

# Boeing B-17 Flying Fortress 98" Wing Span Plan.

(Other 39" Plan included)



The **Boeing B-17 Flying Fortress** is 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 many airfields in southern England, such as [Thorpe Abbots airfield](#) and the [Fifteenth Air Force](#) based in Italy - with many units stationed at the existing bases surrounding [Foggia](#) - 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](#).<sup>[4]</sup> The B-17 also participated to a lesser extent in the [War in the Pacific](#) where it conducted raids against Japanese shipping and airfields.

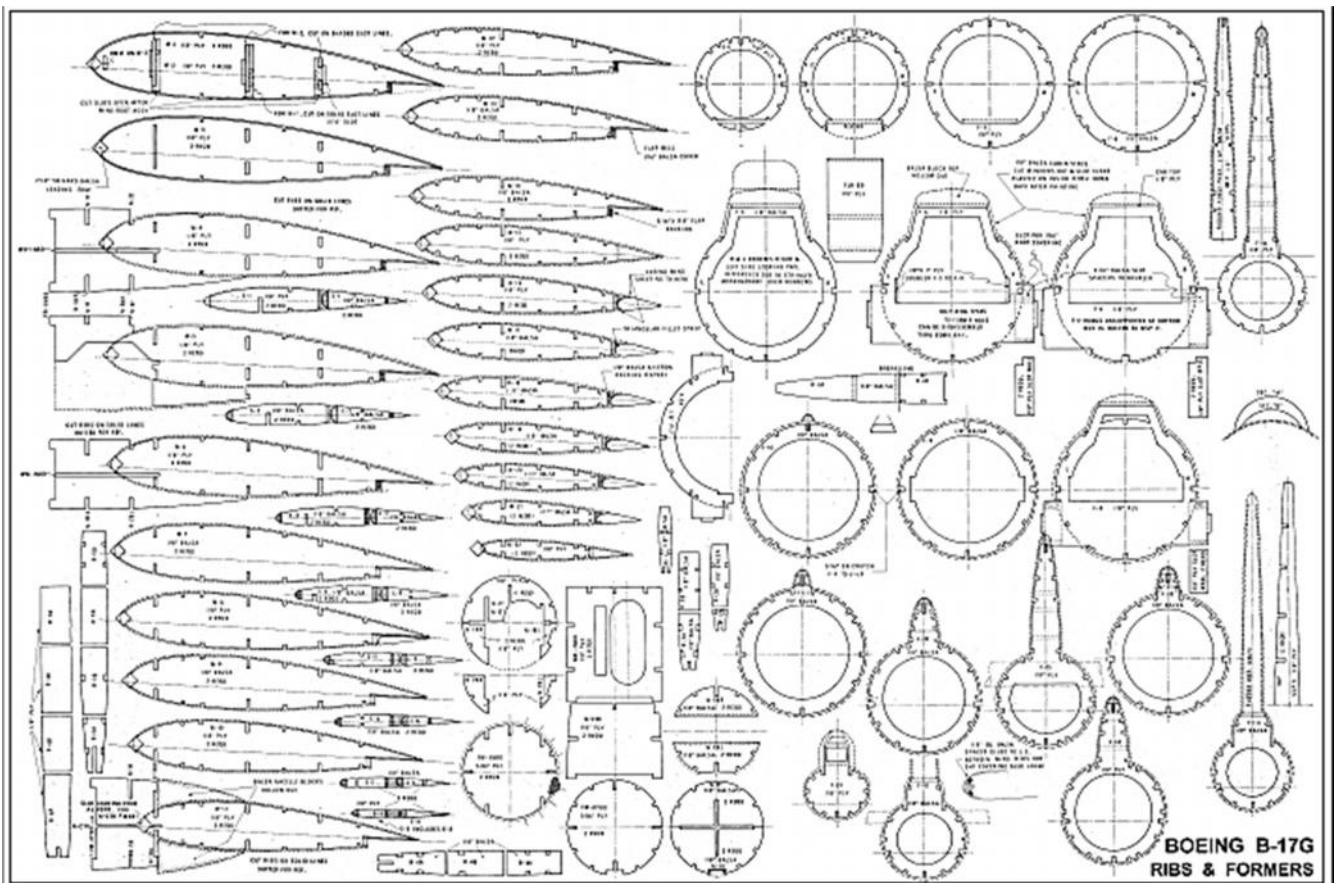
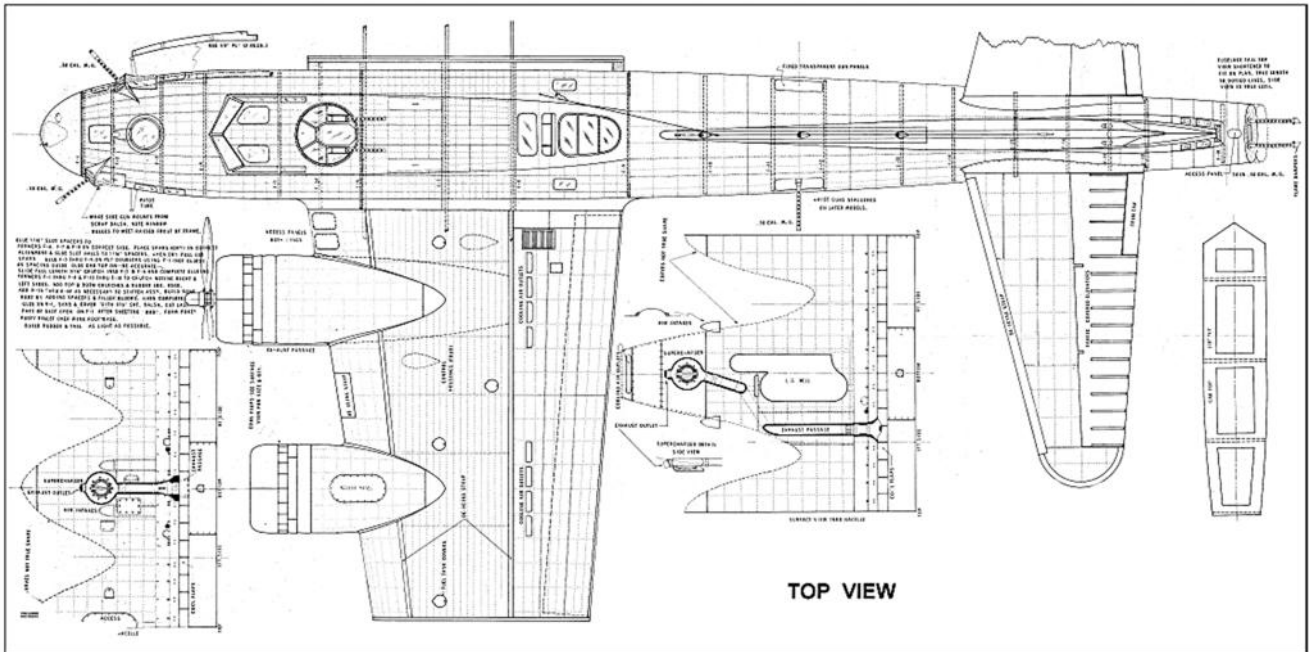
From its pre-war inception, the USAAC (later USAAF) touted the aircraft as a strategic weapon; it was a potent, high-flying, long-range bomber that was able to defend itself, and to return home despite extensive

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battle damage. It quickly took on mythic proportions,<sup>[5][N 1][6]</sup> and widely circulated stories and photos of B-17s surviving battle damage increased its iconic status.<sup>[7]</sup> 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](#) and its occupied territories by U.S. aircraft, 640,000 tons were dropped from B-17s.<sup>[8]</sup>

As of September 2011, [13 airframes](#) remain airworthy, with dozens more in storage or on static display.



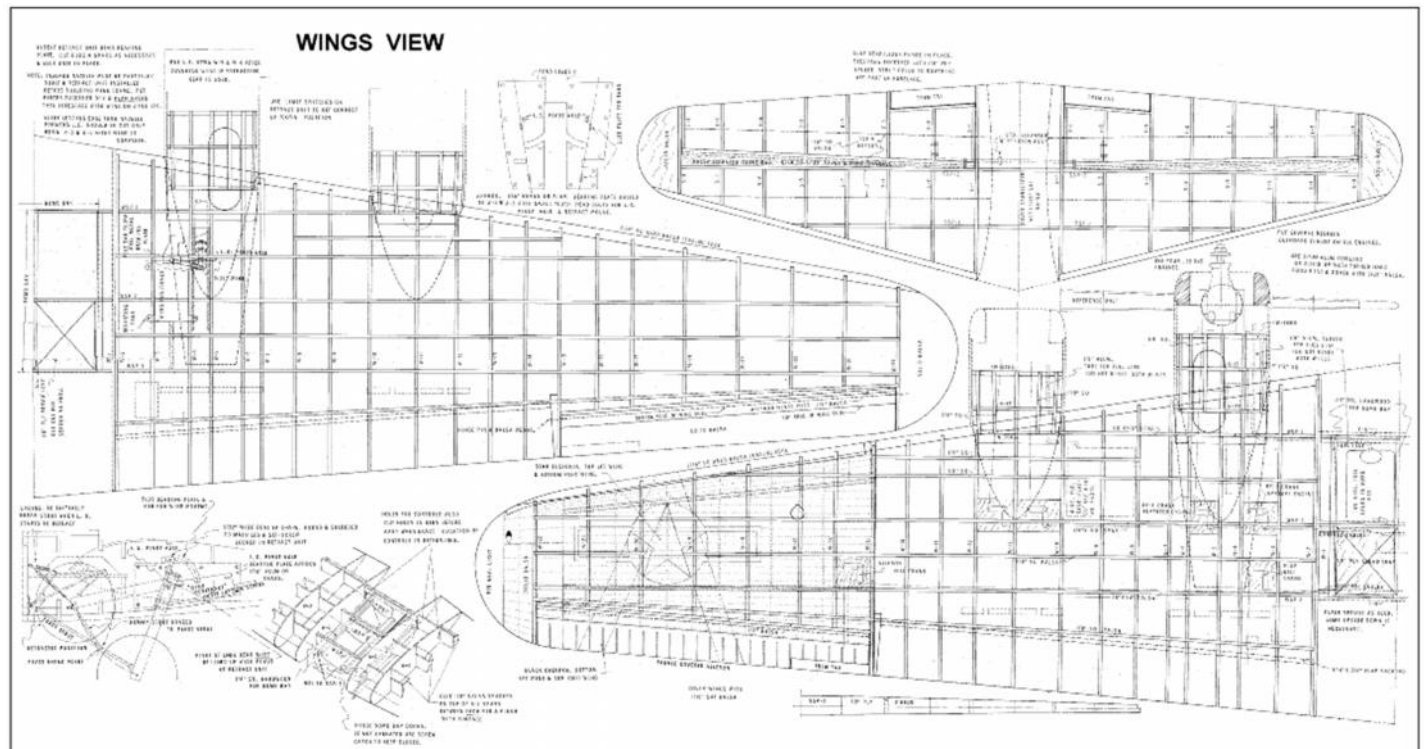
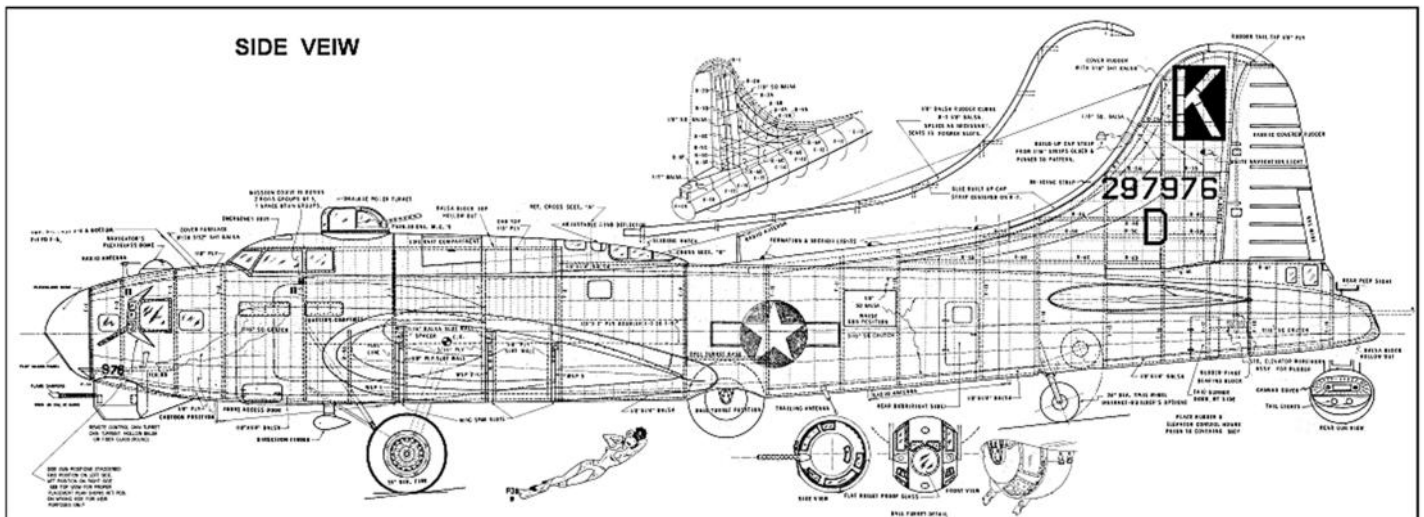
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## Origins

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 was looking for a bomber capable of reinforcing the air forces in Hawaii, Panama, and Alaska.<sup>[9]</sup> 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).<sup>[10]</sup>

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](#).



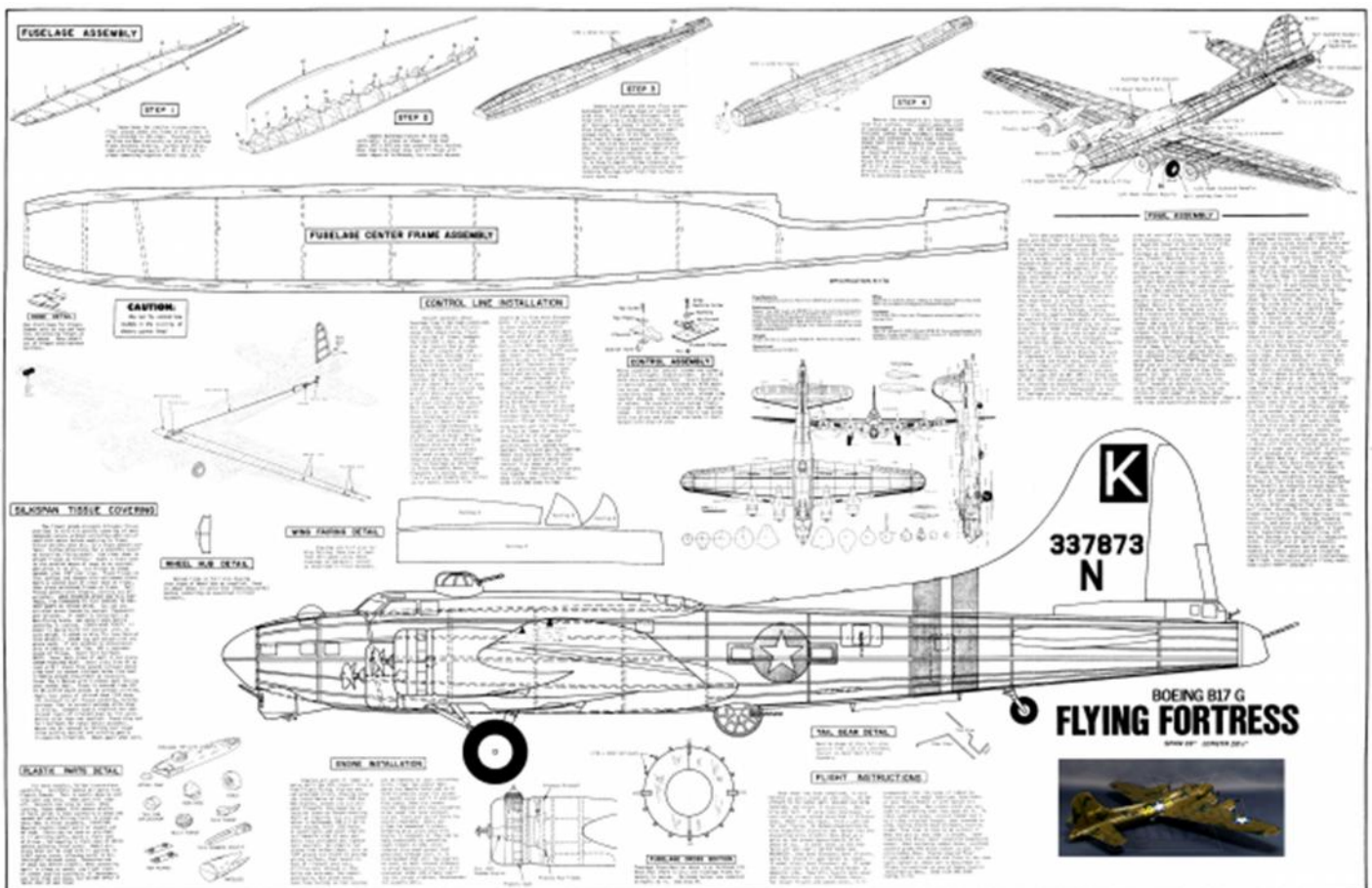
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The prototype B-17, designated Model 299, was designed by a team of engineers led by E. Gifford Emery and [Edward Curtis Wells](#), and was built at Boeing's own expense.<sup>[11]</sup> It combined features of the experimental [Boeing XB-15](#) bomber with the [Boeing 247](#) transport aircraft.<sup>[10]</sup> 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 initially possessed five 0.30 inches (7.62 mm) [machine guns](#). 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.<sup>[11][13]</sup> 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.<sup>[14]</sup> The most unique gun emplacement was the nose installation (see note for description and drawing), which allowed the single machine gun to be fired toward almost any frontal angle that an approaching enemy fighter would take to attack the B-17.<sup>[15]</sup>

Boeing was quick to see the value of the name and had it trademarked for use. Boeing also claimed in some of the early press releases that Model 299 was the first combat aircraft that could continue its mission if one of its four engines, for whatever reason, failed.<sup>[16]</sup> 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.

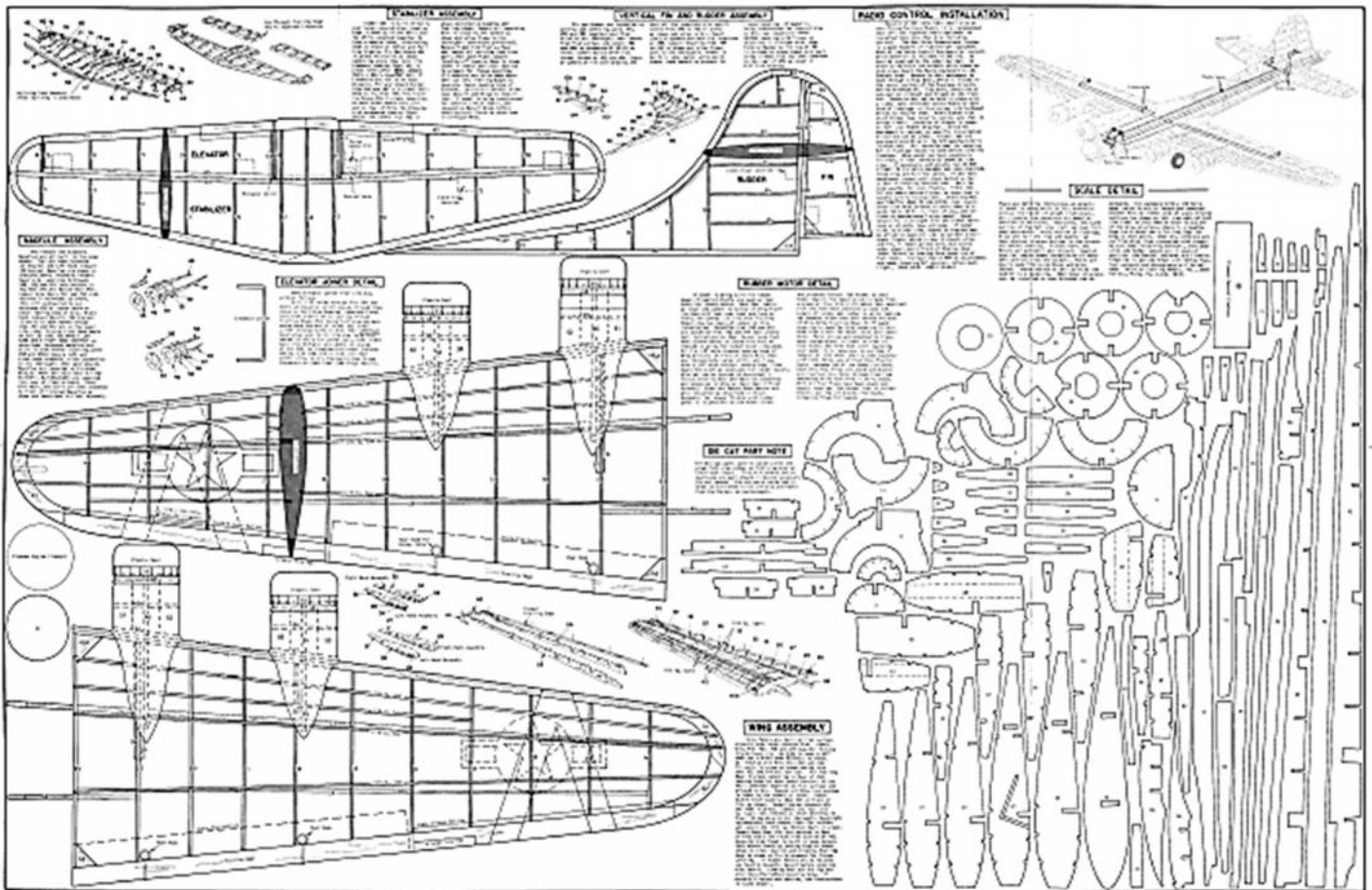


39 Inches Plan

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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 effective than shorter-ranged, twin-engined aircraft, and that the B-17 was better suited to their doctrine.<sup>[18]</sup> His opinions were shared by the Air Corps procurement officers, and even before the competition had finished they suggested buying 65 B-17s.<sup>[19][20]</sup>



*39 Inches Plan*

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. Inadvertently, the crew forgot to disengage the "[gust locks](#)," a system of devices that held the bomber's movable control surfaces in place while the aircraft was parked on the ground. After take-off, the aircraft entered a steep climb, stalled, nosed over, and crashed, killing Hill and Tower (other observers survived with injuries).<sup>[21][22][N 2]</sup>

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<sup>[23]</sup> (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<sup>[24]</sup>), and as the competition could not be completed Boeing was legally disqualified from the consideration for the contract.<sup>[20]</sup> 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.<sup>[19][20]</sup>

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## Design and variants

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.<sup>[34]</sup> 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,<sup>[49]</sup> was re-designated B-17A after testing had finished.<sup>[36][37]</sup>



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](#).<sup>[43]</sup> The B-17C changed from three bulged, oval shaped machine gun blisters to two flush, oval-shaped machine gun window openings and a single "bathtub" machine gun housing on the lower fuselage.<sup>[44]</sup> Models A through D of the B-17 were designed defensively, while B-17E was the first model primarily focused on offensive warfare.<sup>[49]</sup>

The B-17E was an extensive revision of the Model 299 design: The fuselage was extended by 10 ft (3.0 m); a much larger rear fuselage, vertical tail fin, rudder, and horizontal stabilizer were added to the design; a gunner's position was added in the new tail; the nose (especially the bombardier's well-framed nose glazing) remained relatively the same as the earlier -B through -D versions had, but with the addition of an electrically-powered manned dorsal [gun turret](#) just behind the cockpit, and the similarly-powered Sperry manned ventral [ball turret](#) just aft of the bomb bay - replacing a relatively hard-to-use remotely operated ventral turret on the earliest examples of the -E variant, that had also been used on the earlier marks of the [B-25 Mitchell](#) - resulted in a 20% increase in aircraft weight.<sup>[49]</sup> The B-17's [turbocharged Wright R-1820 Cyclone 9](#) engines were upgraded to increasingly more powerful versions of the same powerplants multiple times throughout its production, and similarly, the machine gun locations were increased to enhance their aircraft's combat effectiveness.<sup>[50]</sup>

The B-17F variants were the primary versions flying for the Eighth Air Force to face the Nazis in 1943, and had standardized the manned Sperry ball turret for ventral defense, along with an enlarged, nearly frameless Plexiglas bombardier's nose enclosure for much improved forward vision.

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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 testbed 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.<sup>[51][52]</sup>

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 remotely-operated and fired "chin turret" 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,<sup>[53][54][55]</sup> but not before the final production blocks of the B-17F adopting the YB-40's remotely operated and fired "chin turret" for a much-improved forward defensive weapons installation.

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 completed. The B-17G was the final version of the Flying Fortress, incorporating all changes made to its predecessor, the B-17F,<sup>[49]</sup> adopting the remotely-operated "chin turret" for forward defense from the YB-40 "gunship" version, and in total 8,680 were built,<sup>[56]</sup> the last one (by Lockheed) on 28 July 1945.<sup>[57]</sup> Many B-17Gs were converted for other missions such as cargo hauling, engine testing and [reconnaissance](#).<sup>[58]</sup> Initially designated SB-17G, a number of B-17Gs were also converted for search-and-rescue duties, later to be redesignated B-17H.<sup>[59]</sup>

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 26 June 1944, and assigned the [388th Bombardment Group](#) stationed at [RAF Fersfield](#), a satellite of [RAF Knettishall](#).<sup>[60]</sup>

The first four drones were sent to [Mimoyecques](#), the [Siracourt V-1 bunker](#), [Watten](#) and [Wizernes](#) on 4 August, causing little damage. The project came to a sudden end with the unexplained mid-air explosion over the [Blyth](#) estuary of a [Consolidated 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.<sup>[60]</sup>

## Operational history

The B-17 began operations in [World War II](#) with the RAF in 1941 (but was not successful), and in the Southwest Pacific with the U.S. Army. The 19th Bombardment Group had deployed to Clark Field in the Philippines a few weeks before the Japanese attack on Pearl Harbor as the first of a planned heavy bomber buildup in the Pacific. Half of the group's B-17s were wiped out on 8 December 1941 when they were caught on the ground during refueling and rearming for a planned attack on Japanese airfields on Formosa. The small force of B-17s operated against the Japanese invasion force until they were withdrawn to Darwin. In early 1942, the 7th Bombardment Group began arriving in Java with a mixed force of B-17s and LB-30/B-24s.<sup>[61]</sup> After the defeat in Java, the 19th withdrew to Australia where it continued in combat until it was sent back home by Gen. George C. Kenney when he arrived in Australia in mid-1942.<sup>[62]</sup> In July 1942, the first B-17s

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were sent to England to join [Eighth Air Force](#). Later that year two groups moved to Algeria to join Twelfth Air Force for operations in North Africa. The B-17s were primarily involved in the daylight precision [strategic bombing](#) campaign against German targets ranging from U-boat pens, docks, warehouses and airfields to industrial targets such as aircraft factories.<sup>[63]</sup> 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.<sup>[4]</sup>

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.<sup>[64]</sup> 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).<sup>[clarification needed]</sup> The British heavy bombers, the [Avro Lancaster](#) and [Handley Page Halifax](#), dropped 608,612 and 224,207<sup>[65]</sup> long tons respectively.