North American P-51 Mustang

North American P-51D-30 Mustang cubain exposé

Peu après l'Anschluss, le Royaume-uni envoya une commission d'achat présidée par Sir Henry Self aux Etat-Unis. Seul le P-40 s'approchait des désidératas de la RAF. Curtiss ayant déjà une charge de travail énorme, Self demanda à North American de produire le P-40. North American proposa un avion à la fois plus performant et meilleur marché : le NA-73X, conçu par Edgar Schmued. La commission réclama un appareil propulsé par un Allison V-1710, armé de 4 mitrailleuses de 7,7 mm, pour un coût inférieur à 40000 dollars. 320 appareils furent commandés le 24 avril 1940, dont le premier devait être livré en janvier 1941. North American acquit les données des tests en soufflerie du P-40 et surtout du XP-46, et le prototype sortit d'usine en septembre 1940, ce qui est court. Aujourd'hui encore, il existe un débat sur le fait que North American ait pu s'inspirer du XP-46, contrebalancé par l'argument que le NA-73 était déjà prêt dans ses grandes lignes. Quoiqu'il en soit, l'unique prototype vola pour la première fois le 26 octobre 1940. Son fuselage, de construction semi-monocoque et entièrement en aluminium, avait une grande capacité en carburant. Il disposait de 4 mitrailleuses M1919 de 7,62 mm, deux dans les ailes et deux tirant à travers l'hélice. Son aile disposait d'un profil à écoulement laminaire, conçu conjointement avec le NACA. Son radiateur utilisait le principe de l'effet Meredith, réutilisant l'air chaud pour un surcroît de puissance. Pour le reste, le NA-73 réutilisait ce qui se faisait de mieux à son époque, tout en restant simple à produire. La RAF fut donc la première force aérienne à mettre le NA-73 en service. Les 320 NA-73 furent suivis par 300 NA-83 armés de 4 canons HS-404 (dont deux furent rétrocédés à l'USAAC pour évaluation), et tous ces appareils furent appelés Mustang I par un membre anonyme de la commission d'achat. Ils entrèrent en service en 1941 au sein du 2e squadron de la RAF. Leurs performances au-delà de 4600 mètres d'altitude étaient mauvaises et ils furent cantonnés à la reconnaissance tactique et à l'attaque au sol. Leur première mission de guerre (reconnaissance) eut lieu le 27 juillet 1942 et leur première mission d'attaque au sol le 19 août, lors de l'opération Jubilee (le raid sur Dieppe). La RAF reçut également 93 P-51 (désignés Mustang IA), 50 P-51A (Mustang II), 308 P-51B et 636 P-51C (Mustang III), 281 P-51D (Mustang IV) et 595 P-51K (Mustang IVA). A partir de 1943, ils servirent essentiellement à détecter les sites de lancement de missiles V-1. Ils furent finalement retirés du service en 1947.

North American P-51D aux couleurs néo-zélandaises

L'arrivée des P-51 américains changea considérablement la donne sur le théâtre européen. Leurs performances, en tant qu'escorteurs à long rayon d'action, permit de prendre le pas sur la Luftwaffe, en plus de la supériorité numérique et d'un entraînement plus efficace. Ils permirent largement de détruire la Luftwaffe et de rendre les raids de jour moins dangereux. En revanche, son rôle dans le Pacifique fut réduit. L'Europe était prioritaire et le P-38 bimoteur plus sécurisant. Il fut engagé fin 1944, pour escorter les B-29 au-dessus du Japon à partir d'Iwo Jima. Lors de la Seconde Guerre Mondiale, il fut utilisé par l'Afrique du Sud (Mustang III et IV de 1944 à 1953), l'Australie (84 P-51K, 100 CA-17 Mustang 20 et 120 CA-18 (P-51D construits sous licence) furent utilisés de novembre 1944 à 1960), le Canada (5 squadrons en service à partir de 1942, 150 P-51D après-guerre : ils furent utilisé jusqu'en 1956), la Chine républicaine (P-51C et D début 1945), la France (F-6C et D de fin 1944 au début des années 1950), l'Union soviétique (10 Mustang I furent reçus, mais furent jugés inférieurs aux avions russes et relégués à l'entraînement). La Luftwaffe captura plusieurs P-51 (B, C et 3 P-51D), qui furent évalués au sein du Rosarius Staffel, surnommé "Cirque Rosarius". Le Japon captura un P-51C en 1945. La Suède interna 2 P-51B et 2 P-51D lors de la guerre. 161 P-51D (désignés J-26) furent reçus à partir de 1945. 12 furent modifiés en S-26 de reconnaissance et survolèrent l'URSS. Ils furent remplacés au début des années 1950. La Suisse interna aussi des P-51. Elle acheta 130 P-51 qui servirent jusqu'en 1958. Après la guerre, il fut vendu à la Bolivie (7 P-51D et 2 TF-51), à la Chine (des P-51 capturés), à la Corée du Sud (10 P-51D), au Costa Rica (4 P-51D de 1955 à 1964), à Cuba (3 P-51D acquis illégalement en novembre 1958, qui participèrent à la révolution et furent rapidement cloués au sol faute de pièces détachées), au Guatemala (30 P-51D de 1954 au début des années 1970), à Haïti (4 P-51D de 1950 à 1974), à l'Indonésie (P-51D utilisés lors de la guerre contre le Commonwealth, au début des années 1960, et retirés du service en 1974), à Israël (vendus illégalement en 1948, ils servirent pendant la crise de Suez à couper des fils avec leur hélice), à l'Italie (173 P-51D de 1947 à 1958), au Nicaragua (56 P-51D et 2 TF-51 de 1954 à 1964), à la Nouvelle-Zélande (30 P-51D furent reçus en août 1945, mais ne furent assemblés qu'en 1951 : ils restèrent en service jusqu'en 1957), aux Pays-Bas (40 P-51D en service au sein de la ML-KNIL), aux Philippines (103 P-51D, qui servirent contre les rebelles, notamment communistes, jusque dans les années 1980), à la République Dominicaine (au moins 50 P-51D de 1948 à 1984), au Salvador (au moins 7 P-51D.

Ils participèrent au dernier combat entre chasseurs à hélice, en 1969, où l'un d'eux fut abattu par un F4U-5), à la Somalie (8 P-51D), à l'Uruguay (25 P-51D de 1950 à 1960). Il fut également utilisé dans des patrouilles acrobatiques, comme les Black Eagle sud-coréens jusqu'en 1954, ou les Blue Diamonds philippins à partir de 1953. Il fut sans conteste le meilleur chasseur américain terrestre du conflit, et resta tout-à-fait comparable au Spitfire, au Bf-109 ou FW-190 dans leurs dernières versions. 16766 exemplaires furent construits. Il remporta 4950 victoires, ce qui en fait le second du F6F Hellcat. Il fut de nouveau engagé lors de la guerre de Corée. Remplacé dans le rôle de chasseur par le F-86, il servit aux missions d'attaque au sol. Il fut utilisé jusqu'en 1984 par certaines forces aériennes. L'USAF le retira du service en 1956. Il resta longtemps en service après la guerre, et fut employé par plus de 55 pays. Il faut dire que les pays qui avaient signé le Traité interaméricain d'assistance réciproque (Amérique latine, donc) purent recevoir des centaines d'exemplaires au prix faramineux d'un dollar pièce. Bon nombre de P-51 furent mis sur le marché civil après la guerre, souvent pour participer à des courses. Un grand nombre a survécu et est en état de vol.

Source : https://aviationsmilitaires.net/v3/kb/aircraft/show/2466/north-american-p-51-mustang

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The **North American Aviation P-51 Mustang** is an American long-range, single-seat fighter and fighter-bomber used during World War II and the Korean War, among other conflicts. The Mustang was designed in April 1940 by a team headed by James H. Kindelberger of North American Aviation (NAA) in response to a requirement of the British Purchasing Commission. The commission approached NAA to build Curtiss P-40 fighters under license for the Royal Air Force (RAF). Rather than build an old design from another company, NAA proposed the design and production of a more modern fighter. The prototype NA-73X airframe was rolled out on 9 September 1940, 102 days after the contract was signed, and first flew on 26 October. The Mustang was designed to use the Allison V-1710 engine without an export-sensitive turbosupercharger[5] or a multi-stage supercharger, resulting in limited high-altitude performance. The aircraft was first flown operationally by the RAF as a tactical-reconnaissance aircraft and fighter-bomber (Mustang Mk I). Replacing the Allison with a Rolls-Royce Merlin two-stage supercharged engine resulted in the P-51B/C (Mustang Mk III) model, and transformed the aircraft's performance at altitudes above 15,000 ft (4,600 m) (without sacrificing range),[6] allowing it to compete with the *Luftwaffe*'s fighters.[7] The definitive version, the P-51D, was powered by the Packard V-1650-7, a license-built version of the two-speed, two-stage-supercharged Merlin 66, and was armed with six .50 caliber (12.7 mm) AN/M2 Browning machine guns.[8] From late 1943, P-51Bs and P-51Cs (supplemented by P-51Ds from mid-1944) were used by the USAAF's Eighth Air Force to escort bombers in raids over Germany, while the RAF's Second Tactical Air Force and the USAAF's Ninth Air Force used the Merlin-powered Mustangs as fighter-bombers, roles in which the Mustang helped ensure Allied air superiority in 1944.[9] The P-51 was also used by Allied air forces in the North African, Mediterranean, Italian, and Pacific theaters. During World War II, Mustang pilots claimed to have destroyed 4,950 enemy aircraft.[a] At the start of the Korean War, the Mustang, by then redesignated **F-51**, was the main fighter of the United States until jet fighters, including North American's F-86 Sabre, took over this role; the Mustang then became a specialized fighter-bomber. Despite the advent of jet fighters, the Mustang remained in service with some air forces until the early 1980s. After the Korean War, Mustangs became popular civilian warbirds and air racing aircraft.

Design and development

North American NA-73X, with a short carburetor air-intake scoop and the frameless, rounded windshield: On the production Mustang Mk Is, the frameless windshield was replaced with a three-piece unit that incorporated a bullet-resistant windshield

P-51D on the Inglewood assembly line

In 1938, the British government established a purchasing commission in the United States, headed by Sir Henry Self.[11][12] Self was given overall responsibility for RAF production, research, and development, and also served with Sir Wilfrid Freeman, the Air Member for Development and Production. Self also sat on the British Air Council Subcommittee on Supply (or "Supply Committee"), and one of his tasks was to organize the manufacturing and supply of American fighter aircraft for the RAF. At the time, the choice was very limited, as no U.S. aircraft then in production or flying met European standards, with only the Curtiss P-40 Tomahawk coming close. The Curtiss-Wright plant was running at capacity, so P-40s were in short supply.[13] North American Aviation (NAA) was already supplying its T-6 Texan (known in British service as the "Harvard") trainer to the RAF, but was otherwise underused. NAA President "Dutch" Kindelberger approached Self to sell a new medium bomber, the North American B-25 Mitchell. Instead, Self asked if NAA could manufacture P-40s under license from Curtiss. Kindelberger said NAA could have a better aircraft with the same Allison V-1710 engine in the air sooner than establishing a production line for the P-40. John Attwood of NAA spent much time from January to April 1940 at the British Purchasing Commission's offices in New York discussing the British specifications of the proposed aircraft with British engineers. The discussions consisted of free-hand conceptual drawings of an aircraft with the British officials. Sir Henry Self was concerned that NAA had not ever designed a fighter, insisting they obtain the drawings and study the Curtiss XP-46 experimental aircraft and the wind-tunnel test results for the P-40, before presenting them with detailed design drawings based on the agreed concept. NAA purchased the drawings and data from Curtiss for £56,000, confirming the purchase with the British Purchasing Commission. The commission approved the resulting detailed design drawings, signing the commencement of the Mustang project on 4 May 1940, and firmly ordering 320 on 29 May 1940. Prior to this, NAA only had a draft letter for an order of 320 aircraft. Curtiss engineers accused NAA of plagiarism.[14] The British Purchasing Commission stipulated armament of four .303 in (7.7 mm) machine guns (as used on the Tomahawk), a unit cost of no more than $40,000, and delivery of the first production aircraft by January 1941.[15]

In March 1940, 320 aircraft were ordered by Freeman, who had become the executive head of the Ministry of Aircraft Production (MAP) and the contract was promulgated on 24 April.[16] The **NA-73X**, which was designed by a team led by lead engineer Edgar Schmued, followed the best conventional practice of the era, designed for ease of mass manufacturing.[14] The design included several new features.[nb 1] One was a wing designed using laminar flow airfoils, which were developed co-operatively by North American Aviation and the National Advisory Committee for Aeronautics (NACA). These airfoils generated low drag at high speeds.[17][b] During the development of the NA-73X, a wind-tunnel test of two wings, one using NACA five-digit airfoils and the other using the new NAA/NACA 45–100 airfoils, was performed in the University of Washington Kirsten Wind Tunnel. The results of this test showed the superiority of the wing designed with the NAA/NACA 45–100 airfoils.[19][nb 2]

XP-51 *41-039* is one of two Mustang Mk I aircraft handed over to the USAAC for testing.

The other feature was a new cooling arrangement positioned aft (single ducted water and oil radiators assembly) that reduced the fuselage drag and effects on the wing. Later,[21] after much development, they discovered that the cooling assembly could take advantage of the Meredith effect, in which heated air exited the radiator with a slight amount of jet thrust. Because NAA lacked a suitable wind tunnel to test this feature, it used the GALCIT 3.0 m (10 ft) wind tunnel at the California Institute of Technology. This led to some controversy over whether the Mustang's cooling system aerodynamics were developed by NAA's engineer Edgar Schmued or by Curtiss, as NAA had purchased the complete set of P-40 and XP-46 wind tunnel data and flight test reports.[22][23] The NA-73X was also one of the first aircraft to have a fuselage lofted mathematically using conic sections; this resulted in smooth, low-drag surfaces.[24] To aid production, the airframe was divided into five main sections—forward, center, rear fuselage, and two wing halves—all of which were fitted with wiring and piping before being joined.[24] The prototype NA-73X was rolled out in September 1940, just 102 days after the order had been placed; it first flew on 26 October 1940, 149 days into the contract, an uncommonly short development period, even during the war.[25] With test pilot Vance Breese at the controls,[26] the prototype handled well and accommodated an impressive fuel load. The aircraft's three-section, semi-monocoque fuselage was constructed entirely of aluminum to save weight. It was armed with four .30 caliber (7.62 mm) AN/M2 Browning machine guns in the wings and two .50 caliber (12.7 mm) AN/M2 Browning machine guns mounted under the engine and firing through the propeller arc using gun-synchronizing gear.[nb 3]

While the USAAC could block any sales it considered detrimental to the interests of the US, the NA-73 was considered to be a special case because it had been designed at the behest of the British. In September 1940, a further 300 NA-73s were ordered by the MAP.[15] To ensure uninterrupted delivery, Colonel Oliver P. Echols arranged with the Anglo-French Purchasing Commission to deliver the aircraft and NAA gave two examples (41-038 and 41-039) to the USAAC for evaluation.[27][nb 4] The Allison engine in the Mustang I had a single-stage supercharger that caused power to drop off rapidly above 15,000 feet (4,600 m). This made it unsuitable for use at the altitudes where combat was taking place in Europe. Allison's attempts at developing a high-altitude engine were underfunded, but produced the V-1710-45, which featured a variable-speed auxiliary supercharger, and developed 1,150 horsepower (860 kW) at 22,400 feet (6,800 m). In November 1941, NAA studied the possibility of using it, but fitting its excessive length in the Mustang would require extensive airframe modifications and cause long production delays.[29][30] In May 1942, following positive reports from the RAF on the Mustang I's performance below 15,000 ft, Ronald Harker, a test pilot for Rolls-Royce, suggested fitting a Merlin 61, as fitted to the Spitfire Mk IX.[29] The Merlin 61 had a two-speed, two-stage, intercooled supercharger, designed by Stanley Hooker of Rolls-Royce.[31] Both the Merlin 61 and V-1710-39 were capable of about 1,570 horsepower (1,170 kW) war emergency power at relatively low altitude, but the Merlin developed 1,390 horsepower (1,040 kW) at 23,500 feet (7,200 m) versus the Allison's 1,150 horsepower (860 kW) at 11,800 feet (3,600 m),[32][33][30] delivering an increase in top speed from 390 mph (340 kn; 630 km/h) at ~15,000 feet (4,600 m) to an estimated 440 mph (380 kn; 710 km/h) at 28,100 feet (8,600 m). Initial flights of what was known to Rolls-Royce as the Mustang Mk X were completed at Rolls-Royce's airfield at Hucknall in October 1942.[29] At the same time, the possibility of combining the P-51 airframe with the US license-built Packard version of the Merlin engine was being explored on the other side of the Atlantic. In July 1942, a contract was let for two prototypes, briefly designated XP-78, but soon to become the XP-51B.[34] Based on the Packard V-1650-3 duplicating the Merlin 61's performance, NAA estimated for the XP-78 a top speed of 445 mph (387 kn; 716 km/h) at 28,000 feet (8,500 m), and a service ceiling of 42,000 feet (13,000 m).[29] The first flight of the XP-51B took place in November 1942, but the USAAF was so interested in the possibility that an initial contract for 400 aircraft was placed three months beforehand in August.[35] The conversion led to production of the P-51B beginning at NAA's Inglewood, California, plant in June 1943,[36] and P-51s started to become available to the 8th and 9th Air Forces in the winter of 1943–1944. Conversion to the two-stage supercharged Merlin 61, over 350 lb (160 kg) heavier than the single-stage Allison, driving a four-bladed Hamilton Standard propeller, required moving the wing slightly forward to correct the aircraft's center of gravity. After the USAAF, in July 1943, directed fighter aircraft manufacturers to maximize internal fuel capacity, NAA calculated the P-51B's center of gravity to be forward enough to include an additional 85 US gal (320 L; 71 imp gal) fuel tank in the fuselage behind the pilot, greatly increasing the aircraft's range over that of the earlier P-51A. NAA incorporated the tank in the production of the P-51B-10, and supplied kits to retrofit it to all existing P-51Bs.[29]

Operational history

United Kingdom operational service

A Royal Air Force North American Mustang Mk III (*FX908*) on the ground at Hucknall

The Mustang was initially developed for the RAF, which was its first user. As the first Mustangs were built to British requirements, these aircraft used factory numbers and were not P-51s; the order comprised 320 NA-73s, followed by 300 NA-83s, all of which were designated **North American Mustang Mark I** by the RAF.[37] The first RAF Mustangs supplied under Lend-Lease were 93 P-51s, designated **Mk Ia**, followed by 50 P-51As used as **Mustang Mk II**s.[38] Aircraft supplied to Britain under Lend-Lease were required for accounting purposes to be on the USAAC's books before they could be supplied to Britain, but the British Aircraft Purchasing Commission signed its first contract for the North American NA-73 on 24 April 1940, before Lend-Lease was in effect. Thus, the initial order for the P-51 Mustang (as it was later known) was placed by the British under the "Cash and Carry" program, as required by the US Neutrality Acts of the 1930s. After the arrival of the initial aircraft in the UK in October 1941, the first squadron of Mustang Mk Is entered service in January 1942, the first being No. 26 Squadron RAF.[39] Due to poor high-altitude performance, the Mustangs were used by Army Co-operation Command, rather than Fighter Command, and were used for tactical reconnaissance and ground-attack duties. On 10 May 1942, Mustangs first flew over France, near Berck-sur-Mer.[40] On 27 July 1942, 16 RAF Mustangs undertook their first long-range reconnaissance mission over Germany. During the amphibious Dieppe Raid on the French coast (19 August 1942), four British and Canadian Mustang squadrons, including 26 Squadron, saw action covering the assault on the ground. By 1943–1944, British Mustangs were used extensively to seek out V-1 flying bomb sites. The last RAF Mustang Mk I and Mustang Mk II aircraft were struck off charge in 1945. Army Co-operation Command used the Mustang's superior speed and long range to conduct low-altitude "Rhubarb" raids over continental Europe, sometimes penetrating German airspace. The V-1710 engine ran smoothly at 1,100 rpm, versus 1,600 for the Merlin, enabling long flights over water at 50 ft (15 m) altitude before approaching the enemy coastline. Over land, these flights followed a zig-zag course, turning every six minutes to foil enemy attempts at plotting an interception. During the first 18 months of Rhubarb raids, RAF Mustang Mk.Is and Mk.Ias destroyed or heavily damaged 200 locomotives, over 200 canal barges, and an unknown number of enemy aircraft parked on the ground, for a loss of eight Mustangs. At sea level, the Mustangs were able to outrun all enemy aircraft encountered.[41] The RAF gained a significant performance enhancement at low altitude by removing or resetting the engine's manifold pressure regulator to allow overboosting, raising output as high as 1,780 horsepower at 70 in Hg.[41][32] In December 1942, Allison approved only 1,570 horsepower at 60 in Hg manifold pressure for the V-1710-39.[32] The RAF also operated 308 P-51Bs and 636 P-51Cs,[42] which were known in RAF service as **Mustang Mk III**s; the first units converted to the type in late 1943 and early 1944. Mustang Mk III units were operational until the end of World War II, though many units had already converted to the **Mustang Mk IV** (P-51D) and **Mk IVa** (P-51K) (828 in total, comprising 282 Mk IV and 600 Mk IVa).[43] As all except the earliest aircraft were obtained under Lend-Lease, all Mustang aircraft still on RAF charge at the end of the war were either returned to the USAAF "on paper" or retained by the RAF for scrapping. The last RAF Mustangs were retired from service in 1947.[44]

U.S. operational service

Prewar theory

Prewar doctrine was based on the idea "the bomber will always get through".[45] Despite RAF and Luftwaffe experience with daylight bombing, the USAAF still incorrectly believed in 1942 that tightly packed formations of bombers would have so much firepower that they could fend off fighters on their own.[45] Fighter escort was a low priority, but when the concept was discussed in 1941, the Lockheed P-38 Lightning was considered to be most appropriate, as it had the speed and range. Another school of thought favored a heavily up-armed "gunship" conversion of a strategic bomber.[46] A single-engined, high-speed fighter with the range of a bomber was thought to be an engineering impossibility.[47]

Eighth Air Force bomber operations 1942–1943

P-51 Mustangs of the 375th Fighter Squadron, Eighth Air Force mid-1944

The 8th Air Force started operations from Britain in August 1942. At first, because of the limited scale of operations, no conclusive evidence showed American doctrine was failing. In the 26 operations flown to the end of 1942, the loss rate had been under 2%.[48] In January 1943, at the Casablanca Conference, the Allies formulated the Combined Bomber Offensive (CBO) plan for "round-the-clock" bombing – USAAF daytime operations complementing the RAF nighttime raids on industrial centers. In June 1943, the Combined Chiefs of Staff issued the Pointblank Directive to destroy the Luftwaffe's capacity before the planned invasion of Europe, putting the CBO into full implementation. German daytime fighter efforts were, at that time, focused on the Eastern Front and several other distant locations. Initial efforts by the 8th met limited and unorganized resistance, but with every mission, the Luftwaffe moved more aircraft to the west and quickly improved their battle direction. In fall 1943, the 8th Air Force's heavy bombers conducted a series of deep-penetration raids into Germany, beyond the range of escort fighters. The Schweinfurt–Regensburg mission in August lost 60 B-17s of a force of 376, the 14 October attack lost 77 of a force of 291—26% of the attacking force. [49] For the US, the very concept of self-defending bombers was called into question, but instead of abandoning daylight raids and turning to night bombing, as the RAF suggested, they chose other paths; at first, bombers converted to gunships (the Boeing YB-40) was believed to be able to escort the bomber formations, but when the concept proved to be unsuccessful, thoughts then turned to the Lockheed P-38 Lightning.[50] In early 1943, the USAAF also decided that the Republic P-47 Thunderbolt and P-51B be considered for the role of a smaller escort fighter, and in July, a report stated that the P-51B was "the most promising plane" with an endurance of 4 hours 45 minutes with the standard internal fuel of 184 gallons plus 150 gallons carried externally.[51]

In August, a P-51B was fitted with an extra internal 85-gallon tank, but problems with longitudinal stability occurred, so some compromises in performance with the tank full were made. Since the fuel from the fuselage tank was used during the initial stages of a mission, the fuel tank would be fitted in all Mustangs destined for VIII Fighter Command.[52]

P-51 introduction

The P-51 Mustang was a solution to the need for an effective bomber escort. It used a common, reliable engine and had internal space for a larger-than-average fuel load. With external fuel tanks, it could accompany the bombers from England to Germany and back.[53] By the time the Pointblank offensive resumed in early 1944, matters had changed. Bomber escort defenses were initially layered, using the shorter-range P-38s and P-47s to escort the bombers during the initial stages of the raid before handing over to the P-51s when they were forced to turn for home. This provided continuous coverage during the raid. The Mustang was so clearly superior to earlier US designs that the 8th Air Force began to steadily switch its fighter groups to the Mustang, first swapping arriving P-47 groups to the 9th Air Force in exchange for those that were using P-51s, then gradually converting its Thunderbolt and Lightning groups. By the end of 1944, 14 of its 15 groups flew the Mustang.[54] The Luftwaffe's twin-engined Messerschmitt Bf 110 heavy fighters brought up to deal with the bombers proved to be easy prey for the Mustangs, and had to be quickly withdrawn from combat. The Focke-Wulf Fw 190A, already suffering from poor high-altitude performance, was outperformed by the Mustang at the B-17's altitude, and when laden with heavy bomber-hunting weapons as a replacement for the more vulnerable twin-engined *Zerstörer* heavy fighters, it suffered heavy losses. The Messerschmitt Bf 109 had comparable performance at high altitudes, but its lightweight airframe was even more greatly affected by increases in armament. The Mustang's much lighter armament, tuned for antifighter combat, allowed it to overcome these single-engined opponents.

Fighting the Luftwaffe

Pilots of the all-Black American 332nd Fighter Group (the Tuskegee Airmen) at Ramitelli, Italy: From left, Lt. Dempsey W. Morgran, Lt. Carroll S. Woods, Lt. Robert H. Nelron, Jr., Capt. Andrew D. Turner, and Lt. Clarence D. Lester

At the start of 1944, Major General James Doolittle, the new commander of the 8th Air Force, released most fighters from the requirement of flying in close formation with the bombers, allowing them free rein to attack the Luftwaffe wherever it could be found. The aim was to achieve air supremacy. Mustang groups were sent far ahead of the bombers in a "fighter sweep" to intercept German fighters. Bomber crews complained, but by June, supremacy was achieved.[55] The Luftwaffe answered with the *Gefechtsverband* ("battle formation"). This consisted of a *Sturmgruppe* of heavily armed and armored Fw 190As escorted by two *Begleitgruppen* of Messerschmitt Bf 109s, whose task was to keep the Mustangs away from the Fw 190s as they attacked the bombers. This strategy proved to be problematic, as the large German formation took a long time to assemble and was difficult to maneuver. It was often intercepted by the P-51 "fighter sweeps" before it could attack the bombers. However, German attacks against bombers could be effective when they did occur; the bomber-destroyer Fw 190As swept in from astern and often pressed their attacks to within 90 m (100 yd).[56]

A USAAF armorer of the 100th Fighter Squadron, 332nd Fighter Group, 15th U.S. Air Force checks ammunition belts of the .50 caliber (12.7 mm) Browning machine guns in the wings of a North American P-51B Mustang in Italy, *circa* September 1944

While not always able to avoid contact with the escorts, the threat of mass attacks and later the "company front" (eight abreast) assaults by armored *Sturmgruppe* Fw 190As brought an urgency to attacking the Luftwaffe wherever it could be found, either in the air or on the ground. Beginning in late February 1944, 8th Air Force fighter units began systematic strafing attacks on German airfields with increasing frequency and intensity throughout the spring, with the objective of gaining air supremacy over the Normandy battlefield. In general, these were conducted by units returning from escort missions, but beginning in March, many groups also were assigned airfield attacks instead of bomber support. The P-51, particularly with the advent of the K-14 gyro gunsight and the development of "Clobber Colleges"[57] for the training of fighter pilots in fall 1944, was a decisive element in Allied countermeasures against the *Jagdverbände*.

The numerical superiority of the USAAF fighters, superb flying characteristics of the P-51, and pilot proficiency helped cripple the Luftwaffe's fighter force. As a result, the fighter threat to the US, and later British, bombers was greatly diminished by July 1944. The RAF, long proponents of night bombing for protection, were able to reopen daylight bombing in 1944 as a result of the crippling of the Luftwaffe fighter arm. Reichsmarschall Hermann Göring, commander of the German Luftwaffe during the war, was quoted as saying, "When I saw Mustangs over Berlin, I knew the jig was up."[58][59][53]

Beyond Pointblank

P-51D 44-14888 of the 8th AF/357th FG/363rd FS, named *Glamorous Glen III*, is the aircraft in which Chuck Yeager achieved most of his 12.5 kills, including two Me 262s – shown here with twin single-use 108-gallon (409-l) drop tanks fitted. This aircraft was renamed "Melody's Answer" and crashed on Mar 2, 1945, from unknown causes at Haseloff, west of Treuenbrietzen, Germany

Top-scoring Mustang ace of WWII, Major George Earl Preddy Jr., with 26.83 aerial victories and five aircraft destroyed on the ground (first three victories were achieved on P-47)

On 15 April 1944, VIII Fighter Command began "Operation Jackpot", attacks on Luftwaffe fighter airfields. As the efficacy of these missions increased, the number of fighters at the German airbases fell to the point where they were no longer considered worthwhile targets. On 21 May, targets were expanded to include railways, locomotives, and other rolling stock used by the Germans to transport materiel and troops, in missions dubbed "Chattanooga".[60] The P-51 excelled at this mission, although losses were much higher on strafing missions than in air-to-air combat, partially because the Mustang's liquid-cooled engine (particularly its liquid coolant system) was vulnerable to small-arms fire, unlike the air-cooled R-2800 radials of its Republic P-47 Thunderbolt stablemates based in England, regularly tasked with ground-strafing missions.

P-51D Mustang *Detroit Miss* of the 375th Fighter Squadron: Urban L. Drew flew this aircraft in the autumn 1944 and shot down six German aircraft, including two jet-powered Me 262s in a single mission.

Given the overwhelming Allied air superiority, the Luftwaffe put its effort into the development of aircraft of such high performance that they could operate with impunity, but which also made bomber attack much more difficult, merely from the flight velocities they achieved. Foremost among these were the Messerschmitt Me 163B point-defense rocket interceptors, which started their operations with JG 400 near the end of July 1944, and the longer-endurance Messerschmitt Me 262A jet fighter, first flying with the *Gruppe*-strength Kommando Nowotny unit by the end of September 1944. In action, the Me 163 proved to be more dangerous to the Luftwaffe than to the Allies and was never a serious threat. The Me 262A was a serious threat, but attacks on their airfields neutralized them. The pioneering Junkers Jumo 004 axial-flow jet engines of the Me 262As needed careful nursing by their pilots, and these aircraft were particularly vulnerable during takeoff and landing.[61] Lt. Chuck Yeager of the 357th Fighter Group was one of the first American pilots to shoot down an Me 262, which he caught during its landing approach. On 7 October 1944, Lt. Urban L. Drew of the 361st Fighter Group shot down two Me 262s that were taking off, while on the same day, Lt. Col. Hubert Zemke, who had transferred to the Mustang-equipped 479th Fighter Group, shot down what he thought was a Bf 109, only to have his gun camera film reveal that it may have been an Me 262.[62] On 25 February 1945, Mustangs of the 55th Fighter Group surprised an entire *Staffel* of Me 262As at takeoff and destroyed six jets.[63] The Mustang also proved useful against the V-1s launched toward London. P-51B/Cs, using 150-octane fuel, were fast enough to catch the V-1 and operated in concert with shorter-range aircraft such as advanced marks of the Supermarine Spitfire and Hawker Tempest. By 8 May 1945,[64] the 8th, 9th, and 15th Air Force's P-51 groups [nb 5] claimed some 4,950 aircraft shot down (about half of all USAAF claims in the European theater, the most claimed by any Allied fighter in air-to-air combat)[64] and 4,131 destroyed on the ground. Losses were about 2,520 aircraft.[65] The 8th Air Force's 4th Fighter Group was the top-scoring fighter group in Europe, with 1,016 enemy aircraft claimed destroyed. This included 550 claimed in aerial combat and 466 on the ground. In air combat, the top-scoring P-51 units (both of which exclusively flew Mustangs) were the 357th Fighter Group of the 8th Air Force with 565 air-to-air combat victories and the 9th Air Force's 354th Fighter Group with 664, which made it one of the top-scoring fighter groups.

The top Mustang ace was the USAAF's George Preddy, whose final tally stood at 26.83 victories (a number that includes shared one half- and one third victory credits), 23 of which were scored with the P-51. Preddy was shot down and killed by friendly fire on Christmas Day 1944 during the Battle of the Bulge.[64]

In China and the Pacific Theater

A P-51 Mustang taking off from Iwo Jima.

In early 1945, P-51C, D, and K variants also joined the Chinese Nationalist Air Force. These Mustangs were provided to the 3rd, 4th, and 5th Fighter Groups and used to attack Japanese targets in occupied areas of China. The P-51 became the most capable fighter in China, while the Imperial Japanese Army Air Force used the Nakajima Ki-84 *Hayate* against it The P-51 was a relative latecomer to the Pacific theater, due largely to the need for the aircraft in Europe, although the P-38's twin-engined design was considered a safety advantage for long, over-water flights. The first P-51s were deployed in the Far East later in 1944, operating in close-support and escort missions, as well as tactical photoreconnaissance. As the war in Europe wound down, the P-51 became more common. With the capture of Iwo Jima, USAAF P-51 Mustang fighters of the VII Fighter Command were stationed on that island starting in March 1945, being initially tasked with escorting Boeing B-29 Superfortress missions against the Japanese homeland.

The command's last major raid of May was a daylight incendiary attack on Yokohama on 29 May conducted by 517 B-29s escorted by 101 P-51s. This force was intercepted by 150 A6M Zero fighters, sparking an intense air battle in which five B-29s were shot down and another 175 damaged. In return, the P-51 pilots claimed 26 "kills" and 23 "probables" for the loss of three fighters. The 454 B-29s that reached Yokohama struck the city's main business district and destroyed 6.9 square miles (18 km^2) of buildings; over 1000 Japanese were killed.[66][67] Overall, the attacks in May destroyed 94 square miles (240 km^2) of buildings, which was equivalent to one-seventh of Japan's total urban area. The Minister of Home Affairs, Iwao Yamazaki, concluded after these raids that Japan's civil defense arrangements were "considered to be futile".[68] On the first day of June, 521 B-29s escorted by 148 P-51s were dispatched in a daylight raid against Osaka. While en route to the city, the Mustangs flew through thick clouds, and 27 of the fighters were destroyed in collisions. Nevertheless, 458 heavy bombers and 27 P-51s reached the city, and the bombardment killed 3,960 Japanese and destroyed 3.15 square miles (8.2 km^2) of buildings. On 5 June, 473 B-29s struck Kobe by day and destroyed 4.35 square miles (11.3 km^2) of buildings for the loss of 11 bombers. A force of 409 B-29s attacked Osaka again on 7 June; during this attack, 2.21 square miles (5.7 km^2) of buildings were burnt out and the Americans did not suffer any losses. Osaka was bombed for the fourth time that month, on 15 June, when 444 B-29s destroyed 1.9 square miles (4.9 km^2) of the city and another 0.59 square miles (1.5 km^2) of nearby Amagasaki; 300,000 houses were destroyed in Osaka.[69][70] This attack marked the end of the first phase of XXI Bomber Command's attack on Japan's cities. During May and June, the bombers had destroyed much of the country's six largest cities, killing between 112,000 and 126,762 people and rendering millions homeless. The widespread destruction and high number of casualties from these raids caused many Japanese to realize that their country's military was no longer able to defend the home islands. American losses were low compared to Japanese casualties; 136 B-29s were downed during the campaign.[71][72][73] In Tokyo, Osaka, Nagoya, Yokohama, Kobe, and Kawasaki, "over 126,762 people were killed ... and a million and a half dwellings and over 105 square miles (270 km^2) of urban space were destroyed."[74] In Tokyo, Osaka and Nagoya, "the areas leveled (almost 100 square miles (260 km^2)) exceeded the areas destroyed in all German cities by both the American and British air forces (about 79 square miles (200 km^2))."[74] P-51s also conducted a series of independent ground-attack missions against targets in the home islands.[75] The first of these operations took place on 16 April, when 57 P-51s strafed Kanoya Air Field in Kyushu.[76] In operations conducted between 26 April and 22 June, the American fighter pilots claimed the destruction of 64 Japanese aircraft and damage to another 180 on the ground, as well as a further 10 shot down in flight; these claims were lower than the American planners had expected, however, and the raids were considered unsuccessful. USAAF losses were 11 P-51s to enemy action and seven to other causes.[77] Due to the lack of Japanese air opposition to the American bomber raids, VII Fighter Command was solely tasked with ground-attack missions from July. These raids were frequently made against airfields to destroy aircraft being held in reserve to attack the expected Allied invasion fleet. While the P-51 pilots only occasionally encountered Japanese fighters in the air, the airfields were protected by antiaircraft batteries and barrage balloons.[78] By the end of the war, VII Fighter Command had conducted 51 ground-attack raids, of which 41 were considered successful. The fighter pilots claimed to have destroyed or damaged 1,062 aircraft and 254 ships, along with large numbers of buildings and railway rolling stock. American losses were 91 pilots killed and 157 Mustangs destroyed.[79]

After World War II

In the aftermath of World War II, the USAAF consolidated much of its wartime combat force and selected the P-51 as a "standard" piston-engined fighter, while other types, such as the P-38 and P-47, were withdrawn or given substantially reduced roles. As the more advanced (P-80 and P-84) jet fighters were introduced, the P-51 was also relegated to secondary duties. In 1947, the newly formed USAF Strategic Air Command employed Mustangs alongside F-6 Mustangs and F-82 Twin Mustangs, due to their range capabilities. In 1948, the designation P-51 (P for pursuit) was changed to **F-51** (F for fighter) and the existing F designator for photographic reconnaissance aircraft was dropped because of a new designation scheme throughout the USAF. Aircraft still in service in the USAF or Air National Guard (ANG) when the system was changed included: **F-51B**, **F-51D**, **F-51K**, **RF-51D** (formerly **F-6D**), **RF-51K** (formerly **F-6K**) and **TRF-51D** (two-seat trainer conversions of F-6Ds).

They remained in service from 1946 through 1951. By 1950, although Mustangs continued in service with the USAF after the war, the majority of the USAF's Mustangs had become surplus to requirements and placed in storage, while some were transferred to the Air Force Reserve and the ANG.[4]

An F-51 Mustang, laden with bombs and rockets, taxis through a puddle at an airbase in Korea.

From the start of the Korean War, the Mustang once again proved useful. A "substantial number" of stored or in-service F-51Ds were shipped, via aircraft carriers, to the combat zone, and were used by the USAF, the South African Air Force, and the Republic of Korea Air Force (ROKAF). The F-51 was used for ground attack, fitted with rockets and bombs, and photo reconnaissance, rather than being as interceptors or "pure" fighters. After the first North Korean invasion, USAF units were forced to fly from bases in Japan and the F-51Ds, with their long range and endurance, could attack targets in Korea that short-ranged F-80 jets could not. Because of the vulnerable liquid cooling system, however, the F-51s sustained heavy losses to ground fire. Due to its lighter structure and a shortage of spare parts, the newer, faster F-51H was not used in Korea. On August 5, 1950, Major Louis J. Sebille of the 67th Fighter-Bomber Squadron attacked a North Korean armored column advancing on United Nations military units during the Battle of Pusan Perimeter. Though his aircraft was heavily damaged and he was wounded during the first pass on the column, he turned his F-51 around and deliberately crashed into the convoy at the cost of his life, and was posthumously awarded the Medal of Honor.[87] Mustangs continued flying with USAF and ROKAF fighter-bomber units on close support and interdiction missions in Korea until 1953 when they were largely replaced as fighter-bombers by USAF F-84s and by United States Navy (USN) Grumman F9F Panthers. Other air forces and units using the Mustang included the Royal Australian Air Force's 77 Squadron, which flew Australian-built Mustangs as part of British Commonwealth Forces Korea. The Mustangs were replaced by Gloster Meteor F8s in 1951. The South African Air Force's 2 Squadron used U.S.-built Mustangs as part of the U.S. 18th Fighter Bomber Wing and had suffered heavy losses by 1953, after which 2 Squadron converted to the F-86 Sabre. F-51s flew in the Air Force Reserve and ANG throughout the 1950s.

The last American USAF Mustang was F-51D-30-NA AF serial no. 44-74936, which was finally withdrawn from service with the West Virginia Air National Guard's 167th Fighter Interceptor Squadron in January 1957 and retired to what was then called the Air Force Central Museum,[88] although it was briefly reactivated to fly at the 50th anniversary of the Air Force Aerial Firepower Demonstration at the Air Proving Ground, Eglin AFB, Florida, on 6 May 1957.[89] This aircraft, painted as P-51D-15-NA serial no. 44-15174, is on display at the National Museum of the United States Air Force, Wright-Patterson AFB, in Dayton, Ohio.[90]

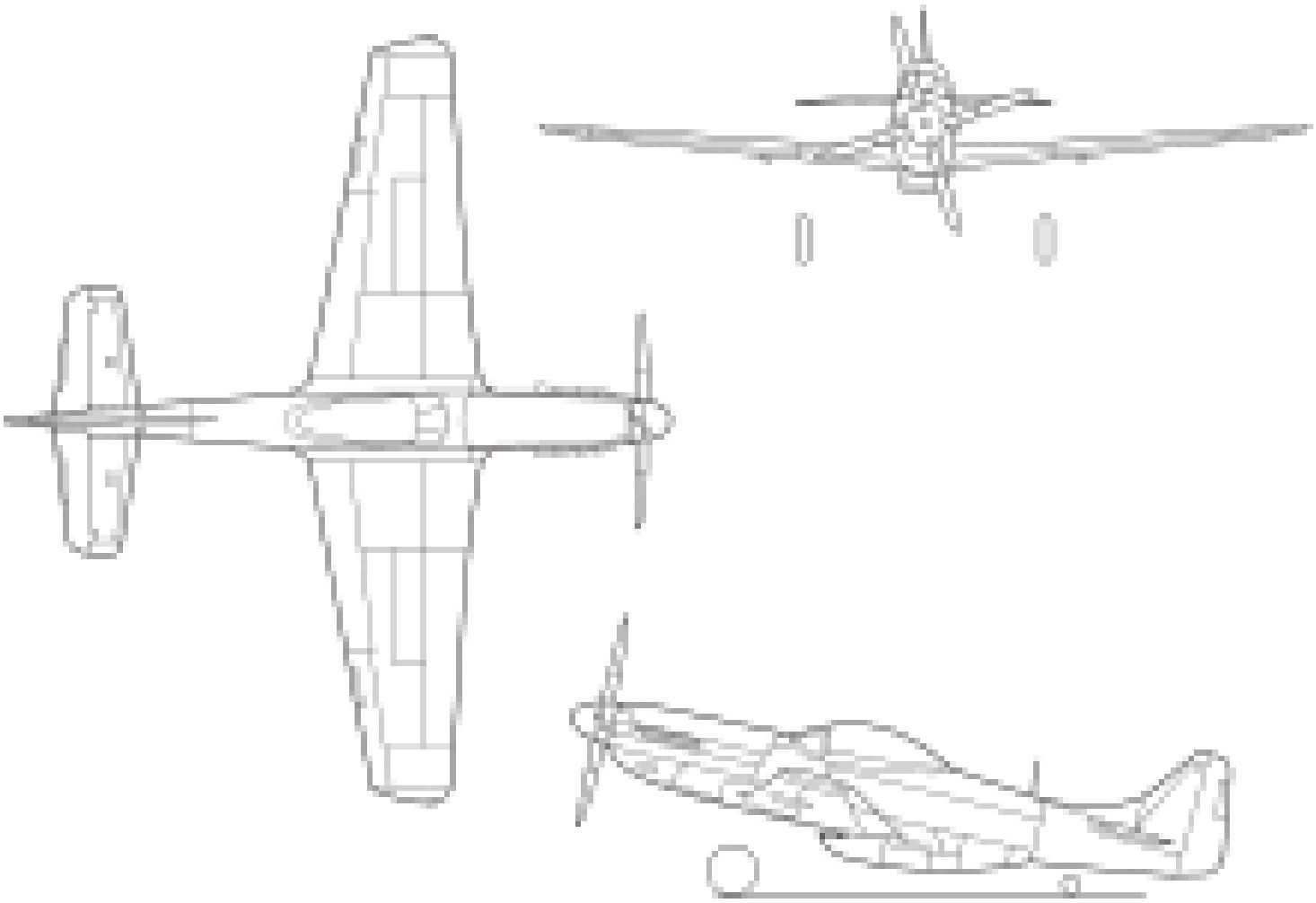
West Virginia Air National Guard F-51D. Note: postwar "uncuffed" propeller unit.

The final withdrawal of the Mustang from USAF dumped hundreds of P-51s onto the civilian market. The rights to the Mustang design were purchased from North American by the Cavalier Aircraft Corporation, which attempted to market the surplus Mustang aircraft in the U.S. and overseas. In 1967 and again in 1972, the USAF procured batches of remanufactured Mustangs from Cavalier, most of them destined for air forces in South America and Asia that were participating in the Military Assistance Program (MAP). These aircraft were remanufactured from existing original F-51D airframes fitted with new V-1650-7 engines, a new radio, tall F-51H-type vertical tails, and a stronger wing that could carry six 13 mm (0.50 in) machine guns and a total of eight underwing hardpoints. Two 1,000-pound (450 kg) bombs and six 130 mm (5 in) rockets could be carried. They all had an original F-51D-type canopy but carried a second seat for an observer behind the pilot. One additional Mustang was a two-seat, dual-control TF-51D (67-14866) with an enlarged canopy and only four wing guns. Although these remanufactured Mustangs were intended for sale to South American and Asian nations through the MAP, they were delivered to the USAF with full USAF markings. They were, however, allocated new serial numbers (67-14862/14866, 67-22579/22582 and 72-1526/1541). The last U.S. military use of the F-51 was in 1968 when the U. S. Army employed a vintage F-51D (44-72990) as a chase aircraft for the Lockheed YAH-56 Cheyenne armed helicopter project. This aircraft was so successful that the Army ordered two F-51Ds from Cavalier in 1968 for use at Fort Rucker as chase planes. They were assigned the serials 68-15795 and 68-15796. These F-51s had wingtip fuel tanks and were unarmed. Following the end of the Cheyenne program, these two chase aircraft were used for other projects. One of them (68-15795) was fitted with a 106 mm recoilless rifle for evaluation of the weapon's value in attacking fortified ground targets.[91] Cavalier Mustang 68-15796 survives at the Air Force Armament Museum, Eglin AFB, Florida, displayed indoors in World War II markings. The F-51 was adopted by many foreign air forces and continued to be an effective fighter into the mid-1980s with smaller air arms. The last Mustang ever downed in battle occurred during Operation Power Pack in the Dominican Republic in 1965, with the last aircraft finally being retired by the Dominican Air Force in 1984.[92]

Service with other air forces

After World War II, the P-51 Mustang served in the air arms of more than 25 nations.[9] During the war, a Mustang cost about $51,000,[93] while many hundreds were sold postwar for the nominal price of one dollar to signatories of the Inter-American Treaty of Reciprocal Assistance, ratified in Rio de Janeiro in 1947.[94]

Specifications (P-51D Mustang)



3-view drawing of P-51D Mustang

Nose of P-51 *Gunfighter*

Wing with three .50 caliber machine guns

General characteristics

- **Crew:** 1
- **Length:** 32 ft 3 in (9.83 m)
- **Wingspan:** 37 ft 0 in (11.28 m)
- **Height:** 13 ft 4.5 in (4.077 m) tail wheel on ground, vertical propeller blade
- **Wing area:** 235 sq ft (21.8 m^2)
- **Aspect ratio:** 5.83
- **Airfoil:** NAA/NACA 45–100
- **Empty weight:** 7,635 lb (3,463 kg)
- **Gross weight:** 9,200 lb (4,173 kg)
- **Max takeoff weight:** 12,100 lb (5,488 kg) 5,490
- **Fuel capacity:** 269 US gal (224 imp gal; 1,020 L)
- **Zero-lift drag coefficient:** 0.0163
- **Drag area:** 3.80 sqft (0.35 m^2)
- **Powerplant:** 1 × Packard (Rolls-Royce) V-1650-7 Merlin 12-cylinder liquid cooled engine, 1,490 hp (1,110 kW) at 3,000 rpm;[150] 1,720 hp (1,280 kW) at WEP
- **Propellers:** 4-bladed Hamilton Standard constant-speed, variable-pitch, 11 ft 2 in (3.40 m) diameter

Performance

- **Maximum speed:** 440 mph (710 km/h, 383 kn)
- **Cruise speed:** 362 mph (583 km/h, 315 kn)

- **Stall speed:** 100 mph (160 km/h, 87 kn)
- **Range:** 1,650 mi (2,660 km, 1,434 nmi) with external tanks
- **Service ceiling:** 41,900 ft (12,800 m)
- **Rate of climb:** 3,200 ft/min (16 m/s)
- **Lift-to-drag:** 14.6
- **Wing loading:** 39 lb/sq ft (190 kg/m^2)
- **Power/mass:** 0.162 / 0.187 hp/lb (0.266 / 0.307 kW/kg) (without / with WEP)
- **Recommended Mach limit** 0.8

Armament

- **Guns:** 6 × .50 caliber (12.7mm) AN/M2 Browning machine guns with 1,840 total rounds (380 rounds for each on the inboard pair and 270 rounds for each of the outer two pair)
- **Rockets:** 6 or 10 × 5.0 in (127 mm) T64 HVAR rockets (P-51D-25, P-51K-10 on)[nb 7]
- **Bombs:** 1 × 100 lb (45 kg) or 250 lb (110 kg) bomb or 500 lb (230 kg) bomb on hardpoint under each wing[151]

Source : https://en.wikipedia.org/wiki/North_American_P-51_Mustang