Bomber Aircrafts of World War II

Loree Vallejo

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Table of Contents

Chapter-1

Boeing B-17 Flying Fortress

B-17 Flying Fortress

Boeing B-17E

Role	Heavy bomber Strategic bomber
National origin	United States
Manufacturer	Boeing
First flight	28 July 1935
Introduction	April 1938
Retired	1968 (Brazilian Air Force)
Primary users	United States Army Air Forces Royal Air Force
Produced	1936–1945
Number built	12,731
Unit cost	US$238,329
Variants	XB-38 Flying Fortress YB-40 Flying Fortress C-108 Flying Fortress
Developed into	Boeing 307

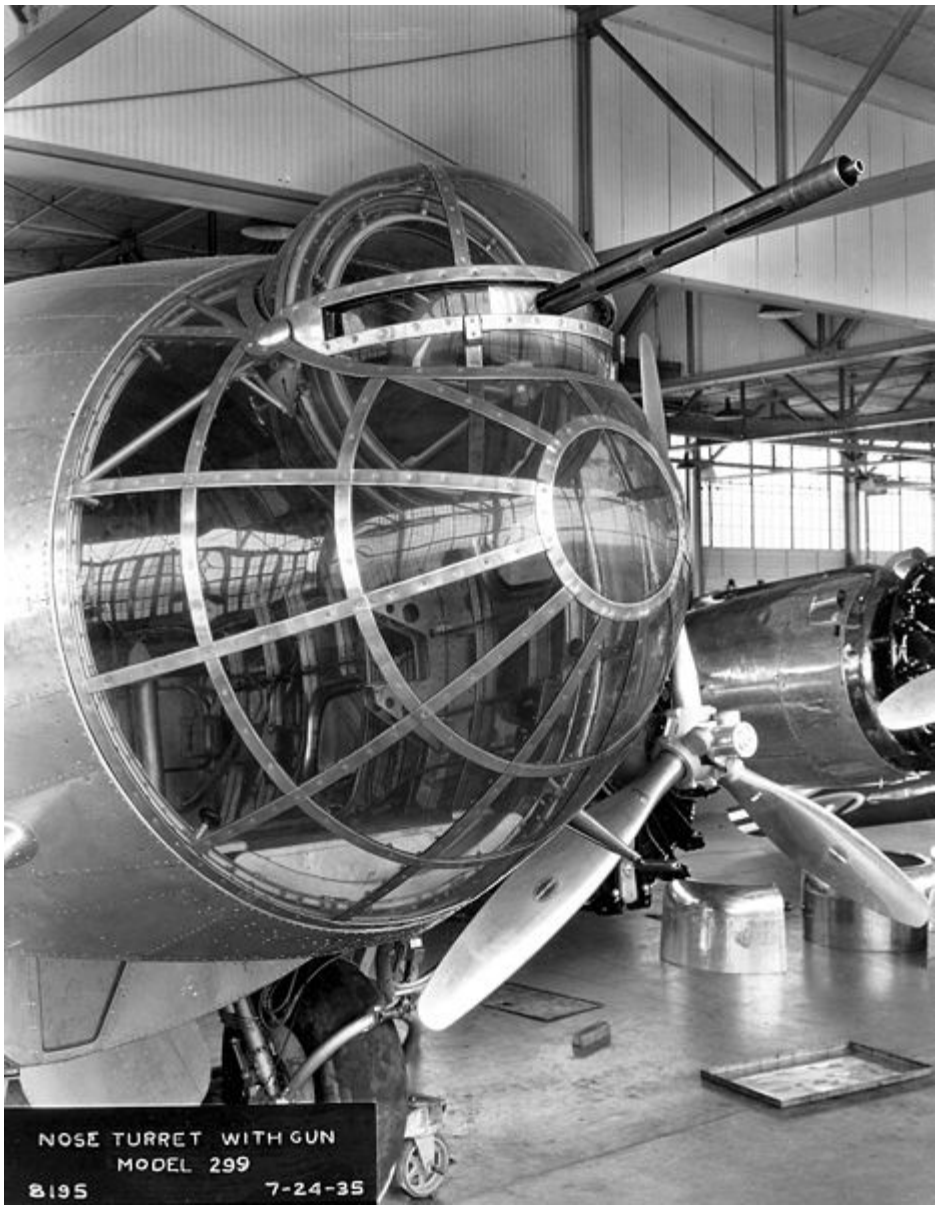
The **Boeing B-17 Flying Fortress** was a four-engine heavy bomber aircraft developed in the 1930s for the then-United States Army Air Corps (USAAC). Competing against Douglas and Martin for a contract to build 200 bombers, the Boeing entry outperformed both competitors and more than met the Air Corps' expectations. Although Boeing lost the contract because the prototype crashed, the Air Corps was so impressed with Boeing's design that they ordered 13 more B-17s for further evaluation. From its introduction in 1938, the B-17 Flying Fortress evolved through numerous design advances.

The B-17 was primarily employed by the United States Army Air Forces (USAAF) in the daylight precision strategic bombing campaign of World War II against German industrial and military targets. The United States Eighth Air Force based at Thorpe Abbotts airfield in England and the Fifteenth Air Force based in Italy complemented the RAF Bomber Command's nighttime area bombing in Operation Pointblank to help secure air superiority over the cities, factories and battlefields of Western Europe in preparation for Operation Overlord. The B-17 also participated to a lesser extent in the War in the Pacific where it conducted raids against Japanese shipping and airfields.

From its pre-war inception, the USAAC (later USAAF) touted the aircraft as a strategic weapon; it was a potent, high-flying, long-range bomber that was able to defend itself, and to return home despite extensive battle damage. It quickly took on mythic proportions, and widely circulated stories and photos of B-17s surviving battle damage increased its iconic status. With a service ceiling greater than any of its Allied contemporaries, the B-17 established itself as an effective weapons system, dropping more bombs than any other U.S. aircraft in World War II. Of the 1.5 million metric tons of bombs dropped on Germany by U.S. aircraft, 640,000 tons were dropped from B-17s.

Development

Model 299 *NX13372*



Nose turret with gun fitted to the prototype

On 8 August 1934, the U.S. Army Air Corps (USAAC) tendered a proposal for a multi-engined bomber to replace the Martin B-10. The Air Corps were looking for a bomber capable of reinforcing the air forces in Hawaii, Panama, and Alaska. Requirements were that it would carry a "useful bombload" at an altitude of 10,000 feet (3 km) for 10 hours with a top speed of at least 200 miles per hour (320 km/h). They also desired, but did not require, a range of 2,000 miles (3,200 km) and a speed of 250 miles per hour (400 km/h). The competition for the Air Corps contract would be decided by a "fly-off" between Boeing's design, the Douglas DB-1 and the Martin Model 146 at Wright Field in Dayton, Ohio.

The prototype B-17, designated Model 299, was designed by a team of engineers led by E. Gifford Emery and Edward Curtis Wells and built at Boeing's own expense. It combined features of the experimental Boeing XB-15 bomber with the Boeing 247 transport airplane. The B-17's armament consisted of up to 4,800 pounds (2,200 kg) of bombs on two racks in the bomb bay behind the cockpit, and five 0.30 inches (7.62 mm) machine guns, and it was powered by four Pratt & Whitney R-1690 "Hornet" radial engines each producing 750 horsepower (600 kW) at 7,000 feet (2,100 m). The first flight of the Model 299 was on 28 July 1935, with Boeing chief test-pilot Leslie Tower at the controls. Richard Williams, a reporter for the *Seattle Times* coined the name "Flying Fortress" when the Model 299 was rolled out, bristling with multiple machine gun installations. Boeing was quick to see the value of the name and had it trademarked for use. On 20 August 1935, the prototype flew from Seattle to Wright Field in nine hours and three minutes at an average cruising speed of 252 miles per hour (406 km/h), much faster than the competition.

At the fly-off, the four-engine Boeing's performance was superior to those of the twin-engine DB-1 and Model 146. Then-Major General Frank Maxwell Andrews of the GHQ Air Force believed that the long-range capabilities of four-engine large aircraft were more efficient than shorter-ranged twin-engined airplanes, and that the B-17 was better suited to their doctrine. His opinions were shared by the Air Corps procurement officers, and even before the competition had finished they suggested buying 65 B-17s.

Crashed Model 299

Development continued on the Boeing Model 299, and on 30 October 1935, Army Air Corps test-pilot Major Ployer Peter Hill and Boeing employee Les Tower took the Model

299 on a second evaluation flight; however, the crew forgot to disengage the airplane's "gust lock," a device that held the bomber's movable control surfaces in place while the aircraft was parked on the ground. Having taken off, the aircraft entered a steep climb, stalled, nosed over and crashed, killing Hill and Tower (other observers survived with injuries). The crashed Model 299 could not finish the evaluation, and while the Air Corps was still enthusiastic about the aircraft's potential, Army officials were daunted by the much greater expense per aircraft (Douglas quoted a unit price of $58,200 based on a production order of 220 aircraft, compared with a price of $99,620 from Boeing), and as the competition could not be completed Boeing was legally disqualified from the consideration for the contract. Army Chief of Staff Malin Craig cancelled the order for 65 YB-17s, and ordered 133 of the twin-engine Douglas B-18 Bolo instead.

Boeing Y1B-17 in flight

Regardless, the USAAC had been impressed by the prototype's performance, and on 17 January 1936, through a legal loophole, the Air Corps ordered 13 YB-17s (designated Y1B-17 after November 1936 to denote its special F-1 funding) for service testing. The YB-17 incorporated a number of significant changes from the Model 299, including more powerful Wright R-1820-39 Cyclone engines replacing the original Pratt & Whitneys. Although the prototype was company-owned and never received a military serial (the B-17 designation itself did not appear officially until January 1936, nearly three months after the prototype crashed), the term "XB-17" was retroactively applied to the airframe and has entered the lexicon to describe the first Flying Fortress.

Between 1 March and 4 August 1937, 12 of the 13 Y1B-17s were delivered to the 2nd Bombardment Group at Langley Field in Virginia for operational development and flight tests. One suggestion adopted was the use of a checklist to avoid accidents such as that which befell the Model 299. In one of their first missions, three B-17s, directed by lead navigator Lieutenant Curtis LeMay, were sent by General Andrews to "intercept" and photograph the Italian ocean liner *Rex* 610 miles (980 km) off the Atlantic coast. The mission was successful and widely publicized. The 13th Y1B-17 was delivered to the Material Division at Wright Field, Ohio, to be used for flight testing.

A 14th Y1B-17 (*37-369*), originally constructed for ground testing of the airframe's strength, was upgraded and fitted with exhaust-driven turbochargers. Scheduled to fly in 1937, it encountered problems with the turbochargers, and its first flight was delayed until 29 April 1938. The aircraft was delivered to the Army on 31 January 1939. Once service testing was complete, the Y1B-17s and Y1B-17A were redesignated B-17 and B-17A respectively to signify the change to operational status.

B-17Bs at March Field, California, prior to attack on Pearl Harbor

Opposition to the Air Corps' ambitions for the acquisition of more B-17s faded, and in late 1937, 10 more aircraft designated B-17B were ordered to equip two bombardment groups, one on each U.S. coast. Improved with larger flaps, rudder and Plexiglas nose, the B-17Bs were delivered in five small batches between July 1939 and March 1940. In July 1940, a significant order for 512 B-17s was issued; however, prior to the attack on Pearl Harbor, fewer than 200 B-17s were in service with the Army. A total of 155 B-17s

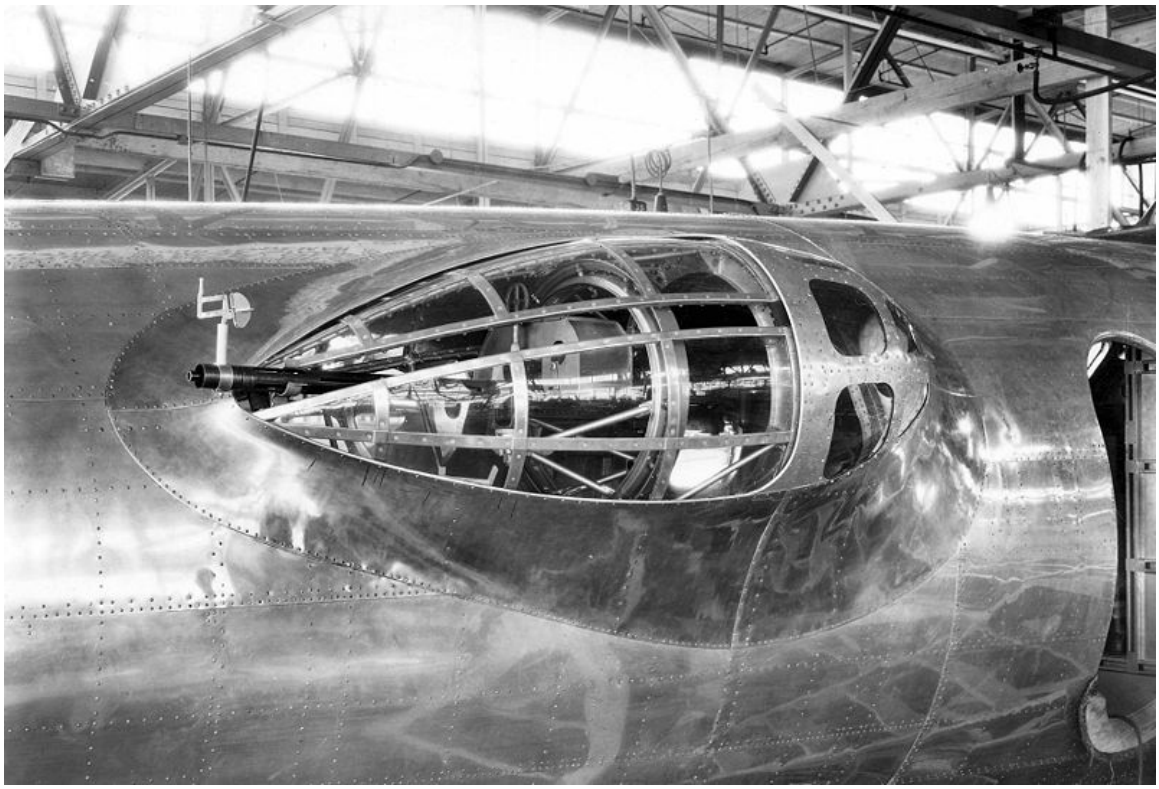
of all variants were delivered between 11 January 1937 and 30 November 1941, but production quickly accelerated with the B-17 eventually setting the record for achieving the highest production rate for large aircraft.The aircraft went on to serve in every World War II combat zone, and by the time production ended in May 1945, 12,731 aircraft had been built by Boeing, Douglas, and Vega (a subsidiary of Lockheed).

Design and variants

Production numbers

Variant	Produced	First flight
Model 299	1	28 July 1935
YB-17	13	2 December 1936
YB-17A	1	29 April 1938.
B-17B	39	27 June 1939
B-17C	38	21 July 1940
B-17D	42	3 February 1941
B-17E	512	5 September 1941
B-17F	3,405	30 May 1942
B-17F-BO	2,300	
B-17F-DL	605	
B-17F-VE	500	
B-17G	8,680	
B-17G-BO	4,035	
B-17G-DL	2,395	
B-17G-VE	2,250	
Grand total	12,731	

The B-17 went through several alterations in each of its design stages and variants. Of the 13 YB-17s ordered for service testing, 12 were used by the 2nd Bomb Group of Langley Field, Virginia, to develop heavy bombing techniques, and the 13th was used for flight testing at the Material Division at Wright Field, Ohio. Experiments on this aircraft led to the use of a turbo-supercharger which would become standard on the B-17 line. A 14th aircraft, the YB-17A, originally destined for ground testing only and upgraded with the turbocharger, was re-designated B-17A after testing had finished.



Blister turret of Model 299, not adopted for production

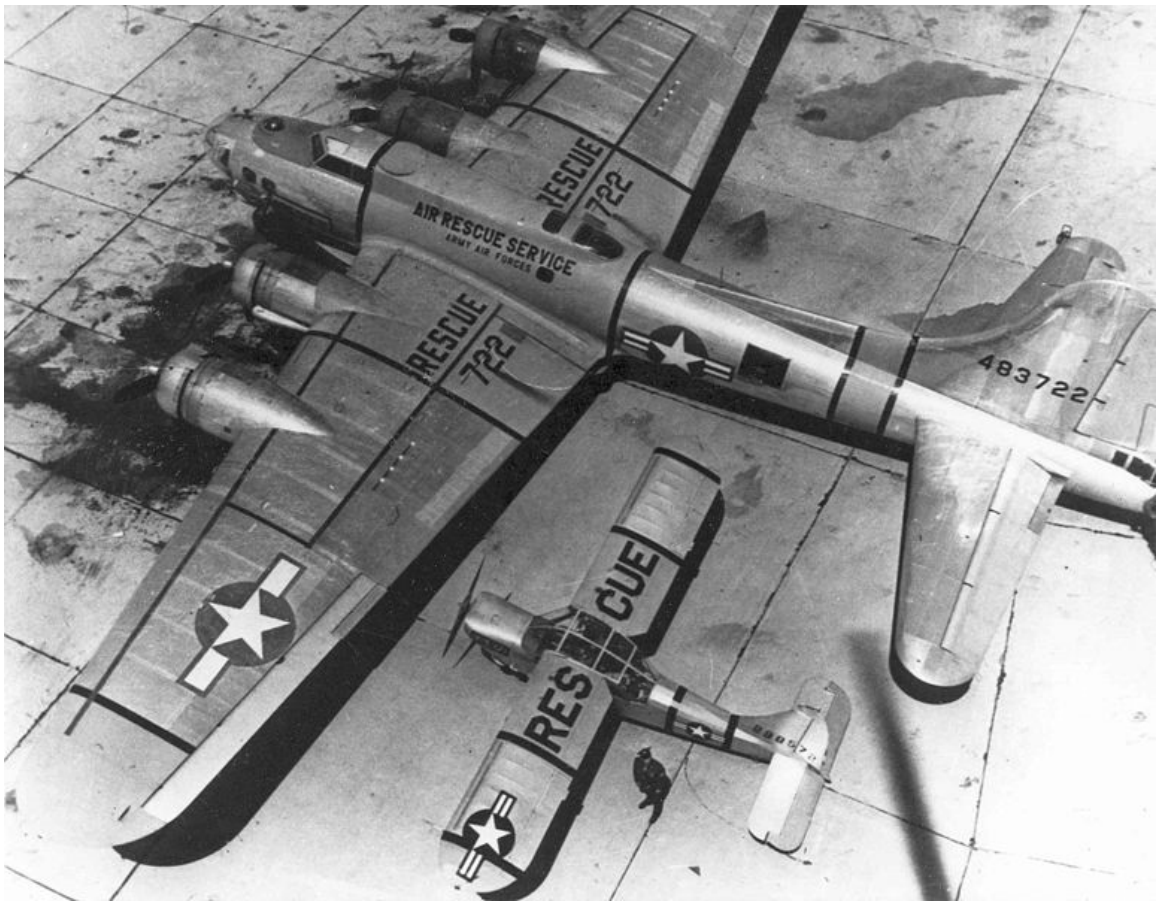
As the production line developed, Boeing engineers continued to improve upon the basic design. To enhance performance at slower speeds, the B-17B was altered to include larger rudder and flaps. The B-17C changed from gun blisters to flush, oval-shaped windows. Models *A* through *D* of the B-17 were designed defensively, while the B-17E was the first model primarily focused on offensive warfare. The B-17E was an extensive revision of the design; the fuselage was extended by 10 ft (3.0 m), a much larger vertical fin and rudder were incorporated into the original design, and a gunner's position in the tail as well as an improved nose were added, resulting in a 20% increase in aircraft weight. The engines were upgraded to more powerful versions multiple times throughout its production, and similarly, the gun stations were altered on numerous occasions to enhance their effectiveness.

B-17G nose detail

By the time the definitive B-17G appeared, the number of guns had been increased from seven to 13, the designs of the gun stations were finalized, and other adjustments were complete. The B-17G was the final version of the B-17, incorporating all changes made to its predecessor, the B-17F, and in total 8,680 were built, the last one (by Lockheed) on July 28 1945. Many B-17Gs were converted for other missions such as cargo hauling, engine testing and reconnaissance. Initially designated SB-17G, a number of B-17Gs were also converted for search-and-rescue duties, later to be redesignated B-17H.

Two versions of the B-17 were flown under different designations, the XB-38 Flying Fortress and the YB-40 Flying Fortress. The XB-38 was an engine test-bed for Allison V-1710 liquid-cooled engines, should the Wright engines normally used on the B-17

become unavailable. The only prototype XB-38 to fly crashed on its ninth flight and the type was abandoned, the V-1710 being kept for fighters. The YB-40 was a heavily armed modification of the standard B-17 used before the P-51 Mustang, an effective long-range fighter, became available to act as escort. Additional armament included an additional dorsal turret in the radio room, a chin turret (which became standard with the B-17G) and twin .50 in (13 mm) guns in the waist positions. The ammunition load was over 11,000 rounds, making the YB-40 well over 10,000 lb (4,500 kg) heavier than a fully loaded B-17F. The YB-40s with their numerous heavy modifications had trouble keeping up with the lighter bombers once they had dropped their bombs, and so the project was abandoned and finally phased out in July 1943.



SB-17G-95DL *44-83722* assigned to the 2nd ERS as a Search and Rescue aircraft

Late in World War II, at least 25 B-17s were fitted with radio controls and television cameras, loaded with 20,000 lb (9,100 kg) of high-explosives and dubbed BQ-7 "Aphrodite missiles" for Operation Aphrodite. The operation, which involved remotely flying Aphrodite drones onto their targets by accompanying CQ-17 "mothership" control aircraft, was approved on June 26, 1944, and assigned the 388th Bombardment Group stationed at RAF Fersfield, a satellite of RAF Knettishall. The first four drones were sent to Mimoyecques, Siracourt, Watten and Wizernes on August 4, causing little damage.

The project came to a sudden end with the unexplained mid-air explosion over the Blyth estuary of a B-24 Liberator, part of the United States Navy's contribution as "Project Anvil", en route for Heligoland piloted by Lieutenant Joseph P. Kennedy Jr., future U.S. president John F. Kennedy's elder brother. Blast damage was caused over a radius of 5 miles (8.0 km). British authorities were anxious that no similar accidents should again occur, and the Aphrodite project was scrapped in early 1945.

Operational history

The B-17 began operations in World War II with the RAF in 1941, and the USAAF Eighth Air Force and Fifteenth Air Force units in 1942. It was primarily involved in the daylight precision strategic bombing campaign against German industrial targets. In the campaign against German aircraft forces in preparation for the invasion of France, B-17 (and B-24 Liberator) raids were directed against German aircraft production while their presence drew the *Luftwaffe* fighters into battle with Allied fighters.

Early models proved to be unsuitable for combat use over Europe and it was the B-17E that was first successfully used by the USAAF. The defense expected from bombers operating in close formation alone did not prove effective and the bombers needed fighter escorts to operate successfully.

During World War II, the B-17 equipped 32 overseas combat groups, inventory peaking in August 1944 at 4,574 USAAF aircraft worldwide. B-17s dropped 640,036 short tons (580,631 metric tons) of bombs on European targets (compared to 452,508 short tons (410,508 metric tons) dropped by the Liberator and 463,544 short tons (420,520 metric tons) dropped by all other U.S. aircraft). The British heavy bombers, the Avro Lancaster and Handley Page Halifax, dropped 608,612 and 224,207 long tons respectively.

The RAF

RAF Fortress B.I *AN529*.

The Royal Air Force (RAF) entered World War II with no heavy bomber of its own in service; the biggest available were long-range medium bombers such as the Vickers Wellington which could carry up to 4,500 lb of bombs. While the Short Stirling and Handley Page Halifax would become its primary bombers by 1941, in early 1940 the RAF entered into an agreement with the U.S. Army Air Corps to be provided with 20 B-17Cs, which were given the service name Fortress I. Their first operation, against Wilhelmshaven on 8 July 1941 was unsuccessful; on 24 July, the target was Brest, France, but again the bombers missed completely.

By September, after the RAF had lost eight B-17Cs in combat or to accidents and many instances of aborts due to mechanical problems, Bomber Command abandoned daylight bombing raids because of the Fortress I's poor performance. The experience showed both the RAF and USAAF that the B-17C was not ready for combat, and that improved defenses, larger bomb loads and more accurate bombing methods were required.

However the USAAF continued using the B-17 as a "day" bomber, despite pleas from the RAF that attempted daylight bombing would be ineffective.

As usage by Bomber Command had been curtailed, the RAF transferred its remaining Fortress I aircraft to Coastal Command for use as a long-range maritime patrol aircraft instead. These were later augmented in August 1942 by 19 Fortress Mk II (B-17F) and 45 Fortress Mk IIA (B-17E). A Fortress from No. 206 Squadron RAF sank U-627 on 27 October 1942, the first of 11 U-boat kills credited to RAF Fortress bombers during the war. No. 223 Squadron, as part of 100 Group operated a small number of Fortresses in support of the bombing offensive for jamming German radar.

Women pilots leaving their B-17, "Pistol Packin' Mama", at Lockbourne AAF, Ohio, during WASP training to ferry B-17 aircraft. Left to Right are Frances Green, Marget Kirchner, Ann Waldner and Blanche Osborn.

Initial USAAF operations over Europe

The Air Corps (renamed United States Army Air Forces (USAAF) on June 20, 1941), using the B-17 and other bombers, bombed from high altitudes using the then-secret Norden bombsight, which was an optical electro-mechanical gyro-stabilized analog

computer. The device was able to determine, from variables input by the bombardier, the point at which the aircraft's bombs should be released to hit the target. The bombardier essentially took over flight control of the aircraft during the bomb run, maintaining a level altitude during the final moments before release.

The USAAF began building up its air forces in Europe using B-17Es soon after entering the war. The first Eighth Air Force units arrived in High Wycombe, England, on 12 May 1942, to form the 97th Bomb Group. On 17 August 1942, 12 B-17Es of the 97th, with the lead aircraft piloted by Major Paul Tibbets and carrying Brigadier General Ira Eaker as an observer, were escorted by RAF Spitfires on the first USAAF raid over Europe, against railroad marshalling yards at Rouen-Sotteville in France, while a further six aircraft flew a diversionary raid along the French coast. The operation was a success, with only minor damage to two aircraft.

As the raids of the American bombing campaign grew in numbers and frequency, German interception efforts arose to respond to the bombers (such as during the attempted bombing of Kiel on 13 June 1943) to the level where unescorted bombing missions became discouraged.

Combined offensive

Boeing B-17F radar bombing through clouds: Bremen, Germany, on 13 November 1943.

The two different strategies of the American and British bomber commands were organized at the Casablanca Conference in January 1943. The resulting "Combined

Bomber Offensive" would weaken the *Wehrmacht*, destroy German morale and establish air superiority through Operation Pointblank's destruction of German fighter strength in preparation of a ground offensive. The USAAF bombers would attack by day, with British operations – chiefly against industrial cities – by night.

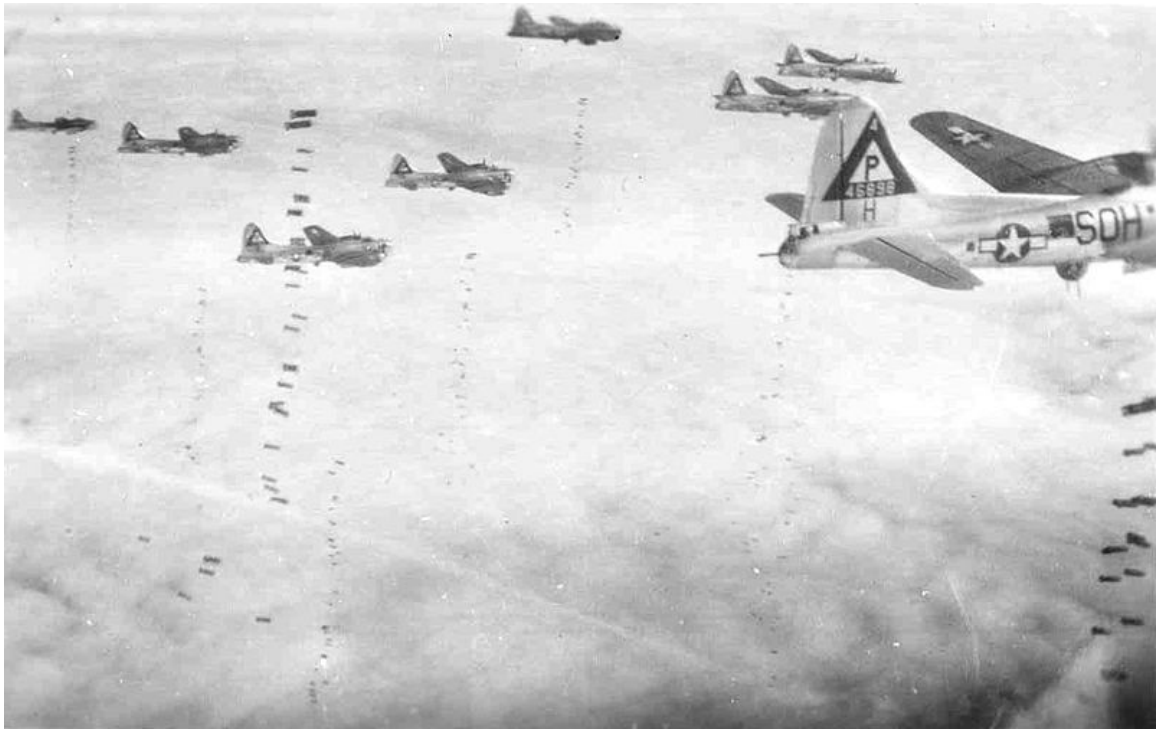
Operation Pointblank opened with attacks on targets in Western Europe. General Ira C. Eaker and the Eighth Air Force placed highest priority on attacks on the German aircraft industry, especially fighter assembly plants, engine factories and ball-bearing manufacturers. Attacks began in April 1943 on heavily fortified key industrial plants in Bremen and Recklinghausen.

B-17F formation over Schweinfurt, Germany, 17 August 1943

Since the airfield bombings were not appreciably reducing German fighter strength, additional B-17 groups were formed, and Eaker ordered major missions deeper into Germany against important industrial targets. The 8th Air Force then targeted the ball-bearing factories in Schweinfurt, hoping to cripple the war effort there. The first raid on 17 August 1943 did not result in critical damage to the factories, with the 230 attacking B-17s being intercepted by an estimated 300 *Luftwaffe* fighters. The Germans shot down

36 aircraft with the loss of 200 men, and coupled with a raid earlier in the day against Regensburg, a total of 60 B-17s were lost that day.

A second attempt on Schweinfurt on 14 October 1943 would later come to be known as "Black Thursday". While the attack was successful at disrupting the entire works, severely curtailing work there for the remainder of the war, it was at an extreme cost. Of the 291 attacking Fortresses, 60 were shot down over Germany, five crashed on approach to Britain, and 12 more were scrapped due to damage – a total loss of 77 B-17s. One hundred and twenty-two bombers were damaged and needed repairs before their next flight. Out of 2,900 men in the crews, about 650 men did not return, although some survived as prisoners of war. Only 33 bombers landed without damage. These losses were a result of concentrated attacks by over 300 German fighters.



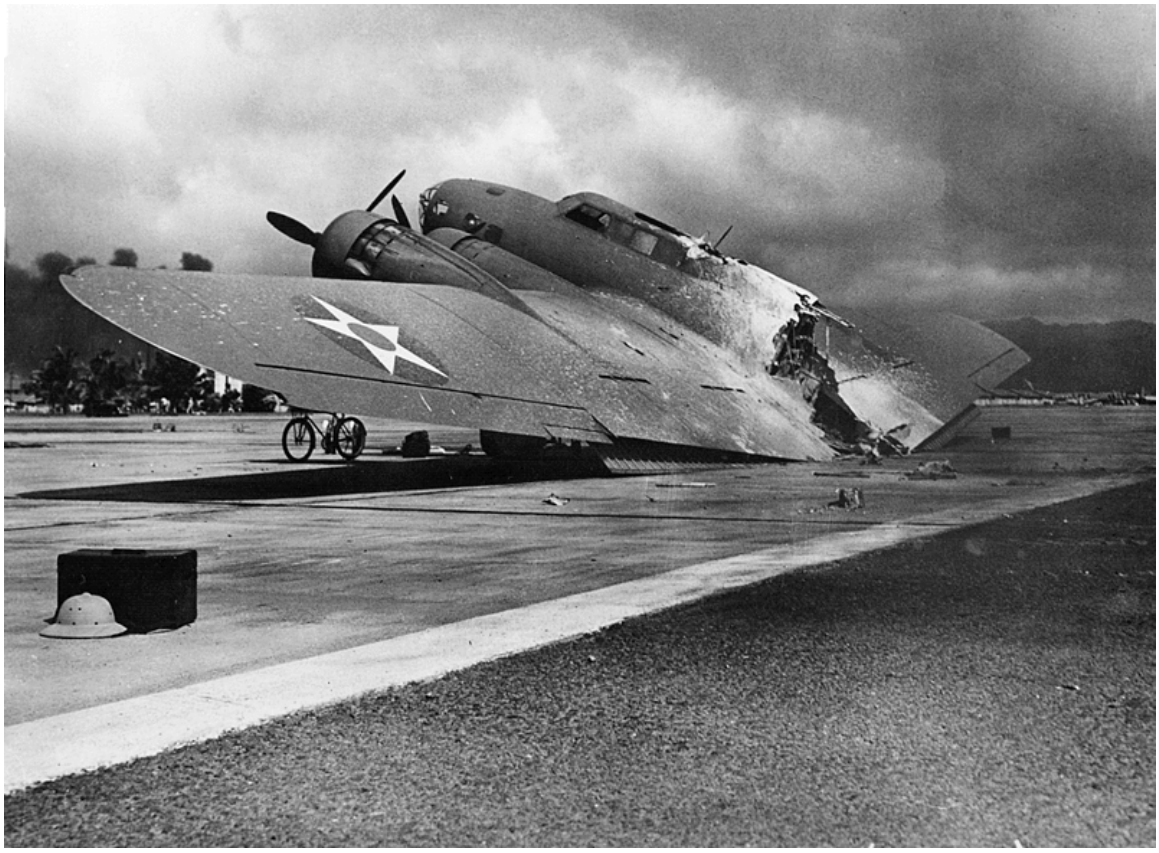
B-17G of the 384th Bomb Group on the bomb run

Such high losses of air crews could not be sustained, and the USAAF, recognizing the vulnerability of heavy bombers to interceptors when operating alone, suspended daylight bomber raids deep into Germany until the development of an escort fighter that could protect the bombers all the way from the United Kingdom to Germany and back. At the same time, the German night fighting ability noticeably improved to counter the nighttime strikes, challenging the conventional faith in the cover of darkness. The Eighth Air Force alone lost 176 bombers in October 1943, and was to suffer similar casualties on 11 January 1944 on missions to Oschersleben, Halberstadt and Brunswick. Lieutenant General James Doolittle, commander of the Eighth, had ordered the second Schweinfurt mission to be cancelled as the weather deteriorated, but the lead units had already entered

hostile air space and continued with the mission. Most of the escorts turned back or missed the rendezvous, and as a result 60 B-17s were destroyed. A third raid on Schweinfurt on 24 February 1944 highlighted what came to be known as "Big Week", during which the bombing missions were directed against German aircraft production. German fighters would have to respond, and the North American P-51 Mustang and Republic P-47 Thunderbolt fighters (equipped with improved drop tanks to extend their range) accompanying the American heavies all the way to and from the targets would engage them. The escort fighters reduced the loss rate to below seven percent, with only 247 B-17s lost in 3,500 sorties while taking part in the Big Week raids.

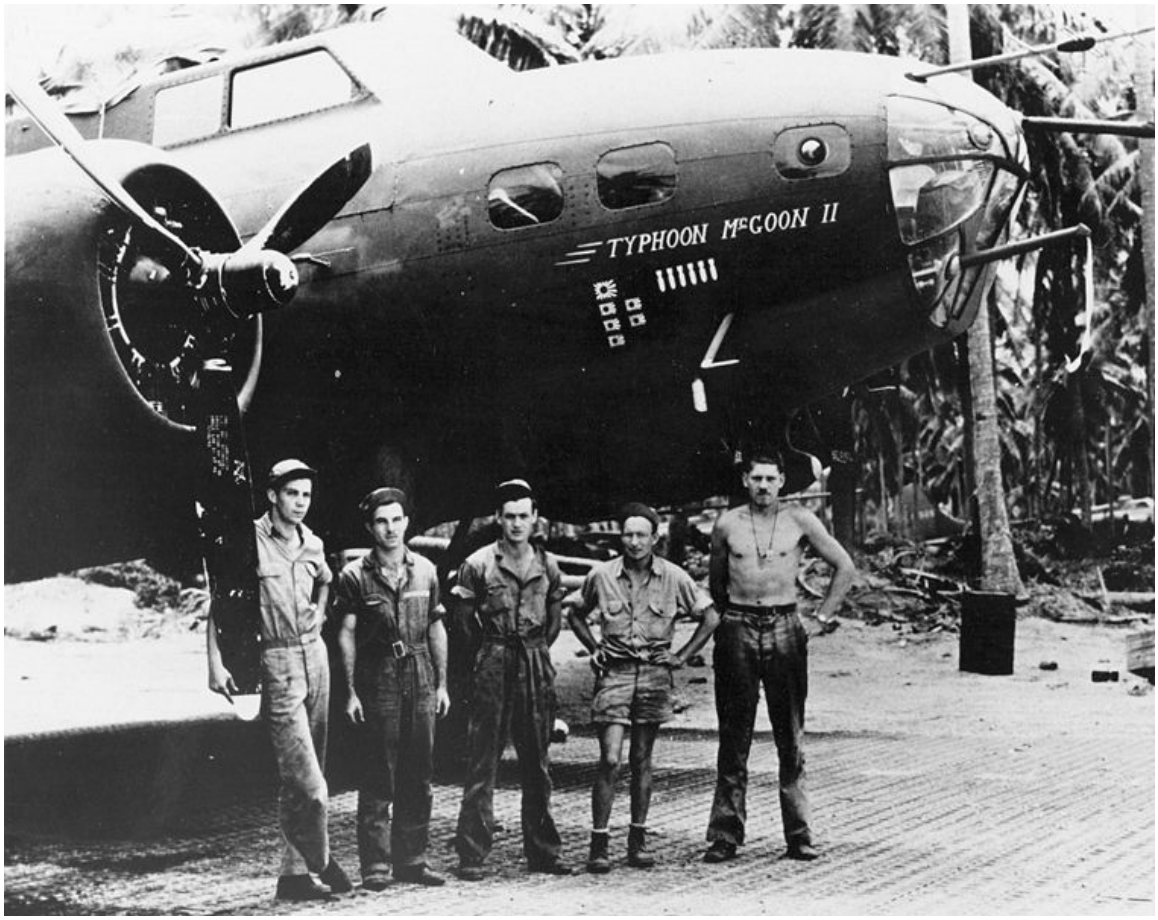
By September 1944, 27 of the 40 bomb groups of the Eighth Air Force and six of the 21 groups of the Fifteenth Air Force used B-17s. Losses to flak continued to take a high toll of heavy bombers through 1944, but by 27 April 1945 (two days after the last heavy bombing mission in Europe), the rate of aircraft loss was so low that replacement aircraft were no longer arriving and the number of bombers per bomb group was reduced. The Combined Bomber Offensive was effectively complete.

Pacific Theater



B-17C AAF S/N *40-2074* at Hickam Field. An onboard fire burnt the plane in two shortly after landing on 7 December 1941. One crewman was killed by Zero attack.

On 7 December 1941, a group of 12 B-17s of the 38th (four B-17C) and 88th (eight B-17E) Reconnaissance Squadrons, en route to reinforce the Philippines, were flown into Pearl Harbor from Hamilton Field, California, arriving during the Japanese attack. Leonard "Smitty" Smith Humiston, co-pilot on First Lieutenant Robert H. Richards' B-17C, AAF S/N *40-2049*, reported that he thought the U.S. Navy was giving the flight a 21-gun salute to celebrate the arrival of the bombers, after which he realized that Pearl Harbor was under attack. The Fortress came under fire from Japanese fighter aircraft, though the crew was unharmed with the exception of one member who suffered an abrasion on his hand. Enemy activity forced an abort from Hickam Field to Bellows Field, where the aircraft overran the runway and into a ditch where it was then strafed. Although initially deemed repairable, *40-2049* (11th BG / 38th RS) received more than 200 bullet holes and never flew again. Ten of the 12 Fortresses survived the attack.

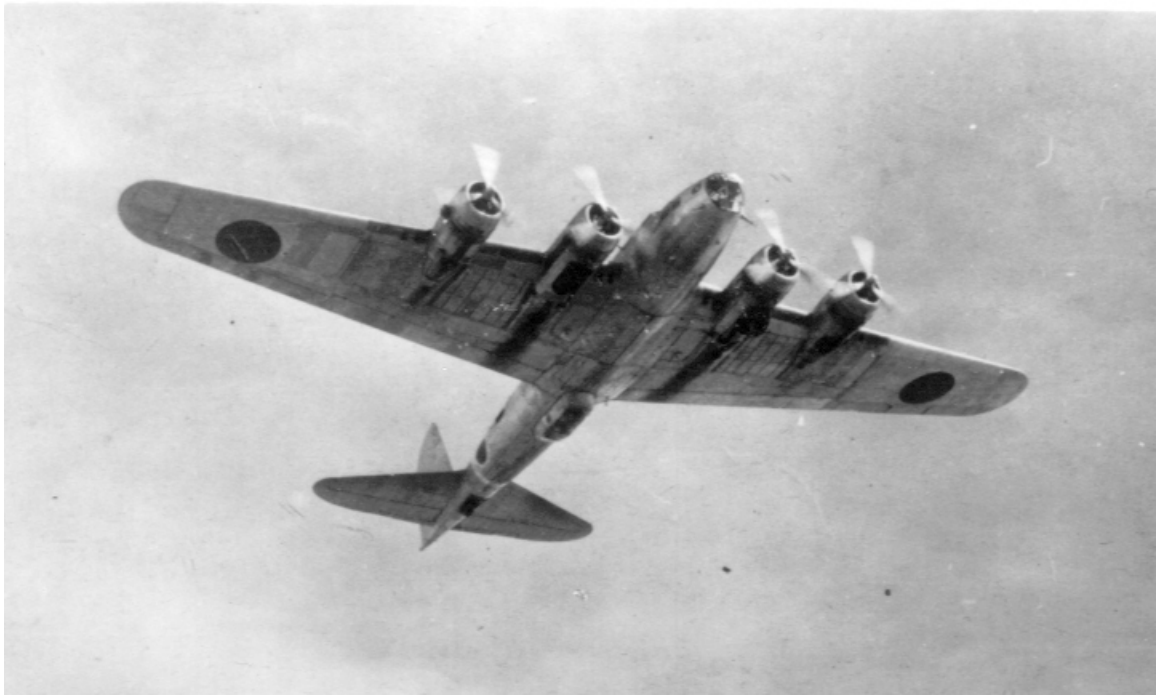


B-17E BO AAF S/N *41-9211*
Typhoon McGoon II of the 11th BG / 98th BS, taken in January 1943 in New Caledonia. The antennas mounted upon the nose were used for radar tracking surface vessels.

By 1941, the Far East Air Force (FEAF) based at Clark Field in the Philippines had 35 B-17s, with the War Department eventually planning to raise that to 165. When the FEAF received word of the attack on Pearl Harbor, General Lewis H. Brereton sent his bombers

and fighters on various patrol missions to prevent them from being caught on the ground. Brereton planned B-17 raids on Japanese air fields in Formosa, in accordance with Rainbow 5 war plan directives, but this was overruled by General Douglas MacArthur. A series of disputed discussions and decisions, followed by several confusing and false reports of air attacks, delayed the authorization of the sortie. By the time the B-17s and escorting Curtiss P-40 fighters were about to get airborne, they were destroyed by Japanese bombers of the 11th Air Fleet. The FEAF lost half its aircraft during the first strike, and was all but destroyed over the next few days.

Another early World War II Pacific engagement on 10 December 1941 involved Colin Kelly who reportedly crashed his B-17 into the Japanese battleship *Haruna*, which was later acknowledged as a near bomb miss on the heavy cruiser *Ashigara*. Nonetheless, this deed made him a celebrated war hero. Kelly's B-17C AAF S/N *40-2045* (19th BG / 30th BS) crashed about 6 mi (10 km) from Clark Field after he held the burning Fortress steady long enough for the surviving crew to bail out. Kelly was posthumously awarded the Distinguished Service Cross. Noted Japanese ace Saburo Sakai is credited with this kill, and in the process, gained respect for the ability of the Fortress to absorb punishment.



B-17D captured by Japanese army, with marks of Hinomaru

B-17s were used in early battles of the Pacific with little success, notably the Battle of Coral Sea and Battle of Midway. While there, the Fifth Air Force B-17s were tasked with disrupting the Japanese sea lanes. Air Corps doctrine dictated bombing runs from high altitude, but it was soon discovered that only one percent of their bombs hit targets. However, B-17s were operating at heights too great for most A6M Zero fighters to reach,

and the B-17's heavy gun armament was easily more than a match for lightly protected Japanese planes.

On March 2, 1943, six B-17s of the 64th Squadron attacked a major Japanese troop convoy from 10,000 ft (3 km) during the early stages of the Battle of the Bismarck Sea, off New Guinea, using skip bombing to sink three merchant ships including the *Kyokusei Maru*. A B-17 was shot down by a New Britain-based A6M Zero, whose pilot then machine-gunned some of the B-17 crew members as they descended in parachutes and attacked others in the water after they landed. Later, 13 B-17s bombed the convoy from medium altitude, causing the ships to disperse and prolonging the journey. The convoy was subsequently all but destroyed by a combination of low level strafing runs by Royal Australian Air Force Beaufighters, and skip bombing by USAAF North American B-25 Mitchells at 100 ft (30 m), while B-17s claimed five hits from higher altitudes.

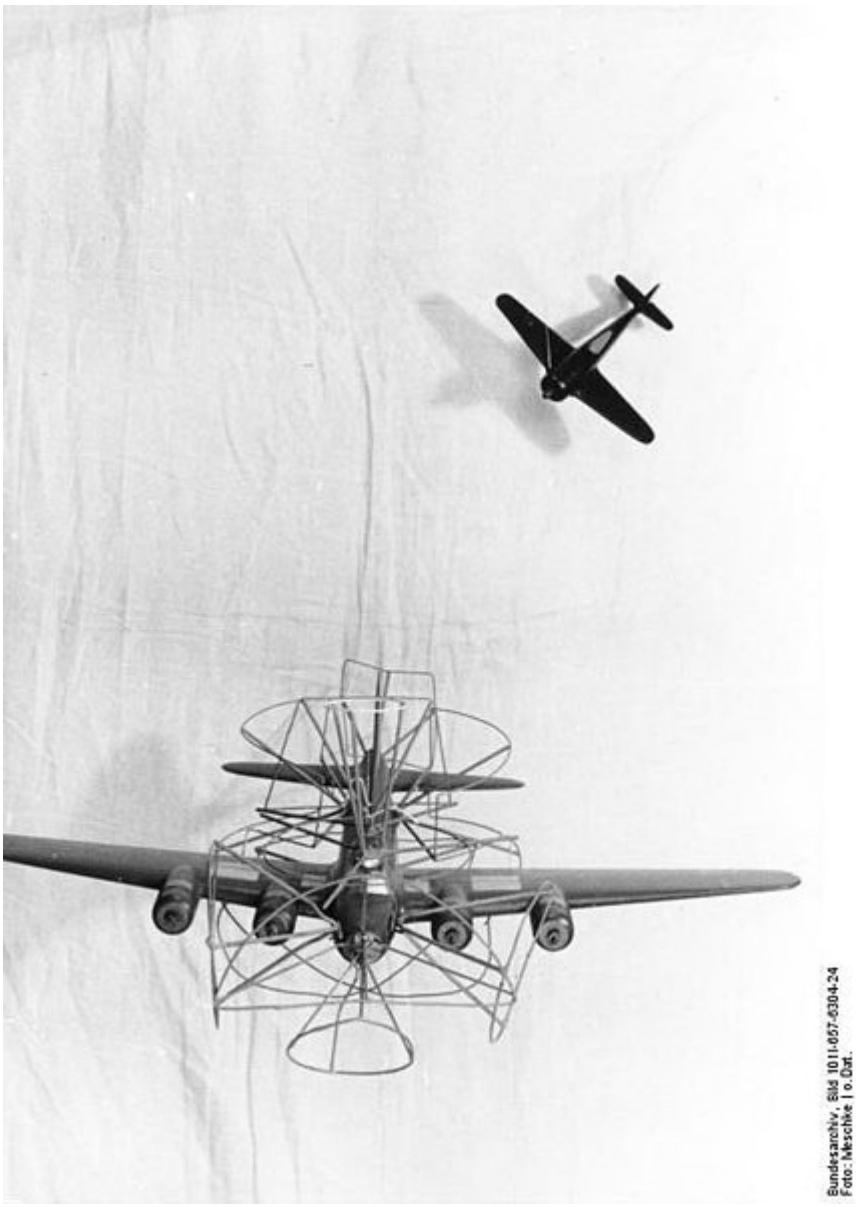
A peak of 168 B-17 bombers were in the Pacific theater in September 1942, with all groups converting to other types by mid-1943.

Bomber defense

Part of a USAAF stream of over 1,000 B-17s

Formation flying through dense flak over Merseburg, Germany

Before the advent of long-range fighter escorts, B-17s had only their .50 in (12.7 mm) M2 Browning machine guns to rely on for defense during the bombing runs over Europe. As the war intensified, Boeing used feedback from aircrews to improve each new variant with increased armament and armor. The number of defensive guns increased from four 0.50 in (12.7 mm) machine guns and one 0.30 in (7.62 mm) nose machine gun in the B-17C, to thirteen 0.50 in (12.7 mm) machine guns in the B-17G. But because the bombers could not maneuver when attacked by fighters, and during their final bomb run they needed to be flown straight and level, individual aircraft struggled to fend off a direct attack.



German training model on how to attack a *fliegendes Stachelschwein*

A 1943 survey by the Air Corps found that over half the bombers shot down by the Germans had left the protection of the main formation. To address this problem, the United States developed the bomb-group formation, which evolved into the staggered combat box formation where all the B-17s could safely cover any others in their formation with their machine guns, making a formation of the bombers a dangerous target to engage by enemy fighters. *Luftwaffe* "*jagdflieger*" (fighter pilots) likened attacking a B-17 combat box formation to encountering a *fliegendes stachelschwein*, or "flying porcupine". However, the use of this rigid formation meant that individual aircraft could not engage in evasive maneuvers: they had to always fly in a straight line, which made them vulnerable to the German flak. Additionally, German fighter aircraft later

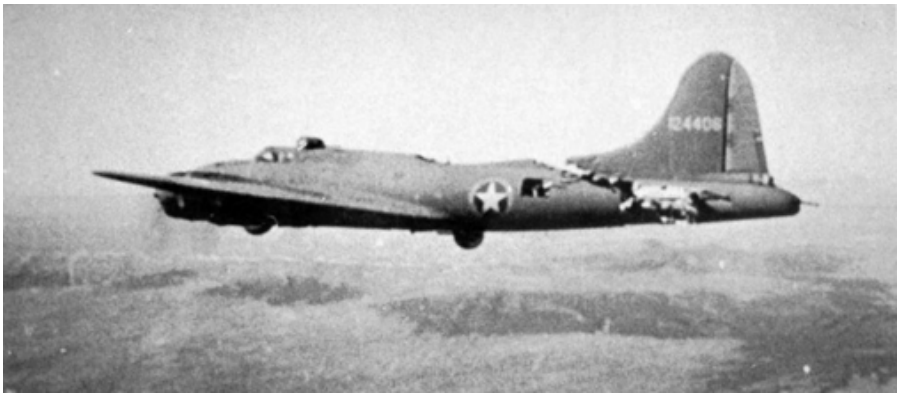
used the tactic of high-speed strafing passes rather than engaging with individual aircraft to inflict damage with minimum risk.

As a result, the B-17s' loss rate was up to 25% on some early missions (60 of 291 B-17s were lost in combat on the second Raid on Schweinfurt), and it was not until the advent of long-range fighter escorts (particularly the North American P-51 Mustang) resulting in the degradation of the *Luftwaffe* as an effective interceptor force between February and June 1944, that the B-17 became strategically potent.

The B-17 was noted for its ability to absorb battle damage, still reach its target and bring its crew home safely. Wally Hoffman, a B-17 pilot with the Eighth Air Force during World War II, said, "The plane can be cut and slashed almost to pieces by enemy fire and bring its crew home." Martin Caidin reported one instance in which a B-17 suffered a mid-air collision with a Focke-Wulf Fw 190, losing an engine and suffering serious damage to both the starboard horizontal stabilizer and the vertical stabilizer, and being knocked out of formation by the impact. The airplane was reported as shot down by observers, but it survived and brought its crew home without injury. Its toughness more than compensated for its shorter range and lighter bomb load when compared to the Consolidated B-24 Liberator or the British Avro Lancaster heavy bombers. Stories abound of B-17s returning to base with tails having been destroyed, with only a single engine functioning or even with large portions of wings having been damaged by flak. This durability, together with the large operational numbers in the Eighth Air Force and the fame achieved by the "Memphis Belle", made the B-17 a significant bomber aircraft of the war. Other factors such as combat effectiveness and political issues also contributed to the B-17's success.

The B-17 design went through eight major changes over the course of its production, culminating in the B-17G, differing from its immediate predecessor by the addition of a chin turret with two .50 in (12.7 mm) caliber M2 Browning machine guns under the nose. This eliminated the B-17's main defensive weakness in head-on attacks.

The Luftwaffe



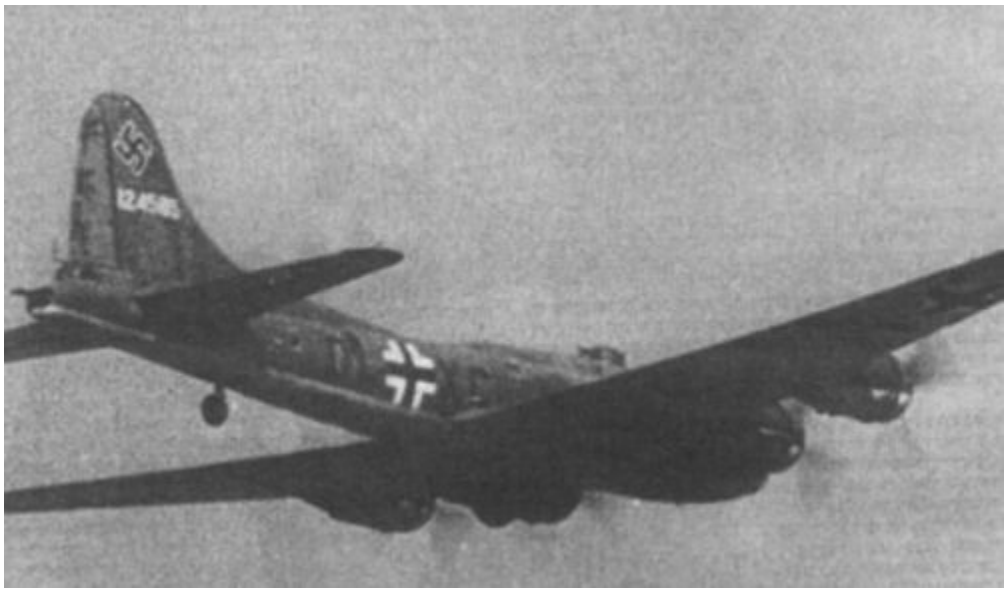
A severely damaged B-17 continues to fly after an attacking Bf 109 fighter collided with the aircraft.

After examining wrecked B-17s and B-24s, *Luftwaffe* officers discovered that on average it took around 20 hits with 20 mm (0.79 in) shells fired from the rear to bring them down. Pilots of average ability hit the bombers with only about two percent of the rounds they fired, so to obtain 20 hits, the average pilot had to fire one thousand 20 mm (0.79 in) rounds at a bomber. Early versions of the Fw 190, one of the best German interceptor fighters, were equipped with two 20 mm (0.79 in) MG FF cannons, which carried only 500 rounds, and later with the better Mauser MG 151/20 cannons, which had a longer effective range than the MG FF weapon. The German fighters found that when attacking from the front, where fewer defensive guns were pointed, it only took four or five hits to bring a bomber down. To address the Fw 190's shortcomings, the number of cannons fitted was doubled to four with a corresponding increase in the amount of ammunition carried, and in 1944, a further upgrade to Rheinmetall-Borsig's 30 mm (1.2 in) MK 108 cannons was made, which could bring a bomber down in just a few hits.

B-17G-15-BO "Wee Willie", 322d BS, 91st BG, after direct flak hit on her 128th mission.

The adoption of the *Werfer-Granate 21* (Wfr. Gr. 21) rocket mortar by the *Luftwaffe* in mid-August 1943 promised the introduction of a major "stand-off" style of offensive weapon – one strut-mounted tubular launcher was fixed under each wing panel on the *Luftwaffe*'s single-engined fighters, and two under each wing panel of a few twin-engined Bf 110 daylight *Zerstörer* aircraft. However, due to the ballistic drop of the fired rocket (despite the usual mounting of the launcher at about 15° upward orientation), and the small number of fighters fitted with the weapons, the Wfr. Gr. 21 never had a major

effect on the combat box formations of Fortresses. Also, the attempts of the *Luftwaffe* to fit heavy-calibre *Bordkanone*-series 37, 50 and even 75 mm (2.95 in) cannon as anti-bomber weapons on twin-engined aircraft such as the special Ju 88P fighters, as well as one model of the Me 410 *Hornisse*, did not have much effect on the American strategic bomber offensive. The Me 262 had moderate success against the B-17 late in the war however. With its usual nose-mounted armament of four MK 108 cannons, and with some examples later equipped with the R4M rocket, launched from underwing racks, it could fire from outside the range of the bombers' .50 in (12.7 mm) defensive guns and bring an aircraft down with one hit.



Captured B-17F-27-BO in *Luftwaffe* colors, the USAAF-named "Wulf Hound", *41-24585*, of the 360th BS/303rd BG, missing in action 16 October 1942. Operated by *Kampfgeschwader* 200.

During World War II, after crash-landing or being forced down, approximately 40 B-17s were captured and refurbished by the *Luftwaffe* with about a dozen put back into the air. Given German markings, the captured B-17s were used to determine the airplane's vulnerabilities and to train German interceptor pilots in tactics. Others, with the cover designations Dornier Do 200 and Do 288, were used as long-range transports by the *Kampfgeschwader* 200 special duties unit, carrying out agent drops and supplying secret airstrips in the Middle East and North Africa. They were chosen for these missions as being more suitable for the role than available German aircraft and not in an attempt to deceive the Allies, being operated in full *Luftwaffe* markings. One of the B-17s of KG200, bearing *Luftwaffe* markings *A3+FB*, was interned by Spain when it landed at Valencia airfield, 27 June 1944, and remained there for the rest of the war. Some B-17s kept their Allied markings and were used in attempts to infiltrate B-17 formations and report on their position and altitude. The practice was initially successful, but the Army Air Forces combat aircrews quickly developed and established standard procedures to first warn off, and then fire upon any "stranger" trying to join a group's formation.

Soviet use

The U.S. did not offer B-17s to the Soviet Union, however, at least 73 were used by the Soviet Air Force. These were aircraft that landed with mechanical trouble during the shuttle bombing raids over Germany, or had been damaged by a *Luftwaffe* raid in Poltava. The Soviets restored 23 to flying condition and concentrated them in the 890th bomber regiment of the 45th bomber division but they never saw combat. In 1946 the regiment was assigned to the Kazan factory to aid in the Soviet effort to reproduce the Boeing B-29 as the Tupolev Tu-4.

Postwar history

U.S. Air Force

Rear interior of late production B-17G, with staggered waist gun positions

Following the end of World War II, the B-17 was quickly phased out of use as a bomber and the Army Air Forces retired most of its fleet. Flight crews ferried the bombers back across the Atlantic to the United States where the majority were sold for scrap and melted down, although significant numbers remained in use in second-line roles such as VIP transports, air-sea rescue and photo-reconnaissance. Strategic Air Command (SAC),

established in 1946, used reconnaissance B-17s (at first called F-9 [*F* for *Fotorecon*], later RB-17) until 1949. With the disestablishment of the US Army Air Forces and the establishment of an independent U.S. Air Force in 1947, most extant B-17s were transferred to USAF.

The USAF Air Rescue Service of the Military Air Transport Service (MATS) operated B-17s as so-called "Dumbo" air-sea rescue aircraft. Work on using B-17s to carry airborne lifeboats had begun in 1943, but they only entered service in the European theater in February 1945, also being used to provide search and rescue support for B-29 raids against Japan. About 130 B-17s were converted to the air-sea rescue role, at first designated B-17H and later SB-17G. Some SB-17s had their defensive guns removed, while others retained their guns to allow use close to combat areas. The SB-17 served through the Korean War, remaining in service with USAF until the mid-1950s.

In 1946, surplus B-17s were chosen as drone aircraft for atmospheric sampling during the Operation Crossroads atomic bomb tests, being able to fly close to or even though the mushroom clouds without endangering a crew. This led to more widespread conversion of B-17s as drones and drone control aircraft, both for further use in atomic testing and as targets for testing surface-to-air and air-to-air missiles. One hundred and seven B-17s were converted to drones. The last operational mission flown by a USAF Fortress was conducted on 6 August 1959, when DB-17P, AF Ser. No. *44-83684* directed a QB-17G, AF Ser. No. *44-83717*, out of Holloman Air Force Base, New Mexico, as a target for an AIM-4 Falcon air-to-air missile fired from an F-101 Voodoo. A retirement ceremony was held several days later at Holloman AFB, after which *44-83684* was retired to the Military Aircraft Storage and Disposition Center (MASDC) at Davis-Monthan Air Force Base, Arizona. Perhaps the most famous B-17, the *Memphis Belle*, is currently being fastidiously restored to its World War II wartime appearance by the National Museum of the United States Air Force at Wright-Patterson Air Force Base, Ohio.

U.S. Navy and U.S. Coast Guard

Under **Cadillac II**, the AN/APS-20 radar was fitted onto the B-17G, designated PB-1W.

During the last year of World War II and shortly thereafter, the United States Navy acquired 48 ex-USAAF B-17s for patrol and air-sea rescue work. The first two ex-USAAF B-17s, a B-17F (later modified to B-17G standard) and a B-17G were obtained by the Navy for various development programs. At first, these aircraft operated under their original USAAF designations but on July 31, 1945, they were assigned the naval aircraft designation PB-1, a designation which had originally been used in 1925 for the Boeing Model 50 experimental flying boat.

Thirty-two B-17Gs were used by the Navy under the designation PB-1W, the suffix -W standing for antisubmarine warfare. A large radome for an S-band AN/APS-20 search radar was fitted underneath the fuselage and additional internal fuel tanks were added for longer range, with the provision for additional underwing fuel tanks, while no armament was fitted. These aircraft were painted dark blue, a standard Navy paint scheme which had been adopted in late 1944. The PB-1W eventually evolved into an early warning aircraft by virtue of its APS-20 search radar. PB-1Ws continued in USN service until 1955, gradually being phased out in favor of the Lockheed WV-2 (known in the USAF as the EC-121, a designation adopted by USN in 1962), a military version of the Lockheed 1049 Constellation commercial airliner.

U.S. Coast Guard PB-1G stationed at CGAS Kodiak, Alaska

In July 1945, 16 B-17s were transferred to the Coast Guard via the Navy; these aircraft were initially assigned U.S. Navy Bureau Numbers (BuNo), but were delivered to the Coast Guard designated as PB-1Gs beginning in July 1946. Coast Guard PB-1Gs were stationed at a number of bases in the U.S. and Newfoundland, with five at Coast Guard Air Station Elizabeth City, North Carolina, two at CGAS San Francisco, two at NAS Argentia, Newfoundland, one at CGAS Kodiak, Alaska, and one in Washington state. They were used primarily for air-sea rescue, but were also used for iceberg patrol duties and for photo mapping. Air-sea rescue PB-1Gs usually carried a droppable lifeboat underneath the fuselage and the chin turret was often replaced by a radome. The Coast Guard PB-1Gs served throughout the 1950s, the last example not being withdrawn from service until October 14, 1959.

Survivors

There are a total of 53 surviving airframes worldwide:

- 12 active flying
- 9 on static display
- 2 currently undergoing restoration to fly
- 3 currently undergoing restoration for display
- 5 in storage
- 19 partial airframes/hulks

Fortresses as a symbol

B-17G-80BO *43-38172* 8th AF 398th BG 601st BS damaged on a bombing mission over Cologne, Germany, on 15 October 1944; the toggler S/Sgt. George E. Abbott was killed.

The B-17 Flying Fortress has become, for many reasons, an icon of American power and a symbol of its Air Force. During the 1930s, the USAAC, as articulated by then-Major General Frank Maxwell Andrews and the Air Corps Tactical School, touted the bomber as a strategic weapon.General Henry H. Arnold, Chief of the Air Corps, recommended the development of bigger aircraft with better performance and the Tactical School agreed completely.

When the Model 299 was rolled out on 28 July 1935, bristling with multiple machine gun installations, Richard Williams, a reporter for the *Seattle Times* coined the name "Flying Fortress" with his comment "Why, it's a flying fortress!". Boeing was quick to see the value of the name and had it trademarked for use. In 1943, Consolidated Aircraft commissioned a poll to see "to what degree the public is familiar with the names of the Liberator and the Flying Fortress." Of 2,500 men in cities where Consolidated adverts had been run in newspapers, 73% had heard of the B-24 Liberator, while 90% knew of the B-17.

After the initial B-17s were delivered to the Air Corps 2nd Bombardment Group, they were used on promotional flights emphasizing its great range and navigational precision. In January 1938, group commander Colonel Robert Olds flew a YB-17 from the east to

west coast, setting a transcontinental record of 13 hours 27 minutes. He also broke the west-to-east coast record on the return trip, averaging 245 mph (394 km/h) in 11 hours 1 minute. Six bombers of the 2nd Bombardment group took off from Langley Field on 15 February 1938 as part of a goodwill flight to Buenos Aires, Argentina. Covering 12,000 miles (19,000 km) they returned on 27 February, with seven aircraft setting off on a flight to Rio de Janeiro, Brazil, three days later. In a well-publicized mission on May 12 of the same year, three B-17s "intercepted" and took photographs of the Italian ocean liner SS *Rex* 610 miles (980 km) off the Atlantic coast.

During the war, the largest offensive bombing force, the Eighth Air Force, had an open preference for the B-17. Lieutenant General Jimmy Doolittle wrote about his preference for equipping the Eighth with B-17s, citing the logistical advantage in keeping fielded forces down to a minimum number of aircraft types with their unique servicing and spares. For this reason, he wanted B-17 bombers and P-51 fighters for the Eighth. His views were supported by Eighth Air Force statisticians, whose studies purportedly showed that Fortresses had utility and survivability much greater than that of the B-24. Making it back to base on multiple occasions despite extensive battle damage, its durability took on mythical proportions; stories and photos of B-17s surviving battle damage were widely circulated during the war. Despite an inferior performance and bombload compared to the more numerous B-24 Liberator, a survey of Eighth Air Force crews showed a much higher rate of satisfaction in the B-17.

Hollywood featured the airplane in its movies, such as *Twelve O'Clock High* starring Gregory Peck. This film was made with the full cooperation of the United States Air Force and made use of actual combat footage. In 1964, the movie was made into a television show of the same name and ran for three years. Footage from *Twelve O' Clock High* was also used, along with three restored B-17s, in the 1962 film *The War Lover*. The B-17 also appeared in the 1938 movie *Test Pilot* with Clark Gable and Spencer Tracy, with Clark Gable in *Command Decision* in 1948, in *Tora! Tora! Tora!* in 1970, and in *Memphis Belle* with Matthew Modine, Eric Stoltz, Billy Zane, and Harry Connick, Jr. in 1990. The most famous B-17, the *Memphis Belle*, toured the U.S. with its crew to reinforce national morale (and to sell War Bonds), and starred in a USAAF documentary, *Memphis Belle: A Story of a Flying Fortress*.

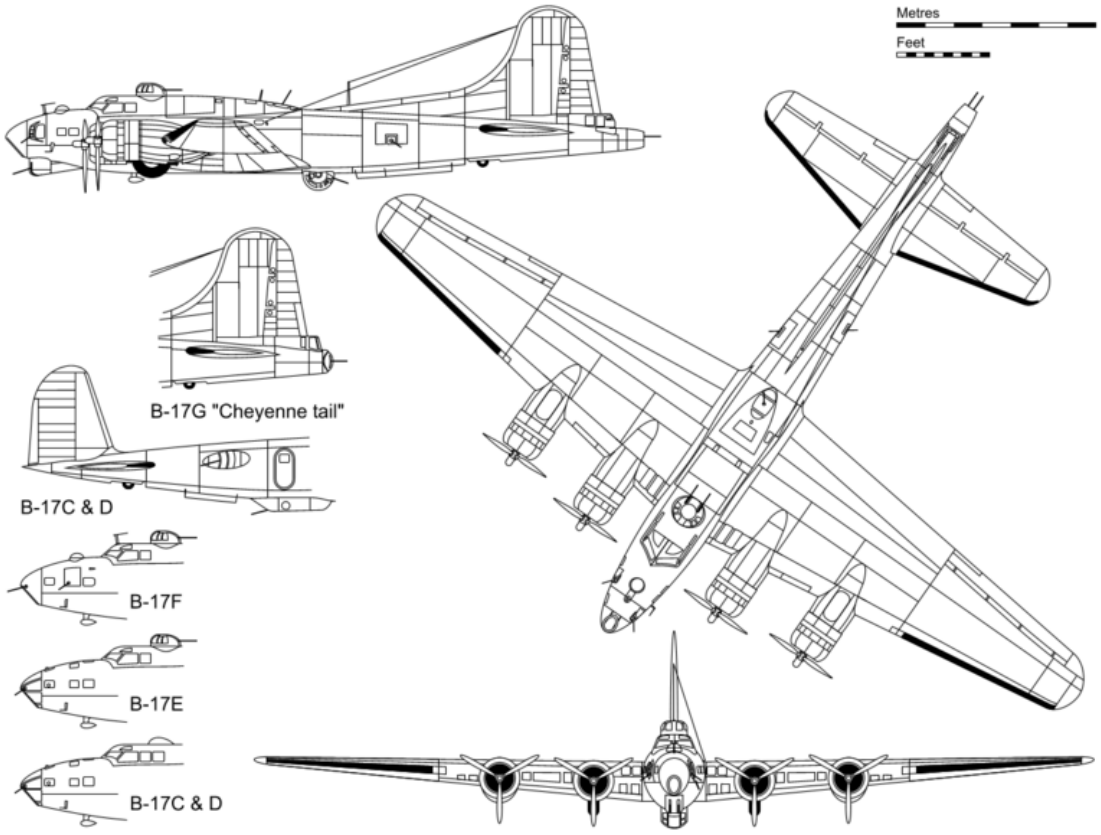
Notable B-17s

B-17G *Shoo Shoo Baby*

- Aluminum Overcast – flying example
- Yankee Lady – flying example Yankee Air Force
- Liberty Belle – former engine testbed restored as flying example
- Memphis Belle
- My Gal Sal
- Murder Inc. – A B-17 bombardier wearing the name of the B-17 "Murder Inc." on his jacket was used for propaganda in German newspapers
- Nine-O-Nine
- Old 666
- Piccadilly Lilly II
- (The) Pink Lady
- Sally B – The last flying example in Europe
- Sentimental Journey
- Shoo Shoo Baby
- Swamp Ghost
- (The) Swoose
- Texas Raiders – flying example Commemorative Air Force
- Thunderbird

- Ye Olde Pub – the B-17 that Franz Stigler did not shoot down, as memorialized in the painting "*A Higher Call*" by John D. Shaw

Specifications (B-17G)



General characteristics

- **Crew:** 10: Pilot, co-pilot, navigator, bombardier/nose gunner, flight engineer-top turret gunner, radio operator, waist gunners (2), ball turret gunner, tail gunner
- **Length:** 74 ft 4 in (22.66 m)
- **Wingspan:** 103 ft 9 in (31.62 m)
- **Height:** 19 ft 1 in (5.82 m)
- **Wing area:** 1,420 sq ft (131.92 m^2)
- **Airfoil:** NACA 0018 / NACA 0010
- **Aspect ratio:** 7.57
- **Empty weight:** 36,135 lb (16,391 kg)
- **Loaded weight:** 54,000 lb (24,500 kg)
- **Max takeoff weight:** 65,500 lb (29,700 kg)
- **Powerplant:** 4× Wright R-1820-97 "Cyclone" turbosupercharged radial engines, 1,200 hp (895 kW) each

Performance

- **Maximum speed:** 287 mph (249 kn, 462 km/h)
- **Cruise speed:** 182 mph (158 kn, 293 km/h)
- **Range:** 2,000 mi (1,738 nmi, 3,219 km) with 2,700 kg (6,000 lb) bombload
- **Service ceiling:** 35,600 ft (10,850 m)
- **Rate of climb:** 900 ft/min (4.6 m/s)
- **Wing loading:** 38.0 lb/sq ft (185.7 kg/m^2)
- **Power/mass:** 0.089 hp/lb (150 W/kg)

Armament

- **Guns:** 13 × .50 in (12.7 mm) M2 Browning machine guns in 4 turrets in dorsal, ventral, nose and tail, 2 in waist positions, 2 beside cockpit and 1 in the lower dorsal position
- **Bombs:**
    - **Short range missions (<400 mi):** 8,000 lb (3,600 kg)
    - **Long range missions (≈800 mi):** 4,500 lb (2,000 kg)
    - **Overload:** 17,600 lb (7,800 kg)

Chapter-2

Consolidated B-24 Liberator

B-24 Liberator

U.S. Army Air Forces Consolidated B-24D Liberator over Maxwell Field, Alabama.

Role	Heavy bomber
Manufacturer	Consolidated Aircraft
First flight	29 December 1939
Introduced	1941
Retired	1968 Indian Air Force
Primary users	United States Army Air Forces United States Navy

	Royal Air Force Royal Canadian Air Force
Produced	1940–1945
Number built	18,482
Unit cost	$297,627 ($4.44 million in today's dollars)
Developed from	Consolidated XB-24
Variants	PB4Y Privateer XB-41 C-87 Liberator Express Consolidated R2Y Consolidated Liberator I

The **Consolidated B-24 Liberator** was an American heavy bomber, designed by Consolidated Aircraft Company of San Diego, California. Its mass production was brought into full force by 1943 with the aid of the Ford Motor Company through its newly constructed Willow Run facility, where peak production had reached one B-24 per hour and 650 per month in 1944. Other factories soon followed. The B-24 ended World War II as the most produced Allied heavy bomber in history, and the most produced American military aircraft at over 18,000 units, thanks in large measure to Henry Ford and the harnessing of American industry. It still holds the distinction as the most-produced American military aircraft. The B-24 was used by several Allied air forces and navies, and by every branch of the American armed forces during the war, attaining a distinguished war record with its operations in the Western European, Pacific, Mediterranean, and China-Burma-India Theaters.

Often compared with the better-known B-17 Flying Fortress, the B-24 was a more modern design with a higher top speed, greater range, and a heavier bomb load; however, it was also more difficult to fly, with heavy control forces and poor formation-flying characteristics. Popular opinion among aircrews and general staffs tended to favor the B-17's rugged qualities above all other considerations in the European Theater. The placement of the B-24's fuel tanks throughout the upper fuselage and its lightweight construction, designed to increase range and optimize assembly line production, made the aircraft vulnerable to battle damage. The B-24 was notorious among American aircrews for its tendency to catch fire. Moreover, its high fuselage-mounted Davis wing also meant it was dangerous to ditch or belly land, since the fuselage tended to break apart. Nevertheless, the B-24 provided excellent service in a variety of roles thanks to its large payload and long range.

The B-24's most famous mission was the low-level strike against the Ploesti oil fields, in Romania on 1 August 1943, which turned into a disaster due to attack waves getting out of sequence.

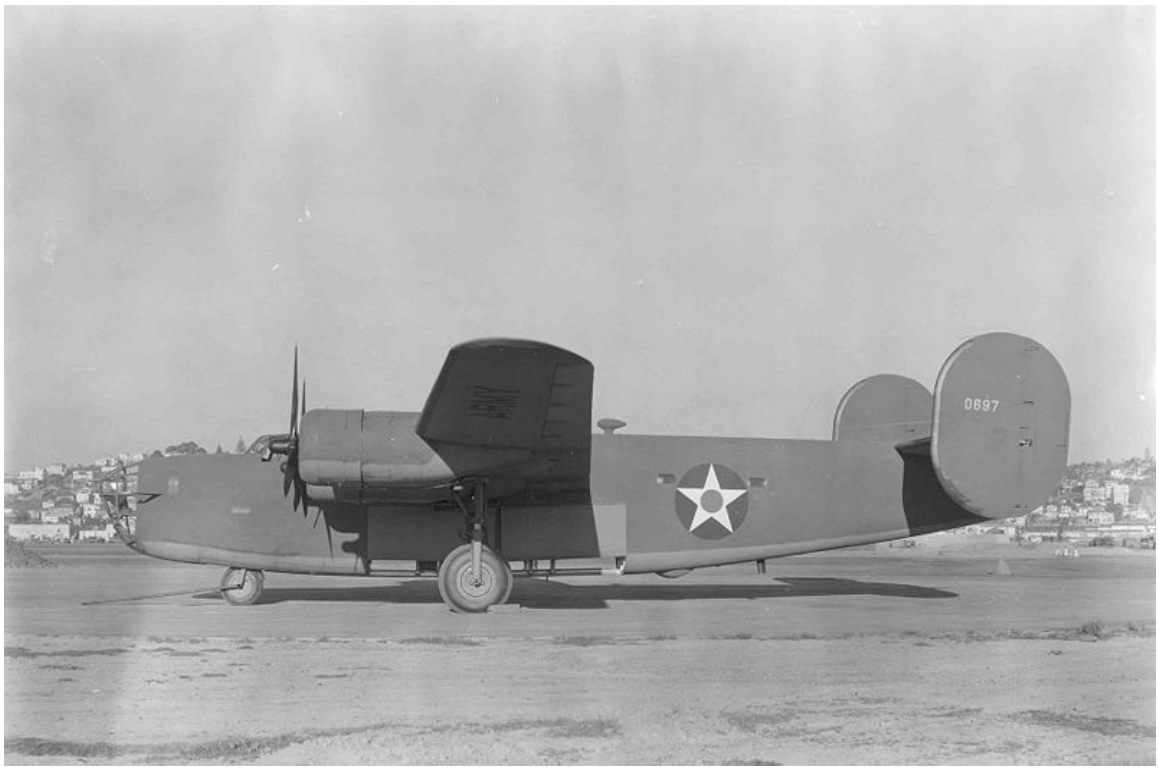
Development

XB-24 in flight

The Liberator originated from a United States Army Air Corps (USAAC) request in 1938 for Consolidated to produce the B-17 under license. This was part of "Project A", a program to expand American industrial capacity for production of the key components of air power. After company executives including President Reuben Fleet visited the Boeing factory in Seattle, Consolidated decided instead to submit a more modern design of its own. In January 1939, the USAAC, under Specification C-212, formally invited Consolidated to submit a design study for a bomber with longer range, higher speed, and greater ceiling than the B-17.

The contract for a prototype was awarded in March 1939, with the requirement that one should be ready before the end of the year. The design was simple in concept but nevertheless advanced for its time. Compared to the B-17, the proposed Model 32 was shorter with 25% less wing area, but had a 6 ft (1.8 m) greater wingspan and a substantially larger carrying capacity, as well as a distinctive twin tail. Whereas the B-17 used 9-cylinder Wright R-1820 Cyclone engines, the Consolidated design used twin-row, 14-cylinder Pratt & Whitney R-1830 "Twin Wasp" radials of 1,000 hp (746 kW). The 70,547 lb (32,000 kg) maximum takeoff weight was one of the highest of the period. Consolidated incorporated innovative features: the new design would be the first

American bomber to use tricycle landing gear, and it had long, thin wings with the efficient "Davis" high aspect ratio design (also used on the projected Model 31 twin-engined commercial flying boat) promising to provide maximum fuel efficiency. Wind tunnel testing and experimental programs using an existing Consolidated Model 31 provided extensive data on the flight characteristics of the Davis airfoil.



YB-24

Consolidated finished the prototype, by then known as the XB-24, and had it ready for its first flight two days before the end of 1939. Seven more YB-24 development aircraft flew in 1940 and Consolidated began preparing production tooling. Early orders—placed before the XB-24 had flown—included 36 for the USAAC, 120 for the French Armée de l'Air and 164 for the Royal Air Force (RAF). Most of the first production B-24s went to Great Britain, including all those originally ordered by the Armée de l'Air after France collapsed and surrendered in 1940. The name, "**Liberator**", was originally assigned to it by the RAF, and subsequently adopted by the USAAF as the official name for the type.

Design

The B-24's spacious slab-sided fuselage (which earned the aircraft the nickname "Flying Boxcar") was built around a central bomb bay that could accommodate up to 8,000 lb (3,629 kg) of ordnance. The bomb bay was divided into front and rear compartments and had a central catwalk, which was also the fuselage keel beam. A universal complaint arose over the extremely narrow catwalk. The aircraft was sometimes disparaged as "The

Flying Coffin" because the only entry and exit from the bomber was in the rear and it was almost impossible for the flight crew and nose gunner to get from the flight deck to the rear when wearing parachutes. An unusual set of "roller-type" bomb bay doors, which operated very much like the movable enclosure of a rolltop desk, retracted into the fuselage, creating a minimum of aerodynamic drag to keep speed high over the target area.

Like the B-17, the B-24 had an array of .50 caliber (12.7 mm) M2 Browning machine guns in the tail, belly, top, sides and nose to defend it from attacking enemy fighters. However, unlike the B-17, the ball turret could be retracted into the fuselage when not in use, a necessity given the low ground clearance of the fuselage.

Operational history

Initial deployment

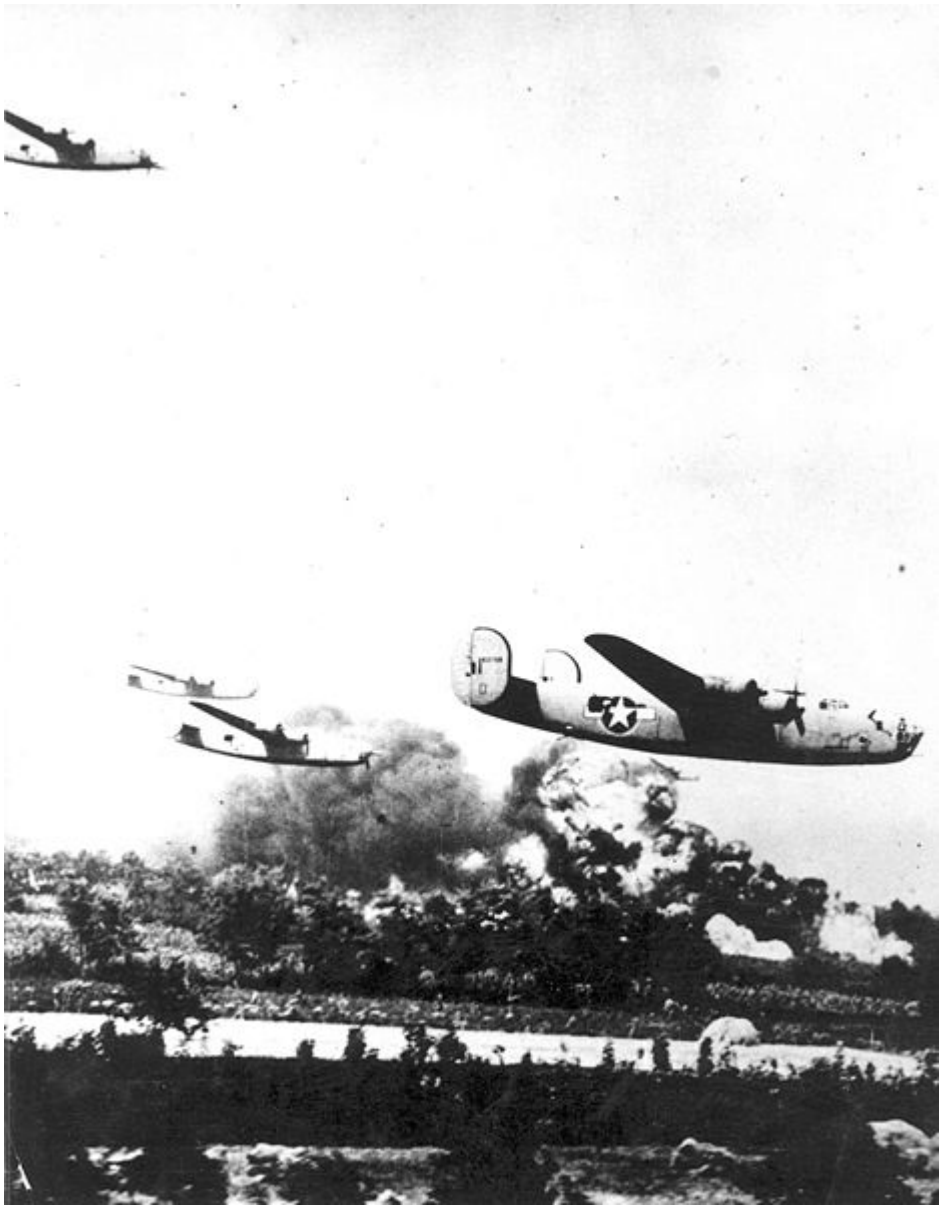
B-24L *Stevonovitch II* (AAF Ser. No. 44-49710) of the 464th BG, hit by 2 cm FlaK 30 while supporting ground troops near Lugo, Italy, 10 April 1945. Colonel James Gilson,

commanding officer of the 779th BS and nine others were killed; one waist gunner was thrown clear and survived.

Liberator GR Is in British service were the first B-24s to be used operationally. The very first use of Liberators in British service was the use of ex-USAAF YB-24s (designated LB-30A), which while not suitable for combat, were used as a long-range transport, operating the Atlantic Return Ferry Service, returning the civilian ferry pilots who delivered aircraft such as the Lockheed Hudson across the Atlantic back to Canada. The most important role for the first batch of the Liberator GR Is was in service with RAF Coastal Command on anti-submarine patrols in the Battle of the Atlantic.

Later in 1941, the first Liberator IIs entered RAF service. This model introduced self-sealing fuel tanks and powered gun turrets. At the same time, Consolidated added a 2 ft 7 in (79 cm) plug in the forward fuselage to create more space for crew members. The Liberator IIs were divided between Coastal Command, Bomber Command, and BOAC. Two RAF squadrons with Liberators were deployed to the Middle East in early 1942, in the first use of the Liberator as a bomber.

America enters the war



B-24s bomb the Ploieşti oil fields in August 1943

The United States Army Air Forces (USAAF) took delivery of its first B-24As in 1941. The sole B-24 in Hawaii was destroyed by the Japanese attack on Pearl Harbor on 7 December 1941. Like the RAF, the USAAF used them as transports at first. American B-24s entered combat service in 1942 when on 6 June, four B-24s from Hawaii staging through Midway Island attempted an attack on Wake Island, but were unable to find it. On 12 June 1942, 13 B-24s flying from Egypt attacked the Axis-controlled oil fields and refineries around Ploesti, Romania.

Over the next three years, B-24 squadrons deployed to all theaters of the war: African, European, China-Burma-India, the Battle of the Atlantic, the Southwest Pacific Theater and the Pacific Theater. In the Pacific, the B-24 (and its twin, the U.S. Navy PB4Y Privateer) was eventually designated as the standard heavy bomber to simplify logistics and to take advantage of their longer range, replacing the shorter-range B-17 which had served early in the war along the perimeter of the Pacific from the Philippines, Australia, Espiritu Santo, Guadalcanal, Hawaii, and during the Battle of Midway from Midway Island.

War-time production

Continued development work by Consolidated produced a handful of transitional B-24Cs with turbocharged instead of supercharged engines. The turbocharged engines led to the flattened oval nacelles that distinguished all subsequent Liberator models.

The first mass-produced model was the B-24D (Liberator III in British service), entering service in early 1943. It had turbocharged engines and increased fuel capacity. Three more 0.50 caliber (12.7 mm) machine guns brought the defensive armament up to 10 machine guns. At 59,524 lb (27,000 kg) maximum takeoff weight, it was one of the heaviest aircraft in the world; comparable with the British "heavies" the Stirling, Lancaster and Halifax.

B-24s under construction at Ford Motor's Willow Run plant

Production of B-24s increased at an astonishing rate throughout 1942 and 1943. Consolidated Aircraft tripled the size of its plant in San Diego and built a large new plant outside Fort Worth, Texas. More B-24s were built by Douglas Aircraft in Tulsa, Oklahoma. North American Aviation built a plant in Dallas, Texas, which produced B-24Gs and B-24Js. None of these were minor operations, but they were dwarfed by the vast new purpose-built factory constructed by the Ford Motor Company at Willow Run near Detroit, Michigan. Ford broke ground on Willow Run in the spring of 1941, with the first plane coming off the line in October 1942. It had the largest assembly line in the world (3,500,000 ft²/330,000 m²). At its peak, the Willow Run plant produced 650 B-24s per month in 1944. By 1945, Ford made 70% of all B-24s in two nine-hour shifts. Pilots and crews slept on 1,300 cots at Willow Run waiting for their B-24s to roll off the assembly line. At Willow Run, Ford produced half of 18,000 total B-24s.

Each of the B-24 factories was identified with a production code: Consolidated/San Diego, CO; Consolidated/Fort Worth, CF; Ford/Willow Run, FO; North American, NT; and Douglas/Tulsa, DT.

In 1943, the model of Liberator considered by many the "definitive" version was introduced. The B-24H was 10 in (25 cm) longer, had a powered gun turret in the upper nose to reduce vulnerability to head-on attack and was fitted with an improved bomb sight, autopilot, and fuel transfer system. Consolidated, Douglas and Ford all manufactured the B-24H, while North American made the slightly different B-24G. All five plants switched over to the almost identical B-24J in August 1943. The later B-24L and B-24M were lighter-weight versions and differed mainly in defensive armament.

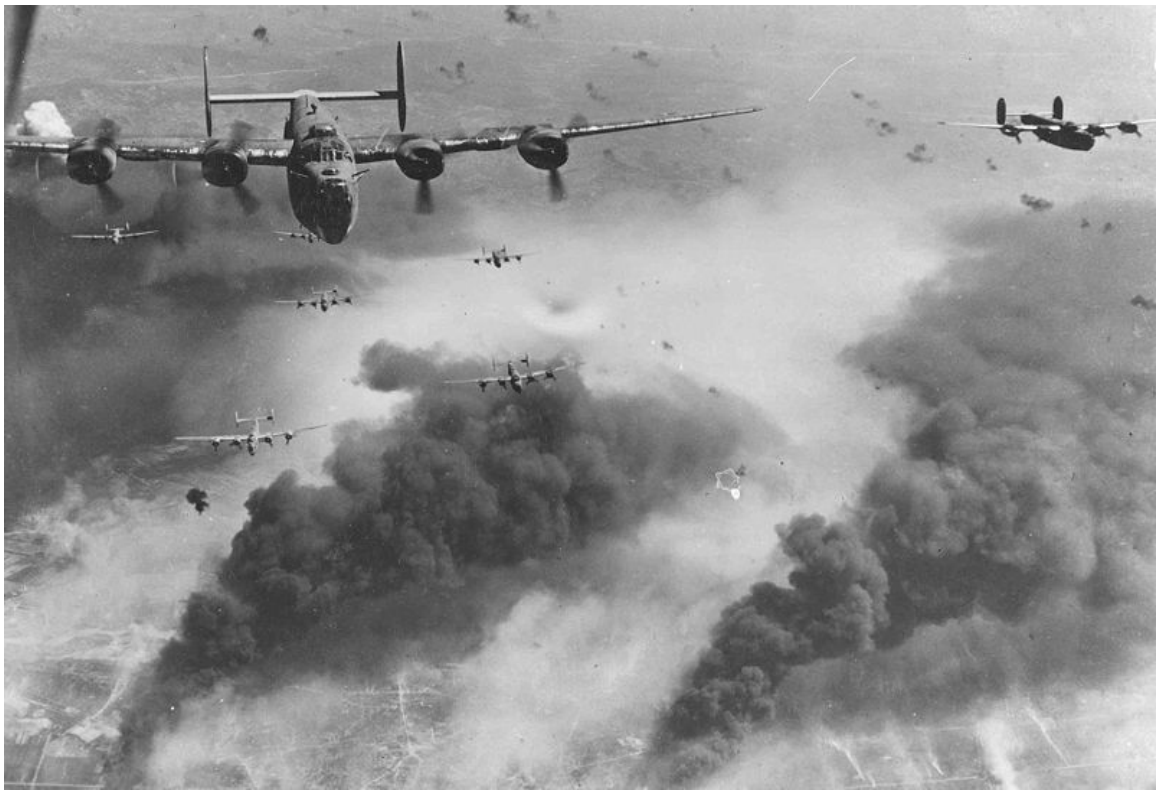
WASP pilots (left to right) Eloise Huffines Bailey, Millie Davidson Dalrymple, Elizabeth McKethan Magid and Clara Jo Marsh Stember, with a B-24 in the background

As the war progressed, the complexity of servicing the Liberator continued to increase. The B-24 variants made by each company differed slightly, so repair depots had to stock many different parts to support various models. Fortunately, this problem was eased in the summer of 1944, when North American, Douglas, and Consolidated Aircraft at Fort Worth stopped making B-24s, leaving only the Consolidated plant in San Diego and the Ford plant in Willow Run.

In all, 18,482 B-24s were built by September 1945. Twelve thousand saw service with the USAAF. The U.S. Navy operated about 1,000 PB4Y-1s, and almost 800 PB4Y-2 Privateers which were derived from the B-24. The Royal Air Force flew about 2,100 B-24s in 46 bomber groups and 41 squadrons; the Royal Canadian Air Force 1,200 B-24Js; and the Royal Australian Air Force (RAAF) 287 B-24Js, B-24Ls, and B-24Ms. Liberators were the only heavy bomber flown by the RAAF in the Pacific. Two squadrons of the South African Air Force based in Italy flew B-24s.

Strategic bombing

The B-24 was one of the workhorse bombers of the U.S. Eighth Air Force in the Combined Bomber Offensive against Germany, forming about one-third of its heavy bomber strength, with the other two-thirds being B-17s. Thousands of B-24s, flying from bases in England, dropped hundreds of thousands of tons of bombs and incendiaries on German military and industrial targets. The 44th Bombardment Group was one of the first two heavy bombardment groups flying the B-24 with the 8th Air Force in the fall/winter air campaigns in the European Theater of Operations. The 44th Bomb Group flew the first of its 344 combat missions against the Axis powers in World War II on 7 November 1942.

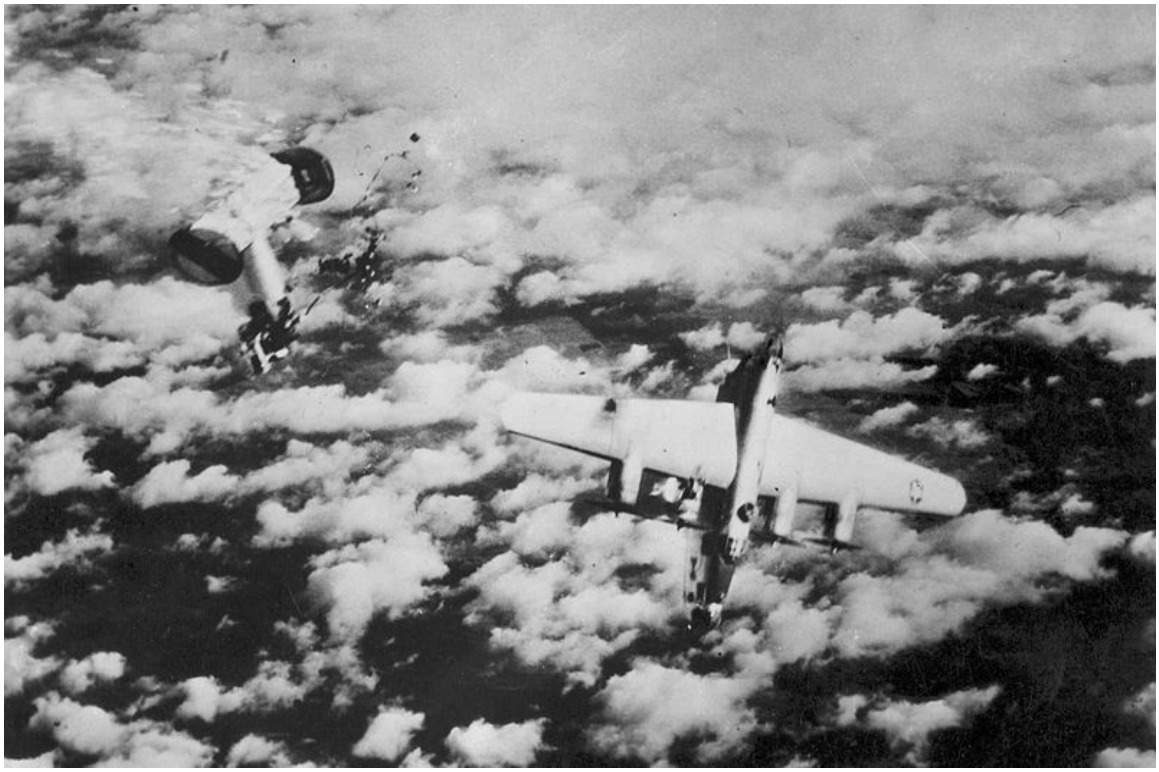


15th Air Force B-24s fly through flak and over the destruction created by preceding waves of bombers.

B-24s of the Ninth Air Force, operating from Africa and Italy, and the Fifteenth Air Force, also operating from Italy, took a major role in strategic bombing. Fifteen of the 15th AF's 21 bombardment groups flew B-24s. The Ninth Air Force moved to England in 1944 to become a tactical air force, and all of its B-24s were transferred to other Air Forces, such as the Fifteenth Air Force in Italy.

The first B-24 loss over German territory occurred on 26 February 1943. Both the German Luftwaffe and the British Royal Air Force had to abandon daylight bombing raids because neither could sustain the losses suffered. However, the Americans persisted, at great cost in men and aircraft. In the period between 7 November 1942 and 8 March 1943, the 44th Bomb Group lost 13 of its original 27 B-24s. For some time, newspapers had been requesting permission for a reporter to go on one of the missions. Robert B. Post and five other reporters of *The New York Times* were granted permission. Post was the only reporter assigned to a B-24-equipped group, the 44th Bomb Group. He flew in B-24 41-23777 ("Maisey") on Mission No. 37 to Bremen, Germany. Intercepted just short of the target, the B-24 came under attack from JG 1's Messerschmitt Bf 109s. *Leutnant* Heinz Knoke (who finished the war with 31 kills) shot down the Liberator. Post and all but two of the 11 men aboard were killed. Knoke reported:

The fire spread out along the right wing. The inboard propeller windmilled to a stop. And then, suddenly, the whole wing broke off. At an altitude of 900 metres there was a tremendous explosion. The bomber had disintegrated. The blazing wreckage landed just outside Bad Zwischenahn airfield.



A B-24M of the 448th Bombardment Group, serial number 44-50838, downed by a Messerschmitt Me 262 jet fighter.

A total of 178 B-24s carried out the famous second attack on Ploesti (Operation Tidal Wave) on 1 August 1943, flying from their bases in northwestern Libya. In late June 1943, the three B-24 Liberator groups of the 8th Air Force were sent to North Africa on temporary duty with the 9th Air Force. The 44th Bomb Group was joined by the 93rd and the 389th Bomb Groups. These three units joined the two 9th Air Force B-24 Liberator groups for the 1 August 1943 low-level attack on the German-held Romanian oil complex at Ploesti. This daring and bold assault by high altitude bombers at tree top level was an experience that had both successes and failures. The 44th destroyed both of its assigned targets, but lost 11 of its 37 bombers and their crews. Colonel Leon W. Johnson, the group commander who led the mission, was awarded the Medal of Honor for his leadership. For its actions on the Ploesti mission, the group was awarded its second Distinguished Unit Citation. Of the 178 B-24s that were dispatched on this operation, 54 were lost.

RAF Bomber Command did not use B-24s as bombers over Europe. No. 223 Squadron RAF, one of Bomber Command's 100 (Bomber Support) Group squadrons, used 20

Liberator VIs to carry electronic jamming equipment to counter German radar. Liberators were also used as anti-submarine patrol aircraft by the RAF.

Other roles

The B-24's long operating range made it suitable for other duties including maritime patrol, anti-submarine patrol, reconnaissance, tanker, cargo hauler, and personnel transport. Winston Churchill used a refurbished Liberator II as his personal transport aircraft.

Formation assembly

B-24D-30-CO assembly ship *First Sergeant*, 458th Bomb Group

In February 1944, the 2nd Division authorized the use of war-weary aircraft specially fitted to aid assembly of individual group formations. Known as Assembly or Formation Ships, they were equipped with signal lighting, provision for quantity discharge of pyrotechnics, and featured distinctive individual paint schemes of psychedelic colors in stripes, checkers, or polka dots to enable easy recognition by their flock of bombers. The aircraft used in the first allocation were B-24Ds retired by the 44th, 93rd and 389th Groups. Arrangements for signal lighting varied from group to group, but generally consisted of white flashing lamps on both sides of the fuselage arranged to form the identification letter of the group. All armament and armor was removed, and in some cases the tail turret. In the B-24Hs used for this purpose, the nose turret was removed and replaced by a "carpetbagger" type nose. Following incidents when flare guns were accidentally discharged inside the rear fuselage, some Formation Ships had pyrotechnic

guns fixed through the fuselage sides. As these aircraft normally returned to base once a formation had been established, a skeleton crew of two pilots, navigator, radio operator and one or two flare discharge men were carried. In some groups an observer officer flew in the tail position to monitor the formation. These aircraft became known as Judas Goats.

Operation Carpetbagger

From August 1943 until the end of the war in Europe, specially modified B-24Ds were used in classified missions. In a joint venture between the Army Air Force and the Office of Strategic Services (OSS) code named "Operation Carpetbagger", pilots and crews flew specially modified B-24Ds painted with a glossy black anti-searchlight paint to supply friendly underground forces throughout German occupied Europe. They also flew C-47s, A-26 Invaders, and British de Havilland Mosquitos. They flew spies called "Joes" and commando groups prior to the Allied invasion of Europe on D-Day and afterward, and retrieved over 5,000 officers and enlisted men who had escaped capture after being shot down. The low-altitude, night-time operation was extremely dangerous and took its toll on these airmen. The first aircrews chosen for this operation came from the anti-submarine bomb groups because of their special training in low altitude flying and pinpoint navigation skills. Also, because of their special skills, they were called upon to fly fuel to General George Patton's army when it outran its fuel supply. When this mission was completed, it was recorded that 822,791 gal (3,114264 L) of 80 octane gasoline had been delivered to three different airfields in France and Belgium.

Maritime patrol

B-24 Very Long Range Liberators at the Consolidated-Vultee Plant, Fort Worth, Texas in the foreground with the dark green and white paint scheme. To the rear of this front line are C-87 "Liberator Express Transports" in various assembly stages.

The Liberators made a great contribution to Allied victory in the Battle of the Atlantic against German U-boats. The decision to allocate some Liberator Is to Coastal Command in 1941 to patrol the eastern Atlantic Ocean produced immediate results. The Very Long Range (VLR) Liberators "almost doubled the reach of Britain's maritime reconnaissance force". This extended range enabled Coastal Command patrols to cover part of the mid-Atlantic gap, where U-boats had operated without risking being attacked and sunk by Allied aircraft.

For 12 months, No. 120 Squadron RAF of Coastal Command with its handful of much-patched and modified early model Liberators, supplied the only air cover for convoys in the Atlantic Gap, the Liberator being the only warplane with sufficient range. The VLR Liberators sacrificed some armor and often gun turrets in order to save weight, while carrying extra aviation gasoline in their bomb-bay tanks. Liberator Is were equipped with

ASV (Air to Surface Vessel) Mark II radar, which together with the Leigh light gave them the ability to hunt U-boats by day and by night.

These Liberators operated from both sides of the Atlantic with the Royal Canadian Air Force and the U.S. Navy from the west; and with the RAF from the east, based in Northern Ireland, Scotland, Iceland, and beginning in mid-1943 from the Azores. This role was dangerous, especially after many U-boats were armed with extra anti-aircraft guns, some adopting the policy of staying on the surface to fight, rather than submerging and risking being sunk by ASW (anti-submarine warfare) torpedoes and depth charges from the bombers. In addition to flying from the East Coast of the United States, American Liberators flew from Greenland, the Azores, Bermuda, the Bahamas, Puerto Rico, Cuba, Trinidad, and from wherever else they could fly far out over the Atlantic.

The rather sudden and decisive turning of the Battle of the Atlantic in favor of the Allies in May 1943 was the result of many factors. However, it was no accident that it coincided with the long delayed arrival of many more VLR Liberators for maritime patrols. Liberators were credited in full or in part with 72 U-boat sinkings.

In addition to *very* long range patrols, the B-24 was vital for patrols of a radius less than 1,000 mi (1,600 km), in both the Atlantic and Pacific theaters where U.S. Navy Privateers and USAAF B-24s took a heavy toll of German and Japanese submarines, and also some Japanese surface shipping.

The Consolidated Aircraft Company PB4Y Privateer was a World War II U.S. Navy patrol bomber that was derived directly from the B-24 Liberator. The U.S. Navy had been using unmodified B-24s as the PB4Y-1 Liberator, and this type of patrol plane was considered to be quite successful. However, a fully navalized design was advantageous, and Consolidated Aircraft developed a purpose-built long-range patrol bomber in 1943, designated PB4Y-2 Privateer, that was visually distinguishable from the B-24 and PB4Y-1 by having a single vertical stabilizer rather than a twin tail.

Air Transports

Early model Liberators were used as unarmed long-range cargo carriers. They flew between Britain and Egypt (with an extensive detour around Spain over the Atlantic), and they were used in the evacuation of Java in the East Indies. Liberator IIs were converted for this role and were used by the British Overseas Airways Corporation (BOAC) for trans-Atlantic services and other various long-range air transportation routes. This version of the Liberator was designated the LB-30A by the USAAF.

By early 1943, the need for a transport with better high altitude performance and longer range than the Douglas C-47 Skytrain had become pressing. A transport version of the B-24 was proposed, and soon afterward, a B-24D that had been damaged in an accident was converted into a cargo aircraft by elimination of its transparent nose and the installation of a flat cargo floor. In April 1943, the C-87 Liberator Express transport entered production at Fort Worth, Texas. The C-87 had a large cargo door, less powerful

supercharged engines, no gun turrets, a floor in the bomb bay for freight, and some side windows. The navigator's position was relocated behind the pilot. Early versions were fitted with a single .50 caliber (12.7 mm) Browning machine gun in their tails, and a few C-87s were also equipped with two .50 caliber (12.7 mm) fixed machine guns in their noses, operable by the pilot, though these were eventually removed. A more dedicated VIP transport, the C-87A, was also built in small numbers.

The C-87 was also designated the RY-2 or Liberator Cargo VII. Although only 287 C-87 and RY variants were produced, they were still important in the Army Air Force's airlift operations early in the war when aircraft with high altitude, long-range heavy hauling abilities were in short supply. The C-87 flew in many theaters of war, including much hazardous duty in flights from Labrador to Greenland and Iceland in the North Atlantic. In the China Burma India Theater (CBI), the C-87 was used to airlift cargo and fuel over the Hump (the Himalayas) from India to China. Early in the campaign, the C-87 was the only readily available American transport that could fly over the Himalayas while heavily loaded, rather than relying on circuitous and highly dangerous routes through valleys and mountain passes.

The C-87 was not very popular with the aircrews assigned to fly it. The aircraft had the distressing habit of losing all cockpit electrical power on takeoff or at landings, while its engine power and reliability with the less-powerful superchargers often left much to be desired. It proved to be quite vulnerable to icing conditions, and was prone to fall into a spin with even small amounts of ice accumulated onto its Davis wing. Since the aircraft had been designed to be a bomber that dropped its loads while airborne, the C-87's nose landing gear was not designed for landing with a heavy load, and frequently it collapsed from the stress. Fuel leaks inside the crew compartment from the hastily modified long-range fuel system were an all-too-common occurrence. Lastly, unlike a typical purpose-designed transport, the B-24 was not designed to tolerate large loading variations because most of its load was held on fixed bomb racks. Consequently, it was far too easy for a poorly trained ground crew to load a C-87 with its center of gravity too far forward or aft, rendering the aircraft longitudinally unstable and difficult to control. In his autobiography, *Fate is the Hunter*, the writer Ernest K. Gann reported that, while flying air cargo in India, he barely avoided crashing an improperly loaded C-87 into the Taj Mahal. As soon as more dependable Douglas C-54 Skymaster and Curtiss-Wright C-46 Commando transports became available in large numbers, C-87s were rapidly phased out of combat zone service, with some later used as VIP transports or B-24 flight crew trainers.

The C-109 was a dedicated fuel transport version of the B-24 conceived as a support aircraft for B-29 Superfortress operations in central China. Unlike the C-87, the C-109 was not built on the assembly line, but rather was converted from existing B-24 bomber production; to save weight, the glass nose, armament, turret fairings and bombardment equipment were removed. Several storage tanks were added, allowing a C-109 to carry almost 2,905 gal (11,000 L) of fuel weighing over 22,000 lb (10,000 kg).

Plans originally called for 2,000 C-109s to support 10 groups of B-29s (approximately 400) in China, but the capture of the Mariana Islands provided a far more easily resupplied location for raids on mainland Japan, and the plans were greatly scaled back. Only 218 C-109s were actually converted. After the transfer of the B-29s, the C-109s were reassigned to the Air Transport Command. According the history of the US Army Air Forces in World War II, at least one squadron was assigned to the IX Troop Carrier Command in Europe to transport gasoline to advancing ground and air forces on the Continent after the Normandy invasion.

However, whereas a combat-loaded B-24 could safely take off with room to spare from a 6,000 ft (1,800 m) runway, a loaded C-109 required every foot of such a runway to break ground, and crashes on takeoff were not uncommon. The aircraft demonstrated unstable flight characteristics with all storage tanks filled, and proved very difficult to land fully loaded at airfields above 6,000 ft (1,830 m) MSL in elevation, such as those around Chengdu. After it was discovered that these problems could be alleviated by flying with the forward storage tank empty, this practice became fairly routine, enhancing aircrew safety at the cost of some fuel-carrying capacity. Many C-109s were lost in flying the Hump airlift to China.

B-24 bombers were also extensively used in the Pacific area after the end of World War II to transport cargo and supplies during the rebuilding of Japan, China, and the Philippines.

In June 1944, Qantas Empire Airways began service with the first of two converted Liberators on the Perth to Colombo route to augment Consolidated PBY Catalinas that had been used since May 1943. This route across the Indian Ocean was 3,513 mi (5,654 km) long, the longest non-stop airline route in the world at the time. The Liberators flew a shorter 3,077 mi (4,952 km) over-water route from Learmonth to an airfield northeast of Colombo, but they could make the flight in 17 hours with a 5,500 lb (2,495 kg) payload, whereas the Catalinas required 27 hours and had to carry so much auxiliary fuel that their payload was limited to only 1,000 lb (454 kg). The route was named *Kangaroo Service* and marked the first time that Qantas' now-famous Kangaroo logo was used; passengers received a certificate proclaiming them as members of *The Order of the Longest Hop*. The Liberators were later replaced by Avro Lancastrians.

Luftwaffe use

The B-24 was operated by the German secret operations unit KG 200, which also tested, evaluated and sometimes clandestinely operated captured enemy aircraft during World War II.

Soviet use

Only one B-24 was officially delivered to the USSR according to the Lend-Lease agreements, stranded in Yakutsk while flying a government mission to the Soviet Union

in November 1942. In addition, 73 Liberators of various models that had force-landed in Europe airfields were recovered and 30 of them were repaired and used by the 45th BAD.

Variants and conversions

U.S. Army Air Force Variants

XB-24 (Consolidated Model 32)
: Designed in 1938 as an improvement on the B-17 Flying Fortress, at the request of the Army Air Corps. It had a wing specially designed for a high aspect ratio, tricycle landing gear, and twin vertical stabilizers. The XB-24 was ordered in March 1939 and first flew on 29 December 1939. (Total: one)

YB-24/LB-30A Preproduction prototypes
: Six examples were sent to Great Britain under Lend-Lease, designated LB-30A.

B-24
: Service test version of the XB-24, ordered on 27 April 1939, less than 30 days after the XB-24 was ordered and before its completion. A number of minor modifications were made: elimination of leading edge slots, addition of de-icing boots. (Total: seven; only one used for actual testing)

LB-30A ex-*Diamond Lil* from the Commemorative Air Force collection. Airframe returned to B-24A configuration and renamed *Ol' 927*

B-24A/LB-30B

Ordered in 1939, the B-24A was the first production model. Due to the need for heavy bombers, the B-24A was ordered before *any* version of the B-24 flew. The main improvement over the XB-24 was improved aerodynamics, which led to better performance. Some sent to Great Britain under Lend-Lease as LB-30B. (Total: 20 LB-30B; 1 B-24A)

XB-24B

When the XB-24 failed to reach its projected top speed, the Pratt & Whitney R-1830-33 radials rated at 1,000 hp (746 kW) it carried were replaced with R-1830-41 turbo-supercharged radials rated at 1,200 hp (895 kW), increasing its top speed by 37 mph (59 km/h). The engine cowlings were made elliptical to accommodate the addition of the turbo-superchargers. The XB-24B version also lacked the engine slots of the original. (Total: one converted XB-24)

B-24C

Conversion of the B-24A using turbo-supercharged R-1830-41 engines. To hold the supercharger and the intercooler intake, the cowlings were made elliptical and the new items added on the sides. The tail air gunner position was improved by adding a hydraulically powered Consolidated A-6 turret with twin .50 caliber (12.7 mm) machine guns; a Martin power turret was added to the forward fuselage. (Total: nine converted B-24As)

B-24Ds of 93rd Bomb Group in formation. Nearest aircraft is *Joisey Bounce* (s/n 41-24226), wingman is *The Duchess*, (s/n 41-24147), and next higher is *Bomerang* (s/n 41-23722).

B-24D

First model produced on a large scale; ordered from 1940 to 1942, as a B-24C with better engines (R-1830-43 supercharged engines). The D model was initially equipped with a remotely operated and periscopically sighted Bendix belly turret, as the first examples of the B-17E Flying Fortress had used, but this proved unsatisfactory in service and was discontinued after the 287th aircraft. Production aircraft reverted to the earlier manually operated "tunnel" mounting with a single .50 caliber (12.7 mm) machine. The tunnel gun was eventually replaced by the retractable Sperry ball turret, which had also been adopted by the later B-17E Fortresses. In late B-24Ds, "cheek" guns were added. (Total: 2,696: 2,381 Consolidated, San Diego; 305 Consolidated, Fort Worth; 10 Douglas, Tulsa, Oklahoma).

B-24E

A slight alteration of the B-24D built by Ford, using R-1830-65 engines. Unlike the B-24D, the B-24E retained the tunnel gun in the belly. The USAAF used the B-24Es primarily as training aircraft since this model was not current in armaments and other technology as were the aircraft being produced by Consolidated / San Diego (CO). Ford also built sub-assemblies for Douglas; these sub-assemblies were identical to Ford-built B-24Es, except that they used the same engines as the B-24D (R-1830-43 radials). These sub-assemblies were called PK ships and were shipped by truck from Willow Run to the final assembly in Tulsa, Oklahoma. (Total: 801)

XB-24F

A prototype made to test thermal de-icers instead of the standard inflatable rubber "boots". (Total: one converted B-24D)

B-24G

Designation for B-24D aircraft built by North American Aviation pursuant to a 1942 contract. Equipped with Sperry ball turret and three .50 caliber (12.7 mm) machine guns in nose. (Total: 25)

B-24G-1

Designation for North American-built version of the B-24H. Most B-24G aircraft were delivered to the 15th Air Force in Italy. (Total: 405)

B-24H

Because of obvious vulnerability of the B-24 to head-on attack, the B-24H design incorporated an electrically powered Emerson A-15 nose turret. Approximately 50 other airframe changes were made, including a redesigned bombardier compartment. The tail turret was given larger windows for better visibility and the Martin A-3 top turret received an enlarged "high hat" dome. The waist gunner positions were enclosed with plexiglas windows and offset to reduce mutual interference between the gunners during battle. Most H model aircraft were built by Ford at the Willow Run factory. (Total: 3,100)

B-24J-55-CO (s/n 42-99949) belonged to 93rd BG, 328th BS; lost 21 September 1944 over Belgium

B-24J

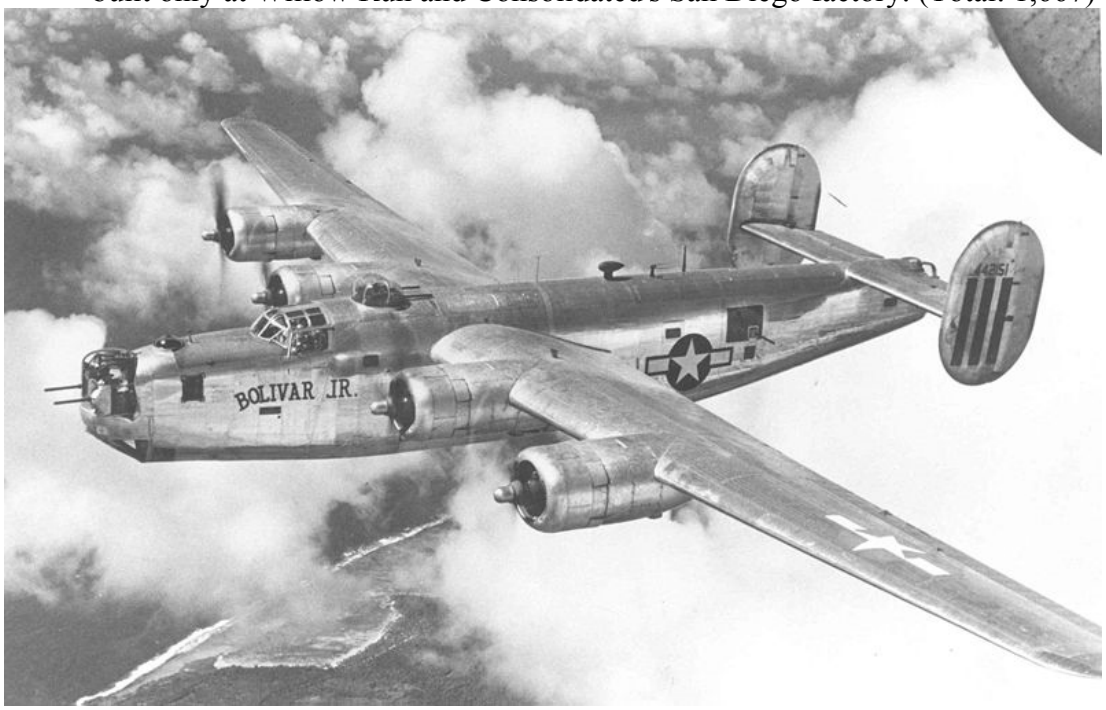
The B-24J was very similar to the B-24H, but shortages of the Emerson nose turret required use of a modified, hydraulically powered Consolidated A-6 turret in most J model aircraft built at Consolidated's San Diego and Fort Worth factories. The B-24J featured an improved autopilot (type C-1) and a bombsight of the M-1 series. B-24H sub-assemblies made by Ford and constructed by other companies and any model with a C-1 or M-1 retrofit, were all designated B-24J. The J model was the only version to be built by all five factories involved in B-24 production. (Total: 6,678)

XB-24K

An experimental aircraft, made by Ford by splicing a B-23 Dragon tail empennage onto a B-24D airframe. The aircraft was more stable and had better handling than other models, leading to the decision to incorporate a single tail in the PB4Y-2 and B-24N. (Total: one converted B-24D)

B-24L

Because of the excessively high gross weight of the B-24J, the Army pushed for a lighter version. In the B-24L, the Sperry ball turret was replaced by a floor ring mount with two .50 caliber (12.7 mm) machine guns, and the A-6B tail turret by an M-6A. Later aircraft were delivered from the factory without tail armament. An A-6B, M-6A, or a manually operated twin .50 caliber (12.7 mm) mounting was then installed at a depot before arrival at operational units. The L model was built only at Willow Run and Consolidated's San Diego factory. (Total: 1,667)



B-24M-20-CO *Bolivar Jr.* (s/n 44-42151) 431st Bomb Squadron, 11th Bomb Group

B-24M

An enhancement of the B-24L with further weight-saving devices. The B-24M used a more lightweight version of the A-6B tail turret; the waist gunner positions were left open. For better visibility from the flight deck, the windshield in Ford-built aircraft was replaced by a version with less framing from Block 20 onward. The B-24M became the last production model of the B-24; a number of the B-24s built flew only the course between the factory and the scrapheap. (Total: 2,593)

XB-24N

A redesign of the B-24J, made to accommodate a single tail. It also featured an Emerson 128 ball turret in the nose and a stationary tail gunner's position. While 5,168 B-24Ns were ordered, the end of the war resulted in cancellation of all contracts before production could begin. (Total: one)

YB-24N

Pre-production service test version of the XB-24N. (Total: seven)

XB-24P

A modified B-24D, used by Sperry Gyroscope Company to test airborne fire control systems. (Total: one converted B-24D)

XB-24Q

A General Electric conversion of the B-24L. Used to test a radar-controlled tail turret intended for use in the Boeing B-47 Stratojet. (Total: one converted B-24L)

XB-41

Because there were no fighters capable of escorting bomber formations on deep strike missions early in World War II, the Army authorized tests for heavily armed bombers to act as escorts for bombing missions. The XB-41 had fourteen .50 caliber (12.7 mm) machine guns, including a Bendix chin turret and a second Martin A-3 turret on the upper fuselage. A single aircraft was completed in 1942. Performance changed drastically with the addition of more turrets. The escorts were also unable to keep up with bomber formations once the bombs had been dropped. The results of 1943 testing were very negative and the project was quickly canceled. (Total: one converted B-24D)

AT-22 or TB-24

C-87 used for flight engineer training.

- **RB-24L**: Developed for training B-29 gunners on an identical remote gun system installed on a B-24L.
- **TB-24L**: As with the RB-24L, but with additional radar equipment.

Experimental B-24J-15-CO, *42-73130*, with B-17G nose section, containing chin turret, grafted on; modification not adopted for production

C-87 Liberator Express

Passenger transports with accommodation for 20 passengers.

- **C-87A**: VIP transports with R-1830-45 instead of -43 engines and sleep accommodations for 16 passengers.
- **C-87B**: Projected armed transport variant with nose guns, dorsal turret, and ventral tunnel gun; never produced.
- **C-87C**: U.S. Army Air Force/Air Force designation for the RY-3.

XC-109/C-109

Tankers with specialized equipment to help prevent explosions, used to ferry fuel from India to China to support initial B-29 raids against Japan.

XF-7

Photographic reconnaissance variant developed from the B-24D.

F-7

Photographic reconnaissance variant developed from the B-24H; -FO block.

F-7A

Photographic reconnaissance variant developed from the B-24J; three cameras in the nose and three in the bomb bay.

F-7B

Photographic reconnaissance variant developed from the B-24J; six cameras in the bomb bay.

BQ-8

A number of worn-out B-24D and B-24Js were converted as radio-controlled flying bombs to attack German targets. Joseph P. Kennedy, Jr. was killed in a BQ-8 during Operation Aphrodite.

U.S. Navy nomenclature and sub-variants

PB4Y-1

U.S. Navy designation applied to 976 navalized B-24D, J, L and M models built at Consolidated's San Diego factory, as well as one North American-built B-24G. Later aircraft were equipped with an ERCO bow turret.

PB4Y-1P

Photographic reconnaissance variant developed from the PB4Y-1.

PB4Y-2 Privateer

P5Y

Proposed twin-engined patrol version of PB4Y-1. Unbuilt.

RY-1

U.S. Navy designation for the C-87A.

RY-2

U.S. Navy designation for the C-87.

RY-3

Transport variant of the PB4Y-2.

British nomenclature and sub-variants

Rare color photograph of an LB-30A (YB-24) in RAF service

Liberator B Mk I
: B-24A, direct purchase aircraft for the RAF. (Total: 20) Considered unsuitable for combat, some rebuilt as the GR.1 and used in British anti-submarine patrol squadrons.

Liberator B Mk II
: The first combat-ready B-24. The modifications included a three-foot nose extension as well as a deeper aft fuselage and wider tailplane—there was no direct B-24 equivalent but similar to the B-24C, built to meet British specifications with British equipment and armament. A small series of B Mk IIs were reconstructed as unarmed transports, designated the LB-30 with the USAAF. (Total production: 165)

Liberator B Mk III
: B-24D variant with single .303 in (7.7 mm) Browning machine gun in the nose, two in each beam position, and four in a Boulton Paul tail turret—similar to that on contemporary British heavy bombers such as the Halifax—as well as other British equipment. The Martin dorsal turret was retained. (Total: 156)

    - **Liberator B Mk IIIA**: Lend-Lease B-24Ds with American equipment and weapons.

Liberator B Mk IV
: Reserved for the B-24E, but there is no record of the RAF actually receiving any.

Liberator B Mk V
: B-24D modified for extra fuel capacity at the cost or armor, with the same armament fit as the Liberator Mk III.

Liberator B Mk VI
: B-24Hs in RAF service fitted with Boulton Paul tail turrets, but retaining the rest of their armament.

Liberator B Mk VIII
: RAF designation for B-24Js.

Anti-Submarine Weapons: Leigh light used for spotting U-boats on the surface at night, fitted to a Liberator aircraft of Royal Air Force Coastal Command. 26 February 1944.

Liberator GR Mk V
: B-24D modified by RAF Coastal Command for the anti-submarine role with search radar and Leigh Light. Some were fitted with eight zero-length rocket launchers, four on each wing.

Liberator GR Mk VI
: B-24G/H/J type used as a long-range general reconnaissance aircraft by RAF Coastal Command.

Liberator GR Mk VIII
: B-24J modified by RAF Coastal Command for the anti-submarine role.

Liberator C Mk VI

Liberator B Mk VIII converted for use as a transport.

Liberator C Mk VII
: British designation for C-87.

Liberator C Mk VIII
: Liberator G Mk VIII converted for use as a transport.

Liberator C Mk IX
: RAF designation for the RY-3/C-87C

Late in the war RAF Liberator aircraft modified in England for use in South East Asia had the suffix "Snake" stenciled below the serial number to give them priority delivery through the Mediterranean and Middle East.

Survivors

- There are two flying Liberators: a B-24J named *Witchcraft* of the Collings Foundation in Stow, Massachusetts, and a B-24A renamed *Ol' 927* (ex *Diamond 'Lil'*), of the Commemorative Air Force kept at Addison, Texas. *Ol' 927* was the 25th Liberator built, originally a B-24A but rolled off the assembly line as an LB-30, Consolidated's designation indicating the 30th in the company's series of "license-built" designs for European customers. Complete with a bomb bay and machine gun positions, *Ol' 927* was never delivered to Europe and instead served as a trainer and then a transport in the U.S. The CAF returned the aircraft to a B-24A configuration.
- Twelve complete B-24 airframes (6 B-24s and 6 PB4Ys) on static display in the United States.
- Five complete B-24 airframes on static display outside of the U.S.
- Fifteen known partial airframes (12 B-24s, 1 British Liberator II and 2 PB4Ys) in the world.
- Eleven wrecked airframes (4 B-24s, 7 PB4Ys). However, it is also known that hundreds of B-24 wrecks lie at the bottoms of oceans, lakes, and rivers around the world.

Specifications (B-24J)

B-24 photographed from above, showing the Davis wing design.

General characteristics

- **Crew:** 7-10
- **Length:** 67 ft 8 in (20.6 m)
- **Wingspan:** 110 ft 0 in (33.5 m)
- **Height:** 18 ft 0 in (5.5 m)
- **Wing area:** 1,048 ft² (97.4 m²)
- **Empty weight:** 36,500 lb (16,590 kg)
- **Loaded weight:** 55,000 lb (25,000 kg)
- **Max takeoff weight:** 65,000 lb (29,500 kg)
- **Powerplant:** 4× Pratt & Whitney R-1830 turbosupercharged radial engines, 1,200 hp (900 kW) each
- **Zero-lift drag coefficient:** 0.0406
- **Drag area:** 42.54 ft² (3.95 m²)
- **Aspect ratio:** 11.55

Performance

- **Maximum speed:** 290 mph (250 kn, 470 km/h)
- **Cruise speed:** 215 mph (187 kn, 346 km/h)
- **Stall speed:** 95 mph (83 kn, 153 km/h)
- **Range:** 2,100 mi (1,800 nmi, 3,400 km)
- **Ferry range:** 3,700 mi (3,200 nmi, 6,000 km)
- **Service ceiling:** 28,000 ft (8,500 m)
- **Rate of climb:** 1,025 ft/min (5.2 m/s)
- **Wing loading:** 52.5 lb/ft² (256 kg/m²)
- **Power/mass:** 0.0873 hp/lb (144 W/kg)
- **Lift-to-drag ratio:** 12.9

Armament

- **Guns:** 10 × .50 caliber (12.7 mm) M2 Browning machine guns in 4 turrets and two waist positions
- **Bombs:**
    - Short range (˜400 mi): 8,000 lb (3,600 kg)
    - Long range (˜800 mi): 5,000 lb (2,300 kg)
    - Very long range (˜1,200 mi): 2,700 lb (1,200 kg)

Chapter-3

North American B-25 Mitchell

B-25 Mitchell

North American B-25 Mitchell	
Role	Medium bomber
Manufacturer	North American Aviation
First flight	19 August 1940
Introduction	1941
Retired	1979 (Indonesia)
Primary users	United States Army Air Forces Royal Canadian Air Force Royal Air Force Soviet Air Force
Number built	9,984
Developed from	XB-21
Developed into	North American XB-28

The **North American B-25 Mitchell** was an American twin-engined medium bomber manufactured by North American Aviation. It was used by many Allied air forces, in

every theater of World War II, as well as many other air forces after the war ended, and saw service across four decades.

The B-25 was named in honor of General Billy Mitchell, a pioneer of U.S. military aviation. The B-25 is the only American military aircraft named after a specific person. By the end of its production, nearly 10,000 B-25s in numerous models had been built. These included a few limited variations, such as the United States Navy's and Marine Corps' PBJ-1 patrol bomber and the United States Army Air Forces' F-10 photo reconnaissance aircraft.

Design and development

Flight Performance School also included work in evaluating the performance of this B-25 Mitchell medium bomber

The B-25 was a descendant of the earlier XB-21 (North American-39) project of the mid-1930s. Experience gained in developing that aircraft was eventually used by North American in designing the B-25 (called the NA-40 by the company). One NA-40 was built, with several modifications later being done to test a number of potential improvements. These improvements included Wright R-2600 radial engines, which would become standard on the later B-25.

In 1939, the modified and improved NA-40B was submitted to the United States Army Air Corps for evaluation. This aircraft was originally intended to be an attack bomber for export to the United Kingdom and France, both of which had a pressing requirement for such aircraft in the early stages of World War II. However, those countries changed their minds, opting instead for the also-new Douglas DB-7 (later to be used by the US as the A-20 Havoc). Despite this loss of sales, the NA-40B re-entered the spotlight when the Army Air Corps evaluated it for use as a medium bomber. Unfortunately, the NA-40B was destroyed in a crash on 11 April 1939. Nonetheless, the type was ordered into production, along with the Army's other new medium bomber, the Martin B-26 Marauder.

Early production

Mitchell production in Kansas City in 1942

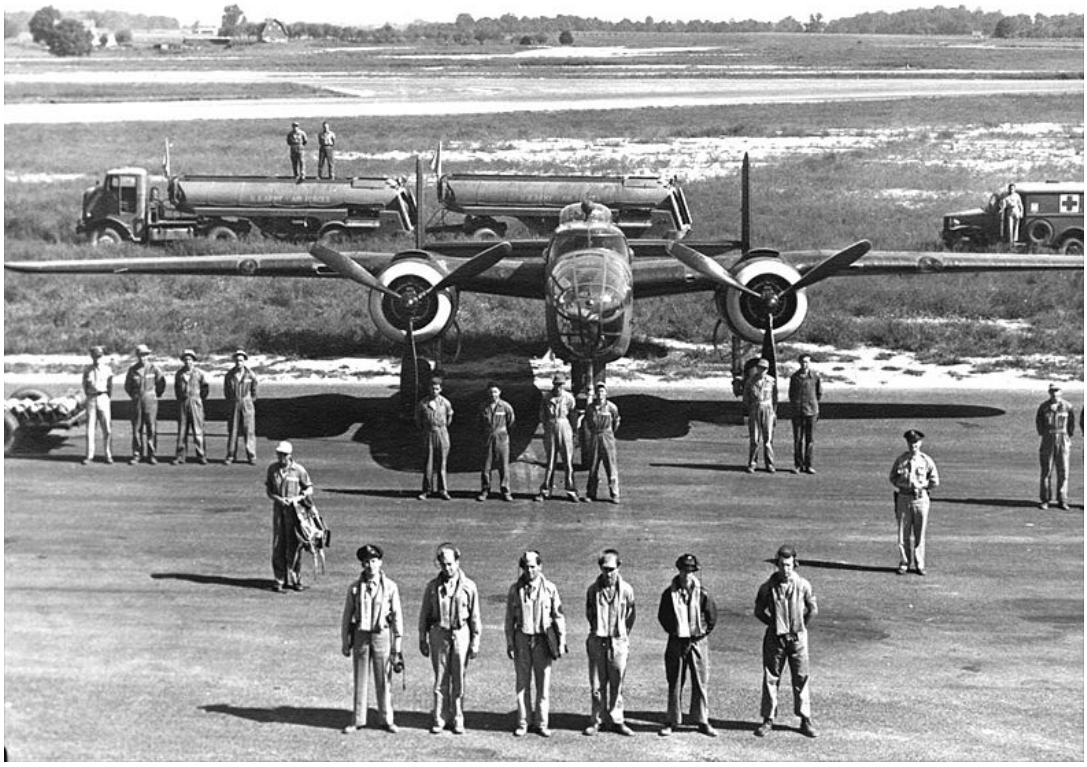
An improvement of the NA-40B, dubbed the **NA-62**, was the basis for the first actual B-25. Due to the pressing need for medium bombers by the Army, no experimental or service-test versions were built. Any necessary modifications were made during production runs, or to existing aircraft at field modification centers around the world.

A significant change in the early days of B-25 production was a re-design of the wing. In the first nine aircraft, a constant-dihedral wing was used, in which the wing had a consistent, straight, slight upward angle from the fuselage to the wing tip. This design caused stability problems, and as a result, the dihedral angle was nullified on the outboard wing sections, giving the B-25 its slightly gull wing configuration. Less noticeable changes during this period included an increase in the size of the tail fins and a decrease in their inward cant.

A total of 6,608 B-25s were built at North American's Fairfax Airport plant in Kansas City, Kansas.

A descendant of the B-25 was the North American XB-28, meant to be a high-altitude version of the B-25. Despite this premise, the actual aircraft bore little resemblance to the Mitchell. It had much more in common with the B-26 Marauder.

Operational history



Lt. Peddy and crew, showing how many people were required to keep a B-25 flying

Doolittle Raid B-25Bs aboard USS *Hornet*

Far East

The majority of B-25s in American service were used in the Pacific. It fought on Papua New Guinea, in Burma and in the island hopping campaign in the central Pacific. It was in the Pacific that the aircraft's potential as a ground attack aircraft was discovered and developed. The jungle environment reduced the usefulness of standard level bombing, and made low level attack the best tactic. The ever-increasing amount of forward firing guns was a response to this, making the B-25 a formidable strafing aircraft.

In Burma the B-25 was often used to attack Japanese communication links, especially bridges in central Burma. It was also used to help supply the besieged troops at Imphal in 1944.

In the Pacific the B-25 proved itself to be a very capable anti-shipping weapon, sinking many of the ships being used to reinforce the Japanese position. Later in the Pacific war the distance between islands limited the usefulness of the B-25, although it was used

against Guam and Tinian. It was also used against Japanese-occupied islands that had been bypassed by the main campaign, as happened in the Marshal Islands.

Middle East and Italy

The first B-25s arrived in Egypt just in time to take part in the battle of El Alamein. From there the aircraft took part in the rest of the campaign in North Africa, the invasion of Sicily and the advance up Italy. In Italy the B-25 was used in the ground attack role, concentrating on attacks against road and rail links in Italy, Austria and the Balkans. The B-25 had a longer range than the A-20 Havoc and A-26 Invaders, allowing it to reach further into occupied Europe. The five bombardment groups that used the B-25 in the desert and Italy were the only US units to use the B-25 in Europe.

Europe

The U.S. Eighth Air Force, based in Britain, concentrated on long range raids over Germany and occupied Europe. Although it did have a small number units equipped with twin engined aircraft, the B-25 was not amongst them. However, the RAF received nearly nine hundred Mitchells, using them to replace Douglas Bostons, Lockheed Venturas and Vickers Wellington bombers. The Mitchell entered active RAF service on 22 January 1943. At first it was used to bomb strategic targets in occupied Europe. After the D-Day invasion the RAF used its Mitchells to support the armies in Europe, moving several squadrons to forward airbases in France and Belgium.

Operators

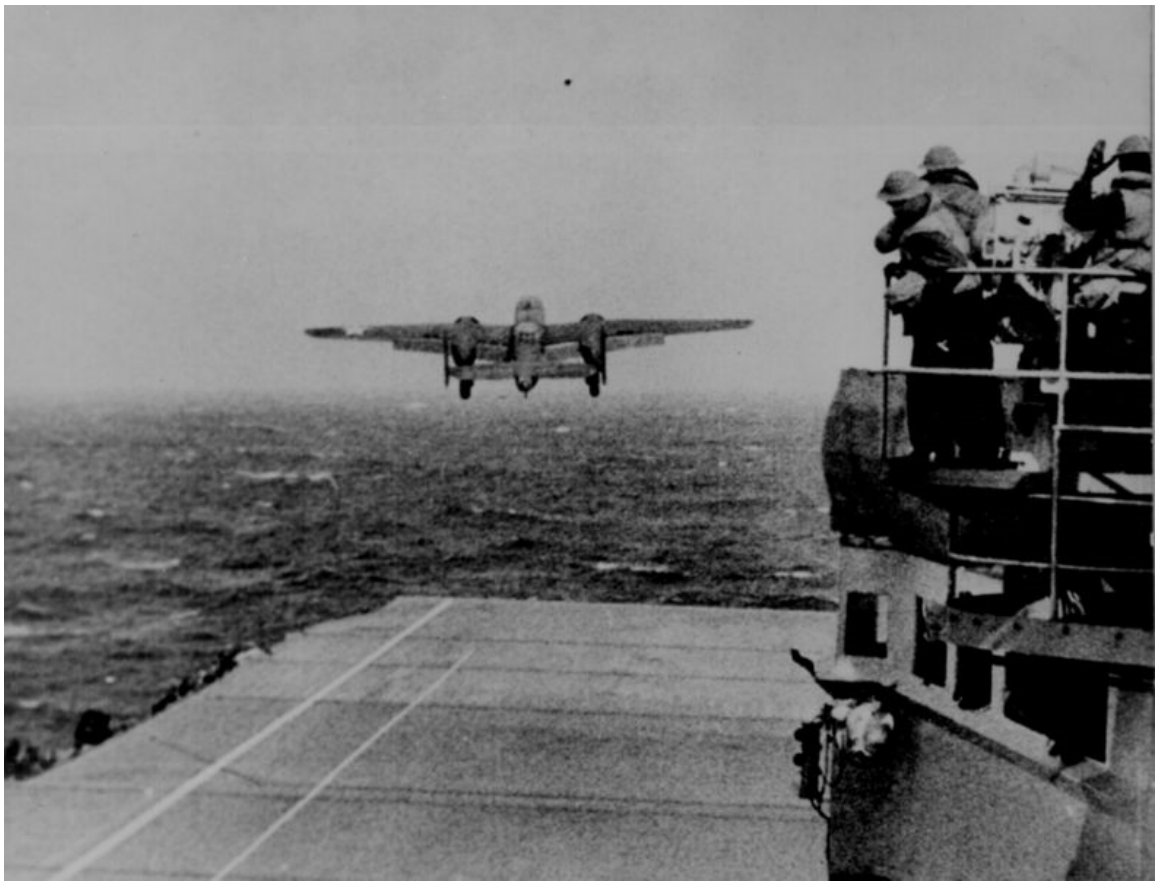
USAAF

A B-25C being refueled

B-25 of 13th Squadron, 3rd Bomb Group, on low-level "skip-bombing" mission in New Guinea

B-25G Mitchell from the AAF Tactical Center, Orlando AAB, Florida, 17 April 1944

Closeup of an early model B-25 gun pod



A B-25 Mitchell taking off from USS Hornet for the Doolittle Raid.

North American B-25 Mitchell.

B-25J of the Canadian Warplane Heritage Museum, taxing for takeoff.

Air exhibition in Poland, 2007.

The B-25 first gained fame as the bomber used in the 18 April 1942 Doolittle Raid, in which 16 B-25Bs led by the legendary Lieutenant Colonel Jimmy Doolittle, attacked mainland Japan four months after the bombing of Pearl Harbor. The mission gave a much-needed lift in spirits to the Americans, and alarmed the Japanese who had believed their home islands were inviolable by enemy troops. While the amount of actual damage done was relatively minor, it forced the Japanese to divert troops for the home defense for the remainder of the war. The raiders took off from the carrier USS *Hornet* and successfully bombed Tokyo and four other Japanese cities without loss. However, 15 subsequently crash-landed *en route* to recovery fields in Eastern China. These losses were the result of the task force being spotted by Japanese fishing vessels forcing the bombers to take off 170 mi (270 km) early, fuel exhaustion, stormy nighttime conditions with zero visibility, and lack of electronic homing aids at the recovery bases. Only one landed intact; it came down in the Soviet Union, where its five-man crew was interned and the aircraft confiscated. Of the 80 aircrew, 69 survived their historic mission and eventually made it back to American lines.

Following a number of additional modifications, including the addition of Plexiglas windows for the navigator and radio operator, heavier nose armament, and deicing and anti-icing equipment, the **B-25C** was released to the Army. This was the second mass-produced version of the Mitchell, the first being the lightly armed B-25B used by the Doolittle Raiders. The B-25C and **B-25D** differed only in location of manufacture: -Cs at Inglewood, California, -Ds at Kansas City, Kansas. A total of 3,915 B-25Cs and -Ds were built by North American during World War II.

Although the B-25 was originally designed to bomb from medium altitudes in level flight, it was used frequently in the Southwest Pacific theater (SWPA) on treetop-level strafing and parafrag (parachute-retarded fragmentation bombs) missions against Japanese airfields in New Guinea and the Philippines. These heavily armed Mitchells, field-modified at Townsville, Australia, by Major Paul I. "Pappy" Gunn and North American tech rep Jack Fox, were also used on strafing and skip-bombing missions against Japanese shipping trying to re-supply their land-based armies. Under the leadership of Lieutenant General George C. Kenney, B-25s of the Fifth and Thirteenth Air Forces devastated Japanese targets in the SWPA from 1942 to 1945, and played a significant role in pushing the Japanese back to their home islands. B-25s were also used with devastating effect in the Central Pacific, Alaska, North Africa, Mediterranean and China-Burma-India (CBI) theaters.

Because of the urgent need for hard-hitting strafer aircraft, a version dubbed the **B-25G** was developed, in which the standard-length transparent nose and the bombardier were replaced by a shorter solid nose containing two fixed .50 in (12.7 mm) machine guns and a 75 mm (2.95 in) M4 cannon, one of the largest weapons fitted to an aircraft, similar to the experimental British Mosquito Mk. XVIII, and German Ju 88P heavy cannon carrying aircraft. The cannon was manually loaded and serviced by the navigator, who was able to perform these operations without leaving his crew station just behind the pilot. This was possible due to the shorter nose of the G-model and the length of the M4, which allowed the breech to extend into the navigator's compartment.

The B-25G's successor, the **B-25H**, had even more firepower. The M4 gun was replaced by the lighter T13E1, designed specifically for the aircraft. The 75 mm (2.95 in) gun fired at a muzzle velocity of 2,362 ft/s (about 720 m/s). Due to its low rate of fire (approximately four rounds could be fired in a single strafing run) and relative ineffectiveness against ground targets, as well as substantial recoil, the 75 mm (2.95 in) gun was sometimes removed from both G and H models and replaced with two additional .50 in (12.7 mm) machine guns as a field modification. The -H also mounted four fixed forward-firing .50 (12.7 mm) machine guns in the nose, four more fixed ones in forward-firing cheek blisters, two more in the top turret, one each in a pair of new waist positions, and a final pair in a new tail gunner's position. Company promotional material bragged the B-25H could "bring to bear 10 machine guns coming and four going, in addition to the 75 mm cannon, a brace of eight rockets and 3,000 lb (1,360 kg) of bombs."

The B-25H also featured a redesigned cockpit area, with the top turret moved forward to the navigator's compartment (thus requiring the addition of the waist and tail gun positions), and a heavily modified cockpit designed to be operated by a single pilot, the co-pilot's station and controls deleted, and the seat cut down and used by the navigator/cannoneer, the radio operator being moved to the aft compartment, operating the waist guns. A total of 1,400 B-25Gs and B-25Hs were built.

The final version of the Mitchell, the **B-25J**, looked much like the earlier B, C and D, having reverted to the longer nose. The less-than-successful 75 mm (2.95 in) cannon was deleted on the J model. Instead, 800 of this version were built with a solid nose containing eight .50 (12.7 mm) machine guns, while other J-models featured the earlier "greenhouse" style nose containing the bombardier's position. Regardless of the nose style used, all J-models also included two .50 in (12.7 mm) guns in a "fuselage package" located directly under the pilot's station, and two more such guns in an identical package just under the co-pilot's compartment. The solid-nose B-25J variant carried an impressive total of 18 .50 in (12.7 mm) guns: eight in the nose, four in under-cockpit packages, two in an upper turret, two in the waist, and a pair in the tail. No other bomber of World War II carried as many guns. However, the first 555 B-25Js (the B-25J-1-NC production block) were delivered without the fuselage package guns, because it was discovered muzzle blast from these guns was causing severe stress in the fuselage; this was cured with heavier fuselage skin patches, while later production runs returned these guns, they were often removed as a field modification for the same reason. In all, 4,318 B-25Js were built.

The B-25 was a safe and forgiving aircraft to fly. With an engine out, 60° banking turns into the dead engine were possible, and control could be easily maintained down to 145 mph (230 km/h). However, the pilot had to remember to maintain engine-out directional control at low speeds after take off with rudder - if this was attempted with ailerons, the aircraft would snap out of control. The tricycle landing gear made for excellent visibility while taxiing. The only significant complaint about the B-25 was the extremely high noise level produced by its engines; as a result, many pilots eventually suffered from various degrees of hearing loss. The high noise level was due to design and space restrictions in the engine cowlings which resulted in the exhaust "stacks"

protruding directly from the cowling ring and partly covered by a small triangular fairing. This directed exhaust and noise directly at the pilot and crew compartments. Crew members and operators on the airshow circuit frequently comment that "the B-25 is the fastest way to turn aviation fuel directly into noise". Many B-25's now in civilian ownership have been modified with exhaust rings that direct the exhaust through the outboard bottom section of the cowling.

The Mitchell was also an amazingly sturdy aircraft and could withstand tremendous punishment. One well-known B-25C of the 321st Bomb Group was nicknamed "Patches" because its crew chief painted all the aircraft's flak hole patches with high-visibility zinc chromate paint. By the end of the war, this aircraft had completed over 300 missions, was belly-landed six times and sported over 400 patched holes. The airframe was so bent, straight-and-level flight required 8° of left aileron trim and 6° of right rudder, causing the aircraft to "crab" sideways across the sky.

An interesting characteristic of the B-25 was its ability to extend range by using one-quarter wing flap settings. Since the aircraft normally cruised in a slightly nose-high attitude, about 40 gal (150 l) of fuel was below the fuel pickup point and thus unavailable for use. The flaps-down setting gave the aircraft a more level flight attitude, which resulted in this fuel becoming available, thus slightly extending the aircraft's range.

By the time a separate United States Air Force was established in 1947, most B-25s had been consigned to long-term storage. However, a select number continued in service through the late 1940s and 1950s in a variety of training, reconnaissance and support roles. Its principal use during this period was for undergraduate training of multi-engine aircraft pilots slated for reciprocating engine or turboprop cargo, aerial refueling or reconnaissance aircraft. Still others were assigned to units of the Air National Guard in training roles in support of F-89 Scorpion and F-94 Starfire operations. TB-25J-25-NC Mitchell, *44-30854*, the last B-25 in the USAF inventory, assigned at March AFB, California as of March 1960, was flown to Eglin AFB, Florida, from Turner Air Force Base, Georgia, on 21 May 1960, the last flight by a USAF B-25, and presented by Brig. Gen. A. J. Russell, Commander of SAC's 822d Air Division at Turner AFB, to the Air Proving Ground Center Commander, Brig. Gen. Robert H. Warren, who in turn presented the bomber to Valparaiso, Florida Mayor Randall Roberts on behalf of the Niceville-Valparaiso Chamber of Commerce. Four of the original Tokyo Raiders were present for the ceremony, Col. Davy Jones, Col. Jack Simms, Lt. Col. Joseph Manske, and retired Master Sgt. Edwin W. Horton. It was donated back to the Air Force Armament Museum circa 1974 and marked as Doolittle's *40-2344*.

Today, many B-25s are kept in airworthy condition by air museums and collectors.

US Navy and USMC

The PBJ-1 was a navalized version of the USAAF B-25. It had its origin in a deal cut in mid-1942 between the Navy and the USAAF. As part of the deal, fifty B-25Cs and 152 B-25Ds were transferred to the Navy from the USAAF. The planes carried Navy serial

numbers beginning with 34998. The first PBJ-1s arrived in February 1943. They were used by Marine Corps pilots, beginning with VMB-413. Many of them were equipped with a search radar with a retractable radome fitted in place of the ventral turret.

Large numbers of B-25H and J variants were delivered to the Navy as PBJ-1H and PBJ-1J respectively. These aircraft joined, but did not necessarily replace, the earlier PBJs.

The PBJs were operated almost exclusively by the Marine Corps as land-based bombers. To operate them, the US Marine Corps established a number of bomber squadrons, beginning with VMB-413, in March 1943 at Cherry Point, North Carolina. Eight VMB squadrons were flying PBJs by the end of 1943, forming the initial Marine Medium Bombardment Group. Four more squadrons were in the process of formation in late 1945, but had not yet deployed by the time the war ended.

Operational use of the Marine Corps PBJ-1s began in March 1944. The Marine PBJs operated from the Philippines, Saipan, Iwo Jima and Okinawa during the last few months of the Pacific war. Their primary mission was the long range interdiction of enemy shipping that was trying to run the blockade which was strangling Japan. The weapon of choice during these missions was usually the five-inch HVAR rocket, eight of which could be carried on underwing racks. Many of the PBJ-1C and D versions carried a rather ugly, bulbous antenna for an APS-3 search radar sticking out of the upper part of the transparent nose. On the PBJ-1H and J, the APS-3 search radar antenna was usually housed inside a ventral or wingtip radome. Some PBJ-1Js had their top turrets removed to save weight, especially toward the end of the war when Japanese fighters had become relatively scarce.

Royal Air Force

The Royal Air Force (RAF) was an early customer for the B-25 via Lend-Lease. The RAF was the only force to use the B-25 on raids against Europe from bases in the United Kingdom, as the USAAF used the Martin B-26 Marauder for this purpose instead.

The first Mitchells were designated Mitchell I by the RAF and were delivered in August 1941, to No 111 Operational Training Unit based in the Bahamas. These planes were used exclusively for training and familiarization and never achieved operational status. The B-25Cs and Ds were designated Mitchell II, altogether, 167 B-25Cs and 371 B-25Ds were delivered to the RAF.

A total of 93 Mitchell Is and IIs had been delivered to the RAF by the end of 1942 and served with No. 2 Group, the RAF's tactical medium bomber force. The first RAF operation with the Mitchell II took place on January 22, 1943, when six aircraft attacked oil installations at Ghent. After the invasion of Europe, all four Mitchell squadrons moved to bases in France to support Allied ground forces. The British Mitchell squadrons were joined by No. 342 (Lorraine) Squadron of the French Air Force in April 1945.

No 305 (Polish) Squadron flew Mitchell IIs from September to December 1943 before transitioning to Mosquitos. In addition to the 2nd Group, the B-25 was used by various second-line RAF units in the UK and abroad. In the Far East, No. 3 PRU, which consisted of Nos. 681 and 684 Squadrons, flew the Mitchell (primarily Mk IIs) on photographic reconnaissance sorties.

The RAF was allocated 316 B-25Js as Mitchell IIIs. Deliveries took place between August 1944 and August 1945. However, only about 240 of these planes actually reached Britain, with some being diverted to No. 111 OTU in the Bahamas, some crashing during delivery and some being retained in the USA.

Royal Canadian Air Force

The Royal Canadian Air Force (RCAF) was an important user of the B-25 Mitchell, although most of the RCAF use of the Mitchell was postwar.

The first B-25s for the RCAF had originally been diverted to Canada from RAF orders. These included one Mitchell I, 42 Mitchell IIs, and 19 Mitchell IIIs. No 13 (P) Squadron was formed unofficially at Rockliffe in May 1944. They operated Mitchell IIs on high altitude aerial photography sorties. They retained the Mitchell until October 1948.

No 418 (Auxiliary) Squadron received its first Mitchell IIs in January 1947. It was followed by No 406 (auxiliary) which flew Mitchell IIIs from April 1947 to June 1958. No 418 Operated a mix of IIs and IIIs until March 1958. No 12 Squadron of Air Transport Command also flew Mitchell IIIs along with other types from September 1956 to November 1960. In 1951, the RCAF received an additional 75 B-25Js from USAF stocks to make good attrition and to equip various second-line units.

Royal Australian Air Force

It was not until the spring of 1944 that the Australians were to get Mitchells. By the spring of 1944, No. 18 Squadron had more than enough Mitchells than which could be used by just one squadron, and could spare a few. Arrangements were made to re-equip the RAAF's No. 2 Squadron with these extra aircraft, replacing their Beauforts.

Dutch Air Force

During the Second World War, the Mitchell served in fairly large numbers with the air force of the Dutch government in exile. They participated in combat both in the East Indies as well as on the European front. Following the war, they were used in a vain attempt of the Dutch to retain control of Indonesia.

On June 30, 1941, the Netherlands Purchasing Commission, acting on behalf of the Dutch government in exile in London, signed contract with North American Aviation for 162 B-25C aircraft. The planes were to be delivered to the Netherlands East Indies to help deter any Japanese aggression into the region.

In February 1942 , the British Overseas Airways Corporation (BOAC) agreed to ferry 20 of the Dutch B-25s from Florida to Australia via Africa and India, and an additional ten via the South Pacific route from California. During March, five of the airplanes on the Dutch order had reached Bangalore, India and 12 had reached Archerfield in Australia. It was agreed that the B-25s in Australia would be used as the nucleus of a new squadron, designated No. 18. This squadron would be staffed jointly by Australian and Dutch aircrews plus a smattering of aircrews from other nations.

It was agreed that the B-25s in Australia would be used as the nucleus of a new squadron, designated No. 18. This squadron would be staffed jointly by Australian and Dutch aircrews plus a smattering of aircrews from other nations, but would operate at least initially under Royal Australian Air Force command. However, the B-25s of No. 18 Squadron would be painted with the Dutch national insignia (at this time a rectangular Netherlands flag) and would carry NEIAF serials.

Discounting the ten "temporary" B-25s delivered to 18 Squadron in early 1942, a total of 150 Mitchells were taken on strength by the NEIAF, 19 in 1942, 16 in 1943, 87 in 1944, and 28 in 1945. They flew bombing raids against Japanese targets in the East Indies. In 1944, the more capable B-25J Mitchell replaced most of the earlier C and D models.

In June 1940, No 320 Squadron of the Royal Air Force had been formed from personnel formerly serving with the Royal Dutch Naval Air Service who had escaped to England after the German occupation of the Netherlands. Equipped with various British aircraft, No. 320 Squadron flew anti-submarine patrols, convoy escort missions, and performed air-sea rescue duties. They acquired the Mitchell II in September 1943, performing operations over Europe against gun emplacements, railway yards, bridges, troops and other tactical targets. They moved to Belgium in October 1944, and transitioned to the Mitchell III in 1945. No. 320 Squadron was disbanded in August 1945.

China Air Force

Well over 100 B-25Cs and Ds were supplied to the Nationalist Chinese during the Second World War. In addition, a total of 131 B-25Js were supplied to China under Lend-Lease.

The 4 squadrons of the 1st BG (1st, 2nd, 3rd, and 4th) of the 1st Medium Bomber Group were formed during the War. They formerly operated Russian-built Tupolev SB bombers, then transferred to the B-25. The 1st BG was under the command of CACW (Chinese-American Composite Wing) while operating B-25. Following the end of the war in the Pacific, these four bombardment squadrons were established to fight against the Communist insurgency that was rapidly spreading throughout the country. During the civil war, Chinese Mitchells fought alongside DeHavilland Mosquitos.

In December 1948, the Nationalists were forced to move to the island of Taiwan, taking many of their Mitchells with them. However, some B-25s were left behind and were impressed into service with the air force of the new People's Republic of China.

Brazilian Air Force

During the war, the Forca Aerea Brasiliera received a few B-25s under Lend-Lease. Brazil declared war against the Axis powers in August 1942. FAB B-25s participated in the war against the U-boats in the southern Atlantic. The last Brazilian B-25 was finally declared surplus in 1970.

Free French

At least 21 Mitchell IIIs were issued by the Royal Air Force to No 342 Squadron, which was made up primarily of Free French aircrews.

Following the liberation of France, this squadron was transferred to the newly formed French air force (Armee de l'Air) as GB I/20 Lorraine. These aircraft were operated by GB I/20 after the war, some being converted from bomber configuration into fast VIP transports. They were finally struck off charge in June 1947.

Empire State Building incident

On Saturday, 28 July 1945, at 0940 (while flying in thick fog), a USAAF B-25D crashed into the north side of the Empire State Building, hitting between the 79th and 80th floor. Fourteen people were killed — 11 in the building, along with Colonel William Smith and the other two occupants of the bomber. Betty Lou Oliver, an elevator attendant, survived the impact and a subsequent uncontrolled descent with the elevator. It was partly because of this incident that Towers 1 and 2 of the World Trade Center were designed to withstand the impact of a Boeing 707 aircraft (though the planes that hit the towers on September 11, 2001 had significantly higher masses and were traveling at substantially higher speeds).

Variants

B-25C Mitchell

USAAF B-25C/D. Note the early radar fitted to the nose

B-25J

B-25J warbird

B-25J N345BG '44-86777'

B-25

The first version of the B-25 delivered. No prototypes were ordered. The first nine aircraft were built with constant dihedral angle. Due to low stability, the wing was redesigned so that the dihedral was eliminated on the outboard section. (Number made: 24.)

B-25A

Version of the B-25 modified to make it combat ready; additions included self-sealing fuel tanks, crew armor, and an improved tail gunner station. No changes were made in the armament. Re-designated obsolete (**RB-25A** designation) in 1942. (Number made: 40.)

B-25B

Rear turret deleted; manned dorsal and remotely-operated ventral turrets added, each with a pair of .50 in (12.7 mm) machine guns. The ventral turret was retractable, but the increased drag still reduced the cruise speed by 30 mph (48 km/h). 23 were delivered to the RAF as the **Mitchell Mk I**. The Doolittle Raiders flew B-25Bs on their famous mission. (Number made: 120.)

B-25C

Improved version of the B-25B: powerplants upgraded from Wright R-2600-9 radials to R-2600-13s; de-icing and anti-icing equipment added; the navigator received a sighting blister; nose armament was increased to two .50 in (12.7 mm)

machine guns, one fixed and one flexible. The B-25C model was the first mass-produced B-25 version; it was also used in the United Kingdom (as the Mitchell II), in Canada, China, the Netherlands, and the Soviet Union. First mass-produced B-25 model. (Number made: 1,625.)

ZB-25C

B-25D

Identical to the B-25C, the only difference was that the B-25D was made in Kansas City, Kansas, whereas the B-25C was made in Inglewood, California. First flew on 3 January 1942. (Number made: 2,290.)

WB-25D

In 1944, four B-25Ds were converted for weather reconnaissance by the 53d Weather Reconnaissance Squadron. originally called the Army Hurricane Reconnaissance Unit, now called the "Hurricane Hunters". Weather recon first started in 1943 with the First Weather Reconnaissance Squadron, with flights on the North Atlantic ferry routes.

ZB-25D

XB-25E

Single B-25C modified to test de-icing and anti-icing equipment that circulated exhaust from the engines in chambers in the leading and trailing edges and empennage. The aircraft was tested for almost two years, beginning in 1942; while the system proved extremely effective, no production models were built that used it prior to the end of World War II. Many prop aircraft today use the XB-25E system. (Number made: 1, converted.)

ZXB-25E

XB-25F-A

Modified B-25C that tested the use of insulated electrical de-icing coils mounted inside the wing and empennage leading edges as a de-icing system. The hot air de-icing system tested on the XB-25E was more practical. (Number made: 1, converted.)

XB-25G

Modified B-25C in which the transparent nose was replaced by a solid one carrying two fixed .50 in (12.7 mm) machine guns and a 75 mm (2.95 in) M4 cannon, then the largest weapon ever carried on an American bomber. (Number made: 1, converted.)

B-25G

To satisfy the dire need for ground-attack and strafing aircraft, the B-25G was made following the success of the prototype XB-25G. The production model featured increased armor and a greater fuel supply than the XB-25G. One B-25G was passed to the British, who gave it the name **Mitchell II** that had been used for the B-25C. (Number made: 420.)

B-25H

B-25H *Barbie III* taxiing at Centennial Airport, Colorado

An improved version of the B-25G. It featured two additional fixed .50 in (12.7 mm) machine guns in the nose and four in fuselage-mounted pods; the heavy M4 cannon was replaced by a lighter 75 mm (2.95 in) T13E1. (Number made: 1,000; number left flying in the world: 1.)

B-25J
: The last production model of the B-25, often called a cross between the B-25C and the B-25H. It had a transparent nose, but many of the delivered aircraft were modified to have a solid nose. Most of its 14–18 machine guns were forward-facing for strafing missions. 316 were delivered to the Royal Air Force as the **Mitchell III**. (Number made: 4,318.)

CB-25J
: Utility transport version.

VB-25J
: A number of B-25s were converted for use as staff and VIP transports. Henry H. Arnold and Dwight D. Eisenhower both used converted B-25Js as their personal transports.

Trainer variants

Most models of the B-25 were used at some point as training aircraft.

TB-25D
: Originally designated **AT-24A** (Advanced Trainer, Model 24, Version A). Trainer modification of B-25D. In total, 60 AT-24s were built.

TB-25G
: Originally designated **AT-24B**. Trainer modification of B-25G.

TB-25C
: Originally designated **AT-24C**. Trainer modification of B-25C.

TB-25J

Originally designated AT-24D. Trainer modification of B-25J. Another 600 B-25Js were modified after the war.

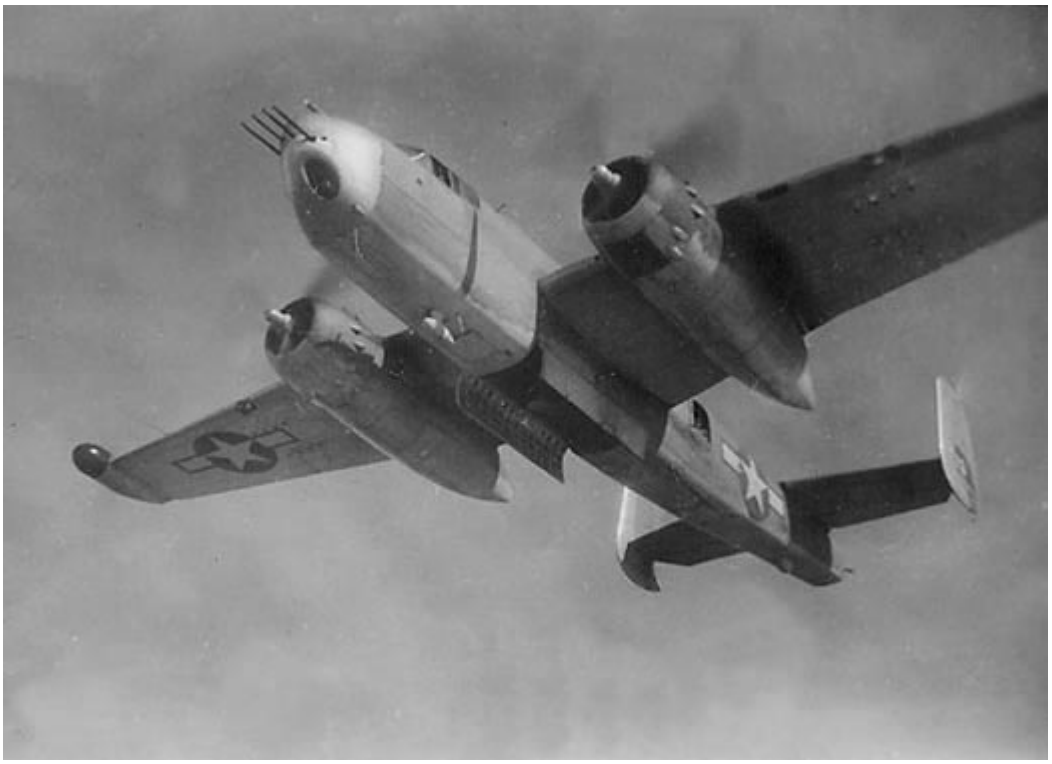
TB-25K
: Hughes E1 fire-control radar trainer (Hughes). (Number made: 117.)

TB-25L
: Hayes pilot-trainer conversion. (Number made: 90.)

TB-25M
: Hughes E5 fire-control radar trainer. (Number made: 40.)

TB-25N
: Hayes navigator-trainer conversion. (Number made: 47.)

U.S. Navy / U.S. Marine Corps variants



A PBJ-1H of VMB-613.

Two PBJ-1Js on Mindanao,1945.

PBJ-1C
: Similar to the B-25C for the US Navy; often fitted with airborne search radar and used in the anti-submarine role.

PBJ-1D
: Similar to the B-25D for the US Navy and US Marine Corps. Differed in having a single .50 in (12.7 mm) machine gun in the tail turret and beam gun positions similar to the B-25H. Often fitted with airborne search radar and used in the anti-submarine role.

PBJ-1G
: US Navy/US Marine Corps designation for the B-25G

PBJ-1H
: US Navy/US Marine Corps designation for the B-25H

PBJ-1J
: US Navy designation for the B-25J-NC (Blocks -1 through -35) with improvements in radio and other equipment. Often fitted with "package guns" and wingtip search radar for the anti-shipping/anti-submarine role.

- One PBJ-1H was modified with carrier take-off and landing equipment and successfully tested on the USS Shangri-La, but the Navy did not continue development.

Survivors

B-25D *Tondelayo*, registered N3476G and was serial number 44-28932.

North American B-25J of the Canadian Warplane Heritage Museum during the Brantford Air Show at the Brantford Airport, Brantford, Ontario, Canada

There are more than one hundred surviving B-25 Mitchells scattered over the world, mainly in the United States. Most of them are on static display in museums, but about 45 are still airworthy.

A significant number of these were brought together for just a single movie. *Catch-22* is a 1970 war film adapted from the book of the same name by Joseph Heller. When Catch-22 began preliminary production, Paramount made a decision to hire the Tallmantz Aviation organization to obtain sufficient B-25 Mitchell bomber aircraft. Tallmantz president, Frank G. Tallman ended up finding war-surplus aircraft, and eventually gathered not only pilots to fly the aircraft but also a ground support crew to maintain the fleet.

On 18 April 2010, 17 airworthy B-25s took off from the airfield behind the National Museum of the United States Air Force and flew over in formation to commemorate the 68th anniversary of the Doolittle Raid. Four of the surviving members of the Raid were in attendance for the reunion; Cole, Griffin, Hite and Thatcher, although Hite departed before the flyover. Secretary of the Air Force Michael Donley, Commander of Air Force Material Command General Donald Hoffman and the Director of the National Museum of the United States Air Force Major General (ret.) Charles Metcalf were there also.

Specifications (B-25J)

General characteristics

- **Crew:** six (one pilot, one co-pilot, navigator/bombardier, turret gunner/engineer, radio operator/waist gunner, tail gunner)
- **Length:** 52 ft 11 in (16.1 m)
- **Wingspan:** 67 ft 6 in (20.6 m)
- **Height:** 17 ft 7 in (4.8 m)
- **Wing area:** 610 sq ft (57 m²)
- **Empty weight:** 21,120 lb (9,580 kg)
- **Loaded weight:** 33,510 lb (15,200 kg)
- **Max takeoff weight:** 41,800 lb (19,000 kg)
- **Powerplant:** 2× Wright R-2600 "Cyclone" radials, 1,850 hp (1,380 kW) each

Performance

- **Maximum speed:** 275 mph (239 kn, 442 km/h)
- **Cruise speed:** 230 mph (200 kn, 370 km/h)
- **Combat radius:** 1,350 mi (1,170 nmi, 2,170 km)
- **Ferry range:** 2,700 mi (2,300 nmi, 4,300 km)
- **Service ceiling:** 25,000 ft (7,600 m)
- **Rate of climb:** 790 ft/min (4 m/s)
- **Wing loading:** 55 lb/ft² (270 kg/m²)
- **Power/mass:** 0.110 hp/lb (182 W/kg)

Armament

- **Guns:** 12-18 × .50 in (12.7 mm) machine guns
- **Hardpoints:** 2,000 lb (900 kg) ventral shackles to hold one external Mark 13 torpedo
- **Rockets:** 3,000 lb (1,360 kg) bombs + eight 5 in (130 mm) high velocity aircraft rockets (HVAR)
- **Bombs:** 6,000 lb (2,700 kg)

Chapter-4

Martin B-26 Marauder

B-26 Marauder

A US Army Air Forces B-26B with D-Day invasion stripes

Role	Medium bomber
National origin	United States
Manufacturer	Glenn L. Martin Company
First flight	25 November 1940
Introduced	1941
Status	Retired
Primary users	United States Army Air Forces United States Army Air Corps Royal Air Force South African Air Force
Produced	1941–1945
Number built	5,288
Unit cost	$102,659.33/B-26A
Developed into	XB-33 Super Marauder (Unbuilt)

The **Martin B-26 Marauder** was a World War II twin-engine medium bomber built by the Glenn L. Martin Company. First used in the Pacific Theater in early 1942, it was also used in the Mediterranean Theater and in Western Europe.

After entering service with the U.S. Army, the aircraft got a reputation as the "Widowmaker " due to the early models' high rate of accidents during takeoff and landings. The Marauder had to be flown by exact airspeeds, particularly on final approach and when one engine was out. The 150 mph (241 km/h) speed on short final was intimidating to pilots who were used to much slower speeds, and whenever they slowed down below what the manual stated, the aircraft would stall-out and crash. The B-26 became a safer aircraft once crews were re-trained and after aerodynamics modifications (increase of wing span and incidence, to give better take off performance, and a larger fin and rudder). After aerodynamic and design changes, the aircraft distinguished itself as "the chief bombardment weapon on the Western Front" according to a United States Army Air Forces dispatch from 1946. The Marauder ended World War II with the lowest loss rate of any USAAF bomber.

A total of 5,288 were produced between February 1941 and March 1945; 522 of these were flown by the Royal Air Force and the South African Air Force. By the time the United States Air Force was created as an independent service separate from the Army in 1947, all Martin B-26s had been retired from US service. The Douglas A-26 Invader then assumed the B-26 designation.

Design and development

In March 1939, the United States Army Air Corps issued Circular Proposal 39-640, a specification for a twin-engined medium bomber, demanding a maximum speed of 350 mph (560 km/h), a range of 3,000 mi (4,800 km) and a bomb load of 2,000 lb (910 kg). On 5 July 1939, the Glenn L. Martin Company submitted its design, produced by a team led by Peyton M. Magruder, to meet the requirement, the Martin Model 179. Martin's design was evaluated as superior to the other proposals and was awarded a contract for 201 aircraft, to be designated B-26. The B-26 went from paper concept to an operational bomber in approximately two years. Additional orders for a further 930 B-26s followed in September 1940, still prior to the first flight of the type.

Closeup view of Martin B-26C in flight.

The B-26 was a shoulder-winged monoplane of all metal construction, fitted with a tricycle undercarriage. It had a streamlined, circular section fuselage, housing the crew, consisting of a bombardier in the nose, which was armed with a .30 in (7.62 mm) machine gun, a pilot and co-pilot sitting side by side, with positions for radio operator and navigator behind the pilots. A gunner manned a dorsal turret armed with two .50 in (12.7 mm) machine guns (the first powered dorsal turret to be fitted to a US bomber), while an additional .30 in (7.62 mm) machine gun was fitted in the tail.

Two bomb bays were fitted mid-fuselage, capable of carrying 5,800 lb (2,600 kg) of bombs, although in practice such a bombload reduced range too much, and the aft bomb bay was usually fitted with additional fuel tanks instead of bombs. It was powered by two Pratt & Whitney R-2800 Double Wasp radial engines in nacelles slung under the wing, driving four-bladed propellers. The wings were of low aspect ratio and relatively small area for an aircraft of its weight, giving the required high performance, but also resulting in a wing loading of 53 lb/sq ft (259 kg/m²) for the initial versions, which at the time was the highest of any aircraft accepted for service by the Army Air Force.

The first B-26, with Martin test pilot William K. "Ken" Ebel at the controls, flew on 25 November 1940 and was effectively the prototype. Deliveries to the U.S. Army Air Corps

began in February 1941 with the second aircraft, *40-1362*. In March 1941, the Army Air Corps started Accelerated Service Testing of the B-26 at Patterson Field, Ohio.

Accidents

While the B-26 was a fast aircraft with better performance than the contemporary B-25 Mitchell, its relatively small wing area and resulting high wing loading (the highest of any aircraft used at that time) required an unprecedented landing speed of 120 to 135 mph (190 to 217 km/h) indicated airspeed depending on load. At least two of the earliest B-26s suffered hard landings and damage to the main landing gear, engine mounts, propellers and fuselage. The type was grounded briefly in April 1941 to investigate the landing difficulties. Two causes were found: insufficient landing speed (producing a stall) and improper weight distribution. The latter was due to the lack of a dorsal turret; the Martin power turret was not ready yet.

Some of the very earliest B-26s suffered collapses of the nose landing gear. It is said that they were caused by improper weight distribution but that is probably not the only reason. They occurred during low-speed taxiing, takeoffs and landings, and occasionally the strut unlocked. Later the Martin electric turret was retrofitted to some of the first B-26s. Martin also began testing a taller vertical stabilizer and revised tail gunner's position in 1941. The Pratt & Whitney R-2800 engines were reliable but the Curtiss electric pitch change mechanism in the propellers required impeccable maintenance. Human error and some failures of the mechanism occasionally placed the propeller blades in flat pitch and resulted in an overspeeding propeller, sometimes known as a "runaway prop". Due to its sound and the possibility that the propeller blades could disintegrate, this situation was particularly frightening for aircrews. More challenging was a loss of power in one engine during takeoff. These and other malfunctions, as well as human error, claimed a number of aircraft and the commanding officer of the 22nd Bombardment Group, Col. Mark Lewis.

The Martin B-26 suffered only two fatal accidents during its first year of flights, November 1940 – November 1941: a crash shortly after takeoff near Martin's Middle River plant (cause unknown but engine malfunction strongly suggested) and the loss of a 38th Bombardment Group B-26 when its vertical stabilizer and rudder separated from the aircraft at altitude (cause unknown, but accident report discussed the possibility that a canopy hatch broke off and struck the vertical stabilizer).

The B-26 was not an aircraft for novices. Unfortunately, due to the need of training many pilots quickly for the war, a number of relatively inexperienced pilots got into the cockpit and the accident rate increased accordingly. This occurred at the same time as more experienced B-26 pilots of the 22nd, 38th and 42d Bombardment Groups were proving the merits of the bomber.

For a time in 1942, pilots in training believed that the B-26 could not be flown on one engine. This was disproved by a number of experienced pilots, including Jimmy Doolittle.

In 1942, Senator Harry Truman was a leading member of the Senate Special Committee to Investigate the National Defense Program (the so-called Truman Committee), which was investigating defense contracting abuses. When Truman and other committee members arrived at the Avon Park Army Air Field in Florida, they were greeted by the still-burning wreckage of *two* crashed B-26s. Truman criticized both Glenn L. Martin and the B-26. Indeed, the regularity of crashes by pilots training at nearby MacDill Field—up to 15 in one 30-day period—led to the exaggerated catchphrase, "One a day in Tampa Bay." Apart from accidents occurring over land, 13 Marauders ditched in Tampa Bay in the 14 months between the first one on 5 August 1942 to the final one on 8 October 1943.

The B-26 received the nickname "Widowmaker". Other colorful nicknames included "Martin Murderer", "Flying Coffin", "B-Dash-Crash", "Flying Prostitute" (so-named because it had "no visible means of support," referring to its small wings) and "Baltimore Whore" (a reference to the city where Martin was based).

According to an article in the April 2009 edition of *AOPA Pilot* on Kermit Weeks' "Fantasy of Flight", the Marauder had a tendency to "hunt" in yaw. This instability is similar to "Dutch roll". This would make for a very uncomfortable ride, especially for the tail gunner.

The B-26 is said, by the 9th Air Force, to have had the lowest combat loss rate of any U.S. aircraft used during the war. Nevertheless, it remained a challenging aircraft to fly and continued to be unpopular with some pilots throughout its military career. In 1944 in answer to a lot of pilots complaining to the press and their relatives back home, the USAAF and Martin took the unusual step during a war, and commissioned large articles to be placed in various popular publications "educating" and defending the so called flying/accident record of the B-26 against "slanders". One of the largest of these articles was in the May 1944 issue of Popular Mechanics.

Operational history

Royal Air Force B-26 flying over Banja Luka during World War II.

The B-26 Marauder was used mostly in Europe but also saw action in the Mediterranean and the Pacific. In early combat the aircraft took heavy losses but was still one of the most successful medium-range bombers used by the U.S. Army Air Forces. The B-26 was initially deployed on combat missions in the South West Pacific in the spring of 1942, but most of the B-26s subsequently assigned to operational theaters were sent to England and the Mediterranean area.

By the end of World War II, it had flown more than 110,000 sorties and had dropped 150,000 tons (136,078 tonnes) of bombs, and had been used in combat by British, Free French and South African forces in addition to U.S. units. In 1945, when B-26 production was halted, 5,266 had been built.

Pacific theatre

The B-26 began to equip the 22d Bombardment Group at Langley Field, Virginia in February 1941, replacing the B-18 Bolo, with a further two Bombardment groups equipping with the B-26 by December. Immediately following the Japanese Attack on Pearl Harbor, the 22d was deployed to the South West Pacific, being sent by ship to

Hawaii and then flown to Australia. The 22d flew its first combat mission, an attack on Rabaul which required an intermediate stop at Port Moresby, New Guinea, on 5 April 1942.

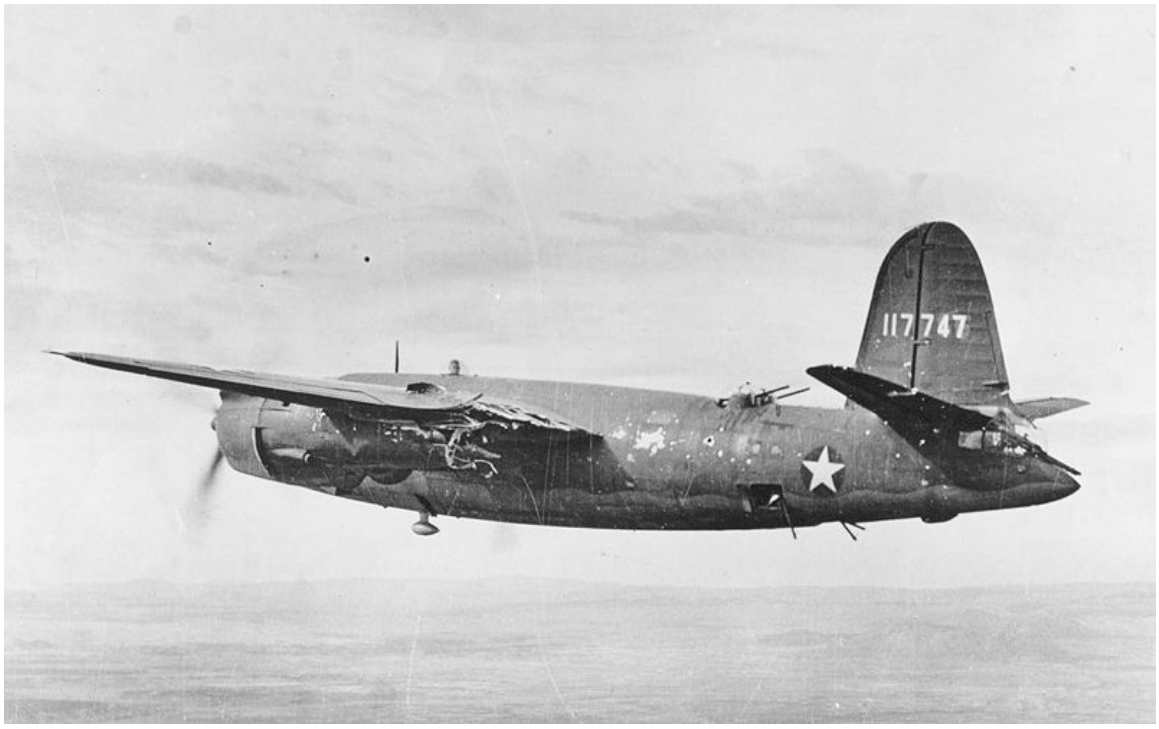
A second Group, the 38th Bombardment Group, received B-26s in November 1941. Immediately after the entry of the United States into World War II, plans to be send the 38th BG to the South West Pacific, to be equipped with B-26Bs fitted with more auxiliary fuel tanks and provisions for carrying aerial torpedos, were tentatively developed. Four of these aircraft were deployed to Midway Island in the build-up to the Battle of Midway, and carried out torpedo attacks against the Japanese Fleet on 4 June 1942. Two B-26s were shot down with the remaining two badly damaged, while their torpedoes failed to hit any Japanese ships, although they did shoot down one A6M Zero fighter, and killed two seamen aboard the aircraft carrier *Akagi* with machine gun fire.

Two squadrons were detached from the 38th BG (which was converting to the B-25) in May 1942 and deployed to Australia to join the 22d, but it was decided to standardize on the B-25 Mitchell in the South West Pacific theatre. The B-26 flew its last combat missions in the theatre on 9 January 1944. Two more squadrons of torpedo armed Marauders were used for anti-shipping operations in the Aleutian Islands Campaign, but there are no records of any successful torpedo attack by a USAAF B-26.

Mediterranean theatre

Three Bombardment Groups were allocated to support the Allied invasion of French North Africa in November 1942. They were initially used to carry out low-level attacks against heavily defended targets, receiving heavy losses with poor results, before switching to medium level attacks. By the end of the North Africa campaign, the three B-26 groups had flown 1,587 sorties, losing 80 aircraft. This was double the loss rate of the B-25, which also flew 70% more sorties with fewer aircraft. Despite this, the B-26 continued in service with the Twelfth Air Force, supporting the Allied advance through Sicily, Italy and Southern France. Air Marshall Slessor considered the 42nd Bombardment Group (Marauders) to be the "best day-bomber unit in the world."

North West Europe



A B-26B with extensive flak damage over Europe, September 1943.

The B-26 entered service with the Eighth Air Force in England in early 1943, with the 322d Bombardment Group flying its first missions in May 1943. Missions were similar to those flown in North Africa with B-26s flying at low level and were unsuccessful. The second mission, an unescorted attack on a power station at IJmuiden, Netherlands resulted in the loss of the entire attacking force of 11 B-26s to anti-aircraft fire and *Luftwaffe* Focke-Wulf Fw 190 fighters. Following this disaster, the UK-based B-26 force was switched to medium altitude operations, and transferred to the Ninth Air Force, set up to support the planned Invasion of France.

Bombing from medium altitudes of 10,000 to 15,000 feet (3,000 to 4,600 m) and with appropriate fighter escort, the Marauder proved far more successful, striking against a variety of targets, including bridges and V-1 launching sites in the build-up to D-Day, and moving to bases in France as they became available. The Marauder operating from medium altitude proved to be a highly accurate bomber, with the 9th Air Force rating it the most accurate bomber available in the final month of the war in Europe. Loss rates were far lower than in the early, low-level days, with the B-26 stated by the 9th Air Force as having the lowest loss rate in the European Theatre of Operations at less than 0.5 %.

The B-26 flew its last combat missions against the German garrison at the Île d'Oléron on 1 May 1945, with the last units disbanding in early 1946.

British Commonwealth

In 1942, a batch of 52 B-26A Marauders (designated Marauder I by the RAF) were offered to the United Kingdom under Lend-Lease. Like the earlier Martin Maryland and Baltimore bombers, these were sent to the Mediterranean, replacing the Bristol Blenheims of No. 14 Squadron in Egypt. No. 14 Squadron flew its first operational mission on 6 November 1942, being used for long range reconnaissance, mine-laying and anti-shipping strikes. Unlike the USAAF, 14 Squadron made productive use of the option for carrying torpedoes, sinking several merchant ships with this weapon. The Marauder also proved useful in disrupting enemy air transport, shooting down considerable numbers of German and Italian transport aircraft flying between Italy and North Africa.

In 1943, deliveries of 100 long wingspan B-26C-30s (Marauder II), allowed two squadrons of the South African Air Force, 12 and 24 Squadron, these being used for bombing missions over the Aegean, Crete and Italy. A further 350 B-26F and Gs were supplied in 1944, with two more South African Squadrons (24 and 30) joining No 12 and 24 in Italy to form an all Marauder wing, while one further SAAF squadron (25) and a new RAF Squadron (39 Squadron) re-equipped with Marauders as part of the Balkan Air Force supporting Tito's Partisans in Yugoslavia. A Marauder of 25 Squadron SAAF, lost on the unit's last mission of the Second World War on 4 May 1945, was the last Marauder to be lost in combat by any user. The British and South African aircraft were quickly scrapped following the end of the war, the United States not wanting the return of the Lend-Lease aircraft.

France

Following Operation Torch, a number of French bomber squadrons were re-equipped with the B-26, being used to support operations in Italy and the Allied invasion of southern France. Replaced in squadron service by 1947, two lingered on as testbeds for the SNECMA Atar jet engine, one of these remaining in use until 1958.

Variants

U.S. Army Air Forces B-26B bomber in flight.

The lone XB-26H, used for testing "bicycle" landing gear.

- **B-26**—The first produced model of the B-26, ordered based upon design alone. The armament on this model consisted of two .30 caliber and two .50 caliber machine guns. (The last model was armed with nearly three times that number.) Approximate cost then: $80,226.80/aircraft.
- **B-26A**—Incorporated changes made on the production line to the B-26, including upgrading the two .30 caliber machine guns in the nose and tail to .50 caliber. A total of 52 B-26As were sent to the United Kingdom, which were used as the **Marauder Mk I**. Approximate cost then: $102,659.33/aircraft (×139)
- **B-26B**—Model with further improvements on the B-26A. Nineteen were sent to the United Kingdom, which were used as the **Marauder Mk.IA**. Production blocks of the 1,883 aircraft built:
    - **AT-23A** or **TB-26B**—208 B-26Bs converted into target tugs and gunnery trainers designated **JM-1** by the Navy.
    - **B-26B**—Single tail gun replaced with twin gun; belly-mounted "tunnel gun" added. (×81)
    - **B-26B-1**—Improved B-26B. (×225)
    - **B-26B-2**—Pratt & Whitney R-2800-41 radials. (×96)
    - **B-26B-3**—Larger carburetor intakes; upgrade to R-2800-43 radials. (×28)
    - **B-26B-4**—Improved B-26B-3. (×211)

    - **B-26B-10 through B-26B-55**—Beginning with block 10, the wingspan was increased from 65 feet (20 m) to 71 feet (22 m), to improve handling problems during landing caused by a high wing load; flaps were added outboard of the engine nacelles for this purpose also. The vertical stabiliser height was increased from 19 feet 10 inches (6.05 m) to 21 feet 6 inches (6.55 m). The armament was increased from six to twelve .50 caliber machine guns; this was done in the forward section so that the B-26 could perform strafing missions. The tail gun was upgraded from manual to power operated. Armor was added to protect the pilot and copilot. (×1,242)
    - **CB-26B**—12 B-26Bs were converted into transport aircraft (all were delivered to the US Marine Corps for use in the Philippines).
- **B-26C**—Designation assigned to those B-26Bs built in Omaha, Nebraska instead of Baltimore, Maryland. Although nominally the B-26B-10 was the first variant to receive the longer wing, it was actually installed on B-26Cs before the B-26B-10, both being in production simultaneously. 123 B-26Cs were used by the RAF as the **Marauder Mk II**. Approximate cost then: $138,551.27/aircraft (×1,210)
    - **TB-26C**—Originally designated **AT-23B**. Trainer modification of B-26C. (×>300)
- **XB-26D**—Modified B-26 used to test hot air de-icing equipment, in which heat exchangers transferred heat from engine exhaust to air circulated to the leading and trailing edges of the wing and empennage surfaces. This system, while promising, was not incorporated into any production aircraft made during World War II. (×1, converted)
- **B-26E**—Modified B-26B constructed to test the effectiveness of moving the dorsal gun turret from the aft fuselage to just behind the cockpit. The offensive and defensive abilities of the B-26E was tested against in combat simulations against normal aircraft. Although test showed that gains were made with the new arrangement, the gain was insignificant. After a cost analysis, it was concluded that the effort needed to convert production lines to the B-26E arrangement was not worth the effort. (×1, converted)
- **B-26F**—Angle of incidence of wings increased by 3.5º; fixed .50 caliber machine gun in nose removed; tail turret and associated armour improved. The first B-26F was produced in February 1944. One hundred of these were B-26F-1-MAs. Starting with 42-96231, a revised oil cooler was added, along with wing bottom panels redesigned for easier removal. A total of 200 of the 300 aircraft were B-26F-2s and F-6s, all of which were used by the RAF as the **Marauder Mk III**. The Marauder III carried the RAF serials HD402 through HD601 (ex-USAAF serials *42-96329* through *96528*). The F-2 had the Bell M-6 power turret replaced by an M-6A with a flexible canvas cover over the guns. The T-1 bombsight was installed instead of the M-series sight. British bomb fusing and radio equipment were provided. (×300)
- **B-26G**—B-26F with standardized interior equipment. A total of 150 bombers were used by the RAF as the **Marauder Mk III**. (×893)
    - **TB-26G**—B-26G converted for crew training. Most, possibly all, were delivered to the United States Navy as the **JM-2**. (×57)

- **XB-26H**—Test aircraft for tandem landing gear, and nicknamed the "Middle River Stump Jumper" from its "bicycle" gear configuration, to see if it could be used on the Martin XB-48. (×1, converted)
- **JM-1P**—A small number of JM-1s were converted into photo-reconnaissance aircraft.

With the exception of the B-26C, all models and variants of the B-26 were produced at Martin's Middle River, Maryland manufacturing plant. The B-26C was built at the Martin plant in Omaha, Nebraska

Survivors

United States

On display

- B-26 (s/n 40-1464), part of the Fantasy of Flight collection in Polk City, Florida. This aircraft is reported to be maintained in flying condition, though it has not flown in several years.
- B-26B (s/n 41-31773) *Flak Bait*. The nose section is on display at the National Air and Space Museum, Washington DC. The remainder (mid and tail fuselage sections, wings, engines, and empennage) are stored at NASM's Paul E. Garber facility in Suitland, MD. This aircraft survived 207 operational missions over Europe, more than any other American aircraft during World War II and will, one day, be restored and displayed at NASM's Steven F. Udvar-Hazy Center at Washington Dulles International Airport, Virginia.
- B-26G (s/n 43-34581) *Shootin In* is on display at the National Museum of the United States Air Force in Dayton, Ohio. This aircraft was flown in combat by the Free French during the final months of World War II. It was obtained from the French airline Air France training school near Paris in June 1965. It is painted as a 9th Air Force B-26B assigned to the 387th Bomb Group in 1945.

Under restoration

- B-26 (s/n 40-1370) is under restoration at Hill Aerospace Museum, Hill Air Force Base, Utah.
- B-26 (s/n 40-1459) is under restoration to flying condition at the MAPS Air Museum in Akron, OH.
- B-26 (s/n 40-1501) is under restoration (wings only, remainder of restoration consists of parts from three unidentified airframes) at Pima Air & Space Museum in Tucson, AZ.

Wreck or in storage

- B-26 (s/n 40-1426) is a derelict on Trobriand Islands.

- B-26B (s/n 41-31856) (nose section only) is stored by Carl Scholl in Ocotillo Wells, California and restoration is to be done by Kermit Weeks of Polk City, FL.
- B-26C (s/n 41-35071) *Carolyn* was in flying condition with the Commemorative Air Force in Midland, TX until it was destroyed in a crash on 28 September 1995.
- B-26C (s/n 41-35075) (nose section only) is stored by Carl Scholl in Ocotillo Wells, California and restoration is to be done by Kermit Weeks of Polk City, FL.

France

On display

- B-26G (s/n 44-68219) is on display at the Musée de l'Air et de l'Espace in Le Bourget, France. It was also recovered from the Air France training school.

Specifications (B-26G)

Martin B-26G Marauder at the National Museum of the United States Air Force.

General characteristics

- **Crew:** 7: (2 pilots, bombardier, navigator/radio operator, 3 gunners)
- **Length:** 58 ft 3 in (17.8 m)

- **Wingspan:** 71 ft 0 in (21.65 m)
- **Height:** 21 ft 6 in (6.55 m)
- **Wing area:** 658 ft^2 (61.1 m^2)
- **Empty weight:** 24,000 lb (11,000 kg)
- **Loaded weight:** 37,000 lb (17,000 kg)
- **Powerplant:** 2× Pratt & Whitney R-2800-43 radial engines, 1,900 hp (1,400 kW) each

Performance

- **Maximum speed:** 287 mph (250 knots, 460 km/h) at 5,000 feet (1,500 m)
- **Cruise speed:** 216 mph (188 knots, 358 km/h
- **Landing speed:** 114 mph (90 knots, 167 km/h))
- **Combat radius:** 1,150 mi (999 nmi, 1,850 km)
- **Ferry range:** 2,850 mi (2,480 nmi, 4,590 km)
- **Service ceiling:** 21,000 ft (6,400 m)
- **Wing loading:** 46.4 lb/ft² (228 kg/m²)
- **Power/mass:** 0.10 hp/lb (170 W/kg)

Armament

- **Guns:** 12 × .50 in (12.7 mm) Browning machine guns
- **Bombs:** 4,000 pounds (1,800 kg)

Chapter-5

Boeing B-29 Superfortress

B-29 Superfortress

A USAAF B-29 Superfortress

Role	Strategic bomber
Manufacturer	Boeing
First flight	21 September 1942
Introduced	8 May 1944
Retired	21 June 1960
Status	Scrapped except for those in museums
Primary users	United States Army Air Forces United States Air Force Royal Air Force
Produced	1943–1946
Number built	3,970
Unit cost	US$639,188 ($8.62 million in today's dollars)
Variants	All models KB-29 Superfortress XB-39 Superfortress XB-44 Superfortress B-50 Superfortress

Tupolev Tu-4

The **Boeing B-29 Superfortress** was a four-engine propeller-driven heavy bomber that was flown primarily by the United States in World War II and the Korean War. The B-29 remained in service in various roles throughout the 1950s. The British Royal Air Force flew the B-29 and used the name **Washington** for the type, and the Soviet Union produced an unlicensed copy as the Tupolev Tu-4. The name "Superfortress" was derived from that of its well-known predecessor, the B-17 Flying Fortress. The B-29 was the progenitor of a series of Boeing-built bombers, reconnaissance aircraft, trainers and tankers including the B-29 variant, B-50 Superfortress. Later jet-powered models from Boeing (the B-47 Stratojet and the B-52 Stratofortress) carried on the lineage.

The B-29 was one of the largest aircraft to see service during World War II. A very advanced bomber for this time period, it included features such as a pressurized cabin, an electronic fire-control system, and remote-controlled machine-gun turrets. Though it was designed as a high-altitude daytime bomber, in practice it actually flew more low-altitude nighttime incendiary bombing missions. It was the primary aircraft in the American firebombing campaign against the Empire of Japan in the final months of World War II, and carried the atomic bombs that destroyed Hiroshima and Nagasaki. Unlike many other World War II-era bombers, the B-29 remained in service long after the war ended, with a few even being employed as flying television transmitters for the Stratovision company. The type was finally retired in the early 1960s, with 3,960 aircraft in all built.

Design and development

YB-29 Superfortresses in flight

Boeing began work on pressurized long-range bombers in 1938, when, in response to a United States Army Air Corps request, it produced a design study for the Model 334, a pressurized derivative of the Boeing B-17 Flying Fortress with nosewheel undercarriage. Although the Air Corps did not have money to pursue the design, Boeing continued development with its own funds as a private venture, so that when, in December 1939, the Air Corps issued a formal specification for a so called "superbomber", capable of delivering 20,000 lbs of bombs to a target 2,667 mi (4,290 km) away and capable of flying at a speed of 400 mph (640 km/h), they formed a starting point for Boeing's response.

Boeing submitted its Model 345 on 11 May 1940, in competition with designs from Consolidated Aircraft (the Model 33, later to become the B-32), Lockheed (the Lockheed XB-30), and Douglas (the Douglas XB-31). Douglas and Lockheed soon abandoned work on their projects, but Boeing received an order for two flying prototypes, given the designation XB-29, and an airframe for static testing on 24 August 1940, with the order being revised to add a third flying aircraft on 14 December. Consolidated continued to work on its Model 33 as it was seen by the Air Corps as a backup in case of problems with Boeing's design. An initial production order for 14 service test aircraft and 250

production bombers was placed in May 1941, this being increased to 500 aircraft in January 1942.

Manufacturing the B-29 was a complex task. It involved four main-assembly factories: a pair of Boeing operated plants at Renton, Washington, and Wichita, Kansas, a Bell plant at Marietta, Georgia ("Bell-Atlanta"), and a Martin plant at Omaha, Nebraska ("Martin-Omaha"). Thousands of subcontractors were involved in the project. The first prototype made its maiden flight from Boeing Field, Seattle on 21 September 1942. Because of the aircraft's highly advanced design, challenging requirements, and immense pressure for production, development was deeply troubled. The second prototype, which unlike the unarmed first was fitted with a Sperry defensive armament system using remote controlled gun turrets sighted by periscopes, first flew on 30 December 1942, this flight being terminated due to a serious engine fire. On 18 February 1943 the second prototype crashed during its second test flight, an engine fire spreading to the wing, and causing the aircraft to crash into a factory just short of the runway, killing the entire 10 man crew and 20 others on the ground. Changes to the production craft came so often and so fast that in early 1944, B-29s flew from the production lines directly to modification depots for extensive rebuilds to incorporate the latest changes. The Air Force operated modification depots struggled to cope with the scale of work required, with a lack of hangars capable of housing the B-29 combined with freezing cold weather further delaying the modification, such that at the end of 1943, although almost 100 aircraft had been delivered, only 15 percent were airworthy. This prompted an intervention by General Hap Arnold to resolve the problem, with production personnel being sent from the factories to the modification centres to speed modification of sufficient aircraft to equip the first Bomb Groups in what became known as the "Battle of Kansas". This resulted in 150 aircraft being modified in the six weeks between 10 March and 15 April 1944. It was still nearly a year before the aircraft operated reliably.

The most common cause of maintenance headaches and catastrophic failures was the engine. Though the Wright R-3350 later became a trustworthy workhorse in large piston-engined aircraft, early models were beset with dangerous reliability problems, many caused by demands that the B-29 be put in operation as soon as possible. It had an impressive power-to-weight ratio, but this came at a heavy cost to durability. Worse, the cowling Boeing designed for the engine was too close (out of a desire for improved aerodynamics), and the early cowl flaps caused problematic flutter and vibration when open in most of the flight envelope. The 18 radial cylinders, compactly arranged in front and rear rows, overheated because of insufficient flow of cooling air, which in turn caused exhaust valves to unseat.

Interior photo of the rear pressurized cabin of the B-29 Superfortress, June 1944

These weaknesses combined to make an engine that overheated regularly at combat weights, particularly during climbs after takeoff. Unseated valves released fuel-air mixtures during engine combustion, which acted as blowtorches against the valve stems. When these burned through the engines disintegrated and caught fire. A fire that was not immediately contained in the forward part of the engine by fire extinguishers became impossible to put out. An accessory housing manufactured of magnesium alloy in the back of the engine often caught fire and produced heat so intense it burned through the firewall to the main wing spar in no more than 90 seconds, causing catastrophic wing failure.

This problem was not fully cured until the aircraft was fitted with the more powerful Pratt & Whitney R-4360 "Wasp Major" in the B-29D/B-50 program, which arrived too late for World War II. Interim measures included cuffs placed on propeller blades to divert a greater flow of cooling air into the intakes, which had baffles installed to direct a stream of air onto the exhaust valves. Oil flow to the valves was also increased, asbestos baffles installed around rubber push rod fittings to prevent oil loss, thorough pre-flight inspections made to detect unseated valves, and frequent replacement of the uppermost five cylinders (every 25 hours of engine time) and the entire engines (every 75 hours).

Pilots, including the present day pilots of the Commemorative Air Force's *Fifi*, the last-remaining flying B-29, describe flight after takeoff as being an urgent struggle for airspeed (generally, flight after takeoff should consist of striving for altitude). Radial engines need airflow to keep them cool, and failure to get up to speed as soon as possible could result in an engine failure and risk of fire. One useful technique was to check the magnetos while already rolling rather than from a "braked" start.

In wartime, the B-29 was capable of flight up to 40,000 feet (12,000 m), at speeds of up to 350 mph (true airspeed). This was its best defense, because Japanese fighters of that day could barely get that high, and few could catch the B-29, even if they were at altitude and waiting. Only the heaviest of anti-aircraft weapons could reach it, and since the Axis forces did not have proximity fuzes, hitting or damaging the airplane from the ground in combat was next to impossible.

With the revolutionary Central Fire Control System (CFCS), the B-29 had four remote controlled turrets, each armed with two .50 cal M2/AN machine guns. Four gunners were able to control these turrets with the use of four General Electric-made analog computers, one above the Norden bombsight in the nose and three in a pressurized compartment in the rear fuselage, which featured clear blown sighting blisters. The gunner manning the sight in the upper rear station was the "Central Fire Control gunner" whose job was to allocate turrets to each of the other three gunners, avoiding confusion in the heat of battle. The CFCS had (at that time) a highly advanced analog computer that corrected for the B-29's airspeed, the target's speed, target lead, gravity, temperature and humidity. Because of this, the .50 caliber machine guns of the B-29 had a maximum effective range of 1,000 yards (910 m), double the range of the manually aimed machine guns of the B-17 Flying Fortress. The tail gunner could only control his own weapons (two M2/AN Brownings plus, in early production B-29s, a 20 mm M2 cannon) and the lower rear turret. After World War II, the tail guns eventually got their own APG-15 gun control radar sets.

In early 1945, with a change of role from high altitude day bomber to low altitude night bomber, LeMay reportedly ordered the removal of most of the defensive armament and remote controlled sighting equipment from his B-29s so that they could carry greater fuel and bomb loads.As a consequence of this requirement, Bell Marietta (BM) produced a series of 311 B-29Bs that had turrets and sighting equipment removed, except for the tail position, which initially had the two .50 cal Browning machine guns and single M2 cannon with the APG-15 radar fitted as standard. This armament was quickly changed to

three .50 caliber Brownings. This version also had an improved APQ-7 "Eagle" bombing-through-overcast radar fitted in an airfoil shaped radome under the fuselage. Most of these aircraft were assigned to the 315th Bomb Wing, Northwest Field, Guam.

The crew enjoyed, for the first time in a bomber, full-pressurization comfort. This first-ever cabin pressure system for an Allied production bomber was developed for the B-29 by Garrett AiResearch. The nose and the cockpit were pressurized, but the designers were faced with deciding whether to have bomb bays that were not pressurized, between fore and aft pressurized sections, or a fully pressurized fuselage with the need to de-pressurize to drop their loads. The decision was taken to have a long tunnel over the two bomb bays so that crews could crawl back and forth between the fore and aft sections, with both areas and the tunnel pressurized. The bomb bays were not pressurized.

Flying characteristics

A Superfortress returns from a training mission, to its base at this Training Command B-29 Transition School

In flight, the pilot called for engine and flap settings instead of moving the throttles and the flap levers himself. Another innovation was the number of calculations the crew had to perform before and during the mission. Prior to the B-29, flight manuals provided only approximate performance figures and pilots relied largely on instinct and experience. The B-29 manual had charts to compute takeoff and landing speeds based on weight, elevation and temperature. Finding the optimum power settings for cruise required

consideration of cruise altitude, outside temperature, aircraft weight, and desired true airspeed. The power settings were recalculated every two hours or with every change in altitude. These types of computations are routine in modern civil and military aviation, but they were an innovation in 1944. The benefits of improved range and performance were irrefutable.

Unlike aircraft such as the B-24 Liberator, the B-29 lacked boosted controls. As a consequence they required considerable physical strength to operate. As it was, most aircrews found the B-29 to be relatively mild-mannered.

Though it could be flown with only two engines once airborne, the bomber suffered from engine overheating issues throughout its service, and several B-29s crashed in Saipan after single engine failures on takeoff at full gross weight.

Operational history

World War II

Enola Gay, a Silverplate version of the Boeing B-29 Superfortress landing after delivering Little boy over Hiroshima

The initial plan, implemented at the direction of President Franklin D. Roosevelt as a promise to China and called Operation Matterhorn, was to use B-29s to attack Japan from four forward bases in southern China, with five main bases in India, and to attack other

targets in the region from China and India as needed. The Chengdu region was eventually chosen over the Guilin region to avoid having to raise, equip, and train 50 Chinese divisions to protect the advanced bases from Japanese ground attack. The XX Bomber Command, initially intended to be two combat wings of four groups each, was reduced to a single wing of four groups because of the lack of availability of aircraft, automatically limiting the effectiveness of any attacks from China.

This was an extremely costly scheme, as there was no overland connection available between India and China, and all supplies had to be flown over the Himalayas, either by transport aircraft or by the B-29s themselves, with some aircraft being stripped of armor and guns and used to deliver fuel. B-29s started to arrive in India in early April 1944. The first B-29 flight to airfields in China (over the Himalayas, or "The Hump") took place on 24 April 1944. The first B-29 combat mission was flown on 5 June 1944, with 77 out of 98 B-29s launched from India bombing the railroad shops in Bangkok and Thailand. Five B-29s were lost during the mission, not to hostile fire.

Forward base in China

On 15 June 1944, 68 B-29s took off from bases around Chengdu, China, 47 of which reached and bombed the Imperial Iron and Steel Works at Yawata Japan. This was the first attack on Japanese islands since the Doolittle raid in April 1942. The first B-29 combat losses occurred during this raid, with one B-29 destroyed on the ground by Japanese fighters after an emergency landing in China, one lost to anti-aircraft fire over Yawata, and another, the *Stockett's Rocket* (after Capt. Marvin M. Stockett, Aircraft Commander)B-29-1-BW 42-6261, disappeared after takeoff from Chakulia, India, over the Himalayas (12 KIA, 11 crew and one passenger)(Source: 20th Bomb Group Assn.) This raid, which did little damage to the target, with only one bomb striking the target factory complex, nearly exhausted fuel stocks at the Chengdu B-29 bases, resulting in a slow-down of operations until the fuel stockpiles could be replenished. Starting in July, the raids against Japan from Chinese airfields continued at relatively low intensity. Japan was bombed on: 7 July 1944 (14 B-29s), 29 July (70+), 10 August (24), 20 August (61), 8 September (90), 26 September (83), 25 October (59), 12 November (29), 21 November (61), 19 December (36) and for the last time on 6 January 1945 (49).

The tactic of using aircraft to ram American B-29s was first recorded on the 20 August raid on the steel factories at Yawata. Sergeant Shigeo Nobe of the 4th *Sentai* intentionally flew his Kawasaki Ki-45 into a B-29; debris from the explosion following this attack severely damaged another B-29, which also went down. Lost were Colonel Robert Clinksale's B-29-10-BW 42-6334 *Gertrude C* and Captain Ornell Stauffer's B-29-15-BW 42-6368 *Calamity Sue*, both from the 486th BG. Several B-29s were destroyed in this way over the ensuing months. Although the term "Kamikaze" is often used to refer to the pilots conducting these attacks, the word was not used by the Japanese military.

B-29s were withdrawn from airfields in China by the end of January 1945. Throughout this prior period, B-29 raids were also launched from China and India against many other targets throughout Southeast Asia. However, the entire B-29 effort was gradually shifted

to the new bases in the Marianas Islands in the Central Pacific, with the last B-29 combat mission from India flown on 29 March 1945.

B-29A-30-BN, *42-94106*, on a long range mission.

New Mariana Islands air bases

In addition to the logistic problems associated with operations from China, the B-29 could only reach a limited part of Japan while flying from Chinese bases. The solution to this problem was to capture the Mariana Islands, which would bring target such as Tokyo, about 1,500 mi (2,400 km) north of the Marianas within range of B-29 attacks. It was therefore agreed in December 1943 to seize the Marianas.

Saipan was invaded by US forces on 15 June 1944, and despite a Japanese naval counterattack which lead to the Battle of the Philippine Sea and heavy fighting on land, was secured by 9 July. Operations followed against Guam and Tinian, with all three islands secured by August.

Work began at once to construct air bases suitable for the B-29, work beginning even before the end of ground fighting. In all, five major air fields were built, with two on the flat island of Tinian and one on Saipan and two on Guam. Each was large enough to eventually accommodate a bomb wing consisting of four bomb groups, giving a total of 180 B-29s per airfield. These bases, which could be supplied by ship and unlike the bases in China, were not vulnerable to attacks by Japanese ground forces, became the launch sites for the large B-29 raids against Japan in the final year of the war. The first B-29

arrived on Saipan on 12 October 1944, and the first combat mission was launched from there on 28 October 1944, with 14 B-29s attacking the Truk atoll. The first mission against Japan from bases in the Marianas was flown on 24 November 1944, with 111 B-29s sent to attack Tokyo. From that point, raids intensified, launched regularly until the end of the war. These attacks succeeded in devastating almost all large Japanese cities (with the exception of Kyoto and several others), and they gravely damaged Japan's war industries. Although less publicly appreciated, the aerial mining program (Operation Starvation) carried out by B-29s against Japanese shipping routes and harbor approaches profoundly degraded Japan's ability to support its population and its army to fight the war.

Turning point with the nuclear bomb

Perhaps the most famous B-29 is the *Enola Gay*, which dropped the atomic bomb 'Little Boy' on Hiroshima on 6 August 1945. *Bockscar*, another B-29, dropped 'Fat Man' on Nagasaki three days later. These two actions, along with the Soviet invasion of Manchuria on 9 August 1945, brought about the Japanese surrender, and the official end of World War II. Both aircraft were handpicked for modification from the assembly line at the Omaha plant that was to become Offutt Air Force Base.

Following the surrender of Japan, V-J Day, B-29s were used for other purposes. A number supplied POWs with food and other necessities by dropping barrels of rations on Japanese POW camps. In September 1945 a long-distance flight was undertaken for public relations purposes: generals Barney M. Giles, Curtis LeMay and Emmett O'Donnell, Jr. piloted three specially modified B-29s from Chitose Air Base in Hokkaidō to Chicago Municipal Airport, continuing to Washington, D.C., the farthest nonstop distance to that date flown by Army Air Forces aircraft and the first-ever nonstop flight from Japan to the U.S. Two months later, Colonel Clarence S. Irvine commanded another modified B-29, *Pacusan Dreamboat*, in a world-record-breaking long-distance flight from Guam to Washington, D.C., traveling 7,916 miles (12,740 km) in 35 hours, with a gross takeoff weight of 155,000 pounds (70,000 kg).

B-29s in Europe

Royal Air Force Washington B.1 of No. 90 Squadron RAF based at RAF Marham

Although considered for other theaters, and briefly evaluated in England, the B-29 was predominantly used in World War II in the Pacific Theatre. The use of YB-29-BW *41-36393*, the so-named *Hobo Queen*, one of the service test aircraft flown around several British airfields in early 1944, was thought to be as a "disinformation" program intended to deceive the Germans into believing that the B-29 would be deployed to Europe.

Postwar, several Royal Air Force Bomber Command squadrons were equipped with B-29s loaned from USAF stocks. The aircraft were known as the **Washington B.1** in RAF service , and remained in service from March 1950 until the last were returned in early 1954, having been replaced by initial deliveries of the UKs 'V-bomber' aircraft.

Soviet copying of the B-29

On three occasions during 1944, individual B-29s made emergency landings in Soviet territory after bombing raids on Japanese Manchuria and Japan. In accordance with Soviet neutrality in the Pacific War, the bombers were interned and kept by the Soviets, despite American requests for their return.

B-29 *Ramp Tramp*

Captain Howard Jarrell and his 10-man crew took off from Chengdu, China, on 31 July 1944 for a mission against a Japanese steel mill in Anshan, Manchuria. Capt. Jarrell's B-

29, called "Ramp Tramp",(B-29-5-BW serial number 42-6256) was assigned to the 462nd (Very Heavy) Bomb Group and was part of a large air strike composed of approximately 100 aircraft.

At the end of the bomb run, the inboard right engine (No. 3) "ran away" and could not be "feathered" (setting the variable pitched propeller blades parallel to the airflow to minimize aerodynamic drag). So, the engine had to be shut down, which increased the drag of the unfeathered propeller. This made the plane burn more fuel, so it could not get back to Chengdu. The pilot headed toward the Allied base at Vladivostok, Russia to land the damaged bomber. The Soviet air force interned the B-29 crew and kept the aircraft.

Reverse engineering

Tupolev Tu-4 at Monino museum

The Tupolev OKB dismantled and studied *Ramp Tramp* and the other two B-29s, and Stalin ordered Tupolev and his design bureau to copy the B-29, and produce a design ready for quantity production as soon as possible. As the supply of aluminum in the USSR was in different thicknesses than available in the US (metric vs imperial), the entire aircraft had to be extensively re-engineered and the Tu-4 cannot be regarded as an exact copy despite external appearances, with Tupolev even substituting his own favored airfoil sections for those used by Boeing. In 1947, the Soviets debuted both the Tupolev

Tu-4 (NATO ASCC code named Bull) copy of the B-29, and the Tupolev Tu-70 transport variant. The Soviets used tail-gunner positions similar to the B-29 in many later bombers and transports.

Between wars

While the end of World War II caused production of the B-29 to be phased out, with the last example completed by Boeing's Renton factory on 28 May 1946, and with many aircraft sent for storage and ultimately scrapping as surplus to requirements, the remaining B-29s formed the combat equipment of Strategic Air Command when it formed on 21 March 1946. In particular, the "Silverplate" modified aircraft of the 509th Composite Group remained the only aircraft capable of delivering the atomic bomb, and so the unit was involved in the Operation Crossroads series of tests, with B-29 *Dave's Dream dropping a Fat Man type bomb in Test* Able *on 1 July 1946.*

The B-29s were outfitted with air filters and monitored debris from above ground nuclear weapons test by the United States and the USSR. The aircraft were also used for long range weather reconnaissance (WB-29) and for signals intelligence gathering and photographic reconnaissance (RB-29).

Korean War and postwar service

The B-29 was used in 1950–53 in the Korean War. At first, the bomber was used in normal strategic day-bombing missions, though North Korea's few strategic targets and industries were quickly reduced to rubble. More importantly, in 1950 numbers of Soviet MiG-15 "Fagot" jet fighters appeared over Korea (an aircraft specifically designed to shoot down the B-29), and after the loss of 28 aircraft, future B-29 raids were restricted to night-only missions, largely in a supply-interdiction role. Over the course of the war, B-29s flew 20,000 sorties and dropped 200,000 tonne (180,000 ton) of bombs. B-29 gunners were credited with shooting down 27 enemy aircraft.

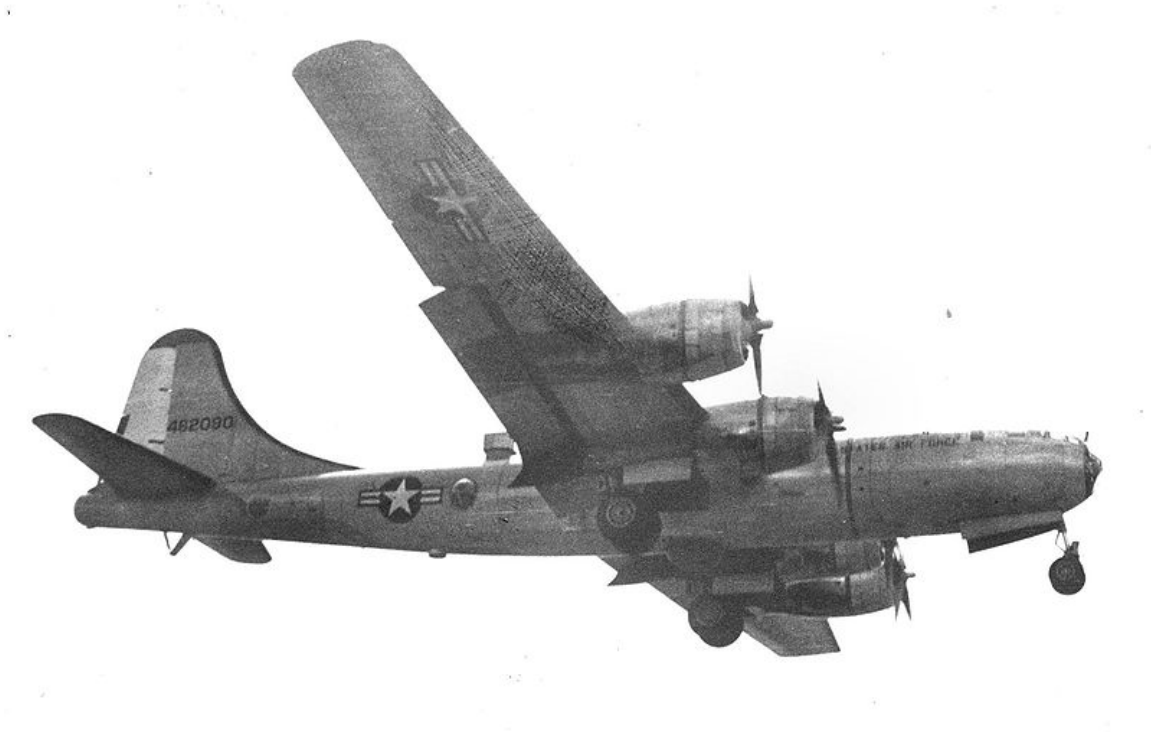
The B-29 was notable for dropping the large "Razon" and "Tarzon" radio-controlled bomb in Korea, mostly for demolishing major bridges, like the ones across the Yalu River and for dams.

The B-29 was soon made obsolete by the development of the jet engined fighter aircraft. With the arrival of the mammoth Convair B-36, the B-29 was reclassified as a medium bomber with the new Air Force. However, the later B-50 Superfortress variant (which was initially designated B-29D) was good enough to handle auxiliary roles such as air-sea rescue, electronic intelligence gathering, and even air-to-air refueling. The B-50D was replaced in its primary role during the early 1950s by the Boeing B-47 Stratojet, which in turn was replaced by the Boeing B-52 Stratofortress. The final active-duty variants were phased out in the mid-1960s. A total of 3,970 B-29s were built.

Variants

Bell X-1 and its B-29 mother ship

Unlike many other aircraft designed to play a similar role, the variants of the B-29 were all essentially the same. The developments made between the first prototype **XB-29** and any of the three versions flown in combat were all minuscule, excluding the Silverplate models built for the Manhattan Project. The biggest differences were between variants modified for non-bomber missions. In addition to acting as cargo carriers, rescue aircraft, weather ships, and trainers, some were used for odd purposes such as flying relay television transmitters under the name of Stratovision.



WB-29A of 53 Weather Reconnaissance Squadron in 1954 showing the fuselage-top observation dustbin

An example of a later variant of the B-29, the **B-50** (which was powered by four 3,500 hp (2,600 kW) Pratt & Whitney R-4360-35 Wasp Major engines), acted as the mothership for experimental parasite fighter aircraft, such as the XF-85 Goblin and F-84s as in flight lock on and offs. It was also used to develop the Airborne Early Warning program; it was the ancestor of various modern radar picket aircraft. A B-29 with the original Wright Duplex Cyclone powerplants was used to air-launch the famous Bell X-1 supersonic research rocket plane.

Some B-29s were modified to act as test beds for various new systems or special conditions, including fire-control systems, cold weather operations, and various armament configurations. Several converted B-29s were used to experiment with aerial refueling and re-designated as **KB-29s**. Perhaps the most important tests were conducted by the **XB-29G**; it carried prototype jet engines in its bomb bay, and lowered them into the air stream to conduct measurements.

Survivors

Twenty-six B-29s are preserved at various museums worldwide, along with six partial airframes, three airframes in storage and known wreck sites of four more. Only two of the 26 museum aircraft are outside the United States, one is at the Imperial War Museum Duxford in the United Kingdom, the other at the KAI Aerospace Museum in Sachon, South Korea.

Notable examples are:

- "*Fifi*" owned and maintained by the Commemorative Air Force (formerly the Confederate Air Force) since 1971 has held the title as the only flyable B-29 for many years. On 5 August 2010, Fifi was flown for the first time in several years, after engine trouble occurred during an airshow. Video of the flight. It was grounded due to costly engine problems. In a joint press release, dated 21 January 2008, the Commemorative Air Force and the Cavanaugh Flight Museum, announced a pledge of $1.2M USD to re-engine *Fifi*. The Wright R-3350-57AM engines have been exchanged for a custom built combination of the R-3350-95W and R-3350-26WD engines.

- The Kansas Aviation Museum is gathering funds for the restoration of a flyable B-29, named "*Doc*", with the intent to keep the aircraft based in Wichita, Kansas.

- The *Enola Gay* is preserved on display at the Steven F. Udvar-Hazy Center of the National Air and Space Museum at Dulles International Airport, Virginia.

- *Bockscar* is preserved on display at the National Museum of the United States Air Force at Wright-Patterson AFB in Dayton, Ohio. It was flown to the Museum on 26 September 1961.

Specifications (B-29)

Boeing B-29 Superfortress

General characteristics

- **Crew:** 11 (5 officers, 6 enlisted): (A/C)Airplane Commander, Pilot, flight engineer (a rated pilot), bombardier, navigator, radio operator, radar operator, blister gunners (two), CFC upper gunner, and tail gunner
- **Length:** 99 ft 0 in (30.18 m)
- **Wingspan:** 141 ft 3 in (43.06 m)
- **Height:** 29 ft 7 in (8.5 m)
- **Wing area:** 1,736 sq ft (161.3 m²)
- **Empty weight:** 74,500 lb (33,800 kg)
- **Loaded weight:** 120,000 lb (54,000 kg)
- **Max takeoff weight:** 133,500 lb (60,560 kg) ; 135,000 lb plus combat load (155,000 lb on record)
- **Powerplant:** 4× Wright R-3350-23 and 23A turbosupercharged radial engines, 2,200 hp (1,640 kW) each
- **Zero-lift drag coefficient:** 0.0241
- **Drag area:** 41.16 ft² (3.82 m²)
- **Aspect ratio:** 11.50

Performance

- **Maximum speed:** 357 mph (310 knots, 574 km/h)
- **Cruise speed:** 220 mph (190 knots, 350 km/h)
- **Stall speed:** 105 mph (91 knots, 170 km/h)
- **Combat range:** 3,250 mi (2,820 nmi, 5,230 km)
- **Ferry range:** 5,600 mi (4,900 nmi, 9,000 km, (record 7,916 miles, 12,740 km))
- **Service ceiling:** 33,600 ft (10,200 m)
- **Rate of climb:** 900 ft/min (4.6 m/s)
- **Wing loading:** 69.12 lb/sqft (337 kg/m²)
- **Power/mass:** 0.073 hp/lb (121 W/kg)
- **Lift-to-drag ratio:** 16.8

Armament

- **Guns:**
  - 10× .50 in (12.7 mm) caliber Browning M2/ANs in remote controlled turrets
  - 2 x .50 in and 1× 20 mm M2 cannon in tail position (the cannon was eventually removed as it proved unreliable in service)
  - B-29B-BW – All armament and sighting equipment removed except for tail position; initially 2 x .50 in M2/AN and 1× 20 mm M2 cannon, later 3 x 2 x .50 in M2/AN with APG-15 gun-laying radar fitted as standard.
- **Bombs:** 20,000 lb (9,000 kg) standard loadout

Chapter-6

Consolidated B-32 Dominator and Douglas B-23 Dragon

Consolidated B-32 Dominator

B-32 Dominator

Consolidated B-32-1CF, the first B-32 built after modification to Block 20 standard.

Role	Heavy bomber
Manufacturer	Consolidated Aircraft
First flight	7 September 1942
Introduced	27 January 1945
Retired	30 August 1945
Primary user	US Army Air Force
Produced	1944-1945
Number built	118

The **Consolidated B-32 Dominator** (**Consolidated Model 34**) was a heavy bomber made for United States Army Air Forces during World War II, and has the distinction of being the last Allied aircraft to be engaged in combat during World War II. It was

developed in parallel with the Boeing B-29 Superfortress as a fallback design should the Superfortress prove unsuccessful. It only reached units in the Pacific during the summer of 1945, and subsequently only saw limited combat operations against Japanese targets before the end of the war. Most of the extant orders of the B-32 were cancelled shortly thereafter and only 118 B-32s of all types were built.

Design and development

The engineering development of the B-29 had been underway since mid-1938 when, in June 1940, the US Army Air Corps requested a similar design from Consolidated Aircraft Company in case of development difficulties with the B-29.

The Consolidated Model 33 used to base its proposal was similar to the B-24 Liberator. Like the B-24 it was originally designed with twin fins and a large Davis-type wing, but with a longer, rounder fuselage and a rounded nose. The powerplants were to be four 2,200 horsepower (1,600 kW) Wright R-3350s, the same as specified for B-29s. The aircraft was designed to be pressurized, and have remote controlled retractable gun turrets with fourteen .50 in (12.7 mm) machine guns. It was to have an estimated gross weight of 101,000 lb (46,000 kg). The first contract for two XB-32s was signed on 6 September 1940, the same day as the contract for the Boeing prototype XB-29.

The first XB-32-CO, AAF s/n 41-141, was constructed next to the Army Air Force (AAF) Base Tarrant Field Airdrome at the AAF Aircraft Plant No. 4 just west of Fort Worth, Texas along the south side of Lake Worth. The Consolidated Vultee Bomber Plant assembly line was six months behind schedule, making its first flight on 7 September 1942. Due to problems with the pressurization system, the gun turrets and landing gear doors, these items were omitted on the first prototype. The aircraft had R-3350-13 engines inboard and R-3350-21s outboard driving three-bladed propellers. The prototype was to have persistent problems with engine oil leaks and poor cooling. The B-29 had similar engine problems. The inboard propellers could be reversed to shorten the landing roll.

The first XB-32 was armed with eight .50 in (12.7 mm) machine guns in dorsal and ventral turrets, and an odd combination of two .50 caliber and one 20 mm (0.787 in) cannon in each outboard engine nacelle firing rearwards, plus two .50 caliber machine guns in the wings outboard of the propellers. The turrets were remotely controlled from periscopic sights in aiming stations inside the aircraft. The sights were coordinated by a sophisticated analog computer system developed by Sperry Gyroscope Company.

XB-32-CO *41-141* on 28 February 1944

On 17 March 1943, the initial contract was signed for 300 B-32-CFs but development problems continued. On 10 May 1943, the first XB-32 crashed on takeoff after making a total of 30 flights before the second XB-32, s/n 41-142, finally flew on 2 July 1943. This aircraft had a traditional stepped cockpit canopy. Upon examination and testing the USAAF recommended a large number of changes that included more conventional gun stations.

The pressurization system problems were never solved, and consequently the aircraft was re-purposed as a bomber to be operated at low and medium altitude; however, this decision only meant that it was easily eliminated from production aircraft. Problems with the remote controlled gun turrets were also never solved and the armament on production aircraft was changed to 10 .50 caliber machine guns in manually operated turrets: Sperry A-17 turrets in the nose and tail, two Martin A-3F-A dorsal turrets, and one Sperry A-13-A ball turret. The bomb load was increased by 4,000 pounds (1,800 kg) to 20,000 pounds (9,100 kg).

The second XB-32 continued to have stability problems. In an attempt to resolve this a B-29 style tail was fitted to the aircraft after its 25th flight but this did not resolve the problem and a Consolidated-designed 19.5 ft (5.9 m) vertical tail was added and first flown on the third XB-32, s/n 41-18336 on 3 November 1943. The first production aircraft was fitted with a B-29 vertical tail initially before a new tail was eventually substituted.

By 1944 testing of the three prototypes permitted the AAF to place orders for over 1,500 B-32s. The first production aircraft was delivered on 19 September 1944, by which time the B-29 was already in combat in China. The first B-32 crashed on the same day it was

delivered when the nose wheel collapsed on landing. Beginning on 27 January 1945, 40 B-32A-5, -10 and -15 aircraft were delivered as unarmed TB-32-CF crew trainers.

Originally, the Army Air Force intended the B-32 as a "fallback" design to be used only if the B-29 program fell significantly behind in its development schedule. As development of the B-32 became seriously delayed this plan became unnecessary due to the success of the B-29. Initial plans to use the B-32 to supplement the B-29 in re-equipping B-17 and B-24 groups before redeployment of the Eighth and Fifteenth Air Forces to the Pacific were stymied when only five production models had been delivered by the end of 1944, by which time full B-29 operations were underway in the Twentieth Air Force.

Operational history

The first assignment of the B-32 began when General George Kenney the commander of Allied air forces in the South West Pacific Area, and commander of the U.S. Fifth Air Force, traveled to Washington D.C. to request B-29s. Since priority had been given to strategic bombing by the B-29, Kenney's request was denied, after which he requested the B-32.

Following a demonstration, the Army General Staff agreed that Kenney could conduct a combat evaluation, and a test schedule of eleven missions was set up, followed by a plan to convert two of the 312th Bomb Group's four Douglas A-20 Havoc squadrons to B-32s. Project crews took three B-32s to Clark Field, Luzon, Philippine Islands in mid-May 1945, for a series of test flights completed on 17 June. The test crews were impressed with its unique reversible-pitch inboard propellers and the Davis wing which gave it excellent landing performance. However, they found a number of faults: the cockpit had an extremely high noise level, a poor instrument layout, the bombardier's vision was impaired, it was overweight and the nacelle design resulted in frequent engine fires.

The three test B-32s were assigned to the 312th BG's 386th Bomb Squadron. On 29 May 1945, the first of four combat missions by the B-32 was flown against a supply depot at Antatet in the Philippines, followed by two B-32s dropping sixteen 2,000 lb (910 kg) bombs on a sugar mill at Taito, Formosa on the 15th of June. On 22 June, a B-32 bombed an alcohol plant at Heito, Formosa, with 500 lb (230 kg) bombs, but a second B-32 missed flak positions with its 260 lb (120 kg) fragmentation bombs. The last mission was flown on 25 June against bridges near Kiirun in Taiwan.

The testing missions were mostly successful, and, in July, the 386th Bomb Squadron completed its transition to the B-32, flying six more combat missions before the war ended. On 13 August, the 386th BS moved from Luzon to Yontan Airfield on Okinawa and flew mostly photographic reconnaissance missions. The missions were intended to monitor Japan's compliance with the cease fire and to gather information such as possible routes occupation forces could take into Tokyo. In addition, Rudolph Pugliese, who was the 386th's assistant intelligence officer, said in 1997 that "the photo-recon missions were also intended to test the fidelity of the Japanese...[adherence] to the terms of the cease-

fire." On 17 August, three B-32s in a flight of four were attacked by Japanese flak and fighters. During the two-hour engagement, the Dominators suffered only minor damage and none of their crew were injured. "Though the B-32 gunners later claimed to have damaged one fighter and 'probably destroyed' two others, surviving Japanese records list no losses for that day or next." Based on the Japanese action on the 17th, U.S. commanders felt that it was important to continue the reconnaissance missions over Tokyo so they could determine if it was an isolated incident or an indication that Japan would reject the cease-fire and continue fighting.

On 18 August, four Dominators were given the task of photographing many of the targets covered on the previous day; however, mechanical problems caused two to be pulled from the flight. Over Japan, a formation of 14 A6M Zeros and three N1K2-J Shiden-Kai fighters (as is often the case, Shiden-Kai is described as Ki-44 Tojo, but it may be a misunderstanding of the crews) attacked the remaining two U.S. aircraft. Saburo Sakai, a Japanese ace, said later there was concern that the Dominators were attacking. Another Japanese ace, Sadamu Komachi, stated in a 1978 Japanese magazine article that the fighter pilots could not bear to see American bombers flying serenely over a devastated Tokyo. The B-32 Dominator *Hobo Queen II* (s/n 42-108532) was flying at 20,000 ft (6,100 m) when the Japanese fighters took off and received no significant damage. *Hobo Queen II* claimed two Zeros destroyed in the action as well as a probable Shiden-Kai. The other Dominator was flying 10,000 ft (3,000 m) below *Hobo Queen II* when the fighters took off. The fighters heavily damaged that Dominator and seriously wounded two crew members. Photographer Staff Sergeant Joseph Lacharite was wounded in the legs (his recovery required several years). Sergeant Anthony Marchione, a photographer's assistant, helped Lacharite and then was fatally wounded himself. Despite the damage it received, the Dominator was able to return to Okinawa. Marchione was the last American to die in air combat in World War II. On 19 August, propellers were removed from all Japanese fighters as per the terms of the cease fire agreement.

The last B-32 combat photo reconnaissance mission was completed on 28 August, during which two B-32s were destroyed in separate accidents, with 15 of the 26 crewmen killed. On 30 August, the 386th Bomb Squadron stood down from operations. Production of the B-32 was cancelled on 8 September 1945, and ceased by 12 October.

TB-32s being assembled at Consolidated's Fort Worth factory

Variants

XB-32

Company Designation Model 33, three built, on first aircraft: Wright R-3350-13 (inboard) and Wright R-3350-21 (outboard) engines, three bladed propeller, rounded, glassed nose, first two aircraft had a twin tail configuration. Second prototype was pressurized and had remotely-controlled retractable gun turrets in the dorsal ventral positions, with a manned tail "stinger." Second and third prototypes had numerous tail variations installed including a B-29 tail installation. First flown 7 September 1942.

B-32-1CF

Model 34 flight testing aircraft first flown 5 August 1944. Wright R-3350-23 engines. First two aircraft initially had modified B-29 tails installed. Installation of armament, single rudder tabs, radar bombing equipment (AN/APQ-5B and AN/APQ-13) and long range navigation equipment, 10 built.

B-32-5CF

Twin rudder tabs made standard. Last 11 aircraft converted to TB-32-5CF with deletion of all armament (openings faired over), deletion of radar bombing equipment, and deletion of long range navigation equipment, 15 built.

TB-32-10CF

Redesigned bombardier's entrance door, replacement of SCR-269-G Radio compass with AN/ARN-7 set, installation of engine fire extinguishers, 25 built.

TB-32-15CF
: Empennage de-icer boots, four built.

B-32-20CF
: Combat equipped aircraft. Pressurization system removed, scanning blister installed in rear fuselage, 21 built.

B-32-21CF
: One B-32-20CF converted to paratroop conversion. All bombing equipment removed and benches installed in rear bomb bay and rear fuselage.

B-32-25CF
: Modified fuel system to allow auxiliary tanks in the bomb bay. AN/APN-9 LORAN, 25 built.

B-32-30CF
: Variant with a stabilized Sperry A-17A nose turret, installation of countermeasure equipment (AN/APQ-2, AN/APT-1 and AN/APT-2) and improved APQ-13A radar bombing equipment. Seven built, last three aircraft flown directly to storage and scrapped.

B-32-35CF
: Seven produced with increased ammunition. Flown directly to storage and scrapped.

B-32-40CF
: Ten built and flown directly to storage and then scrapped

B-32-45CF/50CF
: Thirty-Seven under construction. Partially-assembled machines were stripped of all their government-furnished equipment and engines and were scrapped on site by the contractor.

B-32-1CO
: Three aircraft the same as the B-32-20CF but assembled by Consolidated – San Diego. 1 accepted - remaining two flown directly to storage and scrapped.

300 B-32s ordered, 118 delivered, 130 flyable, 170 cancelled, orders for a further 1,099 B-32-CFs and 499 B-32-COs were cancelled after VJ-Day.

Surviving airframes

No examples remain of a B-32. Most production aircraft were delivered incomplete from the factory and flown directly to Davis-Monthan Field, Arizona for storage. Many were offered for sale by the Reconstruction Finance Corporation but no offers were received. A number of B-32 heavy bombers were flown to the Walnut Ridge Army Airfield, in Walnut Ridge, Arkansas, where they were scrapped by the Texas Railway Equipment Company, which bought 4,871 of the various aircraft stored at Walnut Ridge, including fighters and bombers of differing types. Most B-32s were scrapped by 1947.

B-32-1-CF, s/n 42-108474 was earmarked for display at the National Museum of the United States Air Force (at the time, the Air Force Museum) at Wright-Patterson Air Force Base, Ohio, but was declared surplus and scrapped at Davis-Monthan in August 1949.

One of the only portions of a B-32 surviving is a wing panel removed from a static test model and erected at the Montgomery Memorial near San Diego, California as a monument to aviation pioneer John J. Montgomery.

The National Warplane Museum in Horseheads, NY has a B-32 nose turret that was acquired in 1997.

A flight jacket belonging to a member of the 386th BS, with a B-32 hand-painted on the back, is on display at the National Museum of the United States Air Force near Dayton, Ohio.

Specifications (B-32)

General characteristics

- **Crew:** 10
- **Length:** 82 ft 1 in (25.03 m)
- **Wingspan:** 135 ft 0 in (41.16 m)
- **Height:** 32 ft 2 in (9.81 m)
- **Wing area:** 1,422 ft² (132.2 m²)
- **Empty weight:** 60,278 lb (27,400 kg)
- **Loaded weight:** 100,800 lb (45,800 kg)
- **Max takeoff weight:** 123,250lb (56,023 kg)
- **Powerplant:** 4× Wright R-3350-23A 18-cylinder air-cooled radial engine, 2,200 hp (1,641 kW) each

Performance

- **Maximum speed:** 357 mph (310 knots, 575 km/h) at 30,000 ft (9,150 m)
- **Cruise speed:** 290 mph (252 knots, 467 km/h)
- **Range:** 3,800 mi (3,304 nmi, 6,118 km)
- **Service ceiling:** 30,700 ft (9,360 m)
- **Rate of climb:** 1,050 ft/min (5.3 m/s)

Armament

- **Guns:** 10× .50 in (12.7 mm) machine guns
- **Bombs:** 20,000 lb (9,100 kg)

Douglas B-23 Dragon

B-23 Dragon

A B-23 Dragon in USAAC markings during the early 1940s

Role	Medium bomber
Manufacturer	Douglas Aircraft Company
First flight	27 July 1939
Primary user	United States Army Air Corps
Number built	38

The **Douglas B-23 Dragon** was a twin-engined bomber developed by Douglas Aircraft Company as a successor to (and a refinement of) the B-18 Bolo.

Design and development

Douglas proposed a number of modifications designed to improve performance of the B-18 initially was considered a new redesign, the **XB-22** which featured 1,600 hp Wright R-2600-1 radials. Essentially a complete B-18 redesign was considered promising enough by the USAAC to alter the original contract to produce the last 38 B-18As ordered under Contract AC9977 as the **B-23**. The design incorporated a larger wingspan with a wing design very similar to that of the Douglas DC-3, a fully retractable undercarriage, and increased defensive armament. Notably, the B-23 was the first operational US bomber equipped with a glazed tail gun position.

The B-23 flew on 27 July 1939 with the production series of 38 B-23s manufactured between July 1939 and September 1940.

Operational history

While significantly faster and better armed than the B-18, the B-23 was not comparable to newer medium bombers like the North American B-25 Mitchell and Martin B-26 Marauder. For this reason, the 38 B-23s built were never used in combat overseas, although for a brief period, they were employed as patrol aircraft stationed on the west coast of the United States. The B-23s were summarily relegated to other duties primarily training although 18 of the type were converted into transport versions as the **UC-67**.

Another role for the B-23 was to serve as a test-bed for new engines and systems. The B-23's tall vertical tail was adapted by Ford for use on the B-24 Liberator and resulted in increased performance, but it was never adopted for production. The modification later became standard on the Navy's PB4Y Privateer, which was derived from the Liberator.

After World War II, Howard Hughes converted a B-23 for use as his personal aircraft and other examples were used for executive transportation.

Douglas B-23 converted to executive transport role at Athens (Hellenikon) Airport in 1973

Survivors

Five B-23s are known to survive today.

- B-23 Dragon, s/n *39-0036* is on display at the McChord Air Museum in McChord AFB, Washington.
- B-23 Dragon, s/n *39-0037* is under restoration at the National Museum of the United States Air Force in Wright-Patterson AFB, Ohio.
- B-23 Dragon, s/n *39-0038* is under restoration to flyable condition at the 1941 Historical Aircraft Group in Geneseo, New York.
- B-23 Dragon, s/n *39-0047* is on display at the Castle Air Museum in Atwater, California.
- B-23 Dragon, s/n *39-0051* is on display at the Pima Air & Space Museum in Tucson, Arizona.

Specifications (B-23 Dragon)

General characteristics

- **Crew:** 6
- **Length:** 58 ft 6 in (17.8 m)
- **Wingspan:** 92 ft (28 m)
- **Height:** 18 ft 6 in (5.6 m)
- **Wing area:** 993 ft² (92.3 m²)
- **Empty weight:** 19,089 lb (8,677 kg)
- **Loaded weight:** 26,500 lb (12,000 kg)
- **Max takeoff weight:** 32,400 lb (14,700 kg)
- **Powerplant:** 2× Wright R-2600-3 radial engines, 1,600 hp (1,194 kW) each

Performance

- **Maximum speed:** 282 mph (245 kn, 454 km/h)
- **Range:** 1,400 mi (1,200 nmi, 2,300 km) with 4,000 lb (1,800 kg) of bombs
- **Service ceiling:** 31,600 ft (9,630 m)
- **Rate of climb:** 1,493 ft/min (7.6 m/s)
- **Wing loading:** 26.7 lb/ft² (130 kg/m²)
- **Power/mass:** 0.17 hp/lb (200 kW/kg)

Armament

- **Guns:**
  - 3 × 0.30 in (7.62 mm) machine guns
  - 1 × 0.50 in (12.7 mm) M2 Browning machine gun in tail turret
- **Bombs:** 4,000 lb (1,814 kg)