Racing and Fighter Aircrafts

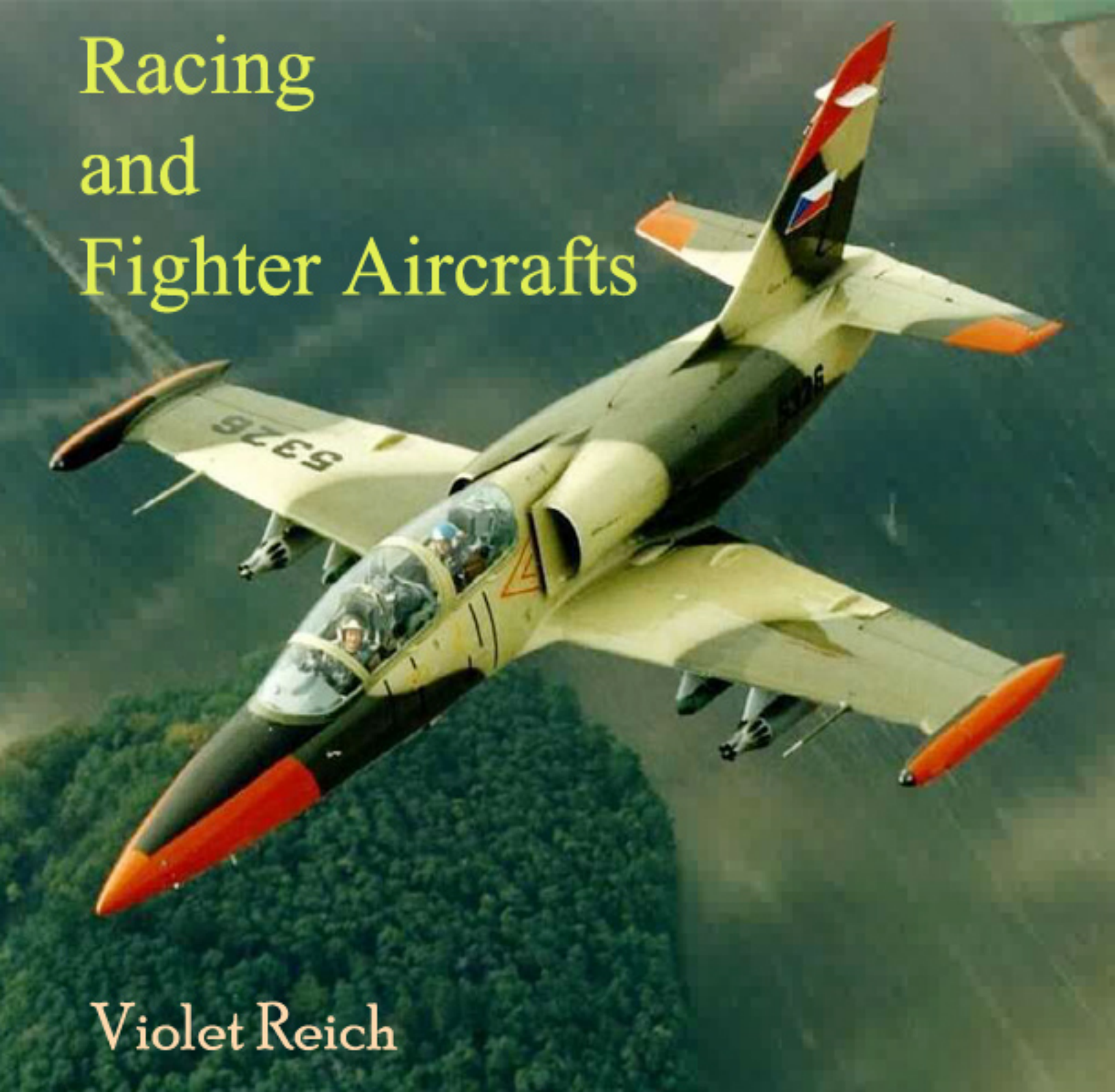

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Table of Contents

Chapter- 1

Aero L-39 Albatros

L-39 Albatros

L-39C, Jet Class, Reno National Championship Air Races #58

Role	Military trainer aircraft Light ground-attack aircraft
Manufacturer	Aero Vodochody
First flight	4 November 1968
Introduced	1971
Status	2,800 still in use in various air forces
Primary users	Soviet Air Force Czechoslovak Air Force Libyan Air Force Royal Thai Air Force
Produced	1970s-1999
Unit cost	US$200,000-300,000
Developed from	Aero L-29 Delfín
Variants	Aero L-59 Super Albatros

Aero L-159 Alca

The **Aero L-39 Albatros** is a high-performance jet trainer aircraft developed in Czechoslovakia to meet requirements for a "C-39" (C for *cvičný* – trainer) during the 1960s to replace the L-29 Delfín. It was the first of the second-generation jet trainers, and the first turbofan-powered trainer produced, and was later updated as the L-59 Super Albatros and as the L-139 (prototype L-39 with engine Garrett TFE731). The design is still produced in an evolved state as the L-159 ALCA, while more than 2,800 L-39s still serve with over 30 air forces around the world. The Albatros – the most widely used jet trainer in the world – is versatile, seeing duty in light-attack missions as well as in basic and advanced pilot training.

Design and development

The L-39 (under the name **Prototype X-02**) first flew on 4 November 1969 and was piloted by Rudolf Duchoň, the factory's test pilot. Serial production began in 1971. The design is Czechoslovak (Czech) – the construction of Aero's chief designer Jan Vlček. The L-39 Albatros is a widely flown trainer/light attack aircraft similar in mission to the Italian MB339. Until now is in service with various former Soviet allies.

The low, slightly swept wing has a double-taper planform, 2½-deg dihedral from the roots, a relatively low aspect ratio, and 100 liter (26½ gal US) fuel tanks permanently attached to the wingtips . The trailing edge has double-slotted trailing edge flaps inboard of mass-balanced ailerons; the flaps are separated from the ailerons by small wing fences.

The tall, swept vertical tail has an inset rudder. Variable-incidence horizontal stabilizers with inset elevators are mounted at the base of the rudder and over the exhaust nozzle. Side-by-side airbrakes are located under the fuselage ahead of the wing's leading edge. Flaps, landing gear, wheel brakes and air brakes are powered by a hydraulic system. Controls are pushrod-actuated and have electrically powered servo tabs on the ailerons and rudder. Operational g-force limits at 4,200 kg (9,259 lb) are +8/-4 g.

A single turbofan engine, an Ivchenko AI-25TL (made in Soviet Union) is embedded in the fuselage and is fed through shoulder-mounted, semi-circular air intakes (fitted with splitter plates) just behind the cockpit; the engine exhausts below the tailplane. Five rubber bag fuel tanks are located in the fuselage behind the cockpit. The main, trailing-arm landing gear legs retract inward into wing bays; the nose gear retracts forward.

A long, pointed nose made of aluminum leads back to the tandem cockpit, in which the student and instructor sit under individual canopies that are hinged on the right. The rear (instructor's) seat is raised slightly; both ejection seats are made by Aero.

The basic trainer is not armed, but has two underwing pylons for drop tanks and practice weapons. Light-attack variants have four underwing hardpoints for ground attack stores; the ZA also has an underfuselage gun pod.

This model is no longer in production and is replaced by the L-159.

Operational history

Civil L-39 in fictional Soviet 84th Light Strike Squadron markings

Royal Thai Air Force L-39ZA/ART in flight during SAREX 2007 at Wing41 Chiang Mai

Abkhazia

In the spring of 2008, a number of Georgian drones were shot down by Abkhaz separatist or Russian forces. In the first of these occasions, on April 20, 2008. Another was shot down by a Russian MiG-29 over Abkhazia region. The Abkhazian separatist forces claimed that one of its missile-equipped L-39 had downed a Georgian Hermes 450 unmanned reconnaissance drone.

Nagorno-Karabakh War

L-39's, along with older L-29's,were used extensively in ground attack missions in the Nagorno-Karabakh War by Azeri forces. Several were shot down by Armenian air-defences.

Popular warbird

While newer versions are now replacing older L-39s in service, thousands remain in active service as trainers, and many are finding new homes with private owners all over the world. This is particularly evident in the United States, where their $200,000-$300,000 price puts them in range of moderately wealthy pilots looking for a fast, agile

personal jet. Their popularity led to a purely L-39 Jet class at the Reno Air Races (though it has since been expanded to include other, similar aircraft). As of mid-March 2006, there are 257 L-39s in the US Federal Aviation register. The first legally registered L-39 private aircraft was successfully flown on a cross country ferry flight in the US on December 9, 1992 with Pilot D. McCue and observer J. Yurick.

Several display teams use the L-39 such as The Patriots Jet Team (4 L-39s) and the Breitling Jet Team (7 L-39s).

There are also several L-39 available for private jet rides: In the United States: in Florida, New York and California, in Czech Republic, Germany, Switzerland and Russia. Those L-39 jets are partly in private hands. But they can also belong to training facilities of the Ministry of Defense, this is the case in Vyazma, Russia.

The L-39 was featured in a skit in the film Jackass 3-D where the exhaust was used to launch various items at different performers.

Variants

L-39X-01 - X-07
: Five prototypes plus two static test airframes.

L-39C *(C for Cvičná - training)*
: Standard basic trainer for Soviet Union, Czechoslovakia and export. Originally designated L-39, but renamed L-39C when later variants appeared. Two pylons under wing. Approximately 2,260 built.

L-39CM *(CM for Cvičná modernizovaná - modernised training)*
: Slovak upgraded C version.

L-39M1
: Ukrainian upgraded C version with AI-25TLSh engines. The conversion is carried out by Odesaviaremservis and the first plane was ready in 2009. The upgrade of a further 7 L-39C's is planned.

L-39V *(V for Vlečná - tug)*
: Single-seat target tug version for Czechoslovakia. Equipped to tow KT-04 target on 1,700 m (5,600 ft) cable. Prototype plus eight production aircraft built.

L-39ZO *(Z for Zbraně - weapons)*
: Interim weapon trainer variant for export. Four pylons stressed for 500 kg (1,100 lb) (inboard) and 250 kg (550 lb) (outboard), with total external load of 1,150 kg (2,500 lb). First flew 25 June 1975, with initial deliveries to Iraq in 1977. 337 built.

L-39ZA
: Significantly upgraded L-39ZO for armed training and light attack, employing sturdier landing gear, a higher payload (total 1,290 kg (2,844 lb)) and notably provision for a GSh-23L 23 millimeter twin barreled cannon attached in a conformal pod under the pilots' compartment, having a 150 round magazine within the airframe. Outer pylons wired to carry K-13 or R-60) air-to-air missiles. Two prototypes, with first flying on 29 September 1976. 208 aircraft delivered.

L-39ZAM

Slovak upgraded ZA version.

L-39ZA/ART
: Thai version of L-39ZA with Elbit avionics. 40 built.

L-39MS
: The Aero L-39MS Super Albatros is a second generation military trainer aircraft developed from the firm's earlier L-39. Compared to its predecessor, it featured a strengthened fuselage, longer nose, a vastly updated cockpit, and a more powerful (21.6 kN (4,850 lbf)) Lotarev DV-2 engine, allowing operation at higher weights and speeds (max speed 872 km/h (542 mph)). First flight on 30 September 1986. It was later designated as the Aero L-59 .

L-139 Albatros 2000
: Revised version with western avionics and 17.99 kN (4,045 lbf) Garrett TFE731-4-1T engine. Single prototype built.

L-159
: Further modernised advanced trainer/combat aircraft with more modern, western avionics and Honeywell F124 engine.

Operators

A Slovak L-39ZA (1701) in Biele Albatrosy colors at Radom Air Show 2005

A Ukrainian L-39 in museum

- Afghanistan
- Algeria
- Armenia
- Azerbaijan
- Bangladesh
- Bulgaria
- Cambodia
- Cuba
- Czech Republic
- East Germany
- Egypt
- Estonia Two L-39s were rented from Czech Republic until 2008
- Ethiopia
- Georgia
- Ghana
- Hungary Withdrawn from use in 2009, to be replaced by L-159 ALCAs
- Iraq
- Kazakhstan
- Kyrgyzstan
- Libya
- Lithuania New engines and avionics. Received offer to buy L-159 ALCAs
- Nigeria
- North Korea
- Romania
- Russia
- Slovakia
- Syria
- Tajikistan
- Thailand L-39ZA/ART (Westernized version, equipped with Israeli avionics)
- Tunisia
- Turkmenistan
- Uganda
- Ukraine
- Uzbekistan
- Vietnam
- Yemen

An Estonian L-39 in flight

A civil L-39C Albatros in Australia

Chapter- 2

Armstrong Whitworth Siskin

Siskin

Role	Fighter
Manufacturer	Sir W.G. Armstrong Whitworth Aircraft Limited
Designed by	F.M. Green
First flight	1919 (Siddeley-Deasy S.R.2 Siskin), 1921
Introduced	1923
Retired	1932
Primary users	Royal Air Force Royal Canadian Air Force
Number built	272

The **Armstrong Whitworth Siskin** was a British biplane single-seat fighter aircraft of the 1920s produced by Armstrong Whitworth Aircraft. The Siskin was one of the first new RAF fighters to enter service after the First World War; it was noted for its aerobatic qualities.

Design and development

The design was a development of the **Siddeley-Deasy S.R.2 Siskin**, which was designed by Major F.M. Green (formerly chief engineer of the Royal Aircraft Factory) of the

Siddeley-Deasy Motor Car Company, to meet the requirements of RAF Specification Type 1 for a single-seat fighter powered by the promising ABC Dragonfly radial engine. Unfortunately, despite the expectations piled on it, the Dragonfly proved to be a disaster, far less powerful than expected and very unreliable, being prone to overheating and vibration. The Siskin first flew in May 1919, powered by a Dragonfly engine delivering 270 hp (200 kW), rather than the promised 320 hp (240 kW). Despite the engine problems, the Siskin displayed good performance and handling, and it was decided to fit an alternative engine, the Siddeley Jaguar, the Jaguar-powered Siskin first flying on 20 March 1921.

In 1920, Siddeley-Deasy merged with Armstrong Whitworth, with the aviation interests combined as Armstrong Whitworth Aircraft.

As well as re-engining with the Jaguar, Major Green decided to redesign the Siskin with an all steel structure, as the **Siskin III**. The Siskin III first flew on 7 May 1923, with first deliveries to the RAF (six for evaluation) taking place in January 1924. The fighter was the first all-metal fighter in the British Royal Air Force.

Following the order from the RAF, Romania ordered 65 aircraft but they were cancelled following a crash on takeoff at Whitley Abbey, Coventry, on 18 February 1925 during acceptance tests; the Romanian pilot being killed.

The main production version was the Siskin IIIA, which originally was powered with a Jaguar IV engine, but was later re-engined with the supercharged Jaguar IVA engine. While the supercharged engine had little effect on performance below 10,000 ft (3,050 m), it greatly improved speed and climb above that height. Following an evaluation of two Siskin IIIs the Royal Canadian Air Force ordered 12 IIIAs which were delivered between 1926 and 1931.

Operational history

RAF Service

A lineup of 29 Squadron Siskins, late 1920s

The first Siskin IIIs were delivered to No. 41 Squadron RAF at RAF Northolt in May 1924, quickly followed by No. 111 Squadron RAF. The Siskin III was popular in service,

being an excellent aerobatic platform, although slightly underpowered. The improved Siskin IIIA was first delivered to No. 111 Squadron in September 1926. The Siskin was used by 11 RAF squadrons. The last operational RAF Siskins were replaced in October 1932 by Bristol Bulldogs.

The Siskin presented thrilling exhibitions of flying at every RAF display from 1925 to 1931.

Sweden

The second Siskin III aircraft was sold to the Royal Swedish Air Force in 1925.

Canada

"The Siskins" flight demonstration team.

Canada used the aircraft from 1926 until 1939. In 1926, the British Air Ministry sent two Siskin IIIs to Canada for testing by the Royal Canadian Air Force (RCAF) under winter flying conditions. The test pilot was Clennell H. Dickins. The Siskin was considered a modern type when it was introduced into RCAF service, which eventually purchased the Mark IIIA, used to equip the Fighter Flight at Camp Borden and Trenton. In 1937, the Flight became No. I (Fighter) Squadron and was transferred from Trenton to Calgary in August 1938.

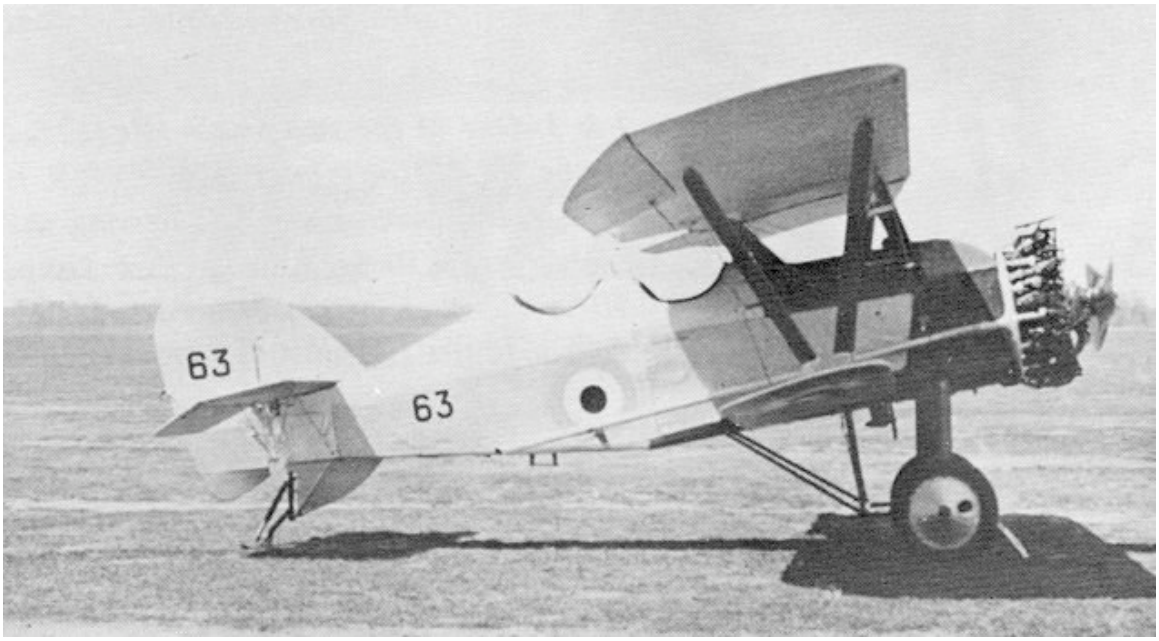
RAF Armstrong-Whitworth Siskin IIIa from No. 41 Squadron at Northolt being serviced with oxygen.

Siskin aircraft remained with this unit until the outbreak of the Second World War, eventually to be replaced by Hawker Hurricanes in 1939. The airframes were then turned over to various technical establishments for use as instructional airframes.

Like its RAF counterparts, in 1929, a three-plane Siskin air demonstration team was formed at Camp Borden, Ontario - the RCAF's first official flight demonstration team. The aerobatic team put on popular solo and formation displays from coast to coast.

Air racing

The Siskin was used as a successful racing aircraft, a Siskin V flown by Flight Lieutenant Barnard winning the 1925 Kings Cup Race at a speed of more than 151 mph (243 km/h).



RCAF Siskin IIIDC, c. 1937 (PAC Photo)

Variants

- **Siddeley Deasy S.R.2 Siskin** - development aircraft (three built)
- **Siskin II** - civil prototype (one built)
- **Siskin III** - all-metal production version (64 built for RAF)
- **Siskin IIIA** - main production variant (Total 348 built, 340 for RAF, eight for RCAF)
- **Siskin IIIB** - prototype with improved engine (one built)
- **Siskin IIIDC** - two-seat dual control version (Total 53 built, 47 for RAF, two for RCAF, two for AST, two for Estonia)
- **Siskin IV** - civil racing version (one built)
- **Siskin V** - civil version for Romania, but used for racing after order was cancelled (two built)

Military operators

Canada

- Royal Canadian Air Force
  - Fighter Flight
  - No. 1 Squadron RCAF

Estonia

- Estonian Air Force

Sweden

- Royal Swedish Air Force

United Kingdom

- Royal Air Force
  - No. 1 Squadron RAF
  - No. 17 Squadron RAF
  - No. 19 Squadron RAF
  - No. 23 Squadron RAF
  - No. 24 Squadron RAF
  - No. 25 Squadron RAF
  - No. 29 Squadron RAF
  - No. 32 Squadron RAF
  - No. 41 Squadron RAF
  - No. 43 Squadron RAF
  - No. 54 Squadron RAF
  - No. 56 Squadron RAF
  - No. 111 Squadron RAF

Civil Operators

United Kingdom

- Air Service Training Limited

Specification (Siskin IIIA)

General characteristics

- **Crew:** 1
- **Length:** 25 ft 4 in (7.72 m)
- **Wingspan:** 33 ft 2 in (10.11 m)
- **Height:** 10 ft 2 in (3.10 m)
- **Wing area:** 293 ft² (27.22 m²)
- **Empty weight:** 2,061 lb (935 kg)
- **Max takeoff weight:** 3,012 lb (1,366 kg)
- **Powerplant:** 1× Armstrong Siddeley Jaguar IV radial engine, 450 hp (336 kW)

Performance

- **Maximum speed:** 136 kn (156 mph, 251 km/h) at sea level
- **Range:** 243 nmi (280 mi, 450 km)
- **Service ceiling:** 27,000 ft (8,230 m)
- **Rate of climb:** 2,953 ft/min (900 m/min)
- **Endurance:** 1 hour 12 minutes
- **Climb to 10,000 ft:** 7 min 5 sec

Armament

- 2 × 0.303 in (7.7 mm) Vickers machine guns
- Provision for up to 4 × 20 lb (9 kg) bombs under wings.

Chapter- 3

Blériot XI

XI

Role	Civil tourer/trainer/military
Manufacturer	Louis Blériot
Designed by	Louis Blériot and Raymond Saulnier
First flight	23 January 1909

Designed by Louis Blériot and Raymond Saulnier (later of Morane-Saulnier), the **Blériot XI** was a light and sleek monoplane constructed of oak and poplar. The flying surfaces were covered with cloth. The original XI was designed and built in 1908 and made its public debut at an indoor Paris airshow in December of that year. The aircraft's original configuration included a R.E.P. engine spinning a four blade metal paddle type propeller which proved to be unsatisfactory.

Design and development

In spring 1909, Blériot decided to use a basically simple 25 horsepower (19 kW) Anzani 3-cylinder W-configuration engine (a central vertical cylinder with the other two at equal angles on either side and in the same plane, often known as fan or semi-radial configurations) and a two blade, carved and laminated Chauviere wooden propeller with much better results. Blériot could be assured of the Anzani 3W engine running continuously for an hour. The Blériot XI also had some ground-breaking technologies such as castering landing gear, allowing for crosswind landings. Wing warping (instead of ailerons) controlled the plane's roll. The tail section of the Blériot XI included a

horizontal stabilizer with an elevator, and a rudder, but no vertical stabilizer. Unintentionally, Blériot added lateral stability to the plane by leaving the aft section of the fuselage uncovered. This created enough drag to add stability to the aircraft's flight characteristics.

Operational history

The Channel Crossing

The original Blériot XI on which Louis Blériot crossed the Channel in 1909. Musée des Arts et Métiers, Paris.

The Blériot XI gained aviation immortality on 25 July 1909 when Louis Blériot crossed the English Channel from Calais to Dover in 36.5 minutes, using an Anzani engine designed by the Italian engineer Alessandro Anzani. For several days bad weather grounded Blériot and his opponents Hubert Latham, who flew an Antoinette monoplane, and Count de Lambert, who brought two Wright Biplanes.

That morning, Blériot awoke—albeit in a bad mood, reportedly due to having scorched his foot in a flying accident, allegedly from stepping on a hot exhaust manifold—to conditions fair enough to fly in. When Blériot took off, Latham's camp was still quiet; Latham had overslept. Fighting fog and bad weather, Blériot did not even have a compass to guide his crossing. It is said that the Anzani engine completed the flight only with the aid of a brief rain shower to cool it off. Letting the aircraft guide itself, Blériot eventually saw the grey line of the English coast.

Approaching closer and closer, he spotted a French reporter waving the French flag to mark the landing spot. Blériot made a very rough "pancake" landing during which the landing gear collapsed and the propeller snapped; but he walked away, winning the

£1000 prize awarded by the *Daily Mail*. The aircraft itself which never flew again was hurriedly repaired and put on limited display at Selfridge's Department Store in London.

Further development

After the successful crossing of the channel, there was a great demand for the Blériot XI. Blériot began to turn his attention from flying to the aircraft manufacturing business. By September 1909, Blériot had received orders for 101 aircraft. Later versions of the Blériot XI used various engines including more powerful Gnome rotary engines and updated Anzani engines. Blériot marketed the aircraft in four categories: trainers, sport or touring models, military aircraft, and racing or exhibition machines. Some notable models in the "*Type Onze*" series:

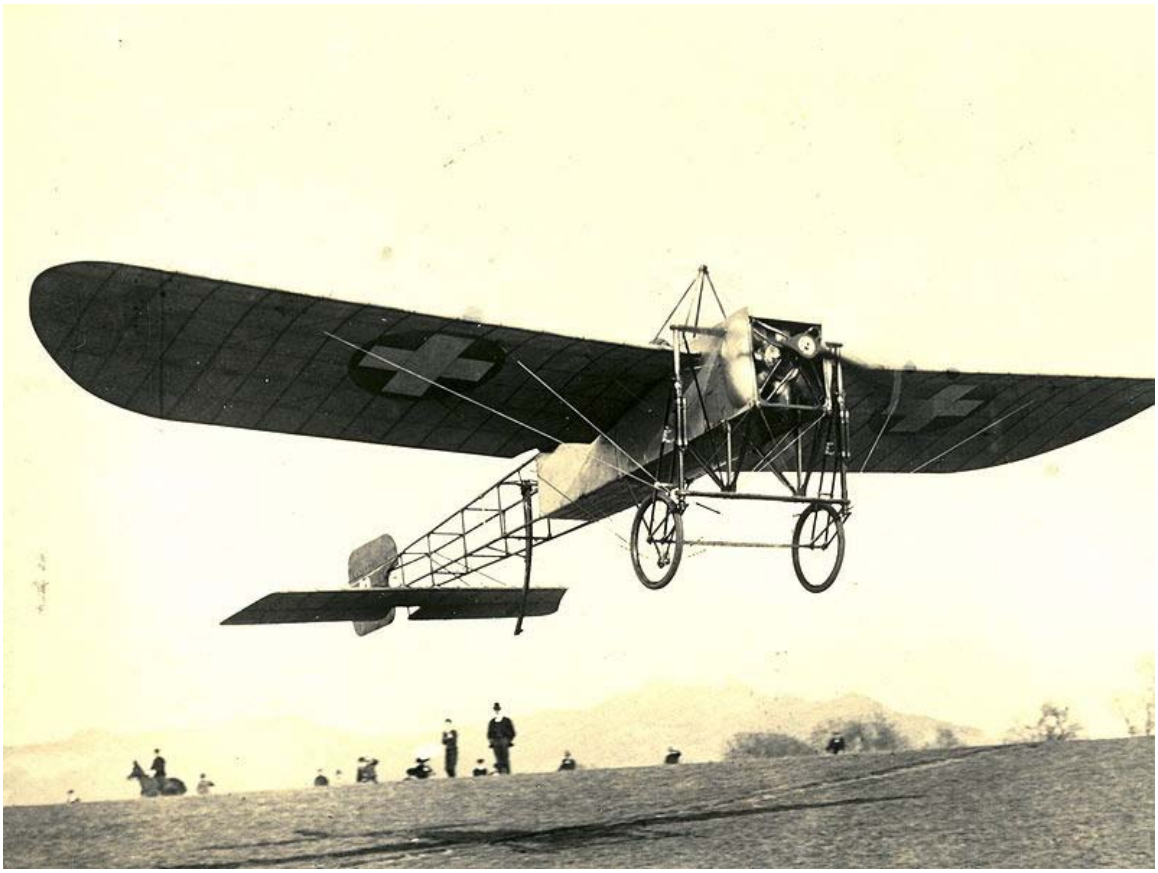
authentic Blériot XI owned and flown by John Domenjoz in 1915; on exhibit at the Smithsonian

Detail of replica Bleriot XI wing, Hamburg Airport Days, 2007

Military use

The first Bleriot XIs entered military service in Italy and France in 1910, and a year later, some of those were used in action by Italy in North Africa (the first bellicose employment of aircraft) and in Mexico. The Royal Flying Corps received its first Bleriots in 1912. During the early stages of World War I, eight French, six British and six Italian squadrons operated various military versions of the aircraft, mainly in observation duties but also as trainers—and in the case of single-seaters, as light bombers with a bomb load of up to 25 kg.

Famous Blériot Monoplane pilots



Oskar Bider starting from Bern to his flight over the Alps

- Oskar Bider - Swiss aviator who flew over the Pyrenees and successfully through the Alps in 1913.
- Jorge Chavez - French-Peruvian aviator who flew through the Alps in 1910. The flight resulted in a fatal crash.
- Denys Corbett Wilson - Anglo-Irish aviator who made the first successful flight from Britain to Ireland in April 1912.
- John Domenjoz (1886–1952) - Performed aerobatics in South, Central and North America in 1914–1918. His Bleriot-XI is displayed at the National Air & Space Museum, Washington.
- Tryggve Gran - Norwegian aviator, first to cross the North Sea from Scotland to Norway in 1914.
- Jan Kašpar - Czech aviator, flew as the first person in Czech lands on 16 April 1910.
- Alfred Leblanc - Broke the flight airspeed record in 1910 while flying the Blériot XI. His speed was calculated at 68.20 mph (109.8 km/h).
- Jan Olieslagers(1883–1942) - Lieutenant in the Belgian Army during the first world war.
- Earle Ovington - First airmail pilot in the United States.

- Adolphe Pégoud - First man to demonstrate the full aerobatic potential of the Blériot XI, flying a loop with it in 1913. Together with John Domenjoz and Edmond Perreyon, he successfully assembled what is thought of as the first air show.
- Harriet Quimby - First licensed female pilot in the United States. First female to solo the English Channel.
- Rene Simon (1885-19??) - In February 1911, the Mexican government engaged Rene Simon, a member of an aerial circus touring the south-western United States, to reconnoiter rebel positions near the border city of Juarez.
- Emile Taddéoli - Swiss aviator who started his first flight on 22 March 1910, in his newly bought Blériot XI, flying about 150,000 kilometres (93,000 mi) within five years on aircraft, among them Blériot XI, Morane-Borel monoplane, Dufaux 4, Dufaux 5 and SIAI S.13 seaplane.

Variants

Blériot XI (mod)
: This model was used to established a new European endurance record of 36 minutes 55 seconds on 13 July 1909, it also won a cross-country prize.

Blériot XI *Militaire*
: Military single-seater, powered by a 50 hp (37 kW) Gnome engine.

Blériot XI *Artillerie*
: Very similar to the *Militaire* version.

Blériot XI-2
: Standard tandem 2-seat touring, reconnaissance, training model, powered by a 70 hp (52 kW) Gnome 7B rotary piston engine.

Blériot XI-2 bis **"*côté-à-côté*"**
: Larger, 2-seat model, with side-by-side seating.

Blériot XI-2 *Hydroaeroplane*
: Mounted on floats with a larger wing area.

Blériot XI-2 *Artillerie*
: Military 2-seat model, powered by a 70 hp (52 kW) Gnome rotary piston engine.

Blériot XI-2 *Génie*
: Military version, designed for easy transport, it could be broken down/reassembled in 25 minutes.

Blériot XI-2 BG
: Two-seat high-wing parasol model.

Blériot XI-3
: Tandem 3-seat model, powered by a twin-row 14-cylinder, 140 hp (100 kW) Gnome Double Lambda rotary engine.

Bleriot XI E1
: Single-seat training version.

Bleriot XI R1
: *Rouleur* or ground training aircraft, fitted with clipped wings.

Military operators

Argentina

Australia

- Australian Flying Corps
  - Central Flying School AFC at Point Cook, Victoria

Belgium
Bolivia
Bulgaria
Chile
Denmark
France
Greece
Guatemala
Italy
Japan
Mexico
Norway
One only Tryggve Gran´s
New Zealand
New Zealand Army - Royal New Zealand Air Force. One aircraft named "Brittania". It was in service from 1913 to 1914.
Romania
Russia
Serbia
Sweden

- Swedish Air Force
- Swedish Navy

Switzerland
Ottoman Empire

- Ottoman Air Force

United Kingdom

- Royal Flying Corps
  - No. 2 Squadron RFC
  - No. 3 Squadron RFC
  - No. 4 Squadron RFC
  - No. 5 Squadron RFC
  - No. 6 Squadron RFC
  - No. 9 Squadron RFC
  - No. 10 Squadron RFC
  - No. 16 Squadron RFC
  - No. 23 Squadron RFC

- No. 24 Squadron RFC

Uruguay

Survivors

Maiden public flight by a Blériot XI, manufactured 1918 under license by Thulinverken in Landskrona, Sweden as type **Thulin A**. The aircraft had never been flown, and has been owned by the Museum of Science and Technology in Stockholm since 1928. It was restored in 2009-2010 to celebrate the Centenary of Flight in Sweden in 2010. Flown at the Stockholm Festival of Flight, 20–22 August 2010, the Blériot took off and landed no less than six times from a grass strip at The Royal Park, and was finally rolled 200 meters back to the Museum Exhibition Hall.
: Photo: Bengt Oberger

A flyable 1909-built Blériot XI, with British civil registration *G-AANG*, is on display at the Shuttleworth Collection, Old Warden, England. It is the world's oldest airworthy airplane. Another restored and flyable Bleriot XI, with US civil registration *N60094*, exists at the Old Rhinebeck Aerodrome (ORA), believed to be only three weeks newer than the Shuttleworth example by date of manufacture, and the oldest known flyable aircraft in the Western Hemisphere. The ORA example was originally built at the Bleriot factory in France, marked with factory serial number 56.

A third flyable Blériot XI, manufactured in 1918 under licence by AETA, Enoch Thulins Aeroplane Works, in Landskrona, Sweden, is owned by The Museum of Science and

Technology in Stockholm, Sweden. The aircraft was registered with the Swedish Civil Air Traffic Authority in 2010 as SE-AEC. Following a two-year restoration by Mikael Carlson, the Blériot XI made its first flight at the Stockholm Festival of Flight in August 2010. This made the aircraft the oldest airworthy craft in Sweden. The Blériot uses its original rotary engine, a Thulin-built copy of the Gnôme Omega.

Another survivor with replica wings has its home at the Museo Nacional de Aeronáutica in Morón, Buenos Aires Province, Argentina. It is powered by a W 3 Cyl Anzani 25 hp engine. It is not airworthy.

A 3/4 scale historically accurate replica of the Bleriot XI is featured in the New York City premiere of FLIGHT, running March 23 - April 11, 2011 at the Connelly Theatre. A tour of the production through southern states will commence in the fall of 2011.

Specifications (Blériot XI)

General characteristics

- **Crew:** one, pilot
- **Length:** 7.62 m (25 ft 0 in)
- **Wingspan:** 7.79 m (25 ft 7 in)
- **Height:** 2.69 m (8 ft 10 in)
- **Wing area:** 14 m² (150 ft²)
- **Empty weight:** 230 kg (507 lb)
- **Powerplant:** 1× Anzani 3-cylinder fan-type, or 120° cylinder angle "true radial"., 16–19 kW (22–25 hp)
- * **Propeller:** Chauvière Intégrale
    - **Diameter:** 2.08 m (6 ft 10 in)
    - **Thrust:** 105 kgf (1,030 N; 230 lbf) @ 1,450 rpm

Performance

- **Maximum speed:** 75.6 km/h (41 knots, 47 mph)

Chapter- 4

de Havilland DH.88

de Havilland DH.88 Comet

G-ACSS *Grosvenor House* on display at the Farnborough Air Show in September 1988

Role	racing aircraft
Manufacturer	de Havilland
First flight	1934
Status	Two in restoration
Number built	5
Unit cost	£5,000

The **de Havilland DH.88 Comet** was a twin-engined British aircraft that won the 1934 MacRobertson Air Race, a challenge for which it was specifically designed. It set many aviation records during the race and afterwards as a pioneer mail plane.

Development

Despite previous British air racing successes, culminating in 1931 in the outright win of the Schneider Trophy, there was no British plane capable of putting up a challenge over the MacRobertson course with its long overland stages. The de Havilland company stepped into the breach by offering to produce a limited run of 200 mph (322 km/h) racers if three were ordered by February 1934. The sale price of £5,000 each would by no

means cover the development costs. In 1935, de Havilland suggested a high-speed bomber version of the DH.88 to the RAF, but the suggestion was rejected. (De Havilland later developed the de Havilland Mosquito along similar lines as the DH.88 for the high-speed bomber role.)

G-ACSS "Grosvenor House"

Three orders were indeed received, and de Havilland set to work. The airframe consisted of a wooden skeleton clad with spruce plywood, with a final fabric covering on the wings. A long streamlined nose held the main fuel tanks, with the low set central two-seat cockpit forming an unbroken line to the tail. The engines were essentially the standard Gipsy Six used on the Express and Dragon Rapide passenger planes, tuned for best performance with a higher compression ratio. The propellers were two-position variable pitch, manually set to fine before takeoff and changed automatically to coarse by a pressure sensor. The main undercarriage retracted upwards and backwards into the engine nacelles. The DH.88 could maintain altitude up to 4,000 ft (1,200 m) on one engine.

De Havillands managed to meet their challenging schedule and testing of the DH.88 began six weeks before the start date of the race. On the day of the race, the three distinctively coloured planes took their places among 17 other entrants ranging from a new Douglas DC-2 airliner to two converted Fairey Fox bombers.

MacRobertson Race

Black Magic

First to take off at 6.30 a.m. on October 20 were Jim and Amy Mollison in their own G-ACSP *Black Magic*. They made a faultless journey to Baghdad, and reached Karachi at around 10 a.m. on the second race day, setting a new England-India record. Problems began for the Mollisons when their landing gear failed to retract, and after returning Karachi for repairs they were again delayed by an inability to navigate at night.

Further problems followed when they made an unscheduled refuelling stop at Jobbolpore but found no aviation fuel. Running instead on fuel used by the local bus company, an engine piston seized and an oil line ruptured. They flew on to Allahabad and retired.

Grosvenor House

The scarlet G-ACSS was the property of Mr.A.O.Edwards and was named *Grosvenor House* after the hotel which he managed. The crew were C. W. A. Scott and Tom Campbell Black. When the Mollisons ran into problems at Karachi, C. W. A. Scott & Tom Campbell Black took over the lead and were first into Allahabad. Despite a severe storm over the Bay of Bengal they reached Singapore safely, 8 hours ahead of the DC-2.

They took off for Darwin, but over the Timor Sea lost power in the port engine when the oil pressure dropped to zero. Repairs at Darwin got them going again, although continuing oil warnings caused them to fly the last two legs with one engine throttled back. Their lead was unassailable despite this, and after the final mandatory stop and more engine work at Charleville they flew on to cross the finish line at Flemington Racecourse at 3.33 p.m. (local time) on October 23. Their official time was 71 hours 18 seconds.

DH88 Comet Racer 'Grosvenor House' at Shuttleworth Collection 2010

Records set by G-ACSS 'Grosvenor House'

Date of Record	Record achieved
October 20-23, 1934	C. W. A. Scott and Tom Campbell Black went from Mildenhall, England to Melbourne, Australia (11000 miles) in 70 hrs 55 min. Still held in 2010.
November 14-16, 1937	A.E. Clouston and Mrs Kirby-Green went from London to Cape Town (7091 miles) in 45 hrs 6 min.
November 18-20, 1937	The return trip was completed in 57 hrs 23 min.
March 15-20, 1938	A.E. Clouston and V. Ricketts went from London to New Zealand (13179 miles) in 104 hrs 20 min.
March 20-26, 1938	The return trip was completed in 140 hrs 12 min. Here the times to and from Sydney, Australia en route to New Zealand were also confirmed as records.

G-ACSR

The third plane G-ACSR had been paid for by racing driver Bernard Rubin and was flown by Owen Cathcart Jones and Ken Waller. They had to make a second unscheduled stop at Baghdad after they found they had had a serious oil leak. They were forced to delay for repairs which were carried out by T.J.Holmes. They caught up with the Mollisons at Karachi. They were the fourth plane to reach Melbourne, in a time of 108 h 13 min 45 s.

Cathcart Jones and Waller promptly collected film of the Australian stages of the race and set off to carry it back to Britain. Their return time of 13½ days set a new record.

After the race

G-ACSR, renamed *Reine Astrid* flew the Christmas mail from Brussels to Leopoldville in the Belgian Congo in 1934. It was then sold to the French government as F-ANPY and set a Croydon-Le Bourget record of 52 minutes on July 5, 1935. It subsequently made Paris–Casablanca and Paris—Algiers high-speed proving flights.

Black Magic was sold to Portugal for a projected flight from Lisbon to Rio de Janeiro. Reregistered CS-AAJ *Salazar* it made various flights from London to Lisbon, setting a time of 5 h 17 min in July 1937. It was found in a ruinous condition in Portugal in 1979. It is currently undergoing restoration in Derby, England.

Grosvenor House in flight

Grosvenor House was later fitted with Gypsy Six series II engines and made several race and record attempts under various names. It claimed fourth place in the 1937 Marseilles-Damascus-Paris race, and later the same year lowered the out-and-home record to the

Cape to 15 days 17 hours. In March 1938, Arthur Edmond Clouston and Victor Anthony Ricketts made a return trip to New Zealand covering 26,450 mi (42,567 km) in 10 days 21 hours 22 minutes.

Two more Comets

A fourth Comet, F-ANPZ, was built for the French government, with a mail compartment in the nose.

The fifth and last Comet named G-ADEF *Boomerang* was built for Cyril Nicholson, and piloted by Tom Campbell Black (of *Grosvenor House* fame) and J.C.McArthur in an attempt on the London-Cape Town record. It reached Cairo in a record 11hr 18 min but the Cape Town attempt was abandoned due to oil trouble.

Last resting places

Grosvenor House flying again, 1980s

Grosvenor House has been restored to flying condition as it was in the MacRobertson race, and is housed at the Shuttleworth Collection at Old Warden in England.

G-ADEF crashed in Sudan September 22, 1935. The crew escaped by parachute.

G-ACSR and F-ANPZ were destroyed in a hangar fire at Istres in France in June, 1940.

Airworthy Replica

An airworthy full-scale replica of the DH.88 Comet was built in 1993 by Thomas W.Wathen of Santa Barbara, California. N88XD flies wearing the full colours and registration of G-ACSS 'Grosvenor House'. Another example, started in the United States, is under steady construction by the Croydon Aircraft Company at Old Mandeville Airfield, near Gore, New Zealand.

Conclusion

DH88 Comet Racer at Shuttleworth Collection

The DH.88 might have been the last of the high performance wooden aircraft but for a shortage of metal for aircraft construction during World War II. As it turned out, experience with the DH.88 would be put to use in designing one of the war's finest aircraft—the de Havilland Mosquito.

The clean lines of the DH.88, especially in the striking colours of *Grosvenor House*, make it a true design classic.

Operators

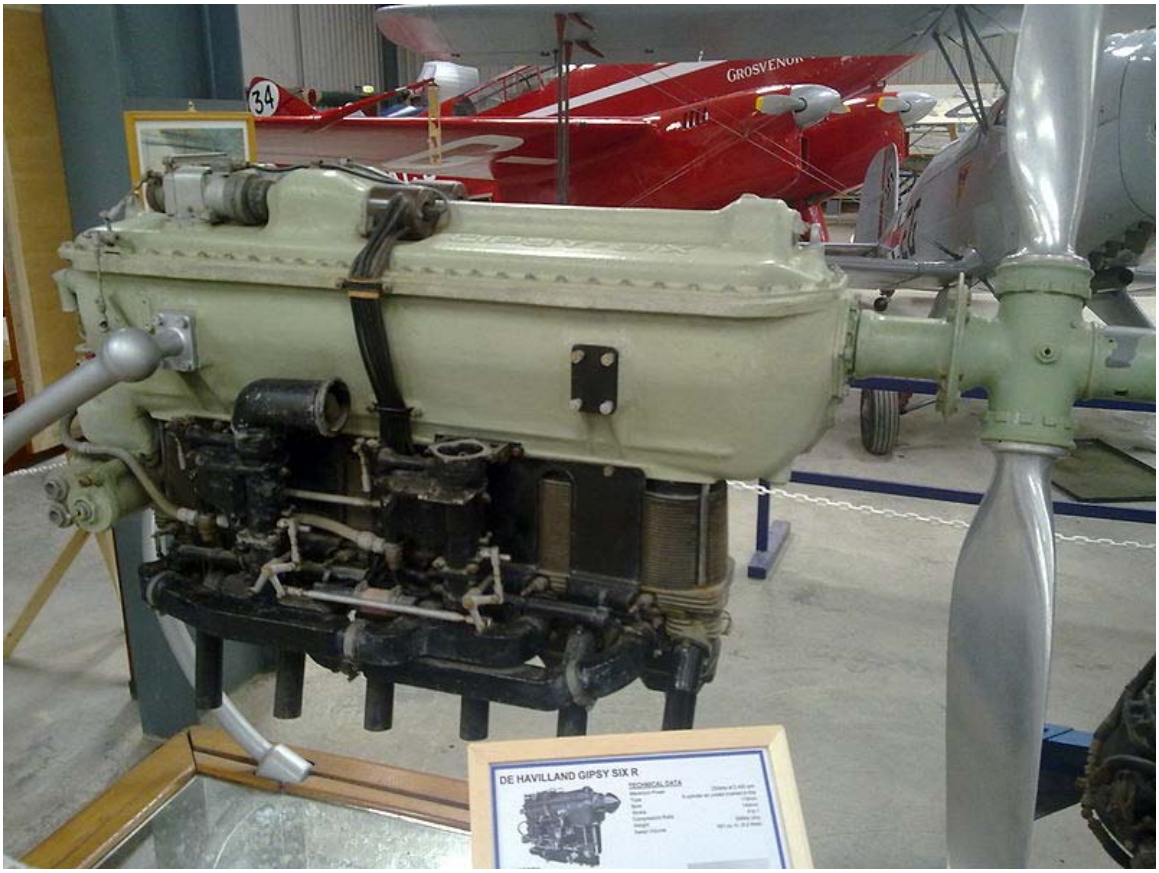
Portugal

- Portuguese Air Force

United Kingdom

- Royal Air Force
  - No. 24 Squadron RAF

Specifications



Preserved at the Shuttleworth Collection One of the original Gipsy Six R racing engines that was fitted to the winning DH.88 Comet Grosvenor House (background) of the MacRobertson Air Race in 1934, the engines were removed from the aircraft following the race and replaced with the more reliable standard Gipsy Six engines.

General characteristics

- **Crew:** 2
- **Length:** 29 ft (8.8 m)
- **Wingspan:** 44 ft (13.4 m)

- **Height:** 9 ft (2.7 m)
- **Wing area:** 213 ft² (19.7 m²)
- **Empty weight:** 3,000 lb (1,400 kg)
- **Loaded weight:** 5,550 lb (2,520 kg)
- **Powerplant:** 2× de Havilland Gipsy Six R, 285 hp (190 kW) each

Performance

- **Maximum speed:** 255 mph (224 kn, 415 km/h)
- **Range:** 2,925 mi (2,541 nmi, 4,710 km)
- **Service ceiling:** 19,000 ft (5,800 m)
- **Rate of climb:** 1,200 ft/min (6.2 m/s)
- **Wing loading:** 26.1 lb/ft² (127 kg/m²)
- **Power/mass:** 0.0811 hp/lb (133 W/kg)

Chapter- 5

Hughes H-1 Racer

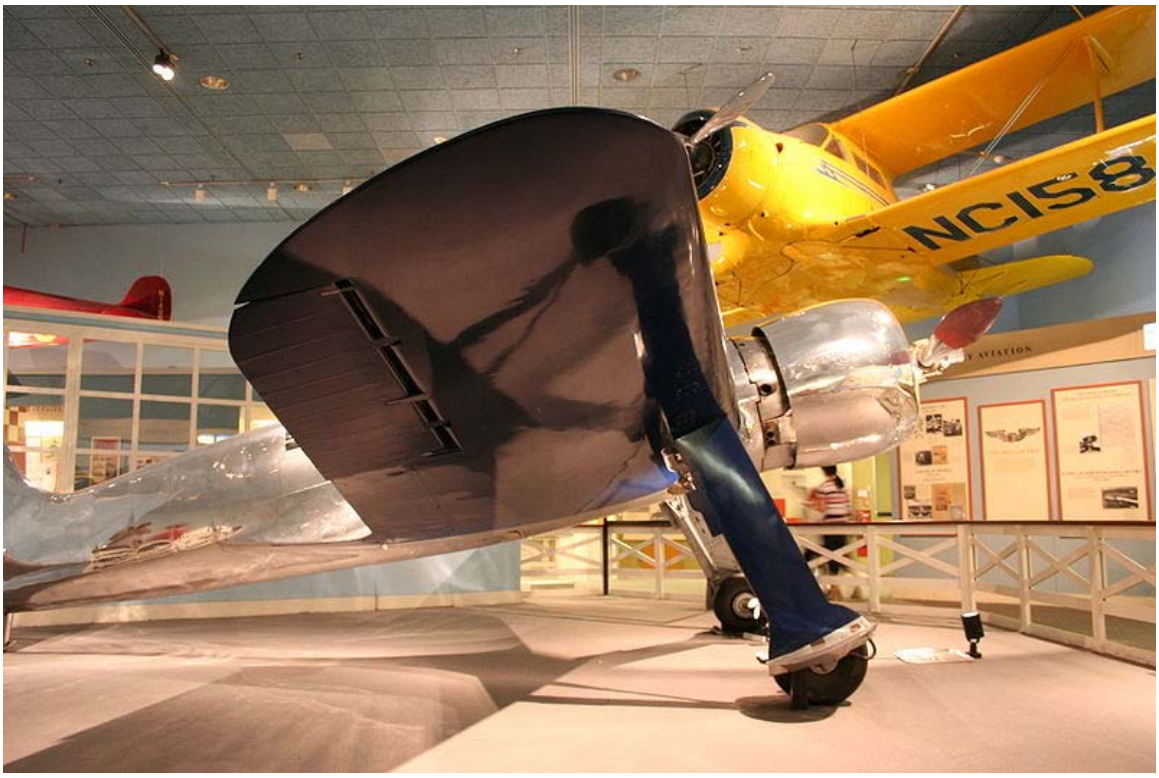
Hughes H-1 Racer

The H-1 Racer at the National Air and Space Museum

Role	Racing aircraft Long-range aircraft [for record attempt]
Manufacturer	Hughes Aircraft
Designed by	Richard Palmer
First flight	September 13, 1935
Primary user	Howard Hughes
Produced	1935
Number built	1
Career	
Registration	NR-258Y
Preserved at	National Air and Space Museum

Tail of H-1 Racer

Rear landing gear



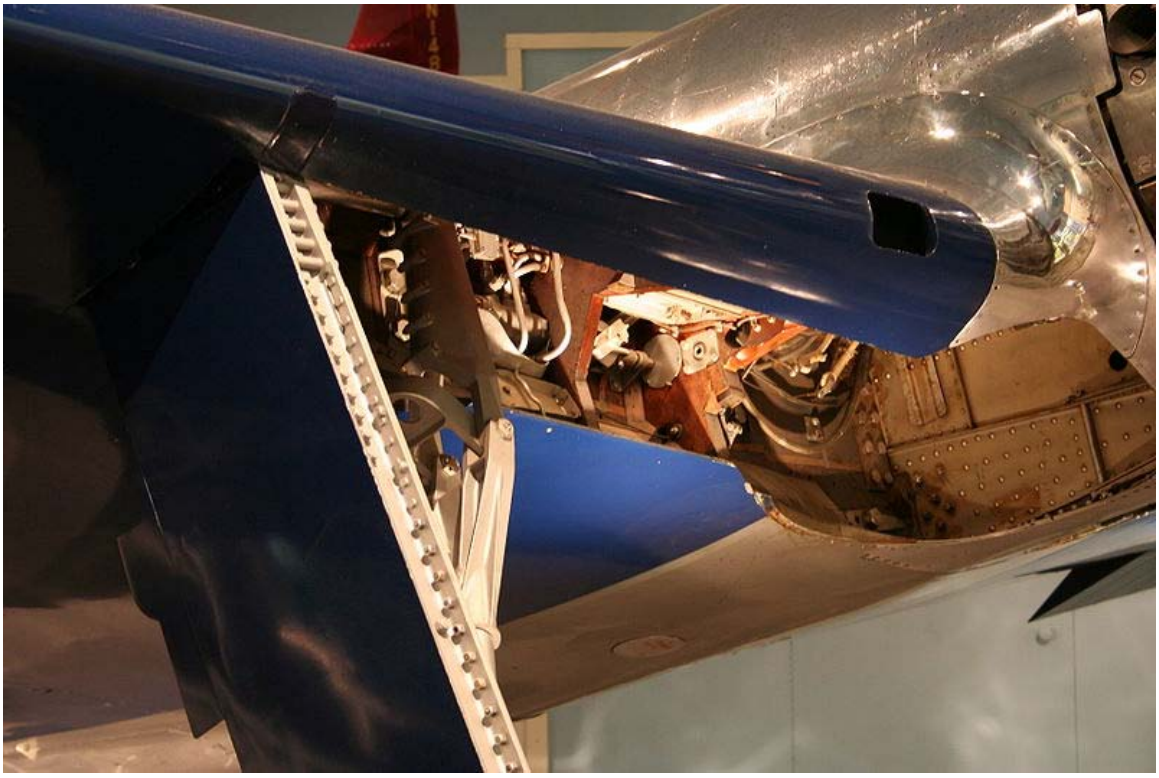
Right side of H-1 Racer

The **Hughes H-1** was a racing aircraft built by Hughes Aircraft in 1935. It set a world airspeed record and a transcontinental speed record across the United States. The H-1 Racer was the last aircraft built by a private individual to set the world speed record; every aircraft to hold the honor since was a military design.

Design and development

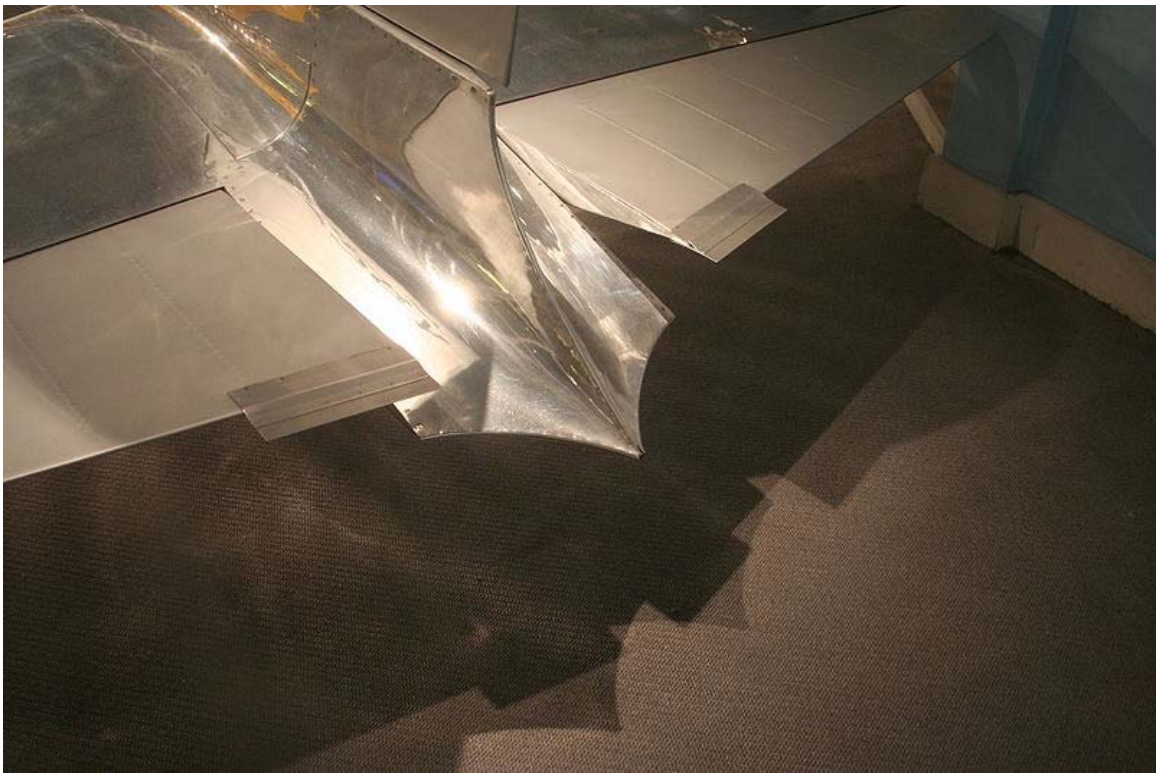
During his work on his movie *Hell's Angels*, Howard Hughes employed Glenn Odekirk to maintain the fleet of over 100 aircraft used in the production. The two men shared a common interest in aviation and hatched a plan to build a record-beating aircraft. The aircraft was given many names, but is commonly known as the **H-1**. It was the first aircraft model produced by the Hughes Aircraft company.

Design studies began in 1934 with an exacting, large scale model (approximately two-three ft in length) that was tested in Caltech's wind tunnel, revealing a speed potential of 365 mph.



Detailed wood and metal work inside

Propeller of H-1



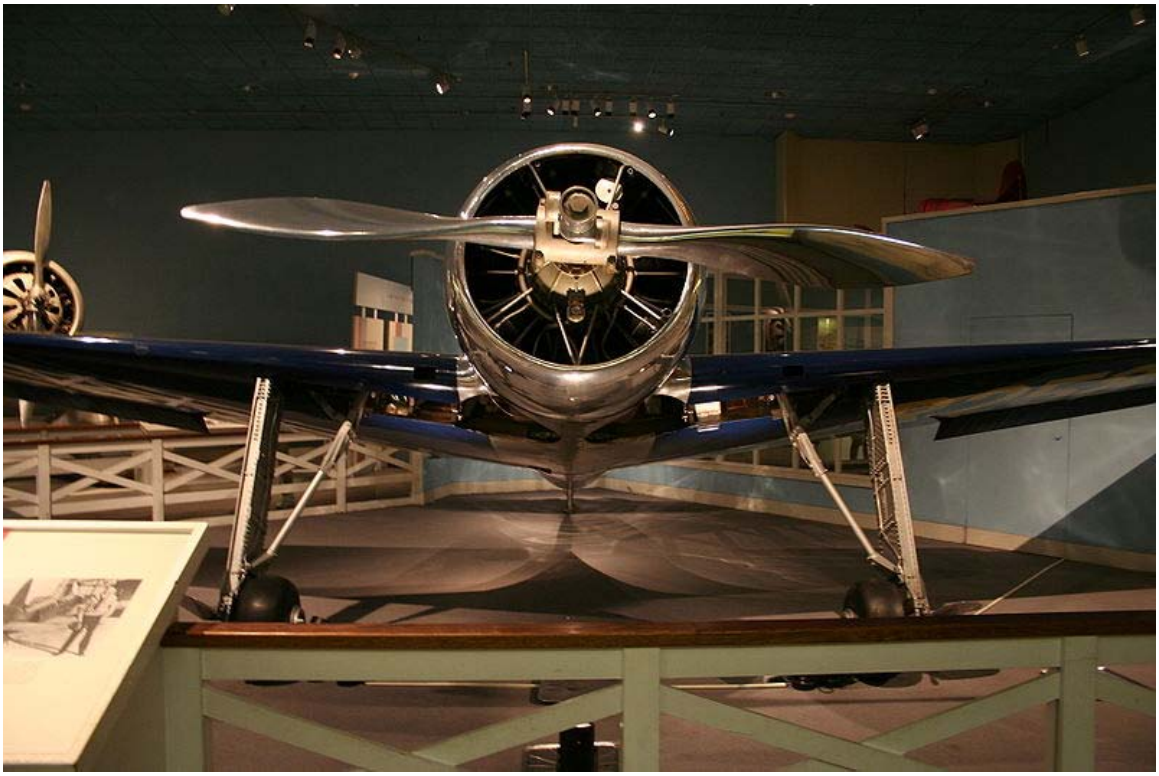
Tip of H-1 tail

Technical details

Streamlining was a paramount design criterion resulting in "one of the cleanest and most elegant aircraft designs ever built." Many groundbreaking technologies were developed during the construction process, including individually machined flush rivets that left the aluminium skin of the aircraft completely smooth. The H-1 also had retractable landing gear to further increase the speed of the aircraft including a fully-retractable hydraulically actuated tail skid. It was fitted with a Pratt & Whitney R-1535 twin-row 14-cylinder radial engine of 25.2 liters, which although originally rated at 700 hp (522 kW), was tuned to put out over 1,000 horsepower (750 kW).

Due to two different roles envisioned for the racing aircraft, a set of short-span wings for air racing and speed records and a set of "long" wings for cross-country racing were prepared.

Operational history



Front of H-1 Racer

The H-1 first flew in 1935 and promptly broke the world landplane speed record with Hughes at the controls, clocking 352 mph (566 km/h) averaged over four timed passes. Hughes apparently ran the aircraft out of fuel and managed to crash-land without serious damage to either himself or the H-1. As soon as Hughes exited the H-1 when he crashed it in a beet field, his only comment was: "We can fix her, she'll go faster". At the time,

the world seaplane speed record was 440 mph (709 km/h), set by a Macchi M.C.72 in October 1934.

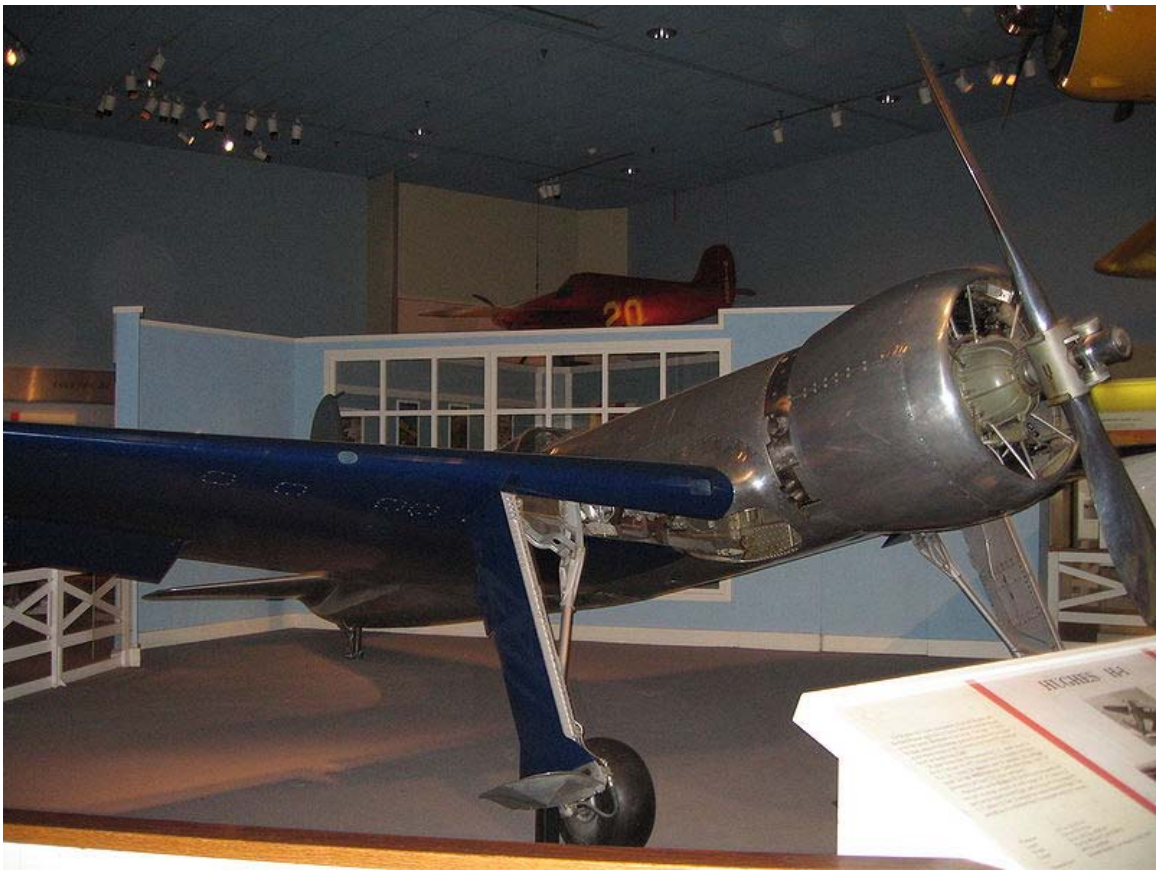
Hughes later implemented minor changes to the H-1 Racer to make it more suitable for a transcontinental speed record attempt. The most significant change was the fitting of a new, longer set of wings that gave the aircraft a lighter wing loading. On January 19, 1937, a year and a half after his previous landplane speed record in the H-1, Hughes set a new transcontinental speed record by flying non-stop from Los Angeles to New York City in 7 hours, 28 minutes and 25 seconds. He smashed his own previous record of 9 hours, 27 minutes by two hours. His average speed over the flight was 322 mph (518 km/h).

Considering the contemporary service aircraft were biplanes, Hughes fully expected the United States Army Air Forces to embrace his aircraft's new design and make the H-1 the basis for a new generation of U.S. fighter aircraft. His efforts to "sell" the design were unsuccessful. In postwar testimony before the Senate, Hughes indicated that resistance to the innovative design was the basis for the USAAF rejection of the H-1: "I tried to sell that airplane to the Army but they turned it down because at that time the Army did not think a cantilever monoplane was proper for a pursuit ship..."

Aviation historians have posited that the H-1 Racer may have inspired later radial engine fighters such as the P-47 Thunderbolt and the Focke-Wulf Fw 190. After the war, Hughes further claimed that "it was quite apparent to everyone that the Japanese Zero fighter had been copied from the Hughes H-1 Racer." He noted both the wing planform, the tail empennage design and the general similarity of the Zero and his racer. Jiro Horikoshi, designer of the Mitsubishi Zero strongly refuted the allegation of the Hughes H-1 influencing the design of the Japanese fighter aircraft.

The Hughes H-1 Racer is featured in the 1940 RKO Radio Pictures movie: *Men Against the Sky*.

Markings



H-1 Racer on display at the National Air & Space Museum

The wings were painted blue. Some sources, including an article from TIME magazine, September 23, 1935 state that the original (short-span) wings were painted red, but the original wings are in storage at the National Air & Space Museum. They are blue and still show the scars from the last forced landing.

Over time, the H-1's wings have been marked with the registration numbers "NR258Y", "NX258Y", and finally, simply "R258Y". Several photos exist of a transitional period in which the "X" was painted directly on top of the "R". Some sources say that the color of the registration letters at the time of the record setting flights was white, with Hughes later repainting the letters to the appropriate yellow color to match the color of his company's logo.

Disposition

The original H-1 Racer was donated to the Smithsonian in 1975 and is on display at the National Air and Space Museum.

Replica

Jim Wright's H-1 on display at Oshkosh Wisconsin

Jim Wright of Cottage Grove, Oregon built a full scale replica of the H-1 that first flew in 2002. So exact was the replica to the original that the FAA granted it serial number 2 of the model. The achievement in recreating the aircraft was heralded in virtually every well-known aviation magazine of the time. On August 4, 2003, after a successful unveiling of the replica at the 2003 AirVenture at Oshkosh, Wisconsin, Wright fatally crashed. On his way home to Oregon, he had landed briefly in Gillette, Wyoming, to refuel. While on the ground, Wright met briefly with local reporters and indicated that the aircraft had been having propeller "gear problems." He then departed, crashing just north of the Old Faithful Geyser in Yellowstone National Park about an hour later. The replica, originally slated for use in the film *The Aviator*, was completely destroyed, and Wright was killed. The official accident report points to a failure of a counterweight on the constant speed propeller. On December 17, 2003, Cottage Grove State Airport was dedicated as Jim Wright Field.

Specifications (H-1 Racer, original wings)

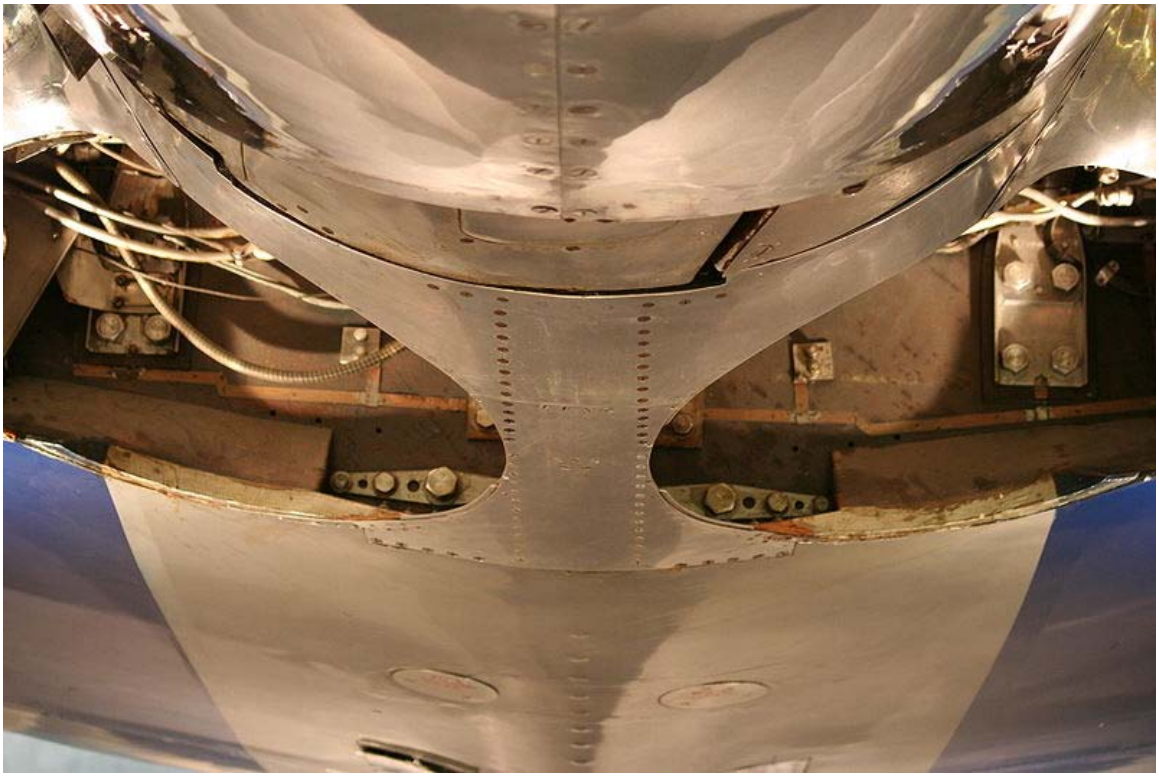
General characteristics

- **Crew:** 1
- **Length:** 27 ft 0 in (8.23 m)
- **Wingspan:** 31 ft 9 in (9.67 m)

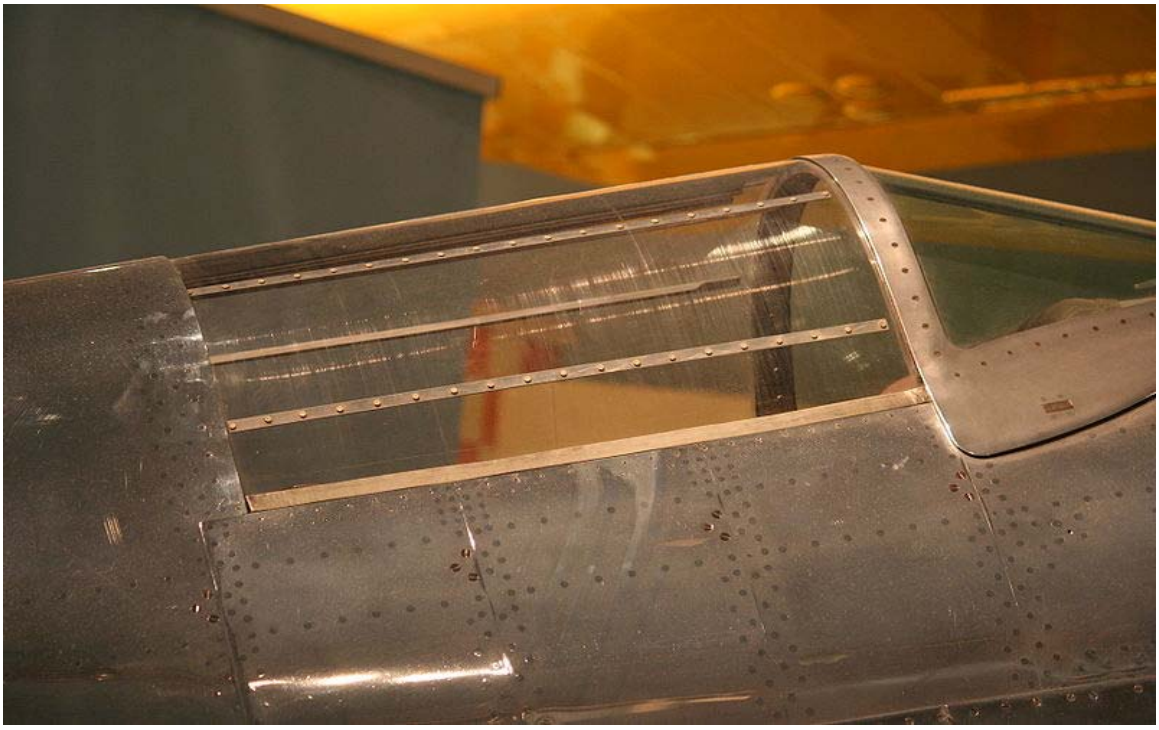
- **Height:** 8 ft (2.4 m)
- **Wing area:** 138 ft² (12.8 m²)
- **Empty weight:** 3,565 lb (1,620 kg)
- **Loaded weight:** 5,492 lb (2,496 kg)
- **Powerplant:** 1× Pratt & Whitney R-1535 radial engine, 700 hp (521 kW)

Performance

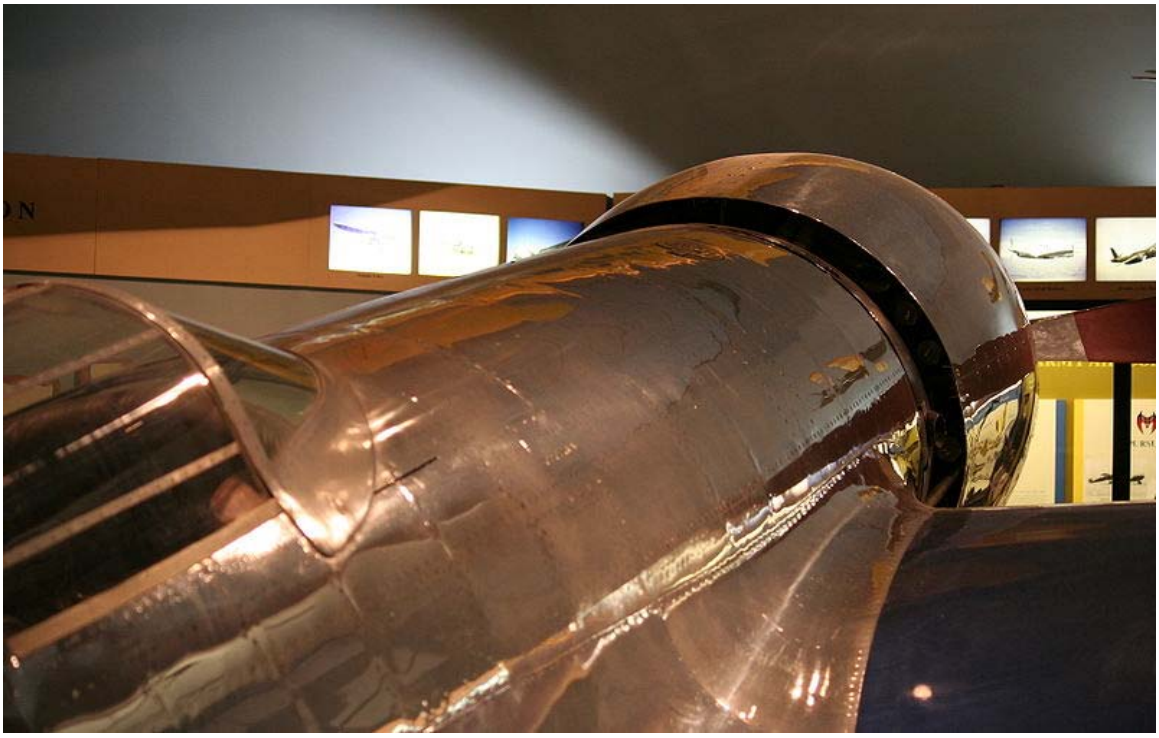
- **Maximum speed:** 352 mph (566 km/h)
- **Wing loading:** 40 lb/ft² (195 kg/m²)
- **Power/mass:** 0.13 hp/lb (210 W/kg)



Flush metalwork for aerodynamics



Canopy with flush metalwork



H-1 nose with exhaust system displayed

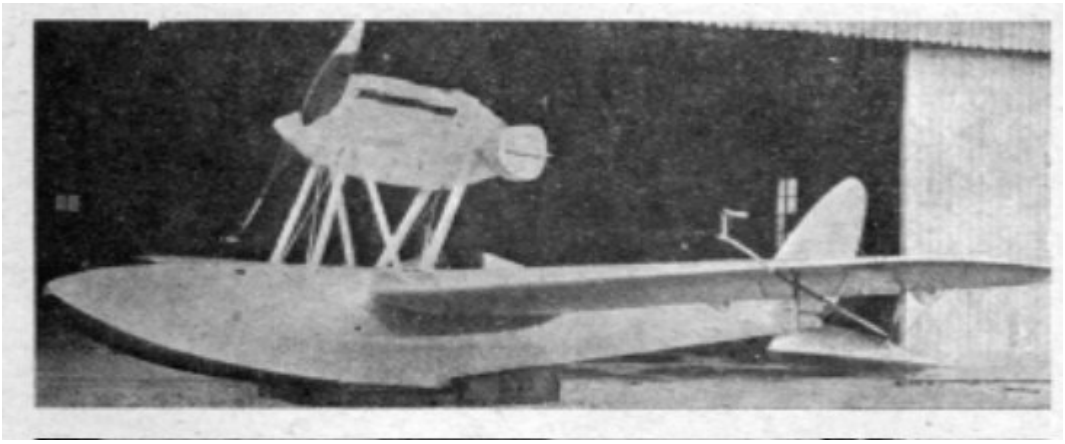
Chapter- 6

Racing Seaplanes

Macchi M.33

Macchi M.33

Role	Racing flying boat
Manufacturer	Aeronautica Macchi
First flight	1925
Primary user	Italy
Number built	2



The **Macchi M.33** was an Italian racing flying boat which competed in the 1925 Schneider Trophy race.

Design and development

The Macchi M.33 was a single-seat, wooden, shoulder-wing monoplane flying boat of very clean aerodynamic design for its time. Its cantilever wing was fairly thick and carried stabilizing floats on each side. Italy lacked competitive racing engines in 1925, so the M.33 was powered with a used 1923 Curtiss D-12 engine rated at 378 kilowatts (507 horsepower) in a steamlined nacelle mounted on struts above the fuselage and driving a two-bladed tractor propeller. The M.33 had a flat-plate radiator, a type that was obsolescent by 1925, rather than modern surface radiators.

The D-12 engines powering M.33s were worn-out and unreliable and lacked the power of newer foreign engines, and pilots reported that the aircraft suffered from wing flutter.

Operational history

Despite the M.33's shortcomings, Italy entered two of them in the 1925 Schneider Trophy race hosted by the United States at Baltimore, Maryland. The one piloted by Riccardo Morselli was scratched from the race because of engine ignition problems. Giovanni de Briganti piloted the other M.33; during the race he did not use full throttle out of fear for his aircraft's engine and wing problems, and was further delayed by a navigational error he made during the second lap of the seven-lap race. He came in third with an average speed of 271 kilometers per hour (168 miles per hour); this was well behind the second place finisher, a British Gloster IIIA piloted by Hubert Broad which finished with an average speed of 321 kilometers per hour (199 miles per hour), let alone the winner, an American Curtiss R3C-2 piloted by Jimmy Doolittle (1896-1993) which finished with an average speed of 374 kilometers per hour (233 miles per hour).

De Briganti's M.33 was the last flying boat to compete in the Schneider Trophy races.

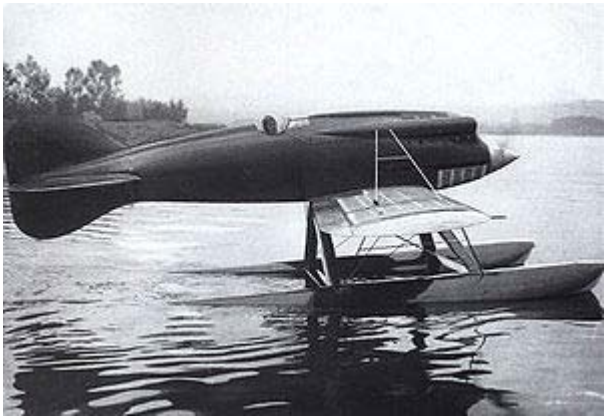
Specifications

General characteristics

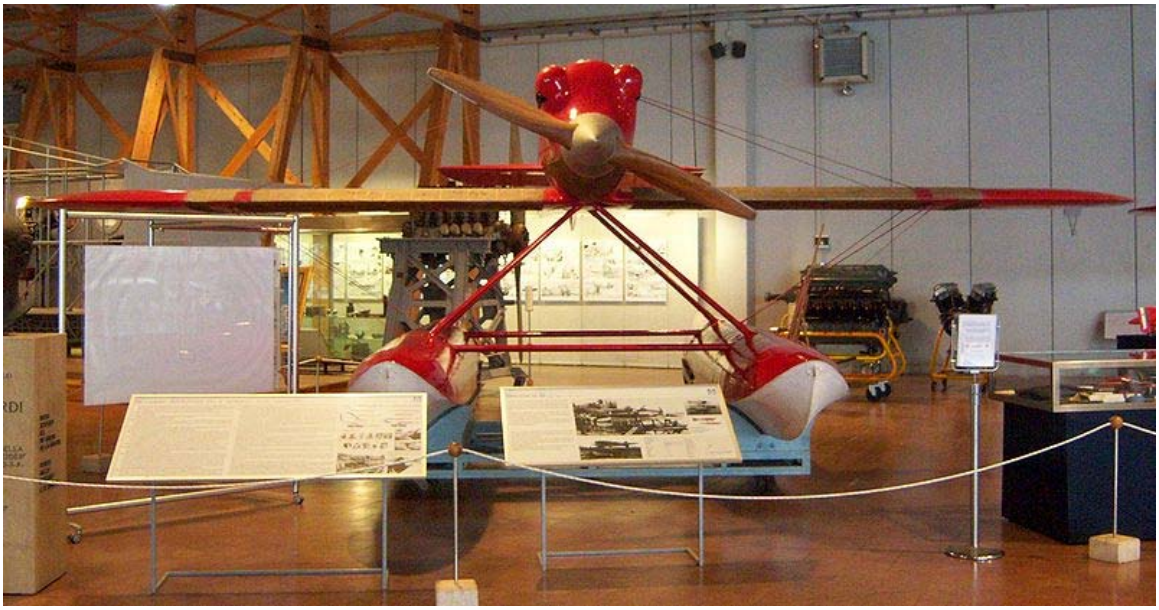
- **Crew:** 1
- **Length:** ()
- **Wingspan:** ()
- **Height:** ()
- **Powerplant:** 1× Curtiss D-12, 378 kW (507 hp)

Macchi M.39

M.39



Role	Racing seaplane
Manufacturer	Aeronautica Macchi
Designed by	Mario Castoldi
First flight	6 July 1926
Primary user	*Regia Aeronautica*
Number built	5 (two trainers and three racers), plus one static-test airframe



Preserved Macchi M.39 in Italy at the *Museo storico dell'Aeronautica Militare di Vigna di Valle*, photographed on 6 June 2009. This aircraft, MM.76, piloted by Major Mario de Bernardi, won the 1926 Schneider Trophy race and set two world speed records that year.

The **Macchi M.39** was a racing seaplane designed and built by the Italian aircraft company Macchi Aeronautica in 1925-1926. An M.39 piloted by Major Mario de Bernardi (1893–1959) won the 1926 Schneider Trophy, and the type also set world speed records that year.

Design and development

The M.39 was designed by Mario Castoldi (1888–1968) to represent Italy in the 1926 Schneider Trophy race, and it was the first low-wing monoplane that he designed for Macchi. It was a single-seat, twin-float racing seaplane, of mixed (metal and wooden) construction. The wings were wire-braced, and the pilot sat in an open cockpit parallel with the trailing edge of the wing; the cockpit's windscreen was profiled into the fuselage decking to reduce aerodynamic drag. The floats carried fuel.

The M.39 had features specialzing it for Schneider Trophy competition. The course circuit required left turns, so the left wingtip was slightly farther from the fuselage than the right wingtip to allow it to make tighter lefthand turns. To counteract propeller torque reaction, the floats had unequal buoyancy.

Macchi built two types of M.39, a trainer version and a racer. The trainer version had a 447-kilowatt (600-horsepower) Fiat AS.2 liquid-cooled V12 engine, while the racing version had a 597-kilowatt (800-horsepower) Fiat A.S. 2. Macchi built two trainers, three racers, and one non-flying static-test airframe. The first M.39, a trainer with serial number MM.72, was built in only a few months. It was soon followed by the second

trainer (MM.73), the three racers (MM.74, MM.75, and MM.76), and the static-test airframe.

Operational history

The first M.39 to fly was the trainer MM.72, which made its first flight on 6 July 1926. On 16 September 1926, the Italian Schneider team captain stalled one of the trainers over Lake Varese, crashed into the lake, and was killed, but development of the M.39 continued.

On 13 November 1926, the three M.39 racers took part in the 1926 Schneider Trophy contest at Hampton Roads, Virginia, in the United States. MM.75 suffered a burst pipe and had to leave the race early, but MM.76, piloted by Major de Bernardi, took first with an average speed of 396.698 kilometres per hour (246.497 mph), setting a new world speed record for seaplanes. MM.74, flown by Adriano Bacula, came in third.

Four days later, on 17 November 1926, de Bernardi used MM.76 to achieve a new world speed record of 416.618 kilometres per hour (258.874 mph) over a 3 kilometres (1.9 mi) course at Hampton Roads.

Castoldi based the design of his next racing seaplane, the Macchi M.52, on that of the M.39.

Specifications

M.39 trainer

General characteristics

- **Crew:** 1
- **Length:** ()
- **Wingspan:** ()
- **Height:** ()
- **Powerplant:** 1× Fiat AS.2 liquid cooled V-12, 447 kW (600 hp)

M.39 racer

General characteristics

- **Crew:** 1
- **Length:** 7.77 m (fuselage length = 6.73 m) (25 ft 6 in)
- **Wingspan:** 9.26 m (30 ft 4½ in)
- **Height:** 2.97 m (9 ft 9 in)
- **Empty weight:** 1,257 kg (2,772 lb)
- **Loaded weight:** 1,572 kg (3,465 lb)
- **Max takeoff weight:** 1,575 kg (3,472 lb)

- **Powerplant:** 1× Fiat AS.2 liquid cooled V-12, 597 kW (800 hp)

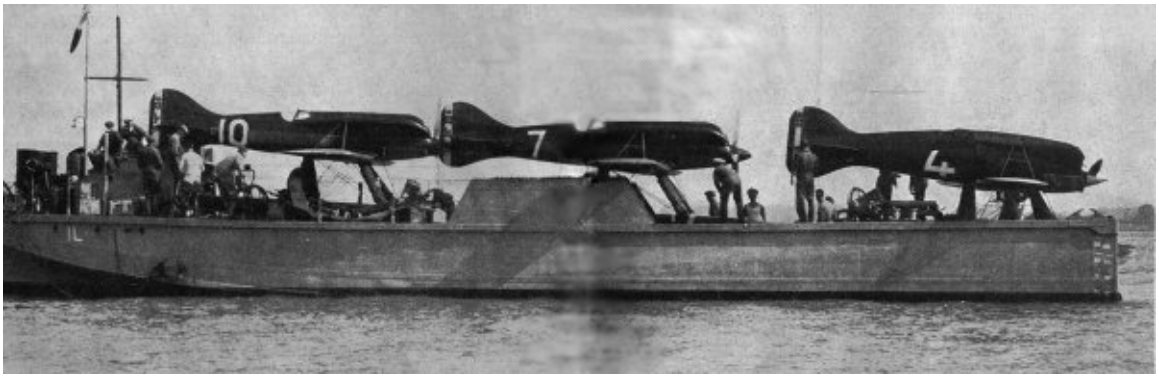
Performance

- **Maximum speed:** 439.44 km/h (237 kn, 272 mph)

Macchi M.52

Macchi M.52

Role	Racing seaplane
National origin	Italy
Manufacturer	Macchi
Designed by	Mario Castoldi
First flight	early August 1927
Number built	3 (M.52) 1 (M.52bis or M.52R)



Italy's three entrants in the 1929 Schneider Trophy race. The M52R, which took second place, is at right; the other two aircraft are Macchi M.67 floatplanes.

The **Macchi M.52** was an Italian racing seaplane designed and built by Macchi for the 1927 Schneider Trophy race. The M.52 and a later variant, the **M.52bis** or **M.52R**, both set world speed records for seaplanes.

Design and development

M.52

Mario Castoldi (1888–1968) designed the M.52, following the formula he used in designing the successful Macchi M.39, which Major Mario de Bernardi (1893–1959) piloted to victory and a world seaplane speed record in the 1926 Schneider Trophy race and to another world seaplane speed record four days later. Like the M.39, the M.52 was a single-engined, low-wing monoplane on twin floats. Slightly smaller than the M.39, it was powered by a much more powerful engine, the 746 kilowatts (1,000 hp) Fiat AS.3. Despite the significant increase in engine power, the M.52 had a maximum takeoff weight 60 kilograms (130 lb) less than that of the M.39. Macchi built three M.52s.

M.52bis or M.52R

A restyled version, known both as the M.52bis and M.52R, also was built. Its wingspan (7.85 metres (25.8 ft) and maximum takeoff weight were reduced further from that of the M.52, and it had streamlining improvements including floats with a smaller frontal area. Macchi built a single M.52bis.

Operational history

M.52

Italy entered all three M.52s in the 1927 Schneider Trophy race, which was held at Venice, Italy, on 26 September 1927. All three suffered engine trouble, and none of them finished the race; the 1926 winner de Bernardi officially finished 10th after dropping out, and the best result among the M.52s was that achieved by the one piloted by Captain

Federico Guazetti, which did not drop out of the race until the final lap. Major de Bernardi, however, used one of the M.52s to establish a new world speed record of 479.3 kilometres per hour (297.8 mph) over a 3-kilometre (1.9 mi) course at Venice on 4 November 1927.

M.52bis or M.52R

At Venice on 30 March 1928, de Bernardi, flying the lone M.52bis (or M.52R), set a new world speed record of 512.776 kilometres per hour (318.624 mph). De Bernardi thus became the first person to exceed 500 kilometres per hour (310 mph)

Although Italy had planned to enter all three of the later Macchi M.67 racing seaplanes in the 1929 Schneider Trophy race, one of them crashed during training. As a substitute, the M.52R was entered alongside the two surviving M.67s to represent Italy in the race, which took place on 7 September 1929. Flown by Warrant Officer Tommasso Dal Molin, it was the only one of the three Italian aircraft to finish, gaining second place with a speed of 457.380 km/h (284.203 mph).

Operators

Italy

Specifications

M.52

General characteristics

- **Crew:** 1
- **Length:** 7.14 m (23 ft 4¾ in)
- **Wingspan:** 8.98 m (29 ft 5½ in)
- **Gross weight:** 1,515 kg (3,340 lb)
- **Powerplant:** 1 × Fiat AS.3 piston engine, 746 kW (1,000 hp)

Performance

M.52bis or M.52R

General characteristics

- **Crew:** 1
- **Length:** 7.14 m (23 ft 4¾ in)
- **Wingspan:** 7.85 m (25 ft 9 in)
- **Gross weight:** 1,480 kg (3,263 lb)
- **Powerplant:** 1 × Fiat AS.3 piston engine, 746 kW (1,000 hp)

Macchi M.67

Macchi M.67

Role	Racing seaplane
National origin	Italy
Manufacturer	Macchi
Designed by	Mario Castoldi (1888-1968)
First flight	1929
Number built	3
Developed from	Macchi M.39

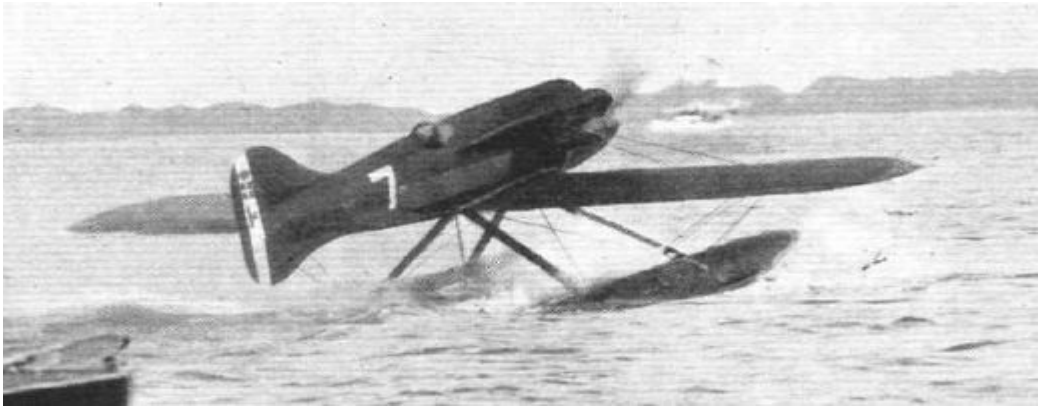
The **Macchi M.67**, was an Italian racing seaplane designed by Mario Castoldi (1888–1968) and built by Macchi for the 1929 Schneider Trophy race.

Design and development

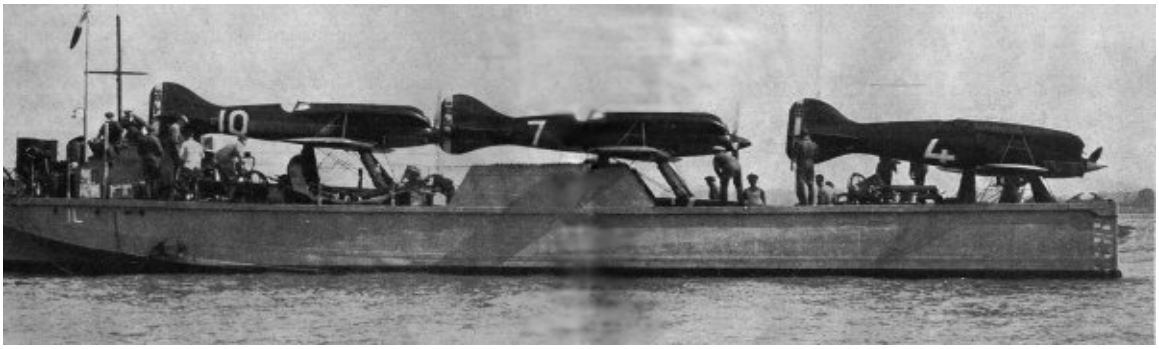
Castoldi based the design of the M.67—a single-seat, low-wing, monoplane, twin-float floatplane -- on that of his Macchi M.39, which had competed for Italy in the 1926 and 1927 Schneider Trophy races, following the M.39's layout but strengthening the M.67 so that it could be fitted with the 18-cylinder, 57.26-liter, 1,341-kilowatt (1,800-horsepower) Isotta-Fraschini *Asso* ("Ace") 1000 W18 engine, a much bigger and more powerful engine than the Fiat AS.2 V12 fitted to the M.39. The M.67 carried fuel in its floats; the powerful engine drove a three-bladed propeller which created a large amount of torque and to counter the torque more fuel was carried in one float than in the other, but this increased weight of one float made takeoffs dangerous.

Although the Italian public expressed a great deal of concern that the *Asso* 1000 engine was not ready for Schneider Trophy competition—Isotta-Fraschini built 27 of them for the 1929 Schneider Trophy race, but some exploded during testing—the Italian Air Minister, Italo Balbo (1896–1940), believed that the M.67 had the best chance of winning the race and selected it to represent Italy. Macchi built three M.67s.

Operational history



The M.67s underwent testing on Lake Garda in northern Italy. In August 1929 *Regia Aeronautica* (Italian Royal Air Force) Captain Giuseppe Motta was killed when his M.67 suddenly dived into the lake during a test flight in which he reached 583 kilometers per hour (362 miles per hour). Italy asked the 1929 race's hosts, the British Royal Aero Club, to postpone the race to allow Italy to correct the flaws in the M.67 and *Asso* 1000 engine, but the British refused. The Italians decided to enter the two surviving M.67s in the race despite the risk to their pilots, Balbo announcing that "the Italian team is going to England merely to perform a gesture of chivalrous sportsmanship." Italy also entered a Macchi M.52R floatplane in the race.



Italy's three entrants in the 1929 Schneider Trophy race. The two M.67s are at left and center; the Macchi M.52R, which took second place, is at right.

The race took place at Calshot Spit in the United Kingdom and began on 7 September 1929, with Lieutenants Remo Cadringher and Giovanni Monti flying the two M.67s. Cadringher's M.67 began the race with an impressive burst of speed, but skidded in the first turn as its cockpit filled with blinding, choking smoke and fumes; Cadringher went into a high-speed spin, pulled out of it over land, then completed one lap at an average speed of 457 kilometers (284 miles) per hour before having to land, unable to see the pylons marking the turns due to smoke in the cockpit. Monti completed the first lap at an average speed of 485.5 kilometers (301.5 miles) per hour, but his M.67's radiator burst as he began the second lap; scalded by steam and boiling water entering his cockpit, Monti managed to make an emergency landing and was taken to a hospital.

The M.52R completed the race, taking second place. During the banquet celebrating the end of the race, Balbo said, "We have finished playing our part as sportsmen. Tomorrow our work as competitors will begin," signalling Italy' intention to be more competitive in the next Schneider Trophy race, scheduled for 1931.

Preserved aircraft

A Macchi M.67 preserved in Italy at the *Museo storico dell'Aeronautica Militare di Vigna di Valle*.

An M.67 is preserved in Italy at the *Museo storico dell'Aeronautica Militare di Vigna di Valle*.

Operators

- Italy

Specifications

General characteristics

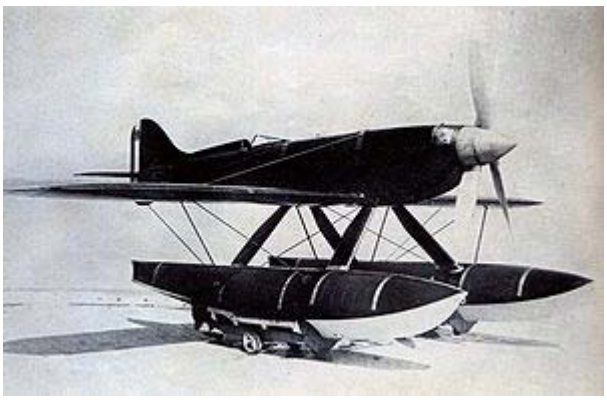
- **Crew:** 1
- **Powerplant:** 1 × Isotta-Fraschini *Asso* ("Ace") 1000 57.26-liter V18 piston, 1,341 kW (1,800 hp)

Performance

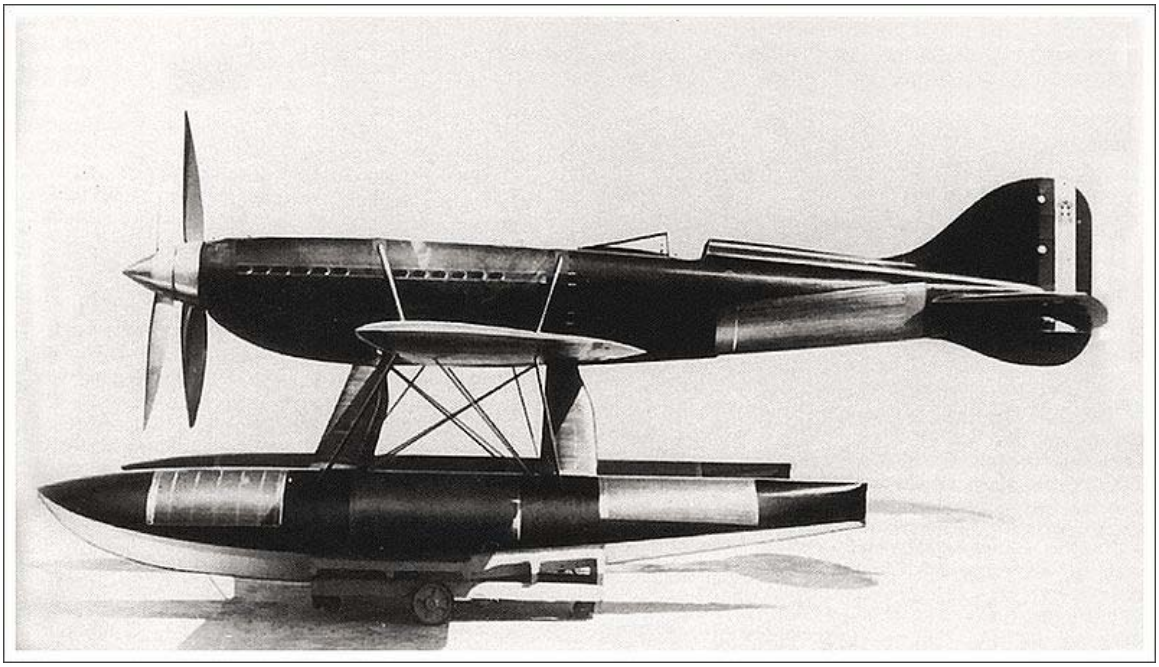
- **Maximum speed:** ? km/h (? mph)

Macchi M.C.72

M.C.72



Role	Seaplane racing aircraft
Manufacturer	Aeronautica Macchi
Designed by	Mario Castoldi
First flight	July 1931
Number built	5



The **Macchi M.C. 72** was an experimental seaplane designed and built by the Italian aircraft company Macchi Aeronautica. The M.C. 72 held the world speed record for all aircraft for five years. In 1933 and 1934, it set a world record speed for seaplanes which still stands to this day.

Design and development

The Macchi M.C. 72 was one of a series of seaplanes developed by Macchi Aeronautica. An earlier model, the M.24 was a twin-engine flying boat armed with machine guns and capable of carrying a torpedo. Later in the 1920s, Macchi focused on speed and on winning the Schneider Trophy. In 1922, the company hired aircraft designer Mario Castoldi to design high-speed aircraft.

In 1926, the company won the trophy with the M.39 which attained a top speed of 396 km/h (246 mph). Further planes (the M.52, M.52R, and the M.67) were designed and built but victory in the Schneider races kept eluding the Italians. Castoldi then designed the ultimate racing seaplane, the M.C. 72, a single seater aircraft with two floats.

The design of the Macchi M.C. 72 was unique with a fuselage partly metal to the cockpit and wood monocoque bolted to the front tubular portion by four bolts. The streamlined nose contours enclosed an oil tank with its outside wall exposed to the airstream. The wing was all metal with flat tubular water radiators smoothly faired into the wings. The twin pontoons had three smoothly-faired radiators on the outer surfaces, the forward radiator for water and the centre and rear radiators for oil cooling. The float struts also featured water radiators and another radiator was fitted during hot conditions under the fuselage running from cockpit to tail.

It was built in 1931 with the idea of competing for what turned out to be the final Schneider Trophy race, but due to engine problems, the plane was unable to compete.

Warrant Officer Francesco Agello, test pilot of the Macchi M.C. 72

Instead of halting development, Macchi continued work on the M.C. 72. Benito Mussolini personally took an interest in seeing development of the M.C. 72 continue and directed state funds to the company.

Operational history

For two years, the plane suffered from many mechanical defects, as well as the loss of two test pilots who died trying to coax world class speed out of the M.C. 72 (first Monti and then Bellini). The final design of M.C. 72 used double, contra-rotating propellers powered by a modified FIAT AS-6 engine V24 engine generating some 1,900-2,300 kW (2,500-3,100 hp) (thanks to supercharging).

After 35 flights, the engines were overhauled in preparation for a record attempt. The aircraft finally lived up to expectations when it set a new world speed record (over water) on 10 April 1933, with a speed of 682 km/h (424 mph). It was piloted by Warrant Officer Francesco Agello (the last qualified test pilot). Not satisfied, development continued as the aircraft's designers thought they could break 700 km/h (430 mph) with the M.C. 72. This feat was in fact achieved on 23 October 1934, when Agello piloted the plane for an average speed of 709 km/h (440 mph) over three passes. This record remains (as of 2010) the fastest speed ever attained by a piston-engine seaplane. After this success, the M.C.72 was never flown again.

Speed record

The M.C. 72 held the world speed record for all aircraft for five years. For comparison, the record holder for a land-based aircraft was held (for a time) by the Hughes H-1 Racer with a top speed of only 566 km/h (352 mph). Then in 1939, two German racing aircraft passed the M.C. 72. The first was a Heinkel He 100 which reached the speed of 746 km/h (463 mph). The second racer was a Messerschmitt Me 209 which set the new world speed record of 756 km/h (469 mph) in August – just days before the start of World War II. The current world speed record for a piston-engine aircraft is 528.33 mph (850.26 km/h) set by a heavily modified American F8F Bearcat named *Rare Bear* in 1989. However, the M.C. 72 record still stands today as the world's fastest propeller-driven seaplane.

Survivors

Preserved Macchi M.C.72 in Italy at the *Museo storico dell'Aeronautica Militare di Vigna di Valle*, photographed on 6 June 2009.

One M.C. 72 is a surviving airframe, and is on display at the Italian Air Force Museum, near Rome. It is the record-setting exemplar.

Specifications (M.C.72)

General characteristics

- **Crew:** 1 pilot
- **Length:** 8.32 m (27 ft 3.5 in)
- **Wingspan:** 9.48 m (31 ft 1.25 in)
- **Height:** 3.30 m (10.83 ft)
- **Wing area:** 15 m² (151.46 ft²)
- **Empty weight:** 2,505 kg (5,512 lb)
- **Loaded weight:** 2,907 kg (6,409 lb)
- **Max takeoff weight:** 3,031 kg (6,669 lb)
- **Powerplant:** 1× Fiat AS.6 Liquid-cooled V24 engine, 2,126 kW (2,850 hp)

Performance

- **Maximum speed:** 709.209 km/h (382.9 kn, 440.681 mph) (world speed record)

Chapter- 7

North American P-51 Mustang

P-51 Mustang

P-51 Mustangs of the 375th Fighter Squadron, 361st Fighter Group, summer 1944. The aircraft second from the camera has the recently introduced dorsal fin.

Role	Fighter
National origin	United States
Manufacturer	North American Aviation
First flight	26 October 1940
Introduction	1942
Status	Retired from military service 1984, still in civil use
Primary users	United States Army Air Forces Royal Air Force, numerous others
Number built	16,766
Unit cost	US$50,985 in 1945 ($622,225 in current value)

Variants	North American A-36 North American Mustang Mk.X Cavalier Mustang
Developed into	F-82 Twin Mustang Piper PA-48 Enforcer

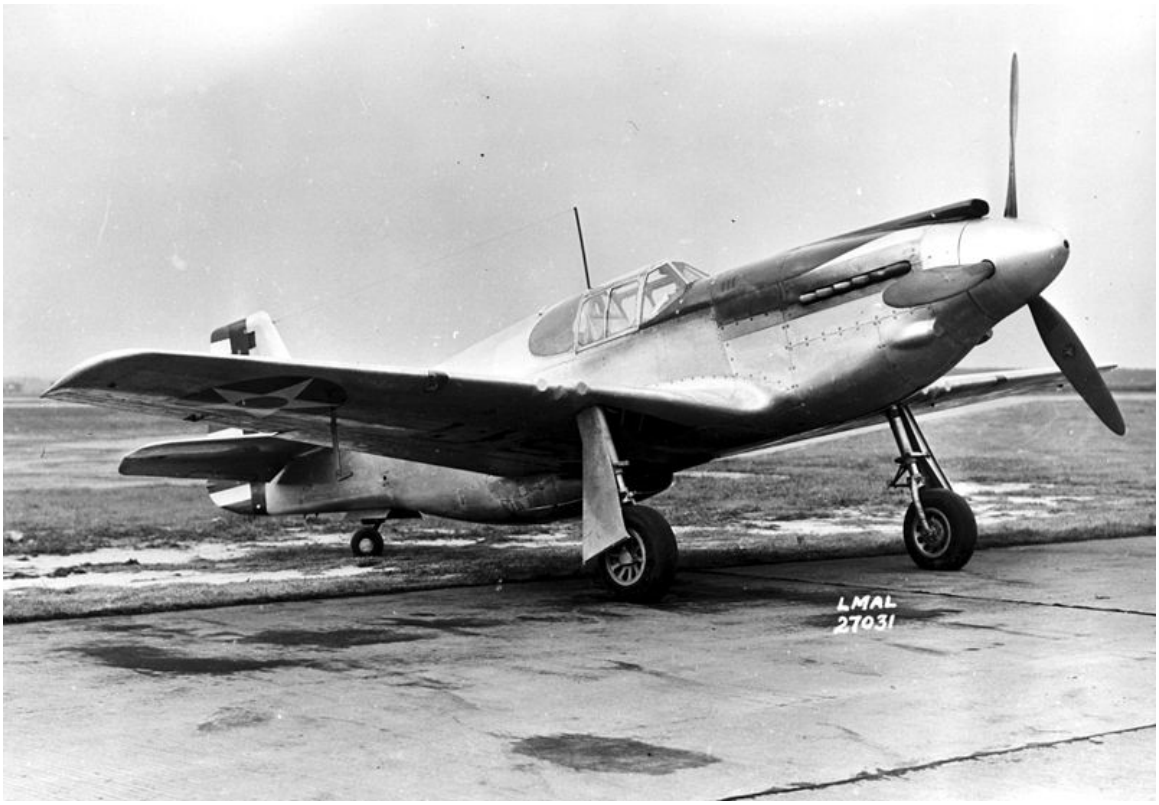
The **North American Aviation P-51 Mustang** was an American long-range single-seat World War II fighter aircraft. Designed and built in just 117 days to a specification issued to NAA by the British Purchasing Commission, the Mustang first flew in Royal Air Force (RAF) service as a fighter-bomber and reconnaissance aircraft before conversion to a bomber escort, employed in raids over Germany, helping ensure Allied air superiority from early 1944. The P-51 was in service with Allied air forces in Europe and also saw limited service against the Japanese in the Pacific War. At the start of Korean War the Mustang was the United Nations' main fighter but the role was quickly shouldered by jet fighters, including the F-86, after which the Mustang became a specialised ground-attack fighter-bomber. In spite of being superseded by jet fighters the Mustang remained in service with some air forces until the early 1980s.

As well as being economical to produce, the Mustang was a fast, well-made, and highly durable aircraft. The definitive version, the P-51D, was powered by the Packard V-1650, a two-stage two-speed supercharged version of the legendary Rolls-Royce Merlin engine, and was armed with six .50 caliber (12.7 mm) M2 Browning machine guns.

After World War II and the Korean War, many Mustangs were converted for civilian use, especially air racing. The Mustang's reputation was such that, in the mid-1960s, Ford Motor Company's Designer John Najjar proposed a new youth-oriented coupe automobile be named after the fighter.

Design and development

Genesis



XP-51 *41-039*

In April 1938, shortly after the German Anschluss of Austria, the British government established a purchasing commission in the United States, headed by Sir Henry Self. Self was given overall responsibility for Royal Air Force (RAF) production and 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 Sub-committee on Supply (or "Supply Committee") and one of his many 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 already flying met European standards, with only the Curtiss P-40 Tomahawk coming close. The Curtiss-Wright plant was running at capacity, so even P-40s were in short supply.

North American Aviation (NAA) was already supplying their Harvard trainer to the RAF, but were otherwise underutilized. NAA President "Dutch" Kindelberger approached Self to sell a new medium bomber, the B-25 Mitchell. Instead, Self asked if NAA could manufacture the Tomahawk under license from Curtiss.

Kindelberger said NAA could have a better aircraft with the same engine in the air in less time than it would take to set up a production line for the P-40. The Commission

stipulated armament of four .303 in (7.7 mm) machine guns, the Allison V-1710 liquid-cooled engine, a unit cost of no more than $40,000, and delivery of the first production aircraft by January 1941. In March 1940, 320 aircraft were ordered by Sir Wilfred Freeman who had become the executive head of Ministry of Aircraft Production (MAP), and the contract was promulgated on 24 April.

The design, known as the **NA-73X**, followed the best conventional practice of the era, but included two new features. One was a new NACA-designed laminar flow wing, which was associated with very low drag at high speeds. The other was a new radiator design that exploited the "Meredith Effect", in which heated air exited the radiator as a form of jet thrust. Because NAA lacked a suitable wind tunnel, it used the GALCIT 10 ft (3.0 m) wind tunnel at Caltech. This led to some controversy over whether the Mustang's cooling system aerodynamics were developed by NAA's engineer Edgar Schmued or by Curtiss, although NAA had purchased the complete set of P-40 and XP-46 wind tunnel data and flight test reports for US$56,000.

The prototype NA-73X was rolled out in early August and first flew on 26 October 1940, respectively just 117 and 178 days after the order had been placed, an uncommonly short gestation period. The prototype handled well and the internal arrangement accommodated an impressive fuel load. The aircraft’s two-section, semi-monocoque fuselage was constructed entirely of aluminium to save weight. It was armed with four .30 in (7.62 mm) M1919 Browning machine guns in the wings and four .50 in (12.7 mm) M2 Browning machine guns, two in the wings and two mounted under the engine and firing through the propeller arc using gun synchronizing gear.

While the United States Army Air Corps (USAAC) could block any sales it considered detrimental to the interests of the United States, the NA-73 was considered to be a special case because it had been designed at the instigation of the British. In September 1940 a further 300 NA-73s were ordered by MAP. To ensure uninterrupted delivery Colonel Oliver P. Echols arranged with the Anglo-French Purchasing Commission to deliver the aircraft, and NAA gifted two examples to the USAAC for evaluation.

Allison-engined Mustangs

Mustang Mk I/P-51/P-51A

A Mustang I in British camouflage and American markings on a test flight from the Inglewood, California factory in October 1942.

It was quickly evident that the Mustang's performance, although exceptional up to 15,000 ft (4,600 m), was markedly reduced at higher altitudes. The single-speed, single-stage supercharger fitted to the Allison V-1710 engine had been designed to produce its maximum power at a low altitude. Above 15,000 feet, the supercharger's critical altitude rating, the power dropped off rapidly. Prior to the Mustang project, the USAAC had Allison concentrate primarily on turbochargers in concert with General Electric; the turbochargers proved to be reliable and capable of providing significant power increases in the P-38 Lightning and other high-altitude aircraft, in particular in the Air Corps's four-engine bombers. Most of the other uses for the Allison were for low-altitude designs, where a simpler supercharger would suffice. Fitting a turbocharger into the Mustang proved impractical, and Allison was forced to use the only supercharger that was available. In spite of this, the Mustang's advanced aerodynamics showed to advantage, as the Mustang Mk I was about 30 mph (48 km/h) faster than contemporary Curtiss P-40 fighters using the same engine (the V-1710-39 producing 1,220 hp (910 kW) at 10,500 ft (3,200 m), driving a 10 ft 6 in (3.20 m) diameter, three-blade Curtiss-Electric propeller). The Mustang Mk I was 30 mph (48 km/h) faster than the Spitfire Mk VC at 5,000 ft (1,500 m) and 35 mph (56 km/h) faster at 15,000 ft (4,600 m), despite the British aircraft's more powerful engine.

The first production contract was awarded by the British for 320 NA-73 fighters, named **Mustang Mk I** by an anonymous member of the British Purchasing Commission; a second British contract soon followed, which called for 300 more (NA-83) Mustang Mk I fighters. Contractual arrangements were also made for two aircraft from the first order to be delivered to the USAAC for evaluation; these two airframes, 41-038 and 41-039 respectively, were designated **XP-51**. The first RAF Mustang Mk Is were delivered to 2 Squadron and made their combat debut on 10 May 1942. With their long range and excellent low-altitude performance, they were employed effectively for tactical reconnaissance and ground-attack duties over the English Channel, but were thought to be of limited value as fighters due to their poor performance above 15,000 ft (4,600 m).

P-51 Mustang on a test flight, October 1942; this particular aircraft (41-37416?) may have been allocated to the RAF as a Mustang 1A.

The first American order for 150 P-51s, designated NA-91 by North American, were placed by the Army on 7 July 1940. The two XP-51s (41-038 and 41-039) set aside for testing arrived at Wright Field on 24 August and 16 December 1941 respectively. The relatively small size of this first order reflected the fact that the USAAC was still a relatively small, underfunded peacetime organisation. After the attack on Pearl Harbor priority had to be given to building as many of the existing fighters - P-38s, P-39s and P-40s - as possible while simultaneously training pilots and other personnel, which meant

that the evaluation of the XP-51s did not begin immediately. However, this did not mean that the XP-51s were neglected, or their testing and evaluation mishandled. The 150 NA-91s were designated **P-51** by the newly formed USAAF and were initially named Apache, although this was soon dropped, and the RAF name, Mustang, adopted instead. The USAAF did not like the mixed armament of the British Mustang Is and instead adopted an armament of four long-barrelled 20 mm (.79 in) Hispano Mk II cannon, and deleted the .50 cal engine cowling mounted weapons. The British designated this model as **Mustang Mk IA**. A number of aircraft from this lot were fitted out by the USAAF as **F-6A** photo-reconnaissance aircraft. The British would fit a number of Mustang Mk Is with similar equipment.

Even before the two XP-51s arrived at Wright, and well before the attack on Pearl Harbor, two more P-51s (the 93rd and 102nd off the production lines) from this order were slated to be fitted and tested with Packard Merlin engines, receiving the designation **XP-51B**.

On 23 June 1942, a contract was placed for 1,200 P-51As (NA-99s), later reduced to 310 aircraft. The P-51A used the new Allison V-1710-81 engine, a development of the V-1710-39, driving a 10 ft 9 in (3.28 m) diameter three-bladed Curtiss-Electric propeller. The armament was changed to four wing-mounted .50 in (12.7 mm) Browning machine guns, two in each wing, with a maximum of 350 rounds per gun (rpg) for the inboard guns and 280 rpg for the outboard. Other improvements were made in parallel with the A-36, including an improved, fixed air duct inlet replacing the movable fitting of previous Mustang models and the fitting of wing racks able to carry either 75 or 150 U.S. gal (284 or 568 l) drop tanks, increasing the maximum ferry range to 2,740 mi (4,410 km) with the 150 gal (568 l) tanks. The top speed was raised to 409 mph (658 km/h) at 10,000 ft (3,000 m). A total of 50 aircraft were shipped to England, serving as Mustang Mk IIs in the RAF.

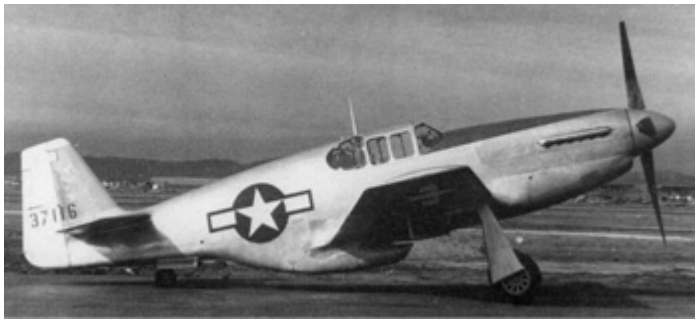
A-36 Apache/Invader

On 16 April 1942, Fighter Project Officer Benjamin S. Kelsey ordered 500 **A-36 Apaches**, a redesign that included six .50 in (12.7 mm) M2 Browning machine guns, dive brakes, and the ability to carry two 500 lb (230 kg) bombs. Kelsey would rather have bought more fighters but was willing instead to initiate a higher level of Mustang production at North American by using USAAC funds earmarked for ground-attack aircraft.

The 500 were designated A-36A (NA-97). This model became the first USAAF Mustang to see combat. One aircraft was passed to the British who gave it the name **Mustang Mk I (Dive Bomber)**.

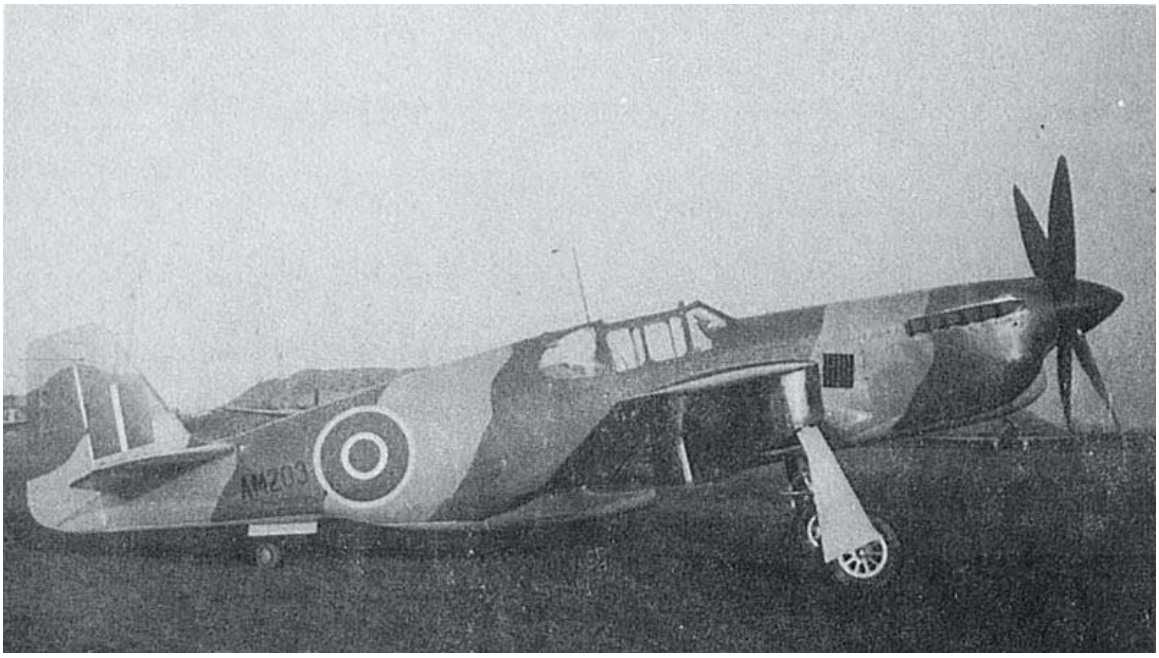
Merlin-engined Mustangs

P-51B and P-51C



P-51B assigned to the 23rd FG, 14th AF in China.

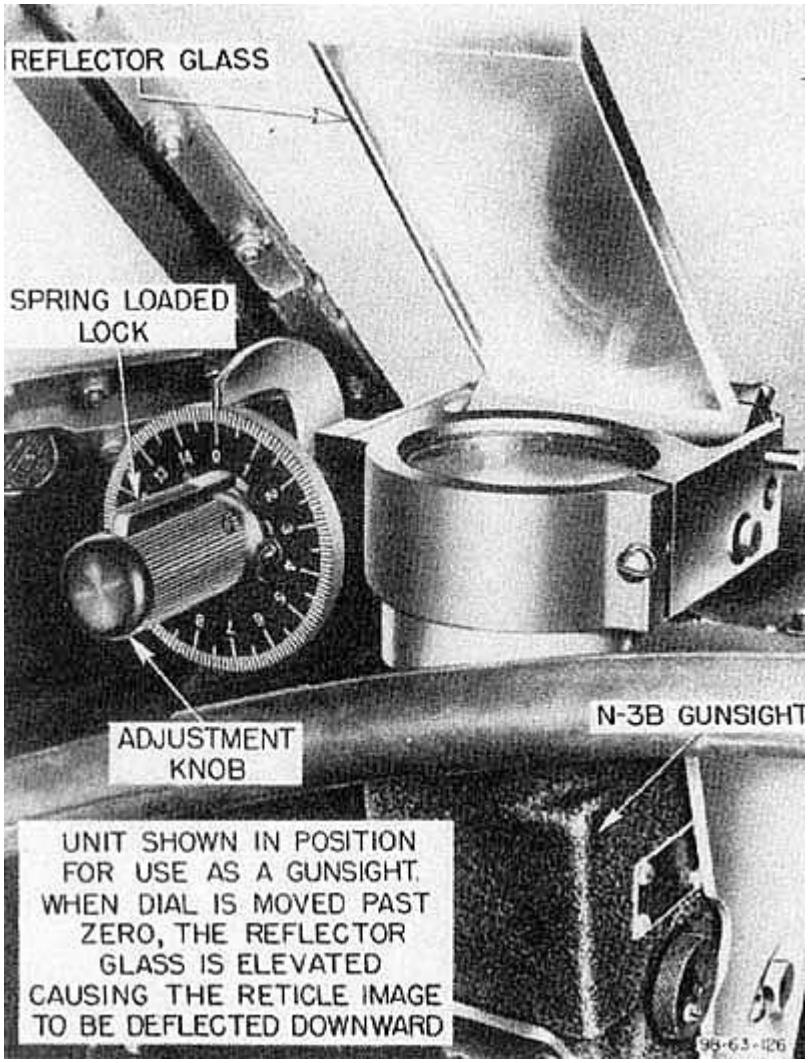
In April 1942, the RAF's Air Fighting Development Unit (AFDU) tested the Mustang and found its performance inadequate at higher altitudes. As such, it was to be used to replace the Tomahawk in Army Cooperation Command squadrons, but the commanding officer was so impressed with its maneuverability and low-altitude speeds that he invited Ronnie Harker from Rolls-Royce's Flight Test establishment to fly it. Rolls-Royce engineers rapidly realized that equipping the Mustang with a Merlin 61 engine with its two-speed two-stage supercharger would substantially improve performance and started converting five aircraft as the **Mustang Mk X**. Apart from the engine installation, which utilized custom-built engine bearers designed by Rolls-Royce and a standard 10 ft 9 in (3.28 m) diameter, four-bladed Rotol propeller from a Spitfire Mk IX, the Mustang Mk X was a straightforward adaptation of the Mustang Mk I airframe, keeping the same radiator duct design. The Vice-Chief of the Air Staff, Air Marshal Sir Wilfrid R. Freeman, lobbied vociferously for Merlin-powered Mustangs, insisting two of the five experimental Mustang Mk Xs be handed over to Carl Spaatz for trials and evaluation by the U.S. 8th Air Force in Britain. The high-altitude performance improvement was remarkable: the Mustang Mk X (serial number AM208) reached 433 mph (697 km/h) at 22,000 ft (6,700 m), and *AL975* tested at an absolute ceiling of 40,600 ft (12,400 m).



The Mustang Mk X *AM203*.

Two XP-51B prototypeswere adapted from P-51 airframes; these were a more thorough conversion than the Mustang X, with a tailor-made engine installation and a complete redesign of the radiator duct. The airframe itself was strengthened, with the fuselage and engine mount area receiving more formers because of the greater weight of the Packard V-1650-3, 1,690 lb (770 kg), compared with the Allison V-1710's 1,335 lb (606 kg). The engine cowling was completely redesigned to house the Packard Merlin, which, because of the intercooler radiator mounted on the supercharger casing, was 5 in (130 mm) taller and used an updraught induction system, rather than the downdraught carburetor of the Allison. The new engine drove a four-bladed 11 ft 2 in (3.40 m) diameter Hamilton Standard propeller that featured cuffs of hard molded rubber. To cater for the increased cooling requirements of the Merlin a new fuselage duct was designed. This housed a larger radiator, which incorporated a section for the supercharger coolant, and, forward of this and slightly lower, an oil cooler was housed in a secondary duct which drew air through the main opening and exhausted via a separate exit flap.

It was decided that the armament of the new P-51B (NA-102) would permanently omit the previously nose-mounted machine guns used on earlier P-51 versions, and only the four wing-mounted .50 in (12.7 mm) M2/AN Browning machine guns (with 350 rpg for the inboard guns and 280 rpg for the outboard) of the P-51A would be used for its gun armament. The bomb rack/external drop tank installation, adapted from the A-36 Apache attack version, would also be used; the racks were rated to be able to carry up to 500 lb (230 kg) of ordnance and were also capable of carrying drop tanks. The weapons were aimed using an N-3B optical gunsight fitted with an A-1 head assembly which allowed it to be used as a gun or bomb sight through varying the angle of the reflector glass. Pilots were also given the option of having ring and bead sights mounted on the top engine cowling formers. This option was discontinued with the later P-51Ds.



N3B gunsight with A-1 head assembly.

The first XP-51B flew on 30 November 1942. Although flight tests confirmed the potential of the new fighter, with the service ceiling being raised by 10,000 feet and the top speed improving by 50 mph at 30,000 ft (9,100 m), it was soon discovered that the radiator duct airflow was breaking up at high speeds, generating a rumble as the exit shutter was closed. Testing at the Ames Aeronautical laboratory led to a redesign of the radiator scoop culminating in a forward slanted upper lip. After sustained lobbying at the highest level, American production was started in early 1943 with the P-51B (NA-102) being manufactured at Inglewood, California, and the P-51C (NA-103) at a new plant in Dallas, Texas, which was in operation by summer 1943. The RAF named these models **Mustang Mk III**. In performance tests, the P-51B reached 441 mph (709.70 km/h) at 30,000 ft (9,100 m). In addition, the extended range made possible by the use of drop tanks enabled the Merlin-powered Mustang to be introduced as a bomber escort with a combat radius of 750 miles using two 75 gal tanks.

The range would be further increased with the introduction of an 85 gal (322 l) self-sealing fuel tank aft of the pilot's seat, starting with the P-51B-5-NA series. When this tank was full, the center of gravity of the Mustang was moved dangerously close to the aft limit. As a result, maneuvers were restricted until the tank was down to about 25 U.S. gal (95 l) and the external tanks had been dropped. Problems with high-speed "porpoising" of the P-51Bs and P-51Cs with the fuselage tanks would lead to the replacement of the fabric-covered elevators with metal-covered surfaces and a reduction of the tailplane incidence. With the fuselage and wing tanks, plus two 75 gal drop tanks, the combat radius was now 880 miles.

Despite these modifications, the P-51Bs and P-51Cs, and the newer P-51Ds and P-51Ks, experienced low-speed handling problems that could result in an involuntary "snap-roll" under certain conditions of air speed, angle of attack, gross weight, and center of gravity. Several crash reports tell of P-51Bs and P-51Cs crashing because horizontal stabilizers were torn off during maneuvering. As a result of these problems, a modification kit consisting of a dorsal fin was manufactured. One report stated:

"Unless a dorsal fin is installed on the P-51B, P-51C and P-51D airplanes, a snap roll may result when attempting a slow roll. The horizontal stabilizer will not withstand the effects of a snap roll. To prevent recurrence, the stabilizer should be reinforced in accordance with T.O. 01-60J-18 dated 8 April 1944 and a dorsal fin should be installed. Dorsal fin kits are being made available to overseas activities"

The dorsal fin kits became available in August 1944, and were fitted to P-51Bs and P-51Cs, and to P-51Ds and P-51Ks. Also incorporated was a change to the rudder trim tabs, which would help prevent the pilot over-controlling the aircraft and creating heavy loads on the tail unit.

A Malcolm Hood-equipped Mustang Mk III flown by Wing Commander Tadeusz Nowierski, CO of 133 (Polish) Wing, RAF Coolham, July 1944.

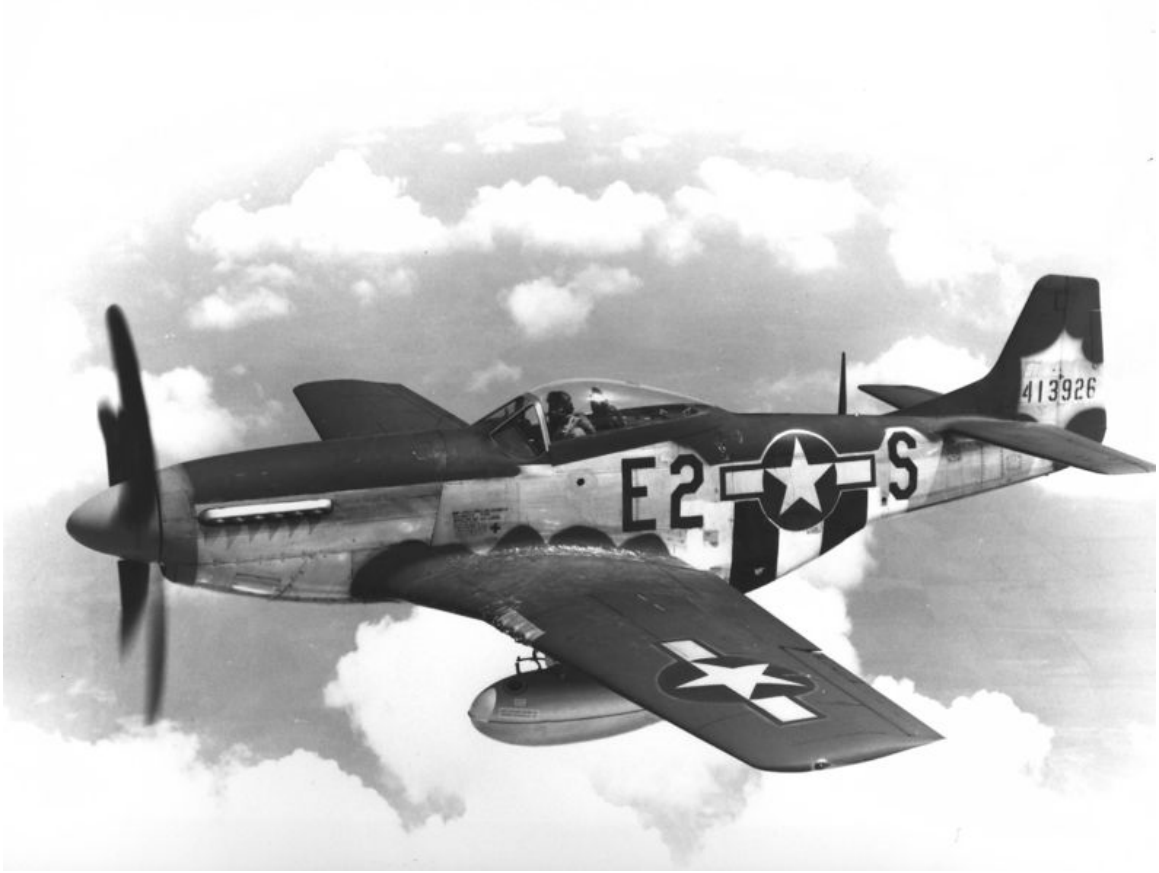
One of the few remaining complaints with the Merlin-powered aircraft was a poor rearward view. The canopy structure, which was the same as the Allison-engined Mustangs, was made up of flat, framed panels; the pilot gained access, or exited the cockpit by lowering the port side panel and raising the top panel to the right. The canopy could not be opened in flight and tall pilots especially, were hampered by limited headroom. In order to at least partially improve the view from the Mustang, the British had field-modified some Mustangs with clear, sliding canopies called Malcolm hoods (designed by Robert Malcolm). The new structure was a frameless plexiglas moulding which ballooned outwards at the top and sides, increasing the headroom and allowing increased visibility to the sides and rear. Because the new structure slid backwards on runners it could be slid open in flight. The aerial mast behind the canopy was replaced by a "whip" aerial which was mounted further aft and offset to the right. Most British Mk IIIs were equipped with Malcolm hoods. Several American service groups "acquired" the necessary conversion kits and some American P-51B/P-51Cs appeared with the new canopy, although the majority continued to use the original framed canopies.

P-51Bs and P-51Cs started to arrive in England in August and October 1943. The P-51B/P-51C versions were sent to 15 fighter groups that were part of the 8th and 9th Air Forces in England and the 12th and 15th in Italy (the southern part of Italy was under Allied control by late 1943). Other deployments included the China Burma India Theater (CBI).

Allied strategists quickly exploited the long-range fighter as a bomber escort. It was largely due to the P-51 that daylight bombing raids deep into German territory became possible without prohibitive bomber losses in late 1943.

A number of the P-51B and P-51C aircraft were fitted for photo reconnaissance and designated **F-6C**.

P-51D and P-51K



P-51D-25 possibly flown by Lieutenant Urban L. Drew. The new canopy structure with the associated modified rear fuselage, and the increased "kinked" wing area inboard of the gun positions are well shown in this photo.

Following combat experience the P-51D series introduced a "teardrop", or "bubble", canopy to rectify problems with poor visibility to the rear of the aircraft. Originally developed as part of the Miles M.20 project, these newer canopies were being adapted to most British designs, eventually appearing on Typhoons, Tempests and later-built Spitfires. In America new moulding techniques had been developed to form streamlined nose transparencies for bombers. North American designed a new streamlined plexiglass canopy for the P-51B which was later developed into the teardrop shaped bubble canopy. In late 1942 the tenth production P-51B-1-NA was removed from the assembly lines. From the windshield aft the fuselage was redesigned by cutting down the rear fuselage formers to the same height as those forward of the cockpit; the new shape faired in to the vertical tail unit. Wind tunnel tests of a wooden model confirmed that the aerodynamics were sound. A new simpler style of windscreen, with an angled bullet-resistant windscreen mounted on two flat side pieces improved the forward view while the new canopy resulted in exceptional all-round visibility.

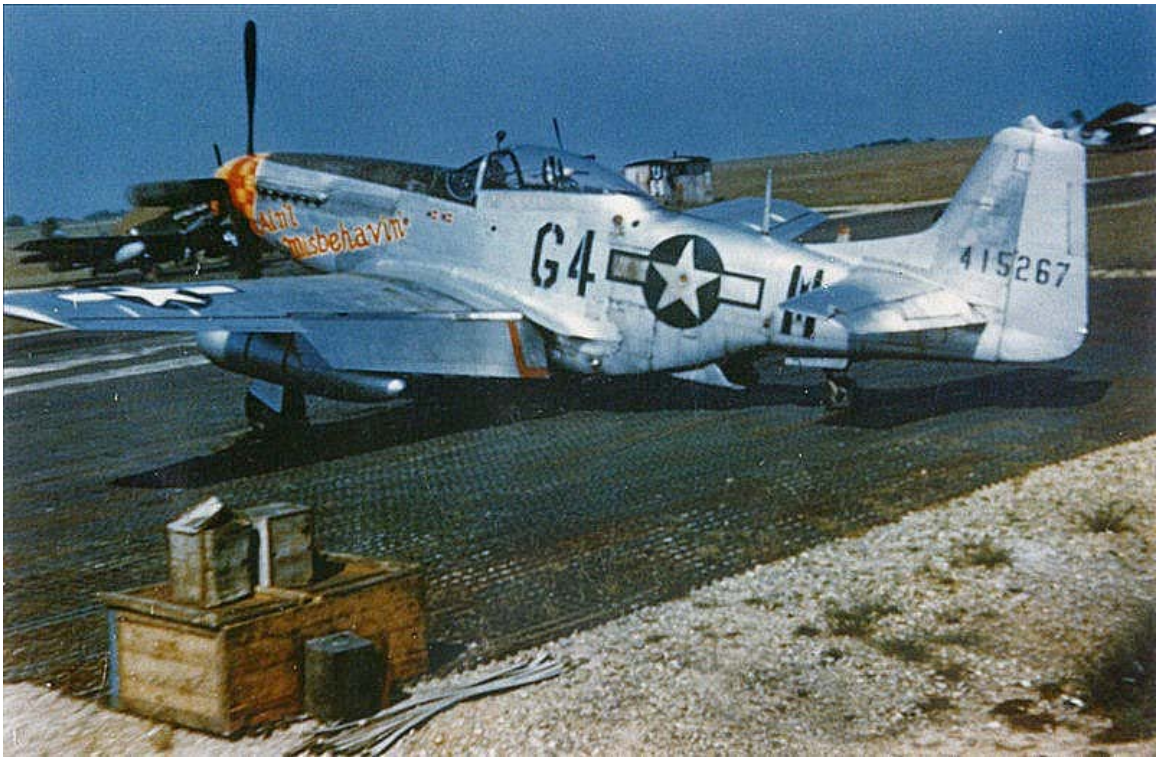
A common misconception is that the cutting down of the rear fuselage to mount the bubble canopy reduced stability, requiring the addition of a dorsal fin to the forward base of the vertical tail. In fact, as described, stability problems affected the earlier P-51Bs and P-51Cs, as well as the subsequent P-51D/P-51K models; this was partly attributable to the 85 U.S. gal (322 l) fuselage fuel tank that had been installed during production of the P-51B-5-NA and caused the center of gravity to move back too far when filled. Other factors were the switch from the three-blade propeller of the Allison-powered series to the four-blade propeller, causing increased destabilization due to the four-bladed propeller's greater side area effect, and, on the P-51D and P-51K, the bubble canopy causing some turbulence ahead of the fin.

Among other modifications, armament was increased with the addition of two more M2 machine guns, bringing the total to six. The inner pair of machine guns had 400 rpg, and the others had 270 rpg, for a total of 1,880. In previous P-51s, the M2s were mounted at an extreme side angle to allow access to the feed chutes from the ammunition trays. This angled mounting had caused problems with the ammunition feed and with spent casings and links failing to clear the gun-chutes, leading to frequent complaints that the guns jammed during combat maneuvers.

The new arrangement allowed the M2s to be mounted upright, remedying most of the jamming problems. The .50 in (12.7 mm) Browning machine guns, although not firing an explosive projectile, had excellent ballistics and proved adequate against the Focke-Wulf Fw 190 and Messerschmitt Bf 109 fighters, which were the main USAAF opponents at the time. The wing racks fitted to the P-51D/P-51K series were strengthened and were able to carry up to 1,000 lb (450 kg) of ordnance, although 500 lb (230 kg) bombs were the recommended maximum load. Later models had removable under-wing 'Zero Rail' rocket pylons added to carry up to ten T64 5.0 in (127 mm) H.V.A.R rockets per plane. The gunsight was changed from the N-3B to the N-9 before the introduction in September 1944 of the K-14 or K-14A gyro-computing sight.

Early P-51Ds without fuselage fuel tanks could be fitted with either the SCR-522-A or SCR-274-N Command Radio sets and SCR-695-A, or SCR-515 radio transmitters, as well as an AN/APS-13 rear-warning set; P-51Ds and Ks with fuselage tanks used the SCR-522-A and AN/APS-13 only.

Alterations to the undercarriage up-locks and inner-door retracting mechanisms meant that there was a change to the shape of the inner-wing leading edge, which was raked forward slightly, increasing the wing area and creating a distinctive "kink" in the leading edges of the wings.



P-51K 44-15672 (Lt. Jessie R. Frey of the 362nd Fighter Squadron, 357th Fighter Group) shows the Aeroproducts propeller unit with the "uncuffed" blades; an AN/APS-13 antenna array can just be seen on the vertical fin and there is an orange formation light in the center of the fuselage star.

The P-51D became the most widely produced variant of the Mustang. A Dallas-built version of the P-51D, designated the P-51K, was equipped with an 11 ft (3.4 m) diameter Aeroproducts propeller in place of the 11.2 ft (3.4 m) Hamilton Standard propeller. The hollow-bladed Aeroproducts propeller was unreliable, due to manufacturing problems, with dangerous vibrations at full throttle and was eventually replaced by the Hamilton Standard.

By the time of the Korean War, most F-51s were equipped with "uncuffed" Hamilton Standard propellers with wider, blunt-tipped blades. The photo reconnaissance versions of the P-51D and P-51K were designated **F-6D** and **F-6K** respectively. The RAF assigned the name **Mustang Mk IV** to the P-51D model and **Mustang Mk IVA** to P-51K models.

The P-51D/P-51K started arriving in Europe in mid-1944 and quickly became the primary USAAF fighter in the theater. It was produced in larger numbers than any other Mustang variant. Nevertheless, by the end of the war, roughly half of all operational Mustangs were still P-51B or P-51C models.

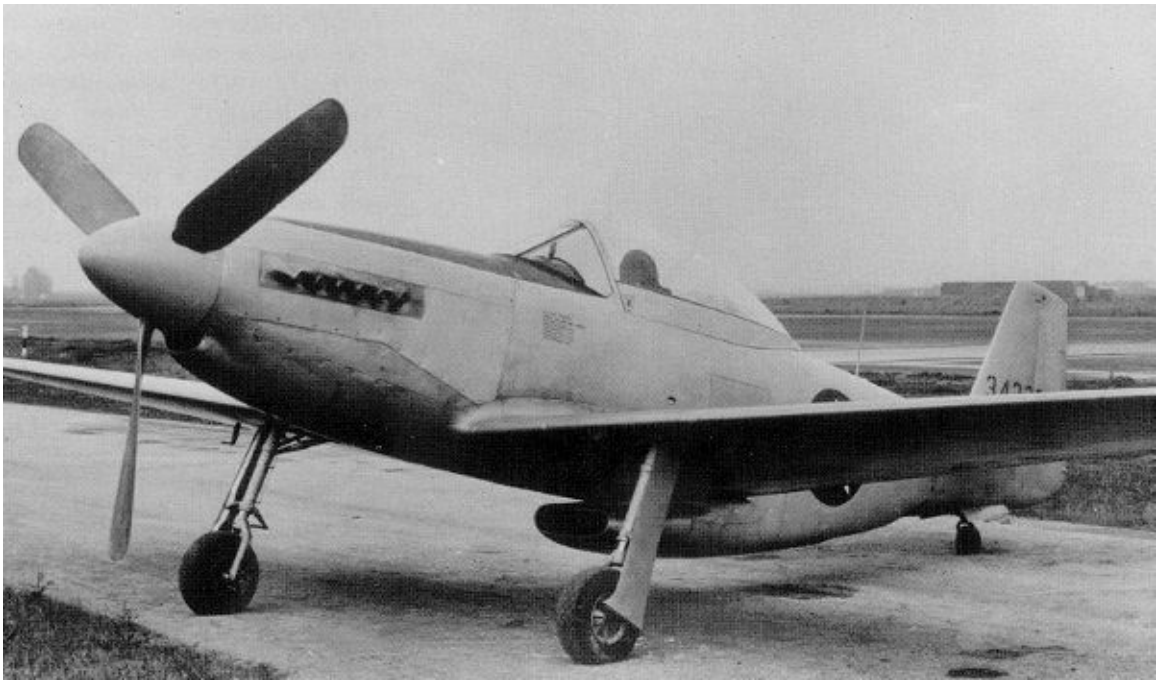
Concern over the USAAF's inability to escort B-29s all the way to mainland Japan resulted in the highly classified "Seahorse" project, an effort to "navalize" the aircraft. In

late 1944, naval aviator (and later test pilot) Lieutenant Bob Elder flew carrier suitability trials aboard the carrier USS *Shangri-La* using P-51D *44-14017*, which had been fitted with an arrestor hook. The project was canceled after U.S. Marines secured the Japanese island of Iwo Jima and its airfields, making it possible for standard P-51D models to accompany B-29s all the way to the Japanese home islands and back.

During 1945–48, P-51Ds were also built under licence in Australia by the Commonwealth Aircraft Corporation.

The "lightweight" Mustangs

XP-51F, XP-51G and XP-51J



An XP-51F (one of three built) with the three-bladed Aeroproducts propeller unit

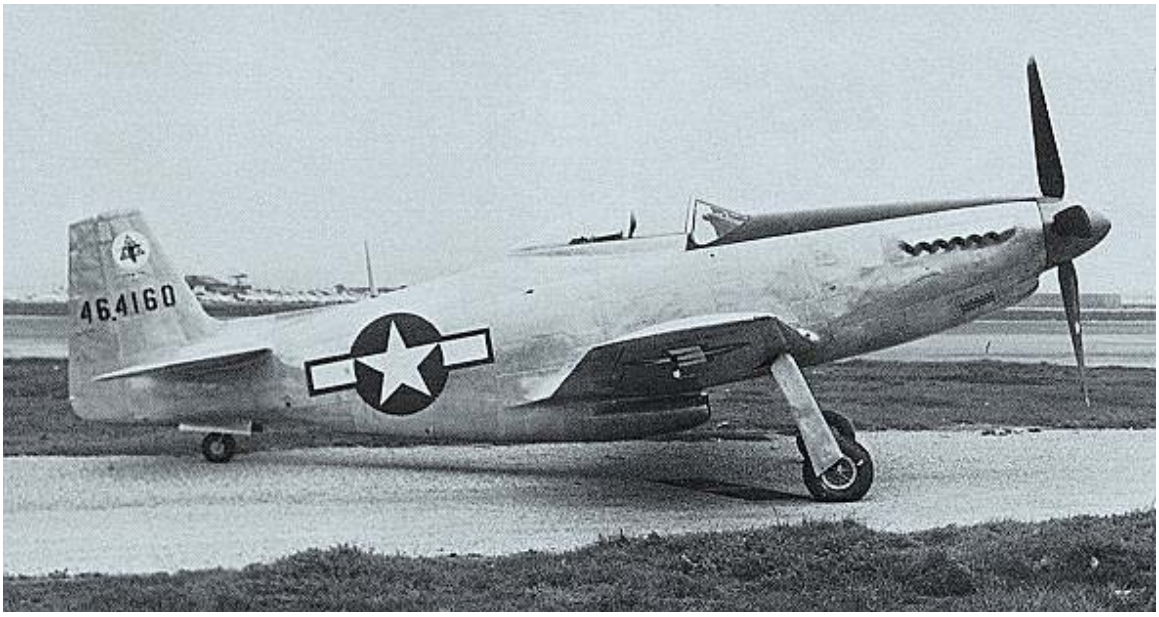
The USAAF required airframes built to their acceleration standard of 8.33 *g* (82 m/s²), a higher load factor than that used by the British standard of 5.33 *g* (52 m/s²) for their fighters. Reducing the load factor to 5.33 would allow weight to be removed, and both the USAAF and the RAF were interested in the potential performance boost. A subtle change made in the lightweight Mustangs was the use of an improved NACA 66 series airfoil and a slightly thinner wing than that used by earlier Mustangs.

In 1943, North American submitted a proposal to redesign the P-51D as model NA-105, which was accepted by the USAAF. Modifications included changes to the cowling, a simplified undercarriage with smaller wheels and disc brakes, and a larger canopy and an armament of four .50 Brownings. In total the design was some 1,600 pounds lighter than the P-51D. In test flights the XP-51F achieved 491 mph (790 km/h) at 21,000 feet. The designation **XP-51F** was assigned to prototypes powered with V-1650 engines (a small

number of XP-51Fs were passed to the British as the **Mustang V**), and **XP-51G** to those with reverse lend/lease Merlin RM 14 SM engines.

A third lightweight prototype powered by an Allison V-1710-119 engine was added to the development program. This aircraft was designated **XP-51J**. Since the engine was insufficiently developed, the XP-51J was loaned to Allison for engine development. None of these experimental lightweights went into production.

P-51H



A P-51H-10-NA showing the longer, slightly deeper fuselage and the lightweight undercarriage with smaller wheels. A taller tailfin was later adopted by the P-51H series.

The **P-51H** (NA-126) was the final production Mustang, embodying the experience gained in the development of the XP-51F and XP-51G aircraft. This aircraft, with minor differences as the NA-129, came too late to participate in World War II, but it brought the development of the Mustang to a peak as one of the fastest production piston-engine fighters to see service.

The P-51H used the new V-1650-9 engine, a version of the Merlin that included Simmons automatic supercharger boost control with water injection, allowing War Emergency Power as high as 2,218 hp (1,500 kW). Differences between the P-51D included lengthening the fuselage and increasing the height of the tailfin, which greatly reduced the tendency to yaw. The canopy resembled the P-51D style, over a raised pilot's position. Service access to the guns and ammunition was also improved. With the new airframe several hundred pounds lighter, the extra power and a more streamlined radiator, the P-51H was among the fastest propeller fighters ever, able to reach 487 mph (784 km/h or Mach 0.74) at 25,000 ft (7,600 m).

The P-51H was designed to complement the P-47N as the primary aircraft for the invasion of Japan, with 2,000 ordered to be manufactured at Inglewood. Production was just ramping up with 555 delivered when the war ended.

Additional orders, already on the books, were canceled. With the cutback in production, the variants of the P-51H with different versions of the Merlin engine were produced in either limited numbers or terminated. These included the **P-51L**, similar to the P-51H but utilizing the 2,270 hp (1,690 kW) V-1650-11 engine, which was never built; and its Dallas-built version, the **P-51M**, or NA-124, which utilized the V-1650-9A engine lacking water injection and therefore rated for lower maximum power, of which one was built out of the original 1629 ordered, serial number 45-11743.

Although some P-51Hs were issued to operational units, none saw combat in World War II, and in postwar service, most were issued to reserve units. One aircraft was provided to the RAF for testing and evaluation. Serial number *44-64192* was designated BuNo *09064* and used by the U.S. Navy to test transonic airfoil designs and then returned to the Air National Guard in 1952. The P-51H was not used for combat in the Korean War despite its improved handling characteristics, since the P-51D was available in much larger numbers and was a proven commodity.

Many of the aerodynamic advances of the P-51 (including the laminar flow wing) were carried over to North American's next generation of jet-powered fighters, the Navy FJ Fury and Air Force F-86 Sabre. The wings, empennage and canopy of the first straight-winged variant of the Fury (the FJ-1) and the unbuilt preliminary prototypes of the P-86/F-86 strongly resembled those of the Mustang before the aircraft were modified with swept-wing designs.

Experimental Mustangs

In early 1944, the first P-51A-1-NA, *43-6003*. was fitted and tested with a lightweight retractable ski kit replacing the wheels. This conversion was made in response to a perceived requirement for aircraft that would operate away from prepared airstrips. The main oleo leg fairings were retained, but the main wheel doors and tail wheel doors were removed for the tests. When the undercarriage was retracted, the main gear skis were housed in the space in the lower engine compartment made available by the removal of the fuselage .50 in (12.7 mm) Brownings from the P-51As. The entire installation added 390 lb (180 kg) to the aircraft weight and required that the operating pressure of the hydraulic system had to be increased from 1,000 psi (6,897 kPa) to 1,200 psi (8,276 kPa). Flight tests showed that ground handling was good, and the Mustang could take off and land in a field length of 1,000 ft (300 m); the maximum speed was 18 mph (29 km/h) lower, although it was thought that fairings over the retracted skis would compensate.

On 15 November 1944, a navalized P-51D-5-NA, *44-14017*, started flight tests from the deck of the carrier *Shangri-La*. This Mustang had been fitted with an arrestor hook, which was attached to a reinforced bulkhead behind the tail wheel opening; the hook was housed in a streamlined position under the rudder fairing and could be released from the

cockpit. The tests showed that the Mustang could be flown off the carrier deck without the aid of a catapult, using a flap setting of 20° down and 5° of up elevator. Landings were found to be easy, and, by allowing the tail wheel to contact the deck before the main gear, the aircraft could be stopped in a minimum distance.

While North American were concentrating on improving the performance of the P-51 through the development of the lightweight Mustangs, in Britain, other avenues of development were being pursued. To this end, two Mustang Mk IIIs (P-51Bs and P-51Cs), *FX858* and *FX901*, were fitted with different Merlin engine variants. The first of these, *FX858*, was fitted with a Merlin 100 by Rolls-Royce at Hucknall; this engine was similar to the RM 14 SM fitted to the XP-51G and was capable of generating 2,080 hp (1,550 kW) at 22,800 ft (7,000 m) using a boost pressure of +25 lbf/in^2 (170 kPa; 80 inHg) in war emergency setting. With this engine, *FX858* reached a maximum speed of 453 mph (729 km/h) at 18,000 ft (5,500 m), and this could be maintained to 25,000 ft (7,600 m). The climb rate was 4,160 ft/min (21.1 m/s) at 14,000 ft (4,300 m).

FX901 was fitted with a Merlin 113 (also used in the de Havilland Mosquito B. Mk 35). This engine was similar to the Merlin 100, but it was fitted with a supercharger rated for higher altitudes. *FX901* was capable of 454 mph (730 km/h) at 30,000 ft (9,100 m) and 414 mph (666 km/h) at 40,000 ft (12,200 m).

Operational history

U.S. operational service

P-51D-5NA *44-13357* of 8th AF / 361st FG / 374th FS **Tika IV**, assigned to Lt. Vernon R. Richards

American pre-war doctrine held that large formations of heavily-armed B-17s flying at high altitudes and using the Norden bombsight would be able conduct precision daylight

bombing of factories and other pinpoint targets, while at the same time avoiding heavy civilian casualties. It was also believed that using tightly grouped bomber formations, which allowed bombers to mutually protect one another with heavy defensive firepower, would mean that the bombers would be able to defend themselves against enemy interceptors without the need for fighter escort. The British viewed this doctrine with scepticism because direct operational experience during the first months of the war showed that unescorted RAF heavy bomber formations attacking targets in daylight were vulnerable to fighters; after formations of Wellingtons took heavy casualties, the RAF switched mostly to night attacks for the duration of the war. During the Battle of Britain the *Luftwaffe* had discovered that even escorted bomber formations were open to daylight attack and eventually resorted to night raids during the Blitz of 1940/41. Regardless of these experiences the Americans continued to believe in the efficacy of daylight precision bombing and, once the US had entered the war, the USAAF began to build up a strategic bomber force based in Britain.

The 8th Air Force started operations from Britain in August 1942; at first, because of the limited scale of operations, there was no conclusive evidence that the American doctrine was failing. In the twenty-six operations which had been flown to the end of 1942 the loss rate had been under 2%. In January 1943, at the Casablanca Conference, the Allies formulated the Combined Bomber Offensive (CBO) plan for "round-the-clock" bombing by the RAF at night and the USAAF by day. In June 1943, the Combined Chiefs of Staff issued the Pointblank Directive to destroy the *Luftwaffe* before the invasion of Europe, putting the CBO into full implementation. The 8th Air Force's heavy-bombers conducted a series of deep-penetration raids into Germany, beyond the range of available escort fighters. German fighter reaction was fierce, and bomber losses were severe—20% in an October 14 attack on the German ball-bearing industry. This made it too costly to continue such long-range raids without adequate fighter escort.

The Lockheed P-38 Lightning had the range to escort the bombers, but was available in very limited numbers in the European theater due to its Allison engines proving difficult to maintain. With the extensive use of the P-38 in the Pacific Theater of Operations, where its twin engines were deemed vital to long-range "over-water" operations, nearly all European-based P-38 units converted to the P-51 in 1944. The Republic P-47 Thunderbolt was capable of meeting the *Luftwaffe* on more than even terms, but did not at the time have sufficient range. The Mustang changed all that. In general terms, the Mustang was at least as simple as other aircraft of its era. It used a single, well-understood, reliable engine and had internal space for a huge fuel load. With external fuel tanks, it could accompany the bombers all the way to Germany and back.

P-51D *44-14888* of the 8th AF/357th FG/363rd FS, named *Glamorous Glennis III*, is the aircraft in which Chuck Yeager, the future test pilot, achieved most of his 12.5 kills

Enough P-51s became available to the 8th and 9th Air Forces in the winter of 1943-44, and, when the Pointblank offensive resumed in early 1944, matters changed dramatically. The P-51 proved perfect for the task of escorting bombers all the way to the deepest targets, thus complementing the more numerous P-47s until sufficient Mustangs became available. The Eighth Air Force immediately began to switch its fighter groups to the Mustang, first exchanging arriving P-47 groups for those of the 9th Air Force using P-51s, then gradually converting its Thunderbolt and Lightning groups until, by the end of the year, 14 of its 15 groups flew the Mustang.

Luftwaffe *Experten* were confident that they could out-manoeuvre the P-51 in a dogfight. Kurt Bühligen, the third-highest scoring German fighter pilot of the Second World War on the Western Front, with 112 victories, later recalled that "We would out-turn the P-51 and the other American fighters, with the (Bf)*109* or the (Fw)*190*. Their turn rate was about the same. The P-51 was faster than us but our munitions and cannon were better". Robert S. Johnson, the second-highest scoring U.S. fighter pilot in European theatre flew the P-47 against German fighters. Johnson pointed out "Generally speaking, I'd say the best (Focke-Wulf) 190s and the P-51 were very close in performance; the difference was probably in the pilot in these combats."

Usually Luftwaffe pilots attempted to avoid U.S. fighters by massing in huge numbers well in front of the bombers, attacking in a single pass, then breaking off the attack, allowing escorting fighters little time to react. The need to inflict heavy casualties on the American bombers was now more pressing than ever. To do this, the German fighters needed to carry very heavy armament. The weight of this armament decreased performance to the point where their aircraft were sitting ducks if caught by the P-51s, likely to appear in large numbers anywhere over Germany. The Luftwaffe answer was the *Gefechtsverband* (battle formation). It consisted of a *Sturmgruppe* of heavily armed and armoured Fw 190s escorted by two *Begleitgruppen* of light fighters, often Bf 109Gs, whose task was to keep the Mustangs away from the Fw 190s attacking the bombers. This scheme was excellent in theory but difficult to apply in practice. The massive German formation took a long time to assemble and was difficult to manoeuvre. It was often intercepted by the escorting P-51s and broken before reaching the bombers. But when the *Sturmgruppe* worked, the effects were devastating. With their engines and cockpits heavily armoured, the Fw 190s attacked from astern and gun camera films show that these attacks were often pressed to within 100 yds.

While not always successful in avoiding contact with the escort (as the tremendous loss of German pilots in the spring of 1944 indicates), the threat of mass attacks, and later the "company front" (eight abreast) assaults by armored *Sturmgruppe* Fw 190s, brought an urgency to attacking the *Luftwaffe* wherever it could be found. The P-51, particularly with the advent of the K-14 gunsight and the development of "Clobber Colleges" for the in-theater training of fighter pilots in fall 1944, was a decisive element in Allied countermeasures against the *Jagdverbände*.

Pilots of all-African 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 P. Lester

Beginning in late February 1944, 8th Air Force fighter units began systematic strafing attacks on German airfields that picked up in 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. On 15 April, VIII FC began Operation Jackpot, attacks on specific *Luftwaffe* fighter airfields, and on 21 May, these attacks were expanded to include railways, locomotives, and rolling stock used by the Germans to transport materiel and troops, in missions dubbed "Chattanooga". The P-51 also excelled at this mission, although losses were much higher on strafing missions than in air-to-air combat, partially because, like other fighters using liquid-cooled engines, the Mustang's coolant system could be punctured by small arms hits, even from a single bullet.

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 US, and later British bombers, was greatly diminished by July 1944. Reichmarshal 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."

P-51s also distinguished themselves against advanced enemy rockets and aircraft. A P-51B/P-51C with 150 octane fuel was fast enough to pursue the V-1s launched toward London. The Messerschmitt Me 163 rocket interceptors and Messerschmitt Me 262 jet fighters were considerably faster than the P-51, but they were not as maneuverable as the Mustang, furthermore they were vulnerable on take-off and landing (as all aircraft are). Chuck Yeager, flying a P-51D, was one of the first American pilots to shoot down a Me 262 when he surprised it during its landing approach. On 7 October 1944, Lt. Urban Drew of the 365th Fighter Group went him one better. During a fighter sweep, he surprised and shot down two Me 262s taking off. On the same day, Hubert Zemke, now flying Mustangs, shot down what he thought was a Bf 109, only to have his gun camera film reveal it to be an Me 262. On 1 November 1944, the Mustang pilots once again demonstrated that the threat could be contained with numbers. While flying as escorts for B-17s, the 20th Fighter Group was attacked by a lone Me 262, which destroyed a solitary P-51. The Me 262 then attempted to attack the bombers, only to be cut off by a mixed formation of P-51s and P-47s. The fighter groups competed for the kill. Eventually, a P-47 pilot of the 56th, and Mustang pilots Lts. Gerbe and Groce of the 352nd Fighter Groups, shared the kill.

P-51Cs and P-51Ds of 118 Tac/R Squadron, Laohwangping, China, June 1945 (Fred Poats photo)

By 8 May 1945, the 8th, 9th and 15th Air Forces' P-51 groups 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, and 4,131 destroyed on the ground. Losses were about 2,520 aircraft. The 8th Air Force's 4th Fighter Group, was the overall

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 aerial combat, the top-scoring P-51 units (both of which exclusively flew Mustangs) were the 357th Fighter Group of the 8th Air Force with 595 air-to-air combat victories, and the Ninth Air Force's 354th Fighter Group with 701, which made it the top scoring outfit in aerial combat of all fighter groups of any type. Martin Bowman reports that in the European Theater of Operations, Mustangs flew 213,873 sorties and lost 2,520 aircraft to all causes. The top Mustang ace was the USAAF's George Preddy, whose final tally stood at 27.5, 24 scored with the P-51, when he was shot down and killed by friendly fire on Christmas Day 1944 during the Battle of the Bulge. The P-51s were deployed in the Far East later in 1944, operating in close-support and escort missions as well as for tactical photo reconnaissance.

An Allied test-pilot's opinion

Chief Naval Test Pilot and C.O. Captured Enemy Aircraft Flight Capt. Eric Brown, CBE, DSC, AFC, RN, tested the Mustang in RAE Farnborough, and noted: "The Mustang was a good fighter and the best escort due to its incredible range, make no mistake about it. It was also the best American dogfighter. But the laminar flow wing fitted to the Mustang could be a little tricky. It could not by no means out-turn a Spitfire. No way. It had a good rate-of-roll, better than the Spitfire, so I would say the plusses to the Spitfire and the Mustang just about equate. If I were in a dogfight, I'd prefer to be flying the Spitfire. The problem was I wouldn't like to be in a dogfight near Berlin, because I could never get home to Britain in a Spitfire!"

Post-World War II

F-51 Mustang taxis through a puddle in Korea, laden with bombs and rockets

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-engine fighter, while other types, such as the P-38 and P-47, were withdrawn or given substantially reduced roles. However, as more advanced jet fighters (P-80 and P-84) were being introduced, the P-51 was relegated to secondary status.

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 been surplussed or transferred to the Air Force Reserve (AFRES) and the Air National Guard (ANG).

USAF F-51D dropping napalm on a target in North Korea

During the Korean War, F-51s, though obsolete as fighters, were used as close ground-support aircraft and reconnaissance aircraft until the end of the war in 1953. Because of its lighter structure and less availability of spare parts, the newer, faster F-51H was not used in Korea. With the aircraft being used for ground attack, their performance was less of a concern than their ability to carry a load.

At the start of the Korean War, the Mustang once again proved its usefulness. With the availability of F-51Ds in service and in storage, a substantial number were shipped via aircraft carriers to the combat zone for use initially by both the Republic of Korea Air Force (ROKAF) and USAF. Rather than employing them as interceptors or "pure" fighters, the F-51 was given the task of ground attack, fitted with rockets and bombs. After the initial invasion from North Korea, USAF units were forced to fly from bases in Japan, and F-51Ds could hit targets in Korea that short-ranged F-80 jet fighters could not. A major concern over the vulnerability of the cooling system was realized in heavy losses due to ground fire. Mustangs continued flying with USAF and ROKAF fighter-bomber units on close support and interdiction missions in Korea until they were largely replaced by Republic F-84 and Grumman Panther jet fighter-bombers in 1953. No. 77 Squadron Royal Australian Air Force (RAAF) operated Australian-built Mustangs as part of British

Commonwealth Forces Korea, replacing them with Gloster Meteor F8s in 1951. No. 2 Squadron South African Air Force (SAAF) operated US-built Mustangs as part of the US 18th Fighter Bomber Wing, suffering heavy losses by 1953, when it converted to the F-86 Sabre.

F-51s flew in the Air Force Reserve and Air National Guard 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 in 1957. This aircraft is now on display at the National Museum of the United States Air Force at Wright-Patterson AFB in Dayton, Ohio. It is, however, painted as P-51D-15-NA Serial No. *44-15174*.

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 out 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 both 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 but were fitted with new V-1650-7 engines, a new radio fit, tall F-51H-type vertical tails, and a stronger wing that could carry six 0.50 in (13 mm) machine guns and a total of eight underwing hardpoints. Two 1,000 lb (454 kg) bombs and six 5 in (127 mm) 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. 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 (FAD) in 1984.

Non-US service

After World War II, the P-51 Mustang served in the air arms of more than 55 nations. During wartime, a Mustang cost about 51,000 dollars, while many hundreds were sold postwar for the nominal price of one dollar to the American countries that signed the Inter-American Treaty of Reciprocal Assistance, ratified in Rio de Janeiro in 1947. Following is a list of some of the countries that used the P-51 Mustang.

 Australia

In November 1944, 3 (RAAF) Squadron became the first Royal Australian Air Force unit to use Mustangs. At the time of its conversion from the P-40 to the Mustang the squadron was based in Italy with the RAF's First Tactical Air Force. By this time, the Australian government had also decided to order Australian-built Mustangs, to replace its Curtiss Kittyhawks and CAC Boomerangs in the South West Pacific theatre. The Commonwealth Aircraft Corporation (CAC) factory at Fishermans Bend, Melbourne was the only non-U.S. production line for the P-51. In 1944, 100 P-51Ds were shipped from the US in kit form to inaugurate production. From February 1945, CAC assembled 80 of these under the designation CA-17 Mustang Mark 20, with the first one being handed over to the RAAF on 4 June 1945. The remaining 20 were kept unassembled as spare parts. In addition, 84 P-51Ks were also shipped directly to the RAAF from the USA. However, in the South West Pacific, only 17 Mustangs reached the RAAF's First Tactical Air Force front line squadrons by the time World War II ended in August 1945.

In late 1946 CAC was given another contract to build 170 (reduced to 120) more P-51Ds on its own; these, designated CA-18 Mustang Mark 21, Mark 22 or Mark 23, were manufactured entirely in-house, with only a few components being sourced from overseas. The 21 and 22 used the American-built Packard V-1650-3 or V-1650-7. The Mark 23s, which followed the 21s, were powered by Rolls-Royce Merlin 66 or Merlin 70 engines. The first 26 were built as Mark 21s,

followed by 66 Mark 23s; the first 14 Mark 21s were converted to fighter-reconnaissance aircraft, with two F24 cameras in both vertical and oblique positions in the rear fuselage, above and behind the radiator fairing; the designation of these modified Mustangs was changed from Mark 21 to Mark 22. An additional 14 purpose-built Mark 22s, built after the Mark 23s, and powered by either Packard V-1650-7s or Merlin 68s, completed the production run. All of the CA-17s and CA-18s, plus the 84 P-51Ks, used Australian serial numbers prefixed by A68.

Several squadrons were issued with P-51s: 76, 77, 82, 83, 84 and 86 Squadrons, converted to P-51s from July 1945. 3(RAAF) Squadron, after returning to Australia from Italy, was renumbered 4 Squadron and converted to CAC-built Mustangs. 76, 77 and 82 Squadrons were formed into 81 Fighter Wing of the British Commonwealth Air Force (BCAIR) which was part of the British Commonwealth Occupation Force (BCOF) stationed in Japan from February 1946. 77 Squadron also used P-51s extensively during the first years of the Korean War, before converting to Gloster Meteor jets.

Five reserve units from the Citizen Air Force (CAF) also operated Mustangs. 21 "City of Melbourne" Squadron, based in the state of Victoria; 22 "City of Sydney" Squadron, based in New South Wales; 23 "City of Brisbane" Squadron, based in Queensland; 24 "City of Adelaide" Squadron, based in South Australia; and 25 "City of Perth" Squadron, based in Western Australia. The last Mustangs were retired from these units in 1960 when CAF units adopted a non-flying role.

In October 1953, six Mustangs, including *A68-1*, the first Australian built CA-17 Mk 20, were allotted to the Long Range Weapons Development Establishment at Maralinga, South Australia, for use in experiments to gauge the effects of low-yield nuclear atomic bombs. The Mustangs were placed on a dummy airfield about 0.62 mi (1 km) from the blast tower on which two low-yield bombs were detonated. The Mustangs survived intact. In 1967, *A68-1* was bought by a US syndicate, for restoration to flight status and is currently owned by Troy Sanders.

 Bolivia

Nine *Cavalier* F-51D (including the two TF-51s) were given to Bolivia, under a program called Peace Condor.

 Canada

Restored P-51D in the markings of No. 402 "City of Winnipeg" RCAF Auxiliary Squadron

Canada had five squadrons equipped with Mustangs during World War II. RCAF No. 400, No. 414 and No. 430 squadrons flew Mustang Mk Is (1942-1944), and Nos. 441 and 442 flew Mustang Mk IIIs and IVAs in 1945. Postwar, a total of 150 Mustang P-51Ds were purchased and served in two regular (No. 416 "Lynx" and No. 417 "City of Windsor") and six auxiliary fighter squadrons (No. 402 "City of Winnipeg", No. 403 "City of Calgary", No. 420 "City of London", No. 424 "City of Hamilton", No. 442 "City of Vancouver" and No. 443 "City of New Westminster"). The Mustangs were declared obsolete in 1956, but a number of special-duty versions served on into the early 1960s.

China

China acquired P-51Cs and P-51Ds from the U.S. 10th AF in India by early 1945. These Mustangs were provided to the 3rd, 4th and 5th Fighter Groups of the China Air Force (CAF) and used to attack Japanese targets in occupied areas of China. After the war Chiang Kai-shek's Nationalist government used the planes against insurgent Communist forces. The Nationalists retreated to Taiwan in 1949. Pilots supporting Chiang brought most of the Mustangs with them, where the aircraft became part of the island's defence arsenal. Taiwan subsequently acquired additional Mustangs from the USAF and other sources. Some Mustangs remained on the mainland, captured by Communist forces when the Nationalists left.

Costa Rica

The Costa Rica Air Force flew four P-51Ds from 1955 to 1964.

Cuba

In November 1958, three US-registered civilian P-51D Mustangs were illegally flown separately from Miami to Cuba, on delivery to the rebel forces of the 26th of July Movement, then headed by Fidel Castro during the Cuban Revolution. One of the Mustangs was damaged during delivery, and none of them was used operationally. After the success of the revolution in January 1959, with other rebel aircraft plus those of the existing Cuban government forces, they were adopted into the Fuerza Aérea Revolucionaria. Due to increasing US restrictions, lack of spares and maintenance experience, they never achieved operational status. At the time of the Bay of Pigs invasion, the two intact Mustangs were already effectively grounded at Campo Columbia and at Santiago. After the failed invasion, they were placed on display with other symbols of "revolutionary struggle", and one remains on display at the Museo del Aire (Cuba).

Dominican Republic

The Dominican Republic (FAD) was the largest Latin American air force to employ the P-51D, with six aircraft acquired in 1948, 44 ex-Swedish F-51Ds purchased in 1948 and a further Mustang obtained from an unknown source. It was the last nation to have any Mustangs in service, with some remaining in use as late as 1984.

El Salvador

The FAS purchased five Cavalier Mustang IIs (and one dual control Cavalier TF-51) that featured wingtip fuel tanks to increase combat range and up-rated Merlin engines. Seven P-51D Mustangs were also in service. They were used during the 1969 Soccer War against Honduras, the last time the P-51 was used in combat.

France

In late 1944, the first French unit began its transition to reconnaissance Mustangs. In January 1945, the Tactical Reconnaissance Squadron 2/33 of the French Air Force took their F-6Cs and F-6Ds over Germany on photographic mapping missions. The Mustangs remained in service until the early 1950s, when they were replaced by jet fighters.

Germany

Several P-51s were captured by the *Luftwaffe* following crash landings. These aircraft were subsequently repaired and test-flown by the Zirkus Rosarius, or "Rosarius Staffel", for combat evaluation at Göttingen. The aircraft were repainted with German markings and bright yellow nose and belly for identification. A number of P-51B/P-51Cs (including examples marked with *Luftwaffe* codes T9+CK, T9+FK, T9+HK and T9+PK) and three P-51Ds were captured. Some of these P-51s were found by Allied forces at the end of the war; others crashed during testing. The Mustang is also listed in the appendix to the novel *KG 200* as having been flown by the German secret operations unit KG 200, which tested, evaluated and sometimes clandestinely operated captured enemy aircraft during World War II.

Guatemala

The Fuerza Aérea Guatemalteca (FAG) had 30 P-51D Mustangs in service from 1954 to the early 1970s.

Haiti

Haiti had four P-51D Mustangs when President Paul Eugène Magloire was in power between 1950 and 1956, with the last retired in 1973-74 and sold for spares to the Dominican Republic.

Indonesia

Indonesia acquired some P-51Ds from the departing Netherlands East Indies Air Force in 1949 and 1950. The Mustangs were used against Commonwealth (RAF, RAAF and RNZAF) forces during the Indonesian confrontation in the early 1960s. The last time Mustangs were deployed for military purposes was a shipment of six Cavalier II Mustangs (without tip tanks) delivered to Indonesia in 1972–1973, which were replaced in 1976.

Israel

A few P-51 Mustangs were illegally bought by Israel in 1948 for use in the War of Independence (1948) and quickly established themselves as the best fighter in the Israeli inventory. Further aircraft were bought from Sweden, and were replaced by jets at the end of the 1950s, but not before the type was used in the Suez Crisis, Operation Kadesh (1956). Reputedly, during this conflict, one daring Israeli pilot literally cut communications between Suez City and the Egyptian front lines by using his Mustang's propeller on the telephone wires.

Italy

Italy was a postwar operator of P-51Ds; deliveries were slowed by the Korean war, but between September 1947 and January 1951, by MDAP count, 173 examples were delivered. They were used in all the AMI fighter units: 2, 3, 4, 5, 6, and 51 *Stormo* (Wing), and some in schools and experimental units. Considered a "glamorous" fighter, P-51s were even used as personal aircraft by several Italian commanders. Some restrictions were placed on its use due to unfavorable flying characteristics. Handling had to be done with much care when fuel tanks were fully utilized and several aerobatic maneuvers were forbidden. Overall, the P-51D was highly rated even compared to the other primary postwar fighter in Italian service, the Supermarine Spitfire, partly because these P-51Ds were in very good condition in contrast to all other Allied fighters supplied to Italy. Phasing out of the Mustang began in summer 1958.

Japan

The P-51C-11-NT *Evalina*, marked as "278" (former USAAF serial: *44-10816*) and flown by 26th FS, 51st FG, was hit by gunfire on 16 January 1945 and belly-landed on Suchon Airfield in China, which was held by the Japanese. The Japanese repaired the aircraft, roughly applied Hinomaru roundels and flew the aircraft to the Fussa evaluation centre (now Yokota Air Base) in Japan.

Netherlands

The Royal Netherlands East Indies Army Air Force received 40 P-51Ds and flew them during the Indonesian National Revolution particularly the two 'politionele acties': Operatie Product in 1947 and Operatie Kraai in 1949. When the conflict was over, Indonesia received some of the ML-KNIL Mustangs.

Nicaragua

Fuerza Aerea de Nicaragua (GN) purchased 26 P-51D Mustangs from Sweden in 1954 and later received 30 P-51D Mustangs from the US together with two TF-51

models from MAP after 1954. All aircraft of this type were retired from service by 1964.

P-51D in 3 (Canterbury) Squadron TAF livery, performing at 2007 Wings over Wairarapa airshow

New Zealand

New Zealand ordered 370 P-51 Mustangs to supplement its F4U Corsairs in the Pacific Ocean Areas theatre. Scheduled deliveries were for an initial batch of 30 P-51Ds, followed by 137 more P-51Ds and 203 P-51Ms. The original 30 were being shipped as the war ended in August 1945; these were stored in their packing cases and the order for the additional Mustangs was cancelled. In 1951 the stored Mustangs entered service in 1 (Auckland), 2(Wellington), 3 (Canterbury) and 4 (Otago) squadrons of the Territorial Air Force (TAF). The Mustangs remained in service until they were prematurely retired in August 1955 following a series of problems with undercarriage and coolant system corrosion problems. Four Mustangs served on as target tugs until the TAF was disbanded in 1957. RNZAF pilots in the Royal Air Force also flew the P-51, and at least one New Zealand pilot scored victories over Europe while on loan to a USAAF P-51 squadron.

Philippines

The Phillippines acquired 103 P-51D Mustangs after World War II. These became the backbone of the postwar Philippine Army Air Corps and Philippine Air Force and were used extensively during the Huk campaign, fighting against Communist insurgents.

Philippine Air Force P-51D. The tailwheels were fixed in the extended position.

Mustangs were also the first aircraft of the Philippine air demonstration squadron, which was formed in 1953 and given the name "The Blue Diamonds" the following year. The Mustangs were replaced by 50 F-86 Sabres in the late 1950s, but some were still in service for COIN roles up to the early 1970s.

People's Republic of China

The Chinese Communists captured a few P-51s from the Chinese Nationalists as they were retreating to Taiwan.

Poland

During World War II, five Polish Air Force in Great Britain squadrons used Mustangs. The first Polish unit equipped (7 June 1942) with Mustang Mk Is was "B" Flight of 309 "Ziemi Czerwieńskiej" Squadron (an Army Co-Operation Command unit), followed by "A" Flight in March 1943. Subsequently, 309 Squadron was redesignated a fighter/reconnaissance unit and became part of Fighter Command. On 13 March 1944, 316 "Warszawski" Squadron received their first Mustang Mk IIIs; rearming of the unit was completed by the end of April. By 26 March 1943, 306 "Toruński" Sqn and 315 "Dęblíński" Sqn received Mustangs Mk IIIs (the whole operation took 12 days). On 20 October 1944, Mustang Mk Is in No. 309 Squadron were replaced by Mk IIIs. On 11 December 1944, the unit was again renamed, becoming "309 Dywizjon Myśliwski "Ziemi Czerwieńskiej" or 309 "Land of Czerwien" Polish Fighter Squadron. In 1945, 303 "Kościuszko" Sqn received 20 Mustangs Mk IV/Mk IVA replacements. Postwar, between 6 December 1946 and 6 January 1947, all five Polish squadrons equipped with Mustangs were disbanded. Poland returned approximately 80 Mustangs Mk IIIs and 20 Mustangs Mk IV/IVAs to the RAF, which transferred them to the U.S. government.

Somalia

The Somalian Air Force had brought 8 P-51D models in service.

South Africa

The South African Air Force operated a number of Mustang Mk Is and Mk IIs (P-51As) in Italy and the Middle East during World War II. After VE-Day, these machines were soon struck off charge and scrapped. In 1950, 2 Squadron SAAF was supplied with F-51D Mustangs by the United States for Korean War service. The type performed well in South African hands before being replaced by the F-86 Sabre in 1952 and 1953.

South Korea

The F-51D in ROKAF service

Within a month of the outbreak of the Korean War, 10 F-51D Mustangs were provided to the badly depleted Republic of Korea Air Force as a part of the Bout One Project. They were flown by both South Korean airmen, several of whom were veterans of the Imperial Japanese Army and Navy air services during World War II, as well as by U.S. advisers led by Major Dean Hess. Later, more were provided both from U.S. and from South African stocks, as the latter were converting to F-86 Sabres. They formed the backbone of the South Korean Air Force until they were replaced by Sabres.

It also served with the ROKAF Black Eagles aerobatic team, until retired 1954.

Sweden

Sweden's *Flygvapnet* first recuperated four of the P-51s (two P-51Bs and two early P-51Ds) that had been diverted to Sweden during missions over Europe. In February 1945, Sweden purchased 50 P-51Ds designated J 26, which were delivered by American pilots in April and assigned to the F 16 wing at Uppsala as interceptors. In early 1946, the F 4 wing at Östersund was equipped with a second batch of 90 P-51Ds. A final batch of 21 Mustangs was purchased in 1948. In all, 161 J 26s served in the Swedish Air Force during the late 1940s. About a dozen were modified for photo reconnaissance and re-designated S 26. A few of these aircraft participated in the top secret Swedish mapping of new Soviet military installations at the Baltic coast in 1946-47 (*Operation Falun*), an endeavour that entailed many intentional violations of Soviet airspace. However, the Mustang could outdive any Soviet fighter of that era, so no S 26s were lost in these missions. The J 26s were replaced by De Havilland Vampires around 1950. The S 26s were replaced by S 29Cs in the early 1950s.

Switzerland

A restored Swiss Air Force P-51D

The Swiss Air Force operated a few USAAF P-51s that had been impounded by Swiss authorities during World War II after the pilots were forced to land in neutral Switzerland. After the war, Switzerland also bought 130 P-51s for $4,000 each. They served until 1958.

United Kingdom

The RAF was the first air force to operate the Mustang. Because the first Mustangs were built to British requirements these 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**s by the RAF. The

first RAF Mustangs diverted from American orders were 93 P-51s, designated **Mark IA**, followed by 50 P-51As used as **Mustang II**s.
The first Mustang Mk Is entered service in 1941 the first unit being 2 Squadron RAF. Due to poor high-altitude performance, the Mustangs were used byArmy Co-operation Command, rather than Fighter Command, and were used for tactical reconnaissance and ground-attack duties. On 27 July 1942, 16 RAF Mustangs undertook their first long-range reconnaissance mission over Germany. During Operation Jubilee (19 August 1942) four British and Canadian Mustang squadrons, including 26 Squadron saw action. By 1943/1944, British Mustangs were used extensively to seek out V-1 flying bomb sites. The final RAF Mustang Mk I and Mustang Mk II aircraft were struck off charge in 1945.
The RAF also operated a total of 308 P-51Bs and 636 P-51Cs 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** and **Mk IVA**s (828 in total, comprising 282 P-51D-NAs or Mk IVs, and 600 P-51Ks or Mk IVA). As the Mustang was a Lend-Lease type, all 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 final Mustangs were retired from RAF use in 1947.

Soviet Union

The Soviet Union received at least 10 early-model ex-RAF Mustang Is and tested but found them to "under-perform" compared to contemporary USSR fighters, relegating them to training units. Later Lend-Lease deliveries of the P-51B/C and D series along with other Mustangs abandoned in Russia after the famous "shuttle missions" were repaired and used by the Soviet Air Force, but not in front-line service.

Uruguay

The Uruguayan Air Force (FAU) used 25 P-51D Mustangs from 1950 to 1960—some were subsequently sold to Bolivia.

P-51s and civil aviation

Many P-51s were sold as surplus after the war, often for as little as $1,500. Some were sold to former wartime fliers or other aficionados for personal use, while others were modified for air racing.

Charles Blair's *Excalibur III* at the Steven F. Udvar-Hazy Center (NASM)

One of the most significant Mustangs involved in air racing was a surplus P-51C-10-NT (*44-10947*) purchased by Paul Mantz, a film stunt pilot. The aircraft was modified by creating a "wet wing", sealing the wing to create a giant fuel tank in each wing, which eliminated the need for fuel stops or drag-inducing drop tanks. This Mustang, called *Blaze of Noon*, came in first in the 1946 and 1947 Bendix Air Races, second in the 1948 Bendix, and third in the 1949 Bendix. He also set a U.S. coast-to-coast record in 1947. The Mantz Mustang was sold to Charles F. Blair Jr (future husband of Maureen O'Hara) and re-named *Excaliber III*. Blair used it to set a New York-to-London (c. 3,460 mi/5,568 km) record in 1951: 7 hr 48 min from takeoff at Idlewild to overhead London Airport. Later that same year, he flew from Norway to Fairbanks, Alaska, via the North Pole (c. 3,130 mi/5,037 km), proving that navigation via sun sights was possible over the magnetic north pole region. For this feat, he was awarded the Harmon Trophy, and the Air Force was forced to change its thoughts on a possible Soviet air strike from the north. This Mustang now resides in the National Air and Space Museum at Steven F. Udvar-Hazy Center.

Miss Helen, a P-51D in its wartime markings as flown by Capt. Raymond H. Littge of the 487 FS, 352 FG, on aerial display in 2007. It is the last original 352 FG P-51 known to exist

The most prominent firm to convert Mustangs to civilian use was Trans-Florida Aviation, later renamed Cavalier Aircraft Corporation, which produced the Cavalier Mustang. Modifications included a taller tailfin and wingtip tanks. A number of conversions included a Cavalier Mustang specialty: a "tight" second seat added in the space formerly occupied by the military radio and fuselage fuel tank.

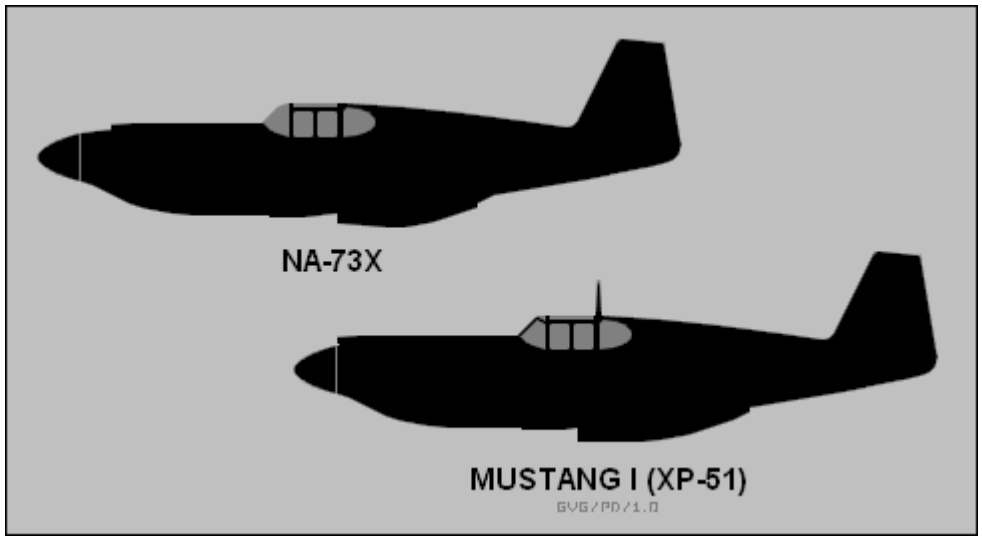
In 1958, 78 surviving RCAF Mustangs were retired from service's inventory and were ferried from their varied storage locations to Canastota, New York where the American buyers had been located. These aircraft make up a large percentage of the aircraft presently flying worldwide.

In the late 1960s and early 1970s, when the United States Department of Defense wished to supply aircraft to South American countries and later Indonesia for close air support and counter insurgency, it turned to Cavalier to return some of their civilian conversions back to updated military specifications.

In the 21st century a P-51 can command a price of more than $1 million, even for only partially restored aircraft. Some privately owned P-51s are still flying, often associated

with organizations such as the Commemorative Air Force (formerly the Confederate Air Force).

Variants



NA-73X

The initial prototype was designated the NA-73X by the manufacturer, North American Aviation.

- Mustang Mk I

  The first production contract was awarded by the British for 320 NA-73 fighters. A second British contract for 300 more Mustang Mk Is was assigned a model number of NA-83 by North American.

  XP-51

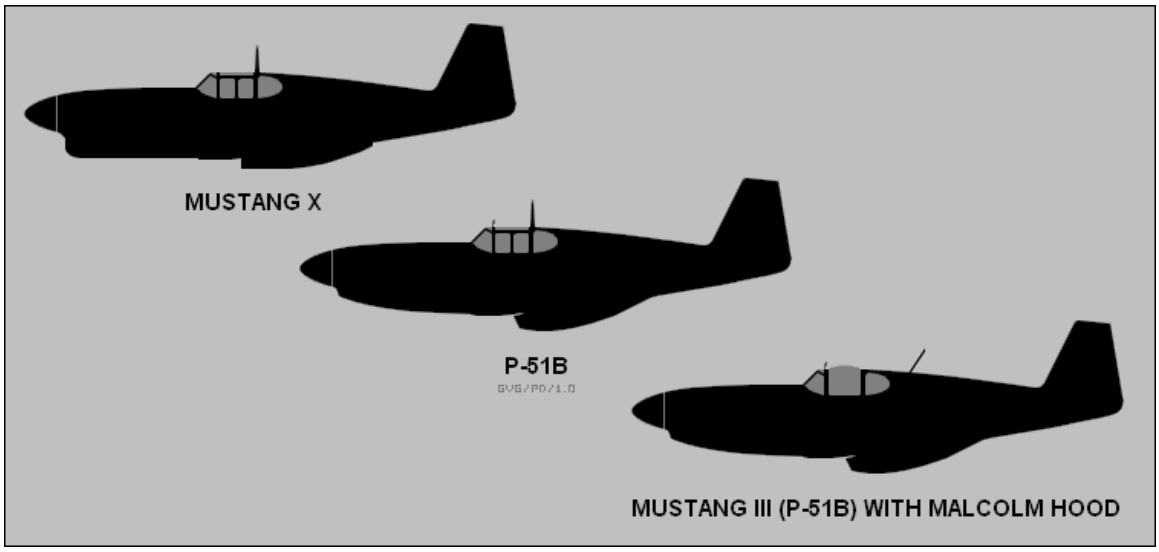
  Two aircraft of this lot delivered to the USAAF were designated XP-51.

P-51

In September 1940, 150 aircraft designated NA-91 by North American were ordered under the Lend/Lease program. These were designated by the USAAF as P-51 and initially named the Apache, although this name was dropped early-on for Mustang. The British designated this model as Mustang Mk IA. They were equipped with four long-barrelled 20 mm (.79 in) Hispano Mk II cannon instead of machine guns. A number of aircraft from this lot were fitted out by the USAAF as photo reconnaissance aircraft and designated F-6A. The British would fit a number of Mustang Mk I fighters with photographic reconnaissance equipment as well. Also, two aircraft of this lot were fitted with the Packard-built Merlin engine and were designated by North American as model NA-101 and by the USAAF initially as the XP-78, but quickly re-designated to XP-51B.

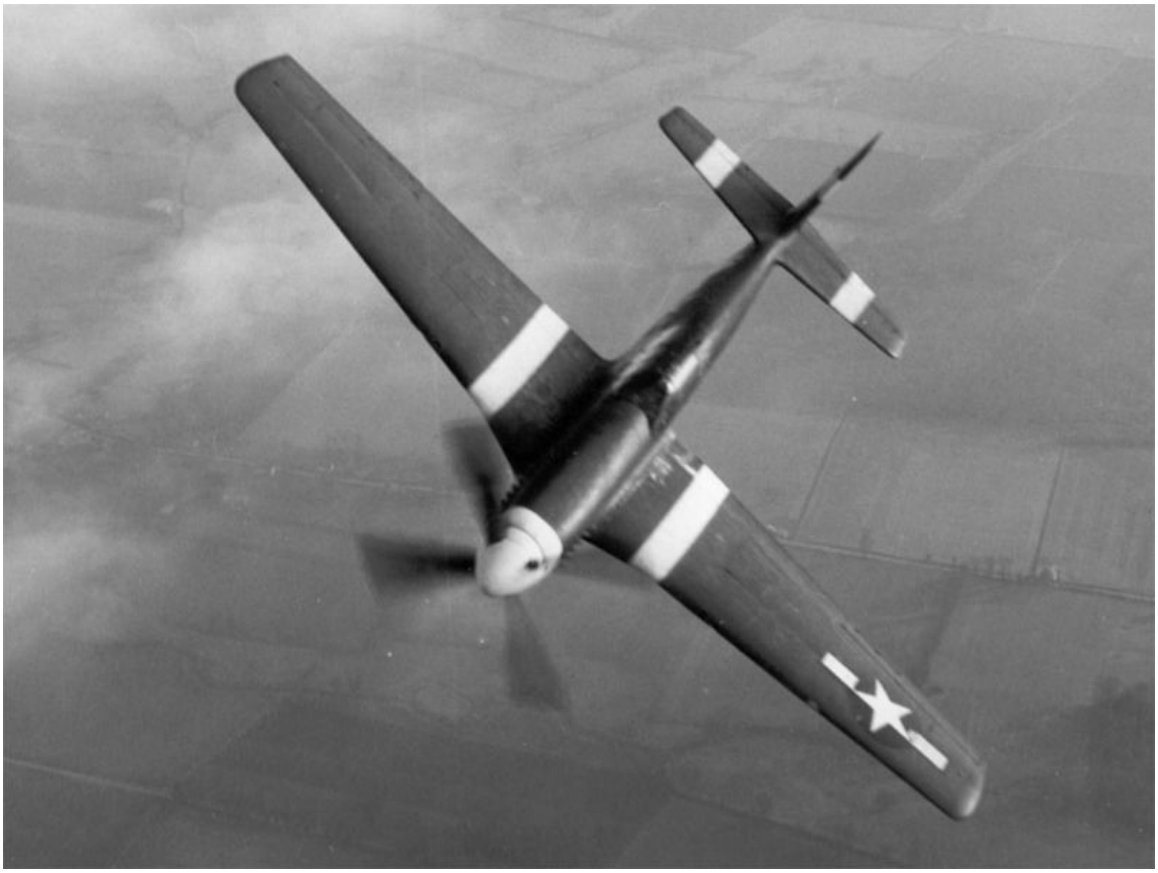
In early 1942, the USAAF ordered a lot of 500 aircraft modified as dive bombers that were designated A-36A. North American assigned the aircraft the model number NA-97. This model became the first USAAF Mustang to see combat. One aircraft was passed to the British, who gave it the name Mustang Mk I (Dive Bomber).

Following the A-36A order, the USAAF ordered 310 model NA-99 fighters that were designated P-51A by the USAAF and Mustang Mk II by the RAF. A number of this lot of aircraft were equipped with K-24 cameras and designated F-6B. All these models of the Mustang were equipped with Allison V-1710 engines except the prototype XP-51B.



Beginning with the model NA-102 Mustang, the Packard V-1650 replaced the Allison. In the summer of 1943, Mustang production was begun at a new plant in Dallas, Texas, as well as at the existing facility in Inglewood, California. The model NA-102 was produced as the P-51B in Inglewood, while the NA-103 as the P-51C was produced at Dallas. The RAF named these models Mustang Mk III. Again, a number of the P-51B and P-51C aircraft were fitted for photo Reconnaissance and designated F-6C.

The prototypes of the bubble canopy change were designated model NA-106 by North American and P-51D by the USAAF. The production version, while retaining the P-51D designation, was assigned model number NA-109 by North American. The P-51D became the most widely produced variant of the Mustang. A variation of the P-51D equipped with an Aeroproducts propeller in place of the Hamilton Standard propeller was designated the P-51K. The photo versions of the P-51D and P-51K were designated F-6D and F-6K respectively. The RAF assigned the name Mustang Mk IV to the P-51D model and Mustang Mk IVA to P-51K models.



P-51B in flight showing wing planform

As the USAAF specifications required airframe design to a higher load factor than that used by the British for their fighters, consideration was given to re-designing the Mustang to the lower British requirements in order to reduce the weight of the aircraft and thus improve performance. In 1943, North American submitted a proposal to do the re-design as model NA-105, which was accepted by the USAAF. The designation XP-51F was assigned for prototypes powered with V-1650 engines and XP-51G to those with reverse lend/lease Merlin 145M engines. Modifications included changes to the cowling, a simplified undercarriage with smaller wheels and disk brakes, and a larger canopy. A third prototype was added to the development that was powered by an Allison V-1710 engine. This aircraft was designated XP-51J. As the engine was insufficiently developed, the XP-51J was loaned to Allison for engine development. A small number of XP-51Fs were passed to the British as the Mustang Mk V.

The final production Mustang, the P-51H, embodied the experience gained in the development of the lightweight XP-51F and XP-51G aircraft. This aircraft, model NA-126, and, with minor differences, NA-129, came too late to participate in World War II, but it brought the development of the Mustang to a peak and was one of the fastest production piston-engine fighters to see service. The P-51H used the Merlin V-1659-9 engine, equipped with Simmons automatic boost control and water injection, allowing War Emergency Power as high as 2,218 hp (1,654 kW). Some of the weight savings

inherited from the XP-51F and XP-51G were invested in lengthening the fuselage and increasing the height of the tailfin, greatly reducing the tendency to yaw, and in restoring the fuselage fuel tank. The canopy was changed back to more nearly resemble the P-51D style, over a somewhat raised pilot's position. Service access to the guns and ammunition was improved. The P-51H was designed to complement the P-47N as the primary aircraft for the invasion of Japan, and 2,000 were ordered to be built at the Inglewood plant. With the solution to the problem of yaw control, the P-51H was now considered a suitable candidate for testing as an aircraft carrier-based fighter; but with the end of the war, the testing was cut short, and production was halted after 555 aircraft were built. Although some P-51Hs were issued to operational units, none saw combat. One aircraft was given to the RAF for testing and evaluation. Serial number 44-64192 was re-serialed as BuNo 09064 and used by the U.S. Navy to test transonic airfoil designs, then returned to the Air National Guard in 1952. The P-51H was not used for combat in the Korean War despite its improved handling characteristics, due to the lack of experience with durability of the lighter airframe under combat conditions as well as limited numbers in the USAF inventory.

With the cutback in production, the variants of the P-51H with different versions of the Merlin engine were produced in either limited numbers or terminated. These included the P-51L, similar to the P-51H but utilizing the 2,270 hp (1,690 kW) V-1650-11 engine, which was never built, and its Dallas-built version, the P-51M, or NA-124, which utilized the V-1650-9A engine lacking water injection and therefore rated for lower maximum power, of which one was built out of the original 1629 ordered, AAF Serial Number 45-11743.

- F-51
  Redesignation of all P-51s in 1947 in the U.S. Air Force, Air Force Reserve and Air National Guard following establishment of the U.S. Air Force as a separate service.
- TF-51D
  Twin seat/dual control version of the F-51 with four versus six guns.

Production

P-51D on runway

- NA.73X Prototype: One built
- P-51: 150 built
- P-51A: 310 built at Inglewood, California
- P-51B: 1,988 built at Inglewood
- P-51C: 1,750 built at Dallas, Texas
- P-51D: A total of 8,156 were built: 6,502 at Inglewood, 1,454 at Dallas and 200 by CAC at Fisherman's Bend, Australia
- XP-51F: Three built
- XP-51G: Two built
- P-51H: 555 built at Inglewood
- XP-51J: Two built

P-51D being assembled, Inglewood, California.

- P-51K: 1,500 built
- P-51L: None built - cancelled
- P-51M: One built at Dallas
- Mustang Mk I: 620 built
- Mustang Mk III: 852 built
- Mustang Mk IV: 281 built
- Mustang Mk IVA: 595 built

Total number built: 16,766 (most numerous American fighter aircraft)

Scale replicas

The P-51 has been the subject of numerous scale flying replicas; aside from ever-popular R/C-controlled aircraft, several kitplane manufacturers offer ½, ⅔, and ¾-scale replicas capable of comfortably seating one (or even two) and offering high performance combined with more forgiving flight characteristics. Such aircraft include the Titan T-51 Mustang, W.A.R. P-51 Mustang, Linn Mini Mustang, Jurca Mustang, Thunder Mustang, and Loehle 5151 Mustang.

Survivors

Among the 287 current airframes and the 154 "flying" Mustangs are the following:

- XP-51 *41-038* Original prototype on display, Oshkosh

- P-51A-1NA Mustang in storage for restoration, Kermit Weeks, Fantasy of Flight, Polk City, Florida
- P-51A-10-NA Mustang now flying and marked as *Miss Virginia*, Planes of Fame, Chino, California
- A-36 Mustang, Planes of Fame, Chino, California
- P-51C-10-NT Mustang flying as *Ina the Macon Belle* of Lt. Lee Archer, the only five-victory ace of the Tuskegee Airmen 332nd FG, 302nd FS. Kermit Weeks, Tamiami, Florida

Ina The Macon Belle taxiing at Fantasy of Flight in Polk City Florida.

- P-51D (s/n *44-74936*) is on display at the National Museum of the United States Air Force at Wright-Patterson AFB in Dayton, Ohio. It was the last P-51 in USAF service as well as the last USAF propeller-driven fighter in operation. It was obtained from the West Virginia Air National Guard in January 1957. It is painted as the P-51D flown by Col C.L. Sluder, commander of the 325th Fighter Group in Italy in 1944. The name of this aircraft, *Shimmy IV*, comes from the names of his daughter, Sharon, and his wife, Zimmy.
- P-51D Mustang, Olympic Flight Museum, Olympia, Washington. In flying condition.
- P-51D Mustang, Indiana Aviation Museum, Valparaiso, Indiana. In flying condition, served with the North Dakota, Alabama, and Kentucky Air National Guards.
- P-51 Mustang (Mk IV), Vintage Wings of Canada, Gatineau, Quebec.

- P-51D Mustang, N167F, Scandinavia Historic Flight, painted as *Old Crow*, the aircraft of one of the 8th AF aces, Col. Clarence E. "Bud" Anderson of the 357th Fighter Group, 363rd Fighter Squadron.
- P-51D Mustang, SE-BIL, *It's About Time*, based in Sweden.
- P-51D Mustang (P-51D-20-NA), Cavanaugh Flight Museum, Addison, Texas. The aircraft is in flying condition.
- P-51D Mustang, *Spam Can*, Planes of Fame, Chino, California
- P-51D Mustang, *Wee Willy II*, Planes of Fame, Chino, California

Ole Yeller, flown by John Bagley at an airshow in Rexburg, Idaho

- P-51D Mustang marked as under restoration, Planes of Fame, Chino, California
- P-51H Mustang *44-64415* Flying, Whittington Bros, Fort Lauderdale, Florida
- P-51D *Old Yeller*, formerly owned by Bob Hoover. In flying condition. Currently owned by John Bagley of Rexburg, Idaho, and displayed at the Legacy Flight Museum.
- CA-17 Mk 20 *A68-1*, N51WB, *44-74960*/*A68-1001 Jeannie Too*, flying, Wiley Sanders, Troy, Alabama.
- CA-18 Mk 21 *A68-104*, VH-BOB, suffered wheels-up landing April 2008, under repair as of November 2009, Bob Eastgate, Australia.
- CA-18 Mk 22 *A68-192*, G-HAEC, 44-72218 *Big Beautiful Doll*, flying, Robert W Davies, Duxford UK.

- P-51D Mustang, G-BTCD Ser. No. *44-73419*, painted to resemble *44-13704*, *Ferocious Frankie*, operated by the Old Flying Machine Company, Imperial War Museum Duxford, Cambridgeshire, UK.
- P-51D Mustang, G-SIJJ, *44-72035* - painted to resemble *44-64076 Jumpin Jacques*, operated by the Hangar 11 Collection, North Weald, UK.
- P-51 Mustang of the Philippine Air Force, painted in original markings with "shark mouth", on display at the Air Force Museum, Villamor Air Base, Pasay City, Philippines
- P-51D Mustang *Never Miss* at the Salem Airport in Salem, Oregon. Flying condition.
- P-51D Mustang *Big Beautiful Doll* tail number *472218*, indoor suspended display at Imperial War Museum, London, UK.

Betty Jane sits on the apron at Page Field

- P-51D Mustang N51DH at Evergreen Aviation & Space Museum, McMinnville, Oregon. Flying condition.
- P-51D Mustang *Old Crow* N451MG at Columbus, Ohio. Formerly owned by Jack Roush. Flying condition.
- P-51D Mustang *Crusader* N51JT at Centennial Airport in Centennial, Colorado. Joe Thibodeau owner and pilot. Flying condition.

- P-51C Mustang *Betty Jane* NL25IMX involved in the Colling Foundation's Wings of Freedom tour. Flying condition.

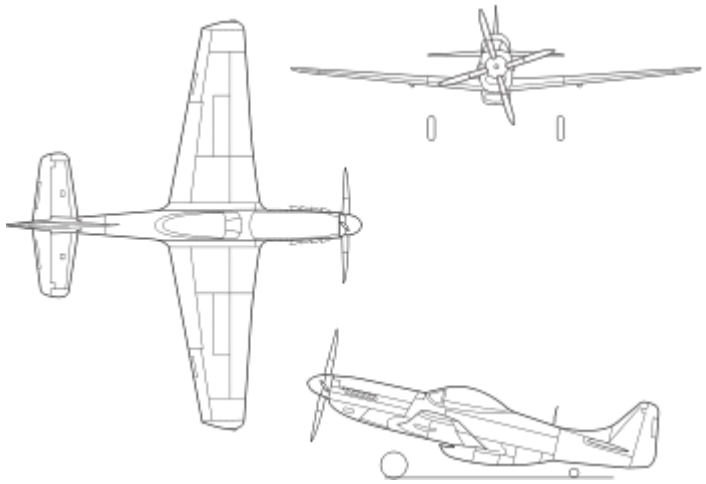
- P-51D-30NA Mustang "***Miss America***" (USAAF 44-74536) Flying condition based in Oklahoma City, Oklahoma, flown each year in the Reno Air Races by Dr. Brent Hisey. The extensive race modifications include: 32 feet (clipped) wingspan, empty weight of 7.000 lbs and a max take off weight of 9,600 lbs. Engine is a highly modified Packard Merlin V-1650. Performance include 50 gph in normal cruise and 150 gph during takeoff, cruise Speed: 245 knots, racing speed: 436+ mph and range: 750 nautical miles.
- P-51D Mustang *Mustang Sally*, N72FT, *44-74494*, tail number 411661 - Private ownership in South Africa. Flying condition.

South Korea

- F-51D Mustang on display at the War Memorial of Korea, Seoul.

Specifications

P-51D Mustang



General characteristics

- **Crew:** 1
- **Length:** 32 ft 3 in (9.83 m)
- **Wingspan:** 37 ft 0 in (11.28 m)
- **Height:** 13 ft 4½ in (4.08 m:tail wheel on ground, vertical propeller blade.)
- **Wing area:** 235 ft² (21.83 m²)
- **Empty weight:** 7,635 lb (3,465 kg)
- **Loaded weight:** 9,200 lb (4,175 kg)
- **Max takeoff weight:** 12,100 lb (5,490 kg)
- **Powerplant:** 1× Packard V-1650-7 liquid-cooled supercharged V-12, 1,490 hp (1,111 kW) at 3,000 rpm; 1,720 hp (1,282 kW) at WEP

- **Zero-lift drag coefficient:** 0.0163
- **Drag area:** 3.80 ft² (0.35 m²)
- **Aspect ratio:** 5.83

Performance

- **Maximum speed:** 437 mph (703 km/h) at 25,000 ft (7,600 m)
- **Cruise speed:** 362 mph (580 km/h)
- **Stall speed:** 100 mph (160 km/h)
- **Range:** 1,650 mi (2,755 km) with external tanks
- **Service ceiling:** 41,900 ft (12,800 m)
- **Rate of climb:** 3,200 ft/min (16.3 m/s)
- **Wing loading:** 39 lb/ft² (192 kg/m²)
- **Power/mass:** 0.18 hp/lb (300 W/kg)
- **Lift-to-drag ratio:** 14.6
- **Recommended Mach limit** 0.8

Armament

- 6× 0.50 caliber (12.7mm) M2 Browning machine guns with 1,880 total rounds (400 rounds for each on the inner pair, and 270 rounds for each of the outer two pair)
- 2× hardpoints for up to 2,000 lb (907 kg) of bombs
- 6 or 10× T64 5.0 in (127 mm) H.V.A.R rockets (P-51D-25, P-51K-10 on)

P-51H Mustang

General characteristics

- **Crew:** 1
- **Length:** 33 ft 4 in (10.16 m)
- **Wingspan:** 37 ft 0 in (11.28 m)
- **Height:** 11 ft 1 in (3.38 m)
- **Wing area:** 235 ft² (21.83 m²)
- **Empty weight:** 7,040 lb (3,195 kg)
- **Loaded weight:** 9,500 lb (4,310 kg)
- **Max takeoff weight:** 11,500 lb (5,215 kg)
- **Powerplant:** 1× Packard V-1650-9 liquid-cooled supercharged V-12, 1,490 hp (1,111 kW) at 3,000 rpm, 2,220 hp (1,655 kW) at WEP

Performance

- **Maximum speed:** 487 mph (784 km/h) at 25,000 ft (7,600 m)
- **Range:** 1,160 mi (1,865 km) with external tanks
- **Service ceiling:** 41,600 ft (12,700 m)
- **Rate of climb:** 3,300 ft/min (16.8 m/s)

- **Wing loading:** 40.4 lb/ft² (197.4 kg/m²)
- **Power/mass:** 0.23 hp/lb (385 W/kg)

Armament

- 6× 0.50 inch (12.7mm) M2 Browning machine guns with 1,880 total rounds (400 rounds for each on the inner pair, and 270 rounds for each of the outer two pair), or 4 of the same guns with 1,600 total rounds (400 rpg)

Chapter- 8

Vought F4U Corsair

F4U Corsair

An F4U-5NL, previously of the Honduran Air Force, at the Geneseo Airshow, with air intercept radar pod on right wing

Role	Carrier-capable fighter aircraft
National origin	United States
Manufacturer	Chance Vought
First flight	29 May 1940
Introduction	28 December 1942
Primary users	United States Navy United States Marine Corps Royal Navy Royal New Zealand Air Force
Produced	1940-1952
Number built	12,571
Developed into	F2G "Super" Corsair

The **Chance Vought F4U Corsair** was a carrier-capable fighter aircraft that saw service primarily in World War II and the Korean War. Demand for the aircraft soon overwhelmed Vought's manufacturing capability, resulting in production by Goodyear and Brewster: Goodyear-built Corsairs were designated **FG** and Brewster-built aircraft **F3A**. From the first prototype delivery to the U.S. Navy in 1940, to final delivery in 1953 to the French, 12,571 F4U Corsairs were manufactured by Vought, in 16 separate models, in the longest production run of any piston-engined fighter in U.S. history (1942–1953).

The Corsair served in with the U.S. Navy, U.S. Marines, Fleet Air Arm and the Royal New Zealand Air Force, as well as the French Navy *Aeronavale* and other, smaller, air forces until the 1960s. . It quickly became the most capable carrier-based fighter-bomber of World War II. Some Japanese pilots regarded it as the most formidable American fighter of World War II, and the U.S. Navy counted an 11:1 kill ratio with the F4U Corsair.

Development

In February 1938, the U.S. Navy Bureau of Aeronautics published two requests for proposal for twin-engined and single-engined fighters. For the single-engined fighter the Navy requested the maximum obtainable speed, and a stalling speed not higher than 70 miles per hour (110 km/h). A range of 1,000 miles (1,600 km) was specified. The fighter had to carry four guns, or three with increased ammunition. Provision had to be made for anti-aircraft bombs to be carried in the wing. These small bombs would, according to thinking in the 1930s, be dropped on enemy aircraft formations.

The XF4U-1 prototype in 1940/41, showing its more forward cockpit location

In June 1938, the U.S. Navy signed a contract for a prototype, the XF4U-1, BuNo 1443. The Corsair was designed by Rex Beisel and the Vought design team. After mock-up inspection in February 1939, construction of the XF4U-1 powered by an XR-2800-4 prototype of the Pratt & Whitney Double Wasp twin-row. 18-cylinder radial engine, rated at 1,805 hp (1,346 kW) went ahead quickly. When the prototype was built it had the biggest and most powerful engine, largest propeller and probably the largest wing on any fighter in history. The first flight of the XF4U-1 was made on 29 May 1940, with Lyman A. Bullard, Jr. at the controls. The maiden flight proceeded normally until a hurried landing was made when the elevator trim tabs failed because of flutter.

On 1 October, the XF4U-1 became the first single-engine U.S. fighter to fly faster than 400 mph (640 km/h) by setting an average ground speed of 405 miles per hour (652 km/h) during a flight from Stratford to Hartford. The XF4U-1 also had an excellent rate of climb but testing revealed that some requirements would have to be rewritten. In full-power dive tests, speeds of up to 550 miles per hour (890 km/h) were achieved but not without damage to the control surfaces and access panels and in one case, an engine failure. The spin recovery standards also had to be relaxed as recovery from the required two-turn spin proved impossible without resorting to an anti-spin chute. The problems clearly meant delays in getting the type into production.

Reports coming back from the war in Europe indicated that an armament of two .30 in (7.62 mm) (mounted in engine cowling) and two .50 in (12.7 mm) machine guns (one in each outer wing panel) was insufficient, so when the U.S. Navy asked for production proposals in November 1940, heavier armament was specified. The Navy entered into a letter of intent on 3 March 1941, received Vought's production proposal on 2 April and awarded Vought a contract for 584 F4U-1 fighters on 30 June of the same year. It was a remarkable achievement for Vought; compared to land-based counterparts, carrier aircraft are "overbuilt" and heavier, to withstand the extreme stress of deck landings.

Design

2,000 hp (1,500 kW) Pratt & Whitney R-2800-8 in a Goodyear FG-1 Corsair

The F4U incorporated the largest engine available at the time: the 2,000 hp (1,500 kW) 18-cylinder Pratt & Whitney R-2800 Double Wasp radial. To extract as much power as possible, a relatively large Hamilton Standard Hydromatic three-blade propeller of 13 feet 4 inches (4.06 m) was used. To accommodate a folding wing, the designers considered retracting the main landing gear rearward, but for the chord of wing that was chosen, it was difficult to make the landing gear struts long enough to provide sufficient clearance for the large propeller. Their solution was an inverted gull wing, which considerably shortened the required length of the main gear legs. The anhedral of the wing's center-section also permitted the wing and fuselage to meet at the optimum angle for minimizing drag, without using wing root fairings. Offsetting these benefits, the bent wing was heavier and more difficult to construct.

The Corsair's aerodynamics were an advance over those of contemporary naval fighters. The F4U was the first U.S. Navy aircraft to feature landing gear that retracted into a fully enclosed wheel well. In a similar manner to that of the Curtiss P-40 the landing gear oleo struts rotated through 90° during retraction, with the wheel atop the lower end of the strut; a pair of rectangular doors completely enclosed the wheel wells, leaving a completely streamlined wing. This swiveling, aft-retracting landing gear design was common to the Curtiss P-40 (and its predecessor, the Curtiss P-36), as well as the F4U Corsair and its erstwhile Pacific War rival, the Grumman F6F Hellcat. The oil coolers were mounted in the center-section of the wings, alongside of the supercharger air

intakes, and used openings in the leading edges of the wings, rather than protruding scoops. The large fuselage panels were made of aluminum and were attached to the frames with the newly-developed technique of spot welding, thus mostly eliminating the use of rivets. While employing this new technology, the Corsair was also the last American-produced fighter aircraft to feature fabric as the skinning for the top and bottom of each outer wing, aft of the main spar and armament bays, and for the ailerons, elevators and rudder. In addition, the elevators were constructed from plywood. Even with its streamlining and high speed abilities, with full flap deployment of 60°, the Corsair could fly slowly enough for carrier landings.

In part because of its advances in technology and a top speed greater than existing Navy aircraft, numerous technical problems had to be solved before the Corsair would enter service. Carrier suitability was a major development issue, prompting changes to the main landing gear, tail wheel and tailhook. Early F4U-1s had difficulty recovering from developed spins, since the inverted gull wing's shape interfered with elevator authority. It also found that the Corsair's starboard wing could stall and drop rapidly and without warning during slow carrier landings. In addition, if the throttle were suddenly advanced (for example, during an aborted landing) the port wing could stall and drop so quickly that the fighter could flip over with the rapid increase in power. These potentially lethal characteristics were later solved through the addition of a small, 6 in (150 mm)-long stall strip to the leading edge of the outer starboard wing, just inboard of the gun ports. This allowed the starboard wing to stall at the same time as the port.

An early F4U-1 showing the "birdcage" canopy with rearwards production cockpit location. Compare with the XF4U-1.

Other problems were encountered during early carrier trials. The combination of an aft cockpit and the Corsair's long nose made landings hazardous for newly-trained pilots. During landing approaches it was found that oil from the hydraulic cowl flaps could spatter onto the windscreen, badly reducing visibility, and the undercarriage oleo struts had bad rebound characteristics on landing, allowing the aircraft to bounce out of control down the carrier deck. The first problem was solved by locking the top cowl flap down permanently, then replacing it with a fixed panel. The undercarriage bounce took more time to solve but eventually a "bleed valve" incorporated in the legs allowed the hydraulic pressure to be released gradually as the aircraft landed. The Corsair was not considered fit for carrier use until the wing stall problems and the deck bounce could be solved. In the event, because the more docile, and simpler to build F6F Hellcat had begun entering service, Corsair deployment aboard U.S. carriers was to be delayed until late 1944.

Production F4U-1s featured several major modifications compared with the XF4U-1. A change of armament to six wing mounted .50 in (12.7 mm) M2 Browning machine guns (three in each outer wing panel) and their ammunition (400 rpg for the inner pair, 375 rpg

for the outer) meant that the location of the wing fuel tanks had to be changed. In order to keep the fuel tank close to the center of gravity, the only available position was in the forward fuselage, ahead of the cockpit. Accordingly a 237 gal (897 l) self-sealing fuel tank replaced the fuselage mounted armament, the cockpit had to be moved back by 32 in (810 mm) and the fuselage lengthened. In addition, 150 lb of armor plate was installed, along with an 1.5 in (38 mm) bullet-proof windscreen which was set internally, behind the curved Plexiglas windscreen. The canopy could be jettisoned in an emergency and curved transparent panels, providing the pilot with a limited rear view over his shoulders, were inset into the fuselage, behind the pilot's headrest. A rectangular Plexiglas panel was inset into the lower center-section to allow the pilot to see directly beneath the aircraft and assist with deck landings. The engine used was the more powerful R-2800-8 (B series) Double Wasp which produced 2,000 hp (1,491 kW). On the wings the flaps were changed to a NACA slotted type and the ailerons were increased in span to increase the roll rate, with a consequent reduction in flap span. IFF transponder equipment was fitted in the rear fuselage. All in all these changes increased the Corsair's weight by several hundred pounds.

Operational history

United States Navy and Marine Corps

The performance of the Corsair was impressive. The F4U-1 was considerably faster than the F6F Hellcat and only 13 mph (21 km/h) slower than the P-47 Thunderbolt, both of the two other fighters also being powered by the R-2800. But while the P-47 achieved its highest speed at 30,020 feet (9,150 m) with the help of an intercooled turbosupercharger, the F4U-1 reached its maximum speed at 19,900 ft (6,100 m), and used a mechanically supercharged engine.

Carrier qualification trials on the escort carrier USS *Sangamon*, on 25 September 1942, caused the U.S. Navy to release the type to the United States Marine Corps. Early Navy pilots spoke disparagingly of the F4U as the "hog", "hosenose" or "bent wing widow-maker". After all, the U.S. Navy still had the Grumman F6F Hellcat, which did not have the performance of the F4U but was a far better deck landing aircraft. The Marines needed a better fighter than the F4F Wildcat. For them it was not as important that the F4U could be recovered aboard a carrier, as they usually flew from land bases. Growing pains aside, Marine Corps squadrons readily took to the radical new fighter.

Early F4U-1s of VF-17

Despite the decision to issue the F4U to Marine Corps units, two Navy units, VF-12 (October 1942) and later VF-17 (April 1943) were equipped with the F4U. By April 1943, VF-12 had successfully completed deck landing qualification. However, VF-12 soon abandoned its aircraft to the Marines. VF-17 kept its Corsairs, but was removed from its carrier, USS *Bunker Hill*, due to perceived difficulties in supplying parts at sea. In November 1943, while operating as a shore-based unit in the Solomon Islands, VF-17 reinstalled the tail hooks so its F4Us could land and refuel while providing top cover over the task force participating in the carrier raid on Rabaul. The squadron's pilots landed, refueled, and took off from their former home, *Bunker Hill* and the USS *Essex* on 11 November 1943.

The U.S. Navy did not get into combat with the type until September 1943 and the Royal Navy's FAA would qualify the type for carrier operations first. The U.S. Navy finally accepted the F4U for shipboard operations in April 1944, after the longer oleo strut was fitted, which finally eliminated the tendency to bounce. The first Corsair unit to be based effectively on a carrier was the pioneer USMC squadron, VMF-124, which joined *Essex*. They were accompanied by VMF-213. The increasing need for fighters as a protection against *kamikaze* attacks resulted in more Corsair units being moved to carriers.

From February 1943 onward, the F4U operated from Guadalcanal and ultimately other bases in the Solomon Islands. A dozen USMC F4U-1s of VMF-124, commanded by Major William E. Gise, arrived at Henderson Field (code name "Cactus") on 12 February. The first recorded combat engagement was on 14 February 1943, when Corsairs of VMF-124 under Major Gise assisted P-40s and P-38s in escorting a formation of B-24 Liberators on a raid against a Japanese aerodrome at Kahili. Japanese fighters contested the raid and the Americans got the worst of it, with four P-38s, two P-40s, two Corsairs and two Liberators lost. No more than four Japanese Zeros were destroyed. A Corsair was responsible for one of the kills, although this was due to a midair collision. The fiasco was referred to as the "Saint Valentine's Day Massacre". Although the Corsair's combat debut was not impressive, the Marines quickly learned how to make better use of the aircraft and started demonstrating its superiority over Japanese fighters. By May the Corsair units were getting the upper hand, and VMF-124 had produced the first Corsair ace, Second Lieutenant Kenneth A. Walsh, who would rack up a total of 21 kills during the war.

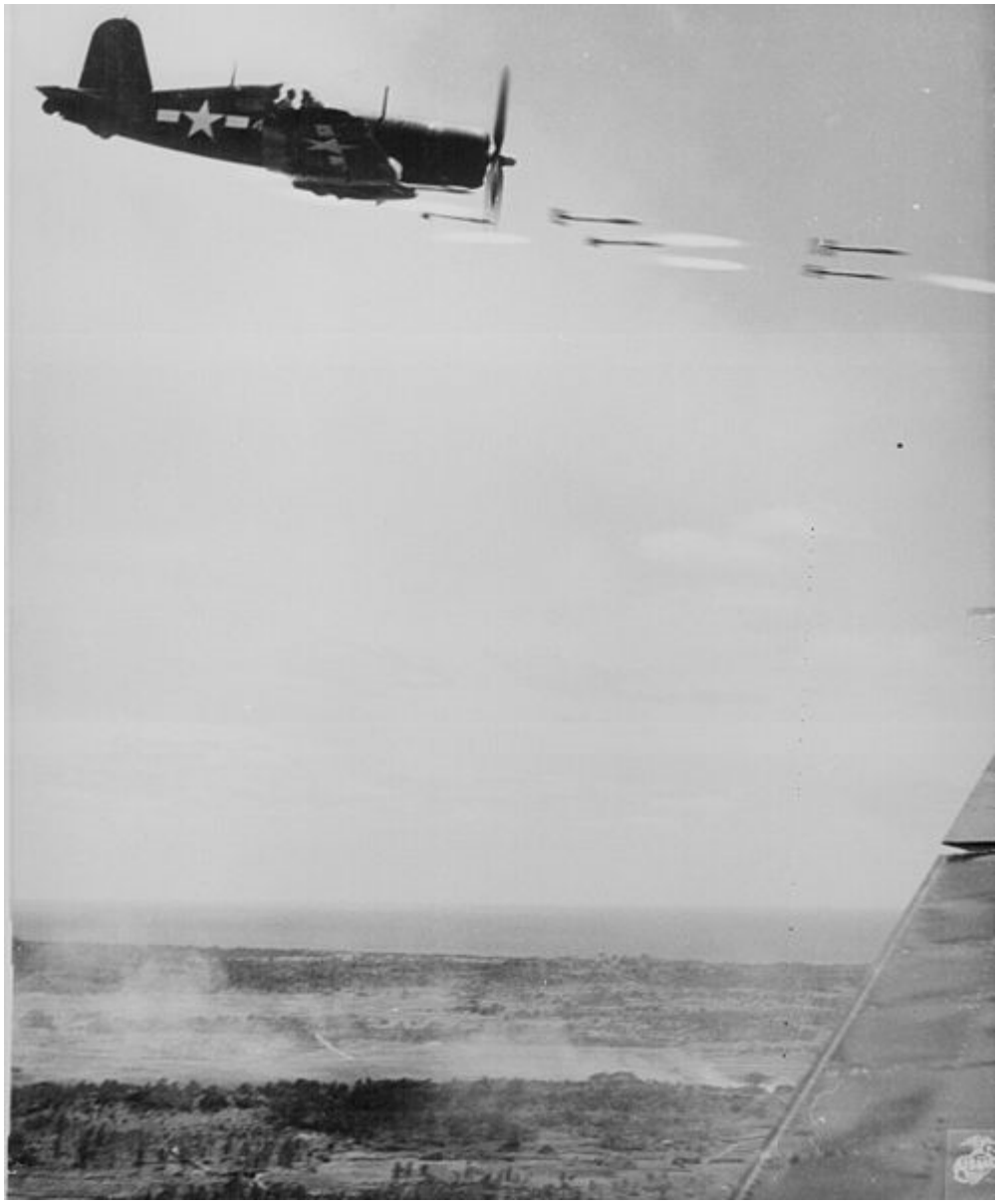
I learned quickly that altitude was paramount. Whoever had altitude dictated the terms of the battle, and there was nothing a Zero pilot could do to change that — we had him. The F4U could out-perform a Zero in every aspect except slow speed manoeuvrability and slow speed rate of climb. Therefore you avoided getting slow when combating a Zero. It took time but eventually we developed tactics and deployed them very effectively... There were times, however, that I tangled with a Zero at slow speed, one on one. In these instances I considered myself fortunate to survive a battle. Of my 21 victories, 17 were against Zeros, and I lost five aircraft in combat. I was shot down three times and I crashed one that ploughed into the line back at base and wiped out another F4U.

VMF-113 was activated on 1 January 1943 at Marine Corps Air Station El Toro as part of Marine Base Defense Air Group 41. They were shortly given their full complement of 24 F4U Corsairs. On 26 March 1944, while escorting 4 B-25 bombers on a raid over Ponape, they recorded their first enemy kills when they downed eight Japanese aircraft. In April of that year, VMF-113 was tasked with providing air support for the landings at Ujelang. Since the assault was unopposed the squadron quickly returned to striking Japanese targets in the Marshall Islands for the remainder of 1944.

Corsairs were flown by the famous "Black Sheep" Squadron (VMF-214, led by Marine Major Gregory "Pappy" Boyington) in an area of the Solomon Islands called "The Slot". Boyington was credited with 22 kills in F4Us (of 28 total, including six in an AVG P-40). Other noted Corsair pilots of the period included VMF-124's Kenneth Walsh, James E.

Swett, and Archie Donohue, VMF-215's Robert M. Hanson and Don Aldrich, and VF-17's Tommy Blackburn, Roger Hedrick, and Ira Kepford. Nightfighter versions equipped Navy and Marine units afloat and ashore.

At war's end, Corsairs were ashore on Okinawa, combating the *kamikaze*, and also were flying from fleet and escort carriers. VMF-312, VMF-323, VMF-224, and a handful of others met with success in the Battle of Okinawa.



A Corsair fires its rockets at a Japanese stronghold on Okinawa

Corsairs also served well as fighter bombers in the Central Pacific and the Philippines. By spring 1944, Marine pilots were beginning to exploit the type's considerable capabilities in the close-support role during amphibious landings. Charles Lindbergh flew

Corsairs with the Marines as a civilian technical advisor for United Aircraft Corporation in order to determine how best to increase the Corsair's payload and range in the attack role and to help evaluate future viability of single- versus twin-engine fighter design for Vought. Lindbergh managed to get the F4U into the air with 4,000 pounds (1,800 kg) of bombs, with a 2,000 pounds (910 kg) bomb on the centerline and a 1,000 pounds (450 kg) bomb under each wing. In the course of such experiments, he performed strikes on Japanese positions during the battle for the Marshall Islands.

By the beginning of 1945, the Corsair was a full-blown "mudfighter", performing strikes with high-explosive bombs, napalm tanks, and HVARs. She proved surprisingly versatile, able to operate everything from Bat glide bombs (without sacrificing a load of 2.75 in/70 mm rockets) to 11.75 in (300 mm) Tiny Tim rockets. The aircraft was a prominent participant in the fighting for the Palaus, Iwo Jima and Okinawa.

Statistics compiled at the end of the war indicate that the F4U and FG flew 64,051 operational sorties for the U.S. Marines and U.S. Navy through the conflict (44% of total fighter sorties), with only 9,581 sorties (15%) flown from carrier decks. F4U and FG pilots claimed 2,140 air combat victories against 189 losses to enemy aircraft, for an overall kill ratio of over 11:1. The aircraft performed well against the best Japanese opponents with a 12:1 kill ratio against Mitsubishi A6M and 6:1 against the Nakajima Ki-84, Kawanishi N1K-J and Mitsubishi J2M combined during the last year of the war. The Corsair bore the brunt of fighter-bomber missions, delivering 15,621 tons (14,171 tonnes) of bombs during the war (70% of total bombs dropped by fighters during the war).

Corsair losses in World War II were as follows:

- By combat: 189
- By enemy anti-aircraft artillery: 349
- Accidents during combat missions: 230
- Accidents during non-combat flights: 692
- Destroyed aboard ships or on the ground: 164

One particularly interesting kill was scored by a Marine Lieutenant R. R. Klingman of VMF-312 Checkerboards, over Okinawa. Klingman was in pursuit of a Kawasaki Ki-45 *Toryu* ("Nick") twin engine fighter at extremely high altitude when his guns jammed due to the gun lubrication thickening from the extreme cold. He simply flew up and chopped off the Ki-45's tail with the big propeller of the Corsair. Despite missing five inches (127 mm) off the end of his propeller blades, he managed to land safely after this ramming attack. He was awarded the Navy Cross.

The Japanese Navy captured two Corsairs from an unknown Allied unit for evaluations fairly late in the war; one of examples originally marked YoD-150 was remarked with Yokosuka Ku air testing signs ED-150, but they never flew them.

Korean War

During the Korean War, the Corsair was used mostly in the close-support role. The **AU-1** Corsair was a ground-attack version produced for the Korean War; its Pratt & Whitney R-2800 engine, while supercharged, was not as highly boosted as on the F4U. As the Corsair moved from its air superiority role in World War II into the close air support role in the Korean War, the gull wing proved to be a useful feature. A straight, low-wing design would have blocked most of the visibility from the cockpit toward the ground while in level flight, but a Corsair pilot could look through a "notch" and get a better ground reference without having to bank one way or the other to move the wing out of the way.

The AU-1, F4U-4B, -4C, -4P and -5N logged combat in Korea between 1950 and 1953. There were dogfights between F4Us and Soviet-built Yakovlev Yak-9 fighters early in the war, but when the enemy introduced the Mikoyan-Gurevich MiG-15, the Corsair was outmatched, though one Marine pilot did get lucky. On 10 September 1952, a MiG-15 made the mistake of getting into a turning contest with a Corsair piloted by Captain Jesse G. Folmar, with Folmar shooting the MiG down with his four 20 millimetre (0.79 in) cannons. The MiG's wingmen quickly had their revenge, shooting down Folmar, though he bailed out and was swiftly rescued with little injury.

Corsair night fighters were used to an extent. The enemy adopted the tactic of using low-and-slow Polikarpov Po-2 intruders to perform night harassment strikes on American forces, and jet-powered night fighters found catching these "Bedcheck Charlies" troublesome. U.S. Navy F4U-5Ns were posted to shore bases to hunt them down, with U.S. Navy Lieutenant Guy Pierre Bordelon, Jr. becoming the Navy's only ace in the war, as well as the only ace to not score any victories in a jet aircraft. "Lucky Pierre" was credited with five kills (two Yakovlev Yak-18 and three Po-2). Navy and Marine Corsairs were credited with a total of 12 enemy aircraft.

More generally, Corsairs performed attacks with cannons, napalm tanks, various iron bombs and unguided rockets. The old HVAR was a reliable standby; however sturdy Soviet-built armor proved resistant to the HVAR's punch. This led to a new 6.5 in (16.5 cm) shaped charge antitank warhead being developed. The result was called the "Anti-Tank Aircraft Rocket (ATAR)." Tiny Tim was also used in combat, with two under the belly. There is also a story of a Corsair pilot who used his arresting hook to snag enemy communications lines from telephone poles.

Lieutenant Thomas J. Hudner, Jr., flying with naval squadron VF-32 off the USS *Leyte*, was awarded the Medal of Honor for crash landing his Corsair in an attempt to rescue his squadron mate, Ensign Jesse L. Brown, whose aircraft had been forced down by antiaircraft fire near Changjin. Brown, who did not survive the incident, was the U.S. Navy's first African American naval aviator.

Royal Navy

FAA Corsair Is at NAS Quonset Point, 1943.

In the early days of the war, Royal Navy fighter requirements had been based on cumbersome two-seat designs, such as the Blackburn Skua (and its turreted derivative the Blackburn Roc) as well as the Fairey Fulmar, on the assumption they would only be fighting long range bombers or flying boats. The Royal Navy hurriedly adopted higher performance aircraft such as the Hawker Sea-Hurricane and the less robust Supermarine Seafire but neither of these aircraft had sufficient range to operate at a distance from a carrier task force. The Corsair was welcomed as a much more robust and versatile alternative.

In Royal Navy service, because of the limited hangar deck height in several classes of British carrier, many Corsairs had their outer wings "clipped" by 8 in (200 mm) to clear the deckhead. The change in span brought about the added benefit of improving the sink rate, reducing the F4U's propensity of "floating" in the final stages of landing. Despite the clipped wings and the shorter decks of British carriers, Royal Navy aviators found landing accidents less of a problem than they had been to U.S. Navy aviators due to the curved approach used. British units solved the landing visibility problem by approaching the carrier in a medium left-hand turn, which allowed the pilot to keep the carrier's deck in view over the dip in the port wing, allowing safe carrier operations, and would later be adopted by US Navy and Marines fliers themselves as well for carrier use of the Corsair.

The Royal Navy developed a number of modifications to the Corsair that made carrier landings more practical. Among these are the bulged Malcolm Hood, raising the pilot's seat 7 in (180 mm) and wiring shut the cowl flaps across the top of the engine compartment, diverting the oil and hydraulic fluid around the sides of the fuselage".

The Royal Navy received 95 **Corsair Mk I**s and 510 **Mk II**s, these being equivalent to the F4U-1 and -1A. Brewster-built aircraft were known as **Mk III**s (equivalent to F3A-1D), and Goodyear-built aircraft were known as **Mk IV**s (equivalent to FG-1D). The Mk IIs and Mk IVs were the only versions to be used in combat. The Royal Navy cleared the F4U for carrier operations well before the U.S. Navy and showed that the Corsair Mk II could be operated with reasonable success even from escort carriers. It was not without problems, one being excessive wear of the arrester wires due to the weight of the Corsair and the understandable tendency of the pilots to stay well above the stalling speed. A total of 2,012 Corsairs were supplied to the United Kingdom.

Fleet Air Arm (FAA) units were created and equipped in the United States, at Quonset Point or Brunswick and then shipped to war theaters aboard escort carriers. The first FAA Corsair unit was No. 1830, created on the first of June 1943, and soon operating from HMS *Illustrious*. At the end of the war, 18 FAA squadrons were operating the Corsair. British Corsairs served both in Europe and in the Pacific. The first, and also most important, European operations were the series of attacks (*Operation Tungsten*) in April, July and August 1944 on the German battleship *Tirpitz*, for which Corsairs from HMS *Victorious* and HMS *Formidable* provided fighter cover. It appears the Corsairs did not encounter aerial opposition on these raids.

At least one Corsair was captured by the Germans, this was Corsair *JT404* from No. 1841 squadron (*Formidable*) which was lost on anti-submarine patrol with Wing Leader Lieutenant Commander RS Baker-Falkner flying a Fairey Barracuda. The Corsair pilot made an emergency landing on 18/19 July 1944 in a field near Bodø, Norway. The Corsair was captured intact, although it is not known if it was taken to Germany.

From April 1944, Corsairs from the British Pacific Fleet took part in a several major air raids in South East Asia beginning with *Operation Cockpit*, an attack on Japanese targets at Sabang island, in the Dutch East Indies.

In July and August 1945, Corsair squadrons Nos. 1834, 1836, 1841 and 1842 took part in a series of strikes on the Japanese mainland, near Tokyo. These squadrons operated from *Victorious* and *Formidable.* On 9 August 1945, days before the end of the war, Corsairs from *Formidable* attacked Shiogama harbor on the northeast coast of Japan. Royal Canadian Navy pilot, Lieutenant Robert Hampton Gray, of 1841 Squadron was hit by flak but pressed home his attack on a Japanese destroyer, sinking it with a 1,000 pounds (450 kg) bomb but crashing into the sea. He was posthumously awarded Canada's last Victoria Cross, becoming the second fighter pilot of the war to earn a Victoria Cross as well as the final Canadian casualty of World War II.

An 1831 Sqn Corsair aboard HMS *Glory*, off Rabaul, 1945.

FAA Corsairs originally fought in a camouflage scheme with a Dark Slate Grey/Extra Dark Sea Grey disruptive pattern on top and Sky undersides, but were later painted overall dark blue. Those operating in the Pacific theater acquired a specialized British insignia — a modified blue-white roundel with white "bars" to make it look more like a U.S. than a Japanese *Hinomaru* insignia to prevent friendly fire incidents.

In all, out of 18 carrier-based squadrons, eight saw combat, flying intensive ground attack/interdiction operations and claiming 47.5 aircraft shot down.

At the end of World War II, under the terms of the Lend-Lease agreement, the aircraft had either to be paid for or to be returned to the U.S. As the UK did not have the means to pay for them, the Royal Navy Corsairs were pushed overboard into the sea near Sydney, Australia.

Royal New Zealand Air Force

Equipped with obsolescent Curtiss P-40s, Royal New Zealand Air Force (RNZAF) squadrons in the South Pacific performed impressively compared to the American units they operated alongside, in particular in the air-to-air role. The American government accordingly decided to give New Zealand early access to the Corsair, especially as it was not initially being used from carriers. Some 424 Corsairs equipped 13 RNZAF squadrons, including No. 14 Squadron RNZAF and No. 15 Squadron RNZAF, replacing SBD Dauntless as well as P-40s. The F4Us were allocated NZ prefixed serial numbers: F4U-1s NZ5201 to NZ5299; NZ5300 to NZ5399; NZ5400 to NZ5487, all of which were assembled by Unit 60; NZ5500 to NZ5577 were assembled and flown at RNZAF Hobsonville. In total there were 237 F4U-1s and 127 F4U-1Ds used by the RNZAF

during the Second World War. 60 FG-1Ds which arrived post war were given serial numbers prefixed NZ5600 to NZ5660.

RNZAF Corsairs with an RAAF Boomerang on Bougainville, 1945.

The first deliveries of lend-lease Corsairs began in March 1944 with the arrival of 30 F4U-1s at the RNZAF Base Depot Workshops (Unit 60) at Espiritu Santo in the New Hebrides. From April, these workshops became responsible for assembling all Corsairs for the RNZAF units operating the aircraft in the South West Pacific and a Test and Despatch flight was set up to test the aircraft after assembly. By June 1944, 100 Corsairs had been assembled and test flown. The first squadrons to use the Corsair were 20 and 21 Squadrons on Espiritu Santo island, operational in May 1944. The organization of the RNZAF in the Pacific and New Zealand meant that only the pilots and a small staff belonged to the Squadron (the maximum strength on a squadron was 27 pilots): Squadrons were assigned to several Servicing Units (**SU**s five-six officers, 57 NCOs, 212 airmen) which carried out aircraft maintenance and operated from fixed locations: hence F4U-1 NZ5313 was first used by 20 Squadron/1 SU on Guadalcanal in May 1944; 20 Squadron was then relocated to 2 SU on Bougainville in November. In all there were 10 front line SUs plus another three based in New Zealand. Because each of the SUs painted its aircraft with distinctive markings and the aircraft themselves could be repainted in several different colour schemes the RNZAF Corsairs were far less uniform in appearance compared with their American and FAA contemporaries. By late 1944, the F4U had equipped all 10 Pacific-based fighter squadrons of the RNZAF.

By the time the Corsairs arrived, there were virtually no Japanese aircraft left in New Zealand's allocated sectors of the Southern Pacific, and despite the RNZAF Squadrons extending their operations to more northern islands, they were primarily used for close

support of American, Australian and New Zealand soldiers fighting the Japanese. New Zealand pilots were aware of the Corsair's poor forward view and tendency to ground loop, but found these drawbacks could be solved by pilot training in curved approaches before use from rough forward airbases. At the end of 1945, all Corsair squadrons but one (No. 14) were disbanded. That last squadron was based in Japan, until the Corsair was retired from service in 1947.

No. 14 Squadron was given new FG-1Ds and, in March 1946 transferred to Iwakuni, Japan as part of the British Commonwealth Occupation Force. Only one airworthy example of the 424 aircraft procured survives: NZ5648/ZK-COR, owned by the Old Stick and Rudder Company at Masterton, NZ. One other mostly complete aircraft and the remains of two others were known to be held by a private collector at Ardmore, NZ, in 1996. Their current whereabouts are unknown.

Aéronavale

First Indochina War, Algerian War, Suez Crisis

Early F4U-7 Corsair

Former Argentine F4U-5NL in Aeronavale 14.F flotilla colors in 2006

The XF4U-7 prototype did its test flight on 2 July 1952 with a total of 94 **F4U-7**s built for the French Navy's *Aéronavale* (79 in 1952, 15 in 1953), with the last of the batch, the final Corsair built, rolled out on 31 January 1953. The F4U-7s were actually purchased by the U.S. Navy and passed on to the Aéronavale through the U.S. Military Assistance Program (MAP). The French Navy used its F4U-7s during the second half of the First Indochina War in the 1950s (12.F, 14.F, 15.F Flotillas), where they were supplemented by at least 25 ex-USMC AU-1s passed on to the French in 1954, after the end of the Korean War.

French F4U-7 Corsairs (with some loaned AU-1s) of the 12.F, 14.F, 15.F and 17.F Flotillas conducted missions during the Algerian War between 1955 and 1961. The 14.F and 15.F Flotillas also took part in the Anglo-French-Israeli seizure of the Suez Canal in October 1956, codenamed Operation Musketeer. The Corsairs were painted with yellow and black recognition stripes for this operation.

In early 1959, the *Aéronavale* experimented with the Vietnam War-era SS.11 wire-guided anti-tank missile on F4U-7 Corsairs. The 12.F pilots trained for this experimental program were required to "fly" the missile at approximatively two kilometers from the target on low attitude with a joystick using the right hand while keeping track of a flare on its tail, and piloting the aircraft using the left hand; an exercise that could be very tricky in a single-seat aircraft under combat conditions. Despite reportedly effective results during the tests, this armament was not used with Corsairs during the ongoing Algerian War.

The *Aéronavale* used 163 Corsairs (94 F4U-7s and 69 AU-1s), the last of them used by the Cuers-based 14.F Flotilla were out of service by September 1964, with some surviving for museum display or as civilian warbirds.

"Football War"

Corsairs flew their final combat missions during the 1969 "Football War" between Honduras and El Salvador, in service with both air forces. The conflict was famously triggered, though not really caused, by a disagreement over a football (soccer) match. Both sides claimed various numbers of kills, and each side disputed the claims of the other. At the outset of the Football War, El Salvador enlisted the assistance of several American pilots with P-51 and F4U experience. Bob Love, a Korean war ace, Chuck Lyford, Ben Hall and Lynn Garrison flew in the world's last combat between propeller-driven fighters. Lynn Garrison had purchased F4U-7 133693 from the French MAAG office when retired from French naval service in 1964. It was registered N693M and was later destroyed in a 1987 crash in San Diego, California.

Legacy

The Corsair entered service in 1942. Although designed as a carrier fighter, initial operation from carrier decks proved to be troublesome. Its low-speed handling was tricky due to the port wing stalling before the starboard wing. This factor, together with poor visibility over the long nose (leading to one of its nicknames, "The Hose Nose"), made landing a Corsair on a carrier a difficult task. For these reasons, most Corsairs initially went to Marine Corps squadrons who operated off land-based runways, with some early Goodyear built examples (designated **FG-1A**) being built with fixed, non-folding wings. The USMC aviators welcomed the Corsair with open arms as its performance was far superior to the contemporary Brewster Buffalo and Grumman F4F-3 and -4 Wildcat.

Moreover, the Corsair was able to outperform the primary Japanese fighter, the A6M Zero. While the Zero could out-turn the F4U at low speed, the Corsair was faster and could out-climb and out-dive the A6M. Tactics developed early in the war, such as the Thach Weave, took advantage of the Corsair's strengths.

This performance advantage, combined with the ability to take severe punishment, meant a pilot could place an enemy aircraft in the killing zone of the F4U's six .50 (12.7 mm) M2 Browning machine guns and keep him there long enough to inflict major damage. The 2,300 rounds carried by the Corsair gave over one full minute of fire from each gun, which, fired in three to six-second bursts, made the F4U a devastating weapon against aircraft, ground targets, and even ships.

Beginning in 1943, the Fleet Air Arm (FAA) also received Corsairs and flew them successfully from Royal Navy carriers in combat with the British Pacific Fleet and in Norway. These were clipped-wing Corsairs, the wingtips shortened 8 in (20 cm) to clear the lower overhead height of RN carriers. FAA also developed a curving landing approach to overcome the F4U's deficiencies.

Underside of a Corsair

Infantrymen nicknamed the Corsair "The Sweetheart of the Marianas" and "The Angel of Okinawa" for its roles in these campaigns. Among Navy and Marine aviators, however, the aircraft was nicknamed "Ensign Eliminator" and "Bent-Wing Eliminator" because it required many more hours of flight training to master than other Navy carrier-borne aircraft. It was also called simply "U-bird" or "Bent Wing Bird". The Japanese allegedly nicknamed it "Whistling Death", for the noise made by airflow through the wing root-mounted oil cooler air intakes.

The Corsair has been named the official aircraft of Connecticut, due to its connection with Sikorsky Aircraft, in legislation sponsored by state senator George "Doc" Gunther; Gunther had also organized a **Corsair Celebration and Symposium** at Sikorsky Memorial Airport in Stratford, Connecticut, on Memorial Day, 29 May 2006.

Variants

An early F4U-1 in flight.

Royal Navy Corsair Mk Is

During World War II, Corsair production expanded beyond Vought to include Brewster and Goodyear models. Allied forces flying the aircraft in World War II included FAA and RNZAF. Eventually, more than 12,500 F4Us would be built, comprising 16 separate variants.

F4U-1 (**Corsair Mk I** Fleet Air Arm): The first production version of the Corsair with the original cockpit seat height and "bird cage" canopy. The differences over the XF4U-1 were as follows:

- Six .50 in (12.7 mm) Browning AN/M2 machine guns were fitted in the outer wing panels, displacing fuel tanks.

- An enlarged 237 gal (897 l) fuel tank was fitted ahead of the cockpit, in place of the fuselage armament. The cockpit was moved back by 32 in (810 mm).
- The fuselage was lengthened from 31 feet 11 inches (9.73 m) to 33 feet 4 inches (10.16 m).
- The more powerful R-2800-8 Double Wasp was fitted.
- 150 pounds (68 kg) of armor plate was fitted to the cockpit and a 1.5 in (38 mm) bullet-resistant glass screen was fitted behind the curved windscreen.
- IFF transponder equipment was fitted.
- Curved transparent panels were incorporated into the fuselage behind the pilot's headrest.
- The flaps were changed from deflector type to NACA slotted.
- The span of the ailerons was increased while that of the flaps was decreased.
- One 62 gal (234 l) non-self-sealing auxiliary fuel cell was installed in each wing leading edge, just outboard of the guns.

A land-based version for the USMC, without the folding wing capability, was built by Goodyear under the designation **FG-1**. In Fleet Air Arm service the F4U-1 was given the name Corsair Mk I. Vought also built a single F4U-1 two-seat trainer; the Navy showed no interest.

F4U-1A (**Corsair Mk II**): The designation F4U-1A does not appear in lists of Corsair Bureau Numbers and was not in official use, being applied post-war to differentiate mid to late production F4U-1s from the early production variant. Mid to late production Corsairs incorporated a new, taller and wider clear-view canopy with only two frames, along with a simplified clear view windscreen. The cockpit seat was raised 7 in (180 mm) which, with the wider canopy top section, allowed the pilot better visibility over the long nose. The Plexiglas rear-view windows as well as the one under the cockpit were omitted. The tailwheel strut was lengthened, which also aided the pilot's forward view. These Corsairs were the first "carrier capable" variant and introduced a 6 in (150 mm)-long stall strip just outboard of the gun ports on the starboard wing leading edge and improved undercarriage oleo struts which eliminated bouncing on landing. F4U-1s supplied to the USMC lacked arrester hooks and the tail wheels were changed to a smaller diameter solid rubber type. Additionally, an experimental R-2800-8W engine with water injection was fitted on one of the late F4U-1As. After satisfactory results, many F4U-1As were fitted with the new powerplant. The aircraft carried 237 gal (897 l) in the main fuel tank, located in front of the cockpit, as well as an unarmored, non-self-sealing 62 gal (235 l) fuel tank in each wing. This version of the Corsair was the first to be able to carry a drop tank under the center-section. With drop tanks fitted, the fighter had a maximum ferry range of just over 1,500 mi (2,400 km).

A land-based version, without the folding wing capability, was built by Goodyear as the **FG-1A**. In British service, the aircraft type was modified with "clipped" wings (8 inches (200 mm) was cut off each wingtip) for use on British aircraft carriers, under the designation Corsair Mk II.

F3A-1 (**Corsair Mk. III**):This was the designation for the Brewster built F4U-1. Just over 700 were built before Brewster was forced out of business. Poor production techniques and shabby quality control meant that these aircraft were red-lined for speed and prohibited from aerobatics after several lost their wings. This was later traced to poor quality wing fittings. None of the Brewster built Corsairs reached front line units.

F4U-1B: This was an unofficial post-war designation used to identify F4U-1s modified for FAA use.

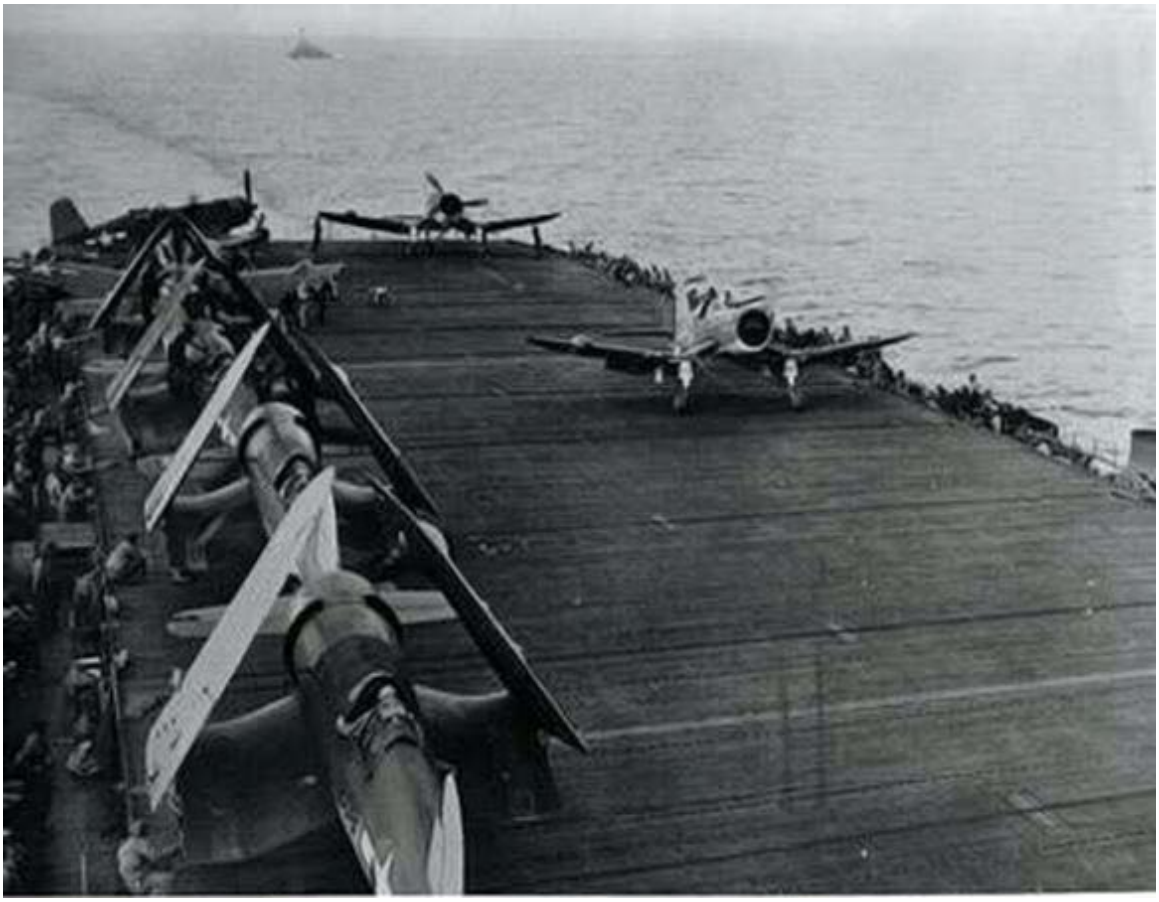
F4U-1C: The prototype F4U-1C, BuNo50277, appeared in August 1943 and was based on an F4U-1. A total of 200 of this variant were built July–November 1944; all were based on the F4U-1D and were built in parallel with that variant. Intended for ground-attack as well as fighter missions, the F4U-1C was similar to the F4U-1D but its six machine guns were replaced by four 20 millimetre (0.79 in) AN/M2 cannons with 231 rpg of ammunition. The F4U-1C was introduced to combat during 1945, most notably in the Okinawa campaign. Aviators preferred the standard armament of six .50 in (12.7 mm) machine guns since they were already more than powerful enough to destroy most Japanese aircraft, and had more ammunition and a higher rate of fire. The weight of the Hispano cannon and their ammunition affected the flight performance, especially its agility, but the aircraft was found to be especially potent in the ground attack role.

An FG-1D with the later style canopy used by the F4U-1D.

F4U-1D (**Corsair Mk IV**): Built in parallel with the F4U-1C, but was introduced in April 1944. It had the new -8W water-injection engine. This change gave the aircraft up to 250 hp (190 kW) more power, which, in turn, increased performance. Speed, for example, was boosted from 417 miles per hour (671 km/h) to 425 miles per hour (684 km/h). Because of the U.S. Navy's need for fighter-bombers, it had a payload of rockets double the -1A's, as well as twin-rack plumbing for an additional belly drop tank.

Such modifications necessitated the need for rocket tabs (attached to fully metal-plated underwing surfaces) and bomb pylons to be bolted on the fighter, however, causing extra drag. Additionally, the role of fighter-bombing was a new task for the Corsair and the wing fuel cells proved too vulnerable and were removed. The extra fuel carried by the two drop tanks would still allow the aircraft to fly relatively long missions despite the heavy, un-aerodynamic load. The regular armament of six machine guns were implemented as well. The canopies of most -1Ds had their struts removed along with their metal caps, which were used — at one point — as a measure to prevent the canopies' glass from cracking as they moved along the fuselage spines of the fighters. Also, the clear-view style "Malcolm Hood" canopy used initially on Supermarine Spitfire and P-51C Mustang aircraft was adopted as standard equipment for the -1D model, and all later F4U production aircraft. Additional production was carried out by Goodyear (**FG-1D**) and Brewster (**F3A-1D**). In Fleet Air Arm service, the latter was known as the Corsair III, and both had their wingtips clipped by 8" per wing to allow storage in the lower hangars of British carriers.

F4U-1P: A rare photo reconnaissance variant.



An F4U-2. The radome on the starboard outer wing is just visible.

XF4U-2: Special night fighter variant, equipped with two auxiliary fuel tanks.

F4U-2: Experimental conversion of the F4U-1 Corsair into a carrier-borne night fighter, armed with five .50 in (12.7 mm) machine guns (the outboard, starboard gun was deleted), and fitted with airborne Intercept (AI) radar set in a radome placed outboard on the starboard wing. Since Vought was preoccupied with more important projects, only 32 were converted from existing F4U-1s by the Naval Aircraft Factory and another two by front line units.

The type saw combat with VF(N)-101 aboard USS *Enterprise* and USS *Intrepid* in early 1944, VF(N)-75 in the Solomons and VMF(N)-532 on Tarawa.

An XF4U-3 in 1946.

XF4U-3: Experimental aircraft built to hold different engines in order to test the Corsair's performance with a variety of power plants. This variant never entered service. Goodyear also contributed a number of airframes, designated **FG-3**, to the project. A single sub-variant **XF4U-3B** with minor modifications was also produced. **XF4U-3B**, planned procurement for the FAA.

XF4U-4: New engine and cowling.

F4U-4: The last variant to see action during World War II, deliveries to the U.S. Navy of the F4U-4 began late in 1944. It fully equipped naval squadrons four months before the end of hostilities. It had the 2,100 hp (1,600 kW) dual-stage-supercharged -18W engine. When the cylinders were injected with the water/alcohol mixture, power was boosted to 2,450 hp (1,830 kW). The aircraft required an air scoop under the nose and the unarmored wing fuel tanks of 62 gal (234 l) capacities were removed for better maneuverability at the expense of maximum range. The propeller was changed to a four blade type. Maximum speed was increased to 448 miles per hour (721 km/h) and climb

rate to over 3,800 ft/min (1,180 m/min) as opposed to the 2,900 ft/min (884 m/min) of the F4U-1A. The service ceiling also increased significantly from 37,000 feet (11,000 m) to 41,000 feet (12,000 m). The "4-Hog" retained the original armament and had all the external load (*i.e.*, drop tanks, bombs) capabilities of the F4U-1D. The windscreen was now flat bullet-resistant glass to avoid optical warping, a change from the curved Plexiglas windscreens with the internal plate glass of the earlier Corsairs. Vought also tested the two F4U-4Xs (BuNos 49763 and 50301, prototypes for the new R2800) with fixed tiptanks (the Navy showed no interest) and an Aeroproducts six-blade contraprop (not accepted for production).

An F4U-4 of VF-1b on board USS Midway, 1947-1948.

F4U-4B: Designation for F4U-4s to be delivered to the British Fleet Air Arm, but were retained by the U.S. for its own use. The Fleet Air Arm received no F4U-4s.

F4U-4C: 300 F4U-4s ordered with alternate gun armament of four 20 millimetres (0.79 in) AN/M2 cannon.

F4U-4E and F4U-4N: Developed late in WWII, these night fighters featured radar radomes projecting from the starboard wingtip. The -4E was fitted with the APS-4 search radar, while the -4N was fitted with the APS-6 type. In addition, these aircraft were often refitted with four 20mm M2 cannons similar to the F4U-1C. Though these variants would not see combat during WWII, the night fighter variants would see great use during the Korean war.

F4U-4K: Experimental drone.

F4U-4P: As with the -1P, a rare photo reconnaissance variant.

XF4U-5: New engine cowling, other extensive changes.

A VMF(N)-513 F4U-5N at Wonsan during the Korean War, 1950.

F4U-5: A 1945 design modification of the F4U-4, first flown on 21 December 1945, was intended to increase the F4U-4 Corsair's overall performance and incorporate many Corsair pilots' suggestions. It featured a more powerful Pratt and Whitney R-2800-32(E) engine with a two stage supercharger, rated at a maximum of 2,450 hp (1,830 kW). Other improvements included automatic blower controls, cowl flaps, intercooler doors and oil cooler for the engine, spring tabs for the elevators and rudder, a completely modernized cockpit, a completely retractable tail wheel, and heated cannon bays and pitot head. The cowling was lowered two degrees to help with forward visibility, but perhaps most striking as the first variant to feature all-metal wings (223 units produced).

F4U-5N: Radar equipped version (214 units produced)

F4U-5NL: Winterized version (72 units produced, 29 modified from F4U-5Ns (101 total). Fitted with rubber de-icing boots on the leading edge of the wings and tail.

F4U-5P: Long-range photo-reconnaissance version (30 units produced)

A factory-fresh AU-1, 1952.

F4U-6: Redesignated **AU-1**, this was a ground-attack version produced for the U.S. Marine Corps.

F4U-7 : AU-1 developed for the French Navy.

FG-1E: Goodyear FG-1 with radar equipment.

FG-1K: Goodyear FG-1 as drone.

FG-3: Turbosupercharger version converted from FG-1D.

FG-4:Goodyear F4U-4, never delivered.

AU:US Marines attack variant re-designated from **F4U-6**

Super Corsair variants

The **F2G-1** and **F2G-2** were significantly different aircraft, fitted with the Pratt & Whitney R-4360 *Wasp Major* 4-row 28-cylinder "corncob" radial engine and teardrop (bubble) canopy, as a specialized interceptor against *kamikaze* attacks. The difference between the -1 and -2 variants was that the -1 featured a manual folding wing and 14 ft (4.3 m) propellers, while the F2G-2 aircraft had hydraulic operated folding wings, 13 ft (4.0 m) propellers and carrier arresting hooks for carrier use. As World War II was drawing to a close, development problems emerged that led to the abandonment of further work on the F2G series. While only 10 were built, several F2Gs went on to racing success after the war, winning the Thompson trophy races in 1947 and 1949.

Operators

Corsair FG-1D (Goodyear built F4U-1D) in the Royal New Zealand Air Force markings

Argentina

- Argentine Naval Aviation

26 F4U-5/5N/5NL Corsairs between 1956-1965 from ARA *Independencia*

El Salvador

- Air Force of El Salvador

France

- French Navy
  - *French Aéronavale 12.F Flotilla*
  - *French Aéronavale 14.F Flotilla*
  - *French Aéronavale 15.F Flotilla*
  - *French Aéronavale 17.F Flotilla*

Honduras

- Honduran Air Force

New Zealand

- Royal New Zealand Air Force
  - No. 14 Squadron RNZAF
  - No. 15 Squadron RNZAF
  - No. 16 Squadron RNZAF
  - No. 17 Squadron RNZAF
  - No. 18 Squadron RNZAF
  - No. 19 Squadron RNZAF
  - No. 20 Squadron RNZAF
  - No. 21 Squadron RNZAF
  - No. 22 Squadron RNZAF
  - No. 23 Squadron RNZAF
  - No. 24 Squadron RNZAF
  - No. 25 Squadron RNZAF
  - No. 26 Squadron RNZAF

United Kingdom

- Royal Navy Fleet Air Arm

United States

- United States Navy
- United States Marine Corps

Survivors

Over two dozen Corsairs are believed to be still airworthy, most in the United States. Others are found in museum collections worldwide.

Specifications

F4U-1A

General characteristics

- **Crew:** 1 pilot
- **Length:** 33 ft 4 in (10.1 m)
- **Wingspan:** 41 ft 0 in (12.5 m)
- **Height:** 16 ft 1 in (4.90 m)
- **Wing area:** 314 ft^2 (29.17 m^2)
- **Empty weight:** 8,982 lb (4,073 kg)
- **Loaded weight:** 14,000 lb (6,300 kg)
- **Powerplant:** 1× Pratt & Whitney R-2800-8W radial engine, 2,250 hp (1,678 kW)

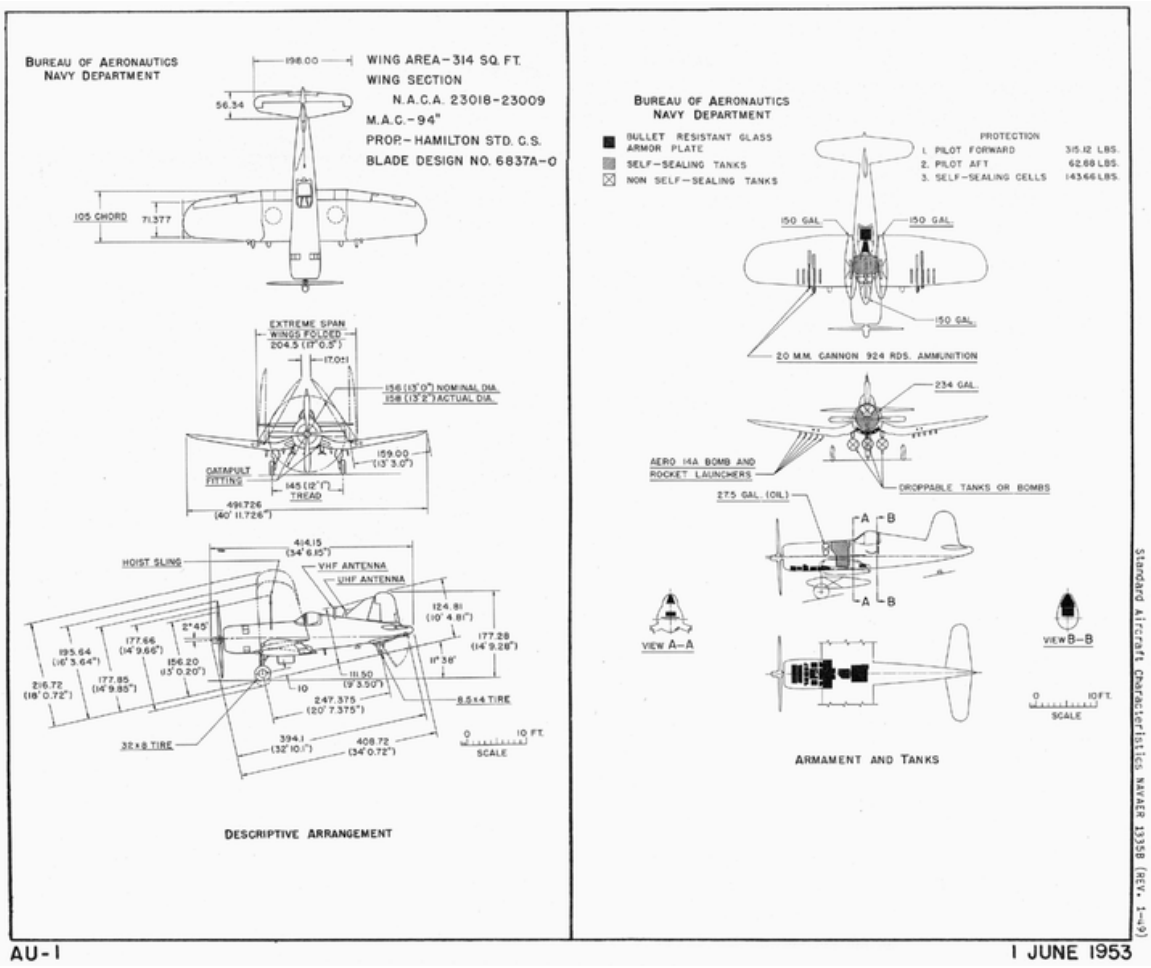
Performance

- **Maximum speed:** 425 mph (369 kn, 684 km/h)
- **Range:** 1,015 mi (882 nmi (1,633 km))
- **Service ceiling:** 36,900 ft (11,200 m)
- **Rate of climb:** 3,180 ft/min (16.2 m/s)

Armament

- **Guns:** 4 × 0.50 in (12.7 mm) M2 Browning machine guns, 400 rpg *and* 2 × 0.50 in Browning M2 machine guns, 375 rpg
- **Rockets:** 4 × 5 in (12.7 cm) High Velocity Aircraft Rockets *and/or*
- **Bombs:** 2,000 pounds (910 kg)

F4U-4



AU-1 Corsair Standard Aircraft Characteristics

General characteristics

- **Crew:** 1 pilot
- **Length:** 33 ft 8 in (10.2 m)
- **Wingspan:** 41 ft 0 in (12.5 m)
- **Height:** 14 ft 9 in (4.50 m)
- **Empty weight:** 9,205 lb (4,174 kg)
- **Loaded weight:** 14,669 lb (6,653 kg)
- **Powerplant:** 1× Pratt & Whitney R-2800-18W radial engine, 2,450 hp (1,827 kW)

Performance

- **Maximum speed:** 446 mph (388 kn, 718 km/h)
- **Range:** 1,005 mi (873 nmi (1,617 km))
- **Service ceiling:** 41,500 ft (12,649 m)

- **Rate of climb:** 3,870 ft/min (19.7 m/s)

Armament

- **Guns:**
  - 6 × 0.50 in (12.7 mm) M2 Browning machine guns, 400 rpg *or*
  - 4 × 20 millimetre (0.79 in) AN/M2 cannon
- **Rockets:** 8 × 5 in (12.7 cm) high velocity aircraft rockets *and/or*
- **Bombs:** 4,000 pounds (1,800 kg)

Chapter- 9

Grumman F8F Bearcat

F8F Bearcat

Role	Fighter aircraft
Manufacturer	Grumman
First flight	21 August 1944
Introduction	1945
Retired	1955 (United States Navy) 1960 (Royal Thai Air Force)
Status	Retired
Primary users	United States Navy United States Marine Corps French Air Force Royal Thai Air Force
Number built	1,265

The **Grumman F8F Bearcat** (affectionately called "Bear") was an American single-engine naval fighter aircraft of the 1940s. It went on to serve into the mid-20th century in the United States Navy and other air forces, and would be the company's final piston engined fighter aircraft.

Design and development

The Bearcat concept was inspired by the early 1943 evaluation of a captured Focke-Wulf Fw 190 by Grumman test pilots and engineering staff. After flying the Fw 190, Grumman test pilot Bob Hall wrote a report directed to President Leroy Grumman, who then personally laid out the specifications for Design 58, the successor to the Hellcat. Design 58 closely emulated the design philosophy of the German fighter, although no part of the Fw 190 was copied. The F8F Bearcat stemmed from Design 58 with the primary missions of outperforming highly maneuverable late-model Japanese fighter aircraft such as the A6M5 Zero. A role which later developed was that defending the fleet against incoming airborne suicide (*kamikaze*) attacks.

Work on the Grumman G-58 Bearcat began in 1943 with the intention to provide the U.S. Navy with a high performance derivative of the Grumman F6F Hellcat. The specifications called for an aircraft able to operate from the smallest carrier, primarily in the interceptor role. The F6F's Pratt & Whitney R-2800 engine was retained but compared to the Hellcat, the Bearcat was 20% lighter, had a 30% better rate of climb and was 50 mph (80 km/h) faster. To achieve this, the range was necessarily sacrificed.

An XF8F-1 prototype at the NACA, in 1945.

In comparison with the Vought F4U Corsair, the initial Bearcat (F8F-1) was marginally slower but was more maneuverable and climbed more quickly. Its huge 12 ft 4 in Aero Products four-bladed propeller required a long landing gear (made even longer by the mid-fuselage position of the wing), giving the Bearcat an easily-recognized, "nose-up" profile. The hydraulically operated undercarriage used an articulated trunnion which extended the length of the oleo legs to lengthen when down; as the undercarriage retracted the legs were shortened, enabling them to fit into a wheel well which was entirely in the wing. An additional benefit of the inward retracting units was a wide track, which helped counter propeller torque on takeoff and gave the F8F good ground and carrier deck handling. For the first time in a production Navy fighter, a bubble canopy offered 360° visibility.

The target loaded weight of 8,750 lb/3,969 kg (derived from the land-based German aircraft) was essentially impossible to achieve as the structure of the new fighter had to be made strong enough for aircraft carrier landings. Structurally the fuselage used flush riveting as well as spot welding, with a heavy gauge 302W aluminum alloy skin. Armor protection was provided for the pilot, engine and oil cooler; weight saving measures include restricting the internal fuel capacity to 160 gal (606 l) (later 183) and limiting the fixed armament to four .50 cal Browning M2/AN machine guns, two in each wing.

As a weight-saving concept the designers came up with detachable wingtips; if the *g*-force exceeded 7.5 *g* then the tips would be allowed to snap off, leaving a perfectly flyable aircraft still capable of carrier landing. While this worked very well under carefully controlled conditions in flight and on the ground, in the field, where aircraft were repetitively stressed by landing on carriers and since the wings were slightly less carefully made in the factories, there was a possibility that only one wingtip would break away with the possibility of the aircraft crashing. This was replaced with an explosives system to blow the wings off together, which also worked well, however this ended when a ground technician died due to accidental triggering. In the end the wings were reinforced and the aircraft limited to 7.5 *g*.

Grumman's project pilot for the Bearcat series was legendary test pilot Corky Meyer, who also had this role on the Grumman F6F Hellcat, F7F Tigercat, F9F Panther, XF10F-1 Jaguar, and the F11F Tiger series. Meyer was head of Grumman Flight Operations at Edwards Air Force Base from 1952–56.

Another famous name is associated with the type; when asked his favorite aircraft to fly, Neil Armstrong's immediate and unequivocal answer was "Bearcat". Armstrong had flown the type in 1950 during his Navy Advanced Training, field qualifying in it at age 19.

Operational history

On 25 August 1946, the Blue Angels transitioned to the Grumman F8F-1 Bearcat and introduced the famous "diamond" formation.

The F8F prototypes were ordered in November 1943 and first flew on 21 August 1944, a mere nine months later. The first production aircraft was delivered in February 1945 and the first squadron, VF-19, was operational by 21 May, but World War II was over before the aircraft saw combat service.

Postwar, the F8F became a major U.S. Navy fighter, equipping 24 fighter squadrons. Often mentioned as one of the best-handling piston-engine fighters ever built, its performance was sufficient to outperform many early jets. Its capability for aerobatic performance is illustrated by its selection for the Navy's elite Blue Angels in 1946, who flew it until the team was temporarily disbanded in 1950, during the Korean War. The F9F Panther and McDonnell F2H Banshee largely replaced the Bearcat in USN service, as their performance and other advantages eclipsed piston-engine fighters.

An unmodified production F8F-1 set a 1946 time-to-climb record (after a run of 115 ft/35 m) of 10,000 ft (3,048 m) in 94 seconds (6,383 fpm). The Bearcat held this record for 10 years until it was broken by a modern jet fighter (which still could not match the Bearcat's short takeoff distance).

Other nations that flew the Bearcat included the French Air Force and Royal Thai Air Force. French aircraft saw combat service against the Viet Minh in the First Indochina War as fighter-bombers in the early 1950s. They were used to support French Forces at the Battle of Dien Bien Phu, operating at the edge of their combat radius, but failed to prevent the French defeat that brought about the end of the war. Upon its creation in 1955, nearly 70 surviving aircraft passed to the Vietnam Air Force.

Air racing

Record-breaking Rare Bear racer

Bearcats have long been popular in air racing. A stock Bearcat flown by Mira Slovak and sponsored by Bill Stead won the first Reno Air Race in 1964. *Rare Bear*, a highly-modified F8F owned by Lyle Shelton, went on to dominate the event for decades, often competing with Daryl Greenamyer, another famous racer with victories in his own Bearcat ("Conquest I", now at the Smithsonian's NASM) and holder of a propeller-driven aircraft world speed record in it. *Rare Bear* also set many performance records, including the 3 km World Speed Record for piston-driven aircraft (528.33 mph/850.26 km/h), set in 1989, and a new time-to-climb record (3,000 m in 91.9 seconds (6425.9 fpm), set in 1972, breaking the 1946 record cited above).

Variants

An F8F Bearcat aboard the USS *Valley Forge* (CV-45)

An F8F-2P reconnaissance aircraft from VC-62 over USS *Midway* (CVB-41), 1949.
G-58A/B

Two civil aircraft. The first was owned by the Gulf Oil Company for the use of Major Alford Williams, the second one was used by Grumman as a demonstrator aircraft.

XF8F-1
: Prototype aircraft, two built.

F8F-1 Bearcat
: Single-seat fighter aircraft, equipped with folding wings, a retractable tailwheel, self-sealing fuel tanks, a very small dorsal fin, powered by a 2,100 hp (1,566 kW) Pratt & Whitney R-2800-34W Double Wasp radial piston engine, armed with four 0.50 in (12.7 mm) machine guns, 658 built.

F8F-1B Bearcat
: Single-seat fighter version, armed with four 20 mm cannons, 100 built.

F8F-1B Bearcat
: Originally designated F8F-1C, redesignated as F8F-1B, 126 built.

F8F-1D
: F8F-1s converted into drone control aircraft.

F8F-1(D)B Bearcat
: Unofficial designation for export version for France and Thailand.

F8F-1E Bearcat
: F8F-1 conversion night-fighter prototype, APS-4 radar.

XF8F-1N
: F8F-1 conversion into night fighter prototypes.

F8F-1N Bearcat
: Night fighter version, equipped with an APS-19 radar, 12 built.

F8F-1P Bearcat
: F8F-1 conversion photo reconnaissance conversion.

F3M-1 Bearcat
: Planned designation for F8F aircraft constructed by General Motors.

XF8F-2
: F8F-1 conversion with engine upgrade, revised engine cowling, taller tail.

F8F-2 Bearcat
: Improved version, equipped with a redesigned engine cowling, taller fin and rudder, armed with four 20 mm (.79 in) cannons, powered by a Pratt & Whitney R-2800-30W radial piston engine, 293 built.

F8F-2D
: F8F-2s converted into drone control aircraft.

F8F-2N Bearcat
: Night-fighter version, equipped with an APS-19 radar, 12 built.

F8F-2P Bearcat
: Photo-reconnaissance version, fitted with camera equipment, armed with two 20 mm (.79 in) cannons, 60 built.

Operators

A Royal Thai Air Force F8F-2.

France

- French Air Force

Thailand

- Royal Thai Air Force

United States

- United States Navy
- United States Marine Corps

South Vietnam

- Vietnam Air Force

Surviving aircraft

Grumman F8F-2P Bearcat G-RUMM N700HL at Flying Legends, Duxford, UK
Airworthy

- F8F-1 Bearcat, BuNo. *90446* is flightworthy and owned by Breckenridge Aviation Museum in Breckenridge, Texas.
- F8F-1 Bearcat, BuNo. *95255* is flightworthy and owned by Banta Aviation Corporation in Dover, Delaware.
- F8F-2P Bearcat, BuNo. *121714* is flightworthy and owned by The Fighter Collection in Duxford.
- F8F-2 Bearcat, BuNo. *121748* is flightworthy and owned by Ray DieckMan of Cincinnati, Ohio.
- F8F-2 Bearcat, BuNo. *121752* is flightworthy and owned by Heritage Flight Museum in Eastsound, Washington.
- F8F-2 Bearcat, BuNo. *121776* is flightworthy and owned by Lone Star Flight Museum in Galveston, Texas.
- F8F-2 Bearcat, BuNo. *122095* is flightworthy and owned by Quality Leasing Company in Indianapolis, Indiana.
- F8F-2 Bearcat, BuNo. *122619* is flightworthy and owned by World Jet Inc. in Ft. Lauderdale, Florida.

- F8F-2 Bearcat, BuNo. *122629* is flightworthy and owned by Lyle T. Shelton of Granada Hills, California.

- F8F-2 Bearcat, BuNo. *122637* is flightworthy and owned by Chino Warbirds Inc. in Carlsbad, California.

- F8F-2P Bearcat, BuNo. *122674* is flightworthy and owned by the Commemorative Air Force in Midland, Texas.

Display

- F8F-1 Bearcat, BuNo. *90454* is on display at the Kalamazoo Aviation History Museum in Kalamazoo, Michigan.

- F8F-1 Bearcat, BuNo. *94956* is on display at the Royal Thai Air Force Museum in Bangkok, Thailand.

- F8F-1 Bearcat, BuNo. *95338* was on display at the Tan Son Nhut Airbase in Vietnam, 1967-1987, but may no longer be in existence.

- F8F-1 Bearcat, BuNo. *95342* was on display at the Nakorn-Swan Airbase in Thailand, 1985-1987, but may no longer be in existence.

- F8F-1 Bearcat, BuNo. *95369* was on display at the Nha Trang Airbase in Vietnam, 1967-1987, but may no longer be in existence.

- F8F-1B Bearcat, BuNo. *121488* was on display at the Tan Son Nhut Airbase in Vietnam in 1971, but may no longer be in existence.

- F8F-2 Bearcat, BuNo. *121646* is on display at the National Air & Space Museum in Silver Hill, Maryland.

- F8F-2 Bearcat, BuNo. *121710* is on display at the National Museum of Naval Aviation in NAS Pensacola, Florida.

- G-58B Gulfhawk (one of two civilian built Bearcats) is on display at the Planes of Fame in Palm Springs, California.

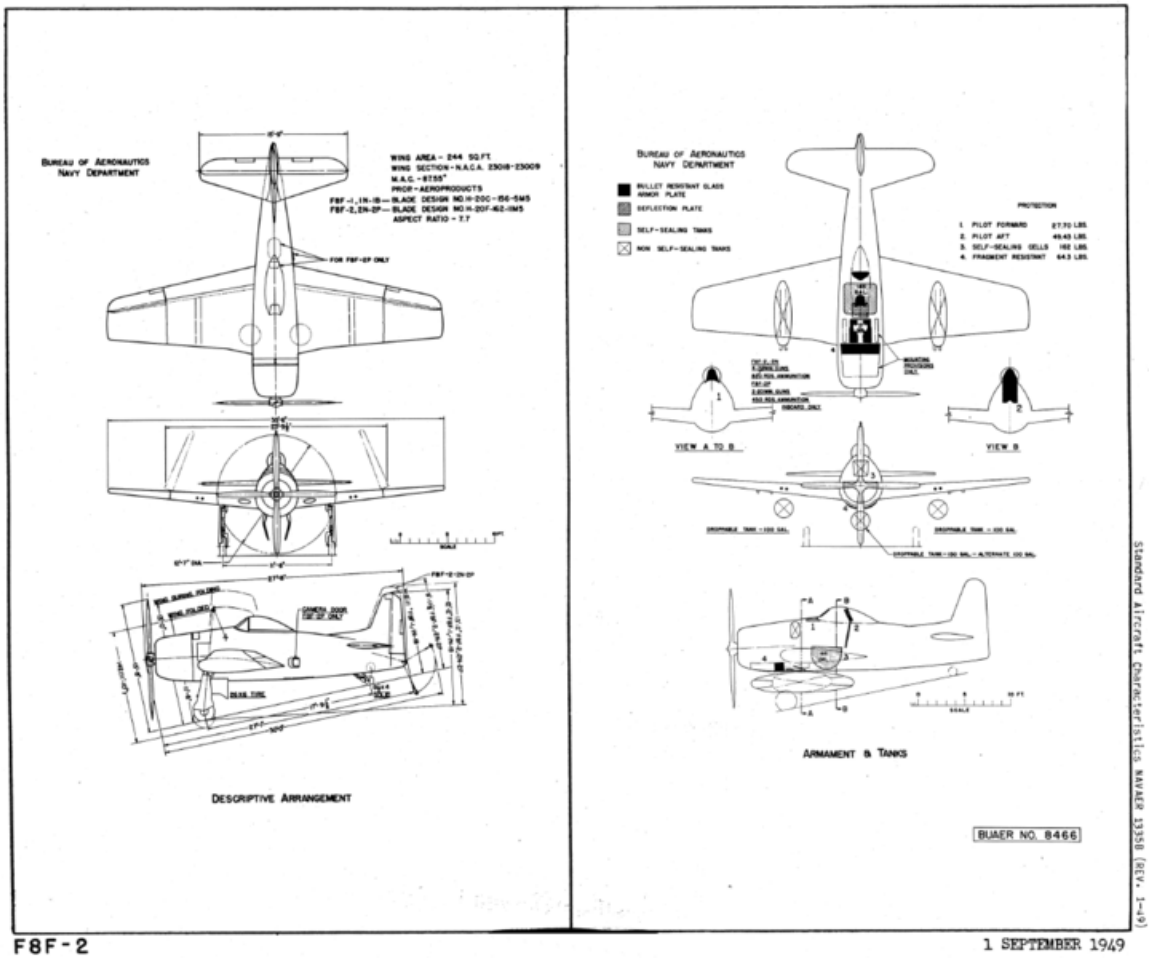
Restoration

- F8F-1 Bearcat, BuNo. *95356* is under restoration to flightworthy condition by John J. Dowd of Syracuse, Kansas.

- F8F-1B Bearcat, BuNo. *122122* is under restoration to flightworthy condition by the Foundation for the Preservation & Development of Thai Aircraft in Thailand.

- F8F-2P Bearcat, BuNo. *122614* is under restoration to flightworthy condition by Steve Hinton, John Maloney & Kevin Eldridge of Chino, California.

Specifications F8F-1 and F8F-2



F8F-2 Bearcat

General characteristics

- **Crew:** 1 pilot
- **Length:** 28 ft 3 in (8.61 m)
- **Wingspan:** 35 ft 10 in (10.92 m)
- **Height:** 13 ft 9 in (4.21 m)
- **Wing area:** 244 ft² (22.67 m²)
- **Empty weight:** 7,070 lb (3,207 kg)
- **Loaded weight:** 9,600 lb (4,354 kg)
- **Max takeoff weight:** 12,947 lb (5,873 kg)
- **Powerplant:** 1× Pratt & Whitney R-2800-34W "Double Wasp" two-row radial engine, 2,100 hp (1,567 kW)

Performance

- **Maximum speed:** 421 mph (366 kn, 678 km/h)
- **Range:** 1,105 mi (1,778 km)
- **Service ceiling:** 38,700 ft (11,796 m)
- **Rate of climb:** 4,570 ft/min (23.2 m/s)
- **Wing loading:** 66.7 lb/ft² (192.1 kg/m²)
- **Power/mass:** 0.22 hp/lb (360 W/kg)

Armament

- **Guns:** 4 × 0.50 in (12.7 mm) machine guns (Four 20mm M3 cannon F8F-1B)
- **Rockets:** 4× 5 in (127 mm) unguided rockets
- **Bombs:** 1,000 lb (454 kg) bombs

General characteristics

- **Length:** 28 ft 3 in (8.61 m)
- **Wingspan:** 35 ft 10 in (10.92 m)
- **Height:** 13 ft 10 in (4.21 m)
- **Empty weight:** 7,650 lb (3,207 kg)
- **Loaded weight:** 10,200 lb (4,627 kg)
- **Max takeoff weight:** 13,460 lb (6,105 kg)
- **Powerplant:** 1× Pratt & Whitney R-2800-30W two-row radial engine, 2,250 hp (1,678 kW)

Performance

- **Maximum speed:** 455 mph (405 kn, 730 km/h)
- **Range:** 1,105 mi (1,778 km)
- **Service ceiling:** 40,800 ft (12,436 m)
- **Rate of climb:** 6,300 ft/min (32.0 m/s)
- **Power/mass:** 0.22 hp/lb (360 W/kg)

Armament

- **Guns:** 4 × 20 mm (.79 in) M3 cannon
- **Rockets:** 4× 5 in (127 mm) unguided rockets
- **Bombs:** 1,000 lb (454 kg) bombs