the wings in an evolution that shaped the aircraft to its sterling role as a ground-attack vehicle. The P-47 flew over 423,000 sorties throughout the war, nearly double the number for the P-51. It destroyed 6,284 enemy aircraft, 3,202 *on the ground*. It delivered 113,963 tons of bombs against enemy targets compared to 5,668 tons for the P-51. Its rugged frame withstood enormous battle damage; the Thunderbolt's loss rate per sortie was a low 0.7 percent while the Mustang's stood at 1.2 percent. In these two instruments, "American" designers gave Allied airmen a rapier and a bludgeon; the fliers used both with telling effect.



The miracles of mass production would have been meaningless if the aircraft turned out in such an impressive volume had not met the current needs of combat: victorious fighters or effective bombers could, in one short year, become victims with disheartening frequency. Changes had to be made to aircraft like the P-38 or the B-17 to incorporate the lessons learned in battle. Typical of this process was the Flying Fortress. The B-17D of 1941 had a range of 2,500 miles and relied on seven hand-operated machine-guns for its protection, whereas the most modern, the G model, could fly a maximum of 3,700 miles—with the addition of fuel tanks in the wings—and had eight of its thirteen machineguns in power-driven turrets. Similarly, the last of the P-40s, due mainly to improvements in the Allison engine, surpassed the 1941 version by a factor of 10 percent in range (for a maximum 1,050 miles with a jettisonable tank), speed (increased to 343 miles per hour), and service ceiling (raised to 31,000 feet) and could carry more than twice the normal bomb load (now 1,500 pounds). The long service rendered by many of the types of aircraft on hand when Japan plunged the United States into war resulted from drastic modifications to the basic design. Some models required changes to improve stability, to aid maneuverability, or to compensate for greater weight. Fighters in particular had to have increasingly more powerful engines, some fitted with water injection to improve combustion and thus provide a brief but dramatic surge of power in emergencies.

Modifications were absolutely essential; the question was where should the airplanes be modified. In terms of the efficient use of manpower, the assembly line was the best place, but frequent changes disrupted production and choked off the supply of aircraft at the source. Another possibility was modification centers, but these, too, had their drawbacks, for airplanes were taken out of service and worked on in comparatively small numbers by a large force of workers. Consequently, the Air Forces tried to employ the best features of both. Modification centers, most operated by the aircraft industry, prepared airplanes for service in a particular theater or climate and made changes that were either minor or so important they could not be postponed. Changes requiring retooling were made at the factory and might take the form of a fairly complete redesign—such as the B-17D with a small vertical stabilizer and no power-operated gun turrets that emerged as the B-17E with a new tail and two power-operated turrets—or the simultaneous incorporation of several minor changes that might already be underway, one or two per aircraft, at the modification centers. To take advantage of the efficiency of the assembly line, the Air Forces grouped a number

of minor refinements and designated them with a block number, so that the basic P-38G became a P-38G-1, or perhaps a P-38G-10, depending on the changes that had been made during manufacture. In one modification conducted literally on the fly, Maj. Gen. Bennett E. Meyers rescued the first 150 B-29s leaving the country for combat. Sidelined at a training field at Salina, Kansas, because of missing parts needed for changes to the aircraft, the planes sat until Meyers arrived, hunted down the errant shipment, borrowed a work force from the Boeing plant at nearby Wichita, and had the entire force on its way to the Far East in six weeks.

Whether buying aircraft or modifying them, the agency of the Air Forces that dealt directly with the aviation industry was the Materiel Command, which evolved from the prewar Materiel Division. When Hitler invaded Poland in 1939, the Materiel Division exercised responsibility over most aspects of logistics—buying airplanes, overhauling aircraft in need of extensive repair, purchasing items of supply unique to the air arm, and distributing everything from motor oil to canned meat. The division's experimental engineering section, working closely with airplane manufacturers, handled research, development, testing, and evaluation. The Air Corps obtained supplies used in common with other branches from the Army's technical services. The Quartermaster Corps, for instance, provided food and uniforms, the Signal Corps radios, and the ordnance and chemical organizations the various kinds of munitions used in aerial warfare. The distribution of supplies, regardless of source, was the task of the Materiel Division's Field Service Section, which operated four major supply and storage depots throughout the United States. Combat elements of the GHQ Air Force drew their supplies from these depots, which also had maintenance facilities to undertake any aircraft repairs that the operating unit could not perform. During the rapid buildup of the air service that preceded America's involvement in the war, General Arnold decided that the combined tasks of maintenance, procurement, and supply would overwhelm the Materiel Division. In April 1941, therefore, he created the Maintenance Command to handle the routine purchase, storage, and distribution of supplies and to perform maintenance at all air bases, thus freeing the Materiel Division to concentrate on developing and acquiring airplanes and the equipment installed in them. Unfortunately, the change preceded by a few months a reorganization of Army aviation that entrusted support functions to the Air Corps and operations to the Combat Command. Supply and maintenance soon became a source of friction between the two.



A Generation of Aircraft

While the American aircraft industry produced prodigious quantities of airframes during the war, designers also improved on existing models and rolled out completely new aircraft that set the course of postwar aircraft technology.

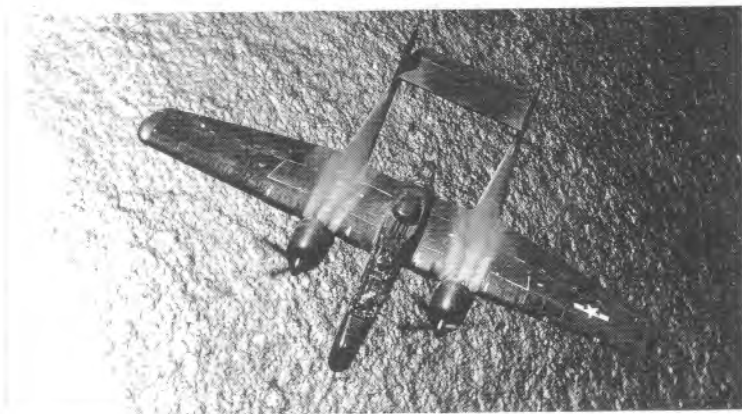
The Boeing B-29 Superfortress (*above*), already on the drawing boards in 1939, went into serial production in September 1943. With a pressurized cabin, the new bomber was designed for operations at altitudes close to 40,000 feet, placing it above the reach of any conventional anti-aircraft weapon. Its defensive armament eliminated windy open turrets and waist guns in favor of a completely automated fire-control system, except for the tail gunner's position. The B-29's bomb load exceeded eight tons, four times that of the earlier B-17. Prone as it was to engine fires, its top speed of over 360 miles an hour made it faster than many fighters of the era. It symbolized the last stages of the air war in the Pacific and caused more casualties than the Japanese Army and Navy suffered during the war.

On the opposite page, the P-40N was the last major variant of the successful Warhawk type, the most widely produced American fighter. Though verging on obsolescence by 1943, the P-40 was a

sound, relatively cheap design constantly improved through 1944. Similarly, the P-38 Lightning, a pre-war conception known for its speed, kept its place in an increasingly sophisticated inventory; it served as a photoreconnaissance craft and the J-model could launch 5-inch rockets in support of ground troops.

The B-24J Liberator and B-17G Flying Fortress bombers sported forward-firing nose or chin machine-gun turrets, the result of hard experience in German head-on attacks during running battles over Germany. A radical night fighter, the Northrop P-61 Black Widow, joined search radar, machine guns and cannon in an effective weapon combination. The A-36 Invader, an attack variant of the Mustang, was equipped with dive brakes and could launch 1,000 pounds of bombs, gunfire, and a rocket barrage against ground targets.

American designers were somewhat behind German engineers in fielding an operational jet fighter. Neither the Bell P-59 Airacomet (*below, left*) nor the more successful Lockheed P-80 Shooting Star saw combat in World War II, but the two-seat trainer based on the latter was still in service thirty years after the war.



The reorganization of the War Department in March 1942 that abolished the Office of Chief of the Air Corps also confirmed the status of an Air Service Command and elevated the Materiel Division to a full-fledged command. The basic distinction between the two centered around their relation to the airplane. The Materiel Command developed and bought aircraft and engines and, in doing so, maintained cadres of engineers, inspectors, and auditors at the various factories throughout the country. The Air Service Command dealt directly with aircraft only in repairing them and processing the spare parts ordered by the Materiel Command; otherwise, it developed and purchased equipment unique to the air arm but not installed in aircraft—items like auxiliary power units for starting aircraft engines—and dealt with the process of supply by ordering, accepting, sorting, forwarding, and salvaging almost everything used by the Air Forces. In accomplishing its duties, the command established a network of depots and subdepots that handled both maintenance and supply. Even before the transfer of the subdepots to local control in January 1944, units overseas were subject to the technical supervision of the Air Service Command but were otherwise under the direct control of the numbered air force operating in the region, like the Eighth Air Force in the United Kingdom or the Fifth in the Southwest Pacific. At its peak strength in late 1943, the Air Service Command operated 11 major depots and 238 subdepots in the United States. These were supplemented as necessary by special depots that functioned as central supply warehouses for critically needed items. The most serious problem facing the service command in carrying out the tasks of maintenance and supply was inventory control, a chore done manually with only the aid of the primitive punched-card business machines of that era. Duplicate serial numbers, lost documentation, and crates of supplies that were simply stacked and forgotten plagued the system throughout the war.

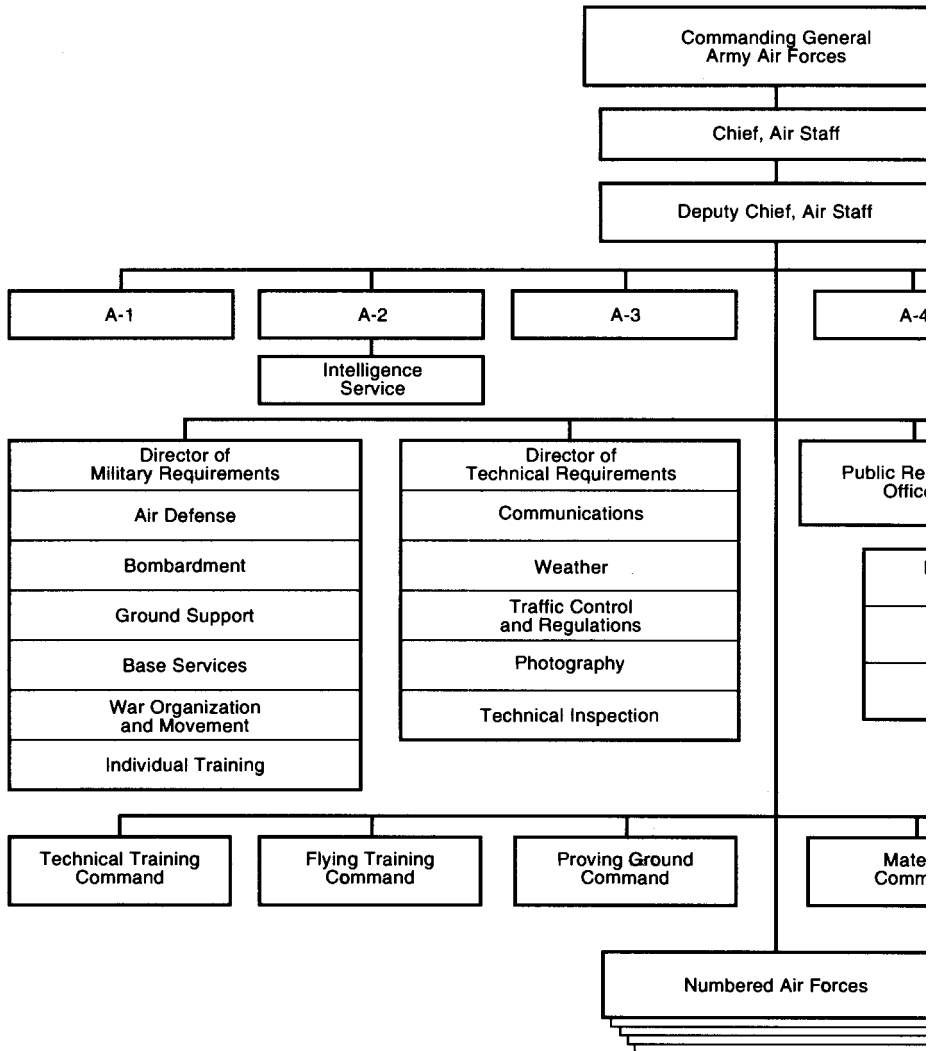
At the outset, the Air Service Command and the Materiel Command seemed to have a clear-cut difference in responsibilities, but the distinction tended to blur as the war progressed, especially in dealing with spare parts for aircraft and engines. The Materiel Command determined the quantity of parts, but the Air Service Command placed the actual order, arranged the production schedule, stored the parts, and distributed them. As a consequence, spare parts were sometimes unavailable when needed, for the service command had to take into account the availability of warehouse space and shipping, along with the needs of the users as established by the materiel specialists. Because of this administrative tangle and because an ideally suited officer was available

to sort it out, the headquarters of the Army Air Forces decided to reintegrate the activities of both commands. General Knudsen, chief of the Materiel Command, had been an executive of General Motors, a member of the original National Defense Advisory Committee, and head of the prewar Office of Production Management. On the basis of this experience, Arnold selected him to command the new agency, the Air Technical Service Command, which combined the Air Service Command and the Air Materiel Command. The official merger of the two organizations took place on September 1, 1944, some three years after the materiel and service functions were separated, but the actual consolidation moved slowly to avoid disrupting wartime projects.

The Air Service Command, and later Knudsen's Air Technical Service Command, undertook the daunting task of shipping war materiel overseas for temporary storage and distribution to the combat forces. During 1942, as the United States built up the overseas stocks that would enable the Allies to contain the enemy and take the offensive, the shipment of cargo remained comparatively simple, for speed was the main consideration. The basic strategy was to defeat Germany first, so the United Kingdom was the likely destination and New York City the most heavily used port of embarkation. Rommel's advance into Egypt in the spring of 1942 and the invasion of Northwest Africa later in the year caused a temporary diversion of men and cargo from Great Britain, but New York remained the principal port. As the war expanded and the volume of deliveries increased, special organizations had to be created to ensure the orderly dispatch of cargo. Beginning in 1943, supplies destined for Air Forces units outside the United States passed through the Atlantic or Pacific Overseas Air Service Commands. When the materiel arrived in the intended theater of operations, it moved through a network of depots and subdepots modeled after the network in the United States but operated by the numbered air force in each theater.

Until early 1943, during the period the overseas buildup was beginning and the great danger was too little of everything rather than too much of anything, the Army Air Forces relied upon automatic resupply to maintain stocks in the various theaters. Unfortunately, the tables governing shipments could not keep pace with changing circumstances, so that a supply officer might find himself inundated with items he did not need. As a result, once the initial frenzy to build and sustain adequate stockpiles had passed, the Air Forces reduced the use of automatic shipments, introducing a requisition system based on locally determined requirements.

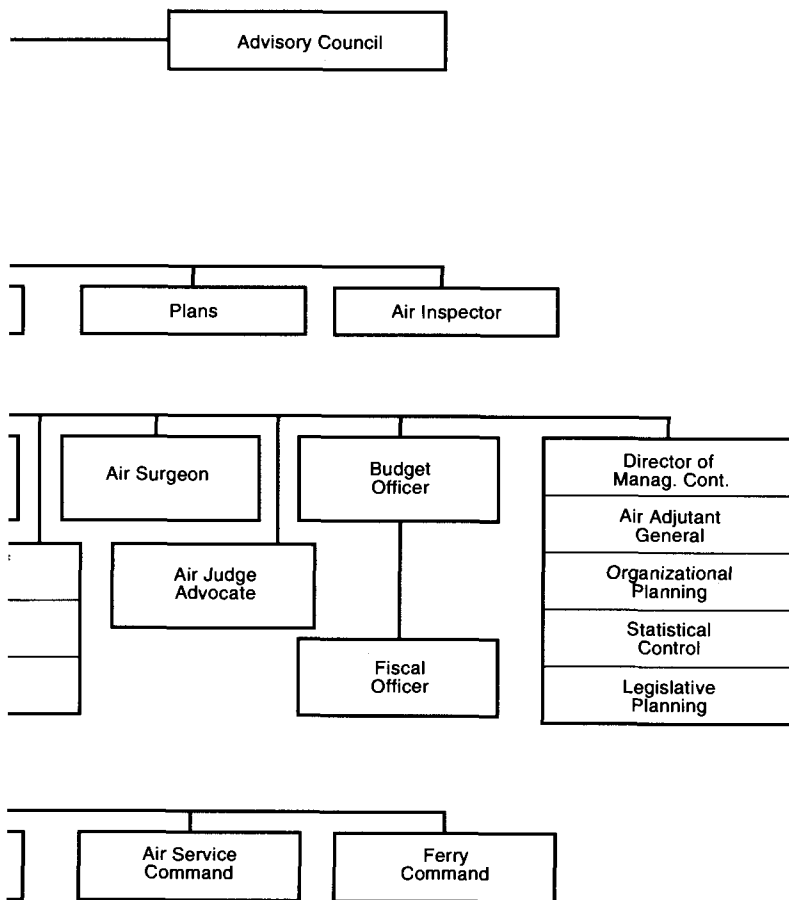
After the supplies and spare parts reached their destination, the depot or subdepot that stored and issued them had a section that



With the onset of war, the United States Army reorganized itself from top to bottom on March 9, 1942, along lines permitting centralized planning and decentralized execution of directives. The main feature of the so-called Marshall Reorganization was the establishment of three large commands for the prosecution of the war: Army Ground Forces, Army Service Forces (initially the Services of Supply), and Army Air Forces, all under War Department auspices. The air element of the new structure was

Army Air Forces Organization

March 9, 1942



already in existence after June 1941, but now achieved a streamlined look that unified service and operational elements for war. General Arnold, commanding general of this new wartime AAF, directed the air staff, oversaw the global deployment of American aerial might, and, with the inherent flexibility of this organization, actually commanded a fielded air force from Washington during the war.

conducted aircraft maintenance. A large, centralized maintenance operation in the United States performed the extensive and time-consuming jobs that could not be done within the flying unit or at the local subdepot, completely rehabilitating an unserviceable aircraft if necessary. A major center required a large number of workers, but since each operation was divided into a series of comparatively simple tasks, like production work on an assembly line, the average individual level of skill did not have to be great. Rather than tie up thousands of trained Air Forces mechanics to man the domestic depots, General Arnold found it easier to hire civilians, many of them women, who possessed or could learn the skills necessary for airframe or engine repair. Uniformed technicians instead operated the more remote centers unattractive to civilian employees and centers in the combat zones. The civilian work force engaged in logistics activity, including aircraft maintenance and repair, increased from 5,500 in 1939 to a peak slightly in excess of 300,000 by the spring of 1943; and the Army Air Forces obtained the services of still other civilians by letting contracts to airlines and other elements of the aviation industry.

Every depot and subdepot had its share of soldiers, members of the Army's technical services assigned to a variety of jobs from driving trucks to operating the laundry. Realizing that an independent postwar air force would be responsible for all technical and housekeeping duties, Arnold's air arm tried gradually to absorb many of these tasks. Besides acquiring the base laundries from the Quartermaster Corps and sharing in the administrative functions of the Adjutant General, the Air Forces obtained authority over the development, procurement, and maintenance of all electronic equipment, thus taking over functions exercised by the Signal Corps throughout much of the war. The service provided by another component of the Army, the Corps of Engineers, required skills in earth moving and heavy construction and could not be absorbed in similar fashion by the Air Forces. Before the United States entered the war, General Arnold had proposed that the engineers train and equip units to perform lighter construction in building, repairing, and camouflaging airfields in the combat theaters. Experience during the Army maneuvers in 1941 demonstrated the value of these aviation engineers, and a battalion was serving at Hickam Field, Hawaii, when the Japanese attacked in December. Units of this sort attained a peak wartime strength of almost 118,000 in February 1945; they served in every theater of war, although sometimes under the direction of the theater engineer officer rather than the senior airman. When commanded by the theater engineer, the aviation engineers tended to function like other elements of the Corps of Engineers and lost their distinctive character.

The output of the American aircraft industry, aided by the vast yet efficient logistics complex that evolved during the war, enabled the Army Air Forces to get replacements for operational losses, accidents, and obsolescence and increase the number of aircraft on hand by more than six-fold, from some 12,000 aircraft at the end of December 1941 to more than 25,000 at the farthest extent of the Axis advance in 1942 to a peak of more than 79,000 in the summer of 1944. Just as aircraft factories were useless without workers, the huge aircraft inventory of the Army Air Forces could accomplish nothing without the hundreds of thousands of men and the comparatively small number of women with such diverse jobs as pilots, members of aircrews, weather observers, engine mechanics, or as teletype operators. To fly, support, and maintain its aircraft, the Air Forces in June 1945 had 2,282,259 persons in uniform, almost one-fourth the aggregate strength of the Army, fifteen times the number of airmen and officers on duty six months before the Japanese attacked Pearl Harbor, and three times the number serving in the air arm six months after the fighting began.

This growth eroded the principle that pilots should dominate the air arm in numbers as well as in authority. The Air Corps Act of 1926 had decreed that 90 percent of the Regular officers should be pilots—aeronautical engineers and even navigators were pilots first and specialists second—but no such policy could apply to a large and semiautonomous branch of service in which temporary officers by far outnumbered the Regulars. Wartime growth multiplied paperwork, and administration soon became a major problem for the Army Air Forces, as it absorbed many of the tasks formerly done by the Army's Office of the Adjutant General. Further complicating both administration and the training of administrators was the transfer of qualified officers experienced in both paperwork and flying, who, with the outbreak of war, were eager to trade their desks for the cockpit. As early as 1942, therefore, General Arnold felt compelled to authorize the creation of an Officer Candidate School, largely to produce specialists in administration. Established at Miami Beach, Florida, though eventually transferred to Maxwell Field, Alabama, the course graduated some 30,000 lieutenants during the war. In addition, the Army Air Forces commissioned individuals directly from civil life, usually because they possessed some skill or profession needed by the Air Forces such as lawyers, businessmen, public relations executives, doctors, and others. The commissioning of nonflying administrators for wartime service was but one element in the shift from what had been a small corps of career officers composed almost totally of pilots to a large officer corps

with numerical preponderance of nonpilots or part-time pilots commissioned for the duration of the war.

Two examples of the need for these specialists were the Army Air Forces Weather Service and the Army Airways Communications Service, both of which expanded from small peacetime organizations located mainly in the United States and its overseas possessions, to worldwide operations essential to an effective air arm. The creation and early expansion of the Army Air Forces Ferrying Command triggered a demand for up-to-date weather information and reliable communications in areas like South America, Central Africa, and Greenland. From some sixty specialists in 1940, the weather service expanded within four years to about 4,000 meteorologists and weather observers serving in such diverse locations as China, the islands of the Pacific, and the airfields of Sicily and Italy. Communications teams accompanied Air Forces units into every theater, providing radio links and navigation aids vital to the air war. Radio operators endured air raids, tropical disease, and fatigue as they not only manned their equipment but also sometimes doubled as infantry, defending against infiltrators or stragglers. By the end of the war, the 49,000 specialists of the communications service operated a network of some 800 radio stations, 570 control towers, 200 message centers, and 1,300 navigation aids.

As the prewar Air Corps became the wartime Air Forces, pilots and support specialists were assigned to noncombat flying that nonetheless helped carry the air war to the enemy. Originally intended to ferry aircraft from factories in the United States to transfer points where British crews took over for the Atlantic crossing, the Ferrying Command evolved during the war into a global organization with 80 percent of its air routes outside the continental United States. Redesignated the Air Transport Command, it ultimately operated about 3,000 aircraft, flying passengers and cargo some 935 million miles. Besides carrying men and cargo, the Air Transport Command continued to deliver aircraft to combat theaters ranging from England to India. Indeed, ferrying crews delivered more than 250,000 airplanes (although those shuttling among several commands were counted each time they changed hands), in the process flying more than 600 million miles but losing just 1,000 aircraft to accidents or hostile action.

In recruiting and maintaining an organization that had a peak wartime strength of 2,400,000 and embraced hundreds of military specialties other than piloting an aircraft, the leadership of the Army Air Forces employed categories of persons normally excluded in peacetime. For example, pressure from Congress forced a reluctant General Arnold to agree in 1940 to accept blacks and

admit them to flight training, although on a racially segregated basis in keeping with War Department policy. Concerned that accepting members of a segregated racial minority into the Air Forces would result in turmoil within the air arm and reduce its efficiency, he tried to minimize contacts between the races by establishing a flight training center at the Tuskegee Institute, a relatively isolated college for blacks in rural Alabama that already trained civilian pilots. The black pilots and crews trained at this one location, where black mechanics serviced their aircraft, and black administrative clerks typed and filed their reports and requisitions. As a result, every black flying unit trained from scratch, without the benefit of a veteran cadre to whom the younger officers and men could look for advice. Despite the handicaps imposed by racial segregation, the Army Air Forces organized four fighter squadrons, which formed the 332d Fighter Group, and four medium bombardment squadrons, incorporated into the 477th Bombardment Wing (Medium). The bomber crews saw no combat, but the fighter pilots destroyed or shared in the destruction of 108.5 German aircraft.

Service in any branch of the military was as much a change for black men as for whites, but it often served to emphasize the predilections of an intolerant society for the black serviceman or woman. Roughly 6 percent of those serving in the Army Air Forces were black Americans, but the vast majority of these were draftees who did not fly aircraft or maintain them but instead manned labor or housekeeping units that patched roads, mended roofs, and cut grass at air bases or manhandled supplies at logistics depots. Their duties were boring, their leadership indifferent, and their morale poor. Restricted to a small range of activity, they had little opportunity for promotion or hope of transfer to fields more clearly related to winning the war. The dissatisfaction bred by this treatment needed only a shove or racial slur to result in violence. At Bamber Bridge in the United Kingdom, for instance, an armed clash erupted after white military police forcibly arrested a black airman for being out of uniform at a village pub. Clearly the Air Forces, reflecting the policy of the Army and the attitudes of a racially segregated nation, did not make full use of the abilities of those blacks who served in its wartime ranks.

Women, too, had an opportunity to contribute to the success of the wartime Army Air Forces. On May 15, 1942, President Roosevelt signed a bill creating a Women's Army Auxiliary Corps, later redesignated the Women's Army Corps. Since the air arm was part of the Army, the women volunteers were eligible to serve there, and in January 1945 the number doing so reached



Black Eagles

Racially segregated American society excluded African-Americans from commissioned rank in the U.S. Army except in token numbers. In 1941, the American military had just five black officers, three of them chaplains; the last two were father and son: Col. Benjamin O. Davis and 1st Lt. Benjamin O. Davis, Jr. Prospective demands for military manpower in an emergency caused the nation to open the ranks to black Americans as it had done hesitantly in all previous wars. The Army Expansion Act of April 1939 brought into existence the all-black 99th Pursuit Squadron the following January, a unit trained at the traditionally Negro Tuskegee Institute in Alabama. The flying program at the institute was commanded by often unsympathetic white officers, with the exception of Maj. Noel Parrish, who built a reputation as a champion of his black fliers. The program began with 47 officers and 429 enlisted in the squadron under the command of Captain Davis, Jr. The Tuskegee program eventually contributed black combat aviators in a number of specialties: 673 single engine pilots, 253 twin engine (medium bomber) pilots, 58 field artillery liaison officers, and 132 navigators. The 99th Pursuit, renamed the 99th Fighter Squadron, led the way for other fighter squadrons, the 100th, the 301st and the 302nd, which, with the 99th, made up the 332d Fighter Group serving under Twelfth Air Force in Italy after February 1944. The younger Davis, now a lieutenant colonel, led the group through a baptism of fire with its P-40 aircraft in North Africa to the

end of the war, which it finished flying from Italian airfields in Fifteenth Air Force P-51 Mustangs. Black airmen were credited with destroying 108.5 enemy aircraft in the air and another 150 on the ground. On escort missions, they never lost or abandoned a bomber. The unit won a Distinguished Unit Citation, its members a Silver Star Medal and 150 Distinguished Flying Crosses.

First Lt. Robert Deiz (*above*) glances over the cockpit of his P-40 after bagging his second German FW 190. On the opposite page (*clockwise from above*), a Tuskegee formation includes an imposing Major Davis in the front rank and Maj. Noel Parrish, the second officer to Davis's left. A black trainee solves a piloting problem in a Lockheed navigation trainer based at Hondo Field in Texas. A ground crew services and refuels a P-40 Warhawk fighter at Selfridge Field in Michigan, where the 332d Group spent the summer and fall of 1943, before it deployed to North Africa. With his father seated next to him, Colonel Davis presides over a press conference for members of the Negro press in September 1943.

American society and its air forces remained racially segregated just after the war, but the record of risk and sacrifice shared by black servicemen fueled the civil-rights movement that gathered force in the decades afterward. The younger Davis had a distinguished career in the independent Air Force, in which he earned the rank of lieutenant general.



29,323, the maximum wartime strength, of whom about 20 percent served outside the continental United States. Blacks, although eligible to enlist, accounted for less than 3 percent of the women in the Army Air Forces.

The so-called Air WACs received various assignments during the war. Initially, most joined the aircraft warning service where they replaced some 6,000 unpaid women volunteers at air defense centers on both coasts. Once the threat of aerial attack on the United States had abated, the women soldiers received different assignments. By January 1945, enlisted women served the Air Forces in more than 200 categories of jobs, while female officers carried out more than sixty kinds of duties. As impressive as the number of jobs might seem, roughly half the women in the Army Air Forces performed administrative or clerical tasks. As file clerks, typists, or stenographers, they did basically what they had done as civilians, though they now were subject to military discipline and had to know procedures, organizations, and terminology unique to the Army. For example, women kept flight records, helped process men and equipment for transfer overseas, and served as dispatchers or operated information desks at air terminals. In the entire Women's Army Corps, no more than 20 individuals were qualified as aircrew members for noncombat flights, though others sometimes went along as radio operators. At least one woman earned the title of crew chief, responsible for the maintenance of a specific airplane, and one flight line was staffed with women mechanics as an experiment. Eventually the number of women mechanics surpassed 1,200.

Another wartime program assigned women pilots to ferry aircraft and perform other flying duty, usually in the United States. Two such groups of civilian volunteers merged into the WASP—Women Airforce Service Pilots. The members were subject to military discipline during training but held no rank and as their director, Jacqueline Cochran, observed, did not have even "the right to a military funeral." The Army Air Forces accepted fewer than 1,900 of the 25,000 who applied to become WASPs, but of those who entered, 1,074 completed their indoctrination and began flying. A total of thirty-seven died in accidents and thirty-six sustained injuries of varying severity. Although ferrying planes was their first and principal duty, they also towed targets at gunnery school and served as instructors at flight schools. By the time the Air Forces, facing a surplus of male aviators, disbanded the WASP in December 1944, the women had flown about sixty million miles on operational duty.

Women also played an important, if more traditional, role as nurses. By 1944, some 6,500 Army nurses served in the Air

Forces, most assigned to military hospitals. About 500 flight nurses cared for critically wounded soldiers during air evacuation missions, helping to reduce the mortality rate and thus contributing to higher morale among combat troops. Nurses accepted for flight duty had to undergo an eight-week training course so strenuous as to persuade one observer that each graduate should have received a medal. The curriculum, for instance, required the nurses to crawl the length of an infiltration course while machine-gun fire cracked overhead.

The demand for manpower, which resulted in a lowering of the barriers that had excluded entire groups from the Air Forces, also led to an easing of standards, whether for draftees or aviation cadets. The Selective Service System tried to assign each of the services a share of the draftees who had scored poorly on the general classification test, but the Air Forces, because of the need for so many enlisted technicians, accepted a smaller proportion than the Army Ground Forces. Besides accepting a number of draftees with lower scores than it would have preferred, the air arm had to adjust downward the standards for admission to pilot training. The minimum age for pilot training was reduced from twenty to eighteen years, and the required two years of college could be waived for applicants who passed a general educational test. High school graduates who had never attended college could become cadets with the understanding that they would serve as sergeant pilots rather than as commissioned officers after completing the required training. Instead of sergeants, some became flight officers, as the Air Forces called its flying warrant officers, and a few were commissioned. One of this talented few was Charles E. "Chuck" Yeager, the self-described "D history student from Hamlin High" in West Virginia, who became a fighter ace, set aviation records, and eventually retired as a general officer.

So overwhelming was the response to the call for air cadets that the Army Air Forces began using an enlisted reserve as a manpower reservoir to hold qualified volunteers, subject to the draft, who could not immediately be accommodated at cadet training facilities. The enlisted reserve also served as a means to retain the civilian instructors at primary flying schools like the Thunderbird Field complex in Arizona. Since these instructors performed just the one task, normally at a single base, and were not available for combat, Secretary of War Henry L. Stimson declined to offer them commissions, leaving them subject to the draft. If they wished to continue with the essential job of teaching others to fly, they had to choose between enrolling in the reserve or accepting direct commissions as flight instructors in the Navy.

Women Pilots





The contributions of female pilots to Army Air Forces activities during the war resulted from the initiatives of two women with decidedly different backgrounds. With Germany's conquest of western Europe, Nancy Harkness Love promoted a plan to have accomplished women pilots serve the Air Forces by ferrying aircraft around the country, releasing male pilots for combat assignments. A thousand flying hours logged and co-ownership of a Boston flying business gave Love a circle of colleagues that let her offer the Ferrying Division of the AAF's Air Transport Command a cadre of experienced women pilots in September 1942. Her "originals" began flying light aircraft and trainers from factory doors and repair facilities to Army airfields. They remained civilian pilots in a Women's Auxiliary Ferrying Squadron, or WAFS, under Ferrying Division at New Castle Army Airfield in Delaware. More skilled women were soon in C-47 transports and even the latest fighters. Jacqueline Cochran, a deprived orphan who never precisely knew her own birthdate, received a pilot's license in 1933. By 1938, she won the first of several Harmon Trophies and took the Bendix Trophy in a Seversky P-35. As the WAFS flights began, Cochran returned from England where she had recruited American women for service in the British Air Transport Auxiliary. Her influence with Eleanor Roosevelt gave her an entrée with General Arnold and facilitated the start of her own program, which trained novice women pilots for employment in the Ferrying Command. She inaugurated her Women's Flying Training Detachment with a class of twenty-eight in November 1942 at a field in Houston, Texas. In April 1943, the school opened new facilities at Av-

enger Field, Sweetwater, Texas, thereafter the home of the program that produced eighteen classes before it ended on December 20, 1944.

In July 1943, Arnold resolved the duplication between the two programs by appointing Cochran director of women pilots and on September 5, 1943, announced the merger of the programs as the Women's Airforce Service Pilots, popularly known as WASPs. Though never granted the same military status as the Women's Army Corps, the WASP flew every type of Army aircraft built in the war, including the B-29 Superfortress; women pilots ferried every P-47 built in the last half of 1944. They logged sixty million miles of air time. Thirty-eight of these pilots died in the service of their country, but the government did not support even their interment costs. Only in late 1977 did the nation recognize WASP service as the contribution it was, and in 1990 surviving women pilots received the same World War II Victory Medals that their brothers had received at the end of the conflict.

The two leaders of the women pilots are shown above, Cochran on the right, flanking the Walt Disney character, Fifiella, created for the WASP. On the opposite page (clockwise from the far left), WASP Helen M. Schaefer flight checks a P-47 Thunderbolt. Two women pilots shepherd a B-17 Flying Fortress to its destination. A young woman pilot pauses before the nose of a B-26 Marauder; the Martin aircraft took exacting skills to fly. Jacqueline Cochran and Brig. Gen. Ralph F. Stearley inspect a group of women assigned to a target towing squadron at Camp Davis, North Carolina.

The latter course, which removed them from the Air Forces program, often proved more attractive.

As in the Air Corps of the interwar years, the pilot remained the most important (although no longer the most numerous) of officers in a vastly expanded and greatly diversified wartime air arm. Pilot training began with preflight instruction; and early in the war, all cadets received this indoctrination at a replacement center, with about 175 hours devoted to physical training, drill, organized athletics, and classroom instruction that included an introduction to meteorology, mathematics, photography, wireless telegraphy, map reading, and the recognition of Allied and enemy ships and aircraft. Because the existing Army preflight schools could not absorb all the men seeking to enter the aviation cadet program, General Arnold made arrangements with colleges and universities, largely devoid of male students because of the war, to teach portions of the curriculum. Faculty members taught the academic aspects of preflight training like mathematics and meteorology, and officers assigned to each detachment handled the purely military instruction, including map reading and radio communication. During 1944, when the backlog of cadets diminished to manageable size, the Air Forces abandoned the college program.

From preflight training, future pilots entered primary training, where they learned to fly a docile, but rugged, airplane like the Boeing PT-17, usually under the tutelage of a civilian instructor. To complete this phase of instruction, which required up to sixty-five hours in the cockpit, the student had to solo and perform certain elementary maneuvers like loops and rolls. For a time, the Flying Training Command tried to introduce fledgling pilots to night flying during primary training, but few cadets could meet the challenge, and the subject was postponed until basic training, the next phase of instruction.

During basic training, almost always administered by uniformed instructors, trainees mastered the military applications of the fundamental techniques learned in the earlier phase. Flying an aircraft like the Vultee BT-13, students spent up to seventy-five hours at the controls, practicing aerobatics, formation flying, and daylight navigation. During basic training, future pilots first encountered the sensations of blind flying in the Link trainer, a simple flight simulator named for its inventor, Edwin A. Link. Seated beneath a hood, which prevented him from looking outside, an individual student followed the instructions received over earphones; manipulated the controls, which caused the machine to rotate on a pivot; and learned to trust aircraft instruments rather than his own senses. Because trainees had to



Pilot Training

In reacting to the shameful end of the Czech crisis late in 1938, President Roosevelt spoke of building 20,000 American aircraft. This announced policy for the moment far outran the capacity of the American aircraft industry. Even if this many could be produced and large numbers of the planes were sold abroad, the Army Air Corps had to embark on an expanded program of training to absorb the new equipment. That year, the Army produced only 300 pilots; by early 1939, plans were in place to turn out 4,500 men in 1940 alone. A year later, when the Army Air Forces was planning fifty-four combat groups, the projected training figures rose to 12,000, then to 30,000 each year.

The expansion of the trained cadre required the evolution of standards for new recruits, the Air Corps insisting on the highest test scores for flight cadets. General Arnold joined the rush for land and built new training bases, contracted with flying schools for their services, and built an Air Training Command empire that sent entrants through primary, basic and advanced flight training.

Above, the North American AT-6 Texan advanced trainer flies over Laredo Army Airfield, Texas, in May 1943. Clockwise at right, basic class members head for their BT-9s at Randolph Field; Maj. Gen. Barton Yount ran the Air Training Command for the duration of the war. The Curtiss AT-9 was an advanced multiengine trainer used to school bomber pilots. Link trainers gave many cadets an introduction to instrument flying. Student pilots strap on parachutes with a Stearman PT-17 Kaydet in the background. Over 190,000 pilots graduated into AAF service during the war, along with 45,000 bombardiers, 297,000 gunners, and 50,000 navigators.



absorb so much so quickly, the curriculum for basic training changed several times, with less emphasis sometimes placed on formation and instrument flying to permit greater attention to aerobatics and with aerobatics sometimes yielding time to instruction in blind flying.

Basic training marked a watershed, for successful graduates afterward began to specialize in single-engine or multiengine aircraft. Those selected to fly fighters received advanced training in the single-engine North American AT-6, whereas future bomber or transport pilots faced the challenge of a twin-engine type like the Curtiss AT-9 or Beech AT-10. During advanced training, all cadets returned to the Link trainer, since instrument flying formed an important part of the curriculum, and received further instruction in aerial navigation. The potential fighter pilots (some of whom, depending on the needs of the moment, would become copilots in bombers or transports) devoted much of their seventy hours in the air to practicing aerobatics and gunnery. The cadets received their wings after advanced training and, with the exception of those few that already held commissions or became sergeant pilots or flight officers, received the wartime rank of second lieutenant in the Army Air Forces.

Graduate pilots then entered transition training, an extension of the advanced course emphasizing combat skills. Subjects included more gunnery and aerobatics for fighter pilots, who devoted about ten of their thirty hours in the cockpit flying obsolete aircraft like the P-40. Bomber and transport pilots spent a hundred hours at the controls, did further work on instrument flying, and received an introduction to the aircraft they would be assigned to fly, perhaps the B-17 or the C-47. Next in the normal course of events came assignment to an operational unit in the United States for combat training, followed by duty overseas. Chuck Yeager called combat training a "gruesome weeding out process" from which only the best survived. Thirteen pilots who entered combat training with him died in crashes caused by stalling when making too tight a turn at low speed and low altitude, by cutting it too close while buzzing the Nevada wasteland and hitting the crest of a ridge, or by failing to recover from a high-speed dive. Including transition and combat training, the average American pilot spent about a year preparing for combat, logging about 400 hours in the air before going into battle. In contrast, by mid-1944 German aviators received perhaps 150 hours of training and Japanese fewer than a hundred.

The number of weeks devoted to pilot training for Army aviators changed during the war. The preflight course, originally a four-week indoctrination, finally stabilized at ten weeks, largely

because of the importance of subjects like meteorology and aircraft identification and the need of many cadets for additional instruction in mathematics. While the program lasted, cadets assigned to training detachments at colleges could remain on campus for as long as five months before reporting for the next phase of training. Otherwise, acceleration was the watchword until victory drew near. In the summer of 1939, the Air Corps reduced the cycle of primary, basic, and advanced training from twelve months to nine; it declined during the following year to seven months, with thirty weeks of actual instruction, and to twenty-seven weeks after the United States entered the war. Not until March 1944, did the trend reverse and the time allotted for training return to thirty weeks. As a general rule, the less the demand, the longer and presumably more thorough the course of instruction, regardless of the specialty being taught.

During World War II, 193,000 men emerged from advanced training to receive the silver wings of a pilot in the Army Air Forces. Another 124,000, almost 40 percent of the total, began primary training but failed at some stage of the process or become victims of accidents. The number undergoing flight training at any given time reflected the anticipated needs of the service. In December 1943, the total peaked at 74,000, which resulted in too many pilots and caused the air arm to begin reducing the number of cadets accepted until only 5,000 were in training when the hostilities ended.

Some who did not complete the course received the opportunity to train for other positions within aircrews. Most bombardiers, in fact, learned that specialty after elimination from pilot training. Until 1940, no formal school for bombardiers existed; enlisted men and the few nonpilot officers learned this skill while serving in bombardment squadrons. During 1940, however, the Air Corps opened a school for instructors at Lowry Field, Colorado; and in 1941, graduates began teaching the subject, following a curriculum that at first lasted twelve weeks but was extended to eighteen and finally to twenty-four weeks as the demand for bombardiers decreased. Once again, the less the need for a particular specialist, the greater was the time invested in training.

Although the almost 45,000 graduates of bombardier training learned the rudiments of navigation, success depended on demonstrating the ability to put bombs on a target. The cadets trained with the Norden sight, for a time the Sperry as well, or with a different type intended for medium-altitude attack. Perched on the A-2 simulator—a wheeled, self-propelled, steel device—students scored their first hits on paper targets placed on the floor of a hangar. After this introduction, they dropped dummy and practice

bombs from a Beech AT-11 fitted with a bombsight and an automatic pilot. During subsequent training, bombardiers learned the characteristics of the planes in which they entered combat and became functioning aircrew members.

The Air Corps had provided some instruction in aerial navigation since the early 1930s, but the courses that were functioning when the war began could not produce the necessary number of graduates. Until the expanded Army schools could begin operating, Pan American Airways taught students at its facility in Florida. Mastering a curriculum that lasted eighteen weeks (twenty weeks after December 1944), more than 50,000 students learned four basic methods of aerial navigation. The first method, dead reckoning, involved the computation of the speed and heading necessary, allowing for the effect of wind, to follow a charted course. A second technique, pilotage, required the use of general compass headings in conjunction with checkpoints visible from the air. The other two methods, celestial navigation and radio navigation, relied on the use of the stars and the sun or on radio signals from known locations on the ground to keep the aircraft on course. Emphasis throughout the period of instruction rested on practical solutions rather than theory, with each trainee flying about twenty missions totaling a hundred hours.

Both navigators and bombardiers received some training in flexible gunnery, since in most bombers they had this additional duty. All enlisted men in a bomber crew served as aerial gunners, whether this was their primary function or a collateral task, as with radio operators and some armorers or mechanics. The 297,000 graduates of gunnery courses usually received six weeks of training. First, they fired at fixed or moving targets at ranges on the ground; they then went aloft in trainers like the Lockheed AT-18 to engage towed targets or use gun cameras against maneuvering fighters. An attempt to fire frangible (disintegrating) bullets at heavily armored target P-63 fighters proved unsuccessful; the reduced charge in the cartridges fouled the machineguns firing them, and the flying targets were still susceptible to damage from hits in unarmored spots or the ingestion of munition fragments into the cooling system and air ducts. Gunners manning the remote-control turrets of the B-29 required additional specialized instruction, for in that airplane only the tail gunner actually aimed and fired his guns from inside a housing; the others aimed through plexiglas bubbles on the fuselage and fired the weapons by remote electrical control. An officer with the rating of bombardier manned a scanning station atop the fuselage and served as "gun captain," coordinating the defensive fire. The two waist gunners in B-29s received additional training, one as an

electrician, the other as an armorer, and between them they made emergency repairs to the firing circuits or the guns.

The B-29, besides requiring specially trained gunners, had a flight engineer who inspected, monitored, and adjusted the four temperamental engines and the oxygen and hydraulic systems. Instructors trained by Lockheed Aircraft conducted basic and advanced courses for flight engineers that lasted a total of twenty-nine weeks. About 7,800 airmen completed the training, which like the bombardier and navigator courses resulted in a commission for those who graduated.

The emergence of airborne radar in bombers and nightfighters created a need for other new courses of instruction. Since B-17s, B-24s, and B-29s used radar to attack targets obscured by cloud or darkness, some 7,600 graduate bombardiers or navigators received the additional ten weeks or more of instruction that qualified them in the techniques of radar bombardment. Another 500 officers, graduates of a course in communications, became radar countermeasures specialists and learned to frustrate enemy efforts to track bomber formations. Similarly, 1,000 men trained to become radar operators in night fighters; most were aviation cadets dropped from pilot training but were commissioned or appointed warrant officers after the nine-week radar course.

Aircrew survival and success depended on mechanics who kept the airplanes flying. Individuals with skills that included engine overhaul, sheet metal work, and radio repair were not equally important as pilots to the war effort. Between the attack on Pearl Harbor and the cessation of hostilities, almost 1,400,000 persons had some kind of technical training, an indication of the importance of these specialists. Before the war a single technical school at Chanute Field, Illinois, had produced all the mechanics the Air Corps needed, no more than 900 graduates per year; but the wartime Army Air Forces relied heavily on contractors to train the vast number of technicians required. The prewar graduates, moreover, worked on airframes, engines, and comparatively few aircraft accessories like radios, hydraulics, or electrical systems. In the 1930s, one mechanic could perform almost every job on any aircraft, but this was not so during World War II. New warplanes were not only more numerous but far more complex, with accessories that included power-driven turrets (sometimes operated by remote control), radar, pressurization systems, engine superchargers, and components made of magnesium, a more difficult material to work than aluminum. In recognition of the growing complexity of the modern airplane, students concentrated not only on a single skill, like sheet metal work or engine repair, but also on a specific category of aircraft. Radically different aircraft like

the B-29, the helicopter, and the jet-propelled P-80 required the preparation of new courses designed exclusively for each type and its components. Throughout the war, service schools, including the one at Chanute Field, usually taught fundamentals to the mechanics, who then received further training from contractors, either in private institutions or at aircraft factories. During the first six months of 1942, the number of private institutions under contract increased from nine to sixteen, among them the Curtiss-Wright Technical Institute, the Boeing School of Aeronautics, Parks Air College, and the Embry-Riddle School of Aviation. The number of mechanics in training approached 8,000 at mid-year, and the courses dealt with such specialties as engines, sheet metal work, instruments, hydraulics, and propellers.

Specialists in electronic fields also received training at service schools and from contractors. Enlisted radio operators and repairmen trained at Chanute Field; but officers specializing in radio communication received their initial instruction at Chanute Field until 1943, then at Yale University, and at Scott Field, Illinois, beginning in 1944. Radar training began at the Massachusetts Institute of Technology, where a few officers attended classes in 1941. As the use of radar became more common, schools opened at Scott Field; Truax Field, Wisconsin; and Boca Raton Army Airfield, Florida. A basic course in electronics, eventually required before radar training, was offered at Chanute Field, Harvard University, and the Massachusetts Institute of Technology.

The Army Service Forces, which provided technical services to the Ground Forces and the Air Forces, also provided instruction in certain specialties needed throughout the Army. Cooks, bakers, and supply clerks graduated from schools operated by the Quartermaster Corps. Pay clerks received training from the Finance Corps, and Air Forces chaplains trained at Harvard University under the auspices of the Army Chaplain Corps. The Ordnance Corps taught men to fuze and handle high-explosive bombs, and the Chemical Warfare Service trained airmen to work with fire bombs, although the Air Forces taught the repair and maintenance of aerial machineguns and cannon. Weather was of vital interest to the entire Army, but the air arm needed unique kinds of data and therefore trained its own weathermen. During the war, the Air Forces began exerting greater control over courses in chemical munitions, finance, and military police procedures in preparation for the day when the service became independent and no longer relied on the Army Service Forces.

The Army Medical Service helped supply specialists for the Air Forces. As before the war, the Army Medical Service shared in the

training of doctors and nurses, offering general instruction in medical subjects likely to be encountered throughout the Army. The Air Forces then took over the training program, sending newly assigned doctors to its School of Aviation Medicine, where they became flight surgeons, and training officers of the Army Nurse Corps in subjects related to military aviation. The Air Forces also operated schools where enlisted medical technicians and hospital stewards received instruction in health, hygiene, and first aid. Important wartime advances in aviation medicine included the use of transports fitted with litters to fly the wounded to well-equipped hospitals away from the combat zone, the development of effective and reasonably comfortable oxygen masks, and the improvement of electrically heated flying suits. Less successful were attempts to develop an ejection seat for fighter pilots and an inflatable corset or "G-suit" that maintained an adequate oxygen supply to the brain by compressing the lower body and extremities to keep a full blood flow above the heart-level and to the airman's head. This prevented blackouts in violent aerial maneuvers. A few of the G-suits, so called because they compensated for the effect of forces several times the pull of gravity, appeared before the fighting ended, but not the ejection device. To compensate in part for the lack of an ejection seat, the Air Forces substituted the bailout bottle, a portable metal container for oxygen fastened to the parachute harness that enabled a pilot to breathe at high altitude while escaping from a damaged airplane and parachuting to safety. Flight surgeon William R. Lovelace, II, tested the bottle by making a parachute jump, his first, from an altitude of 40,000 feet.

The flight surgeon held the key to medical care within the Air Forces. With a team of nurses, medical technicians, psychologists, and psychiatrists, he examined those seeking to enter the service and cared for those accepted. Because the requirement for academic training had been relaxed to obtain more cadets, the medical service developed a battery of psychological and medical tests designed to eliminate at the outset those unlikely to complete pilot training. After interviewing instructors, graduates, and non-graduates, psychologists prepared a multiple-choice test believed capable of measuring a cadet's aptitude for flight training or other instruction. Scores helped determine whether a cadet might train to be a pilot, begin immediately to master the duties of a bombardier or navigator, or be rejected for instruction as an aircrew member. General Arnold insisted that the tests were well worth the cost at less than five dollars per candidate, and the failure rate in pilot training of roughly forty percent did represent an improvement over the 50-percent attrition during World War I,

when psychological testing was not attempted. Moreover, many of those barred from entering pilot training, along with a good many of those who were eliminated during the course, succeeded in becoming navigators or bombardiers, contributing to the efficient use of manpower.

The function of the flight surgeon was a delicate one. In the bombardment or fighter group he determined not only if a man was physically able to fly but whether he could still function as part of a fighting team. Besides caring for the flyer's immediate medical needs, flight surgeons had to diagnose and treat the stress encountered in aerial combat, whether affecting the mind, body, or both. The sudden transition from an airfield in rural England to an air battle five miles above Germany intensified the stress of waging a fight for life that lasted from a few minutes to several hours, a fight in which cold or a lack of oxygen could prove as deadly as fire from anti-aircraft guns or fighters. Indeed, as Air Forces physicians soon discovered, stress, though difficult to diagnose, could disable a man just as surely as wounds from bullets or shell fragments. The average doctor serving as a wartime flight surgeon had little previous experience with psychosomatic reactions, since the tensions of peacetime were far different from those of war. Yet, the surgeons, aided by psychiatrists and psychologists, discovered how to help the airmen through the worst times, and commanders came to treat the effects of stress as a medical rather than a disciplinary problem. Cooperation between medical specialists and flying commanders contributed to a remarkable stability among bomber crews—only 1.5 percent of the crew members were grounded permanently either for reaction to stress or for other causes that did not involve physical injury. Another small group, fewer than three percent, were removed temporarily from flying status but returned to the air war over Germany.

For some members of bomber crews, personal armor proved a simple, but effective, means of reducing anxiety and stress by providing the wearer some degree of protection against death or disability. If possible, a crewman donned both an infantryman's steel helmet and a newly developed vest or apron that could at least stop nearly spent shell fragments or ricocheting bullets. Col. Malcolm C. Grow, the Eighth Air Force Flight Surgeon, launched the study that analyzed the kinds of wounds suffered by bomber crewmen and resulted in the development of body armor.

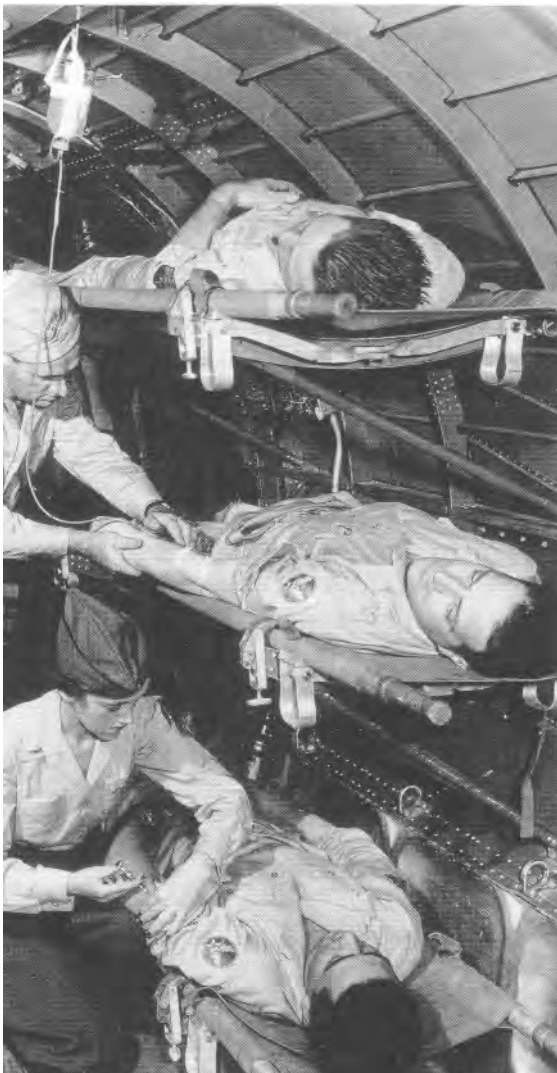
In their early efforts to deal with victims of stress, Eighth Air Force flight surgeons found that the absence of a fixed combat tour contributed to anxiety or emotional breakdown. Crew members facing disheartening rates of attrition needed a goal, a sense of making progress toward relief from the demands of aerial

combat. As a result, in March 1943, General Eaker, then in command of the Eighth Air Force, announced a tour of duty of twenty-five missions for bomber crews and 150 to 200 operational flying hours for fighter pilots. Even so, bomber crewmen in particular remained haunted by the thought that the odds were heavily against them. Curtis E. LeMay, while a brigadier general in the Eighth Air Force, used rough calculations and determined leadership to inspire resignation, if not confidence, among the bomber forces he commanded in Europe during 1943. Col. Charles B. Thornton of General Arnold's statistical control unit adopted a different approach in 1944, when he tried to demonstrate mathematically that a crew member flying from the United Kingdom had a "better than 60 percent chance of completing his tour and a better than 50 percent chance of living even if he was shot down," a combination that resulted in an 80 percent prospect of survival. Thornton's numbers, however, may have been reflected an overly optimistic view of the collapse of German resistance. A postwar analysis of six bombardment groups flying missions against targets in Europe examined the fate of 2,051 crewmen who began a cycle of twenty-five missions and discovered that by the time of the last mission 1,295 had been killed or reported missing and another 197 were ill or recovering from wounds. Clearly, other commanders had good reason to follow Eaker's example and establish a standard combat tour for each theater. Because circumstances varied, policies differed from one theater to another and within a given theater according to the particular time. In the Mediterranean Theater of Operations, typical bomber crews had to fly between fifty and sixty missions and fighter pilots 300 hours or more, but in the Pacific 500 to 600 hours constituted a tour in either bombers or fighters. The China-Burma-India Theater had no announced policy at all.

Rest and recreation supplemented the effect of the fixed tour. Throughout the world, the Army Air Forces medical service established rest centers where airmen could escape the stress of war. The prospect of visiting such a center depended on the theater of operations and the tempo of the war; in the Pacific, the Fifth and Thirteenth Air Forces tried to schedule leave every three months, whereas in Eighth Air Force in Europe the interval varied from two to five months.

Another means of easing anxiety, raising morale, and saving the lives of trained airmen was the Air-Sea Rescue Service operated jointly by the Army Air Forces and the Navy. Lacking a rescue organization early in the war, the Air Forces assembled and trained one in a remarkably short time. In England, Army airmen supplemented the work of the Royal Air Force, and during 1943

Aviation Medicine



Largely unsung in the war's history are the remarkable achievements of the Air Forces' medical establishment. Army Air Service doctors had established what became the School of Aviation Medicine in 1922. Here the staff worked and lectured on the effects of flight on human physiology. Central to this knowledge was the developing information on such subjects as oxygen starvation at altitude, the effect of flight on vision, and even aviation neuro-psychiatry. Surgeons influenced the design of early oxygen masks and the layout of crew spaces in new aircraft designs. In the Army Air Forces, the Air Surgeon during World War II, Maj. Gen. David N. W. Grant, (*left portrait, opposite*) promoted techniques for evacuating battle casualties by air. Air evacuation could reduce the time needed to move a casualty to a general hospital to a single hour, compared to as many as fifteen by a road-bound ambulance. In the scene above, an ambulance crew loads wounded aboard a specially configured Troop Carrier Command C-47 Skytrain for transport to a major facility. The interior of an evacuation aircraft (*left*) shows the arrangement of litters and the services administered to wounded in flight. Field tested and in use by the end of the Allied North African campaign, aerial evacuation was especially critical in more primitive areas; U.S. Marine wounded from the assault on Tarawa and later Central Pacific amphibious operations were moved by Army aircraft and medical attendants, which contributed greatly to the survival rate among these men.



Air operations over Europe posed special hazards for Army airmen. Over 77 percent of all Air Forces casualties occurred in European skies; many were wounded by flak splinters in aerial combat and endured a life-threatening ride of several hours home. The Eighth Air Force Surgeon, Maj. Gen. Malcolm Grow (*right portrait, above*), designed a flak vest (*right*) to stop nearly spent shards that could still cause serious injury. In one documented case, a radio operator wearing a vest took an exploding German 20-mm. cannon round in the back and survived; the vest's armor absorbed the blast and left its wearer with superficial bruises where it buckled. Operating conditions in the bomb units also contributed to crew casualties. The Eighth's medical staff sought solutions for the complications of wounds in low-temperature, anoxic conditions and for the recurrent frostbite among gunners, especially those exposed in the open waist positions of a B-17. Electrically heated pouches to enclose a wounded aviator in flight ward off shock and assisted in the administration of first aid. Similar heated coverings were developed to shroud the breech blocks of .50-cal. machine guns (*below, right*); gunners removing a glove to clear a jam often froze their hands to the gunmetal at altitudes where temperatures fell to -40 degrees Fahrenheit.

In the Pacific and China areas, air operations had their own distinct medical aspects. The prevalence of open-water rice farming and sewage and natural climatic conditions around bases made malaria a year-round medical problem for air surgeons in the more primitive operating theaters. Sound diet among airmen and ground crews was erratic in the absence of refrigeration. The introduction of the B-29 Superfortress, its pressurized cabin system permitting operations up to 42,000 feet, increased medical concerns about anoxia and the effects of rapid cabin decompression in flight. The flight fatigue experienced among crews in Europe was compounded in Asia and the Pacific, where bombing missions often lasted over fourteen hours and especially taxed the escort pilots in their cramped single-engine fighters.



rescue units of the two nations saved about 28 percent of the Eighth Air Force crews that went down off the coast of Britain. The proportion saved increased as the war continued, reaching as high as 90 percent in a single month as the fighting neared an end. By March 1945, 1,972 American flyers had been saved by British and American rescue units in the North Sea, the English Channel, and other waters surrounding the British Isles. On the opposite side of the world, ships or rescue aircraft picked up half the B-29 crewmen reported to have crash landed between the Mariana Islands and Japan. Indeed, the rescue effort in support of the bombing of Japan became so immense that on the final B-29 mission of the war, some 2,400 men, about one fourth of those taking part in the operation, manned rescue aircraft.

Unlike the tightly structured military society of the 1920s or 1930s, the wartime air arm was diverse in background and outlook, composed overwhelmingly of wartime airmen whose service in uniform represented a temporary aberration rather than a career. As a result, the armed forces had to ease the transition of the citizen soldier from civil society to life in uniform by making a special effort to preserve some of the amenities he was used to. Chaplains and agencies such as the Red Cross and Army Emergency Relief helped in this regard by offering counsel, or even small amounts of cash, in time of personal crisis or family emergency. Morale also benefited from recreational activities sponsored by Army Air Forces Special Services. This organization presented movies, supplied athletic gear, ran hobby shops, distributed scarce radios and phonographs, and in conjunction with the United Service Organization arranged for professional entertainers to perform at air bases. Special Services sponsored athletic competition at bases everywhere; the Eighth Air Force alone had over 500 basketball teams.

Education and cultural development was not overlooked. Commanders encouraged enrollment in the United States Armed Forces Institute or other correspondence courses. Symphony concerts and operatic performances were available for men stationed near Naples, and airmen in Britain could learn to appreciate the art in the galleries there. Indeed, almost everywhere base education sections arranged off-duty sightseeing tours; supplied and ran libraries; published newspapers; and distributed news maps, copies of officially sponsored publications like *Stars and Stripes* and *Yank*, and commercial newspapers and magazines.

The expense of such an establishment kept pace with the costs of a world wide conflict. Because of its sudden growth, which involved the acquisition of vast tracts of land and extensive construction,

and the heavy investment in advanced technology as well as in manpower, land-based American air power, when unleashed in World War II, provided anything but the inexpensive means of victory that Douhet, Mitchell, and other visionaries had predicted. In part the high cost resulted from a lavish use of materials, an expansible work force, increased plant capacity, and a program of subsidies that encouraged a greater volume of production than was absolutely necessary. At no time did the aircraft industry have to slight the Army to favor the Navy or slight the bomber to favor the fighter. Few hard choices proved necessary once production received a priority over long-range development. Indeed, production took on a life of its own, sometimes churning out aircraft far in excess of American needs, although useful to the nation's allies, and providing alternatives to unproven weapons like the B-29. Prodigal as well as prodigious, aircraft production typified a war effort that mass-produced everything from rifles to merchant ships. Between July 1940 and the cessation of hostilities in August 1945, the Army Air Forces accepted equipment worth \$43.5 billion, roughly 37 percent of the amount spent by the War Department for military procurement. Actually the air arm's share of the cost was even larger, for elements of the Army Service Forces (which embraced the technical commands) purchased a variety of items for use by the Air Forces. The Army Ordnance Corps, for example, provided high-explosive bombs and rockets, the Chemical Warfare Service supplied fire bombs, and the Signal Corps furnished a great deal of radio and radar equipment. Because of this assistance from the Army Service Forces, the Air Forces could devote almost 83 percent of its procurement funds to the purchase of aircraft, some of them transferred to the U.S. Navy or to the armed forces of Allied governments.

The U.S. Treasury reported that from September 1939 until the fighting ended in 1945 it released \$160 billion to the War Department. Spending patterns suggest that the Army Air Forces used roughly \$50 billion or about 30 percent of the total, a sum that does not take into account either War Department expenditures on industrial facilities for aircraft manufacture or items the technical services supplied to the air arm. The War Department invested a comparable proportion of its uniformed manpower in military aviation. The strength of the Air Forces fluctuated between 23 and 31 percent of the total serving in the wartime Army, reaching a peak in excess of 2,300,000 men and women in 1944. The Air Forces suffered 52,173 killed in action and 63,209 wounded, approximately 12 percent of the Army's 936,259 battle casualties, which vindicated the belief that it would cost fewer lives to wage aerial warfare than to fight a land campaign.

Casualties per hundred men in uniform stood at five and one-tenth for the Air Forces but ten for the rest of the Army. In addition to battle deaths, however, the Air Forces lost 13,093 officers, enlisted men, or cadets in fatal aircraft accidents, a total almost 30 percent of the number killed in combat.

The actual deployment and use of this large and costly air force changed as the war progressed. Until late 1942 Army aviation gathered strength while helping check the Axis advance, a sharp contrast to the decisive role envisioned in earlier decades by enthusiasts for air power. Once the Allies stopped the enemy and the necessary programs of production, logistics, and recruitment, and training reached peak efficiency, the Army Air Forces assumed the status of an offensive weapon in the execution of a war plan calling for the defeat of Germany and Italy as the necessary prelude to victory over Japan. Beginning in 1943, land-based air power struck its first blows—blows that increased in destructive power throughout 1944 as the war entered its final decisive phases.

5

Defeating Italy and Germany

Part of what British Prime Minister Winston Churchill called “the end of the beginning”—the end of the defensive war for the Allies and the beginning of the offensive—was the invasion of French Northwest Africa. In this operation, called TORCH, the Anglo-American allies, using the ships, men, and aircraft immediately available to them, sought to gain control of the Mediterranean Sea and divert the German forces plunging deep into the Soviet Union. As early as the Argentia conference in August 1941, the prime minister had raised the possibility of such an operation if the United States should go to war. Again, during a visit to Washington shortly after the Japanese attack on Pearl Harbor, Churchill and his military advisers proposed an African landing, preferably at the invitation of French colonial authorities, in conjunction with a British advance across the Libyan desert. This plan never came to fruition, however, because a German counter-attack hurled the British back into Egypt.

After relegating the North African invasion to an “academic exercise,” the Combined Chiefs of Staff, at the urging of General George C. Marshall, Army Chief of Staff, and the American Joint Chiefs of Staff, addressed the possibility of storming ashore in France and establishing a permanent lodgment there, either to relieve German pressure on the Red Army and provide a secure base for future operations in Europe or to take advantage of a sudden collapse of the Hitler regime. The British, although willing to plan for an invasion with these limited purposes, were wary of actually attempting it, and rightly so. An estimate of the men and machines available in the near future revealed that the Anglo-American forces could not overcome determined opposition and seize a beachhead in France, and a vicious fight seemed certain, since the Nazis gave every indication of having firm control of

Germany and seemed likely to remain in control for the near future. Because some sort of offensive seemed necessary in 1942, at least to distract the Germans who had driven deep into the Soviet Union, the Combined Chiefs of Staff endorsed an invasion of French Northwest Africa. The planners expected light resistance to landings there, since the colonial government seemed likely to side with the Americans and British. An advance eastward from the invasion beaches could not only force Hitler to shift men and materiel from the Soviet Union to Africa but also cut off the Axis divisions that in the autumn of 1942 still posed a threat to the Suez Canal.

Planned in part to compel the Germans to reappropriate resources, the assault on French Northwest Africa forced the British and the Americans to realign some aviation units. The earlier invasion proposal had resulted in the creation of the Eighth Air Force, which deployed to the United Kingdom when the operation was cancelled. With the decision to actually launch the attack, some Eighth Air Force units already in the United Kingdom, along with fighter and bomber groups that otherwise would have joined it there, moved to Africa. The Rouen strike of August 17, 1942, had not yet taken place when Lt. Gen. Henry H. Arnold notified his commanders in England that the very group chosen to make the attack would soon be en route to North Africa, along with another B-17 group, a minimum of three Eighth Air Force fighter groups, and much of its medium and light bomber strength. These units, with other units from the United States, formed the Twelfth Air Force, commanded by Brig. Gen. James H. Doolittle, recently returned from leading the strike against Japan in April 1942.

Operation TORCH began on November 8, 1942, when American troops landed at Casablanca, Morocco, and Oran in western Algeria, while British forces seized the city of Algiers, to the east. Reflecting the initial geographic separation, each national contingent had a different air organization—Doolittle's Twelfth Air Force supported the Americans and Air Marshal Sir William Welsh's smaller Eastern Air Command the British—an arrangement that continued during the advance eastward into Tunisia. The division of the air component according to nationality violated the spirit of War Department doctrine which endorsed the principle that an airman should exercise centralized control of military aviation within a theater of operations. The arrangement for Northwest Africa had originated with Maj. Gen. Carl Spaatz, ironically the air officer of the European Theater of Operations as well as the commander of the Eighth Air Force, who expressed concern that the more experienced British airmen would dominate

their American counterparts in an Anglo-American command structure. Consequently, unity of command over air power during the expedition existed only insofar as Welsh and Doolittle took their orders from Lt. Gen. Dwight D. Eisenhower, the Allied commander for Operation TORCH.

Besides linking the efficient use of air power to centralized control within the theater, War Department doctrine also recognized the importance of collaboration at the operational level between the senior ground commander and the senior airman. The appropriate manual, FM 31-35, *Aviation in Support of Ground Forces*, adopted in April 1942, specified that an air support command, part of a theater air force, would specialize in flying missions for the principal combat force within that theater, such as a field army. The air support commander, who operated from the army headquarters, advised the ground commander on the employment of tactical aviation. Ideally, the airman and the army commander formed a team, the ground officer identifying critical targets and the aviator explaining how air power might be used and then issuing orders for whatever strikes the two decided were necessary. The ground commander, however, made the final decision whether to attack a particular target. To ensure a rapid response by the supporting aircraft, the airman might assign an element of the air support command to assist a specific corps or other ground formation; and whenever circumstances required him to make such an assignment, the air support commander also established control elements at the corps command post. The manual specified that, even though certain aircraft supported a particular ground unit, the corps commander or other ground officer did not assume command of the squadrons, which remained under the control of the airman in charge of the air support command. If communications should fail, for instance, and the air support commander became unable to employ his aircraft effectively, he might attach some of his squadrons to a ground unit, and the commander of that organization would assign them missions. The manual advised, however, that instances of actually attaching aviation units to ground forces would be comparatively rare.

On the day after the landings in Morocco and Algeria, German troops began arriving in Tunisia, disembarking from trimotor Junkers Ju 52 transports, as many as fifty of which landed at Tunis in a single day. Meanwhile, Field Marshal Erwin Rommel retreated westward from El Alamein in Egypt toward Tunisia where he intended to join forces with the units arriving by sea as well as by air. To frustrate the German plan, the Allies attempted a rapid advance from the TORCH beachheads, but poor roads, a

shortage of trucks, rain, unreliable communications, and stiffening resistance impeded the ground forces. Allied airmen fared little better, for the combination of rain and unpaved airfields often immobilized their airplanes in the mud, while German fighters, the Bf 109 and the newer Focke-Wulf FW 190, operated from all-weather surfaces that shed the rain and enabled the *Luftwaffe* to gain mastery of the Tunisian skies.

As early as the end of November 1942, Eisenhower became concerned that the Twelfth Air Force, elements of which had to deploy all the way from the Atlantic coast of Morocco to the eastern reaches of Algeria, moved too slowly in occupying its designated forward bases. Moreover, the Eastern Air Command had failed to provide the kind of air support that the senior British ground commander, Lt. Gen. Kenneth A. N. Anderson, demanded. Since he had no senior airman at hand in Northwest Africa, Eisenhower conferred with Spaatz at Gibraltar, then summoned him to Northwest Africa, and on December 3 appointed him Acting Deputy Commander in Chief for Air of the Allied forces in the region. Brig. Gen. Ira C. Eaker assumed command of the Eighth Air Force, and Spaatz functioned as an adviser and trouble shooter for Eisenhower. In his new assignment, Spaatz sped the deployment of aviation engineers to eastern Algeria, where they set to work on new airfields, and arranged for Doolittle to attach some light bombers to Welsh's Eastern Air Command.

In December 1942, while Spaatz was trying to bring some unity to the employment of aviation, Air Chief Marshal Sir Arthur Tedder, the Air Officer Commanding, Middle East, showed a representative of the Army Air Forces how the Royal Air Force supported ground operations. Personal observation of the command structure in Northwest Africa had convinced Tedder that the existing air organization was "almost crazy," with Doolittle and Welsh maintaining separate headquarters, both some distance from Eisenhower's command post. To demonstrate the importance of collaboration between ground and air, Tedder took Brig. Gen. Howard A. Craig, who headed the Air Support Command of Doolittle's Twelfth Air Force, to see how the air and ground staffs interacted at Cairo. When Craig's airplane developed engine trouble, Tedder found time to give the American a tour of the headquarters of the Western Desert Air Force, which supported the advance of the British Eighth Army, under General Bernard Law Montgomery, from El Alamein toward Tunisia. The commander of the Western Desert Air Force, Air Vice Marshal Sir Arthur Coningham, made use of a system of air support that had been evolving since the battle for France in 1940. British soldiers

and airmen cooperated at every level of command, beginning at the top where Montgomery and Coningham maintained their headquarters at the same location, their planners working in tents a few yards apart. Elsewhere in the command structure, army officers trained as air liaison specialists served at the various air and ground headquarters, trying to create an understanding of what air power could do and what the troops needed. A joint control center, staffed by soldiers and airmen, maintained direct communication between the ground unit needing support and the aviators providing it. This center served as a clearinghouse for requests from army units, culling out those that could not be fulfilled for lack of resources or other reasons and sending the rest to Coningham's headquarters. Every level of command within the Eighth Army had a communication center capable of contacting the joint control center.

Besides introducing Craig, and through him Spaatz, to a mechanism for air support that became a model for the Americans, Tedder and Coningham helped influence Eisenhower to choose an air officer for the Northwest African theater. As Spaatz had feared when he argued against such an appointment, Eisenhower gave serious consideration to a British officer, Tedder, before deciding on Spaatz, who was more familiar with the existing command arrangements and the problems they had caused. On January 5, 1943, Spaatz took command of the Allied Air Forces in North Africa.

The appointment of Spaatz did not ensure cooperation and efficiency in providing air support for the ground forces. Aircraft remained in short supply as the new year began, a result in part of a shortage of spare parts and a lack of adequate maintenance facilities. The Twelfth Air Force at mid-January could muster only about half its authorized number of aircraft, and not all of these could support the war on the ground. Despite a near obsession with air cover, the senior American ground commander, Lt. Gen. Lloyd R. Fredendall of II Corps, got along well with General Craig, whose XII Air Support Command flew missions for the unit. German air attacks had impressed Fredendall with the need for an aerial umbrella overhead, and on one occasion he insisted that British night fighters patrol the daytime skies above his sector in an obvious misuse of the aircraft.

The shortage of suitable airplanes and the American general's well-known insistence on air cover may have caused him to be blamed for the rejection of a request from the 242 Group of the Royal Air Force to take over support missions for which the Northeast Air Command did not have the necessary aircraft. According to the British, General Craig had turned down the

North African Diversion

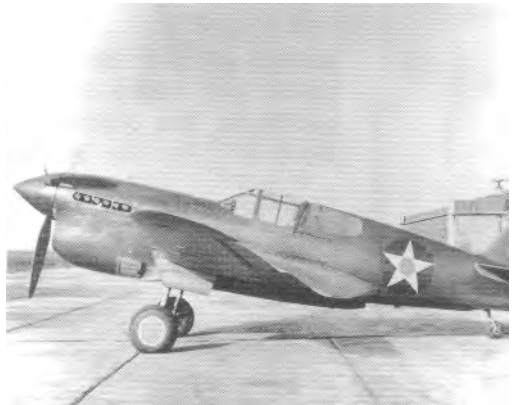


American aviation in the invasion of North Africa in 1942 met political and operating conditions that taxed the ingenuity of its commanders. Maj. Gen. Carl A. Spaatz wrestled with a continually evolving Anglo-American coalition command in which American air units came under the U.S. Twelfth Air Force by early December. Spaatz then headed the Northwest African Air Forces. The command in the theater alternated British and American officers in senior billets, with often mixed results. French forces in Africa joined the Allied effort under Free French command. British and American equipment and supply then flowed to a new ally.

A number of other problems surfaced in the logistically austere theater. In one typical scene, seasonal rains maroon B-26 Marauders (above) on

runways at Algeria's Tataroui Airdrome as primitive offroad accommodations became swamps. The Allies failed to preempt Axis reinforcement of the German-Italian bridgehead in Tunisia, and the ensuing battles also produced confusion over air support of troops engaged, with ground commanders demanding constant air umbrellas over their lines. In addition to transferring complete combat units to the new theater, Spaatz denuded American fighter forces in England of their P-38 Lightnings (opposite, right) to provide more long-range reconnaissance, interdiction, and ground support in Africa than P-40s could offer.

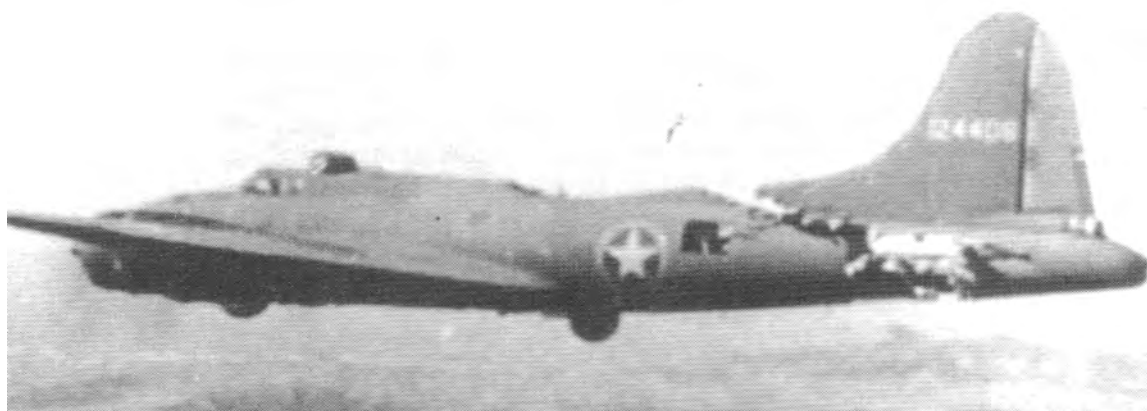
Strategic forces in Spaatz's NWAAF were soon within range of German bases at Cagliari on Sardinia (top two photos, far right opposite) and the docks at Palermo, Sicily (opposite, midpage). Though





bomber losses were low during the campaign, the B-17's legendary robustness revealed itself in one mission over Tunisia in February 1943. A Bf 109 with a dead German pilot at the controls sliced through the after section of one Fortress (*below*). The crew escaped uninjured and the bomber came home.

P-40Fs (*right photo, below, opposite*) were the mainstay of American tactical air units in North Africa, where American pilots met Germans in determined contests for air superiority for the first time. These aircraft also went to French units now joining the Allied cause. In the last photo, Spaatz and General Doolittle, right, commanding Twelfth Air Force, turn over P-40s to French airmen.



request because the only available fighters, P-39s, did not have sufficient range for the mission. Doolittle, however, believed that Fredendall had made the decision, complained that Craig was not standing firm against the ground officer, and requested that Spaatz look into the matter. Although Spaatz was content merely to remind Fredendall that the air support commander served at corps headquarters to prevent the ground commander from making "damn fool decisions," Craig's days were numbered, for Doolittle had decided that he was a better staff officer than air support commander. When Craig fell suddenly ill, Doolittle replaced him with Col. Paul Williams, who got along as well with Fredendall as Craig had. "General Fredendall and General Patton," the colonel reported, "both stated in substance 'Don't wait for us to order air missions, you know what the situation is, just keep pounding them'."

Like the XII Air Support Command under Craig and Williams, the Eastern Air Command also suffered from a shortage of aircraft. Its resources stretched to the breaking point, Welsh's organization could not take advantage of the network of air liaison officers and control specialists—which the British termed the "tentacles" of the control system—and duplicate the air-ground team that, under Montgomery and Coningham, had driven the Germans and Italians back from El Alamein. Moreover, Air Marshal Welsh and the senior British ground commander, General Anderson, disliked each other, rarely exchanged views, and maintained separate headquarters. Had the two officers been more willing to cooperate, they might have made better use of the available aircraft; however, collaboration, no matter how enthusiastic, could not have compensated for the scarcity of aircraft that persisted into 1943.

At the beginning of the year, the Anglo-American allies in Northwest Africa did not have enough first-line aircraft to defend the ports and bases in Algeria, seize control of the skies over Tunisia, attack German lines of communication and supply, and support the advance on the ground. Existing American doctrine acknowledged the need to establish air superiority, but the German superiority in numbers and bases proved difficult to overcome. Consequently, the drive into Tunisia bogged down, for the Allies could not advance on the ground while the enemy still controlled the air.

While the American and British forces, and the French troops now fighting alongside them, gathered strength to renew the attack and the Germans lashed out with limited counterattacks, the Anglo-American military and political leadership met at Casablanca, between January 18 and 24, to shape the immediate course

of the war against Hitler. The Combined Chiefs of Staff agreed during the sessions to a reorganization of the Allied command structure for operations throughout the Mediterranean region. Eisenhower became the overall commander in chief, with British officers assuming command of the major components for land, sea, and air. Tedder took over the Mediterranean Air Command, which had three principal elements: the Northwest African Allied Air Forces, under Spaatz; the Malta Air Command; and the Middle East Command. The Northwest African Air Forces consisted of elements for strategic, service, training, aerial reconnaissance, and coastal patrol work, and air support of tactical units. Doolittle assumed command of the strategic arm, built around the bomber command of his Twelfth Air Force. Eisenhower chose Coningham to head the air support element, designated the Northwest African Tactical Air Force and made up of the XII Air Support Command and the Northeast Air Command, in the expectation that the British airman could ensure the same cooperation between air and ground in Tunisia that had characterized the fighting in Egypt and Libya. Coningham denied, however, that the term "cooperation" described the relationship between the British Eighth Army and the Western Desert Air Force. "I submit," he told Eisenhower and other senior commanders, "that we in the Eighth Army are beyond the cooperation stage, and that work is so close that we are, in effect, one unit."

On January 26, two days after the Casablanca Conference ended, while Coningham prepared to change assignments, Eisenhower appointed an airman to take over Allied air support operations until the British officer arrived. Brig. Gen. Laurence S. Kuter, who had helped write AWP/1 in 1941 and served most recently as Eisenhower's air officer, took charge of the Allied Air Support Command, the title used during the period of transition. Kuter still directed tactical aviation when the Germans launched a series of counterattacks, including a thrust by Rommel that on February 19 overwhelmed Fredendall's troops dug in at Kasserine Pass. By the time Coningham assumed command of the Northwest African Tactical Air Force on February 23, the bad weather that had hampered Allied airmen ended, and Rommel was retreating through the pass.

Armed with Eisenhower's endorsement of his plan to centralize control over tactical aviation and strike a balance between efficiency and effectiveness acceptable to airmen and ground commanders, Coningham immediately set about making the system work. A survey of the situation in Tunisia convinced the British officer that the Allies had been trying to do too much with too little. As late as the end of February, he did not have enough

aircraft to defend the rear areas, maintain the kind of aerial umbrella over the battlefield that Fredendall had wanted, and at the same time to attack the enemy from his front lines to his distant ports and depots. Instead of massing for a decisive effect, tactical aviation had only struck scattered and ineffectual blows that cost the Allies vitally needed men and aircraft without doing serious harm to the enemy. The air marshal's experience in desert fighting convinced him that tactical air power could make its greatest contribution to the destruction of an Axis army by sending its limited number of aircraft beyond the front lines, attacking airfields, gaining control of the air, and then disrupting supply lines and battering the enemy's frontline positions. After he took charge of all Allied tactical aviation in North Africa, he demonstrated once again the belief in the offensive, a hallmark of the Royal Air Force, which had characterized the operations of Maj. Gen. Sir Hugh Trenchard over the western front during World War I. Coningham's dedication to offensive operations, along with his insistence on collaboration between airmen and ground commanders, provided an example for American leaders like Brig. Gen. John K. Cannon and Brig. Gen. Elwood R. Quesada and greatly influenced American tactical doctrine.

Air Marshal Coningham's reforms signaled the triumph of the principle of centralized control of tactical aviation. Experience in the Northwest African Tactical Air Force validated the principles tested in Egypt and Libya. In Tunisia, an air officer in continuous consultation with the senior ground commander controlled all the tactical aircraft available to support the operation, and this number increased as spring approached and brought better flying weather. Coningham's first responsibility was to seize control of the skies, using his squadrons offensively to forestall enemy air attacks; afterwards, he could employ his forces to isolate the battlefield and batter enemy strongpoints. Centralization, the basic concept underlying Coningham's success, also formed a part of existing American aerial doctrine, although an exception permitted aircraft to be attached to a particular ground unit and take orders from its commander.

Even though able thus far to work amiably with as prickly an individual as Montgomery, Coningham within six weeks ran afoul of Lt. Gen. George S. Patton, Jr., who had replaced Fredendall after the defeat at the Kasserine Pass. The new commander of II Corps soon became convinced that his American troops did not receive enough air support under Coningham's centralized arrangement. When Patton complained in his daily situation report of April 1, 1943, that "Total lack of air cover for our units has allowed the German air force to operate at will," Coningham

replied in kind, angrily charging that Patton's troops were not "battleworthy." Since a quarrel between the two might jeopardize the harmony between air and ground that Coningham's appointment was supposed to promote, Tedder, the senior Allied airman in the theater, ordered his subordinate to apologize, and Coningham did so. The last word, however, belonged to Patton, who was meeting with Tedder and Spaatz when four strafing German fighters, apparently flown by pilots who did not realize that Coningham ruled the skies, interrupted the discussions. Asked how he had got the *Luftwaffe* to cooperate in demonstrating his point, Patton answered, "I'll be damned if I know, but if I could find the sons of bitches who flew those planes, I'd mail each one of them a medal."

Although Patton continued to grumble about the tactical air support his soldiers received, air power was helping turn the enemy's North African bridgehead into a trap for more than a quarter million soldiers and their commander, General Jürgen von Arnim, who had assumed overall command when Rommel departed for Germany. ULTRA intelligence, which decoded messages sent using the standard German enciphering machine, often revealed not only departure times but also the cargo carried, enabling Allied aircraft to prey on the supply ships that threaded their way through narrow channels in the Axis minefields planted between Sicily and Tunisia. ULTRA also helped Allied airmen intercept the Junkers trimotors and the six-engine Messerschmitt Me 323s carrying men and cargo across the Mediterranean. Indeed, communications intercepts set the stage for the so-called Palm Sunday massacre, April 18, 1943, when the North African Air Forces claimed the destruction of fifty to seventy transports and sixteen escorting fighters.

Lessons learned from the Tunisian fighting, which ended with the Axis surrender on May 12, 1943, inspired a new War Department field manual, FM 100-20, *Command and Employment of Air Power*. Influenced by the command structure used so successfully by Air Marshal Coningham, the publication declared that "land power and air power" were "co-equal and interdependent," that neither was "an auxiliary of the other." After issuing this declaration of equality and interdependence, the document rejected the practice of attaching air units to ground commands and stated more clearly and forcefully than its predecessors that "control of available air power must be centralized and command must be exercised through the air force commander" to realize the flexibility and effectiveness of the aerial weapon. By listing air superiority as the "first requirement for the success of any major land operation," the new manual called attention to earlier

doctrine, which had been ignored in the headlong advance into Tunisia after the invasion of Northwest Africa.

Some Air Forces officers found fault with the new statement of doctrine. Brig. Gen. Orvil A. Anderson, a rated balloon pilot and also an advocate of strategic bombing, complained that it should have treated air power as an indivisible whole instead of discussing the strategic, tactical, air defense, and service functions within the theater air force. Regardless of objections like his, the publication had implications for every aspect of air power and did more than merely establish the relationship of air and ground commanders in a campaign like the recent fighting in North Africa or the forthcoming invasion of France. Since air and ground were coequal, the senior Air Forces officer in the United Kingdom had the same status as the commanding general of the ground forces, with equal access to the theater commander. The airman could present the case for every application of air power just as the army commander might argue the merits of any operation on the ground. Arnold and the other leaders of the Air Forces believed that strategic bombardment, if given the chance, could utterly cripple the enemy; recognition of air as the equal of ground seemed an important step toward making sure that the bomber would have the opportunity to attack German industry. Once the bombing of German factories had produced the anticipated result, this success would justify the postwar emergence of Army aviation as an independent service.

The Army Air Forces considered strategic bombardment the most effective manifestation of air power; indeed, the commanders and crews of the B-17s and B-24s served as Arnold's shock troops in both the war against Hitler and the drive for postwar independence. During 1942, however, the few bombers available to the Eighth Air Force could inflict very little damage on Hitler's Fortress Europe. For example, the attacks on the submarine bases along the Atlantic coast of France, which began in October 1942, proved fruitless, for not even the 2,000-pound general purpose bomb, the largest that American aircraft carried, could penetrate the concrete-roofed structures that sheltered the U-boats. At year's end, British leaders were again questioning the value of daylight bombing. Would the Americans, they wondered, not make a greater contribution to victory if they abandoned daylight precision attack and joined the Royal Air Force Bomber Command in raids on German cities by night? In January 1943, when Roosevelt and Churchill met with the Combined Chiefs of Staff at Casablanca, this question surfaced once again. The British prime minister demanded an explanation why not one American bomb



Casablanca Conference

With Allied armies advancing across North Africa, British and American leaders and their staffs met at the French Moroccan city of Casablanca from January 14 to 23, 1943, to discuss the future direction of the war. Above, the American delegates line up for an official group portrait on the occasion. Army Chief of Staff General George C. Marshall and Chief of Naval Operations Admiral Ernest King are seated with President Franklin Roosevelt; standing are (left to right) Harry Hopkins, Roosevelt's special assistant, General Henry Arnold, Army Air Forces, General Brehon Somervell, Army Service Forces, and Ambassador Averell Harriman. The better prepared British delegation held out for pursuing their peripheral strategy, identifying Sicily and Italy as the next goals rather than concentrating on northwestern France as the decisive strategic route of advance. Arnold summoned Maj. Gen. Ira Eaker (right), then commanding the U.S. Eighth Air Force in England, to discuss the faltering American aerial effort and the effects of the North African venture on it. In the event, Eaker prepared an appeal to the irascible Winston Churchill at the meeting in which he won the prime minister's support for a bomber offensive that would continue the Royal Air Force Bomber Command's incursions over Germany by night but committed American air elements to daylight precision attacks. Eaker's success marked the beginning of the Allied combined bomber assault on German targets lasting until war's end.



had yet fallen on Germany. Eaker stepped forward to save the day for the Air Forces and its doctrine of daylight bombing. Summoned from England to defend his Eighth Air Force and its tactics, he ignored the disappointing past, described a future when Americans by day and British by night would "soften the hun for land invasion and the kill," and persuaded Churchill to allow the daylight attacks to continue. The prime minister, with his gift for the dramatic, recast Eaker's arguments into a slogan, a ringing pledge to "bomb the devils 'round the clock.'" Persuasive though Eaker had been, Churchill proved a willing listener. The British leader did not consider daylight bombing a critical issue at this time; the Americans, he believed, should have an opportunity to try such tactics, provided they did not close their minds to night bombing in the event daylight attacks failed.

In sharing his vision of day and night attacks, Eaker did not foresee a centrally directed Anglo-American air campaign, but rather a coordinated offensive, with his Eighth Air Force operating on its own, although receiving guidance and advice from the British. Had he proposed a truly unified campaign, the logical choice as commander would have been Air Marshal Harris of the Royal Air Force Bomber Command. Eaker worried that the veteran British airman, if placed in charge, would take advantage of his access to Churchill and try to arrange the diversion of the Eighth Air Force from the daylight precision bombardment of industries to area attacks on cities by night. At Casablanca, General Marshall, the Army Chief of Staff, sided with Eaker and the other American airmen. Marshall viewed the bombing of Germany as an indispensable means of preparing for an invasion of Europe, and he also realized that the Allies could not mount so ambitious an amphibious assault in the immediate future, which left the bomber the only weapon capable of carrying the war to the enemy. More important, Marshall had confidence enough in Arnold and the Army Air Forces to insist that the Americans control their own bombing tactics, subject only to operational guidance from the British and overall direction from the Combined Chiefs of Staff. The British agreed, thus ensuring that the Eighth Air Force would be able to begin daylight precision attacks.

The Anglo-American Combined Chiefs of Staff promptly established a purpose and priorities for a Combined Bomber Offensive. The directive approved at Casablanca called for the "progressive destruction and dislocation of the German military, industrial, and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened." Broad enough in purpose to

embrace both daylight precision attacks on factories and night raids designed to burn out cities, the Casablanca Directive gave first priority to disrupting submarine construction. The directive also called for campaigns against aircraft manufacture, the transportation net, oil production, and other elements of German industry. Ironically in view of the inclusion of enemy morale as a target, the Allied leaders at Casablanca adopted unconditional surrender as their ultimate aim. While military officers drew up a bombing campaign intended at least in part to undermine German morale, Churchill and Roosevelt slammed the door on a negotiated peace and endorsed a policy that might deny Germany an alternative to fighting on despite the aerial bombardment that lay ahead.

General Eaker and his staff immediately set to work on a more detailed plan for carrying out the bomber offensive approved at Casablanca. The resultant POINTBLANK Directive, ratified in principle by the Combined Chiefs of Staff during a May 1943 conference at Washington, D.C., adjusted priorities by acknowledging the importance of gaining air supremacy. The document, however, designated the bomber itself as the means for attaining this end through attacks on airplane plants and the destruction of German fighters in aerial combat. This concept, in addition to reflecting prewar American doctrine on bombardment, recognized existing reality—at this time the Allies had no fighter capable of escorting missions deep into Germany.

The principle underlying the Anglo-American effort remained coordination rather than centralized control. The POINTBLANK Directive assumed, rather than insisted, that Air Marshal Harris would make selective nighttime strikes on cities housing the same industries that General Eaker proposed to hit by day. The British airman remained a free agent who persisted in his distrust of what he called “panacea” attacks on supposedly vital elements of the enemy war machine. The air marshal preferred to wage a nighttime offensive against the towns where German workers lived, disrupting their rest and destroying their homes, although in the process he might set fires that consumed the factories that employed them. The Combined Bomber Offensive thus came to consist of two efforts based on similar intelligence and economic data, but only loosely coordinated, one designed to destroy industrial plants by day and the other to raze whole towns by night. Together they choked off German production almost completely. According to estimates made after the war by the Federal Republic of Germany, the around-the-clock bombing destroyed more than three million dwellings and killed more than a half-million civilians.

An Anglo-American planning committee, taking into account the agreed strategy of the Combined Chiefs of Staff, produced a list of daylight and nighttime targets. In making specific recommendations, the American members of the planning committee reviewed the general military situation and the findings of the Committee of Operations Analysts. Established by Arnold, this latter committee tried to determine, often using the American economy as a model, what industries were truly critical to the German war effort. The British Air Ministry and the Ministry of Economic Warfare also provided data on the German industrial base. Other sources of information included aerial photography, which helped assess bombing results as well as identify targets; reports from recently arrived refugees; and even prewar analysis by attachés at Allied embassies.

At most, however, the Anglo-American planners created an illusion of collaboration in the Combined Bomber Offensive. Harris did not consider himself bound by the agency's work and retained final responsibility for choosing the cities to be bombed. On a particular night, he might or might not attack a city containing an industry like ball bearing production or aircraft manufacture that the Eighth Air Force was trying to destroy by day. At times, Harris chose to cooperate, especially in the latter part of the war, but the choice remained his.

Once a mission ended, analysts reviewed the results, again using aerial photographs, though a particularly successful strike might inspire radio traffic vulnerable to ULTRA code breaking. In the case of bombing results, the British tried in general to relate urban destruction to German morale and industrial manpower, whereas American researchers sought a connection between gutted factories and overall military effectiveness. Whatever the perspective, an accurate assessment of the impact of the bombing proved difficult.

Throughout the war, American airmen continued to insist that their heavy bombers were destroying German war industries rather than urban areas surrounding the factories. Since the writing of AWPD/1 in the summer of 1941, Army Air Forces planners had tended to regard attacks on civilian morale as a *coup de grâce* for an enemy already in his death throes. They remained wary of striking such a blow as late as the spring of 1945, when General Eaker wrote, "we should never allow the history of this war to convict us of throwing the strategic bomber at the man in the street." His main concern, however, may have been the postwar reputation of an independent air force rather than the fate of the German populace. Years later, he would concede that there was "no strong moral sentiment among the leaders of the Army Air Forces" concerning the bombing of Germany; the objective of

these senior officers was to defeat Hitler and the Third Reich. As Spaatz later declared, objections to area bombing or other forms of aerial attack aimed directly or indirectly at civilian morale arose strictly from considerations of effectiveness: the extent it would hasten the destruction of the German war machine, thus saving the lives of Allied soldiers, sailors, and airmen. An ethical debate did occur at lower levels among the officers who recommended targets, with officers like Brig. Gen. Charles P. Cabell and Col. Richard D'O. Hughes arguing that, insofar as equipment and tactics permitted, only military targets should be bombed.

In actual practice, however, daylight bombing proved too inaccurate to destroy with surgical precision a military installation or armaments plant in an urban setting. With clear skies, a formation using the Norden sight could place almost 90 percent of its explosives within a one-mile radius of the aiming point, which meant that the bombs landed inside a circle with an area of slightly more than three square miles. This was not the legendary kind of accuracy that placed the bomb in the pickle barrel, but it was not all that bad considering that a whole formation dropped its bombs when the lead bombardier released his. Radar, used to bomb through cloud cover, proved less than half as accurate as the Norden sight. The dispersal of production among hard-to-pinpoint urban sites and the destruction of structures that served as visual reference points in many cities also reduced accuracy against industrial targets, so that Eaker's man in the street, living near his place of work, may not have realized he was being spared, if indeed that was the general's main concern.

In the weeks following the Casablanca Conference, the American dropped too few bombs to give rise to questions of ethics—the Eighth Air Force had barely begun to carry the war to Germany. On January 27, 1943, a force of B-17s, prevented by thick cloud from bombing Vegesack, attacked Wilhelmshaven, conducting the first raid by American heavy bombers on a target in Germany. Other attacks followed, directed at shipyards building submarines and, as time passed, against aircraft plants and other factories farther inland.

Because the P-38s had gone from the United Kingdom to North Africa, the escort mission devolved on the Republic P-47 Thunderbolt, a new fighter flown for the first time some six months before the United States went to war. Although durable and heavily armed, these Thunderbolts had only early versions of the new jettisonable fuel tanks and could not operate beyond Aachen, at the German border. On long flights, whether deep into Germany or to distant targets in France, the bombers had to rely



Over the Reich



The demands of the TORCH operation left the Eighth Air Force understrength and able to mount no more than a hundred bombers for any one raid on the Continent even as late as January 1943. Some four days after the Casablanca directive for the combined bomber offensive, the Eighth Air Force sent ninety-one B-17 and B-24 bombers against the U-boat construction yards in Wilhelmshaven at the mouth of the Weser River. This effort on January 27, 1943, was the first American incursion into German territory. Fifty-three bombers hit the installation; two more struck Emden; three were lost. At left, a stick of 500-pounders descends on the city's harbor and basin. This first test of American daylight precision attack was a tentative beginning attended with some luck through the middle of 1943.

The Wilhelmshaven raid met with confused flak defenses and a cautious fighter opposition. More experienced German fighter units were still deployed in the west, where they gave stiff resistance to raids against German coastal installations just outside escort range. Later American daylight attacks into German airspace met increasing resistance, but nothing causing calamitous losses. Formation discipline and fire control, especially against head-on German fighter passes, increased with experience. In April, the Eighth struck Bremen's aircraft plants, losing sixteen of 107 planes and sustaining damage to 46 in the largest mission mounted to that time. Enemy fighters hounded the bombers to the target and well past the German coast on the return leg. Below, a B-17 over Kiel in August 1943.

Through the height of summer, the unescorted bombers seemed to be able to take a toll of the enemy with acceptable cost. The *Luftwaffe* would soon raise the stakes.

for escort on YB-40s, B-17s carrying extra machineguns, ammunition, and armor instead of bombs. Unfortunately, these aerial dreadnoughts failed because they could not keep pace with formation, especially during the return flight when the weight of bombs no longer slowed the other aircraft.

During the summer of 1943, bomber commanders decided that the best defense was a disciplined formation that permitted the massing of .50-caliber fire from many Flying Fortresses or Liberators. The basic formation of that period, the awe-inspiring but cumbersome combat wing, consisted of three 18-plane groups, each with three squadrons, arranged to present a frontage of 7,000 feet, a height of about 1,000 feet, and a depth in excess of 1,800 feet. Maneuvering so large a formation proved awkward, with planes farthest from the pivot point of a turn roaring along at full throttle in a desperate effort to maintain station and those near the pivot wallowing at near stalling speed. As a result, when fighter protection improved, the combat wing disappeared, replaced by a 36-plane group, which remained the standard alignment until supplanted by an even more flexible 27-plane formation in 1945.

Escorting P-47s still had to turn back near Germany's western border when General Eaker, on August 17, 1943, launched strikes against the ball bearing plants at Schweinfurt and a Messerschmitt aircraft factory at Regensburg. Plans had called for the Regensburg force to take off first, attack its target, and turn southward to land in North Africa. Then, before the *Luftwaffe* interceptors that had opposed the first mission could land for fuel and ammunition, the Schweinfurt force would thunder across Germany, returning to England after dropping its bombs. Unfortunately, fog disrupted the timing of the two raids.

The force bound for Schweinfurt could do nothing until the mists cleared. While the crewmen waited at their planes for word to take off, their thoughts focused on the day's mission, an ordeal that would last some seven hours, unless cut short by mechanical failure or enemy action. Since they would fly at altitudes where the air temperature might drop to fifty degrees below freezing on the Fahrenheit scale, the men wore either bulky, heavily lined clothing or the new and unreliable electrically heated flight suits. Neither the E or F model of the B-17 could generate enough surplus electrical current for more than a few of the heated suits, and the wiring in those actually used proved dangerously fragile. A break anywhere cut off heat throughout the entire garment, so that a failure in the boot could result in frostbitten fingers. Similarly, a gunner who, in trying to clear a jammed weapon, removed one of the heavy gloves worn with the old suit also ran

the risk of frozen fingers and possible amputation. The extreme cold, moreover, could freeze oxygen lines, causing loss of consciousness and, ultimately, death.

Bomber crews faced dangers other than cold, as they raced along at a ground speed that could exceed 200 miles per hour. German fighter pilots and antiaircraft gunners used all their skills to destroy the plane and kill the men inside. A B-17 might vanish in a streak of flame; a pilot might turn his head and find the copilot mangled by bullets or shell fragments; a direct hit could tear away the tail gunner's compartment and send it, along with the man inside, tumbling earthward.

Even as the men of the Schweinfurt force waited and thought of the battle to come, the 146 B-17s of the Regensburg force began taking off despite the fog. German radar detected the formation as it assembled over England, and FW 190s intercepted the flight as the P-47 escort neared the limit of its endurance. Other German fighters joined in, attacking from various directions or remaining beyond range of defensive machineguns and launching 210-mm rockets to scatter the bombers. Lt. Col. Beirne Lay, Jr., a staff officer who had volunteered as copilot on one of the Flying Fortresses, welcomed a chance to take over the controls, after watching helplessly as fighters tore into the massed B-17s; the mechanics of flying diverted his attention from the swarming interceptors. Fourteen bombers went down before the formations reached Regensburg and encountered the radar-controlled antiaircraft defenses. Despite the attacking fighters and the German barrage over the target, bombing accuracy proved excellent.

German fighter controllers expected to direct further attacks as the Regensburg force returned to England, but to their surprise, the B-17s headed instead for North Africa, where they landed at primitive airfields in Tunisia. A suitable target soon appeared on the early warning radars, however, for at midmorning, the 230 B-17s assigned to bomb Schweinfurt began assembling over the British Isles. Having replenished fuel and ammunition, the German fighters now attacked the formation bound for the important ball bearing factories. The number of haystacks burning on farms below puzzled one of the navigators, until he realized he was seeing the funeral pyres of B-17s shot down by the enemy. Antiaircraft batteries put up a barrage over the target itself, and fighters resumed the attack during the return flight.

During the day's two raids, the defenders shot down 60 of General Eaker's bombers, almost one-sixth of the B-17s assigned to the day's mission or about one-fifth of the 306 B-17s that actually bombed Regensburg and Schweinfurt, while another 27 B-17s sustained serious damage. A total of 601 officers and men

were killed, captured, or interned in a neutral country. These losses raised the possibility that the Flying Fortresses and Liberators would prove incapable of penetrating Germany's defenses without fighter escort. Faced with similar evidence, the Royal Air Force Bomber Command had halted daylight operations and concentrated on night attack. Not so the Americans. Eaker and his colleagues gave no serious thought to abandoning daylight precision bombing, not only because of the formidable task of retraining crews and modifying aircraft but also because of an abiding belief that doctrine would prevail.

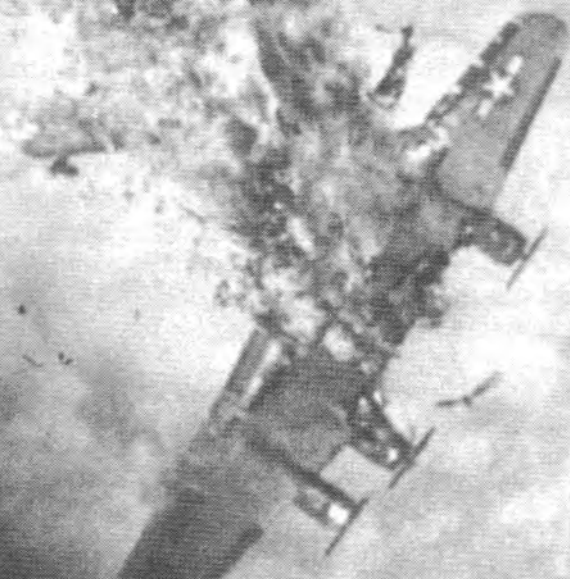
Despite this confidence, the Eighth Air Force did investigate British methods. Brig. Gen. Fred L. Anderson, who led Eaker's bomber command, had already flown as an observer on a few night missions. Then, after the loss of forty-five B-17s on a raid against Stuttgart in September, one squadron of Flying Fortresses participated with the Royal Air Force Bomber Command in seven night attacks, with an average of five aircraft flying on each and a total of two lost. During the first week of October, this familiarization project ended; although the squadron continued to fly at night, it dropped propaganda leaflets rather than bombs. The night bombing experiment ended in part because of the difficulties the crews encountered in adapting to a radically different kind of operation, but the principal reason was Eaker's conviction that, given enough airplanes and crews, the Eighth Air Force could fight its way in daylight to any target within bomber range and return without suffering crippling losses.

What effect did the strikes against Regensburg and Schweinfurt have on the enemy? The Eighth Air Force had hurt the German war machine at Schweinfurt, if not at Regensburg. The accurate attack on the Messerschmitt plant damaged most of the main buildings but, according to Albert Speer, Hitler's minister of armaments and war production, had "only minor consequences." Much of the machinery escaped serious damage, and the aircraft firm went ahead with plans to disperse among nearby villages and towns hard-to-locate shops that would manufacture aircraft components for assembly at Regensburg. In contrast, the less precise bombing at Schweinfurt temporarily reduced German ball bearing output by some 38 percent, complicating an existing shortage and forcing Speer to increase production elsewhere and draw on reserve stocks. By October, however, manufacturers in Germany produced more ball bearings than before the August bombing.

After a brief period of recuperation, the Eighth Air Force returned to Germany. The tempo of operations rapidly increased until the bombers flew three missions deep into Germany in a single week, culminating on October 14 in a second raid on



The Disasters





POINTBLANK, the Allied strategic directive for the combined bomber offensive, did not resolve the differences in British and American approaches to destroying and dislocating the German war economy. The RAF's Bomber Command under Air Marshal Arthur Harris stepped up its night offensive against German factories and their workers. With different tactics, Maj. Gen. Ira Eaker's Eighth Air Force in the summer and fall of 1943 sought to apply the American theories of strategic bombardment developed during the inter-war period. Self-defending American bombers in deep-penetration raids would attack with daylight precision the key centers of the German war industry. Attempts at this produced disasters that threatened the entire American concept of aerial operations.

Virtually every implement of mechanized war, including aircraft, depended for smooth function on antifriction ball-bearings. A large proportion of the German supply came from Sweden, but manufacture in the Reich centered in the Bavarian city of Schweinfurt, a vulnerable concentration that had prompted German plans to disperse production of this vital industry. For the Americans, attacking it would slow or halt not only aircraft production, but the assembly of ground fighting vehicles, too.

On August 17, 1943, two bomb wings set out toward the city, the first to hit the more distant Regensburg, an aircraft production center, then fly onward to North Africa. The closely timed departures of the wings failed when weather delayed the second wing, bound for Schweinfurt. With no fighter escort east of the

Belgian border, the bombers took the full brunt of the defenses on the longest mission of the war to that time. The Schweinfurt mission, following hours behind the Regensburg one, ran into a fully alert *Luftwaffe*; operations for the day cost sixty Fortresses with more written off as beyond repair after the survivors landed.

The second raid, on October 14th, felled another 60 B-17s of 291 involved over the Continent, with 22 more lost before the mission's end or junked afterwards. The *Luftwaffe* had convincingly contested these incursions into Germany. The Eighth suspended deep-penetration missions after these missions until fighter-escorts with auxiliary fuel tanks could take the raiders to their targets, a regular event only after January 1944. The precept of a self-defending bomber force in American air doctrine perished on "Black Thursday," the day of the second Schweinfurt attack. German bearing output was only briefly affected in the more accurate October raid. By February 1944, most of the industry was dispersed. Other measures to assess inventories and continuing purchases from Sweden actually improved the German ball-bearing supply even in the face of another fourteen Allied raids on Schweinfurt through the rest of the war.

In an all-too-familiar sight during the early assaults on the bearing works (*far left*), a B-17 plunges earthward after a direct flak hit. Another (*above, right*), braves flak over the target. The center photos (*top down*) show Schweinfurt in ruins in 1945, the interior of the Kugelfischer bearing factory, and the bomb concentration in a raid of May 1944.

Schweinfurt. Escorted a short distance by P-47s, a formation of 291 B-17s started eastward against increasingly savage opposition. Defying fighters and anti-aircraft fire, 228 Flying Fortresses succeeded in bombing the target, causing damage that reduced ball bearing production an estimated 67 percent.

For a second time within 60 days, daylight bombing had disrupted the critical ball bearing industry, but to Speer's amazement the Allies did not follow up the attack. Two factors brought about this unexpected reprieve: first, no central authority existed to overcome Air Marshal Harris's scorn for panacea targets and compel him to unleash Royal Air Force Bomber Command against Schweinfurt and other centers of ball bearing production; and second, the *Luftwaffe* controlled the skies over Germany. The Eighth Air Force suffered dismaying losses on the second mission against Schweinfurt—60 out of 291 B-17s, more than one in five, failed to return. The day's toll brought the number of bombers shot down in a single week to 148, each carrying a ten-man crew. Eaker could, with justification, announce: "Now we have got Schweinfurt," but his command had paid a staggering price.

The losses among B-17 crewmen proved crippling, at least for the immediate future. General Eaker had entered October with some seven hundred B-17 crews on hand. Even though the mid-October losses cut deeply into this force, new arrivals increased the total assigned to more than 800 crews by the end of the month. These strength figures were misleading, however, for the inexperienced men had to be integrated into squadrons and acquire the skills of the veterans they replaced, a process that took time. Compared to the problems of absorbing reinforcements, aircraft repair moved swiftly, an important consideration since less than a third of the planes that took off in the second Schweinfurt mission returned without serious damage. Earlier experience had prompted the Eighth Air Force to transfer responsibility for the repair of major battle damage from the operating groups to central depots, and combat units performed only those jobs they could finish within thirty-six hours, so that the workload would not overwhelm the available mechanics.

Eaker remained confident that, given the investment of several weeks for training, the Eighth Air Force would again launch hundreds of bombers against distant targets as it had before the second raid on Schweinfurt. Against Emden on November 2, his bombers used radar for the first time to attack through cloud cover, and this innovation promised to increase the number of days that the reconstituted bomber force could attack Germany. Unaffected by Eaker's optimism, Arnold believed the Eighth Air Force was recovering too slowly from the October battles. To

provide additional fighter escort, Arnold sent P-38s, replacing those diverted to the Mediterranean, and sent the first of the new P-51Bs, which had even greater range. Modifications to shackles and pylons enabled the P-47 to carry two under-wing jettisonable tanks, plus a larger one beneath the fuselage, thus increasing fuel capacity some fifty percent. Even as he tried to improve the quality of the fighters available to the Eighth Air Force, Arnold became convinced that the root of the problem was less a lack of fighter cover than a failure of leadership. From the vantage of Air Forces headquarters, Eaker's bomber crews seemed to be spending too much time training in the United Kingdom or flying what amounted to practice missions, and airworthy bombers remained on the ground because the men who flew them were on leave, recovering from the ordeal of combat. Arnold wanted new and firmer hands in control of the daylight bombing offensive, so in January 1944 he sent Eaker to the Mediterranean, appointed General Doolittle to command the Eighth Air Force, and entrusted the American role in the Combined Bomber Offensive to Spaatz, as commander of the newly created U.S. Strategic Air Forces in Europe.

Eaker's arrival and the departure of Spaatz and Doolittle were the latest in a series of changes in the Mediterranean area during 1943. Operations in that theater diminished in importance as the time approached for an assault across the English Channel against the heavily defended coast of France. General Brereton's Ninth Air Force, which had conducted some strategic operations, became exclusively a tactical air force. After handing over most of its combat elements to the Twelfth Air Force in September, the Ninth established itself in the United Kingdom, received new fighters and other aircraft, and began preparing to support the assault across the Normandy beaches. To replace Brereton's command, the Twelfth Air Force, at that time under Spaatz (prior to his leaving for the United Kingdom), reconstituted itself as a tactical force, while the XII Bomber Command formed the nucleus of the new Fifteenth Air Force, a strategic command headed by Doolittle until his departure for Great Britain.

By the end of the year, a major shift of senior commanders between the United Kingdom and the Mediterranean had taken place. Not only had Spaatz gone to Great Britain to direct the entire American strategic bombing offensive and Doolittle accompanied him to take over the Eighth Air Force, but Eisenhower, with Tedder as his deputy, had also gone to London to assume command of the planned Allied invasion of Europe. Tedder's departure from the Mediterranean opened a vacancy for Eaker,

whose administrative skill and ability to work with the British Arnold continued to value, however disappointed he was with the recent efforts of the Eighth Air Force. On January 15, 1944, Eaker replaced Tedder in command of the Mediterranean Allied Air Forces. General Cannon took over the Twelfth Air Force and Maj. Gen. Nathan F. Twining the Fifteenth, which was a part of the U.S. Strategic Air Forces that Spaatz now commanded from the United Kingdom. Spaatz arranged, however, to route his orders to Twining by way of Eaker, who might modify them if circumstances required.

Eaker's new headquarters occupied a palace at Caserta in Italy, where Allied troops were advancing doggedly northward. The Casablanca Conference, which in January 1943 had approved the Combined Bomber Offensive, also set in motion a series of events that within the year carried Allied forces across the Mediterranean and about three-fourths of the way from the toe of the boot-shaped Italian peninsula to Rome, the capital city. At Casablanca, the Anglo-American leadership had looked beyond victory in Tunisia, which at the time was far from won, and decided to take advantage of the momentum gained in North Africa by seizing the island of Sicily and opening the Mediterranean to Allied convoys. Sicily, however, proved a stepping stone to further conquests, for the Allies invaded Italy and forced that nation to turn against the Axis. What began in 1943 as a means of maintaining pressure on Germany, using troops that might otherwise have been idle during the immediate future, became a full-scale land campaign, weakening the Axis but also tying down Allied divisions and aircraft that could have been preparing for an invasion of France followed by a thrust into the heart of Germany.

Although Sicily was the first objective decided on at Casablanca, an obstacle lay in the path of the North African forces, which Eisenhower commanded until he left for the United Kingdom in January 1944. Astride the sea route between Tunisia and Sicily loomed the island of Pantelleria, its volcanic features studded with a hundred gun emplacements, an outpost too dangerous to ignore. After a series of harassing attacks, a massive aerial bombardment began on June 1, 1943, lasting 10 days and totaling more than 4,800 tons of bombs, with naval gunfire adding to the deluge of explosives. A preinvasion hammering by warships and aircraft followed, and when landing craft carrying the assault force started shoreward on June 11, the Italian defenders raised the white flag of surrender.

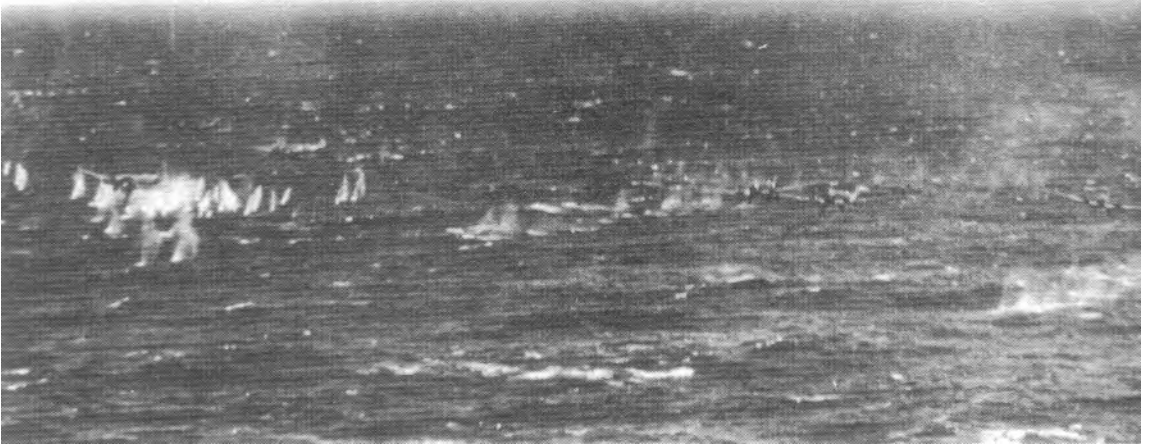
During the battle of Pantelleria, the Tuskegee-trained black airmen of the 99th Fighter Squadron, the first blacks ever to fly for the Army, made their debut in aerial combat. Initially, the

pilots seemed unsure of themselves, a result of racial segregation, for the black squadrons had no cadre of veteran flyers to serve as a steadying influence for the younger men. All the Tuskegee pilots had about the same number of flying hours, and only one, Lt. Col. Benjamin O. Davis, Jr., a 1936 graduate of the Military Academy, had any appreciable experience as an officer or familiarity with Army procedures. As a result, black units entered combat at a distinct disadvantage and at the outset performed poorly compared to squadrons that had veteran leaders with many hours in the air. As time passed, however, efficiency improved, and by war's end black fighter pilots successfully and routinely escorted bombers from Italy deep into Germany. In *Those Who Fall*, his memoir of wartime service as a bomber pilot, John Muirhead paid tribute to the Tuskegee airmen, describing how they suddenly appeared, exactly on schedule, and stayed with the bombers all the way to the target, during the final minutes ignoring the concentrated antiaircraft fire that usually discouraged both American escorts and German interceptors. They were, wrote Muirhead, "the best of shepherds."

Operations from Italy lay some months in the future, however. After Pantelleria came Sicily, invaded by air and sea following systematic aerial attacks that tried to isolate the island from Italy and prevent intervention by the *Luftwaffe*. On the night of July 9, 1943, hours before the next morning's amphibious landings, British troops in gliders and American parachute infantry approached the beachhead their countrymen planned to seize. High winds and inexperience on the part of the crews of the C-47s towing the gliders contributed to errors in navigation that caused 121 of the 133 gliders to miss the designated landing zone, with 65 of them coming down at sea. Despite this tragedy, the glider-borne troops seized and held an important bridge leading inland from the invasion beaches. At Gela, almost 65 miles to the west, wind and navigational error also scattered the almost 3,500 American paratroops, but did not prevent them from making contact with the force landing by sea.

The Troop Carrier Command of the Northwest African Tactical Air Force staged two other major airborne operations during the Sicilian fighting. On the night of July 11, another mission near Gela ended in failure because Allied ships, unaware of an approaching American formation, opened fire on the C-47s, twenty-three of which failed to return to their North African bases. The airborne troops landed over a wide area and suffered casualties that General Eisenhower considered "in excess of any damage inflicted on the enemy." Nor were friendly antiaircraft gunners advised of the final drop, on July 13, when a combination

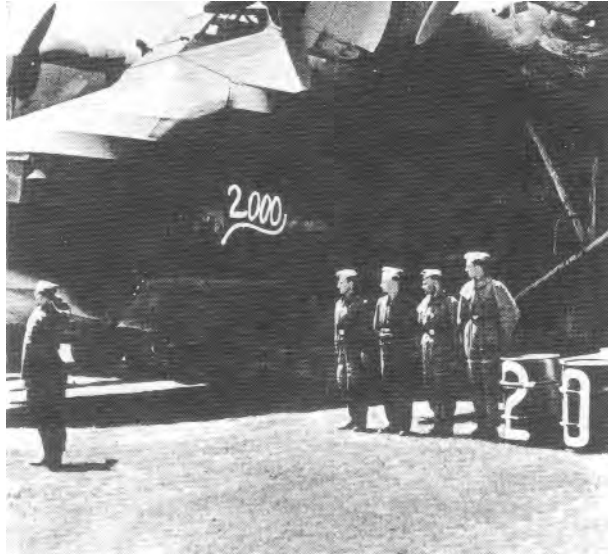
End Game in North Africa



Auspiciously begun with lightly opposed landings, the campaign in North Africa led to a tough fight against the entrenched and reinforced Axis in northeastern Tunisia. American ground forces suffered a serious reverse at the Kasserine Pass in February, but recovered rapidly from their failure. Twelfth Air Force also came together as a fighting force, especially in striking enemy lines of communication. Allied fighter forces established air superiority over the Tunisian battlefield only in early April 1943, but confusion and argument still reigned over the control of air elements supporting embattled infantry and armor. With the advantage of intelligence gleaned from the ULTRA system, medium bombers gained the upper hand over Axis shipping between Sicily and Tunisia and then savagely interdicted Axis aerial resupply from Sicily. B-25s (above) take on a serial of twelve Ju 52s hugging the Mediterranean waves; none of the transports survived the encounter recorded here.

German forces pressed the enormous Me 323 *Gigant*, a glider reconfigured as a powered aerial freighter (top, left column opposite), into service on this run, but lost most of those engaged. Medium bombers operating over the German bridgehead hazarded intense flak at low level; B-25s chase their shadows (left column, opposite) over a scrub Tunisian landscape. In the far right column (top to bottom), General Spaatz confers on a hotel balcony in Algiers with Lt. Gen. George S. Patton, Jr., commanding II Corps in the ground action. Two British officers, Air Chief Marshal Arthur Tedder, left, and Air Vice Marshal Arthur Coningham influenced the development of American operations and the control of air forces. A new U.S. Army doctrine published after the North African campaign, FM 100-20, *Command and Employment of Air Power*, made land and air power "co-equal and interdependent."

A Ninth Air Force Liberator crew based near



Benghazi in Libya gets a "chalk talk" on targets north of Sicily; an effective raid on the docks of the Sicilian capital of Palermo in March forced the focus of German supply further north. These strategic forces also supported Allied operations in the Sicilian invasion later in the summer.

On May 8, 1943, the Axis command surrendered nearly 240,000 troops, a third of them Italians. Large quantities of guns and matériel fell to the Allies. German prisoners of war are seen stacking captured small arms in the Tunisian sun.

In a final act closing the North African drama, Allied air forces struck the isolated target of Pantelleria, an Italian possession forty-four miles off the Tunisian coast. Harboring a garrison of over 10,000 that could have interfered with Allied plans for Sicily, the island took 5,000 tons of bombs and a naval bombardment for six days before surrendering. The last photograph shows the island's main harbor at the end of the fray.



of Allied and German fire shot down fourteen transports carrying British parachutists and drove off almost twice that number before the troops could jump. The airborne force succeeded, however, in recapturing a bridge over the Simeto River, some twenty miles northwest of Syracuse. No wonder that an analysis of airborne operations in Sicily emphasized the need for planning by a single headquarters, further training in aerial navigation, and the proper use of identification signals within clearly defined flight corridors.

Despite the confusion that hampered airborne activity, Allied air power rapidly gained control of the skies over Sicily and southern Italy. This aerial superiority could not, however, prevent the Germans from conducting a carefully planned withdrawal across the narrow Strait of Messina to the Italian mainland. Antiaircraft fire from the beaches and from the evacuation craft prevented fighters and medium bombers from pressing their daylight strikes. The Germans feared high-altitude bombardment from beyond the reach of the defending batteries, for a night strike by British Wellington medium bombers had temporarily disrupted operations on the Sicilian beaches, but the Wellingtons and the American heavy bombers concentrated on ports along the Italian coast where intelligence incorrectly reported the evacuees were landing. By holding out until mid-August, the Germans gained time to send additional forces into Italy and prepare, if necessary, to take over the defenses manned by increasingly dispirited Italian troops.

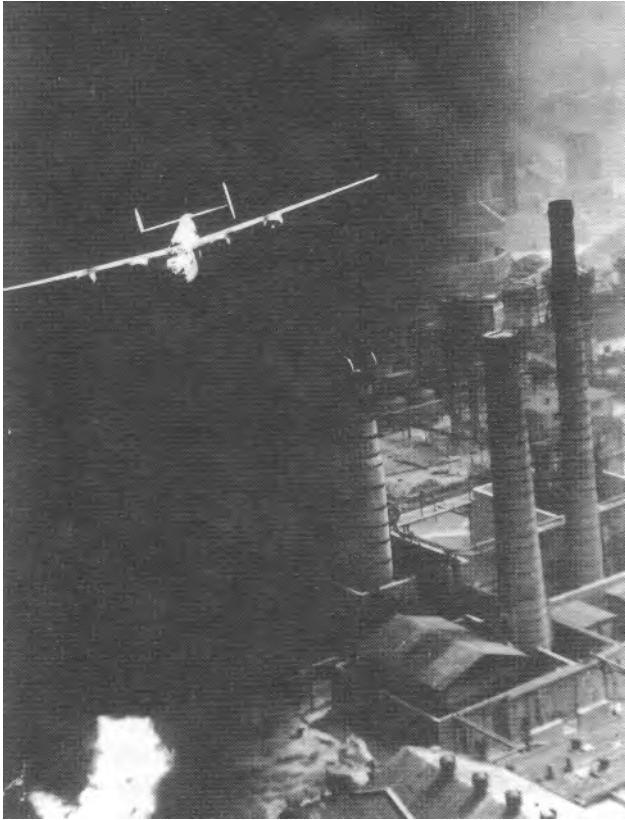
During the battle for Sicily, American strategic bombers returned to Ploesti, attacking the refineries from rooftop height. For the August 1 raid, General Brereton assumed control of five B-24 groups—two from his own Ninth Air Force, two on loan from the Eighth Air Force, and one that had been scheduled to join General Eaker's command. After training against a mock-up of the target constructed in the Libyan desert, Brig. Gen. Uzal G. Ent led 177 bombers on the long flight from North Africa. Near the coast of Greece, fate intervened; the B-24 carrying the lead navigator for the expedition plunged suddenly into the sea and exploded. Another aircraft dived low to look for survivors, could not catch up with the formation, and returned to Africa, carrying with it the alternate for the navigator killed in the crash.

Shortly after the bomber went down, the surviving aircraft crossed the coast of Europe and came under surveillance by German radar. The early warning network had gone on alert when the enemy intercepted and decoded a radio message advising Allied forces that a large formation was flying northward from Libya, a warning designed to prevent antiaircraft gunners from firing on the friendly bombers. German control centers tracked the Americans until they descended below the level of the radar

coverage. As the bombers drew near, anti-aircraft crews around Ploesti manned their weapons, and fifty-two interceptors, flown by Germans or Rumanians, took off to do battle.

As the bombers neared the target, they had to turn at a particular village and head directly for the refineries. To pick out the proper landmark required precise navigation, and here the death of the lead navigator and the absence of his alternate proved decisive. Two of the attacking groups turned at the wrong village and followed a course toward Bucharest, Rumania's capital, rather than Ploesti. The crews soon realized the mistake and changed headings, their B-24s flying in ragged clusters instead of the prescribed formations. In doing so, they approached the refineries from the wrong direction and bombed targets assigned to other groups. The navigational error brought the two groups over the deadliest of the area's anti-aircraft defenses, forcing the gunners on board the aircraft to open fire, not at interceptors, but against batteries on the ground. Maj. Norman Appold, a pilot, credited George Barwell with silencing three of six 88-mm anti-aircraft guns firing directly at one of the groups. Barwell, a British officer and instructor in aerial gunnery who had volunteered for the mission, knocked out the anti-aircraft guns from the top turret of Appold's B-24. The defenses that challenged the bombers were ingenious and deadly. For example, two parallel formations of B-24s that had made the proper turn to Ploesti were skimming the farmland on either side of a rail line when the sides of several boxcars dropped to reveal anti-aircraft guns that opened fire in both directions. Beyond this anti-aircraft train, some of the crews found their assigned targets already in flames, bombed by aircraft in the groups that had got lost, and had to brave dense smoke and exploding delayed-action bombs to deliver attacks of their own. Second Lieutenant Lloyd D. Hughes flew his B-24 through a wall of flame that ignited gasoline streaming from punctured fuel tanks; the crew managed to drop the bombs, but only two gunners survived when the aircraft cartwheeled and exploded during an attempted crash landing.

The turn toward Bucharest had temporarily confused the enemy fighters, but they arrived in time to attack the last American groups approaching Ploesti. Other German fighters intercepted the B-24s over the Ionian Sea on the flight back to Benghazi and shot down four bombers that had survived the earlier battles. In all, fifty-four of the B-24s either failed to return or crashed while trying to land, for a loss rate in excess of 30 percent, and the roster of killed or missing listed more than 500 names. More than 100 of the missing, however, actually were prisoners of war, captured after parachuting safely or surviving crash landings or



Spilling Hitler's Oil

No combatant in World War II could function without oil. In its own economic preparations for war, the Hitler government invested heavily in synthetic processes and plants for deriving aviation and motor fuel to compensate for Germany's lack of natural wells. Allied to Nazi Germany was Rumania, whose Ploesti fields, the largest in Europe outside the Soviet Union, supplied 58 percent of the processed natural petroleum that Germany imported as the war began. Four major refineries there and their rail links became obvious targets for Allied bombers. Through 1943, attempts at reducing the flow from this source were intermittent at best. The first, led by Col. Harry A. Halverson, comprised twelve B-24 Liberators originally bound for China, but diverted to an attack on Ploesti from North Africa on June 11, 1942. The so-called HALPRO (for Halverson Project) mission did little damage and only convinced the Germans and Rumanians to improve their defenses. Over a year later, on August 1, 1943, 177 B-24Ds duplicated the feat, flying roundtrip over 2,700 miles from Ninth Air Force bases in Libya. Without escort, the force under Brig. Gen. Uzal G. Ent executed an extremely low-level attack to confuse the enemy. In Operation TIDAL WAVE, the four committed bomb groups encountered intense antiaircraft fire and fighter opposition, but started

extensive fires in storage tanks and destroyed pumping and other facilities. Ent's force lost 54 bombers. While the raid affected Ploesti's output for several weeks, it could not be readily repeated to sustain pressure against the enemy.

Once established at Foggia in south central Italy in early November 1943, the U.S. Fifteenth Air Force directed new attention to the Rumanian oil targets. From April through August 1944, the Foggia base launched over 5,400 sorties and over 13,000 tons of bombs against the oil complex in a campaign that saw twenty daylight strikes by American bombers. Before the advancing Red Army captured the area in September, the complex was in ruins.

Shown clockwise from above are scenes from the successive air battles. A lone B-24 drones through the smoke from burning oil in the TIDAL WAVE attack. A formation bypasses flaming oil tanks at an altitude prompting reports of aircraft picking up cornstalks in their bomb bays as they flew over Rumanian fields. The bomber stream soars through flak



during the attack of May 31, 1944. Two views inside the Concordia Vega refinery show the destruction there in 1944. The small inset shows a German Würzburg radar, numbers of which figured prominently in the defense of the Ploesti area.



ditchings at sea. The cost in lives and machines proved out of proportion to the results achieved, for the enemy compensated for the damage by using idle refining capacity. Moreover, no follow-up attack discouraged repair crews or added to the destruction. Whatever its results, the mission demanded the ultimate in skill and courage. Five officers received the Medal of Honor. Colonels Leon Johnson and John R. "Killer" Kane survived to receive theirs for leading their groups through savage anti-aircraft fire, flame, and smoke to drop their bombs on the refineries. Posthumous awards commemorated three others—Lieutenant Hughes, Maj. John L. Jerstad, and Lt. Col. Addison L. Baker—who sacrificed their lives to guide burning aircraft to the assigned targets.

Despite the losses, the bombardment groups that had hit the refineries were back in action within two weeks. On August 13, they sent sixty-five B-24s to bomb an aircraft factory at Wiener Neustadt in what had been Austria, the first raid on Hitler's Reich from bases in Libya. After flying through dense clouds, the bombers encountered light opposition at the target, losing two of their number but damaging hangars and other buildings.

By late August, the battle for Sicily was coming to a successful end. An advance into Italy seemed the next logical step, since it would enable the Allies to maintain pressure on Germany and take advantage of an obvious Italian willingness to abandon the Axis and even take up arms against Germany. Mussolini was overthrown on July 25, 1943, and even as the new government announced that the war would continue, its representatives began negotiating with the Allies. By the time British forces landed on September 2 at the heel and toe of the Italian boot, King Victor Emmanuel had secretly agreed to surrender. Increasing German strength around Rome forced the last-minute cancellation of a planned American airborne descent on the capital to protect the king and his fellow conspirators, who nevertheless went ahead with their plan. On September 8, a spokesman for the group announced that Italy had capitulated. The king and others escaped from Rome, joined the Allies, and formed a government that, on October 13, declared war against Germany. Meanwhile, the Allies landed at Salerno on September 9 in an attempt to capitalize on Italy's surrender by quickly seizing nearby Naples, a task that took three hard-fought weeks.

In General Eisenhower's phrase, air power "went flat out" in support of the Salerno landings. An American airman, Maj. Gen. Edwin J. House, served as fighter director during the amphibious assault, controlling all such aircraft, whether land-based or flown

from British carriers. Unfortunately, Allied fighters based on Sicily operated at the end of their tether over Salerno, so that after the first few days their lack of time on station and the need for unremitting attacks on German ground forces left holes in the aerial umbrella. Through these gaps the *Luftwaffe* mounted raids, harassing the hard-pressed Allied troops and scoring hits with radio-guided bombs on three warships; but the enemy airmen did not prevail. Transport aircraft parachuted reinforcements onto the beachhead, while Allied fighters and bombers helped break the German grip on the heights dominating the beaches. Allied air power then spearheaded the advance inland. Falling back from Salerno, the enemy exploited winding, rain-swollen streams and mountainous terrain to slow the advance toward Rome.

One week after Eaker began his new assignment in the Mediterranean Theater, the Allies attempted an end run around the main line of resistance to capture Rome. The landing at Anzio on January 22, 1944, caught the Germans off guard but failed to break through to the Italian capital. Allied aircraft had cratered nearby airfields and attempted to isolate the battlefield by attacking overland lines of communication, but the air strikes did not prevent men and machines from reaching the hills overlooking the beachhead. Hitler succeeded in massing troops from as far away as Yugoslavia and bottling up the invasion force.

An attempt to advance from the south to join forces with the Anzio beachhead encountered determined German resistance, especially in the vicinity of Monte Cassino, site of an abbey that traced its history to the sixth century. Convinced that the Germans had posted observers at the monastery to direct artillery fire, the Allied commanders trying to break through the defenses asked that the structure be destroyed. During a final aerial reconnaissance, Eaker and another American general thought they saw a radio antenna and several German soldiers on the monastery grounds. In fact, the enemy soldiers had not entered the gates, although they had established positions some fifty yards from the abbey's walls.

After dropping warning leaflets, one of which found its way into the hands of the abbot, American airmen attacked the mountaintop on the morning of February 15, 1944. Some 250 bombers dropped about 600 tons of high explosive, with Allied artillery adding to the destruction. The bombardment began before the monks or the civilians who had taken refuge with them could react to the warning and flee, and the bombs and artillery shells took an unknown toll among the noncombatants. Afterward, German troops dug in among the ruins of the monastery, converting Monte Cassino into a redoubt.

Up the Boot



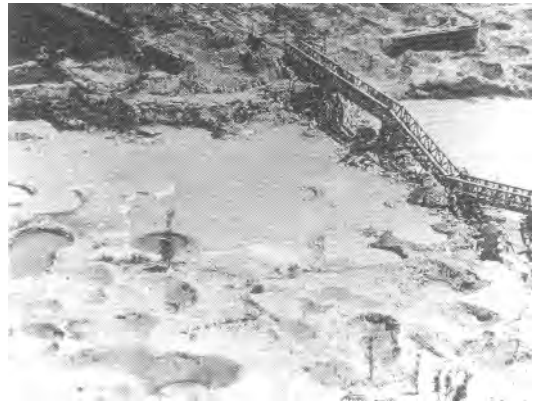
Political exigency led the American military command in 1943 to accept reluctantly Winston Churchill's demands for an advance against the Axis by way of Europe's "soft underbelly." Starting with landings at Salerno in September 1943, the Italian campaign against an enemy dug into mountainous terrain was bitter and costly. On this semi-static front, air power constricted enemy supply, impeded rear-area troop movement, and destroyed German fortified positions in support of Allied ground elements. Fifteenth Air Force was established in south-central Italy in November 1943; it attacked strategic targets in northern Italy and in the Reich beyond, complicating the defensive task for a *Luftwaffe* already straining to deflect Allied aerial attacks from England. Twelfth Air Force provided tactical and medium bombardment support in Italy, especially after the Allies established a precarious beachhead at Anzio in January 1944.

In Operation STRANGLE, beginning in March 1944, Allied mediums and fighter-bombers focussed on Italian rail lines, marshalling yards, and bridges 100 miles behind the front and then on enemy truck traffic on the roads leading to the fighting lines. German supply could soon move only at night, but

the enemy sustained his fourteen divisions in Italy at a subsistence level, enough for a stout positional defense, but not for serious counterattack or an elastic, fighting withdrawal. Air power helped stave off greater threats to encircled Anzio, but the Germans could always vacate their defenses in Italy in good order and take up successive new defense lines further

north through the end of the war despite the Allied aerial interdiction campaign.

Above, B-26 Marauders during STRANGLE; B-25 Mitchells (*opposite, above*) bomb rail lines near the Brenner Pass. The rail bridge at Cicina (*opposite, midpage*), lies askew amid bomb craters in March 1944. In the main rail yard in Florence (*opposite, below*), a locomotive has turned turtle in a 1,000-pound bomb crater. Two Twelfth Air Force fighter-bomber pilots (*right*) take a turn on the ground as a ROVER JOE team calling in air attacks on German positions. The centuries-old abbey of Monte Cassino (*inset*), dominating the Liri Valley approach to Rome, lies in ruins after air attacks on February 15, 1944. Allied leaders mistakenly believed that German combatants had occupied the treasured monastery and were directing their artillery from its heights.



Despite the failure of the first bombardment, General Arnold urged Eaker to return with all the bombers at his disposal, breaking up "every stone . . . behind which a German soldier might be hiding." The commanding general of the Army Air Forces was determined that air power shatter the stalemate in Italy to prevent ground commanders from gaining control of tactical aviation and attempting to divert strategic bombers from the offensive against German industry. Eaker, however, favored a different use of air power to achieve Arnold's goals. Pointing out that Spaatz endorsed his idea, he proposed the "cutting of communications, road and rail, and the destruction of enemy coastal shipping to a point where he cannot possibly supply his . . . divisions." The Allies called this aerial campaign Operation STRANGLE.

Intended to "reduce the enemy's flow of supplies to a level which will make it impractical to maintain and operate his forces in Central Italy," STRANGLE reflected the theories of Solly Zuckerman, professor of anatomy in peacetime Great Britain who had become a pioneer in the field of operations analysis, but American airmen and intelligence specialists also made a contribution. Zuckerman argued that marshaling yards formed the Achilles' heel of railroad transportation, whereas the Americans proposed concentrating on chokepoints, especially bridges. Operation STRANGLE tried to do both by attacking railyards, rolling stock, and railroad bridges throughout an interdiction zone that extended from Rome to Florence and irregularly across the breadth of the peninsula. Disruption of rail service would force the enemy to rely on trucks, which were judged to be in short supply and vulnerable, at least during daylight, to air attack.

STRANGLE began as scheduled in March 1944 and soon produced important results. Tactical aircraft, assisted at times by heavy bombers, battered the marshaling yards, but the Germans easily repaired the damage. In addition, most freight traffic originated north of the Alps so that raids on railroad yards in Italy had no impact on the organization of trains and dispatching of cargo. In contrast, attacks on railroad bridges proved crippling, for to repair the twisted ruins of such structures required engineering skill, heavy equipment, and the use of scarce steel. Until work crews could repair a viaduct, the enemy had to shift cargo from freight cars to trucks. During the day, fighter-bombers attacked the roads and highway bridges that the motor convoys used and strafed the trucks. Only during darkness could trucks safely travel the highways of Italy, for the Allies had no aircraft capable of night interdiction, but doing so meant that a comparatively short journey might have to be broken into several nighttime segments. The resulting delay, along with the limited cargo

capacity of trucks compared to railroad cars, prevented the Germans from adequately replenishing stocks of ammunition depleted in the steady fighting. STRANGLE did not force the Germans to withdraw, but during Operation DIADEM, when the Allied troops before Cassino successfully attacked to link up with those at the Anzio beachhead, the ammunition shortage, which could not be made good because of continued interdiction of roads and rail lines, reduced the German powers of resistance. Monte Cassino fell to the Allies in mid-May and Rome on June 4.

During the six months that saw the cracking of the German defenses south of Rome and the occupation of that city, the air campaign from the United Kingdom had rapidly intensified. The capture of Foggia in southern Italy gave the Allies a large air base much closer to strategic targets in Germany, Austria, and Rumania. A coordinated air campaign against central European targets now ensued. Doolittle assumed command of the Eighth Air Force at a time when its fortunes were on the rise. Because of increased production and accelerated training programs in the United States, at the end of January 1944 he had twice the number of B-17s and B-24s and bomber crews that Eaker had commanded at the end of October of the previous year. Far more important, however, was the growing number of P-51 Mustangs. Even though the Ninth Air Force, a tactical organization, received the first group of P-51s to reach the United Kingdom, these aircraft escorted strategic bombers of the Eighth Air Force on missions deep into Germany. The new design gave Doolittle what Eaker had lacked—a fast, maneuverable fighter with jettisonable fuel tanks and a new internal tank behind the cockpit that could protect bombers over Berlin and beyond.

The appointment of General Spaatz to direct the American strategic air forces in Europe demonstrated that daylight precision bombing would continue despite the reverses suffered in October 1943. Although Eaker's British associates regretted the departure of a personable and undoubtedly competent commander, Spaatz soon came to exert greater influence in Anglo-American councils than his American predecessor or such British airmen as Harris or Air Chief Marshal Sir Trafford Leigh-Mallory, the Commander in Chief, Allied Expeditionary Air Forces. The influence wielded by Spaatz resulted from his harmonious and militarily successful relationship with Eisenhower, who, as the war in Europe neared an end, ranked Spaatz as one of his two best generals, and also from the fact that Arnold selected him and held him in high regard.

The P-51 contributed immensely to the revival under Spaatz of daylight bombing offensive. The escort fighters had their short-

comings, however. The P-51 had poor cockpit ventilation and an uncomfortable seat that could combine to cause fatigue on a long flight; and the oil for the superchargers in the P-38 could congeal in the extreme cold, leaving the Allison engines gasping for air at a time when the pilot needed maximum power. Even when their aircraft functioned perfectly, tired or overly aggressive pilots could push their fighters beyond performance limits. Capt. John T. Godfrey, credited with destroying sixteen and one-third German aircraft, attempted too violent a maneuver in the thin air at high altitude and, according to an eyewitness, tumbled end over end before regaining control of his P-47. Combat six miles above the soil of Germany demanded a finely tuned machine and the full attention of an alert and well trained pilot.

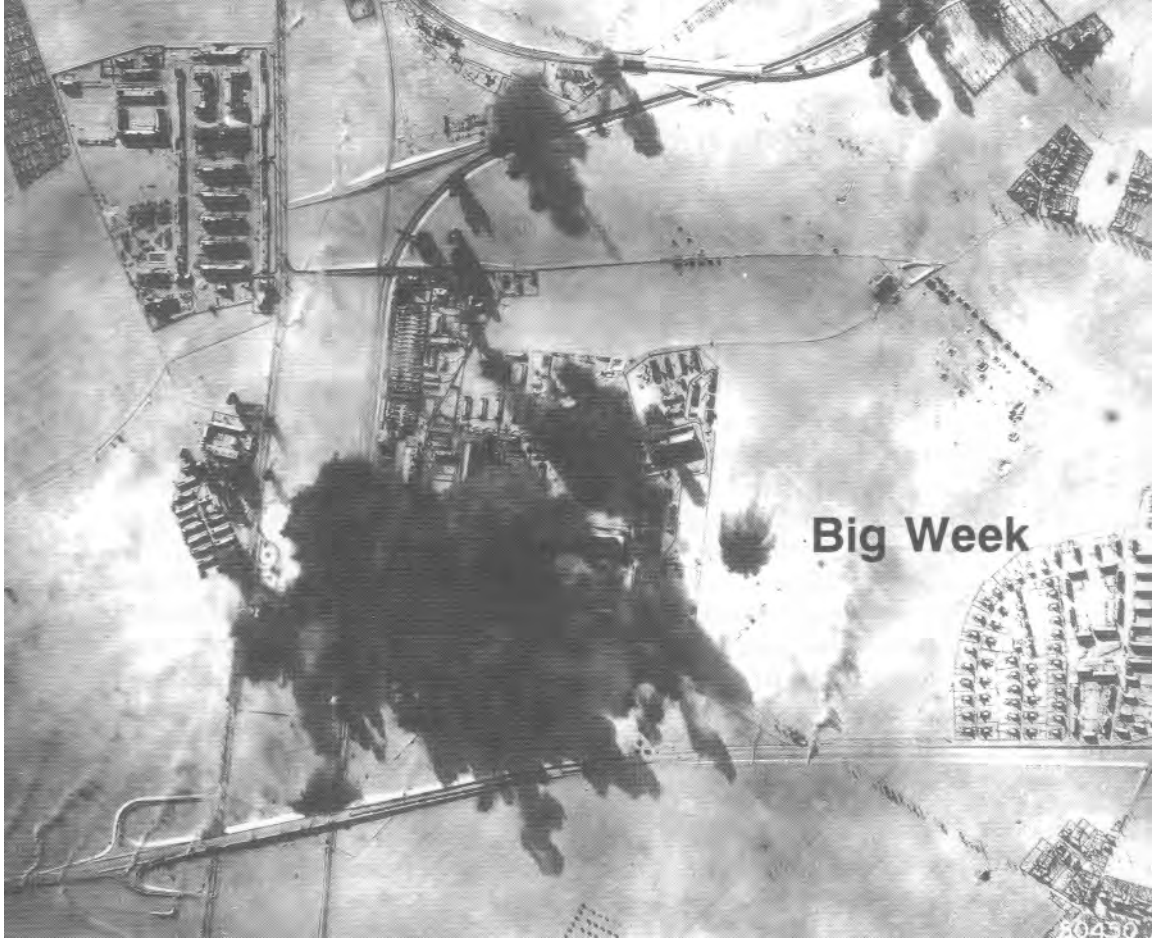
As the American fighters increased in number and improved in performance, Spaatz attacked Germany with aircraft from the Fifteenth Air Force based in Italy and Doolittle's Eighth Air Force, now stronger and better equipped than it had been under Eaker. The renewed offensive was governed by a February 1944 modification of the POINTBLANK Directive, which gave overriding priority to the destruction of the German fighter force. To accomplish this end, the American strategic bombers launched Operation ARGUMENT, a coordinated attack on the German aviation industry. Between February 20 and 25, 1944, the Eighth Air Force dispatched some 3,300 bomber sorties and the Fifteenth Air Force about 500 against targets from Regensburg and Steyr in southern Germany, to Tutow near the Baltic coast, and to Posen in Poland. During this so-called Big Week, the B-17s and B-24s dropped 10,000 tons of bombs on factories manufacturing airplanes or aircraft components and also on the ball bearing plants at Schweinfurt. Air Marshal Harris's night bombers, though engaged in a sustained attack on Berlin, mounted five raids on cities connected with the aircraft industry, following up the American daylight strikes on Steyr, which produced both aircraft components and ball bearings, and on Schweinfurt. American bomber losses averaged 6 percent during Big Week, roughly one-third the loss rate suffered in the October 1943 missions against similarly distant targets. The improvement resulted in large measure from the 3,500 or more long-range fighter sorties flown to protect the B-17s and B-24s.

Sperr and his associates feared one aspect of the Big Week attacks more than any other, for they believed that the destruction of the ball bearing industry, which had belatedly begun to disperse its manufacturing facilities, could cripple the German war machine. Once again production plummeted as a result of the bombing, but Allied airmen again failed to pursue a potentially

decisive campaign. "As it was," the German armaments minister later wrote, "not a tank, plane, or other piece of weaponry failed to be produced because of lack of ball bearings."

The German aircraft industry responded quickly to Big Week and the threat of systematic air attack. The various firms dispersed their factories and plants and agreed to devote efforts to turning out a few critically needed types. As their American counterparts already had done, German manufacturers now sought to avoid making minor design changes on the assembly line, shifting this work to modification centers. After an abrupt decline early in 1944, Speer and his colleagues marshaled a labor force, set up small and widely separated factories, and succeeded in increasing fighter production from 1,300 planes in January to 1,600 in April and to 3,000 in September of that year. In achieving these impressive totals, Germany built single-engine fighters almost exclusively, since this type was desperately needed to defend the Reich. The United States produced more than twice as many aircraft, in categories ranging from light observation craft to the heavy bombers battering Germany, and five times the number of aircraft engines. Moreover, the United States had the fuel and the time to train replacements for the pilots and crews lost in combat.

At most, Speer managed to reduce to some extent the odds against the *Luftwaffe*. Attrition among German pilots, who could not be replaced because a shortage of fuel hampered training, helped neutralize the effect of Speer's efforts. Even before Operation ARGUMENT and the Big Week signaled a systematic attack on the aircraft industry, the combination of aerial combat against American daylight raids; sustained operations against British night attacks; action in North Africa, Sicily, and Italy; and the continued heavy fighting in the Soviet Union resulted in severe losses among fighter pilots. Indeed, during 1943 the monthly attrition rate in the fighter squadrons peaked in July at 16 percent, before declining as winter approached and the air war diminished in intensity. In that single year, the *Luftwaffe* lost some 35,000 of the 49,000 pilots and other aircrew members killed or missing since the war began. The year's heavy toll testified to the increasing impact of the Combined Bomber Offensive. Since the conquests of 1940 and the unsuccessful air campaign against the British Isles, Hitler had ignored western Europe, using the *Luftwaffe* to further his conquests in the Balkans, Greece, Crete, North Africa, and the Soviet Union, but in 1943 the Third Reich began to experience the fury of aerial warfare. The Royal Air Force Bomber Command destroyed Hamburg in a terrible fire storm, and not even the losses inflicted on the Eighth Air Force at

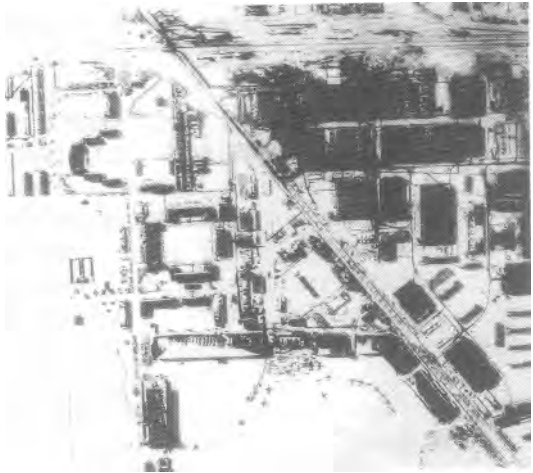


Winter cloud cover over targets in Germany limited the effect of visual bombing missions, but in mid-February 1944, General Spaatz got an unexpected promise of several days of good visibility. Now coordinating the operations of strategic forces in England and the Mediterranean under the new U.S. Strategic Air Forces in Europe command, he began Operation ARGUMENT, in which the Eighth and Fifteenth Air Forces concentrated on the German aircraft industry for six days — Big Week. Facilities at fifteen locations throughout Germany and Austria took the brunt of an effort to cripple the *Luftwaffe* in the air, on the ground, and in the factories. Above, the snow-covered grounds at a plant in Leipzig-Heiterblick appear at the moment of impact of the first salvos of the assault on February 20. The complex manufactured components for Bf 109s.

Clockwise on page opposite, a formation of B-17Gs releases high explosive on targets. A lone FW 190, top left of photo, flies a pursuit curve with four B-17s in view below. The bombers are making for the Messerschmitt assembly plant near Braunschweig. In before and after views of the Gothaer

Waggonfabrik, turning out Bf 110s that were one of the mainstays of the German night-fighter force, the tight bomb pattern within the factory compound is evident. The flight of P-51s carries the teardrop-shaped wing tanks that made long-range penetration of Germany by fighters possible. Big Week marked the first large-scale employment of this equipment; escort fighters could now range over the entire Reich, protecting bombers and confronting the German aerial defense.

Over 3,300 Eighth Air Force bombers and 500 from the Fifteenth dropped nearly 10,000 tons of bombs on a single German industry, more ordnance in one week than the Eighth had delivered in the previous year. The attacks destroyed 75 percent of the structures in facilities that sustained 90 percent of German aircraft output. Machine tools, though intact, had to be dug out of ruins before production came up again. By summer, the Germans had recovered and actually increased airframe output through the end of 1944, but American airpower in all its forms had clearly come of age over Europe. The German homeland and the *Luftwaffe* had entered a decidedly new phase of the air war.



Schweinfurt in August and October could offset the gathering strength of its bomber command.

In 1944 the effect of attrition on the *Luftwaffe* worsened as the hundreds of attacking Allied bombers became thousands, and the long-range P-51 appeared in ever increasing numbers. Losses among German fighter pilots continued, with some 2,200 dead or missing between January 1 and the end of May, when the rate of attrition reached 25 percent. During all of 1944, almost 21,000 pilots and crewmen were lost out of a pool of aviators that had shrunk in size and skill from the force that had been available a year earlier. Increased fighter production thus proved a hollow triumph, for in a statistical sense, *Luftwaffe* fighter units underwent a complete numerical turnover of single-engine pilots during the first five months of 1944. Only the ablest (or luckiest) survived to fly the aircraft that German industry produced, as new pilots joined fighter squadrons in rapid succession, their brief careers averaging 30 days or less.

When German fighter production began its increase under Speer's prodding, Allied heavy bombers that might otherwise have attacked this industry had to deal with radical new weapons that the enemy developed and deployed. Photographic confirmation of these so-called vengeance weapons came during the summer of 1943, when a British reconnaissance pilot brought back film that revealed two large rockets lying on trailers at a research center in the Baltic hamlet of Peenemünde. On the night of August 17, within hours of the first American raid on Schweinfurt, Bomber Command attacked the site, causing damage that delayed the appearance of the V-2 long-range rocket. Later that same month, the Eighth Air Force joined in the campaign against the vengeance weapons, an undertaking eventually called Operation CROSSBOW, sending B-17s to bomb a massive concrete structure at Watten, France, that intelligence had linked to the rocket program.

As the threat grew more ominous, the diversion of bombers became more frequent. Aerial reconnaissance soon discovered that at various places in western Europe the Germans were building flat-roofed hangars, inclined ramps, and sheds with a gently curved shape that resembled a ski placed on edge. These "ski sites" stored, serviced, and launched another vengeance weapon, the V-1, a pilotless, jet-propelled flying bomb. As the number of launch facilities for the two new weapons proliferated, CROSSBOW intensified, so that from December 1943 to June 1944 American and British aircraft had dropped some 36,000 tons of bombs on V-1 and V-2 installations. This bombardment did not prevent the enemy from launching the first V-1 on the morning of June 13,

1944, and the first V-2 on September 8. Attacks by these two vengeance weapons lasted until March 1945, despite air raids on launch sites, propellant factories, and plants manufacturing V-1 and V-2 components. General Spaatz even experimented with missiles of his own, war-weary bombers loaded with explosives and directed by radio signals against V-weapons sites. The *Luftwaffe*, in turn modified some of its bombers to launch the V-1, and the less mobile V-2 continued to menace British towns and the Belgian port of Antwerp, a supply conduit for the advancing Allied armies. The last vengeance weapons exploded in Antwerp on March 28, 1945, and in London a day later.

Although reluctant to do so, both Doolittle and Harris diverted some of their heavy bombers in an attempt to neutralize Hitler's V-weapons. Harris was especially concerned about shifting targets, since Bomber Command late in 1943 had launched the Battle of Berlin, a series of sixteen night raids that ended on March 24, 1944. "We can wreck Berlin from end to end," he had declared, "provided the USAAF [United States Army Air Forces] will come in on it." The Eighth Air Force, however, continued to hit the German aircraft industry, while at the same time taking part in CROSSBOW, and had to delay its first Berlin strike until March 4. As it turned out, raiding Berlin by daylight actually reinforced the campaign against the aircraft industry, for the *Luftwaffe* felt compelled to fight in defense of the capital, giving the pilots of the long-range Mustang an opportunity to accelerate the attrition of the German fighter force. Unfortunately, the first American attack on Berlin fell victim to bad weather, for out of 300 bombers just 29 succeeded in finding the cloud-covered city and bombing one of its suburbs, and then only because they failed to hear the recall order. Indeed, weather had become such a hindrance to planned operations that the Eighth Air Force began sending P-51 fighters on last-minute reconnaissance missions to check on conditions over primary and alternate targets. Despite this practice, clouds impeded bombing accuracy on three additional missions flown between March 6 and March 22 against industrial targets in Berlin and its suburbs. Aircraft losses suffered in these strikes varied from 2 to 10 percent per mission; the raid of March 6 proved the deadliest, with 69 bombers shot down out of 672 that reached the target.

During the Anglo-American raids, which inflicted serious damage on Berlin, the night fighters protecting the city proved deadlier than the daytime defenses. Royal Air Force bomber losses, some 5 percent on the earliest missions, had nearly doubled by the time the aerial battle of Berlin ended. Moreover, a long-range mission to Nuremberg, flown in bright moonlight on the night of March



The Luftwaffe Challenged

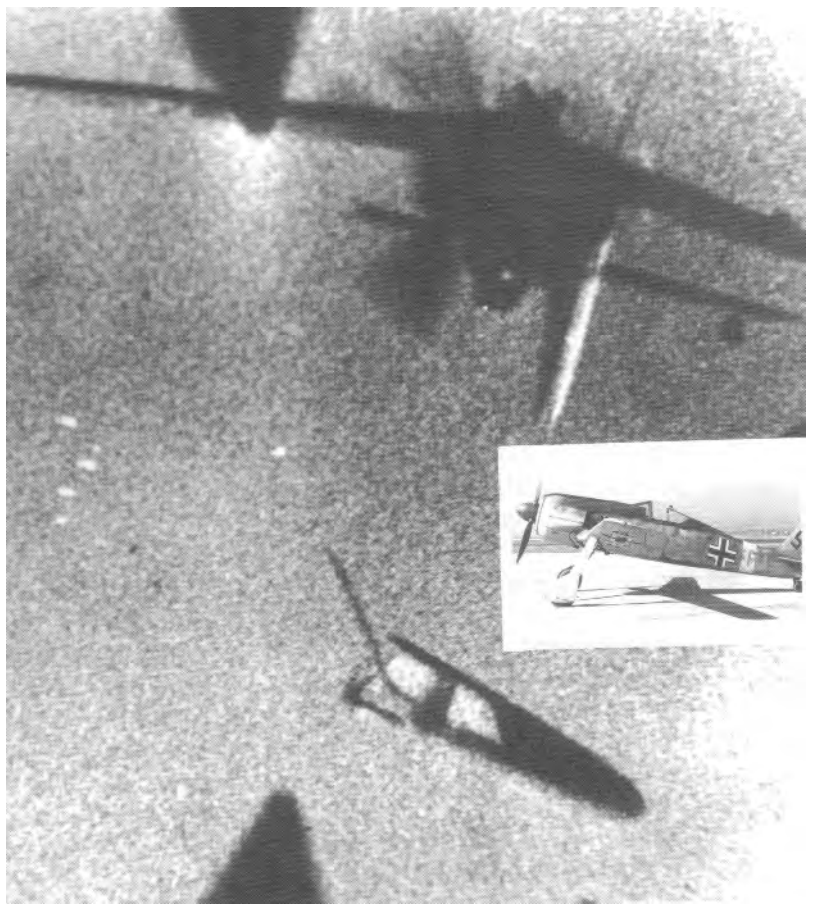
In the months after the American assault on German aircraft works, the combined strategic weight focused on German resources and the Luftwaffe itself. As the two-and-a-half-year air offensive progressed, American forces concentrated heavily on the oil and gasoline capacity of the Reich, especially the synthetic production plants that fueled German aircraft. The Allies threw down a gauntlet; the German air force had to fight if only to preserve its own resources. In the event, its institutional and planning deficiencies combined with Allied attacks to bring the Luftwaffe to ruin.

In this attritional battle, the employment after late 1943 of drop tanks, shown on the wings of a flight of P-51s above, tilted the battle against the Germans. Eighth and Fifteenth Air Force fighters could protect bomber streams to their targets and back and engage the enemy at will. A gun-camera frame (opposite, right above) captures the destruction of an FW 190, the Luftwaffe's first-line fighter (inset in same photo) of the latter years of the war. In the see-saw contest, older German aircraft produced in newer models continued the fight; a Bf 109G appears in the classic overhead frontal assault on a B-17G in

artist Rick Ruhman's *Point of No Return* (opposite, midpage left). German technical genius brought the turbojet-powered Me 262 *Schwalbe* (opposite, midpage center) into front-line action in 1944, but not in enough numbers to stem the Allied tide. Part of the production of this capable fighter was delayed by Hitler's interest in seeing the new aircraft employed as a bomber. At far right of the photo array opposite, a Bf 110, which failed as a heavy fighter, but excelled now as a night fighter, carries Lichtenstein radar for locating RAF bombers. The advent of radar-fouling aluminum chaff dropped from Allied bombers had compounded the enemy's defense against night raids; the Germans countered with these airborne radars and new tactics that gave them local successes and frequently caused heavy losses among their attackers. The Bf 110 could not survive in the air during daylight battles against Mustangs and Thunderbolts.

German fighter and flak defenses were still dangerous to the last days of the war, as the inset on this page attests; a B-17, Number 3 engine afire, plunges into urban Berlin on March 6, 1945. In contrast, the photo of a B-17 group over Betzdorf six days later





(below right) shows no German aerial opposition as the bombers drop ordnance on targets identified by H2X radars electronically scanning images of cityscapes under the concealment of the "ten-ten" cloud seen below the aircraft.

In April 1944, the Chief of German Fighter Forces reported to his superiors that the *Luftwaffe* had lost over 1,000 experienced pilots in the first four months of the year. This wastage could not be made good. The German training base by this point in the war was nonexistent. Fledgling German combat fliers were thrown into the fray with less than a hundred hours in the cockpit even as the American training base was closing down, and surplus aviation manpower went to other Army assignments after November 1944.



30, inflicted moderate damage at a prohibitive cost. Bomber Command lost 95 of 782 aircraft, 743 crewmen killed or wounded, and 159 taken prisoner. Even more disheartening than the losses was the fact that a strenuous and costly night campaign, which included the attacks on Berlin, had failed to produce decisive results; Germany fought on, and Hitler continued to rule in spite of the destruction within the capital and in other cities throughout the nation. By early April 1944, the defenders controlled the night skies over Germany, although only briefly, as events would prove. The British bomber crews needed time to rest and regroup, as General Eaker's had after the second Schweinfurt attack.

Although Germany had proved resilient under air attack, Spaatz continued to believe that bombing could defeat the enemy without the need of an invasion, provided that the bombers crippled an industry vital to the German war machine. As Speer later acknowledged, ball bearing plants formed such a target, but the Allies failed to press the advantage gained at Schweinfurt during August and October 1943 and again in February 1944, giving the enemy time to move machinery to small, widely separated factories less vulnerable to aerial bombing. Early in March 1944, General Spaatz revived a target that the British had tried unsuccessfully to attack four years earlier, one that American planners had included in AWPD/1. He proposed the destruction of the German oil industry, believed to consist of fifty-four refineries and synthetic fuel plants. The approach of D-Day for the invasion of France interfered with his plans, however. Eisenhower, Tedder, and Leigh-Mallory believed that an attack on the oil industry, decisive though it might be in the long run, would take effect too slowly to undermine German resistance to the invasion. They favored employing both strategic and tactical aviation on targets other than oil production that were more directly related to the German defense of the Normandy beaches. What Eisenhower and his staff had in mind was an attack on the transportation system that would isolate the defenders of the coastline from their inland sources of supply and reinforcement.

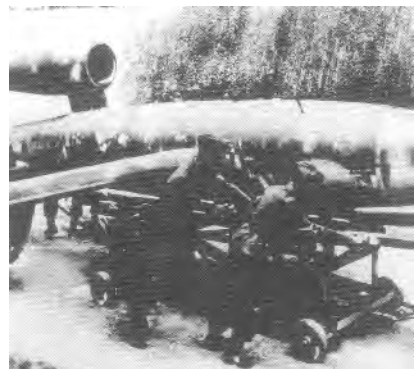
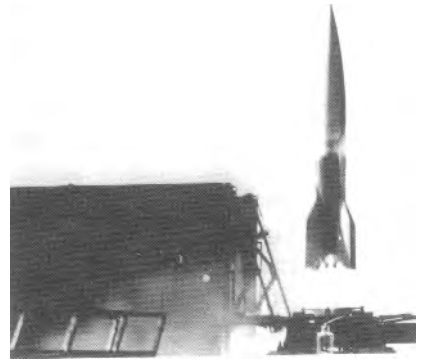
To demonstrate the importance of destroying the oil refineries, Spaatz, at Arnold's suggestion, resorted to subterfuge. At a time when Tedder and Leigh-Mallory were determined to use the American strategic air force against transportation, Spaatz directed the Fifteenth Air Force in Italy to attack the marshaling yard at Ploesti, knowing full well that the pattern of the bombing would include some of the oil refineries. On April 5, 1944, the bombers attacked Ploesti for the first time since August of the previous year, and the results were so encouraging that Spaatz had the target hit again on the 15th and the 24th. Invoking the



Among the war's more alarming developments for the Allies was the appearance of pilotless cruise and ballistic missiles in German arsenals. With ranges of up to 175 miles, these devices could reach London and other major cities from the coasts of occupied Europe. The German Army began work on the A-4 ballistic rocket in 1936 and centered research for what evolved into the V-2 at the remote Baltic coastal town of Peenemünde; a main part of the complex there is pictured above with the test launch stands along the curved segment in the upper center. Here the V-2 rocket, shown at the right on its mobile trailer and in a test launch, was perfected as a weapon mounting a one-ton warhead capable of demolishing several city blocks. A complex machine prefiguring the space exploration and weapons technology of later decades, this vengeance implement showed up along the western front in mid-1944; of nearly 6,000 V-2s manufactured, 1,115 fell on English soil, another 1,675 on the Continent after the invasion, most aimed at Antwerp.

The *Luftwaffe*-sponsored V-1, being towed to its launching ramp by a German crew at bottom right, was a far simpler pulse-jet powered, winged airframe that could deliver the same explosive effect as the V-2. Of 32,000 flying bombs produced, many in Volkswagen automotive plants and other sites employing slave labor, over 9,000 were launched against Great Britain; some 4,600 were destroyed or deflected by Allied fighters. Its uncommon gnat-like drone in flight caused it to be named the "buzz bomb" by its potential victims in England. The V-1's noisy, 400-mile-an-hour approach provoked a somewhat greater moral effect over its targets than the V-2, whose silent arrival at 3,500 miles an hour gave no warning before a thunderous detonation.

The V-weapons, so-called for the German word *Vergeltung*, meaning vengeance or retaliation, could not alter the course of the war for Germany, and even Hitler lost faith in them by January 1945, though they continued to fly at Allied territory through March of that year. The V-2 especially represented an immense diversion of German resources to a spectacular weapon of only small military value. Intense Allied aerial operations targeted the weapons and their launch sites under the code name CROSSBOW.



autonomy that Spaatz allowed him as commander of the Mediterranean Allied Air Forces, Eaker gave the Fifteenth Air Force permission to continue attacking the oil industry. Meanwhile, Spaatz tried to persuade Eisenhower to approve sending the Eighth Air Force after synthetic fuel plants deep inside Germany. The airman argued that attacks on oil production would make an immediate contribution to the success of the invasion by destroying enemy aircraft, since the *Luftwaffe* had no choice but to defend its source of fuel. In addition, the destruction of the oil industry would ultimately hobble the German armed forces, depriving them of mobility as well as air cover. Eisenhower surely realized that Spaatz wanted nothing less than an offensive against the oil industry, but he was confident that the airman would also support the invasion when directed. As a result, the supreme commander raised no objection to attacking oil production even though D-Day for the Normandy invasion was fast approaching. After a three-week delay because of bad weather, 800 bombers struck eight oil manufacturing plants on May 12, at a cost to the Eighth Air Force of 46 bombers and 10 escorting fighters.

ULTRA intercepts revealed that these first systematic attacks on the petroleum industry produced immediate results. Decoded radio traffic disclosed that the Germans were shifting anti-aircraft units from centers of aircraft manufacture to protect oil refining and synthetic fuel production. In addition, messages began referring to an incipient shortage of aviation gasoline that might soon require cutbacks in training flights. Speer later acknowledged that the May 12 attacks had signaled "a new era in air warfare," the beginning of a campaign that ultimately "meant the end of German armaments production." Although the raids on the oil industry may have sounded a death knell for Hitler's Reich, the actual burial lay months in the future. Conservation measures helped keep the machines of war moving, and as many as 350,000 workers struggled to repair production facilities so that the output of fuel could continue.

A diplomatic success now promised to benefit the oil campaign and the entire bombing offensive. Since entering the war, the United States had tried to persuade a wary Soviet Union to provide bomber bases for raids on Germany and Japan. Although not yet willing to provoke the Japanese, with whom Stalin had entered a nonaggression pact in 1941, the Soviet government at last allowed American strategic bombers to use its airfields for attacks against German territory. Fifteenth Air Force bombers flew the first such mission on June 4, 1944, returning to Italy a week later, but bad weather persisted during the stay in the Soviet Union, and the group, led by General Eaker himself, struck just

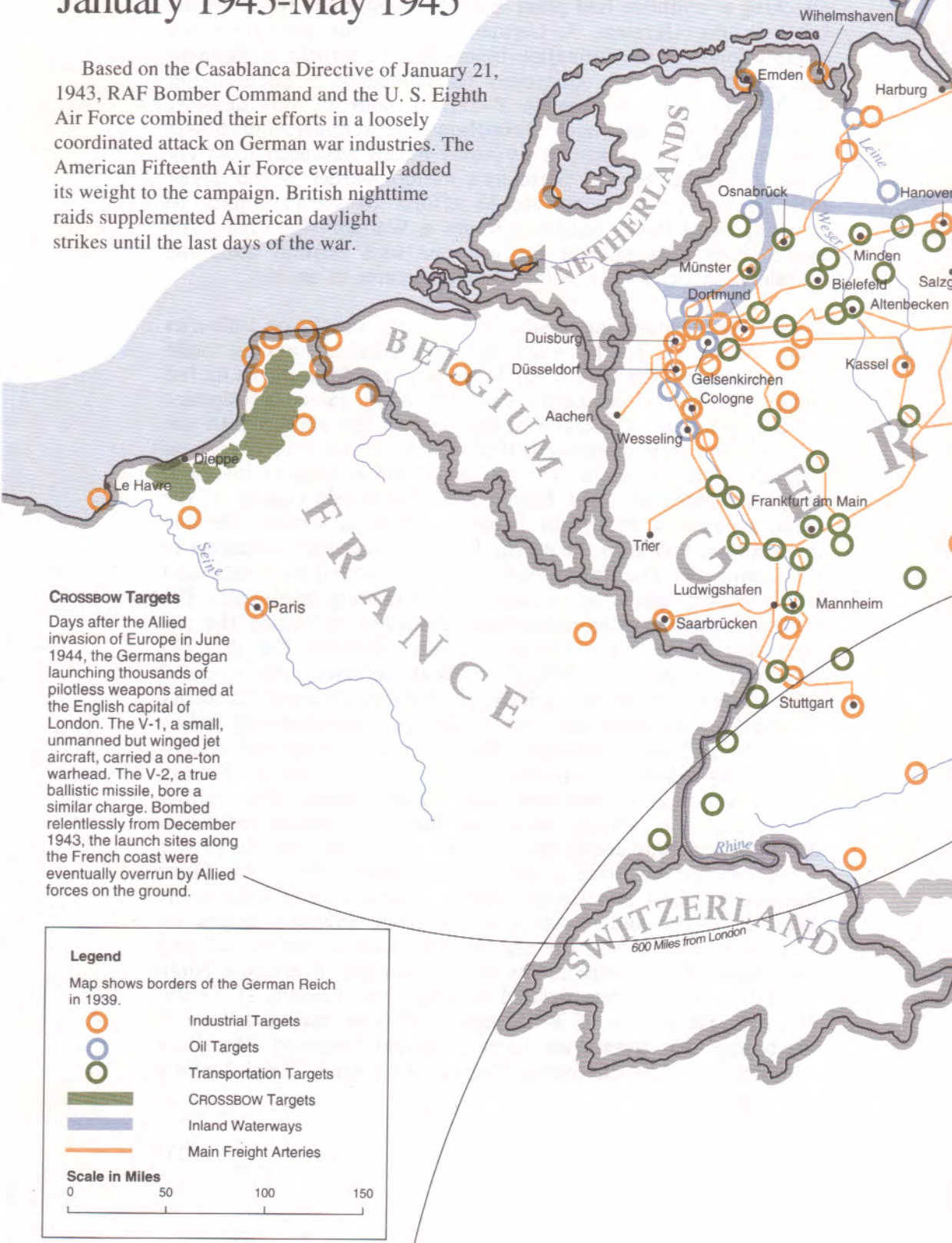
three targets. On June 21, the Eighth Air Force joined in, attacking a synthetic fuel plant near Berlin en route to Soviet air bases in the Ukraine. A German high-altitude reconnaissance aircraft followed the formation bound for the airfield at Poltava, and a raid that night destroyed forty-three of a hundred-odd B-17s and fifteen of seventy P-51s. In spite of this disaster, shuttle bombing continued throughout the summer, but Soviet bases became less important as Allied troops advanced from the invasion beaches toward Germany's western border. When Soviet officials refused to cooperate in efforts to drop supplies to noncommunist Polish resistance forces in Warsaw—the Eighth Air Force received permission for just one such mission using the Ukrainian airfields—the shuttle campaign came to an end.

Despite the encouraging results of the early attacks on refineries and synthetic oil plants, which successful shuttle bombing might have magnified, the Eighth Air Force was unable to throw its full weight into the oil campaign. Until the Allies gained a lodgment on the continent, General Eisenhower had the authority to use strategic bombers for missions that would contribute to victory on the battlefield. To assure the success of the Normandy invasion, air power based in Great Britain had to maintain control of the skies, won in a six-month battle of attrition against German interceptors, and keep the enemy from bringing reinforcements to the beachhead. The transportation plan advocated by Tedder and Leigh-Mallory aimed at isolating the Normandy battlefield. The critical element in this undertaking consisted of cutting the rail lines that could carry German forces, especially the armored divisions, to reinforce Hitler's coastal defenses, the so-called Atlantic Wall. As he had in Italy, Zuckerman advanced his theory of attacking railyards and destroying repair facilities and rolling stock. Leigh-Mallory endorsed this action and urged that American strategic bombers concentrate on the rail hubs in France. Spaatz, although he liked and respected Zuckerman, believed that the analyst was wrong; what had happened during Operation STRANGLE in Italy convinced the American officer that the proper targets should be bridges and viaducts, which Ninth Air Force medium bombers and fighter-bombers could destroy without the help of B-17s and B-24s diverted from strategic targets or CROSSBOW operations. The argument dragged on until a trial raid demonstrated the vulnerability of the bridges. Brereton's Ninth Air Force, using a plan devised by Brig. Gen. Frederic H. Smith, Jr., sent out a force of B-26s and P-47s that damaged three of the bridges that crossed the River Seine and destroyed a fourth, a 650-foot steel railroad span at Vernon. As a result, Leigh-Mallory

Combined Bomber Offensive

January 1943-May 1945

Based on the Casablanca Directive of January 21, 1943, RAF Bomber Command and the U. S. Eighth Air Force combined their efforts in a loosely coordinated attack on German war industries. The American Fifteenth Air Force eventually added its weight to the campaign. British nighttime raids supplemented American daylight strikes until the last days of the war.



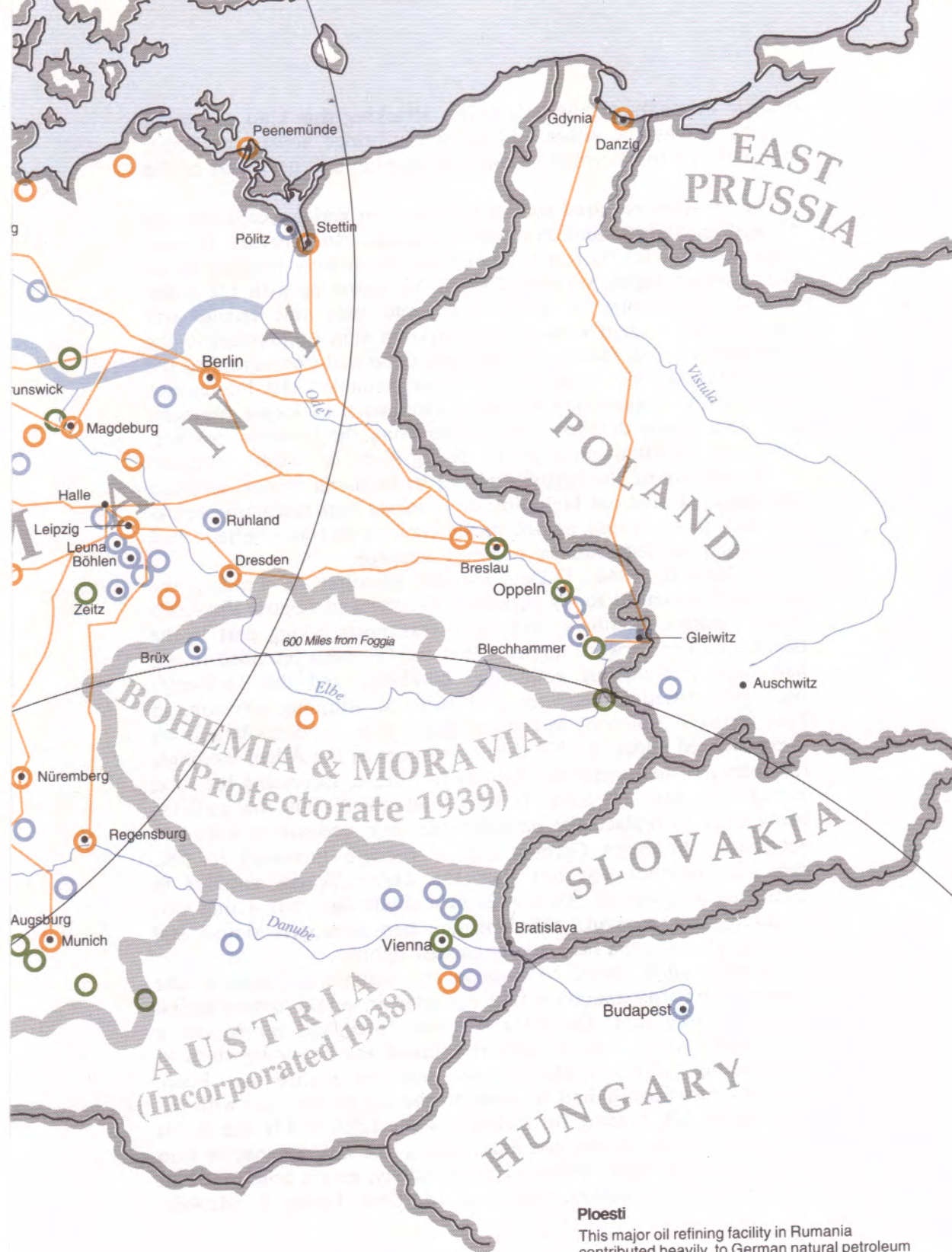
Crossbow Targets
Days after the Allied invasion of Europe in June 1944, the Germans began launching thousands of pilotless weapons aimed at the English capital of London. The V-1, a small, unmanned but winged jet aircraft, carried a one-ton warhead. The V-2, a true ballistic missile, bore a similar charge. Bombed relentlessly from December 1943, the launch sites along the French coast were eventually overrun by Allied forces on the ground.

Legend

- Industrial Targets (Orange circle)
- Oil Targets (Blue circle)
- Transportation Targets (Green circle)
- CROSSBOW Targets (Green shaded area)
- Inland Waterways (Blue line)
- Main Freight Arteries (Orange line)

Scale in Miles

0 50 100 150



Ploesti

This major oil refining facility in Rumania contributed heavily to German natural petroleum reserves. After an initial small strike in 1942, Ninth Air Force bombers struck the plant on August 1, 1943, in an attempt to limit the flow of the lifeblood of German motorized and air forces.

became belatedly enthusiastic about attacking this kind of target, and by D-Day the Allies had cut every bridge across the Seine, immobilizing the German troops and supplies still northeast of the river.

The invasion required special efforts from aerial reconnaissance as well as fighter and bomber squadrons. Just before D-Day, Capt. Charles R. Batson skimmed the Normandy beaches in an F-5, a photographic version of the P-38, returning with 130 bullet and shrapnel holes in the aircraft and only one engine still functioning. A strip camera that exposed film continuously, the brainchild of Col. George C. Goddard (who had photographed the interception of the liner *Rex* in 1938), enabled the intelligence specialists who examined Batson's handiwork to locate obstacles and other beach defenses. Besides covering the invasion beaches, American reconnaissance pilots, flying F-5s or faster, stripped-down variants of the British Spitfire or twin-engine de Havilland Mosquito, carried out high-altitude missions over Germany, bringing back pictures that helped locate such targets as synthetic fuel plants or provided evidence of bomb damage.

On June 6, 1944, D-Day for the invasion of France, the *Luftwaffe* managed to fly perhaps 100 sorties to oppose the 8,000 Allied fighters, bombers, and troop transports taking part in the operation. The forward airfields that the Germans intended to use had been put out of action by bombing, and the *Luftwaffe* squadrons based in the area had suffered crippling attrition, in May losing 712 aircraft in combat and 656 in accidents largely by inexperienced pilots. Within thirty-six hours of the Allied landings, the enemy rushed some 200 fighters to France, increasing the total strength in that category by about one-third, but the airfields being built to replace the ones bombed into uselessness were not yet ready. Although German fighter strength increased to 800, even this number was too few; the *Luftwaffe* did succeed in launching as many as 500 sorties in a single day, but within two weeks of the invasion, Allied airmen had destroyed almost 600 German aircraft, the bulk sorely needed fighters.

The *Luftwaffe* failed to impede the amphibious assault, the predawn airborne operation that preceded it, or the consolidation of the landing sites. Once the invasion force had carved out a beachhead, Allied tactical aircraft eclipsed the heavy bombers in contributing to battlefield success, but the Eighth Air Force bombers occasionally had to come to the aid of the man with the rifle. At St. Lô, France, for instance, some 1,500 B-17s and B-24s helped sever local enemy communications and kill, wound, or stun the German frontline soldiers. Unfortunately, errant bombs caused 102 American casualties, including Lt. Gen. Lesley J. McNair.

Shuttle Bombing



Late in 1943, American Ambassador Averell Harriman proposed to Joseph Stalin that the Soviet government make available airfields in the east to accommodate Eighth and Fifteenth Air Force units. These would fly missions from England and Italy, continue eastward and land in Russian territory, then refuel and rearm to strike other targets on the return leg to their home airfields. The reticent Soviets entered into arrangements only after February 1944, but had three Ukrainian airfields at Piryatin, Mirgorod, and Poltava ready by May. The project took the code name **FRANTIC**.



Fifteenth Air Force planes, Lt. Gen. Ira Eaker leading, ran the first mission, landed at Poltava (*above*) on June 2, 1944, and returned to Italy eleven days later. A mile-long runway at Poltava was built by American engineers assisted by Red Army women (*midpage, right*), who were routinely seen in the heaviest labor details. A Red Army enlisted man and a Fifteenth Air Force waist gunner clasp hands across a stack of inscribed 500-pound bombs in a publicity photo.

The second **FRANTIC** mission met disaster later in June. A German reconnaissance bomber followed an Eighth Air Force mission to Poltava after the Americans struck Berlin the 21st. After midnight, a German air attack destroyed forty-seven B-17s and damaged nineteen more. The remaining bombers retreated to fields further east and avoided a second raid at Mirgorod the next night, which caught large ammunition and fuel stocks in the open. Hulks litter the Poltava field (*below*) after the German raid.

FRANTIC continued through late summer 1944, but was less urgent once the Allies were ashore in France and could use airfields there, especially for fighters.



The tragic accident contributed to a delay between the bombing and the infantry attack that enabled the defenders to recover from the initial shock and resist bitterly, if unsuccessfully.

Following the breakout at St. Lo, the enemy counterattacked before dawn on August 7 at Mortain, overran the town, and cut off an American infantry battalion. Thanks to a warning from ULTRA and some determined American opposition, the Germans failed to reverse the tide of battle. Fighter-bombers intervened after daylight, alerted by ULTRA to the routes assigned the enemy units, and took a heavy toll in armor moving toward Mortain. Although the Germans persisted for almost a week, they never generated the striking power to punch through the American lines, a failure that resulted mainly from the attacks by P-47s on enemy tanks during the first day of the counterattack.

During the thrust across France, the Ninth Air Force supported the operations of Lt. Gen. Omar N. Bradley's 12th Army Group, made up of the First Army, under Lt. Gen. Courtney H. Hodges, and the Third Army, commanded by General Patton. The IX Fighter Command, with some 1,500 P-38s, P-47s, and P-51s divided among eighteen groups, had organized into two tactical air commands specializing in fighter-bomber operations. General Breton, who commanded the Ninth Air Force until Maj. Gen. Hoyt S. Vandenberg succeeded him during the course of the campaign, assigned one such command to each American army. The IX Tactical Air Command, under General Quesada, supported Hodges' forces, and Brig. Gen. Otto P. Weyland's XIX Tactical Air Command worked with General Patton's army. Each tactical air command established its headquarters at the army command post, following the practice adopted in North Africa. The IX Bomber Command, with eleven groups of medium bombers and attack aircraft, remained under Ninth Air Force control, available to assist any element of the army group. Fighters from the Eighth Air Force at times lent a hand, but their pilots lacked experience hitting targets in close proximity to friendly troops and therefore usually flew interdiction missions.

In supporting the two armies, the tactical air commands followed the principle of cooperation between air and ground forces, with neither subordinate to the other. Coordination between air and ground took place at every level from the army and tactical air command headquarters downward through corps, division, and regiment or combat command, to battalion. At each headquarters, an appropriate number of airmen were available to advise the commander and plan the support he required. Requests for air support were usually consolidated at a division headquarters, then were submitted to corps headquarters, and ultimately to

the tactical air command. The commander of a battalion or larger unit sometimes called for strikes in conjunction with a planned attack or merely asked that fighter-bombers, when available, attack a specific target. He might, however, face a threat requiring an immediate strike, in which case the fighter control center at the tactical air command could divert aircraft from less important missions.

Whether dispatched according to plan or diverted from another strike, the aircraft came under the control of an airman in a control party, who cooperated with the unit commander in directing the attack without unnecessarily endangering friendly troops. As had been the practice in Italy, these parties normally used jeeps, equipped with radios capable of communicating with the pilots overhead. General Quesada, however, modified the practice, placing an airman and his radio inside a tank within an advancing armored column and assigning a specific number of fighter-bombers to escort the unit. Whenever the tanks encountered opposition, the controller identified the source of the resistance, pointed it out to the pilots, and the fighter-bombers pounced on it.

Generals Quesada and Weyland frequently assigned entire groups of fighters—forty-eight aircraft or more—to provide support for a specific division on a given day. Dedicating fighter-bombers to cooperate with a particular ground unit reflected the Allied preponderance in the sky, a degree of dominance undreamed of at the time of Kasserine Pass. The practice did not conflict with the doctrine that had evolved from the experience in North Africa, for the fighter-bombers remained under the control of an airman, not the division commander. The fighter control center might divert any or all of the aircraft to meet some emergency, and a tactical control party provided by the Army Air Forces directed the actual strikes. Instances of friction between airmen and ground commanders proved rare, partly because the overwhelming aerial resources at the disposal of the Americans ensured that help would come, weather permitting, but also because the aviators at every operational level, from Quesada or Weyland to the officer with a radio in a jeep or tank, cooperated fully with their counterparts in the ground forces.

By the time the battlefield stabilized along the eastern border of France, the Ninth Air Force had brought over from England its combat squadrons, command structure, and logistic base. Aviation engineer units landed in Normandy at midmorning of D-Day to begin work on the first in a network of 241 airfields—some rebuilt, others carved out of farmland—that ultimately extended from the invasion beaches into Holland, Luxembourg, and Ger-



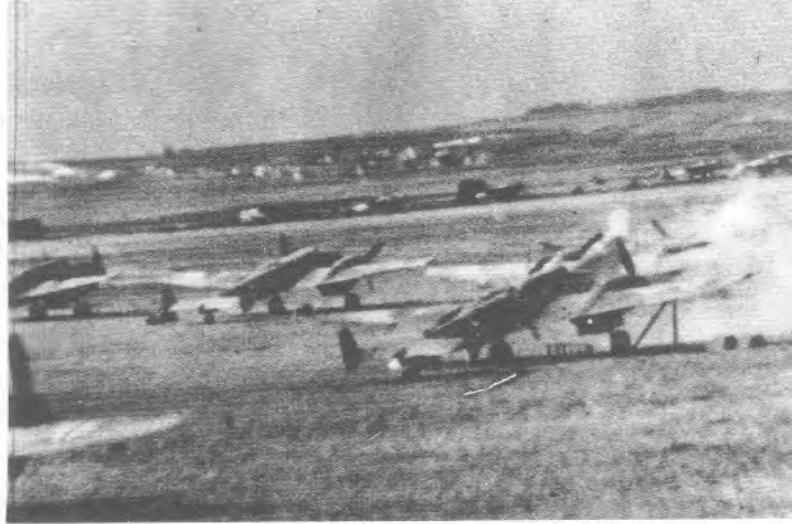
Preparing the Battlefield

With the dawn of 1944, Allied air forces hit stride in the POINTBLANK offensive against German industrial targets. Reinforced now with the arrival of the Ninth Air Force in England in October 1943, General Carl Spaatz looked to a new task, the physical isolation of the Normandy region that was the initial objective of the planned operation OVERLORD. Even as Eighth and Ninth Air Forces gathered fighter and medium bombers and joined the RAF's 2d Tactical Air Force for this purpose, the *Luftwaffe's* efficiency deteriorated dramatically; in the first half of 1944, it continued to lose irreplaceable pilots at an alarming rate.

From late 1943 through February 1944, the Ninth concentrated on German coastal airfields in north-western France. The *Luftwaffe* withdrew fighter strength east to preserve it for use against strategic attacks against German industry. In May, the American air forces turned to transportation targets, especially rail lines, locomotives, and marshalling yards. Late in the month, Operation CHATTANOOGA CHOO CHOO committed 800 Allied fighters against the remaining rail nets in France.

As the invasion approached, these fighters and mediums also had dropped all but one of twenty-two bridges across the Seine River on main roads between Paris and the Channel coast. German supply and reinforcement now moved only at night over circuitous routes.

A P-47 pilot in a daredevil run (*above*) at a German flak tower on a French airfield is caught by his wingman's gun camera as the Ninth goes after the *Luftwaffe*. Clockwise from above, opposite, parked Bf 110s feel the weight of an Allied ground attack during a low-level raid on German air strength. A-20 Havocs cross the Channel coast on their return from a bridge-busting mission in late April 1944. B-26 Marauders are outbound on a similar mission. The Seine bridge at Port du Gravier carried traffic to Normandy until Allied fighter-bombers felled one span. A P-47 attacks a German ammunition truck with spectacular results; pilots risked damage to their own aircraft in these low-level assaults. Hawker Typhoons of the RAF 2d Tactical Air Force were one of the mainstays of the interdiction campaign.



many. The IX Service Command also moved to the Continent, but it could not simultaneously provide maintenance for combat units, distribute supplies, and operate a supply line extending from the French seaports. As a result, early in 1945, Maj. Gen. Hugh J. Knerr, deputy for logistics to General Spaatz, took charge of a newly designated Air Technical Service Command in Europe, which delivered supplies, weapons, and munitions. General Knerr also consolidated under his direction the repair, modification, and maintenance of all Eighth and Ninth Air Force airplanes. Logistic problems arose—the supply system, for instance, could hardly stay abreast of consumption when transporting fuel by air, road, or pipeline across the French countryside. Nonetheless, the Ninth Air Force managed to keep a greater percentage of its planes in action from airfields on the continent than it had from bases in England. Contributing to this increase was the decline of Germany's fighter force and a consequent reduction in battle damage.

Meanwhile, the Fifteenth Air Force, after launching the oil offensive, concentrated on support for the invasion of southern France. In preparation for this operation, which began on August 15, 1944, heavy bombers attacked military installations in a region stretching from Genoa, Italy, to Marseilles, France, isolating the assault beaches and inland drop zones located midway between the two ports. As in Normandy, paratroops led the way, followed by amphibious forces. The principal source of air support for the advance northward from the beachhead was Brig. Gen. Gordon P. Saville's XII Air Support Command, operating initially from airfields in Corsica taken from the Germans shortly after Italy's surrender. Early in September, troops that had landed in southern France joined with the armies advancing from Normandy, forming a single front from the English Channel to the Swiss border.

Following the breakout from Normandy in late July, Marshall and Arnold advised Eisenhower to use his airborne divisions, which formed a theater reserve, in conjunction with the advancing ground armies. Brereton became a key figure in any such action, for after leaving the Ninth Air Force, he assumed command on August 8 of the First Allied Airborne Army. His new headquarters drafted plans for eighteen operations of varied complexity, all canceled as unnecessary when the Allies surged forward on the ground. When the Allied offensive lost momentum, General Montgomery obtained control of Brereton's force on September 10 and began drawing up plans for the airborne troops to vault the Rhine at Arnhem in the Netherlands and outflank the main defenses of Germany's industrial heartland, the Ruhr Valley. On September 17, 1,500 transports and 500 gliders, protected by more than 1,300 fighters, crossed the North Sea to land some 20,000

Airlift



Less celebrated than the fighters and bombers in Allied service during the war, but no less critical to the effort, were the transports pressed into military service. The two principal workhorses of the Army Air Forces were derivatives of commercial airliners. Most famous was the C-47 Skytrain, the slightly modified military adaptation of the Douglas DC-3, which had revolutionized air travel in the United States by 1940. It served in every fighting theater; 2,000 were built under license by the Soviet Union. The U.S. Army bought 10,368; these saw extended service in troop carrier commands. Powered by two Pratt & Whitney R-1830-92 radials, the C-47 had a top speed of 210 miles an hour and a normal freight capacity of five tons or 27 combat-loaded paratroops. Above, two C-47s serve as glider tugs in one of the aircraft's most publicized roles during the American airborne assault in Normandy on D-day, June 6, 1944.

A Curtiss C-46 Commando (*right*) loads troops during a stateside maneuver. Designed as a commercial freighter, it hauled seven and a half tons of cargo and had nearly double the troop-passenger capacity of the C-47. With a similar engine layout, the Commando cruised at 169 miles an hour and could hit 269. Engineering problems delayed its full deployment until 1944. The Air Forces accepted 3,144 of the transports.

Below, a C-47 appears on a Chinese airfield. The rugged Douglas product made a reputation for reliability in every climate.



troops by parachute and glider. Recovering from their initial surprise, the Germans encircled the British force at Arnhem, rushing anti-aircraft batteries into place to cut the air route that provided supplies and reinforcements. At the same time, the enemy stopped an armored column trying to advance along the highway leading to Arnhem and the Rhine. During the fighting, some 250 Eighth Air Force B-24s parachuted cargo to American airborne troops holding the critical bridges over which the British tanks had to pass, delivering the supplies accurately despite heavy anti-aircraft fire and ill-defined drop zones. In spite of the persistence in delivering supplies by air, the daring operation, called MARKET GARDEN, ended in failure, as the British abandoned the isolated bridgehead at Arnhem.

While Allied forces liberated France, but suffered a setback in Holland, Anglo-American bombers hammered away at German petroleum production. Although still skeptical of the value of industrial targets recommended by specialists in economic warfare, Harris eventually enlisted Bomber Command in the oil offensive. Taking advantage of radar and radio beams as aids to accurate bombing, his men dropped roughly 40 percent of the total bomb tonnage directed at oil production between April 1944 and the end of the war. The British, however, did almost all their bombing of this industry after November 1944, for Harris often derided the notion of panacea targets and only reluctantly attacked something that might fall in that category. "I still do not think it was reasonable at the time to expect that the campaign would succeed," Harris has written; "what the Allied strategists did was bet on an outsider, and it happened to win." The long-shot victory that he spoke of came in a race that pitted German engineers dedicated to maintaining oil production against Allied airmen determined to choke it off as completely as possible. Synthetic fuel plants proved hard to destroy and difficult to locate on radar. Frequent layers of cloud kept the Allies from hitting them often enough to stop production entirely; indeed, the British sometimes had clearer skies at night than the Americans encountered in daylight. Air power did succeed, however, in reducing production to a mere trickle. Soviet ground forces also contributed to the victory, overrunning the battered refineries at Ploesti in August 1944 and thus freeing the Fifteenth Air Force to bomb synthetic oil plants in southern Germany, Poland, and Czechoslovakia. German efforts to conserve fuel for essential operations became so desperate that in the autumn of the year Speer discovered fighters grounded in good flying weather, student pilots logging only one hour a week in the air, and horses pulling trucks over the roads of northern Italy.

Maneuver War in Northwest France



Quitting the Normandy invasion lodgment, the American 12th Army Group thrust south, then east to flank and envelop the defending German Seventh Army. With U.S. Third Army in the lead, Allied forces dashed across northwest France, halting only when they outran their supply lines. By September, the Allies drew up before the German border. In all these drives the U.S. Ninth Air Force flew direct support missions for rampaging American armor.

American P-47s of the IX and XIX Tactical Air Commands flew from hastily prepared airstrips (*above*), often with wire matting or pierced steel planking stabilizing the surface. During the Normandy breakout, IX Tactical Air Command, under Maj. Gen. Elwood Quesada (*left portrait*), hammered German forces in the pocket created near Falaise with such ferocity that the enemy fled without most of his heavy equipment. XIX TAC, commanded by Maj. Gen. Otto P. Weyland, proved itself to Lt. Gen. George S. Patton, Jr. Weyland cultivated the choleric Patton while putting an umbrella of Thunderbolts over the Third's armor columns. Patton, still mindful of less sanguine experiences with air cover in the Mediterranean, was soon converted to the larger possibilities of air power.

The enemy could not risk putting his own columns on roads in daylight. In the war of maneuver, Allied ground attack aircraft, far outnumbering the *Luftwaffe*, singled out individual enemy vehicles. A German Mark V Panther tank (*right*) lost its treads in a Luxemburg field during a Ninth Air Force bomb and rocket strike. Below, Marauders seek out key bridges and retreating German columns in the fluid war between July and September 1944.



As the German war effort began to feel the impact of the oil offensive, the *Luftwaffe* introduced a pair of revolutionary fighters, one of which, had it appeared sooner, might conceivably have prolonged the war, though it could not have changed the eventual outcome. The more formidable of the two was the world's first operational turbojet interceptor, the Messerschmitt Me 262. Heavily armed and faster than conventional aircraft, this fighter flew its first sorties in April 1944 and saw increasing service during the summer and early autumn. At the time, the Royal Air Force had only a mere handful of its new Gloster Meteor jets, and an American jet fighter suitable for combat did not appear until 1945. The German aircraft industry succeeded in producing some 1,500 Me 262s and might have turned out even more of them sooner, had the program not encountered a series of delays resulting from indecision about the role of the airplane—whether fighter or fast bomber—and difficulty in developing reliable engines. Continuing engine problems and a lack of trained pilots—the latter a result of attrition over the years and a shortage of fuel to train replacements—reduced the effectiveness of the few hundred Me 262s that did enter combat.

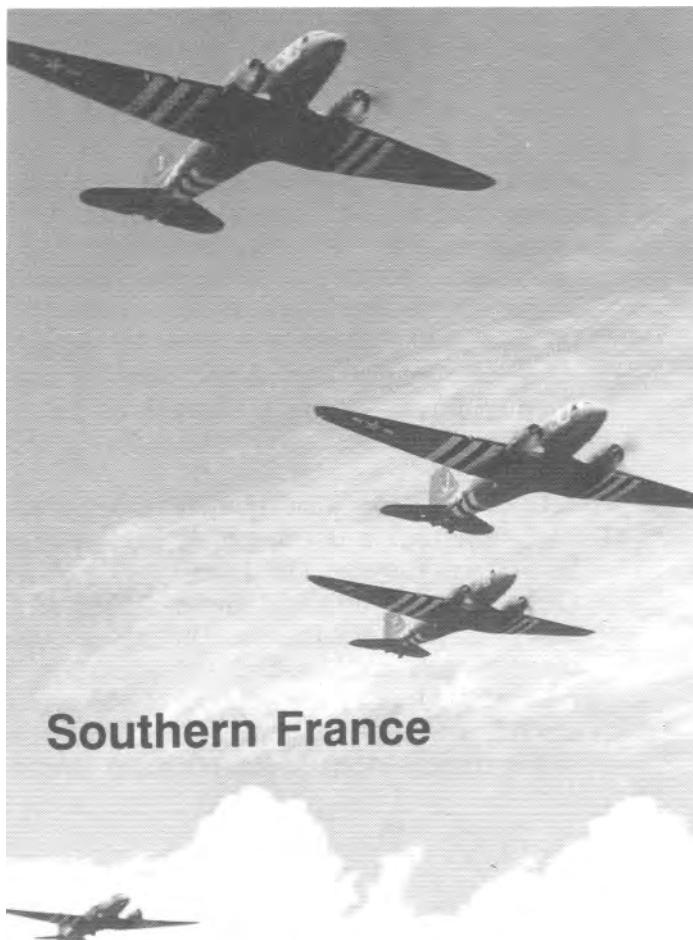
The other fighter was the rocket-powered Messerschmitt Me 163, an interceptor capable of speeds approaching 600 miles per hour. After streaking to an altitude of 30,000 feet, the Me 163 quickly exhausted its chemical fuel in a few high-speed passes at a bomber formation, then glided to earth, landing on a metal skid beneath the fuselage. In an overly hard landing, the plane tended to flip over, detonating any of the highly volatile fuel that remained in the tanks. The rocket-powered fighter made its combat debut late in July 1944, but slow production, with fewer than 300 actually accepted for service, and the need for exceptionally skilled pilots imposed an impossible demand on a *Luftwaffe* that was desperate for time and had few such veterans after five years of war.

Although Germany's ground forces had suffered the same kind of attrition as the *Luftwaffe*, the Third Reich fought stubbornly on two fronts as the Allies advanced from east and west. The only hope, Hitler believed, lay in prolonging resistance until differences between the Soviet Union and the western democracies sundered their alliance. To gain time he proposed a counteroffensive launched from the concealment of the Ardennes, a region of woods and river gorges that extended from the German border into Belgium and Luxembourg, in the hope of recapturing the port of Antwerp. On December 16, 1944, the enemy lunged forward, carving out an extensive salient and triggering what came to be called the Battle of the Bulge.



Five weeks after the Allies stormed ashore in Normandy, another Allied force comprising the U.S. Seventh Army and the First French Army seized beaches on the French Riviera. Operation ANVIL, later rechristened DRAGOON, had as its initial objectives the major French port of Marseilles and the naval base at Toulon, then the Rhone valley, the link with Allied forces in northern France. Twelfth Air Force supported the entire invasion, mounted from the Gulf of Naples in Italy.

In the days before the assault, American fighter-bombers ran interdiction sweeps behind the beaches, flying 5,400 sorties and ranging inland to restrict German reinforcement of beach defenses. They also prepared ground for a landing by an Allied airborne force. Fog on the morning of August 15, 1944, left C-47 troop carrier pilots (*right*) unable to see ground markers, but the scattered airborne troops met little serious resistance. German forces withdrew hastily up the Rhone, as Allied air power struck at their retreating columns (*above*).



German reliance on telephone and telegraph reduced the volume of radio traffic, but ULTRA nevertheless acquired a number of intercepts, which unfortunately proved ambiguous. The information could have indicated the possibility of a major counterattack or merely the creation of a strategic reserve to meet future American thrusts. Given the Allied optimism of the moment, the latter seemed far more probable. Bad weather hampered aerial reconnaissance in the weeks preceding the attack, but photographic evidence and visual sightings of enemy movement by road and rail multiplied. This intelligence, open to interpretation as was that obtained through ULTRA, could have indicated reinforcement rather than preparations for an offensive. In any event, the wooded Ardennes seemed an unlikely springboard for a winter counterattack by an army believed to be approaching exhaustion.

As the enemy counterattacked, his pilots displayed unexpected aggressiveness, at times forcing American fighter-bombers to jettison their explosives and engage in aerial combat, but the greatest problem for Allied airmen was not so much the *Luftwaffe* as the winter weather. Even so, neither surprise nor the persisting cloud cover enabled the German thrust to gain its initial objective, the Meuse River, for American troops clung to key positions, including the Belgian village of Bastogne. On December 23, the skies cleared and the full weight of Allied air power, including Eighth Air Force fighter and bomber units temporarily under the operational control of General Vandenberg's Ninth Air Force, pounded the German salient and the supply lines sustaining it. Allied aircraft attacked the roads and rail lines carrying German troops and supplies, bombed German fighter airfields, and parachuted supplies into Bastogne. For five days, the Allies took advantage of good weather to dominate the skies over the battlefield, but wind and blowing snow limited air activity during the last three days of December. By the end of the year, however, air power had disrupted the flow of men and materiel to the German forces, although a month of fighting remained before the Americans and British could restore the front lines of mid-December.

Once the bad weather that ended the year had abated, the *Luftwaffe* took a last desperate gamble to seize the aerial initiative in western Europe. On January 1, 1945, a force of almost 900 German planes attacked eleven Allied airfields in Belgium, Holland, and northern France. The enemy avoided the use of radio in planning and coordinating the operation, a measure designed to prevent a surge in the volume of message traffic that might alert the Allies to the likelihood of imminent attack, and the absence of radio transmissions unintentionally neutralized ULTRA. Having

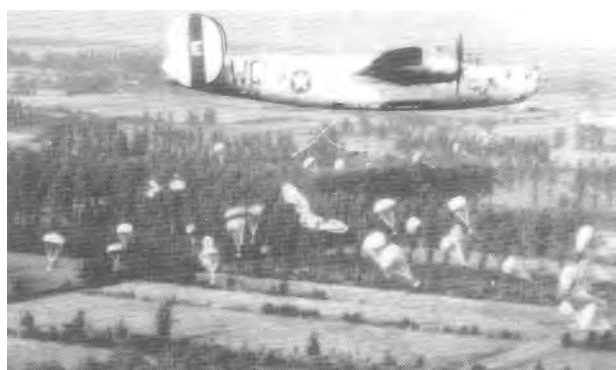


MARKET-GARDEN

Operation MARKET-GARDEN was Field Marshal Bernard Montgomery's ill-fated attempt to break rapidly through Holland and into the Ruhr. Planned as a converging operation in which armored columns would advance to link with Allied airborne units dropped around the cities of Eindhoven, Nijmegen, and Arnhem in September 1944, it failed of its larger purpose. MARKET, the American airborne operation against the first two cities, succeeded brilliantly; the other side of the operation, GARDEN, sacrificed the entire British 1st Airborne Division at Arnhem without result.

Elements of the Troop Carrier Command flew the American 82d and 101st Airborne Divisions to their objectives. Troops spill from their C-47 Skytrains near the town of Grave on September 23 (above) while livestock resume grazing among the gliders that have just landed in their midst. Curtiss C-46s (right) continue the reinforcement of American airheads in their assigned areas.

The battle in all the drop zones found forces in desperate need of resupply. American heavy bombers flew missions to drop food, ammunition, medical aid, and other necessities to the surrounded airborne infantry. B-24s (right) parachute sustenance to forces below. C-46 Commandos (right below) of Maj. Gen. Paul Williams's Troop Carriers circle above their release points, parapakcs on their bellies.



thus frustrated Allied intelligence and achieved tactical surprise, the Germans destroyed about 150 Allied aircraft, though at an excessive cost to themselves. Perhaps a third of the attacking planes failed to return, some shot down by German antiaircraft gunners, who, kept ignorant of the operation for security reasons, assumed that any large formation had to be American or British. The Allied losses had little effect on the course of the war, for seemingly endless streams of replacements were leaving American aircraft factories; but Germany, despite its miracles of airplane production, could not replace the fuel burned or, given the lack of gasoline for training, the pilots shot down.

The Ardennes counteroffensive and the aerial attacks of January 1, 1945, gained Germany a little time, but the hoped-for split among the Allies failed to develop. Hitler's armed forces had wasted their carefully husbanded stores of petroleum and were now burning fuel almost as fast as the battered oil industry could produce it. The flurry of action in December and January did, however, create an illusion that Germany remained capable of savage counterthrusts, and this belief affected Allied planning. British and American bombers therefore pursued the oil campaign, preventing a resurgence of that industry, and resumed an attack on railroad transportation throughout a rapidly shrinking Reich.

The final transportation campaign, begun in the fall of 1944, represented an attempt to duplicate within Germany the success that air power had enjoyed against French railroads during the preparations for the Normandy landings. Although the systematic bombing of the bridges across the Seine had played a dominant part in disrupting rail transportation in France, marshalling yards and rail centers in Germany at first received the greatest attention, largely at the insistence of Zuckerman and Tedder. The bridges across the Rhine escaped attack because of their sturdy construction, their powerful antiaircraft defenses, and, most of all, because the Allies hoped to use them soon for the assault on Germany. The Battle of the Bulge intervened, but the transportation campaign resumed early in 1945. By that time, however, the Allies had aircraft enough of every type to attack almost any target within Germany, whether a synthetic oil plant, a railyard, a bridge, or even a string of boxcars at a siding. Zuckerman, still advocating bombing rail centers, hoped to continue the kind of attacks on transportation begun before the Ardennes fighting and expected a clash with Spaatz, the champion of the oil offensive. No confrontation occurred, however, for Spaatz now had so many men and aircraft that he could do whatever was asked of him without worrying about priorities. Actually, the transportation campaign gave his bombers a target to attack by radar when bad

weather concealed the synthetic oil plants. The sprawling railyards tended to be located in areas identifiable on radar, whereas the compact oil facilities all too often disappeared amid the radar return from urban areas. The oil offensive depended on decent weather and visual aiming with the Norden sight, but Spaatz's strategic forces could bomb the switching yards through an overcast. Moreover, the broad expanse of rails presented a suitable target for formation bombing, and any bombs that missed the mark had some effect, since they landed among warehouses, factories, and homes. The campaign against German transportation, far from interfering with the oil offensive, increased the number of days when the B-17s and B-24s could attack worthwhile targets. As the spring of 1945 approached, airmen like Spaatz and Tedder no longer faced hard choices; they had the aerial resources to carry out a transportation campaign without easing pressure on the oil industry.

The attacks on transportation facilities rapidly intensified. While Harris employed Bomber Command, by day as well as night, to cut the canals and railroads that linked the coal mines and factories of the Ruhr to the rest of Germany, American strategic and tactical aircraft hit railroad centers throughout the nation. As more and more transportation targets collapsed in rubble and twisted steel, the number of genuine rail hubs not yet attacked rapidly declined. Minor railroad junctions became targets, and civilian morale at last came under attack, especially by the Allied fighter-bombers, which demonstrated to many Germans who had thus far escaped the worst consequences of Hitler's madness that the *Luftwaffe* could no longer protect them. On February 22 and 23, American airmen conducted two operations, grouped under the code-name CLARION, that in effect extended the war to the undamaged towns along Germany's rail system by attacking hundreds of viaducts, marshaling yards, repair shops, railroad stations, and roundhouses. The transportation campaign, including the two CLARION operations, delivered new destruction almost daily and fatally disrupted the German rail system, forcing the trains to move cargo circuitously and slowly, bypassing damaged switching yards and trackage until repairs were made.

During the final phase of the war, the German air force was so crippled by lack of fuel and the death or capture of trained pilots that American and British airmen rarely encountered formidable resistance except in the vicinity of Berlin. Elsewhere the Anglo-American allies could apply crushing force against whatever targets they chose. Several factors influenced the use of air power during the early months of 1945, including the overwhelming might of the Allied strategic air forces; the more cautious

assessment of German strength caused by the Ardennes attack, the appearance of the jet fighter, and the persistent threat from the vengeance weapons; and the destruction of major industrial centers, which catapulted lesser targets into prominence. These considerations helped seal the fate of Dresden, set ablaze by a British night attack on February 13, then pounded by American bombers in daylight on the 14th and 15th and again on March 2.

“Dresden,” a Royal Air Force briefing officer intoned before the February 13 mission, is “the seventh largest city in Germany” and also “by far the largest unbombed area the enemy has got.” Although famed for its china, the city had developed into what the briefer described as “an industrial city of first-class importance.” Dresden, he continued, also had a special strategic value, for “like any large city with its multiplicity of telephone and rail facilities,” it would prove “of major value for controlling the defence of that part of the front now threatened by Marshal Konev’s breakthrough.” The advance of Soviet forces under Marshal Ivan S. Konev focused special attention on Dresden, an industrial city containing several factories that produced armaments or military equipment and a large railroad marshalling yard through which men and supplies must pass to oppose the Red Army. Dresden had for some time occupied a place on Bomber Command’s list of possible targets, but other industrial cities, many now in ashes, lay nearer at hand. Harris had not loosed his bombers against the city because the long flight might well have resulted in severe losses when the German night defenses were at their deadliest. Now those defenses had crumbled, except around Berlin. The bombing of Dresden had become feasible and militarily useful.

Dresden could be bombed and seemed worth bombing. Whether the attack would actually take place depended on the interaction of other circumstances, principally Anglo-American hopes of striking a final aerial blow to knock Germany out of the war and a meeting of the Allied leaders—Roosevelt, Churchill, and Stalin—scheduled for Yalta in the Crimea during February. To end the war, American and British planners suggested a massive attack on Berlin, Operation THUNDERCLAP, but Harris broadened the proposal to include Chemnitz, Leipzig, and Dresden, three rail centers largely untouched by bombing. Spaatz agreed but with reservations. The American officer persuaded the Royal Air Force Chief of Air Staff, Sir Charles Portal, who represented the Combined Chiefs of Staff in directing the bomber offensive, that attacks on the cities added by Harris to Operation THUNDERCLAP should wait until the Red Army had advanced far enough to benefit from the resulting disruption of German lines of communication and supply.

Looking ahead to the impending conference at Yalta, Churchill would tolerate no delay. When he prodded his advisers about plans for “blasting the Germans in their retreat from Breslau [now Wroclaw, Poland],” roughly 140 miles east of Dresden, Portal mentioned the bombing, as weather permitted, of Berlin, Dresden, Chemnitz, Leipzig, and possibly other cities. The purpose of the attacks had changed, however, from driving the last nails into the coffin of the Reich, the object of THUNDERCLAP, to disrupting German transportation in support of the Soviet advance.

Pressured by Churchill somehow to impede the German retreat, the British military delegation arrived at Yalta ready to bomb Berlin and the various rail hubs of eastern Germany. During the meetings, General Alexsey Antonov, the acting chief of staff of the Soviet armed forces, suggested that it would be of great help if the American and British bombers could “paralyze the junctions of Berlin and Leipzig.” Since Dresden also lay on a rail line over which German reinforcements traveled eastward, it, too, became a target, even though it was not specifically nominated by Soviet authorities.

A decade later, when the communist press of East Germany denounced the attack on Dresden as an Anglo-American atrocity, Antonov’s remarks formed the basis for a response. Ignoring the earlier Allied interest in Dresden—Harris considered it a worthwhile target, and the Americans had bombed it twice, once as a target of opportunity and again to damage the railroad yards—American officials tried to turn the tables and declared flatly that the attack, about which a Soviet satellite complained so bitterly, had resulted from a Soviet request. Antonov’s statement at Yalta, and the fact that no objection was forthcoming when an American liaison officer told his Red Army counterpart of the planned raid on Dresden, served as evidence that Soviet authorities had asked for the bombing. Antonov, however, had not singled out Dresden, and the Soviet liaison officer, who worried mainly about the accidental bombing of Konev’s troops, would not have been troubled by a strike on a city that lay some seventy miles from the nearest Red Army column.

The unfortunate city, with its factories and railroad complex, became the target of a typical Royal Air Force nighttime urban area raid on February 13, followed on successive days by two American daylight attacks on the rail stations and the marshalling yard. A fuel-starved *Luftwaffe* proved incapable of defending Dresden, the Allied advance on the ground had overrun the early warning radar sites, and the heavy antiaircraft batteries had been moved to guard more important industries elsewhere. Testimony to the weakness of the defenses was the fact that the 1,200 British



As Hitler's Reich faced certain defeat in February 1945, Royal Air Force and Eighth Force bombers attacked the city of Dresden in one of the most devastating blows of the war to a German city. The attack on the Saxon capital became a controversial symbol of the effects of modern aerial bombardment. The city was an unscathed target with an armament industry and a major rail center. Refugees fleeing the advancing Red Army also crowded the city. The RAF Bomber Command, in standard operating procedures, planned to induce a firestorm by dumping into the city center a mix of high-explosive and incendiary bombs that would first flatten buildings or expose flammable materials, then set fierce blazes among the ruins. On February 13, British bombers started a massive conflagration, producing a violent thermal updraft fed by gale force winds sucked in from the city's periphery. People suffocated as the flames drew oxygen from their underground shelters and replaced it with carbon monoxide. The following day, Eighth Air Force B-17s going for the rail yards poured an identical high-explosive and incendiary combination into the same area. Civilian deaths, never accurately assessed, numbered at least 35,000. In the aerial photo above, the devastated urban center after the raid shows little sign of life. A string of bombs, blunt-nosed incendiary clusters alternating with conoidal high-explosive missiles, falls through broken cloud cover during the American raid on February 14. On the 15th, an American force diverted from an oil target struck again with high explosive. American bombers returned to Dresden late in the war. B-17s disgorge their loads on April 17, 1945 (below); incendiaries leave the bays last as the bombardiers drop on the smoke marker sailing groundward at the bottom of the picture.

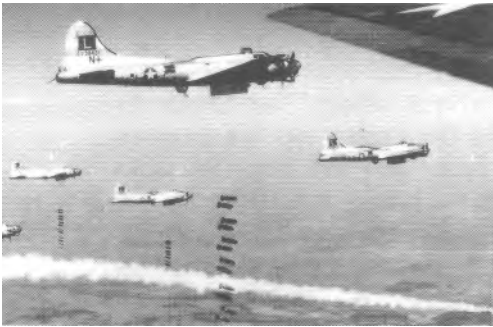
and American bombers that attacked during the three days lost less than 1 percent of their number. Dresden's fire service proved as feeble as the fighter and anti-aircraft defenses and could not deal with the fire storm generated by the nighttime bombing, which consumed the heart of the city and killed most of the estimated 35,000 persons who perished during the three raids. Cloud cover hampered daylight bombing accuracy by forcing the Eighth Air Force crews to rely on radar or fleeting glimpses of reference points on the ground and thus contributed to the loss of life. A vital railway bridge escaped destruction, however; and since the bridge remained intact, and rails and roadbed were easily repaired, train traffic resumed three days after the third raid. Dresden's war industry, never a specific objective of the attacks, recovered, according to Speer, "with comparative rapidity."

Speer's attitude toward city busting changed during the war. He feared in 1943 that a half dozen attacks on the scale of the raid that set Hamburg ablaze would cause Germany to collapse, but he soon realized that he had underestimated the resilience of the populace. He acknowledged, however, that a series of attacks, like the three successive bombings in February that consumed so much of Dresden, caused "a considerable shock effect," although by this time a mood of fatalism deadened the impact on the German people. Looking back on the war, Speer advised the victorious Allies that "a bomb load is more effective if it is dropped on economic targets than if it is expended upon towns and cities."

As Dresden lay in ruins, Allied armies moved into position to crush Hitler's Reich. One final airborne assault, Operation VARSITY, took place on March 24, 1945, as Anglo-American parachutists and glider troops landed near Wesel, Germany, in conjunction with an amphibious crossing of the Rhine. The smoke that screened the landing craft from German gunners also blanketed some landmarks that defined the airborne landing zones, but poor visibility did not disrupt the operation. German anti-aircraft crews inflicted casualties, however, and the new Curtiss-Wright C-46 transport proved likely to burn if fuel or hydraulic lines were punctured. Except for the anti-aircraft fire, the transports and gliders encountered little opposition; Allied heavy bombers had battered all nearby airfields before the attack, and *Luftwaffe* fighters could offer no more than token resistance. As in the previous year's airborne landings in Holland, Eighth Air Force bombers dropped supplies to the VARSITY assault force.

The Allied forces that had landed in Normandy and southern France now launched their final drive, which carried them to Lübeck on the Baltic, the Elbe River, Pilsen in Czechoslovakia, Linz in Austria, and the Brenner Pass leading into Italy, where the

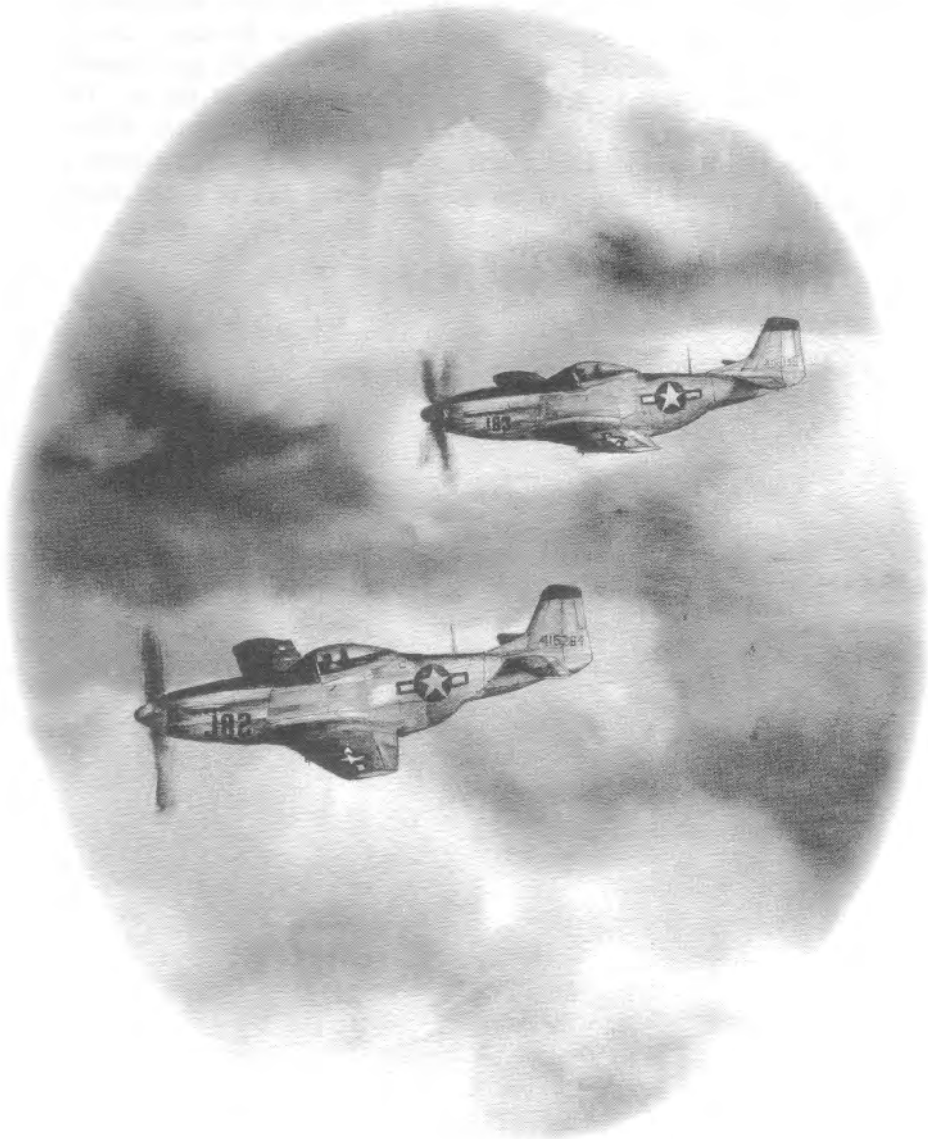
Germany Quits



By April 1945, the interiors of many larger German cities such as Cologne (*above*) were gutted, and the lack of pilots and fuel increasingly grounded the defending *Luftwaffe*. In March, Allied armies had already crossed the Rhine River in the west, and the Russians hammered the outer defenses of Berlin. At this late stage of the war in Europe, the enemy had lost his industrial heartland in the Ruhr Valley. Remnant German forces fought desperately to defend Hitler's battered capital, bombed continually in February during Operation THUNDERCLAP to induce a German surrender. Eighth and Fifteenth Air Force bombers flew through still dangerous skies to the end of the war. A mission unloads bombs (*left*) on the rail junction at Donauwörth on April 17, 1945, releasing on a smoke marker. Raids continued to lose aircraft to flak and the dwindling fighter resistance, but the German cause moved to an inevitable end.

The war's conclusion found large numbers of serviceable German fighters, including the new Me 262 jets, with empty tanks. Many captured aircraft and valuable German aeronautical engineering data fell into Allied hands; German research influenced western and Soviet aircraft and rocket development heavily in the postwar years. The remains of the once-fearsome *Luftwaffe* were assembled for destruction in such holding areas as Bad Aibling (*left*) in Bavaria. The German Air Force's commander, Reich Marshal Hermann Goering (*left, below*), surrendered on May 7 near Salzburg on the German-Austrian border even as German High Command representatives capitulated to the Allied command in the west. German and Allied delegates repeated the act in Berlin the following day with Red Army signatories. Condemned to the gallows as a war criminal in October 1946, Goering managed to take his own life on the eve of his scheduled execution.

German defenders surrendered on May 2. The *Luftwaffe* could do little more than harry the waves of aircraft that ranged ahead of the relentless advance on the ground, attacking lines of communication and virtually anything that moved on the German side. Wherever resistance stiffened, P-47 fighter-bombers and fast bombers like the B-26 helped pound the enemy into submission. At last, with Hitler's suicide on April 29 and Russian troops overrunning the streets of Berlin, an interim German government in the northern German town of Flensburg accepted defeat. On the morning of May 7, 1945, at Rheims, France, General Alfred Jodl, a staff officer in Hitler's former high command, signed a surrender agreement, ratified on the following day in a ceremony amid the ruins of Berlin.



6

Victory over Japan

The basic Anglo-American strategy against the Axis called for remaining generally on the defensive in the Pacific, defeating Italy and Germany first, and then bringing overwhelming might to bear against Japan, whose surprise attack had plunged the United States into the war. Once the purely defensive phase of the war against the Japanese ended, the Allies launched a series of limited offensives designed at first to improve the security of Australia and later to prevent the enemy from consolidating his defensive perimeter. Although limited in scope and commitment, these operations at the time seemed daring indeed. In January 1943, Admiral of the Fleet Sir Dudley Pound, First Sea Lord and a member of the British delegation at the Casablanca Conference, suggested allowing Japan to disperse its forces throughout the vast Pacific, since, in his opinion, no major objective like the Philippines could be retaken until the defeat of Germany permitted the transfer of Allied troops from Europe. Yet, even as the admiral proposed giving up the initiative in the Pacific, limited attacks in New Guinea and the Solomon Islands had already begun to reverse the course of the Pacific war. Under the cover of air power operating from aircraft carriers or captured islands, the Allies would advance on Japan at a pace which pessimists could only have found amazing. In August 1942, the American 1st Marine Division took a tentative step on what became the road to Tokyo by invading Guadalcanal and a few neighboring islands in the southern Solomons, an operation intended mainly to protect the sea and air routes between Hawaii and Australia. Except for the diversion to the Pacific of some B-17s, the Solomons venture at its outset imposed no great strain on the buildup in Europe and did not challenge the strategy of defeating Germany first.

The location of the Solomons did, however, cause controversy over command arrangements in the far Pacific. In March 1942,

the Joint Chiefs of Staff divided the Pacific war arena into major theater commands. The so-called Pacific Ocean Areas, comprising most of the water areas of the region, remained a Navy responsibility. The neighboring Southwest Pacific Area to the west, taking in the major islands of the western Pacific, was an Army theater. The boundary between these two commands ran directly north to south through the Solomon Islands. Since the ultimate objective of the campaign begun at Guadalcanal was Rabaul, on the island of New Britain and west of the boundary between the South Pacific and Southwest Pacific Areas, General Douglas MacArthur, in command of the Southwest Pacific, sought to direct the entire operation. Regardless of the relationship of Rabaul to the existing boundary, Admiral Ernest J. King, the Chief of Naval Operations, refused to entrust precious aircraft carriers to an Army officer, especially to one who intended to use them within range of Japanese land-based air power. Consequently, the Solomons became a Navy sector under Vice Adm. Robert L. Ghormley, the South Pacific commander. Ghormley, in turn, remained a subordinate of Admiral Chester W. Nimitz, the Commander in Chief, Pacific Fleet, with headquarters in Hawaii. Like Nimitz, Ghormley placed naval officers in key positions throughout his headquarters. For example, Rear Adm. John S. McCain exercised operational control over all aviation units, Army as well as Navy or Marine Corps, and prescribed their training and doctrine. Army airmen objected to placing their squadrons under this all-embracing authority, fearing in particular that naval officers would assign the B-17s missions incompatible with Army Air Forces doctrine and retrain the crews accordingly. To safeguard the status of Army aviation in an essentially naval headquarters, War Department planners agreed to appoint an airman, Maj. Gen. Millard F. Harmon, as commander of Army forces assigned to the South Pacific.

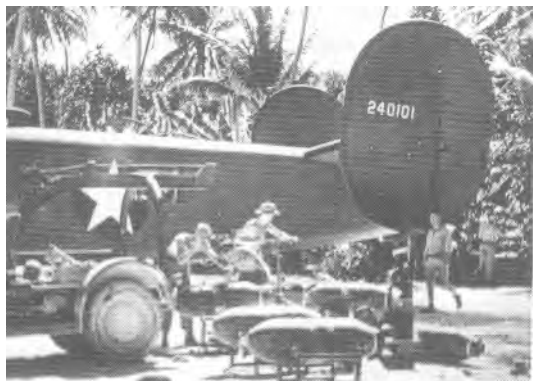
Although he exercised administrative rather than tactical control, General Harmon, backed by his superiors at Washington, guided training and doctrine along paths acceptable to Army airmen. He also exerted influence over the employment of B-17s, resisting—insofar as the military situation permitted—attempts by Admiral McCain and his successor, Rear Adm. Aubrey W. Fitch, to use the Flying Fortresses on search missions at the expense of attacks on bases like Rabaul. Ultimately, General Harmon succeeded in obtaining for the South Pacific a full-fledged air force, which assumed tactical control of Army aviation in the theater. Activated in January 1943 and entrusted to Maj. Gen. Nathan F. Twining, who had been Harmon's chief of staff, the new Thirteenth Air Force remained under the operational control of a naval officer throughout the campaign in the southern Solomons.

In July of that year, when the war moved into the central Solomons with the invasion of New Georgia, Twining became the Commander, Air, Solomons, replacing a naval officer. At year's end, when he departed for the Mediterranean theater, Twining handed over the organization to Maj. Gen. Ralph J. Mitchell of the Marine Corps.

The fighting for the Solomons began at Guadalcanal in the summer of 1942 and ended in the spring of 1944 with the repulse of the last Japanese counterattacks on Bougainville, almost 400 miles to the northwest. Launched by Admiral Ghormley, the campaign proceeded after October 1942 under the direction of Admiral William F. Halsey, Jr., whose task force had launched Jimmy Doolittle's B-25s against Japan in April 1942. A few Army B-17s had bombed the beaches in preparation for the landing at Guadalcanal, and aircraft like these contributed in varying degrees to the victory there and to subsequent successes, usually by bombing distant airfields or anchorages. Although high-altitude attacks on warships rarely proved effective, the Japanese credited a flight of B-17s with surprising the destroyer *Mutsuki* and sending it to the bottom when it stopped to take off troops from a sinking transport. More successful in the waters around the Solomons was a squadron of SB-24s, Liberator bombers fitted with radar for nighttime bombing from low altitude. The unit, commanded by Col. Stuart P. Wright, arrived at Guadalcanal in August 1943 and quickly demonstrated its effectiveness against surface ships that presented a sharp radar image against the background of the open sea.

During the early fighting ashore at Guadalcanal, the Army airmen based there operated on a shoestring, hard-pressed for maintenance and relying on the Bell P-400, an export model of the P-39, which excelled at strafing but climbed sluggishly and lacked the oxygen equipment necessary to do battle with the Japanese Zero. At the outset, Japanese bombers made daily raids, with warships at times adding to the weight of the bombardment, in an attempt to knock out Henderson Field, the airstrip on Guadalcanal taken over from the enemy and named in honor of Maj. Lofton Henderson, a Marine Corps aviator killed in the Battle of Midway. Although these blows occasionally staggered the Americans, Army airmen joined Marine and Navy flyers in seizing control of the skies over the Solomons and slaughtering the reinforcements the Japanese were ferrying by sea to Guadalcanal. The aircraft of the Army Air Forces flying from the island came to include P-39s and P-38s, and these, along with all the other fighters based there, came under the operational control of a Marine Corps airman.

The Pacific Offensive Begins



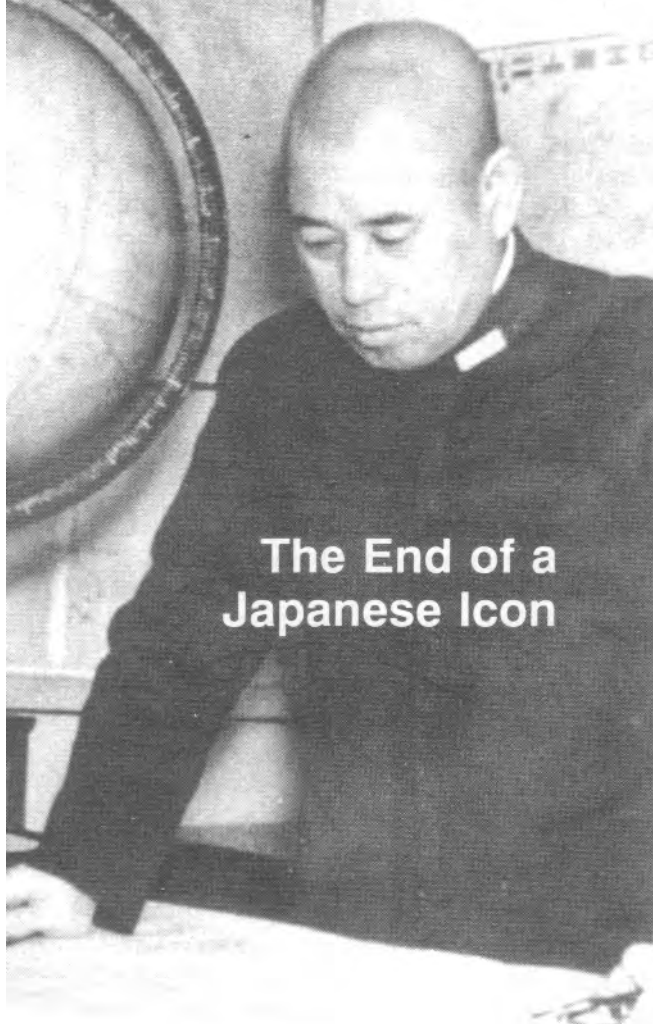
Europe first, the declared priority of the Allied war effort, left the Pacific a backwater and the Japanese ocean perimeter uncontested until August 1942. U.S. Marines landed on Guadalcanal in the Solomon Islands for the first of many bitter Pacific island campaigns. Denying the enemy reinforcements was critical; the transport *Kinugawa Maru* (above) lies beached after being holed by naval fire and bombs. The Navy F4F Wildcat fighter (left), obsolescent at the war's outbreak, was the main aerial defender of the Marine outpost.

Army Air Forces P-39 Airacobras perch on waterlogged runways at fog-bound Adak Airfield in the Aleutians as American forces gathered at this remote location and in Australia to oppose further Japanese expansion. The P-400, an export version of the P-39, reinforced Navy aircraft on Guadalcanal when the Army relieved the Marine garrison in January 1943. Below, a B-24 Liberator is armed with bombs at a barebones airstrip on the island of Funafuti. A radar-directed searchlight (inset) was part of the night anti-aircraft defenses on Guadalcanal's embattled Henderson Field.

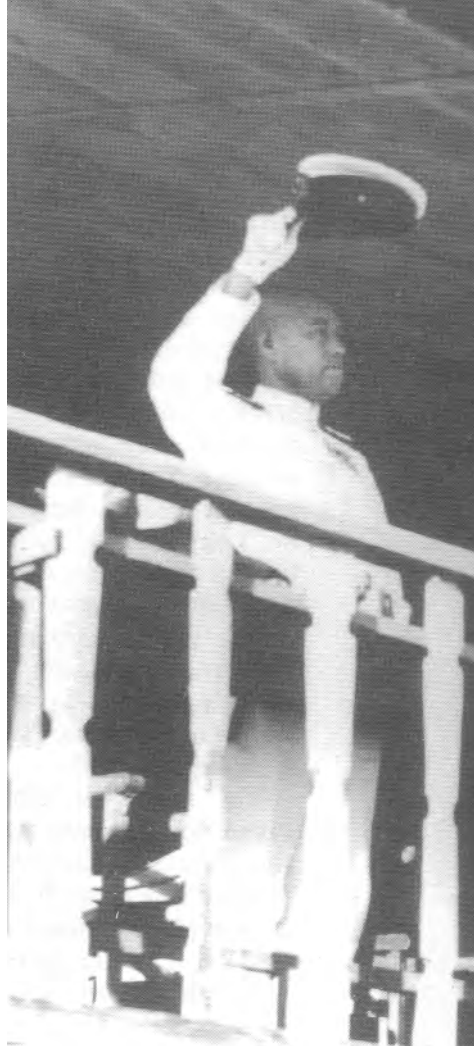
In April 1943, with Guadalcanal secured and preparations under way for attacking New Georgia, Japanese message traffic yielded another important secret to American cryptanalysts: Admiral Isoroku Yamamoto, the commander in chief of the Japanese Combined Fleet and the architect of both the raid on Pearl Harbor and the expedition against Midway, planned to visit the island of Bougainville. Although no other source of information, such as routine aerial reconnaissance, could readily conceal the breaking of the Japanese naval code, American planners decided that the admiral's real and symbolic value to the enemy outweighed the possibility of compromising an important source of intelligence. On April 18, 1943, the anniversary of Doolittle's raid on Tokyo, Maj. John W. Mitchell led sixteen P-38s (one other blew a tire trying to take off and still another turned back after experiencing engine trouble) to the farthest extent of their combat radius and succeeded in intercepting the two bombers carrying Yamamoto and his inspection party and the six Zero fighters escorting them. In a wild aerial battle that began low over the jungle and continued offshore, both bombers were shot down and Yamamoto killed.

The tangle of conflicting reports by the pilots involved has taken years to sort out and remains the object of debate despite the reports of various panels that have tried to re-create the day's events. When the P-38s returned from the mission, Capt. Thomas G. Lanphier claimed one bomber, as did 1st Lt. Besby F. Holmes, and 1st Lt. Rex Barber. Until Japanese testimony became available, the Americans assumed that a third bomber had been present, so Barber, Lanphier, and Holmes each claimed credit for destroying one. When Japanese sources revealed after the war that only two bombers carried the admiral and his staff and all the available records were examined, Barber shared credit for the destruction of both, collaborating with Lanphier in downing the bomber that carried Yamamoto and with Holmes in shooting down the other aircraft. This decision has not gone unchallenged, even though it reflected statements by both Japanese and American eyewitnesses and took into account the performance characteristics of the P-38.

The failure in March 1944 of a Japanese counterattack in the jungles of Bougainville, the island where Yamamoto died, ensured the security of the Allied lodgment there and decided the Solomons campaign. Meanwhile, General MacArthur's forces in the Southwest Pacific had approached Rabaul from its opposite flank, a drive during which air power protected a series of amphibious landings, helped disrupt Japanese traffic on the sea lanes, and contributed to the neutralization of the bastion on New



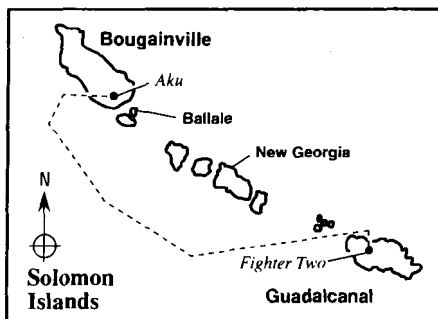
The End of a Japanese Icon



Among Japan's wartime naval leaders was an eccentric genius who had made a name for himself by championing the use of oil in the Japanese fleet, espousing the introduction of aircraft carriers, and promoting the design of the A6M Zero fighter. Isoroku Yamamoto learned English in the course of an assignment to Harvard University and during a separate stint as naval attaché in Washington in the 1920s. A world-class poker player and master strategist, Yamamoto directed the planning for the Japanese attack on Pearl Harbor, though he quietly voiced misgivings at the ignorance of his political leaders on the dangers of a collision with the United States.

In 1943, as head of the Japanese Combined Fleet, Yamamoto left Rabaul to inspect his air units striking American forces on Guadalcanal. American codebreakers plotted his itinerary and made possible an aerial interception on April 18, 1943, by eighteen P-38s flying a 1,000-mile mission. Armed with precise information, the

American pilots destroyed two G4M BETTY bombers over southern Bougainville, one of them Yamamoto's. Though the Allies had taken the risk of revealing that they were reading Japanese codes, the enemy never deduced this, and one of Japan's great wartime commanders was reported to a mourning public as killed in action.



In the left picture above, Yamamoto pores over maps during a Japanese fleet exercise in 1940. At right, he appears in white uniform to offer a traditional wave of his cap to pilots departing Rabaul for counterair attacks on American airfields on Guadalcanal in Operation I, which he conceived. This is supposedly the last known photograph of the admiral.

The map inset marks the route of the American interceptors, with the village of Aku marking the spot nearest the wreckage of Yamamoto's plane, rediscovered in 1972. Controversy continues over the destruction of the bomber and the death of its celebrated passenger.

Britain. The American aerial organization assigned to MacArthur's theater was the Fifth Air Force, organized in September 1942 under the command of General George C. Kenney, who also headed the Allied Air Forces, Southwest Pacific Area. Kenney established a close relationship with MacArthur, who sent the airman as a representative to various strategic planning sessions and also used him as an emissary to the leaders of the Republican party in an unsuccessful attempt to obtain the Presidential nomination in 1944. In gaining MacArthur's trust, Kenney sold the theater commander on a basic concept of aerial attrition, which began with operations "to take out the Jap air strength until we own the air over New Guinea," and then made the plan work. Once Kenney's flyers had destroyed enough enemy aircraft in aerial combat or by bombing airfields, MacArthur's land and amphibious forces could advance, always moving in the shadow of Allied fighters and bombers.

Despite the vast distances over which men and aircraft had to travel to reach the Fifth Air Force, the productive capacity of the United States and the increasing security of the sea route to Australia enabled Kenney to seize and maintain air superiority over the Japanese. American air forces in the Southwest and South Pacific surpassed 1,000 aircraft of all types by January 1943, more than 2,000 by December of that year, and reached 5,500 by the time the war ended. By then, the Far East Air Forces, consisting of the Fifth Air Force and the Thirteenth, had advanced into the Philippines and was preparing for the invasion of Japan. As early as the end of 1944, the inventory of aircraft flown by Kenney's Far East Air Forces outnumbered the total available to the Japanese throughout the entire Pacific; and once opened, the gap widened.

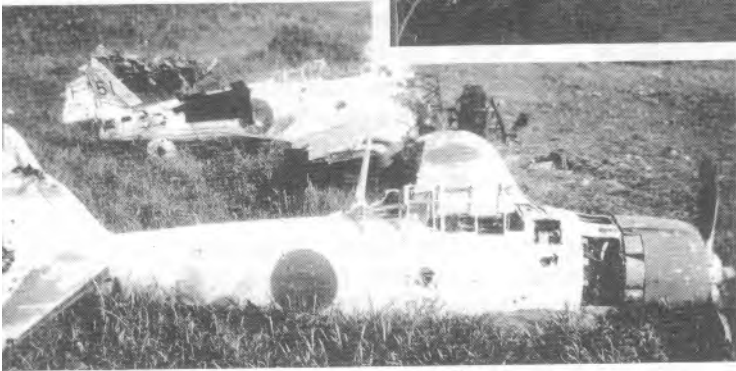
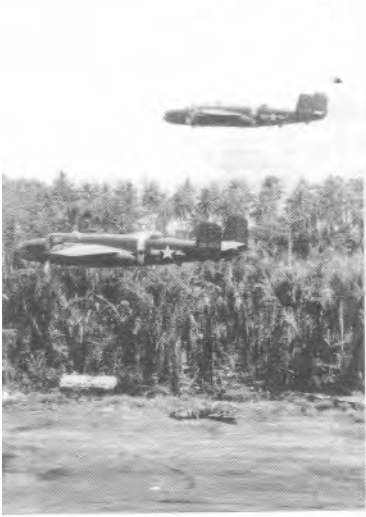
During the battle for New Guinea, Kenney's varied responsibilities and the tenuous communications between Australia and New Guinea persuaded him to entrust combat operations to a Fifth Air Force advance echelon located at Port Moresby and commanded by his deputy, Brig. Gen. Ennis C. Whitehead. The relationship between the Allied Air Forces, Southwest Pacific Area, and the Fifth Air Force remained informal, since Kenney and some of his staff officers held the same assignment in both. The willingness to delegate authority and the interchangeability of assignments between the senior officers at Allied and American air force headquarters persisted after June 1944, when Kenney assumed command of the Far East Air Forces.

In keeping with Kenney's views on the use of air power to seize control of the skies before advancing on the ground or by sea, General MacArthur's drive toward Rabaul began with a concen-



Aerial operations in the Southwest Pacific theater had a character markedly different from those in Europe. Strategic bombing came heavily into play only in the later stages of the war, when bases within reach of the enemy homeland were finally in Allied hands. Army air elements struck at isolated enemy garrisons, their seaborne lines of supply, and airfields that defended Japanese conquered areas. Above, artist Michael Hagel depicts a devastating assault by Fifth Air Force B-25s on the Japanese anchorage at Rabaul in his *Simpson Harbor*. In scenes showing the nature of air combat (*clockwise on page opposite*), a B-25 formation storms at tree-top height over a Japanese coastal airstrip at Wewak, the site of repeated American strikes at Japanese air strength. Parafrag bombs, whose slow descent allowed attacking planes to escape the effects of detonations, float down a line of Japanese planes parked in a tree line. A flaming Japanese troopship circles amidst low-level Allied air attacks during the battle of the Bismarck Sea in early March 1943, when Allied aircraft caught an enemy convoy headed for New Guinea; nearly 3,000 Japanese troops were lost. Smoke covers the former Dutch Pandansari refinery at Balikpapan, on the island of Borneo, as American Thirteenth Air Force B-24s struck it in September and October 1944. The hazards of low-level attack are starkly shown in a sequence in which an A-20, struck in its right engine, plunges out of control into a lagoon at Karas, Dutch New Guinea. Against a smoke backdrop, C-47s drop troops of the 503d Airborne Infantry at Nadzab, New Guinea, on September 5, 1943. Zero hulks litter a field at Lae, New Guinea, in the wake of American air attacks. Japanese resistance grew desperate as the Allied offensives eroded the empire assembled through 1942. A Japanese ground crew at a Philippine base (*below*) cheers a departing kamikaze pilot off on his one-way mission against U.S. Navy targets.





tration of forces under an aerial shield that extended only as far as eastern New Guinea. The struggle for that island had barely begun in 1942 when the C-47 emerged as the only form of transportation able to defy the mountains and jungle that hampered movement there. With the passing of time, these aircraft flew in reinforcements from Australia, evacuated the wounded, and carried men and supplies across the Owen Stanley Mountains as the war moved farther away from Port Moresby. In September 1943, Army Air Forces C-47s dropped Australian and American parachute troops at Nadzab during an Allied drive toward the island's northeast coast. Nine months later, as the New Guinea campaign drew to a successful close, transport aircraft dropped some 1,500 paratroops at Noemfoor Island off the northwest coast.

The effective use of unarmed C-47s depended, however, on control of the air, which Kenney's flyers extended over all of New Guinea by early 1943 and ultimately pushed all the way to the Philippines. The fighter was essential to this success. Starting with a few P-400s, P-39s, and P-40s, General Kenney's fighter command soon acquired P-38s, P-47s, and in 1944 a few P-61s. The last of these types, the Northrop Black Widow, was the most effective night fighter to reach the Air Forces squadrons in the Pacific for use against aerial harassment after dark. With the arrival of the newer day fighters, which eventually included the P-51, American pilots no longer complained that they always seemed to be attacking from below because their aircraft lacked the power to climb above Japanese formations.

Interception, though always dangerous, formed only a part of the fighter pilot's duties. Indeed, these operations might prove fatal even when what looked like enemy bombers on the radar actually proved to be a fast moving, late afternoon thunderstorm. The flyers, after returning from the false alarm, would have to land on rain-slickened metal planking, made all the more dangerous by gusty wind and gathering darkness. Many sorties, however, consisted of attacks on Japanese infantry strongpoints, invisible from the cockpit of a P-39 and marked only by a burst of tracers fired into the jungle by an Australian spotter plane. Days sometimes passed before the Americans learned the results of such a strafing attack. A note of congratulations might arrive from an Australian unit fighting its way along a ridge in New Guinea or, better yet, a messenger bringing with him a present from the ground commander—whiskey to help relieve the boredom and discomfort of a forward airfield or to overcome the fear caused by a close call over Rabaul or a surprise bombing attack on the base.

Important though it was, the fighter, or fighter-bomber, provi-

ded just one of the weapons that enabled General Kenney to defeat Japanese air power. Low-flying A-20s destroyed parked enemy aircraft by dropping 23-pound fragmentation bombs fitted at the general's suggestion with small parachutes that slowed descent and enabled the attackers to escape the hail of metal when the devices detonated. Delayed-action high-explosive bombs from B-25s and Kenney's few B-26s cratered runways, and low-altitude strafing by bombers and fighters added to the toll among Japanese aircraft. Maj. Paul I. Gunn, a former naval aviator commissioned from civilian life during the recent fighting in the Philippines, and Jack Fox, a technical representative of North American Aviation modified several B-25s, creating especially deadly strafers. Instead of the usual glassed-in bombardier's compartment, their attack version had a solid nose and eight forward-firing machineguns capable of unleashing a torrent of fire against parked airplanes, barges, or small ships. Gunn again applied his ingenuity in July 1943, when a new model of the B-25 fitted with a 75-mm gun, arrived in the Southwest Pacific. He strengthened the air frame and the metal skin to withstand the recoil of this weapon and increased firepower by adding four forward-firing machineguns.

Besides attacking enemy air power, General Kenney directed an interdiction campaign designed to neutralize Rabaul and disrupt the passage of supply convoys bound for New Guinea. In 1942, while en route to Australia, Kenney had become interested in skipbombing, the dropping from masthead height of a delayed-action bomb that would carom off the surface of the sea, penetrate the thin hull of a merchantman, and explode inside, fatally rupturing plates or igniting the cargo. The strafing model of the B-25 proved well suited to skipbombing, an aptitude demonstrated during tests in which even B-17s participated. The experiments revealed, however, that when dropped from a few hundred feet, a delayed-action bomb proved more accurate and did as much damage to a freighter as the same kind of bomb skipped from the surface of the sea. In January 1943, after the B-17s and B-24s that routinely attacked Rabaul reported that enemy shipping was gathering there, an entire squadron of B-25s, fitted out for strafing, began practicing low-altitude bombing.

As the Japanese transport and escort vessels were dropping anchor in Rabaul harbor, the men who had broken Japan's naval code again helped to shape the course of the Pacific war, for they pieced together the orders for an infantry division to embark at the beginning of March on a convoy bound for New Guinea. Intensified aerial patrols sighted the ships, and Allied planes—American B-17s, A-20s, and B-25s and Australian Bristol Beaufofts and Beaufighters—made coordinated attacks under fighter

cover provided by P-38s. Descending below 10,000 feet, Flying Fortresses set fire to one transport, which its crew had to abandon; but the B-25s proved even deadlier, attacking with delayed action bombs from the height of a victim's mast and claiming hits with 17 of 27 bombs dropped. In this action, the Battle of the Bismarck Sea, Allied air power sank 12 of the 16 ships in the convoy, killing approximately half the 6,000 troops on board. In all, fewer than 1,000 soldiers reached New Guinea, the other survivors returning to Rabaul, which remained in Japanese hands for the rest of the war. Although the U.S. Marines established themselves on the island of New Britain, the Allies bypassed Rabaul. Even without the conquest of this stronghold, American and Australian forces had broken Japan's outermost shield; ahead lay the Philippines and perhaps Formosa.

Although the Allies surged forward in the Southwest Pacific, they experienced only modest success in the China-Burma-India Theater. In Burma, especially, the war began badly. By mid-1942 the Japanese had overrun the British colony, inflicting on its defenders what the American commander there, Lt. Gen. Joseph W. Stilwell, described as "a hell of a beating." While the ground forces tried to regroup in China and India, Chennault's Flying Tigers, some of whom followed their commander into the Army Air Forces, and elements of the Tenth Air Force, operating from India, persisted in harassing the Japanese. The war on the Asian mainland now divided into two related campaigns: one to reconquer Burma and the other to defeat the enemy in China and carry the war to his home islands. The common link was the need to open a highway through Burma to carry supplies from India to sustain the land and air operations in China.

The reconquest of Burma would take time, for the operation had a low priority in the worldwide allocation of resources. For example, the buildup of the Tenth Air Force had been delayed to provide the aircraft needed to deal with Rommel's threat to the Suez Canal, and its recently appointed commander, General Brereton, went to North Africa in June 1943 to take charge of American air units there. In August, Brig. Gen. Clayton L. Bissell took over the Tenth Air Force, which at this time exercised control over Chennault's China Air Task Force, succeeding Brig. Gen. Earl L. Naiden, the interim replacement for Brereton. Because Japan had closed the Burma Road, over which military cargo reached China, the fighting there, whether on the ground or in the skies, depended on airlift. Bissell reorganized the command to include a ferrying group, which became the India-China Wing of the Air Transport Command, responsible for the airlift to China.

Because of differing national priorities and competition for scarce supplies, two tangled lines of responsibility emerged within China, Burma, and India. Vice Adm. Lord Louis Mountbatten functioned as supreme Allied commander for Southeast Asia, including Burma, while Generalissimo Chiang Kai-shek, the leader of Nationalist China, exercised similar authority in China. General Stilwell served as U.S. Army commander within the China-Burma-India Theater, a largely administrative assignment, as deputy to Lord Mountbatten, and as chief of staff to the Generalissimo. Although sent to the China-Burma-India Theater to command the Army Air Forces component, Maj. Gen. George E. Stratemeyer served initially as deputy to Lord Mountbatten's air commander. The American airman coordinated the efforts of the Tenth Air Force, the Fourteenth Air Force (commanded from its inception by Chennault as a major general), and the air transport wing flying cargo across the Himalayas. Late in 1943, General Stratemeyer at last assumed command of an operational organization when Lord Mountbatten selected him to direct the Western Air Command, made up of the Tenth Air Force and the Royal Air Force's Bengal Command.

A unique set of circumstances thrust Stratemeyer into this ramshackle command structure. Stilwell wanted a theater air officer but he did not want Chennault, who disagreed with him on matters of strategy and supply and had appealed over his head in an attempt to influence the President. Both Marshall and Arnold were wary of Chennault, who did not seem to understand the logistic difficulty of fighting an intensified war on the Asian mainland. Stratemeyer, senior to Chennault, served as Arnold's Chief of the Air Staff and in that capacity had visited China on an inspection tour that dealt specifically with problems of supply. The difficult and ill-defined assignment went to Stratemeyer because he was experienced in staff work, familiar with logistics in the theater, and satisfactory to Stilwell, Arnold, and Marshall.

As the confusing organizational pattern took shape, American airmen based in India, sometimes aided by bombers and crews borrowed from Chennault, protected the air route across the Himalayas and attacked ports and railroads in Burma. When neutralizing airfields that threatened the airlift or destroying railway bridges, the older P-40s, no longer suitable for dogfights, delivered 1,000-pound bombs with such accuracy that pilots nicknamed them "B-40s." Newer models of the P-40, better adapted to dealing with enemy fighters, helped defend the aerial supply line over the Hump, as the spine of the Himalayas was called, but Japanese fighters for a time remained so dangerous that Brig. Gen. William B. Old, in charge of the airlift in the

latter months of 1943, had to route the transports northward to avoid interception.

The Allies, however, soon gained control of the skies over Burma as the Japanese struggled unsuccessfully against the rapidly expanding American and British air forces. By the end of 1943, General Stratemeyer possessed both the authority to employ air power as circumstances might dictate and the means to hurt the enemy. In contrast, the Japanese were making many of the same errors in Burma that the Americans had made in North Africa, trying to do too much with too little and thus forfeiting the initiative. A need to divert aerial strength, at the time that the Americans and British were increasing theirs, compounded the woes of the Japanese. Bombers, for example, that had launched a promising series of raids on Calcutta, India, suddenly departed so they could oppose General MacArthur's advance.

Control of the air enabled the Allies to move at last against the enemy in Burma. Although a lack of resources ruled out a proposed amphibious assault to recapture the port of Rangoon, Lord Mountbatten set in motion a less ambitious offensive provisioned by air and designed principally to safeguard the aerial supply line and secure the right-of-way for a new road into China. This scaled-down Burma operation began early in 1944 with two Allied thrusts. On March 5, a mixed force of Burmese, British, and Indian troops under British Brigadier Orde Wingate raided behind Japanese lines in northwestern Burma; and a month later, General Stilwell attacked in the northeast with a predominately Chinese force that included 3,000 American infantrymen commanded by Brig. Gen. Frank D. Merrill.

From the standpoint of air power, Brigadier Wingate's effort was the more spectacular, for an air task force led by Brig. Gen. Philip G. Cochran landed some 10,000 men and pack animals in jungle clearings beyond enemy lines. After the initial assault, American and British aircraft dropped perhaps three million pounds of cargo to sustain the attack. Even as they were supplying these soldiers, commanded by Maj. Gen. Walter D. Lentaigne after Wingate's death in a B-25 crash, the transports had to fly the first of more than 12,500 reinforcements and 20,000 tons of supplies to outposts successfully resisting a Japanese offensive west of the area where Lentaigne's troops operated.

Although Stilwell did not rely so heavily on aircraft for mobility and supply, air power did some of the same things for him—flying supply, strike, and reconnaissance missions—that it was doing for Wingate and Lentaigne. Inside stable and reliable C-47s, quartermaster soldiers, who a few days earlier had driven trucks or operated laundries, pushed bundles of food, fuel, medicine, and

ammunition out of the cargo doors onto parachute drop zones established below. Aerial photographs helped pinpoint battlefield targets and the trails the enemy used for supply and reinforcement. Because the jungle restricted fields of fire and hampered the registration of artillery, fighter-bombers did the work of howitzers. When the strike controller assigned to each of Stilwell's major units could not pinpoint a Japanese position, he made radio contact with a low-flying observation plane that then guided the attacking aircraft to the target. Stilwell's men captured Myitkyina airfield and, weeks later, the village itself. Unfortunately, by the time Stilwell's troops seized the latter objective on August 3, 1944, Burma had reverted to a minor battlefield compared to the islands of the Pacific and an advance through the jungles seemed scarcely worth the effort.

Like Burma, which became a backwater area of the war, China did not prove to be the springboard for decisive operations against Japan. The enemy offensive following the Doolittle raid had deprived American airmen of bases within bombing distance of Japan, and supply proved a critical problem. Until northern Burma could be reconquered and a new highway built to China, cargo that had already traveled halfway around the world faced a dangerous flight across the Himalayas. Overworked C-47s, supplemented by their commercial counterparts, Douglas DC-3s (obtained from the Chinese national airline), replaced truck convoys in supplying both the American aerial effort and the armies of Chiang Kai-shek. To guide the heavily laden transports over the Himalaya Mountains, Air Forces communications specialists set up the first elements in a network of nine radio stations extending from the Indian province of Assam to Kunming in China. Understandably, this primitive aerial route did not approach the volume of cargo that might have arrived by highway had the Japanese not intervened.

During January 1943, the airline over the Hump had delivered less than 1,500 tons of freight, but a move to double the size of the transport fleet with new and larger aircraft inspired estimates that the monthly volume would reach 4,000 tons by November. The new aircraft, after all, included the C-87, a cargo version of the B-24, and the C-46, both of which had greater capacity than the C-47. Chiang Kai-shek, however, demanded an apparently unrealistic 10,000 tons each month, and President Franklin D. Roosevelt insisted that this goal be met by September 1943. Testimony to the danger facing the airmen who tried to meet this objective took the form of several "huge black blotches" that Brig. Gen. William H. Tunner saw at the end of the runway at

Chabua in Assam when he took command of the airlift in the summer of 1944. "Each was a lasting memorial," Tunner later wrote, "to a group of American airmen, the crew of a plane that had crashed and burned on the spot." Despite serious handicaps—frequent mechanical failures in the unproven C-46, crew fatigue caused by overwork and primitive living accommodations, and a feeling that a hard and dangerous job was going unrewarded—the aerial supply line met the President's goal by November 1943, just two months beyond his deadline. Moreover, in the last six months of 1944, the fleet of transports and the number of flights per month into China available to Tunner more than doubled, pushing the volume of cargo delivered in December beyond 30,000 tons.

Before this period of rapid growth—indeed, when the route over the Hump had barely begun to function—Chennault began campaigning to expand the air war in China. Ignoring his dependence on aerial supply and airfields defended by ground forces, he insisted that air power could do more to defend China and defeat Japan than the Chinese infantry divisions that Stilwell proposed to equip and train. Bypassing his theater commander, the airman in October 1942 assured President Roosevelt that, if given command of an American air force in China with as few as 147 operational fighters and bombers, he could take the offensive, destroy enemy air power over China, and carry the war to Japan. Since Chennault proposed to break the Japanese hold on the mainland without jeopardizing Chiang's postwar plans for using the American-equipped divisions against the Chinese communists, the Nationalist leader endorsed the Chennault plan, which would divert supplies from the ground forces to the air war. Unlike Chennault and Chiang, Stilwell emphasized the importance of employing China's vast manpower against the Japanese, regardless of the effect on the postwar balance of power between the Nationalists and communists. Although willing to concede the importance of military aviation to operations on the ground, Stilwell doubted that the volume of supplies arriving over the Himalayas could sustain the ambitious air offensive and at the same time permit the development of airfields, the organization and training of ground forces, and the reopening of an overland supply route through northern Burma.

General George C. Marshall and Secretary of War Henry L. Stimson, two persons whose judgment the President greatly respected, shared Stilwell's misgivings and supported a strategy of building a Chinese army and reopening the Burma road. Furthermore, Arnold, the Commanding General of the Army Air Forces, returned in February 1943 from a visit to China convinced that neither Chennault nor Chiang Kai-shek understood the complexity

of mounting a sustained aerial campaign in that region. The Chinese leader, however, remained unwavering in his support of Chennault, and Roosevelt yielded to both Chiang's insistence and his own abiding impulse to support the person who promised immediate results, in this case Chennault, instead of backing Stilwell, who always seemed to be preparing for a decisive action, but sometime in the future. In March 1943, Chennault's China Air Task Force became the Fourteenth Air Force, and the commander of the new organization confessed to a friend, "I feel just like the fellow who said he wanted an elephant and then got one. I suppose I can figure out how to handle it as time goes on."

Handling the elephant proved more difficult than Chennault anticipated. By the summer of 1943, his aerial offensive had begun, but the increased activity—including attacks on coastal shipping, ports, and troop concentrations—prompted a savage reaction. Far from collapsing as expected, the enemy threatened for a time to seize control of the skies over China and neutralize the airfields from which the Fourteenth Air Force mounted its attacks. The timely arrival of fresh pilots and improved fighters enabled Chennault to retain air superiority, but the Chinese ground forces soon faced disaster of a magnitude that jeopardized not only Chennault's air offensive but also another undertaking that the Allied military leadership considered more likely to produce truly decisive results.

The air war that Chennault waged in China paled in comparison to the campaign planned for a force of B-29s based in that country. At the Quebec Conference of Allied leaders in August 1943, American planners first proposed using airfields in China to launch the new bombers against Japan in an aerial offensive designed to help win a victory over Japan just one year after the defeat of Germany. Despite the logistical problems involved, Allied planners had selected China because Chiang's armies already controlled the territory where air bases could be built within B-29 range of the home islands. In the summer of 1943, amphibious forces probing Japan's outer defensive perimeter in the Pacific were an estimated year or more away from objectives within striking distance of the enemy homeland. At the time of the Quebec Conference, therefore, China seemed the best choice for launching the bombing campaign, although attacks might follow from the Mariana Islands in the central Pacific, perhaps as early as December 1944. The B-29 offensive from China, the so-called MATTERHORN project, seemed so important that in November 1943 Arnold vetoed a plan to stage B-24s through bases in eastern China and hit targets in the Sasebo-Nagasaki region of Japan because he did not want to dramatize the vulnerability of the Japanese home islands to air attack.

In the latter part of 1943, with B-29 attacks from China a part of the Allied agenda, the monthly volume of cargo airlifted over the Himalayas approached 10,000 tons, a foreshadowing of the vast increase that occurred in 1944. Encouraging as this progress was, the flight over the Himalayas remained but one piece in a complicated logistic mosaic. Materiel destined for Allied units in India and Burma, as well as China, choked Calcutta, the major port in the region. Chennault, moreover, planned to launch his Fourteenth Air Force on an expanded air campaign in 1944, increasing its consumption of fuel and munitions. At the same time, Stilwell sought to arm and train additional Chinese divisions, warning that these troops might well be needed to stop a Japanese offensive in eastern China triggered by the intensified air war. In brief, no one guaranteed that even the rapidly expanding volume of cargo crossing the mountains could satisfy a competition for supplies made all the keener by the coming of the B-29s.

In earmarking the B-29 for the war against Japan, General Arnold faced the unpleasant prospect of entrusting to theater commanders inexperienced in strategic air warfare a weapon so deadly that it might well force Japan to surrender. Because of distances, aircraft available, and kinds of targets, not MacArthur in the Southwest Pacific, or Stilwell in China and Burma, or Nimitz in the Central Pacific had employed the land-based bomber in quite the way that the advocates of air power had championed. Consequently, Arnold proposed that he retain control of the new bombers and direct their activity from Washington. After all, the air arm could ensure its future independence by bombing Japan into submission, and the B-29 fleet seemed capable of doing just that, provided an experienced airman employed it properly. At Arnold's urging, the Joint Chiefs of Staff assumed operational control of the B-29 offensive, appointing the Commanding General of the Army Air Forces to exercise "executive direction" in their name. The Twentieth Air Force, the designation of the striking force of B-29s, consisted of two bomber commands. The XX Bomber Command would attack from China, under the command of Brig. Gen. Kenneth B. Wolfe, who had helped bring the new aircraft through a series of development crises, the most difficult caused by overheating and fires in the huge engines. After the conquest of the Mariana Islands, the XXI Bomber Command, led by Brig. Gen. Haywood S. Hansell, would operate from airfields in that island chain.

Learning the intricacies of a complicated and largely unproven airplane caused frustrating delays for the men of the XX Bomber Command, organized in November 1943, some five months before the Twentieth Air Force, the headquarters to which it would

report. By the spring of 1944, however, a modification center in Kansas was correcting defects in 150 of the bombers and turning them over to their crews for the flight across Africa to India. From India, the B-29s staged through the Chengtu region of China, where some 75,000 laborers used picks and shovels to turn valuable agricultural land into airfields. Meanwhile, the cargo reaching China by air increased in volume because of the more efficient use of the additional transports flying out of India. Following schedules devised by Lt. Col. Robert S. McNamara, later to become Secretary of Defense, B-29s doubling as transports aided in delivering fuel and other cargo from India to bases in China. McNamara operated a statistical section, patterned after the statistical control unit at Air Forces headquarters, that kept track of all the variables affecting the supply effort—gross and net loads, aircraft available, and the time required to load and unload—and adjusted schedules accordingly.

While the stockpiles grew larger at Chengtu, the bombers conducted badly needed training flights and carried out an ineffectual practice mission from India against Bangkok, Thailand. Training soon became a luxury, however, for Japanese forces were advancing in eastern China, trying to overrun the airfields from which Chennault's Fourteenth Air Force launched its attacks, especially the strikes against coastal shipping. When the enemy surged forward on the ground, threatening to overwhelm the Chinese defenders, Chennault had to intervene, and the air war intensified further, rapidly using up the stocks of fuel and munitions he had accumulated for his operations. General Stilwell promptly arranged to give the Fourteenth Air Force a larger share of the tonnage arriving from India, but weeks would pass before the cargo, in effect diverted from General Wolfe's B-29s, reached General Chennault's squadrons. Although the possibility of a Chinese collapse seemed far from remote, the Joint Chiefs of Staff denied Chiang Kai-shek's request that the Fourteenth Air Force immediately begin drawing on the supplies already flown into China for use by the XX Bomber Command, an indication of their reluctance to delay the bombing of Japan, a project in which the United States had already invested so much effort.

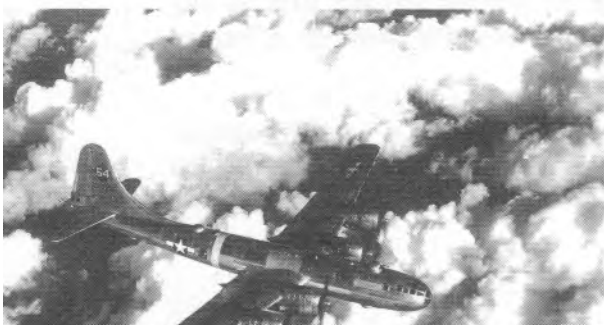
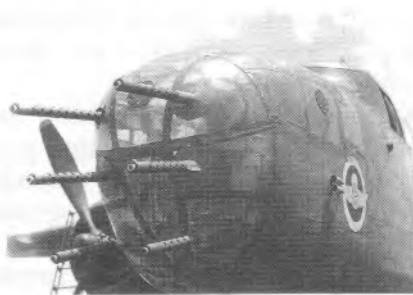
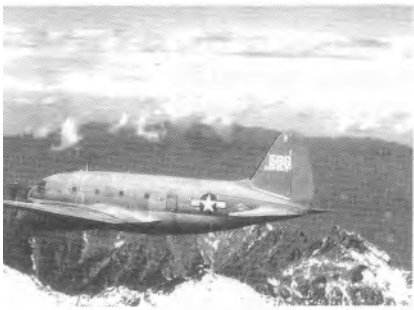
With Allied prospects on the ground in eastern China growing progressively bleaker, General Wolfe's bombers made their first attack on Japan, doing minor damage to the steel mills at Yawata on the night of June 15, 1944. The effort, however, cut deeply into fuel stocks and, because of the long full-power climb to bombing altitude, resulted in engine wear that required extensive overhaul. Repairs to the engines took excessive time, since little depot assistance was available and enlisted crew members had to



Forgotten Theater China-Burma-India

One of the first commitments of American fliers against the Axis in a foreign theater of war came as the result of an active recruitment program by the Chinese Nationalist government of Chiang Kai-shek among commissioned American Army and Navy pilots. Ninety fliers and 150 support personnel under retired Maj. Claire Lee Chennault took their P-40s to Burma in September 1941. Three weeks after the Pearl Harbor attack, this American Volunteer Group went into action against Japanese bombers, shooting down six of ten Mitsubishi Ki-21 SALLY bombers. The group was thereafter renowned as the "Flying Tigers." Its planes, shark-tooth faces evident in one of the famous images of the war (*above*), stand under the eye of a Chinese guard after the Americans moved north in 1942. The AVG was among the first to devise effective hit-and-run tactics against the Japanese A6M ZEKE fighter. On July 4, 1942, the group dissolved and holdovers became the nucleus of the AAF's 23d Pursuit Group, eventually absorbed into the Fourteenth Air Force under Chennault, now a major general (*opposite, left above*). American policy required a theater in being to tie down Japanese forces in the region, but gave ground and air forces

there only a shoestring subsistence. Supply and spare parts had to come in by air over the Himalayan mountain range. Clockwise from far right above on the page opposite, Chinese ground observers formed early warning nets in a system Chennault had proposed at the Air Corps Tactical School in 1936. The control tower at Yangkai, China, was sturdy by local standards. In the MATTERHORN Project, the Twentieth Air Force flew B-29s out of China to bomb Japan from that quarter; the scene over the Showa Steel Works at Anshan, Manchuria, hit by 60 bombers on July 29, 1944, shows the effects of the successful raid. The logistically starved command in the theater, further beset by Chinese political complexities, could barely sustain the B-29 offensive. The center of action transferred to the Marianas once operations reached full stride there. Chennault's Fourteenth Air Force fighters and B-25 Mitchells specially outfitted with multiple .50-caliber guns swept Japanese ore-barge traffic from principal Chinese rivers, a remarkable strategic success for a tactical air force. A Curtiss C-46 Commando navigates the rugged Himalayan "Hump" route between Assam in India and the Chinese airfield at Kunming.



do much of the work. When he could not deliver powerful blows in rapid succession, as General Arnold demanded, General Wolfe returned to the Materiel Command, replaced by a veteran of the strategic air war in Europe, Maj. Gen. Curtis E. LeMay.

The impact on operations was immediate. His predecessor had at times used darkness rather than self-defending formations to frustrate enemy fighters and radar. General LeMay at the outset insisted on developing skill in formation flying and the same daylight bombing techniques his B-17s had employed over Europe. Stepping up the tempo of flight operations, the new commander profited from improvements in the functioning of the aerial supply line. General Tunner made good a promise to deliver more cargo, especially gasoline. The arrival in the theater of thirty-three C-109s, a tanker version of the B-24, increased the amount of fuel flown into China, even though the aircraft had a dangerous tendency to leak gasoline vapor, which collected in the fuselage, needing only a spark to turn the tanker into a flying torch.

General LeMay's efforts to improve bombing effectiveness sometimes paid off in heavy destruction, as at the An-shan steel mills in Manchuria, but he could not sustain continuous attacks. Supply proved an insurmountable obstacle, and emergencies required the diversion of effort from industrial targets. Indeed, an incendiary raid on the docks at Hankow, China, delivered to slow the enemy's advance on the Fourteenth Air Force bases, proved to be one of the most devastating B-29 attacks thus far. Thanks partly to the strike on Hangkow, the Japanese drive outran its supply lines early in 1945. MATTERHORN bombing missions from the airfields at Chengtu ended in January, although the B-29s continued to fly from India under the operational control of Lord Mountbatten. Twice afterward the bombers staged through Chengtu to sow mines in the waters off Shanghai, China, but otherwise bombers from Chengtu attacked targets in Southeast Asia inside a triangle formed by Rangoon, Burma; Cam Rahn Bay, Indochina; and Palembang on Sumatra.

The results achieved by the XX Bomber Command did not live up to expectation. In all, the organization flew forty-nine missions, fifteen against Japanese industries in the home islands, Manchuria, or Formosa. Fortunately for the Allied cause, the pace of the war in the Pacific had so accelerated that, by the time XX Bomber Command flew its first mission against Yawata, amphibious forces were in the process of seizing airfield sites in the Mariana Islands that could mount a massive bomber offensive against Japan from another direction.

The B-29 campaign from China formed part of a general increase in the tempo of the fighting in the Pacific that had been decided

on at the Quebec Conference of August 1943. The conferees agreed that, while preparations went ahead to mount a B-29 offensive from China, Admiral Nimitz should attack westward through the Central Pacific toward the Marianas and General MacArthur bypass Rabaul and fulfill his promise to return to the Philippines. The Combined Chiefs of Staff expected the strategic air campaign from China to be entering its second year before completion of airfields for additional B-29 raids from the Marianas or possibly Luzon.

During the advance toward the Marianas, the Army Air Forces, rather than shift B-17s and B-24s from the South or Southwest Pacific to support an offensive in the Central Pacific, sent squadrons directly from the United States, an acknowledgment by General Arnold that the offensives northward from New Guinea and westward from Hawaii, for the time being, enjoyed equal importance. The new bombers, which began arriving in the fall of 1943 after the Quebec Conference, reversed a decline in Seventh Air Force strength, for beginning shortly after the Battle of Midway it had been releasing B-24 units for service elsewhere in the Pacific. In December 1942, during the period of eclipse, Maj. Gen. Willis H. Hale, the Seventh Air Force commander, bombed Wake Island, accomplishing the goal that had cost General Tinker's life. By the following summer, General Hale's bombers ranged as far as the Gilbert Islands, staging through the Ellice group. The Central Pacific drive began in the Gilberts in November 1943, with an amphibious assault on Tarawa, the occupation of Abemama, and the conquest of Makin Atoll. For the campaign in the Gilberts, General Hale's airmen flew bombing and photo reconnaissance missions (and fighter patrols after the objectives were seized) under the operational control of a Navy task force commander, Vice Adm. John H. Hoover.

Early in 1944, following the hard-fought victory in the Gilberts, American amphibious forces advanced into the Marshall Islands. General Hale's fighters and bombers, some based at recently captured Tarawa, attacked several targets in the Marshalls, including Kwajalein Atoll. After seizing Kwajalein and nearby Majuro Atoll early in February, American forces captured Eniwetok Atoll at the western end of the Marshall chain and hit the Truk Islands of the Caroline group with a carrier strike that forced units of the Japanese Combined Fleet to seek a safer anchorage. The conquest of Eniwetok, declared secure on February 20, 1944, completed an unexpectedly swift advance that avoided a long, bloody struggle for the Marshalls and accelerated the war by some six months. As the fighting moved closer to Japan, General Hale's command joined the Thirteenth Air Force in neutralizing Wotje and Maloe-

lap in the Marshalls and Truk in the Carolines, where the enemy struggled ceaselessly to repair cratered runways and keep those once-formidable bases in the war.

Although harassing Truk and other bypassed Japanese bases became a principal mission of the Seventh Air Force, Hale's airmen also participated in the invasion of the Marianas. Prior to the attack, Seventh Air Force bombers escorted photographic missions, flown by the Navy's reconnaissance version of the Liberator, over Guam and Saipan, two of the objectives. On June 22, 1944, one week after the landings at Saipan, a squadron of P-47s took off from two escort carriers, landed ashore, and began operating from a captured airfield. The Thunderbolts used rockets, machinegun fire, and 500- or 1,000-pound bombs to attack Japanese redoubts impeding the advance of marines or soldiers on Saipan, Guam, and Tinian. The P-47s also served as daytime interceptors, with P-61s patrolling at night. The attack on the Marianas paid important strategic benefits; it not only obtained B-29 base sites sooner than originally planned but also lured the surviving Japanese carriers into a major action, the Battle of the Philippine Sea. During one aspect of this engagement—an air battle called the Marianas Turkey Shoot—American naval aviators downed some 243 aircraft from enemy carriers, in effect destroying the corps of naval aviators that the enemy had reconstituted after the Midway disaster of June 1942.

While the forces in the central Pacific advanced some 2,000 miles from the Gilberts to the Marianas in just eight months, General MacArthur consolidated his grip on New Guinea and obtained the bases needed for a return to the Philippines. His troops occupied Morotai Island, a stepping-stone to the southern Philippines, and units from the Central Pacific seized two islands in the Palau chain, securing airfields from which to fend off aerial incursions from the enemy-held Carolines. Resistance at Peleliu in the Palaus smoldered until late November, after B-24s had begun using the runway there to attack targets in the Philippines.

Morotai, along with Sansapor and Owi off the north coast of New Guinea, provided runways from which B-24s of the Fifth and Thirteenth Air Forces raided the oil refineries at Balikpapan, Borneo. General Kenney failed, however, to obtain B-29s for these attacks, even though he had arranged for the construction at Port Darwin, Australia, of an airfield to accommodate them. Arnold and the other members of the Joint Chiefs of Staff remained determined to use the new bombers exclusively against Japan's home islands. Even the smaller Liberators, however, caused serious damage in their five raids against Balikpapan. To

deal with the fighter opposition there, General Kenney sent P-38s and P-47s on sweeps over the refineries and used them as bomber escorts. As became standard for long, overwater missions in the Pacific, American submarines served as lifeguards along the route, picking up airmen who ditched at sea.

Even as General MacArthur's offensive gathered momentum, questions arose within the Joint Chiefs of Staff of the wisdom of becoming entangled in the Philippines, where the fast carrier task forces would sacrifice much of the mobility they had demonstrated in the Central Pacific. Some felt that Allied forces should ignore the entire island chain, or at least avoid Luzon, and strike directly at Formosa. MacArthur insisted on seizing Mindanao in the Southern Philippines and later reconquering the principal island of Luzon; he argued that the United States owed a "great national obligation" to the Filipinos, who had remained "overwhelmingly loyal to the American cause." Ignoring this debt of honor, he warned, would "admit the truth of Japanese propaganda to the effect that we had abandoned the Filipinos and would not shed American blood to redeem them." The general's view prevailed. During a conference held in July 1944 at Pearl Harbor and attended by General MacArthur, Admiral Nimitz, and President Roosevelt, the Chief Executive is supposed to have referred to the invasion of Mindanao and then asked: "Douglas, where do we go from here?" According to this story, the answer was: "Leyte, Mr. President, and then Luzon." Actually, during September carrier strikes in the southern Philippines revealed that Japanese air power in the region was weaker than assumed, enabling the general to accelerate his plans. He bypassed Mindanao and attacked Leyte, immediately to the north, on October 20, 1944, rather than in December as originally planned.

Leyte promised airfield sites that General MacArthur needed to continue executing his amphibious operations under the cover of landbased aircraft, but the promise almost went unfulfilled. Except at Tacloban, where aviation engineers serving as part of the theater engineering force laid pierced steel matting to extend runways built by the Japanese, construction bogged down in a sea of mud as the seasonal rains began. Hard work at last triumphed over weather, but completion lagged far behind schedule. Years later, General MacArthur's Chief of Engineers, Maj. Gen. Hugh J. Casey, commented on the flooding of Leyte's roads and airfields, declaring, "One thing that was important and I had to personally impress on all our Engineer officers was drainage. Somehow or other . . . they'd build an airdrome or what-not but not give sufficient attention to drainage."

As in the Marianas, the Japanese employed their remaining

carriers in defense of the Philippines, but these ships, short of aircraft and all but devoid of trained pilots, served merely as bait to draw their American counterparts away from Leyte. The Japanese aircraft carriers fulfilled this suicidal mission, sacrificing four of their number but attracting the full attention of the American fast carriers. While the carriers courted destruction, two other Japanese forces converged on Leyte. American battleships intercepted one and defeated it, but the other force attacked the escort carriers supporting the Leyte beachhead and their destroyer screen. Navy aircraft, launched to attack the rapidly approaching task force, could not return to the damaged or violently maneuvering carriers and had to land at Tacloban, where Army aviation ordnancemen hung bombs on them so they could renew the battle. Overestimating the force opposing him, the enemy commander retired after sinking one escort carrier, two destroyers, and a destroyer escort. Army B-24s helped speed the Japanese on their way, dropping bombs close to the flagship and delivering the *coup de grâce* to a cruiser already badly damaged in a related action.

Besides risking his navy off Leyte, the enemy unveiled a new weapon, known as the *kamikaze*, or divine wind, named for the storm that had scattered a Mongol invasion fleet bound for Japan in 1281. The originators of this modern *kamikaze* hoped to defeat another invasion force by crashing planes (or boats) into American warships, exchanging a few lives for the lives of hundreds. *Kamikaze* tactics, and the subsequent development of special suicide weapons like a rocket bomb containing more than a ton of explosives, indicated desperation as well as resolve. At the time of the attack on Pearl Harbor, a Japanese pilot logged roughly 300 hours during training. Now, as the war drew ominously nearer Japan, pilots who had flown as many as 100 hours became increasingly rare. Since 100 hours could not prepare a man for aerial combat with the Americans, the Japanese decided to capitalize on their average airman's willingness to die for his emperor and country. Members of this special corps would receive just enough flight training, as little as fifteen hours, to enable each to fly a single suicide mission.

The Japanese army and navy had, of course, launched ambitious programs to replace flyers killed in action or stranded on bypassed Pacific islands, but the efforts failed. Dwindling stocks of gasoline hampered flight training; because of American submarines, the flow of petroleum from the East Indies declined so sharply that during 1944 the enemy began experimenting with alcohol as a fuel extender. As the war approached a climax, Japan had on hand about 1.5 million barrels of aviation fuel—refined gasoline, some of it spiked with alcohol, and synthetic fuel, none

of it rated higher than 87 octane. This reserve compared poorly to the 4.2 million barrels of gasoline, mostly smoother firing 92 octane, on hand when the fighting began in 1941. Japanese authorities decided to invest much of their diminished supply in suicide attacks by a group of ill-trained pilots flying, in many cases, obsolete airplanes.

Before the *kamikaze* corps went into action off Leyte on October 25, bulldozers had carved out the first of the airfields for the Marianas-based strategic bombing of Japan. On Saipan, aviation engineers, although short of equipment, had enlarged a former Japanese airfield in time for the first B-29 Superfortress to land there on October 12. At the controls was General Hansell, who, during his tours in the Air War Plans Division, had helped prepare the basic plans of the wartime Army Air Forces, AWP/1 and AWP/42. Work at Guam proceeded more slowly, impeded by Japanese resistance, by competing demands such as the building of a naval base, and by the selection of one airfield site so remote that engineers had to build a road to reach it. The Navy construction battalions on Tinian made more efficient use of their men and equipment after General Harmon—who served as the Commanding General, Army Air Forces, Pacific Ocean Areas, until his airplane disappeared over the Pacific early in 1945—persuaded Admiral Nimitz to concentrate on one field at a time, rather than divide the effort between two air bases. By the end of November 1944, facilities in the Marianas could support the hundred-odd B-29s available to Hansell's XXI Bomber Command.

After a half-dozen disappointing practice missions against the fortified islands of Truk and Iwo Jima, General Hansell received a directive to attack an aircraft factory just ten miles from the emperor's palace at Tokyo. An unarmed B-29, fitted with cameras and redesignated an F-13A, conducted a last-minute reconnaissance, and on November 24, after a week's delay caused by rain and adverse winds, Brig. Gen. Emmett O'Donnell, a veteran of the fighting in the Philippines, led 111 bombers aloft from Saipan's runways. As the bombardiers aimed visually through broken cloud or with radar, violent tail winds propelled the B-29s over the target at almost 450 miles per hour and blew the bombs from their intended trajectories. For the first time, American airmen had encountered the winds of the high-altitude jet stream. Of the 88 aircraft that released their bombs, only 24 succeeded in aiming at the plant itself rather than at an alternate target, and just 45 bombs exploded on the factory grounds. The enemy brought down one of O'Donnell's Superfortresses, the victim of an apparent ramming by a damaged fighter.

For almost three months, from the training mission against Truk in late October 1944 until his last attack on Japan in January 1945, Hansell drove his men—perhaps too hard, he later suggested—to improve accuracy and increase the tonnage of bombs on the target in a high-altitude precision campaign directed mainly at the Japanese aircraft industry. Unfortunately, the jet stream caused insolvable problems, affecting not only the speed of the aircraft over the target but also the dispersal of bombs, which might pass from a swiftly moving current of air to a slower layer moving in a different direction. Also, mechanical problems, usually with the engines, caused as many as one aircraft in five to turn back short of the target. At last, aided by calm weather, Hansell's B-29s on January 19, 1945, delivered a devastating attack that cut production at a Kawasaki airplane plant near Kobe by an estimated 90 percent, the final raid before Arnold removed him as commander of the XXI Bomber Command.

In Washington, General Arnold decided well before Hansell's last attack that the B-29 offensive against Japan had reached a dead end. As he had removed an old friend, Ira Eaker, in the aftermath of the second raid on Schweinfurt, he now summoned LeMay from China to replace Hansell at the head of the XXI Bomber Command. In early December, Arnold dismissed the notion that he was "putting the heat on Possum," using Hansell's nickname, but by the end of the month he had decided that Hansell had lost too many B-29s and inflicted too little damage upon Japan.

The declining confidence on Arnold's part occurred as the target planners in Washington were losing their enthusiasm for the kind of high-altitude precision bombardment that Hansell was determined to conduct. The emphasis now shifted from leveling manufacturing plants to igniting flimsy houses, which would fuel raging fires in the congested Japanese cities; whole towns rather than individual factories became targets. As early as December 18, 1944, immediately after LeMay's B-29s had burned out the waterfront at Hankow, China, Brig. Gen. Lauris Norstad, the Twentieth Air Force Chief of Staff, called for an experimental incendiary raid upon Nagoya, Japan. Although reluctant to divert bombers from precision attacks on airframe and aircraft engine plants that produced airplanes for the *kamikazes*, Hansell sent his B-29s against Nagoya on December 22. The squadrons relied on radar to bomb through dense cloud and obtained no better results with incendiaries than they usually achieved with high explosives. A second incendiary attack on the city, carried out on January 3, ignited fires that sent smoke billowing to 20,000 feet but scattered blazes failed to converge and therefore did not create the kind of

firestorm that might have incinerated Nagoya and many of its inhabitants.

However disappointed Arnold may have been with the results of the high-altitude bombing, whether high explosives or incendiaries, Hansell had succeeded in improving both the bombing accuracy of his crews and the mechanical reliability of the aircraft they flew, although the winds at high altitudes over Japan still scattered carefully aimed bombs and the B-29s continued to require careful maintenance, especially if the complex engines were subjected to hard use. Not the least of Hansell's accomplishments while leading the XXI Bomber Command was his creation, in collaboration with the Navy, of a rescue network for the crews of B-29s that covered the ocean between the Marianas and Japan. The odds for survival rose dramatically, despite an occasional setback such as occurred in January 1945, when rescuers saved just 13 of 135 airmen; over the entire bombing campaign, rescue aircraft or submarines retrieved half of the 1,300 crew members who crash landed at sea during the command's missions against Japan.

More important for the survival of B-29 crews than the rescue organization was Iwo Jima. The Japanese used the volcanic island for an early warning radar site and a staging base for a succession of air strikes against the Marianas, including a night attack on December 7, 1944, that destroyed three Superfortresses and damaged twenty-three. Both B-29s and Marianas-based Liberators bombed Iwo Jima, but eventually marines had to storm its beaches. In American hands the island became a radar outpost for the Marianas, a fighter base for the defense of those islands and for escort missions over Japan, and an emergency airfield for disabled Superfortresses.

Neither the aerial bombing of Iwo Jima, conducted with varying intensity over two months, nor a three-day preparatory bombardment by carrier aircraft and warships could destroy the underground defenses that honeycombed the island. The marines landed on February 19, 1945, and, though a captured airfield began functioning on March 6, fighting continued until April 4, with more than 25,000 Americans killed or wounded. The cost in lives and suffering nevertheless seemed justified, especially in view of the number of airmen making emergency landings at Iwo Jima. By the time the war ended, more than 2,000 B-29s, each with 11 men on board, had made emergency landings on the island. Although many of these aircraft might have limped to the Marianas or ditched successfully, Admiral King, the Chief of Naval Operations, estimated that the number of lives saved equaled or exceeded the 6,000 lost in capturing Iwo Jima.



Marianas Operations



Seized and secure by late June 1944, the Mariana Islands became the base that brought the new American superheavy bombers within range of Japan. By the last half of 1944, basing B-29 Superfortresses in China proved logistically impractical, and plans for deploying them to the Philippines and the Aleutians came to naught. The bombers could be more easily supplied and maintained when concentrated in mid-Pacific. They soon overwhelmed the coral strips (*left*) carved out of terrain at Tinian, Saipan, and Guam. The XXI Bomber Command began tentative strikes in late November 1944. The XX Bomber Command moved from China to renew the aerial offensive in early 1945.

Clockwise above, Superfortresses of the 52d Bomb Group run up for the 1,200-mile trip to Japan in early April 1945. An engine dump stockpiles spares for the balky and fire-prone Wright Cyclones that powered the bombers. An ordnanceman loads .50-caliber ammunition for a mission. Inside the B-29's bomb bay, a ground crewman checks bomb shackles.

In January 1945, Maj. Gen. Curtis E. LeMay, on the left in the photograph, relieved Maj. Gen. Haywood Hansell, one of the earliest proponents of precision bombardment. LeMay soon changed the tactics employed against Japanese cities. Below, an engineer bulldozer shoves burning wreckage off a runway after a Japanese raid. Crashes by outbound, loaded B-29s or damaged returning ships created similar scenes.



During the fight for Iwo Jima, B-24s from the Marianas hit suspected enemy strongholds, and P-51s took off from the recently captured airfield on the island to bomb and strafe as the marines inched forward. Despite these Army Air Forces contributions, Navy and Marine Corps airmen flew most of the close air support missions at Iwo Jima. Army pilots carried more of the burden in the Philippines, where the Far East Air Forces, along with some Marine Corps units, helped General MacArthur bypass other objectives nearer at hand to attack Mindoro, invade Luzon, and finally mop up the enemy on the southern islands like Panay, Cebu, Negros, and Mindanao.

Landings on the island of Mindoro, an intermediate objective between Leyte and Luzon, took place on December 15, 1944. Aircraft moved onto an airfield site in time to launch fighters and medium bombers against a Japanese task force of two cruisers and six destroyers approaching from Cape St. Jacques, Indochina, to contest MacArthur's latest operation. Harassment by aircraft from Mindoro apparently forced the enemy to be content with an ineffectual hit-and-run shelling of the beachhead. After parrying this Japanese thrust, Fifth Air Force fighters and bombers from airfields on Mindoro and Leyte followed up carrier raids against Luzon by attacking bridges, road traffic, and rail lines. In the wake of these preparations, American forces landed on January 9, 1945, coming ashore at Lingayen Gulf and advancing toward Manila. Army fighter-bombers, reinforced by Marine Corps dive bombers under Fifth Air Force operational control, responded to instructions radioed by mobile control parties with the advancing troops. Army C-47s dropped parachuting reinforcements and landed drums of gasoline for the columns moving on Manila and dropped paratroops in the assault upon Corregidor, a small island in Manila Bay. Once MacArthur gained control of Luzon, he turned his attention to mopping up the bypassed Japanese in the southern Philippines, where Army and Marine Corps airmen supported American infantrymen and Filipino guerrillas.

The American lodgment on Luzon, besides freeing troops for action in the southern islands, further constricted the supply artery carrying oil from the Netherlands East Indies to Japan. Tankers and other ships now ran a gantlet of air power as they plied the China Sea, coming under attack whether under way or in port. Despite the increasing effectiveness of aircraft, submarines remained the deadliest weapon against enemy shipping, especially oil tankers. When American intelligence learned that the Japanese used alcohol processed from sugarcane on Formosa to blend with a diminished supply of gasoline, bombers—including for a time the new Consolidated B-32—attacked the distilleries there.

Instead of Formosa, Okinawa in the Ryukyu Islands became the next objective, for Okinawa was small enough that a lengthy land campaign would not be necessary yet was large enough to accommodate the bases needed for an assault upon Japan's home islands. From airfields on Okinawa and nearby Ie Shima, bombardment groups that had finished off a battered Germany could join the Marianas-based B-29s in devastating Japan. During the battle for Okinawa, which lasted from April 1 to June 21, 1945, fighter squadrons of the Army Air Forces served under the operational control of a Marine Corps officer, Brig. Gen. William J. Wallace. The Army airmen tried to prevent *kamikazes* based on Formosa or the Japanese island of Kyushu from attacking American ships off Okinawa. Although LeMay had already begun the systematic fire-bombing of Japanese cities and was reluctant to interrupt the campaign, the *kamikazes* posed so great a threat that the Joint Chiefs of Staff, for a period of five critical weeks, empowered Admiral Nimitz to use the B-29s for bombing the airfields on Kyushu the suicide pilots used and the factories that produced aircraft for them.

LeMay's incendiary raids promised to be the kind of decisive aerial bombardment that would vindicate the advocates of strategic bombardment by consuming Japan's cities and with them the nation's capacity to resist. In Europe, the bomber offensive had neither taken the place of an invasion nor prevented the Germans from fighting tenaciously as Allied ground forces tightened the noose about the Third Reich. Against Japan, already short of food and oil, Arnold believed that bombardment could force a surrender, thus avoiding an invasion and a long and bitter ground campaign. To win the victory before the impending assault upon Japan, LeMay, who shared his commanding general's vision, abandoned the daylight precision bombing that he had conducted in Europe and embraced the British theory of nighttime area bombing.

The change in tactics evolved gradually as various officers, including General LeMay, reviewed the indecisive results of the earlier attacks and studied the reports of tests conducted in the United States demonstrating the vulnerability of Japanese houses to incendiary attack. LeMay became convinced that area bombing with incendiaries would prove far more effective than precision attacks. Not only were the houses built of inflammable materials, the tinder-like residential areas encroached on vital factories, and the industries themselves tended to be concentrated in comparatively few cities. LeMay believed, moreover, that a system of cottage industry existed in the towns, with households working at

Home Islands Besieged



Early in the last year of the war, American seaborne forces were closing in on the remnant Japanese empire while the bombing offensive grew in fury. Each of the later island conquests brought the air offensive closer to the enemy's homeland and war production base. The U.S. Marine V Amphibious Corps assaulted Iwo Jima in the Bonin Islands on February 19, 1945, and in a bloody campaign against a fierce defense seized this volcanic outpost only seven hundred miles from Kyushu, the southernmost Japanese island. From here, fighter escorts could easily stage to protect raiding B-29s. Iwo's capture also eliminated a Japanese radar station that gave warning of incoming attacks, further blinding the enemy's faltering air defenses. By June, Okinawa, the main island in the Ryukyu chain, was secure enough to begin basing the heavies there. Above, a damaged B-29 takes refuge at Bolo Strip on Okinawa, limping south after a strike at Japan. Armorers on Ie Shima field (left) reload a P-47's guns. A P-51 (below, left) revs up on pierced-steel-plank runway on Iwo Jima. One of the few Convair B-32 Dominators (below) to see war service takes on gasoline at an Okinawan field.



home on components of various weapons. Since the fire departments in those cities did not meet European standards, they could not deal with the kind of conflagrations that had overpowered better equipped fire fighters at Hamburg and would soon do so at Dresden. Fire raids would kill or injure Japanese workers, destroy their homes and the factories where they worked, and convert the labor force into a demoralized mob of refugees.

American planners showed little concern for the average Japanese citizen, whose German counterpart Eaker had expressed a reluctance to bomb. This difference in attitude resulted at least in part from a desire to avenge Pearl Harbor and retaliate for Japanese wartime atrocities, among them the execution of airmen captured after the Doolittle raid of 1942 and the brutal treatment of American prisoners of war in the Philippines. The wanton murder of American and Filipino captives during the death march from the Bataan peninsula on Luzon to prison camps elsewhere on the island came to light after an Air Forces pilot, Capt. William E. Dyess, Jr., and a few fellow prisoners escaped and, with the aid of Filipino guerrillas, eventually returned to the United States. Other factors influencing the air war against Japan undoubtedly included the lack of widely shared ethnic, cultural, or religious ties with the populace. Perhaps the most powerful argument for unrestrained attack was the refusal of the Japanese to surrender, even when facing overwhelming odds and certain death—an attitude the Americans considered fanatical. In the Marianas, for instance, civilians, including women and children, had chosen suicide rather than internment, and enemy sailors and airmen had become *kamikazes*—willing to ram B-29s, dive aircraft into warships, or ride explosives-laden boats or manned torpedoes to certain death. By the spring of 1945, American planners looked forward with dread to an assault upon the home islands in which the entire populace would rise up and fight to the death. Estimates of Americans killed and wounded in this kind of fight to the death varied from 31,000 in the first 30 days of an invasion of Kyushu to as many as 268,000 in overrunning the entire island town by town.

Having selected the incendiary bomb as the decisive weapon that would prevent such carnage, the question arose how best to deliver it. Hansell's high-altitude attacks had proved disappointing because the incendiaries produced widely scattered fires, a consequence of the ballistic characteristics of the bombs, the comparatively long time they took to fall to earth, and the variable winds that influenced their trajectory. LeMay solved the problem of isolated blazes by attacking at low altitudes, where the winds of the jet stream did not blow. Because Japanese radar was easily

jammed and incapable of precise control over either interceptors or antiaircraft guns, the B-29s could attack at low level by night with near impunity. The lack of effective aerial opposition would, moreover, enable the Superfortresses to substitute bombs for the weight of defensive weapons and ammunition. Finally, low-altitude attacks meant that more B-29s would be available for combat, since the new tactics eliminated a long climb at nearly maximum power, easing the strain on the engines and reducing the frequency of time-consuming maintenance.

General LeMay began burning out Japanese cities on the night of March 9-10, 1945, sending more than 300 bombers against Tokyo at altitudes between 4,900 and 9,200 feet. Some 2,000 tons of incendiaries, which achieved a density of 25 tons per square mile, destroyed more than 250,000 buildings, left a million persons homeless, killed more than 83,000, and injured almost 41,000. The attacking force lost 14 bombers to antiaircraft fire but none to fighters, and five crews were rescued at sea.

Despite some setbacks—due to shortages of incendiaries, failure at times to concentrate a sufficient weight of bombs in the designated areas, and diversions because of the Okinawa campaign—the XXI Bomber Command persisted in its urban bombardment. By mid-June the attacks had reduced to ashes an area of more than 250 square miles divided among six cities, with some 40 percent of the destruction in Tokyo. LeMay's airmen paid a price to achieve this widespread devastation. On the night of May 25, for instance, during a raid on the capital city, a combination of mechanical failure and enemy action downed 26 B-29s, and another 100 of the 502 Superfortresses that bombed the target sustained battle damage. LeMay reacted to the losses by resuming daylight raids, using an escort of P-51s from Iwo Jima to neutralize Japanese fighters and flying the incendiary-laden B-29s at an altitude beyond the reach of antiaircraft guns. He thus reverted to the bombing tactics that Hansell had tested in January, but with a larger force than Hansell had been able to muster. LeMay could launch 500 or more B-29s, escorted by about 100 fighters, on daylight fire raids that achieved a degree of saturation about as destructive as the low-altitude night strikes. Besides setting ablaze the major cities by day or by night, the bombers flew precision strikes against industrial targets, sometimes using radar by night or in cloudy weather, and continued the mine laying begun early in 1945.

As the bombing increased in fury, Nimitz called on the B-29s to step up this campaign of aerial mine laying and help isolate Japan from the resources of its shrunken empire. Arnold and his advisers agreed, though reluctantly, for to them Japanese industry and

A black and white photograph of a B-29 Superfortress bomber in flight, viewed from a high angle. The aircraft is positioned in the upper half of the frame, moving from left to right. It is dropping a large number of firebombs, which appear as a dense shower of small, dark objects falling from the underside of the plane. The tail section of the bomber features a large, dark letter 'Z'. The sky is bright and filled with the falling bombs.

Cities on Fire

The enemy's home islands now inside the range of American land-based air power, General Arnold began experiments in the United States in 1944 to determine the best means of attacking Japan's vulnerable cities. Attempts at high-altitude precision bombing against industrial targets with the few B-29s on hand in the Marianas through mid-January 1945 had only started to produce results. Arnold sent hard-driving Maj. Gen. Curtis LeMay to step up the pace. Between mid-March and the end of the war, LeMay, with his strength now increased to three B-29 wings, began incendiary attacks on the highly flammable structures of urban Japan. Above, a formation from the 500th Bomb Group showers firebombs on targets. In the opening stroke of this new campaign, 334 bombers hit Tokyo itself on March 9. Sixteen square miles of the city center (*right*) were levelled. In the most devastating air raid of the Pacific war to that time, 85,000 died and a million were homeless after a firestorm rivalling that in Dresden a month before. The Tokyo refinery shown next was hit later with high-explosive ordnance.



The B-29s then struck in succession at Nagoya, Osaka, Kobe, and Nagoya again before the supply of firebombs was exhausted on March 17. In April, P-51 Mustangs settled on Iwo Jima, and the attack became irresistible. Japan was virtually defenseless by day and helpless in attack by night. After continuing raids with high explosive, the incendiary attacks resumed in May; by June the hearts of the half dozen largest cities in the home islands were cinders.

Japanese survivors eke out shelter below ground or in small shacks in the center of blackened Yokohama (*below, left*) in this scene after V-J Day. The docks at Kobe, Japan's sixth largest city, fall under the incendiaries on June 5 in the third attack on the city.



industrial cities seemed more important targets than shipping. The admiral, however, viewed the mining of coastal waters as a means of sealing the chinks in a blockade that, he believed, could force Japan to surrender without the need of an invasion. Arnold, who hoped to achieve the same end through aerial bombardment, decided to divert B-29s to mine laying to prevent the Navy from absorbing by default a mission requiring long-range, land-based bombers needed by the Air Forces. The same code-breaking organization, now operating from Guam, that had obtained the intelligence essential for the victories at the Coral Sea and Midway, intercepted and decoded Japanese radio messages dealing with shipping and thus obtained information for sowing the minefields.

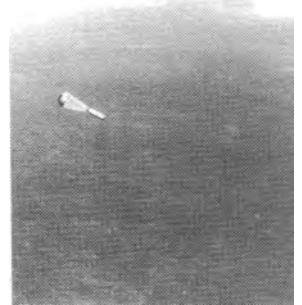
A major factor in the success of the B-29, whether in laying mines or leveling cities, was the rapidly improving logistic support received by the Marianas-based units. A planned maintenance facility took shape on Guam by mid-February 1945, after American soldiers and airmen had brought order to a mile-long agglomeration of shipping crates that had accumulated over the months. Following the establishment of the Guam Air Depot, the monthly total of aircraft unable to complete sorties because of mechanical failure declined from 22 percent in December 1944 to an average of some 7 percent in July and August 1945. Similarly, the tally of bombers grounded for lack of spare parts dropped from almost 13 percent in December to two-tenths of 1 percent when the fighting stopped.

In July 1945, General Carl Spaatz assumed responsibility for directing the day-to-day air war waged against Japan by the strategic bombers of the Twentieth Air Force and, once it arrived from the United Kingdom, the Eighth Air Force as well. The attempt to persuade the Joint Chiefs of Staff to appoint an overall commander for air operations had been frustrated until early in 1945, when the Army and Navy agreed to apportion the final effort against Japan according to service. Once the Joint Chiefs of Staff assigned General MacArthur responsibility for land operations against the home islands and Admiral Nimitz command of the war at sea, they decided that Spaatz should take charge of land based strategic aviation. The Chiefs, with Arnold as their executive agent, coordinated the strategic campaign under Spaatz with the aerial operations conducted by Kenney for MacArthur's invasion forces and those carried out by Nimitz's carrier aircraft. On July 25, Arnold relinquished command of the Twentieth Air Force to LeMay, who served as commander until Twining replaced him on August 2.

Closing the Sea Routes



In the closing months of the war, while strategic bombers struck Japanese cities and industries, mediums prowled the sea routes to help eliminate the remains of enemy seapower. Above, a B-25 of the Apache Group attacks a small Japanese frigate from abeam. Seventy of the ship's crew abandoned ship (*inset*) as the vessel heels over to starboard. Even more telling in closing off Japanese waterways were mining operations against Japanese harbors and shipping, begun quietly in October 1942. For over two years already, Army aircraft adding to the efforts of surface ships and Allied submarines sowed mines along the supply routes of enemy garrisons in New Guinea, the Solomons, the Malay peninsula and archipelago, and the Philippine Islands. B-24 Liberators from bases in India and Ceylon dropped these silent weapons into river estuaries, bays, and harbors on the coasts of Indochina and Malaya. From Kunming in China, B-29s covered northern Indochina and the China coast from Haiphong to Shanghai. Once situated in the Marianas, Twentieth Air Force B-29s carried the mining campaign to the Japanese home islands and the coasts of Korea with devastating effect. A B-29 of the 9th Bomb Group, 313th Bomb Wing, drops Navy Mark 25 mines (*right*) in Japanese waters. The parachute detached itself from the ordnance once it entered the water. The hydrostatically armed mine then lay in the shallows to await the passage of a vessel. American mines left the quarter-mile-wide Strait of Shimonoseki (*below*), separating the southernmost Japanese main island of Kyushu from its neighboring Honshu, completely impassable in the last months of the war. The waterway was one of four main arteries for maritime traffic between the Inland Sea west of Japan and the Pacific Ocean. These weapons sank an estimated 700,000 tons of Japanese naval and maritime shipping.



Before the first B-29s had attacked Japan from China in the summer of 1944, Arnold looked ahead to a new weapon, the atomic bomb, which was taking shape in the minds of some of the nation's leading scientists. About all that Arnold knew for certain about the revolutionary bomb was that it would be heavy and bulky, requiring a B-29 to drop it. In the summer of 1944, the Commanding General of the Army Air Forces launched a program to produce the skilled B-29 crews—backed by maintenance, ordnance, and security specialists—that would drop the weapon when it became available. Col. Paul W. Tibbets, a veteran of the first B-17 mission against Nazi-occupied Europe, assumed command of the 509th Composite Group, built around the 393d Bombardment Squadron, commanded by Maj. Charles W. Sweeney. Tibbets stripped the unit's B-29s of all defensive armament except the tail guns to save weight, thus increasing speed and carrying capacity. Little could be done, however, to modify the planes to accommodate the atomic bomb; instead the scientists, working under the guidance of J. Robert Oppenheimer, a physicist who taught at the University of California and the California Institute of Technology, had to tailor their product to fit the bomb bay of the B-29.

Crew training took place at Wendover Field in western Utah, with the group's bombardiers dropping inert test models of variously shaped atomic weapons. Later, crews flew the bombers to Batista Field, Cuba, where they practiced overwater navigation and radar bombing. In June 1945, after the ground echelon had boarded a ship bound for the western Pacific, the aircrews began the long flight to Tinian. Among the aircraft was a B-29 fresh from the Glenn L. Martin factory at Omaha, Nebraska, a bomber that Colonel Tibbets would name *Enola Gay*.

Meanwhile, the laboratories at Los Alamos, New Mexico, had produced two kinds of atomic weapons. One was a gun type, detonated by firing one mass of uranium down a cylinder into another to create a self-sustaining chain reaction. The other, an implosion bomb, released its energy when an explosive outer shell drove a layer of plutonium inward to collapse into a plutonium core and form a critical mass. The various components of the first weapon left Los Alamos for the Marianas beginning on July 14. Two days later, on the morning of the 16th, the fireball from a test version of the implosion device lit the predawn New Mexico sky to midday brightness, demonstrating that the power of the atom dwarfed the destructiveness of chemical explosives.

Even before this successful test, a debate as to the wisdom and morality of using the bomb had begun among the scientists working on the weapon. Leo Szilard, who had been instrumental

in starting the development program, now feared that use of the bomb would introduce a new and more horrible form of warfare, encouraging future Hitlers to arm themselves with these weapons and attack their neighbors. The issue soon narrowed to a choice between demonstrating the fury of the bomb, perhaps by obliterating an island in Tokyo Bay, or to accomplish the same result and more by leveling an actual city. A panel of scientists, on which Oppenheimer served, concluded that saving American lives outweighed the possible danger of future aggression and that no effective demonstration was feasible. If an announced detonation ended in a misfire, Japanese resistance would be strengthened rather than undermined. The surest way of saving American lives, the panel members believed, was to drop the bomb on a Japanese city, and they recommended this to the Interim Committee on the Atomic Bomb, headed by ex-Senator James F. Byrnes, the personal representative of Harry S. Truman, who had become President on the death of Franklin Roosevelt in April 1945.

Preparations for an atomic attack went forward as the debate among the scientists came to an end. From Tinian the 509th Composite Group flew a series of missions dropping practice bombs on Japan. Filled with high explosives, the orange-painted, five-ton "pumpkins," as they were called, had ballistic characteristics like those of the atomic weapons. These missions enabled the bombardiers to sharpen their skills, while at the same time conditioning the enemy to accept as routine the appearance of one or two B-29s over a major city. Aiming visually and occasionally using radar, the group dropped thirty-seven of the practice bombs.

As preparations for dropping the atomic bomb reached this advanced stage, Arnold became convinced that it would not be needed. Influenced by a visit to LeMay and also by the preliminary findings of teams investigating the effects of aerial bombing on Hitler's defeated Reich, he concluded that incendiary and high-explosive weapons could force Japan to submit, so that neither an invasion nor an atomic bomb would prove necessary. He brought LeMay to describe for the Chiefs the rapidly accumulating devastation wrought by the current bombing campaign. Arriving on June 19 to say his piece, LeMay was a day late; Truman left in motion plans for the invasion of Japan and the debate over the bomb when he departed for the conference at Potsdam the day before. LeMay's listeners were indifferent. During the seventeen-day conference at Potsdam—in the presence of the other Joint Chiefs, Secretary of War Stimson, and President Truman—Arnold raised the possibility of defeating Japan without using the atomic bomb. General Marshall declined, however, to gamble that continued conventional bombing could defeat so determined an enemy and insisted that the atomic bomb

afforded the only possible alternative to invasion. Rather than make an issue of his confidence in the cumulative effect of high-explosive bombs and incendiaries, Arnold deferred to the Army Chief of Staff. Marshall's advice reinforced Stimson's views, the recommendations of the Interim Committee, and Truman's own belief: the atomic bomb should be dropped on a Japanese city in the hope of shocking the enemy into surrender before the invasion, now scheduled for November 1945.

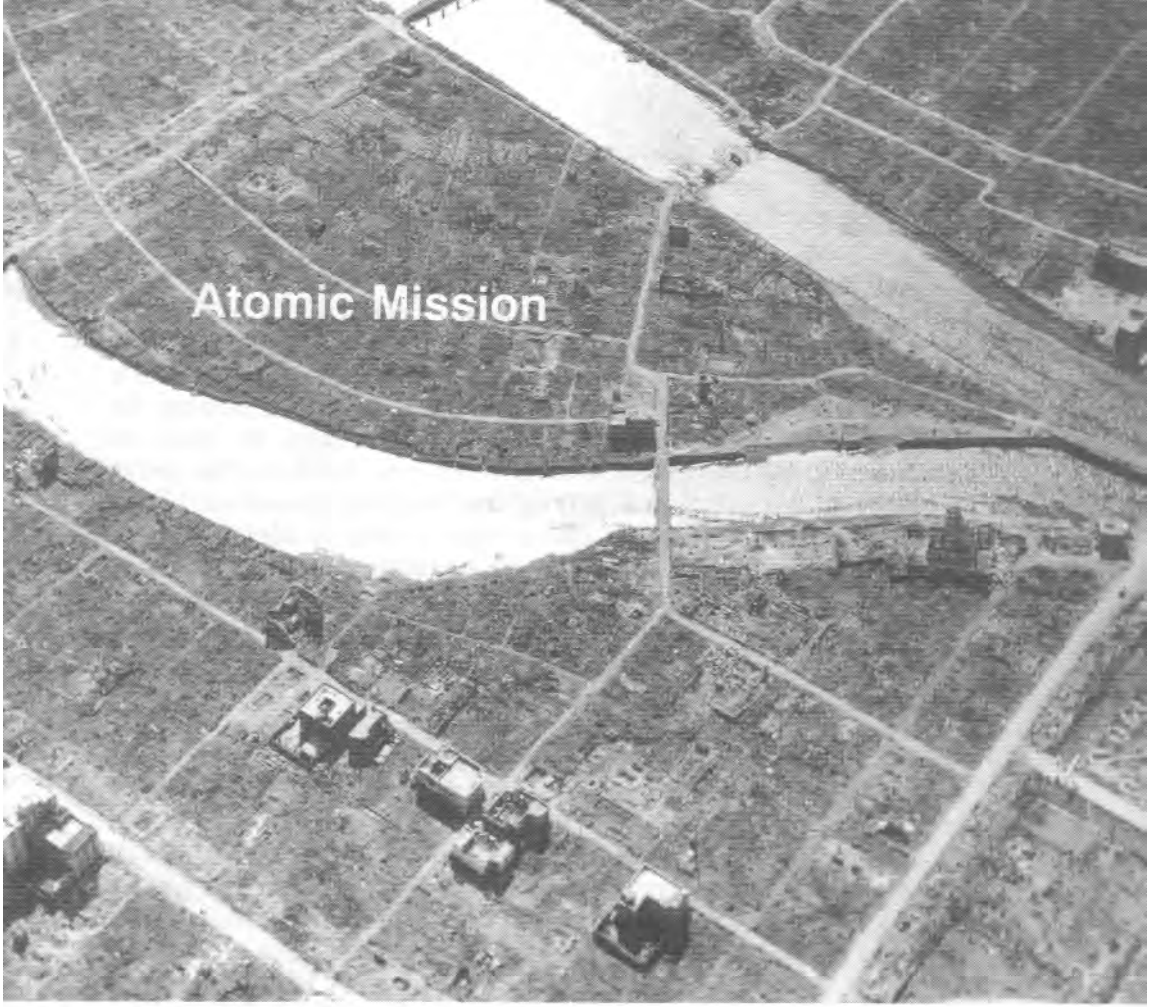
Over Hiroshima on August 6, 1945, the gun-type device, nicknamed *Little Boy*, fell clear of the bomb bay on the *Enola Gay* at 8:15 a.m. local time and detonated seconds later, after Colonel Tibbets had whipped the B-29 through a diving turn. A ball of fire appeared in the sky, and a mushroom cloud of smoke and debris came writhing upward. At the base of the cloud, a combination of blast, fire, and lethal radiation killed at least 70,000 persons, leveling the heart of the city.

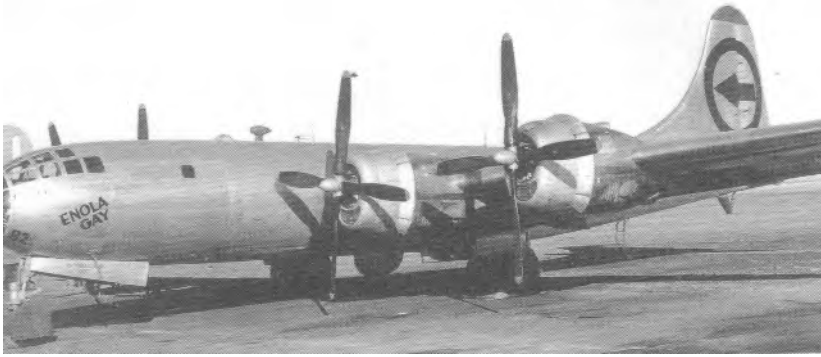
The destruction of Hiroshima did not compel Japan to sue immediately for peace. Describing the nature of the weapon dropped on Hiroshima as unleashing the "force from which the sun draws its power," President Truman warned that Japan faced a "rain of death from the air, the like of which has never been seen on earth." Nevertheless, despite the annihilation of one city and the possible destruction of others, the badly divided Japanese government proved incapable of action. Some of the nation's leaders saw no choice but surrender. Others, although realizing the futility of further resistance, feared that surrender would result in the execution of the emperor, an unacceptable consequence. A small faction advocated fighting to the death as a matter of national honor. Hopes, however faint, that the Soviet Union might mediate on Japan's behalf continued to delude a segment of the leadership. The very paralysis that afflicted the Japanese government at this critical time created an illusion of suicidal determination, which concealed the nation's desperate condition and persuaded the United States to drop its only remaining atomic bomb.

The primary target for the implosion weapon, called *Fat Man*, was Kokura, a steel manufacturing center, which Major Sweeney found obscured by cloud. He therefore turned his borrowed B-29, *Bock's Car*, normally flown by Capt. Frederick C. Bock, toward Nagasaki, the alternate target. At 10:58 a.m. local time on August 9, the bomb exploded at the proper altitude but almost two miles wide of the mark, an error that stemmed from the bombardier's reliance on radar until the clouds suddenly parted, then hurriedly switching to visual aiming. Once again a mushroom cloud marked the devastation of a large city. The nature of the terrain—

Nagasaki lay among hills and ridges, whereas Hiroshima occupied a saucer-like plain—gave some shelter from the blast and helped reduce the number of deaths, though as many as 35,000 perished that morning.

Japan was now reeling. Atomic bombs had destroyed two cities, killing more than a hundred thousand persons. On August 8, Russian forces entered the war and began overwhelming Japanese defenses in Manchuria. Emperor Hirohito realized that Japan's situation was hopeless. Although uncertain of the treatment he would receive at the hands of the victorious Allies, he chose to intervene in the deliberations of government, invoking the moral authority of his office and defying the tradition that made him a spokesman for his ministers rather than a ruler in his own right. "I have given serious thought to the situation prevailing at home and abroad," he told the cabinet, "and have concluded that continuing the war can only mean destruction for the nation and a prolongation of bloodshed and cruelty in the world." Not even the emperor could at a single stroke overcome those officials who, obsessed with notions of honor, tried to foment a mutiny in their determination to avoid the humiliation of surrender. He did prevail, but the maneuvering took time, and, to American eyes, progress toward a cease-fire seemed to stall. As a result, after suspending the air war on August 11, President Truman approved its resumption three days later. Beginning at daylight on August 14, and on into the evening, more than 1,000 Army Air Forces bombers attacked targets in Japan, the last returning to base as President Truman was announcing that hostilities had ended.





Scientists in the **MANHATTAN** Project eventually derived enough fissionable material for four atomic bombs. They still had to resolve many problems of engineering and the ballistic characteristics of the nuclear devices in September 1944, when the Army Air Forces assembled crews to train for a mission that would employ these weapons against an Axis enemy. The specialized crews of the 393th Bombardment Squadron joined a troop carrier squadron to become the 509th Composite Bombardment Group at Wendover Field on the northwestern Utah border in December 1944. The bombardment squadron was the only unit trained for atomic warfare in World War II. The group's commander, taciturn Lt. Col. Paul W. Tibbets, Jr., had one of the most respected combat records in Europe and had been one of Arnold's trouble-shooters in a faltering B-29 program in 1943.

Transferred to Tinian Island in the Marianas in late May 1945, the group flew missions in preparation for the war's last act. On August 6, 1945, Tibbets (*above right*) flew a B-29 named for his mother, shown above arriving on Tinian Island,

to attack the Japanese city of Hiroshima. His aiming point was the city's T-bridge at the right of the aerial photo (*opposite above*). The Hiroshima detonation's mushroom cloud (*opposite, far left*) came to symbolize a new age. Three days later, another atomic bomb struck Nagasaki, whose city center (*opposite, right*) shows the force of the second 20-kiloton blast in an urban setting. The Mitsubishi Steel and Arms Factory (*midpage, left above*) in the city is in ruins after the attack.

The atomic attacks, combined with the cumulative damage from earlier air attack and the strangulation of a naval blockade, precipitated a political crisis in the already reeling Japanese war effort. Its transportation system stalled, and with the shipping lanes in the Inland Sea choked off, Japan had only the advantage of still-adequate food stocks in place and a population willing to fight for the homeland. After a rare imperial intervention in the cabinet's deliberations, Japan capitulated unconditionally on August 14. On September 2, 1945, the formal delegation (*above, midpage*) arrives aboard USS *Missouri* (BB-63) to sign the surrender document.



7

A New Age

In every theater of war and along the transoceanic lifelines that supported the cause against the Axis, the airplane was one of the visible manifestations of allied strength in World War II. An assessment of how this strength, but particularly the heavy bomber, was applied against the enemy was the task of a formal investigating team established during the closing months of the war in Europe. Even before Allied troops had landed in Normandy, Generals Spaatz and Arnold had looked ahead to an analysis of the role that bombing played in the eventual defeat of Germany. They continued to see a direct relationship between the bomber and the future independence of the air arm. Should an unbiased panel conclude that aerial bombardment had proved decisive against Hitler's Reich, the Army's historic fighting doctrine of defeating hostile armies on the battlefield correspondingly would have to yield to a policy of destroying, through air power, an enemy's capacity to make war.

Since the inquiry that Arnold sought would affect future relationships among the armed services, it could not remain solely an Army Air Forces project, but he wanted the Air Forces in control. He therefore proposed that the Joint Chiefs of Staff assign to the Army Air Forces overall responsibility for conducting the investigation, with the Navy, Army Ground Forces, and Army Service Forces "represented in such proportion as deemed advisable for their immediate needs and in order that impartiality be assured." The key to Arnold's plan was the proposal of proportionate representation; as far as the Combined Bomber Offensive was concerned, the Navy had not participated, and its main interest could only be the relationship of aerial bombardment to German submarine warfare. Since the future of his service would not be jeopardized by an investigation of the air war against

Germany, Admiral Ernest J. King, Chief of Naval Operations, readily agreed to Arnold's call for the study. Arnold quietly excluded British participation, possibly because he wanted to avoid debate about day-versus-night bombing or a strategy of attacking industries versus cities that might have detracted from the overall analysis. The Soviet Union routinely denied access by the Survey members to industrial sites occupied by its troops; eastern Europe thus remained out of bounds to the analysts.

The U.S. Strategic Bombing Survey set to work in the spring of 1945, before the surrender of Japan. Under the supervision of Franklin D'Olier, an insurance company executive, a team eventually numbering over a thousand experts examined evidence mainly from American and German sources. The Survey gathered, winnowed, and analyzed information for a study that had two purposes. Its Air Forces sponsors believed it would provide documentation to demonstrate the decisiveness of strategic bombing and thus justify an independent air force within the postwar armed forces, while at the same time yielding data helpful in planning the continuing air war in the Far East.

The close examination of the results of the bomber offensive in Europe produced detailed but narrowly focussed reports on the impact of the bombing on various aspects of German industry. Despite these limitations, the investigation revealed a number of errors in judgment on the part of planners. Too much bomb tonnage was wasted on the all-but-indestructible submarine pens, and too little devoted to crippling the ball-bearing industry. Mistaken, too, was the judgment that airframes rather than engines formed the Achilles' heel of the aircraft industry. The Survey, however, confirmed the importance of the oil offensive, although conceding that the constricting effect on German operations appeared more slowly than anticipated. The investigation pointed out, moreover, that the attacks on the transportation net within Germany had taxed the enemy's ingenuity to the utmost and offset the advantage obtained by dispersing factories.

The assumptions underpinning the bombing were easy to assess once Germany had been defeated. Given the importance of the antisubmarine campaign in the early months of the war and the inability of bombers and escorting fighters to hit shipyards in more distant Germany, the submarine bases in France could not have been ignored. Similarly, when the ball-bearing industry was identified as most vulnerable, the Eighth Air Force lacked the strength to mount continued attacks, and the RAF Bomber Command oriented its attacks on other targets it considered equally important. The defeat of the *Luftwaffe*, more a result of attrition among its fighter pilots than the "dehousing" of aircraft

workers or the leveling of the factories that employed them, facilitated both the oil and transportation offensives. Had the oil offensive begun in the fall of 1943, when bombers were fewer and long-range fighters nonexistent, the results would have been insignificant and the losses among airmen severe. An effective transportation campaign had to await Allied domination of the sky and the advance by the ground forces that brought swarms of fighter-bombers within range of Germany's railroads and canals. Victory might have come earlier, however, if Harris had joined wholeheartedly in a coordinated Anglo-American bomber offensive, attacking the centers of ball-bearing production in 1943, for example, or joining the oil offensive in the spring of 1944 instead of later in the year. Yet, a larger role by Air Marshal Harris in 1943 might conceivably have resulted in his dominating the Combined Bomber Offensive, and this the Americans did not want.

Out of the mountain of evidence came a cautious conclusion, hedged with qualifications. Despite its focus on strategic bombardment, the Survey concluded that "Allied air power"—the combined efforts of Allied tactical and strategic forces—"was decisive in western Europe." Decisiveness, however, was not defined in unequivocal terms. The report did credit the strategic bomber with bringing "to virtual collapse" the industrial underpinning of the German armed forces, but it added that the breakdown of war production occurred after the Normandy invasion so that the "full effect . . . had not reached the enemy's front lines when they were overrun by Allied forces." In short, the analysts tried to evaluate the contributions of air power within the context of a combined air, ground, and naval campaign, concluding that the Army Air Forces had made an essential contribution to victory, though it had not won the war by itself.

By incorporating both tactical and strategic aviation under the overall heading of air power, the Survey acknowledged the impact of the fighter-bombers, medium bombers, and attack aircraft that supported or even cleared the path for the Allied advance. By the hundreds, Allied tactical aircraft had interdicted virtually every line of communication in northwestern France before the invasion; they had completely isolated the battle area before a single troop set foot ashore. German troops could only move by night before and after the Normandy landings. As American troops advanced through the Lorraine region of France they rarely saw "more than a single German plane at a time, although they may have been subjected to a short night bombing or heard a few enemy reconnaissance planes chugging overhead in the darkness." In contrast, German troops had to endure even worse aerial pressure

than the *Luftwaffe* had once imposed on the armies of Poland or France. Air power immobilized and demoralized Germany's soldiers, whether massing for the counterthrust or on the defensive. The mutual relationship between air and ground extended beyond the battlefield itself. The *Luftwaffe* fighter shot down over Berlin could not strafe troops in France, nor could tanks affect the land battle if they sat immobilized on flatcars stopped by a bombed railroad bridge or starved for fuel never produced because bombs had reduced a refinery to rubble. Events thus supported the soundness of the Survey's judgment in treating air power as the sum total of its components.

Although fully aware, as their overall conclusion indicated, of the relationship between tactical and strategic aviation, the analysts who prepared the Survey tended to ignore some of the more unconventional uses of long-range bombers. During attempts to seize a bridgehead across the Rhine in Holland in 1944 and in Germany in 1945, heavy bombers dropped supplies to the airborne forces that had jumped behind German lines in what proved to be a disastrous tactic. In the summer of 1944, General Doolittle diverted bombers from the offensive against German industry to deliver arms and equipment to French partisans, with as many as 180 B-17s taking part in a single drop. Aircraft based in the Mediterranean performed similar work, though on a lesser scale, infiltrating agents and delivering supplies to resistance forces in Italy, Yugoslavia, and Greece.

Air power, the Strategic Bombing Survey revealed, had not lived up to the expectations of airpower proponents like Douhet or Mitchell, who expected that a bolt from the blue would destroy vital industry and render the enemy powerless to resist, even though his army and navy remained intact. In Europe, the air war became a long attritional struggle for control of the skies so that bombers could burn cities and level industries by night and day. Until the summer of 1943, the *Luftwaffe* enjoyed air superiority by night over Germany, but Bomber Command put an end to this mastery when it destroyed Hamburg, using a variety of navigation and bombing aids, new aiming techniques, and a cascade of released aluminum metallic strips that frustrated German radar. The enemy fought back, however, improving fighter tactics and regaining air superiority over the Reich in the spring of 1944. But German dominance could not last; losses of crews and aircraft, a dwindling supply of fuel, and the Allied capture of radar sites along the channel coast shifted the nighttime balance permanently in favor of Bomber Command. The struggle for the skies also took place in daylight. The Americans gained air superiority over Germany early in 1944, benefitting from such technical develop-

ments as the P-51 long-range fighter, from an aircraft industry grown highly efficient by 1943 and untouched by war, and from a training establishment that at peak capacity could turn out more graduates than the Air Forces could absorb. Against this formidable combination, the *Luftwaffe* never regained the mastery of the skies it had exercised in 1943; not even a marvelous jet fighter, the Me 262, could redress the balance of aerial power.

Germany began too late to create the production base necessary to wage war on several fronts simultaneously. The nation's industries performed capably enough when the war was a series of rapid conquests from the Channel coast to the gates of Moscow, but failed, under the pressure of sustained bombing, to meet the demands of a defensive war in which Germany had to disperse its air power to meet danger from many quarters instead of concentrating it for a single campaign. When leaders of the *Luftwaffe* warned of the swelling volume of American aircraft production, Hitler dismissed the figures as mere fantasy. If the numbers were correct, he added, Germany would have to go on the defense in the East and concentrate all resources on air defense. He placed more confidence in so-called vengeance weapons, rockets and flying bombs, which absorbed labor and scarce materials needed for less spectacular weapons.

In short, the Survey recognized that, throughout the fighting in Europe, the Army Air Forces, despite the autonomy that Marshall had given its leaders, had indeed remained a part of the larger Allied war machine. Operationally, Army airmen diverted strategic bombers to support the invasion, the breakout from the beaches, and the Battle of the Bulge. Administratively, too, the Air Forces remained a part of the Army. As the war progressed, the demands of the Army Ground Forces ate into the reserves of manpower for the Air Forces. Allowed for much of the war to receive a disproportionately large share of the draftees with the highest scores on the general classification test, the air arm had to adjust its manpower policy once the War Department realized that it had underestimated the size of the ground forces needed to win the war. Even before the Ardennes counteroffensive resulted in unexpectedly heavy casualties and made the shortage even worse, the Air Forces helped make up the deficit. During 1944, the War Department transferred some 24,000 air cadets, already surplus to the projected needs of the Air Forces, to the Army Ground Forces for retraining as infantrymen and also sent another 6,000 potential pilots or air crewmen to the Service Forces. The Air Forces also exchanged men with the Ground and Service Forces, trading those fit to serve overseas for men qualified for duty only in the United States. The transfers and exchanges accompanied a sharp reduc-

tion in the acceptance of air cadets, which made additional men available for induction into the combat arms of the Army Ground Forces.

Although the Air Forces eventually had an excess of manpower and could help the hard-pressed Ground Forces, the growth that created this surplus nevertheless represented a valuable investment. Until the cross-channel invasion, the airplane was the only weapon that could carry the war to Germany. During these months, air power provided an immediate return in terms of damaging the German war machine, forcing the *Luftwaffe* onto the defensive, and tying down or destroying fighters that otherwise might have strafed Soviet troops, British soldiers in North Africa, or the invading armies that eventually stormed ashore in Normandy. A decision to limit the size of the Army Air Forces earlier in the war might have made additional ground forces available in the United Kingdom, but without the mastery of the skies that overwhelming numbers of aircraft and airmen provided, the troops might have remained in the British Isles long after June 6, 1944. This could have served only as an irritant to the Soviet Union, by immense measure the principal ground combatant in the war against Hitler; troops idle in Britain could have formed no second front in the west to divert more German forces and take pressure off the Red Army on the eastern front. As it turned out, by the time the Anglo-American divisions were powerful enough to pierce the Atlantic Wall, Allied air power had crushed the *Luftwaffe*, giving the invasion flotilla and the forces that fought their way through France and into Germany a freedom from aerial interference undreamed of as late as 1943. The compilers of the Strategic Bombing Survey correctly interpreted the American war against Germany as essentially an indivisible effort; a combination of weapons, techniques for their manufacture and employment, and manpower that ultimately overwhelmed the enemy.

In assessing the aerial effort against Japan, the Survey had something entirely new to contend with. In the final days of the war against Japan a new aerial weapon appeared. The atomic bomb proved so dreadful that it again raised the possibility that air power could alone destroy utterly the foundations of a society. The Strategic Bombing Survey examined the effects of the atomic bomb in the context of strategic bombardment, looking on it as an aerial weapon rather than as a scientific phenomenon. After the first atomic device was exploded at Alamogordo, New Mexico, in July 1945, General Arnold voiced his belief that the new weapon was not necessary to bring Japan to its knees. He preferred the continued application of B-29s to that effort. The success of the

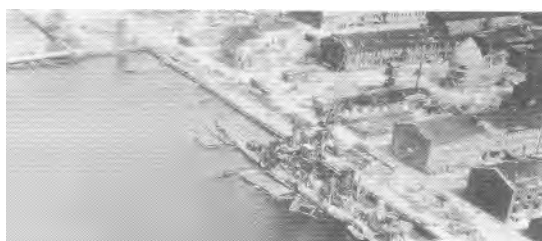
air campaign against Japan was apparent to him, and he hoped it would reveal the best reasons for an independent air arm apart from a super bomb. The bomb had hastened the Japanese decision to surrender, Arnold later wrote in his final report on the war, but conventional air attacks had already reduced the enemy's will to resist and had as their object the defeat of Japan without an invasion.

In dealing with the Pacific war, the Survey encountered an almost predictable conflict between the Air Forces and the Navy. Late in August, President Truman authorized Franklin D'Olier to extend his investigations to conditions surrounding the defeat of Japan. The Survey's Military Analysis Division, under Maj. Gen. Orvil A. Anderson, and the Naval Analysis Division, headed by Rear Adm. Ralph A. Ofstie, a veteran naval aviator, became the centers of contending points of view. Anderson lumped all forms of aviation, land- or carrier-based, Army or Navy, into one general category of air power, which, he insisted, had dominated operations on land and at sea. Ofstie remembered that the independent Royal Air Force had absorbed the control of British carrier aviation after World War I. He stressed the successful role of the aircraft carrier within Navy-controlled task forces in both the great naval battles like Midway and the amphibious conquests in the Pacific that had made it possible to move land-based American bombers within range of Japan. The Air Forces' XXI Bomber Command operated from the Marianas Islands only after marines had wrested control of the mid-ocean bases from the Japanese. The Survey never reconciled the two points of view and published the finished summaries of each division as supporting documents rather than as elements of the final Survey report. The disagreement remained a portent of the debate over a unified defense department in the years to come.

In sidestepping the quarrel between the Army Air Forces and the Navy, D'Olier and the senior directors treated the war against Japan as a unified effort involving the mobilization and application of force in a variety of forms. In the case of the Japanese homeland, however, the investigators mirrored General Arnold's judgment that the atomic bomb had merely propelled the enemy toward an inevitable end, unconditional surrender. According to the Survey, the United States "underestimated the ability of our air attack, coupled as it was with blockade and previous military defeats, to achieve unconditional surrender . . . Having entered the war inadequately prepared, we continued all-out mobilization of all resources to bring ever increasing pressure on Japan beyond the time when this was reasonably required."

The caution of the Strategic Bombing Survey in assessing the

Surveying the Results



When Allied might was firmly in control of liberated France in autumn 1944, General Arnold prevailed upon President Roosevelt to name an investigative commission to undertake an impartial appraisal of American bombing in Europe. The purpose of the U.S. Strategic Bombing Survey, established as a civil-military organization on November 3, 1944, was to derive principles for the continued direction of the air war against Japan. Its findings would inevitably contribute to the postwar role of air power as well. Headquartered in London, the Survey employed many of America's elite eastern-establishment lawyers, economists, and scientists in addition to 350 officers and 500 enlisted men. Data-gathering teams were in action even before the war ended, and several members were killed or injured while combing ruins in Germany for evidence on bombing results. With the war's end in Europe, the Survey carefully measured bombing effect in three defined areas: military operations, a field broadly described as war economy, and civilian concerns, the latter including morale and civil defense. Large combines such as the Krupp Works in Essen (*above*) were examined in detail to determine how resilient industry was under aerial bombardment. The Krupp shipbuilding facility at Kiel (*far left, midpage*) shows the effects of bombardment in a Survey photo taken a week after VE Day in May 1945. The German capital (*left*), a shell after February 1945, was an example of the war's effect on civilian habitation. The inner basin at Wilhelmshaven's harbor shows the sunken cruiser *Köln* at right. Franklin D'Olier (*portrait left*), chairman of the Prudential Insurance Company, presided over the Survey's activities until its dissolution in 1946.



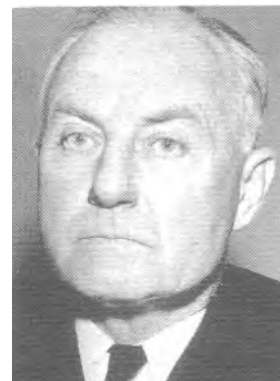
The Survey moved to Japan to carry on work there after that nation's surrender. The different nature of the Pacific war, with its vast water expanses and the need for island bases to sustain aerial striking power, led to different conclusions about the interaction of air and naval power. Much of the destruction in Japan was similar to that found in Europe. An electricity generating station at a synthetic fuel plant in Ube (*right, midpage*) was rendered useless by B-29s. Central Yokohama (*right*) seems devoid of life in September 1945.



In Japan, the Survey members measured the effects of atomic weapons. The impact at the T-bridge aiming point in Hiroshima (*above, left*) is evident in the damage to the concrete structures, to say nothing of the absence of habitation on the city's plain. Behind the Nagasaki streetcar terminal (*above, right*) rises a hill massif that channeled the second atomic burst upward, shielding part of the population and reducing casualties. The Survey noted this phenomenon even as many members found their work increasingly moot. With such a destructive single weapon in being, it seemed useless to measure the role of conventional munitions.



Bitter dispute erupted within the Survey over the contributions of the Air Forces and the U.S. Navy, including naval air, to the Pacific victory. Rear Adm. Ralph A. Ofstie (*bottom, left*) contended against Air Corps Maj. Gen. Orvil Anderson's argument that land-based air power had been "the dominant combat force of the war against Japan . . ." Prefiguring an acerbic postwar debate between the Air Force and the Navy, Anderson's claim bespoke one hard truth: air power had arrived as an indispensable concomitant of warfare.



role of aviation reflected the different character of operations in the Pacific theaters when compared to those in Europe and North Africa. Japan's strategy in the Pacific war was simple. It had relied on the vast distances of the Pacific theaters as a deterrent and the promise of fierce resistance along the outer perimeter of a rapidly conquered empire. This was to dissuade the United States from moving to reverse its gains. Japan had hoped to encourage eventual American acquiescence for the existence of an empire embracing the natural resources necessary for its survival as a military and naval power.

The activities of Allied air power reflected the character of the Pacific war. In the first allied counterthrusts that seized one island after another, Army aviation was more tactical than strategic. In the absence of large industrial complexes across the ocean's expanse, it struck at widely dispersed Japanese garrisons and their supporting airfields. In the Southwest Pacific Area, General Douglas MacArthur's theater command, Maj. Gen. George C. Kenney's Fifth Air Force relied more heavily on medium and light attack bombers in hit-and-run raids against enemy installations. Ground operations in some of the most forbidding terrain in the world centered on battalion-sized units and task forces rather than on the larger corps as had been the case in the fighting in Europe. In some cases entire Army infantry regiments were transported to new positions by air and then resupplied. Airlift and aerial resupply thus became crucial aspects air power contributing to the Allied advance. By the fall of 1944, a senior command, Far Eastern Air Forces, controlled the operations of the Fifth and Thirteenth Air Forces as American forces cleared the Philippine Islands and made ready for the invasion of Okinawa, the last major bastion before the home islands of Japan.

Once American air and amphibious forces breached the Japanese outer perimeter, they could avoid many enemy strongholds, leaving them useless. In the central Pacific, Allied forces advanced in this way to within aerial striking distance of Japan. Here, air operations began to resemble those of the Eighth Air Force over occupied Europe. Heavy bombers devastated a Japanese homeland ill-prepared for such an aerial onslaught. B-29s burned whole cities, in the process razing irreplaceable factories, while attacks on shipping by submarines and aircraft deprived Japan of the raw materials essential for modern war, especially the oil vital to training and combat. In the last stages of the war, B-29s were also heavily mining Japan's estuaries to impede the country's vital shipborne traffic. Whether based on land or aboard ships, whether applied by the Army Air Forces, the Navy, or the Marine Corps, air power had reduced the enemy's aerial and naval strength,

diminished his overall resources, and helped bring him to the brink of surrender.

What the Survey could not specify with certainty was the shape of the postwar world and how it might affect the perception of air power. Five years of global conflict had wrought revolutionary political and technological change across the world. Europe would play only a supporting role thereafter in international politics, the concerns of the former great powers there now subordinate to the agendas of two superpowers, the United States and the Soviet Union. The fundamental differences in the political systems of these two nations and their construction of contending security systems and alliances dominated the political landscape for the half-century after the end of World War II. This struggle for ideological influence flowed into the former colonial areas, which, in gaining independence from former rulers, themselves formed a power bloc referred to as the Third World. In the face of issues in new countries defined along lines of race and human want, sheer military power could often not avail much; the political contest revolved around the appeal of systems of government or the material aid that could mean the difference between continuing a feudal society or evolving into more modern state systems. In all events, means of communication between and among friends, potential enemies, or neutral clients in such a world were essential. One of these was by air.

Among the noticeable changes in the postwar world was the abrupt shrinkage in distances. Signal communication made strides that eventually made nearly any major event instantaneous news for even remote populations; the technological advances in aircraft during World War II made possible the inauguration of intercontinental air travel after the war and the rapid transfer of critical goods over long stretches in emergencies. In one of the more celebrated confrontations of the postwar period between American and Soviet wills, American military air transport lifted enough materiel and foodstuffs to the blockaded western portion of the city of Berlin to sustain its entire population and win recognition of a principle guaranteeing access by western powers to the city, deep within the Soviet zone of occupation in eastern Germany. Continued improvements in navigation, safety, range, comfort, and economy made air transportation accessible and cheap enough to be available to the common man. In the last of the conditions that marked the postwar world, aircraft were, initially, at least, associated with the delivery of the most powerful weapon of all time.

With the detonation of the first atomic test device in July 1945

came the dawn of the nuclear age. Though it promised unlimited peaceful energy, atomic fission made its debut as the principle behind a weapon that underlay the public perception of international relations for the generations since the war. At the close of World War II and for four years thereafter, the United States retained a monopoly on the bomb, and American heavy bombers were the only aircraft then in existence suitable to carry it. This fact alone lent weight to the argument for a separate and independent Air Force that would be the primary strategic weapons carrier in a newly reorganized defense establishment. With the demonstrated capacity of a solitary aircraft to destroy utterly an entire city with one weapon, Douhet's theory of the 1920s had come full circle; a nation's industry, to say nothing of its society, could be devastated by a single bolt from the blue.

Even the ultimate weapon showed its own shortcomings in due time. It was the remote yet convincing force in being behind any American international policy, but its very overwhelming power made it a less than effective instrument in diplomatic exchange over minor issues. Nuclear devices, whose design achieved new sophistication and miniaturization while the manned bomber soon shared a status with intercontinental ballistic missiles as a means of delivery, could not resolve smaller brushfire wars proliferating in the world's gray areas. With the disappearance of the American nuclear monopoly in 1949, the theory of strategic precision bombardment as defined in World War II yielded irrevocably to the concept of deterrence; once each side of a bipolar nuclear balance held enough weapons to obliterate the other, the result was standoff. An uneasy peace prevailed based on the knowledge that any move toward general conflict would invite inevitable destruction at home. War on the scale known in the years 1939 to 1945 had become impossible; the utility of nuclear weapons stockpiles lay in convincing a potential enemy that there was no advantage in using them. The logic of an earlier era had passed and a new, independent United States Air Force evolved from the aerial armada of World War II. In the half century since the war, that service has become a far more complex instrument capable of responding to the demands of its national leadership in a wide range of contingencies anywhere in the world.

Theater Maps

These orthographic projections illustrate the global nature of air operations in World War II. The maps were conceived and executed by Larry A. Bowring, Bowring Cartographics, Arlington, Virginia.

Air Forces Lineages

First Air Force

One of the original four numbered air forces, this organization was constituted as Northeast Air District on October 19, 1940. Activated on December 18, 1940, it was redesignated 1st Air Force on April 9, 1941, and First Air Force on September 18, 1942. On September 17, 1943, it was assigned to the Army Air Forces. It trained new organizations and, later, replacements for combat units. Another of its assigned missions until the end of 1943 was the air defense of the eastern United States.

COMMANDS. I Bomber (later assigned to Second Air Force and redesignated XX Bomber Command): 1941 – 1942. Bomber (Antisubmarine Command prior to assignment to First AF): 1943 – 1946. I Fighter: 1941 – 1946. I Ground Air Support: 1941 – 1942.

STATIONS. Mitchel Field, New York; December 18, 1940; Ft. Slocum, New York, June 3, 1946.

COMMANDERS. Maj. Gen. James E. Chaney, December 18, 1940; Brig. Gen. Arnold N. Krogstad, May 15, 1941 (temporary); Maj. Gen. Herbert A. Dargue, June 24, 1941; Brig. Gen. Arnold N. Krogstad, December 10, 1941; Brig. Gen. John K. Cannon, March 4, 1942 (temporary) Maj. Gen. Follett Bradley, March 5, 1942; Maj. Gen. James E. Chaney, July 23, 1942; Maj. Gen. Ralph Royce, April 18, 1943; Brig. Gen. Westside T. Larson (temporary); Brig. Gen. Glenn O. Barcus, September 10, 1943 (temporary); Maj. Gen. Frank O'D. Hunter, September 17, 1943 – end.

CAMPAIGNS. American Theater.

DECORATIONS. None.

INSIGNE. A white star charged with a red disc in the center and with golden orange stylized wings below the Arabic number "1" in white, all on a blue disc. (Approved January 18, 1944.)

Second Air Force

The Second Air Force was first constituted as the Northwest Air District on October 19, 1940. Activated on December 18, 1940, as an element of the Central Defence Command, U.S. Army, it was designated the 2d Air Force on April 9, 1941, and redesignated Second Air Force on September 18, 1942, when it was an element of the Western Defense Command. It served as both an air defense and as an organization for training units and replacements for heavy and, later, very heavy bombardment operations.

COMMANDS. II Air Support: 1941 – 1943. II Bomber: 1941-1943. II

Fighter: 1941 – 1942. IV Air Support: 1942 – 1943. XX (formerly I) Bomber: 1943. XX Bomber (constituted November 1943): 1943-1944. XXI Bomber: 1944. XXII Bomber: 1944 – 1945.

STATIONS. McChord Field, Washington, December 18, 1940; Ft. George Wright, Washington, January 9, 1941; Colorado Springs, Colorado, June 1943 – March 30, 1946.

COMMANDERS. Maj. Gen. John F. Curry, December 18, 1940; Maj. Gen. Millard F. Harmon, August 5, 1941; Brig. Gen. John B. Brooks, December 19, 1941 (temporary); Brig. Gen. Carlyle Wash, January 28, 1942 (temporary); Maj. Gen. Frederick L. Martin, February 1, 1942; Maj. Gen. Robert Olds, May 14, 1942; Maj. Gen. Davenport Johnson, February 25, 1943; Maj. Gen. Eugene L. Eubank, July 23, 1943 (temporary); Maj. Gen. St. Clair Streett, September 9, 1943; Maj. Gen. Uzal G. Ent, January 15, 1944; Maj. Gen. Robert B. Williams, October 28, 1944 – end.

CAMPAIGNS. American Theater.

DECORATIONS. None.

INSIGNE. On a blue square, a golden orange falcon with jesses in striking attitude below a white star bearing a red disc. (Approved December 16, 1943.)

Third Air Force

The Third Air Force was originally constituted as the Southeast Air District on October 19, 1940. Activated on December 18, 1940, it was assigned to the Southern Air Command, designated the 3d Air Force on April 9, 1941, and redesignated Third Air Force on September 18, 1942. The organization carried out air defense duties during 1940 and 1941 and engaged in antisubmarine activities from December 1941 to October 1942. It was assigned to the Army Air Forces in September 1943, and continued training units, crews, and individuals for bombardment, fighter, and reconnaissance operations.

COMMANDS. II Air Support: 1943; III Air Support: 1941 – 1942. III Bomber: 1941 – 1946. III Fighter: 1941 – 1946. III Reconnaissance (formerly I Ground Air Support): 1942 – 1946. III Tactical Air: 1942 – 1945

STATIONS. MacDill Field, Florida, December 18, 1940; Tampa, Florida, January 1941; Greenville AAB, South Carolina, March 21 - November 1, 1946.

COMMANDERS. Maj. Gen. Barton K. Yount, December 18, 1940; Maj.

Gen. Lewis H. Brereton, July 29, 1941; Maj. Gen. Walter H. Frank, October 6, 1941; Brig. Gen. Carlyle H. Wash, June 25 – November 26, 1942; Brig. Gen. Adlai H. Gilkeson, December 1, 1942; Maj. Gen. St. Clair Streett, December 12, 1942; Maj. Gen. Westside T. Larson, September 11, 1943; Brig. Gen. Edmund C. Lynch, May 14, 1945; Brig. Gen. Thomas W. Blackburn, May 26, 1945; Lt. Gen. Lewis H. Brereton, July 1, 1945 – end.

CAMPAIGNS. Antisubmarine, American Theater.

DECORATIONS. None.

INSIGNE. On and over a blue disc within a yellow border an Arabic numeral "3" in white, in bend sinister, shaded in red perspective with a white star charged with a red disc in the lower loop. (Approved September 1, 1943)

Fourth Air Force

Fourth Air Force, originally constituted as Southwest Air District on October 19, 1940, was activated on December 18, 1940, as part of the General Headquarters Air Force and was subsequently subordinate to the Western Defense Command. It was designated 4th Air Force on April 9, 1941, and redesignated Fourth Air Force on September 18, 1941. This organization provided air defense for the western US until 1943, and at the same time trained new air combat organizations. Later in the war, Fourth Air Force was engaged primarily in training replacements for combat units.

COMMANDS. IV Bomber: 1941 – 1944. IV Fighter: 1941-1944. IV Ground Air Support: 1941 – 1942.

STATIONS. March Field, California, December 18, 1940; Riverside, California, January 16, 1941; Hamilton Field, California, December 7, 1941; San Francisco, California, January 5, 1942 – end.

COMMANDERS. Maj. Gen. Jacob E. Fickel, December 18, 1940; Maj. Gen. George C. Kenney, April 2, 1942; Maj. Gen. Barney McK. Giles, July 22, 1942; Maj. Gen. William E. Kepner, March 18, 1943; Maj. Gen. William E. Lynd, July 8, 1943; Maj. Gen. James E. Parker, July 14, 1944; Brig. Gen. Auby C. Strickland, January 3, 1945; Maj. Gen. James E. Parker, January 25, 1945; Brig. Gen. Edward M. Morris, May 19, 1945; Maj. Gen. Willis H. Hale, July 6, 1945 – end.

CAMPAIGNS. American Theater.

DECORATIONS. None.

INSIGNE. Shield: Azure, a white star, charged with a red disc, all within

a white winged amulet upheld by four golden yellow rays, radiating from base point, all within a border of the last. (Approved September 1, 1943.)

Fifth Air Force

One of the few numbered air forces that never served on American soil, the Fifth was constituted as Philippine Department Air Force on August 16, 1941. It was activated in the Philippines on September 20, 1941, and redesignated Far East Air Force on October 28, 1941, as 5th Air Force on February 5, 1942, and finally as Fifth Air Force on September 18, 1942. This air force lost most of its men and equipment in the defense of the Philippines after December 7, 1941. Later in December 1941 headquarters and some crews and planes moved to Australia, and in January 1942 they were sent to Java to help delay Japanese advances in the Netherlands Indies. The Fifth did not function as an air force for some time after February 1942 (the AAF organizations in the Southwest Pacific being under the control of American-British-Dutch- Australian Command and later Allied Air Forces). Headquarters was remanned in September 1942 and assumed control of AAF organizations in Australia and New Guinea. The Fifth participated in operations that stopped the Japanese drive in Papua, recovered New Guinea, neutralized islands in the Bismarck Archipelago and the Netherlands East Indies, and liberated the Philippines. When the war ended in August 1945 elements of the Fifth were moving to the Ryukyu Islands for the invasion of Japan.

COMMANDS. V Bomber: 1941 – 1946. V Fighter: 1942 – 1946.

STATIONS. Nichols Field, Luzon, September 20, 1941; Darwin, Australia, December 1941; Java, January - February 1942; Brisbane, Australia, September 3, 1942; Nadzab, New Guinea, June 15, 1944; Owi, Schouten Islands, August 10, 1944; Leyte, c. November 20, 1944; Mindoro, January 1945; Clark Field, Luzon, April 1945; Okinawa, July 1945; Irumagawa, Japan, c. September 25, 1945 – end.

COMMANDERS. Brig. Gen. Henry B. Clagett, September 20, 1941; Maj. Gen. Lewis H. Brereton, October 7, 1941 – February 23, 1942; Lt. Gen. George C. Kenney, September 3, 1942; Lt. Gen. Ennis C. Whitehead, June 15, 1944 – end.

CAMPAIGNS. World War II: Philippine Islands; East Indies; Air Offensive, Japan; China Defensive; Papua; New Guinea; Northern Solomons; Bismarck Archipelago; Western Pacific; Leyte; Luzon; Southern Philippines; China Offensive.

DECORATIONS. Distinguished Unit Citations: Philippine Islands,

December 8 – 22, 1941; Philippine Islands, 7 December 1941 – May 10, 1942; Papua, [September] 1942 – January 23, 1943. Philippine Presidential Unit Citation.

INSIGNE. On an ultramarine blue disc, the Southern Cross consisting of five stars - in white between a flaming comet, the head consisting of a white five pointed star, charged with a red roundel, within a blue disc outlined in white, its tail consisting of three white streamers; all surmounted by an Arabic numeral "5," golden orange. (Approved March 25, 1943.)

Sixth Air Force

On October 19, 1940, the predecessor command to the Sixth Air Force was first constituted as Panama Canal Air Force, which was activated in the Canal Zone on November 20, 1940. It was redesignated the Caribbean Air Force on August 5, 1941, as 6th Air Force on February 5, 1942, and as Sixth Air Force on September 18, 1942. It served primarily in defense of the Panama Canal and also engaged in antisubmarine operations.

COMMANDS. VI Bomber: 1941 – 1946. VI Fighter: 1941 – 1942. XXVI Fighter: 1942 – 1946. XXXVI Fighter: 1942.

STATIONS. Albrook Field, Canal Zone, November 20, 1940 – end.

COMMANDERS. Maj. Gen. Frank M. Andrews, December 6, 1940; Maj. Gen. Davenport Johnson, September 19, 1941; Maj. Gen. Hubert R. Harmon, November 23, 1942; Brig. Gen. Ralph H. Wooten, November 8, 1943; Brig. Gen. Edgar P. Sorensen, May 16, 1944; Maj. Gen. William O. Butler, September 21, 1944; Brig. Gen. Earl H. De Ford, July 24, 1945 – end.

CAMPAIGNS. Antisubmarine, American Theater.

DECORATIONS. None.

INSIGNE. On a blue hexagon, a white star charged with a red disc partially over a pair of golden orange wings below a galleon in full sail, golden orange. (Approved July 16, 1943.)

Seventh Air Force

Seventh Air Force was constituted as the Hawaiian Air Force on October 19, 1940, and activated in Hawaii on November 1, 1940. It was

redesignated 7th Air Force on February 5, 1942, and as Seventh Air Force on September 18, 1942. It provided air defense for the Hawaiian Islands and, after mid-1943, served in combat in the central and western Pacific areas.

COMMANDS. VII Bomber: 1942 – 1946. VII Fighter: 1942 – 1945.

STATIONS. Ft. Shafter, Territory of Hawaii, November 1, 1940; Hickam Field, Territory of Hawaii, c. July 12, 1941; Saipan, December 13, 1944; Okinawa, July 14, 1945 – end.

COMMANDERS. Maj. Gen. Frederick L. Martin, November 2, 1940; Maj. Gen. Clarence L. Tinker, December 18, 1941; Brig. Gen. Howard C. Davidson, June 9, 1942; Maj. Gen. Willis H. Hale, June 20, 1942; Maj. Gen. Robert W. Douglass Jr., April 15, 1944; Maj. Gen. Thomas D. White, June 23, 1945 – end.

CAMPAIGNS. Central Pacific; Air Offensive, Japan; Eastern Mandates; Western Pacific; Ryukyus; China Offensive.

DECORATIONS. None.

INSIGNE. On a blue disc a golden orange arabic numeral "7" enfiled in base by a white five-pointed star charged with a red disc, in perspective, all within a golden orange border. (Approved May 21, 1943.)

Eighth Air Force

Eighth Air Force began its lineal existence when it was constituted as VIII Bomber Command on January 19, 1942. It was activated in the United States on February 1, 1942. An advanced detachment was established in England on February 23 and units began arriving from the United States during the spring of 1942. The command conducted the heavy bombardment operations of Eighth Air Force (see also US Strategic Air Forces in Europe) from August 17, 1942, until early in 1944. Redesignated Eighth Air Force on February 22, 1944. Afterward, engaged primarily in bombardment of strategic targets in Europe. Transferred, without personnel, equipment, and combat elements, to Okinawa on July 16, 1945. Although some personnel and combat units were assigned before V-J Day, the Eighth did not participate in combat against Japan.

COMPONENTS. 1st Bombardment Wing: 1942 – 1943. 2d Bombardment Wing: 1942 – 1943. 3d Bombardment Wing: 1942 – 1943. 4th Bombardment Wing: 1942 – 1943. 12th Bombardment Wing: 1942 – 1944. 301st Fighter Wing: 1945 – 1946. 316th Bombardment Wing: 1945 – 1946. 1st Air Division: 1943 – 1945. 2d Air Division: 1943-1945. 3d Air Division: 1943 – 1945. VIII Fighter Command: 1944 – 1945.

STATIONS. Langley Field, Virginia, February 1, 1942; Savannah AAF, Georgia, c. February 1, 1942; Daws Hill, England, February 23, 1942; High Wycombe, England, May 15, 1942 – July 16, 1945; Okinawa, July 16, 1945 – end.

COMMANDERS. Maj. Gen. Ira C. Eaker, February 23, 1942; Brig. Gen. Newton Longfellow, December 2, 1942; Maj. Gen. Frederick L. Anderson, July 1, 1943; Lt. Gen. James H. Doolittle, January 6, 1944; Maj. Gen. William E. Kepner, May 10, 1945; Maj. Gen. Westside T. Larson, June 21, 1945; Lt. Gen. James H. Doolittle, July 19, 1945; Maj. Gen. Earle E. Partridge, September 12, 1945.

CAMPAIGNS. Air Offensive, Europe; Normandy; Northern France; Rhineland; Ardennes-Alsace; Central Europe; Asiatic-Pacific Theater.

DECORATIONS. None.

INSIGNE. Azure, in the lower lobe of the winged Arabic numeral "8" or amulet throughout argent charged with a torteaux. (Approved May 20, 1943.)

Ninth Air Force

Ninth Air Force derived from an element constituted as V Air Support Command on August 21, 1941. It was activated on September 2, 1941, as part of the Air Combat Command, was redesignated 9th Air Force on April 9, 1942, and redesignated finally as Ninth Air Force on September 18, 1942. The organization moved to Egypt to begin operations on November 12, 1942, participating in the Allied drive across Egypt and Libya, the campaign in Tunisia, and the invasions of Sicily and Italy. Transferring to England on October 16, 1943, it became the tactical air force for the invasion of the Continent. It helped isolate battlefield in preparation for the Allied assault on Normandy, supported operations on the beaches in June 1944, and took part in the drive that carried the Allies across France and culminated in victory over Germany in May 1945.

COMPONENTS. 9th Air Division (formerly IX Bomber Command): 1942 – 1945. IX Air Defense Command: 1944 – 1945. IX Fighter Command: 1942 – 1945. IX Tactical Air Command: 1943 – 1945. IX Troop Carrier Command: 1943 – 1944. XIX Tactical Air Command: 1944 – 1945. XXIX Tactical Air Command: 1945.

STATIONS. Bowman Field, Kentucky, September 1, 1941; New Orleans AAB, Louisiana, January 24, 1942; Bolling Field, District of Columbia, July 22 - October 1942; Egypt, November 12, 1942 – October 1943;

England, October 16, 1943 - September 1944; France, September 15, 1944; Germany, June 6 - end.

COMMANDERS. Brig. Gen. Junius W. Jones, September 1941; Col. Rosenham Beam, 1942; Lt. Gen. Lewis H. Brereton, November 12, 1942; Lt. Gen. Hoyt S. Vandenburg, August 8, 1944; Maj. Gen. Otto P. Weyland, May 23, 1945; Maj. Gen. William E. Kepner, August 4, 1945 - end.

CAMPAIGNS. Air Combat, EAME Theater; Egypt - Libya; Air Offensive, Europe; Tunisia: Sicily; Naples-Foggia; Normandy; Northern France; Rhineland; Ardennes - Alsace; Central Europe.

DECORATIONS. None.

INSIGNE. Shield: Azure, a bezant winged argent charged with the Arabic numeral "9" gules, in honor point a mullet of the second bearing a torteau. (Approved September 16, 1943.)

Tenth Air Force

Tenth Air Force was constituted on February 4, 1942, and activated on February 12 as an element of the Air Combat Command. It moved to India on March 5, 1942, and served in the India-Burma Theater and in China until March 1943 when Fourteenth Air Force was activated in China. Then the Tenth operated in India and Burma until it moved to China late in July 1945, where it remained until the end of the conflict.

CAMPAIGNS. Burma, 1942; India-Burma; China Defensive; Central Burma; China Offensive.

COMPONENTS. 3d Combat Cargo: 1944 - 1945. 7th Bombardment: 1942 - 1945. 12th Bombardment: 1944 - 1945. 33d Fighter: 1944 - 1945. 80th Fighter: 1943 - 1945. 311th Fighter: 1943 - 1944. 341st Bombardment: 1942 - 1944. 443d Troop Carrier: 1944 - 1945

STATIONS. Patterson Field, Ohio, February 12 - March 8, 1942; New Delhi, India, May 16, 1942; Myitkyina, Burma, November 2, 1944; Piardoba, India, May 15, 1945; Kunming, China, 1 August 1945; Liuchow, China, August 9 - end.

COMMANDERS. Col. Harry A. Halverson, February 17, 1942; Maj. Gen. Lewis H. Brereton, March 5, 1942; Brig. Gen. Earl L. Naiden, June 26, 1942; Maj. Gen. Clayton L. Bissell, August 18, 1942; Maj. Gen. Howard C. Davidson, August 19, 1943; Brig. Gen. Adlai H. Gilkeson, September 14, 1944; Maj. Gen. Howard C. Davidson, October 11, 1944; Maj. Gen. Albert Hegenberger, August 1, 1945 - end

DECORATIONS. None.

INSIGNE. On an ultramarine blue disc, a white shield in base, winged golden orange, the shield bearing the Arabic numeral "10" ultramarine blue, all below a white five pointed star charged with a red disc, encircled by a white amulet. (Approved January 25, 1944)

Eleventh Air Force

The Eleventh Air Force originated when the Alaskan Air Force was constituted on December 28, 1941, and activated in Alaska on January 15, 1942. It was redesignated 11th Air Force on February 5, 1942, and as Eleventh Air Force on September 18, 1942. It participated in the offensive that drove the Japanese from the Aleutians, attacked the enemy in the Kurile Islands, and served as part of the defense force for Alaska.

COMMANDS. XI Bomber: 1943 – 1944. XI Fighter: 1942 – 1944.

STATIONS. Elmendorf Field, Alaska, January 15, 1942; Adak, August 10, 1943 – end.

COMMANDERS. Lt. Col. Everett S. Davis, January 15, 1942; Col. Lionel H. Dunlap, February 17, 1942; Maj. Gen. William O. Butler, March 8, 1942; Maj. Gen. Davenport Johnson, September 13, 1943; Brig. Gen. Isaiah Davies, May 4, 1945; Maj. Gen. John B. Brooks, June 22, 1945 – end.

CAMPAIGNS. Air Offensive, Japan; Aleutian Islands.

DECORATIONS. None.

INSIGNE. On an ultramarine blue shield, a red Arabic numeral "11" outlined in white, above a winged white star, bend sinisterwise, with a red disc in the center, wing golden yellow. (Approved August 13, 1943.)

Twelfth Air Force

Twelfth Air Force was constituted on August 20, 1942, and activated the same day. It moved to England on September 12, 1942, and then to North Africa for the invasion of Algeria and French Morocco on November 9, 1942. The Twelfth operated in the Mediterranean theater until the end of the war, serving with Northwest African Air Forces from February to December 1943, and afterward with Mediterranean Allied Air Forces.

COMMANDS. XII Bomber: 1942 – 1944; XII Tactical Air: 1942 – 1944;

XXII Tactical Air (formerly XII Fighter): 1942 – 1945.

STATIONS. Bolling Field, District of Columbia, August 20 – 28, 1942; England, September 12 – October 22, 1942; Algeria, November 9, 1942; Tunisia, August 10, 1943; Italy, December 5, 1943 – August 31, 1945.

COMMANDERS. Lt. Col. Roger T. Browne, August 26, 1942; Lt. Col. Harold L. Neely, August 28, 1942; Maj. Gen. James H. Doolittle, September 23, 1942; Lt. Gen. Carl A. Spaatz, March 1, 1943; Lt. Gen. John K. Cannon, December 21, 1943; Maj. Gen. Benjamin W. Chidlaw, April 2, 1945; Brig. Gen. Charles T. Myers, May 26 – August 31, 1945.

CAMPAIGNS. Air Combat, EAME Theater; Algeria-French Morocco; Tunisia; Sicily; Naples - Foggia; Anzio; Rome - Arno; Southern France; North Apennines; Po Valley.

DECORATIONS. None.

INSIGNE. On an ultramarine blue equilateral triangle one point down, a white star with a red disc in the center thereof bearing the numeral "12" in white, below a pair of stylized golden orange wings. (approved December 1, 1943.)

Thirteenth Air Force

The Thirteenth Air Force was constituted on December 14, 1942, and activated on New Caledonia on January 13, 1943. It served in the South Pacific and, later, Southwest Pacific, participating in the Allied drive north and west from the Solomons to the Philippines. It remained in the Philippines as part of Far East Air Forces.

COMMANDS. XIII Bomber: 1943 – 1946. XIII Fighter: 1943 – 1946.

STATIONS. New Caledonia, January 13, 1943; Espiritu Santo, January 21, 1943; Guadalcanal, January 13, 1944; Los Negros, June 15, 1944; Hollandia, New Guinea, September 13, 1944; Noemfoor, September 23, 1944; Morotai, October 29, 1944; Leyte, March 1, 1945.

COMMANDERS. Maj. Gen. Nathan F. Twining, January 13, 1943; Brig. Gen. Ray L. Lowens, July 27, 1943; Maj. Gen. Hubert R. Harmon, January 7, 1944; Brig. Gen. George L. Usher, June 6, 1944 (temporary); Maj. Gen. St. Clair Streett, June 15, 1944; Maj. Gen. Paul B. Wurtsmith, February 19, 1945 – end.

CAMPAIGNS. China Defensive; Guadalcanal; New Guinea; Northern Solomons; Eastern Mandates; Bismarck Archipelago; Western Pacific; Leyte; Luzon; Southern Philippines; China Offensive.

DECORATIONS. Philippine Presidential Unit Citation.

INSIGNE. On a blue disc, bordered golden orange, a pair of golden orange wings surmounted in base by a white star charged with a red disc; all below the Arabic numeral "13" in white. (Approved January 18, 1944.)

Fourteenth Air Force

Fourteenth Air Force was constituted on March 5, 1943, and activated in China on March 10. It served in combat against the Japanese, operating primarily in China, until the end of the war.

WINGS. 68th Composite: 1943 – 1945. 69th Composite: 1943 – 1945. 312th Fighter: 1944 – 1945.

STATIONS. Kunming; China, March 10, 1943; Peishiyi, China, August 7 – December 15, 1945.

COMMANDERS. Maj. Gen. Claire L. Chennault, March 10, 1943; Maj. Gen. Charles B. Stone III, August 10, 1945 – end.

CAMPAIGNS. India-Burma; China Defensive; China Offensive.

DECORATIONS. None.

INSIGNE. On a blue disc, a winged Bengal tiger golden orange with black and white markings, below and partially covering a white star charged with a red disc.(Approved August 6, 1943.)

Fifteenth Air Force

The Fifteenth Air Force was constituted on October 30, 1943, and activated in the Mediterranean Theater on November 1, 1943. It began operations on November 2 and engaged primarily in strategic bombardment of targets in Italy, France, Germany, Poland, Czechoslovakia, Austria, Hungary, and the Balkans until the end of the war.

WINGS. 5th Bombardment: 1943 – 1945. 42d Bombardment: 1943. 47th Bombardment: 1944 – 1945. 49th Bombardment: 1944 – 1945. 55th Bombardment: 1944 – 1945, 304h Bombardment: 1943 – 1945. 305th Bombardment: 1943 – 1945. 306th Fighter: 1944 – 1945. 307th Bombardment: 1944

STATIONS. Tunis, Tunisia, November 1, 1943; Bari, Italy, December 1, 1943 – September 15, 1945.

COMMANDERS. Maj. Gen. James H. Doolittle, November 1, 1943; Maj.

Gen. Nathan F. Twining, January 3, 1944; Brig. Gen. James A. Mollison, May 26, 1945; Brig. Gen. William L. Lee, August 3, 1945; Col. Elmer J. Rogers Jr, August 31 – September 15, 1945.

CAMPAIGNS. Air Combat, EAME Theater; Air Offensive, Europe; Naples - Foggia; Anzio; Rome - Arno; Normandy; Northern France; Southern France; North Apennines; Rhineland; Central Europe; Po Valley.

DECORATIONS. None.

INSIGNE. On a blue disc a white star charged with a red disc in the center and with golden orange stylized wings below a golden orange Arabic numeral "15," all within a golden orange amulet. (Approved February 19, 1944.)

Twentieth Air Force

The Twentieth Air Force was constituted on April 4, 1944, and activated the same day in Washington, D.C., as an element of the Army Air Forces. Though operating from bases around the Pacific Ocean, the organization remained under the direct control of the commanding general of the Army Air Forces through the summer of 1945. Some combat elements moved from the United States to India in the summer of 1944, where they carried out very heavy bombardment operations against targets in Japan, Formosa, Thailand, and Burma. Other combat elements began moving late in 1944 from the United States to the Marianas, being joined there early in 1945 by the elements that had been in India. Headquarters, which had remained in the United States, was transferred to Guam in July 1945. From the Marianas the Twentieth conducted a strategic air offensive that reached a climax with attacks using the world's first atomic weapons against two Japanese cities.

COMMANDS. VII Fighter: 1945. XX Bomber: 1944 – 1945. XXI Bomber: 1944 – 1945

STATIONS. Washington, District of Columbia, April 4, 1944; Harmon Field, Guam, July 16, 1945 – end.

COMMANDERS. General of the Army Henry H. Arnold, April 6, 1944; Maj. Gen. Curtis E. LeMay, July 16, 1945; Lt. Gen. Nathan F. Twining, August 2, 1945 – end.

CAMPAIGNS. World War II: American Theater; India-Burma; Air Offensive, Japan; China Defensive; Eastern Mandates; Western Pacific; Central Burma.

DECORATIONS. None.

INSIGNE. A disc of ultramarine blue marked with white parallels of latitude and meridians of longitude surmounted in base by a white star charged at center with a red disc and circumscribed by an amulet golden orange lined blue, tips enclosing the Arabic numeral "20". (Approved May 26, 1944.)

U.S. Strategic Air Forces in Europe (originally Eighth Air Force)

This command was originally constituted as the Eighth Air Force on January 19, 1942, and activated on January 28. It moved to England, May – June 1942 and engaged primarily in bombardment of targets in Europe. Redesignated U.S. Strategic Air Forces in Europe February 22, 1944, the former element of the Eighth coordinated the activities of Army Air Forces in the EAME Theater, exercising some operational control over both Eighth Air Force (originally VIII Bomber Command) and Fifteenth Air Force with some administrative control over the Eighth and Ninth Air Forces. The organization was redesignated United States Air Forces in Europe in August 1945.

COMMANDS. VIII Air Support: 1942 – 1943. VIII Bomber: 1942 – 1944. VIII Fighter: 1942 – 1944

STATIONS. Savannah AB, Georgia, January 28 – c. May 20, 1942; London, England, June 18, 1942; Bushy Park, England, June 25, 1942; St. Germain-en-Laye, France, September 26, 1944.

COMMANDERS. Brig. Gen. Asa N. Duncan, January 28, 1942; Maj. Gen. Carl A. Spaatz, May 5, 1942; Lt. Gen. Ira C. Eaker, December 1, 1942; General Carl A. Spaatz, January 6, 1944; Lt. Gen. John K. Cannon, June 3, 1945; General Carl A. Spaatz, June 13, 1945; Lt. Gen. John K. Cannon, July 4, 1945 – end.

CAMPAIGNS. Air Combat, EAME Theater; Air Offensive, Europe; Normandy; Northern France; Rhineland; Ardennes-Alsace; Central Europe.

DECORATIONS. None.

INSIGNE. Upon a shield argent charged with letters USSTAF gules, a chief azure charged with a pair of wings displayed or between three mullets one and two of the first in fess point a large mullet of the field that portion on shield fimbriated of the third charged with a torteau. (Approved December 21, 1944.)

Far East Air Forces

Far East Air Forces was constituted as a provisional command on July 31, 1944, and reconstituted as a regular unit and activated on August 3, 1944, to control the operations of Fifth and Thirteenth Air Forces.

COMMANDS. Fifth Air Force, July 31, 1944 – end; Thirteenth Air Force: July 31, 1944 – end.

STATIONS. Brisbane, Australia, August 5, 1944; Hollandia, New Guinea, September 16, 1944; Fort McKinley, Philippine Islands, March 20, 1945

COMMANDERS. Lt. Gen. George C. Kenney, July 31, 1944 – end.

CAMPAIGNS. None.

DECORATIONS. None.

INSIGNE. On a dark blue diamond-shaped background with rounded corners three and a half inches in width and three inches in height, a pair of golden orange wings attached to a white star thirteen sixteenths of an inch in diameter charged in the center with a red disk a quarter inch in diameter, the whole below a golden orange Philippine Sun and above five white stars arranged in the form of the Southern Cross.

Continental Air Forces

The Continental Air Forces was constituted on December 13, 1944, and activated on December 15 as an element to control the activities of all the numbered air forces that remained in the United States during the war.

COMMANDS. First Air Force, December 13, 1944 – end; Second Air Force, December 13, 1944 – end; Third Air Force, December 13, 1944 – end; Fourth Air Force, December 13, 1944 – end.

STATIONS. Washington, DC, December 13, 1944 – end.

COMMANDERS. Brig. Gen. E. H. Beene, December 15, 1944; Maj. Gen. St. Clair Streett, March 1, 1945; General Henry H. Arnold, July 1, 1945 – end.

CAMPAIGNS. None.

DECORATIONS. None.

INSIGNE. None.

Selected Readings

This account of U.S. Army Air Forces operations in World War II is based on numerous published, unpublished, and archival resources. The paper and film record of military aviation in the war is in the custody of such larger repositories as the National Archives and Records Administration in Washington, DC, and the U.S. Air Force Historical Research Agency, Maxwell Air Force Base, Montgomery, Alabama. The National Air and Space Museum of the Smithsonian Institution, Washington, DC, also has an extensive archive and library of information on aviation in the war and the largest single collection of photographic images from the conflict.

The literature recommended below is a selection for general readers and is intended as an introduction to the subject. A complete listing of English-language books alone on World War II would fill several volumes. Each book mentioned usually contains citations of additional material for those interested in pursuing any subject in greater detail. Included are some of the more noteworthy titles dealing with operations, logistics and supply, strategy, intelligence, social issues, technological developments, and aircraft identification. The list is divided into sections listing official volumes and commercially published books separately.

Official Publications

Department of the Air Force

The standard official history of U.S. Army air operations in World War II remains the seven-volume series edited by Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, first published by the University of Chicago Press from 1947 to 1958. The entire series was reprinted by the Office of Air Force History, Washington, DC, in 1983. Other official histories and reprinted titles dealing with the war published by the Air Force include:

- Arakaki, Leatrice R., and John R. Kuborn. *7 December 1941: The Air Force Story*, Hickam Air Force Base, Hawaii: Pacific Air Forces Office of History, 1991.
- Carter, Kit C., and Robert Mueller. *The Army Air Forces in World War II: Combat Chronology, 1941 – 1945*, Washington: Albert F. Simpson Historical Research Center and the Office of Air Force History, reprinted 1991.
- Davis, Richard G. *Carl A. Spaatz and the Air War in Europe*, Washington: Center for Air Force History, 1993.
- Douhet, Giulio. *The Command of the Air*, translated by Dino Ferrari, reprint, Washington: Office of Air Force History, 1991.
- Frisbee, John L., ed. *Makers of the United States Air Force*, Washington: Office of Air Force History, 1987.

- Greer, Thomas H. *The Development of Air Doctrine in the Army Air Arm, 1917 – 1941*, reprint edition, Washington: Office of Air Force History, 1985.
- Hansell, Haywood S., Jr. *The Strategic Air War against Germany and Japan: A Memoir*, Washington: Office of Air Force History, 1986.
- Hennessy, Juliette A. *The United States Army Air Arm, April 1861 to April 1917*, Washington: Office of Air Force History, reprinted 1985.
- Hitchcock, Walter T., ed. *The Intelligence Revolution: A Historical Perspective. Proceedings of the Thirteenth Military History Symposium, United States Air Force Academy, October 12 – 14, 1988*, Washington: U.S. Air Force Academy and Office of Air Force History, 1991
- Kenney, George C. *General Kenney Reports: A Personal History of the Pacific War*, reprint edition, Washington: Office of Air Force History, reprinted 1987.
- Link, Mae Mills, and Hubert A. Coleman. *Medical Support of the Army Air Forces in World War II*, Washington: Office of Air Force History, reprinted 1991.
- Maurer, Maurer. *Air Force Combat Units of World War II*, Washington: Office of Air Force History, 1987.
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- Ravenstein, Charles A. *Air Force Combat Wings: Lineage and Honors Histories, 1947 – 1977*, Washington: Office of Air Force History, 1984.
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- Tunner, William H. *Over the Hump*, reprint edition, Washington: Office of Air Force History, reprinted 1985.
- Warnock, A. Timothy. *Air Force Combat Medals, Streamers, and Campaigns*, Washington: Office of Air Force History, 1990.
- Wolk, Herman S. *Planning and Organizing the Postwar Air Force, 1943 – 1947*, Washington: Office of Air Force History, 1984.

Department of the Army

In 1947 the Department of the Army began publication of a multivolume history, *The United States Army in World War II*. Concluded in the last decade of the century, the series now includes nearly ninety volumes on all aspects of the war, including grand strategy, and the impact of logistics on plans and operations, accounts of field campaigns themselves, and technical services. Recommended for a general understanding of the prosecution of the war from the viewpoint of the U.S. War Department are the following:

- Cline, Ray S. *Washington Command Post: The Operations Division*, Washington: Office of Chief of Military History, 1951.
- Coakley, Robert W., and Richard Leighton. *Global Logistics and Strategy, 1943 – 1945*, Washington: Office of the Chief of Military History, 1968.
- Conn, Stetson, Rose C. Engleman, and Byron Fairchild. *Guarding the United States and its Outposts*, Washington: Office of Chief of Military History, 1964.
- Conn, Stetson, and Fairchild, Byron. *The Framework of Hemisphere Defense*, Washington: Office of Chief of Military History, 1960.
- Holley, Irving B. *Buying Aircraft; Materiel Procurement for the Army Air Forces*, Washington: Office of Chief of Military History, 1964.
- Jones, Vincent C. *MANHATTAN: The Army and the Atomic Bomb*, Washington: Center of Military History, 1985.
- Lee, Ulysses. *The Employment of Negro Troops*, Washington: Office of the Chief of Military History, 1966.
- Leighton, Richard, and Robert W. Coakley. *Global Logistics and Strategy, 1940 – 1943*, Washington: Office of the Chief of Military History, 1955.
- Matloff, Maurice. *Strategic Planning for Coalition Warfare, 1943 – 1944*. Washington: Office of Chief of Military History, 1959.
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- Morton, Louis. *United States Army in World War II: The War Department; Strategy and Command: The First Two Years*. Washington: Office of Chief of Military History, 1962.
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Department of Defense

A number of official research efforts have appeared under the auspices of agencies other than those publishing them. The first included below is among the best on racial matters in the military services from the World War II era through the Vietnam war. Published by the Army, it was included in a series intended to address issues common to all services and hence includes analysis of racial policy in the Navy, the Marine Corps,

the Air Force, and the Coast Guard. The second volume was also produced officially as one of a longer series by the historical program within the Joint Chiefs of Staff.

MacGregor, Morris J., Jr. *Integration of the Armed Forces, 1940 – 1965*, Washington: Center of Military History, 1981.

Hayes, Grace Person. *The History of the Joint Chiefs of Staff in World War II: The War against Japan*, Annapolis, Maryland: Naval Institute Press, [c. 1982].

United States Marine Corps

The U.S. Marine Corps, as a subordinate element of the Department of the Navy, specialized in amphibious operations in the course of World War II. The exploits of its air arm are detailed in the Marine Corps' official historical series *History of the United States Marine Corps in World War II*. Among other official histories published by the Marine Corps is Charles W. Boggs, Junior's *Marine Aviation in the Philippines*. Washington: Historical Division, Headquarters, United States Marine Corps, 1951.

Department of the Navy

Still counted among the finest histories of World War II is Samuel Eliot Morison's *History of United States Naval Operations in World War II*, Boston: Little, Brown, 1947-1962. 15 vols. Though it bears a commercial publisher's imprint, Morison's work was sponsored by the Navy; he was given commissioned rank as a rear admiral during the war and was in the thick of many of the surface and air actions represented in this series. An abridged version of the Morison history appeared as *The Two Ocean War*, Boston: Little, Brown, 1963.

United Kingdom

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Richards, Denis, and Hilary St. G. Saunders. *The Fight Avails*, vol. II, *Royal Air Force, 1939 – 1945*, London: Her Majesty's Stationery Office, 1954.

Saunders, Hilary St.G. *The Fight Is Won*, vol. III, *Royal Air Force, 1939 – 1945*. London: Her Majesty's Stationery Office, 1954.

Webster, Charles, and Noble Frankland. *The Strategic Air Offensive against Germany*, London: Her Majesty's Stationery Office, 1961. 4 vols.

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General

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