Douglas XB-42 Mixmaster

Le **Douglas XB-42 *Mixmaster***, connu chez son constructeur comme le ***Model 459***, est un prototype de bombardier léger à moteurs à pistons américain conçu par la Douglas Aircraft Company ; il est initialement désigné XA-42, dans la nomenclature des avions d'attaque au sol avant d'être reclassé comme bombardier en 1943. Le projet est développé à partir de 1943, pendant la Seconde Guerre mondiale, comme solution à plus long rayon d'action que le A-20 *Havoc*. En juin 1943, deux prototypes sont commandés par les United States Army Air Forces (USAAF) et le premier réalise son premier vol en mai 1944. Toutefois, en raison de la fin de la guerre et de l'arrivée des avions à réaction, plus performants, le projet ne débouche sur aucune commande en série.

Les deux prototypes sont construits à l'usine Douglas de Santa Monica. Pour leur conception, l'avionneur cherche une solution permettant de réduire la traînée au maximum ; il adopte une solution avec deux hélices coaxiales contrarotatives placées à l'arrière du fuselage qui sont mues par deux moteurs Allison V-1710, installés dans la partie supérieure du fuselage, qui les entraînent via un système de longs arbres concentriques ; cette disposition permet d'améliorer l'efficacité aérodynamique de la voilure. Au cours des essais, avec une vitesse maximale de plus de 650 km/h, l'avion se montre plus rapide que ses contemporains. L'un des prototypes s'écrase en décembre 1945 et l'autre exemplaire est modifié avec des turboréacteurs d'appoint, permettant d'accroître les performances ; cependant, le programme est annulé en juin 1949.

Conception et développement

L'histoire du XB-42 remonte au début de l'année 1943, pendant la Seconde Guerre mondiale, lorsque la Douglas Aircraft Company cherche à développer un bombardier de moyenne capacité, à plus long rayon d'action que les A-20 *Havoc*, B-25 *Mitchell* et B-26 *Marauder* existants. À cette époque, les États-Unis sont en guerre contre le Japon et les bombardiers, bien qu'ayant une autonomie suffisante pour mener efficacement des raids sur le théâtre européen contre l'Allemagne et l'Italie, ne sont pas adaptés pour mener des opérations dans le Pacifique. De plus, les B-17 *Flying Fortress* et B-24 *Liberator*, bombardiers lourds composant la flotte des United States Army Air Forces (USAAF), manquent d'allonge et le Boeing B-29, à autonomie intercontinentale, n'est pas encore opérationnel. Les ingénieurs E. Burton et Carlos Wood du bureau d'études de Douglas créent le *Model 459* et cherchent à réduire la traînée aérodynamique afin d'augmenter la distance franchissable.

L'un des avant-projets étudiés présente une solution particulièrement novatrice : les moteurs sont placés à l'intérieur du fuselage et entraînent des hélices installées tout à l'arrière, en configuration propulsive ; ainsi comme la voilure n'est plus équipée des nacelles des moteurs, son aérodynamique est améliorée. Le projet est soumis aux USAAF en avril 1943 et, le 25 juin, le Materiel Command donne un avis favorable à la proposition de Douglas, avec la signature d'un contrat de 3 millions de dollars portant sur deux prototypes du *Model 459* et une cellule d'essais statiques[1]. L'avion est désigné XA-42, dans la nomenclature des avions d'attaque au sol et des bombardiers légers, avant d'être reclassé en bombardier le 26 novembre 1943 sous la désignation XB-42.

Descriptif technique

Avec une capacité de plus 3 600 kg de bombes, le XB-42 est, à l'époque un bombardier léger. Son fuselage mesure 16,36 m de long et sa voilure, très fine et d'une envergure de 21,49 m, est placée en position médiane par rapport au fuselage, permettant ainsi de séparer ce dernier en une partie inférieure, qui contient la soute à bombes, et une partie supérieure, où sont placés les moteurs. Les deux pilotes sont installés à l'avant sous deux verrières qui donnent à l'avion une forme de tête de mouche ; comme cette disposition n'est pas adaptée pour le travail en équipe des pilotes, le deuxième prototype est équipé d'une grande verrière, unique, au-dessus du poste de pilotage. Un nez vitré permet d'accueillir un troisième membre d'équipage, qui a les rôles de navigateur et d'opérateur bombardier. L'armement défensif consiste en deux mitrailleuses, une placée dans chaque aile et tirant vers l'arrière.

Au sol, le poids de l'avion est réparti sur un train d'atterrissage tricycle avec une roulette orientable à l'avant et deux grandes roues pour le train principal. Comme les ailes sont relativement fines, ce dernier se rétracte dans les flancs du fuselage[4]. L'avion est propulsé par deux hélices placées tout à l'arrière du fuselage, qui partagent le même axe de rotation et sont contrarotatives ; chaque moteur entraîne une hélice par l'intermédiaire de longs arbres de transmission et de réducteurs. Les moteurs sont des Allison V-1710-125L et V-1710-125R, qui diffèrent par leur sens de rotation ; leur alimentation en air se fait via des prises d'air aménagées sur les côtés et le dessus du fuselage. En cas d'urgence, avant d'évacuer l'appareil, les pilotes doivent larguer les hélices en utilisant un système faisant appel à des boulons explosifs. Le XB-42 est équipé d'un empennage cruciforme, la dérive inférieure permettant de maintenir une garde au sol suffisante des hélices pour éviter qu'elles ne touchent le sol en cas de décollage trop cabré.

Histoire opérationnelle

Livré à l'USAAF, le XB-42 effectue son premier vol le 6 mai 1944. Il est jugé performant, bien qu'il présente des défauts. Le principal est la présence d'une dérive placée sous le fuselage, ce qui oblige l'avion à décoller et atterrir avec des incidences relativement faibles. L'un des deux appareils est perdu dans un accident le 16 décembre 1945[6], causé par une défaillance du train d'atterrissage. L'autre est utilisé pour des vols d'essais et reçoit deux turboréacteurs Westinghouse 19XB-2, un sous chaque aile. En 1947, la dérive située sous le fuselage est endommagée lors d'un atterrissage. Bien que l'avion soit réparé, il ne vole plus et le programme est abandonné l'année suivante.

Le programme XB-42 débouche sur le XB-43 *Jetmaster*, premier bombardier à réaction américain, qui vole en 1946 ; il reprend l'apparence du XB-42 mais est motorisé par des turboréacteurs installés dans le fuselage à la manière des avions de chasse. Il ne dépasse toutefois pas le stade de prototype. Par ailleurs XB-42 est à l'origine du projet d'avion de ligne Douglas DC-8, qui reprend son allure générale, en particulier le doublet d'hélices contrarotatives installées à l'arrière. Cependant, le projet est rapidement abandonné sans qu'aucun appareil ne soit construit.

Caractéristiques techniques

Équipage et dimensions

Gros plan sur l'arrière de l'avion. On distingue nettement l'empennage cruciforme, le doublet d'hélices contrarotatives et le logement du train d'atterrissage dans le fuselage.

- Équipage : 3 membres (pilote, copilote/mitrailleur, opérateur bombardier)
- Envergure : 21,49 m
- Longueur : 16,36 m
- Hauteur : 5,74 m
- Surface alaire : 51,6 m^2

Motorisation

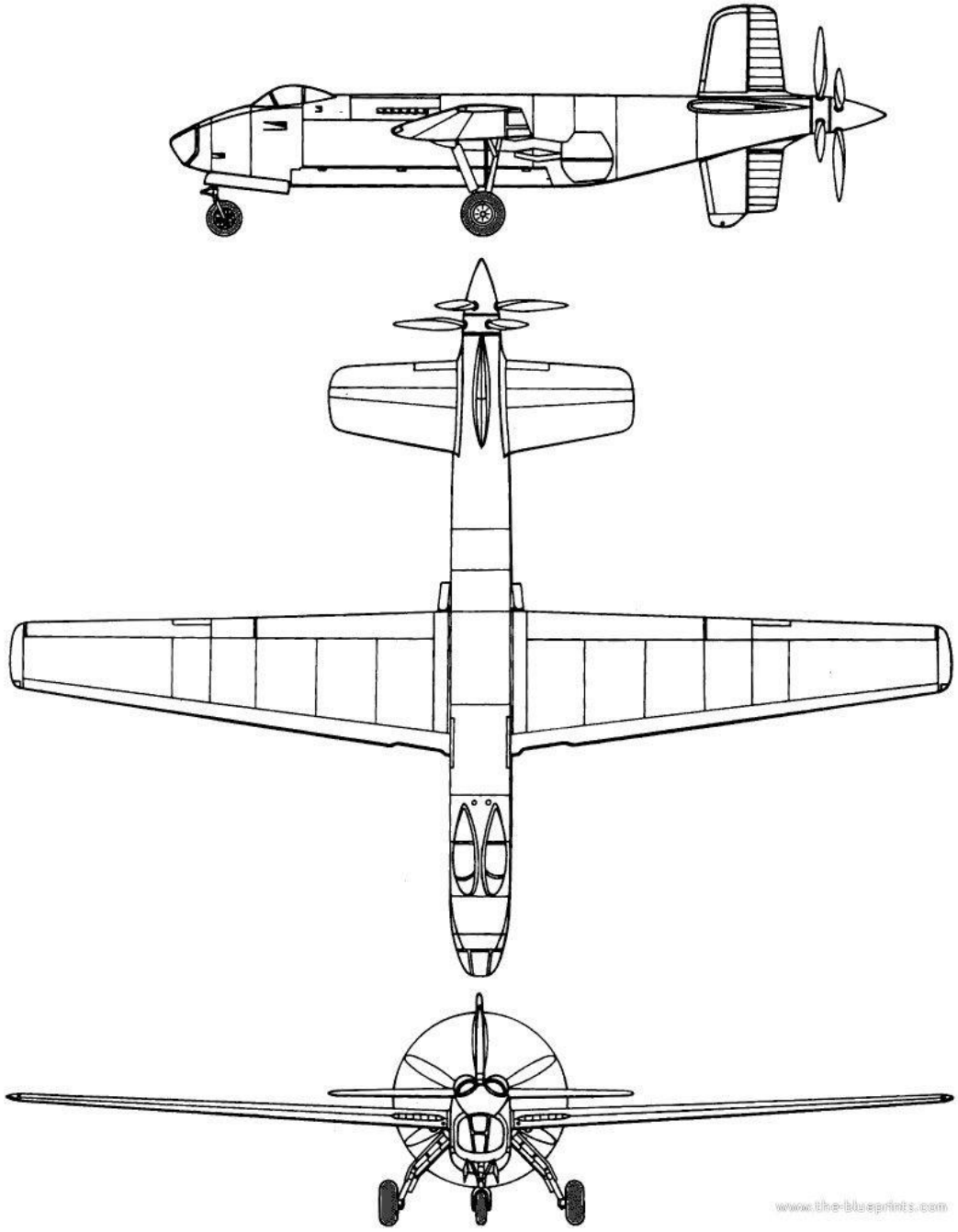
- Motorisation : 2 Allison V-1710-125 (12 cylindres en V).
- Puissance : 988 kW (1 325 ch) par moteur ; 2 650 ch au total.

Masses

- Masse à vide : 9 475 kg
- Masse maximale au décollage : 16 194 kg
- Vitesse maximale : 660 km/h
- Plafond opérationnel : 9 000 m
- Rayon d'action : 2 900 km

Armement

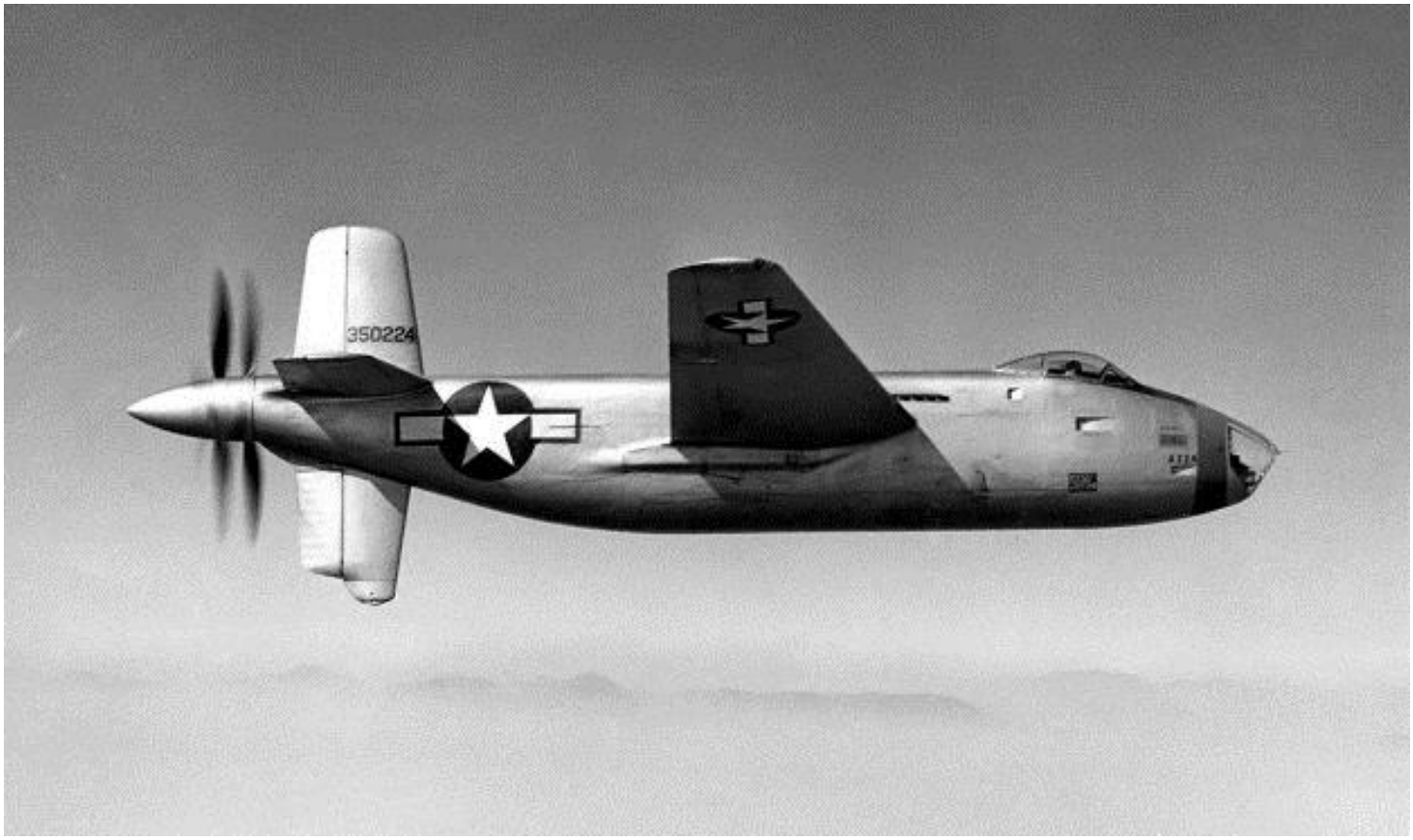
- Armement défensif : 6 mitrailleuses Browning M2 de 12,7 mm
- Armement offensif : 3 630 kg de bombes



Source : https://fr.wikipedia.org/wiki/Douglas_XB-42_Mixmaster

Version anglaise

In the early 1940s, Edward F. Burton began to investigate ways to simplify bomber aircraft. Burton was the Chief of Engineering at the Douglas Aircraft Company (Douglas), and he had noted that each subsequent generation of bomber aircraft was substantially larger, more complex, and more expensive than the preceding generation. Burton and his team started with a clean sheet of paper and designed what would become the XB-42.



The Douglas XB-42 Mixmaster had a unique design that provided very good performance. However, it was too late for World War II and too slow compared to jet aircraft. The first prototype (43-50224) is seen with its short tail on an early test flight.

Acting on their own, with no official United States Army Air Force (AAF) requirement, Burton and his team worked to design a two-engine tactical bomber with a top speed of over 400 mph (644 km/h) and that was capable of carrying 2,000 lb (907 kg) of bombs to a target 2,500 miles (4,023 km) away. The aircraft's high speed would eliminate the need for extensive defensive armament, which would minimize the bomber's crew and save weight. Burton's team placed the wings, tail, and propellers in their optimal positions; the designers then filled in the rest of the aircraft with the needed equipment. What emerged from the drafting table was the Douglas Model 459: a mid-wing aircraft operated by a crew of three. At the rear of the aircraft were a set of coaxial contra-rotating pusher propellers driven by engines buried in the fuselage. In May 1943, Douglas proposed the aircraft to the AAF, and they were sufficiently impressed to order two prototypes and a static test airframe on 25 June 1943.

The AAF originally gave the aircraft the Attack designation XA-42. Douglas had presented the aircraft in a variety of roles that suited the Attack aircraft profile. However, the aircraft was reclassified as a bomber and redesignated XB-42 on 25 November 1943.

Unofficially, the XB-42 was given the name Mixmaster, on account of its eight contra-rotating propeller blades loosely resembling a popular kitchen mixer.

The Douglas XB-42 Mixmaster was a unique aircraft. It was an all-metal aircraft with a tricycle landing gear arrangement, which was novel at the time. A plexiglass nose covered the bombardier's position. Atop the fuselage were two separate bubble canopies for the pilot and copilot. At the rear of the aircraft was a cruciform tail; its ventral fin contained an oleo-pneumatic bumper to protect the propellers from potential ground strikes during takeoff and landing.

Nose view of the first prototype shows the twin bubble canopies to advantage. Both XB-42 aircraft were originally built with the canopies, but they were disliked. The second aircraft was later modified with a more conventional canopy.

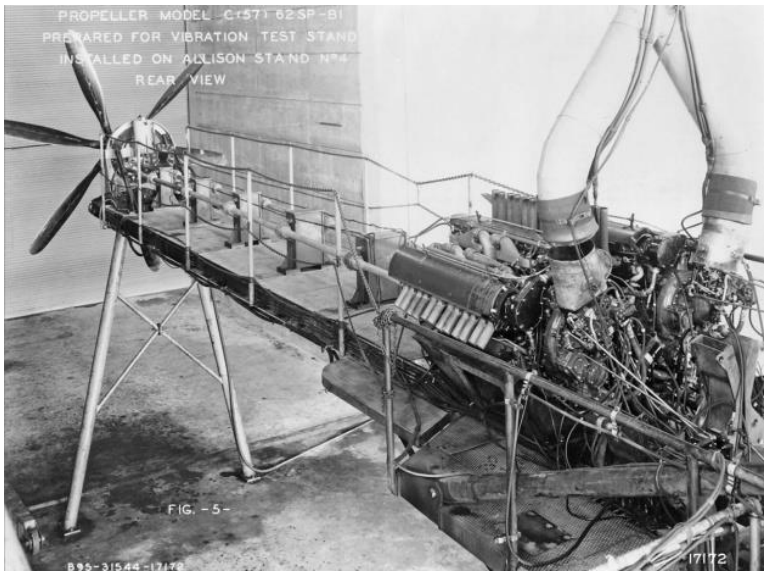
The aircraft's long wing used a laminar flow airfoil and was fitted with double-slotted flaps. An inlet in the wing's leading edge led to the engine oil cooler and radiator, both fitted with electric fans for ground operation. After air flowed through the coolers, it was expelled out the top of the wing. The main landing gear retracted back into the sides of the fuselage, below and behind the wings. The complex retraction required the gear legs and wheels to rotate 180 degrees. Fuel tanks in each wing carried 330 gallons (1,249 L) of fuel. Four additional 275 gallon (1,041 L) fuel tanks could be installed in the bomb bay to extend the aircraft's range. In addition, a 300 gallon (1,136 L) drop tank could be installed under each wing.

Housed in the fuselage behind the cockpit were two Allison V-1710 engines. Each engine was installed with its vertical axis tilted 20 degrees out from center, and the engines were angled toward the tail. Ducts flush with the aircraft's skin and positioned below the cockpit on both sides of the aircraft brought induction air to the engines. A row of exhaust stacks was located above the leading edge of each wing, and two rows of exhaust stacks were positioned along the aircraft's spine. The engines of the first XB-42 prototype produced 1,325 hp (988 kW) at takeoff and 1,820 hp (1,357 kW) at war emergency power. The second prototype had engines that produced 1,675 hp (1,249 kW) for takeoff and 1,900 hp (1,417 kW) for war emergency power.

An unusual view of the second prototype (43-50225) that displays the aircraft's slotted flaps and uncommon main gear retraction that required the legs and wheels to rotate 180 degrees into the fuselage sides. Also visible are the wing guns and revised leading edge inlets, both features exclusive to the second prototype.

Extending from each engine was an extension shaft made up of six sections. The shaft sections were like those used in the Bell P-39 Airacobra (which used two sections). The shafts extended around 29 ft (8.8 m) and connected the engines to a remote, contra-rotating gear reduction box from an Allison V-3420-B engine. The gearbox had been slightly modified for the XB-42 and used a .361 gear ratio that was unique to the aircraft. Each engine turned a three-blade Curtiss Electric propeller. The left engine drove the forward propeller, which was 13 ft 2 in (4.01 m) in diameter. The right engine drove the rear propeller, which was 13 ft (3.96 m) in diameter. The engines and propellers were operated independently—if needed, one engine could be shut down and its propeller feathered while in flight.

To eliminate the danger the propellers presented to the crew during a bail out, a cord of explosives (cordite) was threaded through holes carefully drilled around the gearbox mount. Before bailing out, the crew could detonate the explosives, which would separate the gearbox and propellers from the aircraft.



Two Allison V-1710 engines connected to the V-3420 remote gear reduction for the contra-rotating propellers as used on the XB-42. The power system accumulated over 600 hours on the test stand and never caused serious issues during the XB-42 program.

The XB-42's bomb bay was covered by two-piece, snap-action doors. The bay accommodated 8,000 lb (3,629 kg) of bombs, or a single 10,000 lb (4,536 kg) bomb could be carried if the doors were kept open six inches. The bay was long enough to carry two 13 ft 9 in (4.2 m) Mk 13 torpedoes. Two fixed .50-cal machine guns with 500 rpg were installed in the aircraft's nose. Housed in the trailing edge of each wing, between the aileron and flap, were a pair of rearward-firing .50-cal machine guns, each with 350 rpg. The guns were concealed behind snap-action doors. Once exposed, the guns could be angled through a range of 30 degrees up, 15 degrees down, and 25 degrees to the left or right. Their minimum convergence was 75 ft behind the aircraft. The rear-firing guns were operated by the copilot, who rotated his seat 180 degrees to use the gun's sighting system.

Douglas designers envisioned that the B-42 aircraft could be fitted with a solid nose containing different weapons for different roles. This is the same concept that was applied to the Douglas A-20 Havoc and A-26 Invader. Three of the possible B-42 nose configurations were as follows: eight .50-cal machine guns; two 37 mm cannons and two .50-cal machine guns; or a 75 mm cannon and two .50-cal machine guns. Douglas also thought the aircraft's speed and range would make it very useful in a reconnaissance role. None of these plans made it off the drawing board.

The XB-42 had a 70 ft 6 in (21.49 m) wingspan and was 53 ft 8 in (16.4 m) long. Originally, the aircraft was 18 ft 10 in (5.7m) tall, but the tail and rudder were extended to cure some instability. The extension increased the XB-42's height to 20 ft 7 in (6.3 m). A brochure published by Douglas in April 1944 predicted the B-42 would be able to carry 2,000 lb (907 kg) of bombs over 5,333 miles (8,583 km) and have a top speed of 470 mph (756 km/h). These numbers proved very optimistic. Perhaps the speed was a misprint, because some sources indicate the anticipated top speed was 440 mph (708 km/h). Regardless, the aircraft only achieved 410 mph (660 km/h) at 23,440 ft (7,145 m), and its cruising speed was 312 mph (502 km/h). The XB-42 had an empty weight of 20,888 lb (9,475 kg) and a maximum weight of 35,702 lb (16,194 kg). The aircraft's service ceiling was 29,400 ft (8,961 m). Its combat range was 1,800 miles (2,897 km), but additional fuel tanks in the bomb bay could extend the XB-42's range to a maximum of 5,400 miles (8,690 km).

Rear view of the second prototype shows the ventral tail and rudder. Note the oleo-pneumatic bumper on the tail and its minimal ground clearance. The wing guns and new canopy are just barely visible.

Construction of the XB-42 proceeded rapidly. The AAF inspected and approved an aircraft mockup in September 1943, and the first prototype (43-50224) was completed in May 1944—one year after the aircraft was proposed and 10 months after the contract was awarded. The XB-42 flew for the first time on 6 May 1944, flown by Bob Brush and taking off from the Palm Springs Army Airfield in California. The second prototype (43-50225) flew for the first time on 1 August 1944, taking off from Santa Monica Airport in California.

Both XB-42s were originally fitted with separate bubble canopies. This cockpit layout was not very popular with the pilots. Although they could communicate via intercom, the pilots often found themselves leaning forward to speak with one another face to face under the canopies. The second aircraft was modified with a more conventional single canopy that encompassed both pilot and copilot. While the bubble canopies reduced drag, the single canopy was preferred. Another issue facing the aircraft was that cracks formed in the plexiglass nose. After the plexiglass was replaced several times, the nose was eventually covered with plywood.

Both prototypes were heavier than expected, which reduced performance. Some work went into lightening the second aircraft, like the use of hollow propeller blades. However, issues with vibrations occurred when disturbed air encountered the propellers, and this phenomenon was exacerbated by the hollow blades. No issues were encountered when the aircraft was clean, but when the bomb bay doors were open or when the gear or flaps were deployed, the vibration issue occurred. Some pilots lived with the vibrations and dismissed the issue, but other pilots found it very disconcerting. An improved propeller was designed that featured reversible blades to decrease landing roll and to slow the aircraft in flight. However, it was cancelled in March 1945 and was never built.

Front view of the second prototype illustrates the aircraft's revised canopy. The canopy on production aircraft would have been similar but more refined. Again, note the tail clearance and wing guns.

Some cooling issues were encountered, and modifications to the air intakes were made to improve airflow. The main gear was also modified a few times to improve its retraction and performance.

Overall, the aircraft flew well, but the controls were not well harmonized. In addition, the XB-42 aircraft would encounter a slow dutch roll oscillation if not counteracted by the pilot. As previously mentioned, the tail of the aircraft was enlarged to resolve the issue, but it was never entirely solved. The XB-42 required a very long takeoff run of some 6,415 ft (1,955 m). Because there was only about 9 in (.23 m) of clearance between the ventral tail and the ground, the aircraft needed to build up a substantial amount of speed before it was carefully rotated for liftoff.

The second XB-42 prototype was the only aircraft to have revised wing inlets and to be fitted with its machine gun armament, although the guns were never tested. The second aircraft was flown around 70 hours before it was turned over to the AAF. On 8 December 1945, Lieutenant Colonel Henry E. Warden and Captain Glen W. Edwards flew the second XB-42 from Long Beach, California to Bolling Field in Washington, D.C. The record-setting, point-to-point flight covered 2,295 miles (3,693 km) in a time of 5:17:34—an average of 433.6 mph (697.8 km/h). The XB-42 had benefited from a favorable tailwind, and the aircraft's average true airspeed was around 375 mph (604 km/h).

The guns in the left wing are seen aimed 30 degrees up and 25 degrees inboard. Only the second aircraft was fitted with the guns, and they were never tested. Note the snap-action doors that covered the guns. When open, the doors increased the XB-42's directional stability, resulting in additional rudder force to give the desired yaw.

On 16 December 1945, the second XB-42 was lost during a test flight near Bolling Field. The aircraft was in a landing configuration when there was an issue with extending the landing gear. While the crew was troubleshooting the problem, the left engine began to overheat and then died. The right engine was taken to full power and began to overheat. The decision was made to bail out, and two of the crew safely jumped free before the pilot remembered to jettison the propellers. The propellers and their gearbox were successfully severed from the XB-42, and the pilot bailed out. All three crew members survived the ordeal without any injuries, but the aircraft was completely destroyed.

An exact cause of the crash was never determined, but it was speculated that the coolant doors were inadvertently left in their nearly-closed landing configuration while the crew investigated the gear issue. This resulted in the engines overheating. At the same time, a fuel tank switch was made a bit late and probably led to fuel starvation of the left engine. The second XB-42 had accumulated a little over 118 hours of flight time when it crashed.

The first XB-42 prototype had made 42 flights and accumulated over 34 flight hours by 30 September 1944. A year later, that number rose to around 150 flights, with the aircraft accumulating around 125 flight hours. Before the XB-42 had even flown, Douglas contemplated adding jet engines to the aircraft. An official proposal for the modification was submitted on 23 February 1945. The proposal was approved on 8 March 1946, and modifications to the aircraft began on 26 June 1946. At the time, the first XB-42 had made 168 flights and had flown around 144.5 hours. The two Westinghouse 19XB-2A (J30) jet engines were finally delivered in October 1946 and were installed on the aircraft.

Rear view of the XB-42A illustrates the notches in the new flaps to avoid the jet exhaust. The rest of the aircraft remained relatively unchanged from the XB-42 configuration. The cooling air exit can be seen on the right wing. Note the various Douglas aircraft in the background.

With the jet engines added to the first prototype, the aircraft was redesignated as the Douglas XB-42A. The 1,600 lbf (7.12 kN) thrust jet engines were mounted under the aircraft's wings. New flaps were installed that were notched behind the jet engines. The notches allowed the flaps to avoid the jet exhaust when they were deployed. The fuel tanks in the wings were modified because of the jet engine mounts. Total wing tankage was decreased by 154 gallons (583 L), but two additional 74 gallon (280 L) tanks were installed in the fuselage. The jets themselves burned the same fuel as the piston engines. The aircraft's instrumentation was also modified to accommodate the jet engines.

The XB-42A is listed as having a 70 ft 7 in (21.51 m) wingspan and a length of 53 ft 10 in (16.4 m). In reality, the wingspan was probably the same as the XB-42, and the length was slightly longer due to a different spinner. The aircraft's height was 20 ft 7 in (6.3 m).

The XB-42A had a predicted maximum speed of 488 mph (785 km/h) but only achieved 473 mph (761 km/h) at 14,000 ft (4,267 m); cruising speed was 442 mph (711 km/h). The XB-42A had an empty weight of 24,775 lb (11,238 kg) and a maximum weight of 44,900 lb (20,366 kg). The aircraft's service ceiling was 34,500 ft (10,516 m). The XB-42A had a normal range of around 1,200 miles (1,931 km), but a maximum range of 4,750 miles (7,644 km) could be achieved with additional fuel tanks in the bomb bay.

The XB-42A makes a low pass over Muroc Air Base during an early test flight. Note the exhaust stains above the wing and the oil stains below the wing. The aircraft was outclassed by other jet aircraft, including its XB-43 cousin.

The first flight of the XB-42A (still 43-50224) occurred on 27 May 1947 at Muroc (now Edwards) Air Base in California. The aircraft required a lot of maintenance and did not prove remarkable in any category to justify further development. Despite the increased performance, the XB-42A was perched on the awkward dividing line between piston-powered aircraft of the past and jet-powered aircraft of the future. There is no better indicator of this than the fact that Douglas had already moved forward with an all-jet XB-42 aircraft, designated XB-43. The Douglas XB-43 Jetmaster had its jet engines buried in the fuselage, near were the Allison engines were installed on the XB-42. The first XB-43 was built using the XB-42 static test airframe. The jet-powered XB-43 made its first flight on 17 May 1946—little more than a year before the jet/piston-powered XB-42A first flew. The XB-42A made only 23 flights, accounting for a little under 18.5 hours of flight time.

With technological progress outpacing the XB-42A, the aircraft was donated to the Air Force Museum on 30 June 1949. It was later moved to the National Air and Space Museum's Paul Gerber Facility in Silver Hill, Maryland, where it was stored for a number of years. In 2010, the XB-42A was transferred to the National Museum of the United States Air Force in Dayton, Ohio. The aircraft, along with second XB-43 prototype, will eventually be restored for static display.

Douglas persisted with the pusher configuration and designed a number of other military and commercial aircraft. The most developed design was that of the Model 1004, which was actually designated DC-8. Known as the Skybus, the aircraft was similar to an XB-42, but with an extended fuselage for airline service. The aircraft could seat a maximum of 48 passengers, and the extension shafts from the Allison engines traveled under the passenger compartment. First proposed in October 1945, the Skybus was never built, and the DC-8 designation was reapplied to Douglas's first jet airliner.

Although visually similar to the XB-42, the Douglas DC-8 Skybus was an entirely new design. The aircraft's excellent performance and great single-engine handling was not enough to justify its expense over more conventional designs.

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