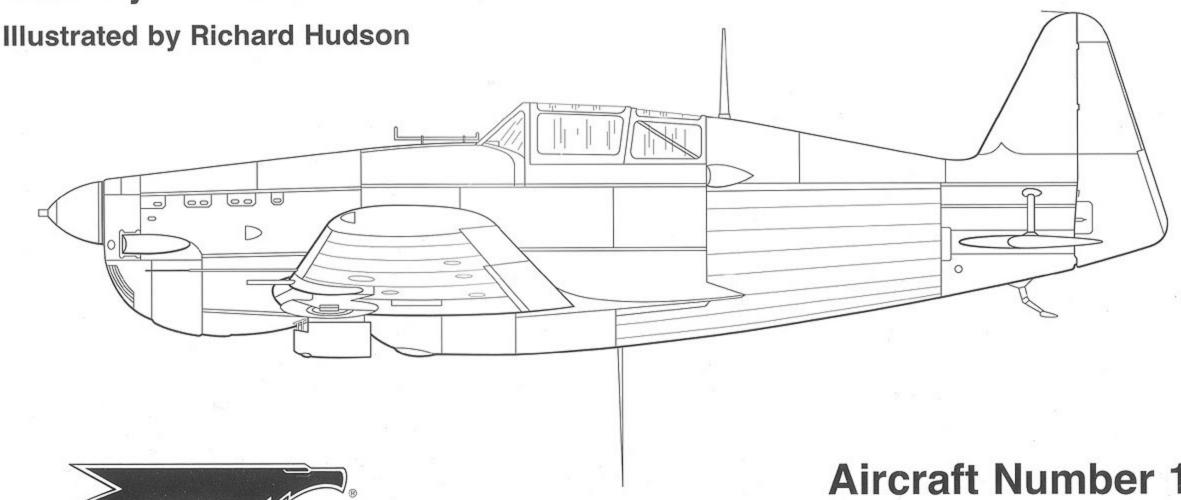
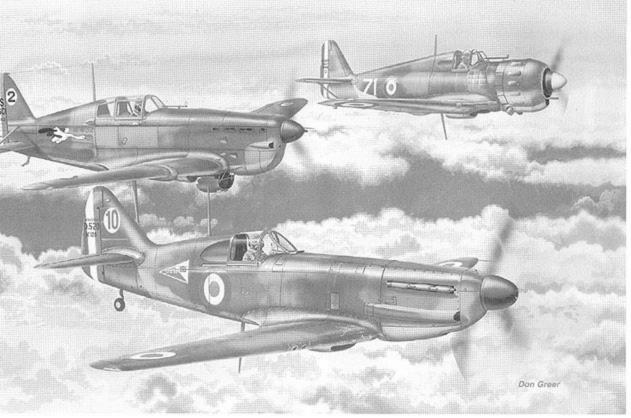
# French Fighters of World War II

in action

By Alain Pelletier Color by Don Greer



Aircraft Number 180 squadron/signal publications



The Dewoitine D.520 (foreground), Morane-Saulnier MS 406 (middle), and Bloch 152 (background) were the three primary Armée de l'Air (French Air Force) fighters during the early part of World War Two. The D.520, Red 10 (No 129) was assigned to Groupe de Chasse (GC; Fighter Group) I/3 (3rd Escadre/Wing). The MS 406, Black 2 (No 432) flew with GC I/2. The Bloch 152, White 71 (No 628), was assigned to the 4th Escadrille (4th Squadron) of GC II/9. The standard French camouflage colors were Khaki (FS24087), Dark Brown (FS20117), and Dark Blue Gray (FS36176), with undersurfaces in Light Blue Gray (FS25189).

### Acknowledgements

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Jean-Jacques Petit

Pierre Rivière (†)

Philippe Ricco

Camouflage Air Club (CAC), Marseille, France

Établissement Cinématographique des Armées (ECA; French Army Cinematography Establishment)

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(Right) This Bloch 152, White 5, was assigned to the 3rd Escadrille (Squadron) of Groupe de Chasse (Fighter Group) II/1 (1st Escadre/Wing). The insignia painted on the vertical stabilizer consisted of a white running skeleton with a scythe on a black disk. This badge was originally used by SPA 94, a SPAD fighter squadron during World War One, which was later designated 3rd Escadrille of GC II/1. The Group began converting to the Bloch 152 in October of 1939. GC II/1 was credited with 42 confirmed and four probable victories during the campaign in May-June of 1940 . (M. Cristescu)



#### Introduction

Nazi Party Führer (Leader) Adolf Hitler became Germany's Chancellor on 30 January 1933. He and the Nazis rode a popular tide to power, based upon discontent in a nation humiliated by defeat in World War One and the harsh terms of the Treaty of Versailles. This 1919 treaty – imposed by the victorious Allies (France, Great Britain, the United States, and Italy) – forbade Germany an air force and a large army with offensive weapons. The Germans began openly defying the Treaty of Versailles soon after Hitler took power. On 27 April 1933, the Germans created the *Reichsluftfahrtministerium* (RLM; Reich Air Ministry), led by World War One Air ace Hermann Göring. His deputy was Erhard Milch, Chairman of Germany's state-run airline Lufthansa. The RLM supervised the creation of the Luftwaffe (German Air Force), which was publicly revealed on 1 March 1935. Nazi Germany's threat to European peace grew during the 1930s and greatly concerned its neighbors, including France – the largest neighbor to Germany's west.

On 1 April 1933, the French Army's Aéronautique Militaire (Military Aeronautics) was renamed the Armée de l'Air (Army of the Air; French Air Force). This service became independent of the Army on 2 July 1934. In May of 1933, French Air Minister Pierre Cot and Armée de l'Air Chief of Staff General Victor Denain proposed an equipment plan (Plan d'Equipment I). This program was adopted in December of 1933 and called for 1445 new military aircraft by the end of 1934. This figure included 350 fighters (200 single-seat aircraft, 70 two-seat fighters, and 80 multi-seat machines). Limited financial resources for aircraft procurement delayed awarding the first contract under Plan I (40 Dewoitine D.500s and five D.501s) until 6 July 1934. The Armée de l'Air inventory at the time included 836 single-seat fighters, comprised of the Gourdou-Leseurre GL 32, the Morane-Saulnier MS 225, the

Nieuport-Delage NiD 62/622, and the Wilbault 72. The French Air Force was also equipped with 40 two-seat Breguet Br 19A2 fighters in mid-1934.

The Dewoitine D.500/501 monoplane fighters entered service in May of 1935. These aircraft were already outdated due to rapid technological advances and the *Armée de l'Air* regarded the D.500/501s as transitional aircraft. On 13 July 1934, the Air Ministry's *Service Technique Aéronautique* (STAé; Aeronautical Technical Service) submitted a new C1 (*Chasse* 1; Single-Seat Fighter) specification to French aircraft manufacturers. It called for an aircraft with a 450 KMH (279.6 MPH) maximum speed, a 2.5 hour duration at 320 KMH (198.8 MPH), a time-to-climb to 4000 M (13,123.4 feet) of less than six minutes, and a service ceiling of 11,500 M (37,729.7 feet). Two categories of fighters were considered under this specification: a standard fighter powered by a 800 to 1000 horsepower (HP) Hispano-Suiza or Gnome & Rhône engine, and a light fighter powered by a 400 to 500 HP Potez or Salmson engine. The new C1's armament consisted of either one 20MM Hispano-Suiza HS 404 cannon with two 7.5MM MAC¹ 1934 machine guns, four 7.5MM machine guns, or two 20MM cannon. Nine proposals were made in response to the STAé specification: the Arsenal VG 30, the Blériot-Spad 710, the Caudron-Renault CR 710, the Dewoitine D.513, the Loire-Nieuport LN 160/161, Loire 250, the Morane-Saulnier MS 405, the ANF-Les Mureaux 190, and the Bloch 150.

By the end of 1935, the air staff set out to replace 25 percent of the aircraft fleet each year. This program called for replacing 96 fighters in service with 30 Dewoitine D.510s and 66 Morane-Saulnier MS 405s. The STAé published a new single-seat fighter specification on 15 June 1936, which called for a maximum speed of 500 KMH (310.7 MPH) and a time to 8000 M (26,246.7 feet) of under 15 minutes. By 18 September, this specification was amended to increase the maximum speed to 520 KMH (323.1 MPH). The new single-seat fighter specification (the A23 Technical Program) was officially presented to French aircraft manufacturers on 12 January 1937. Like the previous plan, the A23 concerned two categories of fighters: stan-

dard and light. The standard fighter category eventually resulted in the Arsenal VG 33, the Bloch 151/152, the Dewoitine D.520, the Loire-Nieuport 60 (CAO 200), and the Morane-Saulnier MS 450. Caudron-Renault's CR 714 resulted from the light fighter request.



MAC (Manufacture d'Armes de Chatellerault; Chatellerault Weapons Manufacturing Company)

Nieuport-Delage NiD 62 sesquiplanes formed the backbone of the French fighter force during the mid 1930s. This aircraft (White 42) parked at Istres was painted overall Picturesque Green (FS24058), except for a few bare metal areas. The military registration (matricule militaire), believed to be R512, was painted in large white lettering under the upper wing. French roundels were displayed only on the wings before 1940 and were (from center) Roundel Blue (FS25090), White (FS27780), and Red (FS21105). Rudder striping was in the same colors, with Roundel Blue facing forward. On 7 March 1936, Germany denounced the Versailles and Locarno treaties<sup>2</sup> and re-occupied the Rhineland – demilitarized since 1919 – along France's eastern border. In due course, the French government decided to reinforce its armed forces and adopted *Plan II* for air force expansion on 26 October 1936. This plan called for a doubling of *Armée de l'Air* strength by the end of 1939; however, only 378 fighters were authorized of the 1554 total combat aircraft planned. Within 14 months (November of 1938 to December of 1939), the French aircraft industry built only 936 combat aircraft, including 273 fighters (D.510s, MS 405/406s, and **Potez 630/631** multi-seat aircraft). This reduced output was partly caused by political instability and by the nationalization of France's aircraft industry on 11 August 1936. The nationalization merged the aircraft companies into regional *Sociétés Nationale de Constructions Aéronautiques* (SNCA; National Aircraft Construction Companies). These groupings were intended to increase production efficiency; however, the hoped-for improvements did not materialize. Procurement difficulties resulted in cancelation of *Plan III* in late 1936 and *Plan IV* in early 1937.

By January of 1938, the most advanced of the *Armée de l'Air* 's 793 fighters on strength were 54 Dewoitine D.510 fixed landing gear monoplanes. The ever-increasing German threat forced a reevaluation of French defense policy, which led to a new equipment program (*Plan V*) aimed at counterbalancing the Luftwaffe. French intelligence services estimated Luftwaffe strength at 2850 aircraft (including 850 modern fighters) by the beginning of 1938. In response to these dramatic figures, the French Parliament upgraded *Plan II* and Premier Edouard Daladier gave top priority to aircraft production. *Plan V* was subsequently developed and hastily approved on 15 March 1938. The main objective was to increase the total number of aircraft in the inventory to 2617, including 1081 fighters. The number of fighters would be sufficient to equip 32 *Groupes de Chasse* (GC; Fighter Groups) and 16 *Escadrilles Régionales* (Local Defense Squadrons). This three-stage plan was scheduled for completion within three years; however, Germany's invasion of Poland on 1 September 1939

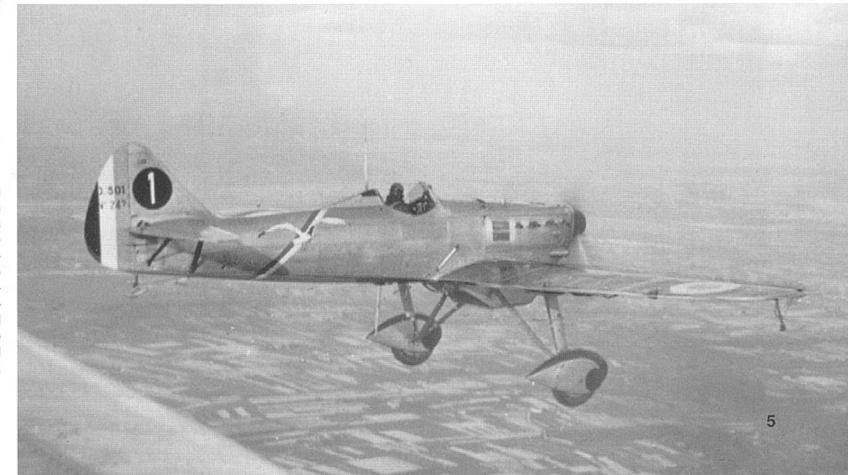
prevented the *Armée de l'Air* from meeting these objectives.

 $^2$  The 1925 Locamo Treaty brought Germany into the western European mutual security network.

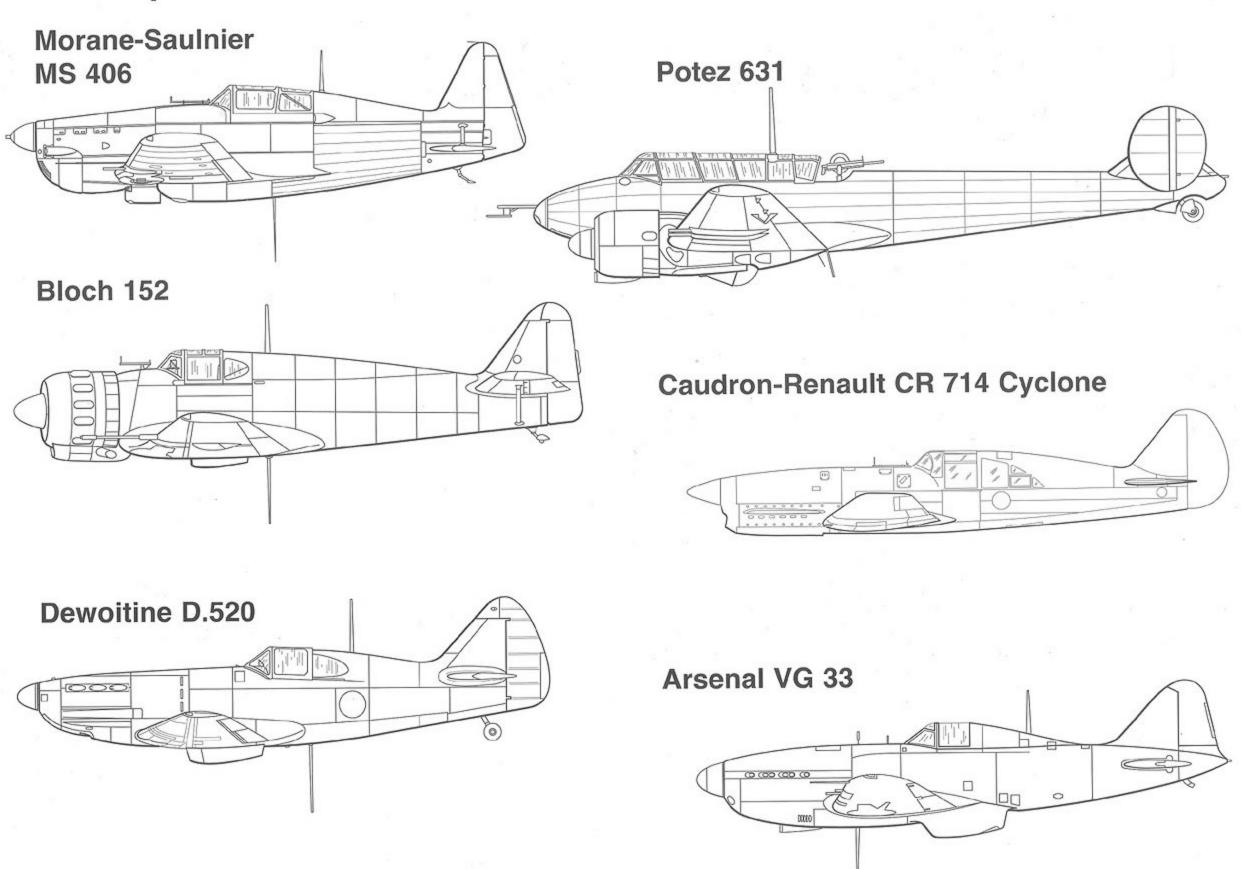
The Dewoitine 500 series aircraft were the first modern French fighters. A Dewoitine D.501, White 1 (No 247) of GC II/1, flies over the French countryside in August of 1937. The D.501 was powered by a 610 HP Hispano-Suiza 12Xcrs 12-cylinder, liquid-cooled, inline engine. It was armed with one 20MM Hispano-Suiza S9 cannon firing through the propeller hub and two wing-mounted 7.5MM Darne machine guns. The aircraft was finished in overall natural metal and Silver (FS17189) doped fabric. The Group insignia was painted on a blue, white, and red diagonal aft fuselage band. Each Armée de l'Air Escadre (Wing) consisted of two Groupes. Each Groupe was composed of two Escadrilles (Squadrons) of 12 aircraft each. (M. Bénichou)



Morane-Saulnier MS 225 parasol fighters were still in the Armée de l'Air inventory in 1937. They were powered by a 500 HP Gnome & Rhône 9Kbrs radial engine and armed with two 7.7MM Vickers machine guns firing through the propeller arc. The lead aircraft was production No 41 (military registration N540) and was assigned to 1st Escadrille of GC I/7. The insignia is a medieval helmet. N519 was parked to the rear of N540. Both aircraft are overall Picturesque Green with natural metal cowlings, forward fuselages, and landing gears.



## **Development**



#### Morane-Saulnier MS 405/406

The Morane-Saulnier MS 405 was designed to the STAé (Service Technique Aéronautique; Aeronautical Technical Service) specification of July of 1934. The design team under René Gauthier used conventional construction techniques to provide the Armée de l'Air with its first modern fighter. The fuselage had four aluminum tubes connecting the bulkheads and wire-braced struts, while the wings used two light alloy spars with steel ribs. The airframe was skinned with Plymax, a composite material formed by bonded layers of plywood and aluminum.

The MS 405 had a wingspan of 10.62 M (34 feet 10 1/8 inches), a length of 8.17 M (26 feet 9 5/8 inches), and a height of 2.71 M (8 feet 10 11/16 inches). The aircraft weighed 2440 KG (5379.2 pounds) fully loaded. It had a maximum speed of 443 KMH (275.3 MPH) at 4000 M (13,123.4 feet) and a range of 1000 KM (621.4 miles). The designed armament was one 20MM Hispano-Suiza S9 cannon firing through the propeller hub and two wing-mounted 7.5MM Darne machine guns.

The MS 405 prototype (Aircraft 01) was built at the company's Puteaux plant and assembled at Villacoublay airfield near Paris. It made its first flight from Villacoublay on 8 August 1935, with Morane-Saulnier test pilot Michel Détroyat at the controls. This aircraft was powered by an 860 HP Hispano-Suiza 12YGrs 12-cylinder liquid-cooled, inline engine, which turned a three-bladed two-pitch Chauvière propeller. It was also fitted with a fixed undercarriage, which was eventually replaced by a fully retractable Messier main undercarriage.

Few minor airframe modifications were needed as a result of early test flights. The MS 405-01 was modified to carry two 7.5MM MAC 1934 machine guns instead of the Darne weapons and an OPL 31 reflector gun sight was installed. The Chauvière propeller was replaced by a three-bladed Ratier 1495M variable-pitch propeller. On 20 February 1936, Morane-Saulnier presented the aircraft to the Centre d'Essais du Matériel Aérien (CEMA; Air Material

Propeller Pitch
Actuator Windmill

860 HP HispanoSuiza 12YGrs
engine

MS 406

860 HP HispanoSuiza 12Y31
engine

Lightened Wing
Structure

Research Center) at Villacoublay for official evaluation.

The MS 405-01 completed approximately 180 flight tests from February of 1936 until August of 1937. The only problem encountered during these tests was lateral instability when the power was off. This was corrected by increasing wing dihedral from 5° 43 minutes to 6° 51 minutes. This prototype was used as a demonstrator for potential foreign sales until it was destroyed in a crash on 8 December 1937.

The second MS 405 prototype first flew at Villacoublay on 20 January 1937. This aircraft differed from the first prototype in using a larger Chauvière three-bladed propeller. This required taller main landing gear struts to insure proper ground clearance. The MS 405-02 was involved in two minor accidents during the spring of 1937 before it was destroyed in a crash on 29 July.

Despite these setbacks, the *Ministère de l'Air* (Air Ministry) ordered 16 pre-production MS 405s on 1 March 1937. These aircraft differed in only minor details from the second prototype. The first pre-production MS 405 (No 1) made its initial flight on 3 February 1938. This aircraft was used for evaluation at CEMA, while No 2 flew operational trials at the *Centre d'Expériences* (Experiment Center) at Rheims. Information from the test flights led to the *Ministère de l'Air* placing a contract for 50 production aircraft designated **MS 406** in April of 1937. These fighters were built by *Société Nationale de Constructions Aéronautiques de l'Ouest* (SNCAO; National Aircraft Construction Company of the West) at Nantes-Bouguenais. (SNCAO acquired Morane-Saulnier during the 1936 nationalization of the French aircraft industry.) A second order for 80 MS 406s was placed with SNCAO the following August.

The first MS 405C1 warms up its engine during testing in 1935. An 860 HP Hispano-Suiza 12YGrs 12-cylinder 'Vee' engine powered the fighter. The powerplant turned a three-bladed Chauvière propeller via a reduction gear, which reduced the engine shaft's speed to a more manageable speed for the propeller. The prototype lacked national markings while it was owned by Morane-Saulnier for manufacturers' tests.





The second pre-production MS 405C1 (No 2, N252) is parked on an airfield after its delivery to the Armée de l'Air (French Air Force) in April of 1938. Early production aircraft had their upper surfaces painted Khaki (FS24087), with Light Blue Gray (FS25189) undersurfaces. The military registration was white on the wing undersurfaces. A windmill pitch actuator was fitted on the MS 405's propeller hub; this actuator was deleted on production MS 406s.

The fourth pre-production MS 405 was completed as MS 406 No 4 and first flew on 20 May 1938. It was powered by an 860 HP Hispano-Suiza 12Y31 12-cylinder, liquid-cooled, inline engine, which turned a Chauvière 351M three-bladed, two-pitch propeller. Late production aircraft were fitted with a Ratier 1607 three-bladed, variable-pitch propeller. The wing structure was modified after tests determined the wings could sustain greater loads than designed, due to the Plymax covering. The three outer ribs in each wing (port and starboard) were lightened and the six oblique stringers were reduced to three. These structural changes saved 23 kg (50.7 pounds) in airframe weight. Tests with the modified wing on MS 405 No 12 resulted in this new wing becoming standard on MS 406s.

The MS 406 had a wingspan of 10.61 m (34 feet 9 3/4 inches), a length of 8.13 m (26 feet 8 1/16 inches), and a height of 2.71 m (8 feet 10 11/16 inches). The aircraft weighed 1893 kG (4173.3 pounds) empty and 2626 kG (5789.2 pounds) fully loaded. Maximum speed of the MS 406 was 486 kmH (302 mpH) at 5000 m (16,404.2 feet). Its service ceiling was 9400 m (30,839.9 feet) and its range was 1000 km (621.4 miles). The MS 406 was armed with one 20mm Hispano-Suiza S9 cannon with 60 rounds firing through the propeller shaft. In March of 1939, this weapon was replaced on the 95th MS 406 by a Hispano-Suiza HS 404 cannon, whose 700 rounds per minute (RPM) firing rate was superior to the S9's 400 RPM rate. The HS 404 had a muzzle velocity of 850 m (2788.7 feet) per second. One 7.5mm MAC 1934 machine gun with 300 rounds per gun were mounted in each wing.

The deteriorating international situation prompted the *Ministère de l'Air* to order 825 additional MS 406s from three SNCAO production lines in April of 1938. The inefficiency of this arrangement led the Ministry to change the contract after No 65 to 905 aircraft from one production line at Nantes-Bouguenais in January of 1939. Lingering production difficulties resulted in only 12 MS 406s in *Armée de l'Air* service on 1 January 1939. Production steadily increased to six aircraft per day by April of 1939.

Seven pre-production MS 405s were delivered to Groupe de Chasse (GC) I/7 (1st Fighter Group, 7th Escadre/Wing) at Rheims in May of 1938. The unit's pilots appreciated the new

fighter's handling, but not the weak and prone to fail undercarriage. This Group received the first production MS 406s in the spring of 1939. Seven more fighter groups converted from D 500/501 monoplanes and Blériot-Spad 510 biplanes by May of 1939.

MS 406 production ended in March of 1940, when the last eight aircraft rolled off the Nantes-Bouguenais production line. These aircraft were ordered the previous May. SNCAO built 15 pre-production MS 405s and 1079 production MS 406 aircraft for France and export.



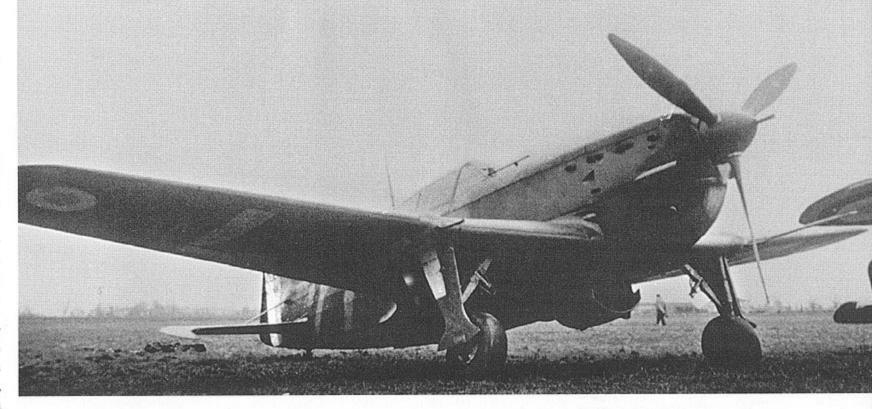
The MS 405C1 No 2 was delivered to the Armée de l'Air in January of 1937. The aircraft's designation and manufacturers' number were black on the blue (forward), white, and red striped rudder. The C1 at the end of MS 405 stood for Chasse 1 (Fighter, Single-Seat). A ring and bead auxiliary gun sight was mounted immediately forward of the windshield. (F. Bergèse)

# MS 406 Improvements and Derivatives

Morane-Saulnier engineers made several attempts to improve the MS 406's performance. The MS 410 featured a revised wing, with four 7.5MM MAC 1934 machine guns (two each to port and starboard). The weapons were heated to allow firing at high altitudes, where air temperatures would otherwise freeze the firing mechanisms. The MS 406's retractable radiator which proved unsatisfactory in service - was replaced with a fixed radiator on the MS 410. An MS 406 (No 1028) served as the MS 410 prototype for flight tests conducted in January and February of 1940. In early 1940, a contract was issued for converting 500 MS 406s to MS 410s. A separate contract called for 150 sets of MS 410 wings. It is believed no MS 410s left the conversion center at Clermont Ferrant-Aulnat prior to France's Armistice with Germany on 25 June 1940. After the Armistice, the occupying Germans supplied 11 MS 410s to Finland and an unknown number to Croatia.

Another MS 406 (No 1005) was equipped with two 148 L (39.1 gallon) flush-fitting auxiliary fuel tanks under the wings. The aircraft flew in December of 1939 and demonstrated a range of 1500 km (932.1 miles) – an increase of 500 km (310.7 miles) over the standard MS 406. The *Ministère de l'Air* (French Air Ministry) approved the external tanks in January of 1940 and ordered 100 sets of these tanks. Some of these tanks were fitted to MS 406s ferried by the *Armée de l'Air de l'Armistice* (Vichy French Air Force) from unoccupied France to Syria in June of 1941.

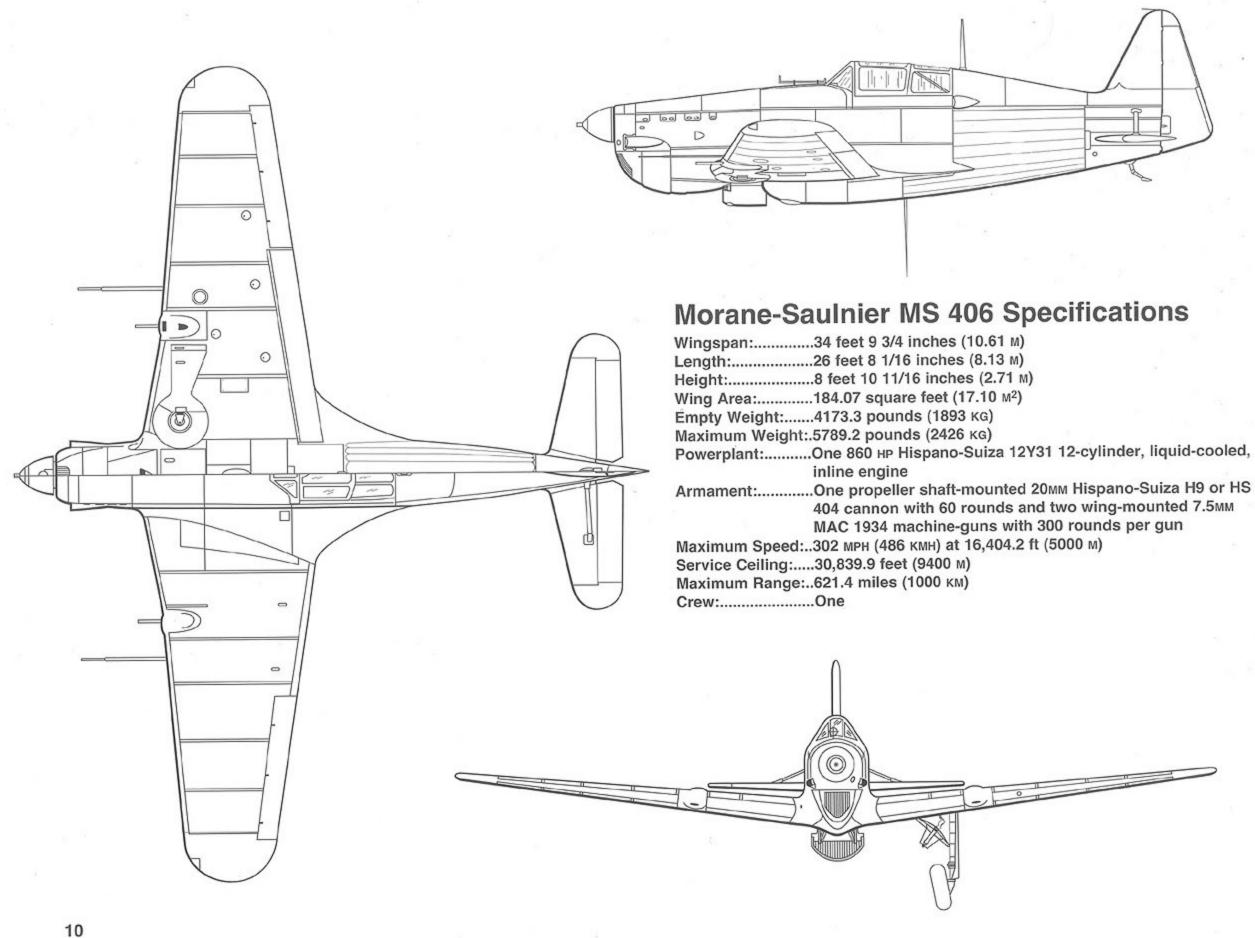
The 12th pre-production MS 405 was equipped with a 910 HP Hispano-Suiza 12Y45 liquid-cooled inline engine and was redesignated the MS 411. MS 405 No 13 flight tested a 1000 HP Hispano-Suiza 12Y51 and was called the MS 408. Neither variant entered production. The 14th MS 405 was fitted with a 930 HP Hispano-Suiza 12YCrs2 engine and modified for high-speed parachute-dropping tests. A compartment for a parachute-equipped mannikin replaced the fuel tank mounted forward of the cockpit. This aircraft received the designation MS 407LP (Lance-Parachute) No 1 and made its maiden flight on 9 December 1938. Two similar aircraft, MS 407 Nos. 2 and 3, were eventually ordered at a later date. The MS 407LPs were used to test improvements in parachutes for Armée de l'Air aircrews.



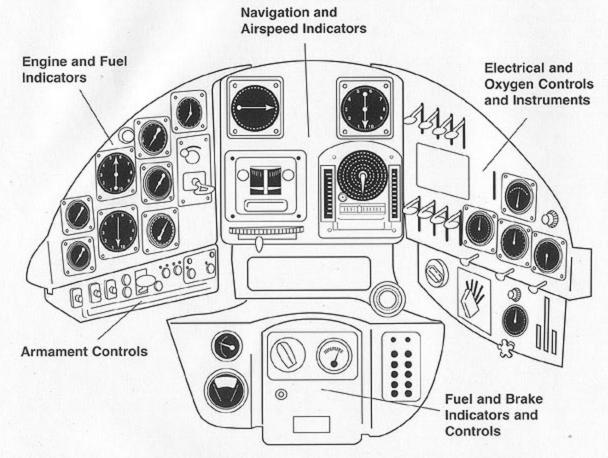
The 748th MS 406 (L777) is parked at SNCAO's Nantes-Bouguenais airfield in December of 1939. The 20мм Hispano-Suiza HS 404 cannon barrel protruded from the propeller spinner. The cannon barrel was placed inside the propeller shaft, with the breech and loading mechanism placed above the engine block. A 7.5мм MAC 1934 machine gun barrel jutted out from each wing fairing. (Via A. Picollet)

This MS 406 has not yet been assigned to a Groupe de Chasse (Fighter Group) and has not received unit markings. The aircraft upper surfaces were painted in narrow, irregular patches of Khaki (FS24087), Dark Brown (FS20117), and Dark Blue Gray (FS36176). No roundels were painted on the fuselage, but 80 cm (31 1/2 inch) diameter roundels were placed on the wings. N· 748 in red was painted on the aft fuselage. (Via A. Picollet)

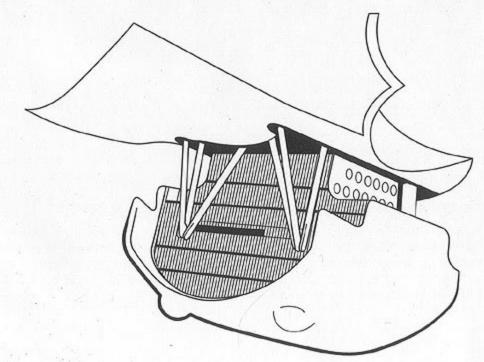




#### **MS 406 Instrument Panel**



#### MS 406 Radiator (Lowered Position)





The matricule militaire (military registration) L777 was painted in white on the wing undersurfaces of MS 406C1 No. 748. The pitot tube mounted on the port wing leading edge collected air flow for the air speed indicator. The MS 406 main undercarriage wheels canted inward when the landing gear was extended. This allowed the wheels to remain in line during crosswind takeoffs and landings. The gear retracted inward, with the wheels lying flush against the wing. (Via A. Picollet)

Commandant (Major) Crémont, commander of Groupe de Chasse III/7, poses before an unidentified MS 406. The radiator was lowered for ground operation, which allowed increased surface area for engine cooling. This radiator was retracted in flight to reduce drag, although still allowing enough air to cool the engine. An engine cooling intake scoop was mounted on the lower cowling, while the oil cooler grill was placed immediately below the propeller spinner. (DR)





An airman armed with a 7.5MM Berthier rifle guards an MS 406 in a wartime French propaganda photograph. A two-pitch, three-bladed Chauvière 351M propeller was standard equipment on production MS 406s. A round oil filler cap was mounted below the cooling intake scoop and an engine compartment cooling vent was fitted immediately forward of the wing root. The wing leading edge obscured the aft three starboard engine exhaust stacks. (DR)



A Sergent (Sgt) works on the upper forward engine cowling of an MS 406. The muzzle for the 20mm Hispano-Suiza HS 9 cannon protruded from the propeller spinner of this early production model. Later MS 406s were armed with the more powerful 20mm Hispano-Suiza HS 404, which had a longer barrel. Both weapons were fed by a 60 round ammunition drum mounted between the engine and the firewall. (DR)

#### MS 406 in French Service

MS 406C1 (Chasse 1; Single-Seat Fighter) production increased from six aircraft per day in April of 1939 to 11 per day by the outbreak of World War Two on 1 September 1939. The Armée de l'Air (French Air Force) had accepted 573 MS 406s by 21 August, which included 367 aircraft assigned to 12 Groupes de Chasse (GC; Fighter Groups). Ten of these Groups were based at Chartres and Dijon in Metropolitan France, while the other two Groups were located at Blida, Algeria. The remaining MS 406s on strength were assigned to various training units. The MS 406 was numerically the most significant fighter in Armée de l'Air service during this period.

France and Great Britain declared war on Germany on 3 September 1939. The period between that date and 10 May 1940 was a time of low activity along the Western Front called the *Drôle de Guerre*, or 'Phony War.' MS 406-equipped GCs flew DAT (*Défense Aérienne du Territoire*; Territory Air Defense), *Chasse aux Armées* (Army Co-Operation), and escort missions during this period. Morane pilots engaged German Luftwaffe aircraft on many occasions, particularly while escorting reconnaissance aircraft. MS 406s tangled with Messerschmitt Bf 109D fighters early in the 'Phony War' and with more potent Bf 109Es late in this period. The Morane fighters seldom flew during the winter of 1939-40, due to lack of heating for the wing-mounted 7.5MM machine guns.

During the *Drôle de Guerre*, MS 406s flew approximately half of the 10,119 *Armée de l'Air* fighter sorties. Their pilots downed 13 confirmed German Bf 109s and had another 16 probable victories (including six Bf 109s). The French lost 13 MS 406s to either combat or otherwise missing in action, plus 33 additional aircraft to various non-combat reasons. Combat demonstrated the Bf 109E's superiority over the MS 406. The French aircraft was underpowered compared to its German rival, lacked armor protection for the pilot, and had unreliable radio equipment. The 7.5mm MAC 1934 machine gun's 1200 rounds per minute (RPM) rate of fire was slightly superior to the German 7.92mm MG17's 1100 RPM rate. The MS 406 was easy to fly and had excellent maneuverability. It could easily outturn a Bf 109E, due to its lower wing loading¹ of 30.07 pounds per square foot. The Bf 109E-3's wing loading was 33.28 pounds per square foot.

By 10 May 1940 – the date German forces invaded the Netherlands and Belgium – 313 MS 406s equipped ten *Armée de l'Air Groupes de Chasse* (Fighter Groups) in Metropolitan France. This total included 163 serviceable aircraft, while the other 150 Group-assigned MS 406s were unable to fly due to mechanical problems. An additional 527 MS 406s were in the French Air Force inventory on this date. This total included 145 aircraft assigned to pilot training or to *Groupes de Chasse de Défense* (Local Defense Fighter Groups), 136 stored aircraft, 111 fighters under repair, and 135 MS 406s deployed to Corsica, French North Africa, and Syria. These 840 MS 406s on *Armée de l'Air* strength were among the 1074 aircraft delivered by SNCAO by this date

The Armée de l'Air was rapidly converting MS 406 units to the newer Bloch 152 or Dewoitine D.520 when the German assault on Western Europe began. MS 406s were often sent to attack highly defended German armored columns; however, the fighter's liquid-cooled engines were highly vulnerable to damage from anti-aircraft fire.

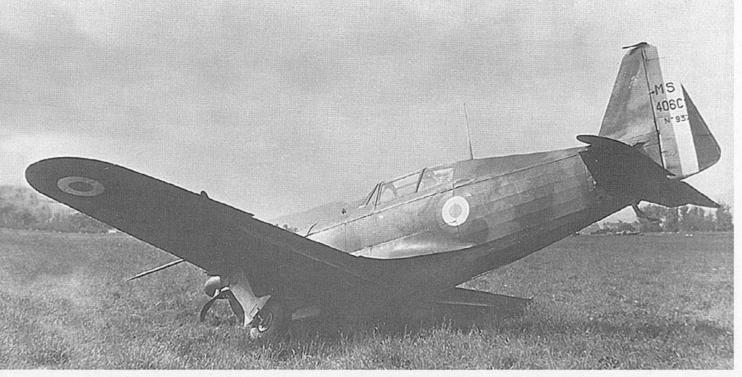
Small groups of MS 406s also engaged well-defended Luftwaffe bomber formations; however, this was difficult for two reasons. One was MS 406 pilots had to attack German aircraft Wing loading is the gross weight or maximum takeoff weight of an aircraft divided by its wing area.



Ten Groupe de Chasse (GC) I/2 MS 406s are lined up on an airfield in early 1940. Most of these aircraft used Roman numerals for their individual numbers; however, the near aircraft (15, No. 949) used an Arabic numeral on the vertical stabilizer. This MS 406 also lacked the fuselage roundel, which became standard on French military aircraft from January of 1940. Camouflage and markings varied among aircraft. A Potez 540 bomber was parked in the background. (Via M. Bénichou)

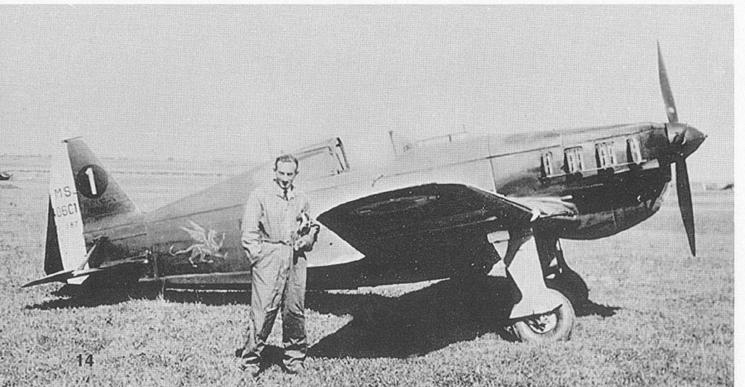
Three MS 406s peel off over their home airfield after returning from a mission. The basic Armée de l'Air element was the patrouille simple (simple patrol), a three-aircraft element. Each Escadrille (squadron) consisted of four patrouilles. This element proved tactically inferior in combat to the German four-aircraft Schwarm (section). (Valentin Collection)





This MS 406C1 (No. 937) sustained a starboard undercarriage collapse during landing at Nantes-Bouguenais. Landing gear failures were a frequent problem with the MS 406 throughout its service career. The lack of unit markings and individual numbers indicated this mishap occurred during a manufacturer's test flight prior to delivery to an operational unit. Ground contact damaged the propeller. (P. Cortet Collection)

A pilot stands beside the starboard wing of a GC II/2 MS 406C1, White 1 (No. 287) at Laon-Chambry, France during the spring of 1940. The 5th Escadrille's dragon insignia was painted on the aft fuse-lage. This and several other MS 406s were fitted with Bronzavia flame damping exhaust stacks, which shielded exhaust flames at night. Exhausts were collected by the damper and vented aft through a narrow tube attached to the exhaust collectors. An unknown number of MS 406s were equipped with Bronzavia dampers. (Valentin Collection)



at short range, due to the 7.5MM MAC 1934 machine gun's low muzzle velocity (800 M/2624.7 feet per second). The other reason was the defensive machine gun fire from the German bombers, which often forced French pilots to fire their guns outside the MAC's effective range and reduced the likelihood of hits.

Despite these difficulties, Morane pilots achieved a number of successes during the Battle of France. On 13 May 1940, six GC II/2 MS 406s shot down six Messerschmitt Bf 110 twin-engine fighters in less than 20 seconds. Nine MS 406s claimed four Junkers Ju 88 bombers without loss to themselves on 5 June. Two notable successes occurred on 8 June, including the downing of three Bf 109s in 15 seconds of combat by *Capitaine* (Capt) Wuillame of GC I/2. The same day saw nine MS 406s of the same *Groupe* score nine confirmed victories against the loss of two of their aircraft.

The French lost approximately 300 MS 406s during the Battle of France, including 150 to Luftwaffe aircraft and anti-aircraft fire. The latter figure included approximately 50 Moranes downed by small arms fire during low-level operations against armored formations. The remaining 150 MS 406s were lost due to accidents or were rendered unserviceable during evacuations from airfields threatened by German ground forces. Frequent redeployments of fighter units from airfields under German threat resulted in disorganized repair and maintenance work. Their crews destroyed many MS 406s and other French aircraft to prevent them from falling into enemy hands. The *Armée de l'Air* lost 75 MS 406 pilots during this campaign, out of 144 French fighter pilots killed in the Battle of France.

Four Fighter Groups in Metropolitan France still flew the MS 406 when the Armistice with Germany became effective on 25 June 1940. (The Armistice was signed three days before at Rethondes in the forest of Compiegne.) Three Fighter Groups in North Africa and one in Syria also flew MS 406s. These units were part of the Armée de l'Air de l'Armistice, the air force of the Vichy French regime in unoccupied southern France. All MS 406 groups except GC I/7 at Rayak, Syria were disbanded in July and August of 1940. The Ecole de l'Air (Air School) at Salon-de-Provence retained some Moranes for advanced training, while Escadrons d'Entraînement (Training Squadrons) at Toulouse operated others into 1942.

On 10 June 1940, Italy declared war on France. The French High Command feared an Italian strike on the Suez Canal from the Libyan province of Tripolitania and ordered GC I/7 to deploy from Rayak, Syria to Ismailia, Egypt, along the Canal. Three MS 406s flew to Ismailia on 23 June; however, the Armistice with Germany became effective two days later and halted further redeployments from Rayak. The pilots who flew to Ismailia with their MS 406s joined the pro-Allied Forces Aériennes Françaises Libres (FAFL; Free French Air Force). These MS 406s were formed with other French aircraft into Groupe de Combat (GC; Combat Group) 2.

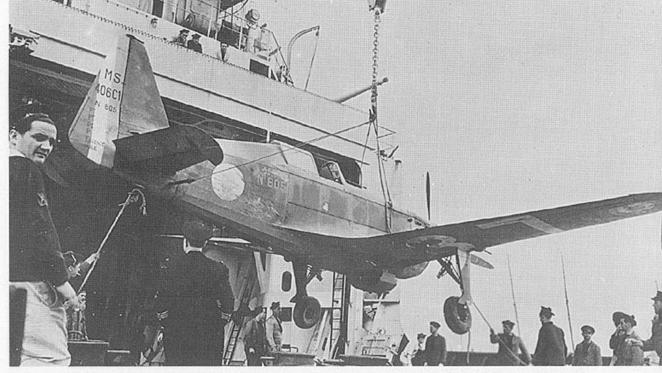
GC 2's Moranes flew with Royal Air Force (RAF) Gloster Gladiator and Hawker Hurricane fighters in the British campaign against pro-Axis Vichy French forces in Syria, which began on 8 June 1941. GC I/7 elements in Syria resisted the Allied forces and flew 591 operational sorties during the campaign. Vichy MS 406 pilots claimed two confirmed 'kills' and two probable victories over Allied aircraft. The campaign ended in victory for the British and Free French forces on 12 July. The RAF commandeered the surviving airworthy MS 406s of GC I/7. These fighters became the basic equipment of the Free French *Groupe de Chasse 'Alsace*,' which was established at Rayak on 15 September 1941.



This MS 406C1, White 7 (No 929) was flown by its pilot to Montpellier-Frejorgues in southern France in June of 1940. The pilot – retreating from the advancing German forces – abandoned the aircraft on the field after landing. Most MS 406s displayed their individual aircraft numbers on the fuselage instead of the vertical stabilizer during this time. Red lettering on the lower vertical stabilizer read S.N.C.A.O. above Bourguenais, FRANCE. (P. Rivière Collection)

An Armée de l'Air de l'Armistice MS 406C1 warms up its engine prior to take off from Toulouse in 1941. The aircraft was assigned to the Escadron d'Entraînement (Training Squadron) at Toulouse. All guns were removed and large white bands were painted around the fuselage and the wings. Vichy French aircraft had Red (FS31105) and Yellow (FS33538) cowl and tail stripes from 24 June 1941. (Via Merle Olmsted)





MS 406C1 No 805 was unloaded from the seaplane tender COMMANDANT TESTE at Beirut, Lebanon during the late summer of 1940. This aircraft was delivered from Vichy France to GC I/7 of the Armée de l'Air de l'Armistice, Vichy France's air force. The Group operated, from Rayak, Syria, from where it fought British and Free French forces in the summer of 1941. Lebanon and Syria – collectively, the Levant – were French colonies between the two World Wars. (ECA)

Three airmen pose beside an MS 406 (No 540) assigned to EC 2/596 at Tong, Indochina in 1941. The Group's flying dragon insignia was painted on the vertical stabilizer. The tail, except for the rudder, was red. Black service stenciling was applied to the lower rudder. The markings were, from top: PT (Poids Total; Total Weight), PE (Poids Equipage; Crew Weight), PC (Poids Carburant; Fuel Weight), P (Poids; Weight) ESSENCE (Gasoline), and HUILE (Oil). (J. Moulin)



#### MS 406 in Foreign Service

The Swiss government evaluated the MS 405 in late 1937 and acquired a manufacturing license for the aircraft. Two pattern aircraft designated MS 406H were ordered from Morane-Saulnier. This fighter was an MS 405 airframe powered by the MS 406's 860 HP Hispano-Suiza 12Y31 12-cylinder, liquid-cooled, inline engine. The first MS 406H was flown from Villacoublay, France to Switzerland on 11 September 1938, with the second aircraft following on 15 May 1939.

The Swiss assigned assembly of the license-built MS 406H – designated **D-3800** – to the *Eidgennössisches Flugzeugwerk* (EFW) at Emmen, Switzerland. The firm built 80 D-3800s (serial number J-3 to J-82) beginning in November of 1939. Two additional aircraft (J-83 and J-84) were later assembled from spare parts. These aircraft were delivered to three *Fliegerkompagnien* (Flight Companies) by April of 1940.

The 12Y31 engine's lack of power prompted the Swiss to fit the 1020 HP Sauer/SLC YS1 engine (an improved Hispano-Suiza 12Y51) in the D-3800. A fixed radiator replaced the D-3800's retractable radiator, while an armored windshield and minor structural strengthening was added. The new fighter was designated D-3801 and entered production in the fall of 1940. The initial contract for 100 aircraft – built by EFW, Dornier-Werke, and Pilatus – was fulfilled between 28 December 1940 and 19 June 1942. Ten more D-3801s were assembled from spare parts during 1943. A further 97 aircraft were built for the Swiss Air Force from September of 1944, which brought total production to 207 aircraft. The D-3801 remained in Swiss service

The first MS 406H – combining an MS 405 airframe with a 12Y31 engine – was delivered to Switzerland in September of 1938. The Swiss Flugwaffe (Air Force) assigned the number J-1 (Jagd; Combat) to this aircraft, which served with a second MS 406H as pattern aircraft for license production. The Chauvière propeller was later replaced by an Escher-Wyss V3 unit and the upper antenna mast was moved forward to the windshield. (Via P. Cortet)



for training and target towing until its final flight at Sion on 31 May 1959.

China ordered 12 MS 406s in 1938; however, the threat of war in Europe delayed this order and the fighters were built to French standards. One year later, 12 MS 406s were withdrawn from French air depots and shipped to Haiphong, French Indochina (now Vietnam, Cambodia, and Laos) for delivery to China. Only one or two MS 406s reached Kunming, China when World War Two began and the *Gouverneur Général de l'Indochine* (Governor-General of Indochina) impressed the remaining Moranes. These aircraft formed the nucleus of *Escadrille de Chasse* (Fighter Squadron) 2/596, established at Bach Mai in late October of 1940. It is not believed that China's MS 406s saw action against the Japanese.

Poland ordered 160 MS 406s in early 1939, with the first 50 aircraft scheduled for delivery by the end of August of 1939. Germany's invasion of Poland on 1 September prevented this delivery from occurring. The French delivered 30 MS 406s from *Armée de l'Air* stocks to neutral Turkey in February and March of 1940.

Finland's *Ilmavoimat* (Air Force) received 30 MS 406s during the winter of 1939-40, while the country was engaged in the 'Winter War' against the invading Soviet Union. Only one Morane was lost in combat against Soviet forces during this campaign. The Finns purchased 27 MS 406s and MS 410s from Germany in 1941, followed by 30 more MS 406s from Vichy France the following year.

Ilmavoimat pilots generally liked the MS 406 for its overall handling; however, the aircraft was most troublesome under the severe winter conditions found on the Finnish-Soviet frontier. Beginning in October of 1942, the Finns began upgrading their MS 406s to face the superior Soviet fighters deployed to the front. The State Aircraft Factory fitted an 1100 HP Klimov M-105P engine and a VISh-61P propeller – both captured by the Germans from Soviet aircraft – onto an MS 406 airframe. (The M-105P was developed from the Hispano-Suiza 12Y and retained the French engine's external dimensions.) The aircraft was also fitted with a Bf 109G oil cooler and was armed with a 20MM Mauser MG 151 cannon firing through the propeller hub.

The Finnish-modified MS 406 was named the *Mörkö Moraani* (Ghost Morane) and first flew on 4 February 1943. Test flights showed a center of gravity problem due to the heavier engine, but this was soon rectified. The M-105P engine gave the *Mörkö Moraani* a climb rate of 1500 m (4921.3 feet) per minute, compared to the standard MS 406's 1080 m (3543.3 feet) per minute climb rate. Maximum speed increased from 486 KMH (302 MPH) to 525 KMH (326.2 MPH) in the *Mörkö Moraani*, whose service ceiling went from 9400 m (30,839.9 feet) to 12,000 m (39,370.1 feet).

The Mörkö Moraani prototype's successful trials led to an Ilmavoimat decision to convert other MS 406s to this new configuration. The Valtion Lentokonetehdas (VL; State Aircraft Factory) at Tampere began the conversion work in August of 1943. Shortages of available 20mm MG 151 cannon led to their replacement by captured Soviet 12.7mm Berezin UB machine guns. The Mörkö Moraani prototype and two conversions saw considerable action before Finland's Armistice with the Soviets on 4 September 1944. Ilmavoimat MS 406 and Mörkö Moraani aircraft claimed 321 victories during Finland's 'Continuation War' (22 June 1941 to 4 September 1944). VL modified 38 additional MS 406s after the war to Mörkö Moraani standard and these served until 1952.

Croatia received 46 MS 406s from Germany in early 1943. The Wehrmacht (German Armed Forces) had captured these aircraft when the Germans occupied Vichy France in November of 1942.



This Swiss-built D-3801 (J-255) has the red and white high visibility markings adopted during the fall of 1944. These markings were intended to avoid confusion with belligerent aircraft. The D-3801 differed from the earlier D-3800 mainly by its fixed radiator, a new armored windshield, and hard points for light ordnance under the wings. (H. H. Stapfer Collection)

This Finnish MS 406 (8, MS-328) was loaned by 1 (Flight)/LeLv (Lentolaivue; Squadron) 28 to LeLv 34 in March of 1943. Temporary white winter camouflage was applied over part of the Olive Green (FS34096) and Black upper surfaces. The engine cowling and the aft fuselage bands were Yellow (FS33538), while five white 'kill' marks were painted on the lower vertical stabilizer leading edge. (H. H. Stapfer Collection)





A pilot sits in the cockpit of an Ilmavoimat (Finnish Air Force) MS 406 (MS-316) in early 1940. This was one of 30 MS 406s delivered to Finland during the 1939-40 'Winter War.' This fighter retained the French Khaki, Dark Brown, and Dark Blue Gray over Light Blue Gray camouflage. This Morane was fitted with Bronzavia flame damping exhaust stacks. (H. H. Stapfer Collection)

This Mörkö Moranni (MSv-633) was assigned to Hävittäjälentolaivue (Fighter Squadron) 21 at Rissala, Finland in March of 1945. The aircraft combined an MS 406 airframe with a captured 1100 hp Kimov M-105P engine. The powerplant increased this fighter's performance over the standard MS 406. Only three conversions were completed before Finland's Armistice with the Soviet Union on 4 September 1944. (Aulis Bremer)



#### Potez 630/631

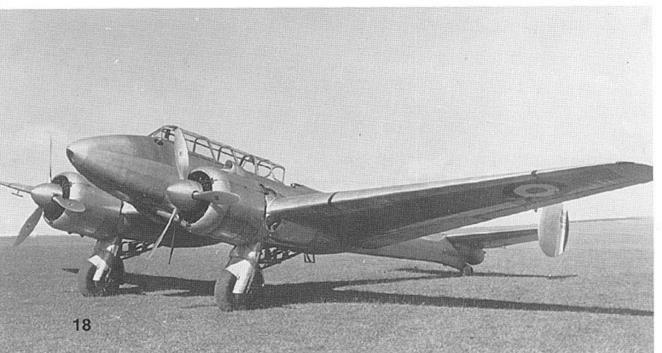
On 31 October 1934 the *Etat-Major de l'Armée de l'Air* (EMAA; French Air Force High Command) issued a specification calling for a twin-engine, two or three seat *multiplace léger de défense* (multipurpose fighter). This type of aircraft was to fulfill three specific missions: Fighter direction<sup>1</sup>, as a C3 (*Chasse* 3; Three-Seat Fighter); bomber escort, as a C2 (*Chasse* 2; Two-Seat Fighter); and, night fighting, as a CN2 (*Chasse Nuit* 2; Two-Seat Night Fighter).

The EMAA specification called for a maximum speed of 450 KMH (279.6 MPH) at 4000 M (13,123.4 feet), a climb to 4000 M in less than 15 minutes, and an endurance of over four hours. This aircraft would be armed with two 20MM Hispano-Suiza HS 404 cannon firing forward and one 7.5MM MAC 34 machine gun firing aft. EMAA suggested using either 450 HP Renault or Salmson in-line engines or 600 HP Hispano-Suiza or Gnome & Rhône radial engines.

Five manufacturers submitted proposals: Breguet (Br 690), Hanriot (H 220, later developed into the SNCAC NC 600), Loire-Nieuport (LN 20), Romano (Model 110), and Potez (Model 63). Potez's proposal included two variants: the Potez 630 with two 580 HP Hispano-Suiza 14 AB 10/11 engines, and the Potez 631 with two 670 HP Gnome & Rhône 14M6/7 engines. Both powerplants were 14-cylinder, air-cooled, radial engines.

Construction of the Potez 630-01 prototype began in April of 1935 and it made its first flight from Méaulte on 25 April 1936, with Fred Nicole at the controls. The aircraft was powered by two 580 HP Hispano-Suiza 14Hbs for its early test flights. It was originally fitted with a braced wooden horizontal stabilizer without dihedral. The Potez 630-01 was ferried to CEMA (Centre d'Essais du Matériel Aérien; Air Material Research Center) at Villacoublay for official Armée de l'Air evaluation on 3 August 1936. A new metal horizontal stabilizer with dihedral and a new landing gear with long-stroke shock absorbers was installed before flight testing resumed <sup>1</sup> Airborne command of single-seat fighter formations.

Potez 630 No 02 was the prototype of the CN2 (Chasse Nuit 2; two-seat night fighter) version. This aircraft was eventually delivered by SNCAN to CEMA at Villacoublay for night fighting experiments. The Potez 630-02 was powered by two 580 HP Hispano-Suiza 14AB 02/03 radial engines, with carburetor scoops mounted atop the cowling.



at the end of August. The Potez 630-01 was later flown to Cazaux for armament trials. It was retrofitted with two 700 HP Hispano-Suiza 14AB engines; however, the aircraft could not fly faster than 455 KMH (282.7 MPH). Nevertheless, test pilots were impressed by the aircraft's outstanding maneuverability.

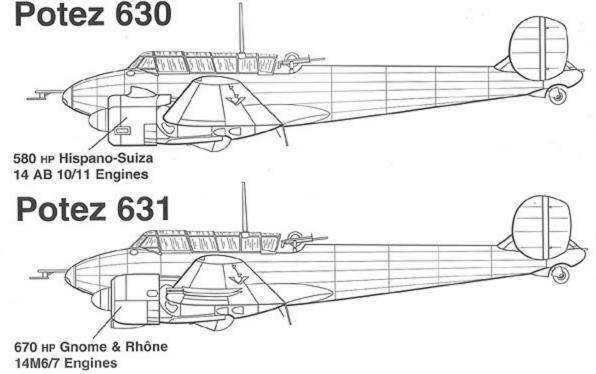
Nationalization of the French aircraft industry resulted in the Potez company being merged into the Société Nationale de Constructions Aéronautiques du Nord (SNCAN; National Aircraft Construction Company of the North) on 23 December 1936. In the meantime, construction began on the Potez 631-01, which was powered by two 700 HP Gnome & Rhône 14 Mars radial engines. Georges Detré piloted the aircraft on its maiden flight in March of 1937. The undercarriage did not lock down properly, resulting in the aircraft making a belly landing. The Potez 631-01 was soon repaired and turned over to CEMA at Villacoublay in November of 1937.

Successful testing of the two prototypes led to an order for ten evaluation aircraft: four Potez 630s, three Potez 631s (including the refurbished Potez 631-01), two Potez 633 B2 light bombers with a bomb bay, and one Potez 637 A3 reconnaissance aircraft with a ventral glazed gondola. One of the two Potez 633s was changed to a Potez 639 AB2 attack bomber.

Both the Potez 630 and Potez 631 were all-metal cantilever monoplanes. Both aircraft had identical external dimensions: a wingspan of 16 M (52 feet 5 15/16 inches), a length of 11.07 M (36 feet 3 13/16 inches), and a height of 3.62 M (11 feet 10 1/2 inches). The Potez 630 had an empty weight of 2808 KG (6190.5 pounds) and a loaded weight of 3850 KG (8487.7 pounds). Equivalent figures for the Potez 631 were 2450 KG (5401.2 pounds) and 3760 KG (8289.2 pounds), respectively. The Potez 630 had a maximum speed of 448 KMH (278.4 MPH) at 4000 M (13,123.4 feet), and a range of 1300 KM (807.8 miles). The Potez 631 could reach 442 KMH (274.7 MPH) at 4500 M (14,763.8 feet) and had a range of 1220 KM (758.1 miles).

The Potez 630 was armed with two 20MM cannon in the nose and one 7.5MM machine gun on a flexible mount in the aft cockpit. The Potez 631 retained these weapons, while adding two additional forward firing 7.5MM machine guns in the nose.

By June of 1937, the first letter of intent was issued to SNCAN for 40 Potez 631s, consisting of 30 three-seat fighters and ten two-seat conversion trainers. Insufficient output of engines from Gnome & Rhône resulted in an order for 80 Hispano-Suiza 14AB-powered Potez 630s at the same time. The letters of intent were replaced by formal contracts in December of 1937,



while an additional order was placed for 50 Potez 633 B2s.

SNCAN offered the Potez 63 series for export customers during 1937. Orders were soon placed by China (four 631 C3s and five 633 B2s), Greece (24 633 B2s), Rumania (20 633 B2s, later followed by 20 more aircraft), Switzerland (one 630 C3 and one 633 B2), and Yugoslavia (two 630 C3s and one 631 C3). The Czechoslovakian company Avia negotiated a production license for the **Potez 636** C3 variant, specifically for Czechoslovakian requirements. The Swiss order was the only one fulfilled before the outbreak of World War Two.

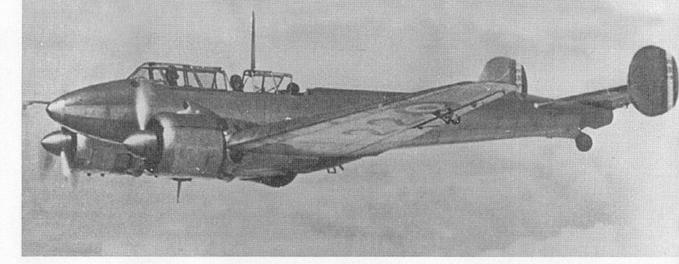
Full production of Potez 63 aircraft began in May of 1937 at three SNCAN factories: Caudebec (fuselage and tail), Le Havre (wings) and Méaulte (final assembly; later moved to Les Mureaux). The first production Potez 630 was rolled out at Méaulte in February of 1938, and made its first flight soon after. The *Armée de l'Air's Plan V* equipment plan – approved on 15 March 1938 – called for 207 Potez 631 three-seat day fighters (C3) and two-seat night fighters (CN2). *Plan V* also called for 449 Potez 633 light day bombers; however, this was later changed to Potez 631s.

SNCAN delivered the first Potez 63 series production aircraft (Potez 630 No 8) to the *Armée de l'Air* on 23 May 1938; however, the first aircraft formally handed over was Potez 630 No 5 on 2 August 1938. Shortages of engines, propellers, and cannon delayed production and deliveries of Potez 630 and 631s. Some early aircraft were armed with four machine guns instead of the two cannon as a temporary measure. *Plan V* called for 201 Potez 630/631 aircraft by 1 January 1939; however, only 45 630s and 27 631s were on charge at that date. An additional 74 aircraft were at the SNCAN factory awaiting engines. Production conditions slightly improved by 1 April, when 77 Potez 630s and 88 Potez 631s were accepted by the *Armée de l'Air*. These totals included 67 Potez 630 and 20 Potez 631s assigned to operational units; the remaining aircraft were used for training.

Six Potez 63 series C3 aircraft were assigned as fighter directors to each single-engine Fighter Wing (Escadre de Chasse). Two Groupes de Chasse de Nuit (GCN; Night Fighter Groups) – GCN III/1 and II/4 – replaced their ancient ANF-Les Mureaux 113s with Potez 630s and later with Potez 631s. GC II/8 replaced their obsolete Morane-Saulnier MS 225 and

The first Potez 631 prototype is parked on the hardstand at SNCAN's Méaulte factory during March of 1937. This aircraft retained the Potez 630's airframe while substituting two 670 HP Gnome & Rhône 14M Mars engines. Engine carburetor intake scoops were not yet fitted to the lower cowling. (Via G. Grod)



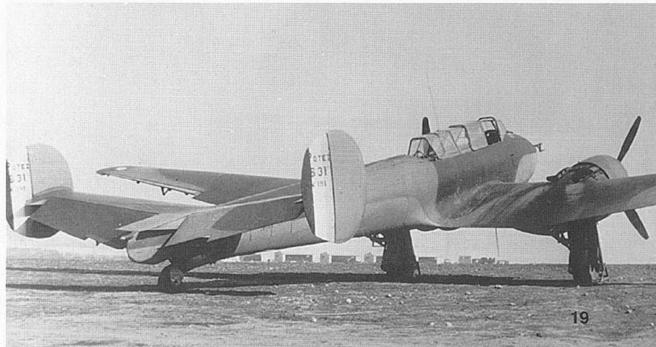


The tenth production Potez 630 (C-522) is airborne on a crew familiarization flight. This aircraft was a C3 (Three-Seat Fighter) version for in-flight fighter direction. The two aft crewmen opened their canopies, while the pilot's canopy was closed. Pre-war Potez 630s were delivered to operational units in bare metal with basic markings.

Dewoitine D.510 single-seat fighters with 18 Potez 631s. Four Potez 631s were delivered to the newly-formed GAM (*Groupe Aérien Mixte*; Mixed Air Group) 500 at Marignana. A similar flight was established in Djibouti in northeast Africa in August of 1939.

By August of 1939, the *Armée de l'Air* had 85 Potez 630s on charge, including 65 aircraft in first-line units. The French also had 206 Potez 631s on strength, with 117 in first-line units. The Potez 63 series aircraft equipped eight *Escadres de Chasse* (Fighter Wings), two *Groupes de Chasse de Nuit*, one *Groupe Aérien Mixte*, and detachments in Djibouti and Tunisia.

A late production Potez 631 (No 191, military registration X-960) is parked after delivery from SNCAN to an Armée de l'Air unit in 1939. The upper surfaces were Khaki, Dark Brown, and Dark Blue Gray over Light Blue Gray undersurfaces. No roundels were painted on the fuselage sides at this time and 30 cm (11 13/16 inch) diameter roundels were placed on the upper wing tips.



#### Potez 63 Series Fighters in Combat

On 28 August 1939 – four days before World War Two began – Escadrille de Guet (EG; Warning Squadron) I/16 was formed at Clermont-les-Fermes. The unit was formed with two Potez 630s and ten Potez 631s taken from six Groupes de Chasse. EG I/16 was redesignated Escadrille de Chasse Multiplace (ECM; Multiplace Fighter Squadron) I/16 on 29 January 1940. Twelve Potez 631s were assigned to Escadrille de Chasse de Nuit (ECN; Night Fighter Squadron) 2/562 on its establishment on 16 October 1939. This unit was redesignated ECN 5/13 on 18 January 1940. The two Night Fighter Groups assigned to defending Paris were split into four independent Escadrilles (ECNs). Potez 631s detached from these Squadrons deployed to Melun-Villaroche for operational training on various night interception techniques; however, these techniques proved ineffective in service.

In February of 1940, the Potez 630/631 flights assigned to GCs were disbanded. The Potez 630s were converted to dual-control training aircraft, while the Potez 631s were reassigned to the ECNs. The *Armée de l'Air* decided to upgrade the Potez 631's armament by adding four 7.5MM MAC 1934 machine guns under the wings and to install two 20MM Hispano-Suiza HS 404 cannon in the noses of all aircraft. Only two Potez 631s had received this upgrade by 10 May 1940, when German forces invaded Western Europe.

Eight Potez 631s were assigned to the 1st Escadrille de Chasse AC1¹ of the Aéronavale (Aéronautique Navale; French Naval Aviation) in early 1940. These aircraft replaced obsolete Dewoitine D.376 parasol fighters. SNCAN delivered 17 additional Potez 631s to the Aéronavale the following spring, which were used to form Escadrille AC2. The aircraft were released from GC II/8, which was converting to Bloch 152 single-seat fighters.

The Armée de l'Air had 75 Potez 631s assigned to six ECNs on 10 May 1940; this total <sup>1</sup> AC was the Aéronavale code for Avion. Chasse embarquee (Shipboard Fighter, Wheeled Undercarriage).

A Potez 633B2 (two-seat bomber), R29, flies a training mission during 1939. This Potez 631 variant had a central bomb bay placed between the pilot and rear gunner, which could carry up to eight 50 kg (110.2 pound) bombs. Two Gnome & Rhône 14 Mars engines powered this Potez 63 series variant. SNCAN produced 71 Potez 633B2s for the Armée de l'Air.



included 53 serviceable aircraft. The Aéronavale had Flottille (Flotilla) F1C, with Escadrilles AC1 and AC2, at Calais-Marck.

Night alert missions began on 11 May, but did not succeed in downing a German aircraft over the next week. The French high command decided to use the Potez 631 night fighters on daylight attack missions against German armored columns. The first attack mission occurred on 17 May, when 18 Potez 631s attacked Wehrmacht units in the Fourmies area. Six of the French aircraft were lost to German anti-aircraft fire. One day later, an ECN 1/13 Potez 631 intercepted and shot down a Heinkel He 111 bomber for the first victory scored by an ECN aircraft.

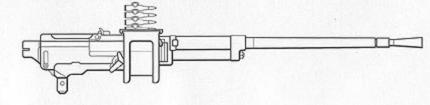
The similar appearance of the Potez 630/631 to the Messerschmitt Bf 110 resulted in several 'friendly fire' casualties among Potez units. On 18 May, *Adjudant* (Warrant Officer) Martin's Potez 631 from ECN 2/13 was hit by two German aircraft, French anti-aircraft fire, and was finally downed by an MS 406. He was able to return to base after the incident. Five days later, three Bloch 152s downed a Potez 631. This resulted in an *Armée de l'Air* directive of 24 May, which specified 4 M (13 foot 1 7/16 inch) long white stripes on the fuselage sides of Potez 631s. These aircraft also had their fuselage roundels increased in size and outlined in white.

SNCAN delivered the first Potez 631 with upgraded armament (four wing-mounted 7.5MM machine guns) to ECN 4/13 on 28 May. The first operational missions of these aircraft were flown by ECN 5/13 on 1 June. This Squadron was assigned to defend the Lyon-Saint Etienne-Le Creusot area of southeast France. Several He 111s were intercepted, but none were shot down; however, one Potez 631 was downed by French anti-aircraft gunners. The night fighter units retreated south of the advancing Germans from 20 June. The five ECNs scored four confirmed victories and eight probable victories during the Battle of France. Ten Potez 631s were lost to enemy action and three were victims of 'friendly fire.' The most successful Potez 631 unit during this battle was *Flottille* F1C, which destroyed 12 German aircraft over the North Sea while losing eight of their own fighters.

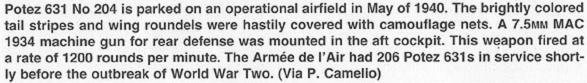
When France's Armistice with Germany was signed on 22 June 1940, 32 Potez 630s and 112 Potez 631s were deployed in the Free (unoccupied) Zone of France and 53 other aircraft were based in North Africa. The Germans allowed a few Potez 631 units to remain active. When the Germans invaded the Free Zone (Vichy France) on 13 November 1942, they captured 134 Potez 63s of all variants. Several of these were refurbished and delivered to the Royal Rumanian Air Force.

The last Potez 63 series fighters to see action were three Potez 631s recaptured from the Luftwaffe by the Forces Françaises de l'Intérieur (FFI; French Interior Forces) in September of 1944. They were assigned to the FFI's Groupe de Reconnaissance III/33 'Périgord.' GR III/33 flew reconnaissance missions over German strongholds in the Royan area (the 'Atlantic pocket') of southeast France. After the war, the three Potez 631s were used by the Centre d'Essais en Vol (CEV; Flight Research Center) at Brétigny-sur-Orge for training and as platforms for rocket tests. Total production of the Potez 63s through 1940 came to 88 Potez 630s and 215 Potez 631s.

#### 7.5мм MAC 1934 Machine Gun







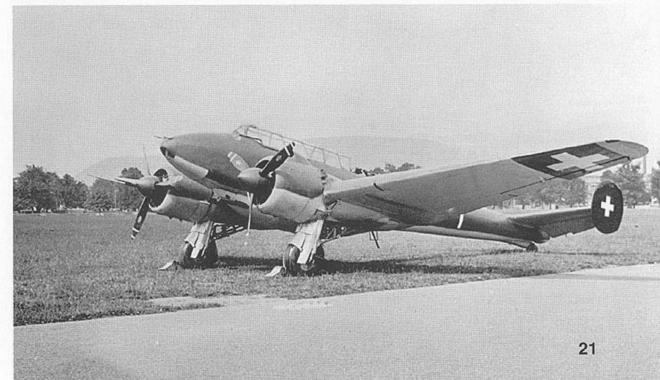
Potez 631 No 181 was assigned to ECN I/13 in the Vichy Air Force. This aircraft retained the recognition markings adopted to avoid confusion with the visually similar Messerschmitt Bf 110. On 24 May 1940, all Potez 631s were marked with a white stripe along the fuselage side, while the fuselage roundel was increased in diameter and outlined in white. Vichy tail and cowl stripes were red and yellow.





Two officers stand before an Escadrille de Chasse de Nuit (Night Fighter Squadron) I/13 Potez 631CN2 – missing its propeller spinners at Nîmes-Courbessac. ECN I/13 was assigned to the Vichy Groupement de Chasse (Fighter Grouping) 23 in 1941. The Squadron insignia – a black bat on a yellow disc – was painted on the nose. Blue, white, and red diagonal wing bands were painted on Vichy aircraft from December of 1941. The Germans ordered red and yellow cowl and tail stripes on Vichy aircraft; however, the apparent replacement port cowl had not yet been painted with the stripes.

One Potez 630 C3, B-1 (Bomber), was delivered to the Swiss Air Force in early 1939. A Potez 633 B2, coded B-2, was flown to Switzerland at the same time. Both Potez aircraft were armed with Swiss manufactured 7.45mm FI Mg 29 machine guns. Upper surfaces were painted Dark Green (FS34050), while undersurfaces were Light Blue (FS35352). (H. H. Stapfer)



#### **Bloch 151/152**

Avions Marcel Bloch designer Maurice Roussel designed the Bloch 150 as a private venture to meet the 1934 C1 specification by the STAé (Service Technique Aéronautique; Aeronautical Technical Service). This all-metal, low wing cantilever monoplane was powered by an 850 HP Gnome & Rhône 14 Kfs 14-cylinder, air-cooled, radial engine. Prototype construction began at Bloch's Courbevoie plant in 1935 and was completed in early 1936. The Air Ministry's preference for the Morane-Saulnier MS 406 slowed the Bloch 150's development into 1937. The 1936 nationalization of France's aircraft industry saw Avions Marcel Bloch joining Société Nationale de Constructions Aéronautiques du Sud-Ouest (SNCASO; National Aircraft Construction Company of the Southwest).

In 1937, Bloch 150 development resumed and the prototype was sent from Courbevoie to the Centre d'Essais du Matériel Aérien (CEMA; Air Material Test Center) at Villacoublay. Test pilot André Curvale flew the prototype on its maiden flight from Villacoublay on 4 May 1937. The aircraft experienced ground handling problems and was fitted with a new Messier undercarriage. This landing gear caused a slight redesign of the wing, increasing its wing area from 15 M² (161.5 square feet) to 15.35 M² (165.2 square feet). The modified Bloch 150 flew again on 29 September 1937, but its engine showed a lack of power. The aircraft was returned to Courbevoie to receive an 890 HP Gnome & Rhône 14N-07 radial engine. The Bloch 150 was returned to CEMA for further tests in February of 1938. The aircraft was refitted at Villacoublay with an 1135 HP Gnome & Rhône 14N-21 radial engine, which offered improved cooling and lubrication.

The Bloch 150 was modified with a new wing center section in the late summer of 1937. Wing modifications were needed for the new Messier landing gear, which retracted into wells fitted ahead of the wing torsion box. The prototype was unarmed, although 20мм cannon fairings were installed on the wing leading edges. (G. Botquin)



MS 406 production delays resulted in heightened Aviation Ministry interest in the Bloch fighter. The Ministry awarded two contracts to SNCASO on 7 April 1938. One was for 25 preproduction Bloch 150s with an option for 450 additional aircraft. The other contract was to develop three prototypes, each equipped with Gnome & Rhône 14P, Hispano-Suiza 14Aa, and Pratt & Whitney Twin Wasp engines.

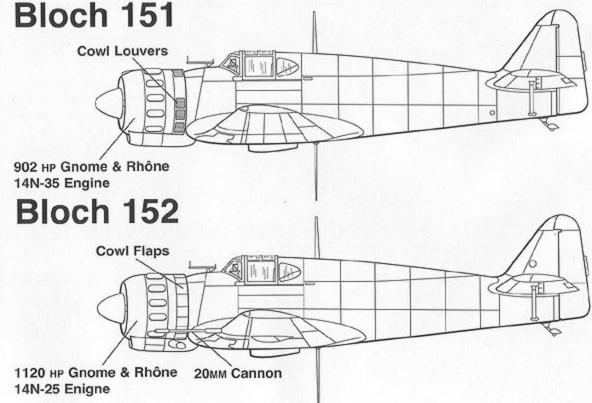
The Bloch 150 was designed to fly at 550 kmH (341.8 MPH); however, testing soon revealed engine cooling problems that prevented the aircraft from approaching this speed. Armament tests with the two wing-mounted 20MM Hispano-Suiza S9 cannon proved more successful. Bloch designer Lucien Servanty's team redesigned the Bloch 150 airframe to rectify performance shortfalls and make it more suitable for mass production. This effort led to a new aircraft, designated Bloch 151. It retained the Bloch 150's general appearance, but featured a new wing with 5°20 minute dihedral (upward angle). The fuselage retained a semi-monocoque¹ structure, with an aft section made into two vertical halves bolted together. The Bloch 150's tail wheel was replaced by a tail skid.

The Bloch 151 had a wing span of 10.54 M (34 feet 6 15/16 inches), a length of 9.11 M (29 feet 10 10/16 inches), and a height of 3.64 M (11 feet 11 5/16 inches). The aircraft weighed 2073 KG (4570.1 pounds) empty and 2522 KG (5560 pounds) fully loaded. Its maximum speed at 2600 M (8530.2 feet) was 437 KMH (271.5 MPH). The Bloch 151 had a range of 640 KM (397.7 miles).

The Bloch 150's two 400 L (105.7 gallon) wing fuel tanks were replaced by one fuselage-mounted 415 L (109.6 gallon) fuel tank on the Bloch 151. All controls surfaces were metal covered, instead of the fabric-covered surfaces commonly used on aircraft during this period. The Bloch 151's original powerplant was the 910 HP Gnome & Rhône 14N-11 14-cylinder, aircooled, radial engine. The engine was mounted 2.5° to port to counter engine torque. The 14N-11 turned a three-bladed, variable pitch Chauvière propeller. Two 20MM S9 cannon and two 7.5MM MAC 1934 machine guns were mounted in the wings.

The first production Bloch 151 made its maiden flight from Villacoublay on 18 August 1938,

<sup>1</sup>Semi-monocoque airframes carry part of the aerodynamic load by its frame/stringer combination and part by the aircraft's skin.



with Rodolphe Blanc at the controls. The contractor's test results caused SNCASO to make several modifications to the aircraft. The engine mount was lengthened to move the center of gravity forward, the horizontal stabilizers were enlarged, and a Gnome & Rhône propeller was fitted. Flight tests at CEMA began on 8 September 1938, which resulted in a new rudder, a modified oil cooler, and other modifications to the Bloch 151.

The French government amended its 7 April 1938 contract with SNCASO for 475 Bloch 151s, reducing this order to 432 aircraft in three batches. The first production batch consisted of 144 Bloch 151s powered by the Gnome & Rhône 14N-35 engine. The 288 remaining aircraft were of an improved machine, designated Bloch 152. The Bloch 152 order was split between 144 aircraft with 14N-25 engines and 144 with 1120 HP 14N-49 engines.

The Bloch 152 retained the basic construction of the earlier Bloch 151. The newer fighter had a wingspan of 10.57 M (34 feet 8 1/8 inches), a .03 M (1 1/8 inch) increase over the Bloch 151. This increased the wing area from 17.21 M² (185.3 square feet) to 18.17 M² (195.6 square feet). The wing dihedral remained at 5°20 minutes; however, the Bloch 152's horizontal stabilizers received a 1°20 minute dihedral. These aerodynamic refinements improved low-speed characteristics and reduced drag compared to the Bloch 151. The Bloch 151's length of 9.11 M (29 feet 10 11/16 inches) and height of 3.64 M (11 feet 11 1/4 inches) were retained on the Bloch 152. The new fighter weighed 2298 KG (5066.1 pounds) empty and 2706 KG (5965.6 pounds) fully loaded.

Rodolphe Blanc flew the Bloch 152 prototype (No 433) on its first flight from Villacoublay on 15 December 1938. This aircraft was retrofitted with an 1120 HP 14N-25 engine and a four-bladed fixed pitch Chauvière 5414 propeller in January of 1939. The Bloch 152 reached 530 KMH (329.3 mph) in level flight during tests at CEMA in February. Weak climb performance led to tests using other propellers, eventually settling on the three-bladed, variable pitch Chauvière 371propeller. Engine cooling problems resulted in trials using various exhaust systems and cowlings with different aperture diameters. This problem was never fully solved on the Bloch 152, which used various cowlings during production. The production fighter had a maximum speed of 500 KMH (310.7 MPH) at 5500 M (18,044.6 feet). The Bloch 152's service ceiling was 10,000 M (32,808.4 feet) and its range was 580 KM (360.4 miles).

The wing-mounted armament consisted of two 20MM Hispano-Suiza HS 404 cannon with 60 rounds per gun and two 7.5MM MAC 1934 machine guns with 500 rounds per gun. The Bloch 152 was fitted with either the Baille-Lemaire GH 38 or the OPL R-39 reflector gun sights. French pilots commonly called the R-39 *La Lanterne* (the Lantern).

Bloch's new fighter was stable along the three axes (pitch, roll, and yaw), although lateral stability was marginal during low speed turns. The aircraft displayed unwanted reactions when the undercarriage and flaps were lowered. It was easy to fly; however, the controls were slightly heavy. The Bloch 152 had good stall characteristics with no tendency to spin. It could turn tighter than a Dewoitine D.520, but not as tightly as the Morane-Saulnier MS 406. The Bloch fighter was a stable gun platform when it fired its 20MM cannon.

#### **Bloch 151/152 Production and Deliveries**

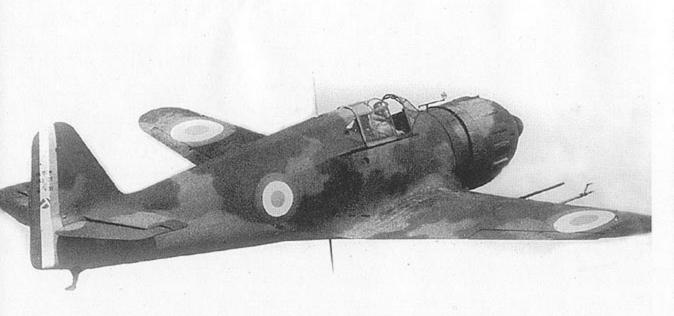
Bloch 151 and 152 production was split among several SNCASO plants: Châteauroux-Déols (fusclages), Bordeaux-Mérignac and Suresnes (wings), and Rochefort-sur-mer (tail assemblies). Final assembly of the first 19 aircraft was split between Courbevoie and Châteauroux-Déols. Aircraft 20 through 500 were assembled at Bordeaux-Mérignac (odd-numbered) and



Rodolphe Blanc flew the Bloch 151-01 on its maiden flight from Villacoublay on 18 August 1938. The original cowling fit closely over the engine, with fairings placed over the rocker arms. Engine overheating problems resulted in changes to the cowling shape. The cockpit was placed well forward on Bloch 150 series fighters. (Sud Aviation)

This Bloch 151 (No 75, Y-562) was assigned to GC III/10 at Le Havre-Octeville in January of 1940. The military registration was black on the wing undersurfaces. The pitot tube was mounted on the starboard wing of production Bloch 151s; this tube was placed on the prototype's port wing. The wing flaps fully lowered when hydraulic power bled off after flight. (S. Joanne)





The Châteauroux-Déols-built Bloch 152 No 501 was the first truly combat capable production aircraft. In April of 1940, it made a reception flight at the CEMA (Air Material Research Center), located at Orléans-Bricy. The red and white SNCASO emblem was painted on the rudder below the black designation and construction number. SNCASO produced 488 Bloch 152s between December of 1938 and June of 1940. (M. Marrand)

A Bloch 152 rests in the dispersal area of a French airfield during the spring of 1940. Production difficulties resulted in only 48 Bloch 151 and 137 Bloch 152 fighters being taken into Armée de l'Air service by 1 May 1940. Only 121 of these 185 fighters were fully operational. The French had 584 fighter aircraft available for combat from the 825 total fighters on strength at the time. (J. Cuny)

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Châteauroux-Déols (even-numbered). From aircraft No 501 in January of 1940, the Châteauroux-Déols plant assembled all other Bloch 151s, while the Bordeaux-Mérignac facility concentrated on producing the Bloch 174 twin-engine reconnaissance aircraft. Components shortages resulted in 61 of the 696 Bloch 152s ordered not being completed.

The Armée de l'Air officially accepted its first Bloch 152 (No 4) on 7 March 1939. Nine more aircraft were accepted by mid-May for operational tests by CEMA and the Centre d'Expériences (Test Center) at Rheims. An Escadrille d'Expérimentation (Test Squadron) was formed on 1 July 1939 and deployed from Rheims to Orléans-Bricy. SNCASO produced 249 Bloch 151/152s by France's entry into World War Two on 3 September 1939; the Armée de l'Air had officially accepted 123 of these aircraft into service. Many Bloch fighters were grounded due to lack of propellers, radios, or armament, while a few aircraft were fitted with four-bladed fixed-pitch wooden propellers. Operational tests demonstrated continuing engine cooling problems. This resulted in a new cowling with a 0.85 M (2 foot 9 7/16 inch) diameter opening and manually-operated cowl flaps. The cowling was standard on new production Bloch 152s and was retrofitted to existing aircraft. The Bloch 151s were assigned to training and home defense units, due to their disappointing performance.

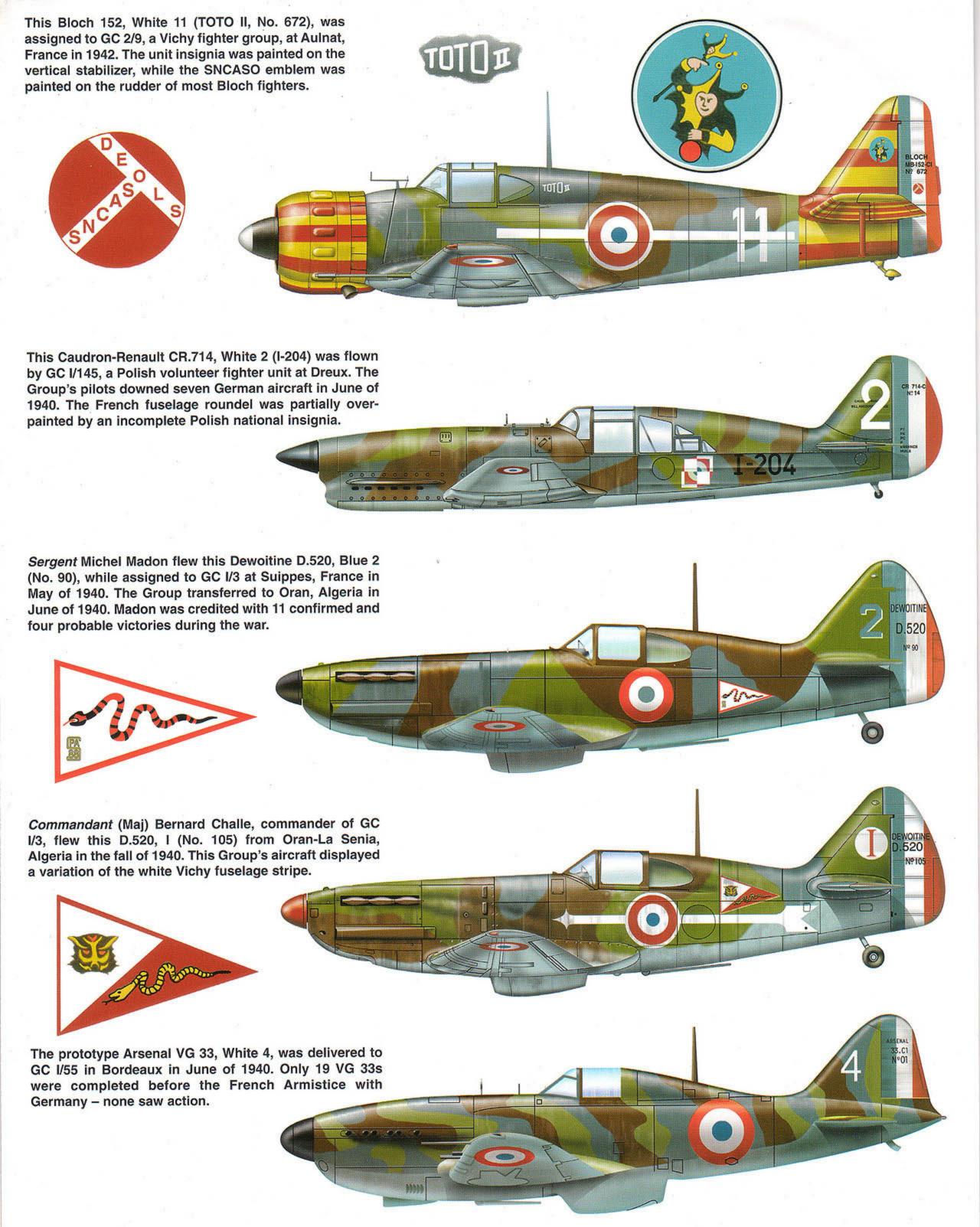
Additional modifications were required for the Bloch152s to be declared bon de guerre ('good for war'; i.e., serviceable). These included a downward-blowing exhaust collector with heating air for the carburetor and wing guns, a semi-recessed oil cooler, and mechanical main landing gear lock. Shortages of 20MM cannon led to priority given to Bloch 152s, with most Bloch 151s being armed with four 7.5MM machine guns.

Production difficulties resulted in the *Armée de l'Air* having only 140 Bloch 151s and 363 Bloch 152s in service on 10 May 1940 – the day Germany invaded the Netherlands and Belgium. These totals included 37 Bloch 151s and 93 Bloch 152s at fully operational status.

Two mechanics warm up the 1000 HP Gnome & Rhône 14N engine of a GC II/6 Bloch 152. The Groupe converted from MS 406s to Bloch 152s in May of 1940. This aircraft was nicknamed BALEK (Arabic for 'Go away') on the fuselage aft of the cockpit. Arabic mottoes were given to several Bloch 152 of GC II/6, which was based at Anglure-Vouarces during that month. (A. Duvernoy).



Sergent-Chef (Chief Sergeant) Pierre Le Gloan flew this Morane-Saulnier MS 406, White 6 (No. 597, L536) for GC (Groupe de Chasse; Fighter Group) III/6 from Chartres, France. On 23 November 1939, Le Gloan shot down a Do 17P for the first of his 18 confirmed victories during World War Two. White 1 (No. 307/N719) was an MS 406 flown by Capitaine (Capt) Pierre Pouyade when he commanded Escadrille de Chasse (EC; Fighter Squadron) 2/595. The Vichy French unit was based at Tong, French Indochina in June of 1941. The Finnish Air Force's LeLv (Lentolaivue; Squadron) 34 flew this MS 406, Black 8 (MS-328) from Vitti, Finland in March of 1943. Five white 'kill' marks were painted on the vertical stabilizer leading edge. Black 204 was a Potez 631 (No. 204) assigned to Escadrille de Chasse Multiplace du Jour (ECMJ; Multiseat Day Fighter Squadron) 1/16 in May and June of 1940. The Squadron operated from Nimes during the Battle of France. The 3rd Escadrille of GC II/1 was assigned this Bloch 152, White 3 (No. 306), at Buc in May of 1940. GC II/1 pilots downed 24 confirmed Luftwaffe aircraft during the Battle of France.

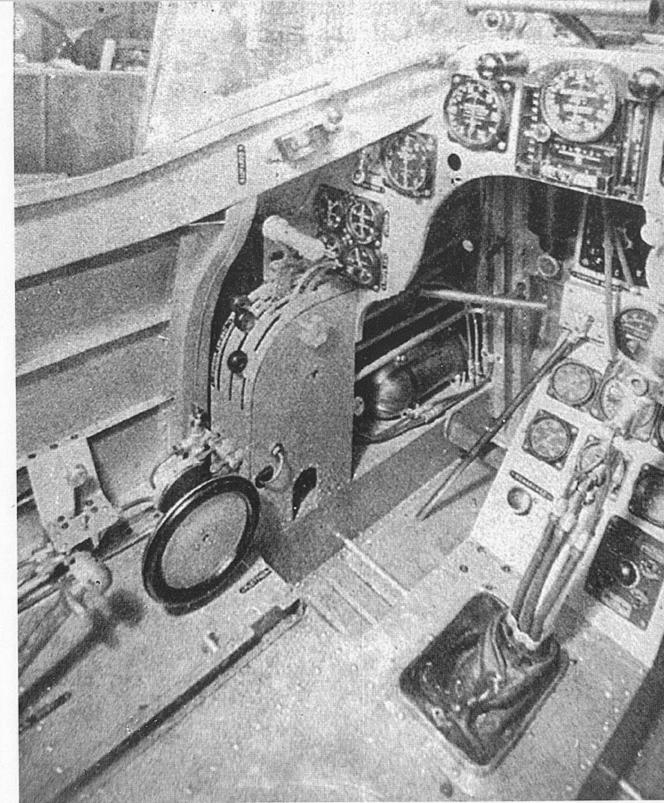




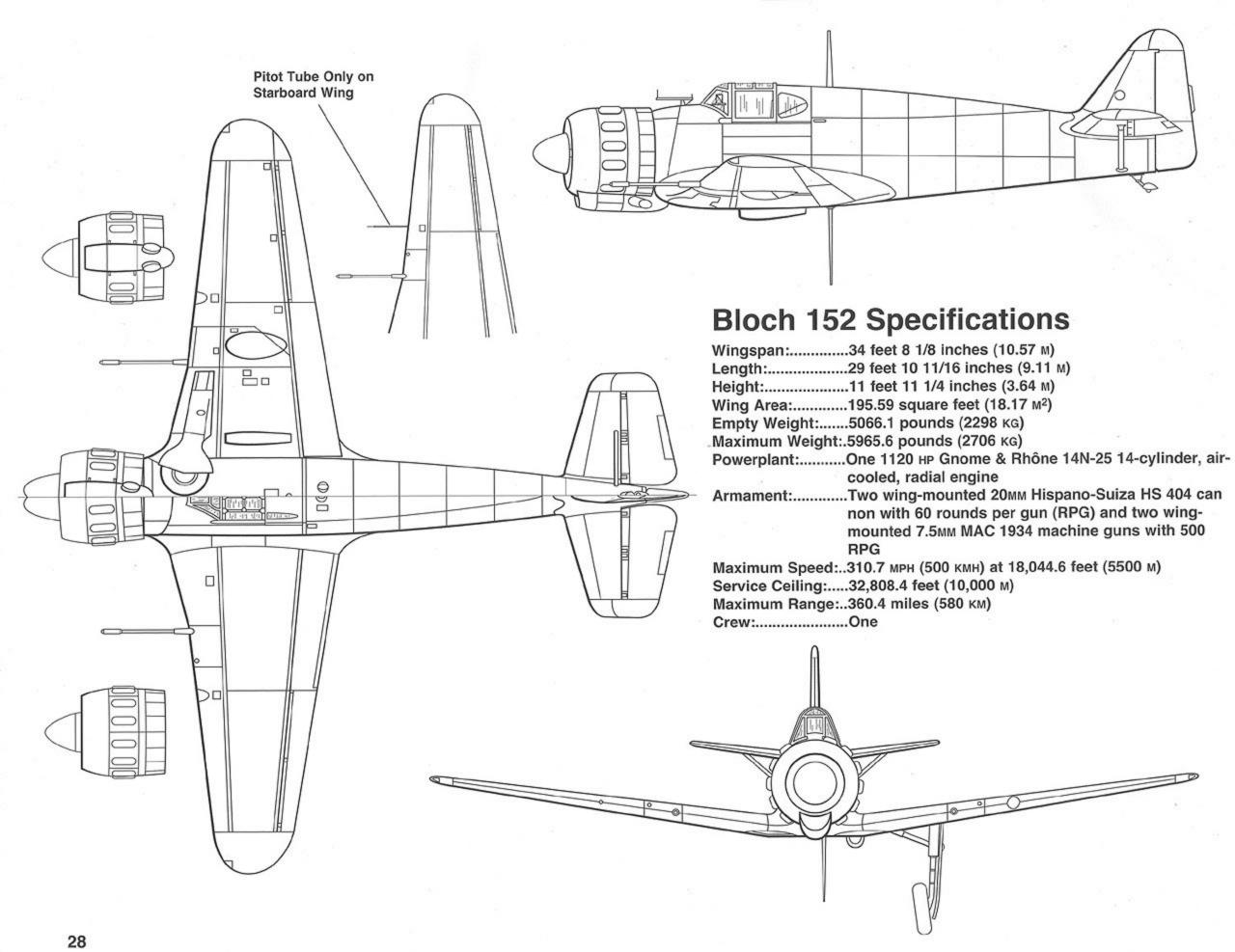
This Bloch 152 was equipped with the definitive engine cowling, which had an 85 cm (33 7/16 inch) diameter front opening for engine cooling. The cowling also included inclined exhaust pipes on both port and starboard sides. Pilot-controlled cowl flaps fitted to the aft cowling section allowed heated air to escape the cowling. Despite these measures, engine overheating remained a major problem for the Bloch 152 throughout its service career.

A pilot sits in the cockpit of a Bloch 152 prior to takeoff. This aircraft was equipped with the Baille-Lemaire GH-38 reflector gun sight, which was mounted atop the instrument panel. Small lights are projected from the gun sight base onto an angled piece of glass, which enabled the pilot to aim at fast moving targets. Some Bloch 151/152s were equipped with the OPL gun sight, nicknamed La Lanterne (the Lantern). A ring-and-bead auxiliary gun sight mounted ahead of the windshield was used in case the reflector sight failed.





The Bloch 152 throttle was mounted on a curved console along the port cockpit wall, immediately aft of the instrument panel. Pilots pulled aft on French throttles to increase power, in the opposite manner of most aircraft throttles. The Bloch 152 cockpit was well instrumented, but many indicators were hard to read. This included several instruments placed on the center console, forward of the control stick. French aircraft interiors were Protective Green (FS14108) with black instrument bezels. Seat belts and shoulder harnesses were tan with silver buckles.



#### Bloch 151/152 in Combat

The first operational Bloch 152 unit was *Groupe de Chasse* (GC; Fighter Group) I/1 at Chantilly, which received its first three aircraft on 3 October 1939. Only 35 of 162 Bloch 152 delivered had the standard three-bladed Chauvière propeller. Gnome & Rhône propellers were fitted to 40 machines, while another 40 aircraft had fixed-pitch wooden propellers. Forty-seven Bloch 152s lacked propellers. GC I/1 was fully equipped with 25 Bloch 152s by the end of October, followed by GC II/1 and GC I/8 by the end of 1939. SNCASO delivered 274 Bloch 152s by 10 January 1940; however, only 88 of these were operational. The first fully operational Bloch 152 direct from the factory was finally delivered to the *Armée de l'Air* on 5 March 1940. The French Air Staff considered these machines the only Bloch 152s suitable for combat.

Seven Groupes de Chasse were equipped with Bloch 151s and 152s on 10 May 1940, when German forces attacked Western Europe. These units had a total of 55 Bloch 151s and 140 Bloch 152s, but only 26 Bloch 151s and 75 Bloch 152s were serviceable. The Blochs were immediately thrown into battle alongside other French fighters against the Germans. The Bloch 152's short-comings soon became apparent in combat against the Luftwaffe. The aircraft could neither fly fast nor rapidly climb. It had a short range of only 580 km (360.4 miles) and both its radio equipment and variable-pitch propellers were unreliable. The Bloch 152's positive qualities included its maneuverability, its two wing-mounted 20mm cannon, and its ability to take heavy punishment and continue flying. On one occasion, a Bloch returned to base with at least 360 bullet and cannon shell holes scattered over its airframe.

Bloch 151/152 pilots claimed 146 German aircraft shot down during the Battle of France, with 34 probable victories. These 'kills' included 44 Messerschmitt Bf 109s, 25 Bf 110s, 33 Dornier Do 17 bombers, and 28 Heinkel He 111s. Nearly 270 Bloch 151s and 152s were lost to combat or abandonment to the enemy. Casualties among Bloch pilots totaled 40 killed and 42 wounded.

Two more Fighter Groups transitioned to Bloch 152s during the Battle of France, bringing the total to nine *Groupes de Chasse* with 152 aircraft on 5 June 1940. Additionally, eight *Escadrilles Légères de Défense* (Light Defense Squadrons) flew 34 Bloch 151s and 152s. These units were assigned to protect aircraft plants against Luftwaffe bombers. Two *Aéronavale* (French Naval Aviation) squadrons, *Escadrilles* AC3 and AC2, converted to Bloch 152s in April and May of 1940, respectively. *Esc.* AC3 pilots scored six victories against Italian aircraft during June.

Bloch pilots were left stranded in Metropolitan France when the Armistice with Germany took effect on 25 June 1940. Only four AC3 pilots were able to cross the Mediterranean to Bone, Algeria, via Corsica at that time. The Free Zone of Vichy France had 320 Bloch fighters (51 Bloch 151s, 260 Bloch 152s, and nine new Bloch 155s) on strength on 20 July. These aircraft formed the backbone of the Armée de l'Air de l'Armistice (Vichy French Air Force), operated by six Groupes de Chasse. An Aéronavale unit at Saint Raphaël flew three Bloch 152s. The Germans captured all 173 surviving Blochs when they invaded Vichy France on 13 November 1942. Several Bloch 152s were used by the Luftwaffe as advanced trainers and for local fighter duties with 2.(Staffel/Squadron)/JG 100 (Jagdgeschwader/Fighter Wing) and other units. Approximately 20 Blochs were sent to Romania, but further details on their use are unknown.

Greece ordered 25 Bloch 151s in late 1939, but only nine were delivered between late April of 1940 and the Armistice. These fighters were assigned to No 24 Squadron from Thriassion Eleusinos; however, additional details on their operational service are unknown.

Two Bloch 152s – No 639 and an unidentified aircraft – survived World War Two and were briefly operated by the *Centre d'Essais en Vol* (CEV; Flight Test Center) at Brétigny in 1947. A fairly damaged Bloch airframe was salvaged from the La Courtine military gun range during the 1990s. The airframe was taken to a storage facility operated by the French *Musée de l'Air et de l'Espace* (Air and Space Museum); however, it was complete destroyed by a fire at the facility.



This Bloch 151 was painted in the typical French mottled camouflage scheme used early in World War Two. The upper surfaces were Dark Blue Gray (FS36176), Khaki (FS24087), and Dark Brown (FS20117); undersurfaces were Light Blue Gray (FS25189). All camouflage colors were separated by soft edges. Upper wing roundels measuring 30 cm (11 13/16 inches) in diameter were authorized from September of 1938 until September of 1939, although larger roundels were slow to appear. No fuselage roundels or unit markings were painted on this aircraft. (M. Cristescu)

Ground crewmen placed canvas covers on the engine cowling and canopy of this GC III/10 Bloch 151 (Y-562, No 75) in January of 1940. The fighter group was based at Le Havre-Octeville, near the English Channel. The French Air Ministry ordered 144 Bloch 151s in April of 1938; however, only 140 were built, including 25 for the Aéronavale (French Naval Aviation). (S. Joanne)





This Bloch 152 (White 1, No 359) was flown by Capitaine Canel of the 3rd Escadrille (Squadron) of Groupe de Chasse (GC; Fighter Group) II/9 (9th Escadre/Wing). Commandant (Maj) Rollet led GC II/9 when they re-equipped with the Bloch 152 in May of 1940. The unit was credited with 16 confirmed victories over German aircraft during the Battle of France. These 'kills' included six Hs 126s, five Do 17s, two He 111s, two Bf 109s, and one Do 215.

This Bloch 152, White 1, was assigned to the 3rd Escadrille of GC II/8 at Calais-Marck. The Squadron's blue shark insignia was placed immediately aft of the canopy, although this was hardly discernible against the camouflage. The three-tone upper surface camouflage scheme varied in pattern among Bloch fighters produced during 1939-40. (CAC)



White 3 was a Bloch 152 assigned to the 3rd Escadrille of GC II/1 at Buc in the spring of 1940. The Squadron insignia was painted on the vertical stabilizer. GC II/1 was one of the top scoring Bloch units during the Battle of France. Their 24 confirmed victories included seven Bf 109s, four Bf 110s, four He 111s, three Do 215s, three Hs 126s, two Ju 87s, and one Do 17. The Bloch 151/152 fighters used a tail skid in place of the Bloch 150's tail wheel. (M. Cristescu)

Several Bloch 152s of GC II/9's 3rd Escadrille are parked at Clermont Ferrand-Aulnat in June of 1940. These aircraft included White 45 (No. 634) in the foreground and White 71 immediately aft and to 45's port wing. GC II/9 became one of six Armée de l'Air de l'Armistice fighter groups to fly Bloch 152s. (P. Rivière)

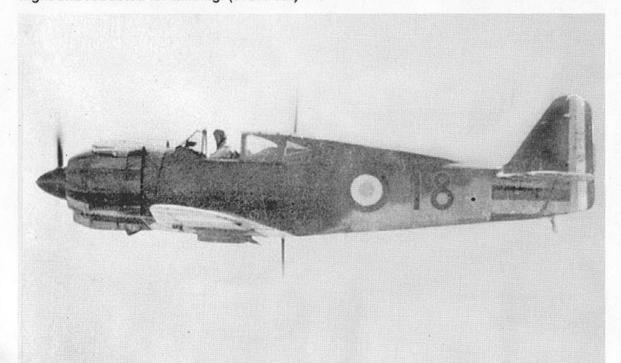


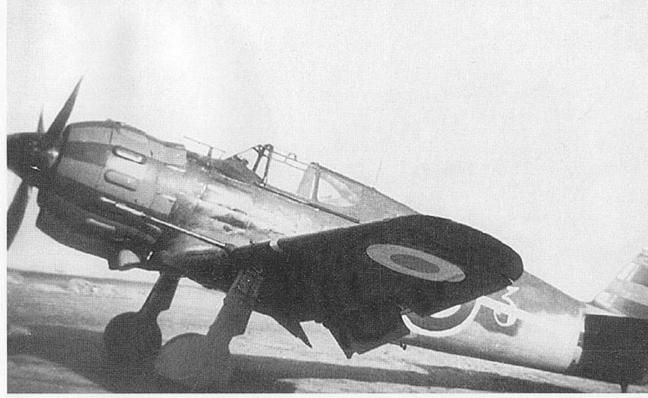




Two Bloch 152s of the 4th Escadrille of GC II/8 – including aircraft 6 in front – are parked on the ramp at Marignane during the fall of 1940. The Squadron's red and white insignia was placed immediately aft of the canopy. This Group converted to Bloch 152s in January of 1940 and flew the aircraft until the Armistice took effect on 25 June 1940. Led by Commandant Gibon-Guilhem, GC II/8's pilots were credited with 11 confirmed kills (six He 111s, four Bf 109s, and one Ju 88). (CAC)

A Bloch 152 assigned to the 4th Escadrille of GC II/8 flies over southern France. The aft fuselage number 18 was red with white trim. This number indicated the aircraft's position in the squadron. The 4th Escadrille insignia aft of the canopy represented a thistle on a red and white pennant. The motto 'Qui s'y frotte s'y pique' (Gather thistles, expect prickles) was written on this pennant. The lower radio antenna on French fighters extended in flight and retracted for landing. (J. J. Petit)





White 3 was a Bloch 152 assigned to GC I/1 of the Armée de l'Air de l'Armistice in 1941-42. The fighter was believed to have been based at Lyon-Bron. A white stripe was painted across the fuselage and the roundel trimmed in white on Vichy French aircraft from mid-1940. The red and yellow cowl and tail stripes were added in 1941. The Bloch 152's flaps were lowered when hydraulic pressure bled off on the ground. (J. Moulin)

This Bloch 152, No. 639, was one of only two Bloch 150 series fighters that survived World War Two. The aircraft was parked in a hangar at the CEV (Flight Test Center) at Brétigny-sur-Orge in 1946. No 639 was used for training pilots assigned to the center. Information on the use and fate of the other post-war Bloch fighter is unknown. (J.J. Petit)



#### Bloch 155

In October of 1938, a production Bloch 152 (No. 434) was modified to accept the 1200 HP Pratt & Whitney R-1830SC3-G Twin Wasp. This American powerplant was a 14-cylinder, aircooled, radial engine. The Twin Wasp turned a three-bladed Hamilton propeller. This aircraft was designated Bloch 153 and first flew at Villacoublay on 8 April 1939. The aircraft was tested at CEMA before being accepted by the *Armée de l'Air* on 28 May 1940. The Bloch 153 was to have been produced at Courbevoie; however, it was not ordered. The sole example was destroyed in a landing accident in late May of 1940.

Another Bloch 152 airframe was to be powered by another American engine, the 1200 HP Wright GR-1820-G205A Cyclone. This was a nine-cylinder, air-cooled radial engine. The fighter was designated **Bloch 154**; however, late engine delivery prevented the aircraft from being completed.

During the autumn of 1939, Bloch designer Lucien Servanty began work on an improved performance variant of the Bloch 152. This new fighter – designated Bloch 155 – offered higher speeds, greater range, and a smaller turning radius than the Bloch 152. The new fighter retained the Bloch 152's airframe to reduce development and production time. The engine cowling diameter was increased to eliminate rocker arm fairings and incorporate an oil cooler intake. Curved contour fairings were placed over the existing lower fuselage skinning. Other aerodynamic refinements included deletion of the horizontal stabilizer bracing struts and a cockpit repositioned further aft. The cockpit was moved 0.5 M (1 foot 7 11/16 inches) aft to allow for an additional 60 L (15.9 gallon) fuel tank in the forward fuselage.

The aircraft had the same wingspan and length as the earlier Bloch 152 – 10.57 M (34 feet 8 1/8 inches) in wingspan and 9.11 M (29 feet 10 11/16 inches) in length. The Bloch 155 stood 3.95 M (12 feet 11 1/2 inches) in height, 0.31 M (1 foot 3/16 inch) taller than the Bloch 152. The Bloch 155 weighed 2140 KG (4717.8 pounds) empty and 2850 KG (6283.1 pounds) fully loaded.

The Bloch 155 prototype taxis during its flight test program during the winter of 1939-40. This was a standard Bloch 152 modified for a more powerful Gnome & Rhône 14N-49 engine. The larger engine cowling lacked the rocker arm fairings of the Bloch 152 cowling. Horizontal stabilizer bracing struts were deleted on the prototype, although they were reinstated on production Bloch 155s. (M. Cristescu)



The Bloch 155 was powered by a 1100 HP Gnome & Rhône 14N-49, a 14-cylinder, air-cooled, radial engine. It originally turned a three-bladed Chauvière 371 propeller, which was later replaced by a three-bladed Bloch propeller. The Bloch 155 had a maximum speed of 520 KMH (323.1 MPH) at 4500 M (14,763.8 feet) and had a range of 1050 KM (652.5 miles). The Bloch 152's maximum speed was 500 KMH (310.7 MPH) at 5500 M (18,044.6 feet) and the range amounted to 580 KM (360.4 miles). The new fighter retained the Bloch 152's armament of two 20MM Hispano-Suiza HS 404 cannons with 60 rounds per gun (RPG) and two 7.5MM MAC 1934 machine guns with 500 RPG in the wings.

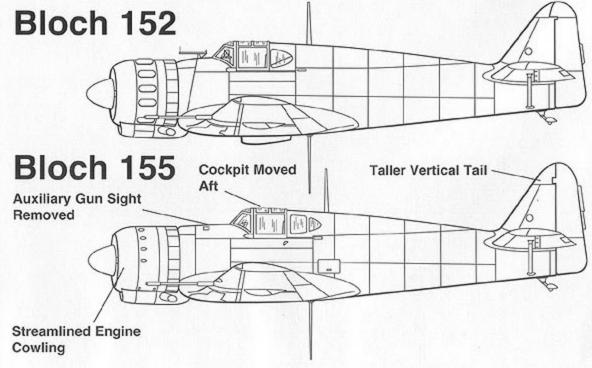
Maurice Bellecroix flew the prototype on its maiden flight from Châteauroux-Déols on 3 December 1939. The Bloch 155-01 performed well on its test flight, although it suffered a minor accident at Villacoublay on 4 February 1940. Horizontal stabilizer bracing struts were added and other slight modifications were made after the accident.

SNCASO soon received a contract for 403 Bloch 155s, with production concentrated at Châteauroux-Déols. Production aircraft incorporated an additional 60 L (15.9 gallons) of fuel and a more streamlined canopy. The initial production Bloch 155 (No. 701) made its first flight from Châteauroux-Déols on 3 April 1940. Nine more aircraft were completed before the Armistice became effective on 25 June 1940; none saw action during the Battle of France. These Bloch 155s served with GC I/8 of the Vichy French Air Force at Montpellier and were joined by 19 aircraft built after the Armistice. The Luftwaffe commandeered the remaining Bloch 155s after Germany occupied Vichy France in November of 1942.

SNCASO considered installing a 1310 HP Gnome & Rhône 14R radial engine into a Bloch 152 in 1939, under the designation **Bloch 156**. The engine's weight of 819 KG (1805.6 pounds) made an effective installation into the airframe difficult and the Bloch 156 was not completed.

Servanty decided to design a new fighter to take full advantage of the 14R engine, while retaining the Bloch 152's structural principles. Design and construction of the Bloch 157 proceeded rapidly, with the aircraft using a 1590 HP Gnome & Rhône 14R-4 engine. The German advance on Paris resulted in SNCASO personnel attempting to transport the Bloch 157 from Villacoublay to Poitiers on 9 June 1940. German troops captured the aircraft before it could leave Villacoublay and it was taken to Bordeaux-Mérignac. The Bloch 157 was completed under German supervision and first flew in March of 1942.

The Bloch 157 reached a maximum speed of 710 кмн (441.2 мрн) at 7850 м (25,754.6 feet)



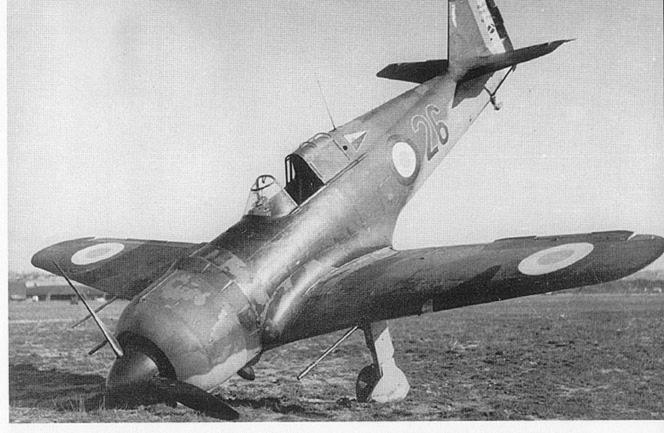


This Bloch 155 (No 707) was flown by the 4th Escadrille of Groupe de Chasse (GC) II/8 at Marseilles-Marignane in 1941. Aircraft 1 was assigned to the Group's commander, Captitaine (Capt) de Vaublanc. GC II/8 operated the only Bloch 155s built before and after the French Armistice with Germany. Production Bloch 155s were built with horizontal stabilizer bracing struts, based on flight test results. (CAC)

and a range of 1095 km (680.4 miles). This impressive performance caused the Germans to order its flight from Bordeaux-Mérignac to Paris-Orly for further tests in early 1943. After arrival, the engine was removed for separate testing while the airframe sat derelict in a hangar. The Bloch 157 was eventually destroyed in a US bombing raid on Paris-Orly during the war.

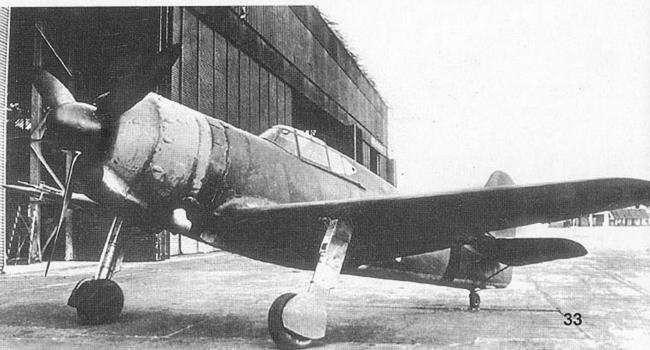
German forces captured this unidentified Bloch 155 at Orange, France in November of 1942. Luftwaffe markings were painted on the French camouflage finish for the evaluation program. The propeller spinner is believed to be yellow with a black spiral. This Bloch 155 was apparently fitted with an additional air scoop on the upper fuselage immediately aft of the cowl flaps. The Germans apparently replaced the tail skid with a tail wheel. (M. Cristescu)





This Bloch 155, Red 26 (believed to be No 706), stands on its nose after a taxiing mishap. The fighter was assigned to the 4th Escadrille of Groupe de Chasse (GC) II/8. The Bloch 155 featured improved aerodynamics – particularly with the engine cowling – over the earlier Bloch 152. The newer fighter used the same engine fitted to late production Bloch 152s, yet flew 20 кмн (12.4 мрн) faster and 470 км (292.1 miles) farther than the earlier aircraft. (CAC)

The Bloch 157 No 01 was parked at Bordeaux-Mérignac airfield before the Germans ferried it to Paris-Orly in early 1943. This aircraft displayed outstanding performance thanks to its 1590 HP Gnome & Rhône 14R-4 radial engine. It achieved a maximum level speed of 710 кмн (441.2 мРн) during French tests in 1942. (M. Cristescu)



#### Caudron-Renault CR 714 Cyclone

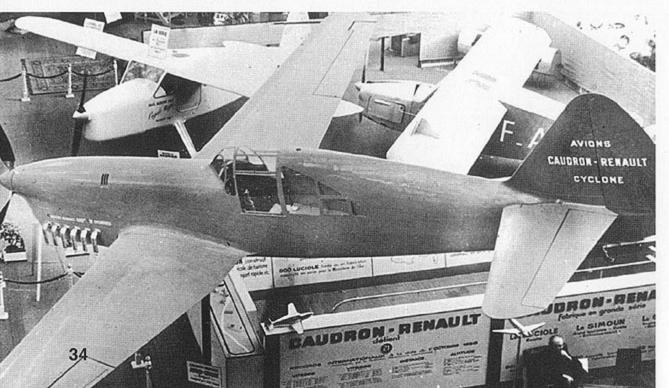
The Caudron-Renault CR 714 Cyclone was one of the few lightweight fighters to reach production status during World War Two. It was derived from the C 710, an experimental fighter based on the C 561 racing aircraft. The C 561 was designed to compete at the 1936 Coupe Deutsch de la Meurthe race around Paris. Marcel Riffard designed the C 710, whose prototype first flew from Guyancourt on 18 July 1936. This small fighter was powered by a supercharged 450 HP Renault 12R-01 12-cylinder, air-cooled, inline engine. The all-wood aircraft weighed approximately 500 KG (1102.3 pounds) lighter than contemporary fighters. The C 710 was entered in the Armée de l'Air single-seat fighter competition in 1937, where it lost to the Morane-Saulnier MS 405. The prototype C 710 was lost in a fatal crash on 1 February 1938.

The unfinished second C 710 airframe was completed as the prototype C 713 Cyclone in 1937. The aircraft retained the C 710's 12R-01 engine, but used a retractable undercarriage in place of the earlier aircraft's fixed landing gear. The C 713-01 first flew on 15 December 1937 and was able to fly up to 485 KMH (301.4 MPH) at 4000 M (13,123.4 feet). Its disappointing climb performance – 9 minutes 25 seconds to 4000 M – ended further interest in the C 713.

Riffard's team began redesigning the C 713 during the fall of 1937. Their new fighter was designated C 714, which was essentially similar to the C 713. The C 714 used a revised airfoil section, an enlarged vertical stabilizer, and a reinforced fuselage. The aircraft had a wooden structure with metal-framed control surfaces and fabric and wood skinning. It had a wingspan of 8.97 M (29 feet 5 1/8 inches), a length of 8.63 M (28 feet 3 3/4inches), and a height of 2.87 M (9 feet 5 inches). It weighed 1560 KG (3439.2 pounds) empty and 1750 KG (3858 pounds) fully loaded.

The C 714 (redesignated CR714 for Caudron-Renault) was powered by a 500 HP Renault 12R-03, 12-cylinder, inline, air-cooled engine. It was armed with four 7.5MM MAC 1934

The Caudron-Renault CR 714 C1 Cyclone prototype was displayed at the 1938 Salon de l'Aéronautique (Air Show) in Paris. This aircraft was derived from the CR 713 prototype, but used a reinforced fuselage, enlarged horizontal tail surfaces, and a new wing design. The Renault 12R engine exhausts flared out and down on the CR 714 prototype, but were recessed on production aircraft.



machine guns installed in underwing gondolas, with 300 rounds per gun. The CR 714's maximum speed was 455 KMH (282.7 MPH) at 4000 M (13,123.4 feet) and its range was 900 KM (559.2 miles).

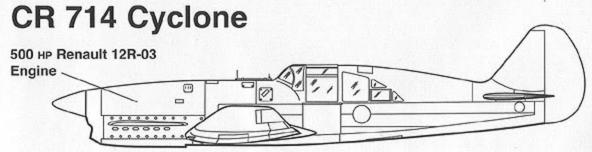
Raymond Delmotte flew the CR 714 prototype for the first time from Guyancourt on 6 July 1938. A few weeks later, the aircraft was sent to CEMA (*Centre d'Essais du Matériel Aérien*; Air Material Test Center) at Villacoublay for trials. The CR 714 reached 485 KMH (301.4 MPH) at 4000 M during these tests, in which the aircraft reached this altitude in 6 minutes 45 seconds. It reached 700 KMH (435 MPH) during a dive test.

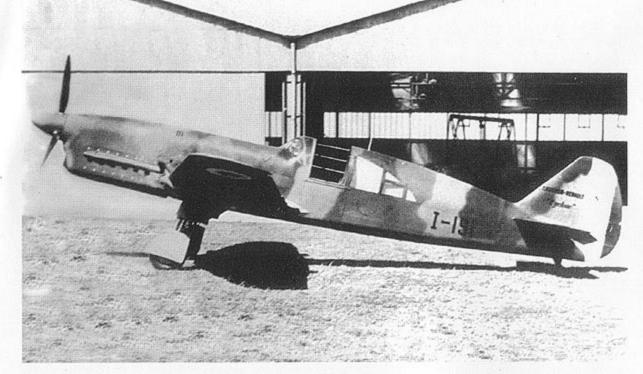
Although its performance was average compared to its rivals, the CR 714 interested the *Armée de l'Air* for several reasons during 1938. It used non-strategic construction materials, the engine was readily available, and it only required 5000 man-hours to assemble, compared to 12,000 man-hours for the MS 406. Caudron-Renault was awarded a contract for 20 CR 714s, plus an option for 180 more aircraft, on 5 November 1938. The first production aircraft was rolled out of Renault's Le Point-du-Jour factory near Paris on 10 June 1939 – one month behind schedule, due to assembly delays. Six more aircraft were delivered by the end of July. Flight testing revealed the aircraft's degraded performance due to the installation of armament and other mandatory equipment. This reduced the CR 714's operational maximum speed to 470 KMH (292.1 MPH) at 5000 M (16,404.2 feet), which was reached in 12 minutes.

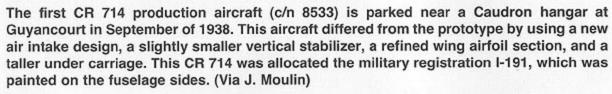
The availability of MS 406s, Bloch 152s, and the promising D.520 reduced the need for the CR 714. The production contract was reduced to 83 aircraft and the *Armée de l'Air* offered them for training or export. In January of 1940, the first five CR 714s were assigned to the *Ecole de Chasse et d'Instruction* (ECI; Fighter Training School) at Lyon-Bron for training Polish exile pilots. At the same time, the French planned to send 77 CR 714s to Finland. A first batch of 20 aircraft was scheduled to ship from France in February; however, only six CR 714s reached Finland.

Only one of the ECI's eight CR 714s was serviceable when the Germans invaded Western Europe on 10 May 1940. Approximately 38 other aircraft on charge awaited weapons, propellers, and other equipment. The CR 714s were flown by the Polish exile pilots of *Groupe de Chasse* (GC) I/145, led by *Commandant* (Major) Józef Képinski. GC I/145 was deployed from Lyon-Bron to Dreux on 2 June 1940 with only 18 serviceable CR 714s out of their 34 assigned aircraft. Their first combat with Luftwaffe aircraft occurred on 8 June, when five CR 714s engaged 20 Bf 110s. The Polish pilots claimed one probable victory while a battle-damaged Caudron made a forced landing. The next day, the CR 714s attacked several Do 17 bombers and their 20 Bf 109 escorts. GC I/145 pilots downed three Bf 109s and a Do 17, but lost three CR 714s shot down with three more making emergency landings due to combat damage.

On 10 June, the Group intercepted 15 Do 17s and their Bf 109 escorts over Dreux, downing three bombers and a fighter without losses. The Poles evacuated Dreux for Sermaize the next day, destroying 11 disabled CR 714s. The advancing Germans forced the *Groupe* to leave Sermaize for Châteauroux on 13 June – the same day the *Armée de l'Air* grounded the CR 714s and disbanded GC I/145. The Polish Caudron pilots were officially credited with seven confirmed and two probable victories, while losing five pilots killed and 24 aircraft destroyed (four to combat, the rest to other reasons). The Germans seized 20 incomplete







CR 714s at Guyancourt by mid June of 1940. Only eight Caudron fighters remained in southern France when the Armistice went into effect on 25 June. None of these aircraft is believed to have flown in Vichy French service after the Armistice.

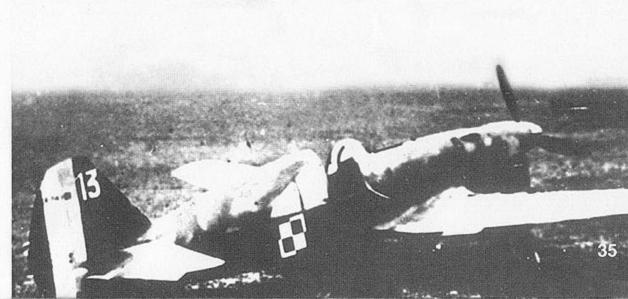
Camouflage and basic markings are painted on this newly built CR 714 during the spring of 1940. The cockpit canopy offered the pilot limited visibility, especially downward. Cockpit access was made through sliding canopy panels, which were jettisoned in an emergency for ease of escape.

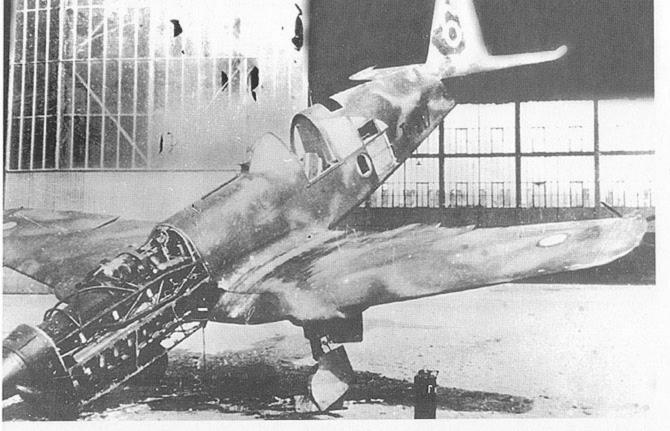




A production CR 714 C1 rests on the grass at Guyancourt before delivery to the Armée de l'Air. The fighter's sleek lines owed its origins to Caudron's racing aircraft of the mid-1930s. Power from the 500 HP Renault 12R03 engine enabled the CR 714 to reach a speed of 405 кмн (251.7 мРн) at sea level and 455 кмн (282.7 мРн) at 4000 м (13,123.4 feet). Fully loaded with machine guns and ammunition, the Cyclone's maximum speed was only 470 кмн (292.1 мРн) at 5000 м (16,404.2 feet). The pitot tube was mounted on the starboard wing. (Via M. Bénichou)

This CR 714 Cyclone (White 13) was assigned to the 2nd Escadrille of GC I/145, a Polish exile unit deployed to Dreux on 2 June 1940. Sous-Lt. (2/Lt) B. Gladych was believed to have flown this fighter. The Polish pilots were officially credited with seven confirmed victories during the Battle of France. The Group lost four CR 714s in combat and five pilots killed, including Commandant Józef Képinski, the unit's commander.





German troops cut out the Polish markings from the fuselage of this abandoned CR 714 Cyclone in June of 1940, White 6. Sous-Lt. J. Czerniak of the 2nd Escadrille of GC I/145 was believed to have flown this CR 714. Small upper wing roundels were painted on the three-tone camouflage finish. (Via M. Cristescu)

The sole CR 760 C1 is prepared for a test flight from Orléans-Bricy in May of 1940. This was a derivative of the CR 714 powered by a 760 HP Isotta-Fraschini Delta RC 40 engine. Its designed armament was six wing-mounted 7.5MM MAC 1934 machine guns with 300 rounds per gun. French ground crewmen destroyed the CR 760 on 11 June 1940 to prevent its capture by the Germans. (Via F. Bergèse)



### **CR 714 Derivatives**

Caudron-Renault developed three CR 714 derivatives, which offered improved performance over the production fighter. The CR 760 (formerly CR 715) was powered by an Italian-built 730 HP Isotta-Fraschini Delta RC 40 12-cylinder, air-cooled, inline engine. It was slightly larger than the CR 714, with a wingspan of 8.98 M (29 feet 5 1/2 inches), a length of 8.9 M (29 feet 2 6/16 inches), and a height of 2.9 M (9 feet 6 3/16 inches). The CR 760 weighed 1560 KG (3439.2 pounds) empty and 2050 KG (4519.4 pounds) fully loaded. It was armed with six 7.5MM MAC 1934 machine guns under the wings with 300 rounds per gun.

The aircraft first flew in early May of 1940 and demonstrated it could climb to 4000 M (13,123.4 feet) in 5 minutes 25 seconds. It had a maximum speed of 455 KMH (282.7 MPH) at sea level and a range of 1500 KM (932.1 miles). On 11 June, the CR 760 was burned at Orléans-Bricy to prevent its capture by advancing German troops.

The CR 770 was nearly identical to the CR 760 and first flew during November of 1939. The fighter was powered by an 800 HP Renault 626 16-cylinder, air-cooled, inline engine. It had a wingspan of 9 M (29 feet 6 5/16 inches), a length of 9.95 M (32 feet 7 3/4 inches), and a height of 2.9 M. It weighed 1750 KG (3858 pounds) empty and 2250 KG (4960.3 pounds) fully loaded. The CR 770's designed speed was 590 KMH (366.6 MPH) at 5000 M (16,404.2 feet) and its range was 1430 KM (888.6 miles). It was to be armed with six wing-mounted 7.5MM MAC 1934 machine guns. The CR 770 suffered a crankshaft failure early in its flight testing. This engine was never repaired and the aircraft was destroyed at Guyancourt before the Germans reached the airfield.

The CR 780 was proposed in August of 1938 as a fighter powered by a 500 HP Renault 468 engine driving two counter-rotating three-bladed propellers. The aircraft was designed to fly up to 530 KMH (329.3 MPH) at 4000 M; however, it was never built.

The CR 770C1 prototype (c/n 8978) was another CR 714 derivative. This aircraft was nearly identical to the CR 760, but was powered by an 850 HP Renault 626 engine. The only CR 770 built was rolled out in mid-October of 1939 and first flew the following month. The crankshaft failed during this flight and the aircraft never flew again.

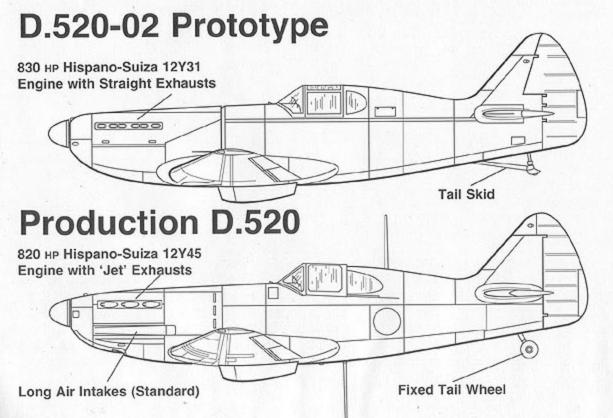


# **Dewoitine D.520**

The French Air Ministry's Service Technique Aéronautique (STAé; Aeronautical Technical Service) issued a new fighter specification to French aircraft manufacturers on 13 July 1934. This called for new fighter aircraft to replace the obsolete Dewoitine D.510, whose prototype first flew on 14 August 1934. The program's main requirement was for a 450 KMH (279.6 MPH) maximum speed at 4600 M (15,091.9 feet). Dewoitine submitted its D.513 monoplane in response to this 1934 specification. Company founder Emile Dewoitine was inspired by the Heinkel He 70 high-speed monoplane, which was displayed at the 1934 Salon de l'Aéronautique (Air Show) in Paris. The D.513 – like the He 70 – was an all-metal monoplane with an elliptical wing and a fully retractable undercarriage. Dewoitine's new fighter was powered by an 860 HP Hispano-Suiza 12Ycrs 12-cylinder, liquid-cooled, inline engine.

The D.513 prototype was first flown by Dewoitine test pilot Marcel Doret on 6 January 1936. He immediately encountered longitudinal (nose to tail) instability, an inoperative undercarriage, and excessive drag during the flight. Despite a complete redesign of the aircraft, the D.513 was inferior to the Morane-Saulnier MS 405 and the Dewoitine project was abandoned. The second D.513 prototype was completed as the **D.514LP** (*Lance Parachute*) for high speed, low altitude parachute tests in September of 1938. A dummy was dropped from a fuselage bay immediately in front of the cockpit. The D.514LP did not match the performance of the MS 407LP, an MS 406 derivative also employed for parachute testing.

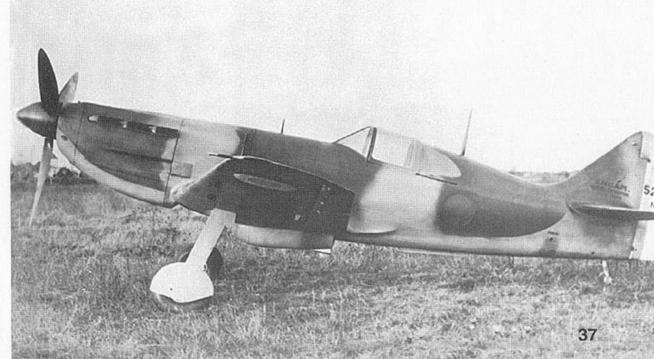
Emile Dewoitine's firm, the Société Aéronautique Française — Avions Dewoitine (SAF-AD), was set to close after completion of the D.510 contract in late 1936. Dewoitine left the firm in June of 1936 to have a free reign in designing an entirely new fighter. He formed a private design office with Robert Castello and Jacques Henrat as its designers that month and asked them to produce an aircraft as quickly and cheaply as possible. This fighter would be powered by the 900 HP Hispano-Suiza 12Y21 engine and capable of flying at 500 KMH (310.7)





The second Dewoitine D.520 prototype makes a test flight from Villacoublay in March of 1939. The fictitious designation D.520 N.1 was painted on the rudder. This aircraft first flew from Toulouse-Francazal on 6 January 1939, before it was transferred to Villacoublay in February.

The second production D.520 C1 is parked on the grass at Toulouse-Francazal on 26 November 1939. The fighter was painted in the standard French camouflage colors and markings for the period. These markings included the designation D.520 C1 on the rudder stripes. SNCAM (Société Nationale de Constructions Aéronautique du Midi), the manufacturer's name, was painted on the vertical stabilizer. SNCAM absorbed Dewoitine during the nationalization of the French aircraft industry in 1936. D.520 No 2 has not received the OPL RX 39 gun sight atop the cockpit instrument coaming.



мрн). Within three months, Dewoitine's team submitted a proposal to the Air Ministry. The Ministry rejected the proposal since its A23 specifications called for a top speed of 520 кмн (323.1 мрн).

A modified project designated D.520 (after the required speed) was submitted to the STAé in January of 1937. Dewoitine's new proposal had a wingspan of 10.2 M (33 feet 5 1/2 inches) – a reduction from the 12.06 M (39 feet 6 13/16 inch) wingspan of his earlier D 513. The D.520 had a wing area of 16 M<sup>2</sup> (172.2 square feet) and the leading edges were fitted with Handley-Page slots for improved low-speed handling. This aircraft also had a provision for installing the 1200 HP Hispano-Suiza 12Z engine, which was under development.

On 4 March 1937, SAF-AD — instead of going out of business — was nationalized and formed part of the *Société Nationale de Constructions Aéronautiques du Midi* (SNCAM; National Aircraft Construction Company of the Mediterranean). Emile Dewoitine was appointed SNCAM's deputy managing director. The STAé agreed that the D.520 would likely meet its A23 specifications; however, the Air Ministry had ordered the MS 405/406 to re-equip its *Groupes de Chasse* (GC; Fighter Groups). This lack of order slowed D.520 development during 1937. By early 1938, Emile Dewoitine decided to proceed with detail drawings and construction of a prototype. The Air Ministry issued a contract on 3 April 1938 for two D.520 prototypes, plus a static test airframe. The first prototype — powered by the 890 HP 12Y21 engine — was to be delivered to the STAÉ by 1 November 1938.

The D.520-01 private venture prototype neared completion in mid-1938. On 27 June 1938, the STAé examined a full-scale wooden mock-up and requested some minor modifications to the design. The first prototype was rolled out during September and Marcel Doret flew it on its maiden flight from SNCAM's Toulouse-Francazal airfield on 2 October. A two-bladed wooden propeller was installed and the cockpit canopy was removed for the early test flights. Excessive drag from the underwing radiators reduced the D.520-01's maximum speed to 480 KMH (298.3 MPH). The radiators also caused engine overheating, while engine torque reduced directional stability to a marginal level. These problems were addressed by replacing the two underwing radiators with a single radiator under the fuselage and increasing the vertical stabi-

lizer and rudder areas.

The D.520-01 displayed improved performance during later test flights. On 28 November, Doret forgot to lower the undercarriage and the aircraft made a wheels-up landing. The Dewoitine aircraft was only slightly damaged in this mishap. The D.520-01 was re-engined with a 12Y29 engine, whose original straight exhaust pipes were later replaced by angled 'jet' pipes. The engine and exhaust modifications finally allowed the prototype to reach 520 KMH on 13 January 1939.

Doret flew the second D.520 prototype on its first flight on 28 January 1939. This aircraft received the fictitious designation D.520 No 1 on the rudder and displayed its authentic matricule militaire (military registration) F-317 in large black letters under the wings. The second prototype featured a redesigned tail section, an aft-sliding canopy, a new Olaer designed undercarriage, and deletion of the Handley-Page wing slots. Provision was made for a 20MM Hispano-Suiza HS 404 cannon firing through the propeller hub and two 7.5MM MAC 1934 machine guns in underwing gondolas. This armament was not installed on the D.520 No 2. On 10 February, Doret ferried the second prototype from Toulouse-Francazal to the Centre d'Essais du Matériel Aérien (CEMA; Air Material Test Center) at Villacoublay for French government flight tests.

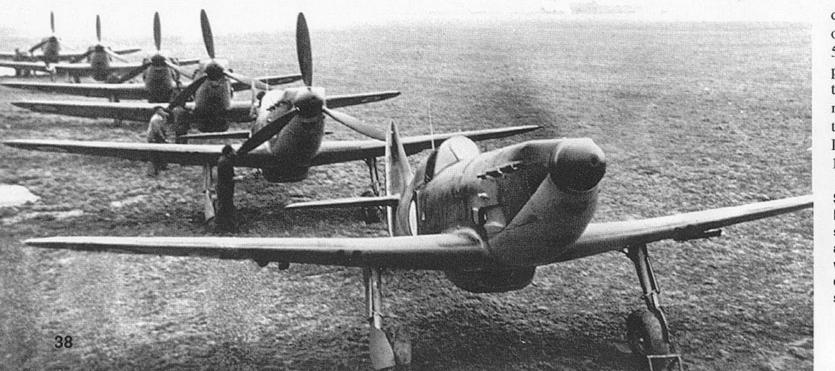
Capitaine (Capt) Constantin Rozanoff flew the D.520-02 in March of 1939 when it reached a speed of 527 kmH (327.5 mpH) at 5000 m (16,404.2 feet). The fighter climbed to 8000 m (26,246.7 feet) in 13 minutes 45 seconds on the same test flight. The Air Ministry was encouraged by these results and awarded SNCAM a contract for 200 D.520 production fighters on 7 April 1939. The second prototype was fitted with the 830 HP 12Y31 engine, which was intended for production aircraft. Additional flight tests showed the aircraft reaching a maximum speed of 550 kmH (341.8 mpH) at 5200 m (17,060.4 feet) and a climb to 8000 m in 12 minutes 52 seconds.

The third D.520 prototype (F-318) replaced the Hispano-Suiza engine supercharger with a Szydlowski-Planiol supercharger and the fixed tail skid with a steerable fixed tail wheel. Doret piloted the aircraft on its maiden flight from Toulouse-Francazal on 5 May 1939 and it was

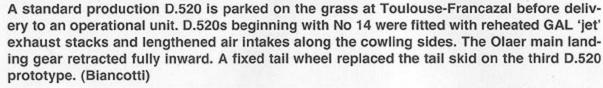
delivered to CEMA in late September. It was used for armament trials at Cazaux and flown to Orléans-Bricy in October before it was lost in an accident on 12 May 1940.

The Air Ministry's initial contract called for the 200 D.520s to be delivered between September and December of 1939. A second order for 600 D.520s was placed on 5 June 1939; this was reduced to 510 aircraft the following July. A third contract for 170 D.520s was placed on 12 September 1939, which increased the total D.520 order to 880 machines. The aircraft production rate was to be 200 per month from May of 1940. These contracts were amended several times over the next several months and eventually called for 2205 D.520s produced at the rate of 350 per month from November of 1940. This *Armée de l'Air* (French Air Force) order did not include

Six early production D.520s are lined up at SNCAM's Toulouse-Francazal airfield on 9 February 1940. The first aircraft in line started its engine prior to taxiing and subsequent take off. This aircraft had four hard points for light bombs fitted under its wings – an unusual addition. The early production D.520s were equipped with short air intakes on the engine cowling sides and short exhaust stacks. (Via Merle Olmsted)







120 additional D.520s ordered by the Aéronavale (French Naval Aviation).

The first production D.520 (F-187) made its initial flight on 31 October 1939, with the next three aircraft following in December. Production fighters incorporated several changes from the three D.520 prototypes. The fuselage was lengthened by 51 cm (20 1/16 inches), the engine cowling was modified, two integral fuel tanks were added to the wing leading edge, and a 5MM armor plate was fitted aft of the pilot's seat.

The D.520 was an all-metal monoplane with a wingspan of 10.2 m (33 feet 5 1/2 inches), a length of 8.6 m (28 feet 2 5/8 inches), and a height of 2.57 m (8 feet 5 1/8 inches). It weighed 2123 kG (4680.3 pounds) empty and 2677 kG (5901.7 pounds) fully loaded. The production D.520 was powered by an 820 HP Hispano-Suiza 12Y45 12-cylinder, liquid-cooled, inline engine with a Szydlowski-Planiol S39-H3 supercharger. This powerplant turned a three-bladed, variable-pitch Ratier 1606M electrically-operated propeller. It had a maximum speed of 534 kmH (331.8 mpH) at 5500 m (18,044.6 feet) and a range of 1540 km (956.9 miles). The fighter was armed with one 20mm HS 404 cannon with 60 rounds firing through the propeller hub and four 7.5mm MAC 1934 machine guns in the wings with 675 rounds per gun.

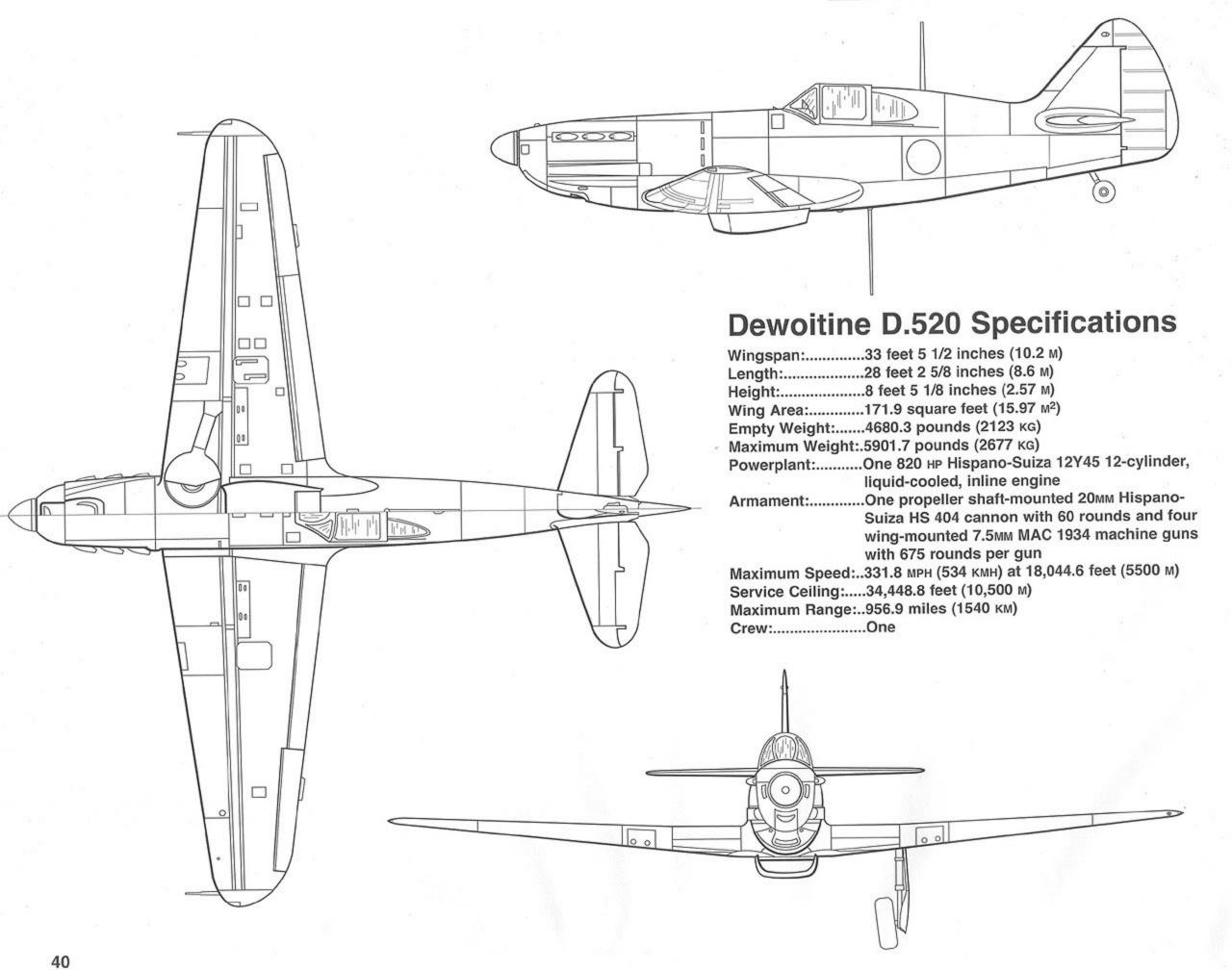
Lengthy and difficult engine problems resulted in the first production D.520 not reaching Cazaux for armament trials until 26 December 1939. This resulted in the second production aircraft being delivered earlier than expected to CEMA for performance evaluation on 10 January 1940. Official tests recorded a maximum speed of 535 kmH (332.4 mpH) at 5400 m (17,716.5 feet) and a climb to 8000 m (26,246.7 feet) in 13 minutes 24 seconds. The service ceiling was 10,250 m (33,628.6 feet) and the range with a full fuel load was 1540 km (956.9 miles). Only 13 D.520s were produced by the beginning of 1940, compared to the 44 aircraft specified in the contract schedule. The lack of adequate exhaust pipes and supercharger air intakes limited the maximum speed to 510 kmH (316.9 mpH). Four production aircraft (Nos. 13, 30, 31, and 36) were returned to SNCAM on 1 March 1940. These D.520s served as test beds for improvements to these nagging problems. The operational standard for the D.520 was not frozen until the 19th aircraft was rolled out from the factory in early April of 1940.



A D.520, White 4, flies on a delivery flight during the spring of 1940. The lower radio receiver antenna extended in flight, while the transmitter antenna aft of the cockpit was fixed. Short exhaust stacks were fitted to this D.520. The propeller spinner was black while the upper surfaces were camouflaged in Dark Blue Gray (FS36176), Dark Brown (FS20117), and Khaki (FS24087).

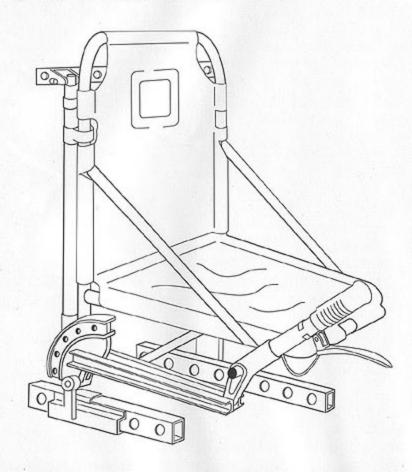
The first production D.520 saw considerable service after performing SNCAM tests in late 1939 and early 1940. The fighter was assigned to GC II/7, the Armée de l'Air's fourth D.520 fighter group. Assigned squadron code 5, this aircraft was painted with the white Vichy fuselage stripe and roundel trim while operating from Alger-Maison Blanche airfield, Algeria in late 1940.



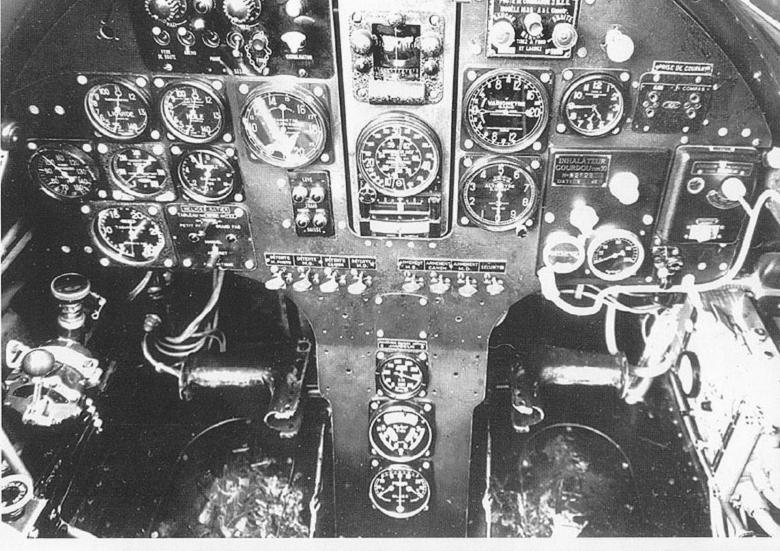


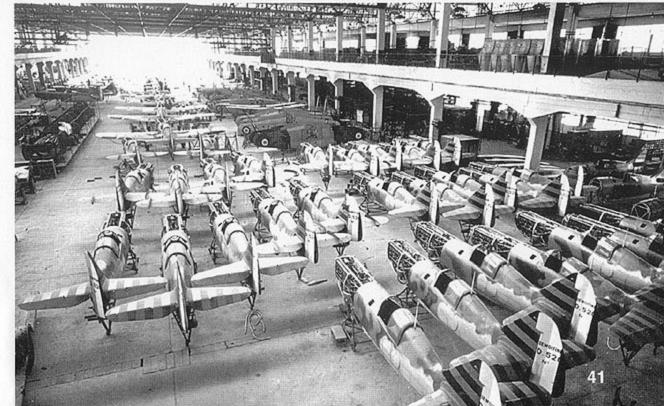
Lighting controls were placed in the upper port section of the standard D.520 instrument panel. The Vion magnetic compass was mounted at the upper center section, with the flare launcher controls and greasing knob to starboard. Water and oil temperature gauges and the anemometer for wind speed were placed on the port side below the lighting controls. The airspeed indicator was immediately below the compass, while to starboard were (left-right) the rate of climb indicator, clock, and socket outlet. The lower left instruments were the intake manifold pressure indicator, carburetor indicator, manifold oil gauge, tachometer, and propeller controls. Armament control switches were mounted on the lower center row, while the altimeter, oxygen controls, and electrical relay were placed to starboard. The center console instruments were (top-bottom): the fuel gauge, manifold pressure indicator, and brake pressure gauge. SNCAM painted D.520 cockpits Dark Blue (FS35045). (M. Cristescu Collection)

## D.520 Pilot's Seat



D.520s fuselages are prepared for final assembly at SNCASE's Saint-Martin-du-Touch factory in 1942. The tail assemblies were painted in the red and yellow Vichy stripes; however, construction numbers were not yet applied to the rudders. Wings awaited mating to the fuselages further along the production line. D.520 production resumed under German supervision in July of 1941. SNCASE – which absorbed SNCAM in 1941 – built 349 D.520s through December of 1942.

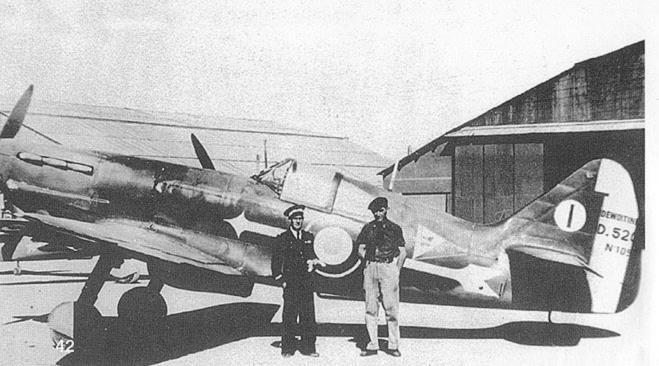






The pilot of this D.520 opened his canopy while flying alongside another aircraft. This fighter was assigned to GC I/3, the first D.520 operational unit. The white fuselage band – mandatory on Vichy aircraft from late June of 1940 – was modified to an arrow on this aircraft. The 80 cm (31 1/2 inch) diameter roundels are painted in six positions. The Groupe insignia was painted on the aft fuselage. (Biancotti)

This D.520 (I, No 105) of GC I/3 is parked at Oran-La Senia, Algeria in July of 1940. Commandant (Maj) Bernard Challe, the Group's commander, flew this aircraft, which was delivered to the Armée de l'Air on 26 April 1940. The unit insignia painted on the port side represented a cat's head on a red and white flag. GC I/3 was one of four Vichy French Air Force D.520 groups in North Africa. (Biancotti)



#### The D.520 Enters Service and Combat

The first unit to convert to the D.520 was GC I/3, an MS 406 unit, in November of 1939. The Group moved from Velaine-en-Haye to Cannes-Mandelieu in early December to accept their new fighters. GC I/3 was scheduled to be fully equipped with 34 D.520s by the end of January of 1940; however, production difficulties pushed this back to 7 May. The Group also received three D.520s equipped for high-altitude reconnaissance.

SNCAM produced 246 D.520s by the beginning of the German offensive against Western Europe on 10 May 1940; the *Armée de l'Air* had accepted 79 of these aircraft into service. The 34 D.520 fighters assigned to GC I/3 were among France's 609 front line fighters available to face 3500 Luftwaffe aircraft. The *Groupe* was rapidly deployed from Cannes-Mandelieu to Wez-Thuisy, near Rheims, on 11 May. Problems with the new exhaust pipes required replacement by older design pipes, which prevented these D.520s from becoming operational until 13 May. That day saw the D.520's combat debut over Sedan. The GC I/3 fighters downed three Henschel Hs 126 reconnaissance aircraft and one Heinkel He 111 bomber without loss. The next day, the Group's pilots shot down ten confirmed German aircraft (four Bf 110s, two Bf 109s, two Do 17s, and two He 111s) and one probable Bf 110; however, the French lost two pilots killed and two others wounded in the engagement.

A 16 May German air raid on Wez-Thuisy forced GC I/3 to move to Meaux-Esbly with its six surviving D.520s. Ten new production aircraft were ferried from the Toulouse factory to Meaux-Esbly on 24 May, while the Group continued sustained operations against German aircraft. The rapid German advance into France forced GC I/3 to frequently move into southern France during late May and early June. The Group's pilots claimed 50 confirmed and 18 probable 'kills' over the Luftwaffe, before France's Armistice became effective on 25 June.

During the Battle of France, additional *Groupes de Chasse* transitioned to D.520s. GC II/2 began training on the Dewoitine fighters on 6 April, using GC I/3 aircraft. This unit was followed by GC III/3 on 19 April, GC II/7 (29 April), and GC III/6 (8 June). These five Groups combined to score 108 confirmed and 39 probable victories over German and (from 10 June) Italian aircraft during this campaign. The French units lost 106 D.520s, including 26 to air combat and 80 to other causes. Two additional Fighter Groups (GC II/6 and GC III/7) were converting to D.520s when the French Armistice with Germany took effect on 25 June. Four *Aéronavale Escadrilles* (*Esc.* AC1, AC2, AC3, and AC4) transitioned to D.520s between 9 June and 25 June.

SNCAM built 437 D.520s by 25 June 1940; of these, 351 were delivered to the *Armée de l'Air* and 52 to the *Aéronavale*. The 106 aircraft lost reduced this total to 331 D.520s. These remaining Dewoitine fighters included 153 in unoccupied France (34 of these had not been handed over by SNCAM), 175 were ferried to French North Africa, and three D.520s flown to Great Britain on 26 June. Two of the latter aircraft were assigned to the *Forces Aériennes Françaises Libres* (FAFL; Free French Air Force).

The German occupation authorities allowed the Vichy government in unoccupied France to field a limited air force, the Armée de l'Air de l'Armistice. D.520s equipped four Groupes de Chasse and two Aéronavale Escadrilles in North Africa, while aircraft in Vichy France were stored at Châteauroux and Istres. On 23 June 1941, German authorities ordered 550 D.520s from SNCASE (Société Nationale de Constructions Aéronautiques du Sud-Est). The first 22 aircraft from this contract were delivered in August of 1941. Production under the contract was terminated with the 349th aircraft, delivered to the Germans on 31 December 1942. This brought total D.520 production to 786 aircraft to date.

<sup>1</sup>SNCAM was dissolved in 1941 and its Toulouse facilities absorbed by SNCASE.

SNCASE modified D.520 No 465 to enhance its performance in late 1941. This aircraft received the designation **D.520** 'Amélioré' (Upgraded). The modifications included fitting individual 'jet' exhaust pipes, a new Messier undercarriage, a heat exchanger in place of the standard oil cooler, and a coolant radiator incorporating a boundary layer trap. The D.520 'Amélioré' was powered by a 820 HP 12Y49 engine turning a Chauvière 10105 propeller. The aircraft reached a maximum speed of 575 KMH (357.3 MPH) at 6500 M (21,325.5 feet). SNCASE built 197 late production D.520 fighters for the Armée de l'Air de l'Armistice from the 349 total D.520s produced between August of 1941 and the end of 1942. These aircraft were similar to the D.520 'Amélioré,' but reverted to the standard exhaust pipes.

D.520s assigned to two Fighter Groups and an Aéronavale squadron in Syria fought against British and Free French forces in the summer of 1941. The three units scored a combined 30 confirmed and six probable victories during this campaign, while losing 32 D.520s (11 to air combat, seven destroyed on the ground, and 14 to other causes).

The Armée de l'Air de l'Armistice had 173 D.520s (including 142 serviceable aircraft) with five Groupes de Chasse and two naval Escadrilles in North Africa by 8 November 1942. The Anglo-American invasion of French North Africa saw the Dewoitines in heated combat with Allied combat aircraft. The French lost 35 D.520s (16 by the air force, 19 by the navy) during this campaign.

On 11 November 1942, Germany responded to the invasion of French North Africa by invading unoccupied France. The *Armée de l'Air de l'Armistice* was disbanded on 27 November and the Germans seized its 1876 aircraft, including 246 D.520s. The invaders captured 169 additional D.520s in various stages of assembly at SNCASE's Toulouse plant.

On 15 August 1944, Franco-American forces invaded southern France (Operation ANVIL). Four days later, the Forces Françaises de l'Intérieur (FFI; French Interior Forces) formed a fighter unit equipped with D.520s recaptured from the Germans. The unit was named Premier Groupe de Chasse FFI (Main FFI Fighter Group) and nicknamed the Groupe Doret, after former test pilot Marcel Doret, the unit's commander. The Group's two D.520 squadrons aided in attacking German strongholds in southwestern France. The Groupe Doret was redesignated GC II/18 'Saintonge' on 1 December 1944. From 1 March 1945, most of the Group's D.520s were transferred to Groupe de Chasse et de Bombardement (GCB; Fighter-Bomber Group) I/18 'Vendée.' Approximately 55 more D.520s were recovered during the Allied advance towards Germany.

#### **D.520 Derivatives**

SNCAM and SNCASE planned several variants of the standard D.520; however, most were never built and none saw operational service. In October of 1939, SNCAM engineers planned to fit an 880 HP Rolls-Royce Merlin III engine to the 251st production D.520. This project was cancelled one month later, due to priority given to supplying Merlins for the Amiot 353/354 twin-engine bombers. The project was revived in early 1940 and a Merlin was mounted on D.520 No 41. The aircraft was redesignated D.521 and first flew on 9 February 1940. The Merlin-powered aircraft had a superior rate of climb to the standard D.520 and achieved 570 KMH (354.2 MPH) at altitude. The D.521 made seven test flights before it was reconverted to the standard D.520 configuration.

The 45th D.520 served as the **D.523** prototype during 1940. This variant combined a D.520 with the 1000 HP Hispano-Suiza 12Y51 engine. The prototype flew between 9 May and 14 June 1940. This aircraft was reconverted to a standard D.520 after the French Armistice. Performance figures for this variant are unknown.



Aéronavale D.520s of Escadrille 1AC are lined up at Tafaraoui, Algeria on 1 March 1941. The Squadron's seahorse insignia was painted on a red disc located aft of the cockpit. The white unit designator 1AC was painted immediately aft of the fuselage roundel, while white individual aircraft numbers were painted on the vertical stabilizers. (Aéronavale)

Sergent (Sgt) Lombaert stands in the cockpit of White 6, his D.520 (No 31) of the 1st Escadrille of GC I/2 at Châteauroux, France in early 1942. The Squadron's famous Cigogne (Stork) insignia, which dated from World War One, was painted ahead of the white fuselage band. Red (FS21105) and Yellow (FS23538) cowl and tail stripes were painted on Vichy aircraft from June of 1941. (Via M. Bénichou)





White 3 was a D.520 assigned to the 1st Escadrille of GC I/2 at Châteauroux in 1942. The Light Blue Gray fuselage sides were mottled with the upper surface colors: Khaki, Dark Brown, and Dark Blue Gray. Roundels were not painted on the fuselage, but were painted on the wings. No serial number was painted on this rudder. (Via Biancotti)

The D.520 'Amélioré' (No 465) was displayed outside SNCASE's Saint-Martin-du-Touch plant on 12 March 1942. This aircraft had a smoother aerodynamic finish, a new undersurface radiator, and doors covering the entire main landing gear when retracted. These aerodynamic improvements enabled the 'Improved' D.520 to reach 575 кмн (357.3 мрн) at 6500 м (21,325.5 feet).

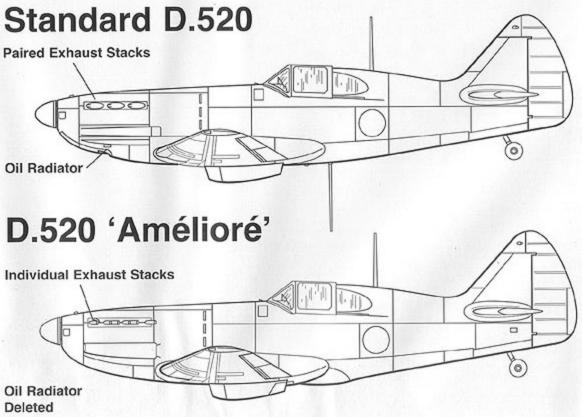


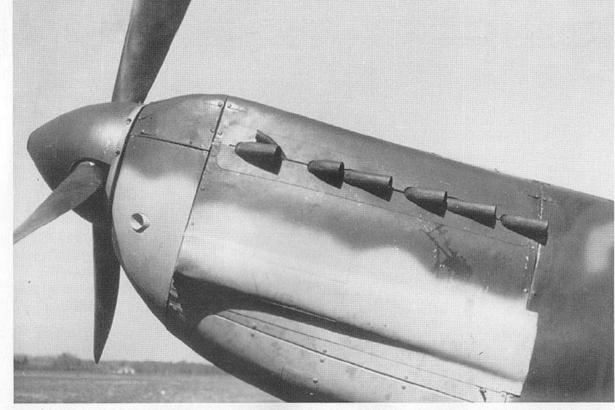
In mid-June of 1940, D.520 No 41 was fitted with a 1200 HP Hispano-Suiza 12Z89 engine, under the designation **D.524**. The aircraft was intended to reach an estimated speed of 616 KMH (382.8 MPH). The Armistice prevented any test flights and the D.524 was refitted with a standard 12Y45 engine in July of 1941.

The HD.780 seaplane fighter combined a modified D.520 fuselage with larger wings and twin floats. It was 9.7 M (31 feet 9.7/8 inches) long and had a wingspan of 12 M (39 feet 4.7/16 inches). The aircraft was powered by a Hispano-Suiza 12Y51 engine fitted with a low altitude compressor and was intended to reach a maximum speed of 442 KMH (274.7 MPH). One prototype was built between November of 1939 and April of 1940, but it never flew.

The **D.551** was a military variant of the **D.550**, a racing derivative of the D.520. The D.551 retained the D.550's reduced wing span of 9.33 M (30 feet 7 5/16 inches) and greater streamlining while powered by a 12Y51 engine. This fighter was calculated to reach a maximum speed of 662 KMH (411.4 MPH) at 6000 M (19,685 feet). The D.551 was to have been armed with five 7.5MM machine guns – one firing through the propeller hub and four in the wings. The **D.552** was a D.551 with a 12Z engine and two additional wing-mounted machine guns. The first five D.551s neared completion when France signed the Armistice with Germany. On 9 August 1940, the Germans allowed the conversion of two D.551s into **D.560** sports aircraft; however, the D.560s were later forbidden to fly and scrapped with the other D.551s.

SNCASE agreed with the German armistice commission to produce 105 **D.520Z** fighters on 12 September 1942. The forward fuselage was lengthened by 36.5 cm (14 6/16 inches) and streamlined to accept the 1600 HP Hispano-Suiza 12Z engine. It was to be armed with two 20MM cannon and two 7.5MM machine guns in the wings. The first D.520Z was equipped with a 1200 HP 12Z01 engine and a conventional D.520 wing. This variant had an estimated maximum speed of 659 KMH (409.5 MPH) at 9150 M (30,019.7 feet). The Germans never allowed the D.520Z to fly and it remained in storage until 1947. Plans were made to use it as a testbed for the 12Z engine intended for the Breguet **Br. 482** bomber. The D.520Z was given the civil registration F-WEPJ. Engine problems delayed the first taxi test until 22 October 1948 and further testing was cancelled in January of 1949.

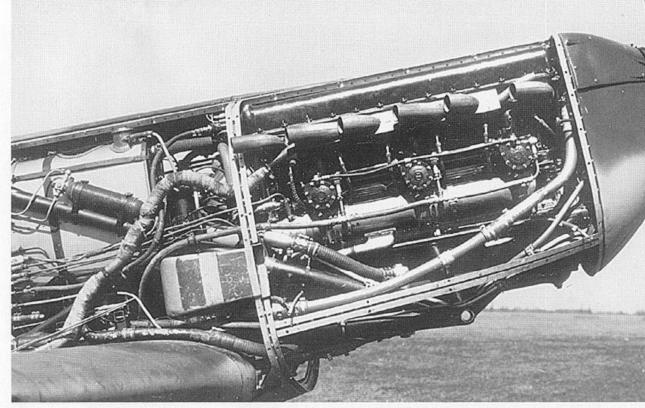




The D. 520 'Amélioré' engine cowling had a smoother finish than the cowling fitted to earlier D.520s. Six individual exhaust stacks per side replaced the paired stacks previously employed. A small auxiliary intake was mounted aft of the propeller spinner and the supercharger air inlet was placed low on the cowling side.

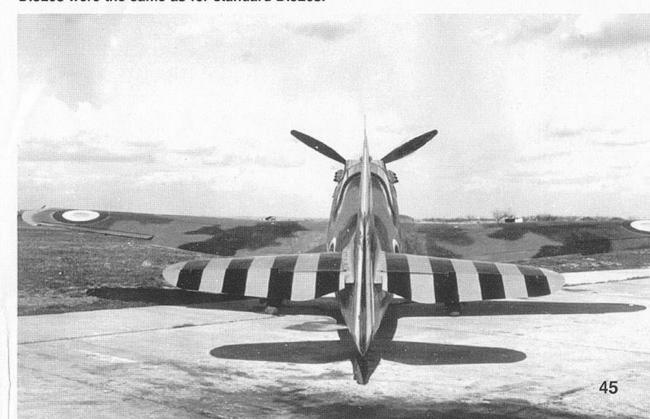
A late production D.520 (No 494) – whose 12Y49 engine was fitted with the older exhaust stacks – is parked on the Saint-Martin-du-Touch ramp in March of 1942. The aircraft was finished in standard French camouflage with the Vichy cowl, fuselage, and tail markings. This D.520 was later delivered to GC II/5 at Casablanca, French Morocco, where unit markings were painted on the fighter.

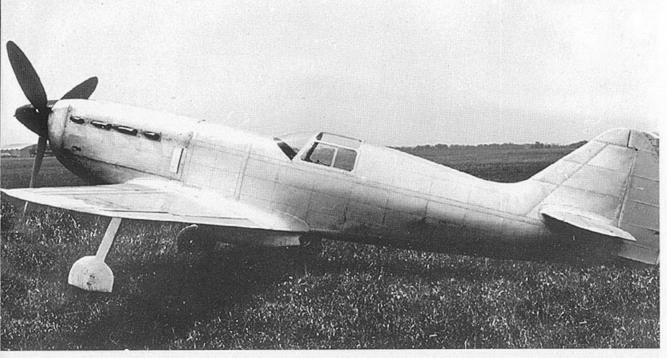




Removed cowl panels reveal the 820 HP Hispano-Suiza 12Y49 engine fitted to the D.520 'Amélioré'. The oil radiator was deleted from under the engine and replaced by an intercooler unit. The supercharger inlet base was mounted just above the wing root. Engine accessories were placed immediately aft of the engine.

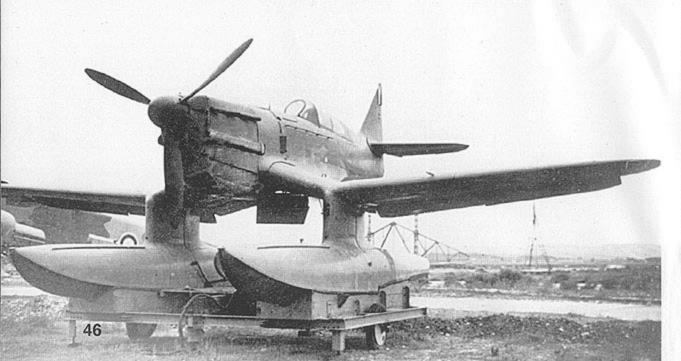
The horizontal tail surfaces of D.520 No 494 had the standard red and yellow striping carried by Vichy French aircraft. Upper surfaces were painted Khaki, Dark Blue Gray, and Dark Brown, with light gray added to the wingtips. Standard 80 cm (31 1/2 inch) diameter French roundels appeared on the wings. The external dimensions of late production D.520s were the same as for standard D.520s.





The D.550 racing aircraft rests soon after its first flight on 23 June 1939. This aircraft reached a speed of 677 KMH (420.7 MPH) at 6000 M (19,685 feet) on 23 October 1939. The D.550 was the basis of the D.551 fighter, whose development was ended by the French Armistice of 25 June 1940. The D.550 was badly damaged in its Toulouse hangar by Allied bombing on 4 April 1944.

The sole Dewoitine HD.780 floatplane fighter built was displayed after the Armistice. This aircraft mated a modified D.520 fuselage to enlarged wings – which folded over twice for improved stowage aboard ships – and a 1050 HP Hispano-Suiza 12Y51 engine. The HD.780 was completed in April of 1940, but did not fly. (CAC)



# Foreign and Post-War Service

The German invasion of unoccupied (Vichy) France on 11 November 1942 resulted in the capture of 246 D.520s. The Germans directed SNCASE to deliver 19 aircraft in full flight condition and complete assembly on 150 others on the production line. This task was completed by the summer of 1944, concluding D.520 production at 905 aircraft. These fighters were primarily used as trainers with three Luftwaffe *Jagdgeschwaderen* (JGs; Fighter Wings): JG 101, JG 103, and JG 105. German pilots praised the D.520's maneuverability, but found cross wind take offs and landings most challenging. This difference in handling between the Dewoitine fighter and German types resulted in high D.520 attrition in the Luftwaffe.

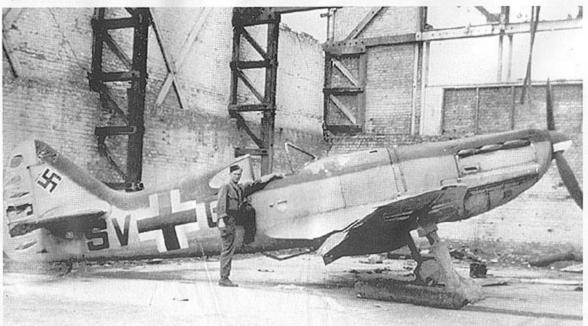
The Germans transferred 60 D.520s to Italy, where they saw limited service with eight *Gruppi* (Groups). A further 100 D.520s were sent to Bulgaria, where they formed the main strength of the No 6 Regiment. Many of these Bulgarian fighters were destroyed in combat with the US 9th Air Force and were replaced by the more potent Messerschmitt Bf 109G-6.

On 1 June 1945, 17 D.520s were on strength with *Base École* (Training Base) 704 at Tours to train *Armée de l'Air* flight instructors. One of these aircraft (No 243) was converted to a two-seat trainer and first flew in this configuration on 19 October 1945. This aircraft was accepted by the CEV in 1946 and the modified aircraft was designated **D.520DC** (*Double Commande*; Dual Controls). A batch of 20 D.520s was approved for conversion into D.520DCs; however, only 12 were completed. The six remaining serviceable D.520s of Base École 704 were allocated to two other units when the Base was disbanded on 31 August 1947.

The last D.520 unit was the Escadrille de Présentation de l'Armée de l'Air (EPAA; Air Force Presentation Squadron) 58 at Étampes, also called the 'Patrouille d'Étampes.' This unit flew four single-seat D.520s and three two-seat D.520DCs at air shows throughout France. EPAA was disbanded on 30 September 1953. No 474 made the final flight by an Armée de l'Air D.520 on 3 September 1953.

Three of the EPAA 58 D.520s survived the unit's disbandment, including two-seat No 603. It was restored to its original single-seat configuration and placed in storage by the *Musée de* 

An airman stands by a recaptured D.520 (SV+GB, No 544) at Grimbergen airfield, Belgium in January of 1945. This aircraft was used by the Luftwaffe's JG 103 for fighter training duties. The D.520 was painted RLM 61 Dark Brown (FS30040) on the upper surfaces, with RLM 02 Gray (FS36165) sides and RLM 27 Yellow (FS33637) undersurfaces. The propeller spinner was black and white. (Via M. Cristescu)





This unidentified D.520 is parked at an unknown French airfield soon after World War Two. The Dewoitine was painted with US colors: Olive Drab (FS34087) upper surfaces and Neutral Gray (FS36173) undersurfaces. The propeller blades were painted blue, white, and red, with a blue spinner. The spinning blades recreated the French roundel with the engine running. (Biancotti)

l'Air & de l'Espace (Air and Space Museum) at Le Bourget Airport in Paris. No 650 is on loan to the Aéronavale Museum in Rochefort, while No 862 is on display at the Musée de l'Air & de l'Espace. A fourth aircraft, No 408, was restored to flying condition during the late 1970s. It flew again on 27 August 1980 and appeared at several air shows before it was destroyed in a fatal accident in 1986.

One of the 12 D.520 DC dual control aircraft converted from single-seaters is parked at Étampes, France. It was operated by the Escadrille de Présentation de l'Armée de l'Air (EPAA; Air Force Presentation Squadron) 58, also called the 'Patrouille d'Étampes.' These D.520 DCs were painted overall aluminum with a flat black anti-glare panel and spinner.





The Armée de l'Air flew many D.520s in North Africa after World War Two. This aircraft was assigned to GC I/2, a fighter training group, at Meknès, French Morocco. The overall color scheme is unknown, but it is believed to be a light gray. Large roundels with yellow borders were painted under the wings.

The restored D.520 No 408 flies with the landing gear lowered near Le Bourget airfield, Paris on 20 September 1980. The Musée de l'Air & de l'Espace (Air and Space Museum) restored this aircraft to represent Sous-Lieutenant (2/Lt) Michel Madon's fighter during the Battle of France. This D.520 flew displays until it was lost in a fatal accident at Vannes, France on 13 July 1986. Another restored D.520 (No 862) is displayed at this museum, located at Le Bourget. (Musée de l'Air & de l'Espace)



# **Arsenal VG 33**

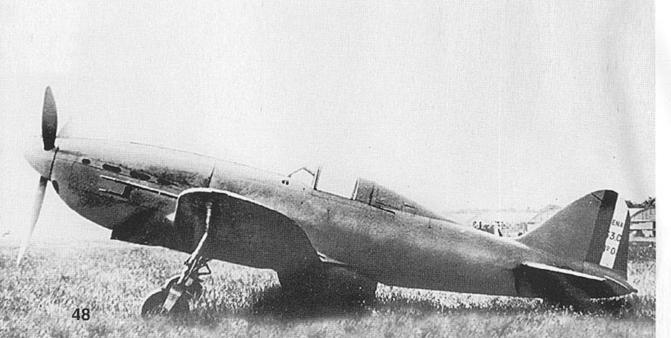
The Arsenal VG 33 was a contender for the A23 specification issued by the French Air Ministry on 12 January 1937. This aircraft – intended to replace the Morane Saulnier MS 406 – was designed at the Arsenal de l'Aéronautique (Aeronautical Arsenal) at Villacoublay, near Paris. The designers were the Arsenal's director, Ingénieur-Général (General Engineer) Michel Vernisse and Jean Galtier. (The VG in the designation comes from Vernisse and Galtier.)

The VG 33 had its roots in the VG 30, an all-wood lightweight fighter ordered in early 1938. The prototype first flew on 6 October 1938, powered by a 610 HP Potez 12Dc 12-cylinder, aircooled, horizontally opposed engine. A full-scale wooden mockup was displayed at the *Salon de l'Aéronautique* at Paris' *Grand Palais* in late 1938. The VG 30 prototype flew government trials at the *Centre d'Essais du Matériel Aérien* (CEMA; Air Material Research Center) from 24 March through 17 July 1939. It reached 485 KMH (301.4 MPH) at 4950 M (16,240.2 feet) and reached 5000 M (16,404.2 feet) in 7 minutes 15 seconds. The VG 30's performance was comparable to that of the MS 406, which used the more powerful 860 HP Hispano-Suiza 12Y31 engine.

The VG 31 was a VG 30 adapted to use a Hispano-Suiza 12Y31 12-cylinder, liquid-cooled, inline engine. The wing area was to be reduced by approximately 1.85 M<sup>2</sup> (19.9 square feet) from the VG 30, but the increased speed was deemed insufficient to cancel out the higher stalling speed and poorer handling. The VG 31 was never completed and its fuselage served as the basis for the third VG 33 prototype.

The VG 32 was similar to the VG 30, but was designed to use the 1040 HP Allison V-1710-C15 12-cylinder, liquid-cooled, inline engine. The engine was supercharged and turned a three-bladed Curtiss propeller. The French Air Ministry selected the US-built Allison power-plant to hedge against a shortage of Hispano-Suiza engines. The VG 32 prototype featured a lengthened fuselage and provision for two 20mm cannon and two 7.5mm machine guns in the

The Arsenal VG 33 prototype is parked at Villacoublay after its delivery to CEMA on 11 August 1939. It was built entirely of wood and was armed with one engine-mounted 20mm cannon and four wing-mounted 7.5mm machine guns. This VG 33 was eventually camouflaged with large Khaki, Brown, and Dark Blue Gray upper surface patches.



wings. Engine delays resulted in the VG 32 appearing after the VG 33. The sole VG 32 was captured engineless by German troops at Villacoublay in June of 1940.

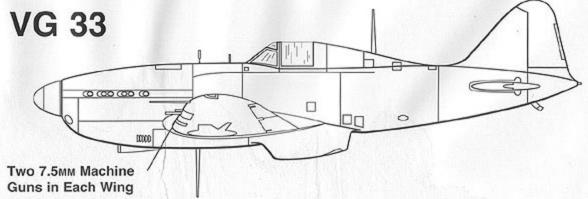
The Air Ministry selected the VG 33 for mass production and authorized construction of five prototypes. The VG 33-01 used an 860 HP Hispano-Suiza 12Y31 engine, which drove a three-bladed, variable pitch Chauvière 375 propeller. This aircraft first flew on 25 April 1939 and was delivered to CEMA at Villacoublay for official trials on 11 August 1939. It attained a speed of 558 KMH (346.7 MPH) at 5200 M (17,060.4 feet) while at CEMA. On 8 October, the VG 33 prototype was sent to Cazaux for armament trials.

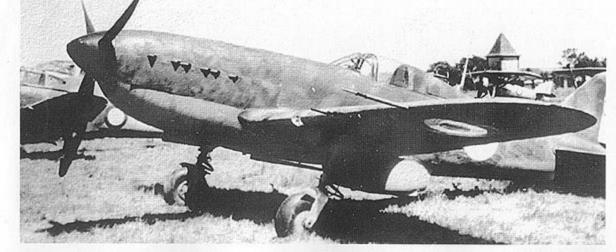
The VG 33-02 was intended to use the 910 HP 12Y49 powerplant with a Szydlowski-Planiol supercharger. This aircraft was not completed, but its wings were combined with the VG 31's fuselage to create the VG 33-03. This third prototype was later sent to the *Société de Constructions Aéronautiques du Nord* (SNCAN) plant at Sartrouville, where it served as the production prototype. A later prototype, also designated VG 33-02, was built and first flew on 25 February 1940. VG 33-04 was modified before flight into the first prototype of the later VG 35. The fifth VG 33 served as the first representative production aircraft.

The VG 33 had a wingspan of 10.8 m (35 feet 5 3/16 inches), a length of 8.55 m (28 feet 5/8 inch), and a height of 3.35 m (10 feet 11 7/8 inches). It was of all-wood construction and used a one-piece, two-spar wing with hydraulically operated flaps. The aircraft weighed 1800 kg (3968.3 pounds) empty and 2450 kg (5401.2 pounds) fully loaded. The fighter had a maximum speed of 558 kmH (346.7 mpH) at 5200 m (17,060.4 feet) and a service ceiling of 9500 m (31,168 feet). Two external 100 L (26.4 gallon) tanks under the wings could supplement the VG 33's internal fuel capacity of 400 L (105.7 gallons). It had a range of 1060 km (658.7 miles). The Arsenal fighter's armament consisted of one 20mm Hispano-Suiza HS 404 cannon with 60 rounds firing through the propeller hub and four 7.5mm MAC 1934 machine guns with 500 rounds per gun in the wings. A Baille-Lemaire 40 gun sight was fitted for the pilot's use.

SNCAN's Sartrouville plant was awarded a contract for 200 VG 33s on 17 September 1939. The first ten aircraft were scheduled for delivery in January of 1940. The contract was later amended: first to 500 VG 33s, then increased to 720 aircraft. Early aircraft were assembled at Sartrouville, but later examples were to be produced by Michelin at Clermont-Ferrand. The first production VG 33 made its maiden flight on 21 April 1940. SNCAN had 160 VG 33s in various stages of assembly when German forces entered Paris on 14 June 1940. Only 19 aircraft had been completed and flown by this date. Approximately 20 VG 33s missing their undercarriages were destroyed at Villacoublay just before German forces could capture the fighters. The Armée de l'Air had accepted five VG 33s (Nos. 3 to 7) by 14 June and received the first two aircraft a few days later. Twelve Arsenal fighters were placed in storage at the Châteauroux depot after the Armistice became effective on 25 June. In November of 1942, the Germans seized two VG 33s at Châteauroux and are believed to have captured two others at Bordeaux-Mérignac. The VG 33 never saw combat with French forces, before or after the Armistice.

Arsenal proposed several variants of the VG 33, none of which entered service. The



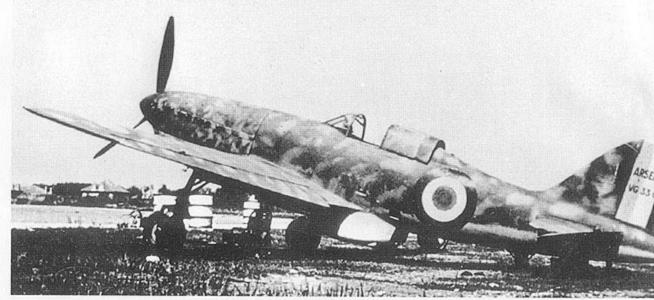


A production VG 33 rests at an aircraft storage facility in Châteauroux. SNCAN delivered seven VG 33s to the Armée de l'Air by 25 June 1940, but none saw combat. The SNCAN factory in Sartrouville typically applied upper surface camouflage colors in small patches on these aircraft. (M. Bénichou Collection)

VG 34-01 first flew on 20 January 1940. Powered by a Hispano-Suiza 12Y45 engine, it reached 358 KMH (222.5 MPH) at 6000 M (19,685 feet). It was flown to Toulouse on 18 June 1940, but no further work was done on the aircraft. The VG 35-01 (formerly the fourth VG 33 prototype) tested the 1100 HP Hispano-Suiza 12Y51 engine intended for the later VG 36. The first VG 35 flew from Villacoublay on 25 February 1940; however, its ultimate fate is unknown. The VG 36-01 featured a deepened aft fuselage, a smaller ventral radiator, and a redesigned canopy. It was intended to replace the VG 33 on the production line. On 14 May 1940, VG-36-01 flew for the first time. It was destroyed at La Roche-sur-Yon after a brief flight test program. Two proposals that were never built were the VG 37 with a 1000 HP Hispano-Suiza engine and the VG 38 with a Hispano-Suiza 12Y77 engine fitted with two Brown-Boveri exhaust-driven turbo-superchargers.

The landing gear doors are removed from this VG 33. These doors – built to cover the lower two-thirds of the gear strut – were left off many Arsenal fighters built during the Battle of France's last days. A radiator for cooling the Hispano-Suiza 12Y31 engine was mounted under the mid-fuselage.





The canopy is fully opened on this production VG 33. Only 12 flyable Arsenals were flown from Villacoublay to Châteauroux – just ahead of the advancing Germans. The fighters were stored at Châteauroux, where Germans seized them after the invasion of unoccupied (Vichy) France in November of 1942.

The last Arsenal fighter built before France's collapse was the VG 39. This aircraft was powered by a 1280 HP Hispano-Suiza 12Z89 engine with a lengthened fuselage. It was armed with six wing-mounted 7.5MM machine guns. The prototype first flew on 3 May 1940 and it reached a maximum speed of 625 KMH (388.4 MPH) during flight trails at Toulouse-Blagnac. The VG 39-01 last flew on 15 June 1940; it was destroyed on the ground at Toulouse-Blagnac ahead of the advancing Germans.

The Arsenal VG 36 was intended to replace the VG 33 on the production line. The newer aircraft had a new streamlined radiator on the centerline, a redesigned canopy and aft fuselage, and a 1100 HP Hispano-Suiza 12Y51 engine. This sole VG 36 first flew on 14 May 1940, then flew several times before it was destroyed in a crash.





(Above) A Bloch 155, Red 4 (No. 704), flies a patrol over southern France during 1942. The aircraft was assigned to the 1st *Escadrille* (Squadron) of GC I/8, an *Armée de l'Air de l'Armistice* (Vichy French Air Force) fighter group based at Montpellier, France.

(Below) White 2 was a Dewoitine D.520 recaptured by Free French forces from the Germans in mid-1944. This fighter operated with GC II/18 'Saintonge' over southeast France during the winter of 1944-45.

