

The official pictorial history
of the **AAF**

BY THE HISTORICAL OFFICE OF THE ARMY AIR FORCES

DUELL, SLOAN AND PEARCE • NEW YORK

RETURN TO AIR HISTORICAL LIAISON OFFICE

HQ. USAF, , WASHINGTON 25, D.C.

Copyright, 1947, by

ARMY AIR FORCES AID SOCIETY, WASHINGTON 25, D. C.

*All rights reserved, including
the right to reproduce this book
or portions thereof in any form.*

first printing

PRINTED IN THE UNITED STATES OF AMERICA

Foreword

This graphic presentation of our air power should quicken the pride of every American. For airmen it is a faithful record of significant developments in equipment over the four decades since the first flight. It illustrates the past of the air force in which so many of them gallantly served. Its wide appeal, however, is to the air consciousness of the American people who, in the fullness of their vigorous strength and imagination, are now demonstrating their fitness as a nation to enter a new period of world history—the true Air Age.

A handwritten signature in cursive script, reading "Carl Spaatz". The signature is fluid and elegant, with a long horizontal stroke at the beginning and a large, stylized "S" at the end.

*CARL SPAATZ,
Commanding General, Army Air Forces.*

Preface

Little less than 40 years stand between the 8,800-horsepower Superfortress, flying its tons of explosives from Saipan to Tokyo, and the 30-horsepower Wright Flyer, aloft over the parade ground at Fort Myer, making the first powered flight in U. S. Army history. Little less than 30 years separate the first awakening to the military possibilities of the airplane in World War I and the realization of overwhelming air power as spearhead and decisive factor in World War II.

The story of military aeronautics in the making and in action has been recorded in this volume prepared at the direction of General of the Army H. H. Arnold by personnel of the AAF Historical Office. The editors of this pictorial history searched the photographic records of the Army Air Forces, the Signal Corps, the National Archives, the Smithsonian Institution, and the Library of Congress in the preparation of this first complete, graphic account of the development of U.S. Army aviation. Chief editorial duties were performed by Maj. John T. McCoy, Jr., who was responsible for selection of photographs, book design, and paintings, and by Lt. Col. Bayrd Still, who edited the text. Special acknowledgment is due to Capt. William S. Newman, who prepared the catalog of military aircraft, and to S/Sgt. David H. Stech and Mrs. Wilhelmine Bureh for layout and editorial assistance.

All royalties from the sale of this book will be assigned to the Army Air Forces Aid Society, Washington 25, D. C.

Contents

AIR CORPS CHIEFS	5
----------------------------	---

Part I

BALLOONS WERE THE FIRST AIR WEAPONS OF THE U. S. ARMY	9
EYES OF THE UNION ARMIES	11
Civil War saw beginning of U. S. military aviation	
LOWE ORGANIZED FIRST BALLOON CORPS	12
Lincoln urged General Scott to use Lowe's balloon	
BALLOONS ABANDONED	14
Army not convinced of value. First corps disbanded before war's finish	
SPANISH-AMERICAN WAR	15
When it began the Army had only one balloon	
THE CAMPAIGN IN CUBA	17
Army's single balloon sighted Spanish fleet	
TURN OF THE CENTURY	18
1907 Aeronautical Division was ancestor of today's AAF	

Part II

PIONEERS OF POWER FLIGHT DEVELOPED NATION'S NEXT AIR WEAPON	21
WRIGHT'S FIRST TRIAL	22
Fatal crack-up at Fort Myer delayed Army approval	
THE FINAL TRIAL	24
1909 saw Wrights win contract	
FIRST MILITARY AVIATORS	26
For the next three years the Army learned to fly	
AMERICA'S YOUNG AIR FORCE	28
Training came first	
THE NORTH ISLAND SCHOOL	30
Rising death toll brought new training planes	
AIRCRAFT CONTROL SYSTEMS	32
Wright, Curtiss, "Dep," and Stick	
MEXICAN EXPEDITION	33
U. S planes made a poor showing	

Part III

WORLD WAR I BROUGHT FIGHTING AND BOMBING PLANES	35
MOBILIZING AN AIR ARM	36
TRAINING IN FRANCE	38
American boys learned combat flying in Europe	
TRAINING IN BRITAIN AND ITALY	40
U. S. squadrons apprenticed with Allies	
BALLOONS AGAIN PROVED WORTH	42
Sentries of sky served Allies in war of position	
GERMAN FIGHTING CRAFT	43
Tested Allied skill	
AMERICA'S FIRST ACES	44
Their daring tactics downed aerial foe	
FLYING AND GROUND PERSONNEL	46
Home training program not at peak till 1918	
FLYING AIDS	48
First instructors learned while teaching	

ARMY PIONEERED OFFICIAL AIR MAIL	49
First air mail pilots followed iron beam	
U. S. SQUADRONS IN ACTION	50
Final punch proved value of America's air power	
AIRPLANES AND ENGINES	52
Production reached high gear by last months of war	

Part IV

BETWEEN WARS AMERICA HAD 23 YEARS TO DEVELOP USE OF AIR POWER	55
THE POSTWAR AIRMEN	56
Some stayed in service but most got out	
THE ARMY AIR SERVICE	58
It laid foundation for future air power	
AIR POWER vs. SEA POWER	60
General Mitchell prompted the tests that proved bombs could sink warships	
THE ARMY'S AIRSHIPS	62
Provided valuable experience but brought a major disaster	
ARMY PLANES MADE RECORD FLIGHTS IN THE POSTWAR DECADE	64
TRANSCONTINENTAL RECORDS	66
Army pilots achieved first continental nonstop and dawn-to-dusk flights	
ROUND THE WORLD BY AIR	68
Army succeeded where all others had failed	
BIG-TIME SPEED EVENTS	70
Army won the two main races in 1925 competition	
PAN-AMERICAN GOOD-WILL FLIGHT	71
Air Corps flyers toured 25 capitals	
FIRST FLIGHT TO HAWAII	72
Maitland and Hegenberger made it in less than 26 hours	
WORLD ENDURANCE RECORD	73
Air Corps flyers stayed aloft nearly a week	
KELLY FIELD	74
Cadets used old planes to train in modern manner	
RANDOLPH FIELD	77
It was Air Corps training center in the thirties	
WARPLANES IN THE THIRTIES	78
All-metal monoplane tested in Alaskan flight	
GHQ AIR FORCE	81
Developed strategic plans for heavy bomber	
THE FLYING FORTRESS	82
B-17 symbolizes AAF heavy-bomber program	
B-17 AND B-15 FLIGHTS	84
Long-range missions proved worth of heavy bomber	
THE NATIONAL AIR RACES	86
Army flyers took part every year from 1921 to 1939	
EXPLORING THE STRATOSPHERE	87
Air Corps balloons reached greatest height known to man	
FROM AIR CORPS TO AAF	88
Organizational problems	
EXPANSION IN TRAINING	90
More flyers and mechanics to man more planes	
GIRDING FOR WAR	92
Roosevelt asked for 50,000 planes and got more	
PREWAR MANEUVERS	94
Air skill was tested just before Pearl Harbor	

Part V

DECISIVE ROLE IN WORLD WAR II WINS RECOGNITION FOR AIR POWER . . .	97
PEARL HARBOR	98
Jap air attack unites all America	
EARLY STABS AT JAPANESE	100
AVG and Tokyo raid boost American morale	
HEADQUARTERS, AAF	102
It is nerve center of world's greatest air organization	
TRAINING IN WORLD WAR II	105
AAF speeds training of combat crews	
TRANSITION TRAINING	107
Readies air crews for combat action	
AAF EXPERIMENTAL CENTERS	108
Tactics and equipment are tested before combat use	
ARMY AIRWAYS COMMUNICATIONS SYSTEM	110
Guides Army's pilots along global routes	
AIR TRANSPORT COMMAND	113
Rushes men and cargo to world battlefronts	
AIR TECHNICAL SERVICE COMMAND	114
Supplies planes and equipment to "keep 'em flying"	
AERIAL PHOTOGRAPHY	116
AAF photo units provide source of intelligence	
FIRST, SECOND, THIRD, FOURTH, AND SIXTH AIR FORCES	119
Domestic air forces train operational units and defend America	
ANTISUBMARINE COMMAND	120
Wages air war against U-boat offensive	
SEVENTH AIR FORCE	122
Offensive in Central Pacific	
ELEVENTH AIR FORCE	123
Pounds Japs in North Pacific	
FIFTH AIR FORCE	124
Strikes from Southwest Pacific	
THIRTEENTH AIR FORCE	125
Action in South Pacific	
EIGHTH AIR FORCE	126
Carries air war into Germany	
FIFTEENTH AIR FORCE	127
Hits Germany via underside	
NINTH AIR FORCE	130
Sees action on two fronts	
TWELFTH AIR FORCE	131
Paces drive up Italian boot	
TENTH AIR FORCE	132
Air battles in Burma	
FOURTEENTH AIR FORCE	133
Air war in China	
TWENTIETH AIR FORCE	134
Takes war to Jap homeland	
AIR POWER PAVES THE WAY FOR D-DAY	136
Aerial blows reduce enemy's capacity to resist	
AIR POWER AND THE NORMANDY LANDINGS	139
June 6, 1944 sees greatest coordinated attack in history	
INVASION FOLLOW-THROUGH	140
It shows air force versatility	

FROM THE ARDENNES TO THE RHINE	142
Air arm helps check Bulge threat, aids Rhine crossing	
VICTORY IN EUROPE	144
Allied air power decisive in surrender of Reich	
THE ROAD BACK	147
Air attack implements amphibious advance to Philippines	
CLOSING IN ON JAPAN	148
Air arm helps penetrate Japan's inner defenses	
PACIFIC SHOWDOWN	150
Superbomber assaults speed victory without invasion	
V-J SURRENDER	152
Aerial armada brings Allied conquerors to Japan	
THE PRICE OF VICTORY	154
AAF had its share of war casualties	
" . . . TO KEEP A LASTING PEACE."	156

Part VI

INDUSTRIAL AND SCIENTIFIC "KNOW-HOW" MAKES U. S. AIR POWER POSSIBLE	158
WRIGHT FIELD	160
Air Technical Service Command runs "world's biggest business"	
ARMY DEVELOPS NEW WEAPONS	162
Overcomes weather to reach and destroy enemy	
EVOLUTION OF MILITARY AIRCRAFT	163
Army's planes went through several stages of design	
THREE-VIEW DRAWINGS OF PLANE TYPES	164
EVOLUTION OF THE B-17	168
Ten years of development	
THE ARMY'S AIRPLANES	170
PRE-WORLD WAR I	170
The Army's first planes served as trainers	
PRIMARY TRAINERS	173
The first planes flown by cadets	
BASIC TRAINERS	176
Transition from primary to advanced training	
ADVANCED TRAINERS	177
Simulate warplane flying for future AAF pilots	
OBSERVATION TYPES	179
Their mission is the oldest in military aeronautics	
FIGHTERS	186
These planes perform many combat duties	
BOMBERS	195
They carry the war to the enemy	
ATTACK PLANES	200
They work closely with ground troops	
TRANSPORTS	204
They save time and fly everywhere	
ROTARY-WING AND GLIDER AIRCRAFT	209
Prove useful types in World War II	
ENGINES POWER AIR ATTACKS	210
Landmarks in engine development	
A LIST OF MODEL DESIGNATIONS OF ARMY AIRPLANES NOT INCLUDED IN THE PICTORIAL CATALOG	211



General Carl A. Spaatz, Commanding General of the AAF, directed strategic bombing campaigns during World War II.

AIR CORPS CHIEFS

In the choice of General Carl A. Spaatz for its post-war commander, the AAF found a leader fully in the tradition of the great builders of U. S. military air power, from Greely to Arnold, who are pictured on the following pages. Like his illustrious predecessor, Spaatz had been associated with Army aviation "from the ground up"; his elevation to the position of Commanding General of the Army Air Forces was the culmination of a distinguished career in aerial warfare.

Spaatz did his first flying for the Army in the old Aviation Section of the Signal Corps and on his first operational mission piloted an ancient Curtiss R-4 reconnaissance plane in support of Pershing's expedition into Mexico in 1916. During World War I he led the Thirty-first Aero Squadron to France and downed

three Hun Fokkers to win the Distinguished Service Cross. Between wars he combined command of fighter and bomber units with aeronautical experiments like the endurance flight of the *Question Mark* in 1929.

With the outbreak of World War II, Spaatz became one of the chief exponents of the application of strategic air power. As head of the Eighth Air Force, the Twelfth Air Force, the Northwest African Air Forces, and later of the U. S. Strategic Air Forces in Europe he directed the relentless blows which crippled Germany's capacity to make war. With the war in Europe won, he took command of the U. S. Strategic Air Forces in the Pacific to manage the aerial assault on already crumbling Japan. As Commanding General of the AAF after March 1, 1946, when he relieved General of the Army Henry H. Arnold, Spaatz continued to champion an alert and adequate air force as a bulwark of America's defense.



General Henry H. Arnold, the AAF's five-star General of the Army, piloted the Army Air Forces through World War II.

The career of General Henry H. Arnold so nearly parallels the history of the U.S. Army Air Forces that the story of the man virtually becomes the epic of American air power. Only 33 years separate the frail "pusher" he flew in 1911 and the mighty B-29 of World War II; yet in this short span of years the world's greatest aerial striking force was built.

The decade of Arnold's birth in 1886 saw General Greely's early encouragement of military aeronautics within the Signal Corps. The young lieutenant's graduation from West Point in 1907 coincided with the creation of the Aeronautical Division, forerunner of the AAF. Detailed to the Signal Corps in 1911, Arnold became one of the Army's first flying instructors and with a handful of daring pioneers accomplished the record-breaking feats that were forecasting the utility of Army aviation. In 1912 he achieved an altitude record of 6,540 feet and won the Mackay Trophy in a

30-mile reconnaissance flight in which he flew his plane at a speed of 43 m.p.h.

When America entered World War I the Army's air strength was still confined to a small section of the Signal Corps, its all-time war experience limited to slight participation in the punitive expedition into Mexico in 1916 and earlier lighter-than-air activities in the Civil and Spanish-American wars. New recognition came when the Air Service, A.E.F., was placed directly under General Pershing in 1917 and air activity divorced from the Signal Corps in the following year. During this first real test of military aeronautics, Colonel Arnold's talent for organization was cultivated in his management of training problems in the Office of the Director of Military Aeronautics. The postwar future of Army aviation was to depend on vision and organizational skill; and these, General Patrick, Chief from 1921 to 1927, and aides like Arnold and others supplied.



Maj. Gen. Oscar Westover

1935-1938. Began expansion of Air Corps in period when Maj. Gen. Frank M. Andrews was in command of General Headquarters Air Force.



Maj. Gen. Benj. D. Foulois

1931-1935. Veteran flyer, headed the Air Corps when General Headquarters Air Force was established as combat element for the air arm.



Maj. Gen. James Fechet

1927-1931. As Chief of Air Corps, he guided the development of military aeronautics during boom in commercial aviation in the late twenties.



Maj. Gen. Mason M. Patrick

1921-1927. Commanded Air Service, later Air Corps, in critical postwar period, with needed vision, insight, enthusiasm, and organizational skill.



Maj. Gen. Chas. T. Menoher

1918-1921. As Director of Air Service from December 1918, and later Chief, he shouldered difficult duties of the demobilization period.



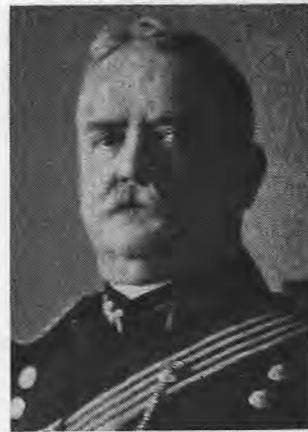
Maj. Gen. Wm. L. Kenly

1918. As Director of Military Aeronautics, shared war problems with John D. Ryan, head of aircraft production, later Director of Air Service.



Maj. Gen. George O. Squier

1917-1918. As Chief Signal Officer, became first U. S. wartime air chief; had top authority for World War I mobilization of air power.



Brig. Gen. George Scriven

1913-1917. Headed Signal Corps when creation of Aviation Section, in 1914, advanced status of air service, increased numbers and pay.

Between wars Arnold was identified with the peacetime evolution of military aeronautics—forest patrols, materiel development, and such record tests as the Alaskan flight of 1934. He was identified, too, with the organizational changes which strengthened the air arm in these years: the creation of the Air Corps in 1926, the organization of the General Headquarters Air Force in 1935, and the establishment of the Army Air Forces in June 1941. In 1938 he became Chief of Air Corps; in 1940, Deputy Chief of Staff for Air; in 1941, Chief, AAF; and in 1942, Commanding General, AAF. From May 1941 to March 1942 Maj. Gen. G. H. Brett and Maj. Gen. W. R. Weaver served successively as Chief of Air Corps. Arnold's membership on the Joint and Combined Chiefs of Staff gave air a voice in high councils during World War II; and America's 2½-million-man air force looked to him for leadership until after victory for the democracies was achieved.



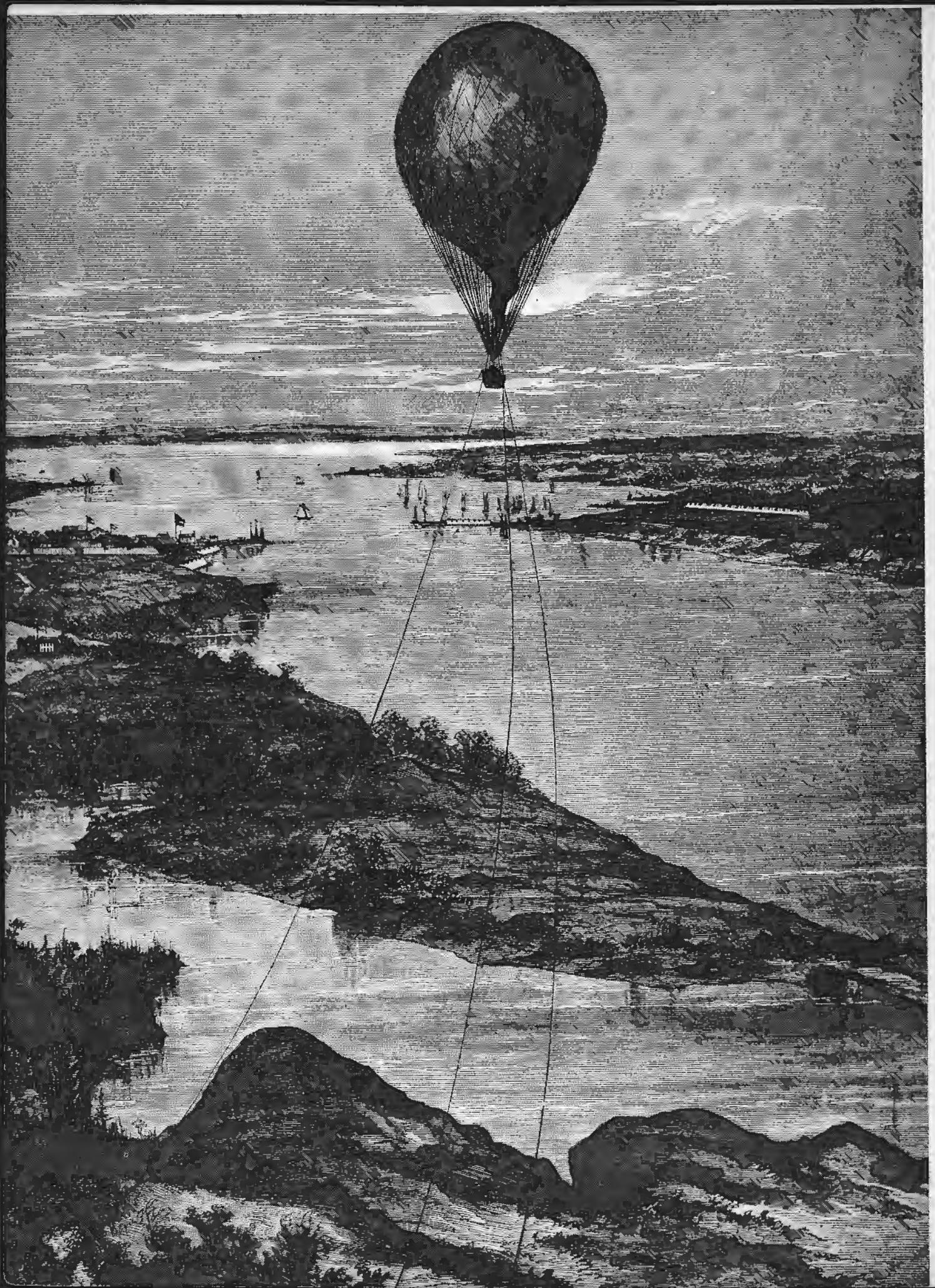
Brig. Gen. James Allen

1906-1913. Commanded Signal Corps at creation of Aeronautical Division, August 1, 1907; accepted first Army plane, August 1909.



Maj. Gen. Adolphus Greely

1887-1906. Fathored a balloon section in the Signal Corps in 1892; encouraged experiments with heavier- and lighter-than-air craft by Army.



Balloons were the first air weapons of the U. S. Army

The nineteenth century—though no age of flight—saw the first attempts of the United States Army to make military use of the air. From George Washington's day to that of Theodore Roosevelt the military possibilities of aircraft were the subject of speculation, and in the sectional conflict of President Lincoln's time the Army had its first opportunity to put aeronautics to an actual military trial.

Frenchmen pioneered the lighter-than-air travel that was destined to give war a new dimension. The crude hot-air balloon of the Montgolfier brothers and the hydrogen-filled spheres of the Robert brothers and Dr. Jacques Charles made successful flights in 1783. To silence pessimists who denied that life could exist in the atmosphere above the ground, a *montgolfière* carried a sheep, cock, and duck aloft without fatal effect; and that same year the first human aeronaut, Jean François de Rozier, in dodging a tree, proved the principle of controlled flight.

Within 10 years Washington and other dignitaries were witnessing the first successful balloon flight to take place in the United States. A band played and cannon fired as the President watched Jean Pierre Blanchard go aloft for a journey that took him from Philadelphia into New Jersey. Further exhibitions of the spectacular art bolstered public interest. In the 1830's Charles Durant made ascensions in Boston and New York and won the reputation of being America's first professional aeronaut. By the outbreak of the Civil War, America had a handful of young balloonists ready to put their aeronautical talents to military use.

The first successes of the Montgolfier brothers in 1783 led to discussion of the use of balloons in war. To America's resourceful Benjamin Franklin they promised a new mobility for armies, new possibilities of offensive action. Five thousand balloons, said he, each carrying two men and descending from the clouds, could "do an infinite deal of mischief." Other amateur strategists played with the idea of using lighter-than-air craft to

His balloon tethered 1,000 ft. above York River in 1862, T. S. C. Lowe reported positions of Confederate redoubts and rifle pits from one of seven balloons attached to the Army of the Potomac.

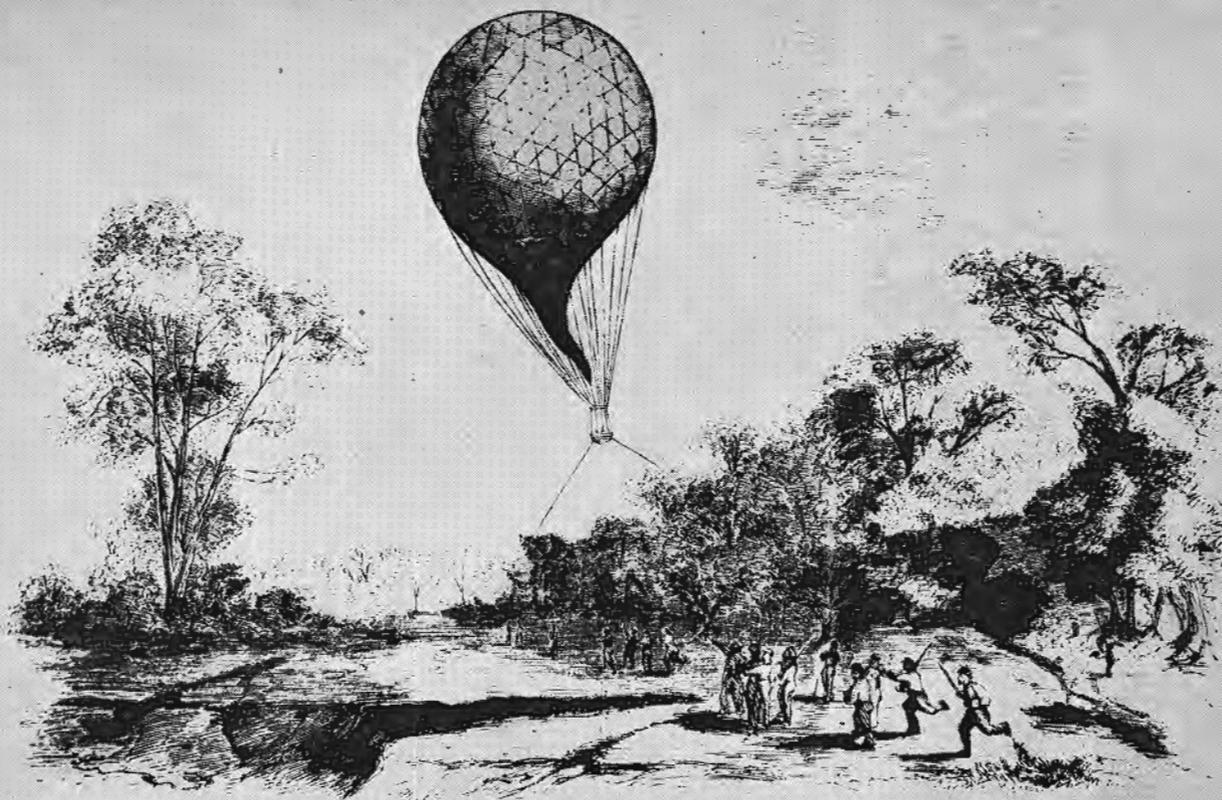
bombard an enemy with explosives or loose torrents of propaganda leaflets.

The world's first air force, created by the French Government in 1794, made effective use of balloon reconnaissance during the wars that followed in the wake of the French Revolution. But as Napoleon came to power, interest in military aeronautics declined. In 1807 the Danes suggested balloon bombardment as a means of breaking the British blockade of Copenhagen. The next year, they used aerostats to drop propaganda leaflets over Sweden. First large-scale trial of aerial bombardment came in 1849 when a besieging Austrian army sent a hundred explosive-laden *montgolfières* over the city of Venice with slight effect. During the Crimean War (1854-56) the British discussed the possible use of balloons but did nothing with them until America's Civil War experience.

Meanwhile, American balloonists had volunteered aid to the U.S. Army for both aerial observation and offense. The first was Col. John H. Sherburne, who in 1840 proposed that a balloon be supplied for each column advancing against the elusive Seminole Indians in the five-year-old Florida campaign. Aerial observers were to make night ascensions to locate the enemy campfires. But the military commander in Florida did not consider the scheme practicable and the suggestion for aerial observation was tabled.

Six years later, during the Mexican War, John Wise proposed the aerial destruction of the fortified castle of San Juan de Ulúa, guarding the key city of Vera Cruz. He suggested the construction of a balloon capable of carrying both a 10-man crew and 18,000 pounds of percussion torpedoes and shells. Tethered by a five-mile cable, this "aerial battery" was to hang a mile above the castle and from that height silence the Mexican guns. Despite popular interest, Wise's proposal for aerial bombardment was not accepted, and Vera Cruz was reduced by land attack.

With the coming of the Civil War, Army officials took advantage of the one proved use of lighter-than-air craft to provide aerial "eyes" for the armed forces. From this service came the U.S. Army's first "air arm."



PROFESSOR LA MOUNTAIN, THE AERONAUT, RECONNOITERING THE REBEL POSITIONS NEAR FORTRESS MONROE.—FROM A SKETCH BY OUR SPECIAL ARTIST

A BALLOON RECONNAISSANCE AT FORTRESS MONROE.

The first time balloons were used for the purpose of reconnoitering was by Louis Napoleon, during the Italian war. With true American

aptitude, we have adopted it, and, as usual, improved upon it, by attaching an electric telegraph, which makes it available on the field of battle. Our Artist has sent us a sketch of one of Professor

La Mountain's ascents, in a field between Fortress Monroe and Hampton. The utility of these aerial observations in an open country is very great, as they protect our troops against a surprise.

Leslie's artist sketched the ascent of John La Mountain's balloon Atlantic near Fortress Monroe, Va., in August 1861.

EYES OF THE UNION ARMIES

Civil War saw beginning of U. S. military aviation

With the attack on Fort Sumter, prominent American balloonists offered their services to the Union cause. Among them were James Allen, John Wise, John La Mountain, and Thaddeus S. C. Lowe, organizer of the nation's first official balloon corps. Ill fortune attended the early efforts of Wise and Allen. The latter volunteered his services in April 1861, but by mid-July accidents had destroyed his two balloons. Wise, whose scheme for the aerial bombardment of Vera Cruz had been rejected 15 years before, had no better luck. His balloon, built at Government expense for observations during the Battle of Bull Run, was damaged in transport. Five days later, being moved toward the front again, the repaired balloon sawed its mooring rope in half on a telegraph wire, drifted toward enemy lines, and had to be shot down by Union soldiers.

La Mountain, accepting the offer of Maj. Gen. Benjamin F. Butler, commanding Fortress Monroe, became a free-lance aerial observer in the Department of Virginia. From July 25 to August 10, 1861, he made ascents to as high as 3,500 feet, reporting concealed Confederate forces by counting tent lights at night. Twice he tethered his balloons to a tug in Hampton Roads. He

continued to observe Confederate activities through December, using his two balloons, *Saratoga* and *Atlantic*, with such success that they were purchased by the Government for the Army's permanent use. On a free ascent of December 10 he hovered over enemy lines for several hours before entering the prevailing easterly air current and descending near Washington.

Friction with Lowe was responsible for La Mountain's separation from Government service. In September 1861, Lowe was designated to form an official balloon corps for the Army of the Potomac, using balloons built at Government expense. He resented La Mountain's spectacular and somewhat unscientific exploits and feared that they might ultimately discredit military ballooning. La Mountain blamed his rival for the denial of his request for a Government balloon and accused Lowe of deliberately storing aeronautical equipment in order to buy it, unused, when the war was over. Lowe retaliated with charges that La Mountain was demoralizing his men and taking unfair advantage of his inventions. On February 19, 1862, General McClellan, supporting Lowe's point of view, ordered La Mountain's dismissal from Government service.



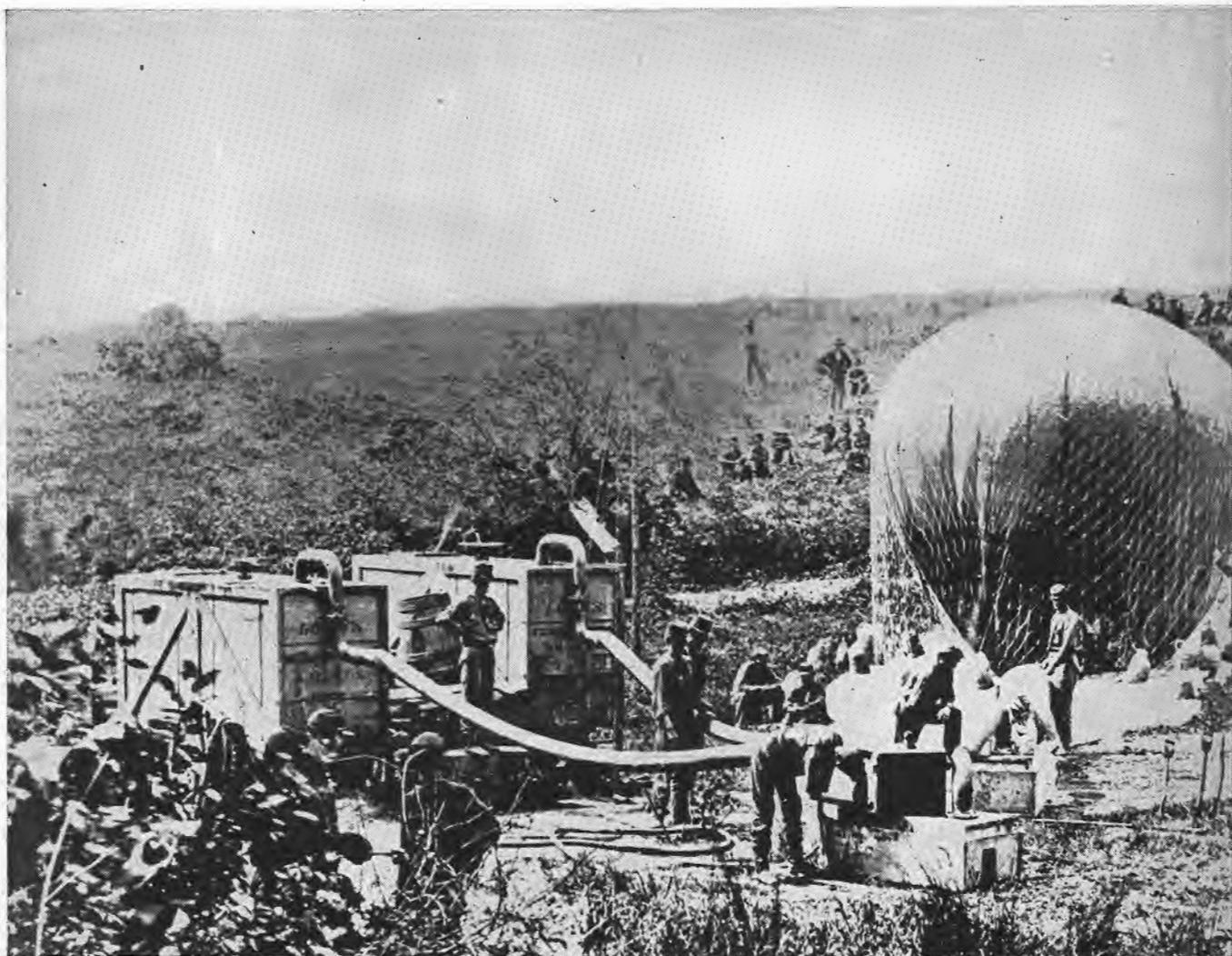
In August 1861, Lowe, shown in Brady's portrait, was officially made military aeronaut. He was ordered to build a balloon for field service, drew \$5 a day during construction, \$10 a day afterwards.

LOWE ORGANIZED FIRST BALLOON CORPS

Lincoln urged General Scott to use Lowe's balloon

Thaddeus S.C. Lowe, most famous of the Civil War aeronauts, abandoned plans for a transatlantic flight in April 1861 and offered his services to the Government. Supported by President Lincoln and Secretary of War Chase, Lowe received an appropriation of \$250 for demonstration purposes. On June 18 he ascended over Washington in the *Enterprise* and from an altitude of more than 500 feet sent a message to the President, the first telegraphed from the air. Wired Lowe: "This point of observation commands an area nearly 50 miles in diameter. . . ."

Lowe made his early military ascents at the request of Maj. Gen. Irvin McDowell, commander of the hard pressed Army of the Potomac. In July, his report of weak Confederate resources helped to quell alarm in Washington following Union rout at Bull Run.



Army of the Potomac's observation balloons were inflated with hydrogen produced by portable generators. Twelve such gas generators, developed by Lowe, were built during the Civil War.

Though Lowe's balloon corps was an official part of the Union Army, its novelty made it difficult to detail a sufficient number of ground crewmen to handle generators, towropes, and balloons.

A BALLOON RECONNOISSANCE.

ON page 679 we publish a picture entitled a WAR BALLOON PREPARING FOR A RECONNOISSANCE, from a sketch by Mr. Ed. Pietsch.

The balloon shown in our picture is that which is sailed by Mr. Lowe, and is stationed at Arlington Heights, close to the head-quarters of General M'Dowell. Every day or two, or whenever the scouts bring in intelligence of a movement by the enemy, an ascent is made, and accurate information is thus obtained of the state of affairs. Professor La Mountain is serving with his balloon at Fortress Monroe; much useful information has been obtained by him in his various ascents.

The use of War Balloons did not become general until the Italian war, in 1859. During that war Napoleon used them regularly, and when the rebellion broke out in this country, our aeronauts had no difficulty in obtaining employment from Government. The War Balloon is attached to the earth by a strong but fine rope. It ascends from two to five hundred feet in the air, and is hauled down when its aims have been fulfilled. The importance of gaining such a height for observation can be appreciated by all readers of military annals.

Will Lieut Genl. Scott
please see Professor
Lowe, over now about
his balloon?

July 25, 1861. A. Lincoln

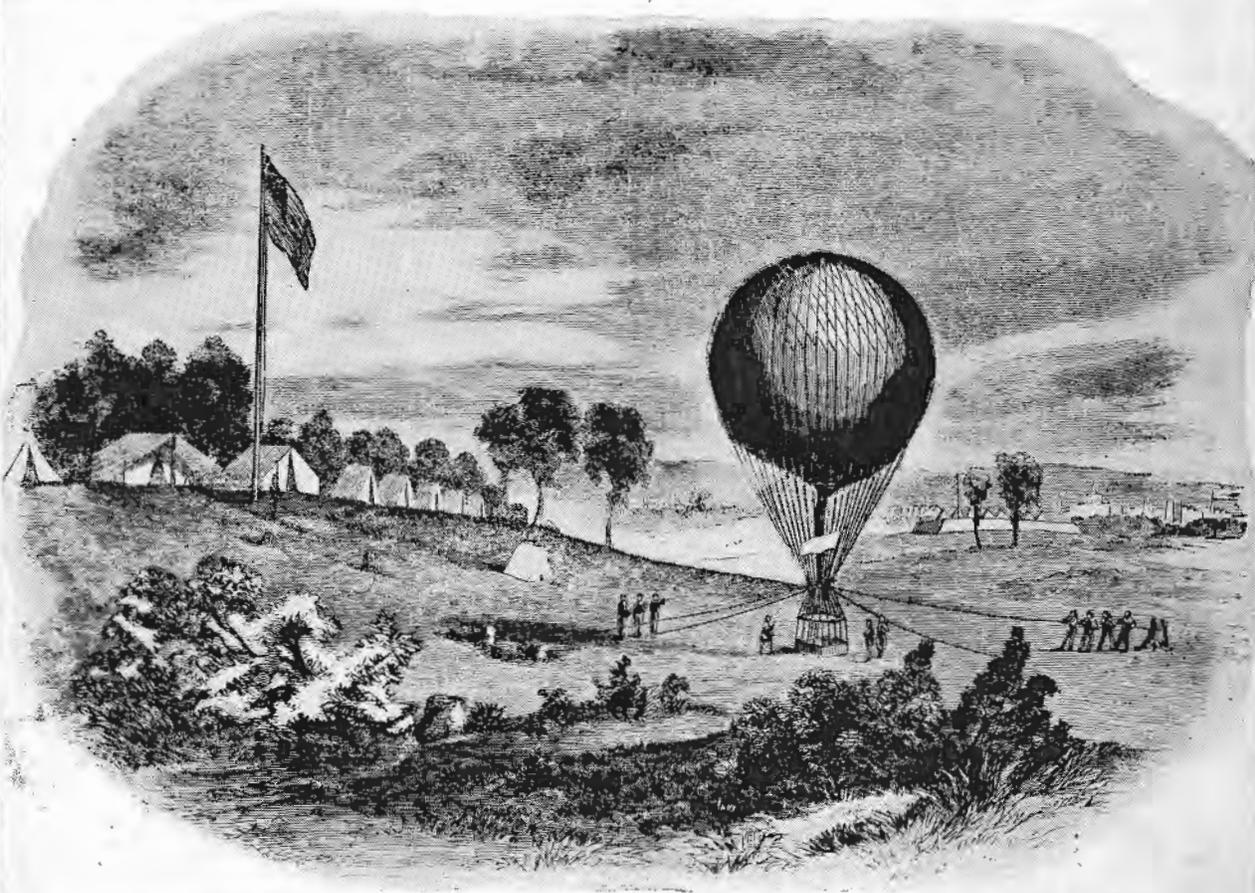
Lowe's most valuable supporter was President Lincoln. When aged Lieut. Gen. Winfield Scott refused to see Lowe, Lincoln took him to the general, exacted a promise that Scott would take action. In a few days, the Government hired Lowe.

Public interest was captured by work of Lowe and La Mountain. Papers and magazines featured "sailings" of these "Generals of the Skies."

OCTOBER 27, 1861.]

HARPER'S WEEKLY.

679



THE WAR BALLOON AT GENERAL M'DOWELL'S HEAD-QUARTERS PREPARING FOR A RECONNOISSANCE.—SKETCHED BY ED. PIETSCH.—[SEE PAGE 677.]

BALLOONS ABANDONED

Army not convinced of value. First corps disbanded before war's finish

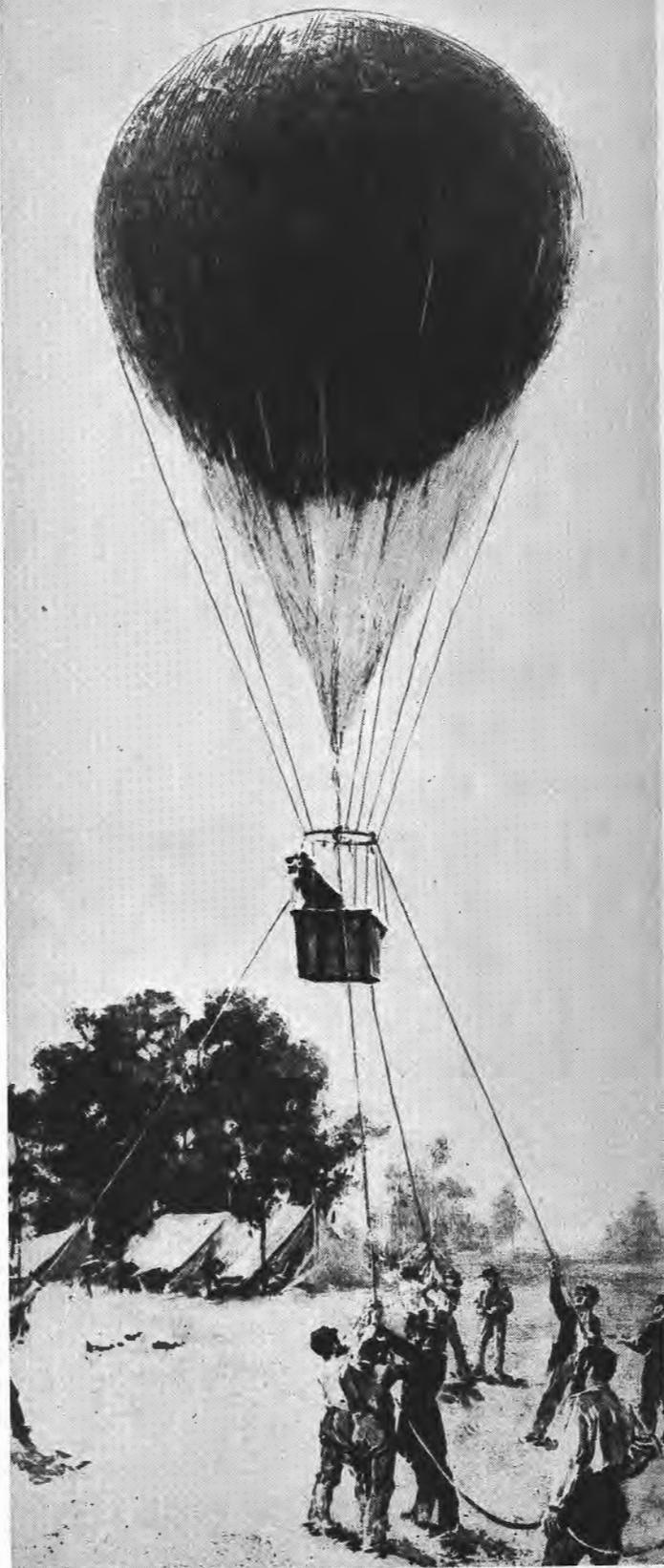
For over a year the Balloon Corps, organized in September 1861, performed effective service from one end to the other of the Army of the Potomac's lines. Lowe had seven aerostats at his disposal: the *Union*, *Intrepid*, *Constitution*, *Eagle*, *United States*, *Washington*, and *Excelsior*. They varied in size from 15,000 to 32,000 cubic feet and cost from \$1,000 to \$1,500.

Lowe's balloons were in almost constant use during the campaign for Richmond in 1862, on one occasion permitting observations every 15 minutes. In the Battle of Fair Oaks, the work of the corps may have saved the Union forces from defeat. Observing along the Potomac, Lowe ascended from the *G.W. Parke Custis*, a coal barge converted to form America's first "aircraft carrier." His activities continued through the period of the battle of Chancellorsville, May 1863.

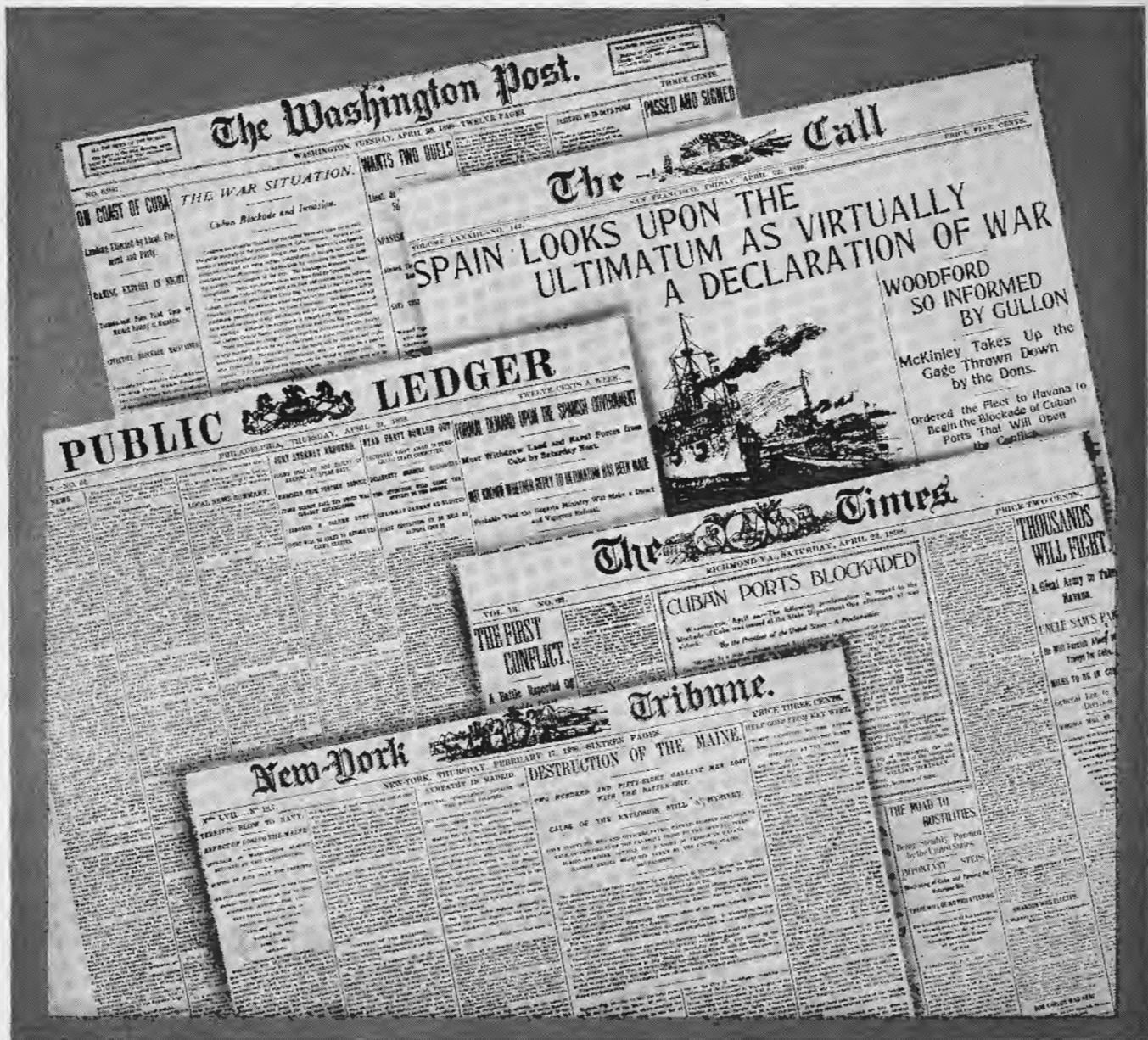
Elsewhere, balloons were used with less effect. Two of Lowe's men, assigned to the Southern and Western Departments with the *Eagle* and the *Washington*, were unable to convince local commanders of their value. The Confederacy, lacking silk and other materials, had few balloons. Rumors of their use were confirmed in June 1862 with the appearance of a balloon used effectively until its capture by Federal forces in July.

Civil War aeronauts had to cope with many operating difficulties. Calm weather brought poor visibility; on clear days, winds pitched the balloons about so as to hinder observation. Storms meant runaway balloons; cold weather brought ice damage. A lesser peril was Confederate gunfire. Southern artillerists resented the "infernal nuisances" and never failed to take potshots when the spherical targets came into view.

Moreover, the Balloon Corps, from the first, was beset by grave problems from within. Faulty organization, red tape, shortages of equipment, and difficulties of transportation retarded the effectiveness of its operations. The removal of McClellan and Fitz-John Porter brought to authority officers less appreciative of its work. In less than two years administration was shifted from the Bureau of Topographical Engineers to the Quartermaster Department and later to the Corps of Engineers. Key aeronautical personnel remained civilians, despite McClellan's promise that Lowe should have a commission as head of an independent aeronautical branch. Demands made by Cyrus B. Comstock, chief of the Topographical Engineers, brought matters to a head. On May 7, 1863, believing the military crisis past, Lowe resigned as head of the Aeronautic Department. Without his leadership, balloon activities declined, and in June 1863 came the disbandment of the corps, 23 months before peace, but not before it had proved the value of aerial observation to the Army.



Balloon observers reported findings in brief telegraph messages. "236-Reedsburg-24-NW-8" told ground commanders, "I can observe cavalry near Reedsburg advancing northwest on our left."



The beginning of hostilities with Spain in April 1898, after 33 years of peace, found America's air weapon undeveloped.

SPANISH-AMERICAN WAR

When it began the Army had only one balloon

The peace that followed Appomattox brought no development of U.S. military aeronautics. During a period that saw balloons in use by the Germans, French, English, Russians, Spanish, and Italians, there was no U.S. aeronautical establishment. Finally, in 1892, a balloon section within the Signal Corps was established by Brig. Gen. Adolphus W. Greely, Chief Signal Officer, a balloon enthusiast since the Civil War.

Lt. William A. Glassford was sent to Europe to study the latest balloon developments. From the French, Glassford purchased a medium-sized model, which upon

delivery to the United States was christened the *General Myer*. At the Chicago World's Fair, in 1893, the *General Myer* made several hundred demonstration ascents.

In 1894 the Army's balloon was moved to Fort Logan, Colorado, where Glassford developed a balloon section as part of a Signal Corps telegraph train. When the *General Myer* was destroyed in inflation, he employed Sgt. Ivy Baldwin, well-known stunt balloonist who had joined the corps, to build a new bag. This model, hand-sewn of silk by Baldwin and his wife, was the only balloon owned by the Army when the war began.

GEN. GREELY WANTS BALLOONS.

He Has a Conference on the Subject with Secretary Alger.

WASHINGTON, March 23.—Secretary Alger had with him in conference for some time to-day Gen. A. W. Greely, Chief Signal officer of the army. In the course of the conference they talked about the use of balloons in case of war. This matter Gen. Greely thinks of great importance to the army. He has asked repeatedly for an appropriation from Congress for experiments in this line, but thus far his efforts to obtain money have been unsuccessful. He has hopes that more money may be put at his command for experimenting with balloons, as he believes they would be invaluable for many purposes in time of war.

For instance, he says, while floating in the air off the coast around any of the seaport cities they could observe the presence of ships of the enemy's fleet at great distance off shore and by means of the cable attached to them and connecting with telegraphic instruments below could disseminate information of the fact while the ships were yet a great distance off. Balloons, moreover, he thinks, would be of great value to the military branch of the service. Should an army of occupation be sent to Cuba, the balloons would be of use, it is thought in the observations of the operations of the enemy's army, the country being quite heavily wooded so that it would be impossible to ascertain the movement of opposing troops on the ground.

Gen. Greely does not believe there is much danger to be feared from the fire of the enemy, as experience has shown it to be a very difficult matter to gauge properly the height to which the aeronaut takes his balloon, and guns of peculiar pattern and manufacture are almost a necessity for use against balloons.

THE WAR BALLOON USED AT SANTIAGO BELIEVED TO BE IN CHARGE OF MAJOR MANFIELD—IT WAS IMPORTED FROM FRANCE.

Chicago, July 1.—The balloon that is now in active use and sailing over the beleaguered city of Santiago, in plain view of twenty-five thousand Spaniards and seventeen thousand Americans, was shipped from Tampa with General Shafter's forces, together with the submarine cable and other field telegraph equipments now being used by the Signal Corps of the Regular Army in Cuba. W. J. Lloyd, assistant district superintendent of the Western Union Telegraph Company, says that it is probably one of the finest and most improved equipments used in warfare.

This balloon was shipped from Paris early in May, and is charged with hydrogen gas from tubular reservoirs, which have been in use by the Army for experimental purposes at Fort Riley. The balloon is charged and then allowed to ascend, being held captive by wire cables wound on a large reel beside fast in a field wagon. The cable is used as a telegraph and telephone conductor, and the occupants of the balloon transmit to the ground their observations.

There is little danger of the balloon being pierced by a rifle shot on account of its constant swaying and the extreme difficulty of hitting anything at an elevation of eighteen hundred feet, which is the usual limit of a balloon cable. The French claim to have a field gun which will pierce a balloon, but it is supposed there are none in use either in the American or Spanish armies. Had one of these balloons been aboard of Sampson's fleet, much anxiety would have been prevented pending the final discovery of Admiral Cervera in Santiago Harbor.

It is Mr. Lloyd's belief that the balloon is in charge of Major Joseph E. Maxfield, who was formerly signal officer of the Department of the Missouri with General Brooke at Chicago. This particular balloon has a lifting capacity of three hundred or four hundred pounds, which would enable it to carry two signal men of ordinary weight, as well as a camera and photographic apparatus.

BALLOONS AND PONTOONS.

ARRANGEMENTS FOR SENDING THEM TO THE FRONT.

HOW THE WAR BALLOONS WILL BE EMPLOYED IN CUBA—LOOKING OUT FOR TRANS-PORT SHIPS.

Important preparations have been made for the transportation of balloons and bridge pontoons to the front for army use in active operations in the invasion of Cuba. The Quartermaster's Department in the Army Building received notice yesterday to hold itself in readiness to transport both to Tampa, Fla. The large balloon with which experiments have been conducted at Fort Logan, Colorado, for several years was recently brought to Fort Wadsworth, on Staten Island. That was before any orders for troops to proceed to the Gulf coast had been issued. The conclusion was drawn that as the balloon was brought to this point it was to be used for the purpose of observing ships at sea, and learning when they were approaching with hostile intent.

"That conclusion is entirely incorrect," said Lieutenant Hale, at department headquarters on Governor's Island yesterday. "A balloon would be practically useless for such a purpose, as it is possible to see a ship from a fort or other eminence as far away as it is within range of the heaviest artillery, and any observation in advance of that would be useless for practical purposes. No war balloons are only of use in field operations for the purpose of discovering troops when they cannot be observed from the surface of the ground at the highest points, owing to irregularities, intervening woods and other obstacles. Then a balloon is of immense practical value. It is only recently that captive balloons in this way have been made of use, and it is in France and Germany especially that the most has been done in the organization and training of balloon corps."

The balloon at Fort Wadsworth has been placed in the hands of expert men of the signal service, who have had experience with balloon work on Western plains and in the Rocky Mountains. Two more large balloons have been contracted for, and as soon as they are delivered here, probably in a day or two, a balloon train will be loaded with the equipments and sent to Tampa, Fla., where it will be ready to have the balloons transported with the troops to Cuba.

It is understood that the plan of operations includes the formation of two armies of invasion, one to land in the Havana region and the other at the eastern end of Cuba, and each will be equipped with a balloon for observations in the field, and the third balloon will be available in emergency or in case of accident to the others. A balloon corps is to be organized under the direction of Lieutenant Joseph E. Maxfield, who will be under the immediate orders of Captain James Allen, the signal officer on the staff of General Miles. Each balloon has three wagons to form its train. One contains the gas bag, basket and netting, together with the reel, and about one thousand feet of stout wire cable to hold the inflated balloon captive. On the other wagons are carried the stout steel cylinders filled with hydrogen for inflating, the sandbags for ballast, and the apparatus for use by the observers. This includes a telephone, camera and field glasses. When the balloon rises it carries an aeronaut and a signal officer, and the result of observations is communicated at once to headquarters, enabling operations to be intelligently conducted within a radius of thirty or forty miles from the point of observation.

The material used for the best modern balloons is goldbeater's skin, made from the outside membrane of the large intestines of the ox. This is light and strong, and practically impervious to gas. It is much better, although more expensive, than oiled silk. As the cost of each inflation of a large balloon is in the neighborhood of \$40, no experiments will be made that are not absolutely necessary. Associated with Lieutenant Maxfield in the balloon operations will be Sergeants Baldwin, Keeney, Burnett and Myers, all of the Signal Corps. They expect to go from Fort Wadsworth to Tampa early next week, and will form the nucleus of the balloon corps.

USES OF WAR BALLOONS.

HOW CERVERA'S FLEET CAN BE FOUND IF IN HARBOR.

FEASIBILITY OF OBSERVING SANTIAGO DE CUBA FROM A CAPTIVE AIRSHIP ATTACHED TO A WAR VESSEL.

Washington, May 28.—The possibility that the balloon can be made a useful adjunct of the war is suggested by the problem that confronts Commodore Schley. If Admiral Cervera is really "bottled up" in Santiago Harbor a practical way of ascertaining that fact beyond all doubt would be to send up a balloon from one of the warships which are supposed to be at the mouth of the harbor on a tour of observation. This, it is believed, could be done without any great risk or danger to the persons in the airship. The Signal Office has a balloon equipment, but it could not be ascertained that any of the vessels of the fleet are furnished with it.

From the experience of the past there would be no trouble in inflating a balloon, which, soaring at an elevation of a thousand feet or more, could have ample opportunity of observing the entire stretch of country surrounding Santiago Harbor, of detecting the strength of the Spanish squadron, and of noting with considerable detail all the fortification works on either side of the harbor leading to the city.

Such information as might be obtained, it is pointed out, would be of inestimable value to the American fleet and enable it to act intelligently in determining what future operations were desirable.

Balloons have been tried with more or less success in European countries in army operations, although it is not stated whether they have ever been put to practical use in actual warfare. However, experience abroad has shown that when high in the air they are practically free from the guns of the opposing forces, as it is with the greatest difficulty that an accurate range of their height can be obtained, and even then specially constructed weapons are needed for destroying them, which it is thought the Spaniards do not possess.

General A. W. Greely, Chief Signal Officer, has been informed officially of the arrival at New-York yesterday of two war balloons, which are to be used in the Cuban campaign. They have been transferred to Governor's Island, where certain finishing touches are to be put to them, after which they will be shipped to Tampa. In addition to these two balloons, General Greely has another of American manufacture ready for use, and has given orders for a fourth.

Probably a week or more will elapse before the two from Europe and the American balloon will reach Tampa, and in the interval work will go forward on other features of the equipment which are necessary for the successful working of the airships. The balloon train will be made up of two parts, which will include one balloon for active service while another will be held in reserve.

The expectation is that those brought from abroad will first be put to practical use. Accompanying the train will be complete apparatus and material for making gas and also for compressing it 100 atmospheres, which will permit the transportation of large quantities in steel tubes, ready for inflating the balloons in emergencies. Each balloon will float a cable, through which telephonic communication may be had with persons below.

Numerous inquiries, both verbally and by telegraph, have been made of General Greely whether by the use of balloons it could be definitely ascertained if Admiral Cervera's fleet is actually in Santiago Harbor. The General feels certain that the true state of the case could only be determined by the use of balloons.

Before the war with Spain, General Greely reiterated the proved value of observation balloons and made repeated requests for funds for experimentation. The press agreed that balloon observation would be useful should Spain send an army of occupation to heavily wooded Cuba. Newspapers

suggested that balloon reconnaissance could determine whether the Spanish fleet was anchored in Santiago harbor and reported that the two armies to be sent to Cuba would each be equipped with a balloon, wagons, and telephones and cameras, newly developed aids.



Army's balloon observation suggested direction of artillery fire during the attack on San Juan Hill, Cuba, July 1, 1898.

THE CAMPAIGN IN CUBA

Army's single balloon sighted Spanish fleet

The Army's one balloon performed successful, if short-lived, service during the Spanish-American War. Ivy Baldwin's silk bag was shipped to New York from Denver to form the nucleus of equipment for two balloon trains. Each was to be provided with two balloons, a generator, 160 tubes of compressed hydrogen, and necessary wagons. Under the charge of Lt. Col. Joseph E. Maxfield of the Signal Corps, existing equipment was repaired and sent to Tampa. On his arrival there, he received word that a balloon train must be ready within three days to accompany the expeditionary force that was about to be dispatched to Cuba.

Maxfield was handicapped by lack of personnel and his equipment was tied up in a congestion of railroad cars without record of contents. Nevertheless he succeeded in assembling the balloon with accessories, generator, a reserve hydrogen supply in tubes, as well as officers and men, and had them aboard the transport *Rio Grande* within the allotted time, although the balloon train was ill equipped for combat action.

But Maxfield's troubles were just beginning. Although troops began disembarking on June 22, the balloon detachment was held on board until the 28th.

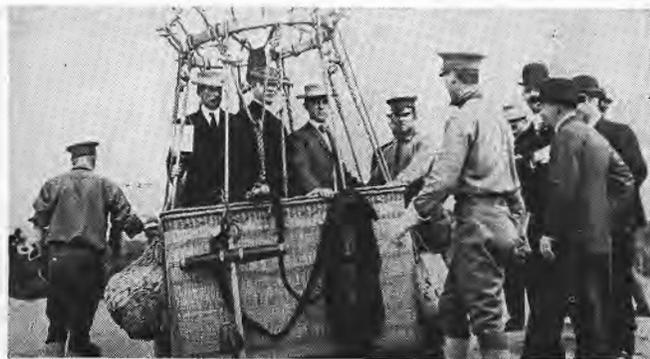
Maxfield was unable to get permission to unload the generator and inflate his balloon at the landing place and did not reach headquarters—in spite of pressing needs for observation—until June 29. There, it was found that heat and moisture had injured the envelope.

Three ascents on June 30, carried out in a balloon which in peacetime would have been called unsafe, definitely confirmed the presence of Admiral Cervera's fleet in Santiago harbor and supplied information on the battle terrain. Next day, against Maxfield's advice, the balloon was hauled to an open meadow in the immediate rear of troops waiting to attack San Juan Hill. From this dangerous position the reopening of artillery fire was suggested. The balloon was shortly so riddled by Spanish fire that it was hauled down.

Colonel Maxfield returned to Tampa on July 27 to find two new balloons, equipment, and personnel ready for shipment, too late to be of use. The Signal Corps was criticized at first for complying with directions of higher authority and operating the balloon so as to draw enemy fire. Later, however, Colonel Maxfield won praise for the speed and effectiveness of his work in the face of paralyzing administrative difficulties.



Following the Spanish-American War, the Army's balloons were housed in this corrugated iron shed at Fort Myer, Va.



In 1908, Maj. Edgar Russel, Capt. C. S. Wallace, and Lt. Frank P. Lahm experimented with radio and received messages at 3,000 ft.



Above is balloon plant at Fort Omaha, Neb., opened by Signal Corps in 1908. Other balloon equipment was housed at Fort Myer.

TURN OF THE CENTURY

1907 Aeronautical Division was ancestor of today's AAF

The rise of ballooning as a sport gave a boost to flagging military aeronautics after the war. The Aero Club of America, formally organized in 1905, attracted Americans to the sport of "aerostat and aeronat." A number of young Army officers, among them Capt. Charles Chandler and Lt. Frank P. Lahm, took great interest in European aeronautical activity and entered several of the international competitions that kept balloon activities in the nation's headlines.

In 1906 Lahm and Maj. Henry B. Hersey of "Rough Rider" fame piloted their balloon *United States* from Paris to Fyling Dales, England, to win the Gordon Bennett Competition, the first international balloon race. In October, Chandler and Maj. Samuel Reber officially represented the War Department in a free ascent in Massachusetts sponsored by the Aero Club of America. A year later, Chandler and James McCoy flew Signal Corps Balloon No. 10 a distance of 473 miles from St. Louis, to win the Aero Club's Lahm trophy for bettering the 1906 record.

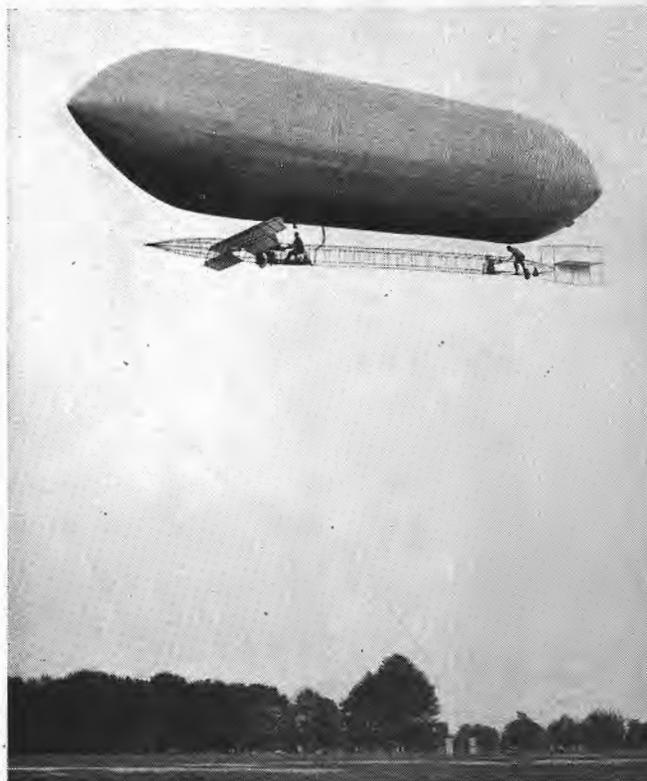
These exploits took place at a time when the Signal Corps had neither funds nor men to advance the cause



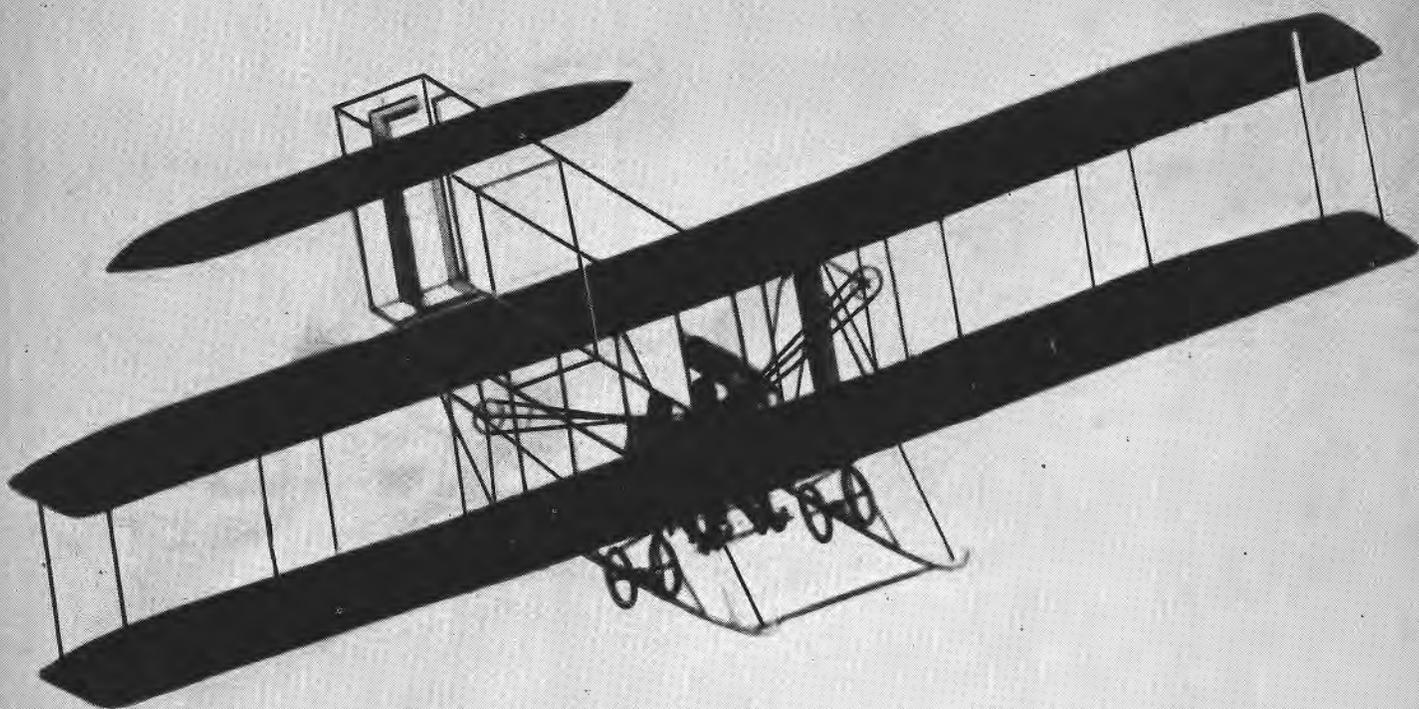
Army's first airship undergoes trials at Fort Myer. It cost \$6,750, less 15% penalty for failure to achieve speed of 20 m.p.h.

of military aeronautics. The balloon detachment of 1898 had ceased to exist in 1899, but, save for a small detachment assembled for Army maneuvers in 1902, no steps were taken to rebuild the Army's air arm until 1907. In June of that year two enlisted men were detailed to aeronautical duty, and they became the nucleus from which developed the present Army Air Forces. On August 1, 1907, an Aeronautical Division was set up in the Office of the Chief Signal Officer, U.S. Army, and Chandler was given the command. The new division had charge of *all matters pertaining to military ballooning, air machines, and all kindred subjects.*

The interest of the Chief Signal Officer, Brig. Gen. James Allen, in developing an Army airship led to the award of a contract to Capt. Thomas S. Baldwin for building a dirigible balloon. In its 1908 speed test, this ship averaged 19.61 miles an hour, and in its endurance test it remained aloft the required two hours. Accepted, Army Dirigible No. 1 was used for exhibition and instruction for four years. But the growing interest in heavier-than-air craft (a dozen different planes were flying in Europe, and the Wrights demonstrated their Flyer that same year) was challenging the use of balloons or dirigibles for military reconnaissance. In 1913, Fort Omaha was abandoned as an active post and balloon school facilities were consolidated at Fort Leavenworth. The year before, Dirigible No. 1 had been inspected for safety, condemned, and sold at auction.



Baldwin and Curtiss demonstrate Dirigible No. 1. Lifted by 20,000 cu. ft. of hydrogen, the Baldwin airship had a 500-lb. useful load.



Pioneers of power flight developed nation's next air weapon

What the Wright brothers demonstrated at Kitty Hawk, North Carolina, on a raw December day in 1903 foreshadowed developments of great importance for military aeronautics. Their achievement of controlled power flight made possible the development of an aerial weapon that could fly low and fast, one that was capable of taking the offensive in modern war. To this date the Army's interest in aviation had been primarily for purposes of reconnaissance, for the aerial dimension permitted observation not possible from the highest hill. Even the first heavier-than-air craft were evaluated for military purposes in these terms and praised for their ability to scout rough terrain with relative freedom from gunfire. But once the Wrights had proved that man could leave the ground under power, new and deadlier uses of the aerial weapon were certain to be developed for the armed forces.

As early as 1898, the War Department had prompted experimentation in heavier-than-air machines. Samuel Langley was subsidized to the amount of \$50,000 in his work on a steam-powered plane. By 1903, Professor Langley was ready to try his full-sized "aerodrome." Carrying a pilot and equipped with Manly's five-cylinder radial engine which developed 52.4 horsepower for a weight of 125 pounds, Langley's plane was damaged when, catapulted from a Potomac River houseboat, it snagged and failed to become airborne. Under congressional fire for foolish spending, the Army withdrew its support for Langley's ill-fated enterprise.

Less than two weeks later, the bicycle-making Wright brothers achieved what Langley had failed to do. The Wrights had practiced gliding and had developed a control system for a modified box-kite. Now in 1903 they added to the biplane a four-cylinder motor of their own design and two chain-driven, counter-rotating, pusher propellers. This was the machine that accomplished the first controlled power flight in history, December 17, 1903.

The Army tries its wings. Here, in 1912, a Wright B, the second Army model, flies over College Park, Md., Army airplane instruction center. Pilots are Lts. H. H. Arnold and T. D. Milling.

For the four years that followed this milestone in air history, most of the world either did not know or refused to believe what had happened. Although the Wrights were making closed-circuit flights of more than a half hour's endurance by the autumn of 1905, their offer of the plane to the U.S. Army was met with the reply, "... the Board does not care to ... take any further action until a machine is produced which by actual operation is shown to be able to produce horizontal flight and to carry an operator."

Despite such skepticism, others besides the Wrights were at work. Santos-Dumont, the Brazilian aeronaut, developed a box-kite plane with which in 1906 he made the first public exhibition of heavier-than-air flight. Louis Blériot's experiments, begun in 1905, were developing the design of a plane which he was to fly across the English Channel in 1909.

In the United States, Alexander Bell developed a new wing type, the relatively stable tetrahedral kite. He organized a group of pioneers, including F.W. Baldwin, Glenn Curtiss, J.A.D. McCurdy, and Lt. Thomas Selfridge, who built the power flyers, *Red Wing*, *White Wing*, *June Bug*, and *Silver Dart*, all of which were flown in 1908. None of the other experimenters, however, in Europe or the United States, could rival the Wright product for endurance and speed.

Encouraged by the support of President Theodore Roosevelt for military aeronautics, the War Department opened bids in 1907 for a "heavier-than-air flying machine" that could carry two passengers and fuel, and travel 40 miles an hour. Nineteen of the 41 bids submitted were nonsensical. Three met specifications: the Wrights' at \$25,000, Herring's at \$20,000, and Scott's at \$1,000. Bound by legalities, the War Department had to accept the lower bids which, together, absorbed all available funds. Fortunately for the history of U.S. aviation, someone recalled that the President controlled a small appropriation left over from the Spanish-American War. With \$25,000 from this fund, the War Department accepted the Wrights' bid as well, and with this move the Army entered the era of power flight.

SIGNAL CORPS SPECIFICATION, NO. 486.

ADVERTISEMENT AND SPECIFICATION FOR A HEAVIER-THAN-AIR FLYING MACHINE.

TO THE PUBLIC:

Bids, proposals, or designs, will be received at this office until 12 o'clock noon on February 1, 1908, on behalf of the Bureau of Ordnance and Fortification for furnishing the Signal Corps with a heavier-than-air flying machine. All proposals received will be opened at the Board of Ordnance and Fortification at its first meeting after February 1 for its official action.

Persons wishing to submit proposals under this specification may obtain the necessary forms and envelopes by application to the Chief Signal Officer, United States Army, War Department, Washington, D. C. The United States reserves the right to reject any and all proposals.

Unless the bidders see also the manufacturers of the flying machines they must state the name and place of the maker.

Particulars.—This specification covers the construction of a flying machine supported entirely by the dynamic reaction of the atmosphere and having no gun lag.

Acceptance.—The flying machine will be accepted only after a successful trial flight, starting which it will comply with all requirements of this specification. No payments on account will be made until after the trial flight and acceptance.

Inspection.—The Government reserves the right to inspect any and all processes of manufacture.

GENERAL REQUIREMENTS.

The general dimensions of the flying machine will be determined by the manufacturer, subject to the following conditions:

1. Bidders must submit with their proposals the following:

- (a) Drawings to show clearly the general dimensions and shape of the flying machine which they propose to build under this specification.
- (b) Statement of the speed for which it is designed.
- (c) Statement of the total surface area of the supporting planes.
- (d) Statement of the total weight.
- (e) Description of the engine which will be used for motive power.
- (f) The material of which the frame, planes, and propellers will be constructed. Materials used will not be shown in other bidders.

2. It is desirable that the flying machine should be designed so that it may be quickly and easily assembled and taken apart and packed for transportation in army wagons. It should be capable of being assembled and put in operating condition in about one hour.

3. The flying machine must be designed to carry two persons having a combined weight of about 250 pounds, also sufficient fuel for a flight of 15 miles.

4. The flying machine should be designed to have a speed of at least forty miles per hour in still air, but bidders must submit calculations in their proposals for cost depending upon the speed attained during the trial flight, according to the following scale:

- 30 miles per hour, 100 per cent.
- 35 miles per hour, 90 per cent.
- 40 miles per hour, 80 per cent.
- 45 miles per hour, 70 per cent.
- 50 miles per hour, 60 per cent.
- 55 miles per hour, 50 per cent.
- 60 miles per hour, 40 per cent.
- Less than 30 miles per hour rejected.
- 41 miles per hour, 110 per cent.
- 42 miles per hour, 120 per cent.
- 43 miles per hour, 130 per cent.
- 44 miles per hour, 140 per cent.

5. The speed accomplished during the trial flight will be determined by taking an average of the time over a measured course of more than five miles, against and with the wind. The time will be taken by a flying start, passing the starting point at full speed at both ends of the course. This test subject to such additional details as the Chief Signal Officer of the Army may prescribe at the time.

6. Before acceptance a trial endurance flight will be required of at least one hour during which time the flying machine must remain continuously in the air without landing. It shall return to the starting point and land without any damage that would prevent it immediately starting upon another flight. During this trial flight of one hour it must be steered in all directions without difficulty and at all times under perfect control and equilibrium.

7. Three trials will be allowed for speed as provided for in paragraphs 4 and 5. Three trials for endurance as provided for in paragraph 6, and both tests must be completed within a period of thirty days from the date of delivery. The expense of the tests to be borne by the manufacturer. The place of delivery to the Government and trial flights will be at Fort Myer, Virginia.

8. It should be so designed as to ascend in any country which may be encountered in field service. The starting device must be simple and transportable. It should also land in a field without requiring a specially prepared spot and without damaging its structure.

9. It should be provided with some device to prevent it from falling in case of an accident to the propelling machinery.

10. It should be sufficiently simple in its construction and operation to permit an intelligent man to become proficient in its use within a reasonable length of time.

11. Bidders must furnish evidence that the Government of the United States has the lawful right to use all patented devices or apparatuses which may be a part of the flying machine, and that the manufacturers of the flying machine are authorized to convey the same to the Government. This refers to the inventor's right to use the flying machine made to the Government, but does not contemplate the exclusive purchase of patent rights for duplicating the flying machine.

12. Bidders will be required to furnish with their proposal a certified check amounting to ten per cent of the price stated for the 50-mile speed. Upon making the award for the flying machine these certified checks will be returned to the bidders, and the successful bidder will be required to furnish a bond, according to Army Regulations, of the amount equal to the price stated for the 50-mile speed.

13. The price quoted in proposals must be understood to include the instructions of two men in the handling and operation of the flying machine. No extra charge for this service will be allowed.

14. Bidders must state the time which will be required for delivery after receipt of order.

JAMES ALLEN,
Brigadier General, Chief Signal Officer of the Army.

HEADQUARTERS,
WASHINGTON, D. C., December 22, 1907.

24149 A C.



This Article of Agreement entered into this _____ day of _____

February _____ nineteen hundred and eight, between _____

_____ Signal Corps, United States Army, of the one part and _____

_____ of _____

_____ in the county of _____ State of _____

_____ of the second part, Whereas, that in conformity with copy of the advertisement, specifications, and proposal hereto attached, and which, in so far as they relate to this contract, form a part of it, the said _____

Signal Corps, United States Army, for and in behalf of the United States of America, and the said _____

_____ (hereinafter designated as the contractor) do covenant and agree, to and with each other, as follows, viz:

ARTICLE I. That the said contractor shall manufacture for and deliver to the United States of America,

One (1) heavier-than-air flying machine, in accordance with Signal Corps Specification No. 486, dated December 22, 1907.

Specifications (left) and contract (right) for the Army's first plane also required Wright brothers to train two pilots.

WRIGHTS' FIRST TRIAL

Fatal crack-up at Fort Myer delayed Army approval

After signing a contract that called for delivery, before the end of August 1908, of a plane capable of carrying two people 125 miles at 40 miles an hour, the Wrights turned to their old 1905 model. They gave it a new engine, revised the seating and control plan so that the plane could be operated from a sitting position, and took it to Kitty Hawk for test flying. There, in mid-May, Wilbur took a passenger up for the first time, proving that the plane could carry two people. By many standards, the 1908 Flyer was a crude affair. Pilot and passenger sat with legs over the lower wing's leading edge, feet braced against a crossrail. A biplane

elevator perched at the front end of a pair of curved landing skids; a biplane rudder trailed aft, precariously guyed and braced between the arcs of two 8½-foot pusher propellers. The 180-pound water-cooled engine turned out 30 horsepower. Take-off was from a short monorail, assisted by a dropping-weight catapult.

Pretest flights began at Fort Myer early in September 1908, attracting curious crowds of Washington spectators. On September 17 came the accident that brought Army aviation's first fatality. Orville Wright, with Lieutenant Selfridge as his passenger, was making routine turns at 150 feet when one of the propellers fouled a rudder guy-wire. Propeller and wire broke, and the plane, out of control, fell to the ground. Selfridge died a few hours later. Wright, severely injured, remained in the Fort Myer hospital for several weeks. To allow for his recovery and repairs to the plane, the War Department postponed delivery date to summer 1909.



FIRST MILITARY AVIATORS

*For the next three years
the Army learned to fly*

The Wrights' contract called for the training of two officers in "the handling and operation of this flying machine," and Lieutenants Lahm and Frederic E. Humphreys, both on duty with the Signal Corps, were selected. Wilbur Wright took over the instruction at a site near College Park, Maryland, early in October 1909, and by the 26th both pupils had soloed. Lt. B. D. Foulois, returning from overseas duty, received unofficial instruction from both Wright and Humphreys.

Winter brought new problems. The Army's airplane was transferred to Fort Sam Houston, near San Antonio, where all-year flying was possible. But the Army's only two qualified pilots were summarily returned to their own branches of the service, Lahm to the cavalry and Humphreys to the engineers. That left Foulois,



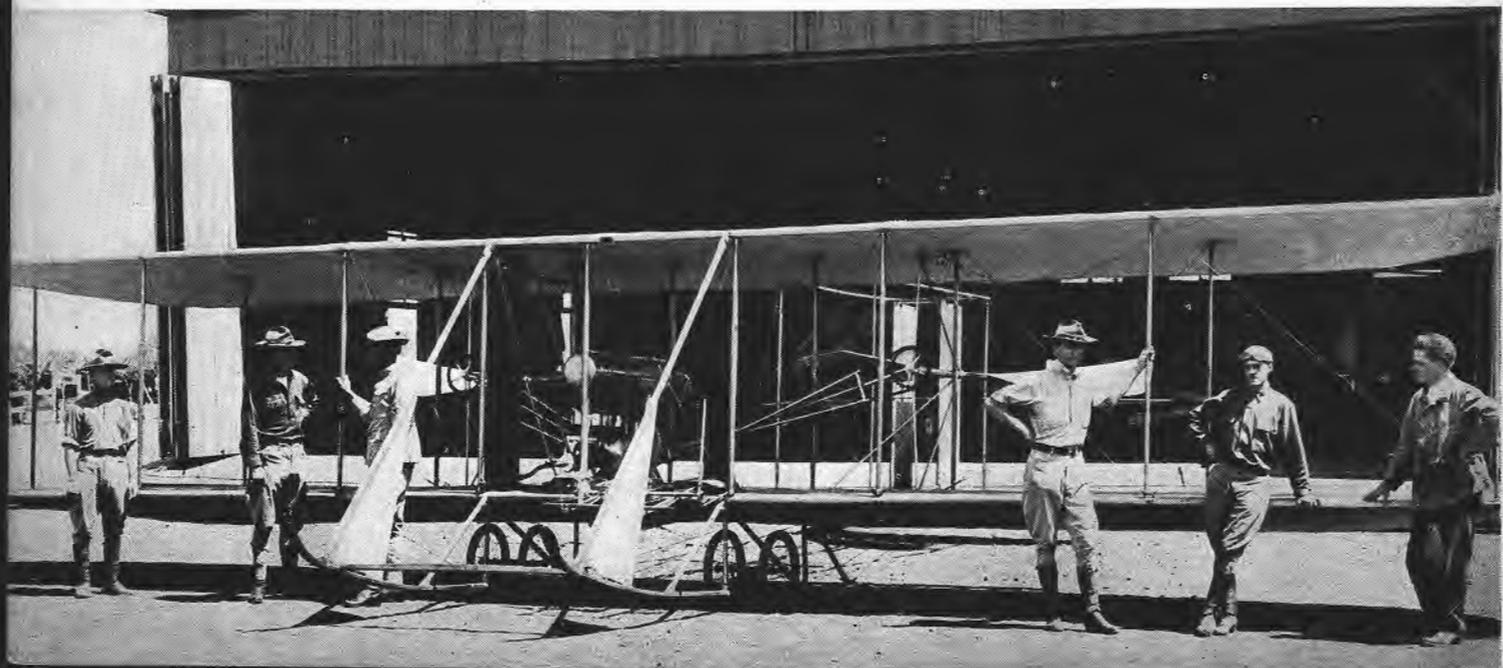
Lieutenant Arnold wears the football helmet and heavy gauntlets of a 1911 airman as he sits at controls of a Wright B plane.

with his casual three-hour training, the Army's only pilot. He had the job of teaching himself to solo. He got off the ground alone at Fort Sam Houston for the first time on March 2, 1910, and by September had managed to log some nine hours of flying time.

After a year as a trainer, Army Airplane No. 1 was getting ragged, but Congress was slow to heed the Chief Signal Officer's warning that the United States was being far outdistanced by France and Germany in aeronautical strength. In 1911, however, the Signal Corps received an air appropriation of \$125,000, whereupon Airplane No. 1 was presented to the Smithsonian Institution and more modern planes were ordered.

With new equipment, the pilot training program came out of the "one man" class. Lts. Paul W. Beck,

Wright Model B, shown at Fort Sam Houston in 1911, took the place of the original Airplane No. 1, presented to Smithsonian.





Chandler (left) and Kirtland pose with the Lewis gun on day following firing tests, when Milling was pilot, Chandler observer.



Weight-dropping tests occurred even before the first bombsight trials. Here is first live bomb to be dropped, with long lath for fin.

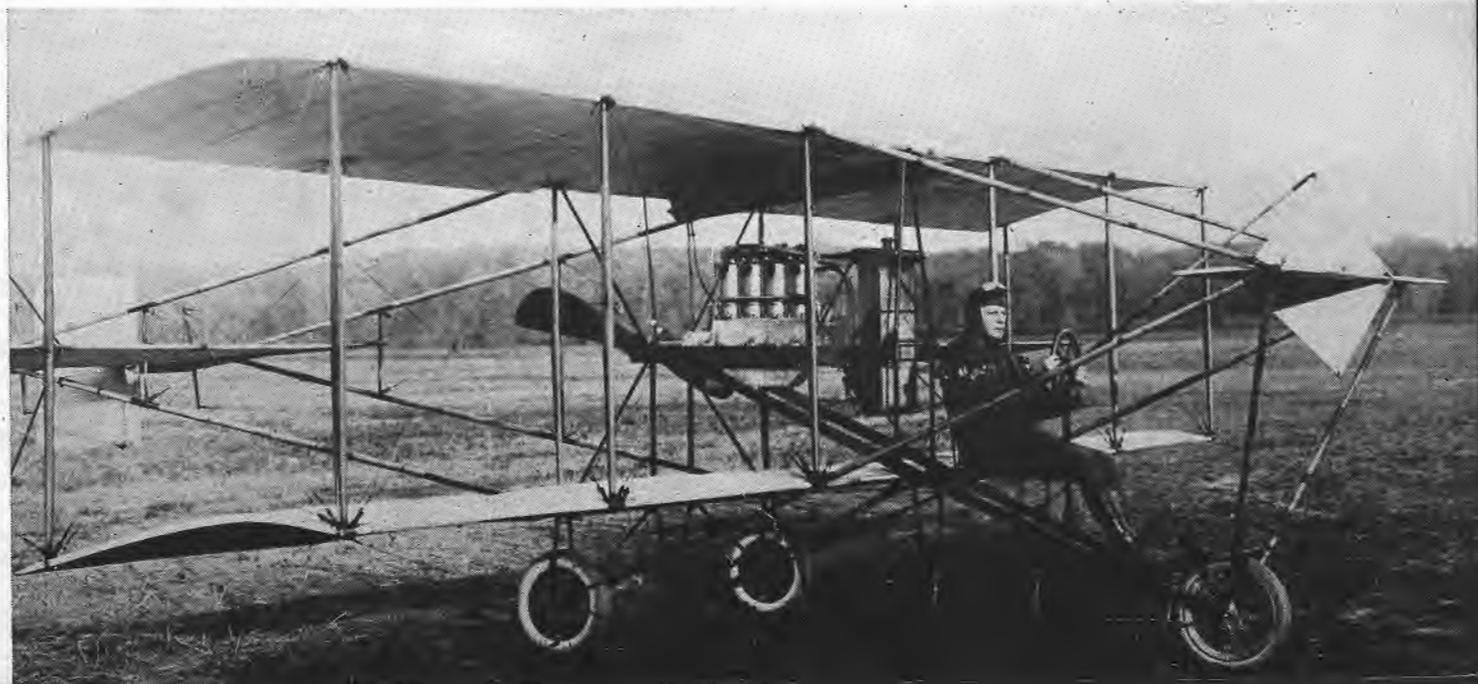
G.E.M. Kelly, and John C. Walker, who had been partly trained by Curtiss at San Diego, reported to San Antonio in the spring of 1911. The group's luck was bad. Walker lost control one day and escaped so narrowly that he requested relief from flight training. Kelly crashed on May 10 and became the first training casualty. This brought a prohibition of further flying on the drill grounds at Fort Sam Houston, but already plans were being made to return training to Maryland.

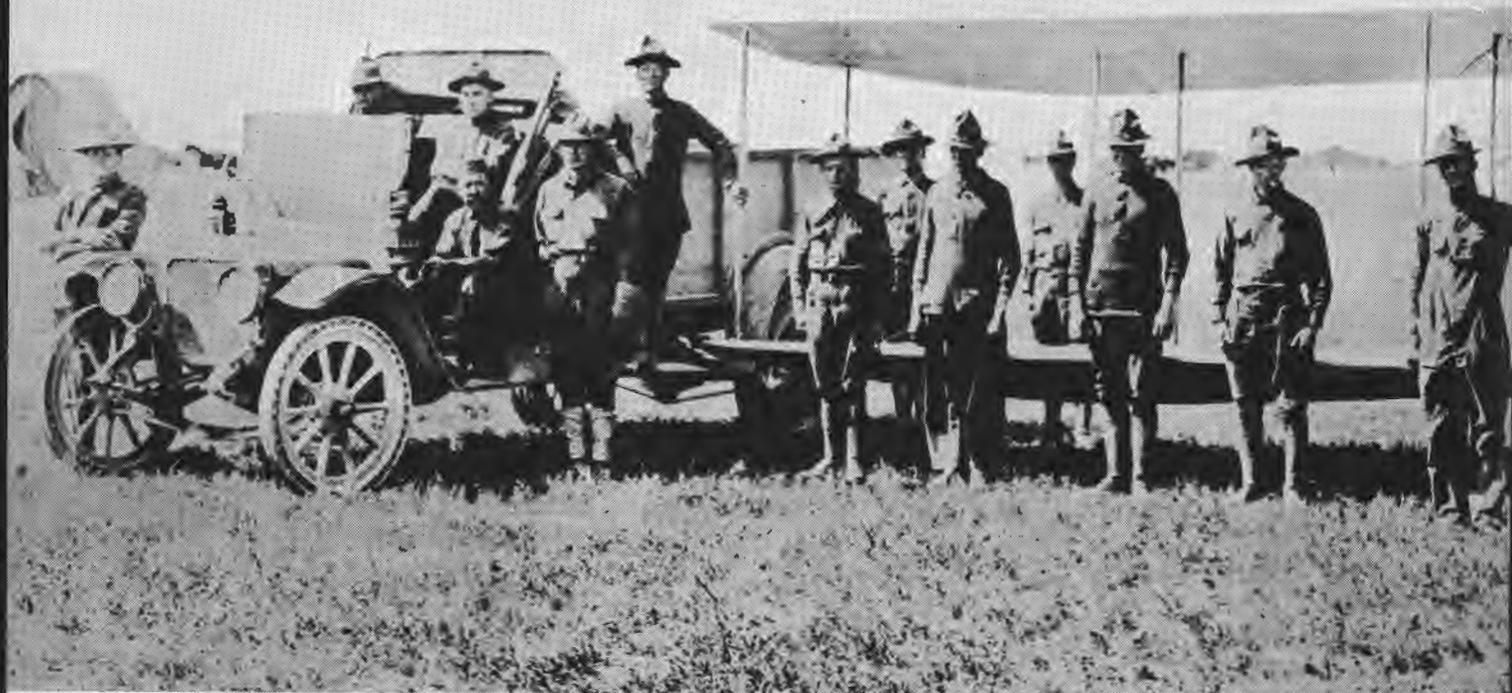
At College Park, things went more smoothly. Lieutenants Arnold and Milling, trained at the Wright Company, were assigned to the reopened Maryland station, their job being to instruct Captain Chandler, commander, and Lt. Roy C. Kirtland. In February 1912 the rating of Military Aviator (insignia left above) was

established. By the close of 1912 there were 17 living Army pilots, officer and enlisted, rated and unrated.

Besides instruction, several cross-country flights, and altitude attempts, two events at College Park excited the young airmen. First, in the autumn of 1911, Riley E. Scott brought a bombsight of his design to be tested. It was accurate enough to drop small bombs within 10 feet of a small target from 400 feet. Then Col. Isaac N. Lewis brought his air-cooled machine gun, in June 1912, for similar experiment. Encouraged by reporters who found good stories at College Park, the pilots elaborated a misty future when whole battles might be fought in the air. Asked for comment, a War Department spokesman took pains to point out that the Army's airplanes were intended only for reconnaissance.

Curtiss built the other early Army trainer. Its inter-plane ailerons improved upon the Wright system of warping wings.





First Provisional Aero Squadron, under Captain Chandler, was formed in Texas City, March 1913. With seven pilots

AMERICA'S YOUNG AIR FORCE

Training came first

During 1913 training continued to be the first consideration of the handful of pioneers who were furthering the development of Army aeronautics between 1909 and 1917. From July 1912 to the close of 1913, 24 officers were rated Military Aviator, among them Lieutenants Arnold, Foulois, and Lewis E. Brereton. Training was moved to a better climate at North Island, San Diego, where Glenn Curtiss had been operating a flying school since January 1911.

The Army's few pilots had not yet moved from winter quarters at Augusta, Georgia, when orders were received to report for tactical duty with the mobilizing 2d Division then guarding the Texas border. At Texas



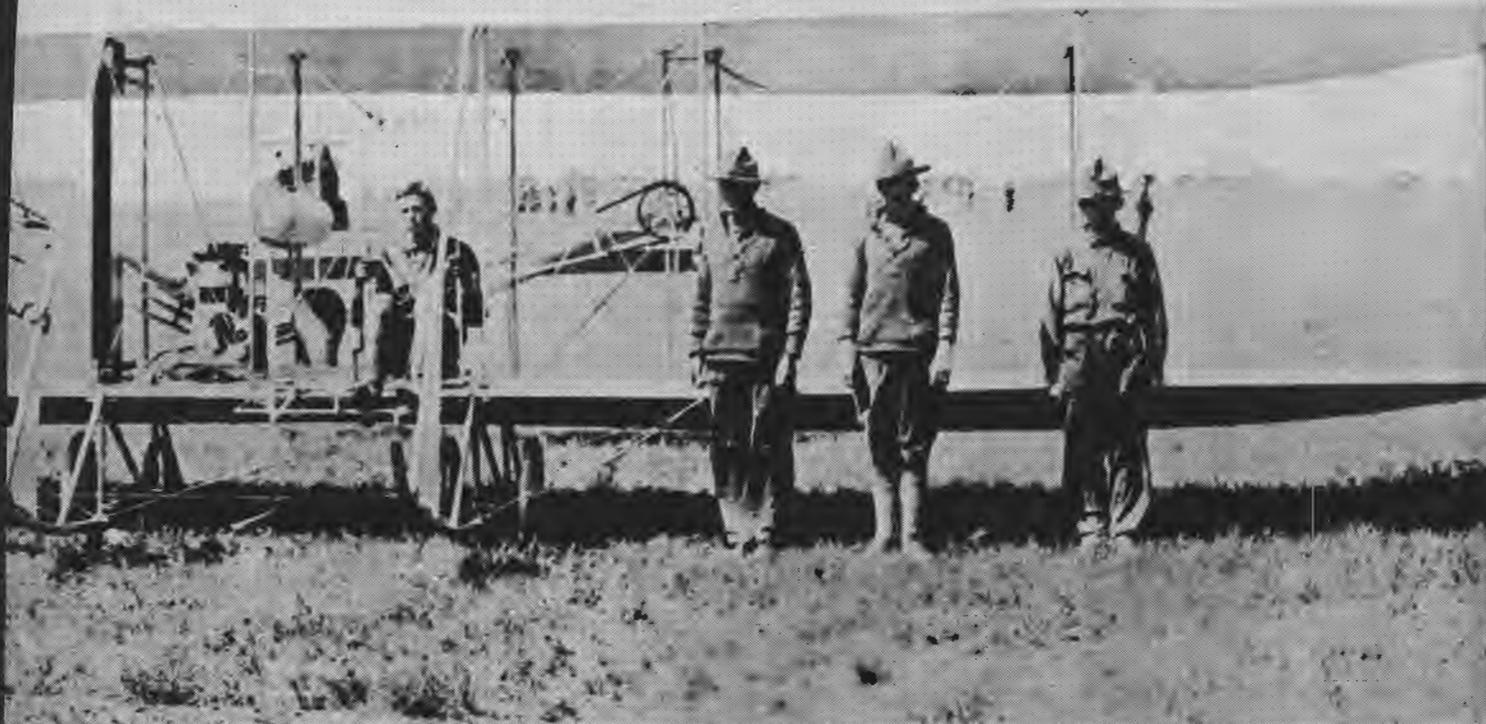
At Fort Riley, Kansas, 1912, Lieutenants Arnold and Bradley spotted artillery fire from air in Wright C.



Tests proved that, for artillery liaison, use of air-ground radio, shown here, was superior to dropped messages.



This machine shop kept airplane engines in tune at Signal Corps Aviation School on North Island. Army shared island with Curtiss.



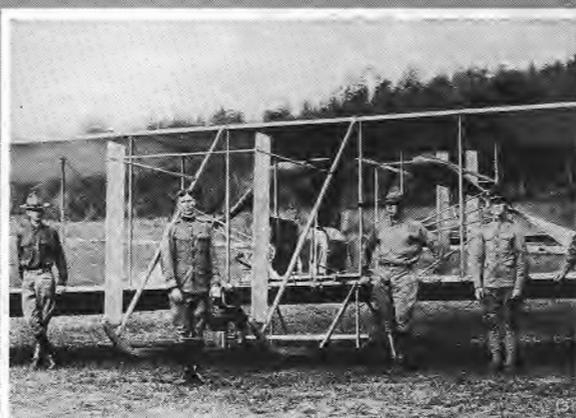
originally assigned, and seven Wright B airplanes, it served with the 2d Division during tense relations with Mexico.

City Captain Chandler, Augusta commandant, formed his students and instructors into the First Provisional Aero Squadron. From March until mid-June they worked with ground forces, made record cross-country flights, and gained valuable training in liaison and reconnaissance. Then, since the expected trouble with Mexico had not materialized, most of the group went on to the school at North Island.

Meanwhile, additional training was in progress in America's outposts in the Pacific. Flying training began in 1912 in the Philippines where Lieutenant Lahm, who had returned to the cavalry in 1909, was given temporary aviation duty. During 1912 and 1913 he taught flying to four officers and one enlisted man at Fort McKinley. From July to November 1913, Lt. Harold Geiger operated a short-lived flying school at Fort Kamehameha, Hawaii, but conditions unsuitable to flying the 1913 type of plane led to its close.



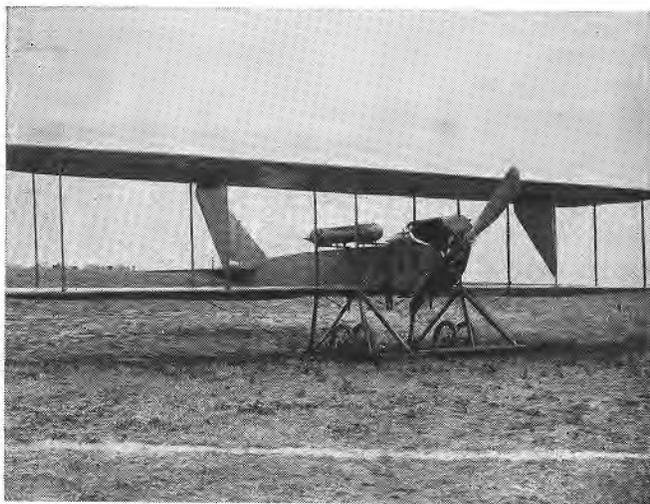
By 1914 Wrights' Dayton factory had built 13 planes of different types for Army use. This factory was occupied in fall of 1910.



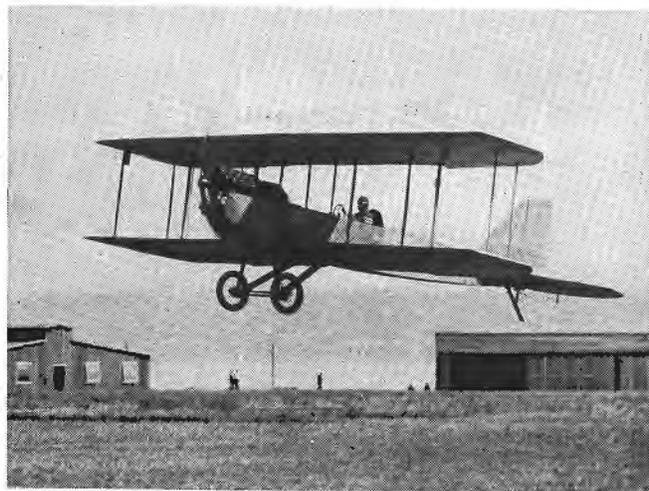
Lieutenant Lahm poses beside one of two Wright C's used at Fort McKinley in the Philippines, May 1913.



Float-planes were useful in the Islands. This Burgess-Wright belonged to the Corregidor garrison in 1914.



Before rebuilding, this Burgess-Wright tractor had heavy landing gear and the long warping wings of the standard Wright design. It flew 58 m.p.h. and could climb to 1,800 feet in 10 minutes.



After Loening's work, the Burgess was a new airplane. Wing, undercarriage, tail, and control system were changed, plane lightened. Its new speed was 72 m.p.h., its 10-minute climb, 3,200 feet.



Curtiss JN-1, first plane of the JN series, marked an advance in design. It had its ailerons trailing the wings rather than between them. Its OX engine, 90 hp., permitted a speed of 80 m.p.h.

THE NORTH ISLAND SCHOOL

Rising death toll brought new training planes

By the close of 1913, continental flight training had been concentrated at the Signal Corps school on North Island, San Diego. To date the Army had bought 28 airplanes. Nine had been destroyed; the remaining 19 were in the Philippines, Hawaii, Texas, and San Diego. Of the some 40 men who had received flight instruction, 11 had been killed in crashes, the mounting list of fatalities in 1913 including Lts. H.M. Kelly, Rex Chandler, J.D. Park, Moss L. Love, and Eric Ellington.

By mid-February 1914, more crashes, one of them fatal, and two requested transfers focused attention on the poor safety record. Oscar Brindley, recently chief instructor at the Wright school and civilian instructor at San Diego since December 1913, reported the planes to be in bad condition and suggested that they be rebuilt. After board action on the accident which cost the life of Lt. H. B. Post, all the existing Curtiss and Wright pushers were condemned.

There was good reason for grounding the pushers. They were easily stalled, a situation particularly dangerous when recovery from stalls was not understood. When one cracked up, even mildly, the engine was likely to tear loose and fall upon pilot and passenger. As for individual faults, the Wright engines were criticized as unreliable and the Curtiss throttle and gas-line installations, as flimsy. But the condemnation of 11 planes in 1914 left the Army with only five training planes, one Curtiss tractor and four Burgesses.

The job of reconditioning some of this equipment fell to Grover C. Loening, who left the Wright Company to accept an appointment as Aeronautical Engineer, U.S. Signal Corps, and with Lieutenant Milling set up a construction and repair department at North Island. Undertaking to rebuild the four Burgesses, Loening revised the control system, substituting the modern Curtiss ailerons for the Wright wing-warping. He eliminated the clumsy skid-equipped landing gear and substituted one of his own design. Wing span was reduced, tail design simplified. When the job was done, the modified Burgess-Wrights were 200 pounds lighter and 14 miles an hour faster.

While the rebuilding project was in progress, training came virtually to a halt for lack of flying equipment. Fortunately, Glenn Martin had just completed a fine sport plane in his Los Angeles workshop. The Model T, converted into a dual-control trainer for Army use, was an immediate success. July 1914 saw the completion of the Curtiss JN-1, one of a series of trainers that ultimately was to outshadow both the rebuilt Burgess and the Martin T. With the purchase of 11 of these Burgess, Martin, and Curtiss models in 1914, Army flight training was again stepped up. Time in the air averaged 75 hours a month, and training accidents were greatly reduced in number.



Glenn Martin's Model T, early Army training airplane, comes in, dead stick, for a landing at North Island flying field. From early 1913 Army flyers trained at North Island, San Diego. Center was named Rockwell Field during World War I.

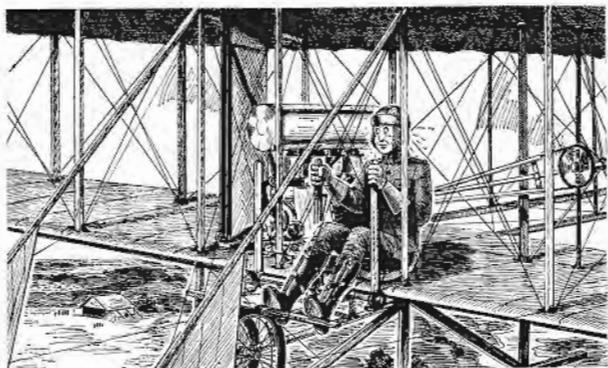


CONTROL SYSTEMS

Wright



A pair of levers controlled the flight of Wright biplanes. Left-hand lever moved the elevator; a push forward on the lever brought the nose down, a pull back brought it up. Motion of the right-hand lever both warped the wings and moved the rudder for normal turns, forward for left bank, back for right bank. Additional rudder control was provided by side-to-side motion of right lever's top portion which "broke" right or left for the equivalent rudder motion. This early Wright system of control was more mechanical than instinctive.

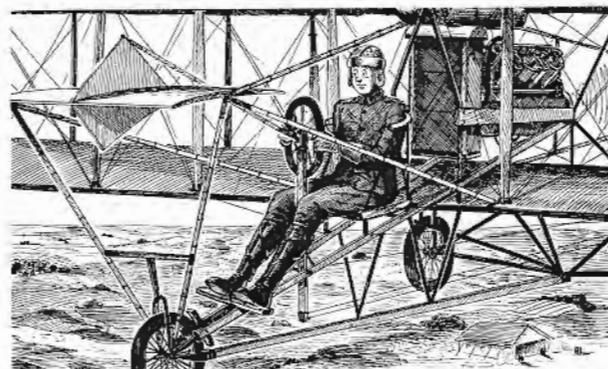


Lever-happy, this early airman is headed for a stall.

Curtiss



A column with wheel and set of shoulder-yokes made up the Curtiss control system. Fore-and-aft motion of the column lowered and raised the nose. To bank, the pilot leaned his body in the desired direction, pushing the shoulder-yoke, which controlled the ailerons, left or right. The rudder was linked to a steering-wheel on top of the column, and it followed the wheel motions, left or right. Advantage of the Curtiss control system over the Wright system of levers was that the motions of control more nearly approached the instinctive.



Except for calloused shoulders, this man is doing O.K.

"Dep"



Déperdussin, European airplane designer, linked the ailerons to a Curtiss-type wheel and added rudder control worked by the pilot's feet. The column's forward and back motion still moved nose down and up, while a roll of the wheel dropped and raised the wings. On the rudder bar, the pilot pushed his foot forward in the desired direction of turn. This more instinctive "Dep" system, in general use by 1915, was accepted by the U. S. Army shortly after that. Today, all but a few single-engine airplane types are flown by "Dep" control.

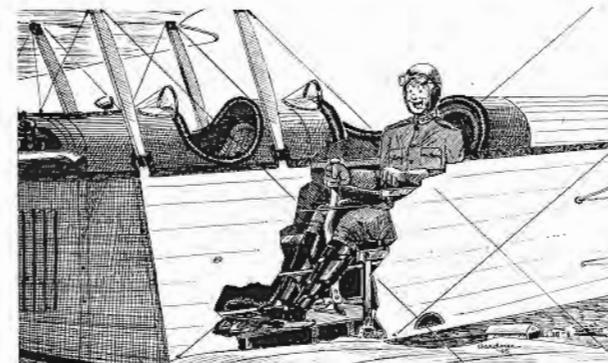


Content at last, this flyer feels confident with "Dep."

Stick



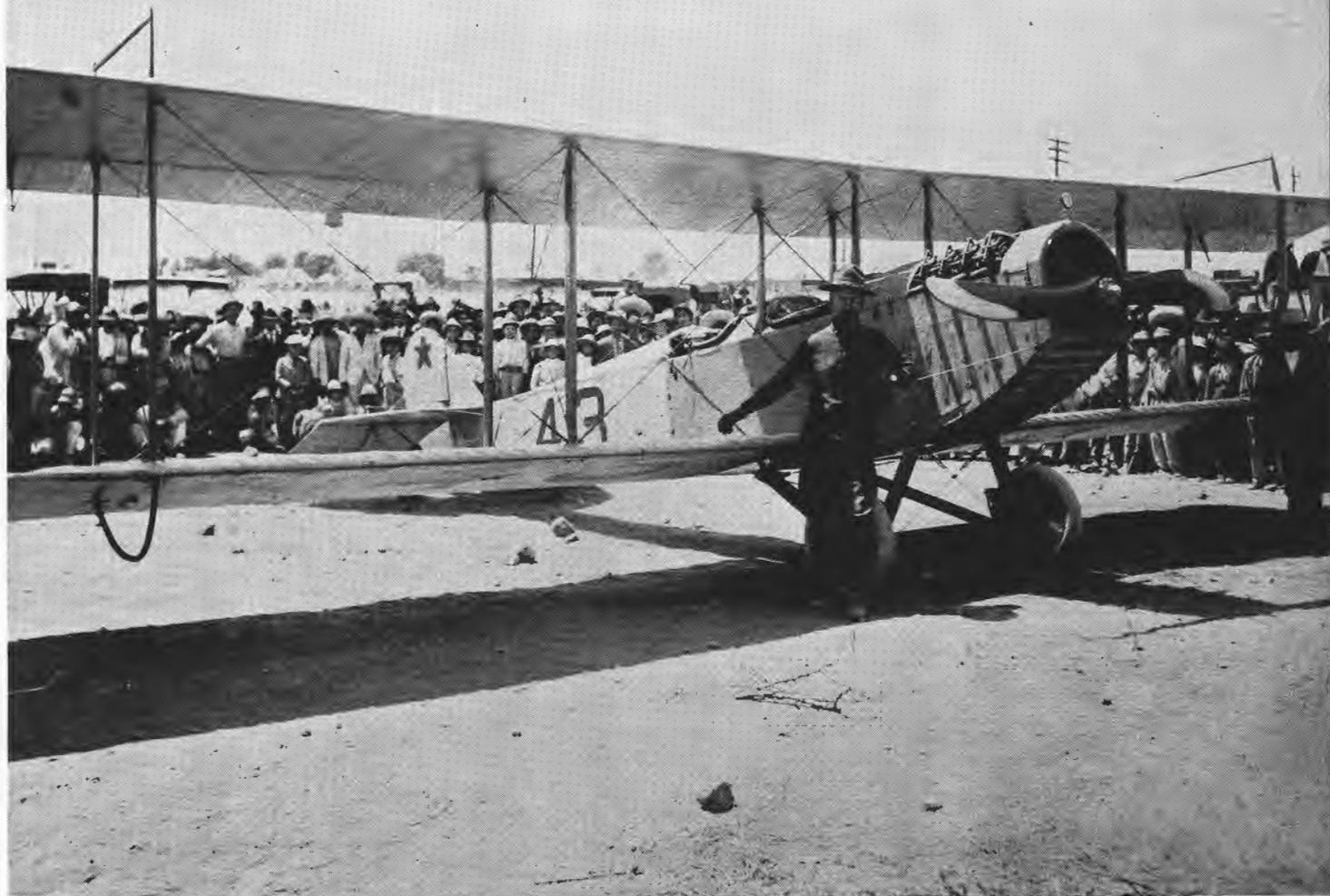
Robert Esnault-Pelterie used the universal movement of a stick to control aileron and elevator action. Forward and back motion moved nose down and up. Sideward motion dropped and raised the wings. Stick could be used simultaneously for aileron and elevator action. Rudder bar was used the same as in "Dep" control. The "stick" system was used by the Allied and Central powers from the beginning of World War I and it was adopted by the Army in 1917 for all but heavy-type aircraft. Little if any transition is required between stick and "Dep" control.



As in "Dep," pilot takes to instinctive stick action.

First decade of power flight saw an evolution of control systems from primitive weight-shifting techniques to the present-day methods. There was never any disagreement about the three motions that needed control, the movements about longitudinal, lateral, and vertical axes, but each designer approached the problem with

different mechanical solutions. Early pilots engaged in heated controversies over the relative merits of the Wright and Curtiss methods; and since all pilots were originally either Wright- or Curtiss-trained, they had to master both systems in order to fly all available equipment. Above panels trace the development of controls.



Carrying dispatches, Lt. H. A. Dargue kept off this hostile Chihuahua crowd by posing for local Mexican photographer.

MEXICAN EXPEDITION

U. S. planes made a poor showing

Army aviators had their first chance for action in connection with troubles on the Mexican border in 1916. On March 9 the outlaw Villa and a band of desperadoes raided Columbus, New Mexico, killing 17 Americans. To this the United States responded by dispatching troops into Mexico under orders to get Villa, dead or alive. Brig. Gen. John J. Pershing was in charge of the expedition, and the First Aero Squadron, at Fort Sam Houston, was ordered to Columbus for duty. Eleven pilot officers, 82 enlisted men, and one civilian mechanic comprised the personnel. Captain Foulois was in charge.

The initial flight of the eight-plane squadron from Columbus to Casas Grandes, Mexico, was typical of what was to come. One plane turned back to Columbus with engine trouble. Three became lost and made random night landings near different Mexican towns; one cracked up. The other four, staying together, were forced down by darkness. Reconnaissance activities on the following day demonstrated further difficulties.

Capt. T.F. Dodd, pilot, with Captain Foulois as observer, was unable to lift his plane high enough to cross the Sierra Madre, and Lt. T.S. Bowen cracked up, caught in a whirlwind in landing. After a month of carrying mail and dispatches and searching for friendly and enemy troops the squadrons had only two planes left, and these were unfit for further field service. The squadron returned to Columbus on April 22.

Terrain, more than anything, had licked them. High mountains, with wind and dry climate, had stood in the way of success. But their equipment, too, was worn and inadequate—trainers sadly underpowered for flight in high altitudes. New Curtiss R-2's, arriving in late spring and summer, developed propeller trouble, and by the time repairs were effected American withdrawal from Mexico was being contemplated. The First Aero Squadron's first venture in tactical operations was over. Few of its members could have foreseen that within a year the squadron would be on its way to a new test that was greatly to affect America's destiny in the air.



World War I brought fighting and bombing planes

Modern air warfare had its origins in World War I, a conflict that wrought tremendous changes in the employment of America's air arm. At the outset of the struggle in 1914, the warring powers had little respect for aircraft as an offensive weapon. To British, French, and German generals alike balloons, dirigibles, and airplanes had the one proved function of reconnaissance. But by the time the United States entered the war, airplanes were already much more than the "eyes" of the armed forces. Britain's Sopwiths had fought off bombing raids of Zeppelins; and aerial duels between Germany's Fokkers and the Allies' Spads and Nieuports had tested the offensive possibilities of a weapon that was to revolutionize the technique of war.

At the outbreak of hostilities the European contestants were about equally matched in resources of aircraft available for immediate service. In the first month of war Britain's tiny Royal Flying Corps, operating in the traditional role of observers, had saved the British Army from virtually complete annihilation during the retreat from Mons. Almost immediately, however, Germany gained a control of the air which she retained until well into 1916. This she won through taking advantage of Fokker's development, in a fast fighter plane, of a mechanism allowing machine-gun fire through the propeller disc without interfering with the blades. Fixed machine guns outmoded the free fire of one plane upon another with rifles and pistols which had marked the beginning of fighter aviation in 1914.

Aerial bombardment, too, was raising the prestige of the air weapon. Germany bombed Compiègne in August 1914, and three months later three English Avros flew 250 miles over enemy country to bomb the Zeppelin works at Friedrichshafen. First definite cooperation between bombing and army operations occurred in September 1915; and night bombing from airplanes

began a year later. Aerial direction of artillery fire and aerial photography became increasingly important as the war progressed.

By the time the United States was ready to lend a hand at making the world "safe for democracy" she was committed to action in the air as well as on land and sea. Congress, which hitherto had provided only scanty funds for aviation, now appropriated almost unbelievable sums for air warfare. Secretary of War Baker predicted that America's airmen and planes might "turn the tide." France urged the United States to have 5,000 pilots and 4,500 planes at the Front by spring of 1918. It was a large order for America's relatively undeveloped air organization and aviation industry. The spirit was willing but the arm was weak.

It soon was only too apparent that the United States—cradle of heavier-than-air flight—had lagged behind her European neighbors in the field of military aeronautics. Europe's combat experience was clouded in military secrecy. The National Advisory Committee for Aeronautics, single agency for the scientific study of aircraft, was hampered for want of funds. Many of America's young men were already flying with the Allies, in such organizations as the Lafayette Escadrille. Hearings in January 1916 disclosed the fact that the already small Aviation Section was seriously under strength. Alarm over developments in Europe led to increases in appropriations and authorized personnel but in spite of this, at the opening of 1917, the United States ranked fourteenth among the nations in terms of aviation. At a time when the European belligerents were sending aloft planes of a dozen specialized types, U.S. military aviation stood pitifully unready for a war in which armies were now relying on power in the air. A handful of flying officers, a half-dozen small training fields, not a plane capable of combat use, and an aviation industry still in its infancy—these were the meager resources from which America was to forge an air weapon capable of contributing to victory for the Allies.

Americans of 1st Aero (Corps Observation) Squadron fly French Salmson over the German lines during Château Thierry action. Flvers photographed enemy strongpoints from planes of this type.

"All the News That's Fit to Print"

The New York Times.

THE WEATHER
Clearing today; tomorrow probably
fair with showers.

VOL. LXVI, NO. 21,622 NEW YORK, FRIDAY, APRIL 6, 1917. TWENTY-TWO PAGES

HOUSE, AT 3:12 A. M., VOTES FOR WAR, 373 TO 50; \$3,000,000,000 ASKED FOR ARMY OF 1,000,000; NATION'S GIGANTIC RESOURCES MOBILIZED

WAR BUDGET FOR WAR

\$3,000,000,000 Needed for the Army and Navy at Once.

ESTIMATES GO TO CAPITAL

Warfare and a \$3,500,000,000 bond issue considered as a means of getting funds.

WILL RAISE INCOME TAXES

Food price of 3 1/2 for bread.

American Box in Belgium May Be Landed in Germany

WASHINGTON, April 5.—A dispatch from the Associated Press, London, says that a German consignment of American boxes, which were seized by the British in Belgium, is being sent to Germany.

FIVE GERMAN SHIPS AT BOSTON SEIZED

Five German ships, which were seized by the British in Belgium, are being sent to Boston.

DETAILS OF THE ARMY BILL

Universal Service Embodied in Measure Presented to Congress.

SELECTIVE DRAFT AT ONCE

Regulars and Militia to be Put on a War Footing and 500,000 Others Called.

WILL BE TO GO MUST ENROLL

President Authorized to Enlist 500,000 Men.

German Warships Seize Ship That Helped Save U-Boat

WASHINGTON, April 5.—The German warships, which were seized by the British in Belgium, are being sent to Germany.

32,000 PLANTS OFFERED

No Nation Ever Had Such Enormous Resources for Waging War.

TWO YEARS OF PREPARATION

Summary of What Has Been Achieved in Naval, Military, and Industrial Fields.

OUR NAVY READY FOR ACTION

List of Fifty Members of House of Representatives Who Voted Against the Adoption of War Resolution

WASHINGTON, Friday, April 6.—The fifty Representatives who voted against the war resolution were:

ALTON BROWN	WILLIAM (DR.) WOODS (Iowa)
BENNETT	JOHN (S. D.) JOHNSON (S. D.)
CARY	KEENE
CHAMBERLAIN	REYNOLDS
CONNELLY (Iowa)	ROSS (Iowa)
DAVISON	SMITH
DILL	STANTON
DUNN	SWANSON
ELIOTT	WHEELER
FRANK	

GERMANY GARBLES FRANCE AROUSED

WASHINGTON, April 5.—The German warships, which were seized by the British in Belgium, are being sent to Germany.

DEBATE LASTED 16 1/2 HOURS

One Hundred Speeches Were Made—Miss Rankin Sobbing, Votes No.

ALL AMENDMENTS BEATEN

Resolution Will Take Effect This Afternoon with the President's Signature.

KITCHEN WITH RADICALS

THE NEW YORK HERALD.

PART II. NEW YORK, MONDAY, JUNE 18, 1917. PRICE ONE CENT

GREATEST OF AERIAL FLEETS TO CRUSH THE TEUTONS; RUSSIAN DUMA ORDERS THE RENEWAL OF BIG OFFENSIVE

\$600,000,000 FOR FLYING FLEET TO DRIVE PRUSSIANS FROM AIR BACKED BY WAR DEPARTMENT

Aerial Domination, Recognized by Experts as Essential to the Overthrow of the Prussian Autocracy, is Aim of Bill Urged by Mr. Baker.

UNITED STATES TO BECOME AVIATION TRAINING BASE FOR ALL THE ALLIES

Project, It is Declared, Will Not Interfere in Any Way with Great Program for the Army or for the Shipments of Food and Munitions.

Domination of the air by the Allies is the object sought to be accomplished by the bill which will be introduced in Congress tomorrow.

Such domination is recognized by the experts of all the Allies as being essential to the overthrow of Prussian autocracy, and that end will be achieved by applying the immense latent energy of the United States to the task of rearing the rapidly growing aviation which now manifests its possibilities.

The War Department is believed to be in accord with every phase of the project.

Most Effective Use for the Flying Fleet will be in the attack on the Prussian coast.



FOOD PRICES PLUNGE SHARPLY AS THE GOVERNMENT MOVES TO CONTROL THE NATION'S SUPPLY

OFFENSIVE BY RUSSIAN ARMY VOTED IN DUMA

Resolution Declares Separate Peace or Inactivity is Treason to Allies.

SAFETY OF RUSSIA DEPENDS ON ACTION

Evolution of Swiss Secular View Aided as Peace Agent is Favored.

The Russian Duma has voted for a separate peace, and the government has declared that it will not accept such a peace.

Quotations for Week Show Marked Decline in Several Staples.

FURTHER DECREASES SOON ARE PREDICTED

However, Back in Washington Pushing the Voluntary Conservation Program.

DROP IN PRICES BECOMES APPARENT

Prices of many commodities have fallen sharply since the government took control of the supply.

The government has taken steps to control the supply of food and other necessities.

The government has also taken steps to control the price of food and other necessities.

On April 6, 1917, the United States declared war on Germany. Optimistic America envisioned the speedy creation of a flying fleet that would soon dominate Europe's skies and expected the country's enormous potential of men and ma-

terial to provide the strength needed to overwhelm the Hun. The Army's meager air arm—about 65 officers and 50 flying students, some National Guard and Reserve officers with flying experience, and 1,087 enlisted men—accepted the challenge.

PRESIDENT TO ASK \$600,000,000 FOR GREAT AIR FLEETS

Record-Breaking Project Will Be Submitted to Congress, Probably This Week.

BAKER CHAMPIONS PLANS

"A Few Trained Aviators May Spell the Difference Between Victory and Defeat."

TEST OF AMERICAN METTLE

Action Is Expected to Give Impetus to Movement for a Department of Aeronautics.

Special to The New York Times.

WASHINGTON, June 11.—The Administration will submit to Congress, probably the present week, estimates of appropriations for the greatest air fleet ever devised. The aviation program calls for an expenditure of \$600,000,000, and the President is understood to have given his approval to a bill prepared by officials of the War and Navy Departments and the Council of National Defense.

Secretary Baker issued a statement tonight saying: "The War Department is behind the aircraft plans with every ounce of energy and enthusiasm at its command. The aircraft program seems by all means the most effective way in which to exert America's force at once in telling fashion."

Leaders in Congress were advised today that the Administration would seek a record-breaking appropriation for aviation. Information at the Capitol is that the Aircraft Production Board has decided \$600,000,000 is required for the

PROJECT BIG FLEET OF BATTLE PLANES

2,000 a Month Are Included in Expanded Program of Aircraft Board.

PARTS TO BE STANDARDIZED

Automobile and Typewriter Factories to be Called Upon to Help.

Special to The New York Times.

WASHINGTON, June 20.—The United States Government is making plans to turn out engines for battle planes at the rate of 2,000 a month, and will be prepared to deliver the first consignment by November, according to information obtained today from representatives of the Aircraft Production Board, of which Howard Coffin is Chairman.

In the meantime training planes will be turned out in great numbers to supply the camps in Europe and the United States. Within a comparatively short time, if Congress grants the proposed appropriation of \$600,000,000, it is hoped to relieve the British and French factories from all work except the making of the highly specialized fast fliers, which are capable of 140 miles an hour or more. Factories in this country, eventually, will also turn out that type of machine.

The heavy battle planes which American manufacturers now propose to produce will be capable of a speed of from 110 to 120 miles an hour and will be used for bombing and other fighting within a short distance of the lines of the allied armies.

The plans were discussed in detail today at conferences between Mr. Coffin and General George O. Squier, who is in charge of the army aviation program. They are urging Congress to grant the big appropriation and they have the support of the President. After a careful investigation of the industrial situation in this country they have come to the conclusion that the output of America will be limited only by the amount of money which is placed in the hands of the men who are pushing the airplane program. Manufacturers of automobile engines are ready to respond and turn their plants over to the Government without protest. In fact, at this time, some of the plants are at

AIR FLEET BILL PASSED BY SENATE

No Change Made in \$640,000,000 Measure, Which Now Goes to President.

DRAFT PROVISION KEPT IN

Amendment Eliminating Compulsory Flying Beaten, 66 to 12—To Build 22,000 Planes.

WASHINGTON, July 21.—The House bill appropriating \$640,000,000 for the aviation service was passed late today by the Senate without amendment or a record vote and with less than an hour's discussion. It now goes to the President.

The Senate's only dispute, with many members expressing a desire to pass the bill immediately, was over an amendment of Senator Hardwick of Georgia to strike out a clause authorizing drafting of the men for the aerial service. The amendment was rejected 66 to 12, after Senator La Follette and Gronna had made brief speeches opposing the draft.

Details of plans for expending the huge sum appropriated have been withheld, but it is known that it provides for about 22,000 airplanes and nearly 100,000 men.

The President is expected to sign the bill Monday, and the work of building one of the greatest air fleets the world has seen will be pushed with vigor. During the first year officials hope to produce at least 3,500 machines, with a great increase the next year. For the first few months virtually the entire attention will be centred on construction of student planes, and there has been talk of bringing British and French aviation student officers to the United States to help in training.

In rejecting the Hardwick amendment the dozen Senators voting to strike out the draft clause were Borah, Broussard, Curtis, Gore, Gronna, Hardwick, Kirby, La Follette, McKellar, Norris, Owen, and Vardaman.

President Wilson's request in June for \$600,000,000 to meet the needs of military aviation staggered a Congress which since 1898 had allotted a total of less than \$80,000,000 for military aeronautics. But according to Secretary of

War Baker, "The supremacy of the air, in modern warfare, is essential to a successful army. . . . America's airmen and airplanes may turn the tide. They furnish our supreme opportunity for immediate service on the fighting line."



Aviators prepare to take off in flimsy, French-built Morane rouleur which served Americans for instruction in flying at Tours.



Devices for teaching gunnery at Cazaux, French school where Americans improved technique, took full course in aerial gunnery.



Issoudun, main American training center in France. Instruction for observation and pursuit pilots progressed through 10 fields.

TRAINING IN FRANCE

American boys learned combat flying in Europe

It was easier to talk about "turning the tide" of victory than to produce American flyers to do the job. Combat planes were lacking, as well as pilots to fly them. First Americans to see action trained on European fields, flew European planes, and fought with Allied armies. It was September 1917 before the first American squadron reached Europe and seven months more before it was in combat. By the time America's air arm was ready for independent action the war had less than four months to run.

American trainees began arriving in Europe in the summer of 1917 for flying instruction, particularly in French schools, such as those at Tours and Clermont-Ferrand. At Issoudun the construction of a large American training center got under way. The United States was to furnish workmen, materials, and a narrow-gauge railway; France would contribute planes, engines, and cleared land. Lack of personnel and materiel delayed the opening of Issoudun until late in October 1917, and with the newly constructed site a sea of mud and makeshift barracks, it was months before training there was in full swing. A further handicap was the priority given to line troops which prevented the arrival in Europe of practically any Air Service personnel between December 1917 and July 1918. But in spite of many obstacles, by the Armistice, 1,674 fully trained American pilots and 851 observers had been trained in overseas schools of the United States and the Allies.

Even before the declaration of war on Germany, many young Americans had cast their lot with the Allies. Of these the most famous were the members of the Lafayette Escadrille, organized in March 1916 and baptized at Verdun. They flew under the French for nearly two years and later became the nucleus of the 103d Pursuit, first American squadron to see action at the Front. Arriving there in February 1918, the squadron

TRAINING IN BRITAIN AND ITALY

U. S. squadrons apprenticed with Allies

Training facilities in Britain and Italy, as well as in France, were early recruited in America's hurried attempt to swell its flying force. About a third of the U.S. pilots flying over enemy lines at the close of the war were British-trained; more than 400 received training at a school for Americans in Foggia, Italy.

American flying cadets began to arrive at Oxford early in September 1917 to attend the British School of Military Aeronautics, and by the end of the war more than 500 flyers had received either complete or partial training in British schools at an estimated cost of \$5,000 for each cadet trained.

Many of these aviators went into action with the British; others joined the A.E.F. Capt. Robert A. Little, ranking U.S. ace, and Lt. Stanley Rosevear were among the Americans who gave their lives in service with the British. Two British-trained American squadrons—the 17th and 148th—flew Sopwith Camels with the R.A.F. in the field until November 1, 1918, when they were ordered to join the American 2d Army. In August while operating in the northern sector, the 17th caught three flights of Fokkers on the ground, bombed and

strafed them, and returned at low altitude, shooting up transports on the road. In the following weeks the squadrons supported the British in tangling with technically superior Fokkers, and in mid-September they gave vital aid to the British in their drive on Cambrai. They harassed the retreating enemy by dropping bombs on troops and supplies and developed the technique for ground strafing by pursuit planes.

Britain further cooperated in the development of America's air force by training aircraft mechanics and agreeing to supply workers to assemble Handley-Page bombers from parts made in American factories. Difficulties of transportation impeded both of these programs, but by the close of the war nearly 12,000 American mechanics had been trained in England for service on training and combat aircraft in France.

Nearly 85 American pilots saw action with Italian units. On June 20, 1918, the first detachment of 18 bomber pilots, under Capt. Fiorello La Guardia, arrived at the Italian front; and from that date to November 2, American pilots took part in 65 bombardment missions in cooperation with their Italian allies.

Mechanics stand ready to swing propellers as American pilots board British Sopwith Camels for combat mission. Two





American pilots in French Nieuports return from patrol in the Toul sector where U. S. squadrons operated, April-May 1918.

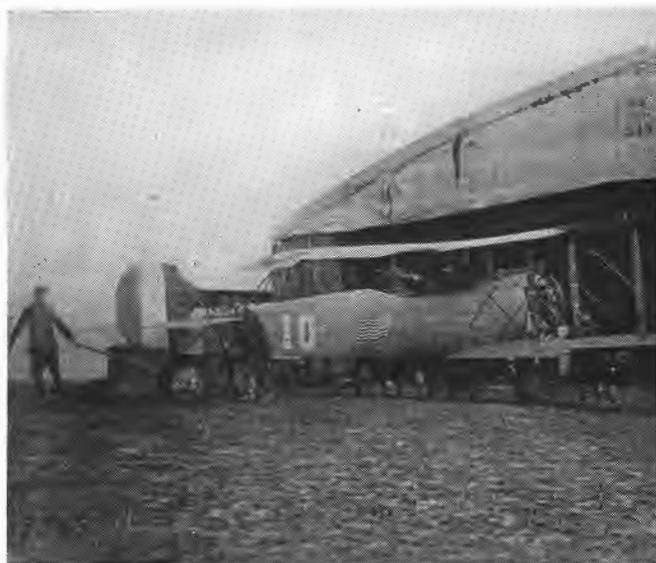
served as part of the French Army until June 30, when it was transferred to American control.

Meanwhile American flying units, reaching Europe in the fall of 1917, were being schooled for combat. The arrival of the 1st Aero Squadron, under Maj. Ralph Royce, on September 2, was followed in November by the coming of other squadrons including the 88th, 90th, 91st, 93d, 94th, 95th, and 96th. At Amanty and Epiez, and later Colombey-les-Belles, these squadrons trained in antiquated craft until they could be equipped with the latest combat machines and schooled by experienced French pilots for action at the Front.

Apprenticeship for the independent American action of September 1918 was gained by U.S. flyers while they were attached to Allied forces in the spring and summer. The quiet Toul sector provided an opportunity to learn the techniques of aerial warfare. In mid-March the 94th and 95th Pursuit Squadrons patrolled enemy lines; on April 12 the 1st Aero Squadron was attacked by enemy planes while on reconaissance; and on April 14 Americans won their first aerial victory over the Hun when Lts. Alan F. Winslow and Douglas Campbell brought down two German planes over the Toul airdrome. On June 12 the 96th Squadron had its first chance for action when five planes dropped 80 bombs with observed success on railroad yards at Dommary-Baroncourt, northwest of Metz.

American squadrons and balloon companies had their first taste of real warfare along the Marne and Vesle in July and August when they played a part in operations culminating in the famous Château Thierry counteroffensive. Here the 1st Corps Observation Group carried out reconaissance in the face of bitter attack by Fokkers of the latest type manned by German aces. The 1st Pursuit Group, operating as part of the French air service, flew in double-tier formation carrying warfare into enemy territory against heavy odds.

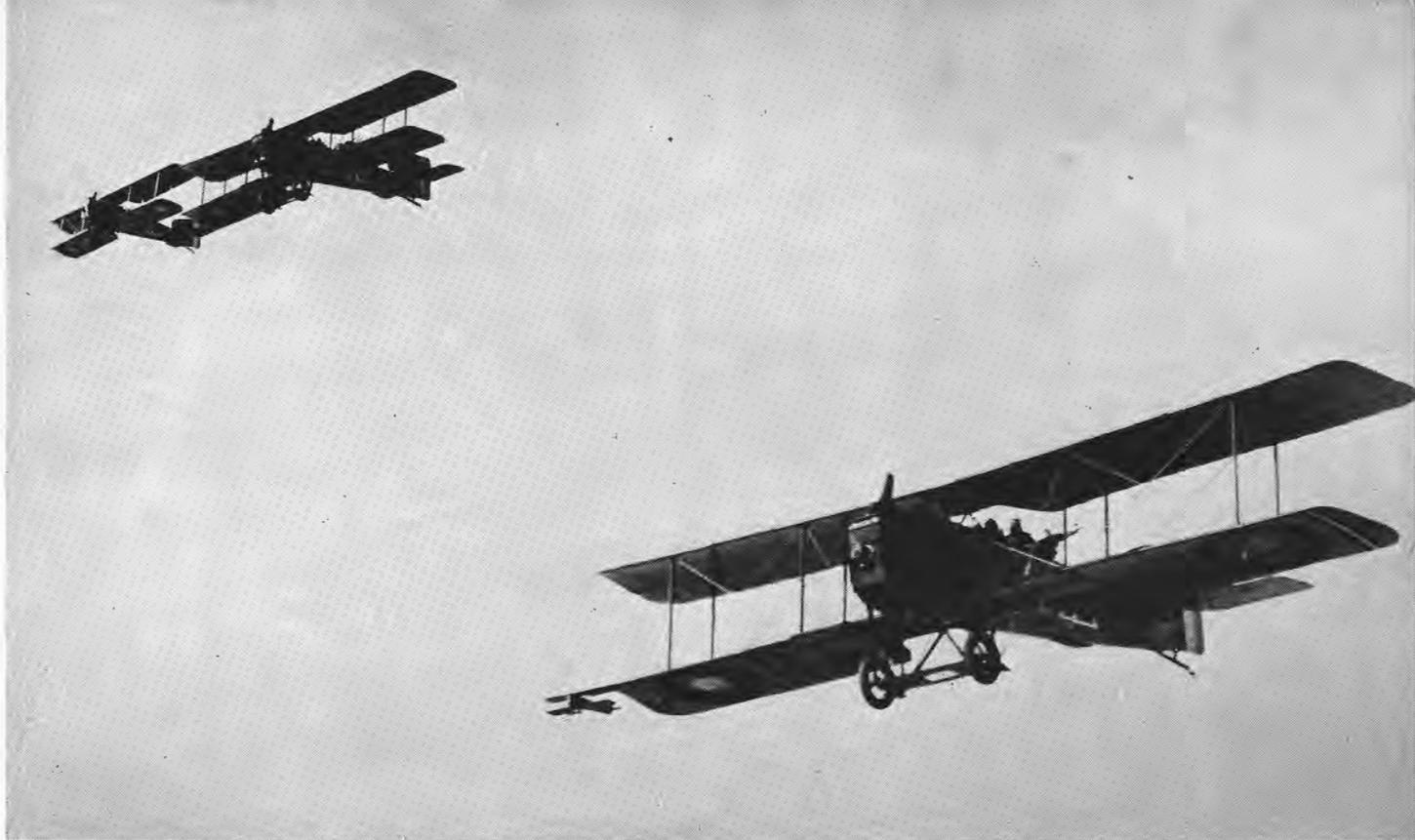
By mid-August 1918, this background of training and action had readied America's young air force for vital action with the newly organized U.S. 1st Army in the climactic offensives of St. Mihiel and the Meuse-Argonne which culminated in the Armistice, November 11.



Men of 1st Aero push Salmson out of hangar at Gondrecourt. With 12th and 88th, the 1st saw bitter action at Château Thierry.



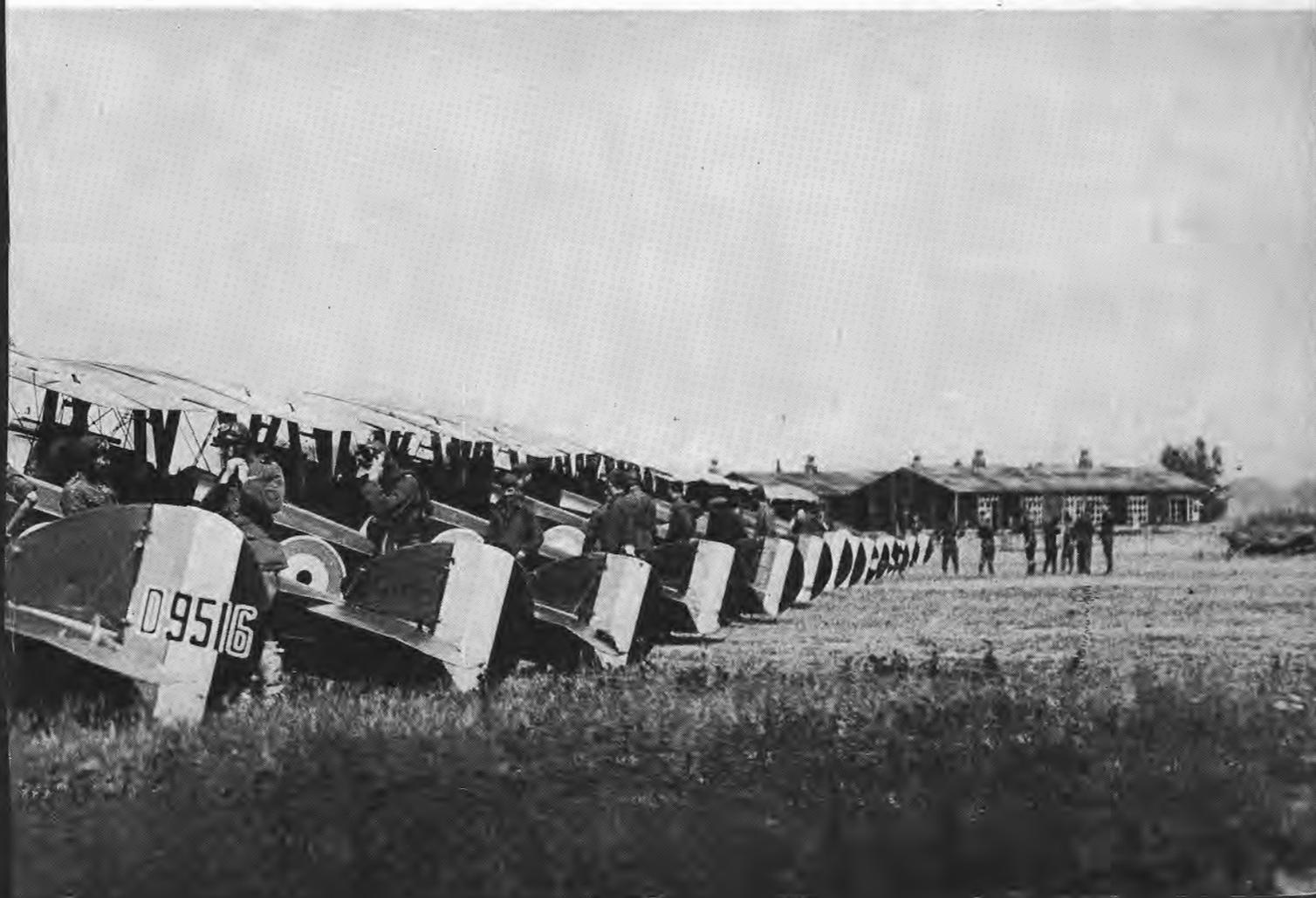
Col. W. G. Schaulfler and observer of 1st Aero Squadron prepare to take off in Breguet on one of first U. S. flights over German lines.



French-built Breguets of the 96th Bombardment Squadron head for daylight bombing assault on German territory. Americans

used Breguets and DH-4's for bombing. Plans were under way for using two-engine Handley-Page for night bombing.

squadrons of British-trained Americans—the 17th and 148th—served with Royal Air Force from July until November 1918.



BALLOONS AGAIN PROVED WORTH

Sentries of sky served Allies in war of position

Balloons—the Army's earliest aerial weapon—did yeoman service in lending "eyes" to the Allied armies. The four companies of the 2d Balloon Squadron reached France late in 1917 and took their place in the Toul sector the following February. By November 1918, 35 balloon companies were operating in France. Seventeen were serving under fire with the 1st and 2d Armies, and six others were assigned to the Front. At this date, the Balloon Section, A.E.F., comprised 446 officers and 6,365 enlisted men.

Relatively steady in high winds, the captive kite balloon, developed during the war, provided a fixed aerial observation post from which enemy information could be reported by means of a telephone installed in the observer's basket. Such messages were not subject to the interferences with which the Germans obstructed reception of radio messages from planes. The balloon was attached to the ground by a steel cable and could be rapidly lowered by winding the cable on the drum of a balloon truck. Highly vulnerable to enemy attack, the trick in handling the balloons was to keep them up as long as possible, get them down in a hurry.

Balloons were useful in reporting and regulating artillery fire, gaining information on shell bursts, sighting aircraft and balloons, observing fire of enemy batteries, and reporting movements of infantry, traffic on roads and railroads, and evidences of smoke, fire, flares, and explosions. In all, U.S. balloons made over 1,600 ascensions, were in the air more than 3,100 hours.

In the Allied counteroffensive of mid-July 1918, regulation of artillery fire proved to be needed more than

photographic reconnaissance. Tireless balloonists kept up with the advance of the 1st Army, reporting hourly. Eight balloons were brought down by enemy pursuit; 12 observers parachuted. In the September St. Mihiel engagement, 15 American and six French balloon companies took part, regulating artillery fire and securing valuable information; a total of 19 companies participated in the battle of the Meuse-Argonne.

Balloonists were given preliminary training in the United States and at artillery firing centers in France and saw first action in the quiet Toul sector at the Front. An A.E.F. balloon school, first established at Cuperly, was later moved to Souge. Balloon companies were under constant pressure and had to work doubly hard to make up for their lack of numbers.

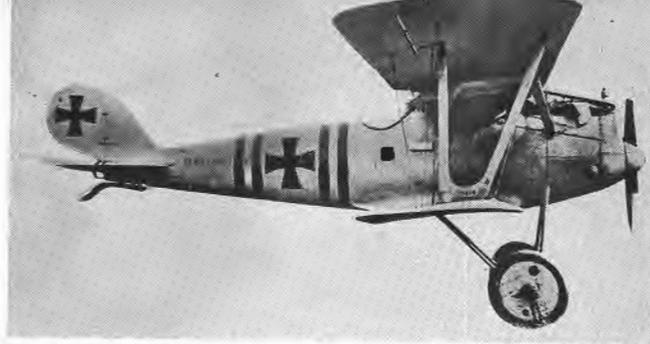
The Balloon Section, operating under the direction of the Army's veteran balloonist, Colonel Chandler, had the advantage of recourse to France's well-developed balloon industry for supplies. French equipment completely outfitted the first 10 American companies to arrive overseas. Even after American-made balloons were available in sufficient numbers, 75 per cent of the accessories such as winches and trucks continued to be supplied from French sources. An adequate hydrogen supply was obtained by pooling resources with France, the United States contributing chemicals. Balloon activities were always less spectacular than those of heavier-than-air craft, but, supported by the cooperation of the French and working strenuously at top speed, the Balloon Section had achieved by the end of the war one of the most completely satisfactory records in the A.E.F.



American soldiers steady basket of observation balloon as observers prepare to go aloft. Observations were reported by telephone.



In developing this type of kite balloon, France's Captain Caquot overcame the bobbing and swaying that had impeded observation.



Pfalz D-3 single-seater. 160 hp Siemens engine. 112 mph operating speed. Service ceiling, 26,732'. Span, 27'6". Useful load, 507 lbs.



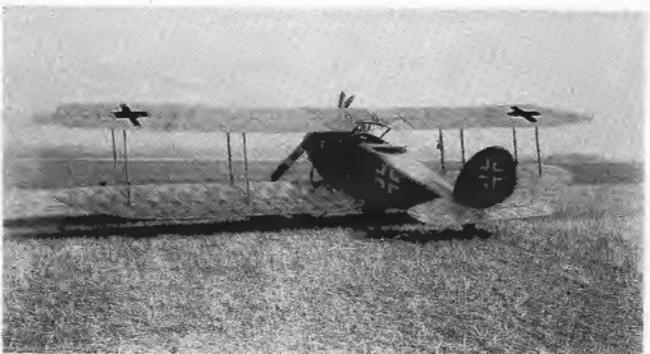
Albatros D-5 single-seater. 160 hp Mercedes engine. 100 mph operating speed. Service ceiling, 16,400'. Span, 29'6". Load, 517 lbs.



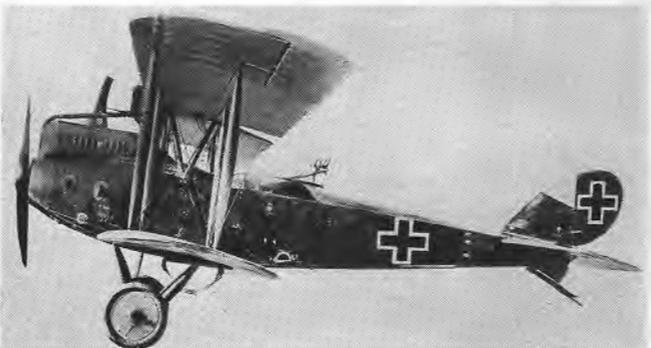
Fokker D-VII single-seater. 185 hp B.M.W. engine. 135 mph operating speed. Service ceiling, 20,000'. Span, 29'2". Camouflaged.



Rumpler two-seater. 260 hp Mercedes engine. 109 mph operating speed. Service ceiling, 22,304'. Span, 41'7". Useful load, 1,279 lbs.



Halberstadt two-seater. 200 hp Benz engine. 112 mph operating speed. Service ceiling, 16,400'. Span, 44'7". Useful load, 1,014 lbs.



L.V.G. two-seater. 220 hp Benz engine. 105 mph operating speed. Service ceiling, 19,680'. Span, 42'7". Useful load, 914 lbs.

GERMAN FIGHTING CRAFT

Tested Allied skill

Enemy aircraft put up stiff resistance to America's pilots on the Western Front. Red-nosed Fokkers of the "flying circus" challenged Allied bombing and observation craft and U.S. pursuits on escort and patrol.

Germany unleashed its first aerial surprise late in 1915 with the appearance of the famous Fokker, first plane to permit effective machine-gun fire through the propeller disc. Designed by Anthony Fokker, Dutch engineer whose offer of service the Allies had rejected early in the war, this fast-diving plane could stalk its prey, then swoop down, hawk-like, with deadly fire.

In the spring of 1916 the Allies, quick to copy Fokker's invention, brought out the DH-2 and the Nieuport scout; but by the close of that year the enemy countered with a double threat—its new planes, a fast Halberstadt and the D-type Albatros, and the skilled aerial tactics of Richthofen's "flying circus." On

the eve of America's entrance into the war, German aerial equipment, with few exceptions, appeared to outclass that being used by the Allies.

America's pursuit squadrons first met the enemy's Albatros and Pfalz scouts with such out-dated Nieuports as her Allies could spare; but by mid-August Rickenbacker's famous "Hat-in-the-Ring" outfit and others were flying the speedy and maneuverable French Spad; and Britain's Sopwith Camels and SE-5's were matching the best craft her adversaries had to offer.

The Germans pinned their last aerial hopes on a new Fokker which appeared in May 1918—the D-VII biplane, equipped with a B.M.W. engine, that could outclimb Allied planes by reaching 6,600 feet in four minutes. With this scarlet-nosed fighter and the yellow-tailed Pfalz, the German air arm held out tenaciously until the closing days of the war, intercepting America's day bombardment squadrons, protecting observation by their own Rumplers and L.V.G.'s, and dog-fighting the Spads and Camels with which the Allied aces were winning the air battles of World War I.



Ready for the kill. Rickenbacker in his famous No. 1 plane of the 94th Pursuit Squadron trains the two Vickers machine

AMERICA'S FIRST ACES

*Their daring tactics
downed aerial foe*



It's a snug fit for Capt. Eddie Rickenbacker in his Nieuport 28 in which he scored the first five of his 26 recorded victories.

The sky battles of World War I were fought in glove-tight planes constructed of wood and fabric. Bullet- and leak-proof gas tanks were not yet perfected; and stove lids, borrowed from French friends, were the only armor protection. Lack of parachutes usually made fire and structural defect fatal. Pursuit craft were powered by less horsepower than the primary trainer of today, and the aces of World War I finished the war with less flying time than pilots in World War II logged up at the end of training.

American boys proved to be ace material, whether in British, French, or U.S. service. Maj. Raoul Lufbery transferred from the Lafayette Escadrille after many victories and sparked the members of the 94th Pursuit



*Lt. Frank Luke, Jr., Phoenix
Ariz., 27th Sq., 21 victories.



*Maj. Raoul Lufbery, Walling-
ford, Conn., 94th Sq., 17 vic.



Maj. Geo. A. Vaughn, Brook-
lyn, N. Y., 17th Sq., 13 vic.



Capt. Elliot W. Springs, Lan-
caster, S. C., 148th Sq., 12 vic.



*Capt. Field E. Kindley, Gra-
vette, Ark., 148th Sq., 12 vic.



Maj. Reed Landis, Chicago, Ill.,
25th Pursuit Sq., 10 victories.



Capt. Jacques N. Swaab, New
York, 22d Sq., 10 victories.



Capt. Frank O. D. Hunter,
Savannah, Ga., 103d Sq., 9 vic.

guns of his French-built Spad on a fleeing Fokker D-VII.

Squadron to early triumphs. Capts. Douglas Campbell and E. V. Rickenbacker became aces in late May 1918, about six weeks after the former brought down his first plane, April 14. Combat injury soon grounded Campbell, first American-trained pilot ace.

Rickenbacker, former auto-racer, went to France as Pershing's chauffeur, bided his time to get a chance to fly, and became Ace of Aces in the A.E.F., despite three months of illness which kept him on the ground. Frank Luke, wild "balloon buster" from Arizona, was probably the most colorful American ace, as well as the only aviator to receive the Medal of Honor during World War I. A fearless pilot, Luke, with his partner, Lt. Joe Wehner, brought down two balloons and three airplanes within seven minutes, ran up a total of 21 victories within two weeks during September 1918, and finally met death on September 29 after destroying three balloons, two airplanes, strafing ground troops, and holding off the enemy with his automatic pistol. *At right, famous American aces. (*Killed in action.)*

FLYING AND GROUND PERSONNEL

Home training program not at peak till 1918

The nation at war plunged into a training program to man the new-found aerial weapon. College classrooms were opened to the schooling of aviators. New flying fields were rushed to completion. Cadets by the thousands hurried to earn their wings. The skills needed for aerial warfare could not be learned overnight; and the war was over before much of the training could be reflected in action at the Front. But by the Armistice the Army's home flying fields had increased from five to about 27 and the supply of pilots from less than 100 to over 11,000.

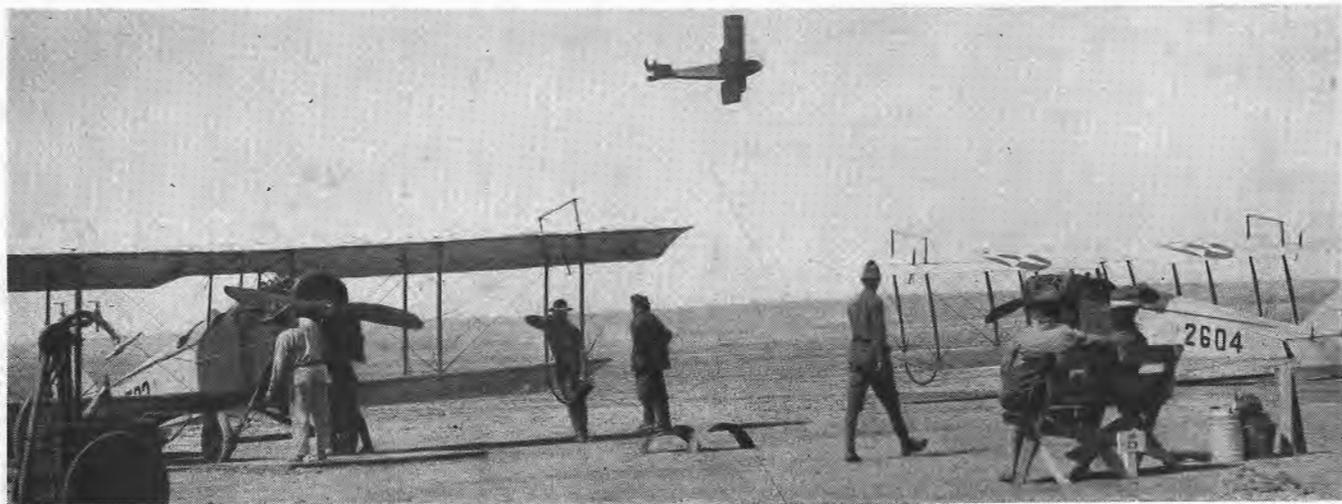
With no time to develop a system of its own, the Army turned to Canada for a pattern of training. Eight weeks of ground school at leading American universities were to be followed by instruction at flying schools as yet in the blueprint stage. Ground courses began at California (Berkeley), Cornell, Texas, Illinois, Ohio State, and the Massachusetts Institute of Technology on May 21, 1917. By mid-July, 147 graduates were ready to proceed to flying training. Additional ground schools were opened at Princeton University and the Georgia School of Technology in July.

Work was soon under way on new flying fields to supplement those then existing at San Diego, Mineola, Memphis, Chicago, and Essington, Pennsylvania. Before the end of the year 15 had been added, including Selfridge, Chanute, and Wilbur Wright (ready little more than three months after war was declared), Scott, and numerous southern fields such as Taliaferro, Love, Call, Rich, and Ellington in Texas, Post at Fort Sill, Oklahoma, and Gerstner at Lake Charles, Louisiana. Nearly an equal number were added in 1918. Six weeks to two months of training won the pilot his wings and a commission as second lieutenant (Reserve Military Aviator). From four to 10 hours of dual, 24 of solo, and 16 of cross-country made up the 40 to 50

hours of primary training in the air. The flyer then awaited his orders to advanced training.

There was no dearth of trainees. Applications poured in at the rate of 3,000 a week; and 71 medical boards screened prospective material. By the close of the war, 16,587 cadets had graduated from ground schools and 8,689 from primary training in the United States. Advanced training had to be given in Europe until combat-type planes were available in America. It was hoped that by the summer of 1918 pilots could be completely trained before reaching Europe. But in spite of good intentions not a single pursuit or observation pilot who had been completely trained in the United States and only eight bombing pilots so trained reached the Front by the time the war was over. Administrative hitches and delays complicated the program to provide primary and advanced training in Canada, England, France, and Italy; but the skill of American flyers in combat testified to the effectiveness of this training.

Meanwhile a high-pressure program got under way for training the nonflying personnel needed to keep the airplanes in the air. Supply officers and adjutants were trained at Kelly Field and later at Georgia Tech and Ohio State, engineer officers at M.I.T., and armament officers at Fairfield, Ohio. Biggest problem was that of expanding the existing handful of experienced airplane mechanics into the thousands needed for wartime aviation. The first 500, who reached Europe on September 15, 1917, were routed to British schools. Others were trained at European aircraft factories and flying fields. An agreement to hold a pool of 15,000 mechanics in British schools and factories curtailed manpower badly needed in France. In the United States, mechanics training was finally concentrated at St. Paul and Kelly Field, and by the war's close over 14,000 enlisted mechanics had completed training.

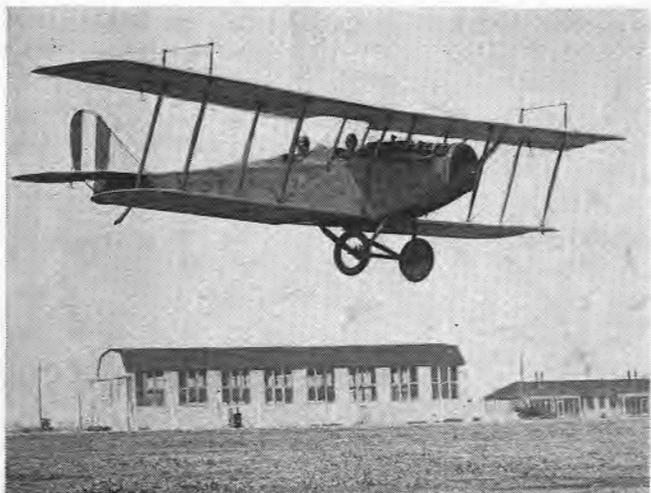


Wartime activity on the flying line at Kelly Field, Tex., scene of primary flying training for hundreds of Uncle Sam's fu-

ture pilots. Ground crews service the JN-4D. This famous training plane was affectionately known as the "Jenny."



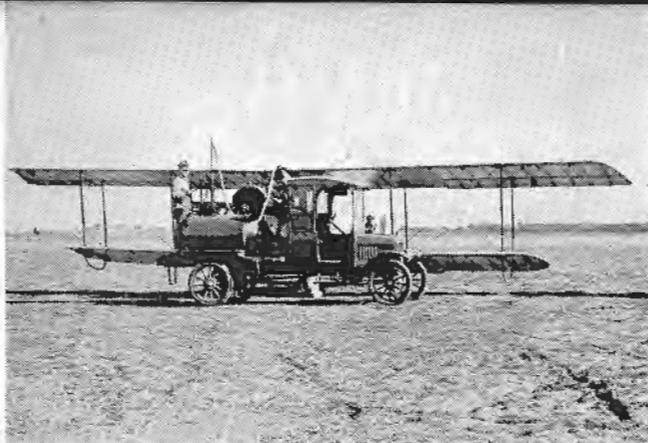
Cadet flies solo in Curtiss JN-4D, all-American training plane used for primary instruction of thousands of U. S. cadets.



Instructor coaches student in for landing during dual training at Kelly Field. Slow landing speed of "Jenny" lessened risks.



These JN-4H's, lined up at Ellington Field, Tex., were powered by Hispano-Suiza engines for advanced training of bomber pilots.



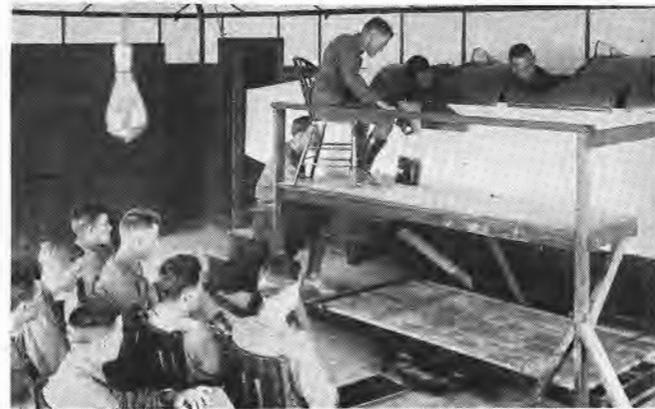
Ford Model T, fueling JN-4D with hand pump, contrasts strangely with modern trucks capable of pumping 80 gallons a minute.



Doughboy fire fighters with Model T truck and hand-drawn carts protected Army's hastily constructed flying fields during World War I.



Cement bombs with charge of powder were the practice bombs of World War I. Four were attached under each wing of the "Jenny."



Student bombardiers sight target on moving map. At signal, instructor clocks theoretical fall of bomb, judges merit of strike.

FLYING AIDS

First instructors learned while teaching

By comparison with present-day training resources, cadets of World War I learned to fly the hard way. The Army pressed into service as flight instructors the existing handful of civilian pilots, making commissions available to them. With sometimes as little as 10 hours' solo time themselves, they started teaching youngsters the art of flying; and many were the rough landings which, in the early days, an inexperienced instructor passed off on his greener student. However, as class followed class, these instructors gained skill until they had become a proficient training force. Many of them—more than the veterans of combat—stayed in flying after the war to become the pioneers of commercial aviation in the United States.

The JN-4D with its OX-5 engine was ideal for training. It could take a lot of punishment and both student and instructor walked away from many a crack-up. The toll of casualties—one to every 65 who won their wings—might have been higher under today's flying methods. In those days, after take-off, the "Jenny's" nose was cautiously lowered until plenty of airspeed was obtained, then gently lifted for the climb, and lowered again for turns. Training devices were similar in principle but bore slight resemblance to the highly mechanized aids for training aviation crews in World War II.



A "Hisso Jenny" converted to an ambulance plane. Posed stretcher case wears goggles—pilot's trademark in the early flying days.



Original caption for this photo was "Device for practice of cloud flying." Aviators recognized value of flying "under the hood."



President Wilson with members of his cabinet and Japanese postmaster, K. Kambara (carrying camera), speed first north-

bound air mail, Washington, D. C., May 15, 1918. Lt. G. L. Boyle, pilot, lost his way, was forced to land in Maryland farmyard.



Torrey Webb lands at Bustleton Field, Pa., in JN-4H, after completing first lap of initial air-mail flight to Washington, D. C.



DH-4, converted for air mail after Post Office Department took over service in August 1918, pioneered air-mail routes until 1926.

ARMY PIONEERED OFFICIAL AIR MAIL

First air-mail pilots followed iron beam

Army pilots flew the aerial relays that inaugurated the U.S. air-mail service on May 15, 1918. President Wilson witnessed the historic departure of Lt. George Boyle for New York with four sacks of mail and a letter to be auctioned for the benefit of the Red Cross. Lt. Torrey Webb piloted a JN-4H on the first lap of the southbound trip, and Lt. James C. Edgerton sped on from Philadelphia, following the iron rails, to complete the 218-mile run from New York City to Washington, D.C., in three hours and 20 minutes.

Wartime aviation needs had threatened to put off a service that had been under discussion since 1910. But equipment was cleared when both Maj. Gen. George O. Squier, Chief Signal Officer, and Col. E.A. Deeds, of the Aircraft Production Board, suggested that flying the mail might be considered training for Army pilots. Maj. R. H. Fleet was put in charge.

By midsummer the air mail was well established in spite of the inexperienced pilots and inadequate equipment used when every available plane and pilot were needed at the Front. Postage was 24 cents a half-ounce, but revenues, totaling less than \$50 a trip, fell far short of the expected \$3,800. Pressure to divorce the service from Army control, where it was tied up with the fate of the war effort, led to legislation transferring operation to the Post Office Department on August 12, 1918.

U.S. SQUADRONS IN ACTION

Final punch proved value of America's air power

The September push into the St. Mihiel salient proved that after hard months of preparation the Army's air arm was combat-ready for the conclusive blows of World War I. An air armada of more than 1,500 Allied planes was put at the disposal of Col. "Billy" Mitchell; and these became the basis of a daring and generally effective plan for strategic assault on the enemy's communications, factories, and fighter force, as well as for tactical operations in observation, direction of artillery fire, and ground strafing. In the final thrust in the Meuse-Argonne, American flyers proved they were a match for the enemy's best. In spite of bad weather, U.S. airmen scanned German territory, screened troop movements, ferreted out machine-gun nests with low-flying aircraft, destroyed enemy balloons, bombed strategic targets, and, by drawing off Germany's fighters in combat, kept them from seriously impeding the movement of American troops and supplies.

More than 200 American bombers, accompanied by about 100 pursuits and 53 triplane machines, stemmed an enemy counterattack on October 9 by dropping 32 tons of bombs and disabling 12 enemy fighters. Pursuits as well as bombers carried bombs which were released electrically from racks under the wings, no longer carried in a basket and tossed over the side as earlier in the war.

When hostilities ceased, 45 squadrons were flying at the Front with a total of 767 pilots, 481 observers, and 23 aerial gunners. In addition to observation and pursuit, American squadrons had dropped 137 tons of explosives on the enemy. This total was to be dwarfed by a day's pay load in World War II, but contemporary observers were predicting an expansion of this "navy of the air" until no part of Germany should be "safe from the rain of bombs" and "Berlin itself" would have reason to know "what an air raid means."

Pilots and observers of 11th Day Bombardment Squadron which saw action in St. Mihiel and Meuse-Argonne offensives, Septem-



American De Havilland-4's on daylight bombing mission over

ber and October 1918. DH-4's in the background carry squadron's official insignia, "Jiggs" of "Bringing Up Father" cartoon.



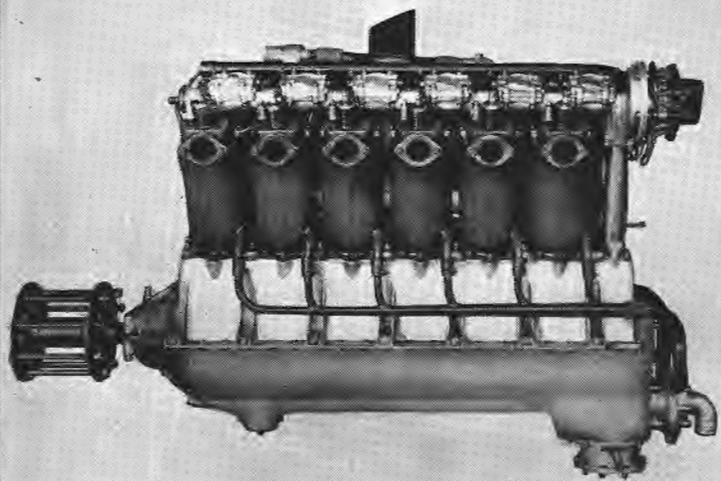


German lines. Adapted from British plans, the DH-4 was the only American-produced battle plane to reach the Front.

Owl and telescope insignia identify this plane as belonging to 278th Sq. As in World War II, pilots named planes for girl friends.

Officer of the 96th Day Bombardment Squadron, still wearing Signal Corps insignia, checks loading of bomb rack under lower wing.





Liberty engine, America's outstanding production achievement in World War I. Early changed from 8 to 12 cylinders, it was manufactured by Ford, Lincoln, Cadillac, Packard, Buick, and others.



DH-4 No. 1,000 comes off assembly lines. This all-purpose plane, equipped with Liberty engine, was based on British design. First DH-4's reached France, May 1918, crossed lines August 2, 1918.



More than 8,000 OX-5 engines were produced by Curtiss to power trainers. By November 11, U. S. factories had turned out nearly 30,000 engines, including LeRhone, Hispano-Suiza, and others.

AIRPLANES AND ENGINES

Production reached high gear by last months of war

Allied opinion—and even the German press—expected of America's industrial genius an immediate output of planes sufficient to swarm over the enemy. But again hopes exceeded achievement, and months elapsed before production was in high gear. Policy on models was at first confused and ill coordinated. To the delays attending the development of new tools and equipment were added complications of wartime ocean transport. It was August 1918 before American-built DH-4's first crossed enemy lines.

The best results were achieved in the production of trainers and in the development of the Liberty engine, finest aviation motor produced to that date. The famous Curtiss "Jennies" were soon appearing in quantity, and by the Armistice 3,746 JN-4D's had been manufactured. About 1,600 Standard J-1's were delivered. By the war's close, the potential output of Liberty engines was 46,000 a year.

The manufacture of combat craft got off to a slower start. America's Bolling Commission, in consultation with European experts, arranged for meeting the im-

The DH-4 observation and bombing aircraft, adapted from



mediate needs of Yankee aviators with planes and engines purchased from France and made from American tools and material. Meanwhile U.S. factories would concentrate on a few specific combat types. But production in France was delayed for want of supplies from America, and lack of models and conflicting orders slowed U.S. activity. With plans for an American-made Spad delayed, the DH-4 was the only combat plane given quantity production in America before the Armistice. By that date a total of 1,213 had been delivered to the A.E.F., and they were rolling off the assembly lines at the rate of 1,100 a month.

This stepped-up production was but one indication of the tremendous advance in America's air establishment by the war's close. Over-all strength had increased from less than 1,200 to nearly 190,000, pilots from about 100 to more than 11,000, training fields from five to over 40 at home and overseas. At the Front, 45 combat squadrons were augmenting the early contribution of a handful of volunteers to total 35,000 hours over the lines, 1,642 balloon ascensions, 150 bombing raids. The infant aircraft industry had developed a productive capacity of more than 20,000 planes a year. The war closed before this potential might was fully translated into action; but in spite of early unreadiness, lack of experience, and over-optimism, by November 11, 1918 the American air arm had come of age.

British model, goes into production at Wrights' Dayton Plant.



First giant U. S.-built Handley-Page is christened the "Langley" and flown before notables, July 1918. Parts for 100 of these bombers, to be assembled in England, had been shipped by war's close.



The Martin four-place bomber—America's first true bomber—was Glenn Martin's answer to pleas for improvement on the Handley-Page. It would have been in production had war lasted into 1919.



This two-seater fighter-observer was Grover Loening's contribution to the effort to top the British Bristol. Of simple design, capable of great speed, its type became popular following the war.



Between wars America had 23 years to develop use of air power

America's Army air organization following World War I was quite different from the Signal Corps' small and struggling Aviation Section of prewar days. Although demobilization reduced its wartime strength by almost 95 per cent, its more than 9,500 officers and men still totaled over eight times the prewar figure. And more important, it had emerged from the war freed of its former attachment to the Signal Corps. There could be no further question as to the need of an air arm in the over-all military. But just what its place should be and how it should fit in—that was to be the battleground for advocates of air power like "Billy" Mitchell throughout the 23 peacetime years that separated U.S. participation in World Wars I and II.

The great majority of Army airmen returned to civilian life. Some of these, like James Norman Hall and Fiorello La Guardia, gave up flying to enter different fields. Others, like "Casey" Jones and Eddie Rickenbacker, became important pioneers in the development of modern commercial aviation. Still others, taking advantage of cheap surplus equipment available after the war and the only marketable skill many of them had acquired, became barnstormers and gypsy flyers. Later some of the barnstormers settled down to establish the beginnings of present-day fields, air lines, and aeronautical companies.

Drastic cuts in authorized strength permitted relatively few to stay in the Air Service, and yet many experienced flyers might have remained in uniform had the Air Service offered greater inducements. This it was unable to do until a degree of stability was established by the Army reorganization act of June 4, 1920. Among those who did remain were men like Andrews, Arnold, Mitchell, Kenney, Westover, Yount, Eaker, Brereton, Spaatz, and the Harmon brothers—to name but a few. From their number came the pioneers, planners, and leaders of the present Army Air Forces.

The DH-4 was Army's mainstay for a decade after World War I. This DH-4B was one of some 1,100 made safer by placing gas tank in front of pilot and moving landing gear forward.

The DH-4 remained the Air Service's mainstay among combat planes, while the JN-4 and J-1 were the standard trainers. More than 220 types, chiefly Allied or enemy products, were on hand at the close of hostilities. The Bureau of Aircraft Production had seriously considered 122 types during the war, but only about a dozen had reached the experimental stage. Large outstanding contracts for approved planes like the VE-7, SE-5, Thomas-Morse scout, Le Pere two-place fighter, and the Martin bomber were canceled when the Armistice was signed. Developed late in the war, some of these were regarded as superior to any existing planes of their types.

How to dispose of the surplus among the nearly 3,000 DH-4's left after the Armistice was a major problem for the Air Service which had use for only 250 a year at most. Sale of the planes to individuals was largely prevented by terms of the manufacturers' contracts. Besides, private buyers seldom wanted a plane so heavy and costly to keep up, and as time passed, Air Service heads advised against selling equipment subject to deterioration after long storage. More than a third of the DH-4's were ultimately remodeled into DH-4B's and other types in order to overcome deficiencies experienced during the war. Since prolonged storage and remodeling were often costlier than the production of new, up-to-date equipment, many DH-4's were disassembled, some of the parts being salvaged for replacements and the rest sold as junk.

The JN-4 and, to a lesser extent, the Standard J-1 were the planes the barnstormers and gypsy flyers bought after the war. They were cheap and easy to operate, and light and slow enough to land in anybody's cow pasture. Wholesale buyers could get them for as little as \$50 apiece. By transferring the gas tank to the upper wing, the exceptionally wide Standard fuselage could be made to accommodate five instead of two. The "Jenny" (JN-4) could be seen above many an airfield until the late twenties, and the last De Havillands were still flying in the early years of the next decade.

THE POSTWAR AIRMEN

Some stayed in service . . .

Pilots of America's postwar Air Service found an immediate peacetime need for their activities in flying aerial patrols for the prevention of West Coast forest fires. This service was begun in June 1919 at the request of the District Forester of California. To that date the solitary ranger, mounted or afoot, had been the only protection against the havoc and wastage for which reforestation was no sufficient remedy. Dependent on natural vantage points and slowed by the terrain, the ranger rarely reported a fire before it had made strong headway. On the other hand, pilots flying high above could detect fires that were invisible, especially in a smoky haze, to the ground lookouts. They could cover large areas in a relatively short time. They could direct counteractive measures from the air and quickly transport supplies and drop them to the fire lines.

Reconstructed Liberty-powered De Havilland planes, throttled down to a speed of 100 miles an hour, were used on the patrols. By 1921 radio communication between the pilot and his base replaced the dispatch of carrier pigeons or the dropping of messages by parachute. Ordinarily the location, type, and extent of a fire could be reported to the proper headquarters, as far as 150 miles away, within 20 minutes of its discovery. A forest-fire patrol manual was prepared, covering in detail the duties of the patrol service. Further, during the winter of 1920-21 a special course of instruction was given to forestry and Air Service officials.

Under the general supervision of Maj. H. H. Arnold and his successor, Lt. Col. Wm. E. Gillmore, both Ninth Corps Area air officers, impressive results were achieved. The patrols were soon extended to cover both Oregon and California. In California 27 per cent fewer acres were wasted by fire in the three years after air patrols started than in the three years previous. In Oregon the figure for the same years was 62 per cent. Even in 1922 when limited funds usually permitted the 10 planes in commission to take off from their bases only on call, 114 of the 458 fires discovered were spotted first from the air. That same year a single 200-mile flight lasting 2½ hours was reported to have accomplished a survey ordinarily requiring weeks.

The timely discovery of nearly 4,000 fires in the first four years of this service brought about the saving of untold millions of dollars in timber. Yet the patrols had to be discontinued in 1923-24 for lack of funds, although in 1920 alone a few aircraft had prevented the burning of standing timber valued at more than the total Air Service appropriation of \$35,124,300 for the fiscal year 1920-21. Army reconnaissance was partially resumed in 1925 upon requests from both the Air Service and the Department of Agriculture, but it was finally discontinued in 1926 when Secretary of War Davis suggested that the aircraft industry would benefit by the substitution of commercial for military planes in future activities of the aerial forest patrol.



Over the vast timberlands of the Pacific Northwest, Air Service pilots flew regular patrols, guarding against costly forest fires.



Carrier pigeons, parachuted messages, and radio communication were used to send word to patrol headquarters when fires were seen.

. . . but most got out

Many war-trained pilots continued to fly after they left the Air Service because flying was in their blood or because it was the only trade they knew. By capitalizing on public curiosity and cheap equipment that flooded the market after the war, they managed to eke out a living as barnstormers or gypsy flyers. Among them were some of the generation's most famous flyers, men like Hawks, Turner, "Casey" Jones, Dean Smith, Stinson, and the sensational short-lived stuntist Omar Locklear. To them goes the credit for popularizing flying while it was still something of a distinction for the average man to get a close-up view of an airplane.

Working on the principle, as the veteran Dick Depew liked to put it, that the "greatest hazard in flying is the risk of starving to death," their method was to seek out community fairs and traveling circuses where they could do exhibition flying or sell thrill rides. Almost any pasture or vacant town lot served as a landing field for their "Jenny" or Standard. Sometimes they merely landed where they spied suitable farm land, hoping to dicker with the farmer for the right to do business with families in the neighborhood.

Estimates indicated that the gypsy flyers operated up to 600 aircraft some 3,000,000 miles annually in the first years after the war. Before long, however, the excessive number of accidents which their recklessness caused and the use of obsolete, weather-beaten "crates" gave a sorry black eye to developing aviation programs. Still, the fine arts of wing walking, plane changing, and hanging from the undercarriage were not wholly without their values. They added to the knowledge of flying and with all their dangers they inspired a certain confidence in saner methods of air travel.

Passenger traffic at first meant paying from \$3 to \$15 for the joy of circling the field a time or two for perhaps as many minutes. Soon a few customers ventured to hire the less capricious pilots for pressing commercial trips. In those localities where there was enough business to enable a gypsy flyer to settle down—that is, to rent a field and erect a hangar, often by pooling resources with another flyer—there grew up the private intercity air taxi services which were the direct ancestors of some of our present commercial airlines.

The extent of these private services, which eventually attracted at least half of the gypsy flyers, was soon discovered to exceed by far the mileage flown and the passengers carried by any of the government-subsidized lines in Europe, where private flying had failed to take hold. Figures compiled by the Aeronautical Chamber of Commerce showed that, in 1920, 87 American organizations carried 115,163 passengers and flew 3,136,550 miles. For 1925, according to another estimate, 527 commercial operators reported an impressive total of 9,203,165 airplane miles. This was more than four times the French mileage, which was the greatest officially recorded for European lines to that time.



Omar Locklear, former Army instructor, balances atop the wing of a "Jenny," standard barnstorming plane, during exhibition.



Plane to plane on a trapeze—such tricks were the barnstormer's bread and butter. Locklear was killed in 1920, stunting for movies.



A flight of Thomas-Morse MB-3A's from one of the Air Service pursuit squadrons stationed at Luke Field, Honolulu.

THE ARMY AIR SERVICE

It laid foundation for future air power

Congressional sanction for the Air Service on June 4, 1920, as part of an over-all Army reorganization, represented a final consolidation of the work of the Department of Military Aeronautics and the Bureau of Aircraft Production, agencies which were created at the separation of air activities from the Signal Corps in May 1918. Coordinated by a Director of Air Service (Maj. Gen. Charles T. Menoher since December 1918), they had borne the brunt of responsibility for carrying out the wartime aviation program.

This new act set the top strength of the Air Service at 1,514 officers and 16,000 enlisted men. With separate units for pursuit, observation, and bombardment, plus other lighter- and heavier-than-air subdivisions, a basis was laid for a more effective cooperation of the air

arm with other combat elements.

The Air Service began with two wing headquarters, one at Langley Field, Virginia, and the other at Kelly Field, Texas. It operated seven groups in all. Four groups were stationed in this country: the 1st Day Bombardment Group equipped chiefly with DH-4B's and the 1st Pursuit Group with SE-5A's at Kelly Field, the 1st Surveillance Group with DH-4B's at Fort Bliss, El Paso, and the 1st Army Observation Group with DH-4B's at Langley. There were three groups outside continental United States—the 1st Observation at Paranaque Field, Manila; the 2d, at Luke Field, Honolulu; and the 3d, at France Field in the Canal Zone. They were equipped for the most part with the DH and JN models which could be seen flying over many Army airfields in the early twenties.

Altogether, 28 squadrons, two air park companies, four airship companies, nine photo sections, and 28 balloon companies were authorized. For each of the outlying zones as well as the nine corps areas in this country an air officer acted as technical representative



Macready begins 1921 record altitude flight. Oxygen supply was greater problem for him than for his supercharged plane.

of the chief in Washington. With the supply program reduced to such functions as the depots at Fairfield, Montgomery, Middletown, San Antonio, and Rockwell Field could perform, the Army Air Service settled into the basic organization which carried on until the period of expansion which accompanied the change-over to "Air Corps" in 1926.

Notable improvements in plane performance and flying safety were among the practical achievements of the Air Service. Three world altitude records were made in an experimental Liberty-powered Le Pere designed and built at the direction of the Engineering Division at McCook Field, Dayton. Maj. R.W. Schroeder and Lt. G.E. Elfrey established a two-man record when they flew to 31,821 feet on October 4, 1919. On February 27, 1920, Schroeder set a solo record of 33,113 feet. This fell, on September 28, 1921, to Lt. J.A. Macready who used a turbosupercharger to get up to 34,508 feet. (Macready later made an American record of 38,704 feet on January 29, 1926, after the world record for solo flight had passed to foreign pilots.)



Before take-off, Macready stands by his plane, dressed in heavy high-altitude clothing. He wears the early seat-pack parachute which became required equipment two years later. Note face mask.

AIR POWER vs. SEA POWER

General Mitchell prompted the tests that proved bombs could sink warships

During the early twenties the effectiveness of aerial bombardment was the subject of heated controversy between the Army and Navy, waged both in and out of Congress. The main issue was the vulnerability of warships to air attack and the means of deciding were tests conducted under the direction of the Army and Navy in 1921 and again in 1923.

Chief Army proponent for the value of air power was Brig. Gen. William Mitchell, distinguished former commander of wartime Air Service activities at the Front. As Assistant Chief of the Air Service under Generals Menoher and Mason M. Patrick, Mitchell took every opportunity to argue for a separate air arm, an over-all air secretary coequal with the secretaries of the Army and the Navy, and a wider acceptance of the airplane as a new and unsurpassed weapon of defensive and aggressive warfare.

In January 1921 the Air Service sought a \$60,000,000 appropriation, only half again as much as the cost of one of the largest and newest warships. On its behalf Mitchell asserted that the battleship under air attack became as obsolete as did the "plumed knight in armor" once gunpowder was introduced. The country's

press, sensing the dramatic possibilities, urged that his theory be put to test. In February Navy Secretary Daniels and Secretary of War Baker agreed on a joint demonstration controlled by the Navy. For three months both Army and Navy airmen trained at Langley Field and Hampton Roads. Then, using four war prizes from the German imperial fleet, the tests began.

Nearly 100 miles off the Virginia capes, many notables watched from ships of the Atlantic Fleet on June 21 as three Navy F-5L's sank the submarine U-117 in 16 minutes. Twelve 163-pound bombs had been dropped from about 1,100 feet. On June 29 a sea search, intended to reveal whether aircraft could find approaching "enemy" ships, ended successfully in one hour and 57 minutes. Navy and Marine flyers had found the old U.S. battleship *Iowa* in a test area of 25,000 square miles.

On July 13 General Mitchell himself took part. From his plane he directed the 11 SE-5 pursuits which dropped forty-four 25-pound bombs "to clear the decks" of the destroyer G-102. After that, 28 Martin bombers sank the ship in 19 minutes, dropping 300-pound bombs from 1,500 feet. The doubters were momentarily reassured when a joint and then a Navy attack against the light cruiser *Frankfurt* on July 18 failed to effect vital damage. But 11 bombs dropped by Army Martin bombers later that day sank the ship in 35 minutes.

The most important test came on July 20 and 21—the bombing of the modern battleship *Ostfriesland*. Again, in spite of direct hits, the first attacks with light bombs appeared to do no real damage. But the next

Two 1,100-pound bombs finish off the old American battleship Alabama in an Air Service test of September 1921.



day's story was different. Under Mitchell's direction, seven Army planes, each carrying one 2,000-pound bomb, made the *Ostfriesland* roll over and sink by the stern in 21½ minutes. This attack helped confirm a theory suggested by the sinking of the *Frankfurt*: a burst close to the hull under water could be more deadly than a direct hit.

As a result of these trials a Joint Board of the Army and Navy concluded "that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and the Navy." The tests were a brilliant success, even if many years were to go by before their significance was fully appreciated. Later sinkings of the *Alabama* in September and of two other old American battleships in 1923 only provided further confirmation.

A step toward realizing Mitchell's bombardment theories was the development of the Barling bomber, first of the U.S. "heavies" and largest U.S. plane built to that time. This triplane, painstakingly designed by Walter H. Barling of the Engineering Division, was approved in 1920. Because of many upsets and added costs it did not fly until August 1923 when, according to the report, it made "a beautiful flight" of 20 minutes. With a span of 120 feet, a length of 65, and six 520-horsepower Liberty engines, the Barling had a service range of 335 miles and an operating speed of 61 m.p.h. Even the original hopes for it, which were never achieved, were modest by today's standards. Because of certain structural deficiencies in the plane, 1925 was the last year in which the Barling bomber was flown.



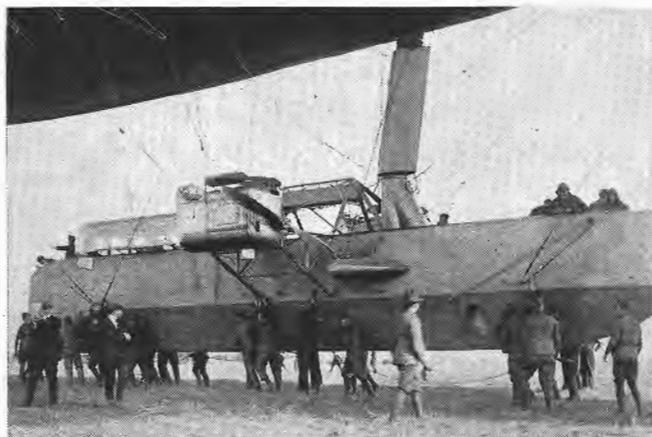
Brig. Gen. William Mitchell wears coveted decorations from United States and the Allies for his part in air phase of World War I.

The huge Barling bomber was an early postwar attempt at a superhomer which could undertake strategic air attacks.





Zodiac, postwar Army airship, flies at Langley Field, Virginia. French-built, it was designed to carry bombs and guns.



The 55-foot *Zodiac* cabin, suspended by steel cable, housed the crew of 12, fuel, and two Liberty engines capable of 60 m.p.h.



The TC-2, one of the efficient series of helium-filled Army airships which replaced the *Zodiac*, was a forerunner of today's blimps.

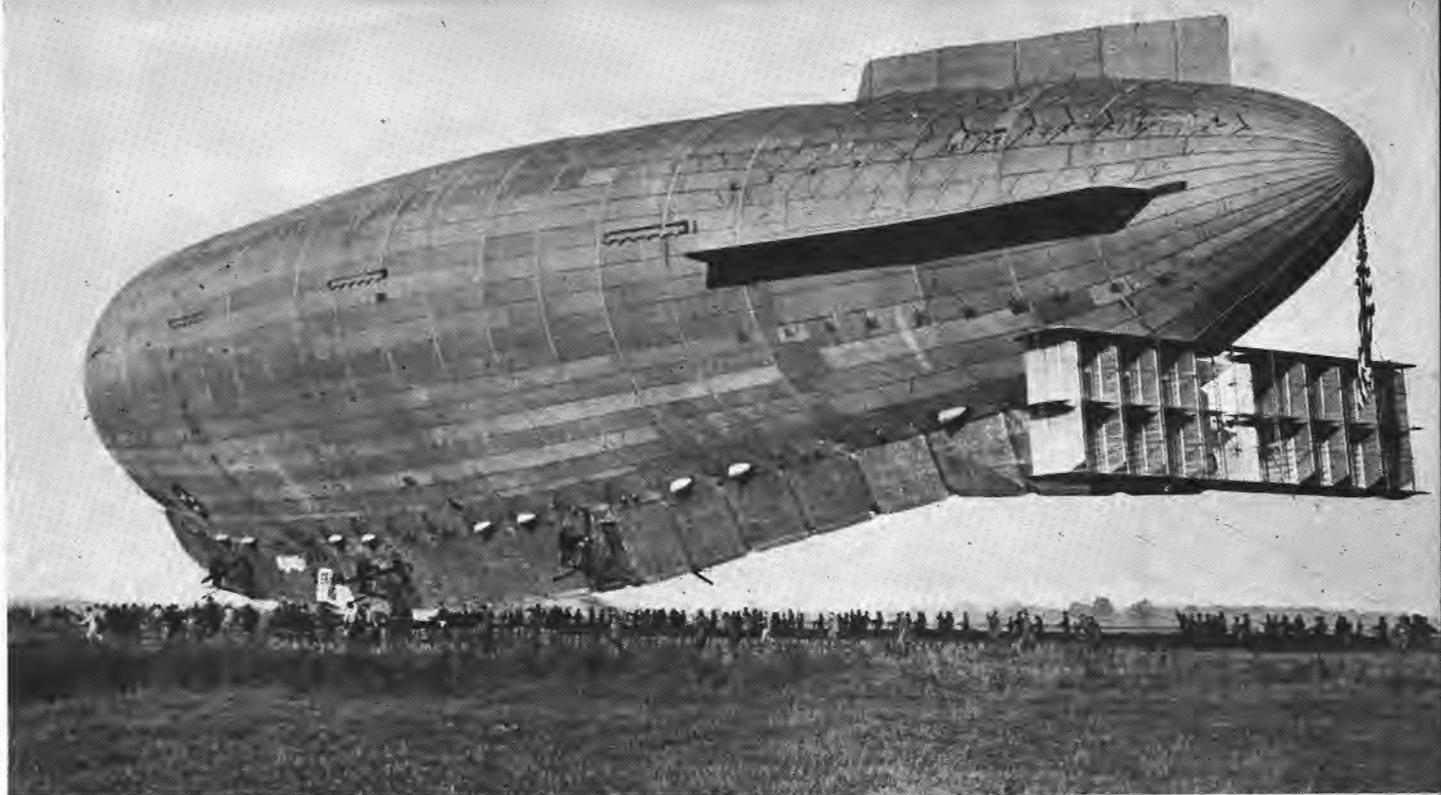
THE ARMY'S AIRSHIPS

*Provided valuable experience
but brought a major disaster*

Encouraged by A.E.F. successes, the Army maintained an active if limited interest in a lighter-than-air program until 1942. All work with rigid airships was left to the Navy by common understanding, and except for two semirigids the Army procured only nonrigid types.

One of the first nonrigids was the *Zodiac*, a French blimp bought by the Navy and turned over to the Air Service for assembly at Langley Field early in 1920. Then the largest of its kind, it was 263 feet long and had a gas capacity of 340,000 cubic feet. The *Zodiac* never flew much because it was so often in the process of remodeling. Yet its experimental and training values in construction, bombing, radio, and photography were considerable. It was redesignated RN-1 early in 1923 after most of its parts had been replaced by U.S. made-to-order ones. In the fall of 1924, after a minor injury to its bag, it was recommended for storage in view of the more efficient design and lift of the new TC series of nonrigid airships.

At General Mitchell's instigation the Air Service bought the *Roma* from Italy in 1920. Distinguished by its full-length external keel with built-in cabin and a box-kite arrangement of elevators and rudders, this 410-foot semirigid had a capacity of 1,100,000 cubic feet. Its first U.S. inspection flight on November 15, 1921 showed its six Ansaldo engines to be inadequate. Their repeated failure to start caused the first official flight to be canceled on December 9 and further embarrassment when that ceremony was delayed on De-



The Italian-built *Roma*, the world's largest semirigid, at the time of its first test flight at Langley Field, Virginia. ✕

ember 21. Finally, Liberty engines were substituted—an operation that grounded the *Roma* until its fatal flight early in the following year.

The disaster occurred at Norfolk, Virginia, on February 21, 1922. Not long before, a transcontinental flight had been discussed, and an Army administrator had cautioned "that any accident to the *Roma* would probably sound the death knell for the Army and Navy airship services for a good many years to come." The airship had been in the air less than half an hour when suddenly it dived from an altitude of 600 feet, broke a high-tension wire, and exploded in flames upon striking the ground. In all, 13 officers, 16 enlisted men, and 5 civilians were killed, 11 survivors injured.

Investigations suggested that the extra speed which the more powerful Liberty engines gave may have caused the keel to buckle. In any case, the casualties resulted chiefly from fire, and one important outcome was the almost universal substitution of helium for hydrogen in airships.

The Army tried one other semirigid, the RS-1, built by Goodyear from plans it had submitted to the Army early in 1922. In 1925 the airship was assembled and flown at Scott Field. Designed for a maximum speed of 75 miles per hour, it was the first and largest semirigid built in America—275 feet long with a helium capacity of 710,000 cubic feet. A crew of 10 was required to navigate it and tend its four 300-horsepower Liberty engines. There had been hopes that the semirigid could serve as an airplane carrier, and that it would "cruise with perfect safety from New York to San Francisco or from Liverpool to New York." But its useful lift was only 11,200 pounds and there were undeniable structural deficiencies. Its bag worn, after little more than two years of flight the airship was put aside.



These officers are waiting to board the *Roma* on its first flight. Their cabin is built amidships within the external keel.



Biggest American-built semirigid was the RS-1. Its internal keel, extending from stem to stern, was superior to *Roma* design.

1923: COAST TO COAST NONSTOP

1923: ENDURANCE RECORD BY REFUELING IN MID-AIR

1924: ACROSS AMERICA, DAWN TO DUSK

1924: AROUND THE WORLD IN 175 DAYS

1925: VICTORY IN PULITZER AND SCHNEIDER SPEED RACES

1926-27: GOOD-WILL TOUR OF SOUTH AMERICA

1927: CALIFORNIA TO HAWAII, FIRST TIME

1929: IN THE AIR NEARLY A WEEK

Army planes made record flights in the postwar decade

Army flyers of the twenties were the first to refuel in mid-air, the first to fly nonstop across the country, the first to cross the Pacific to Hawaii, and the first to fly around the world. These achievements, far from being stunt flights, were aviation of the most practical sort. Dependent on extensive preparation for their success, their purposes were several: the development of better planes, engines, and navigational equipment; the training of personnel; the advancement of flying techniques; the exploration of new flight areas. In addition to proving the possibility of flying military craft long distances, these flights helped the U.S. citizen to realize the increasing reliability and efficiency of flying.

As early as 1919, a Martin bomber was flown for the first time completely around the rim of the United States. Less than a year later, four DH-4B's led by Capt. St. Clair Streett completed the first round-trip flight between New York and Nome, Alaska. The outstanding Army flights pictured here began in 1923. In May of that year the first nonstop flight from coast to coast was made by Lts. Oakley G. Kelly and John A. Macready. In 1922 these flyers had left San Diego twice with the hope of reaching New York. The first time, bad weather forced them back. On their second attempt, a leaky radiator had caused them to halt their flight at Indianapolis, Indiana.

Now, on their third try, Kelly and Macready reversed the direction of the flight so as to have a lighter gas load when they short-cut over the western mountains. In this way they flew nonstop from New York to San Diego in less than 27 hours. They had shown that in a national emergency, troops and supplies could be transported from coast to coast in little more than a day. They had also covered the greatest distance ever made in a single cross-country flight.

The year 1923 saw also a notable Army endurance flight (see photographs). On August 27 and 28, Capt. Lowell H. Smith and Lt. John P. Richter established a world endurance record of over 37¼ hours by means of mid-air refueling. To keep them aloft, a second De

Havilland, flown by Lts. Virgil Hine and Frank W. Seifert, was used as a servicing plane. Every six hours the needed fuel was transferred through a 50-foot hose which the endurance flyers had to catch and insert into the large opening of an extra tank behind the rear cockpit. Smith and Richter had hoped to stay up four days and four nights. But when a heavy fog gathered over Rockwell Field the evening of the second day, it became impossible to transfer the gas, and at 6:19 P.M. they landed. The flight suggested significant possibilities. An overloaded bomber could take off with a minimum supply of gas and refuel after it was airborne in order to complete its mission. Or it could take on gas in mid-air over territories where landing facilities were not adequate for the type of plane involved.

The following year Lt. Russell L. Maughan piloted a Curtiss PW-8 across the American continent in less than 22 hours, about five hours under the record time Kelly and Macready had made. Leaving New York at dawn, June 23, 1924, Maughan reached the West Coast by dusk without a single mechanical failure in his plane. His flight showed that pursuit planes located anywhere in the United States could be transferred to any of its borders within 24 hours.

The same year saw the first round-the-world flight in aviation history. Six of the eight Air Service flyers who began the hazardous journey succeeded in circling the globe in 175 days. The amount of preparation for their flight was prodigious. So that various foreign nations could be visited, extensive diplomatic arrangements had to be made by the State Department. Special Douglas World Cruisers were designed and built. The most advantageous route was determined, charted, and divided into sections. Officers were sent ahead to prepare landing fields, and supplies were shipped in advance to key points all along the proposed route.

In 1925, in competition with the Navy and foreign contenders, the Army won both the Pulitzer Trophy and the international Schneider Cup—two of the world's great speed awards. These events were regarded



Smith and Richter on 1923 record endurance flight. Note inlet to extra gas tank behind the cockpit, for mid-air refueling.

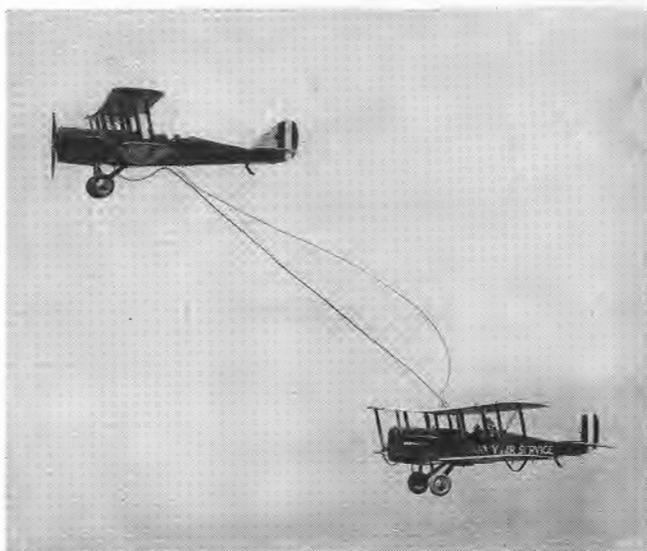
as excellent opportunities to introduce and test new equipment. The Pulitzer race was won by Lt. "Cy" Bettis. Two weeks later, "Jimmy" Doolittle, then an Air Service lieutenant, won the Schneider race.

During the succeeding year, elaborate preparations were completed for a Pan American Good-Will tour, to include the capitals of every Central and South American republic. It was made between December 21, 1926 and May 2, 1927 by an expedition under the command of Maj. Herbert A. Dargue. A highlight of the trip was the hop over the Andes made during a remarkable 650-mile flight, nonstop, across the South American continent from the Pacific to the Atlantic coast. After the flyers had returned, one ambassador reported that their flight had done "more good than ten years of diplomatic correspondence."

In 1927, the year of Lindbergh's flight to Paris, Lts. Lester J. Maitland and Albert F. Hegenberger flew from Oakland, California, to Hawaii. Their flight connected the United States by air with this Pacific territory. Exhaustive preparations, skillful navigation with the latest instruments, expert piloting, and sound judgment were the special factors that assured its success.

A second Army endurance record was made during the early part of January 1929. This time a Wright-powered Fokker monoplane, built by the same "Tony" Fokker who had designed German fighters in World War I, remained in the air for nearly a week, while servicing planes delivered all the gas, oil, meals, and miscellaneous supplies that were needed. The feat provided sensational evidence of the sturdiness of American-made engines.

Many an AAF leader in World War II gained his training in these flights, the requirements of which led to major developments in aeronautical equipment. Most important, these accomplishments, along with Lindbergh's, paved the way and prepared the public for the development of the long-range aircraft, capable of trans-oceanic flight, which were to be indispensable in the future achievement of plans for strategic bombardment.



Smith and Richter prepare to grab refueling hose in one of the contacts during their 37¼-hour flight. Both planes are DH-4B's.



Choker collars, still worn by Smith and Richter, chafed the necks of busy pilots until General Mitchell helped get rid of them.

PACT WITH GERMANY FORECAST

TRIBUTE PAID AIR KINGS BY SAN DIEGO

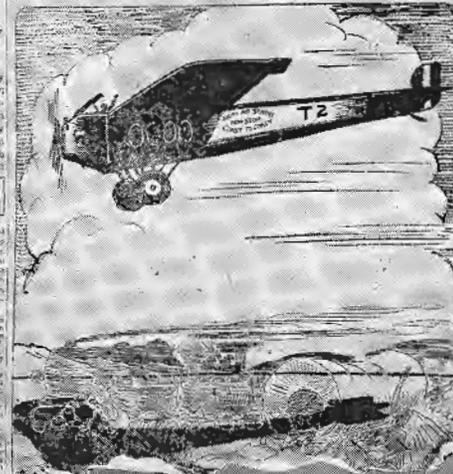
REDISTRICTING PLAN BEATEN BY OLD GANG

BY HERBERT PARKER
 (Special Correspondent)
 SAN DIEGO, May 4.—The redistricting plan proposed by the state legislature today is a complete failure. The old gang of political bosses has beaten the new plan, and the legislature has agreed to the old plan. The new plan was proposed by the state legislature in 1921, and it was a complete failure. The old gang of political bosses has beaten the new plan, and the legislature has agreed to the old plan.

HONORS SHOWERED ON DARING AVIATORS WHO FLEW ACROSS COUNTRY

BY A. J. BROWN
 SAN DIEGO, May 4.—With the speed of the very wind itself, Lieutenants John A. Macready and Oakley G. Kelly, Interim Army aviators, who last November attempted a non-stop ocean-to-ocean flight across the United States from San Diego and failed when within sight of their goal, today accomplished their feat, flying from New York to San Diego in less than twenty-seven hours and thereby setting a mark which brought them a perfect flood of congratulatory messages from all over the world.

The Pioneers



NOTE CLEARS AIR DESPITE ATTITUDE TAKEN BY FRANCE

BY MYRTLE WILSON
 (Special Correspondent)
 PARIS, May 4.—Despite the indications of the majority from the ranks of his political leaders and the quick decision of the Cabinet that Germany's reparations offer is unacceptable, the situation between France and Germany already is clearer than it has been in months.

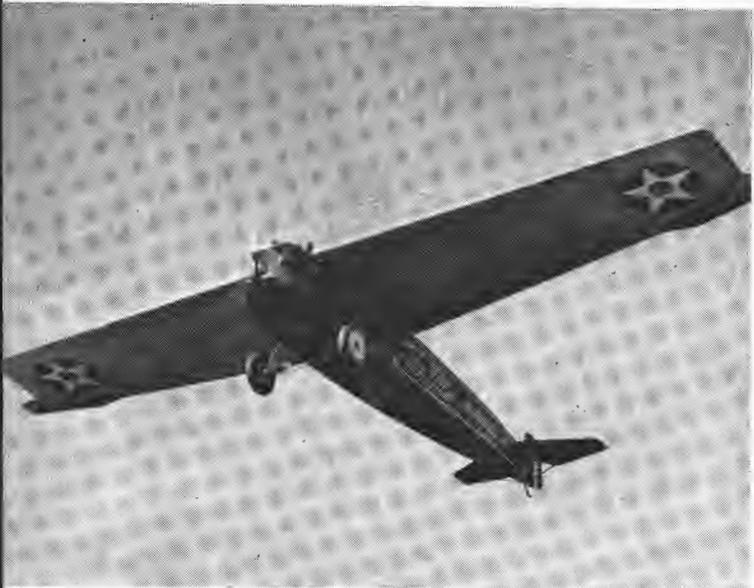
TRANSCONTINENTAL RECORDS

Army Pilots achieved first continental nonstop and dawn-to-dusk flights

The Liberty-powered Fokker T-2 had span of nearly 75 feet.

On May 2, 1923, at 12:36 P.M., Lieutenants Kelly and Macready took off from Roosevelt Field, New York. Twenty-six hours and 50 minutes later, the two flyers landed at Rockwell Field, California, to complete the first nonstop flight from coast to coast. The plane which carried them 2,520 miles cross-country at an average of 94 miles an hour was the T-2, a giant Fokker monoplane loaded with 780 gallons of gasoline and weighing 10,000 pounds. Built in 1922 by Fokker as a commercial transport, it was adapted by the Air Service for this flight to hold extra gas in the wing and forward

Macready (left) and Kelly stand ready for the third trial.



ROUND THE WORLD BY AIR

Army succeeded where all others had failed

Four sturdy Douglas biplanes, led by Maj. Frederick L. Martin and each manned by a pilot and mechanic, took off from a lake near Seattle on April 6, 1924. 175 days later, two of the original planes returned to complete the first round-the-world flight in aviation history. America had succeeded where Great Britain, Italy, Portugal, France, and Argentina had failed.

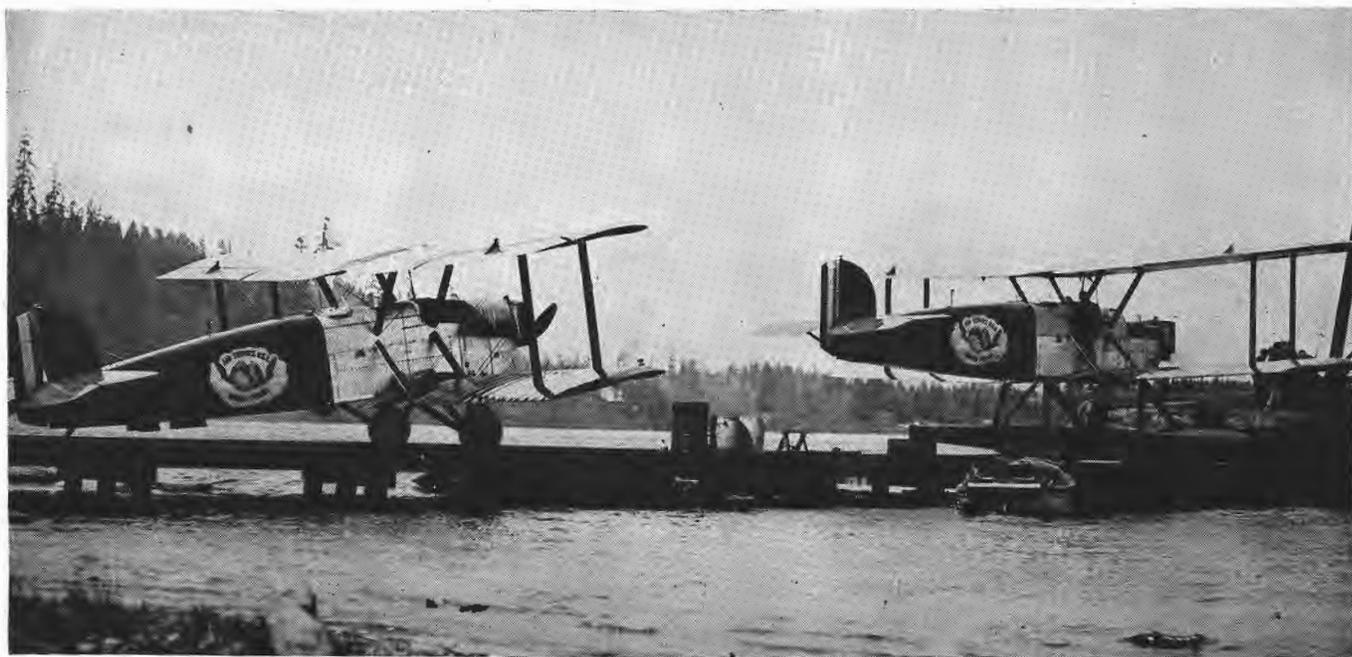
After leaving Seattle, the four World Cruisers flew north to Sitka and then westward to Dutch Harbor. In bad weather between Chignik and Dutch Harbor, the *Seattle*, lead plane of the flight, became lost far inland and crashed into a mountain peak. Its flyers, Major Martin and S/Sgt. Alva L. Harvey, were later rescued and returned to the United States. In Martin's place, Lt. Lowell H. Smith was appointed commander for the remainder of the tour. The difficult flight farther west to Paramushiru, in Japan's Kurile Islands, marked the first crossing of the Pacific to be made by air. The men made good use of their earth-inductor compasses, for they met little but fog, sleet, and heavy snow storms on this difficult westward leg.

They were on schedule from Japan to India. On June 7, between Shanghai and the Tchinkoen Bay, they passed Capt. Peltier D'Oisy, unsuccessful French contender for world-flight honors. Nearly three weeks

later, on the way to Akyab, Burma, they passed Capt. Stuart MacLaren, unsuccessful British contender, who had landed in a protected harbor on the coast because of the approach of dangerous typhoons.

The trip from India to England was made in 16 days, well ahead of schedule. It passed over some very rugged terrain. In one area the men had to fly through treacherous mountain country. Then followed additional delays in the far north. Flying from Scotland to Iceland, the men ran into the sort of fog that had delayed them in Alaska. Between the Faroe and Orkney islands, the *Boston*, flown by Lt. L. Wade and S/Sgt. H. Ogden, was wrecked and abandoned. Fortunately, its crew was able to resume the flight in the *Boston II*, a fifth Douglas World Cruiser hurriedly substituted. It was on the next and most dangerous hop of the trip—the 830 miles from Reykjavik, Iceland, to Frederikshaab, Greenland—that the Italian contender, trailing the Americans across the Atlantic, was rescued by the U.S.S. *Richmond*.

The final jumps across the American continent were like a triumphal procession. At Washington President Coolidge met the flyers. By September 28 they had returned to their starting point near Seattle, having traversed 27,553 miles in less than 400 hours' actual flying.



Two World Cruisers are docked to undergo change from wheels to pontoons. Conversion of land planes into seaplanes solved many

a landing problem for the world flyers, removed much of the danger of long water hops. The change was made several times.

New Stores
BY ORDER OF THE BOARD OF SUPERVISORS
OF SAN FRANCISCO DURING THE LAST SIX
MONTHS 200 STORES WERE ESTABLISHED
San Francisco's Booming

San Francisco Chronicle

LEADING NEWSPAPER OF THE PACIFIC COAST
REG. U.S. PAT. OFF.

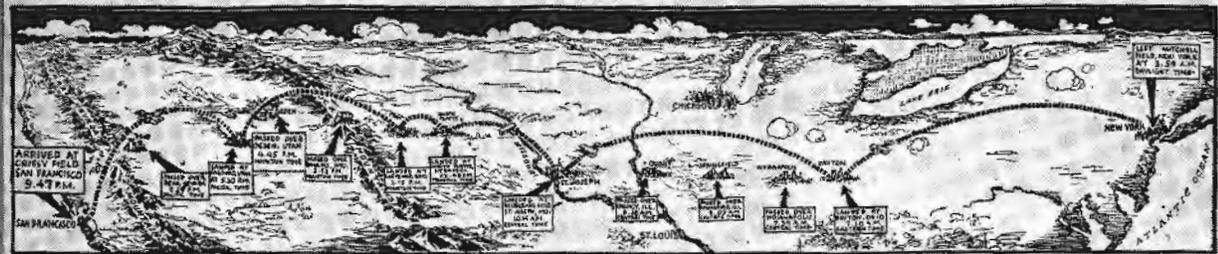
FAIR WEATHER
Thursday, June 24, 1924. In heavy
fog, moderate west wind.
Friday—Fair; moderate
west wind. Saturday—Breeze-
less, moderate fog.
Sunday—Light breeze, moderate
fog. Weather Service at San Fran-
cisco.

FOUNDED 1865—VOL. CXXIV, NO. 161

SAN FRANCISCO, CAL., TUESDAY, JUNE 24, 1924

DAILY 5 CENTS, SUNDAY 10 CENTS

MAUGHAN CROSSES U. S. IN DAY



Dawn-to-Dusk Birdman Cheered Wildly at End of 2850 Mile Flight

Maughan did it.
At 9:47 last night, while the frenzied cheering of countless thousands of San Franciscans drowned out the roar of his airplane's motor, the dawn-to-dusk, sea-to-sea flyer touched the wheels of his machine in the dim of Crissy Field in a perfect landing, completing his record-breaking trip.
It took him a few minutes under twenty-two hours to fly the 2850 miles from Mitchel, Long Island, to the edge of the Golden Gate. And the first thing this dauntless American said after he had switched off his motor at Crissy Field was:
"Well—I had a wonderful time!"
A few minutes later the official time for the flight was given as—21 hours, 57 minutes, 45 seconds, which meant an average speed of about 130 miles an hour, including stops.

**Time Table of
Lt. Maughan's
Flight**

Here is a graphic presentation of Lieutenant Russell Maughan's spectacular race with the sea across America. It reveals better than words can tell the magnitude of this lone flyer's magnificent performance. Hopping off just before dawn at Mitchel, Long Island, Maughan drove his little plane at lightning speed in the attempt to reach the Pacific's shores before the last light of day had faded. The map shows where the flyer's stops were made.

GENERAL GRANT PARK IS IN PATH OF FOREST FIRE

Assistance Asked to Fight
Flames Now Reported
Uncontrollable
SACRAMENTO, June 23.—(U. S. P. O.)—General Grant Park is in the path of a forest fire which an air force plane is attempting to extinguish. The fire is reported to be in the vicinity of the park and is now reported to be uncontrollable.

Record Shipment Of Japan Brides Arrives as Ban Date Draws Near

564 Nipponese Immigrants
Come on Tenyo Maru;
2 Other Liners Due
This Week
CHICAGO, June 23.—(U. S. P. O.)—The record shipment of 564 Japanese brides arrived in Chicago today on the Tenyo Maru. Two other liners are due in Chicago this week.

JAPAN FEELING OVER MURDERS GROWS TENSE

Possibility of War is Being
Widely Discussed in
Tokyo Press
By RODERICK MATHESON
Special Correspondent to the Chronicle
TOKYO, June 23.—The possibility of war is being widely discussed in the Tokyo press following the slaying of several Japanese in California. It is reported that the Japanese government is considering the possibility of war.

WAR SPLITS DEMOCRATS

BOURBONS NEED NEW ASPIRANT, BLYTHE THEORY

Failure of Either McAdoo or
Smith to Land Demo-
cratic Prize Forecast
By SAMUEL G. BLYTHE
Special Correspondent to the Chronicle
NEW YORK, June 23.—The cry for the aspirant, the failure of either McAdoo or Smith to land the Democratic prize forecast.

NEWS ODDITIES OF THE DAY

Blaise Judges for
Ankle Contest
Sought in Taft
Several months in the clouds.
TAFT, June 23.—Reports of the idea to discover the most beautiful woman among the members of the club are now being tried to see those who will exhibit.

PARTY SHAKEN BY BATTLE ON EVE OF MEET.

Two Rival Camps Ready to
Spring at Each Other's
Throats
By ARTHUR S. HENNING
Special Correspondent to the Chronicle
NEW YORK, June 23.—The battle between the two rival camps is now being fought on the eve of the meeting.

cabin. A set of controls was added inside the cabin so that the plane could be flown while the pilots changed places every six hours. The tensest moments of the flight occurred at the take-off itself, when the heavily laden plane barely cleared the Curtiss hangars at the far end of the field, and a little later over New Jersey, when Macready had to repair the voltage regulator by replacing the defective switch in flight.

Lieutenant Maughan accomplished the dawn-to-dusk flight on June 23, 1924. He took off from Mitchel Field, New York, at 2:59 A.M. After 18 hours and 20 minutes

Maughan waves good-bye at start of dawn-to-dusk flight.

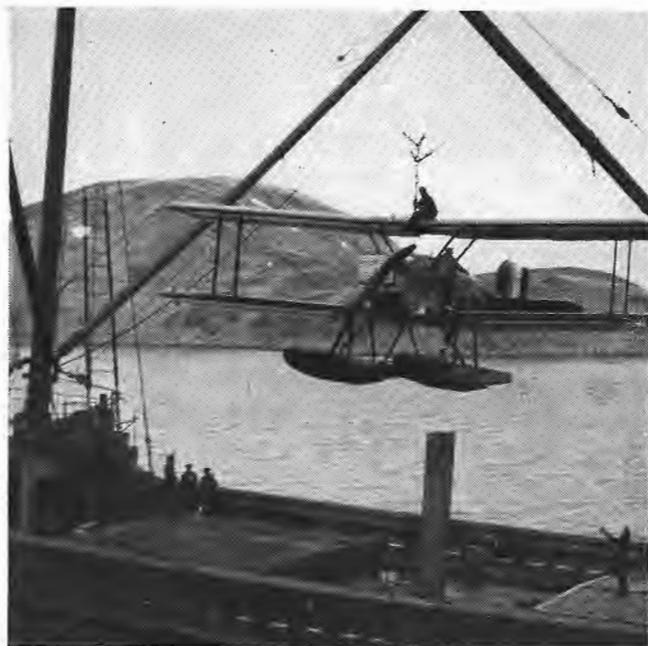
of flying and three hours and 28 minutes spent at five refueling stops, he arrived over Crissy Field, San Francisco, a minute before dusk, circled in the fog for eight minutes, and landed. His Curtiss PW-8 had covered the 2,850 miles at an average of more than 156 miles an hour. Most of the way he fought fatigue and nausea, troubled with head winds that reduced his speed. The only mishap occurred at McCook Field in Dayton where an overzealous mechanic delayed the flight an hour by tightening a fuel safety valve so hard that it broke away from its connection with the plane's tanks.

Curtiss PW-8 was one of Army's new "hot" pursuit planes.





World-flight officers, left to right: Lieutenants Harding, Nelson, and Wade, Major Martin, Lts. L. P. Arnold and Smith.



The *Boston*, Lt. Leigh Wade pilot, is hauled aboard the *Brookdale* at Unalaska for repairs. With pontoons it weighed 5,180 pounds.



Arriving in Seattle, the famous airmen were wined and dined until orders came from General Patrick to proceed to Dayton—by train.



Army and Navy used identical Curtiss planes in the 1925 Pulitzer race. Army's (left) was painted black, Navy's blue.

BIG-TIME SPEED EVENTS

Army won the two main races in 1925 competition

The Air Service entered its last big-time races in 1925 and quit in a burst of glory. In the Pulitzer race the Army and Navy created special interest by agreeing to use like planes so that victory would depend largely upon flying skill. For the event, Curtiss built three R3C2 racers (one to be held in reserve), powered by 610-horsepower Curtiss engines which weighed only 1.1 pounds per horsepower. On October 12, after two days of bad weather, Lt. "Cy" Bettis and Navy Lt. "Al" Williams decided to take off anyway. Bettis won, averaging 248.9 miles an hour, seven better than Williams. His new racer barely surpassed the 1923 record because of strong winds and a ban on dives across the starting line to gather speed, a practice which had cost an Army flyer's life in 1924.

Two weeks later, Lt. "Jimmy" Doolittle used Bettis' same plane, with pontoons instead of wheels, to win the Schneider race. The victory was all the more significant since 1925 was the only year the Air Service entered this event, restricted to seaplanes. Competing with Doolittle were one British, one Italian, and two Navy entrants. His speed over the closed course near Baltimore averaged 232.6 miles an hour, a world record. Not yet satisfied, Doolittle broke the world straight-away record the next day when he averaged 245.7 miles an hour, still using the same seaplane.



Doolittle was second U. S. winner of Schneider seaplane trophy. A third success by 1927 would have brought trophy here to stay.



Lt. "Cy" Bettis and the Curtiss racer that won both the Pulitzer and the Schneider races. Only change was substitution of pontoons.



Three of the five Loening amphibians, used on the Good-Will tour of 25 Pan-American capitals, pass bleak Duarte Island.



At Bolling Field, Major Dargue (left) and Captain Eaker receive Distinguished Flying Crosses from President Coolidge.



Capt. Ira C. Eaker (right) and Lt. Muir S. Fairchild tune up the *San Francisco*. Inverted Liberty engine permits prop to clear hull.

PAN-AMERICAN GOOD-WILL FLIGHT

Air Corps flyers toured 25 capitals

Led by Maj. Herbert A. Dargue, five planes headed south from Kelly Field, Texas, December 21, 1926, on the first leg of a 22,065-mile tour of Central and South America. Eight of the 10 flyers returned on May 2, 1927, after accomplishing a mission that had been planned for more than two years. Important to their success had been the new COA-1 amphibians built by Loening. In all kinds of weather and climate and over mountains, jungles, lakes, and swamps, these ships proved their all-round utility.

Mishaps plagued the flyers. Once they were delayed seven days by a burned-out motor. Five more days were lost when the *New York's* landing gear was wrecked. Attempting to take off from rough shallow water in the Canal Zone, the *San Antonio* sank and could not rejoin the tour until much later. Then, over Buenos Aires, tragedy struck when the *Detroit* and *New York* collided in mid-air. Major Dargue and Lt. Ennis C. Whitehead in the *New York* parachuted to safety, but Capt. Clinton F. Woolsey and Lt. John W. Benton, not wearing chutes, were killed in the *Detroit's* crash.

Slowing their pace once they had returned to North America, the flyers timed their arrival at Bolling Field, D.C., to coincide with the opening of the Pan-American air conferences. When they landed, President Coolidge awarded them Distinguished Flying Cross certificates.



Left to right: Air Corps Chief Patrick, Maitland, Asst. Chief Fechet, Hegenberger. At Bolling "the old man" greets his "boys."

FIRST FLIGHT TO HAWAII

Maitland and Hegenberger made it in less than 26 hours

At 7:09 A.M. on June 28, 1927, the *Bird of Paradise* left Oakland, California, and headed over the Pacific toward Hawaii. Twenty-five hours and 50 minutes later, the trimotor Fokker monoplane landed at Wheeler Field, near Honolulu, after a nonstop flight of 2,418 miles. At the controls of the plane was Lt. Lester J. Maitland, flying a course skillfully navigated by Lt. Albert F. Hegenberger.

Navigation was the chief problem. The margin of possible error for the trip was but $31\frac{1}{2}$ degrees. Yet Hegenberger, by constantly comparing instruments that he had helped develop, succeeded in guiding the plane straight to its goal—a mere dot in the vast Pacific Ocean. Typical of his ingenuity was his discovery, when his radio beacon and induction compass failed, that he could take sightings from whitecaps on the waves.

When they returned to this country, President Coolidge presented Maitland and Hegenberger each with the Distinguished Flying Cross. According to Charles Lindbergh, then at the peak of his own triumphs as an aviator, Lieutenants Maitland and Hegenberger had made "the most perfectly organized and most completely planned flight ever attempted."

PICTURES OF ARMY PLANE'S ARRIVAL AT WHEELER

Honolulu Star-Bulletin Edition

ARMY FLIERS, SPANNING PACIFIC TO HAWAII, LAND SAFE; TELL STORY OF RECORD FLIGHT

TIREDBUT HAPPY MEN TELL STORY

END OF 2100-MILE HOP FROM OAKLAND AIRPORT COMES AS CROWD CHEERS

BASEBALL

Hawaiian flyers laden with the traditional leis when they landed at Wheeler Field. They returned by boat.



The *Question Mark* makes one of 43 contacts with a supply ship during its record endurance flight of over 150 hours.



The *Question Mark* was same type as Hawaiian plane. Its Wright engines showed little wear after nearly a week's steady use.



Five endurance flyers, left to right: Sergeant Hooe, Lieutenants Quesada and Halverson, Capt. Eaker, Major Spaatz (in command).

WORLD ENDURANCE RECORD

Air Corps flyers stayed aloft nearly a week

Future Generals Spaatz and Eaker took part in the 1929 endurance record flight of the *Question Mark*. The plane left Los Angeles, January 1, with less than 100 gallons of gasoline, but, thanks to mid-air refueling as pioneered by Smith and Richter in 1923, when it landed almost 151 hours later, it had flown some 11,000 miles. The five crew members were commanded by Maj. Carl Spaatz, already veteran Army airman. Servicing the trimotor Fokker monoplane with all necessary supplies were Capt. Ross G. Hoyt and Lt. Odas Moon. Some 40 tons of material were transferred in 43 contacts with the endurance plane, nine of them at night. This included 5,660 gallons of gasoline, 245 gallons of oil, meals, batteries, and a variety of other supplies needed for the endurance flight.

On January 7, the *Question Mark's* port motor cut out. Despite a light load of gasoline, the other two motors could not prevent a drop in altitude from 5,000 to 2,500 feet. The crew knew then that the flight was over. At 2:07 P.M. they landed. Engine failure was attributed to plugged grease outlets which had cut off the valve lubrication. After nearly seven days of constant duty the engines showed only "trivial" wear.

KELLY FIELD

Cadets used old planes to train in modern manner

The Armistice brought intensive flying training to a close. At Kelly Field, the largest training center, the only formal training activity conducted during the demobilization was the Air Service Mechanics School. Actually, a limited amount of uncoordinated flying instruction was continued. Two tactical units at Kelly, a pursuit and a bombardment group, took over the advanced training. But meager appropriations severely limited the number of pilots graduated. The Air Service act of June 1920 authorized as many as 2,500 cadets at any one time, yet only 190 airplane and 15 airship pilots were graduated in the fiscal year ending June 1921. In fact, up to the 1939 expansion program there was no year in which as many as 700 cadets were enrolled in flying training schools.

Not until June 1922 was flying instruction formally resumed at Kelly Field. In that month the Army centered heavier-than-air training in the San Antonio area and lighter-than-air at Scott Field, Belleville, Illinois. The mechanics school had been moved more than a year before to Chanute Field.

Based on wartime practices, the course adopted in 1922 made use of the three-phase training sequence still in effect today. After about five months of primary at Brooks Field, the cadet moved to the Advanced Flying School at Kelly for another six months. There, in about 12 weeks of basic he progressed through several stages of flying, including dual, solo, hurdles, eights, 180- and



(Above) The Consolidated PT-1, first of the modern primary trainers, replaced the old "Jenny" in 1927. (Below) Cadets learn to use aerial cameras in Douglas O-2, later redesignated the BT-1.



Airplanes lined up for review at Kelly Field, Texas, important center for advanced flying training since 1917.



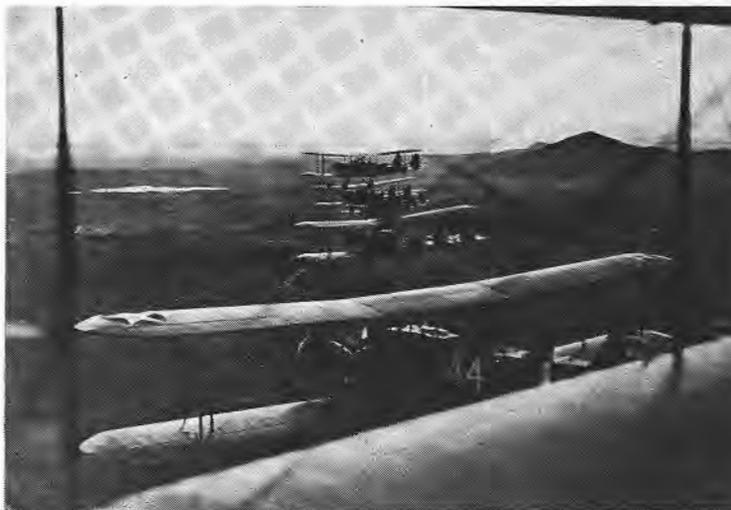
360-degree turns, night flying, cross-country, and formation. In the remaining weeks the cadets were grouped in sections for specialized (i.e., advanced) attack, bombardment, observation, or pursuit instruction. Of the 865 cadets admitted in the five-year period ending February 1928, 480 were graduated—less than 1 per cent of the number graduated in the first half of 1944 alone.

During the twenties the "stick-and-wire" planes and their bulky engines gradually gave way to "cleaner," more efficient designs (see Part VI). At first, old, wartime designs had to do for training purposes, but by September 1927 all remaining "Jennies" were scrapped in favor of the PT-1. And soon the DH-4B, MB-3A, SE-5, and NBS-1 were replaced by the O-1, O-2, AT-4, and AT-5. With the redesignation of the O-2 as BT-1, there was a plane type for each of the three training phases. The distinction between plane types had amounted to little more than training versus combat during World War I, but now the trend was toward more specialized designs to meet more specific requirements. Emphasis was first placed on observation and pursuit designs. Only a few successors to the original Martin bomber of 1918, such as the Barling and Keystone, appeared, for doubts were still raised as to the need for so costly a combat aircraft. In 1926 what bombers remained were fast becoming obsolete and an improved type was sought. At the same time a policy was established favoring more than one engine in bombers and cargo planes.

Not until 1922 was the designation "attack" officially adopted. At first this only meant mounting guns on the wings of the DH-4. But by 1927 fixed guns and bomb racks were built into the wing or fuselage, as in adaptations of the Curtiss Falcon (A-3) and Douglas O-2 (A-2) chosen for their exceptional maneuverability.



(Above) Boeing P-12, powered by Pratt & Whitney radial engine, was standard Air Corps pursuit of early thirties. (Below) Keystone LB-6 was the medium bomber of the late twenties. Note twin fins.



Curtiss Condors (B-2's) over Yosemite. Then the largest Air Corps plane, this was heavy-bomber companion to LB-6.





Administration Building at Randolph. Many an AAF airman remembers this field as the scene of his early flying training

experiences. Architecture at Randolph suggests the Spanish background of Texas, site of many AAF training installations.

RANDOLPH FIELD

It was Air Corps training center in the thirties

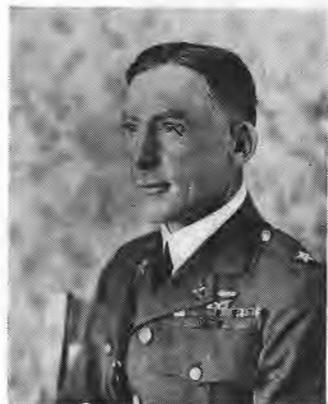
On June 20, 1930, Randolph Field, Texas, "West Point of the Air" and one of the world's great flying training centers, was dedicated. Many military and civilian notables, foreign flying delegations from Mexico and Cuba, and some 15,000 onlookers were present. The flag was raised by the widow of Capt. William M. Randolph, a flying officer who, like others for whom Army airfields were named, had died in line of duty. Fittingly acting as her escort was Brig. Gen. Frank P. Lahm, later called the "father of Randolph Field."

It was General Lahm, one of the first Army officers to become a pilot, who had promoted the establishment of Randolph Field. He had been in command of the first Air Corps Training Center, organized in 1926 at Duncan Field, adjacent to Kelly. Recognizing the need for bringing the whole program under one head and for coordinating its growth, he wrote the reports to General Patrick which ultimately made San Antonio the center for the Army's flying training. President Coolidge's signature on the Air Corps bill, February 19, 1928, made it possible to begin construction work before the end of the year.

At the time of its dedication, Randolph Field was half completed. With a strength of 162 officers and 1,432 enlisted men belonging to 13 organizations, it became both the new headquarters for the Air Corps Training Center and the site of the primary and basic flying schools on October 25, 1931. Its first commanding officer was Maj. F. L. Martin, original leader of the Round-the-World flight. He was succeeded in 1934 by Maj. Henry W. Harms and in 1937 by Col.

John B. Brooks. In December 1940 Col. Idwal H. Edwards, who like both Harms and Brooks had started to fly relatively early in Air Corps history, became the last commanding officer of Randolph Field before Pearl Harbor.

For eight years all of the Air Corps primary and basic training was given in the Primary School at Randolph, and advanced training in the Advanced School



Maj. Gen. Frank P. Lahm

at Kelly. Each of the three stages required four months. Fundamental flying maneuvers were taught in primary training, formation and instrument flying in basic training, and the special problems of the fighter or the bomber in advanced training. Step by step the transition from primary trainers to tactical planes was made. The actual flying hours required of the student during the year's course totaled about 325.

In 1936 a new class of about 150 students entered training every four months. In spite of high entrance qualifications and a surplus of manpower to choose from, only 45 per cent ordinarily finished the course. Upon graduation, the cadet received his cherished wings, his rating, and—except for 1934-37 when he had first to serve an added year in a U.S.-based tactical unit—his lieutenantcy in the Army of the United States.



Living quarters and administration and operations buildings at Randolph Field form a hub surrounded on all sides by airfields.



Flanked by concrete aprons, Randolph's hangar lines often hold 350 trainers. Near center is Operations and Parachute building.

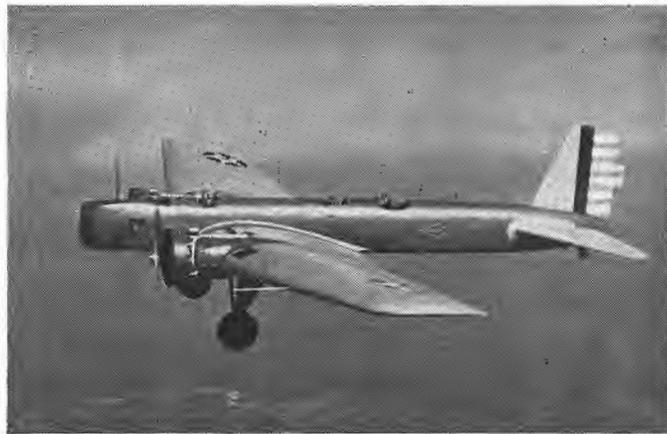


The Boeing P-26, introduced in 1932, was the Air Corps' first all-metal pursuit monoplane to see actual service.

WARPLANES IN THE THIRTIES

All-metal monoplane tested in Alaskan flight

Two important developments in airplane manufacture appeared in the early thirties. One was the change-over to monoplane design, and the other was the trend toward the use of all-metal construction. While these ideas were not new to aviation, their general acceptance had to await certain aerodynamic and structural devel-



Boeing B-9 came out in 1931 as Air Corps' first all-metal monoplane bomber. Equipped with retractable landing gear and powered by two 600-hp Pratt & Whitney engines, it made 188 m.p.h.

opments. Influential in their acceptance by the Army was the successful use being made of them in commercial models. Interest in new warplane designs had been stimulated by the Five-Year Program of expansion authorized in the act which created the Air Corps on July 2, 1926. The goal was 1,800 planes by 1931.

Other pronounced trends during the thirties were toward the monocoque fuselage, enclosed cockpits, retractable landing gear, and air-cooled engines. Near the end of the decade and until the advent of the P-38, P-39, and P-40, only radial air-cooled engines were being used in the standard Air Corps plane types.

The first all-metal monoplane bomber was the twin-engine B-9 brought out by Boeing in 1931. This was one of the models which six leading manufacturers submitted for comparative performance tests in response to a bomber competition instituted in 1930 by the Air Corps. Another entry was Martin's B-10, also a twin-engine, all-metal monoplane. Regarded as the world's fastest and most powerful heavy bomber when it made its initial flight in 1932, the modified B-10 known as the B-12 was soon preferred to the B-9. Its 207-mile-an-hour speed was higher than that of several pursuits then used and in excess of 1932 bomber requirements.

In 1931 Curtiss introduced the A-8 (future A-12 Shrike), all-metal attack monoplane. Boeing's P-26, first all-metal pursuit monoplane, came out in 1932 and was still good for a fight when Japan attacked the Philippines in the Manila area, December 1941.

An excellent trial of ten B-10's was afforded when

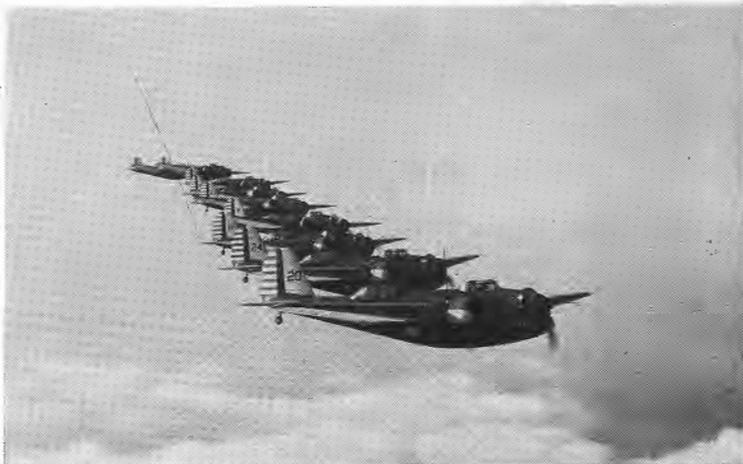


Lt. Col. Henry H. Arnold, in command of the mass flight to Alaska in 1934, receives the key to the city of Fairbanks.

Lt. Col. Henry H. Arnold led a test flight to Alaska in 1934, departing from Washington, D.C., on July 19 and returning August 20. The 7,360-mile round trip was made by 14 officers and 16 enlisted men commissioned to photograph strategic landing areas, determine the feasibility of sending an air force to Alaska in an emergency, and report on the matter of frontier defense. The flight raised many problems of supply, equipment, terrain, and weather.

Stops were made en route to Alaska at Patterson Field, Minneapolis, Winnipeg, Regina, Edmonton, Prince George, and Whitehorse. The flyers arrived at Fairbanks on July 24. There they established a base and photographed some 20,000 square miles of a 400-mile strip 50 miles wide. On August 3 one of the B-10's sank during a forced landing in Cook Inlet. The crew was unhurt but the plane could not be flown for a week. For the rest, the B-10's performed admirably.

The return flight on August 17, made nonstop en masse from Juneau to Seattle, was the first of its kind between Alaska and continental United States. The men flew over water along the coast line without touching Canada, thus demonstrating that a tactical unit might be moved to Alaska without flying over foreign territory. The success of the flight was in part the result of the full cooperation given by the Canadian and the United States signal corps. Its accomplishment reflected the remarkable progress made since 1920 when four DH-4B's had spent more than two weeks each way on the first round-trip Alaskan flight.



(Above) A flight of Martin B-10's, regarded as world's fastest and most powerful heavy bomber in 1932. (Below) Army flyers take off from Bolling Field in B-10's on long-range Alaskan flight.





Chief pursuit plane of the GHQ Air Force and basic design for the P-40, the P-36 was one of first modern pursuits to be ordered

in quantity. The French used this Pratt & Whitney-powered, all-metal monoplane with success early in World War II.

GHQ

GHQ Air Force developed strategic plans for heavy bomber

The establishment of the General Headquarters (GHQ) Air Force on March 1, 1935 marked a new epoch in the history of U. S. military aviation. Although not a final solution of the chronic air-power controversies nor without fault from an administrative standpoint, this organization signified the first real progress toward an autonomous air arm within the U.S. Army. Its immediate purpose was to provide a mobile combat air force coordinate with the four ground armies and capable of strategic defensive bombing as well as cooperation with ground troops. Coequal with the Office, Chief of Air Corps, which continued to administer the problems of supply and training, it was independently responsible to the Chief of Staff, to whom both organizations had to look for final definition and coordination of their activities.

The headquarters for the GHQ Air Force was located at Langley Field, Virginia. One of its three combat wings was also located there, the others being at March Field, California, and Barksdale Field, Louisiana. Widely separated in the East, West, and South, these forces could assemble quickly to strengthen any hard pressed front. First to head the GHQ Air Force was Brig. Gen. Frank M. Andrews, one of the AAF's great leaders. An ardent flyer from World War I to the time of his fatal crash in Iceland, May 1943, General Andrews was an active protagonist for the heavy bomber and wider recognition of air power.

The GHQ Air Force was created during a period of alarming developments on the world scene and remarkable advances in the science of aeronautics. The Hitler menace was by then apparent to all who would see, especially after the attempt on Austria in July 1934.

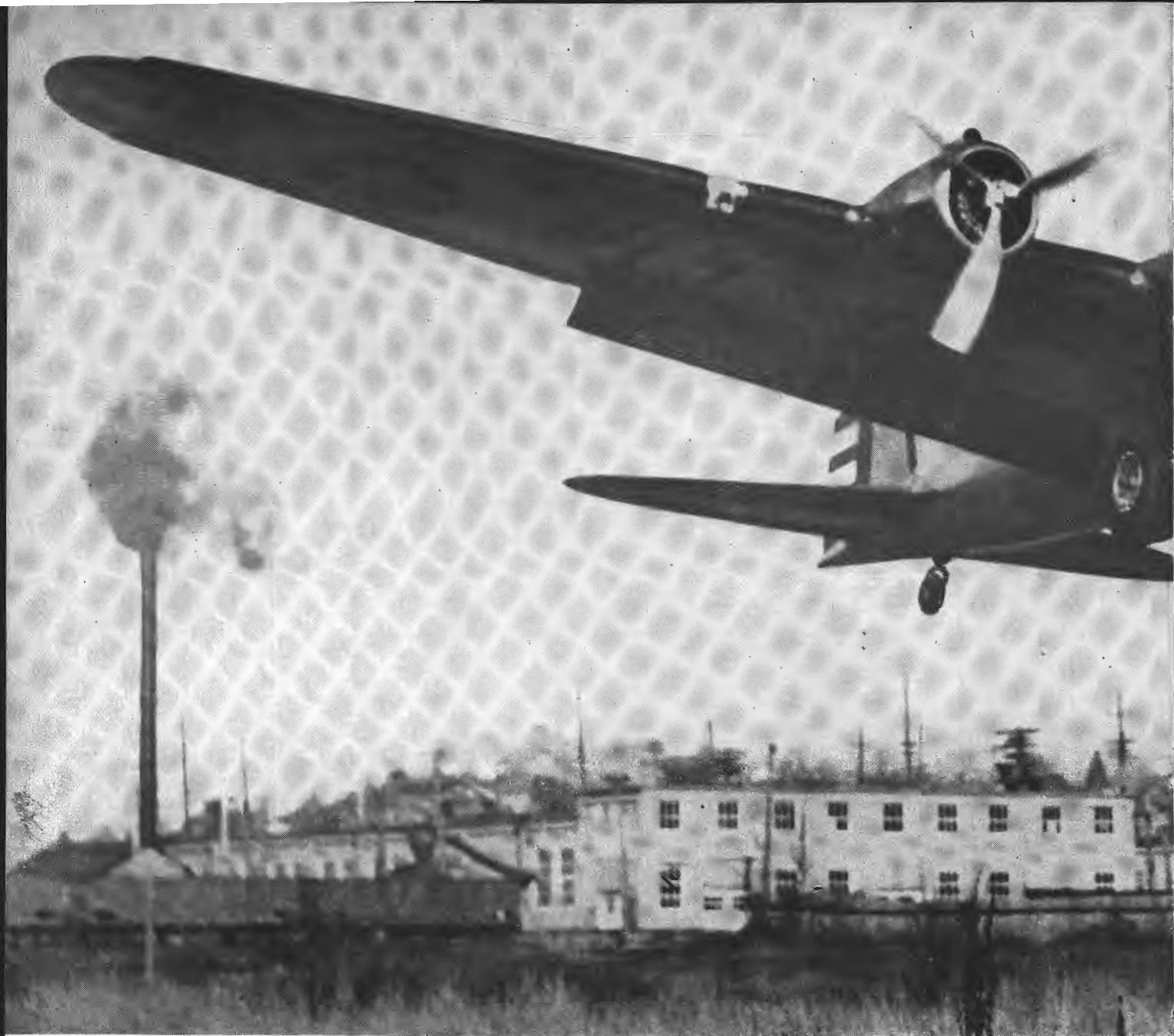


The late Lt. Gen. Frank M. Andrews, first head of the GHQ Air Force and outstanding champion of the four-engine bomber.

The international race in aircraft production threatened to leave America far behind. In the lead were France, Russia, Britain, and Italy, with Germany and Japan presumably trailing the United States but catching up at a frightening rate. America still led both in commercial aviation and in performance of military aircraft, but the Army had scarcely 1,200 serviceable combat planes in 1935. And that figure was to fall to 842 by June 1937. As in most of the anti-Axis nations, aviation improvements were proceeding at such a rate that planes became obsolete faster than their peace-minded governments were replacing them, and production fell far behind experimental research.

The story of the GHQ Air Force is closely related to that of the four-engine heavy bomber. Both reflect a changing concept of air power, a gradual coming-round to the strategic potentialities of bombardment. When the ideas took shape in 1935, the one in a combat organization, the other in the original B-17 Flying Fortress, their common purpose was defense. The plan was to provide a mobile air force capable of engaging in long-range reconnaissance and of intercepting an enemy before he could get within observation or striking distance. If necessary, heavy bombers might be dispatched on short notice to reinforce bases in Hawaii, Panama, or Alaska.

This was the plan, but the struggle by farsighted Air Corps leaders for the full concurrence of the armed forces did not end in 1935. The Navy continued to regard the defense of the coast line and territorial possessions as its prerogative. Many Army officials still were not convinced of the heavy bomber's effectiveness in defensive—let alone offensive strategy.



Original XB-17 completing trial flight. One of world's most photogenic planes, the Flying Fortress has majestic sweeping

THE FLYING FORTRESS

B-17 symbolizes AAF heavy-bomber program

If any one plane best represents the AAF in the minds of the American people it is the B-17 Flying Fortress. The story of this plane is that of a hard-fought victory in the air-power controversies that preceded World War II. It is the story of how the heavy bomber attained its rightful place in the whole scheme of modern air, land, and sea power.

Air doctrine during World War I had foreshadowed the postwar theories of bombardment enthusiasts. And hardheaded military men on the War Department General Staff were impressed if not altogether convinced by the controlled battleship demonstrations of

the early twenties. But in the face of stringent economies, outspoken isolationism, and public apathy, they were little disposed to back new experimental projects. The one bomber whose quantity procurement they did ultimately authorize in the late thirties was the Douglas twin-engine B-18. This they preferred to the B-17 because they regarded it as an all-purpose bomber less than two-fifths as costly to buy and replace, and one from which the "bugs" had already been removed. But to the steadfast advocates of the heavy bomber, like Andrews and Arnold, this was false economy. Quality was being sacrificed for quantity, they said. In terms of load and range, one B-17 could accomplish as much as four B-18's at a much lower cost and with fewer men both on the ground and in the air.

The idea of the B-17 may be traced to a questionnaire circulated in March 1933 by Maj. Gen. B.D.



design that flies well and looks good. The familiar, huge fin that fairs into the fuselage appears in the later B-17E.

Foulois, Chief of Air Corps, to elicit suggestions on the use of bombardment from men in the field. Their enthusiastic response contained many revolutionary suggestions pointing in general to large bombers capable of flying many tons of bombs nonstop across the continent at speeds approaching 250 miles an hour and altitudes above 24,000 feet. Among the designs submitted by manufacturers upon invitation was that of the Boeing Airplane Company which alone dared to call for four engines. Here was the embryonic B-17.

By September 1934 this radically new plane existed as a workable design though many of its innovations had yet to be realized. Its first test flight in July 1935 surpassed even the best hopes of the designers. A month later the experimental B-17 made aviation history with a 2,100-mile nonstop flight from the Boeing plant in Seattle to Wright Field, near Dayton, averaging 232

miles an hour. Unfortunately, this first model of the B-17 crashed during further tests. Though official investigations cleared the B-17 of structural failure, this mishap was followed by decisions to allow the construction of a total of only 18 of these B-17's instead of the 65 which the Air Corps had requested.

The first three of these were tested in January and February 1936 and acclaimed "the best bombardment aircraft in existence," but the procurement of the other 10 was not actually approved until July 1937. After their arrival no other B-17's were delivered up to the outbreak of war in Europe in 1939, although a total of 206 had been requested between October 1935 and June 1939. At last, in August 1939, approval was given for 42 additional B-17's. Before construction of these new bombers could be begun, the Luftwaffe was already paralyzing Warsaw, and the Nazis were on the march.



Officers of the 1938 flight to Buenos Aires stand before one of their B-17's. In center, looking left, is Colonel Olds.

B-17 AND B-15 FLIGHTS

Long-range missions proved worth of heavy bomber

Successful pioneer flights in 1938-39 did much to win favor for the four-engine heavy bomber. These flights were practical long-distance missions in B-17's and in the Army's only B-15, experimental prototype of the Flying Fortress.

One outstanding mission was the Good-Will Flight to Buenos Aires made by six B-17's under the command of Lt. Col. Robert Olds. Leaving Miami on Feb-

ruary 17, 1938, the planes made the entire 5,225 miles to the Argentine capital in only 28 hours of flying, with but one intermediate stop at Lima, Peru. Five of the planes averaged over 200 miles an hour on the second leg. At Buenos Aires, the 49 members of the expedition took part in an aerial review and attended the inauguration of Argentina's new president, Roberto Ortiz, to whom Colonel Olds delivered a personal message from President Roosevelt. The more leisurely return trip began on the 22d and included stops at Santiago, at Lima, and in Panama. Ten days after they had left Miami the flyers completed their friendly 11,082-mile flight at Langley Field.



Six B-17's line up at Municipal Airport, Miami, ready to take off for Lima, Peru, first stop on the Good-Will Flight to Buenos Aires.

These original B-17A's showed the same ruggedness and dependability that have since made the Boeing Flying Fortress famous.



B-17 flyers prove their navigational skill by intercepting the Italian liner Rex at sea 725 miles east of New York City.

Another instructive mission was accomplished when three B-17's of the 49th Bombardment Squadron were dispatched to intercept the Italian steamer *Rex*. This navigation test was a major event of GHQ Air Force maneuvers in May 1938. At 8:30 on the morning of the 12th, the three planes under the command of Maj. Caleb V. Haynes took off from Mitchel Field to find the "enemy warship." The general location was given by radio. In spite of heavy clouds they succeeded in sighting the *Rex* 725 miles east of New York at 12:23 P.M., flew over the ship, and returned to base by 4:30.

An important B-15 mission was the Mercy Flight of nearly 10,000 miles from Langley Field to Chile and

return. Made between February 4 and 14, 1939, its purpose was to deliver 3,250 pounds of medical supplies after an earthquake had devastated sections of Chile. The trip out was made in 29 hours and 53 minutes of flying, with stops only at Colón, in the Canal Zone, and Lima. Major Haynes, again in command, subsequently received the Distinguished Flying Cross. The B-15 he used is still flown by the Air Transport Command as long cargo and transport missions. Delivered in December 1937, it then had insufficient power for its advanced design. With plans for still better heavy bombers under consideration, the idea of putting the B-15 in production was abandoned.



B-15, "big brother" of the B-17, made Mercy Flight to Chile in 1939. Passageway in wing permits access to each of four engines.



These 3,250 pounds of medical supplies, piled in front of the B-15, went to Chile in about 30 hours. Plane carried and 11-man crew.



National Air Races at Cleveland, 1937, give Labor Day crowd a chance to see Army flyers in action with latest planes.

THE NATIONAL AIR RACES

Army flyers took part every year from 1921 to 1939

Army airmen played an active part in the 19 successive National Air Races staged in this country prior to World War II. After 1925, however, their principal contribution was exhibition flying. They had found less reason to participate in races as the laboratory became a safer and more efficient means of testing new equipment. But they did continue to enter those races in which they had a particular interest like the Liberty Engine Builders Trophy and the John L. Mitchell Trophy, the latter open only to members of the 1st Pursuit Group.

All but three of the gigantic air shows of the thirties took place at Cleveland's large municipal airport. Spectators at these shows remember well the precision formation flying of the 1st Pursuit Group and the 17th Attack Group and the thrilling stunts performed by such specialty units as the "Three Musketeers" and "Skylarks" from Maxwell Field, Alabama, or the "Sextet" from Barksdale Field, Louisiana.

Among the best known Air Corps participants was Shell Oil's "Jimmy" Doolittle, then a major in the Air Corps Reserve. Already the recipient of many flying honors, Doolittle won the transcontinental Bendix Trophy race in 1931 and the Thompson Trophy race in 1932. Flying his Wasp-powered "Gee Bee Super-Sportster" at an average speed of 296.8 miles an hour in the Thompson race, he recaptured the world land speed record lost to France in 1924.



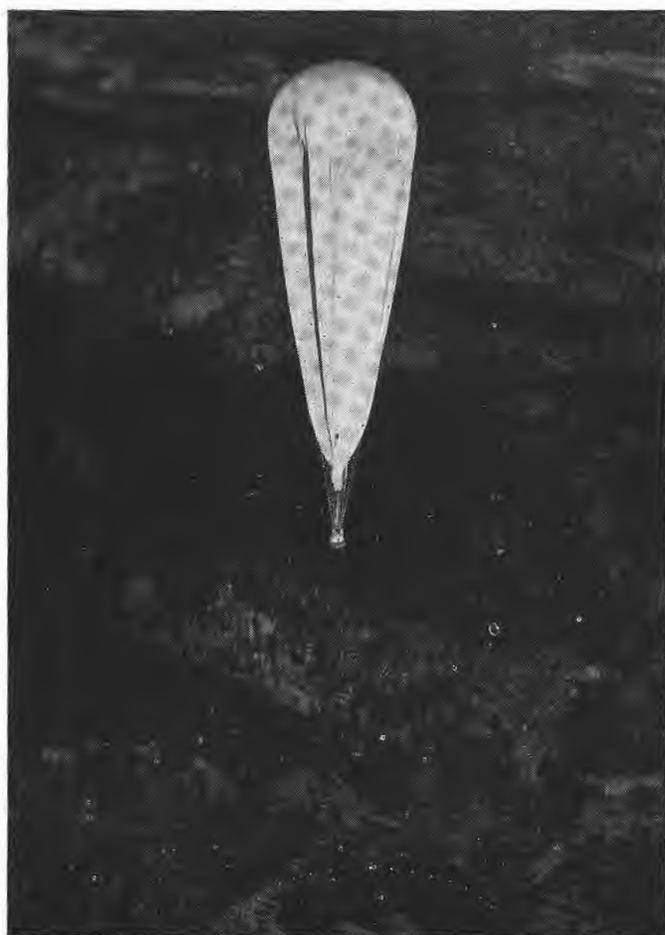
"Skylarks," trio of "hot" pilots in Boeing P-12E's from Maxwell Field, dazzled 1937 crowds with stunt and precision flying.



He may well grin, for 1932 was the year "Jimmy" Doolittle won the Thompson, Shell, and Bayles trophies and Shell Gold Plaque.



TC-13, largest U. S.-built nonrigid. Like its sister ship, TC-14, it was designed for coastal patrol and training.



Explorer II rises above Rapid City. Largest balloon ever built, it held 700,000 cu. ft. more gas than Explorer I, destroyed in 1934.

EXPLORING THE STRATOSPHERE

Air Corps balloons reached greatest height known to man

Air Corps balloonists furthered knowledge of the stratosphere when in 1935 Capt. Albert W. Stevens and Orvil A. Anderson ascended in the *Explorer II* to a record height of 72,395 feet. Equipped with the latest instruments, Stevens in command and Anderson as pilot rose from the "stratobowl" at Rapid City, South Dakota, at 7:01 A.M., November 11. Their nine-foot airtight gondola prevented suffering from cold, changes of air pressure, or lack of oxygen. During the ascension, which lasted eight hours, 13 minutes, they covered a lateral distance of some 225 miles.

For the flight and its valuable findings, Stevens and Anderson were awarded National Geographic's coveted Hubbard medal. They were credited with increasing the world's knowledge of cosmic rays, of the sun's spectrum, the upper atmosphere, the earth's actual curvature, and the effects of great altitude on fruit flies and spores. They took more than 15,000 photographs.

The Air Corps' interest in lighter-than-air activities ended, except for the barrage balloon program, in 1938 when the TC-13 and TC-14, last of its nonrigid training ships, were turned over to the Navy. Completed in 1933 as the largest of its type, the TC-13 evoked special interest because of a "sub-cloud" car which hung, by means of a flexible cable, 1,000 feet below. From this an observer could communicate by telephone with the crew above and even direct maneuvers of the 200-foot-long nonrigid during adverse weather conditions.

FROM AIR CORPS TO AAF

*Organizational problems
were the growing pains
of over-all expansion
and increasing independence
for the Army's air arm.
They reflected
attempts to meet threats
in world conditions
leading to dreaded
second global war*

The crucial years before America's entrance into World War II saw important organizational changes within the Army air establishment, changes from which an autonomous air arm was ultimately to emerge. On March 1, 1939 the four-year-old GHQ Air Force was placed under the administration of the Office, Chief of Air Corps. This step was intended to remedy the duplications and conflicting responsibilities of the preceding four years when the two organizations had been coequal but dependent on the War Department General Staff for their coordination. At the same time Maj. Gen. Delos C. Emmons succeeded General Andrews as head of the GHQ Air Force.

On November 19, 1940—during a period of intensive expansion—the GHQ Air Force was once more placed on a footing coequal with that of Office, Chief of Air Corps. Fortunately Maj. Gen. H. H. Arnold, who had been Acting Chief of Staff for Air since November 11, was in a position to give needed coordination to the two elements of the air arm. Arnold had served as Chief of Air Corps since the tragic death of Maj. Gen. Oscar Westover in a plane accident at Burbank, California, in September 1938. Maj. Gen. George H. Brett now became Acting Chief of Air Corps. Further coordination was made possible by the designation on December 26, 1940 of Robert A. Lovett as Special Assistant to the Secretary of War. Lovett, a former Navy flyer, was given the primary responsibility of coordinating problems of air procurement.

The creation of the Army Air Forces on June 20, 1941 brought additional changes. Headed by General Arnold it represented another attempt to reconcile the conflicts in authority and responsibility that continued



Maj. Gen. Delos C. Emmons

to exist between the combat and administrative elements. But channels of authority were still devious and organization was cumbersome and ill fitted to the rapidity of action necessary in the conduct of modern war. The result was that in a complete reorganization of the War Department on March 9, 1942, the AAF—less than 35 years after the creation of the tiny Aeronautical Division in the Signal Corps—was recognized as one of three autonomous branches within the War Department—supply, ground, and air.

The European war that some had declared inevitable for more than a decade broke out on September 1, 1939, and with it, from the outset, war in the skies. Ethiopia, Spain, and China had served as proving grounds for plane types that already were rapidly becoming obsolete. The democratic peoples as a whole awoke with a start to the pitiful inadequacy of their air forces by comparison with Germany's.

Air Corps observers, sent to Poland, witnessed the Nazi realization of Giulio Douhet's theories on air warfare. They saw what it meant to face superior strength and numbers without equipment or reserves and without the 150,000 or more items of supply that must be close at hand if an air force is to operate. They saw, too, what was needed to fight back. Recognizing the role the United States might be called upon to play both in Europe and in the Far East, they helped to formulate plans for future U.S. air strategy. The immediate procurement of heavy bombers without equal in range, armament, performance, or capacity was urged.

Meanwhile, Britain, France, and many lesser nations were placing large orders for planes with U.S. manufacturers. Although neutrality resolutions passed be-

CHAMBERLAIN ANNOUNCES BRITAIN IS AT WAR WITH GERMANY

"All the News That's Fit to Print."

The New York Times.

EXTRA Section 1

NEWS INDEX, PAGE 21, THIS SECTION VOL. LXXXVIII, No. 29,597 NEW YORK, SUNDAY, SEPTEMBER 3, 1939

BRITAIN AND FRANCE IN WAR AT 6 A. M.; HITLER WON'T HALT ATTACK ON POLES; CHAMBERLAIN CALLS EMPIRE TO FIGHT

<p>SOVIET IN WARNING</p> <p>British-French Action to Bring Western Border Revision, Berlin Hears</p>	<p>Announcement of Final Ultimatum</p> <p>LONDON, Sunday, Sept. 3.—Following is the text of today's communique regarding the final ultimatum to Germany:</p> <p>On Sept. 2 His Majesty's Ambassador in Berlin was instructed to inform the German Government that unless they were prepared to give His Majesty's Government in the United Kingdom satisfactory assurance that the German Government had suspended all aggressive activities against Poland and were prepared promptly to withdraw their forces from Polish territory, His Majesty's Government in the United Kingdom would without hesitation fulfil their obligations to Poland.</p> <p>At 9 A. M. this morning His Majesty's Ambassador in Berlin informed the German Government that unless not later than 11 A. M. British Summer time, today, Sept. 3, satisfactory assurance to the above effect had been given by the German Government and had caused His Majesty's Government in London a state of war would exist between the two countries as from that hour.</p>	<p>ROME ASKED PEACE</p> <p>Pressed Its Proposal for a 5-Power Parley on Britain and France</p>	<p>NAZIS REPORT GAINS</p> <p>Hitler's Aims in Corridor Already Won, They Say, Telling of Big 'Trap'</p>	<p>Text of Chamberlain Address</p> <p>The following is the text of the address by Prime Minister Chamberlain from 10 Downing Street this morning:</p> <p>I am speaking to you from the Cabinet Room from 10 Downing Street. This morning the British Ambassador at Berlin handed the German Government the final note stating that unless we heard from them by 12 o'clock (which New York time) that they were prepared to cease to withdraw their troops from Poland a state of war would exist between us. I have to tell you now that no such undertaking has been received and consequently this country is at war with Germany.</p> <p>German troops crossed the Polish frontier. Germany will never give up force and can only be stopped by force. We are prepared to uphold our treaty with Poland and to protect them from the wicked and unprovoked attacks on the Polish people. France is joining Britain in fulfilment of her pledges. We have a clear conscience and the situation has become intolerable. Now that we have determined to fulfil it, I know that you will all play your part.</p>	<p>TO END OPPRESSION</p> <p>Premier Calls It 'Bitter Blow' That Efforts for Peace Have Failed</p>
<p>NAZIS GREET MISSION</p> <p>Hitler to Receive New Russian Ambassador and General Today</p>	<p>WAR MEASURES CUT</p> <p>Press Expressed the Hope Germany Would Win in Poland</p>	<p>RESISTANCE IS NOTED</p> <p>But Armies Drive On and Navy Is in Command of Baltic, Germans Hold</p>	<p>WARNING UNHEEDED</p> <p>Demand on Reich to Withdraw Army From Poland Ignored</p>		

World War I was to be the last. Yet at its end began a growing dread of what air power might mean in the next war.

tween 1935 and 1937 tended to curtail munitions exports, the Air Corps tried to let its contractors manufacture any planes for foreign sale that were no longer considered secret. After 1935 the policy of "universality" in which all countries were treated alike was replaced by one in which each request was considered individually. The "cash and carry" neutrality act, passed on November 4, 1939, helped the Allies by allowing the sale of munitions to belligerents, without endangering American ships.

By May 1940 personnel in America's aviation industry had more than doubled, and some 2,000 badly needed planes had been sent to France and Britain. Chief among these were the B-18A, A-20, PT-19, and P-40. After the fall of France, Britain took over French contracts for American-made aircraft, increasing her orders to a total of about 14,000 planes. With these

added to the now-expanded Air Corps program soon to call for more than 21,000 planes, U.S. aircraft manufacturers were faced with unprecedented demands.

Immediate priority had to be given to British needs once the Battle of Britain began in August. In September 1940 the Army-Navy-British Purchasing Commission Joint Committee was set up, eventually to coordinate all foreign contracts in this country. The legislation which really opened up the flow of strategic U.S. supplies, however, was the Lend-Lease act, passed March 11, 1941. This act approved a policy of Defense Aid by which materiel could be transferred to whichever nations the President might designate. By the time of Pearl Harbor, working Lend-Lease agreements had been effected with Russia, Great Britain, and China. Deliveries had begun and some of the Army Air Force's own stock was already being transferred.

This DB-7 (the original Douglas Bomber A-20) was slated for sale to France. Note markings of the French Armée de l'air.





Pilot cadets in full gear begin basic training on BT-9's at Randolph Field. From July 1939 to December 1941 more than



British cadets line up before PT-13's preparatory to training flight at U. S. civilian flying school. The AAF equipped and supervised the instruction of all foreign cadets trained in the United States.

EXPANSION IN TRAINING

More flyers and mechanics to man more planes

Training was a major problem for the Air Corps, now expanding in the face of war. Aircrews had to be ready to man the planes rolling with increasing speed off American assembly lines; and as General Arnold later wrote, the AAF "had to become the largest single educational organization in existence in a very short time." Existing facilities for the graduation of about 500 pilots yearly were entirely inadequate to the need.

According to an act passed in June 1939, students could begin their primary training at civilian flying schools. Another six months at Randolph, Brooks, or



9,000 flying cadets were graduated. More than 52,000 courses for technicians, mostly enlisted men, were completed.

Kelly fields completed their basic and advanced training. In July 1940 Southeast and West Coast Training Centers, with headquarters at Maxwell and Moffett fields respectively, were added to the old Air Corps Training Center. The latter, with headquarters at Randolph, was now renamed Gulf Coast Training Center.

The annual quota of Army pilots for 1941 was set at 33,000. The schools of the Gulf Coast Center were to train 12,000; and of these, about 4,500 were to go through Randolph Field at the rate of a new class of 400 every five weeks. Meanwhile some 18,000 enlisted specialists were needed by the end of June 1941—aircraft and radio mechanics, armorers, cooks, clerks, and many others. To meet this demand, technical schools at Chanute, Scott, and Lowry fields were greatly expanded; and more than 2,000 enlisted men were trained at civilian mechanics schools.



Cadet flies BT-9 under hood on instruments while observer watches for other planes. During expansion program pilot training was accelerated from four months to 10 weeks for each training phase.

Weather Forecast
 Cloudy; light showers tonight; tomorrow partly cloudy and warmer.
 Temperature today—High, 74, at midnight, 58, at 12:30 p.m., 72 at 2 p.m.
 From the United States Weather Bureau report. For details see page 4.

The Evening Star

WITH SUNDAY MORNING EDITION

Circulation Gains
 The circulation of The Evening Star is 11,000 daily greater than at this time last year and 23,000 greater than 2 years ago.

Closing New York Markets—Sales, Page 18
 88th YEAR. No. 35,111.

WASHINGTON, D. C. MONDAY, JUNE 17, 1940—THIRTY-SIX PAGES. ***

THREE CENTS.

FRANCE, STILL FIGHTING, ASKS PEACE; HITLER AND DUCE TO CONFER ON TERMS

Britain, Anxious About French Fleet, Determines to Fight on Alone

Full Capitulation Sole Basis For Armistice, Nazis Declare; Henderson Warns of Invasion

Spain Reported Invited To Parley, Expected 'Munich' Tomorrow

Cannot Carry On On Amateur Lines, Island Is Told



Fierce Battle Begun After Petain Appeal; Nazis Sweep South

New Premier Tells Nation He Asked Means to Stop the Fight; Maginot Line Gone

Never so sick at heart as when this news appeared, the remaining democracies were spurred to new defense efforts.

GIRDING FOR WAR

Roosevelt asked for 50,000 planes and got more

By June 1940 America was being drawn relentlessly into the European maelstrom. Poland, Denmark, Norway, and Holland had been defeated; Belgium was in Axis hands; with the penetration of Allied defenses the fate of France appeared to be in jeopardy. But the United States already had begun to gird for a crisis; and unlike the situation in 1917 the air arm was being trained to strike.

On May 16, 1940 President Roosevelt told Congress that in the past year "American production capacity

for warplanes, including engines," had risen "from approximately 6,000 planes a year to more than double that number, due in great part to the placing of foreign orders. . . . I believe that this nation should plan at this time a program that would provide us with 50,000 military and naval planes." Nor were these idle words. Total U.S. plane production for the first half of 1941 increased about 94 per cent over the preceding six-month figure. By Pearl Harbor the AAF alone had about 12,000 planes, including some 200 heavy bombers, 700 mediums, 750 light bombers, and 2,000 fighters.

Approximately 180,000 officers and enlisted men were added to the Air Corps between September 1940 and October 1941. Many experienced leaders were drawn from the National Guard, personnel of which made up 29 observer squadrons and bolstered other new units.



The President inspects U. S. aircraft production in 1940. Franklin D. Roosevelt speaks to workers at Curtiss-Wright Buffalo plant.

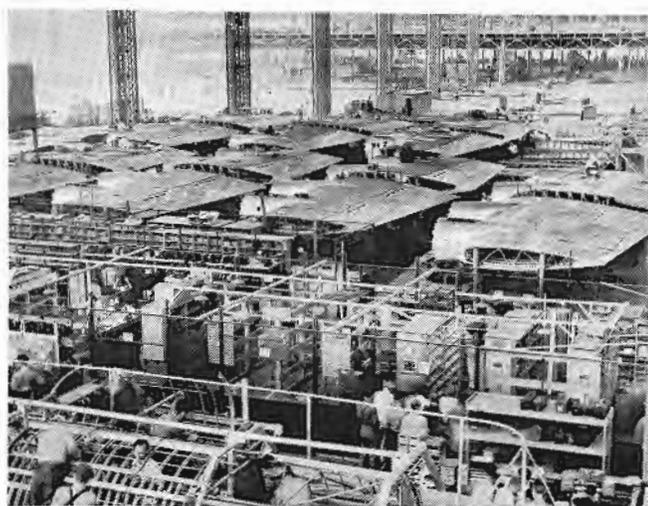


Mass production of P-40's at Curtiss-Wright final assembly plant in Buffalo. P-40 was principal U. S. fighter on hand at start of war.



Members of New York National Guard's 27th Aviation Division flying their Douglas O-46's past the Empire State building in New

York City. The 102d Squadron of this division was created March 22, 1921. Among its members were five aces of World War I.



Mass production of B-17's at one of the Boeing Aircraft Company plants. Note signs of plant expansion in the background.



North American O-47 was one of the last planes used by National Guard, some of whose air units were organized before World War I.



A-20's buzz Marston, North Carolina, airstrip during "Battle of the Carolinas." Construction by aviation engineers of

PREWAR MANEUVERS

Air skill was tested just before Pearl Harbor

On the eve of Pearl Harbor the AAF had valuable opportunities to train personnel and test materiel under simulated war conditions. This occurred in large-scale maneuvers staged by the Army in Louisiana during September and in the "Battle of the Carolinas" in November 1941.

Nearly 850 Army, Navy, and Marine Corps planes took part. They consumed some 4,000,000 gallons of gasoline in 3,000 to 4,000 missions and covered approximately 8,000,000 miles in some 40,000 hours of flying. If real bombs and bullets had been used, they would have spent about 5,000 tons of bombs and 7,500,000 rounds of ammunition. More than 500,000 Army men were thus introduced to air-ground techniques.

The A-20A attack bomber and the A-24 dive bomber showed special promise. The latter received its first try-



This Lockheed P-38 rests in a revetment, protected by sandbags from "enemy" bomb splinters. The 1941 maneuvers gave this sensational fighter of World War II one of its earliest trials.

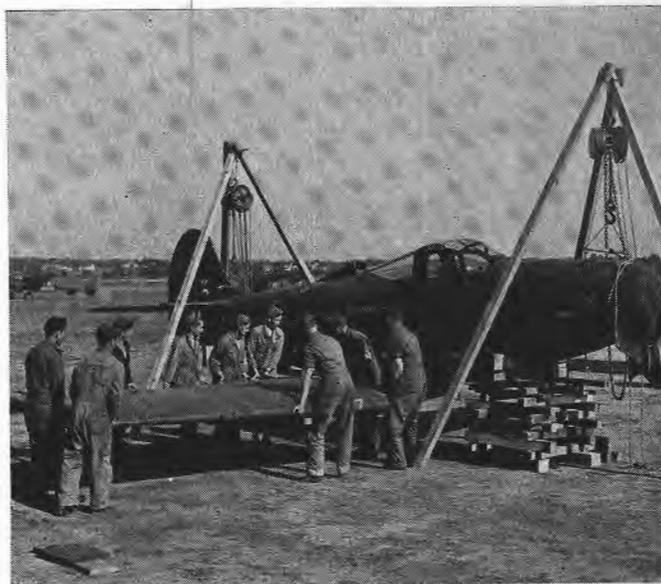


the portable metal mat, to prove so useful in World War II, was called by Arnold "year's greatest achievement in aviation."

out in the Louisiana maneuvers and proved superior in performance characteristics to the German JU-87 Stuka. The medium bombers B-25 and B-26 gave a good account of themselves. The only heavy bomber participation was a brilliant demonstration of precision bombing given by 12 B-17's from 15,000 feet.

All of the fighters distinguished themselves during the war games. Those used were the Lockheed twin-engine P-38, the Bell P-39 Airacobra, advance models of the Curtiss P-40, and Republic's P-43, forerunner of the P-47 Thunderbolt. For observation purposes, large numbers of O-47's and O-49's were employed. A highlight was the first appearance of a "grasshopper squadron," composed of various types of light planes for use in liaison work. Excellent results were experienced with the use of steel landing mats.

On the eve of America's participation in another war the 1941 maneuvers attested the gains made during 23 years of experimental flights, technical advance, growth in status, and expanded equipment and personnel—accomplishments which readied the U.S. air arm for the gruelling tests of World War II.



Mechanics of 37th Materiel Squadron, 27th Air Base, make necessary repairs on Bell P-39. A fighter which saw service in World War II, the P-39 was prototype of the more powerful P-63.



Decisive role in World War II wins recognition for air power

Japan's surprise blow at Pearl Harbor, on December 7, 1941, gave another terrible proof of the strategic value of air superiority and brought the United States into a war that was to show as never before the tremendous military capabilities of aerial power. During her 27 months on the sidelines, America had had a chance to note the telling use of air power in every major engagement since Germany's initial assault on Poland. Nazi air power had countered Britain's naval opposition to the invasion of Norway in April 1940. It had implemented the seizure of the Low Countries in May, when the Luftwaffe's screaming dive bombers softened the approach for tanks and motorized infantry. It underwrote the march on Paris with the now-familiar preliminary raids to neutralize enemy air opposition before the main drive—tactics that confounded war plans based on positional defenses.

But for the contribution "owed by so many to so few" Nazi air power might have brought Great Britain to her knees after one year of war, with raids on English cities that daily increased in ferocity and introduced every tactical surprise the Nazi leaders could devise. Air power was of major importance in Germany's quick conquest of Yugoslavia and Greece in April 1941. It made possible the capture of Crete near the end of May, when history's first airborne invasion was accomplished by trains of troop-carrying gliders capable of landing in almost any clearing. And it won from Moscow the admission, only a few weeks after the Nazi invasion of Soviet territory in June 1941, that already 4,000 U.S.S.R. planes were lost.

Luckily the advantages of air power had not been enjoyed solely by the Axis. America had observed the increasing air effort of the Royal Air Force and the Red Air Force, often with planes she herself had supplied. The RAF had made possible the magnificent evacuation of about 335,000 Allied troops at Dunkirk. It had staved off imminent invasion of the English

coast when virtually all that remained to oppose the worst of the Luftwaffe blitz was a mere handful of indomitable Hurricane and Spitfire pilots. Air power enabled Britain to start attacking on her own, at first with defensive raids on German-held Channel bases and later with growing strikes at the centers of Germany's key industries. By the time of Pearl Harbor, aerial reconnaissance was proving of value in the shifting Libyan campaign; and the recuperating Red Air Force had aided in the recapture of Rostov and was helping to defend Moscow.

America thus entered a three-dimensional war which had already proved that power in the air was as important as power on land and sea. At the moment the Army's air arm and attached services totaled some 23,000 officers, 16,000 cadets, 275,000 enlisted men, and 12,000 planes. Eight air forces—four in the United States and one each in the Philippine Islands, Hawaii, Alaska, and the Caribbean area—formed its potential striking fist. A few other overseas units had been stationed in Iceland since July 1941. And there were future AAF flyers both in the all-American Eagle Squadron, which had been flying with the RAF since the Battle of Britain, and in the American Volunteer Group, which since July had been training under Claire L. Chennault at bases leased from the British in Burma.

Thanks to the energy and farsightedness of AAF leaders and the experimental ingenuity of commercial pioneers, the important U.S. Army planes of this war were now past the planning stage. Among four-engine heavy bombers, Boeing's B-17 Flying Fortress and Consolidated's B-24 Liberator were already in production. So were the two-engine medium bombers, North American's B-25 Mitchell and Martin's B-26 Marauder, and among fighters, Lockheed's P-38 Lightning, Bell's P-39 Airacobra, Curtiss's P-40 Warhawk, Republic's P-47 Thunderbolt, and North American's P-51 Mustang. These planes represented great improvements over the types they superseded, and they were to undergo many further modifications in the wartime race for superior performance and fire power.

Leaving vapor trails at high altitude, this fleet of 8th Air Force B-17's is typical of the vast armadas of four-engine bombers which enabled virtual air armies to strike at heart of enemy resources.



The Japanese bombardment of Hickam Field. (Above) B-17E just arrived from the States amidst Pearl Harbor disaster. (Below) This was fate of some B-17's that flew from United States during attack.



PEARL

Jap air attack

The American people, listening to their radios on Sunday afternoon, December 7, 1941, were stunned by the news that the Japanese were bombing the Pearl Harbor Naval Base. At a time when diplomatic formalities were still being observed in Washington, suddenly and treacherously the Japanese had struck at the Hawaiian island of Oahu, one of America's most heavily garrisoned outposts in the Pacific and home of the Hawaiian Air Force based at Hickam, Wheeler, and other Air Corps fields.

Already the War and Navy Departments had warned of an impending break in the fast disintegrating relations between the United States and Japan; and commanders in Hawaii had alerted their forces. But, through greater fear of sabotage than air attack, planes had been brought together in hangars and open fields near-by rather than dispersed. These proved to be a likely target when at 7:55 on the morning of that "date which will live in infamy" more than 100 carrier-based planes swarmed over Oahu for their three-hour attack on America's Pacific bastion.

The Navy's toll of damage was five battleships, three destroyers, a target ship, a minelayer, and a large floating drydock, sunk or so severely damaged that the Navy was not able to use them for at least a year. Damage was also inflicted on three other battleships,



AVG's P-40B Tomahawks excelled opponents in durability and firepower. They had two .50-cal. guns in nose, four .30's in wings.



Surmounting maintenance difficulties, AVG ground men worked miracles with minimum equipment, improvising repairs outdoors.

An alert sounds, and pilots of the China Air Task Force dash out to their shark-toothed P-40's at Kunming Air Base.

EARLY STABS AT JAPANESE

AVG and Tokyo raid boost American morale

In the dark days that followed Pearl Harbor there were two bright spots: the achievements of the Flying Tigers, American Volunteer Group (AVG) in Burma and China, and Doolittle's daring Tokyo raid.

Recruited from Army and Navy personnel to protect the Burma Road, life line of China, the Flying Tigers were headed by Claire L. Chennault, retired Air Corps captain. From their first encounter on December 20, 1941 to their disbandment on July 4, 1942 they won every air combat they waged with the enemy. At no time could they muster more than 71 pilots or 55 outmoded, shark-toothed P-40's; but, working against odds which have been estimated as high as nine to one, they shot down about 287 Jap planes with as many more probables, at a loss of only eight American pilots in combat. Their activity helped keep open the Burma Road and its port for almost three months after the Japanese offensive began, helped check the Jap push into southern China at the Salween Gorge, and gave Chungking its first respite from bombs in four years. When the AVG disbanded, some of its members accepted induction in the China Air Task Force, a unit of the AAF's Tenth Air Force.

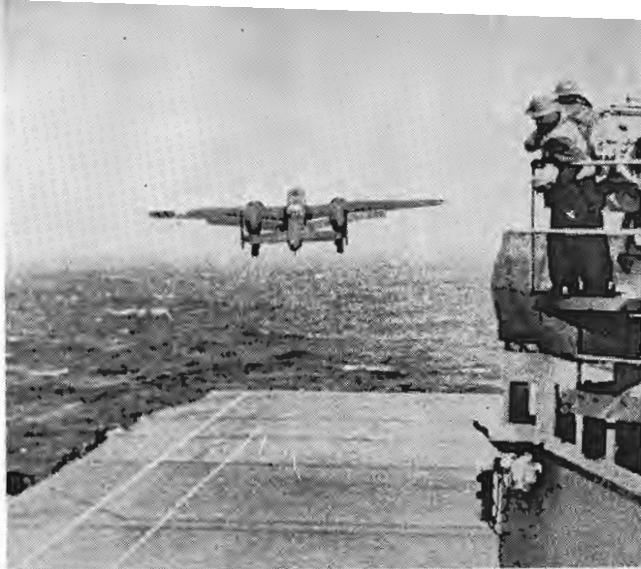
The first Tokyo raid was one of the most dramatic in AAF history. The plan was conceived early in January 1942. The B-25 was selected as best suited for range, load, and carrier take-off and specially adapted to the needs of the raid with extra fuel tanks, a bombsight concocted for low altitudes, dummy guns to discourage pursuit from the rear, special ammunition and bombs, improved armament, and automatic



cameras. Less than a month was spent training crews that had volunteered for a hazardous but undisclosed mission. On the 1st of April, 16 planes were hoisted on the decks of the carrier *Hornet*, and Doolittle came aboard with 70 officers and 130 men of the AAF. On April 2 the *Hornet* was under way.

Take-off for the last lap of the mission was precipitated when an unexpected contact with Jap surface craft made it seem likely that the task force had been detected. Leaving the carrier in quick succession at 7:25 A.M., April 18, the 16 planes headed for Japan, a half day and 150 miles sooner than planned, thus committing themselves to daylight attack. Fifteen planes succeeded in bombing targets on the Japanese mainland, the other being forced by mechanical difficulties to jettison its bombs. Eight hit Tokyo itself, and seven attacked targets in Yokohama, Yokosuka, Nagoya, and Kobe. The flyers met little interference. Enemy pursuits caused one plane to change its target, and flak did some damage to another. By coincidence an air raid drill, complete with plane maneuvers, was staged in Tokyo just before the raid. But this appears to have had the fortunate effect of dulling the enemy's alertness.

All of the planes but one, which landed safely at Vladivostok, were able to continue at least to the China coast under their own power. The 30-mile tail wind which sped them on was a by-product of storms that had defeated every effort to prepare landing fields and beacons in east China and now made night landings a virtual impossibility. All crews had to abandon their planes when gas gave out. Only one known death occurred in this way. Peasants and guerrilla fighters guided the men inland, spiriting three crews from under the enemy's very nose. Of eight Americans captured, three flyers were tried and executed, one died in prison camp, and four were rescued by U.S. parachutists on August 21, 1945.



About 650 miles east of Tokyo one of 16 B-25's takes off from the carrier *Hornet* to bring the war for the first time to Jap homeland.



One of the B-25's passes over Yokosuka Naval Base on Tokyo Bay. In the foreground are a cruiser and destroyer, old Japanese types.

A-20543A

Tokyo flyers line up at Bolling Field, June 27, 1942, to receive DFC's from Lt. Gen. H. H. Arnold, at right of line.



HEADQUARTERS, AAF

It is nerve center of world's greatest air organization



With the attack on Pearl Harbor, World War II became world-wide in fact. Every major power was now involved, every continent affected. Before long the AAF, too, became world-wide in scope, carrying men and supplies to every theater of war, doing battle wherever America had contact with the enemy.

Coordinating the vast activities of this greatest air organization in history was an over-all headquarters, one of several in Washington, D. C., that together made up the nerve center of America's war effort. Apart from its units at Gravelly Point, Munitions, and other buildings, it was housed principally in The Pentagon, world's largest office building—a structure whose unique design suggests its role as the hub of wartime activity. Under the same roof were housed the offices of the Secretary, the Under Secretary, and the Assistant Secretary of War; the Assistant Secretary of War for Air; the War Department General Staff; and the headquarters of the Army Service Forces.

Many obstacles had to be surmounted, many proposals tested by actual experience before the AAF achieved its wartime position within America's military establishment. The original Army Air Forces, as established on June 20, 1941, was a coordinating headquarters agency only, designed to bring the Air Force Combat Command (formerly GHQ Air Force) and the Office, Chief of Air Corps once more under one responsible head. With the former Plans Division in Office, Chief of Air Corps now elevated to the status of an air staff—the first such agency in the Army's air arm—the Army Air Forces gained authority through the delegation to it of many of the air matters formerly handled by the War Department General Staff. Yet, because of qualifications placed upon the new authority, the desired degree of autonomy was not achieved. Moreover, the expansion program was further handicapped by the failure to lodge complete responsibility for the activities of the air arm in a single agency.

The tensions of war and the growing expectation of America's entrance underlined the need for a greater unification of control. Wartime participation dictated changes which culminated in a fundamental reorganization of the War Department on March 9, 1942. On that date the Army Air Forces was made one of three coequal autonomous branches, the other two being the Army Ground Forces and the Services of Supply (later Army Service Forces). A key figure in effecting the War Department reorganization was Maj. Gen. J. T. McNarney, a veteran flyer whom Gen. George C. Marshall had recalled from England for that purpose. By this 1942 reorganization, the Air Force Com-



World's largest office building and nerve center of the
bat Command and the Office, Chief of Air Corps were absorbed into the Army Air Forces, and to Lt. Gen. H. H. Arnold, so long associated with the evolution of the Army's air arm and Chief of the original Army Air Forces, went the position of Commanding General of the rapidly developing AAF.

In an attempt to organize Headquarters, AAF to meet wartime needs, responsibilities for planning and operating functions were divided between two staffs. The Air Staff (A-1, A-2, A-3, A-4, Plans, and Air Inspector) was to make the policies; and the directorates (made up of experts in bombardment, weather, communications, fighter aircraft, etc., and grouped under the three main categories of military requirements, technical services, and management control) were to put these policies into operation.

A three-month trial showed that this division of functions only retarded coordination and decentralized responsibility without accomplishing the desired separation of policy from operating activities. The need for a streamlining of functions still remained. As a result, on March 29, 1943 the directorates were abolished and their functions taken over by six Assistant Chiefs of Air Staff (personnel; intelligence; plans; materiel, maintenance, and distribution; training; opera-



U. S. war effort, The Pentagon has about 17½ miles of corridors and floor area capacity for over 30,000 workers.

tions, commitments, and requirements). At the same time the number of Deputy Chiefs was increased to three.

Tested in the pressures of war, this organization as laid down in March 1943 directed the activities of the some 2½ million uniformed men and women and more than 300,000 civilians who waged the aerial aspects of world-wide war. From time to time organizational shifts were made. Notably, the Special Staff (including the Air Surgeon, Air Judge Advocate, Budget and Fiscal, etc.) was augmented from five to ten offices; Management Control, the AAF's efficiency agency, was attached to the office of the Chief of Air Staff; and increased authority was given to the continental commands and air forces. This organization was maintained without fundamental change during the course of the war. In an August 1945 adjustment, made with a view to peacetime administration, the time-honored staff structure was restored.

A major consideration in the wartime reshufflings was the desire to reduce the gap which often exists between policy-making and authorization at headquarters and action against the enemy at the front. Between those extremes are the great tasks of procurement, training, and transportation. The Commanding General, AAF had authority for converting plans into

action equal to that of the commanding generals of the Army Ground Forces and the Army Service Forces. However, his membership on the Joint Chiefs of Staff and Combined Chiefs of Staff gave him an additional voice in over-all military strategy. He had direct control of all air organizations in this country: the First to Fourth Air Forces, ultimately brought under an intermediate authority, the Continental Air Forces; the Training, Air Technical Service, Air Transport, and Personnel Distribution Commands; the Tactical Center; the Weather Service; and the Army Airways Communications System.

The Commanding General, AAF also had direct control of certain widespread overseas organizations, including not only the overseas units of the Air Transport Command, but also the Twentieth Air Force whose operations were of such a nature as to warrant their direction from the core of the American war effort. The other 11 air forces outside of this country came under the jurisdiction of their respective theater commanders. While the Commanding General, AAF did not exercise direct control, he was able by constant liaison to coordinate their requirements for supplies and men and to operate a clearinghouse for the interchange of new developments and procedures.



Flight of six North American AT-6's powered by 600-hp. Pratt & Whitney engines, at Santa Ana, Cal. The trim formation in echelon of these modern advanced trainers illustrates the high degree of

military flying skill taught by the AAF Training Command in the final stage of the cadet's pilot instruction. This phase of training completed, pilot won his wings, was ready for transition training.

TRAINING IN WORLD WAR II

AAF speeds training of combat crews

First big wartime job of the AAF was to produce the most proficient air and ground crews in the world. This responsibility was shouldered by the various air forces, other AAF organizations, and especially the Training Command, a huge institution extending from Stewart Field at West Point to Santa Ana, California, with more than 150 schools, most of them in the southern states, in between. Here the 30 months following December 1941 saw an increase over the preceding 30-month period of 3,930 per cent in flying courses and 1,353 per cent in technical courses completed.

Establishment of the Technical Training Command in 1941 and of the Flying Training Command in 1942 gave order to previously ill-coordinated training facilities. Hotels, factories, and college campuses, as well as acres of new barracks and flying lines, became the scene of stepped-up instruction; training planes were rushed into production; and civilian flyers and air crew graduates, garage mechanics and college professors pressed into uniform undertook the training of the thousands of young men eager to win their wings. Consolidation of the two commands as the Training Command in July 1943 gave direction of the individual training phase of the program to the former chief of the Flying Training Command, Maj. Gen. B. K. Yount, long associated with Air Corps training.

Biggest single job of the Training Command was the preparation of enlisted men for ground duty. At one time 314 separate skills were taught in 80 different types of courses for maintenance men, radio operators, armorers, photographers, weather experts, and other specialists. In this as in the training of aircrews, it was no hit-or-miss process by which the AAF developed its personnel. As many as 40 to 65 weeks of carefully

planned, intensive training lay behind the award of coveted pilot, navigator, or bombardier wings. Gunners, airplane mechanic-gunners, or radio operators learned their trade in a shorter space of time. Aptitude tests, and on occasion basic military training, preceded the 10 long weeks of preflight instruction in aircraft and naval recognition, code, mathematics, physics, and the interpretation of maps and charts—basic tools for the aerial warrior. A six-week course in gunnery gave bombardiers and navigators an additional skill.

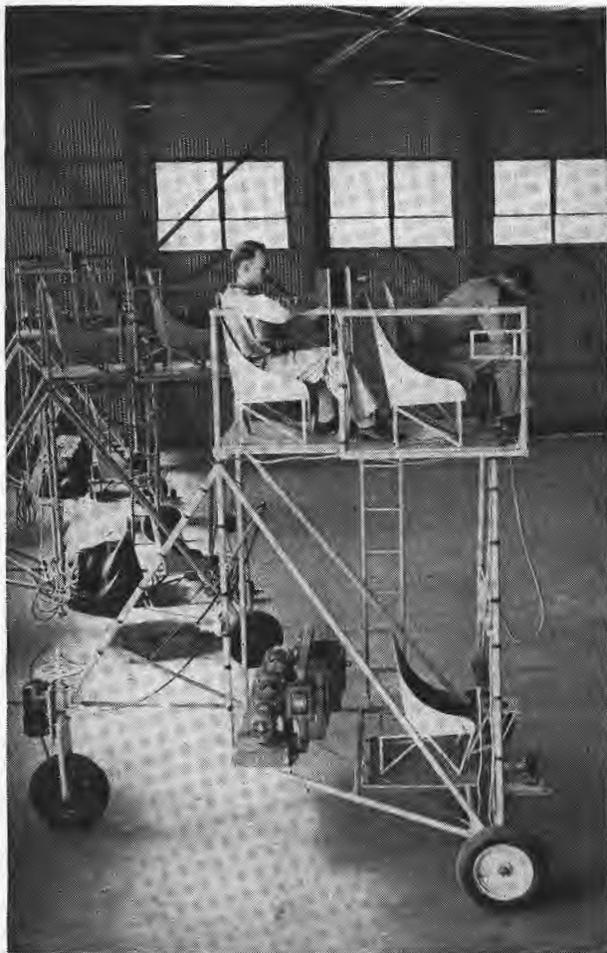
With preflight behind them, most cadets turned to the eagerly anticipated training for their specialty—pilots to get the feel of the 175-horsepower trainer, bombardiers to try their hands with bombsight and precision bombing, and navigators to solve the mysteries of dead-reckoning and celestial navigation. For the pilot, 10 weeks of primary flying training were followed by basic, with the same pattern of barracks and flying line, ground school and "P. T.," but this time with a more powerful trainer. Then, with the 10-week advanced school, came the 600-horsepower AT-6's for potential fighter pilots, the twin-engine AT-9's, 10's, and 17's for the men earmarked for bombardment, troop carrier, or air transport. The 20-week advanced course for navigators offered 104 hours of practical navigation in the air; for bombardiers, 120 hours in AT-11's practicing bombing runs. A course for bombardier-navigators provided the dual training needed for B-29's and lead planes in medium-bomber missions. Completion of the advanced course in all the specialties brought "graduation exercises," silver wings, second lieutenantcies or flight officerships for many, and anxiously awaited orders to transition or unit training, way station on the road to aerial combat.



This Fairchild PT-19, with 175-hp. engine, was a popular primary trainer of World War II. After 8 to 12 hours of dual primary instruction in this plane, cadets had thrill of soloing for first time.



Flying cadets and instructors at attention before BT-13 basic trainers, powered by 450-hp. Pratt & Whitney engines. Weight and power were stepped up considerably between the successive trainer types.



A cadet bombardier peers into bombsight as ground trainer starts run on simulated target. Student pilot sits behind.



Cadets in Beechcraft AT-11 practice skip bombing—technique that paid good dividends in air war in Southwest Pacific.



After bombing mission in AT-11, armed cadets remove secret bombsight to safekeeping. Note "black eyes" from eyepiece.



Cadet navigators, aided by enlisted instructors, learn the use of the essential drift meter in these novel ground navigation trainers.



In a Lockheed AT-18, cadet navigators employ computers, triangles, and other devices to chart course during actual cross-country flight.



Big problem after cadet earned his wings was to shift over to heavy and complex combat ships like these B-26's above.



Flying the fast P-40, the graduate single-engine pilot receives transition and masters tricks of a fighter pilot's trade.

TRANSITION TRAINING

Readies air crews for combat action

For the pilot who had won his wings there still remained the transition from the advanced trainer to the complex bombardment plane or fighter aircraft which he was to fly in combat. Some pilots went directly to Operational or Replacement Training Units in one of the four domestic air forces for this transition training. But most attended the five- to 10-week post-graduate schools operated by the AAF Training Command. Between Pearl Harbor and V-J Day nearly 50,000 pilots and co-pilots attended four-engine transition schools; while more than 16,500 flew P-40's in single-engine transition training.

In World War I a simple check-off of equipment usually sufficed for the transition from training to combat planes. As more powerful and intricate types were

introduced, the process was lengthened and formalized, especially after the first tactical use of heavy bombers in 1937. In 1939 transition training was transferred from the training center to U.S. tactical units. But, since these units needed to concentrate on combat drill, by early 1944 the Training Command had reassumed responsibility for practically all transition training.

Operational requirements helped determine specific transition programs. By 1944 the pilot of a B-17, B-24, or B-26 ordinarily took a 10-week course after graduating from advanced twin-engine school. He spent 105 hours learning to fly his plane and did further work in ground school. Actually he was not only making the transition but advancing his flying skills, often under the guidance of officers who had seen combat. He went out on long-distance missions, met every kind of weather, learned to fly with one or more engines out, and undertook extensive navigation problems. The pilot of a P-38 or P-40 usually took a five-week course which included 10 hours in the air and considerable training in the techniques of aerial gunnery.



Crew of mock-up Fortress takes to rubber boats in practice ditching procedures at the AAF Center in Orlando, Florida.

AAF EXPERIMENTAL CENTERS *Tactics and equipment are tested before combat use*

Testing the combat-worthiness of AAF tactics and war equipment was the responsibility of four Florida agencies: the AAF Center, Board, School, and Proving Ground. In an 8,000-square mile practice war theater—an area about the size of Sicily—the AAF Center tested, developed, and demonstrated tactics under combat conditions, transmitting latest AAF doctrine to selected AAF, Army, Navy, and staff personnel. Personnel of the Proving Ground Command, at Eglin Field, Florida, tested the battle efficiency of all AAF equipment, from a tool-kit to a B-29, after it had been laboratory-tested at Wright Field. The School provided advanced in-

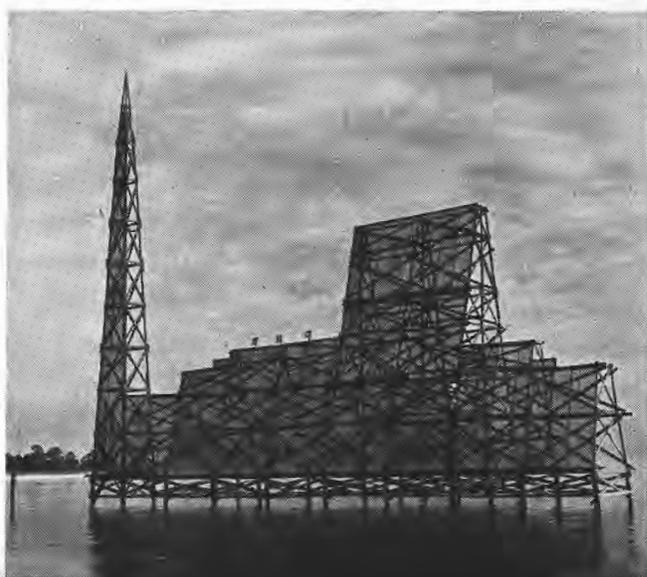
struction in administration, command, logistics, tactics, and related subjects, while the Board developed tactics, techniques, doctrines, and other military requirements of the AAF and recommended them to higher authority.

At the close of World War I the Director of the Air Service recommended the creation of a school to standardize the training of officers in the tactics and techniques of the Air Service. The result was the Field Officers School, established at Langley Field in 1920 and soon renamed the Air Service School of Tactics. After its removal to Maxwell Field in 1931, tactical research and a demonstration air force were in time added to tactical instruction. In 1942 wartime needs prompted the establishment of the AAF School of Applied Tactics. Its four departments of instruction included fighter tactics—a course which succeeded that of the Fighter Command School in Orlando; bombard-

P-38 pilot executes low-level skip bombing at AAF Center.



Ship mock-up is water target at Proving Ground Command.





An A-20 pilot practices skip bombing at AAF Center. Bombs with delayed fuzing are released 30 yards from the target.

ment; ground support—the tactics of coordinated air and ground action; and air service—the supply and maintenance of aircraft under combat conditions. When the AAF Tactical Center was established in October 1943 the School of Applied Tactics became the instructional agency for the new tactical center. In June 1945 the School and the AAF Board, which sprang to some extent from the Air Corps Board of prewar days, were placed under the jurisdiction of the AAF Center.

In providing last-minute tactical instruction to the officers and noncommissioned men about to fill key positions in combat theaters, the Center proved to be a training agency of extreme importance. The determination of the suitability of U.S. aircraft to combat in theaters throughout the world helped to keep AAF combat losses to a minimum. Its review of AAF doctrine, organization and equipment tables, and train-

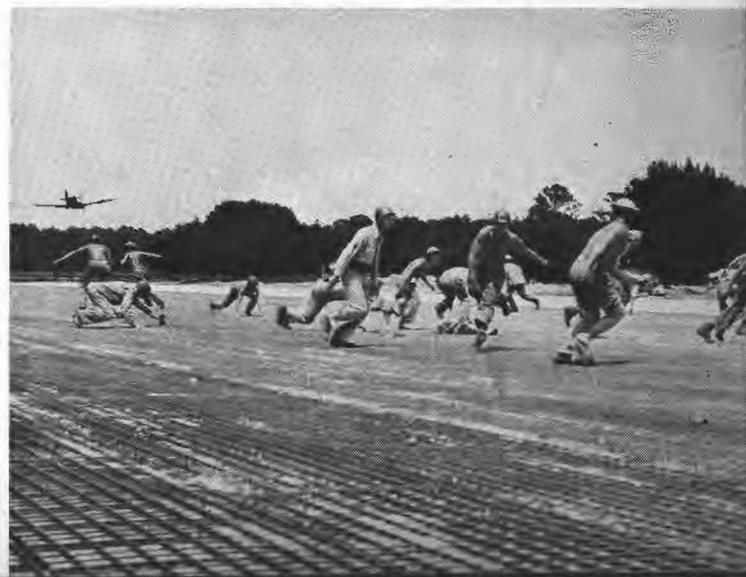
ing standards insured adequate and up-to-date tactical operations for the AAF.

The Proving Ground Command began operations as the Air Corps Proving Ground in the summer of 1941. Urged by AAF leaders for years before the outbreak of war, the Proving Ground did not experience full-scale development until 1942 when Brig. Gen. Grandison Gardner assumed command. The job of testing AAF equipment required the construction of a complex system of flying fields, ranges, and technical facilities as well as the development of new procedures. Test flights and experiments, undertaken night and day at the 700-square-mile reservation at Eglin Field, over the Gulf of Mexico near-by, and in Alaska, South Dakota, Maryland, Arkansas, Alabama, and Utah, insured the combat efficiency of the aircraft, guns, and other battle equipment of the AAF.

This pressure chamber is used in work of Proving Ground.



Air engineers work under simulated combat conditions.





Remote AACS direction-finding station guides AAF pilots hundreds of miles away, plots position of stranded aircraft.



These Nissen huts house the officer and 18 men responsible for the radio, repair, and rescue activities at Greenland weather station.



Concrete-reinforced AACS station in China is camouflaged beneath a rice-paddy field. It is clearinghouse for air transport into China.

ARMY AIRWAYS COMMUNICATIONS SYSTEM

Guides Army's pilots along global routes

Throughout the United States and into 62 countries around the world, the Army Airways Communications System (AACS) guided the AAF flyer on his varied wartime missions. By means of modern navigation and communication facilities, it charted his course, provided radio beams over the shortest safe paths, broadcast changing weather conditions to him en route, kept tab on his progress, arranged for the repairs he requested, and employed special electronic devices both to aid in his rescue when downed and to guide him out of enemy territory during radio silence.

The Army pioneered in the development of this system of facilitating air travel. As early as 1921 the Air Service had been able within the limits of its meager budget to construct model airways in the northeastern part of the United States. Weather and routing information was given over a radio net, landing-field catalogues and maps were furnished, and routes were projected to connect nearly all U.S. cities. From this beginning developed the civil and commercial airways of the late twenties and early thirties. After 1925 the Army found little opportunity to further the airways system until 1934. In this year its assignment to carry the domestic air mail emphasized the need of a better system of military airways.

The routes and radio stations established between 1934 and 1936 were the groundwork for AACS, created in November 1938. For a year AACS was engaged chiefly in overcoming problems springing from inferior equipment, inadequate housing of facilities, static in-



At an AACS terminal: operator reports arrivals and departures, controller talks with pilots, student learns the job.

interference from improperly located installations, insufficient and overworked personnel, and the need of training new men. By 1940 it began to extend its facilities around the world. First it thrust its airways north-east to Newfoundland and across the North Atlantic to Europe. Next, the exchange of overage destroyers for British bases enabled it to set up communications in the Caribbean to implement the Panama airways. Then it braved the isolation and cold of Alaska to anticipate by some months the Japanese invasion of the outer Aleutian Islands.

By April of 1942 AACS had advanced from its Caribbean centers down the Brazilian coast and, in a thrilling conquest of the South Atlantic, across to Africa in time for the North African invasion. Meanwhile from an outpost in Hawaii, AACS pushed on to Australia and the South Sea Islands, entering Guadalcanal immediately behind the first Marines. There remained only one more area, and late in 1942 the airways were extended from Africa and the Middle East into India and across the "Hump" to China. In February 1943 India greeted Australia via AACS, and the U. S. airways circled the globe.

As constituted by V-J Day, AACS consisted of more than 700 communications centers manned by nearly 40,000 men living under every variety of environmental condition. In frozen northern tundras, amidst jungle and tropical swamps, and on deserts, mountains, and isolated islands in mid-ocean, AACS men were standing guard over the airways, dedicated to the high purpose of "Safety in Flight."

In this as in many other AAF organizations, the air members of the Women's Army Corps (WAC) filled a vital role. Except for actual combat, Air Wacs discharged many important duties and comprised almost half of the total WAC enrollment.



Eglin Field, Fla., WAC members prepare maps for flyers. Air Wacs handled virtually every type of job for AAF but actual combat.



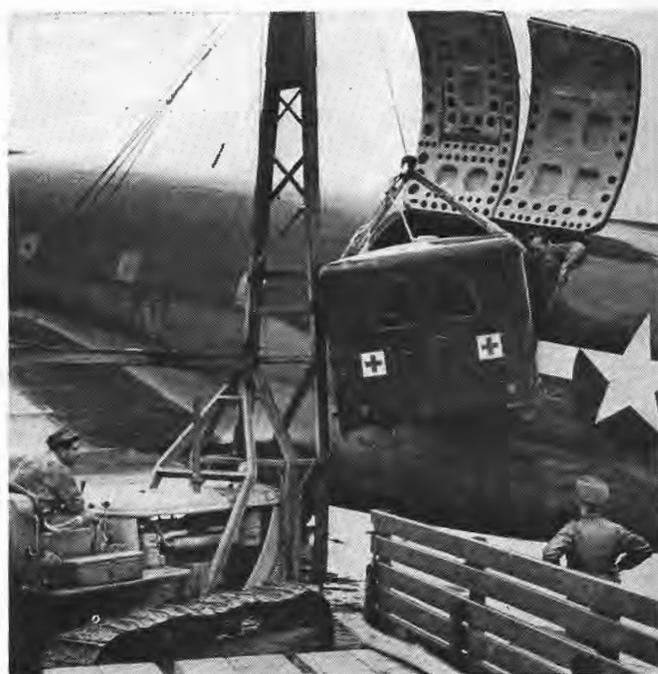
Officers and a Women Airforce Service Pilot (WASP) beside B-25 regularly flown along AAF airways to check AACS radio facilities.



An ATC C-46 flies "the Hump" between India and China, making routine a feat almost unheard of in prewar days.



A Pratt & Whitney radial aircraft engine delivered by the ATC is unloaded at Oran, Algeria. The resourceful methods of the ATC speeded filling of requests for emergency shipments like this one.



Ammunition and an ambulance being loaded on C-46. In August 1944 the ATC began to carry badly needed whole blood direct to theaters. Speedy handling made up for lack of proper refrigeration.

AIR TRANSPORT COMMAND

Rushes men and cargo to world battle fronts

The Army's great aerial transportation agency was the Air Transport Command. Whenever men, planes, and supplies had to be delivered in a hurry or whenever there was no other means of getting them where they were needed the Air Transport Command took on the job. Under wartime conditions transport or combat planes crossed the Atlantic on an average of one every 13 minutes, the broader Pacific, every hour and a half; and, in one year, more than a billion pounds of high priority cargo, passengers, and mail were carried to war theaters around the globe.

The ATC began as the Air Corps Ferrying Command on May 29, 1941 with two officers, one civilian, a world map posted in a Washington office, and an assignment to assist in delivering military aircraft to the countries then fighting for democracy. Within a year, airfields, isolated stations, and lonely weather and communications outposts had been built on deserts, tropical islands, and arctic wastes. The first ferry delivery reached Montreal on June 9, 1941. The first transatlantic transport flight—from Washington to Prestwick—departed on July 1. A trip to Cairo was undertaken in September, followed by a round-the-world journey touching Washington, Prestwick, Moscow, and Singapore. From the first contract in August 1941, fullest use was made of the skill and experience of the commercial airlines flying under contract to the War Department and dependent for control upon the ATC.

After America entered the war many civilian trans-

port pilots were commissioned as officers to ferry military aircraft. Experienced commercial airline executives donned uniform to serve on the staff of veteran flyer Lt. Gen. Harold L. George, who had assumed command of the Ferrying Command on April 1, 1942.

By June 1942, ATC routes touched all six continents. Routes were inaugurated to Alaska in April 1942, and in June, when the ATC took its present name, B-17's were delivered on short notice to participate in the Battle of Midway, and personnel and munitions were rushed to Dutch Harbor to check the Japanese in the Aleutians. In July the first plane landed at Ascension Island, base on the South Atlantic route, P-38's were flown to the United Kingdom in August, and A-20's to North Africa with the U.S. landings in November. In December the ATC took over the route from Assam to China, flown since April 1942 by the 1st Ferrying Group of the Tenth Air Force.

By 1945 the ATC, with more than 200,000 members in uniform, was flying with clocklike regularity routes that were considered unflyable before the war. To supply the Fourteenth Air Force and the XX Bomber Command, it carried fuel, bombs, jeeps, five-ton trucks, and 12½-ton roadscrapers over the towering Himalayas, achieving during July 1945 an average of one plane every 1.3 minutes over the Hump. By the war's end ATC operated 11 divisions, delivering at airplane speed to every front the critically needed items on which global victory was to hinge.



At ATC base in Greenland a TWA-flown Douglas four-engine C-54 takes off. This ship, used for long overwater hops by commercial airlines under contract with the Army, is the type in which Presi-

dent Roosevelt returned from the Casablanca conference and made the Teheran-Cairo trip of 1943. Powered by four Pratt & Whitney engines it is capable of carrying heavy loads to any part of the globe.

AIR TECHNICAL SERVICE COMMAND

Supplies planes and equipment to "keep 'em flying"

The man-sized job of supplying and maintaining AAF planes once they left the factory was the work of the Air Service Command (ASC). Combined with the Materiel Command in September 1944 to form the Air Technical Service Command, it was responsible for the supply of parts for AAF planes throughout the world, their final inspection and repair while in this country, the training of supply and maintenance personnel, the operation of supply, maintenance, and specialized depots in America and overseas, and much of the supervision over shipment of Lend-Lease planes.

Perhaps the earliest ancestor of the ASC was the Wright Field Air Service Depot established at Wilbur Wright (now Patterson) Field in 1917. Between World Wars I and II supply and maintenance functions were performed by a variety of organizations, most of them under the Materiel Division. On October 17, 1941 the ASC was created to provide a supply system that would operate in time of war. It was to be responsible for all storage, equipment, supplies, maintenance, repair, overhaul, and salvage. It was to compile requirements, issue technical orders on care of AAF equipment, and have technical control of extra-continental air depots.

Shortly after America entered the war the first in-transit depot was established at Stockton, California, to relieve the pressure at the San Francisco port of embarkation. The Overseas Division was set up in Washington, and 80 air depot groups were activated to be trained for maintenance work in the overseas theaters. Maj. Gen. Walter H. Frank, who assumed command of the ASC in November 1942, realigned the internal organization on an industrial rather than military basis. Three operating divisions and a control office replaced the old-type general staff. Responsibility was decentralized to 11 area air service commands. Two new units—the Atlantic and Pacific Overseas Air Service Commands—were created to control the shipment of all AAF materiel to foreign theaters.

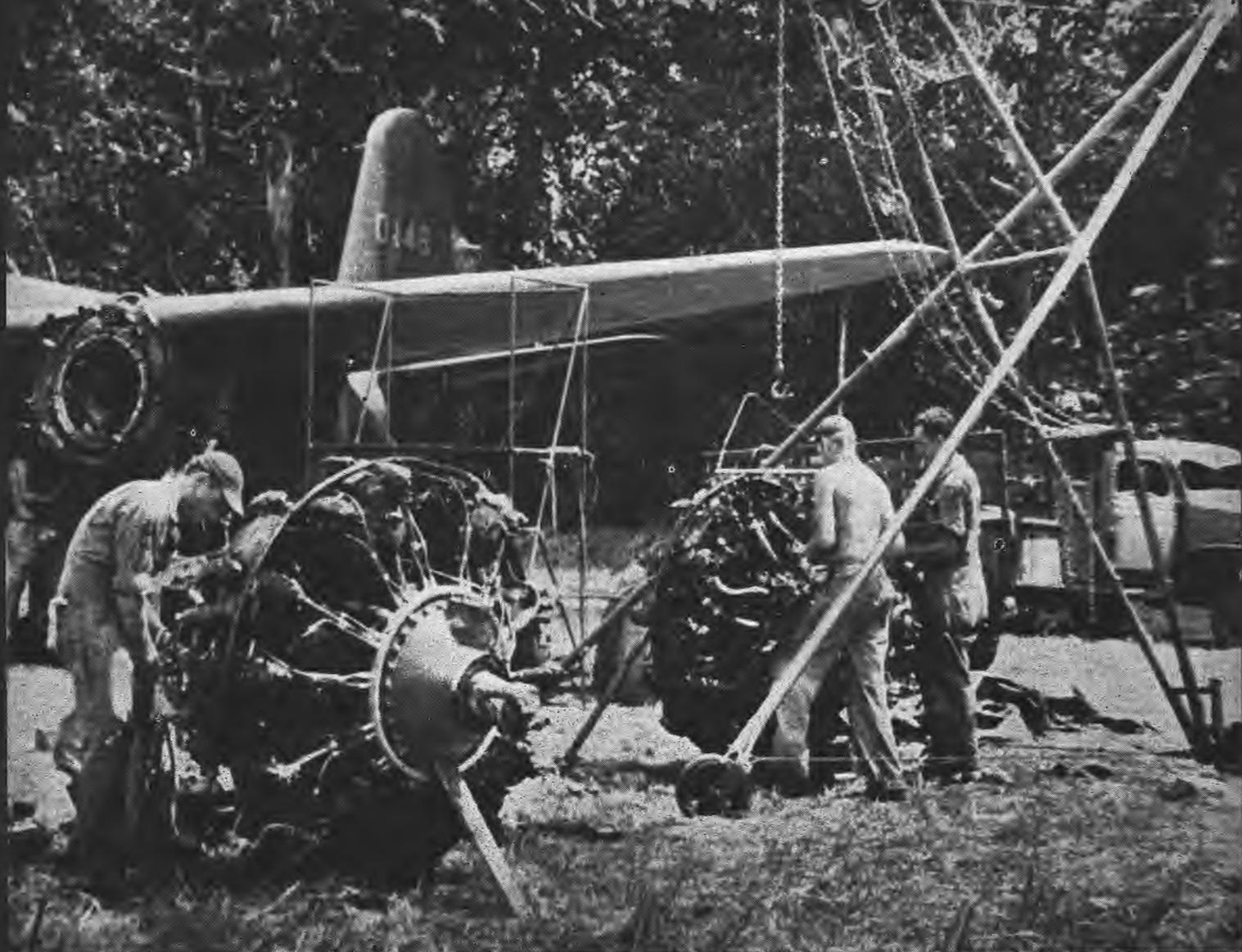
Under this organization the ASC steadily reduced the percentage of planes rendered inoperative through need of repairs. It kept tab on and handled over 400,000 kinds of items, ranging from nuts and bolts, bullets, bombs, and bombers to fuel, lubricants, flying suits, jungle kits, radio sets, and medical supplies. It kept planes flight-worthy under every extreme of environment encountered by U.S. fighting men in worldwide theaters. Alaskan cold, the heat and dust of North African deserts, and the corrosive dampness and fungi of South Pacific jungles were among the many difficult factors which complicated the work of supply, maintenance, and repair. But Air Service personnel had the skill and ingenuity, the "know how," to help them improvise in emergencies and get the job done with efficiency and speed.



Hardworking Air Service Command mechanics overhaul the



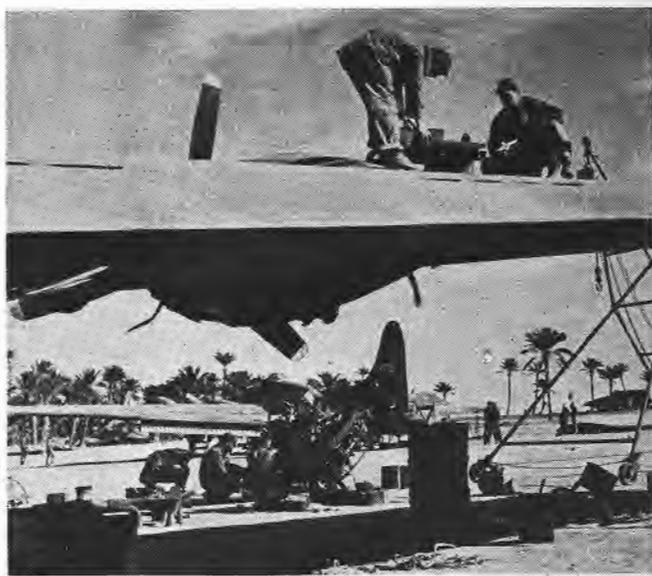
Airplane repair under the Southern Cross. A roof of canvas and jungle branches and improvised benches on a dirt floor are setting in which ASC technicians service instruments in New Guinea.



twin Wright engines of the Daisy Mae, famous Douglas A-20, concealed at an advance base in the South Pacific.



Air Service Command technician puts the finishing touches on a propeller assembly at this North African shop. Note the condition of the damaged propeller on top of the tool box at the left.



ASC mechanics doing repair work under bright North African sun. They often worked on same plane many times, for a much-used bomber wore out as many as 20 engines on runs over enemy targets.



Equipped with cameras in place of guns, the Lockheed P-38 is known as the F-5. Speed, altitude, and range protect it

AERIAL PHOTOGRAPHY

AAF photo units provide source of intelligence

Aerial reconnaissance, original function of military aeronautics, gave vital visual aid in World War II. In all theaters wartime photographic missions provided daily reports on airdrome, port, and communications activities; reconnaissance of shipping, ground and antiaircraft defenses, industrial targets, radar facilities, and night-bomber positions; assessment of bomb damage; and combat mapping of enemy territory.

These missions, which accounted for some 7,400 Ninth Air Force sorties alone during 12 weeks of the 1944 drive on Germany, freed naval vessels for other work and supplied a major source of intelligence on the enemy's order of battle on the ground and in the air. They located drop zones for airborne troops and supplied the Aeronautical Chart Service with large quantities of photographs vitally needed in combat theaters.



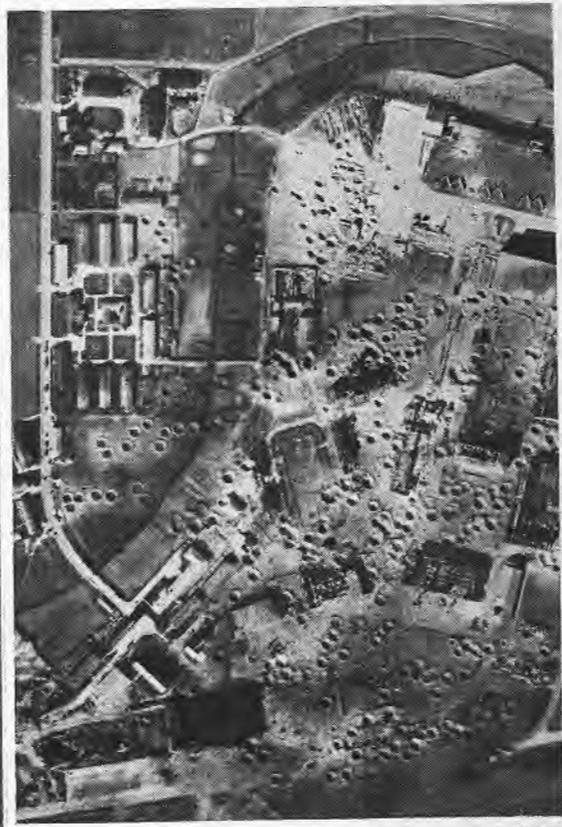
Film magazines are hurriedly removed from five \$3,000 aerial cameras in nose of P-38 just back from Germany, then rushed to special jeep lab so that no time is lost processing negatives or prints.



from enemy and make it valuable in photo reconnaissance.



In England, large washing machines rinse the chemicals out of the thousands of prints produced in photo-reconnaissance laboratories. AAF aerial photography supplied many of the pictures in this book.



Before and after saturation bombing on one of the industrial areas of Marienburg, Germany, in September 1943. Photo unit's bomb-damage assessment mission provided clear evidence of destruction.



A formation of Lockheed P-38 Lightnings in the Pacific Northwest. These sensational twin-engine fighters, which were the terror

of the enemy in all theaters, figured significantly in the training and defense programs established in the four domestic air forces.



FIRST, SECOND, THIRD, FOURTH, AND SIXTH AIR FORCES

Domestic air forces train operational units and defend America

The call to war in 1941 brought tremendous new activity to the air forces—the striking and defending arms of the Army's aerial war machine. By V-J Day their number had increased to 16. The First, Second, Third, and Fourth Air Forces were concerned primarily with the aerial defense of the United States and the formation and training of crews for overseas assignment. To the Sixth went responsibility for the aerial defense of the Panama Canal, most vital U. S. waterway. The remaining members of the aerial team took up their combat positions on global fronts—the Eleventh in Alaska and the Aleutians; the Eighth, Ninth, Twelfth, and Fifteenth in Western Europe and the Mediterranean; and the Fifth, Seventh, Tenth, Thirteenth, Fourteenth, Twentieth, and ultimately the Eighth in the Pacific and Far East.

Immediate ancestors of the first four air forces were the Northeast, Northwest, Southeast, and Southwest Air Districts, originally organized as theaters of operations and redesignated from the old GHQ Air Force wings, on November 19, 1940. This move to decentralize tactical control and the administration of operational training was prompted by the conviction that the stepped-up preparations for combat were introducing problems better solved in lower echelons.

Continued expansion and the growing likelihood that America would enter the war led to the replacement of the districts by the first four air forces in the spring of 1941. The authority of the commanding generals was increased and the air forces were whipped into units capable of taking the field against the enemy. In the fear of imminent invasion that gripped the country at the outbreak of war, the First and Fourth Air Forces were placed under the jurisdiction of the Eastern and Western Theaters of Operations, respectively, and given the primary mission of aerial defense of the United States. The decision to put the First and Fourth under the domestic theaters and make overseas units responsible to overseas commanders removed the combat mission of the Air Force Combat Command, successor to the GHQ Air Force. The Second and Third Air Forces now became training agencies almost exclusively, reporting directly to the Chief, AAF.

All four air forces assumed continually greater responsibilities as increasing numbers of crews had to be welded into coordinated teams of specialists to fly and service America's aircraft. Through their Operational

or Replacement Training Unit programs (OTU or RTU), new fighter, bombardment, transport, reconnaissance, troop carrier, and ground units were provided for America's ever-growing air arm. Pressure for time and materiel was great; and important assignments like Doolittle's Tokyo raid were accomplished in the face of difficult odds. Moreover, the increasing tempo of aerial conflict and constant improvement in combat aircraft necessitated frequent changes in training schedules and techniques.

By the summer of 1943 the United States was considered reasonably safe from invasion, and with the Eastern and Western Theaters of Operations already returned to the status of defense commands, plans were made to return the First and Fourth Air Forces to the jurisdiction of the Commanding General, AAF. This was done in September, with the understanding, however, that in the event of an invasion emergency they would go back to defense command control. The I Bomber Command, separated from the First Air Force in October 1942 to concentrate on antisubmarine operations, returned to that organization in August 1943.

During 1944 and 1945 the four air forces were mainly training agencies. They organized and prepared units for overseas assignment, participated with the Army Ground Forces in maneuvers intended to test and develop doctrines and tactics of air-ground cooperation, and provided units and planes for the defense of continental United States. By the last months of 1943 most of the authorized operational training units had been formed. In the following year, emphasis shifted from the preparation of entire units to the replacement of members for individual flying crews. Low casualty rates made the demand for replacement ground crews relatively slight. In December 1944, Headquarters, Continental Air Forces was created to coordinate the activities of the four domestic air forces and I Troop Carrier Command and take over certain functions of Headquarters, AAF.

As early as 1940, with the vulnerability of the Panama Canal causing concern, the Panama Canal Air Force was created with Maj. Gen. Frank Andrews as commander. By the time of Pearl Harbor, it had been renamed the Caribbean Air Force under the command of Maj. Gen. Davenport Johnson and was operating in the Canal Zone and the Caribbean. Designated as the Sixth Air Force in the following February, it undertook a 24-hour alert, flying patrol in the U-boat war.



In 1942 Army pilots helped combat U-boat menace that made ship graveyard of area off the Virginia and Carolina capes.

ANTISUBMARINE COMMAND

Wages air war against U-boat offensive

The news of Pearl Harbor alerted America's military leaders for defense of the coastal areas of the United States. On that day, at the Navy's request, the First Air Force's I Bomber Command was ordered to begin over-water reconnaissance for enemy shipping, especially submarines. The patrols started the following afternoon; from then until August 1943 the AAF shared with the Navy, while acting under the latter's operational control, the responsibility for countering the German U-boat menace.

To the initial emergency patrols the AAF assigned all bombardment and reconnaissance aircraft available on the East Coast after some of the most experienced units had been dispatched to the Pacific. This improvised antisubmarine striking force consisted of A-20's, A-29's, B-17's, B-18's, and B-25's, none equipped with radar. By March 1942 a few B-18's had radar, and for the rest of the year they became the work horses of the command. The ultimate backbone of the counter-attack on the U-boat fleet was the radar-equipped B-24, its large capacity and long range making it an ideal land-based antisubmarine plane. In time other special devices, lacking on the early patrols, were adapted to antisubmarine aircraft. This progress was made with the help of the Sea Search Attack Development Unit, established at Langley Field in 1942, and other re-

search organizations, including that of the Navy.

Fortunately for the motley antisubmarine force assembled by the AAF in December 1941, the enemy's U-boats took nearly a month to begin their devastating work in American waters. Their first success in the Eastern Sea Frontier occurred on January 14, 1942. Through the following spring and summer the Nazis kept enough U-boats in America's East Coast waters to make the area a veritable graveyard of Allied merchant shipping vessels. The offensive in the Eastern and Gulf Sea Frontiers reached its peak in May 1942 with a toll of 47 sinkings. By October 1942 the enemy had been virtually eliminated from home waters; and the U-boats continued southward to prey on United Nations shipping in the Trinidad area, posing a serious threat during the coming African invasion.

In October 1942 the I Bomber Command officially became the AAF Antisubmarine Command, under Brig. Gen. Westside T. Larson. This command, greatly aided in organizational and tactical matters by the Royal Air Force Coastal Command, was able to deploy its forces so as to strike at U-boats both in the Bay of Biscay, temporarily home waters for the submarines, and on the North Atlantic convoy route. They thus contributed to the defense when, in the spring of 1943, the Nazis began an all-out U-boat offensive against the life lines of the anti-Axis war effort along the North Atlantic route. Through Allied cooperation, air and surface defenses successfully countered the attacks. In September Churchill was able to announce that for the past three months no United Nations vessel had been lost to submarine action in that area. Never again



Crew of a radar-equipped Douglas B-18 makes final check of its course just after being briefed for antisubmarine sweep.

were U-boats to constitute a major threat to United Nations war strategy, although they continued to be a problem, even after D-day, June 6, 1944.

The record of the Antisubmarine Command cannot be measured entirely by the number of enemy submarines attacked and sunk. Simply by patrolling vast areas of vital shipping lanes its 25 squadrons materially reduced the efficiency of enemy operations. But the I Bomber Command and its successor, the Antisubmarine Command, nevertheless did deal telling blows against the U-boat fleet, particularly after being provided with specially equipped and modified B-24's. These ordinarily went out singly many hundreds of miles from base, farther than any other type of land-based aircraft at that time, and thus were ready to attack suddenly whenever a target might be discovered in the vast stretches of the Atlantic.

These sorties, carried out in large numbers, did much to disperse the U-boat wolf packs and demoralize their crews in the North Atlantic, the Bay of Biscay, and in the waters off Gibraltar. Among the most effective units were the 479th and 480th Antisubmarine Groups. In nine days of July 1943 the B-24's of the 480th made 12 attacks on enemy submarines in the approaches to Gibraltar, sinking one, probably sinking three, and damaging three others. Thanks in a measure to their efforts, convoys on the way to reinforce invasion troops in Sicily reached the Mediterranean relatively untouched. By August 1943 the worst was over, the Navy assumed full responsibility for antisubmarine activity, and the AAF Antisubmarine Command returned to its former functions as the I Bomber Command.



B-24 makes surprise bomb run on surfaced German U-boat. Bombs dropped within 15 seconds of submarine's dive were 90% effective.



Nazi submarine crash-dives in effort to escape from attacking aircraft. Pilot will concentrate on the swirl to gauge release of bombs.



The Seventh Air Force in action at Midway. B-17's attack Akagi, Jap aircraft carrier converted from a battle cruiser.

SEVENTH AIR FORCE

Offensive in Central Pacific



The Seventh Air Force had to devote its early efforts to protecting the Hawaiian area against Jap advances in the Central Pacific. In spite of handicaps in supply, some of its B-17's and B-26's went into the battle of Midway in June 1942, and from July to the following February its 11th Bombardment Group pounded enemy positions throughout the Solomons.

Until mid-1943 lack of equipment was a continuing handicap. But by autumn, B-24's of the VII Bomber Command were ready to join in the Central Pacific offensive. With headquarters now set up in the Elice Islands, 2,200 miles from Oahu, its strategy from November was to blast enemy bases as a prelude to amphibious assaults. Under Maj. Gen. Willis Hale and his successor, Maj. Gen. Robert Douglass, Jr., scores of sorties were flown against Tarawa, Makin, Nauru, Wotje, Jaluit, Maloelap, and Kwajalein. The fall of Tarawa in November 1943 provided bases for further strikes against the Marshalls.

As the offensive moved west, milk runs against bypassed Marshall bases were coupled with blows on the Carolines to neutralize Truk, Ponape, and Kusaie and ease the way into Eniwetok. The June assault on Saipan, where P-47's of the VII Fighter Command attacked enemy ground troops, and the fall of Guam and Tinian in July gained new bases for strikes on the Bonins and Carolines. Reorganization as a mobile tactical air force in August 1944 streamlined the Seventh Air Force for the final strides to Tokyo.



(Above) Youthful flyers of Seventh Air Force being briefed for first bombing mission. (Below) B-24 plows homeward from Truk through phosphorus bombs dropped by the Jap planes 1,000 feet overhead.





Twin-engine B-25's of the Eleventh Air Force warming up on the line at Ladd Field, Alaska, in 35-below-zero weather.



(Above) Fur-clad engineers lay the metal strips of a steel landing mat for an 11th Air Force runway at an Alaskan base. (Below) A well-aimed bomb demolishes a Japanese installation in Aleutians.



ELEVENTH AIR FORCE

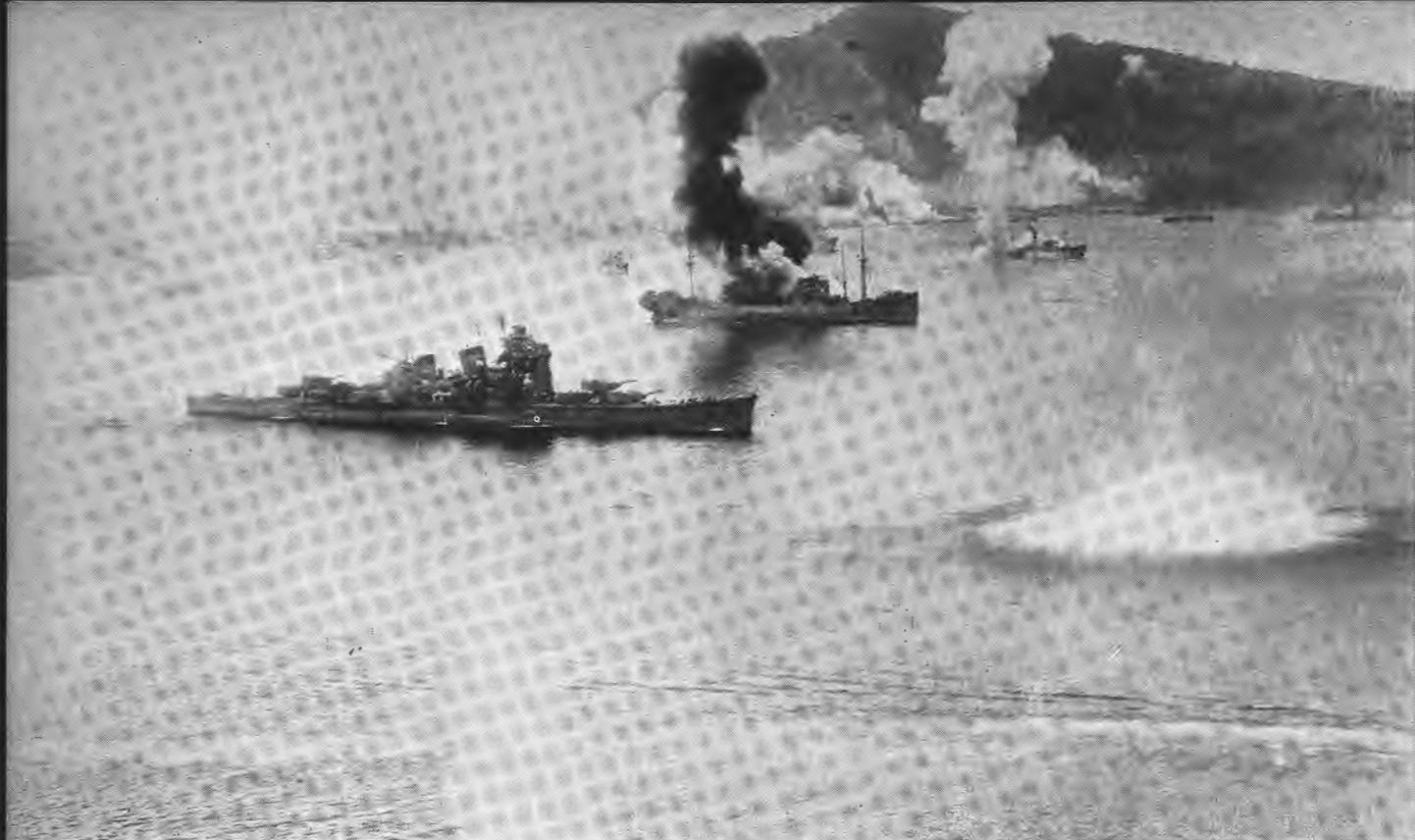
Pounds Japs in North Pacific



Defense of the Alaskan area fell to the Eleventh Air Force, redesignated from the meager Alaskan Air Force in February 1942. Leading both east and west, the Aleutians not only called for protection against Jap advance but provided a means of striking offensive blows at the enemy as well.

Unexpected opposition from units of the AAF aided in checking a Jap assault on Dutch Harbor begun June 3, 1942, but on June 11 reconnaissance revealed enemy landings on Attu and Kiska, also in the Aleutians. The Eleventh, under Maj. Gen. William O. Butler, hammered at Jap bases whenever weather permitted, dropping a total of nearly 7,000,000 pounds of bombs. Fifteen months after the Jap landings, combined ground and naval forces were able to clear the islands of the enemy. This gave the Eleventh, under command of Maj. Gen. Davenport Johnson, clear passage to the Kurile Islands near the Japanese homeland.

In July 1943 the Eleventh struck these fog-bound islands in one of the first land-based bomber attacks close to Japan itself. During 1944 and the summer of 1945 its B-24's and B-25's found good targets on Shimushu and Paramushiru, site of the Japs' strongest concentrations of air facilities and ground defenses in these islands. This action, carried on in spite of the handicap of continually bad weather, kept the Japanese reminded that they were vulnerable from both north and south and forced them to continue to deploy precious air strength in the North Pacific.



This photo, taken in 5th AF bomber under Jap cruiser fire, shows at least four Jap ships sinking or burning after air attack.

FIFTH AIR FORCE

Strikes from Southwest Pacific



The Fifth Air Force undertook both defense and offense in the Southwest Pacific. Early in 1942 its parent organizations, the Far East Air Force and the Allied Air Forces, sought to stem the tide of Japanese advance toward Australia. As General MacArthur moved to dislodge the enemy's foothold in New Guinea, the Allied Air Forces, commanded first by Lt. Gen. G. H. Brett, then by Lt. Gen. G. C. Kenney, countered the Jap thrusts. The Fifth, constituted in September under Kenney as a part of the Allied force, was assisted by the RAAF in pointing up the attack. Striking at shipping and bases, defending Allied installations, carrying troops and supplies, and cooperating with ground action, they employed every capability of air power to help expel the enemy from the Papuan tip of New Guinea by mid-January 1943.

This pattern was further developed during 1943 and 1944 as the Fifth annihilated a Jap convoy in the Bismarck Sea in March 1943, cooperated with ground and naval forces in landings along the New Guinea and New Britain coasts, and perfected new bombing techniques in attacks on Wewak and Rabaul and in the April 1944 conquest of Hollandia. By July 1944 the Fifth had spearheaded amphibious advances to the westernmost point of New Guinea where MacArthur stood poised for invasion of Morotai and the return to the Philippines. To coordinate air action in the drive to Tokyo, the Fifth and Thirteenth were associated as the Far East Air Forces, June 15, 1944.



(Above) A pair of B-25's stage coordinated low-altitude strafing and bombing attack on Jap merchant vessel. (Below) Low-flying B-25's drop parafrags on three single-engine Jap Tonys, New Guinea.





B-25's of Thirteenth Air Force withdraw from Bougainville after plastering supply area seen burning in the background.



(Above) Low-flying 13th Air Force B-25 strafes 75-mm. ack-ack positions in Rabaul as Japs huddle alongside in dugouts. (Below) B-17 takes on bomb load before attacking Jap targets in Solomons.



THIRTEENTH AIR FORCE Action in South Pacific



First big job of the Thirteenth Air Force and its predecessor units was to halt Jap advances in the Solomons. In spite of difficulties of terrain and equipment, their heavies pounded supply points and shipping up and down this jungle chain. In the Guadalcanal campaign, August 1942 to February 1943, fighter units equipped with P-39's did yeoman service with ground troops; and the arrival of P-38's gave the heavies long-range escort in striking enemy bases in the northern Solomons.

With Guadalcanal secured by February 9, 1943, Allied forces moved relentlessly northwestward. Conquest of New Georgia, Bougainville, and finally the Admiralties, by February 1944, brought Rabaul and Kavieng within range of all aircraft types and made the Carolines vulnerable to B-24 attack. Once Truk and Woleai were neutralized, heavies of the Thirteenth swung westward from the Admiralties to help the Fifth Air Force prepare Noemfoor Island for MacArthur's assault. In June 1944 its blows at Yap cut the link between Jap positions in the south and the Marianas to ease the capture of Saipan. It then turned to softening the Palaus for the September 1944 invasion of the outer defenses of the Philippines.

Between its activation on January 13, 1943 and its integration with the Fifth in FEAF under General Kenney in June 1944, commanders of the Thirteenth were Maj. Gen. N. F. Twining, Brig. Gen. R. L. Owens, Maj. Gen. H. R. Harmon, Maj. Gen. St. Clair Streett.



B-17's of the Eighth Air Force head homeward after destructive strikes against the Nazi aircraft industry at Bremen.

EIGHTH AIR FORCE

Carries air war into Germany



The mission of the strategic air forces, as phrased by the Casablanca conference, was the destruction and dislocation of the German economy to a point where its war machine could no longer resist. This was to be done by a combined bomber offensive coupling daylight precision strikes by the Eighth Air Force with night area bombardment by the RAF.

The veteran Eighth, organized January 28, 1942, was destined to provide leadership for many air forces and see action on many fronts. Under top-flight leaders, including Generals Spaatz, Eaker, and Doolittle, it numbered at its peak more than 200,000 officers and men. Its initial assault on Europe, begun on August 17, 1942 when 12 Fortresses struck Rouen, was retarded by the needs of the African invasion; but by summer 1943 it was piling increasing devastation on Nazi targets, turning from its early attention on the U-boat menace to strike increasingly at the Nazi aircraft industry. With the advent of escorting Mustangs early in 1944 its heavies penetrated deep into Germany, shuttling to African bases after their attacks on German industry.

The destruction of aircraft assembly plants together with the operational wear on Nazi fighter strength contributed significantly to the D-day ineffectiveness of the Luftwaffe and gained the air superiority needed for the invasion of the Continent. Strategic attacks on the Nazi oil supply, both before and after D-day, and on the German transportation system brought the ultimate breakdown of the Nazi war machine.

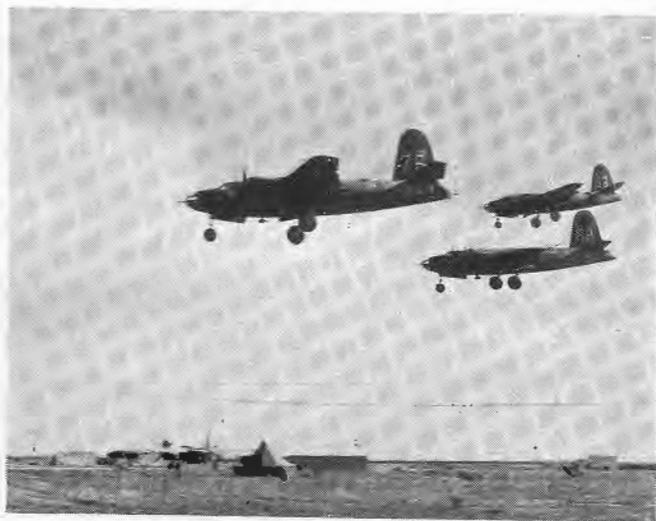


(Above) B-17's leave Marienburg, Germany, after spectacular precision strike, Oct. 9, 1943. (Below) Allied reserves of high explosives piled ready for bomber offensive against German centers.





Bombs from the Fifteenth Air Force B-17's strike vital target, Nazi aircraft factory at Wiener-Neustadt, near Vienna.



(Above) Medium bombers take off and land three at a time to save fuel and extend range approximately 50 mi. (Below) Pall of smoke hangs over the ruins of Cassino, Italy, after destructive air attack.



FIFTEENTH AIR FORCE

Hits Germany via underside



The Fifteenth Air Force, activated on November 1, 1943 from units previously in the XII Bomber Command, teamed with the Eighth in two-way strikes from both England and Italy to hit strategic Nazi targets. Commanded by Generals Doolittle and, later, Twining, it pared down the Luftwaffe, cooperated in ground action on the Italian mainland, and battered strategic targets in the Balkans.

Its initial raid, flown on November 2, 1943 against aircraft plants at Wiener-Neustadt, destroyed their target value for four months. In January and February 1944 it hammered at airfields and industries vital to fighter production in Germany, Italy, and the Balkans and destroyed hundreds of aircraft on the ground. To further ground operations in Italy, it interdicted communications and supply points behind battle lines. From December 1943 through February 1944 marshaling yards alone were hit by 7,000 tons of bombs.

In April 1944 it began a five-month bomber offensive designed to cripple the oil refineries and railroad yards at Ploesti and Bucharest, Rumania. The success of these attacks strengthened the Soviet left flank and, in reducing oil stocks needed by the Nazis, imperiled the Axis position in the Balkans during summer, 1944.

Air effort in the Mediterranean cut across international lines. U.S. and RAF units cooperated as the Northwest African Air Forces and later as the Mediterranean Allied Air Forces (MAAF), commanded by Generals Spaatz and Eaker.



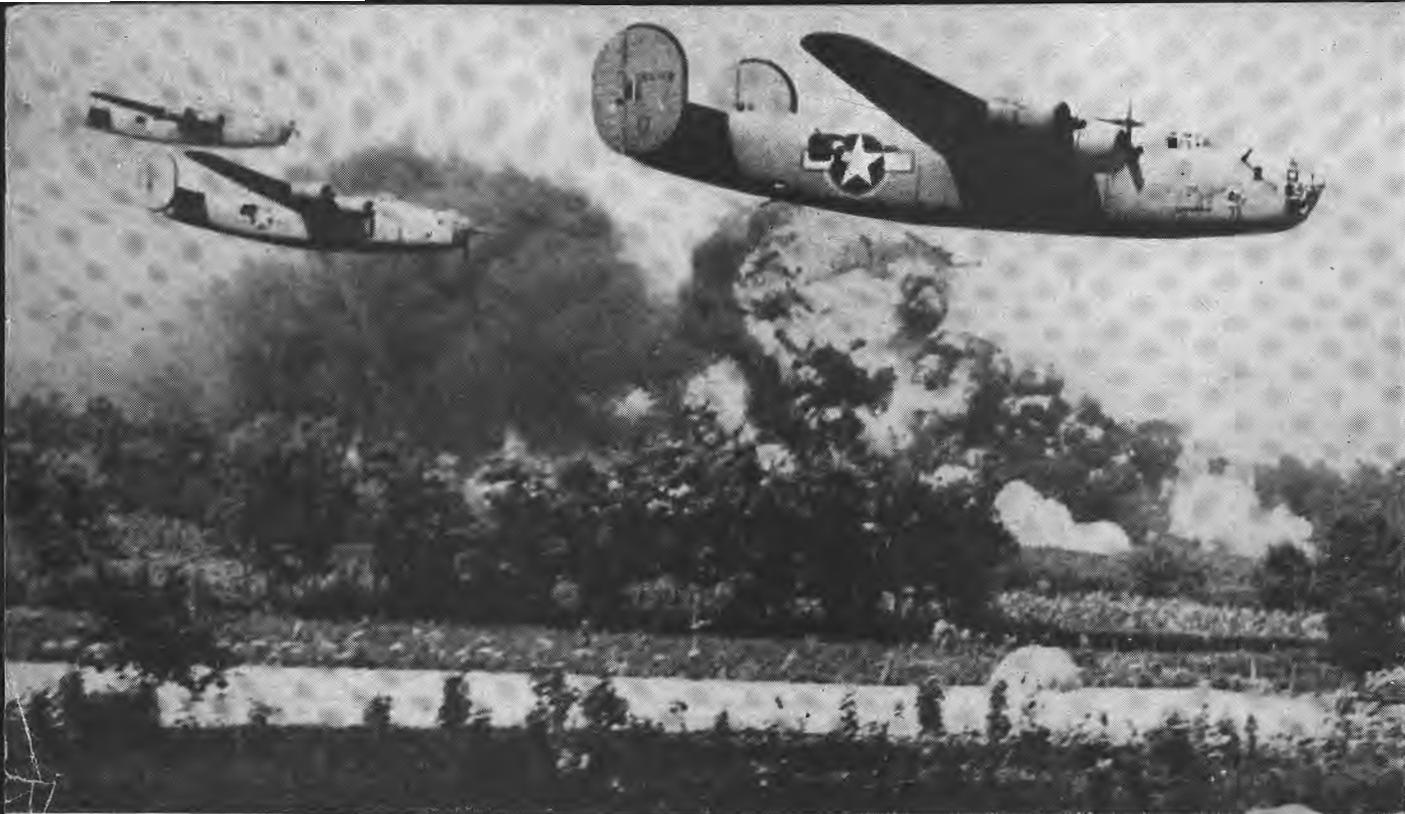
Strategic bombing by the Eighth and Fifteenth Air Forces during the last week of February 1944 did much to cripple the offensive punch of the Luftwaffe. A 1,000-plane attack on February 20th

halted the work at factories producing 80% of Germany's fighters. "Round-the-clock" bombing by RAF and Eighth was followed on the 22nd by first coordinated attack by U. S. Strategic Air Forces



in Europe, under command of General Spaatz. At that time, heavies of the Eighth (see above) were joined by Italy-based bombers of the Fifteenth. A record 2,000-plane raid on the 25th climaxed

five days of disaster for the Nazi aircraft industry which reduced German fighter production by 75% and forced the Nazis to disperse industry into 300 small factories, many of them underground.



Low-flying B-24's of Ninth Air Force leave Ploesti oil refineries, August 1, 1943, against background of burning fuel.

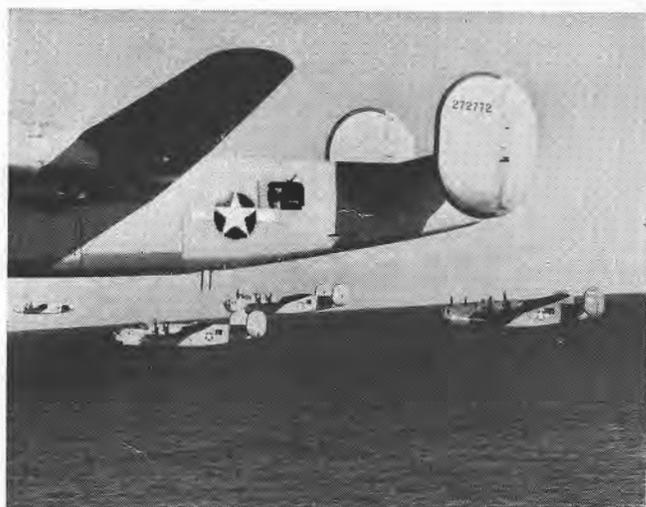
NINTH AIR FORCE *Sees action on two fronts*



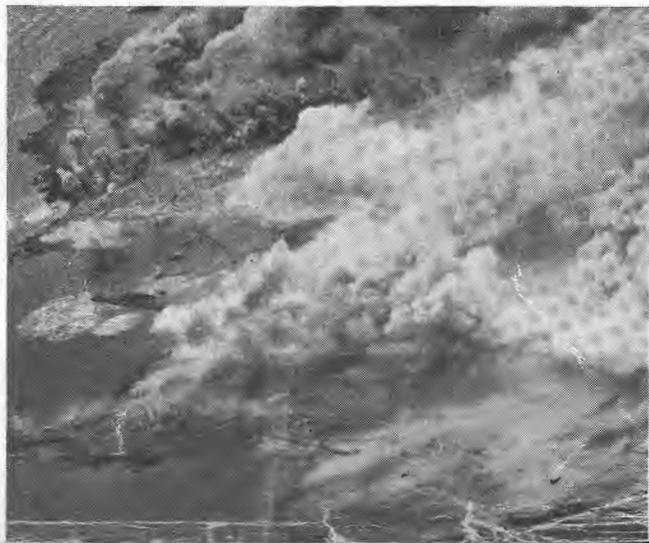
The Ninth Air Force speeded victory on several fronts. Its predecessor, the U. S. Army Middle East Air Force, created in June 1942 under Maj. Gen. L. H. Brereton, aided the RAF against Rommel. Its bombardment of Mediterranean ports and Axis convoys at sea deprived the Desert Fox of needed supplies and reinforcements. Air cooperation in the victorious advance from El Alamein to Tunis gave its mediums and fighters valuable experience for its later operations as a tactical air force.

In December 1942 the air force, known since November as the Ninth, began to strike European targets. Rome was first hit in July 1943. An August 1 mission greatly reduced the oil output at Ploesti, and on the 13th a raid on the Wiener-Neustadt aircraft works struck Austria for the first time from this theater. Sicily was softened for July invasion by attacks on airdromes and communications there and in southern Italy.

A regrouping of air forces based in North Africa led to the absorption of the Ninth's operational units by the Twelfth Air Force, but the identity of the Ninth was maintained. In October 1943 its commanding general and headquarters moved to England where it was reconstituted as the tactical air force designed to participate in the invasion of Europe. At first its combat units assisted in escorting the Eighth's heavies on strategic missions and struck flying-bomb installations, airdromes, and communications targets on the Continent. On D-day it turned to air-ground cooperation.



(Above) B-24's based in Middle East fly over Adriatic to bomb targets in northern Italy. (Below) Pantelleria under attack. This was combined effort of 9th and 12th Air Forces, RAF, and Royal Navy.





Mitchells of the Twelfth Air Force riddle these Axis transports flying low over the Sicilian straits during action of early 1943.



(Above) AAF troops rush to set up station at new U. S. airdrome in North Africa. (Below) 9th Air Force bombers attack important enemy shipping and harbor facilities at Tripoli on Nov. 29, 1942.



TWELFTH AIR FORCE Paces drive up Italian boot



The Twelfth Air Force, organized under General Doolittle on August 20, 1942, paced the Allied drive from North Africa up the Italian boot. United with the RAF in the Northwest African Air Forces under General Spaatz, its attacks against the Nazis retreating through the Kasserine Pass were repeated at the final break-through to Tunis and Bizerte in May 1943. It raided transports shuttling between Sicily and Tunisia and sank the 10,000-ton Italian cruiser *Trieste* in a Sardinian harbor.

The Twelfth also played the leading role in the three-week bombardment of Pantelleria which capitulated on June 11, 1943 to assault from air and sea alone. Here the A-36, dive-bomber version of the P-51, was introduced with good results. In the July invasion of Sicily the Twelfth dropped paratroops and struck tactical and strategic targets there and in Sardinia. Fortresses of the Twelfth joined the Ninth Air Force in the raid on Rome which preceded Mussolini's downfall.

In November 1943 the Twelfth turned over its strategic functions to the Fifteenth, retaining responsibility for tactical air activity. Its operations between 15 March and 11 May 1944, designed to disrupt enemy communications to the battle area in central Italy, set a pattern for interdiction campaigns to come. The Twelfth cooperated with RAF units as the U.S. component of the Mediterranean Allied Tactical Air Force (MATAF), commanded during much of its history by Lt. Gen. J. K. Cannon, commander of the Twelfth.



A bomb squadron of the Tenth Air Force sinks oil flat, scores direct hits on dock facilities at Rangoon, November 1943.

TENTH AIR FORCE

Air battles in Burma



The Tenth and Fourteenth Air Forces accomplished an uphill task in Asia, effecting the aerial cover, transport, evacuation, and supply essential to Allied warfare in this theater. Organized early in 1942, the Tenth flew its first mission against the Andaman Islands on April 3 with General Brereton, its original commander, in the lead.

Designed to support the Chinese but unable to do so directly because of the fall of Burma, the Tenth under Brereton and his successors, Maj. Gen. C. L. Bissell and Brig. Gen. H. C. Davidson, established and defended an aerial ferry from India to China and mounted bombing and strafing missions against Rangoon, Myitkyina in Burma, and targets as far east as Bangkok, Thailand. But long supply lines and low priorities hindered their efforts to halt the Japs.

Reinforcements and new-type equipment greatly augmented the accomplishments of the Tenth in 1943 and 1944. Its achievement of almost complete air supremacy over Burma multiplied enemy losses. With the arrival of Maj. Gen. G. E. Stratemeyer, the AAF and RAF pooled their strength as tactical and strategic forces and won almost uncontested control of the air in southeastern Asia. Their destruction of shipping, supply dumps, convoys, and oil refineries and their cooperation with ground troops were important factors in stemming Jap advances into India and China and in the success of the Allied campaign which culminated in the recapture of Myitkyina in August 1944.



(Above) Jap trackage in Burma after AAF "spike bombing." (Below) Britain's Maj. Gen. O. C. Wingate and Col. "Flip" Cochran of 1st Air Commando Force brief Allied officers on points of strategy.





Flames shoot 3,000 feet as 14th Air Force B-25's bombard Japanese oil storage dump on mainland opposite Hong Kong.



(Above) P-40's of 14th Air Force retain design of AVG Flying Tigers. 1,000-lb. bombs on taxiway await loading. (Below) Jap field on Formosa under attack, Nov. 1943, by 14th Air Force fighters.



FOURTEENTH AIR FORCE

Air war in China



The Fourteenth Air Force was created March 10, 1943 from units of the China Air Task Force, which since the summer of 1942 had been pounding a 5,000-mile front in the southern part of occupied China. This task force had absorbed the spectacular AVG on July 4, 1942. Including the 23d Fighter Group, 16th Squadron (51st Fighter Group), and 11th Squadron (341st Bomb Group), it inflicted damage out of all proportion to its meager numbers on Jap installations in occupied China, French Indo-China, and Burma.

Employing tactics which General Chennault had tested during AVG triumphs, the China Air Task Force guarded a wide stretch of the China theater against Japanese attack. Its medium bombers blasted Hankow, Canton, Haiphong, Hanoi, and Hong Kong as well as ships off the China coast. Its fighters strafed and dive-bombed targets in the same area and cooperated with Chinese ground troops.

Heavy bombardment squadrons, added after the creation of the Fourteenth with Maj. Gen. Claire L. Chennault in charge, made heavy inroads on enemy shipping in the China Sea and brought vital targets on Formosa and Hainan within range. With the Burma Road closed, units in China had to be supplied entirely by air. Much credit for the success of the Fourteenth in providing vital tactical aid to the Chinese during 1944 is due both the Air Transport Command, which tripled its tonnage during the year, and the squadrons defending the China end of the India-China ferry route.



Boeing's four-engine B-29 Superfortress made it possible for the AAF to span the last lap to the Japanese homeland. This aerial giant is 28 feet high, has a width of more than 141 feet, a length

of 99. It was one of three very-long-range bombers, designs for which were accepted in early 1940. By one year after Pearl Harbor three experimental models of the plane were received by AAF. Less than



(Above) Chinese refuel B-29 from five-gallon cans after emergency landing. (Below) B-29's line up at forward base of XX Bomber Command in west China prior to attack on Japanese city of Yawata.



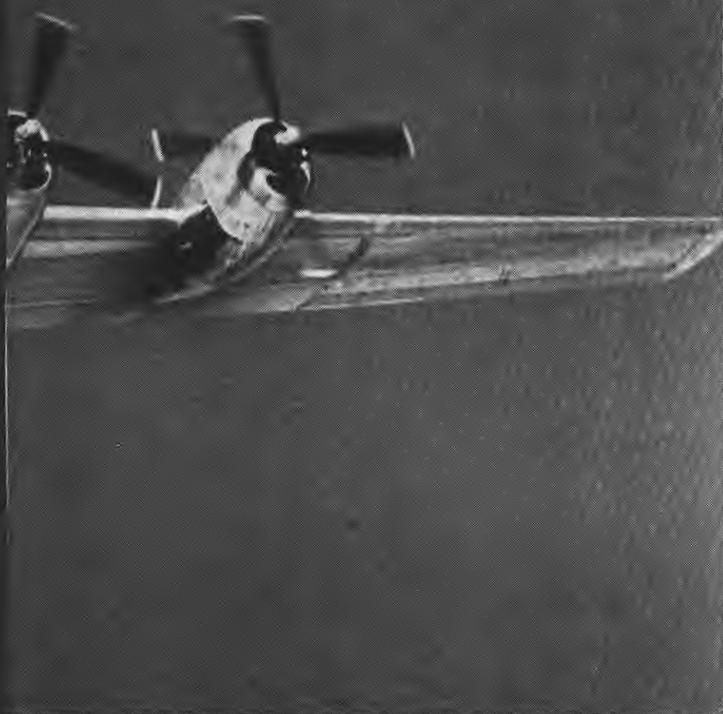
TWENTIETH AIR FORCE

Takes war to Jap homeland



To the Twentieth Air Force went the spectacular job of striking the first overwhelmingly destructive blows at the Japanese homeland. Organized in April 1944 for very-long-range strategic bombardment, its weapon was the four-engine Boeing B-29 Superfortress. To exploit the extraordinary range of this plane and the potential mobility of a force capable of striking from any one of several theaters, a unique command arrangement was inaugurated. Command of the Twentieth was vested in the Joint Chiefs of Staff with General Arnold, as Commanding General of the AAF, executive agent. Brig. Gen. Lauris Norstad served as chief of staff with each assistant chief of air staff at Headquarters, AAF holding, ex officio, a corresponding position on the Twentieth's staff. In the theater, this over-all direction from Washington was translated into action by the commanding generals of the XX Bomber Command, with headquarters in western China, and the XXI Bomber Command whose headquarters were moved from Saipan to Guam early in 1945.

The great range of the B-29 made it possible to occupy rear bases in India and conduct long-distance missions by using forward bases in China and elsewhere as staging fields. Various theater commanders



two years later the thousandth B-29 was ready for action. It was made the most important item in the 1945 munitions program with February 1945 production more than doubling that of October 1944.

assumed the responsibility, directed by the Joint Chiefs of Staff, for the construction and defense of these B-29 bases. The building of the advance bases in China by hundreds of thousands of Chinese laborers was one of the greatest feats to be accomplished without heavy machinery since the building of China's Great Wall.

The logistic problems of the Twentieth were enormous. All supplies for the Chinese bases had to be delivered by air, with a resulting division of responsibility between the Air Transport Command and the Twentieth itself. At first these difficulties severely limited the frequency of operations. But with the acquisition of other bases like Saipan, where the logistic problems of the XXI Bomber Command were simpler, the number and size of the operations increased considerably.

After a warm-up raid against Bangkok on June 5, 1944, about 50 B-29's struck their first blow at the Jap homeland 10 days later by bombing the enemy iron and steel center of Yawata on Kyushu Island. The first B-29 reached Saipan in mid-October, and on November 24 more than a hundred Saipan-based Superfortresses attacked the Nakajima aircraft works and urban area of Tokyo from 30,000 feet. From that date to March 1945 the increasing tempo of B-29 strikes on Japan's aircraft industry, Formosa, Indo-China, and industrial Manchuria was determining the operational capabilities of the B-29 and foreshadowing that rain of destruction that was to be visited upon the heart of the Jap empire in the last six months of the Pacific war.



(Above) B-29 of XX Bomber Command hits the Showa Steel Works, key Jap industrial unit at Anshan, Manchuria. (Below) Same industrial center in one of first photos of the B-29 over Jap territory.





AIR POWER PAVES THE WAY FOR D-DAY

Aerial blows reduce enemy's capacity to resist

For months preceding the June 6 assault on Fortress Europe the Allied air forces had been preparing the way for the D-day landings. The long-range program to cripple the Nazi aircraft industry reached a peak in the devastating attacks of February 1944. On March 6, U. S. bombers struck Berlin for the first time in force. This offensive retarded German aircraft production until Allied superiority in the air was certain. Moreover, as the heavies and their escorting P-47's and P-51's struck deep into Germany they challenged the defending fighters and took a mounting toll of their number. The resulting ineffectiveness of the Luftwaffe assured the D-day landing force of protective superiority in the

skies. Meanwhile the Ninth Air Force, operating since October 1943 as a tactical air force, was setting the stage for invasion by neutralizing airfields and marshalling yards and attacking V-bomb launching sites.

As invasion loomed, the aerial offensive against the aircraft industry was suspended in favor of a campaign to interrupt enemy communications and impede the movement of men and supplies into the area of impending battle. Enemy airfields within 130 miles of the proposed assault beaches were targets for smashing blows, and the eve of invasion saw intensified attacks on enemy transportation facilities and against Nazi defenses along the proposed invasion coast.



Vital Nazi industries in Hamburg area are plastered during tremendous bomber offensive in months preceding Normandy landings.



Combined bomber offensive plan, issued in June 1943, substituted aircraft industry for submarine installations as priority target.



Symbol of the concentrated drive to knock out the Luftwaffe, these bombs plummet to the heart of Wiener-Neustadt factory for manu-

facturing Me-109's. Peak of the drive came late in February 1944. Encounters with P-47 and P-51 escort also took toll of Luftwaffe.



C-47's of a Twelfth Air Force troop carrier division repeat the airborne tactics used over Normandy on D-day to unload these para-

chutes with men and supplies during August 1944 invasion of southern France. Scene of action is a point between Nice and Marseilles.

The Weather

Today—For the weather, see page 1.
This, too, is a detail on page 1.

The Washington Post

Single Copy Price
5c

NO. 24,827

Printed at World City Bldg.,
Washington, D. C.

Copyright 1944
By The Washington Post

WASHINGTON, TUESDAY, JUNE 6, 1944

FIVE CENTS

CANADA: MAILING
POST AND FREIGHT ... 10c per copy
Retail Price, 10c per copy. — See page 1 for details.

WHOLE COPY PRICE
5c

ALLIES LAND IN FRANCE, WIPE OUT BIG AIR BASES

Allies Chase
Returned

1st Atlantic Flattop Loss
U. S. Escort Carrier Is Sank;

Roosevelt
Sees Costly

Bulletin
London, June 6 (Tuesday) (AP).—An

Nazis Admit First
Blow Success as

AIR POWER AND THE NORMANDY LANDINGS

June 6, 1944 sees greatest coordinated attack in history

Dawn of D-day found air power ready to play a partner's role in the greatest air-ground-sea effort of World War II. The Allied air forces, based in England, supplied air cover, isolated the battlefield by attacking enemy rail and road communications, and waged air war in the battle area in cooperation with the ground advance. Some 13,000 sorties, more than 8,000 by U. S. aircraft, assured the landings and checked defending counterblows by the already weakened Nazi air arm.

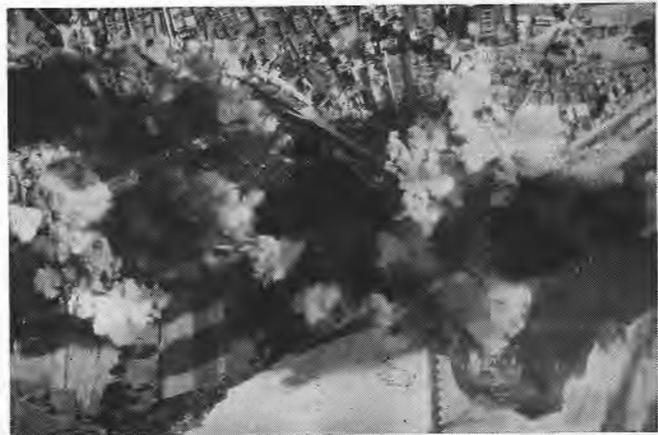
In the war's most elaborately coordinated use of air power the AAF employed its resources to the full. More than 2,500 heavy bombers of the Eighth Air Force crossed the Channel on tactical rather than strategic missions. Climaxing earlier blows on airfields and transportation, the Eighth now concentrated its entire attention upon coastal batteries and road choke-points to

prepare for the invasion assault and isolate the battlefield. Its own escorting fighters combated enemy aircraft wherever found and bombed and strafed ground targets.

The Ninth Air Force flew 4,371 sorties as a tactical air force. Its mediums hit coastal batteries, paved the way for the assault on the westernmost beach, and continued their attacks on communications behind enemy lines. Its Troop Carrier Command dropped two airborne divisions on the Cherbourg peninsula to assist the Army's movement inland. Fighters of the Eighth and Ninth protected the crowded shipping lanes and together with the RAF maintained complete air supremacy over the landing beaches. Fighter-bombers of the Ninth joined in the battle area attack, and its engineers, moving ashore with the assault, had an emergency landing strip operational before D-day ended.



A-20's of Ninth Air Force head for home bases in England after plastering enemy targets in operations contributing to D-day success.



Eighth AF heavies blast Mont Jean bridge in northern France. Communications were major targets during the invasion period.



IX TAC, cooperating with First Army invasion, moves into speedily constructed landing fields while area is still under Nazi fire.



Quickly laid steel-mesh landing strip is finished in time for arrival of one of many C-47's supplying invasion march through France.



Refueled and rearmed, 9th Air Force P-47's take off from a French strip for second mission before returning to their bases in Britain.



B-17's in post-invasion strike on Merckweiler, Germany.

INVASION FOLLOW-THROUGH

It shows air force versatility

Post D-day activities, culminating in the unconditional surrender of all land, sea, and air forces of the Reich on May 7, 1945, continued to prove the versatility of the air weapon and its importance to victory.

Following D-day, the Ninth Air Force enlarged its program of interdiction, sealing off the battlefield in the Loire-Seine triangle and participating in operations leading to the capture of Cherbourg, St. Malo, and Brest. "Carpet bombing," primarily by the Eighth, broke the stubborn shell of German resistance to permit the St. Lo break-through, July 25, 1944. In this operation more than 1,500 aircraft saturated an area 7,000 by 250 yards with 3,400 tons of heavy explosives.

As the First Army widened the gap, the protective umbrella of IX TAC fighter-bombers restricted the enemy to movement by night. In the Third Army's dash to Paris in August, XIX TAC covered its exposed flank in what General Patton called "the best example of the combined use of air and ground troops" he had ever seen. In mid-September, 2,800 planes and 1,600 gliders landed General Brereton's First Allied Airborne Army in Holland; and as General Eisenhower moved



The strategic bombing program continued after D-day.

by late autumn of 1944 against the Siegfried Line and through the Hurtgen Forest, tactical air operations continued to implement the force of Allied arms.

Meanwhile the strategic program of General Spaatz' air armies was crippling Germany's transport system and driving its already dislocated industry underground. Heavies of the Eighth continued to rain tons of explosives on German factories, arsenals, oil refineries, and the launching sites of pilotless aircraft. Triangular shuttle-bombing runs, begun in June between bases in Britain, the U.S.S.R., and Italy, extended Allied striking power. Bombardment units of General Eaker's MAAF softened and isolated southern France for airborne and amphibious assault on August 15, 1944; and during the fall and winter months the strategic and tactical operations of Italy-based aircraft gave the Allies what General Marshall called "our margin of advantage" in the almost equally matched war in Italy. Attacks by the Twelfth and Fifteenth Air Forces on Po River bridges and on the more distant Brenner Pass rail route denied supplies to the entrenched enemy. Flights to the Balkans carried aid to Yugoslav patriots; and missions, carefully coordinated with strategic operations from Britain, hurled weekly bomb loads averaging nearly 4,000 tons on oil and rail targets in Austria and southern Germany. This pressure continued until the capitulation of the Germans in Italy on May 2, 1945.



Formation of P-51 Mustangs over France. These deadly fighter-bombers helped clear skies of threat to Allied invasion of Continent.

FROM THE ARDENNES TO THE RHINE

Air arm helps check Bulge threat, aids Rhine crossing

On December 16, 1944, von Rundstedt's armor smashed westward through the Ardennes, launching the last real threat to the liberation of Fortress Europe. The air arm rallied to the defense, flyers of the Eighth crippling enemy strongpoints within the Nazi Bulge, the TAC's of the Ninth aiding a tenacious infantry at Bastogne and St. Vith. Mediums and heavies struck the enemy's rear, retarding the flow of badly needed reserves and supplies. By the end of January the Bulge had been wiped out. On one single day air attack damaged more than 4,000 pieces of heavy equipment; and the Nazi retreat attested the impossibility of victory on the ground without superiority in the air.

With the Ardennes again in Allied hands, the ground forces took up their delayed march toward the Rhine. To prepare for the Ninth Army's assault across the swollen Roer, the entire transportation network of the Reich was subjected to aerial attack. In operation CLARION on February 22, strikes from more than 10,000 Allied planes hastened the paralysis of Germany's already weak rail system, thus bringing large-scale mobility of its armies to an end.

With the impending envelopment of the Ruhr, air power was next applied to quarantining this battle area as it had the Normandy beachhead in 1944. Spearheaded by planes of the Ninth Air Force, the air forces established a line of interdiction from Bremen through Marburg to Coblenz and by March 24 had made impassable nearly all the bridges along this line.

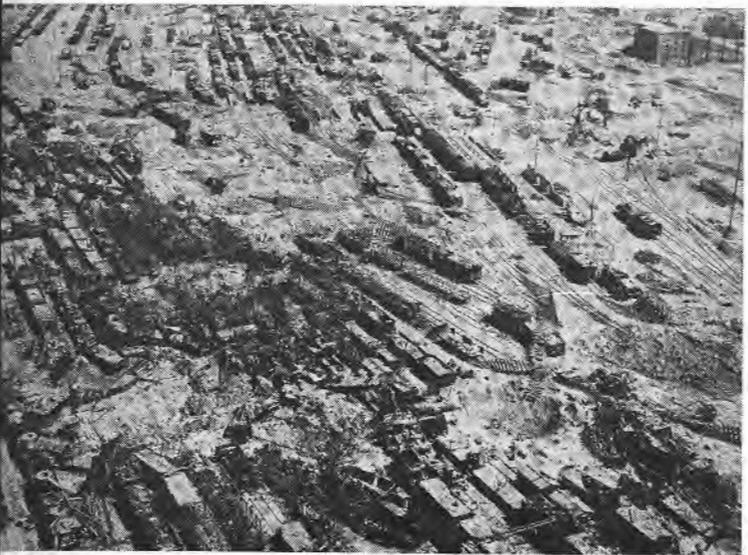
Eighth Air Force Liberators stream across Rhine River to



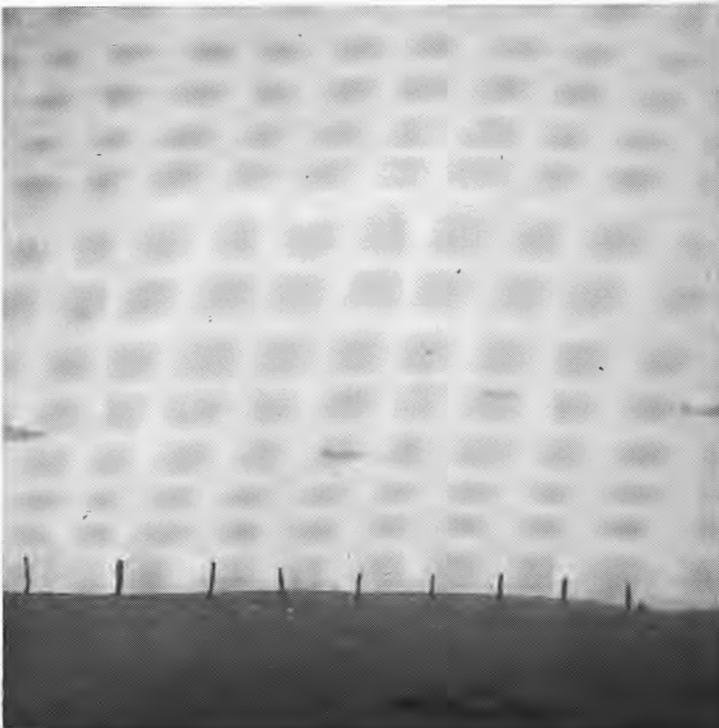
Driving snow did not ground this Mustang, taking off to hit back at von Rundstedt's threatening, but hopeless, offensive in Ardennes.



Engine and 300-foot span over the Moselle River fall to Allied tactical air superiority, decisive factor in winning "Battle of Bulge."



Eighth Air Force devastation of these marshalling yards at Ulm dislocated supply and brought failure of Nazi counteroffensive.





The greatest airborne invasion of the war assisted the Allied armies as they lunged across the Rhine to deliver the Nazi war machine its knockout blow. On March 24 a giant armada of 3,000 aircraft and gliders lifted the First Allied Airborne Army from airfields in France and Britain and landed it on the east bank of the Rhine, north and east of the air-devastated city of Wesel. Ground troops, moving since the night of the 23d, soon established contact with the airborne forces, and within a week the bridgehead had been extended 25 miles into the heart of Germany.

Allied air power had already softened the invasion area. In the week ending March 22, U.S. aircraft alone made more than 22,000 bomber attacks and nearly 30,000 fighter sorties against European targets. On March 24, 7,000 sorties struck the area bounded by the Bremen-Coblenz interdiction line. Fighter-bombers hit enemy flak positions and flew armed reconnaissance against Nazi communications. Italy-based heavy bombers of the Fifteenth Air Force drew off German fighters in a diversionary raid on central Germany. The highly successful landings of men, ammunition, and supplies by the IX Troop Carrier Command were followed on invasion day by the dropping of 582 tons of supplies and equipment from Liberators of the Eighth Air Force.

supply Allied airborne armies on day of the Rhine crossing.



Twisted railroad tracks in foreground and pock-marked terrain show aerial preparation of Wesel, focal point for Rhine crossing.



An innovation in the Rhine crossing was the double-tow glider formation, employed here by 17th Airborne Division over drop area.



These glider troops waste no time getting ready to meet the enemy at Wesel. 40,000 of them took part in largest airborne invasion.



Flexibility of air operations hastened the last phase of the war in Europe. The May 7, 1945 surrender brought admission from key

Nazis that Allied air domination was root of their disaster, that constant fear of bombardment had speeded final collapse of Reich.



Fighters and fighter-bombers of 9th Air Force spearheaded advance of U.S. ground forces. This P-51 has landed at damaged Nazi base.

VICTORY IN EUROPE

Allied air power decisive in surrender of Reich

Once the Rhine barrier had been breached, the windup was swift. As the Allies encircled the Ruhr pocket and raced toward the April 25 junction with the Red Army, their advance was implemented by air-ground cooperation of the highest order. Allied columns were protected by a tactical air cover which the Luftwaffe could not penetrate. Aerial resupply sustained the breakneck speed of the offensive as C-47's of the Troop Carrier Command delivered gasoline, ammunition, and rations at the most forward airstrips. The evacuation of casualties by plane reduced the interference of ambulances with the forward advance.

By mid-April, resistance had vanished in the Ruhr pocket, its transportation system a shambles and its main industrial and railroad centers in ruins. On the 16th, General Spaatz announced the end of the strategic air war. April 7 had witnessed the last stand of the Luftwaffe—a suicide ramming mission; and in the ensuing fortnight came the end of the German air force. By April 20, 55 per cent of Germany's airfields had been captured and their fuelless aircraft demolished. Taking a two weeks' toll of 3,484 Nazi planes in the air and on the ground, tactical air power finished the destruction of the Luftwaffe which strategic



15th Air Force bombers quieted threat of these jet Me-262's, most modern plane in general operation at close of war in Europe.

attacks on fuel and factories had begun.

A vanquished Luftwaffe was only one of many achievements of Allied air activity in a war distinguished by the decisive role of the air arm. From the moment the United States entered the struggle, the AAF implemented the strategic plan for victory. Deployed in such a fashion as to pave the way for and facilitate a land invasion, the air team delivered blows of ever increasing might and accuracy on the Axis war machine. By V-E Day, the AAF had dropped about a million and a half tons of bombs in the European war, in sharp contrast with the 137 tons dropped by American squadrons in World War I.

Coordinated in round-the-clock bombing with the RAF and ultimately employing bases in the U.S.S.R., the air activity of the AAF reflected the changing strategy of the war. Strategic bombardment struck successively against the submarine menace, aircraft production and related industries, and, after D-day especially, oil. It piled further damage on industrial cities already reduced to rubble by the area bombing of the RAF. Most specifically effective was the demoralizing air attack on transportation, a program that reduced production, barred men and supplies from battle areas, and completed the total breakdown of the Nazi war economy. After D-day, the AAF became the partner of the ground forces, providing aerial cover, reconnaissance, transport, evacuation, and supply, and contributing to the air domination which speeded the unconditional surrender of the German nation on May 7, 1945.



Air attack contributed to campaign against the undersea menace, in precision bombing of modern submarines on ways at Bremen.



Bombardment of German assembly plants as well as rail lines kept vital equipment from reaching front. Eighth Air Force wrecked this tank assembly (above). Dornier-335's knocked out at source (below).





Powerful engines of a Superfort and formation of P-51 Mustangs, equipped with droppable fuel tanks for long-distance escort, sym-

bolize aerial might that was visited upon the Japanese homeland as Allied forces moved in for final showdown of 45-month Pacific war.

THE ROAD BACK

Air attack implements amphibious advance to Philippines

By autumn of 1944 the net was beginning to close in on Japan's ill-won empire. In two years of island-hopping tactics the Allies had edged their way back toward the Philippines; by mid-1944 they stood within potential aerial striking distance of the Japanese homeland. Priorities afforded the European war still handicapped operations in the Pacific, but the pattern of triphibious assault, uniting land- and carrier-based aviation, ground action, and sea warfare, had been clearly marked out. In such operations air had a three-fold responsibility: 1) to soften the proposed invasion point; 2) interdict the battle area by neutralizing bases of potential supply; and 3) cooperate with the landing force. In August 1944 Lt. Gen. M. F. Harmon took command of all AAF activity in the Pacific Ocean Areas.

Forecast of America's return to the Philippines came in the midsummer raids of the Fifth Air Force on Halmahera, where the Japs were feverishly husbanding aerial strength for the defense of Mindanao. On September 1, 60 Liberators struck Davao in force—for the first time since 1942. On the 15th came the Allied invasion of the Palau Islands and of Morotai, inner sentinels of Japan's stolen realm. From the Palaus the Seventh Air Force could pound the central Philippines; while the Fifth and Thirteenth, striking Mindanao, Halmahera, and the Celebes, seconded carrier-based assault on the invasion area and checked enemy threats against the flank and supply line of the coming amphibious landings on Leyte. China-based B-29's attacked Formosa in support of the invasion scheme.

The first steps in the liberation of the Philippines came sooner than many expected. Abandoning plans for three intermediary landings, the Allies moved in



Generals O'Donnell, Harmon, and Hansell plan 20th Air Force operations. Harmon was lost on a Pacific flight in February 1945.

on October 20, 1944, their naval armada protected by planes from 18 escort carriers and by Halsey's carrier task force standing out to sea. Soon the V Fighter Command was operating from muddy Tacloban Field in northern Leyte. The Japs, committing their fleet to the defense, precipitated one of the decisive sea battles of history; and by the end of November the U.S. Third and Seventh Fleets had virtually canceled Japan's pretensions to naval power. At first the Japs succeeded in reinforcing their besieged garrisons by sea, but by mid-December Kenney's land-based aircraft and Halsey's carrier planes had stopped the flow. Fighters of the Fifth and B-25's in masthead attacks riddled entire Jap convoys in Ormoc Bay; the mid-December occupation of Mindoro provided its heavies with bases on Philippine soil. From these and bases in the south, the Fifth joined the Thirteenth, established on Morotai, in reducing what remained of Jap air strength in the Philippines. The stage was now set for the long-awaited return to Clark Field and the "Rock."



Air Apaches B-25, its snout gleaming with war paint, swoops down on Jap destroyer. 345th Bomb Group was skilled at low-level attack.



Jap destroyer escort under attack by B-25's of V Bomber Command. Air attack on convoys halted Jap reinforcement of Philippines.



American fighters and transports lined up on Iwo Jima, springboard for fighter escort of B-29's after March 1945.



Smoking shell of Clark Field after December 1944 attacks by fighter-escorted heavies and low-flying A-20's and B-25's of Fifth Air Force.



Wrecked aircraft in hangars after bombers of Fifth Air Force returned in December and January to avenge Jap theft of Clark Field.

CLOSING IN ON JAPAN

Air arm helps penetrate Japan's inner defenses

Command of the air was a decisive factor in wresting the Philippines from Jap control. Operating from airfields quickly constructed on Mindoro, Leyte, and Samar, the Fifth Air Force softened Luzon and Corregidor for invasion, destroying the enemy's aircraft and pulverizing his repair shops and storage depots. Dummies, dropped from planes as MacArthur landed in Lingayen Gulf during the first week in January 1945, simulated paratroop landings and confused Yamashita's defense; and actual airborne assault helped overcome resistance in the Manila area by February 23. Meanwhile, General Kenney's airmen were raining destruction on Corregidor, unloading more than 3,000 tons of bombs in less than a month. On February 16 an aerial armada of C-47's, carrying the 503d Parachute Regiment, heralded amphibious landings which by early March had returned the "Rock" to American hands. Throughout the campaign the Fifth Air Force flew hundreds of ground-cooperation sorties, blanketed enemy hiding places with jellied fire, and blockaded supply. Blows from the Thirteenth canceled out the Netherlands East Indies as a Jap staging area. By the end of June the Philippines were virtually liberated.

The activities of land-based aircraft in the Philippines freed the carrier craft for operations that were to win Allied bases even nearer the Jap homeland. Iwo Jima, vital to the enemy for warning and interception against B-29 assaults on the home islands, was softened by bombardment and invaded on February 19.

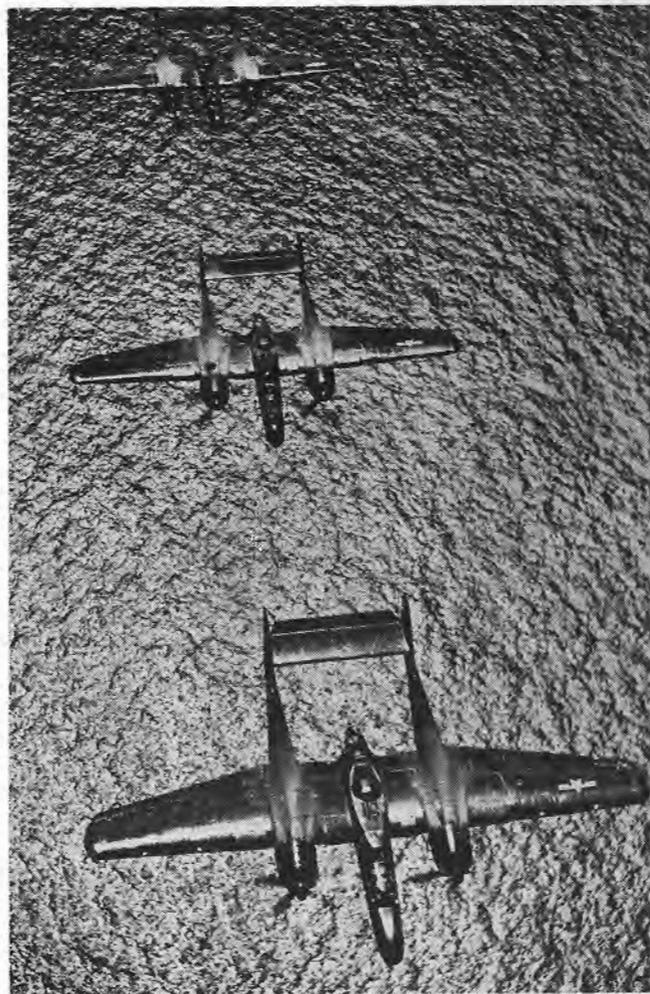


A few of these B-32 Dominators, Consolidated's very heavy bomber, saw action with Kenney's FEAF before war's end.

Its conquest brought the Allies within 775 miles of Honshu and provided them with both a staging base for Mustang escort and a refuge for battle-damaged Superforts unable to return to the Marianas.

The April attack on Okinawa, in the Ryukyus, saw the best-coordinated air effort of the Pacific war to that date. Carrier strikes in advance of D-day pounded Kyushu, Formosa, and Okinawa itself. As the grim campaign progressed, Formosa, potential base of supply and reinforcement, was struck by the XX Bomber Command from China and by heavies and mediums of the Fifth Air Force from the Philippines. Airfields in Kyushu were targets for P-51's from Iwo and Marianas-based B-29's of the XXI Bomber Command. The Fourteenth Air Force neutralized Jap airfields on the China coast. To counter the desperate enemy's Kamikaze squadrons, the AAF struck at the bases of the rocket-accelerated suicide craft. June 21, 1945 saw the end of organized resistance on Okinawa; but even before that date construction had begun on the bases there that were to house the invasion air force; and coordinated air attacks by the Fifth and Seventh Air Forces were riddling important targets in Japan itself.

Meanwhile the air arm was of vital use in halting Jap advances on the continent of Asia. In India, Allied air superiority prevented interference with air transport from Assam to China; and in the campaign that led to the May 1945 capture of Rangoon, large ground units were transported and supplied by air. In China, the activities of the Fourteenth Air Force kept the Japs from capitalizing on their inevitable ground superiority. Chennault's flyers protected Hump traffic, defended B-29 bases, cooperated with China's hard pressed armies, and impeded Jap movements by attacking rail lines, airfields, supply depots, troops, and river craft.



These P-61 Black Widow night fighters defended Iwo Jima, Bonin Islands haven for crippled B-29's from early March 1945 to V-J Day.

"All the News
That's Fit to Print"

The New York Times

CITY EDITION

Printed at the Times Building, 485
N. York Ave., New York 17, N. Y.
Copyright, 1945, by The New York Times Company.
Published daily, except on Sundays and public holidays.
Subscription price—\$12.00 per year in advance.
Single copy price—15¢.

Vol. 64, No. 152

Printed at the Times Building, 485
N. York Ave., New York 17, N. Y.

NEW YORK, TUESDAY, AUGUST 7, 1945.

THREE CENTS

FIRST ATOMIC BOMB DROPPED ON JAPAN; MISSILE IS EQUAL TO 20,000 TONS OF TNT; TRUMAN WARNS FOE OF A 'RAIN OF RUIN'

HIRAM W. JOHNSON, REPUBLICAN DEAN IN THE SENATE, DIES

Isolationist Helped Prevent U. S. Entry Into League—Opposed World Charter

CALIFORNIA EX-GOVERNOR

Ran for Vice President With Theodore Roosevelt in '12—In Washington Since '17

WASHINGTON, Aug. 6—Sen. Hiram Warren Johnson, of those battles was too valuable in California. He had served as a member of the Senate since 1917.

Jet Plane Explosion Kills Major Bong, Top U. S. Ace

Flier Who Downed 40 Japanese Craft, Sent Home to Be 'Safe,' Was Flying New 'Shooting Star' as a Test Pilot

By the Staff Writer
BURBANK, Calif., Aug. 6—(AP)—Richard Bong, America's greatest jet pilot, died today in the flaming wreckage of a jet-powered fighter plane which crashed while he was flying it.
Only 25 years old, he was decorated with the nation's highest award, the Congressional Medal of Honor. He had received countless air battle and shoot-downs of Japanese planes without a scratch.
The knowledge he gained in those battles was too valuable to be lost. He was on that "safe" home when the P-51 he was flying crashed over a field.

KYUSHU CITY RAZED

Kenney's Planes Blast Tarunaku in Record Blow From Okinawa

ROCKET SITE IS SEEN

B-29's Set Vast Fires in Four Target Areas in Devastating of Japan

By FRANK L. KEEFE
MANTLA, Tuesday, Aug. 7—More than 400 fighters and bombers rained down on the area for two hours Sunday over Tarunaku.

REPORT BY BRITAIN

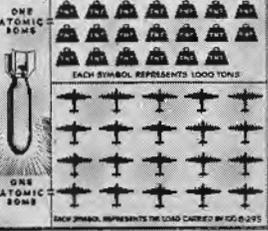
Churchill Says We Beat Nazis to Bomb 'by God's Mercy'

FOE'S SHOPS RAIDED

Commandos Destroyed Norway Laboratory—Missile Called Vital

The test of Mr. Churchill's statement is in page 5.
By CLYDE DANIEL
LONDON

THE BLASTING POWER OF THE NEW BOMB



NEW AGE USHERED

Day of Atomic Energy Hailed by President, Revealing Weapon

HIROSHIMA IS TARGET

'Impenetrable' Cloud of Dust Hides City After Single Bomb Strikes

From editorial statements in atomic bomb, page 4.
SIDNEY HALETT
The New York Times

Air war monopolized headlines as the newspapers reported devastation of Hiroshima by history-making atomic bomb.



Smoke belches above Nagasaki after second use of atomic bomb had pulverized more than 40% of its built-up area in August 9 attack.

PACIFIC SHOWDOWN Superbomber assaults speed victory without invasion.

B-29 strikes on the Jap homeland played a vital part in bringing victory without invasion in the Pacific war. By V-J Day the Marianas-based giants had flown a total of nearly 90 million miles to and from Japan to rain more than 150,000 tons of bombs and mines on enemy targets—an average of more than a thousand tons daily in the last three months of the war. By the war's end more than 175 square miles of urban Japan were in ruins, the industrial productivity of nearly 60 of her cities virtually destroyed.

Victory in Europe accelerated the air campaign. By mid-July Doolittle's Eighth Air Force, redeployed from Europe, and the Twentieth, under General Twining formerly of the Fifteenth, had been combined as a strategic force for the Pacific under command of General Spaatz, veteran strategist of the air war in Europe. Over-all strategic control of the Superfortress fleet remained with the Joint Chiefs of Staff, General Arnold acting as agent for the Army Air Forces.

During July the B-29 raids grew in frequency and magnitude, and bomb loads increased from 2.6 tons in November 1944 to 7.4 tons in July 1945. An early concentration on the five principal industrial cities gutted whole sections of Tokyo, Nagoya, Osaka, Kobe, and Yokohama; but in time more than 60 other cities were from 20 to 80 per cent destroyed. In late June,



The explosive force of the August 6th atomic bomb on Hiroshima equaled that of maximum bomb load of 2,000 B-29's.

the targets became more specific, with especial attention to the production of aircraft and synthetic oil. Mines, released by radar at night, bolstered the blockade that was strangling the enemy's war economy and hindering his ability to supply outlying battle zones. On August 1 came the heaviest raid of the war when more than 800 of the giant bombers hurled 6,000 tons of fire and demolition bombs into the heart of industrial Japan. Mustangs from Iwo Jima not only escorted the B-29's but also scoured the Tokyo area, strafing powerhouses, radio stations, and airfields; while General Kenney's Far East Air Forces, based on Okinawa since late July, cooperated with the strategic assault in tactical strikes on ships, docks, and warehouses. In the face of mounting blows, the Jap air force rarely offered more than token resistance.

The Japanese moved swiftly along the road to unconditional surrender during the first weeks of August. Already the shadow of invasion loomed over Japan, as Jap cities came under the fire of Nimitz' warships and MacArthur's men moved into staging bases for a three-pronged landing on Kyushu scheduled for autumn 1945. On August 6 (Tokyo time) the Japs, already battered almost to the point of giving in, felt the ultimate in aerial assault. An atomic bomb, carried by the B-29 *Enola Gay*, blew three-fifths of Hiroshima off the face of the earth. On August 8 (Moscow time) the U.S.S.R. declared war, and on the 9th the Red Army was driving into Manchuria. The same day a second atomic bomb raised the smoking ruins of Nagasaki 50,000 feet into the air. On August 14 Japan's unconditional surrender brought World War II to an end.



(Above) Enola Gay settles into parking space after historic flight over Hiroshima. (Below) General Spaatz and others "sweat out" return of atomic-bombing B-29 at Marianas Superfortress base.





Scores of C-54's crowd hardstands at Okinawa in readiness to carry history's first airborne occupation army into conquered Japan.



V-J SURRENDER

Aerial armada brings Allied conquerors to Japan

On the morning of August 28, AAF transports rolling onto Atsugi airfield outside Tokyo heralded the airborne occupation of vanquished Japan. Fifth Air Force technicians set to work preparing the airdrome, and two days later streams of C-54's landed the 11th Airborne Division, vanguard of MacArthur's occupation force. By nightfall 2,000 men had been brought in, to be followed on Z plus one by another 4,000 men and nearly two million pounds of equipment. During the September 2 surrender ceremony on the U.S.S. *Missouri*, 400 Superforts—symbol of airpower's long-range strategic assault—roared overhead.

Command of the air had proved a decisive factor in the Pacific war. During three years of island-hopping from Guadalcanal to Okinawa, air attack was both prelude to and partner of landed invasion. From bases ever closer to the home islands, aerial blows softened successive invasion spots, neutralized still other Jap strongpoints, assailed enemy shipping, and decimated the Jap air force, thus permitting the Navy and its carrier-based air arm to strike effectively at enemy installations. Once within range of the enemy homeland, the Superforts unleashed their strategic assault on Jap industry and finally delivered the atomic bomb. Always essential to amphibious success along the road to Tokyo, control of the air ultimately played a vital part in making unnecessary the land invasion of Japan itself.

Actually, many forces brought the fall of Japan's ill-won empire—the progressive loss of island resources vital to her war machine, the defeat of her Axis partner



Blood plasma was administered to this wounded American airman both before plane landed and during transfer to an ambulance.



Wounded in bomb run on Brunswick, Germany, this flyer left his plane unassisted but was ordered to stretcher by flight surgeon.



Flight surgeon gives emergency treatment to victim of crash-landed B-24 before wounded flyer is rushed to near-by hospital.

THE PRICE OF VICTORY

AAF had its share of war casualties

America's enthusiasm over victory was tempered by an awareness of the human cost of war. Between Pearl Harbor and V-J Day the AAF suffered more than 120,000 overseas casualties, nearly 90 per cent of them in combat. Of the total, some 40,000 died, 18,000 were wounded and evacuated, and 63,000 were interned, captured, or missing. Enlisted men made up approximately 59 per cent of the total. More than 57,000 of the casualties returned to duty.

For the return of these men to service and the fact that the total casualties were not considerably higher, much credit was due the wise precautions of the AAF. Since June 1943 the School of Air Evacuation at Bowman Field, Kentucky, had taught flight surgeons, nurses, and enlisted men skillful ways of transporting wounded aviators to hospitals behind the lines. Carefully prepared manuals and kits helped the stranded flyer to cope with problems of food, health, shelter, and transportation in arctic, desert, and jungle climates. The Emergency Rescue Training program assured the flyer that if he were forced down on land or sea spe-

This flaming Douglas A-20 was caught by enemy flak and



cially trained squadrons would be sent to rescue him.

Air casualties in the United States were held to a minimum in spite of efforts to provide realistic preparation for combat. AAF training authorities early determined to subject operational training units to every possible weather, navigational, and combat hazard they might be expected to encounter overseas, as well as to expose them to the dangers inherent in learning to fly speedy combat aircraft. Thanks in large part to the activities of the Office of Flying Safety, wartime air fatalities were held to less than 15,000 within the United States. The ratio of training fatalities to pilots graduated from advanced training was slightly less than 1 to 100 during the war years, with great improvement in the later months.

Figures compiled after V-J Day show that AAF plane losses for the entire war totaled about 65,200. Aircraft lost overseas numbered about 43,600, of which some 22,900 were destroyed on combat missions and about 20,700 from other causes. Of the combat losses, about 8,300 were lost in the presence of enemy planes. AAF flyers claimed the destruction of nearly 28,000 enemy planes in the air, a ratio of 3.4 to 1 in favor of the AAF. In the continental United States plane losses totaled about 21,600. Of these, about 37 per cent were retired because they were obsolete or worn out; the others were wrecked, half in fatal accidents.

downed during surprise low-level attack on Nazi target.



The left wing of this B-26 was shot off by 88-mm. flak shell. Pilot applied full right aileron, but plane plunged a moment later.



Two men were able to bail out of this burning 15th Air Force B-24 which crashed after flak explosion had crumpled one wing.



Flak sent this B-29 hurtling down in flames over Japan. But less than 350 of the hardy giants were lost in Pacific combat missions.



The Consolidated Vultee B-36 Bomber completely dwarfs all veterans of World War II. This titan has a 230-foot wingspan

“... to keep a lasting peace . . . is the true mission of our air power.”

—ARNOLD

“We have one real defense: a planned and ready air offensive.”

—SPAATZ

Victory in World War II closed a chapter in the story of military aeronautics in the United States. Axis surrender coincided with the approaching end of an age of military flight based on the kind of aircraft which first succeeded at Kitty Hawk—planes with wings,

a tail, and a propeller-driven engine—and on tactical patterns tried in World War I and carried to furious accomplishment in World War II. On January 26, 1946, a jet-propelled P-80 spanned the American continent at an average speed of 584 miles an hour; and already foreshadowed was an age of propellerless, pilotless, and all-wing planes, guided by electronic devices of infallible accuracy and carrying super-explosives of devastating might. The Pearl Harbors of the future were sure to come with ever more obliterating suddenness from the skies.

The AAF faced the atomic age proposing to defend the United States with an air-force-in-being, 400,000 strong, ready to counter or forestall threats from whatever far-flung quarter they might come. A March 1946 announcement revealed the postwar organization. Three major combat commands (Strategic, Tactical,

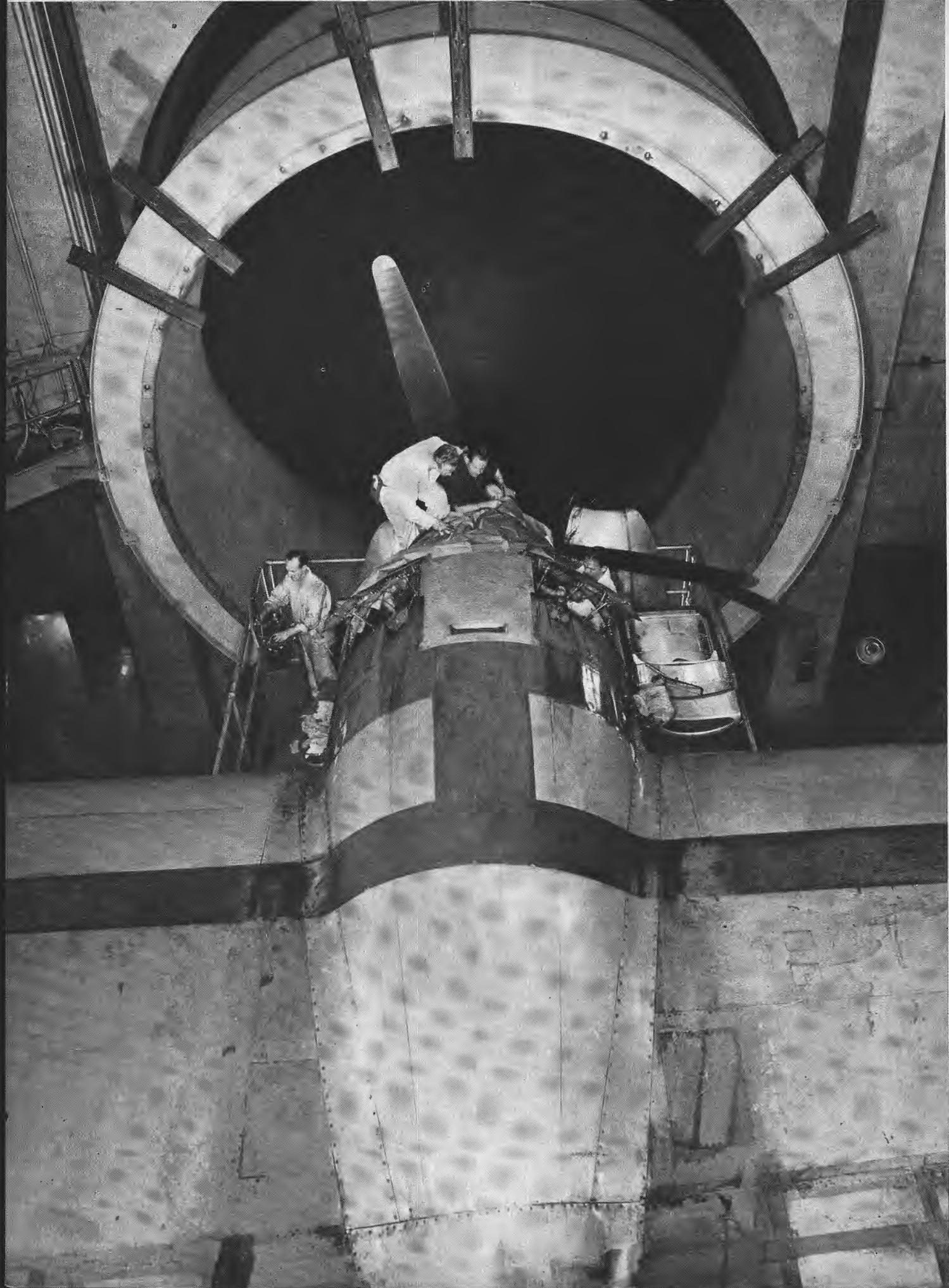


and is powered by six Pratt and Whitney pusher-type engines which develop 18,000 h.p. Its bomb capacity exceeds 30 tons.

and Air Defense) were to be supplemented by an Air Reserve and five supporting agencies: the materiel, training, air transport, and proving ground commands, and an air university. Seventy groups of airmen with 17,000 first-line and reserve aircraft would constitute the peacetime aerial team. According to General Spaatz, who became Commanding General, AAF, on March 1, 1946, America's "best insurance" was "an adequate, alert air force," equal in status with the ground and naval services of the nation.

When General Arnold was relieved, the direction of America's air arm passed from a man who in his own lifetime had seen the evolution of military aeronautics from shaky box-kite to Superfortress and who, more than any other one person, both represented and was responsible for America's aerial might. Yet his successor marked no break with the traditions of American air

power. For like Arnold, Spaatz had grown up with American aviation. He was a veteran of the Aviation Section, Signal Corps, the Air Service of World War I, and the experimental flights of Air Corps days. As one of the AAF's top men in World War II, he had demonstrated the potentialities of strategic bombardment in both the European and Pacific theaters of war. Under his leadership the postwar air force promised to pursue the same vigorous and forward-looking course his illustrious predecessor had set, persisting in aeronautical experimentation and research, encouraging the development of a dependable industrial "know-how," fostering the growth of an air-minded public opinion, and cooperating with the other branches of the armed services in such a way as to maintain an air arm "in offensive readiness," as General Arnold has said, "to perpetuate peace—to provide for national security."



Industrial and scientific "know how" makes U.S. air power possible

Vital to the achievement of air power in World War II was the production of planes that could match and surpass the best the enemy had to offer. On America's mechanical genius and industrial ingenuity, frequently under the Army's guidance, depended the quantity and quality of these weapons that made AAF history in World War II. The evolution of the airplane is the story of one of the twentieth century's most rapidly developing industries. The founding of the Wright, Curtiss, and Martin companies in 1908-09 laid the basis of an infant industry that World War I forced into productive capacity. Postwar expansion was stimulated by competition for Government contracts, foreign orders, and the demands of an era just awakening to the possibilities of commercial aviation.

Between 1918 and the middle thirties the Boeing Aircraft Company, which stemmed from a small plant incorporated in 1916, produced a variety of aircraft including flying boats, trainers, the P-26, and commercial models. Creators of the World Cruisers, the Douglas Aircraft Company, founded in 1921, filled Government and foreign contracts and in 1933 delivered the successful DC-1, prototype of their famous transport series. Consolidated, organized in 1923 (later to become Consolidated Vultee Aircraft Corporation), supplemented its output of flying boats with trainers.

The Curtiss-Wright Company, resulting in 1929 from a merger of Wright Aeronautical and the Curtiss Airplane and Motor Company, made Hawk-type fighters from the early twenties and introduced a prototype of the C-46 in 1936. In 1933 the Martin Company, which had built America's first twin-engine bomber in 1918, introduced the superior B-10; and three years later North American Aviation put into production the BT-9, a forerunner of the AT-6, after winning the Air Corps competition for a combat trainer.

By the later thirties war talk was in the news, and aircraft engineers found an immediate outlet for their inventive genius. In 1935 Boeing brought out the first

B-17, developing quantity production before Pearl Harbor; and Curtiss-Wright offered the Army a new pursuit from which emerged the P-36 and P-40 series. In 1936 Douglas began work on what was to be the C-54. North American's experiments with a twin-engine craft emerged as the Mitchell, and Martin's as the swift Marauder. The Seversky Aircraft Corporation, later Republic, found a market for the P-35 both at home and abroad. Lockheed's P-38 and Bell Aircraft's P-39 were first flown in 1939; Fairchild's PT-19 and Ryan Aeronautical's PT-22 met the expanding need for trainers; and by December 1939 Consolidated had test-flown its first experimental B-24 Liberator.

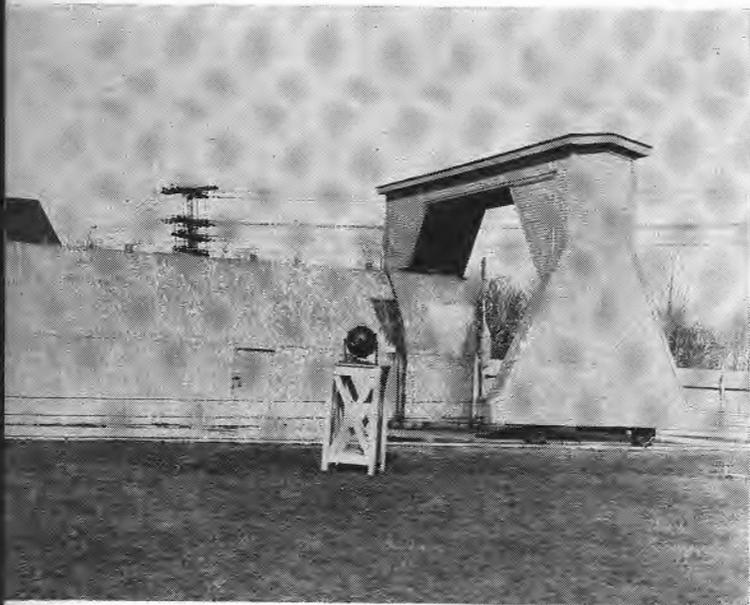
With the forties came accelerated production needed to supply the ever-demanding war machine. Continued experimentation brought ever-better performance. The design of Boeing's Superfortress was initiated in 1940; and Northrop Aircraft, organized in 1939, was planning the powerful Black Widow night fighter. Douglas improved upon its A-20 with the A-26; Republic stepped up the P-35 to produce the P-43 and P-47; and Bell's jet-propelled fighter was announced in January 1944. A year later Boeing's C-97 flew the continent at an average speed of 383 m.p.h.

Miracles of production went hand in hand with experimentation. Plant expansion and labor mobilization were symbols of the all-out effort. Production at Douglas increased 2,700 per cent between 1939 and 1944; early in the latter year Boeing's Plant 2 was turning out nearly a Flying Fortress an hour. Curtiss-Wright's Airplane Division completed its 15,000th fighter in 1944 and closed the year with 180,000 workers as compared to 8,500 in 1939. Answer to expanding demands was the production pool. Ford Motor, Douglas, and North American agreed to manufacture B-24's; and Douglas and Lockheed entered into an agreement to produce B-17's. Superfortress production was the result of one of the widest pools ever devised in America. In 1945 Boeing, Martin, and Bell plants were turning out completed B-29's, while subassemblies and other supplies were produced by Chrysler Corporation, General Motors, Goodyear, and a number of other firms.

Vast research facilities are required to develop air power. Wright Field technicians prepare engine nacelle of new transport before testing assembly in 450-m.p.h. windstream of 20-foot wind tunnel.



Aerial "circus" at McCook, Army center for aircraft engineering and research, 1917-26. The field was too small and too near Dayton.



Propeller test rig at McCook, though improvement over original Westinghouse, was much simpler than present one on opposite page.

This is the sandbag wing-load test as administered by the old Engineering Division at McCook Field in early twenties.



WRIGHT FIELD

Air Technical Service Command runs "world's biggest business"

The Air Technical Service Command became the chief AAF agency for coordinating the development, production, and distribution of the materials on which air power was to depend. By 1945 nearly 325,000 persons performed the many functions by which this vast organization—"the biggest business in the world"—underwrote the material basis of AAF strength.

The demands of World War I led to the selection of a field near Dayton, Ohio, for developing and testing military aircraft. Named for the "fighting McCooks" of Civil War fame, McCook Field became the test-site for the Liberty engine, electrically heated clothing, and other new air equipment of the period. A new location, fittingly named Wright Field, was occupied in 1926, after a group of Dayton business men had donated 4,500 acres of land to the Army as a site for aeronautical experimentation. Here, in the years between the wars, the steps were taken which developed the mechanical side of America's air strength.

Once the strategic need for a new plane or a new part was recognized, the military characteristics were studied and specifications drawn. Bids were then let for one or more of the experimental article. As soon as industry had complied, the product was run in the huge wind tunnel to determine the value of the airfoils, efficiency of maneuverability, and other qualities; but not until service tests had discovered all the "bugs" were the final contracts let, by which the plane or part was accepted as standard.

When war broke out in Europe in 1939, Wright Field was solidly established with laboratories and special devices for testing airplanes and component equipment; and by the time of Pearl Harbor it had become the largest aeronautical research center in the world. Buildings sprang up almost overnight. The 20 build-

ings of 1927 had doubled by 1941; there were 300 three years later. Between 1926 and peak activity in 1944 personnel at Wright Field alone increased from a handful to approximately 28,000 people.

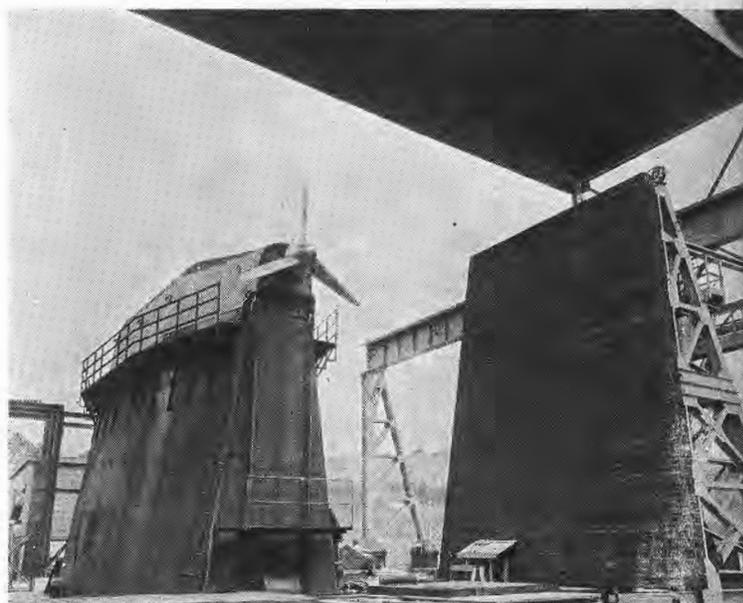
Wright Field equipment for testing World War II planes dwarfed that used at McCook Field. A \$3,000,000 wind tunnel tested models up to 16 feet in wingspread at speeds up to 450 miles an hour. Lead weights were used to try the resistance of planes to stress and strain; huge cranes plucked them bodily from the ground, dropped them to determine the effects of landing. Giant whirl-test rigs proved propeller endurance.

With quality assured through scientific experimentation, quantity production became a further responsibility. Mobilization of American industry was the critical problem after 1939. Plants were greatly expanded, both at company expense and through the application of billions in Government funds. During September 1939 only 117 airplanes were built for the Army; in the month following Pearl Harbor 3,000 were produced; and by January 1944 the monthly figure had reached more than 8,000. By December 1944 the year's total of planes built under AAF cognizance exceeded 95,000.

With increasing activity came changes in organization and command. At Dayton, the 1917 Airplane Engineering Department of the Signal Corps soon became the Engineering Division of the Air Service. In 1926, this became the enlarged Materiel Division of the Air Corps, the same year in which the five-year program for 1,800 planes was inaugurated. Soon after Pearl Harbor, the Materiel Division was renamed the Materiel Center, then the Materiel Command in 1943, and, when merged with the Air Service Command in August 1944, the Air Technical Service Command. At Headquarters in Washington, the directional and coordinating office ultimately became the Assistant Chief of Air Staff, Materiel and Services. Many AAF leaders had a hand in the development of the materiel program, including Spaatz, Kenney, Brett, and Echols. Among the wartime commanders of Wright Field were Lt. Gen. Wm. S. Knudsen and Maj. Gen. Hugh J. Knerr.

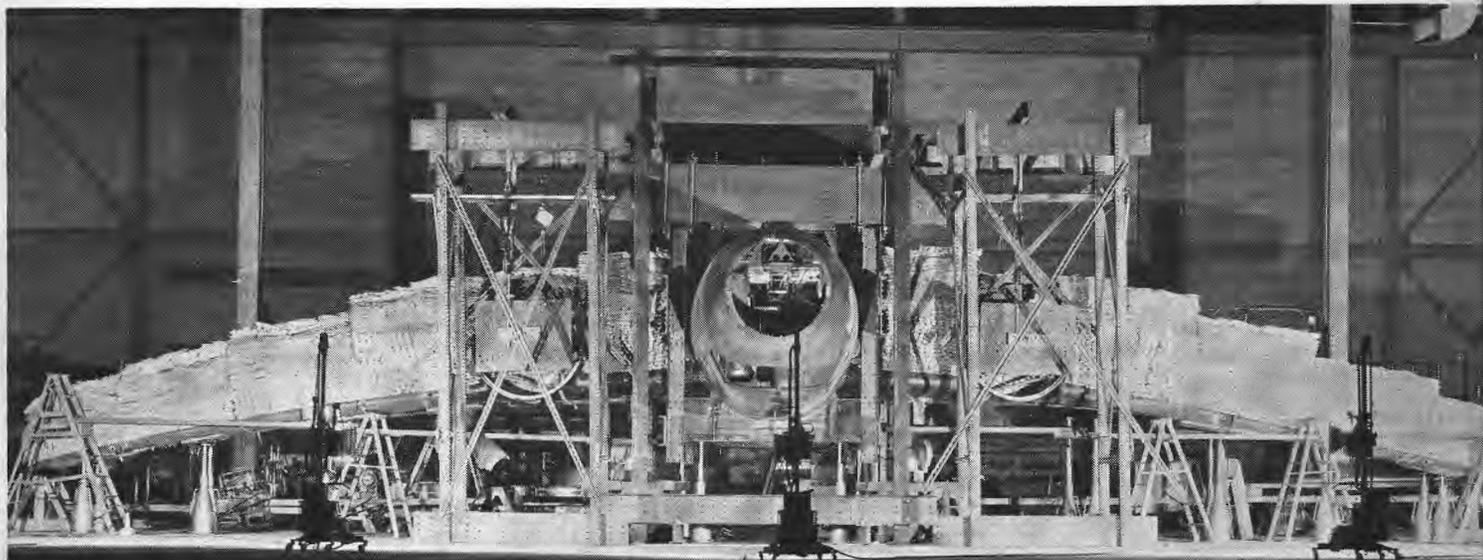


The extensive plant at Wright Field suggests the expansion incident to World War II. Its 300 buildings occupy some 3,000 acres.



Covered by insulated protective structure, these stands for testing propellers at Wright Field are said to be the world's largest.

In Static Test Laboratory at Wright Field a B-26 is given the modern structural strength test with the use of lead bars.





Engine tune-up and 20-mm. guns bristling from wings symbolize quest for stepped-up performance and fire power in AAF planes.

ARMY DEVELOPS NEW WEAPONS

Overcomes weather to reach and destroy enemy

Two major adversaries with which America's combat planes had to cope were weather and enemy fighters. The Army's research activities made it possible for U. S. aircraft to operate the world over—both at sub-zero altitudes and in torrid equatorial temperatures. Wright Field's stainless steel "all-weather" room simulated desert, tropic, or arctic conditions. Radar, the radio altimeter, air position indicator, and other devices for bombing through overcast were designed as a means of whipping the natural obstacles imposed by weather. Without such developments the long-range operations of the Superforts could not be carried out.

Wright Field technicians also stepped up the fire power of America's combat planes. Gun-testing equipment advanced far beyond that of World War I's McCook Field with its single room and small test range. Pre-war tests of the .50-caliber machine gun and 20-mm. cannon contributed greatly to the striking power with which such World War II planes as the Thunderbolt were ultimately equipped. Further advantage came from improving the electrically operated bomb racks and adapting to aircraft use the 37-mm. and 75-mm. cannon. Greater accuracy resulted from the use of power-operated remote gun turrets manned from centralized stations.

Wright Field propeller tests, run under simulated icing conditions, prepare America's combat planes for flight at sub-zero temperature.



EVOLUTION OF MILITARY AIRCRAFT

Army's planes went through several stages of design

In the nearly 40 years that separated the Ft. Myer trials of the Army's first airplane and long-range flights of Superforts against a distant enemy, Army aircraft passed through several stages of design.

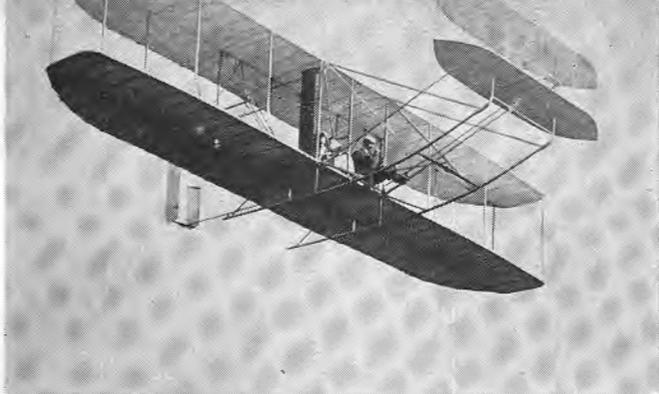
First concern of the airplane designer was a craft that could become airborne with some degree of safety. Planes like Army Airplane No. 1 were built around the wings. Engine, fuel, and crew were located on the wings, and outrigger supported the control surfaces. There was little regard for head resistance or for protecting the pilot against the elements. Spruce was used for wing structure and rigging; and builders like Curtiss used bamboo to support the elevators and rudders and provide the push rods for the controls.

The enclosure of engine, fuel, and passengers within a fuselage marked the next step in design. The Army's first cockpit plane, the Burgess H Tractor, sent to College Park in 1912, was later followed by the famous "Jenny." Now the fuselage was the key part about which the rest of the airplane was built. The introduction of a cockpit permitted the pilot to stay longer in the air. By the early twenties the desire for further reduction of resistance ushered in a third stage of plane construction.

Here the "stick and wire" bracing of the structure was replaced by an internally strengthened wing, and the streamlining of exposed parts became a standard practice. Biplanes continued in favor. With the fourth and final stage, beginning in the early thirties, the popularity of the biplane waned and attention turned to today's all-metal monoplane. Cockpits were completely enclosed, gunners operated in turrets, and bomb bays were developed to carry bombs inside the fuselage as well as on the under surface of the wings.

World War I brought the adoption of color and markings as a means of identifying combat craft. The varnished white or aluminum-painted surfaces of the prewar Wrights and Curtisses gave way to camouflage coloration. The red-centered star on blue background was rejected by General Pershing in favor of insignia similar to the Allies': red, blue, and white concentric circles. On January 1, 1921 the original star insignia became standard and remained so until the changes of World War II.

In the late twenties yellow wings and control surfaces varied the former all-over olive drab coloring of the Army's planes. In the late twenties and early thirties the color of the fuselage was changed from olive-drab to blue, a finish which was retained until the advent of all-metal construction. After a brief period of coloration the metal finish was left in its natural state. With the outbreak of World War II camouflage was again employed until a concern more for speed than for concealment prompted retention of the natural surface. Drawings on following pages show aircraft illustrating trends.



In this Wright model the plane is built around the wings. The pilot is exposed, and no thought given to reducing the resistance.



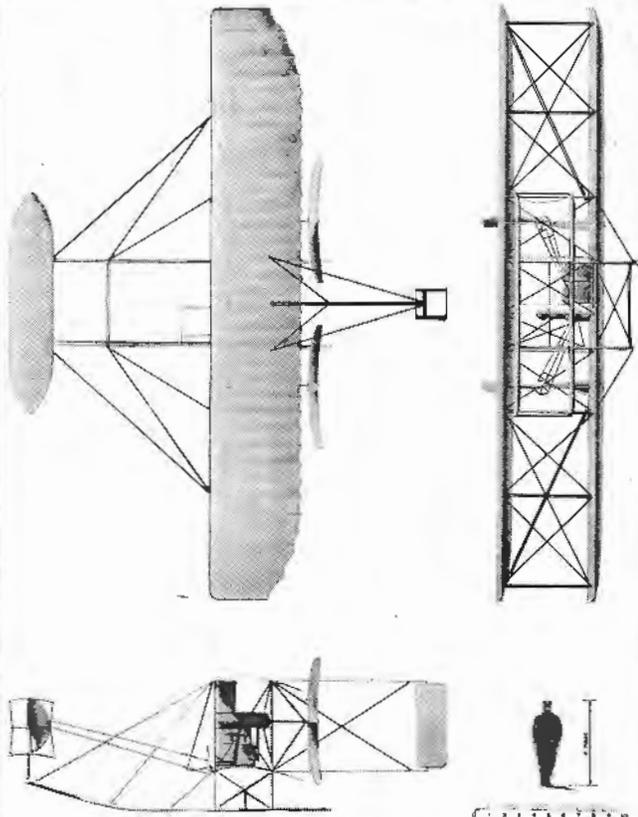
This Thomas-Morse model of World War I design illustrates the tendency to house engine, fuel, and crew members within fuselage.



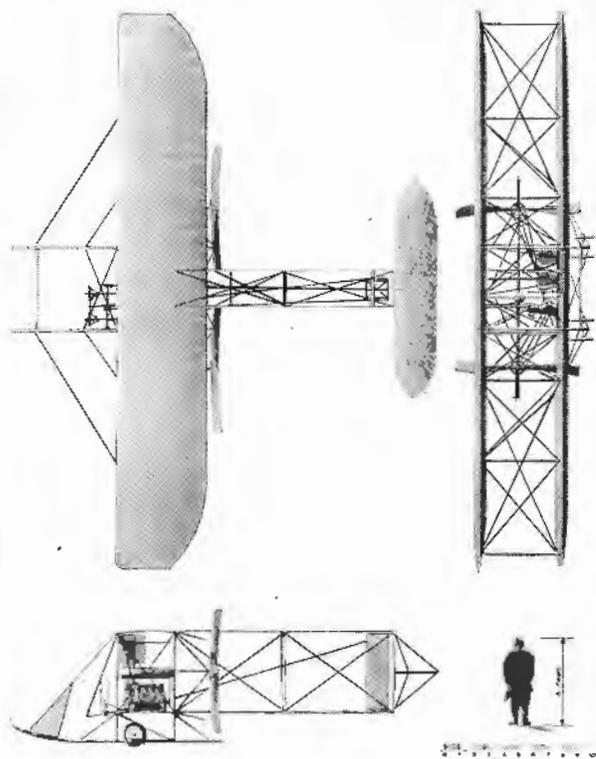
Curtiss P-1, prototype of pursuit craft, reflects the trend of the twenties to eliminate the "stick and wire" bracing on U. S. aircraft.



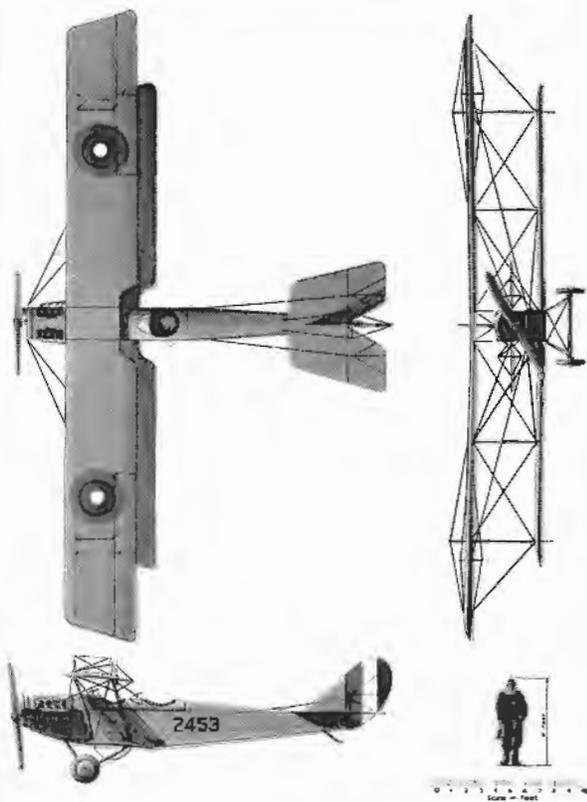
The all-metal monoplane was the standard type in the thirties. North American's P-51 typifies today's modern aeronautical design.



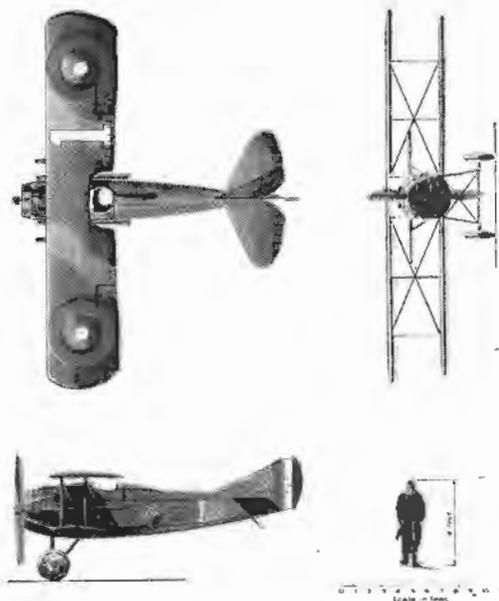
WRIGHT A FLYER



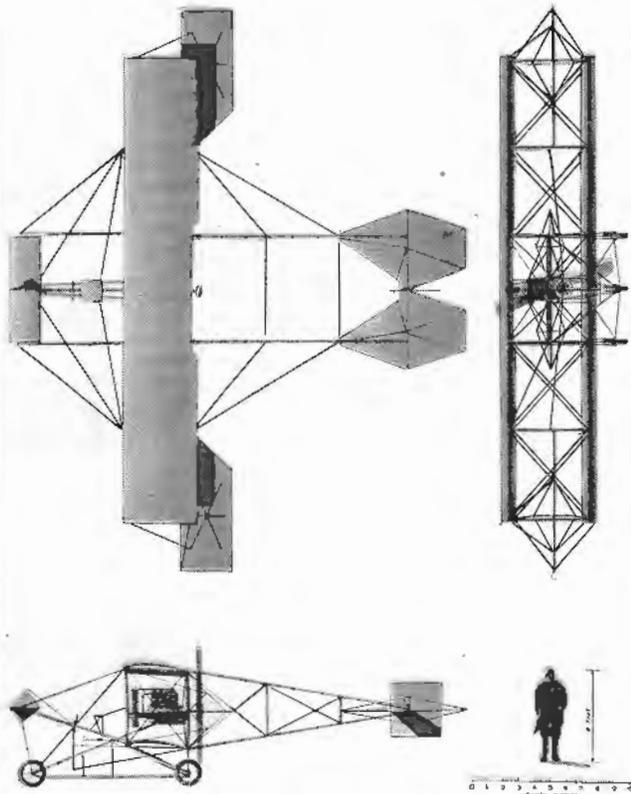
WRIGHT B



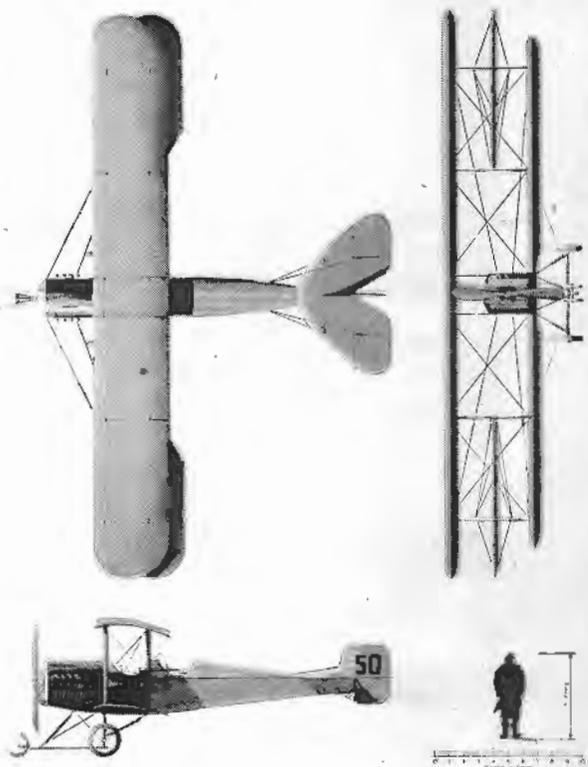
CURTISS JN-4D



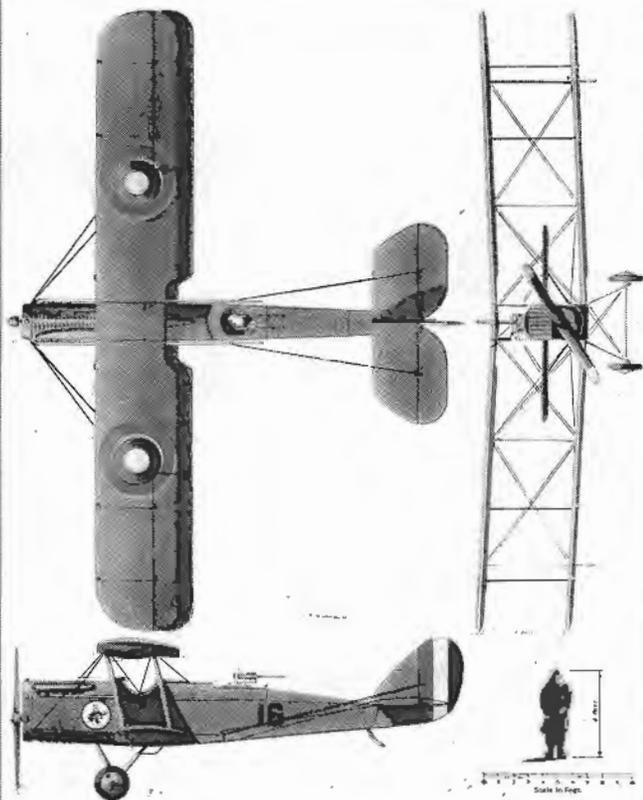
SPAD 13



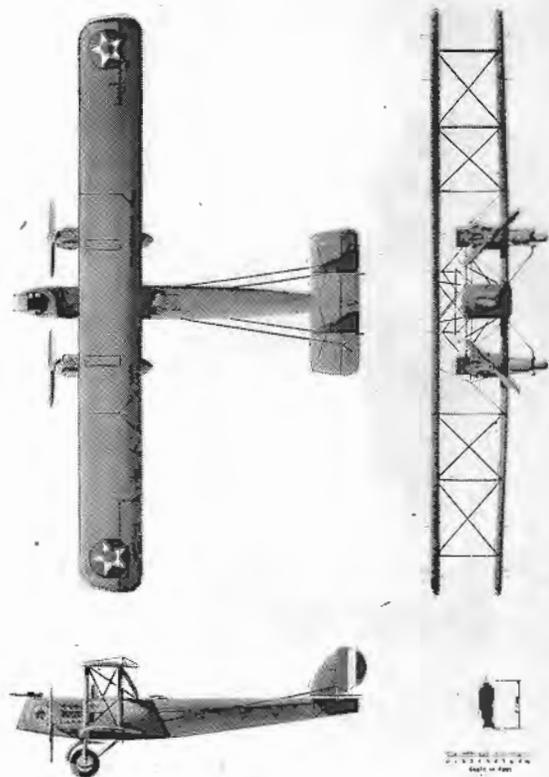
CURTIS IV MILITARY



MARTIN TT

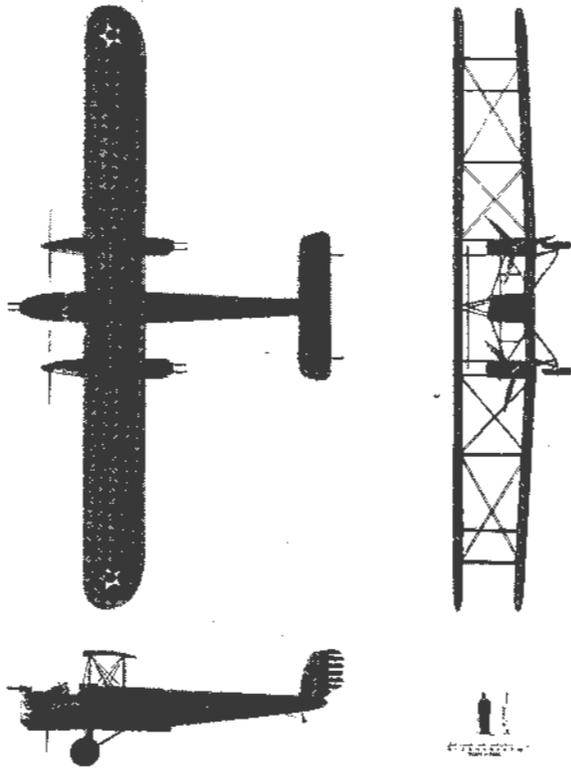


DE HAVILLAND DH-4

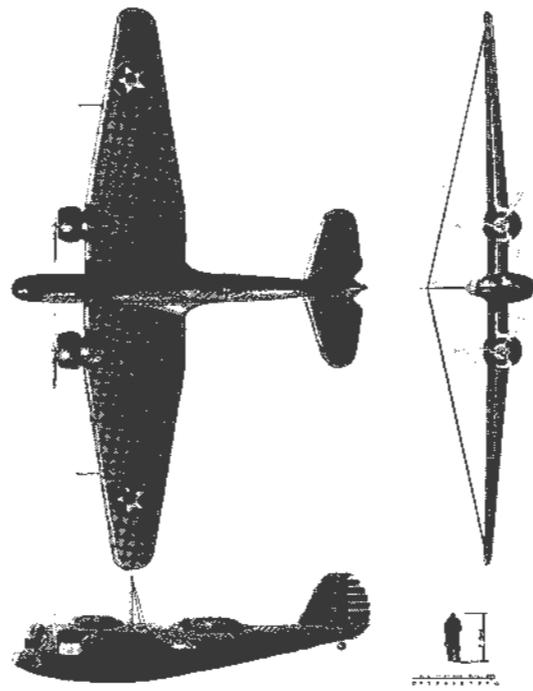


MARTIN MB-2

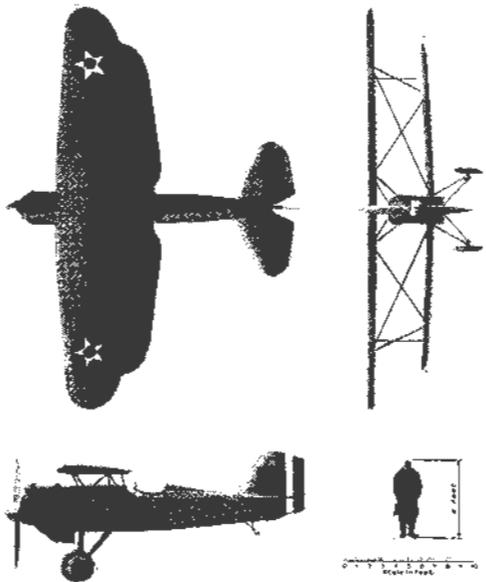
105



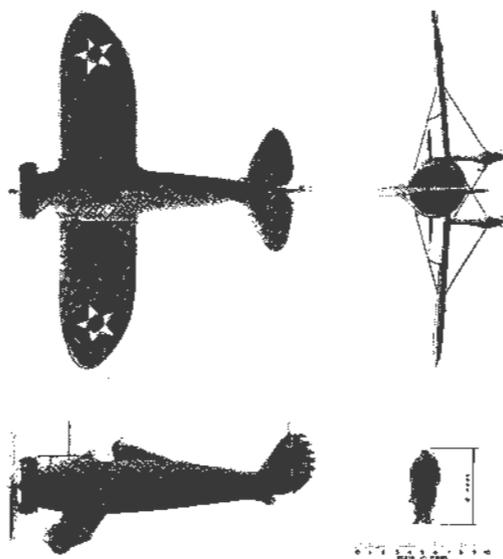
CURTISS B-2



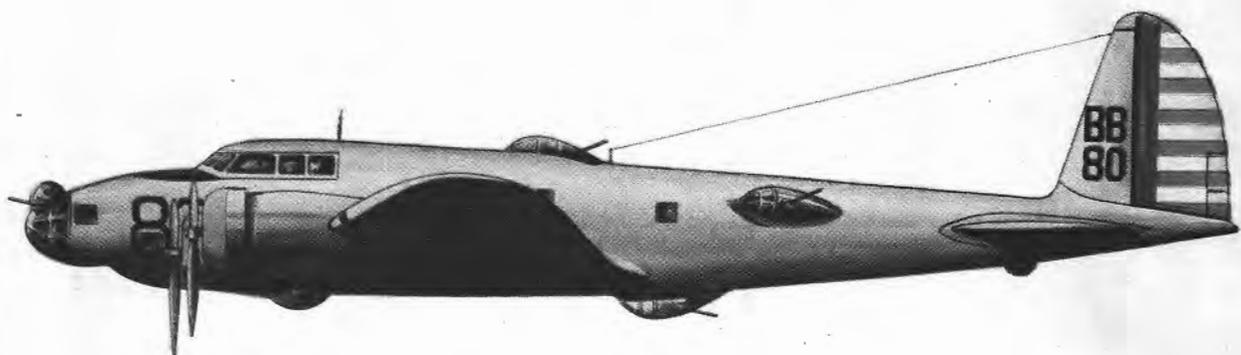
MARTIN B-10



CURTISS P-1



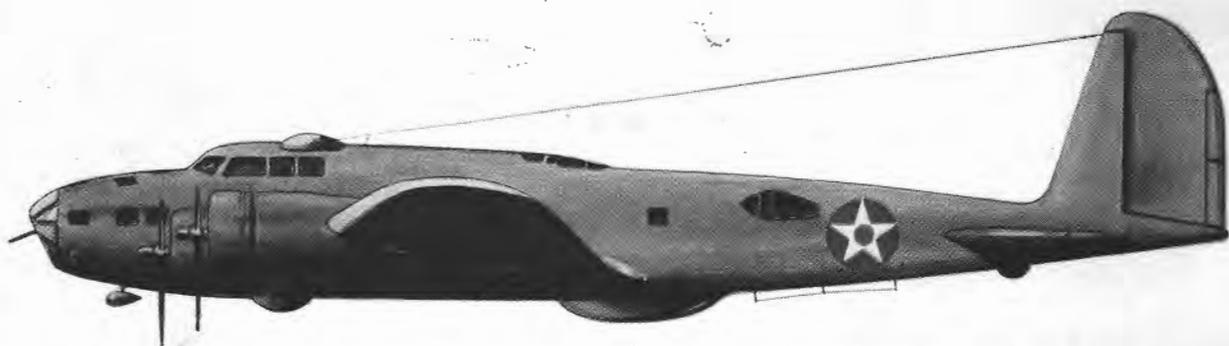
BOEING P-26



1—Original B-17 type, first flown in July 1935, was used up to 1939. This plane revolutionized heavy bomber design.



2—In this B-17B, delivered well before the outbreak of World War II, the gun turret was removed from the nose.



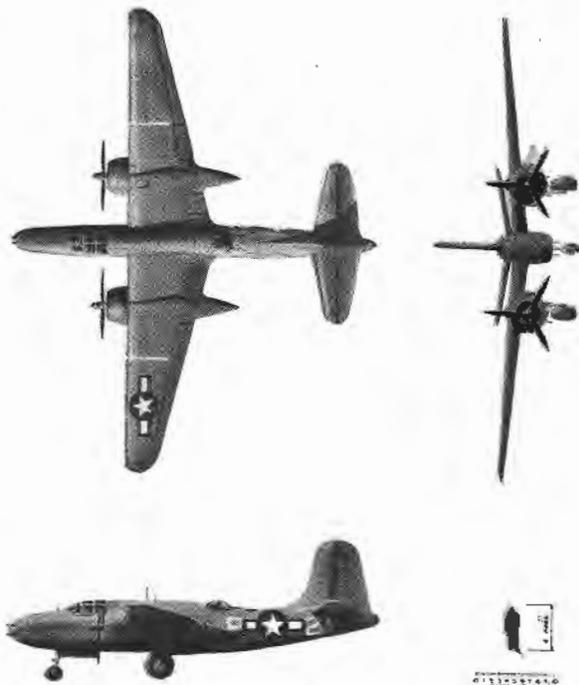
3—Flush windows in place of blister turrets distinguished B-17C and B-17D, produced months before Pearl Harbor.

These six models of the Flying Fortress illustrate not only changes in color, camouflage, and insignia used in Army planes, but also the evolution of the design of one of the great heavy bombers of World War II.

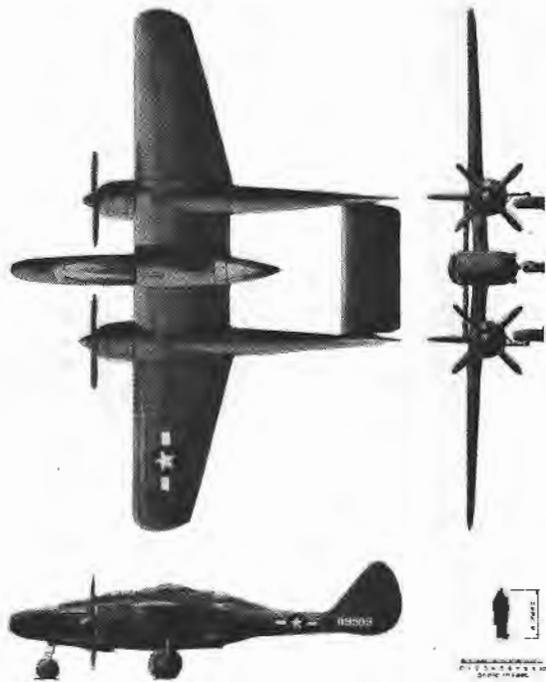
The YB-17, RB-17, and B-17A, first modifications of the

Fortress, differed little from the original B-17, which was first flown at Seattle in July 1935 by Boeing's chief test pilot, the late Leslie Tower.

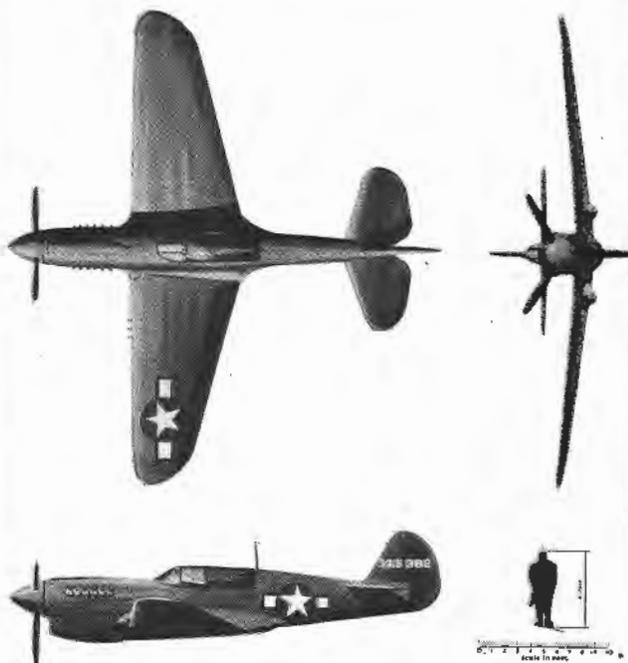
With the appearance of the B-17B the gun turret was removed from the nose of the plane, partly to improve the



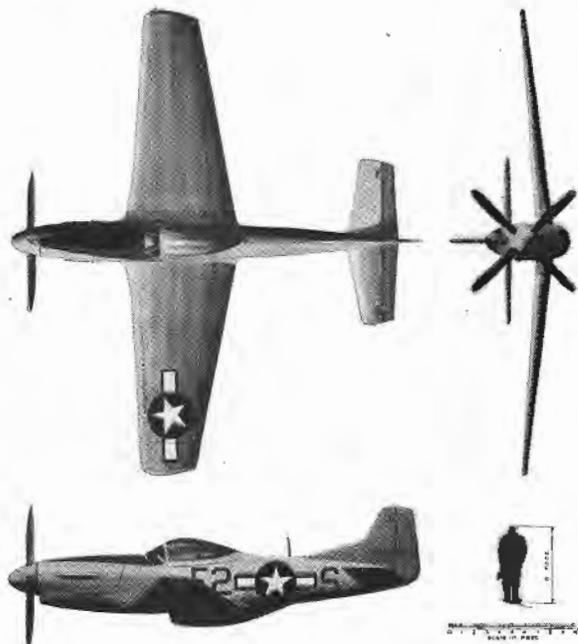
DOUGLAS A-20



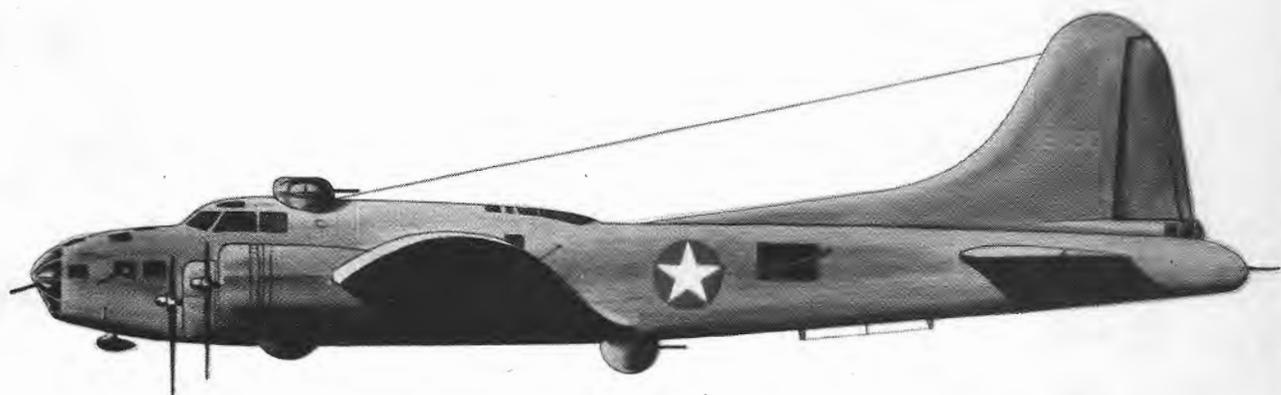
NORTHROP P-61



CURTISS P-40



NORTH AMERICAN P-51



4—The completely redesigned B-17E, also on hand before Pearl Harbor, provided tail-gun post in a longer fuselage.



5—A plexiglas nose and greater bomb capacity were features of B-17F, which appeared shortly after Pearl Harbor.



6—With B-17G came a chin turret operated by remote control and glass-enclosed gun position on side of fuselage.

bombardier's position. The B-17B was in production by early 1939, the first B-17C's were delivered in late 1940, and the first D's early in 1941. The only major difference was the addition of self-sealing gas tanks in the latter. Some of these, assigned to Great Britain, were ferried to England at once.

The battle-proved E, F, and G models were characterized by a tall fin which was faired into a fuselage lengthened by more than five feet. They had power-driven turrets and a tail gun position. The B-17F was equipped with a plexiglas nose and the B-17G with a remote-controlled chin turret.

THE ARMY'S AIRPLANES

The pictorial catalog of Army airplanes which follows includes virtually all the important models procured since the original Wright of 1909. The first section covers the period up to World War I, and succeeding sections consider the planes by types. Within the sections the arrangement is roughly chronological. From the late twenties on, the present system of model designations, then introduced, has been followed. It provides a convenient index for recent planes though it does not necessarily indicate a correct sequence. Where planes are omitted in the designation series—usually because they are substantially like other models—they are accounted for on the final page which follows the pictorial survey of engine development.

The technical data in the accompanying captions are derived chiefly from official Army records of performance and characteristics. Such data may vary widely depending on many conditioning factors. The figures here printed must be regarded as only approxi-

mate because space does not permit the full qualification of such general terms as landing speed or range, and because the data usually apply to ideal performance of only one representative modification of each model.

Abbreviations and terms used are as follows:

A: air-cooled; ARMT: armament; BOMBS: normal capacity; clb: climb, minutes/altitude; clg: ceiling, service/absolute; cn: cannon; cyl: cylinders; DESCR: description; ENG: engine; fpm: feet per minute; hp: maximum take-off horsepower; ht: height; L: liquid-cooled; lgth: length; m: miles; mgs: machine guns; mm: millimeter; mph: miles per hour; PERF: performance; rg: range, at operating speed with maximum built-in fuel unless otherwise qualified; span: tip-to-tip measurement of longest wing; SPECS: specifications; spd: speed, operating/maximum/landing (minimum weight); wt: weight, empty/normal gross.

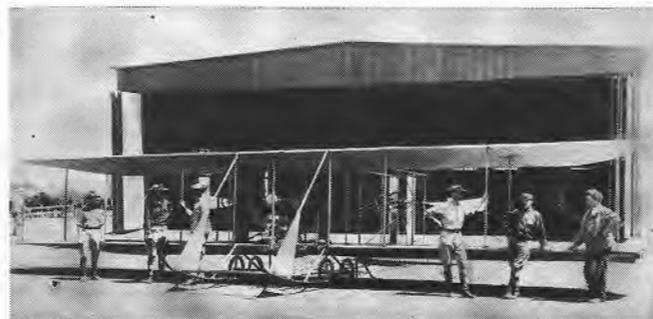
PRE-WORLD WAR I

The Army's first planes served as trainers

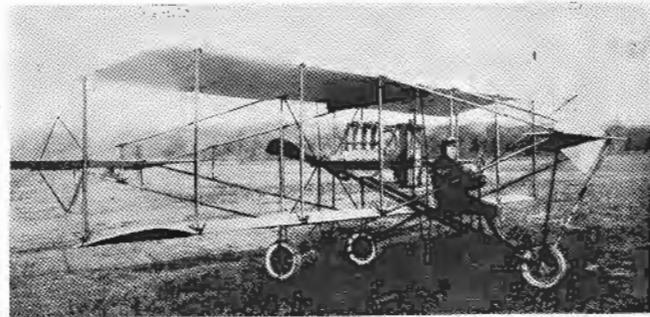
From 1909, when the Army accepted its first plane, the Wright A, to the time of America's entry into World War I, the primary concern in aircraft construction was for the development of types that could be flown with reasonable safety. Many improvements had to take place before the combat applications of the military airplane could receive full attention: the change from pusher to tractor, the transition from shoulder-yoke to Dep and finally to stick control, the substitution of ailerons for wing-warping, the introduction of the fuselage, the development of the landing gear and tail assembly, and the achievement of greater aerodynamic and engine efficiency.



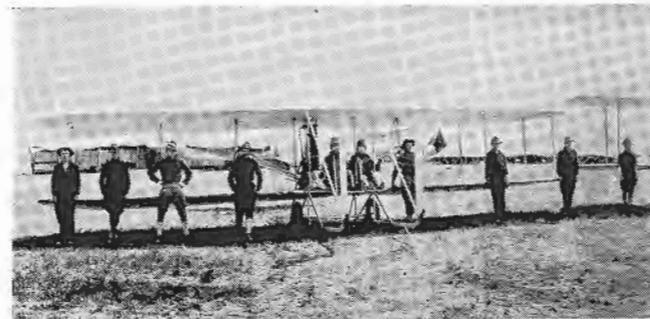
WRIGHT A FLYER. ENG: Wright, L, 30 hp, 4 cyl. SPECS: span 36'4", lgth 28', ht 8'6"; wt 740/1,200#. PERF: spd -/44/23 mph; clg 400+/-'; rg 155 m. DESCR: Procured in 1909, this warping-wing 2-seater was Army's first plane. It rose from a track, landed on skids. Lahm, Humphreys, and Foulois, first Army plane pilots, trained in it.



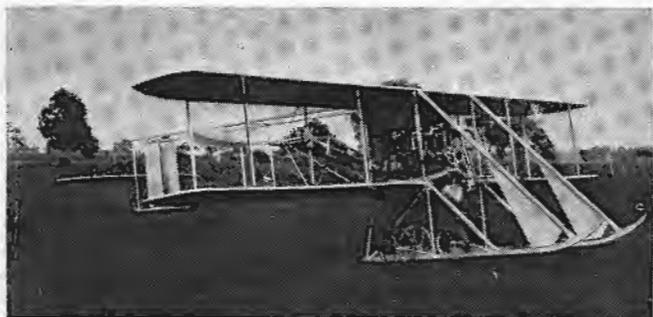
WRIGHT B. ENG: Wright, L, 30 hp, 4 cyl. SPECS: span 39', lgth 26', ht 8'; wt 812/1,250#. PERF: spd 42/49/23 mph; clb 4.5/1,270; clg -/6,450+/-'; rg 125 m. DESCR: Three B's, used from 1911-14, had wheels and rear control surfaces. In them, radio, bombs, bomb sights, machine guns, night flying, pontoons, and altitude records were tried.



CURTISS IV, MILITARY (*Lizzie*). ENG: Curtiss, L, 51 hp, 8 cyl. SPECS: span 30', lgth 29'3", ht 7'10"; wt 700/1,100#. DESCR: Delivered in 1911, this was Army's first Curtiss and its first plane to have tricycle landing gear. Lt. G. Kelly was killed in it, May 1911. It was then rebuilt with a 4-cylinder engine for primary training.



WRIGHT C, M-1 SCOUT. ENG: Wright, L, 50 hp, 6 cyl. SPECS: span 38', lgth 30', ht 8'; wt 930/1,380#. PERF: spd -/54/35 mph; clb 200+ fpm at sea level; rg 280 m. DESCR: In 1912-13, seven "weight-carriers" were bought, similar to B-type except for full dual controls and more power. Two of the new C's were flown at Maui.



WRIGHT D SPEED SCOUT. ENG: Wright, L, 60 hp, 6 cyl. SPECS: No official data available. PERF: spd -/67/- mph; clb 3/1,574; rg 200+ m. DESCR: Similar in size and design to the civilian "Baby Wright" of 1910, the Speed Scout was to be a light, fast solo, predecessor of today's fighter. It crashed on ploughed ground in tests, 1913.



BURGESS-DUNNE. ENG: Salmson, L, 120 hp, 9 cyl. SPECS: span 47', lgth 24'8", ht 11', wt with floats 1,700/2,300#. PERF: spd -/75/- mph; clb 300 fpm at sea level. DESCR: Inherent stability was claimed for this land or hydroplane pusher of British design in late 1914. It had an armored car and water-cooled radial engine.



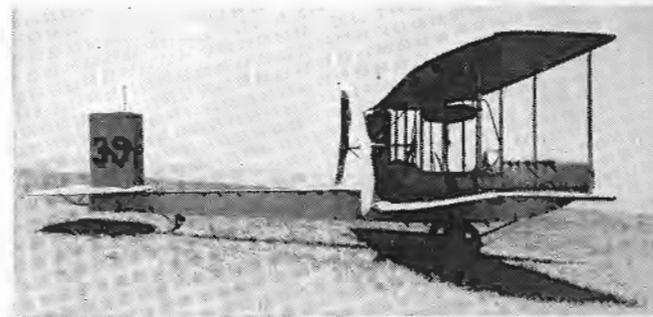
BURGESS H TRACTOR. ENG: Renault, L, 70 hp, 8 cyl. SPECS: span 34'6", lgth 27'9"; wt 1,000/1,600#. PERF: spd 66/70/45 mph; clb 10/2,000+; clg 300+/-'; rg 300 m. DESCR: The Army's first tandem cockpit plane had Wright C-type controls, used wheels or twin floats. This is modification of the H sent to College Park in 1912.



MARTIN TT. ENG: Curtiss OX, L, 90 hp, 8 cyl. SPECS: span 38'8", lgth 24'5", ht 9'4"; wt 1,200/1,700#. PERF: spd 51/72/40 mph; clb 10/3,400; rg 290 m. DESCR: Army's first Martin was a dual-control trainer adapted in 1914 from a commercial design. A record-making tractor type, it was thought safer than the old pushers.



BURGESS I (Coast Defense Hydro). ENG: Sturtevant, L, 60 hp, 6 cyl. SPECS: span 39'10", lgth 31'4"; wt 775# useful load. PERF: spd 59/-/- mph; clb 210 fpm at sea level; rg 380 m. DESCR: Equipped with Wright controls, a Coast Defense was flown in Florida in early 1913. In 1915 it was wrecked by Lt. H. Dargue at Corregidor.



WRIGHT F (Tin Cow). ENG: Austro-Daimler, L, 90 hp, 6 cyl. SPECS: span 42'; wt 450+# useful load. PERF: spd -/80/- mph; clb 10/4,000+; rg 320+ m. DESCR: Army's only Wright fuselage type was delivered August 1914. Named for its ratty aluminum fuselage cover, it had pusher props, shaft- and chain-driven by forward engine.



CURTISS MILITARY TRACTOR. ENG: Curtiss OX, L, 80 hp, 8 cyl. SPECS: span 37'4", lgth 24'; wt 1,050/-#. PERF: spd 60/75/45 mph; clb 200 fpm at sea level; rg 315 m. DESCR: One of few tractors on hand when the Army condemned pushers as unsafe in early 1914. It still had shoulder-yoke controls and a chain-drive propeller.



CURTISS J. ENG: Curtiss OX, L, 90 hp, 8 cyl. SPECS: span 30', lgth 26'4". PERF: spd -/86/42 mph; clb 10.5/4,000; clg -/17,185'; rg 430+ m. DESCR: A predecessor of the famous Curtiss "Jenny" with OX engine, the J still used shoulder-yoke control at tests in Sept. 1914. Another version had an overhanging upper wing of 40'2".



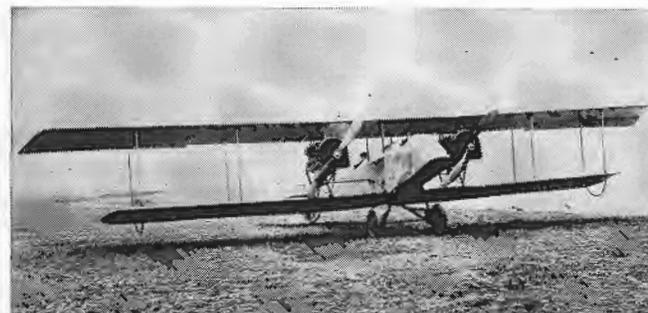
CURTISS N. ENG: Curtiss OXX, L, 100 hp, 8 cyl. SPECS: span 41'7", lgth 27'2". PERF: spd -/75/40 mph; clb 10/4,000. DESCR: Built in 1914, this 2-seater tractor was an ancestor of the "Jenny." It had pronounced wing dihedral, carried enough fuel for 5 hours, and still used the old skids, shoulder-yoke controls, and inter-wing ailerons.



CURTISS JN-1 (Jenny). ENG: Curtiss OX, L, 90 hp, 8 cyl. DESCR: The details of the first "Jenny" were much like those of the famous JN-4D of World War I, except for differences in landing gear and rudder and a less clean design. The JN-1 of 1915 still had shoulder-yoke controls. Its name derived from a combination of J and N.



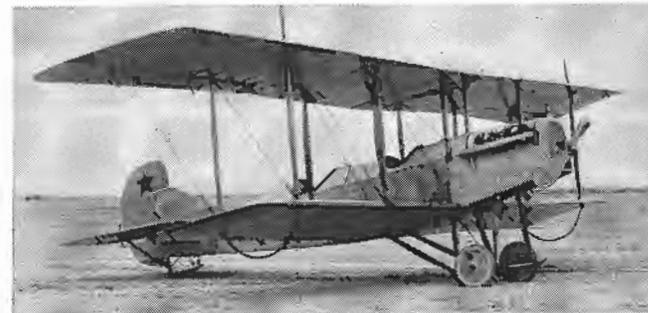
THOMAS D-5. ENG: Thomas, L, 135 hp, 8 cyl. SPECS: span 52'9", lgth 29'9"; wt 1,300/2,500#. PERF: spd -/86/- mph; clb 10/3,600. DESCR: This 2-place corps observation biplane, with a slight wing dihedral, was built in 1915 and early 1916 just before W. T. Thomas and F. L. Morse formed the Thomas-Morse Aircraft Corporation.



CURTISS JN TWIN. ENG: 2 Curtiss OXX, L, ea 100 hp, 8 cyl. SPECS: span 52'10", lgth 28', ht 9'7"; wt 1,900/2,800#. PERF: spd -/100/45 mph; clb 10/5,000; clg -/16,500'; rg 410 m at full speed. DESCR: Built in 1916, this was the Army's first 2-engine plane and also its largest to that date. It was a 2-seater with Dep controls.



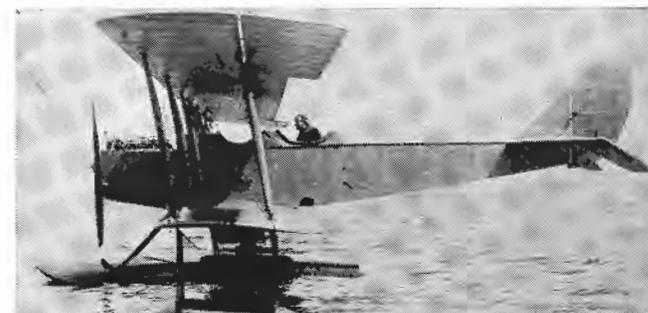
STURTEVANT S-4. ENG: Sturtevant 5A, L, 140 hp, 8 cyl. SPECS: span 50', lgth 28'; wt 1,500/2,025#. PERF: spd -/73/40 mph; clb 12/4,000. ARMT: 2 mgs. DESCR: Remarkable for its steel frame and twin-gun turrets built into lower wing on either side of the fuselage, this 2-place reconnaissance tractor of 1916 was designed by Loening.



CURTISS R-2. ENG: Curtiss VX, L, 160 hp, 8 cyl. SPECS: span 48', lgth 28'5"; wt 1,800/2,800#. PERF: spd -/90/50 mph; clb 10/4,000; rg 460 m at full speed. DESCR: In April 1916 the Signal Corps ordered some R-2's to Columbus, N.M., to be used during the punitive expedition into Mexico. They had both shoulder and Dep controls.



STANDARD H-3. ENG: Hall-Scott A-5, L, 140 hp, 6 cyl. SPECS: span 40', lgth 27'; wt 1,900/2,700#. PERF: No official data available. DESCR: Forerunner of the Standard J and J-1 trainers of World War I, the H-3 land reconnaissance machine was bought in small quantity in late 1916. It had a 10-degree sweepback in the upper wing.



CURTISS N-9. ENG: Curtiss OXX-3, L, 100 hp, 8 cyl. SPECS: span 53'4", lgth 29'11", ht 11'; wt 1,901/2,410#. PERF: spd -/70/45 mph; clb 10/2,000; rg 200 m at full speed. DESCR: Ordered just before America entered World War I, this tandem "tractor sea biplane" was generally similar to the B version of the JN-4 trainer landplane.

PRIMARY TRAINERS

The first planes flown by cadets

The primary trainer, the first plane the cadet learns to fly, is especially suited to the need of focusing all his attention on the business of flying. By comparison with most other Army planes its speed, climb, altitude, and range are less important, its design is simple, its controls and instruments are few, and its engine is of small horsepower. It costs relatively little, carries no armament, drops no bombs, and presents few flying hazards.

As a type, the primary trainer is not only the oldest of the training planes but the oldest Army airplane as well. The first Wright plane was little more than a primary trainer. Not until late in

World War I did the Army develop a plane that was predominantly military in function. The most famous of the old-time trainers was the "Jenny." The best known model, the JN-4D, underwent numerous changes and was used by barnstorming flyers long after the war's end. Among its versions was the JN-4H or "Hisso Jenny" which, because of its greater engine power, was originally used as an advanced trainer. After the war, however, the JN-4H served as a primary trainer. It was also flown by the Reserve and the National Guard.

The year 1927 saw the last of the "Jenny" and the beginning of the actual PT series. Certain designs stand out in that series. These are the PT-1, PT-3, PT-13, PT-16, and PT-19. Among the trainers now used are the PT-17 (based on the PT-13), the PT-19, and the PT-22 (based on the PT-16). If not enough tribute has been paid to the sturdy little primary trainer it is chiefly because of the students' overshadowing interest in the more advanced types of planes used in the later phases of pilot training.



CURTISS JN-4D (*Jenny*). ENG: Curtiss OX-5, L, 90 hp, 8 cyl. SPECS: span 43'7", lgth 27'4", ht 9'11"; wt 1,525/2,016#. PERF: spd 64/73/45 mph; clb 33.4/6,500; clg 6,500/-'; rg 250 m. DESCR: A JN-4A with stick rather than Dep control, the JN-4D was used by an estimated 95% of all the U.S. pilots trained during World War I.



VOUGHT VE-7. ENG: Hispano-Suiza E, L, 180 hp, 8 cyl. SPECS: span 34'1", lgth 24'5", ht 8'7"; wt 1,559/2,095#. PERF: spd -/114/-mph; clb 8.3/6,500; clg 17,000/-'. DESCR: To some, the VE-7 was the best trainer designed during World War I. Slated for quantity production if the war had gone on, it was still being flown in 1926.



CURTISS JN-4H (*Hisso Jenny*). ENG: Hispano-Suiza A or I, L, 150 hp, 8 cyl. SPECS: span 43'7", lgth 27'1", ht 9'11"; wt 1,595/2,145#. PERF: spd 81/93/48 mph; clg 18,000/-'; rg 235 m at full speed. DESCR: Like the JN-4D except for a more powerful engine. The various "Jenny" types were widely used throughout the twenties.



COX-KLEMIN TW-2. ENG: Wright (Hispano-Suiza), L, 150 hp, 8 cyl. SPECS: span 29', lgth 23'9", ht 8'7"; wt 1,783/2,505#. PERF: spd -/99/47 mph. DESCR: By June 1922 the first of three experimental TW-2 trainers was tested. It was side-by-side 2-place wire-braced biplane with a steel fuselage and fuel tanks in the top wing.



STANDARD J-1. ENG: Hispano-Suiza, L, 150 hp, 8 cyl. SPECS: span 43'10", lgth 26'7", ht 10'10"; wt 1,660/2,206#. PERF: spd -/85/- mph; clb 8.5/6,500; clg 15,000/-'. DESCR: A wartime successor to the Standard J whose 4-cylinder Hall-Scott engine lacked power, this J-1 trainer became a favorite with barnstormers.



DAYTON-WRIGHT TW-3. ENG: Wright E, L, 172 hp, 8 cyl. SPECS: span 34'9", lgth 25'7", ht 9'; wt 1,719/2,427#. PERF: spd -/100/45 mph; clb 12.3/6,500; clg 13,150/15,000'; rg 390 m at 90 mph. DESCR: Another experimental model of the early twenties, this side-by-side trainer with dual controls had a pronounced wing stagger.



CONSOLIDATED PT-1. ENG: Wright, E. L., 189 hp, 8 cyl. SPECS: span 34'10", lgth 27'8", ht 9'6"; wt 1,806/2,551#. PERF: spd 79/99/51 mph; clb 9.5/5,000; clg 13,450/16,000'. DESCR: The PT-1, last primary trainer with a liquid-cooled engine, became standard in 1927 after the "Jenny" was scrapped.



CONSOLIDATED XPT-8. ENG: Packard R-980, A, 225 hp, 9 cyl. SPECS: span 34'6", lgth 28', ht 9'8"; wt 1,919/2,629#. PERF: spd 93/117/43 mph; clb 730 fpm at sea level; clg 19,250/20,000'. DESCR: The XPT-8 of about 1931 was a converted XO-17A Courier. It derived from the XO-17, National Guard version of the PT-3.



CONSOLIDATED PT-3A. ENG: Wright J-5, A, 220 hp, 9 cyl. SPECS: span 34'6", lgth 28'1", ht 10'3"; wt 1,755/2,481#. PERF: spd 81/102/48 mph; clb 7.6/5,000; clg 14,000/-'. rg 300 m. DESCR: First of the air-cooled primary trainers, the PT-3 was originally built in 1928 and flown as late as 1941. A better engine distinguished the PT-3A.



STEARMAN PT-9. ENG: Wright R-540, A, 165 hp, 5 cyl. SPECS: span 32', lgth 24'8", ht 9'7"; wt 1,733/2,400#. PERF: spd 87/110/42 mph; clb 710 fpm at sea level; clg 12,300/14,350'; rg 395 m. DESCR: First built in 1931, a few PT-9's were flown until 1942. Other PT-9 versions had Continental, Lycoming, or Kinner engines.



CONSOLIDATED PT-6 (Fleet). ENG: Kinner R-370, A, 115 hp, 5 cyl. SPECS: span 28', lgth 21'5", ht 8'1"; wt 977/1,549#. PERF: spd 82/102/48 mph; clb 9.7/5,000; clg 13,820/16,500'. DESCR: Tried out in the early thirties, the PT-6 Fleet was of all-metal construction except for its wing spars. Later PT-6's had larger cockpit openings.



VERVILLE PT-10. ENG: Lycoming R-680, A, 200 hp, 9 cyl. SPECS: span 33', lgth 25', ht 9'3"; wt 1,915/2,557#. PERF: spd 90/108/52 mph; clb 12.3/15,000; clg 12,000/-'. DESCR: The PT-10 was a 2-place tandem biplane first produced in 1931. It was tried out with several different engines including the same ones used in the PT-9.



MOHAWK XPT-7 (Pinto). ENG: Kinner R-370, A, 110 hp, 5 cyl. SPECS: span 34'9", lgth 24'5", ht 7'8"; wt 1,096/1,773#. PERF: spd 85/109/54 mph; clb 10.7/5,000; clg 12,100/14,650'. DESCR: Better known in its commercial version, the experimental 2-place Pinto was the first low-wing monoplane in the primary trainer series.



CONSOLIDATED PT-11. ENG: Continental R-540, A, 165 hp, 7 cyl. SPECS: span 31'7", lgth 26', ht 9'10"; wt 1,742/2,423#. PERF: spd 93/112/50 mph; clb 7.4/5,000; clg 10,200/12,200'. DESCR: The PT-11 had a steel fuselage and a wood wing. First tested in 1931 and flown until Pearl Harbor, it underwent several engine changes.



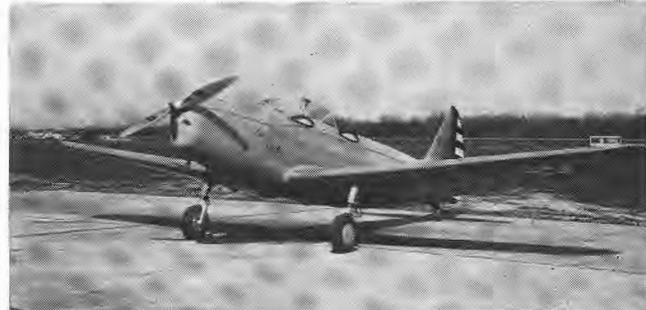
BOEING PT-13 (Caydet). ENG: Lycoming R-680, A, 220 hp, 9 cyl. SPECS: span 32'2", lgth 25', ht 10'3"; wt 2,000/2,665#. PERF: spd 103/122/56 mph; clb 18.8/10,000; clg 13,600/15,750'; rg 410 m. DESCR: Late versions of the PT-13, introduced in the middle thirties, are still being flown. By 1945 some 2,100 PT-13's had been ordered.



BOEING PT-17 (Caydet). ENG: Continental R-670, A, 220 hp, 7 cyl. SPECS: span 32'2", lgth 25', ht 10'3"; wt 1,962/2,665#. PERF: spd 103/124/55 mph; clb 19/10,000; clg 13,800/-'; rg 410 m. DESCR: Like the PT-13 save for its engine, the PT-17 was extensively used during World War II. More than 5,700 were ordered by 1945.



WACO PT-14. ENG: Continental R-670, A, 220 hp, 7 cyl. SPECS: span 30', lgth 23'6", ht 8'5"; wt 1,898/2,650#. PERF: spd 116/132/- mph; clb 5.9/5,000; clg 15,000/-'. DESCR: Never ordered in quantity, this plane was tried out about 1940. It was originally a conventional commercial 2-seater with all-wood wings and a steel fuselage.



FAIRCHILD PT-19 (Cornell). ENG: Ranger L-440, A, 175 hp, 6 cyl. SPECS: span 36', lgth 28', ht 10'; wt 1,700/2,409#. PERF: spd 109/132/60 mph; clb 17.5/10,000; clg 15,300/-'; rg 470 m. DESCR: A low-wing monoplane, the PT-19 has had wide use by the Army. Its late versions are equipped with night and blind-flying instruments.



ST. LOUIS PT-15. ENG: Wright R-760, A, 225 hp, 7 cyl. SPECS: span 33'10", lgth 25', ht 9'4"; wt 2,058/2,766#. PERF: spd 105/125/53 mph; clb 7.2/5,000; clg 14,500/-'; rg 355 m. DESCR: The PT-15 was an all-metal 2-seater of stressed-skin monocoque construction, first of that type among PT's. A few were tried about 1940.



RYAN PT-22 (Recruit). ENG: Kinner R-540, A, 160 hp, 5 cyl. SPECS: span 30', lgth 22'6", ht 9'4"; wt 1,308/1,860#. PERF: spd 100/125/67 mph; clb 21.8/10,000; clg 13,100/-'; rg 310 m. DESCR: Like the PT-21 except for a different Kinner engine. A large number of Recruits were ordered, a few by the Netherlands.



RYAN PT-16. ENG: Kinner R-440, A, 132 hp, 5 cyl. SPECS: span 30', lgth 21'6", ht 6'11"; wt 1,091/1,600#. PERF: spd 100/116/42 mph; clb 19.9/9,000; clg 12,300/-'; rg 325 m. DESCR: The PT-16 was tried out about 1940 and ordered in small quantity. It was a 2-place, low-wing, wire-braced monoplane of semi-monocoque design.



FAIRCHILD PT-23 (Cornell). ENG: Continental R-670, A, 220 hp, 7 cyl. SPECS: span 36', lgth 25'11", ht 10'; wt 2,046/2,450#. PERF: spd 104/128/62 mph; clb 19.4/10,000; clg 13,250/-'; rg 400 m. DESCR: Similar to the PT-19 except for its engine. Many were built by Aeronca, Howard, St. Louis, and Fleet of Canada.



DE HAVILLAND PT-24 (*Tiger Moth*). ENG: De Havilland Gipsy Major I, A, 140 hp, 4 cyl. SPECS: span 29'4", lgth 23'11", ht 8'9"; wt 1,230/1,825#. PERF: spd 90/107/48 mph; clb 8.5/5,000; clg 14,600/-'; rg 270 m. DESCR: A British plane tried out in the early forties and designed by the company that created the DH-4 in 1917.



RYAN PT-25. ENG: Lycoming O-435, A, 185 hp, 6 cyl. SPECS: span 32'10", lgth 24'4", ht 6'8"; wt 1,385/1,800#. PERF: spd 105/125/- mph; clb 16/9,000; clg 14,000/-'; rg 315 m. DESCR: An experimental, low-wing, cantilever monoplane made of wood with fabric-covered wings and equipped for night- and blind-flying training.

BASIC TRAINERS

Transition from primary to advanced training

The basic trainer was designed for the cadet who had learned the fundamentals of flying and was ready to master the more intricate details of modern aviation. It bridged the gap between the more elementary primary trainer and the more specialized advanced single- or twin-engine trainer, used by the pilot to train for wartime duty. By comparison with the primary trainer, it was more high-powered—flew faster, higher, and farther. It took off and landed faster; its controls were more sensitive. The cadet still did not have to worry about retractable landing gear or armament,

but he now had to work flaps, rudder trim tabs, radio, propeller position, and many other devices that were new to him.

Not until the Seversky BT-8 was first produced in 1935 did the Army have a trainer originally designed for basic training. The earlier types had been only redesignations of observation models or adaptations of primary trainers in which a more powerful engine was substituted and certain equipment added. The most popular designs after the BT-8 were the BT-9, the BT-13, most widely used basic trainer in World War II, and the BT-14.

In 1944 there began a trend toward proceeding directly from primary to advanced trainers, leaving out instruction on the basic trainer. A flying cadet might thus move directly from the primary trainer to an advanced training plane like the AT-6 for his basic training. In the period of advanced training he could continue to use the AT-6 or in the event of assignment in a two-engine school even be assigned to flying an actual combat model like the B-25.



SEVERSKY BT-8. ENG: Pratt & Whitney R-985, A, 400 hp, 9 cyl. SPECS: span 36', lgth 24'4", ht 8'10"; wt 3,017/4,124#. PERF: spd 152/175/61 mph; clb 5.4/5,000; clg 15,750/-'; rg 565 m. DESCR: The BT-8 was the first specifically designed basic trainer. Production of about 30 of these all-metal low-wing monoplanes began in 1935.



FLEETWING BT-12 (*Sophomore*). ENG: Pratt & Whitney R-985, A, 450 hp, 9 cyl. SPECS: span 40', lgth 29', ht 11'4"; wt 3,302/4,497#. PERF: spd 150/170/- mph; clb 10/10,000; clg 18,000/-'; rg 675 m. DESCR: A stainless-steel monoplane first built in 1939. Like all basic trainers since the BT-8, it had a sliding canopy cockpit.



NORTH AMERICAN BT-9 (*Yale*). ENG: Wright R-975, A, 400 hp, 9 cyl. SPECS: span 42', lgth 28', ht 13'7"; wt 3,314/4,466#. PERF: spd 147/170/64 mph; clb 11.1/10,000; clg 19,750/-'; rg 875 m. DESCR: Many AAF pilots of World War II trained in the BT-9, first built in 1936 and still used at the time of Pearl Harbor.



CONSOLIDATED VULTEE BT-13 (*Valiant*). ENG: Pratt & Whitney R-985, A, 450 hp, 9 cyl. SPECS: span 42', lgth 28'9", ht 12'4"; wt 3,164/4,227#. PERF: spd 140/156/61 mph; clb 10.5/10,000; clg 19,400/-'; rg 880 m. DESCR: This 2-place monoplane was most widely used of basic trainers. Some 8,700 had been ordered by 1945.



NORTH AMERICAN BT-14 (Yale). ENG: Pratt & Whitney R-985, A, 450 hp, 9 cyl. SPECS: span 41', lgth 28'5", ht 12'; wt 3,368/4,496#. PERF: spd 147/181/57 mph; clb 9.2/10,000; clg 21,650/-'; rg 725 m. DESCR: Built from 1939 on, the BT-14 is a modified BT-9 with longer fuselage of semi-monocoque construction aft of canopy.



STEARMAN XBT-17. ENG: Pratt & Whitney R-985, A, 450 hp, 9 cyl. No official data on specifications or performance are available. DESCR: The BT-17 was an experimental low-wing monoplane with fixed landing gear. Built during World War II, it had a wood wing of cantilever construction and a fuselage contrived of tubular steel.

ADVANCED TRAINERS

Simulate warplane flying for future AAF pilots

The advanced trainer is the biggest, heaviest, most powerful, and most complex of the trainer types. In it the cadet learns to control equipment like retractable landing gear, constant-speed propellers, and hydraulic flaps. It permits him to perfect his instrument flying and practice aerial gunnery and bomb-dropping. There are marked differences between the single- and two-engine types flown respectively by fighter and bomber pilot trainees, but their fundamental purpose is the same. They provide the means by which the cadet learns to fly a plane with characteristics approaching those of combat types.



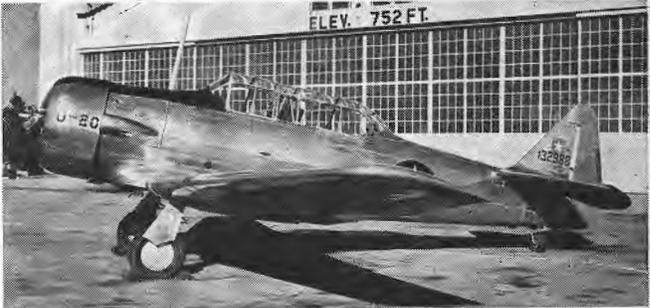
HUFF-DALAND AT-1. ENG: Wright E, L, 179 hp, 8 cyl. SPECS: span 29'4", lgth 24'8", ht 9'3"; wt 1,607/2,358#. PERF: spd 98/112/- mph; clb 13.1/6,500; clg 12,075/14,200'; rg 325 m. ARMT: 1x.30 mg. DESCR: First of the trainers originally designed for advanced training, AT-1 saw limited service in the middle twenties.



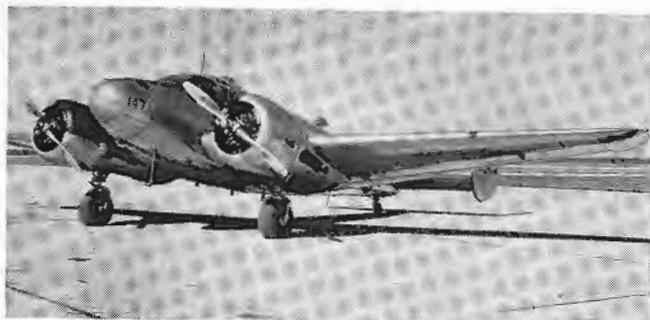
CURTISS AT-5. ENG: Wright J-5, A, 236 hp, 9 cyl. SPECS: span 31'8", lgth 22'6", ht 8'10"; wt 1,718/2,471#. PERF: spd 102/128/60 mph; clb 5.6/5,000; clg 17,840/19,750'; rg 600 m at full speed. ARMT: 1x.30 mg. DESCR: A standard type in the late twenties, the AT-5 was a modified Curtiss PW-8 or P-1, with less powerful engine.



BOEING AT-3. ENG: Wright E, L, 211 hp, 8 cyl. SPECS: span 31'11", lgth 23'5", ht 8'7"; wt 1,939/2,476#. PERF: spd -/129/- mph; clb 8.5/6,500; clg 16,175/18,000'; rg 305 m. ARMT: 1x.30 mg. DESCR: A modified PW-9, Boeing's first pursuit design, AT-3 had different engine and was planned mainly for pursuit training.



NORTH AMERICAN AT-6 (Texan). ENG: Pratt & Whitney R-1340, A, 600 hp, 9 cyl. SPECS: span 42', lgth 29', ht 11'9"; wt 4,138/5,300#. PERF: spd 150/208/65 mph; clb 7.7/10,000; clg 24,000/-'; rg 850 m. ARMT: 2 or 3x.30 mgs. DESCR: This was the first and most widely used of the modern advanced trainers.



BEECH AT-7 (Navigator). ENG: 2 Pratt & Whitney R-985, A, ea 450 hp, 9 cyl. SPECS: span 47'8", lgth 34'3", ht 10'; wt 5,935/7,850#. PERF: spd 190/224/67 mph; clb 6.8/10,000; clg 24,000/-'; rg 730 m. DESCR: Built in moderate quantity since 1941, the AT-7, first 2-engine advanced trainer, was intended for navigation training.



CESSNA AT-8 (Bobcat). ENG: 2 Lycoming R-680, A, ea 295 hp, 9 cyl. SPECS: span 41'11", lgth 32'9", ht 9'11"; wt 4,000/5,100#. PERF: spd 165/185/65 mph; clb 9.6/10,000; clg 18,400/-'; rg 585 m. DESCR: Like the AT-7, the AT-8 is a low-wing cabin monoplane with a retractable landing gear. A few were built from 1941.



CURTISS-WRIGHT AT-9. ENG: 2 Lycoming R-680, A, ea 295 hp, 9 cyl. SPECS: span 40'4", lgth 31'8", ht 9'10"; wt 4,600/6,000#. PERF: spd 165/197/75 mph; clb 8.6/10,000; clg 19,000/-'; rg 765 m. DESCR: A 2-engine low-wing monoplane, the AT-9 has been built in fair quantity since 1941, has all-metal fuselage and wings.



BEECH AT-11 (Kansan). ENG: 2 Pratt & Whitney R-985, A, ea 450 hp, 9 cyl. SPECS: span 47'8", lgth 34'2", ht 9'8"; wt 6,176/8,727#. PERF: spd 142/215/86 mph; clb 10/10,000; clg 20,000/-'; rg 870 m. ARMT: 2x.30 mgs. BOMBS: 1,000#. DESCR: A successful modified AT-7 since 1941 which provides for bombardier training.



REPUBLIC AT-12. ENG: Pratt & Whitney R-1830, A, 1,050 hp, 14 cyl. SPECS: span 41', lgth 27'8", ht 12'5"; wt 4,747/6,433#. PERF: spd 170/285/75 mph; clb 5/10,000; clg 33,000/-'; rg 1,500 m. ARMT: 3 or 4x.30 mgs. BOMBS: 1,100#. DESCR: Originally ordered for Sweden, 50 AT-12's (modified P-35's) were built in 1941.



FAIRCHILD AT-13 (Yankee Doodle). ENG: 2 Pratt & Whitney R-1340, A, ea 600 hp, 9 cyl. SPECS: span 52'6", lgth 37'7", ht 15'; wt 8,884/12,401#. PERF: spd 185/211/72 mph; clb 10.4/10,000; clg 18,000/-'; rg 800 m. ARMT: 1x.30 mg. BOMBS: 1,000#. DESCR: A 4-place mid-wing bombardier trainer produced in the early forties.



BOEING AT-15 (Crewmaker). ENG: 2 Pratt & Whitney R-1340, A, each 600 hp, 9 cyl. SPECS: span 59'10", lgth 42'; wt 8,338/12,061#. PERF: spd 185/202/70 mph; clb 10/10,000; clg 18,500/-'; rg 850 m. ARMT: 1x.30 mg. BOMBS: 1,000#. DESCR: A 4- to 6-place bombardier trainer superseded, like the AT-13, by the AT-21.



CONSOLIDATED VULTEE AT-19 (Reliant). ENG: Lycoming R-680, A, 295 hp, 9 cyl. SPECS: span 41'11", lgth 29'6", ht 11'; wt 2,868/4,000#. PERF: spd 118/135/62 mph; clb 9/5,000; clg 11,500/-'; rg 940 m. DESCR: A recent fabric-covered 3- or 4-place monoplane of Stinson design, AT-19 was intended as navigation trainer.



FEDERAL AT-20. ENG: 2 Jacobs R-915, A, ea 330 hp, 7 cyl. SPECS: span 56'6", lgth 42'3", ht 13'1"; wt 4,950/7,660#. PERF: spd 150/178/65 mph; clb 11.6/10,000; clg 19,500/-; rg 600 m. DESCR: Ordered from Canada in small quantity in 1943, the AT-20 was a 4-place English "Anson." It was originally intended for crew integration.



VULTEE BC-3. ENG: Pratt & Whitney R-1340, A, 600 hp, 9 cyl. SPECS: span 42', lgth 29'2", ht 9'4"; wt 4,366/6,240#. PERF: spd 200/223/- mph; clb 7.6/10,000; clg 23,000/-; rg 325 m. DESCR: The only sample of the Vultee BC-3 was procured in 1939, a 2-place, all-metal monoplane with retractable landing gear.

OBSERVATION TYPES

Their mission is the oldest in military aeronautics

The earliest use of aircraft showed their suitability for observation. For the Army, observation planes have done distinguished service in photographing and mapping terrain to be invaded, securing information prerequisite to the dispatch of striking forces, and assessing damage to targets. They have also been used to detect enemy shipping, locate lost units, and furnish liaison.

The Army's earliest interest in heavier-than-air craft was for reconnaissance, and until World War I its only effective use of military aeronautics had been for that purpose. Even after the introduction of bombardment and pursuit, the use of the plane

for observation was called its most important service. As military aircraft were increasingly equipped for offensive action, the observation plane was similarly affected. Thus the DH-4 and the Douglas O-2 were equipped with machine guns for both pilot and observer and were capable of flying almost as far, as high, and as fast as any other contemporary Army plane. On the eve of Pearl Harbor, the O-46 and O-47, flown by the National Guard, were outstanding types.

The specialization not only of combat types but of reconnaissance in World War II brought the disappearance of the observation plane as a general type. The O designation came to be assigned only to the small, liaison (L) types used as artillery spotters and as the aerial counterpart of the jeep. With the expansion of photographic reconnaissance, many combat types have been equipped for this purpose. Thus the A-20 has become the F-3, the P-38 (F-4, F-5), P-51 (F-6), P-80 (F-14), B-24 (F-7), B-17 (F-9), B-25 (F-10), and B-29 (F-13).



BREGUET 14-B2. ENG: Renault, L, 300 hp, 12 cyl. SPECS: span 47'1", lgth 29'6", ht 10'10"; wt 2,392/3,771#. PERF: spd -/118/- mph; clb 21.8/16,400; clg 20,000'. ARMT: 3x.30 mgs. DESCR: Flown by the 96th Aero Squadron, first A.E.F. squadron to bomb enemy territory. It also served for photography and artillery spotting.



DE HAVILLAND DH-4. ENG: Liberty 12, L, 400 hp, 12 cyl. SPECS: span 42'7", lgth 29'11", ht 9'8"; wt 2,391/3,582#. PERF: spd -/125/- mph; clb 8/6,500; clg 20,000/-; rg 325 m at full speed. ARMT: 4x.30 mgs. DESCR: An English design with U.S. engine, only U.S. quantity-produced combat plane of World War I.



SALMSON 2-A2. ENG: Salmson Z9, L, 250 hp, 9 cyl. SPECS: span 38'6", lgth 27'10", ht 9'6"; wt 1,835/3,036#. PERF: spd -/116/- mph; clb 11/6,560. ARMT: 2x.30 mgs. DESCR: Powered by an early radial-type engine, this French-built plane was employed by the 1st and many of the other squadrons for observation and photography.



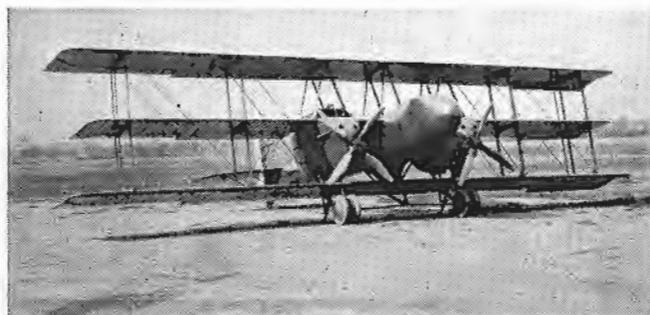
LE PERE U.S.AC-11. ENG: Liberty 12, L, 425 hp, 12 cyl. SPECS: span 41'7", lgth 25'3", ht 9'6"; wt 2,562/3,746#. PERF: spd 94/133/- mph; clb 6/6,500; clg 20,200/21,500'; rg 320 m at 128 mph. ARMT: 4x.30 mgs. DESCR: A fine experimental type developed near war's end. Lt. J. Macready flew it to world's record height in 1921.



LOENING M-8. ENG: Wright H, L, 344 hp, 8 cyl. SPECS: span 32'10", lgth 24'4", ht 6'9"; wt 1,663/2,639#. PERF: spd -/144/- mph; clb 5.2/6,500; clg 18,600/19,900'; rg 325 m at 135 mph. ARMT: 4x.30 mgs. DESCR: One of the Air Service's first mono-planes, this small fighter-observation 2-seater was designed at war's end.



SPERRY M1-A (*Messenger*). ENG: Lawrence, A, 63 hp, 3 cyl. SPECS: span 20', lgth 17'11", ht 6'9"; wt 683/1,076#. PERF: spd 77/90/- mph; clb 27.8/6,500; clg 6,750/8,800'. DESCR: An ancestor of the modern liaison type, this popular light plane, originally a commercial design, was used during the period from 1922 to 1927.



PACKARD LE PERE USAO-11 TRIPLANE. ENG: 2 Liberty 400, L, ea 425 hp, 12 cyl. SPECS: span 54'6", lgth 38'2", ht 14'; wt 5,455/8,577#. PERF: spd 94/112/- mph; clb 9.3/6,500; clg 15,350/17,300'; rg 475 m at 106 mph. ARMT: 4x.30 mgs. DESCR: A World War I 3-seater built for high-altitude long-range surveillance.



COX-KLEIN CK-CO-1 HEINKEL. ENG: Liberty 400, L, 425 hp, 12 cyl. SPECS: span 42'4", lgth 30'6", ht 10'8"; wt 2,870/4,485#. PERF: spd 112/134/- mph; clb 8.1/6,500; clg 16,600/18,500'; rg 395 m. ARMT: 3x.30 mgs. DESCR: A 2-place U.S. reworking of an Ernst Heinkel design, noted for the single thick strut on each side.



DE HAVILLAND DH-4B. ENG: Liberty 12, L, 416 hp, 12 cyl. SPECS: span 42'5", lgth 29'11", ht 9'8"; wt 2,939/4,595#. PERF: spd 94/118/61 mph; clb 8.2/5,000; clg 12,800/14,700'; rg 260 m at full speed. ARMT: 4x.30 or .50 mgs. DESCR: One of the many DH-4 variants still flown in early thirties. Pilot now sat behind wing.



GALLAUDET CO-1. ENG: Liberty 12, L, 390 hp, 12 cyl. SPECS: span 55'9", lgth 33'7", ht 10'4"; wt 2,977/4,751#. PERF: spd -/118/- mph; clb 10.4/6,500; clg 16,000/18,400'; rg 515 m at 111 mph. ARMT: 4x.30 mgs. DESCR: Designed for ground observation in the early twenties, CO-1 was Air Service's first all-metal monoplane.



DAYTON-WRIGHT B-1A. ENG: Wright H, L, 360 hp, 8 cyl. SPECS: span 39'5", lgth 25'6", ht 9'10"; wt 2,155/3,791#. PERF: spd 101/130/- mph; clb 7.5/6,500; clg 18,900/21,000'; rg 495 m at 125 mph. ARMT: 5x.30 mgs. DESCR: An Air Service design of about 1920, tested for photography, radio, bombing, and liaison.



ENGINEERING DIVISION CO-2. ENG: Liberty 12, L, 400+ hp, 12 cyl. SPECS: span 41'1", lgth 30'9", ht 10'9"; wt 2,669/4,084#. PERF: spd -/137/- mph; clb 17.1/10,000; clg 21,250/23,300'; rg 500 m at 125 mph. ARMT: 4x.30 or .50 mgs. DESCR: Designed and built by the Engineering Division at McCook Field, tested in 1922.



ATLANTIC CO-4. ENG: Liberty 12, L, 435 hp, 12 cyl. SPECS: span 41'10", lgth 30'4", ht 10'7"; wt 2,967/4,525#. PERF: 109/135/- mph; clb 7.8/6,500; clg 15,300/16,850'; rg 440 m at 122 mph. ARMT: 1x.30 mg. DESCR: Designed by Tony Fokker, the CO-4 with new metal-type propeller was built early in the twenties.



CURTISS O-1 (*Falcon*). ENG: Curtiss D-12, L, 449 hp, 12 cyl. SPECS: span 38', lgth 28'4", ht 10'1"; wt 2,417/4,165#. PERF: spd 115/143/63 mph; clb 5.4/5,000; clg 17,375/19,100'; rg 400 m at full speed. ARMT: 3x.30 mgs. DESCR: A successful entry in the Army competition of 1924 and a basic design for several other models.



ENGINEERING DIVISION CO-5. ENG: Liberty 12, L, 428 hp, 12 cyl. SPECS: span 43', lgth 27'2", ht 10'2"; wt 2,869/4,427#. PERF: spd 110/133/- mph; clb 7.2/6,500; clg 17,750/19,500'; rg 450 m at 123 mph. ARMT: 5x.30 or .50 mgs. DESCR: The supercharged CO-5 of early twenties was designed for high-altitude corps observation.



DOUGLAS O-2. ENG: Liberty 12, L, 439 hp, 12 cyl. SPECS: span 39'8", lgth 29'6", ht 10'10"; wt 3,032/4,785#. PERF: spd 114/129/65 mph; clb 10.9/6,500; clg 12,275/14,025'; rg 400 m. ARMT: 3x.30 mgs. DESCR: Also designed for the 1924 Army competition for observation aircraft, the O-2 replaced the DH-4B as the standard type.



ENGINEERING DIVISION CO-6. ENG: Liberty 12 inverted, A, 427 hp, 12 cyl. SPECS: span 48', lgth 29'8", ht 9'8"; wt 3,049/4,607#. PERF: spd 113/133/- mph; clb 8.8/6,500; clg 16,600/18,300'; rg 435 m at 125 mph. ARMT: 3x.30 mgs. DESCR: Rated best plane of its type in 1925, originally powered by conventional Liberty.



DOUGLAS O-2H. ENG: Liberty 12, L, 433 hp, 12 cyl. SPECS: span 40', lgth 30', ht 10'6"; wt 2,818/4,485#. PERF: spd 107/133/58 mph; clb 5.5/5,000; clg 17,100/18,900'; rg 510 m at full speed. DESCR: An improved model in the O-2 series, the O-2H had a modified rear cockpit, brakes, and a somewhat revised stabilizer control.



BOEING CO-7. ENG: Liberty 12 inverted, A, 420 hp, 12 cyl. SPECS: span 45', lgth 29'2", ht 10'8"; wt 3,107/4,665#. PERF: spd 111/122/- mph; clb 10.5/6,500; clg 13,050/14,850'; rg 335 m. ARMT: 3x.30 mgs. DESCR: Boeing's CO-7, an experimental development of the mid-twenties, was similar in design to the DH-4ML.



WRIGHT XO-3. ENG: Wright T-3, 645 hp, 12 cyl. SPECS: span 45', lgth 31', ht 10'7"; wt 4,193/5,997#. PERF: spd 132/146/- mph; clb 6.9/6,500; clg 18,450/20,200'; rg 395 m. DESCR: Another entry in the 1924 observation competition, this experimental model was the last of Wright Aeronautical Corporation's planes.



THOMAS-MORSE O-6. ENG: Liberty 12, L, 435 hp, 12 cyl. SPECS: span 39'9", lgth 28'8", ht 11'; wt 2,947/4,734#. PERF: spd 116/129/61 mph; clb 9.6/6,500; clg 13,175/14,825'. ARMT: 3x.30 mgs. DESCR: The O-6 of the mid-twenties was a Douglas O-2 rebuilt in metal. Although heavier, its performance was about like the O-2.



THOMAS-MORSE O-19. ENG: Pratt & Whitney R-1340, A, 450 hp, 9 cyl. SPECS: span 39'9", lgth 29', ht 10'; wt 2,779/3,990#. PERF: spd 124/142/57 mph; clb 4.6/5,000; clg 20,000/21,800'; rg 290 m at full speed. ARMT: 2x.30 mgs. BOMBS: 232#. DESCR: Flown during most of the thirties, O-19 was another metal Thomas-Morse.



THOMAS-MORSE O-6B. ENG: Pratt & Whitney Wasp, A, 410 hp, 9 cyl. SPECS: span 39'9"; wt 2,430/4,104#. PERF: spd 111/138/58 mph; clb 1,084 fpm at sea level; clg 17,750/-'. ARMT: mgs. DESCR: Another version of the O-2, the Thomas-Morse O-6B differed from the O-6 chiefly in its engine, struts, and landing gear.



DOUGLAS O-22. ENG: Pratt & Whitney R-1340, A, 450 hp, 9 cyl. SPECS: span 38'1", lgth 28'4", ht 9'8"; wt 2,389/3,800#. PERF: spd 115/142/59 mph; clb 4.7/5,000; clg 20,750/22,600'; rg 405 m. ARMT: 2x.30 mgs. BOMBS: 464#. DESCR: Built in small quantity in 1929 with all-metal semi-monocoque fuselage and wood wings.



DOUGLAS XO-14. ENG: Wright R-790, A, 240 hp, 9 cyl. SPECS: span 30'1", lgth 23'10", ht 8'8"; wt 1,758/2,500#. PERF: spd 97/121/52 mph; clb 6.4/5,000; clg 15,250/17,100'; rg 250 m at full speed. ARMT: mgs. DESCR: An experimental biplane of about 1930, with single bay wing, split axle, wheel brakes, and steel-tube fuselage.



FOKKER O-27. ENG: 2 Curtiss V-1570, L, ea 600 hp, 12 cyl. SPECS: span 64'7", lgth 47'6", ht 14'6"; wt 8,092/10,639#. PERF: spd 153/177/68 mph; clb 9.7/10,000; clg 20,750/-'. rg 840 m. ARMT: 2 mgs. DESCR: First 2-engine O type, called a "flying wing" in the early thirties because its engine nacelles faired into wings.



KEYSTONE XO-15. ENG: Wright R-790, A, 236 hp, 9 cyl. SPECS: span 37'3", lgth 27'1", ht 9'9"; wt 1,776/2,518#. PERF: spd 95/119/52 mph; clb 6.8/5,000; clg 16,600/18,625'; rg 240 m at full speed. ARMT: mgs. DESCR: Another 1930 type with several features of the XO-14, the XO-15 had a 5% sweepback in the upper wing.



VOUGHT O-28 (Corsair). ENG: Pratt & Whitney R-1340, A, 625 hp, 9 cyl. SPECS: span 36', lgth 24'8", ht 10'1"; wt 2,404/3,865#. PERF: spd 125/157/59 mph; clb 3.6/5,000; clg 22,100/23,600'. DESCR: This was an Army adaptation of the Navy's O-2U Corsair landplane. The only one built was destroyed by fire in March 1930.



DOUGLAS O-31. ENG: Curtiss V-1570, L, 675 hp, 12 cyl. SPECS: span 45'8", lgth 33'10", ht 11'9"; wt 3,751/4,635#. PERF: spd 168/191/65 mph; clb 3/5,000; clg 22,700/24,000'. ARMT: 2x.30 mgs. DESCR: An externally braced gull-wing 2-place monoplane first produced in 1930. A few O-31's were flown throughout the thirties.



CURTISS O-40. ENG: Wright R-1820, A, 650 hp, 9 cyl. SPECS: span 44'1", lgth 28'6", ht 10'7"; wt 3,429/4,565#. PERF: spd 169/193/64 mph; clb 1,685 fpm at sea level; clg 24,000/25,600'. DESCR: Produced first in 1932, the O-40 sesquiplane (wing-and-a-half) had metal monocoque fuselage and pronounced sweepback in upper wing.



THOMAS-MORSE O-33. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 39'9", lgth 29'2", ht 10'2"; wt 3,130/4,291#. PERF: spd 143/165/58 mph; clb 3/5,000; clg 22,600/24,000'. ARMT: mgs. DESCR: This plane was the same as the B modification of the O-19 except for a different engine. Only one O-33 was procured, in 1930.



CURTISS O-40B. ENG: Wright R-1820, A, 690 hp, 9 cyl. SPECS: span 41'8", lgth 28'10", ht 10'8"; wt 3,754/5,180#. PERF: spd 160/188/62 mph; clb 3.4/5,000; clg 23,100/-'. ARMT: 2x.30 mgs. DESCR: Chief difference between the O-40 and O-40B was a change-over to monoplane construction. A few B's were used in the 1930's.



DOUGLAS O-35. ENG: 2 Curtiss V-1570, L, ea 600 hp, 12 cyl. SPECS: span 65'8", lgth 45'6", ht 12'6"; wt 7,896/10,376#. PERF: 157/179/- mph; rg 700 m. ARMT: 2 mgs. DESCR: Second 2-engine O type, a gull-wing monoplane with metal monocoque fuselage and crew of three in tandem. A few O-35's were flown during 1930's.



DOUGLAS O-43. ENG: Curtiss V-1570, L, 675 hp, 12 cyl. SPECS: span 45'8", lgth 33'11", ht 12'3"; wt 3,834/5,012#. PERF: spd 163/188/69 mph; clb 3.1/5,000; clg 23,200/24,600'. ARMT: 2x.30 mgs. DESCR: This plane was much like the O-31 except for a parasol wing and smaller tail surface. A few O-43's flew about 1932-40.



DOUGLAS O-38. ENG: Pratt & Whitney R-1690, A, 525 hp, 9 cyl. SPECS: span 40', lgth 31'3", ht 10'10"; wt 3,072/4,458#. PERF: spd 128/150/60 mph; clb 4.6/5,000; clg 20,700/22,500'; rg 330 m at full speed. ARMT: 2x.30 mgs. BOMBS: 464#. DESCR: Last of O-2 line, procured partly for the National Guard's use during 1930's.



DOUGLAS O-46. ENG: Pratt & Whitney R-1535, A, 725 hp, 14 cyl. SPECS: span 45'9", lgth 34'9", ht 10'4"; wt 4,700/6,135#. PERF: spd 170/200/58 mph; clb 3/5,000; clg 24,150/25,400'; rg 500 m. ARMT: 2x.30 mgs. BOMBS: 232#. DESCR: Like the O-43 except for its engine and wing bracing. It was first procured in 1935.



NORTH AMERICAN O-47. ENG: Wright R-1820, A, 975 hp, 9 cyl. SPECS: span 46'4", lgth 33'3", ht 13'; wt 6,171/7,594#. PERF: spd 200/223/75 mph; clb 12.6/15,000; clg 23,200/-'; rg 500 m. ARMT: 2x.30 mgs. DESCR: This 3-place monoplane, largely built of metal, with observer's post in belly, was important type in 1930's.



CURTISS O-52 (Owl). ENG: Pratt & Whitney R-1340, A, 600 hp, 9 cyl. SPECS: span 40'10", lgth 26'5", ht 10'; wt 4,231/5,307#. PERF: spd 169/208/70 mph; clb 8.2/10,000; clg 23,200/-'; rg 770 m. ARMT: 2x.30 mgs. DESCR: Built in moderate quantity since 1940, this 2-seater was designed to give unobstructed ground view.



VULTEE-STINSON O-49 or L-1 (Vigilant). ENG: Lycoming R-680, A, 295 hp, 9 cyl. SPECS: span 51', lgth 34'3", ht 10'3"; wt 2,668/3,400#. PERF: spd 112/122/- mph; clb 24.5/10,000; clg 12,800/-'; rg 280 m. DESCR: The maneuverability and small-area landing and take-off of this 1940 plane made it useful liaison type.



TAYLORCRAFT O-57 or L-2 (Grasshopper). ENG: Continental O-170, A, 65 hp, 4 cyl. SPECS: span 35'5", lgth 22'9", ht 8'; wt 874/1,300#. PERF: spd 74/88/47 mph; clb 14.2/5,000; clg 10,050/-'; rg 310 m. DESCR: Small low-powered plane with short take-offs and landings, ordered in quantity during World War II.



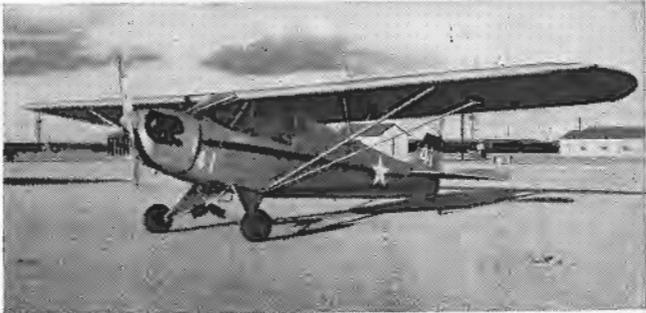
BELLANCA O-50. ENG: Ranger V-770, A, 420 hp, 12 cyl. SPECS: span 55'6", lgth 35'2", ht 9'10"; wt 3,086/3,887#. PERF: spd 114/126/27 mph; clb 19,420/-'; rg 240 m. DESCR: This externally braced high-wing 2-seater monoplane was produced in 1940. Of the three then ordered none is now in service. Wing was plywood covered.



AERONCA O-58 or L-3 (Grasshopper). ENG: Continental O-170, A, 65 hp, 4 cyl. SPECS: span 35', lgth 21', ht 7'3"; wt 863/1,300#. PERF: spd 79/87/42 mph; clb 1/400; clg 7,750/-'; rg 195 m. DESCR: Another of the small, high-wing monoplanes that spotted artillery, took on-the-scene pictures, and did liaison in World War II.



RYAN O-51 (Dragonfly). ENG: Pratt & Whitney R-985, A, 440 hp, 9 cyl. SPECS: span 52', lgth 34'5", ht 11'1"; wt 3,432/4,200#. PERF: spd 119/130/30 mph; clb 13.1/10,000; clg 19,700/-'; rg 265 m. DESCR: Shown with flaps down, the highly maneuverable O-51 was another 1940 2-seater. A few O-51's were sent to training schools.



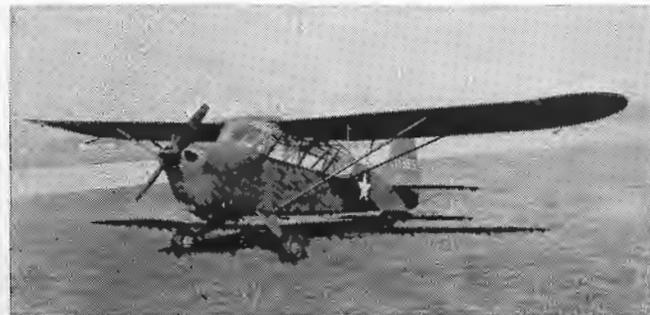
PIPER O-59 or L-4 (Grasshopper). ENG: Continental O-170, A, 65 hp, 4 cyl. SPECS: span 35'3", lgth 22'5", ht 6'8"; wt 729/1,220#. PERF: spd 70/83/47 mph; clb 14.4/5,000; clg 9,300/-'; rg 200 m. DESCR: Ordered in moderate quantity in the 1940's, this high-wing tandem 2-seater was originally the well-known commercial Piper Cub.



CONSOLIDATED VULTEE-STINSON O-62 or L-5 (Sentinel). ENG: Lycoming O-435, A, 185 hp, 6 cyl. SPECS: span 34', lgth 24'1", ht 8'6"; wt 1,526/2,045#. PERF: spd 112/128/50 mph; clb 6.4/5,000; clg 16,000/-'; rg 315 m. DESCR: Called the "Flying Jeep," this popular liaison plane was widely used after Pearl Harbor.



DOUGLAS OA-3. ENG: 2 Wright R-975, A, ea 350 hp, 9 cyl. SPECS: span 60'3", lgth 43'10", ht 14'1"; wt 5,825/8,547#. PERF: spd 120/140/63 mph; clb 7.1/5,000; clg 14,200/-'; rg 430 m. DESCR: A 2-engine type with steel fuselage, the Army's first monoplane amphibian was built from 1932 and flown until Pearl Harbor.



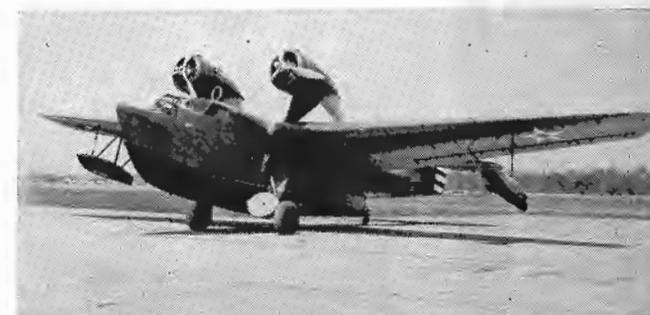
INTERSTATE O-63 or L-6. ENG: Aircooled Motors O-200, A, 102 hp, 4 cyl. SPECS: span 35'6", lgth 23'5", ht 7'6"; wt 1,102/1,650#. PERF: spd 87/104/54 mph; clb 11.4/5,000; clg 12,100/-'; rg 585 m. DESCR: This 2-place tandem monoplane, developed during World War II, has proved highly maneuverable in small space.



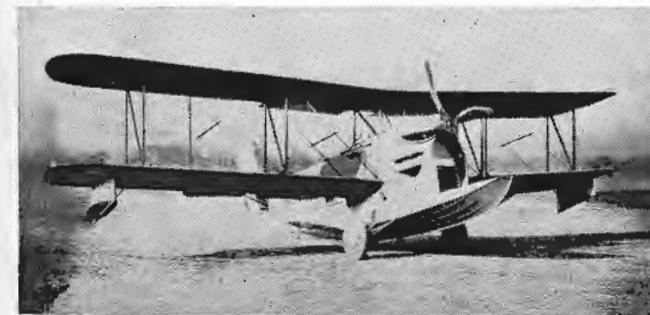
DOUGLAS OA-4. ENG: 2 Pratt & Whitney R-985, A, ea 350 hp, 9 cyl. SPECS: span 60', lgth 45'5", ht 14'3"; wt 5,992/8,571#. PERF: spd 118/137/70 mph; clb 7.8/5,000; clg 13,200/-'; rg 605 m. DESCR: Formerly known as a C-26 transport, this plane differed from OA-3 chiefly in engine. Later version had stainless-steel wing.



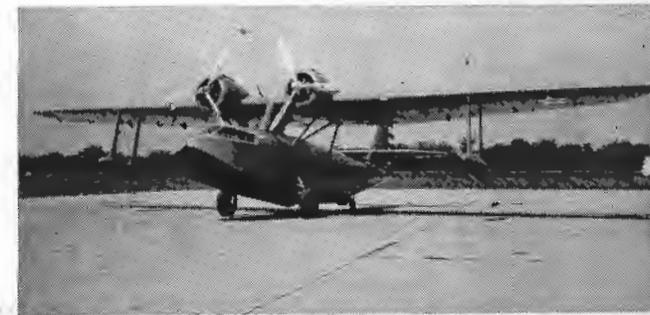
LOENING OA-1. ENG: inverted Liberty 12, L, 428 hp, 12 cyl. SPECS: span 45', lgth 34'7", ht 12'1"; wt 3,440/5,010#. PERF: spd 95/119/63 mph; clb 9.8/5,000; clg 11,900/14,160'; rg 360 m at full speed. ARMT: 1 mg. DESCR: The OA-1, Army's first true amphibian, made the 22,065-mile Pan-American flight of 1926-27.



DOUGLAS OA-5. ENG: 2 Wright R-1820, A, ea 930 hp, 9 cyl. SPECS: span 89'9", lgth 69'9", ht 21'; wt 14,038/20,000#. PERF: spd 152/170/75 mph; clb 13/10,000; clg 18,900/-'. ARMT: 3x.30 mgs. DESCR: An all-metal 5-place monoplane produced in 1933. An improved version of the OA-5 was considered but not procured.



LOENING OA-2. ENG: inverted Wright V-1460, A, 480 hp, 12 cyl. SPECS: span 44'11", lgth 34'11", ht 12'; wt 3,841/5,414#. PERF: spd 90/112/56 mph; clb 14.12/5,000; clg 8,475/10,725'. ARMT: mgs. DESCR: An original Loening design built and tested about 1930. The inverted engine kept prop clear of hull and water.



SIKORSKY OA-8. ENG: 2 Pratt & Whitney R-1690, A, ea 800 hp, 9 cyl. SPECS: span 86', lgth 52'1", ht 17'7"; wt 13,878/20,000#. PERF: spd 147/185/80 mph; clb 5.2/5,000; clg 18,900/21,300'; rg 1,325 m. DESCR: Adapted from 11-place commercial model to meet Army amphibian requirements, this plane was first produced in 1937.



GRUMMAN OA-9 (*Goose*). ENG: 2 Pratt & Whitney R-985, A, ea 450 hp, 9 cyl. SPECS: span 49', lgth 38'4", ht 12'; wt 5,832/7,932#. PERF: spd 145/195/70 mph; clb 16.1/15,000; clg 21,700/-; rg 880 m. DESCR: This 6-place type has had limited use since 1938. Its wheels, as in other recent amphibians, retract fully into the hull.



FAIRCHILD F-1. ENG: Pratt & Whitney R-1340, A, 410 hp, 9 cyl. SPECS: span 50'2", lgth 33', ht 9'3"; wt 2,947/4,632#. PERF: spd 105/131/63 mph; clb 6.5/5,000; clg 16,585/18,660'. DESCR: A commercial type purchased in 1929-31, the F-1 was the first Army plane bought for photography, later became a utility cargo plane.



CONSOLIDATED OA-10 (*Catalina*). ENG: 2 Pratt & Whitney R-1830, A, ea 1,200 hp, 14 cyl. SPECS: span 104', lgth 63'10", ht 20'10"; wt 18,486/27,603#. PERF: spd 130/185/80 mph; clb 4.9/5,000; clg 19,700/-; rg 2,000 m. ARMT: 2x.30, 2x.50 mgs. BOMBS: 4,000#. DESCR: Army version of the PBV-5A, Navy patrol bomber.



DE HAVILLAND F-8-DH (*Mosquito*). ENG: 2 Packard V-1650, L, ea 1,300 hp, 12 cyl. SPECS: span 54'2", lgth 40'10", ht 17'5"; wt 14,543/20,000#. PERF: spd 273/365/95 mph; clb 9.9/20,000; clg 30,000/-; rg 2,400 m. DESCR: One of Britain's best in World War II, a fast long-range photographic 2-seater also used by the AAF.

FIGHTERS

These planes perform many combat duties

In modern warfare the fighter comes as near as any type to being an all-purpose combat aircraft. Beside its principal function of destroying enemy planes in aerial combat, it cooperates with ground troops by dive-bombing and strafing enemy troops and supplies, escorts bombers over enemy territory, conducts long-range reconnaissance missions, and even stages its own bombing attacks as a "fighter-bomber." The success of these activities depends to a large extent on whether the fighter plane has greater speed, range, climb, maneuverability, and fire power than the enemy planes it meets. Its success also depends, even more than

in other combat types, on pilot skill.

Requirements for a "military scout," lighter and faster than the "reconnaissance weight carrier," were announced as far back as 1911. But this early unarmed type served only as a trainer. Not until World War I did real fighters make their appearance, the first being foreign types like the Spad which the Army copied and improved. Many important U. S. "pursuit" designs followed in the years between wars, including the MB-3, PW-8, P-1, P-12, P-26, P-35, and P-36.

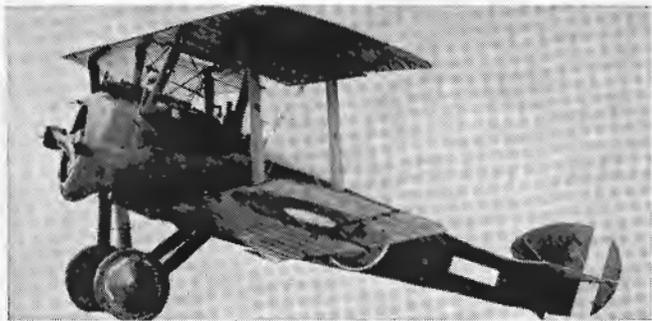
Fighters like the P-38, P-47, and P-51 rank among the most outstanding planes of World War II. Toward the war's end, still newer models were developed, some the products of radical experimentation. Tailless "flying wings" and other unconventional designs were tried in order to overcome present aerodynamic limitations and excel in speed, climb, range, and maneuverability. The advent of the jet-propelled fighter—first the P-59, then the P-80 which has been called one of the world's fastest planes—marked a new epoch in the history of military aeronautics in the United States.



NIEUPOURT 28. ENG: Gnome, A, 150 hp, 9 cyl. SPECS: span 27', lgth 21'2", ht 8' 1"; wt 953/1,636#. PERF: spd -/130/- mph; clb 19.8/16,350; clg 21,975/-; DESCR: One of the earliest French fighters, the Nieuport scored with high speed and maneuverability. It was the first fighter to be flown by A.E.F. flyers in World War I.



SPAD 13. ENG: Hispano-Suiza, L, 226 hp, 8 cyl. SPECS: span 27'1", lgth 20'4", ht 7'7"; wt 1,326/2,069#. PERF: spd -/132/- mph. DESCR: Successor to the Nieuport as the stand-by of the Air Service, the Spad, developed by French designers, was called the leading Allied pursuit of World War I. Captain Rickenbacker's squadron used it.



SOPWITH CAMEL. ENG: Clerget, A, 130 hp, 9 cyl. SPECS: span 28', lgth 19'1", ht 8'8"; wt 1,201/1,482#. PERF: spd 97/108/- mph; clb 825 fpm at 6,000'; clg 20,000/-'. ARMT: 2x.30 mgs. DESCR: An offspring of the Sopwith Tabloid of 1913, the Sopwith Camel was a British fighter flown by A.E.F. pilots attached to British squadrons.



AEROMARINE PG-1. ENG: Wright K, L, 300 hp, 8 cyl. SPECS: span 40', lgth 24'6", ht 8'; wt 3,030/3,918#. PERF: spd -/130/- mph; clb 9.5/6,500; clg 17,000/19,000'; rg 195 m at full speed. ARMT: 1x.50 mg; 1x37-mm cn. DESCR: A Packard-powered PG1 was flown by the Third Attack Group at Kelly Field in middle twenties.



ROYAL AIRCRAFT SE-5. ENG: Hispano-Suiza E, L, 180 hp, 8 cyl. SPECS: span 26'9", lgth 20'11", ht 10'; wt 1,486/2,060#. PERF: spd -/122/- mph; clb 8/6,500; clg 20,400/-'; rg 280 m at full speed. ARMT: 2x.30 mgs. DESCR: The SE-5 was to replace the Spad. Plans to have Curtiss build 1,000 SE-5's were canceled at war's end.



BRITISH AERIAL TRANSPORT BANTAM F.K. 23. ENG: A.B.C. Wasp, A, 184 hp, 9 cyl. SPECS: span 25', lgth 18'5", ht 6'4"; wt 683/1,128#. PERF: spd -/135/50 mph; clb 3.7/5,000; rg 445 m at 127 mph. ARMT: 2 mgs. DESCR: This small British single-seater with monocoque fuselage was used by Air Service in early twenties.



VERVILLE VCP-1. ENG: Wright H, L, 300+ hp, 8 cyl. SPECS: span 32', lgth 22'7", ht 8'4"; wt 2,014/2,669#. PERF: spd -/154/- mph; clb 4.4/6,500; clg 25,400/27,000'; rg 300 m at 149 mph. ARMT: 2x.30 mgs. DESCR: A postwar design by Alfred V. Verville of the Engineering Division, this day pursuit was made into a racer.



CURTISS PN-1. ENG: Liberty 6, L, 200+ hp, 6 cyl. SPECS: span 30'10", lgth 23'6", ht 10'3"; wt 1,631/2,311#. PERF: spd -/108/- mph; clb 5.5/6,500; clg 23,900/25,600'; rg 255 m at full speed. ARMT: 2x.30 mgs. DESCR: Intended as a night pursuit, this experimental plane of early 1920's had overhanging ailerons and wing.



CURTISS ORENCO D. ENG: Wright H, L, 330 hp, 8 cyl. SPECS: span 33', lgth 21'6", ht 8'4"; wt 1,908/2,820#. PERF: spd -/140/- mph; clb 6.9/6,500; clg 18,450/20,250'; rg 315 m at 125 mph. ARMT: 2 mgs. DESCR: Never produced in quantity, the Orenco D was a biplane of stick-and-wire construction designed near war's end.



ENGINEERING DIVISION TP-1. ENG: Liberty 12, L, 415 hp, 12 cyl. SPECS: span 36', lgth 25'1", ht 10'; wt 2,787/4,416#. PERF: spd -/132/- mph; clb 6.5/6,500; clg 20,300/-'; rg 380 m at 10,000 feet. ARMT: 5x.30 or .50 mgs. DESCR: This pursuit of early twenties, with a side-type supercharger, had unusually heavy armament.



THOMAS-MORSE MB-3 (Scout). ENG: Hispano-Suiza H, L, 330 hp, 8 cyl. SPECS: span 26', lgth 20', ht 8'6"; wt 1,506/2,094#. PERF: spd 122/152/- mph; clb 3.9/6,500; clg 23,700/24,900'; rg 290 m at 144 mph. ARMT: 2x.30 or .50 mgs. DESCR: Based on Spad design and slated for quantity production prior to war's end.



LOENING PW-2. ENG: Wright H, L, 320 hp, 8 cyl. SPECS: span 39'8", lgth 24'2", ht 9'; wt 1,876/2,788#. PERF: spd 105/132/- mph; clb 6.2/6,500; clg 20,000/21,800'; rg 300 m at 121 mph. ARMT: 2x.30 or .50 mgs. DESCR: An early monoplane pursuit of the mid-twenties, the PW-2 was remarkable for its 4-blade propeller.



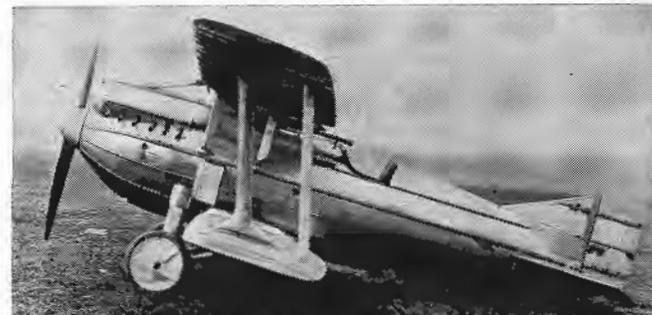
BOEING MB-3A. ENG: Wright H, L, 320 hp, 8 cyl. SPECS: span 26', lgth 20', ht 7'8"; wt 1,717/2,485#. PERF: spd -/140/- mph; clg -/21,200'. ARMT: 2x.30 or .50 mgs. DESCR: Based on the design of the Thomas-Morse MB-3, the single-place MB-3A was the first Boeing-built pursuit. An order for 200 was completed in 1923.



ORDNANCE PW-3 (Orenco). ENG: Wright H, L, 320 hp, 8 cyl. SPECS: span 27'9", lgth 23'10", ht 8'1"; wt 1,870/2,669#. PERF: No official data available. DESCR: An internally braced thick-wing biplane, one of several fighters designed soon after World War I. Its name was a contraction of Ordnance Engineering Corporation.



THOMAS-MORSE TM-24. ENG: Curtiss D-12, L, 440 hp, 12 cyl. SPECS: span 30', lgth 20'5"; wt -/3,470#. PERF: spd -/143/63 mph; clb 1,178 fpm at sea level. DESCR: Designed and tested in the middle twenties, the TM-24 was a 2-seater intended as both a pursuit and corps-observation type. It was of all-metal construction.



GALLAUDET PW-4. ENG: Packard-Liberty, L, 350 hp, 12 cyl. SPECS: span 29'10", lgth 22'8", ht 8'; wt 2,203/3,040#. PERF: No official data available. DESCR: The PW-4 of the mid-twenties was one of the first U.S. pursuits whose airframe and covering were made entirely of metal. Its bullet-shaped lines anticipated today's designs.



CURTISS PW-1. ENG: Packard-Liberty, L, 350 hp, 12 cyl. SPECS: span 32', lgth 22'6", ht 8'4"; wt 2,069/3,005#. PERF: spd -/146/- mph; clb 6.3/6,500; clg 19,300/21,000'; rg 330 m at 132 mph. ARMT: 2x.30 or .50 mgs. DESCR: Mid-twenties PW-1 had first funnel-type radiator, first droppable gas tank inclosed in fuselage.



FOKKER PW-5. ENG: Wright H, L, 320 hp, 8 cyl. SPECS: span 39'5", lgth 27'2", ht 9'; wt 2,170/3,015#. PERF: spd -/138/- mph. ARMT: 2x.30 mgs. DESCR: The PW-5 was an experimental type of the mid-twenties, one of the first U.S. pursuits to be designed by Tony Fokker, Hollander who built German fighters in World War I.



FOKKER PW-6. ENG: Wright H, L, 335 hp, 8 cyl. SPECS: span 29'6", lgth 23'4", ht 9'; wt 1,926/2,763#. PERF: spd 117/139/-mph; clb 6.3/6,500; clg 16,750/18,200'; rg 295 m. DESCR: This plane was similar in design to the German Fokker D-7 of World War I. It was another of the experimental types of the middle twenties.



CURTISS P-1 (Hawk). ENG: Curtiss D-12, L, 450 hp, 12 cyl. SPECS: span 31'7", lgth 22'10", ht 8'7"; wt 2,058/2,846#. PERF: 136/163/59 mph; clb 3.1/5,000; clg 22,500/23,800'; rg 400 m at full speed. ARMT: 2x.30 or .50 mgs. DESCR: Based on Curtiss PW-8A design, P-1 was adopted as a standard type in the late twenties.



FOKKER PW-7. ENG: Curtiss D-12, L, 440 hp, 12 cyl. SPECS: span 38'4", lgth 23'11", ht 9'4"; wt 2,271/3,176#. PERF: spd -/151/- mph; clb 4.5/6,500; clg 20,700/22,000'; rg 350 m at 145 mph. ARMT: 2 mgs. DESCR: Unlike Fokker's PW-5, the PW-6 and the PW-7 were biplanes. The PW-7 was larger and more powerful.



CURTISS P-2. ENG: Curtiss V-1150 L, 505 hp, 12 cyl. SPECS: span 31'7", lgth 22'10", ht 8'7"; wt 2,081/2,869#. PERF: spd 138/172/65 mph; clb 3.5/6,500; clg 22,950/24,000'; rg 400 m at full speed. ARMT: 2x.30 or .50 mgs. DESCR: Based on the P-1, this standard type of late twenties shows early use of the supercharger.



CURTISS PW-8A (Hawk). ENG: Curtiss D-12, L, 440 hp, 12 cyl. SPECS: span 30', lgth 22'6", ht 8'; wt 2,007/2,820#. PERF: spd -/178/- mph; clb 4/6,500; clg 22,250/23,400'; rg 335 m at 167 mph. ARMT: 2x.30 or .50 mgs. DESCR: The better-designed PW-8A, middle-twenties pioneer in the Hawk series, outdid the PW-8.



CURTISS P-3. ENG: Pratt & Whitney R-1340, A, 426 hp, 9 cyl. SPECS: span 31'7", lgth 22'6", ht 8'7"; wt 1,864/2,689#. PERF: spd 122/154/57 mph; clb 2.9/5,000; clg 22,400/23,650'; rg 390 m at full speed. DESCR: Designed like the P-1A the experimental P-3 marked appearance of Pratt & Whitney air-cooled engines in pursuits.



BOEING PW-9. ENG: Curtiss D-12, L, 440 hp, 12 cyl. SPECS: span 32'1", lgth 22'10", ht 8'9"; wt 2,011/2,971#. PERF: spd -/161/- mph; clb 3.8/6,500; clg 22,000/22,850'; rg 425 m at 150 mph. ARMT: 2x.30 or .50 mgs. DESCR: First of a new line of Boeings leading to P-12, and a late-twenties stand-by of the Air Service.



CURTISS P-6. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 31'6", lgth 23'2", ht 8'10"; wt 2,743/3,436#. PERF: spd 172/198/61 mph; clb 5.2/10,000; clg 23,900/25,800'; rg 460 m. BOMBS: 250#. ARMT: 2x.30 or .50 mgs. DESCR: First pursuit to be ordered in quantity, P-6 was flown from 1932 to World War II.



BOEING XP-9. ENG: Curtiss V-1570, L, 583 hp, 12 cyl. SPECS: span 36'6", lgth 25'8", ht 7'9"; wt 2,694/3,604#. PERF: spd 145/181/70 mph; clb 2.3/5,000; clg 25,300/26,400'. DESCR: This all-metal experimental model of the early thirties, with externally braced gull wing, reintroduced monoplane construction into pursuit design.



BERLINER-JOYCE P-16. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 34', lgth 28'5", ht 8'11"; wt 2,756/3,927#. PERF: spd 148/176/68 mph; clb 2.36/5,000; clg 26,200/28,000'; rg 650 m. BOMBS: 244#. ARMT: 3 mgs. DESCR: The P-16 (formerly PB-1) was standard in the early thirties, first of several 2-place types.



CURTISS XP-10. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 33', lgth 24'6". PERF: No official data available. DESCR: This gull-wing biplane equipped with supercharged engine was built to meet a need for a pursuit capable of high speed at 12,000 feet. The only one produced was sent to Chanute Field for school purposes.



CURTISS XP-17. ENG: inverted Wright 1460, A, 600 hp, 12 cyl. SPECS: span 31'7", lgth 22'10", ht 8'7"; wt 2,204/2,994#. PERF: spd 130/165/62 mph; clb 3.4/5,000; clg 21,400/22,800'. ARMT: 2 mgs. DESCR: The XP-17 was produced about 1930 at Wright Field by installing a Wright inverted air-cooled engine in a standard P-1.



BOEING P-12. ENG: Pratt & Whitney R-1340, A, 500 hp, 9 cyl. SPECS: span 30', lgth 20'1", ht 8'8"; wt 2,048/2,740#. PERF: spd 162/189/59 mph; clb 4/5,000; clg 26,600/27,900'; rg 475 m. ARMT: 2x.30 or .50 mgs. DESCR: Best Army acrobatic plane, the P-12 was used by Chennault and other flyers in air shows during the thirties.



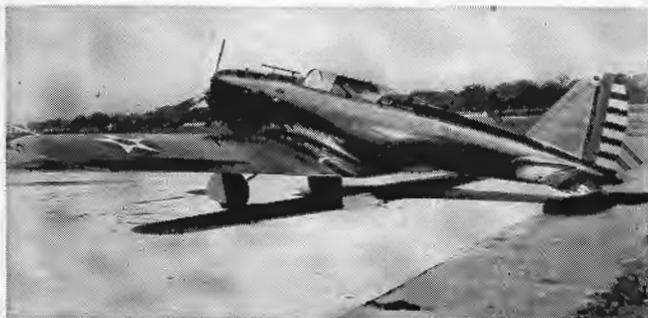
CURTISS YP-20 (Hawk). ENG: Wright R-1820, A, 575 hp, 9 cyl. SPECS: span 31'6", lgth 20', ht 9'2"; wt 2,432/3,189#. PERF: spd 157/187/61 mph; clb 2.6/5,000; clg 25,800/26,800'. ARMT: 2x.30 or .50 mgs. DESCR: An experimental Hawk of the early thirties, with the fuselage, tail surfaces, and wings of the earlier Curtiss P-6E.



THOMAS-MORSE P-13 (Viper). ENG: Curtiss H-1640, A, 600 hp, 12 cyl. SPECS: span 28', lgth 23'6", ht 8'5"; wt 2,262/3,256#. PERF: spd 138/173/67 mph; clb 2.6/5,000; clg 20,775/22,000. DESCR: In the early thirties, Thomas-Morse built two experimental Viper models. The second one, with Pratt & Whitney engine, crashed.



CURTISS P-23. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 31'6", lgth 23'10", ht 9'6"; wt 3,274/4,124#. PERF: spd 180/223/70 mph; clg 30,000/-'; rg 450 m. BOMBS: 488#. ARMT: 2x.30, 1x.50 mgs. DESCR: A sleek P-6E of early thirties with droppable gas tank; had all-metal wings and monocoque fuselage.



DETROIT P-24. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 42'9", lgth 28'9", ht 8'6"; wt 3,193/4,360#. PERF: spd 186/215/60 mph; clb 3.1/5,000; clg 26,400/28,000'. ARMT: mgs. DESCR: A wood-wing pursuit with veneer-covered monocoque fuselage (basic design for the P-25), the P-24 was procured about 1931.



CURTISS XP-31 (Swift). ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 36', lgth 26'. DESCR: Designed for high speed at low altitude, XP-31 was the first of the Curtiss low-wing monoplanes. Equipped with fixed landing gear, it had an all-metal monocoque fuselage and wings that were constructed of fabric-covered metal.



CONSOLIDATED P-25. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 43'10", lgth 29'4", ht 8'7"; wt 3,887/5,110#. PERF: spd -/205/- mph. DESCR: An unsuccessful all-metal low-wing monoplane, the P-25 used retractable landing gear. A contract for four of these 2-seaters was canceled after two of them crashed during tests.



REPUBLIC P-35. ENG: Pratt & Whitney R-1830, A, 1,050 hp, 14 cyl. SPECS: span 36', lgth 25'2", ht 12'5"; wt 4,575/5,953#. PERF: spd 260/290/80 mph; clb 6.9/15,000; clg 31,400/-'; rg 1,150 m. BOMBS: 350#. ARMT: 2x.30, 2x.50 mgs. DESCR: Based on Severky-designed model, the modern P-35 featured integral-wing gas tanks.



BOEING P-26. ENG: Pratt & Whitney R-1340, A, 570 hp, 9 cyl. SPECS: span 28', lgth 23'10", ht 10'5"; wt 2,271/2,950#. PERF: spd 200/235/82 mph; clb 5.1/10,000; clg 27,400/-'; rg 360 m. BOMBS: 232#. ARMT: 2x.30 mgs. DESCR: First built in 1933, P-26 was used against Japs soon after Pearl Harbor by Far East Air Force.



CURTISS P-36. ENG: Pratt & Whitney R-1830, A, 1,050 hp, 14 cyl. SPECS: span 37'4", lgth 28'6", ht 12'2"; wt 4,567/5,555#. PERF: spd 270/311/75 mph; clb 4.9/15,000; clg 33,700/-'; rg 830 m. ARMT: 1x.30, 1x.50 mgs. DESCR: Used by France, P-36 was probably the first American pursuit to go into action in World War II.



BOEING P-29. ENG: Pratt & Whitney R-1340, A, 550 hp, 9 cyl. SPECS: span 29'5", lgth 25'2", ht 7'8"; wt 2,573/3,267#. PERF: spd 208/245/80 mph; clb 6.8/10,000; clg 24,200/-'; rg 520 m. BOMBS: 327#. ARMT: 2x.30 or .50 mgs. DESCR: Last of the old Boeing pursuits. Thereafter Boeing turned its attention to bombers.



CURTISS P-37. ENG: Allison V-1710, L, 1,000 hp, 12 cyl. SPECS: span 37'4", lgth 32'10", ht 9'6"; wt 5,273/6,889#. PERF: spd 308/340/85 mph; clb 8.1/20,000; clg 34,000/-'; rg 570 m. ARMT: 1x.30, 1x.50 mgs. DESCR: The experimental P-37, basically a P-36 with a liquid-cooled Allison engine, was a forerunner of the P-40.



LOCKHEED P-38 (Lightning). ENG: 2 Allison V-1710, L, ea 1,425 hp, 12 cyl. SPECS: span 52', lgth 37'10", ht 12'10"; wt 12,700/17,500#. PERF: spd 300/414/104 mph; clb 8.8/25,000; clg 40,000/-'; rg 1,460 m. ARMT: 4x.50 mgs; 1x20-mm cn. DESCR: One of war's best, this first U.S. 2-engine fighter can carry two tons of bombs.



REPUBLIC P-43 (Lancer). ENG: Pratt & Whitney R-1830, A, 1,200 hp, 14 cyl. SPECS: span 36', lgth 28'6", ht 14'; wt 5,654/7,910#. PERF: spd 280/349/78 mph; clb 5.5/15,000; clg 38,000/-'; rg 800 m. ARMT: 2x.30, 2x.50 mgs. DESCR: P-43 resembled P-41 in construction, had flush-type landing gear and a turbosupercharger.



BELL P-39 (Airacobra). ENG: Allison V-1710, L, 1,200 hp, 12 cyl. SPECS: span 34', lgth 30'2", ht 12'5"; wt 5,967/7,600#. PERF: spd 235/376/80 mph; clb 6.1/15,000; clg 38,000/-'; rg 350 m. ARMT: 4x.50 mgs; 1x37-mm cn. DESCR: Engine to the rear of pilot and nose cannon characterize the P-39, important early in the Pacific war.



REPUBLIC P-47 (Thunderbolt). ENG: Pratt & Whitney R-2800, A, 2,000 hp, 18 cyl. SPECS: span 40'9", lgth 36'1", ht 14'2"; wt 9,957/14,500#. PERF: spd 340/433/100 mph; clb 2/5,000; clg 40,000/-'; rg 600 m. ARMT: 8x.50 mgs. DESCR: A heavyweight, the P-47 was used with outstanding success in global theaters of World War II.



CURTISS P-40 (Warhawk). ENG: Allison V-1710, L, 1,040 hp, 12 cyl. SPECS: span 37'4", lgth 31'9", ht 12'4"; wt 5,590/7,600#. PERF: spd 280/352/80 mph; clb 5.1/15,000; clg 32,400/-'; rg 700 m. BOMBS: 500#. ARMT: 4x.30, 2x.50 mgs. DESCR: Used by AVG in China, P-40 had largest AAF combat production in December 1941.



GRUMMAN XP-50. ENG: 2 Wright R-1820, A, ea 1,200 hp, 9 cyl. SPECS: span 42', lgth 31'11"; wt 8,307/10,558#. PERF: spd 317/424/- mph; clb 5/20,000'; rg 570 m. BOMBS: 200#. ARMT: 2x.50 mgs; 2x20-mm cn. DESCR: Like the Navy's XF5F-1 except for landing gear and armament. The sole XP-50 crashed in May 1941.



CURTISS XP-42. ENG: Pratt & Whitney R-1830, A, 1,050 hp, 14 cyl. SPECS: span 37'4", ht 8'5"; wt 4,818/5,919#. PERF: spd 286/315/- mph; rg 730 m at 286 mph. ARMT: 1x.30 or 1x.50 mg. DESCR: The XP-42, a modified P-36A, represented an early effort to enclose an air-cooled engine within a longer, streamlined cowling.



NORTH AMERICAN P-51 (Mustang). ENG: Packard V-1650, L, 1,450 hp, 12 cyl. SPECS: span 37', lgth 32'3", ht 13'8"; wt 7,125/10,100#. PERF: spd 375/440/100 mph; clb 1.7/5,000; clg 43,000/-'; rg 1,050 m. ARMT: 6x.50 mgs. DESCR: One of World War II's best, P-51 first reached RAF in Nov. 1941, AAF in July 1942.



VULTEE XP-54. ENG: Lycoming H-2470, L, 2,300 hp, 24 cyl. SPECS: span 54'3", lgth 52'9"; wt 13,148/-#. PERF: spd -/450+/- mph; clb 17/26,000; clg 37,000/-'. ARMT: 2x.50 mgs; 2x37-mm cn. DESCR: Going back to ideas used in the early Burgess-Dunne, the twin-boom XP-54 was one of the Army's first modern pushers.



CURTISS P-60. ENG: Pratt & Whitney R-2800, A, ea 2,000 hp, 18 cyl. SPECS: span 41'4", lgth 33'11", ht 15'; wt 8,600/10,525#. PERF: spd -/415/89 mph; clb 4.3/15,000; clg 35,000/-'. ARMT: 4x.50 mgs. DESCR: An improved P-40 with modified P-40D fuselage, laminar-flow wings, and in some models dual-rotation propellers.



CURTISS XP-55 (Ascender). ENG: Allison V-1710, L, 1,275 hp, 12 cyl. SPECS: span 40'7", lgth 29'7"; wt 5,325/6,885#. PERF: spd 300/390/80 mph; clb 7.1/20,000; clg 34,600/-'; rg 900 m. ARMT: 4x.50 mgs. DESCR: Its engine mounted in the rear and its horizontal stabilizer forward, the modern P-55 recalls the "Early Bird" pushers.



NORTHROP P-61 (Black Widow). ENG: 2 Pratt & Whitney R-2800, A, ea 1,850 hp, 18 cyl. SPECS: span 66', lgth 48'11", ht 14'2"; wt 22,900/29,700#. PERF: spd -/375/- mph; clb 2.2/5,000; clg 31,300/-'; rg 800 m. BOMBS: 6,400#. ARMT: 4x.50 mgs; 4x20-mm cn. DESCR: A 3-place night fighter with twin tail boom.



NORTHROP XP-56. ENG: Pratt & Whitney R-2800, A, 2,000 hp, 18 cyl. SPECS: span 42'7", lgth 23'7"; wt 8,699/11,350#. PERF: spd 396/467/- mph; clb 7.2/20,000; rg 445 m. ARMT: 4x.50 mgs; 2x20-mm cn. DESCR: This stubby, tailless fighter craft is an AAF engineering test type. It has two counter-rotating, pusher propellers.



CURTISS XP-62. ENG: Wright R-3350, A, 2,300 hp, 18 cyl. SPECS: span 53'8", lgth 39'6"; wt 11,773/14,660#. PERF: spd -/448/85 mph; clb 6.6/15,000. ARMT: 8x20-mm cn. DESCR: A heavily armed fighter with a supercharged cabin for high altitudes and electrically controlled, constant-speed dual-rotation props. Not in production.



BELL P-59A (Airacomet). ENG: 2 General Electric I-16 jet propulsion. SPECS: span 49', lgth 38'10", ht 12'4"; wt 10,410/-#. PERF: spd -/413/- mph; rg 350 m. ARMT: 3x.50 mgs, 1x37-mm cn; or 2x37-mm cn. DESCR: The jet-propelled P-59A, first flown in 1942, was built in fair number and used for experiment and training.



BELL P-63 (Kingcobra). ENG: Allison V-1710, L, 1,325 hp, 12 cyl. SPECS: span 38'4", lgth 32'8", ht 12'3"; wt 6,539/8,350#. PERF: spd 262/410/- mph; clb 1.4/5,000; rg 550 m. BOMBS: 1,500#. ARMT: 4x.50 mgs; 1x37-mm cn. DESCR: Intended as an improvement of the P-39 series, the larger P-63 has similar lines.



NORTH AMERICAN P-64. ENG: Wright R-1820, A, 875 hp, 9 cyl. SPECS: wt 4,658/5,990#. PERF: 235/270/70 mph; clg 27,500/-'; rg 680 m. BOMBS: 550#. ARMT: 2x.303 mgs; 2x20-mm cn. DESCR: Originally purchased for the Royal Thai Air Force, the few P-64's that were built could not be exported and thus reverted to the AAF.



BELL XP-77. ENG: Ranger V-770, A, 520 hp, 12 cyl. SPECS: span 27'6", lgth 22'11"; wt 2,760/3,583#. PERF: spd 250/350/92 mph; clb 3/8,500; clg 30,100/-'; rg 550 m. ARMT: 2x.50 mgs; 1x20-mm cn. DESCR: Built for possible use against agile Jap Zeros, this small monoplane was made chiefly of wood during metal shortage.



VULTEE P-66. ENG: Pratt & Whitney R-1830, A, 1,200 hp, 14 cyl. SPECS: span 36', lgth 28'5"; wt 5,237/7,384#. PERF: spd 290/340/82 mph; clb 5/12,600; clg 28,200/-'; rg 850 m. ARMT: 4x.30, 2x.50 mgs. DESCR: A few all-metal P-66's were tested during World War II. The fuselage is part welded steel, part aluminum alloy.



NORTHROP XP-79. ENG: 2 Westinghouse jet-propulsion. SPECS: span 38', lgth 14', ht 7'. PERF: Information not released. DESCR: First flown in late 1945, the XP-79 is a pioneer flying-wing pursuit. The plane lands on four wheels, has pressure cabin, twin fins on wing top, rudder-assist ducts in wing tips. Pilot lies prone.



MCDONNELL P-67. ENG: 2 Continental I-1430, L, ea 1,350 hp, 12 cyl. SPECS: span 55', lgth 41'10"; wt 16,661/21,000#. PERF: spd 270/448/93 mph; clb 17/25,000; clg 37,000/-'; rg 700 m. ARMT: 6x37-mm cn. DESCR: A fast interceptor with airfoil-shaped fuselage and nacelles, pressurized cabin, turbo-exhaust jet thrust.



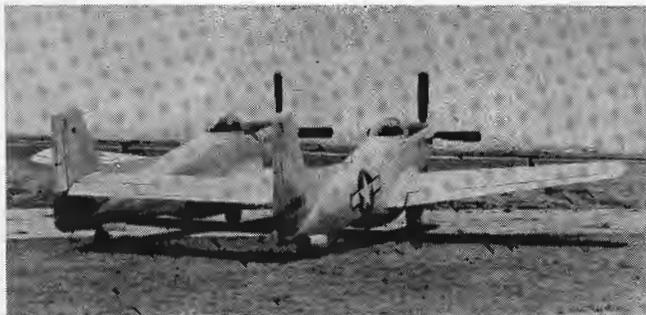
LOCKHEED P-80 (Shooting Star). ENG: General Electric I-40 jet-propulsion. SPECS: span 39', lgth 32', ht 11'4"; wt -/11,950#. PERF: spd -/575+/- mph. ARMT: 6x.50 mgs. DESCR: Though never in combat this jet fighter is regarded as one of world's fastest, has pressurized cabin, instant warm-up, no vibration, little sound.



GENERAL MOTORS XP-75. ENG: Allison V-3420, L, 2,600 hp, 24 cyl. SPECS: span 49'1", lgth 41'6"; wt 11,440/17,878#. PERF: 250/475/82 mph; clb 7/20,000; clg 37,000/-'. ARMT: 4x.50 mgs. DESCR: The P-75, a composite plane designed to use production parts of other aircraft, has P-40 wings, A-24 tail, F4U landing gear.



CONSOLIDATED XP-81. ENG: 2 General Electric, jet-propulsion aft, same combined with internal-combustion fore. SPECS: span 50'6", lgth 44'8", ht 13'11". PERF: Information not released. DESCR: Combining propeller drive with jet-propulsion, the XP-81 flies on prop when range and economy (at less speed) are needed.



NORTH AMERICAN XP-82. ENG: 2 Packard V-1650, L, ea 1,520 hp, 12 cyl. SPECS: span 51'3", lgth 38'1"; wt 13,403/22,000#. PERF: spd 315/482/- mph; clb 4.5/20,000; clg 25,000/-'; rg 2,600 m. BOMBS: 4,000#. ARMT: 6x.50 mgs. DESCR: A design dating to 1937, the new XP-82 combines two P-51's for greater range.



SUPERMARINE 21 (Spitfire). ENG: Rolls Royce (Griffon), L, 1,780 hp, 12 cyl. SPECS: span 37'1", lgth 32'6", ht 10'; wt 7,873/8,530#. PERF: spd 250/454/- mph; clb 8/20,000; clg 43,000/-'. ARMT: 4x20-mm cn. DESCR: This great English fighter was widely used by Eagle squadrons and by AAF before arrival of the P-47.



BELL XP-83. ENG: 2 General Electric jet-propulsion. SPECS: span 53', lgth 45', ht 14'. PERF: Information not released. DESCR: A single-place interceptor, the XP-83 is a recent successor to the original Bell P-59A jet type. Larger all around, it features heavy armor and armament, high speed, long range, and a pressure cabin.



BELL FM-1 (Aircuda). ENG: 2 Allison V-1710, L, ea 1,150 hp, 12 cyl. SPECS: span 69'10", lgth 44'10", ht 13'7"; wt 13,376/17,333#. PERF: spd 244/271/77 mph; clb 10/15,000; clg 30,500/-'. ARMT: 2x.30, 2x.50 mgs; 2x37-mm cn. DESCR: Powered by pusher engines, this fighter was designed to combat high-speed bombers.

BOMBERS

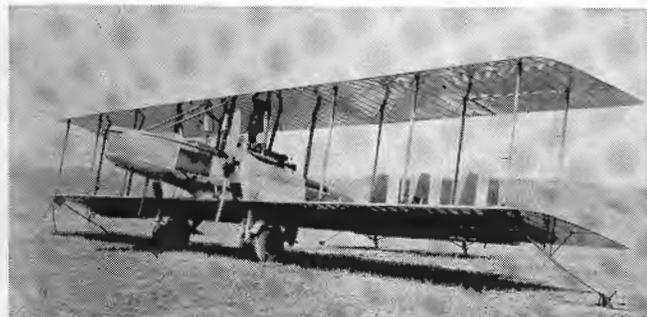
They carry the war to the enemy

Bombardment is both the most telling and the most spectacular phase of AAF action, and much of the vast program of the air arm is pointed toward the end of dropping bombs wherever they will impede an enemy's war effort. The bomber achieves this purpose whether it is engaged in a tactical strike on a road junction to interdict enemy traffic or in strategic blows on a far-off oil refinery to cripple the enemy's industrial potential.

Small bombs were dropped from a Wright B in 1911, but the Army's first bomber, a Martin, was not built until 1918. Lack of funds and opposition to the bomber idea limited the program

until the late twenties and early thirties when competition for new designs brought the LB-6, B-2, and the B-9 and B-10 monoplanes. A further stimulus to new developments was the organization of the GHQ Air Force, established in March 1935 and founded on faith in the strategic potentialities of heavy bombardment.

World War II saw tremendous advances in the striking power of the heavy bomber. From bombers capable of carrying bombs weighing 6,000 pounds for a combat radius of 900 miles at 200 miles an hour came planes that could carry 20,000 pounds of bombs to targets 1,600 miles away at speeds of 350 miles an hour and altitudes of over 35,000 feet. In October 1945 General Arnold foretold the production within a few years of jet-propelled bombers capable of flying 500 to 600 miles an hour to reach targets 1,500 miles away. He predicted the development of bombers with a 100,000-pound bomb capacity operating at stratospheric altitudes, at speeds faster than sound, and with range adequate to attack any spot on earth and return to a friendly base.



CURTISS CAPRONI. ENG: 3 Liberty 12, L, ea 360 hp, 12 cyl. SPECS: span 76'10", lgth 41'2", ht 12'1"; wt 7,700/12,350#. PERF: spd -/103/- mph; clb 14.2/6,500. BOMBS: 1,330#. ARMT: 4x.30 mgs. DESCR: The Caproni was planned in 1917 as a short-range night bomber. Two samples were made before close of World War I.



STANDARD HANDLEY-PAGE. ENG: 2 Liberty 12, L, ea 400 hp, 12 cyl. SPECS: Span 100', lgth 62'10", ht 22'; wt 8,721/14,425#. PERF: spd 82/94/- mph; clb 27.1/6,500; clg 7,400/9,600'. BOMBS: 2,000#. ARMT: 5x.30 mgs. DESCR: Parts for this bomber were produced in the U.S., assembled in England; seven ready by Armistice.



MARTIN GMB. ENG: 2 Liberty 12, L, ea 400 hp, 12 cyl. SPECS: span 71'5", lgth 44'10", ht 14'7"; wt 6,702/10,225#. PERF: spd 92/105/- mph; clb 14.6/6,500; clg 10,300/-'; rg 390 m. BOMBS: 1,040#. ARMT: 5x.30 mgs. DESCR: Built in 1918, this first U.S.-designed bomber flew completely "around the rim" of the U.S. in 1919.



GALLAUDET DB-1. ENG: 750-W, 700 hp, 18 cyl. SPECS: span 67', lgth 44', ht 10'2"; wt 8,200/11,160#. PERF: spd 128/145/- mph; clb 12.4/10,000; clg 17,150/18,850'. ARMT: 2x.30 mgs. DESCR: The Army-built engine, internally braced wing, steel and Duralumin construction, and monoplane design were all new in 1921.



MARTIN MB-2. ENG: 2 Liberty 12, L, ea 418 hp, 12 cyl. SPECS: span 74'2", lgth 42'8", ht 14'8"; wt 7,069/12,027#. PERF: spd 91/98/- mph; clb 23.8/6,500; clg 7,700/9,900'. BOMBS: 1,040#. ARMT: 5x.30 mgs. DESCR: A modification of the original Martin, this was type used in historic bomber-battleship trials, July 1921.



WITTEMAN-LEWIS NBL-1 (Barling). ENG: 6 Liberty 12, L, ea 520 hp, 12 cyl. SPECS: span 120', lgth 65', ht 27'; wt 27,703/32,203#. PERF: spd 61/96/- mph; clg 7,275/10,200'; rg 170 m. ARMT: 7x.30 mgs. DESCR: This early-twenties triplane with six engines in four nacelles had disappointing speed, load, and endurance.



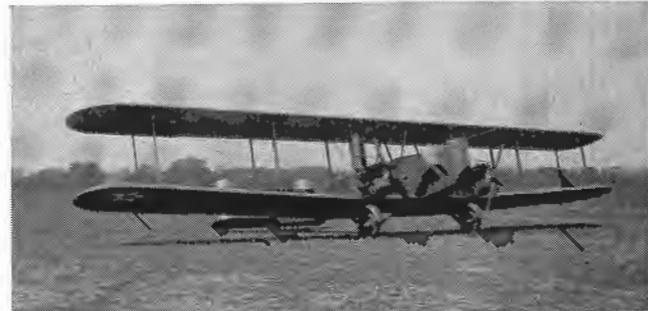
POMILIO VL-12. ENG: Liberty 12, L, 400+ hp, 12 cyl. SPECS: span 48'3", lgth 31'7", ht 9'9"; wt 2,824/4,552#. PERF: spd 94/111/- mph; clb 11.3/6,500; clg 13,700/15,900'; rg 485 m. BOMBS: 350#. ARMT: 2x.30 mgs. DESCR: Designed by the Pomilio brothers when dispatch of bombers against Germany was discussed in 1918.



ELIAS NBS-3. ENG: 2 Liberty 12, L, ea 425 hp, 12 cyl. SPECS: span 77'6", lgth 48'5", ht 16'10"; wt 8,809/14,343#. PERF: spd -/101/- mph; clb 23.5/6,500; clg 8,680/11,500'; rg 485 m at 93 mph. ARMT: 5x.30 mgs. DESCR: Procured in 1922, two twin-fin NBS-3's were tested up to 1926 for night bombing; had crew of four.



L.W.F. (Owl). ENG: 3 Liberty 12, L, each 400+ hp, 12 cyl. SPECS: span 105', lgth 53'10", ht 17'6"; wt 12,600/20,200#. PERF: spd -/110/55 mph; clb 9/6,000; clg 17,500/-'. DESCR: A 3-engine 2-place biplane originally called "Giant Bomber," the Owl had triple fins and four landing wheels, and was built about 1921 for cargo too.



CURTISS NBS-4 (Condor). ENG: 2 Liberty, L, ea 423 hp, 12 cyl. SPECS: span 90'2", lgth 46'5", ht 15'9"; wt 7,809/13,740#. PERF: spd -/101/53 mph; clb 14.9/5,000; clg 9,200/11,900'; rg 505 m at full speed. ARMT: 5x.30 mgs. DESCR: Still flown in 1930, this popular night bomber, ancestor of B-2 Condor, was built in 1923-24.



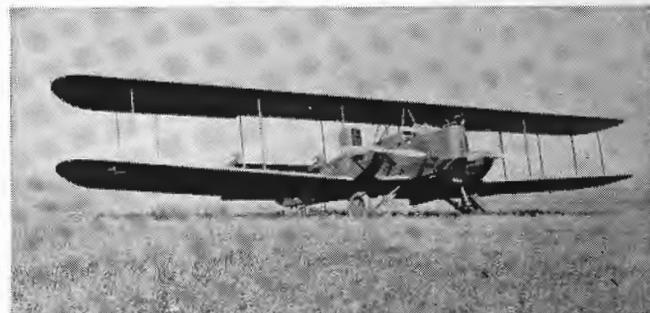
HUFF-DALAND LB-1. ENG: Packard 2500, L, 787 hp, 12 cyl. SPECS: span 66'6", lgth 46'2", ht 14'11"; wt 6,237/12,414#. PERF: spd 105/120/- mph; clb 14/6,500; clg 11,150/13,700'. ARMT: 3x.30 mgs. DESCR: The first plane to be called a "light bomber," the Huff-Daland LB-1 was built in small quantity beginning in 1926.



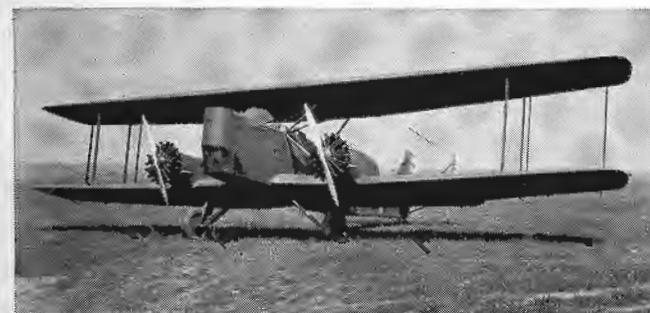
HUFF-DALAND XB-1 (Super-Cyclops). ENG: 2 Packard 1A-1500, L, ea 500 hp, 12 cyl. SPECS: span 84'9", lgth 59', ht 19'3"; wt 9,462/17,037#. PERF: No official data available. ARMT: 6x.30 mgs. DESCR: In this first B-type, built about 1927, rear gunner and radio operator sat aft in engine nacelles. Keystone built the later XB-1B.



ATLANTIC XLB-2. ENG: 2 Pratt & Whitney R-1340, A, ea 844 hp, 9 cyl. SPECS: span 72'10", lgth 51'5", ht 13'3"; wt 5,916/12,039#. PERF: spd 93/116/67 mph; clb 11.5/5,000; clg 10,925/13,400'; rg 540 m. ARMT: mgs. DESCR: Designed for air-cooled inverted Liberty engines, this bomber of 1928 used Wasps, then Hornets.



CURTISS B-2 (Condor). ENG: 2 Curtiss V-1570, L, ea 632 hp, 12 cyl. SPECS: span 90', lgth 47'6", ht 16'3"; wt 9,039/16,516#. PERF: spd 108/132/53; clb 6.8/5,000; clg 17,100/19,400'. ARMT: 6x.30 mgs. DESCR: Twelve B-2's ordered after tests in 1928 proved B-2 preferable to XB-1 or Curtiss NBS-4. Gunners sat aft of engines.



KEYSTONE LB-3. ENG: 2 Pratt & Whitney R-1340, A, ea 846 hp, 9 cyl. SPECS: span 67', lgth 45', ht 16'10"; wt 6,065/11,682#. PERF: spd 93/116/59 mph; clb 11.3/5,000; clg 11,210/13,700'; rg 545 m at full speed. ARMT: 2x.30 mgs. DESCR: Similar to the 1-engine LB-1 except for the two nacelles and changes in the nose.



DOUGLAS B-7. ENG: 2 Curtiss V-1570, L, ea 675 hp, 12 cyl. SPECS: span 65', lgth 46'7", ht 12'1"; wt 7,519/9,953#. PERF: spd 158/182/78 mph; clb 3.7/5,000; clg 20,400/21,800; rg 411 m. BOMBS: 1,200#. ARMT: 2x.30 mgs. DESCR: A gull-wing fast day bomber first developed for observation work as the XO-36 in 1930.



KEYSTONE LB-6 (Panther). ENG: 2 Wright R-1750, A, ea 542 hp, 9 cyl. SPECS: span 74'9", lgth 43'6", ht 18'1"; wt 6,605/13,018#. PERF: spd 93/116/58 mph; clb 7.9/5,000; clg 14,770/17,050'; rg 440 m at full speed. ARMT: 3x.30 mgs. DESCR: Like the LB-3 except for wing changes and engines; first built in the late twenties.



FOKKER B-8. ENG: 2 Curtiss V-1570, L, ea 600 hp, 12 cyl. SPECS: span 64', lgth 47', ht 11'6"; wt 6,861/10,545#. PERF: no official data available. BOMBS: 1,100#. DESCR: A modified O-27, the B-8 had a bomb rack installed in its fuselage. In 1931, four B-8's were built to be tested in service as dual bombardment and observation types.



BOEING B-9. ENG: 2 Pratt & Whitney R-1860, A, ea 600 hp, 9 cyl. SPECS: span 76'9", lgth 51'6", ht 12'8"; wt 8,362/13,351#. PERF: spd 165/188/63 mph; clb 9.5/10,000; clg 19,200/21,000'. BOMBS: 1,900#. DESCR: The B-9 was Army's first all-metal low-wing monoplane bomber, a product of the 1931 design competition.



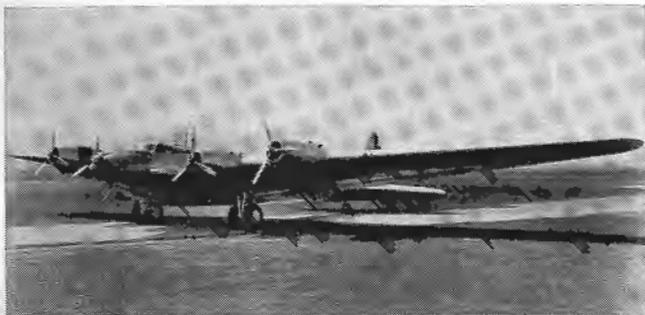
DOUGLAS B-18 (Bolo). ENG: 2 Wright R-1820, A, ea 930 hp, 9 cyl. SPECS: span 89'6", lgth 56'8", ht 15'2"; wt 15,749/27,087#. PERF: spd 167/217/64 mph; clb 9.1/10,000; clg 24,200/25,850'; rg 1,200 m. BOMBS: 4,000#. ARMT: 3x30 mgs. DESCR: A 6-place, all-metal mid-wing monoplane, standard medium bomber of late 1930's.



MARTIN B-10. ENG: 2 Wright R-1820, A, ea 700 hp, 9 cyl. SPECS: span 70'6", lgth 45'3", ht 15'5"; wt 9,450/14,400#. PERF: spd 188/213/65 mph; clb 3.4/5,000; clg 24,400/-'; rg 600 m. BOMBS: 2,260#. ARMT: 3x30 mgs. DESCR: Another 1931 competition winner, this outstanding bomber made the 1934 record Alaskan flight.



DOUGLAS B-18A (Bolo). ENG: 2 Wright R-1820, A, ea 1,000 hp, 9 cyl. SPECS: span 89'6", lgth 57'10", ht 15'2"; wt 16,321/27,673#. PERF: spd 167/216/69 mph; clb 9.9/10,000; clg 23,900/-'; rg 1,100 m. BOMBS: 4,000#. ARMT: 3x30 mgs. DESCR: First built in 1937, this type was used with radar in early forties for antisub work.



BOEING XB-15. ENG: 4 Pratt & Whitney R-1830, A, ea 1,000 hp, 14 cyl. SPECS: span 149', lgth 87'11", ht 18'5"; wt 37,709/65,068#. PERF: spd 171/197/70 mph; clb 14.9/10,000; clg 18,850/20,900; rg 3,400 m. BOMBS: 12,000#. ARMT: 3x30, 3x50 mgs. DESCR: Resembling the B-17, the larger B-15 was built in 1935.



DOUGLAS XB-19. ENG: 4 Wright R-3350, A, ea 2,000 hp, 18 cyl. SPECS: span 212', lgth 132'2", ht 42'; wt 84,431/160,000#. PERF: spd 160/224/73 mph; clg 23,000/-'; rg 5,200 m. BOMBS: 36,000#. ARMT: 6x30, 5x50 mgs; 2x37-mm cn. DESCR: Built in 1941, the 4-engine Douglas XB-19 was the Army's largest bomber to date.



BOEING B-17 (Fortress). ENG: 4 Wright R-1820, A, ea 1,200 hp, 9 cyl. SPECS: span 103'9", lgth 74'4", ht 19'1"; wt 36,134/55,000#. PERF: spd 195/317/90 mph; clb 7/5,000; clg 30,000/-'; rg 1,950 m. BOMBS: 6,000#. ARMT: 1x30, 13x50 mgs. DESCR: This new-type B-17E had redesigned surfaces, more power and armament.



NORTH AMERICAN XB-21. ENG: 2 Pratt & Whitney R-2180, A, ea 1,200 hp, 14 cyl. SPECS: span 95', lgth 61', ht 14'9"; wt 19,080/27,255#. PERF: spd 195/220/- mph; clb 10/10,000; clg 25,000/-'; rg 1,950 m. BOMBS: 2,200#. ARMT: 5x30 mgs. DESCR: A medium type, with superchargers and power turrets, tried in 1939.



DOUGLAS B-23 (*Dragon*). ENG: 2 Wright R-2600, A, ea 1,600 hp, 14 cyl. SPECS: span 92', lgth 58'4", ht 18'6"; wt 19,059/30,477#. PERF: spd 210/282/80 mph; clb 6.7/10,000; clg 31,600/-'; rg 1,400 m. BOMBS: 4,000#. ARMT: 3x.30, 1x.50 mgs. DESCR: An improved, supercharged B-18A, the B-23 was standard in 1940-42.



NORTH AMERICAN XB-28. ENG: 2 Pratt & Whitney R-2800, A, ea 2,000 hp, 18 cyl. SPECS: span 72'7", lgth 56'5", ht 14'; wt 25,575/35,740#. PERF: spd 255/372/86 mph; clb 9/10,000; clg 34,600/-'; rg 2,040 m. BOMBS: 4,000#. ARMT: 3x.30, 6x.50 mgs. DESCR: One of two XB-28's built in 1940 was for photography.



CONSOLIDATED B-24 (*Liberator*). ENG: 4 Pratt & Whitney R-1830, A, ea 1,200 hp, 14 cyl. SPECS: span 110', lgth 67'2", ht 18'; wt 36,000/56,000#. PERF: spd 220/300/90 mph; clb 5.3/5,000; clg 30,000/-'; rg 1,950 m. BOMBS: 6,000#. ARMT: 10x.50 mgs. DESCR: Outstanding World War II heavy, much changed since 1939.



BOEING B-29 (*Superfortress*). ENG: 4 Wright R-3350, A, ea 2,200 hp, 18 cyl. SPECS: span 141'3", lgth 99', ht 27'9"; wt 70,138/120,000#. PERF: 235/342/105 mph; clb 8/5,000; clg 35,000/-'. BOMBS: 20,000#. ARMT: 12x.50 mgs. DESCR: This first very-long-range bomber in combat, flown since 1942, was decisive in the Pacific war.



NORTH AMERICAN B-25 (*Mitchell*). ENG: 2 Wright R-2600, A, ea 1,700 hp, 14 cyl. SPECS: span 67'7", lgth 52'11"; ht 15'9"; wt 19,500/33,500#. PERF: spd 220/272/97 mph; clb 5/5,000; clg 23,500/-'; rg 1,275 m. BOMBS: 3,200#. ARMT: 13x.50 mgs; 1x75-mm cn. in attack version. DESCR: A great "medium" since 1941.



CONSOLIDATED B-32 (*Dominator*). ENG: 4 Wright R-3350, A, ea 2,200 hp, 18 cyl. SPECS: span 135', lgth 82'11", ht 33'; wt 60,000/100,000#. DESCR: Another bomber designed for very-long-range strategic attacks in World War II, the B-32, slated for use in the Pacific, had only limited production, was more conventional than B-29.



MARTIN B-26 (*Marauder*). ENG: 2 Pratt & Whitney R-2800, A, ea 1,920 hp, 18 cyl. SPECS: span 71', lgth 56'1", ht 20'4"; wt 23,800/37,000#. PERF: spd 216/283/120 mph; clb 8.1/5,000; clg 25,000/-'; rg 1,100 m. BOMBS: 4,000#. ARMT: 11x.50 mgs. DESCR: Another great "medium" of World War II, from 1941 to late 1944.



VEGA B-34 (*Ventura*). ENG: 2 Pratt & Whitney R-2800, A, ea 2,000 hp, 18 cyl. SPECS: span 65'6", lgth 51'5", ht 11'11"; wt 17,274/25,678#. PERF: spd 250/315/80 mph; clb 8.2/15,000; clg 24,000/-'; rg 950 m. BOMBS: 3,000#. ARMT: 6x.30, 4x.50 mgs. DESCR: Used in World War II for bombardment training and patrol.



BOEING XB-39 (Superfortress). ENG: 4 Allison V-3420, L, ea 2,600 hp, 24 cyl. SPECS: span 141'3", lgth 98'2", ht 27'9"; wt 71,170/120,000#. PERF: spd 253/388/- mph; clb 26.5/25,000; clg 25,000/-'; rg 3,100 m. BOMBS: 20,000#. ARMT: 10x.50 mgs. DESCR: B-29 with Allison engines substituted for Wright type.



DOUGLAS XB-42 (Mixmaster). ENG: 2 Allison V-1710, L, ea 1,325 hp, 12 cyl. SPECS: span 70'6", lgth 53'8"; wt 18,577/35,702#. PERF: spd 238/410/- mph; clb 45/25,000; clg 27,000/-'; rg 2,090 m. BOMBS: 8,000#. ARMT: 6 to 8x.50 mgs. DESCR: First 400-mph bomber, the XB-42 has counterrotating pusher propellers.

ATTACK PLANES

They work closely with ground troops

Attack planes play a versatile role in the job of military aviation. With duties ranging from those of fighters to those of bombers, they possess some of the characteristics of each of these combat types. Attack planes are called upon to engage in strafing, horizontal and dive bombing, torpedo dropping, and—when necessary—aerial combat. They serve primarily in tactical cooperation with ground forces, dealing hard-hitting blows against road junctions, troop movements, locomotives, coastal and river shipping, munitions dumps, flying-bomb installations, and enemy supplies.

Although General Mitchell recognized the value of attack aviation in World War I, the attack designation was not adopted until 1922. The first plane so designated was the A-2, A-1 already having been assigned to an ambulance plane. The early attack planes were only adaptations of successful observation types in which wing guns had been added for ground strafing. Original attack designs with built-in guns and bomb racks began to appear in the early thirties. The A-12 and A-17 were outstanding examples.

In World War II conspicuous service was performed by such attack types as the A-24, originally a Navy dive bomber, the swift A-20, which saw continuous action in both European and Pacific theaters, and the A-36, a modification of the P-51 which went into use at Pantelleria. Most sensational of the newer attack types in combat is the three-place, heavily armed A-26. At the war's end, this plane, called one of the world's fastest bombers, was replacing not only its prototype, the A-20, but the B-25 and B-26.



ENGINEERING DIVISION GA-1. ENG: 2 Liberty 12, L, ea 442 hp, 12 cyl. SPECS: span 65'6", lgth 33'7", ht 14'3"; wt 7,532/9,740#. PERF: spd 95/105/- mph; clb 3.7/2,000; clg 9,600/11,500'; rg 185 m. ARMT: 8x.30 mgs; 1x37-mm cn. DESCR: This triplane with extra guns and heavy armor was built at McCook Field in 1920.



BOEING GA-2. ENG: 750-W, L, 700 hp, 18 cyl. SPECS: span 54', lgth 37', ht 12'; wt 6,784/9,085#. PERF: spd 100/110/- mph; clb 16.5/6,500; clg 11,100/13,000'; rg 165 m. ARMT: 2x.30, 2x.50 mgs; 1x37-mm cn. DESCR: Two of these ground strafers were tried in 1921 and 1923, powered by an engine developed at McCook Field.



LE PERE USAGH-11. ENG: Liberty 12, L, 408 hp, 12 cyl. SPECS: span 47'1", lgth 24'4", ht 10'11"; wt 3,913/5,109#. PERF: spd 95/114/- mph; clb 9.4/6,500; clg 15,300/17,000'; rg 275 m at 107 mph. ARMT: 1x.30, 1x.50 mgs. DESCR: Flown during early twenties, this sturdy 2-seater was designed to work along with infantry.



DOUGLAS XA-2. ENG: inverted Liberty V-1400, A, 433 hp, 12 cyl. SPECS: span 39'8", lgth 29'7", ht 11'; wt 3,179/4,985#. PERF: -/130/- mph. ARMT: 8x.30 mgs. DESCR: The sole example of this experimental attack model, equipped with internal bomb racks, built in 1927, was a modified version of O-2. A-3 superseded it.



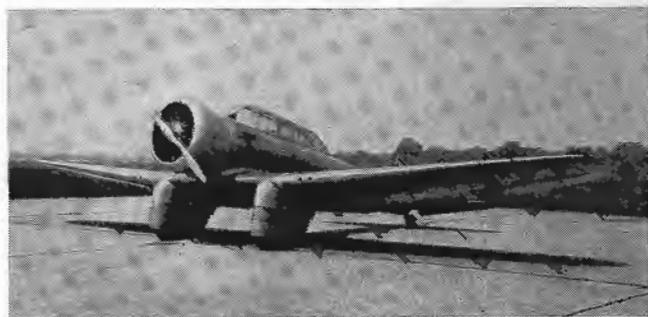
CURTISS A-3 (Falcon). ENG: Curtiss V-1150, L, 429 hp, 12 cyl. SPECS: span 38', lgth 28'4", ht 10'1"; wt 3,131/4,378#. PERF: spd 116/141/61 mph; clb 5.8/5,000; clg 15,600/17,300'; rg 630 m at full speed. BOMBS: 600#. ARMT: 4x.30 mgs. DESCR: This modified O-1 was standard attack type 1927-32, carried bombs externally.



CURTISS A-12 (Shrike). ENG: Wright R-1820, A, 690 hp, 9 cyl. SPECS: span 44', lgth 32'3", ht 9'4"; wt 3,898/5,900#. PERF: spd 150/177/69 mph; clb 5.1/5,000; clg 15,150/16,600'; rg 510 m. BOMBS: 464#. ARMT: 5x.30 mgs. DESCR: The A-12 was a redesigned A-8 built around a radial engine. In 1933-34, 46 were built.



FOKKER XA-7. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 46'9", lgth 31', ht 9'5"; wt 3,866/5,650#. PERF: spd -/184/61 mph. ARMT: 5x.30 mgs. DESCR: First monoplane for attack purposes, built in 1930 for greater speed, fire power, and visibility, it had four wing guns. The nose was improved when rebuilt in 1931.



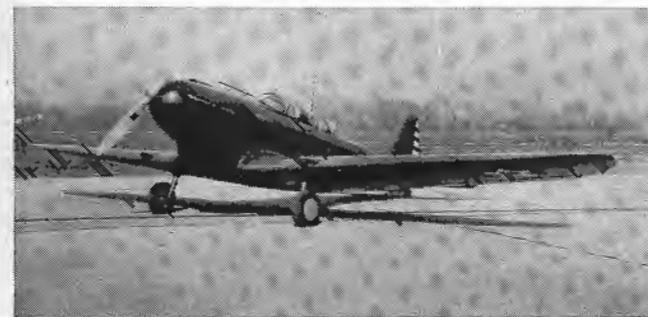
NORTHROP A-13. ENG: Wright R-1820, A, 650 hp, 9 cyl. SPECS: span 48', lgth 29'2", ht 9'2"; wt 3,600/6,463#. PERF: spd 181/297/70 mph; clb 4.3/5,000; clg 21,750/23,600'. ARMT: 5x.30 mgs. DESCR: Ancestor of A-17 and Douglas A-24, one A-13 was modeled after Frank Hawk's "Sky Chief" in 1933. It had an enclosed cabin.



CURTISS A-8. ENG: Curtiss V-1570, L, 600 hp, 12 cyl. SPECS: span 44', lgth 32'10", ht 9'; wt 3,938/5,706#. PERF: spd 158/183/- mph; clb 10.8/10,000; clg 18,100/-'; rg 440 m. BOMBS: 400#. ARMT: 5x.30 mgs. DESCR: One of the first all-metal Curtiss planes, built 1931-32, A-8 had four fixed guns mounted in landing gear.



CURTISS XA-14. ENG: 2 Wright R-1670, A, ea 775 hp, 14 cyl. SPECS: span 59'5", lgth 40'3", ht 10'9"; wt 8,456/11,738#. PERF: spd 211/254/75 mph; clg 27,125/28,500'. BOMBS: 600#. ARMT: 5x.30 mgs. DESCR: Designed and built in 1933-36, this prototype of the A-18 was Army's first 2-engine attack plane since the 1920 GA-1.



CONSOLIDATED A-11. ENG: Curtiss V-1570, L, 675 hp, 12 cyl. SPECS: span 43'11", lgth 29'3", ht 9'10"; wt 3,805/5,490#. PERF: spd 193/228/84 mph; clb 3.4/5,000; clg 24,900/-'; rg 470 m. BOMBS: 300#. ARMT: 5x.30 mgs. DESCR: The A-11 of 1934 was like the P-30, with unbraced wings, retractable landing gear.



NORTHROP A-17. ENG: Pratt & Whitney R-1535, A, 825 hp, 14 cyl. SPECS: span 47'9", lgth 31'8", ht 12'; wt 5,106/7,550#. PERF: spd 170/220/64 mph; clb 3.9/5,000; clg 19,400/20,800'; rg 730 m. BOMBS: 654#. ARMT: 5x.30 mgs. DESCR: Procured in some quantity and standard, 1936-41. The A-17A had retractable landing gear.



CURTISS A-18. ENG: 2 Wright R-1820, A, ea 930 hp, 9 cyl. SPECS: span 59'6", lgth 42'4", ht 15'; wt 9,410/13,170#. PERF: spd 211/238/73 mph; clb 2.2/5,000; clg 28,650/30,000'; rg 675 m. BOMBS: 654#. ARMT: 5x.30 mgs. DESCR: An improved XA-14 and forerunner in late thirties of the U. S. 2-engine light bomber.



MARTIN XA-22. ENG: 2 Pratt & Whitney R-1830, A, ea 1,200 hp, 14 cyl. SPECS: span 61'4", lgth 46'8", ht 16'6"; wt 11,170/16,805#. PERF: spd 261/279/- mph; clg 20,000/-'; rg 820 m. BOMBS: 1,800#. ARMT: 6x.30 mgs. DESCR: A single A-22 was built in 1940. The fuselage was redesigned in its successor, the A-30.



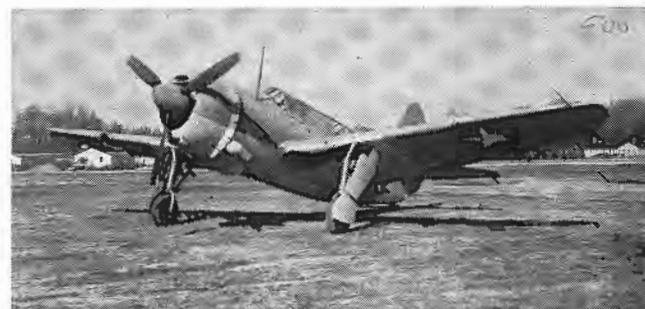
VULTEE A-19. ENG: Pratt & Whitney R-1830, A, 1,200 hp, 14 cyl. SPECS: span 50', lgth 37'10", ht 10'; wt 6,607/10,286#. PERF: spd 207/230/- mph; clb 19.2/15,000; clg 20,000/-'; rg 1,110 m. BOMBS: 1,080#. ARMT: 6x.30 mgs. DESCR: Tested with various engines about 1939, this 3-seater was like the foreign-sale V116B.



DOUGLAS A-24 (*Dauntless*). ENG: Wright R-1820, A, 1,200 hp, 9 cyl. SPECS: span 41'6", lgth 33', ht 12'11"; wt 6,330/10,250#. PERF: spd 180/247/73 mph; clb 6.1/10,000; clg 27,000/-'; rg 950 m. BOMBS: 1,000#. ARMT: 2x.30, 2x.50 mgs. DESCR: This early standard dive bomber of World War II was a modified Navy SBD-3.



DOUGLAS A-20 (*Havoc*). ENG: 2 Wright R-2600, A, ea 1,700 hp, 14 cyl. SPECS: span 61'4", lgth 48', ht 18'1"; wt 16,800/26,000+#. PERF: spd 260/322/97 mph; clb 2.7/5,000; clg 25,000/-'; rg 1,000 m. BOMBS: 4,000#. ARMT: 9x.50 mgs. DESCR: A standard World War II type used by the AAF, RAF, and the Soviet air force.



CURTISS A-25 (*Helldiver*). ENG: Wright R-2600, A, 1,700 hp, 14 cyl. SPECS: span 49'9", lgth 36'8", ht 14'6"; wt 10,300/17,000#. PERF: spd 240/275/80 mph; clb 6.5/10,000; clg 26,800/-'; rg 700 m. BOMBS: 3,000#. ARMT: 5x.50 mgs. DESCR: A standard 2-place dive bomber to late 1943, A-25 was like Navy SB2C, SBW, SBF.



STEARMAN XA-21. ENG: 2 Pratt & Whitney R-2180, A, 1,400 hp, 14 cyl. SPECS: span 65', lgth 53'1", ht 14'2"; wt 12,760/18,257#. PERF: spd 200/257/- mph; clg 20,000/-'; rg 720 m. BOMBS: 2,700#. ARMT: 6x.30 mgs. DESCR: An all-metal type built for a 1939 attack-bomber competition and later released for export sale.



DOUGLAS A-26 (*Invader*). ENG: 2 Pratt & Whitney R-2800, A, ea 2,000 hp, 18 cyl. SPECS: span 70', lgth 50'7", ht 18'6"; wt 22,200/35,000#. PERF: spd 270/355/98 mph; clb 2.7/5,000; clg 24,000/-'; rg 1,150 m. BOMBS: 4,000#. ARMT: 10x.50 mgs. DESCR: Successor to A-20, larger A-26 was replacing B-25 and B-26 at war's end.



LOCKHEED A-29 (Hudson). ENG: 2 Wright R-1820, A, ea 1,200 hp, 9 cyl. SPECS: span 65'6", lgth 44'3", ht 11'11"; wt 12,800/20,500#. PERF: spd 205/253/68 mph; clb 6.3/10,000; clg 26,500/-'; rg 1,500 m. BOMBS: 1,400#. ARMT: 5x.30, 1x.50 mgs. DESCR: Used for photography, transport, and advanced training; similar to A-28.



CONSOLIDATED VULTEE A-35 (Vengeance). ENG: Wright R-2600, A, 1,700 hp, 14 cyl. SPECS: span 48', lgth 39'9", ht 13'7"; wt 10,307/16,400#. PERF: spd 230/279/84 mph; clb 11.3/15,000; clg 22,300/-'; rg 550 m. BOMBS: 2,000#. ARMT: 7x.50 mgs. DESCR: 1943 all-metal 2-seater like A-31 except for engine, guns, and bombs.



MARTIN A-30 (Baltimore). ENG: 2 Wright R-2600, A, ea 1,700 hp, 14 cyl. SPECS: span 61'4", lgth 48'6", ht 14'2"; wt 15,439/22,622#. PERF: spd 226/320/87 mph; clb 5/10,000; clg 25,000/-'; rg 1,000 m. BOMBS: 2,000#. ARMT: 6x.30, 2x.50 mgs. DESCR: Built chiefly for British under Lend-Lease; similar to earlier A-22.



NORTH AMERICAN A-36 (Mustang). ENG: Allison V-1710, L, 1,325 hp, 12 cyl. SPECS: span 37', lgth 32'3", ht 12'2"; wt 6,600/10,000#. PERF: spd 235/310/82 mph; clb 3.5/10,000; clg 27,000/-'; rg 700 m. BOMBS: 1,000#. ARMT: 6x.50 mgs. DESCR: Standard in World War II, like P-51 except for diving brakes and two nose guns.



BREWSTER A-32. ENG: Pratt & Whitney R-2800, A, 2,100 hp, 18 cyl. SPECS: span 45'6", lgth 40'1"; wt 11,820/15,500#. PERF: spd 200/311/75 mph; clb 5.7/10,000; clg 26,000/-'; rg 600 m. BOMBS: 4,000#. ARMT: 6x.50 mgs; 4x20-mm cn. DESCR: An experimental converted Navy dive bomber and torpedo dropper of 1944.



BEECH XA-38. ENG: 2 Wright R-3350, A, ea 2,440 hp, 18 cyl. SPECS: span 67'4", lgth 51'9"; wt 22,480/33,965#. PERF: spd 167/376/103 mph; clb 11.5/20,000; clg 20,000/-'; rg 1,420 m. BOMBS: 2,000#. ARMT: 6x.50 mgs; 1x75-mm cn. DESCR: Modeled after the popular C-45 Expediter, XA-38 is larger and heavier.



BREWSTER A-34 (Buccaneer). ENG: Wright R-2600, A, 1,600 hp, 14 cyl. SPECS: span 47', lgth 39'2", ht 15'3"; wt 8,275/11,715#. PERF: spd 160/314/72 mph; clb 4/10,000; clg 26,630/-'; rg 1,000 m. BOMBS: 500#. ARMT: 8x.30 mgs. DESCR: Army's version of the Navy SB2A-2, this shore-based type was tested only, about 1942.



VULTEE XA-41. ENG: Pratt & Whitney R-4360, A, 3,000 hp, 28 cyl. SPECS: span 54', lgth 48'8"; wt 13,400/18,800#. PERF: spd 270/353/87 mph; clb 4.3/10,000; clg 15,500/-'; rg 800 m. BOMBS: 1,050#. ARMT: 4x.50 mgs; 2x37-mm cn. DESCR: A single-seater for low-level attacks, dive bombing, and torpedo dropping.

TRANSPORTS

They save time and fly everywhere

The mission of the transport plane is to carry men and supplies wherever speed is a consideration and travel by land or water impractical. There are two main classes of transports. The large cargo type is capable of flying long distances with jeeps, tanks, trucks, and other heavy supplies or troops in full gear. The utility cargo type carries personnel or short-haul supplies within a single zone or theater. In both types, the space and weight capacity of the plane is a fundamental factor in design.

The ability to carry a "pay load" has always been an important



MARTIN GMP or XT-1. ENG: 2 Liberty 12, L, ea 400+ hp, 12 cyl. SPECS: span 71'5", lgth 44'10", ht 14'7"; wt 6,756/10,225#. PERF: spd 95/106/- mph; clb 13.7/6,500; clg 11,000/-; rg 510 m. DESCR: The GMP (later redesignated XT-1) was an experimental 12-place transport, patterned in 1919 on original 1918 Martin bomber.



FOKKER T-2. ENG: Liberty 12, L, 408 hp, 12 cyl. SPECS: span 74'10", lgth 49'1", ht 11'10"; wt 5,037/7,993#. PERF: spd 94/101/- mph; clb 5.5/2,000; clg 8,050/10,700'. DESCR: An 8-passenger transport built in 1922, the T-2 was used in May 1923 by Lts. J. A. Macready and O.G. Kelly in their record nonstop coast-to-coast flight.



L.W.F. T-3. ENG: Liberty 12, L, 426 hp, 12 cyl. SPECS: span 54', lgth 42', ht 12'6"; wt 4,645/7,316#. PERF: spd 89/99/- mph; clb 36.2/6,500; clg 6,150/9,000'; rg 385 m. DESCR: One T-3 was built for the Army for experimental purposes in 1923. Its capacity was six passengers, crew of two, and baggage. Total pay load was about a ton.

concern in plane construction. The earliest planes could carry little beside the pilot and the needed fuel; and the addition of gun or radio often meant the difference between flying and stalling. The Army's first real cargo type, an adaptation of the Martin bomber in 1918, was built after World War I. Since then most of the Army's transport planes have been adapted from commercial models. Typical of these were the trimotored Fokkers and Fords, the Lockheed "Electra," the Douglas DC-2, and the Bellanca "Airbus."

Among the transports used in World War II, the C-46, C-47, C-54, and C-69 were based on commercial designs, while the C-87 and C-97 were adaptations of the B-24 and B-29. Fairchild's twin-boom C-82, capable of carrying almost anything an infantry division needs, was designed originally for military use. These planes dropped whole armies of paratroops behind enemy lines, evacuated the wounded to safety and medical care, and speeded vital supplies to the inaccessible jungle and island battle fronts of global war.



DOUGLAS DWC (*World Cruiser*). ENG: Liberty 12, L, 400+ hp, 12 cyl. SPECS: span 50', lgth 35'3", ht 13'7"; wt 4,433/9,162#. PERF: spd 69/105/53 mph; clg 7,750/10,500'; rg 830 m. DESCR: Built in 1923, two World Cruisers made the first round-the-world flight in history in following year, covering 27,553 miles in 175 days.



COX-KLEMIN XA-1. ENG: Liberty 12, L, 424 hp, 12 cyl. SPECS: span 44'9", lgth 30'8", ht 11'2"; wt 3,013/4,797#. PERF: spd 90/121/60 mph; clb 8.5/6,500; clg 15,550/17,300'; rg 358 m. DESCR: One of the first Army planes designed for ambulance use, with space for two stretcher patients and a medical officer; built in 1924-25.



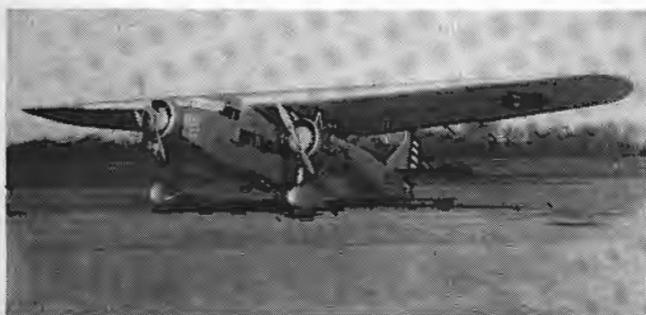
DOUGLAS C-1. ENG: Liberty 12, L, 435 hp, 12 cyl. SPECS: span 56'7", lgth 35'4", ht 14'; wt 3,836/6,443#. PERF: spd 97/116/55 mph; clb 12.6/6,500; clg 14,850/17,500'; rg 485 m at 108 mph. DESCR: First built in 1925, this was a standard cargo and troop-carrier plane until 1929. It carried six passengers or equivalent load.



ATLANTIC C-2. ENG: Wright J-5, A, ea 200 hp, 9 cyl. SPECS: span 71'2", lgth 48'4", ht 13'6"; wt 5,856/9,715#. PERF: spd 93/116/63 mph; clb 9.9/5,000; clg 13,100/15,500'; rg 355 m at full speed. DESCR: Based on a Fokker commercial design, this 1926 model flew nonstop to Hawaii in 1927, made 1929 endurance record.



CURTISS XC-10. ENG: Warner R-420, A, 110 hp, 7 cyl. SPECS: span 41', lgth 25'9", ht 7'10"; wt 1,472/-#. PERF: no official data available. DESCR: This was a commercial Curtiss Robin with a different engine, purchased in 1929-30 in order to develop a radio-controlled "aerial torpedo." It was modified for aerodynamic experiments.



FORD C-4. ENG: 3 Pratt & Whitney R-1340, A, ea 450 hp, 9 cyl. SPECS: span 77'11", lgth 51', ht 12'7"; wt 8,434/13,515#. PERF: spd 128/148/69 mph; clb 5.5/5,000; clg 18,050/20,000'. DESCR: Originally a commercial design, the C-4 was a standard Army type from 1930 to 1936. It was as like C-9 and C-3, but larger and faster.



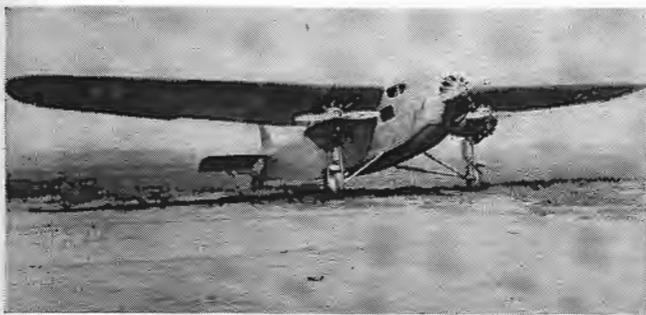
LOCKHEED C-12. ENG: Pratt & Whitney R-1340, A, 450 hp, 9 cyl. SPECS: span 41', lgth 27'6", ht 9'3"; wt 2,613/4,173#. PERF: spd 149/179/66 mph; clb 4.6/5,000; clg 20,675/22,600'. DESCR: One C-12 was purchased in 1931, together with the similar C-17 for trial as a small, high-speed transport for pilot and four passengers.



SIKORSKY C-6. ENG: 2 Pratt & Whitney R-1340, A, ea 420 hp, 9 cyl. SPECS: span 71'6", lgth 40'10", ht 14'; wt 7,089/10,147#. PERF: spd 99/123/64 mph; clb 7.3/5,000; clg 14,200/16,000'. DESCR: A 10-place amphibian airplane, similar to Sikorsky's commercial "sesquiplane," S-38A. In 1929-31, 11 C-6's were purchased.



FOKKER C-14. ENG: Wright R-1750, A, 525 hp, 9 cyl. SPECS: span 59', lgth 43'3", ht 12'10"; wt 4,529/7,200#. PERF: spd 115/133/62 mph; clb 10/5,200; clg 14,300/17,000'; rg 690 m. DESCR: This commercial design carried a pilot, six passengers, and baggage. Two of 20 C-14's bought in 1931 were converted to C-15 ambulances.



FORD C-9. ENG: 3 Wright R-975, A, ea 300 hp, 9 cyl. SPECS: span 73'11", lgth 50', ht 12'3"; wt 6,244/9,984#. PERF: spd 105/131/63 mph; clb 5.3/5,000; clg 18,930/20,880#. DESCR: A 10-place transport like the C-3 except for greater power, the C-9 (originally C-3A), first purchased in 1929, saw limited service until 1935.



NORTHROP C-19. ENG: Pratt & Whitney R-1340, A, 450 hp, 9 cyl. SPECS: span 41'10", lgth 28'7", ht 9'6"; wt 2,818/4,516#. PERF: spd 133/159/65 mph; clb 5.8/5,000; clg 18,000/20,100'; rg 345 m. DESCR: The C-19 carried a pilot and four passengers. A commercial type of 1931 to be used as a light, high-speed transport.



DETROIT C-23. ENG: Pratt & Whitney R-1340, A, 500 hp, 9 cyl. SPECS: span 42'9", lgth 28'4", ht 9'6"; wt 3,235/4,896#. PERF: spd 175/207/67 mph; clb 9.4/7,000; clg 23,800/25,800'. DESCR: This 2-place commercial Lockheed Altair was purchased in 1931 to investigate resonance in monocoque fuselages of metal construction.



CURTISS-WRIGHT C-30. ENG: 2 Wright R-1820, A, ea 670 hp, 9 cyl. SPECS: span 82', lgth 48'10", ht 16'6"; wt 11,448/16,414#. PERF: spd 138/161/66 mph; clb 48.5/17,500; clg 17,500/-'; rg 560 m. DESCR: A commercial Condor, the 11-passenger C-30 of 1933 was modified to provide space for the radio operator and mechanic.



AMERICAN C-24. ENG: Wright R-1820, A, 575 hp, 9 cyl. SPECS: span 57', lgth 39'2", ht 12'1"; wt 4,195/7,106#. PERF: spd 120/136/58 mph; clb 17.2/10,000; clg 15,300/17,700'; rg 500 m. DESCR: Purchased in 1932, four C-24's were used to 1936. They carried the pilot, eight passengers, and baggage, or cargo, or wounded men.



KREIDER-REISNER (FAIRCHILD) XC-31. ENG: Wright R-1820, A, 750 hp, 9 cyl. SPECS: span 75', lgth 56', ht 15'3"; wt 7,412/12,762#. PERF: spd 126/155/52 mph; clb 19.2/10,000; clg 15,200/-'; rg 680 m. DESCR: One test XC-31 was built in 1934. It could carry 15 men or be converted to function as a cargo or ambulance plane.



BELLANCA C-27. ENG: Pratt & Whitney R-1860, A, 650 hp, 9 cyl. SPECS: span 65', lgth 42'9", ht 12'; wt 5,402/9,467#. PERF: spd 128/145/76 mph; clb 10/5,000; clg 12,500/15,000'; rg 670 m. DESCR: A commercial Airbus, this low-speed cargo type was used from 1932 to 1939. It could also carry wounded men or 10 passengers.



DOUGLAS C-32. ENG: 2 Wright R-1820, A, ea 750 hp, 9 cyl. SPECS: span 85', lgth 61'6", ht 19'7"; wt 13,148/18,200#. PERF: spd 200/213/60 mph; clb 1,090 fpm at sea level; clg 23,600/25,400'. DESCR: AAF version of 14-place DC-2, the C-32 was purchased in 1936, modified for cargo use, and still flown at time of Pearl Harbor.



SIKORSKY C-28. ENG: Pratt & Whitney R-985, A, 300 hp, 9 cyl. SPECS: span 52', lgth 33'2", ht 11'7"; wt 2,906/4,390#. PERF: spd 97/119/59 mph; clb 8.1/5,000; clg 13,150/15,700'. DESCR: A commercial amphibian design with capacity of two passengers and two-man crew. One was purchased in 1932 for the U.S. Military Academy.



LOCKHEED XC-35. ENG: 2 Pratt & Whitney R-1340, A, ea 550 hp, 9 cyl. SPECS: span 55', lgth 39'8", ht 10'6"; wt 7,600/10,500#. PERF: spd 208/240/65 mph; clg 32,000/-'; rg 650 m. DESCR: A commercial 6-place Electra, the XC-35 was purchased by the Air Corps in 1936 for experiments with high-altitude supercharged cabin.



LOCKHEED C-36. ENG: 2 Pratt & Whitney R-985, A, ea 450 hp, 9 cyl. SPECS: span 55', lgth 38'7", ht 10'1"; wt 6,426/10,100#. PERF: spd 170/205/65 mph; clb 6.5/5,000; clg 20,000/-'; rg 780 m. DESCR: In 1937 the Army purchased this 8-passenger C-36, which was originally a Lockheed 10A. It was similar to the C-35.



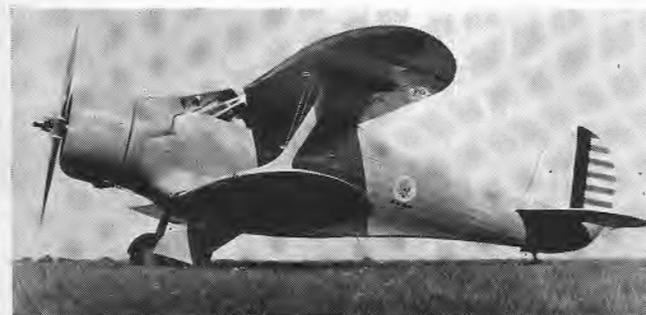
CURTISS C-46 (Commando). ENG: 2 Pratt & Whitney R-2800, A, ea 2,000 hp, 18 cyl. SPECS: span 108', lgth 76'4", ht 22'; wt 29,500/46,000+#. PERF: spd 205/269/84 mph; clb 5.5/5,000; clg 27,000/-'; rg 1,200 m. DESCR: Built for Britain in 1941 and important as an AAF cargo, troop, and ambulance plane after 1942.



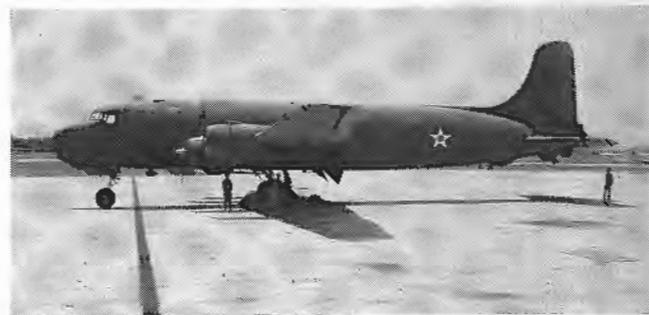
LOCKHEED C-40. ENG: 2 Pratt & Whitney R-985, A, ea 450 hp, 9 cyl. SPECS: span 49'6", lgth 36'4", ht 9'11"; wt 6,120/9,500#. PERF: spd 185/220/75 mph; clb 9.1/10,000; clg 19,200/-'; rg 850 m. DESCR: AAF versions of this commercial type carried a crew of two, three to six passengers, baggage. They were built after 1938.



DOUGLAS C-47 (Skytrain). ENG: 2 Pratt & Whitney R-1830, A, ea 1,200 hp, 14 cyl. SPECS: span 95', lgth 64'6", ht 17'; wt 17,000/26,000+#. PERF: spd 184/230/66 mph; clb 5/5,000; clg 24,000/-'; rg 1,100 m. DESCR: Another outstanding cargo and troop carrier of World War II, a modified DC-3 airliner with very large cargo door.



BEECH C-43 (Traveller). ENG: Pratt & Whitney R-985, A, 450 hp, 9 cyl. SPECS: span 32', lgth 26'2", ht 10'3"; wt 3,020/4,700#. PERF: spd 175/198/60 mph; clb 10/10,000; clg 20,000/-'; rg 900 m. DESCR: A commercial 5-place Beechcraft built in 1939 and used by U.S. military attachés abroad and as utility plane in World War II.



DOUGLAS C-54 (Skymaster). ENG: 4 Pratt & Whitney R-2000, A, ea 1,450 hp, 14 cyl. SPECS: span 117'6", lgth 93'10", ht 27'6"; wt 37,000/60,000+#. PERF: spd 220/275/90 mph; clb 6.2/5,000; clg 22,000/-'; rg 1,500 m. DESCR: An outstanding carrier of World War II, C-54 (modified DC-4 airliner) carries 45 men or 10,000 lbs.



BEECH C-45 (Expediter). ENG: 2 Pratt & Whitney R-985, A, ea 450 hp, 9 cyl. SPECS: span 47'8", lgth 34'3", ht 9'8"; wt 5,870/8,700#. PERF: spd 190/212/60 mph; clb 10.8/10,000; clg 20,500/-'; rg 850 m. DESCR: Originally the commercial Beechcraft, the 6-place C-45 was first purchased in 1940, became popular utility cargo type.



LOCKHEED C-60 (Lodestar). ENG: 2 Wright R-1820, A, ea 1,200 hp, 9 cyl. SPECS: span 65'8", lgth 49'10", ht 12'10"; wt 12,000/21,000#. PERF: spd 207/269/63 mph; clb 3/5,000; clg 30,000/-'; rg 1,450 m. DESCR: A modified commercial design, this transport carries 18 troops or cargo of equivalent weight. It was produced 1942-43.



FAIRCHILD C-61 (Forwarder). ENG: Ranger I-440, L. 200 hp, 6 cyl. SPECS: span 36'4", lgth 25'10", ht 7'7"; wt 1,700/3,200#. PERF: spd 102/122/58 mph; clb 21.4/10,000; clg 12,600/-'; rg 650 m. DESCR: This 4-place commercial model was built in 1941 for the British. Later AAF versions were designed to be utility cargo types.



BOEING C-75 (Stratoliner). ENG: 4 Wright R-1820, A, ea 1,100 hp, 9 cyl. SPECS: span 107', lgth 74'4", ht 20'10"; wt 30,000/45,000#. PERF: spd 184/241/70 mph; clg 23,300/-'; rg 1,750 m. DESCR: A commercial type operated by TWA for important ocean crossings until the ATC got its own long-range transports (C-54's).



NOORDUYN C-64 (Norseman). ENG: Pratt & Whitney R-1340, A, 600 hp, 9 cyl. SPECS: span 51'8", lgth 31'9"; ht 10'1"; wt 4,780/8,200#. PERF: spd 114/160/68 mph; clb 15.5/10,000'; clg 16,500/-'; rg 800 m. DESCR: A commercial type purchased in 1941-44, it was made into a radio and navigation trainer or utility plane.



FAIRCHILD C-82 (Packet). ENG: 2 Pratt & Whitney R-2800, A, ea 2,100 hp, 18 cyl. SPECS: span 106', lgth 75'11", ht 26'4"; wt 26,000/47,000#. PERF: spd 167/220/- mph; clb 4.5/5,000; clg 24,500/-'; rg 3,500 m. DESCR: The C-82 has a capacity for 42 troops in full gear; 15,000 lbs. of cargo; or 75 casualties, 3 medical attendants.



LOCKHEED C-69 (Constellation). ENG: 4 Wright R-3350, A, ea 2,150 hp, 18 cyl. SPECS: span 123', lgth 95'2", ht 23'8"; wt 48,600/82,000#. PERF: spd 284/324/80 mph; clb 3.1/5,000; clg 25,000/35,000'. DESCR: One of the largest Army transports in production, C-69 has flown across U.S. in under 7 hours, to Honolulu in 12.



CONSOLIDATED C-87 (Liberator Express). ENG: 4 Pratt & Whitney R-1830, A, ea 1,200 hp, 14 cyl. SPECS: span 110', lgth 66'4", ht 18'; wt 30,000/56,000#. PERF: spd 212/306/105 mph; clb 4.2/5,000; clg 30,000/-'; rg 2,100 m. DESCR: This cargo-transport version of the B-24 can carry 20 passengers or 6,000 lbs. of cargo.



DOUGLAS C-74 (Globemaster). ENG: 4 Pratt & Whitney R-4360, A, ea 3,000 hp, 28 cyl. SPECS: span 173'3", lgth 124'2", ht 43'9"; wt 82,562/145,000#. PERF: spd 207/300/90 mph; clg 22,000/-'; rg 2,800+ m. DESCR: A new, very large combat transport similar to DC-7, the C-74 carries crew of 9 and 125 equipped men.



BOEING C-97 (Stratocruiser). ENG: 4 Wright R-3350, A, ea 2,200 hp, 18 cyl. SPECS: span 141'3", lgth 110'4"; wt 70,000/120,000#. PERF: spd 217/332/120 mph; clg 35,000/-'; rg 4,000 m maximum. DESCR: A cargo-transport version of the B-29, the C-97 differs chiefly in its enormous 2-deck fuselage, carries up to 140 equipped troops.

ROTARY-WING AND GLIDER AIRCRAFT

Prove useful types in World War II

Although propeller-driven, stationary-wing aircraft comprise the great majority of the Army's air weapons, other types assumed increasing importance in World War II. The autogiro, helicopter, and glider represent ideas antedating successful powered flight; but they developed more slowly than the airplane and only in the last decade were perfected for military use. Pictured here are some of the major current types.

The autogiro, first flown in 1923, differs from conventional airplanes in having a free, rotary wing. This wing largely removes

the danger of stalling by permitting an easy, almost vertical, gliding descent to the ground if engine and propeller should stop. Short take-offs are also possible. Equipped with a "jump" device by which the rotor is power-driven for a few seconds, the autogiro can even ascend vertically for the first few feet, like a helicopter.

Unlike the autogiro, the helicopter, which was flown even earlier, has no propeller and derives both motion and lift from power-driven rotary wings which permit it to move in any direction, hover in one place, and rise or descend vertically. Because of their low speed and range and small landing-space requirements the autogiro and helicopter are most suited to observation and liaison.

The time-honored glider did yeoman service in Allied airborne operations in World War II. It is towed by a powered aircraft or flies free after release from a high point. Capable of controlling its descent, it adds great carrying capacity to the tow plane and can land troops and equipment on almost any kind of terrain.



KELLETT O-60 AUTOGIRO. ENG: Jacobs R-915, A, 330 hp, 7 cyl. SPECS: span 42', lgth 21'5", ht 10'3"; wt 1,960/2,640#. PERF: spd 103/127/30 mph; clb 8/10,000; clg 19,000/-'; rg 215 m. DESCR: A short-range, liaison-observation 2-seater, the rotary-wing O-60 is similar to Kellett R-2 and YG-1, has been tested since 1937.



NASH-KELVINATOR (SIKORSKY) R-6 HELICOPTER. ENG: Franklin O-405, A, 240 hp, 6 cyl. SPECS: span 38', lgth 47'11"; wt 2,016/2,590#. PERF: spd 75/100/0 mph; clb 45/10,000; clg 10,000/-'; rg 395 m. DESCR: The engine with vertical crankshaft is aft of 2-man, side-by-side crew, permitting excellent visibility.



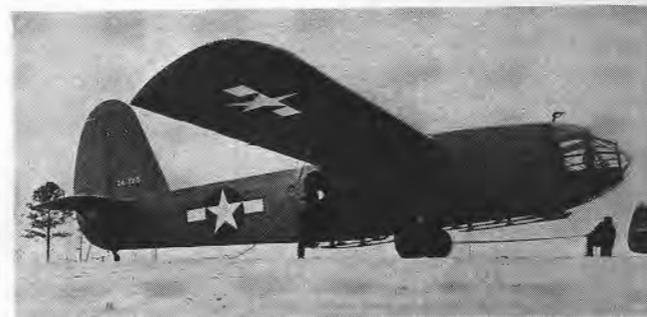
VOUGHT-SIKORSKY R-4 HELICOPTER. ENG: Warner R-550, A, 190 hp, 7 cyl. SPECS: span 38', lgth 48'1", ht 12'; wt 1,965/2,516#. PERF: spd 65/83/0 mph; clb 10.5/5,000; clg 9,425/-'; rg 135 m. DESCR: Used in some quantity in World War II, the R-4 is a successful side-by-side 2-place helicopter designed by Igor Sikorsky.



WACO CG-4 (Hadrian) GLIDER. SPECS: span 83'8", lgth 48'3", ht 12'7"; wt 3,700/7,500#. DESCR: The CG-4 is towed at about 150 and stalls at 44 miles an hour. Besides its crew of pilot and co-pilot it can carry 15 fully equipped men, a jeep and six men, or a 75-mm. pack howitzer and five men. Built of wood, it has no armament.



SIKORSKY R-5 HELICOPTER. ENG: Pratt & Whitney R-985, A, 450 hp, 9 cyl. SPECS: span 48', lgth 57'1"; wt 3,725/4,815#. PERF: spd 70/90/0 mph; clb 45/10,000; clg 10,000/-'; rg 280 m. DESCR: In this later-designed model, 2-man crew sits tandem in plane's transparent nose. The vertical, auxiliary rotor counteracts the torque.



WACO CG-13 GLIDER. SPECS: span 85'7", lgth 54'3"; wt 8,700/18,900#. DESCR: The CG-13 is towed at about 180 and stalls at 56 miles an hour. It can carry 30 fully equipped troops, a 1½-ton 6x6 truck, or a 105-mm. howitzer besides its crew of pilot and co-pilot. It has plywood-covered, externally braced wood wing, steel fuselage.

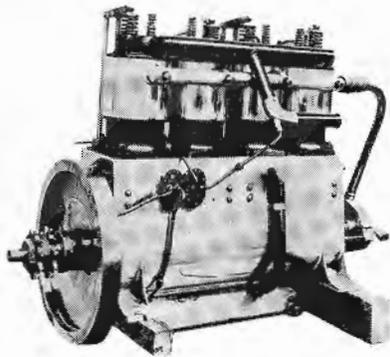
ENGINES POWER AIR ATTACK

Landmarks in engine development

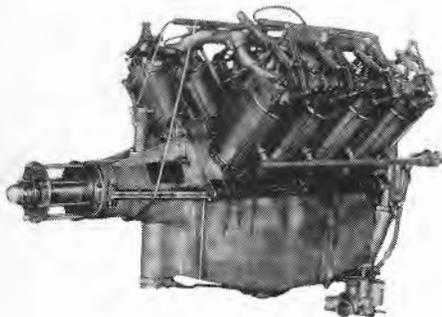
The 10 internal combustion engines pictured on this page illustrate a mechanical evolution responsible for the increased performance of the Army's airplanes. They reveal the progress in weight efficiency, compactness of design, and increased horsepower without which the rate of climb, altitude, speed, range, and safety of today's combat aircraft would be impossible.

Increase of horsepower with a saving of weight has been a constant goal in engine design. The Wright brothers set a stiff pace with the 30-horsepower model that powered the Army's first Wright A, an engine that weighed six pounds per horsepower as against today's ideal of one pound. Three engines were developed during World War I: the Curtiss OX-5, used in the "Jenny"; the Liberty, called America's great mechanical contribution to the war; and the Hispano-Suiza (later Wright E), used in the "Hisco Jenny" and in several postwar observation and advanced trainer types.

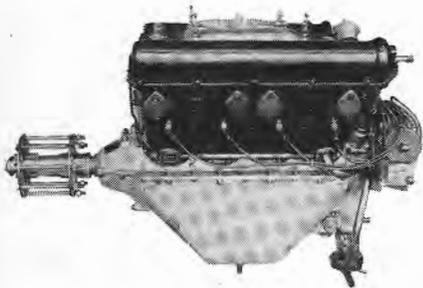
The middle twenties saw the development of the Curtiss liquid-cooled, vee-type D-12 and the Wright air-cooled, radial Whirlwind. These were the engines that powered many of the Army's combat types until the middle thirties. By the time the United States became involved in World War II the "Four Horsemen" of the engine industry, producers of the engines for all the AAF planes that have been used in combat, had built the earlier versions of the last four types pictured here. For example, the Allison engine powers the P-38, P-39, P-40, and P-63; the Packard, the P-51; the Pratt & Whitney, the P-47; and the Wright, called the "world's most powerful engine," the superbombers B-29 and B-32.



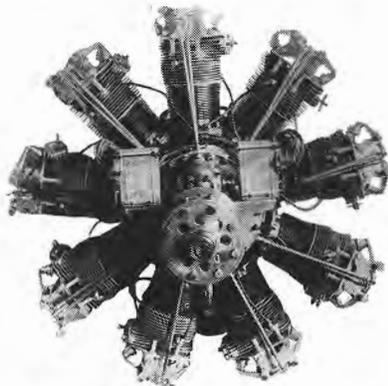
Wright, L, 30 hp, 4 cyl.



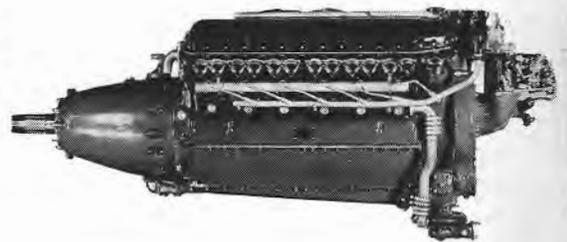
Curtiss OX-5, L, 90 hp, 8 cyl.



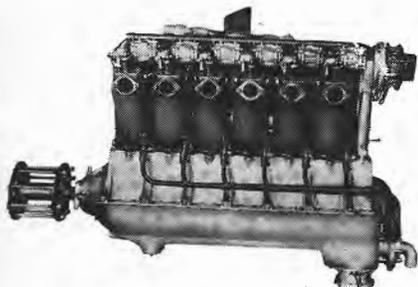
Hispano-Suiza, L, 150 hp, 8 cyl.



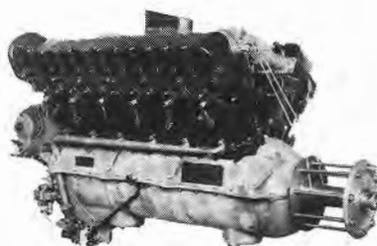
Wright J-5 Whirlwind, A, 350 hp, 9 cyl.



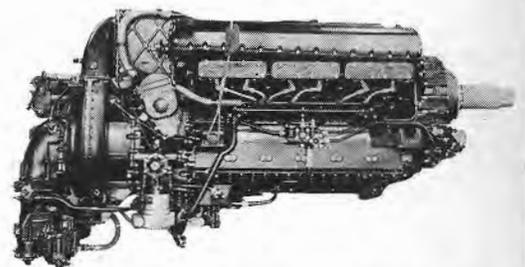
Allison V-1710, L, 1,500 hp, 12 cyl.



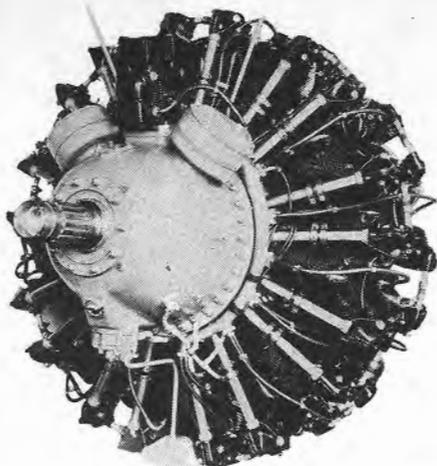
Liberty, L, 400 hp, 12 cyl.



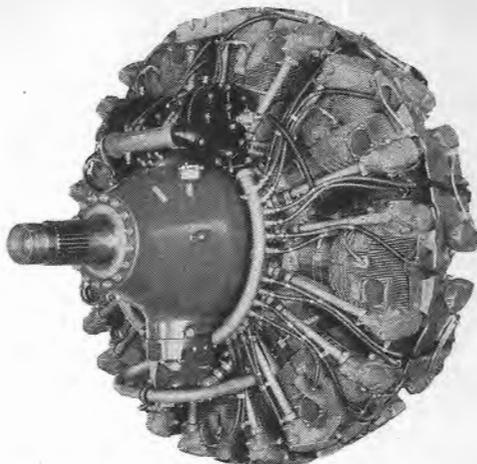
Curtiss D-12, L, 510 hp, 12 cyl.



Packard-Rolls Royce V-1650, L, 1,800 hp, 12 cyl.



Pratt & Whitney R-2800, A, 2,100 hp, 18 cyl.



Wright R-3350 Cyclone, A, 2,200 hp, 18 cyl.

A list of model designations of Army airplanes not included in the pictorial catalog

PRIMARY TRAINERS

- CONSOLIDATED XPT-2, a PT-1 with an air-cooled Wright R-790 engine.
- CONSOLIDATED XPT-4, a PT-3 with an air-cooled, 4-cylinder, radial Fairchild-Caminez 447-C engine.
- CONSOLIDATED XPT-5, a PT-3 with a Curtiss R-600 engine.
- CONSOLIDATED PT-12, a PT-11 with a Pratt & Whitney R-985 engine, fitted for basic training.
- BOEING PT-18 (*Kaydet*), similar to the PT-13A except for a Jacobs R-755 engine.
- RYAN PT-20, similar to the PT-16.
- RYAN PT-21 (*Recruit*), a development of the PT-20 with a longer and wider fuselage.
- FAIRCHILD PT-26 (*Cornell*), similar to the PT-19.
- BOEING PT-27 (*Kaydet*), similar to the PT-17.

BASIC TRAINERS

- DOUGLAS BT-1, a redesignated O-2K.
- DOUGLAS BT-2, a redesignated O-32.
- STEARMAN BT-3, a PT-9 with a Wright R-975 engine, fitted for basic training.
- CURTISS XBT-4, an O-1E fitted for basic training.
- STEARMAN BT-5, a PT-9 with a Pratt & Whitney R-985 engine, fitted for basic training.
- CONSOLIDATED BT-6, a PT-11 with a Wright R-975 engine.
- CONSOLIDATED BT-7, a redesignated PT-12, fitted for basic training.
- NORTH AMERICAN BT-10, similar to the BT-9 except for a Pratt & Whitney R-1340 engine and certain minor changes.
- AIRCRAFT RESEARCH CORPORATION XBT-11, a new-design monoplane with a Pratt & Whitney R-985 engine; project discontinued.

- CONSOLIDATED-VULTEE BT-15 (*Valiant*), similar to the BT-13A except for a Wright R-975 engine.
- VIDAL RESEARCH CORPORATION XBT-16, similar to the BT-13A except for plywood construction.

ADVANCED TRAINERS

- HUFF-DALAND AT-2, similar to the AT-1.
- CURTISS AT-4, similar to the P-1 except for a Wright-E "Hisso" engine.
- BEECH AT-10 (*Wichita*), similar to the AT-7 except for Lycoming R-680 engines and certain minor changes.
- FAIRCHILD XAT-14, similar to the AT-13 except for Ranger V-770 engines.
- NOORDUYN AT-16 (*Harvard*), a Canadian adaptation of the AT-6.
- CESSNA AT-17 (*Bobcat*), similar to the AT-8 except for Jacobs R-755 engines and certain minor changes.
- LOCKHEED AT-18 (*Hudson*), an adaptation of the A-29A for turret gunnery training.
- FAIRCHILD AT-21 (*Gunner*), similar to the AT-13 except for Ranger V-770 engines and gunnery-training equipment.
- CONSOLIDATED AT-22, an adaptation of the B-24D for training aerial-engineer personnel.
- MARTIN AT-23, an adaptation of the B-26B and B-26C for advanced tow-target training.
- NORTH AMERICAN AT-24, an adaptation of the B-25 for advanced two-engine pilot training.
- NORTH AMERICAN BC-1, similar to the AT-6.
- NORTH AMERICAN BC-2, similar to the BC-1.

OBSERVATION PLANES

- ENGINEERING DIVISION CO-3, similar to the CO-2.

- MARTIN XO-4, a new design entered in the observation competition of 1925 but not developed.
- DOUGLAS O-5, similar to the World Cruiser pictured under *TRANSPORTS*.
- DOUGLAS O-7, an O-2 with an upright direct-drive Packard 1A-1500 engine.
- DOUGLASS O-8, an O-2 with an air-cooled Curtiss R-1454 engine.
- DOUGLAS O-9, an O-2 with a geared Packard 1A-1500 engine.
- LOENING XO-10, similar to the OA-1.
- CURTISS XO-11, a redesignated O-1A with a Liberty V-1410 engine.
- CURTISS XO-12, an O-11 with a Pratt & Whitney R-1340 engine.
- CURTISS XO-13, an O-1 with a Curtiss V-1570 engine.
- CURTISS XO-16, an O-11 with a Prestone-cooled Curtiss V-1570 engine.
- CONSOLIDATED O-17 (*Courier*), similar to the PT-3; procured for use by the National Guard.
- CURTISS XO-18, an O-11 with a Curtiss H-1640 engine.
- THOMAS-MORSE O-20, an O-19 with a Pratt & Whitney R-1690 engine.
- THOMAS-MORSE XO-21, an O-19 with a Curtiss H-1640 engine.
- THOMAS-MORSE O-23, an O-19 with a Curtiss V-1570 engine.
- CURTISS O-24, not procured.
- DOUGLAS O-25, an O-2H with a Curtiss V-1570 engine.
- CURTISS O-26, an O-1E with a Curtiss V-1570 engine.
- DOUGLAS O-29, an O-2K with an air-cooled Wright R-1750 engine.
- CURTISS XO-30, a monoplane design with a Curtiss V-1570 engine; contract canceled.
- DOUGLAS O-32, an O-2K with a Pratt & Whitney R-1340 engine.
- DOUGLAS O-34, an O-22 with a liquid-cooled Curtiss V-1570 engine.

DOUGLAS XO-36, redesignated the XB-7.
 KEYSTONE-LOENING O-37, an OA-2 with a Pratt & Whitney R-1340 engine; project canceled.
 CURTISS O-39, an O-1G with a Curtiss V-1570 engine.
 THOMAS-MORSE O-41, project canceled.
 THOMAS-MORSE O-42, assignment canceled.
 DOUGLAS O-44, redesignated the OA-5.
 MARTIN O-45, a converted B-10; assignment canceled.
 DOUGLAS XO-48, an O-46 with a Wright R-1670 engine.
 DOUGLAS O-53, an adaptation of the A-20B for photographic work; project canceled.
 VULTEE-STINSON O-54, a commercial type; not in service.
 ENGINEERING RESEARCH CORPORATION O-55, a commercial type (*Er-coupe*); not in service.
 LOCKHEED O-56 (*Ventura*), similar to the B-34.
 KELLETT O-60, included under *SOME ROTARY WING AND GLIDER AIRCRAFT*.
 AGA AVIATION CORPORATION O-61, similar to the O-60.

AMPHIBIANS

CONSOLIDATED OA-6, a 2-engine 5-place biplane; project canceled.
 CONSOLIDATED OA-7, similar to the OA-4B; project canceled.

PHOTOGRAPHIC PLANES

BEECH F-2, similar to the AT-7.
 DOUGLAS F-3 (*Havoc*), an adaptation of the A-20 for photographic work.
 LOCKHEED F-4 (*Lightning*), an adaptation of the P-38E for photographic work.
 LOCKHEED F-5 (*Lightning*), an adaptation of the P-38E for photographic work.
 NORTH AMERICAN F-6 (*Mustang*), an adaptation of the P-51 for photographic work.
 CONSOLIDATED F-7 (*Liberator*), an adaptation of the B-24 for photographic work.
 BOEING F-9 (*Flying Fortress*), an adaptation of the B-17F for photographic work.
 NORTH AMERICAN F-10 (*Mitchell*), a redesignated B-25D with camera installation.
 HUGHES XF-11, a 2-place 2-engine monoplane for high-altitude reconnaissance, still in an experimental stage.
 REPUBLIC XP-12, a 5-place 4-engine monoplane for long-range high-altitude photographic work; still in the experimental stage.
 BOEING F-13 (*Superfortress*), an adaptation of the B-29 for photographic work.
 LOCKHEED F-14 (*Shooting Star*), a P-80A converted for photographic use.

FIGHTERS

BOEING XP-4, a modified PW-9 with supercharged Packard 1A-1530 engine.
 CURTISS P-5, a P-1A with engine supercharged.

BOEING XP-7, a PW-9D with a Curtiss V-1570 engine.
 BOEING XP-8, an experimental model not developed.
 CURTISS P-11, a P-6 with a Curtiss H-1640 engine.
 CURTISS XP-14, project canceled.
 BOEING XP-15, a high-wing monoplane design; project canceled.
 XP-18, designation for new-type single-place biplane with Wright engine; described in requirements but never developed.
 XP-19, designation for new-type single-place low-wing monoplane with Wright engine; described in requirements but never developed.
 CURTISS XP-21, a P-3A with a Pratt & Whitney R-985 engine.
 CURTISS XP-22, a modified P-6A.
 CONSOLIDATED P-27, a P-25 with an air-cooled Pratt & Whitney R-1340 engine; project canceled.
 CONSOLIDATED P-28, a P-25 with a later type of R-1340 engine; project canceled.
 CONSOLIDATED P-30, similar to the P-25; redesignated PB-2.
 BOEING P-32, similar to the P-29 except for a Wright R-1510 or a Pratt & Whitney R-1535 engine; assignment canceled.
 CONSOLIDATED P-33, similar to the P-30; assignment canceled.
 WEDELL-WILLIAMS XP-34, a new-type monoplane with a Pratt & Whitney R-1830 engine; project canceled.
 REPUBLIC P-41, a P-35 with a later, supercharged version of the R-1830 engine.
 REPUBLIC P-44, a prototype of the P-47; none procured.
 BELL XP-45, redesignated the P-39C.
 CURTISS XP-46, similar to the P-40.
 REPUBLIC XP-48, none procured.
 LOCKHEED XP-49, similar to the P-38 except for V-type Continental I-1430 engines and certain minor changes.
 BELL XP-52, similar to the P-39 except for wing loading and a Continental I-1430 engine; project canceled.
 CURTISS XP-53, similar to the XP-46.
 TUCKER XP-57, a new-type monoplane with a supercharged Miller L-510 racing engine; project canceled.
 LOCKHEED XP-58, a 2-place larger and heavier development of the P-38 with increased armament and air-cooled Pratt & Whitney H-2600 engines.
 GRUMMAN XP-65, Army version of the Navy's new two-engine F-7-F Tigercat; project canceled.
 VULTEE XP-68, a Wright-Tornado-powered design that did not materialize.
 REPUBLIC XP-69, a single-place interceptor with a Wright R-2160 engine and a pressurized cabin; none procured.
 DOUGLAS P-70 (*Havoc*), an adaptation of the A-20 for night fighting.
 CURTISS-WRIGHT XP-71, a 2-place design with two Pratt & Whitney experimental "Wasp" engines and pressurized cabin; never built.
 REPUBLIC XP-72, similar to the P-47 except for experimental Pratt & Whitney R-4360 engine, heavier armament, pressurized cabin.

P-73, designation not assigned.
 P-74, designation not assigned.
 BELL P-76, similar to the P-39M; project canceled.
 NORTH AMERICAN XP-78, similar to the P-51; designation canceled.

BOMBERS

MARTIN XLB-4, a new design with two direct-drive, air-cooled Liberty engines; not developed.
 HUFF-DALAND and KEYSTONE LB-5, similar to the LB-1 except for Liberty engines and a redesigned fuselage nose.
 KEYSTONE LB-7 to LB-12, modified LB-6's with different type Wright R-1750 or Pratt & Whitney R-1690 or R-1860 engines.
 KEYSTONE B-3 to B-6, modified LB-6's with different type Wright R-1750 or R-1820 engines or Pratt & Whitney R-1690 or R-1860 engines.
 DOUGLAS B-11, redesignated the O-44 (OA-5).
 MARTIN B-12, similar to the B-10 except for Pratt & Whitney R-1690 engines.
 MARTIN B-13, similar to the B-10 except for Pratt & Whitney R-1860 engines; none procured.
 MARTIN XB-14, similar to the B-12 except for Pratt & Whitney R-1830 engines.
 MARTIN XB-16, a new long-range design with four Allison V-1710 engines; not developed.
 BOEING XB-20, a modified B-15 with Pratt & Whitney R-2180 engines; none procured.
 DOUGLAS B-22, a B-18A with Wright R-2600 engines; designation canceled.
 MARTIN XB-27, a new high-speed design with two Pratt & Whitney R-2800 engines and a pressurized cabin; none procured.
 LOCKHEED XB-30, bomber version of the C-69 Constellation, in the B-29 and B-32 class; designation canceled.
 DOUGLAS B-31, a proposed design that was never developed; designation canceled.
 MARTIN XB-33, a high-wing type with four Wright R-2600 engines, pressurized cabin, and tricycle landing gear; project discontinued.
 NORTHROP B-35, a flying-wing design; not released.
 CONSOLIDATED XB-36, a six-engine bomber version of the C-99, also being produced as a commercial transport.
 LOCKHEED B-37, a redesignated O-56 (similar to the B-34) with heavier armament and bombardment equipment.
 BOEING XB-38, not released.
 BOEING B-40 (*Flying Fortress*), a B-17F converted into a bomber escort with 14x.50-caliber machine guns.
 CONSOLIDATED XB-41 (*Liberator*), a B-24D converted into a bomber escort with 14x.50-caliber machine guns.

ATTACK PLANES

A-1, a designation assigned to an ambulance type; see under *TRANSPORTS*.
 CURTISS XA-4, an A-3 with an air-cooled Pratt & Whitney R-1340 engine; redesignated the XA-9.

CURTISS A-5, an A-3 with a Curtiss V-1570 engine; designation canceled.

CURTISS A-6, an A-3 with a Curtiss H-1640 engine; designation canceled.

DETROIT A-9, similar to the A-3 except for a Curtiss V-1570 engine; contract canceled.

CURTISS A-10, an A-8 with an air-cooled Pratt & Whitney R-1690 engine.

MARTIN A-15, an adaptation of the B-10 for attack purposes; project canceled.

NORTHROP XA-16, an A-13 with a Pratt & Whitney R-1830 engine.

MARTIN XA-23, a 2-engine type procured by foreign-release agreement; project canceled.

NORTH AMERICAN A-27, similar to the AT-6 except for a Wright R-1820 engine and certain minor changes.

LOCKHEED A-28, similar to the A-29 except for Pratt & Whitney R-1830 engines.

VULTEE A-31, similar to the A-35.

DOUGLAS A-33, similar to the A-24.

HUGHES XA-37, an all-wood type with two Pratt & Whitney R-2800 engines; project discontinued.

FLEETWING XA-39, a single-place all-metal design with a Pratt & Whitney R-2800 engine; project discontinued.

CURTISS XA-40, a single-place low-level design with a Wright R-3350 engine similar to the Navy's XBTC-1; project discontinued.

TRANSPORTS

FORD C-3, similar to the C-9 except for R-790 engines.

ATLANTIC C-5, similar to the C-2 except for Pratt & Whitney R-1340 engines.

ATLANTIC C-7, similar to the C-2.

FAIRCHILD C-8, a redesignated F-1.

CONSOLIDATED C-11, a 4-place high-wing monoplane procured for test purposes.

C-13, designation not assigned.

GENERAL AVIATION C-15, a C-14 converted for ambulance use.

GENERAL AVIATION C-16, a 4-place amphibian monoplane, tested but not procured.

LOCKHEED C-17, similar to the C-12.

BOEING C-18, a 6-passenger monoplane, tested but not procured.

GENERAL AVIATION C-20, a Fokker 4-engine type, tested but not procured.

DOUGLAS C-21, same as the OA-3.

CONSOLIDATED C-22, a C-11 with a Wright R-1820 engine.

DETROIT C-25, similar to the C-23.

DOUGLAS C-26, redesignated the OA-4.

DOUGLAS C-29, similar to the C-26 except for Pratt & Whitney R-1340 engines.

DOUGLAS C-33 and C-34, similar to the C-32.

LOCKHEED C-37 (*Electra*), similar to the C-36.

DOUGLAS C-38 and C-39, similar to the C-33.

DOUGLAS C-41, a cargo-type C-39 except for Pratt & Whitney R-1830 engines.

DOUGLAS C-42, similar to the C-39.

MESSERSCHMITT XC-44, an ME-108 loaned to the U. S. Military Attaché in Berlin prior to Pearl Harbor.

DOUGLAS C-48 to C-53, modified versions of the C-47 (and commercial DC-3) except for Wright R-1820 engines in the C-49 (*Skytrooper*), C-50, and C-51.

CURTISS-WRIGHT C-55, a C-46 converted for longer range.

LOCKHEED C-56 (*Lodestar*) and C-57 (*Lodestar*), commercial types similar to the C-60.

DOUGLAS C-58, a B-18A converted for transport use.

LOCKHEED C-59 (*Lodestar*), similar to the C-60 except for Pratt & Whitney R-1690 engines.

WACO C-62, a high-wing transport with two Pratt & Whitney R-1830 engines and capacity for 22 men including a crew of three; project discontinued.

LOCKHEED C-63, redesignated A-29A.

STOUT XC-65, a commercial model procured for test purposes.

LOCKHEED C-66 (*Lodestar*), another version of the C-60.

DOUGLAS C-67 (*Dragon*), a B-23 adapted to transport use.

DOUGLAS C-68, similar to the C-47.

HOWARD C-70, a commercial 5-place monoplane procured for test purposes.

SPARTAN C-71, a commercial 5-place monoplane procured for test purposes.

WACO C-72, a commercial 4- or 5-place land or sea biplane procured for test purposes.

BOEING C-73, a commercial 2-engine 13-place monoplane procured for test purposes.

CURTISS C-76 (*Caravan*), a high-wing 2-engine design constructed of plywood; project discontinued.

CESSNA C-77, a 4-place commercial monoplane procured for test purposes.

CESSNA C-78, similar to the AT-17B.

JUNKER C-79, a single JU-52 procured for test purposes.

HARLOW C-80, a commercial 2- or 4-place monoplane procured for test purposes.

STINSON C-81, a commercial type similar to the AT-19; procured for test purposes.

PIPER C-83, a commercial 2- or 3-place monoplane procured for test purposes.

DOUGLAS C-84, the commercial DC-3B procured for test purposes.

LOCKHEED C-85, the commercial 4- or 5-place Orion procured for test purposes.

FAIRCHILD C-86, a commercial type similar to the C-61; procured for test purposes.

FAIRCHILD C-88, a commercial 5-place monoplane procured for test purposes.

HAMILTON C-89, a commercial 7-place monoplane procured for test purposes.

LUSCOMBE C-90, a commercial 2-place land- or seaplane procured for test purposes.

VULTEE C-91, a commercial 10-place monoplane procured for test purposes.

FUNK C-92, a 2-place monoplane procured for test purposes.

BUDD C-93, a high-wing monoplane, with two Pratt & Whitney R-1830 engines, designed to carry a crew of two and 24 passengers (or equivalent cargo); contract canceled.

CESSNA C-94, a commercial 4-place land- or seaplane procured for test purposes.

TAYLORCRAFT C-95, 2-place monoplane procured for test purposes.

FAIRCHILD C-96, a 7-place monoplane procured for test purposes.