

Hawker Hurricane

Hurricane	
	
Hurricane Mk I (R4118), which fought in the Battle of Britain	
Role	Fighter
Manufacturer	Hawker Aircraft Gloster Aircraft Company Canadian Car and Foundry Austin Motor Company
Designer	Sydney Camm
First flight	6 November 1935
Introduction	1937
Primary user	Royal Air Force Royal Canadian Air Force
Produced	1937-1944
Number built	14,533 ^[1]

The **Hawker Hurricane** is a British single-seat fighter aircraft that was designed and predominantly built by Hawker Aircraft Ltd for the Royal Air Force (RAF). Although largely overshadowed by the Supermarine Spitfire, the aircraft became renowned during the Battle of Britain, accounting for 60% of the RAF's air victories in the battle, and served in all the major theatres of the Second World War.

The 1930s design evolved through several versions and adaptations, resulting in a series of aircraft which acted as interceptor-fighters, fighter-bombers (also called "Hurribombers"), and ground support aircraft. Further versions known as the **Sea Hurricane** had modifications which enabled operation from ships. Some were converted as catapult-launched convoy escorts, known as "Hurricats". More than 14,000 Hurricanes were built by the end of 1944 (including about 1,200 converted to Sea Hurricanes and some 1,400 built in Canada by the Canada Car and Foundry).

Design and development

Origins



The Hurricane was developed by Hawker in response to the Air Ministry specification F.36/34 (modified by F.5/34) for a fighter aircraft built around the new Rolls-Royce engine, then only known as the PV-12, later to become famous as the Merlin. At that time, RAF Fighter Command comprised just 13 squadrons, each equipped with either the Hawker Fury, Hawker Hart variant, or Bristol Bulldog – all biplanes with fixed-pitch wooden propellers and non-retractable undercarriages.^[2] The design, started in early 1934, was the work of Sydney Camm.

Sydney Camm's original plans submitted in response to the Air Ministry's specification were at first rejected (apparently "too orthodox," even for the Air Ministry). Camm tore up the proposal and set about designing a fighter as a Hawker private venture. With economy in mind, the Hurricane was designed using as many existing tools and jigs as possible (the aircraft was effectively a monoplane version of the successful Hawker Fury); and it was these factors that were major contributors to the aircraft's success.

Early design stages of the "Fury Monoplane" incorporated a Rolls-Royce Goshawk engine, but this was replaced shortly after by the Merlin, and featured a retractable undercarriage. The design came to be known as the "Interceptor Monoplane," and by May 1934, the plans had been completed in detail. To test the new design, a one-tenth scale model was made and sent to the National Physical Laboratory at Teddington. A series of wind tunnel tests confirmed the aerodynamic qualities of the design were in order, and by December that year, a full size wooden mock-up of the aircraft had been created.^[2]

Construction of the first prototype, K5083, began in August 1935 incorporating the PV-12 Merlin engine. The completed sections of the aircraft were taken to Brooklands, where Hawkers had an assembly shed, and re-assembled on 23 October 1935. Ground testing and taxi trials took place over the following two weeks, and on 6 November 1935, the prototype took to the air for the first time, at the hands of Hawker's chief test pilot, Flight Lieutenant (later Group Captain) P. W. S. Bulman.^[3] Flight Lieutenant Bulman was assisted by two other pilots in subsequent flight testing; Philip Lucas flew some of the experimental test flights, while John Hindmarsh conducted the firm's production flight trials.^[4] Sammy Wroath, later to be the founding Commandant of the Empire Test Pilot School, was the RAF test pilot for the Hurricane and his enthusiastic endorsement helped get it into production.

Though faster and more advanced than the RAF's current front line biplane fighters, the Hurricane's design was already outdated when introduced. It employed traditional Hawker construction techniques



Planform view of R4118, a preserved Hurricane from the Battle of Britain

from previous biplane aircraft, with mechanically fastened, rather than welded joints. It had a Warren girder-type fuselage of high-tensile steel tubes, over which sat frames and longerons that carried the doped linen covering.^[5] An advantage conferred by the steel-tube structure was that cannon shells could pass right through the wood and fabric covering without exploding. Even if one of the steel tubes were damaged, the repair work required was relatively simple and could be done by groundcrew at the airfield. An all metal structure, as with the Spitfire, damaged by an exploding cannon shell required more specialised equipment to repair.^[6] The old-fashioned structure also permitted the assembly of Hurricanes with relatively basic equipment under field conditions. Crated Hurricanes were assembled in West Africa and flown across the Sahara to the Middle East theatre, and to save space, some Royal Navy aircraft carriers carried their reserve Sea Hurricanes dismantled into their major assemblies, which were slung up on the hangar bulkheads and deckhead for reassembly when needed.



A Yugoslav Hawker Hurricane. Some 24 British built and 20 Yugoslav built Hurricanes served in the YRAF.

Initially, the wing structure consisted of two steel spars, and was also fabric-covered. Several fabric-wing Hurricanes were still in service during the Battle of Britain, although a good number had had their wings replaced during servicing or after repair. Changing the wings only required three hours' work per aircraft.^[7] An all-metal, stressed-skin wing of duraluminium (a DERD specification similar to AA2024) was introduced in April 1939 and was used for all of the later marks.^[3] "The metal skinned wings allowed a diving speed that was 80 mph (130 km/h) higher than the fabric-covered ones. They were very different in construction but were interchangeable with the fabric-covered wings, and one trials Hurricane, L1877, was even flown with a fabric-covered port wing and metal-covered starboard wing. The great advantage of the metal-covered wings over the fabric ones was that the metal ones could carry far greater stress loads without needing so much structure beneath."^[7]

One of Camm's priorities was to provide the pilot with good all round visibility. To this end, the cockpit was mounted reasonably high in the fuselage, creating a distinctive "hump-backed" silhouette. Pilot access to the cockpit was aided by a retractable "stirrup" mounted below the trailing edge of the port wing. This was linked to a spring-loaded hinged flap which covered a handhold on the fuselage, just behind the cockpit. When the flap was shut, the footstep retracted into the fuselage. In addition, both wingroots were coated with strips of non-slip material.

In contrast, the contemporary Spitfire used all-metal monocoque construction and was thus both lighter and stronger, though less tolerant to bullet damage. With its ease of maintenance, widely-set landing gear and benign flying characteristics, the Hurricane remained in use in theatres of operations where reliability, easy handling and a stable gun platform were more important than performance, typically in roles like ground attack. One of the design requirements of the original specification was that the Hurricane, as well as the Spitfire, was also to be used as a night-fighter. The Hurricane proved to be a relatively simple aircraft to fly at night and was to be instrumental in shooting down several German aircraft during the nocturnal hours. From early 1941, the Hurricane would also be used as an "intruder" aircraft, patrolling German airfields in France at night in an attempt to catch night bombers during takeoffs or landings.

Production

The Hurricane was ordered into production in June 1936, mainly due to its relatively simple construction and ease of manufacture. As war was looking increasingly likely, and time was of the essence in providing the RAF with an effective fighter aircraft, it was unclear if the more advanced Spitfire would enter production smoothly, while the Hurricane used well-understood manufacturing techniques. This was true for service squadrons as well, who were experienced in working on and repairing aircraft whose construction employed the same principles as the Hurricane, and the simplicity of its design enabled the improvisation of some remarkable repairs in squadron workshops. The Hurricane was also significantly cheaper than the Spitfire, requiring 10,300 man hours to produce rather than 15,200 for the Spitfire.^[8]



The last Hurricane ever built, s/n PZ865, of 14,533. A Mk IIc version, originally known as "The Last of the Many" and owned by Hawker, this aircraft is now flown by the Battle of Britain Memorial Flight

The maiden flight of the first production aircraft, powered by a Merlin II engine, took place on 12 October 1937. The first four aircraft to enter service with the RAF joined No. 111 Squadron RAF at RAF Northolt the following December. By the outbreak of the Second World War, nearly 500 Hurricanes had been produced, and had equipped 18 squadrons.^[9]

During 1940, Lord Beaverbrook, who was the Minister of Aircraft Production, established an organisation in which a number of manufacturers were seconded to repair and overhaul battle-damaged Hurricanes. The Civilian Repair Organisation also overhauled battle-weary aircraft, which were later sent to training units or to other air forces; one of the factories involved was the Austin Aero Company's Cofton Hackett plant. Another was David Rosenfield Ltd, based at Barton aerodrome near Manchester.

In all, some 14,000 Hurricanes and Sea Hurricanes were produced. The majority of Hurricanes were built by Hawker (which produced them until 1944), with Hawker's sister company, the Gloster Aircraft Company, making 2,750. The Austin Aero Company built 300. Canada Car and Foundry in Fort William, Ontario, Canada, (where the Chief Engineer, Elsie MacGill, became known as the "Queen of the Hurricanes") was responsible for production of 1,400 Hurricanes, known as the Mk X.

In 1939, production of 100 Hurricanes was initiated in Yugoslavia by Zmaj and Rogozarski. Of these, 20 were built by Zmaj by April 1941. One of these was fitted with a DB 601 and test flown in 1941.

A contract for 80 Hurricanes was placed with Fairey's Belgian subsidiary Avions Fairey SA for the Belgian Air Force in 1938, with the intention of arming these aircraft with four 13.2 mm machine guns. Three were built and two flown with this armament by the time of the *Blitzkrieg* in May 1940, with at least 12 more built by Avions Fairey with the conventional eight rifle calibre machine gun armament.^[10]

Operational history

The first fifty Hurricanes had reached squadrons by the middle of 1938. At that time, production was slightly greater than the RAF's capacity to introduce the new aircraft and the government gave Hawkers the clearance to sell the excess to nations likely to oppose German expansion. As a result, there were some modest sales to other countries. Production was then increased with a plan to create a reserve of aircraft as well as re-equip existing squadrons and newly formed ones such as those of the Auxiliary Air Force. Expansion scheme E included a target of 500 fighters of all types by the start of 1938. By the time of the Munich Crisis there were only two fully operational squadrons of the planned twelve with Hurricanes.^[11] By the time of the German invasion of Poland there were 18 operational Hurricane squadrons and three more converting.

The Phoney War

The Hurricane had its baptism of fire on 21 October 1939. That day, "A" Flight of 46 Squadron took off from North Coates satellite airfield, on the Lincolnshire coast, and was directed to intercept a formation of nine Heinkel He 115B floatplanes from 1/KüFlGr 906, searching for ships to attack in the North Sea. The Heinkels had been already attacked and damaged by two 72 Squadron Spitfires when six 46 Squadron Hurricanes intercepted the Heinkels, which were flying at sea level in an attempt to avoid fighter attacks. Nevertheless, the Hurricanes in rapid succession, shot down four of the enemy (46 Squadron claiming five and the Spitfire pilots two).^[12]

In response to a request from the French government for 10 fighter squadrons to provide air support, Air Chief Marshal Sir Hugh Dowding, Commander-in-Chief of RAF Fighter Command, insisted that this number would deplete British defences severely, and so initially only four squadrons of Hurricanes, 1, 73, 85 and 87, were relocated to France, keeping Spitfires back for "Home" defence. The first to arrive was No.73 Squadron on 10 September 1939, followed shortly by the other three. A little later, 607 and 615 Squadrons joined them.



Sea Hurricane Mk IB in formation, December 1941

“Then, with tail trimmer set, throttle and mixture lever fully forward...and puffs of grey exhaust smoke soon clearing at maximum r.p.m. came the surprise! There was no sudden surge of acceleration, but with a thunderous roar from the exhausts just ahead on either side of the windscreen, only a steady increase in speed...In retrospect that first Hurricane sortie was a moment of elation, but also of relief. Apart from the new scale of speeds that the pilot had to adapt to, the Hurricane had all the qualities of its stable, secure biplane predecessor the Hart, but enhanced by livelier controls, greater precision and all this performance.**”**

—Roland Beamont, a trainee pilot, describing his first flight in a Hurricane.^[13]

After his first flight in October 1939, Beamont subsequently flew operationally with 87 Squadron, claiming three enemy aircraft during the French campaign, and delivered great praise of his aircraft's performance:

“Throughout the bad days of 1940, 87 Sqn had maintained a proficient formation aerobatic team, the precise flying controls and responsive engines permitting precision formation through loops, barrel rolls, 1g semi-stall turns and rolls off half-loops...My Hurricane was never hit in the Battles of France and Britain, and in over 700 hr on type I never experienced an engine failure.**”**

—Roland Beamont, summarising his wartime experience as a pilot.^[14]

On 30 October, Hurricanes saw action over France. That day, Pilot Officer P.W.O. "Boy" Mould of 1st Squadron, flying Hurricane L1842, shot down a Dornier Do 17P from 2(F)/123. The German aircraft, sent to photograph Allied airfields close to the border, fell in flames about 10 miles (**unknown operator: u'strong'** km) west of Toul. "Boy" Mould was the first RAF pilot to down an enemy aircraft on the continent in the Second World War.^{[15][16]}

On 6 November 1939, Pilot Officer P.V. Ayerst from 73° Squadron, was the first to clash with a Messerschmitt Bf 109. After the dogfight, he came back with five holes in his fuselage.^[17] Flying Officer E. J. "Cobber" Kain, a New Zealander, was responsible for 73 Squadron's first victory on 8 November 1939, while stationed at Rouvres.^[18] He went on to become one of the RAF's first fighter aces of the war, being credited with 16 kills.

On 22 December, the Hurricanes in France suffered their first losses. Three Hawker fighters, while trying to intercept an unidentified aircraft, between Metz and Thionville, were jumped by four Bf 109Es from III/JG 53, with the *Gruppenkommander*, Spanish Civil War ace Captain Werner Mölders in the lead. Mölders and *Leutnant* Hans von Hahn shot down the Hurricanes of Sergeant R.M. Perry and J. Winn for no losses.^[17]

Battle of France

In May 1940, Nos. 3, 79 and 504 Squadrons reinforced the earlier units as Germany's *Blitzkrieg* gathered momentum. On 10 May, the first day of the Battle of France, Flight Lieutenant R.E. Lovett and Flying Officer "Fanny" Orton, from 73 Squadron, were the two first RAF pilots to engage combat with the invading German aircraft. They attacked one of the three Dorniers Do 17s from 4./KG2 that were flying over their Rouvres airfield. The Dornier went away unscathed, while Orton was hit by defensive fire and had to force land.^[19] On the same day, the Hurricane squadrons claimed 42 German aircraft shot down during 208 sorties, although none of these were fighters, while seven Hurricanes were lost but no pilots were killed.^[19]

On 12 May, several Hurricanes units were committed to escort bombers. That morning, five Fairey Battle volunteer crews, from No. 12 Squadron, took off from Amifontaine base to bomb Vroenhoven and Veldvedzelt bridges on the Meuse, at Maastricht. The escort consisted of eight Hurricanes of No. 1 Squadron, with Squadron Leader P.J.H. "Bull" Halahan in the lead. When the formation approached Maastricht, it was bounced by 16 Bf 109Es from 2./JG 27. Two Battles and two Hurricanes (including Halahan's) were shot down, two more Battles were brought down by flak and the fifth bomber was forced to crash land. The No.1 Squadron pilots claimed four Messerschmitts and two Heinkel He 112s,^[20] while the *Luftwaffe* actually lost only one Bf 109.^[21]

On 13 May 1940, a further 32 Hurricanes arrived. All ten requested Hurricane squadrons were then operating from French soil and felt the full force of the Nazi offensive. The following day, Hurricanes suffered heavy losses: 27 being shot down, 22 by Messerschmitts with 15 pilots killed (another died some days later) including Squadron Leader J.B. Parnall, the first flight commander to die during the war, and the Australian ace Les Clisby.^{[22][23]} On the same day, No. 3 Squadron claimed 17 German aircraft shot down, Nos. 85 and 87 squadrons claimed four, and No. 607 nine.^[24] During the following three days (15–17 May), no fewer than 51 Hurricanes were lost, in combat or in accidents.^[25] By 17 May, the end of the first week of fighting, only three of the squadrons were near operational strength, but despite their heavy losses, the Hurricanes had managed to destroy nearly double the number of German aircraft.^[26] On 18 May 1940, air combat continued from dawn to dusk where Hurricanes pilots claimed 57 German aircraft and 20 probables (*Luftwaffe* records show 39 aircraft lost). The following day, Nos. 1 and 73 Squadrons claimed 11 German aircraft (three by "Cobber" Kain and three by Paul Richey). But in these two days, Hurricanes suffered heavier losses, with 68 Hurricanes shot down or forced to crash land due to combat damage. Fifteen pilots were killed, eight were taken prisoner and 11 injured. Two thirds of the Hurricanes had been shot down by Messerschmitt Bf 109s and Bf 110s.^[27]

In the afternoon of 20 May 1940, the Hurricane units based in Northern France were ordered to abandon their bases on the continent and return to Great Britain. On the same day, "Bull" Malahan requested the repatriation of the pilots serving in No. 1 Squadron. During the previous 10 days, the unit had been the most successful of the campaign; it had claimed 63 victories for the loss of five pilots: two killed, one taken prisoner and two hospitalized. No. 1 Squadron was the only one awarded ten DFCs and three DFMs during the *Blitzkrieg*.^[28] On the evening of 21 May, the only Hurricanes still operative were those of the AASF that had been moved to the bases around Troyes.^[29] During the 11 days of fighting in France and over Dunkirk on 10—21 May 1940, Hurricane pilots claimed 499 kills and 123 probables. Contemporary German records, examined postwar, attribute 299 *Luftwaffe* aircraft destroyed and 65 seriously damaged by RAF fighters.^[30] When the last Hurricanes left France, on 21 June, of the 452 Hawker fighters engaged during the *Blitzkrieg*, only 66 came back to Great Britain^[31] with 178 abandoned at the airfields of Merville, Abbeville, Lille/Seclin and other bases.^[29]

Operation Dynamo

During Operation Dynamo (the evacuation from Dunkirk of British, French and Belgian troops cut off by the German army during the Battle of Dunkirk), the Hawker Hurricanes operated from British bases. Between 26 May and 3 June 1940, the 14 Hurricane units involved were credited with 108 air victories. A total of 27 Hurricane pilots became aces during Operation Dynamo, led by Canadian Pilot Officer W. L. Willie McKnight (10 victories) and Pilot Officer Percival Stanley Turner (seven victories), who served in No. 242 Squadron, mostly formed with Canadian personnel.^[32] Losses were 22 pilots killed and three captured.^[33]

On 27 May 1940, in one of the final mass encounters of the *Blitzkrieg*, 13 Hurricanes from 501 Squadron intercepted 24 Heinkel He 111s escorted by 20 Bf 110s and during the ensuing battle, 11 Heinkels were claimed as "kills" and others damaged, with little damage to the Hurricanes.^[34] The following day, JG 26 three Gruppen shot down 12 British fighters: six Spitfires over Dunkirk and six Hurricanes along Ostend coast. On 29 May, *Luftwaffe* I.(J)LG 2 destroyed eight Hurricanes (plus a couple of Morane-Saulnier M.S.406s near St. Quentin) over Dunkirk.^[35]

On 7 June 1940, Edgar James "Cobber" Kain, the first RAF ace of the war, got word that he was to return to England for "rest leave" at an Operational Training Unit. On leaving his airfield, he put on an impromptu aerobatic display and was killed when his Hurricane crashed after completing a loop and attempting some low altitude "flick" rolls.^[36]

Initial engagements with the *Luftwaffe* had shown the Hurricane to be a tight-turning and steady platform but the Watts two-bladed propeller was clearly unsuitable. At least one pilot complained of how a Heinkel 111 was able to pull away from him in a chase, yet by this time the Heinkel was obsolescent.^[7] At the start of the war, the engine ran on standard 87 octane aviation spirit. From early 1940, increasing quantities of 100 octane fuel imported from the U.S. became available.^{[37][38]} In February 1940, Hurricanes with the Merlin II and III engines began to receive modifications to allow for an additional 6 psi (**unknown operator: u'strong'** kPa) of supercharger boost for five minutes (although there are accounts of its use for 30 minutes continuously). The extra supercharger boost, which increased engine output by nearly 250 hp (**unknown operator: u'strong'** kW), gave the Hurricane an approximate increase in speed of 25 mph (**unknown operator: u'strong'** km/h) to 35 mph (**unknown operator: u'strong'** km/h), under 15000 ft (**unknown operator: u'strong'** m)^[39] altitude and greatly increased the aircraft's climb rate. "Overboost" or "pulling the plug", a form of war emergency power as it was called in later Second World War aircraft, was an important wartime modification that allowed the Hurricane to be more competitive against the Bf 109E and to increase its margin of superiority over the Bf 110C, especially at low altitude. With the +12 lbf/in² (83 kPa) "emergency boost", the Merlin III was able to generate 1,310 hp (977 kW) at 9000 ft (**unknown operator: u'strong'** m).^[40]

Flt Lt Ian Gleed of 87 Squadron wrote about the effect of using the extra boost on the Hurricane while chasing a Bf 109 at low altitude on 19 May 1940:

 Damn! We're flat out as it is. Here goes with the tit.^[41] A jerk - boost's shot up to 12 pounds; speed's increased by 30 mph. I'm gaining ground  - 700, 600, 500 yards. Give him a burst. No, hold your fire you fool! He hasn't seen you yet... 

Gleed ran out of ammunition before he could shoot the 109 down although he left it heavily damaged and flying at about 50 ft (15.2 m).^[42]

Hurricanes equipped with Rotol constant-speed propellers were delivered to RAF squadrons in May 1940, with deliveries continuing throughout the Battle of Britain; the Rotol propeller transformed the Hurricane's performance from "disappointing" to one of "acceptable mediocrity" and modified aircraft were certainly much sought after among squadrons equipped with aircraft having the older de Havilland two-position propeller.^[43]

Battle of Britain

At the end of June 1940, following the fall of France, the majority of the RAF's 36 fighter squadrons were equipped with Hurricanes. The Battle of Britain officially lasted from 10 July until 31 October 1940, but the heaviest fighting took place between 8 August and 21 September. Both the Supermarine Spitfire and the Hurricane are renowned for their part in defending Britain against the *Luftwaffe* — generally the Spitfire would intercept the German fighters, leaving Hurricanes to concentrate on the bombers, but despite the undoubted abilities of the "thoroughbred" Spitfire, it was the "workhorse" Hurricane that scored the higher number of RAF victories during this period, accounting for 55 percent of the 2,739 German losses, according to Fighter Command, compared with 42 per cent by Spitfires.^[44]

As a fighter, the Hurricane had some drawbacks. It was slower than both the Spitfire I and II and the Messerschmitt Bf 109E, and the thick wings compromised acceleration, but it could out-turn both of them. In spite of its performance deficiencies against the Bf 109, the Hurricane was still capable of destroying the German fighter, especially at lower altitudes. The standard tactic of the 109s was to attempt to climb higher than the RAF fighters and "bounce" them in a dive; the Hurricanes could evade such tactics by turning into the attack or going into a "corkscrew dive", which the 109s, with their lower rate of roll, found hard to counter. If a 109 was caught in a dogfight, the Hurricane was just as capable of out-turning the 109 as the Spitfire. In a stern chase, the 109 could easily evade the Hurricane.^[45] In September 1940, the more powerful Mk IIa series 1 Hurricanes started entering service, although only in small numbers.^[46] This version was capable of a maximum speed of 342 mph (**unknown operator: u'strong'** km/h).^[47]

The Hurricane was a steady gun platform,^[48] and had demonstrated its ruggedness, as several were badly damaged, yet returned to base. But, whilst it was sturdy and stable, the Hurricane's construction made it dangerous in the event of the aircraft catching fire; the wood frames and fabric covering of the rear fuselage meant that fire could spread through the rear fuselage structure quite easily. In addition, the gravity fuel tank in the forward fuselage sat right in front of the instrument panel, without any form of protection for the pilot. Many Hurricane pilots were seriously burned as a consequence of a jet of flame which could burn through the instrument panel. This became of such concern to Hugh Dowding that he had Hawker retrofit the fuselage tanks of the Hurricanes with a fire-resistant material called Linatex.^[49] Some Hurricane pilots also felt that the fuel tanks in the wings, although they were protected with a layer of Linatex, were vulnerable from behind, and it was thought that these, not the fuselage tank, were the main fire risk.^[50]

One lesson learned in combat had been that even eight .303 machine guns would not guarantee a kill in the fast-moving air combats that were taking place. In spite of this, from 10 July to 11 August, for example, RAF fighters fired at 114 German bombers and shot down 80, a destruction ratio of 70%. Against the Bf 109, the RAF fighters attacked 70 and shot down 54 of these, a ratio of 77%. Part of the success of the British fighters was possibly due to the use of the de Wilde incendiary round.^[51]

As in the Spitfire, the Merlin engine suffered from negative-G cut-out, a problem not cured until the introduction of the Miss Shilling's orifice in early 1941.

The only Battle of Britain Victoria Cross, and the only one awarded to a member of Fighter Command during the war,^[52] was awarded to Flight Lieutenant Eric Nicolson of 249 Squadron as a result of an action on 16 August 1940 when his section of three Hurricanes was "bounced" from above by Bf 110 fighters. All three were hit simultaneously. Nicolson was badly wounded, and his Hurricane was damaged and engulfed in flames. While attempting to leave the cockpit, Nicolson noticed that one of the Bf 110s had overshot his aircraft. He returned to the cockpit, which by now was a blazing inferno, engaged the enemy, and may have shot the Bf 110 down.^{[53][54]}

Night fighters and Intruders



Hawker Hurricane Mk IIC PZ865 (Battle of Britain Memorial Flight), the last Hurricane produced. It is in the "Night Intruder" scheme of the aircraft of Czech pilot Karel Kuttelwascher of 1 Squadron in 1942.

Following the Battle of Britain, the Hurricane continued to give service, and through the Blitz of 1941, was the principal single-seat night fighter in Fighter Command. F/Lt. Richard Stevens claimed 14 *Luftwaffe* bombers flying Hurricanes in 1941.

1942 saw the cannon-armed Mk IIc perform further afield in the night intruder role over occupied Europe. F/Lt. Karel Kuttelwascher of 1 Squadron proved the top scorer, with 15 *Luftwaffe* bombers claimed shot down.

1942 also saw the manufacture of twelve Hurricane II C(NF) night-fighters equipped with pilot-operated Air Interception Mark VI radar. After a brief operational deployment with No.245 and No. 247 Squadron RAF during which these aircraft proved too slow to serve effectively in Europe,^[55] these aircraft were sent to India to serve with

No. 176 Squadron RAF in the defence of Calcutta. They were withdrawn from service at the end of December 1943.^[56]

North Africa

The Hurricane Mk II was hastily tropicalised following Italy's entry into the war in June 1940. These aircraft were initially ferried through France by air to 80 Squadron in Egypt to replace Gladiators. The Hurricane claimed its first kill in the Mediterranean on 19 June 1940, when F/O P.G. Wykeham-Barnes reported shooting down two Fiat CR.42s. Hurricanes served with several British Commonwealth squadrons in the Desert Air Force. They suffered heavy losses over North Africa after the arrival of Bf 109E and F-variants and were progressively replaced in the air superiority role from June 1941 by Curtiss Tomahawks/Kittyhawks. However, fighter-bomber variants ("Hurribombers") retained an edge in the ground attack role, due to their impressive armament of four 20 mm (.79 in) cannon and a 500 lb (**unknown operator: u'strong'** kg) bombload. From November 1941, beginning in the Libyan desert, it had to face a new formidable opponent: the new Regia Aeronautica Macchi C.202 *Folgore*. The Italian aircraft proved superior to the Hawker fighter.^[57] The C.202, thanks to its excellent agility and a new, more powerful inline engine, could outperform it in a dogfight.^[58]

During and following the five-day El Alamein artillery barrage that commenced on the night of 23 October 1942, six squadrons of Hurricanes, including the 40 mm cannon-armed Hurricane Mk.IID version, claimed to have destroyed 39 tanks, 212 lorries and armoured troop-carriers, 26 bowsers, 42 guns, 200 various other vehicles and four small fuel and ammunition dumps, flying 842 sorties with the loss of 11 pilots. Whilst performing in a ground support role, Hurricanes based at RAF Castel Benito, Tripoli, knocked out six tanks, 13 armoured vehicles, 10 lorries, five half-tracks, a gun and trailer, and a wireless van on 10 March 1943, with no losses to themselves.^[59]

Defence of Malta

The Hurricane played a significant role in the defence of Malta. When Italy entered the war on 10 June 1940, Malta's air defence rested on Gloster Gladiators which managed to hold out against vastly superior numbers of the Italian air force during the following 17 days.(According to myth, after the first one was lost, the remaining three were named "Faith, Hope and Charity"; in reality, there were at least six Gladiators.) Four Hurricanes joined them at the end of June, and together they faced attacks throughout July from the 200 enemy aircraft based in Sicily, with the loss of one Gladiator and one Hurricane. Further reinforcements arrived on 2 August in the form of 12 more Hurricanes and two Blackburn Skuas.^[60] [61]

The increasing number of British aircraft on the island, at last, prompted the Italians to employ German Junkers Ju 87 dive bombers to try to destroy the airfields. Finally, in an attempt to overcome the stiff resistance put up by these few aircraft, the *Luftwaffe* took up base on the Sicilian airfields, only to find that Malta was not an easy target. After numerous attacks on the island over the following months, and the arrival of an extra 23 Hurricanes at the end of April 1941, and a further delivery a month later, the *Luftwaffe* left Sicily for the Russian Front in June that year.^[62]

As Malta was situated on the increasingly important sea supply route for the North African campaign, the *Luftwaffe* returned with a vengeance for a second assault on the island at the beginning of 1942.

It wasn't until March, when the onslaught was at its height, that 15 Spitfires flew in off the carrier HMS *Eagle* to join with the Hurricanes already stationed there and bolster the defence, but many of the new aircraft were lost on the ground and it was again the Hurricane that bore the brunt of the early fighting until further reinforcements arrived. In relation to this second intensive assault on Malta, Wing Commander P.B. "Laddie" Lucas is quoted as saying:^[63]

For weeks a handful of Hurricane IIs, aided by Group Captain A.B. Woodhall's masterly controlling, had been meeting, against all the odds, the rising crescendo of Field Marshal Kesselring's relentless attacks on Grand Harbour and the airfields. Outnumbered, usually, by 12 or 14 to one and, later – with the arrival of the Bf 109Fs in Sicily – outperformed, the pilots of the few old aircraft which the ground crews struggled valiantly to keep serviceable, went on pressing their attacks, ploughing their way through the German fighter screens, and our flak, to close in with the Ju 87s and 88s as they dived for their targets.

—Wing Commander P.B. "Laddie" Lucas D.S.O., D.F.C.

Air defence in Russia

The Hawker Hurricane was the first Allied Lend-Lease aircraft to be delivered to the USSR with a total of 2,952 Hurricanes eventually delivered,^[64] becoming the most common British aircraft in Soviet service.^[65] Soviet pilots were disappointed by the Hawker fighter, regarding it as inferior to both German and Russian aircraft.^{[64][66]}

Mk II Hurricanes played an important air defence role in 1941, when the Soviet Union found itself under threat from the German Army approaching on a broad front stretching from Leningrad, Moscow, and to the oil fields in the south. Britain's decision to aid the Soviets meant sending supplies by sea to the far northern ports, and as the convoys would need to sail within range of enemy air attack from the *Luftwaffe* based in neighbouring Finland, it was decided to deliver a number of Hurricane Mk IIBs, flying with Nos. 81 and 134 Squadrons of No. 151 Wing RAF, to provide protection. Twenty-four were transported on the carrier *Argus*, arriving just off Murmansk on 28 August 1941, and another 15 crated aircraft on board merchant vessels. In addition to their convoy protection duties, the aircraft also acted as escorts to Russian bombers.

Enemy attention to the area declined in October, at which point the RAF pilots trained their Soviet counterparts to operate the Hurricanes themselves. By the end of the year, the RAF's role had ended, but the aircraft remained behind and became the first of thousands of Allied aircraft that were accepted by the Soviet Union.^[67] Although Soviet pilots were not universally enthusiastic about the Hurricane, Hero of the Soviet Union, Lt. Col Safanov "...loved the Hurricane..." and RAF Hurricane Mk IIB fighters operating from Soviet soil in defense of Murmansk, destroyed 15 *Luftwaffe* aircraft for only one loss in combat.^[68] In some Soviet war memoirs the Hurricane is described very unflatteringly.^[69]

The "Soviet" Hurricane had quite a few drawbacks. First of all, it was 40–50 km/h (25/31 mph) slower than its main opponent, the Bf 109E, at low and medium height, and had a slower rate of climb. The Messerschmitt could outdive the Hurricane because of the low wing loading of the British fighter. But the main source of complaints was the Hurricane's armament. Often the eight or 12 small-calibre machine guns did not damage the sturdy and heavily armoured German aircraft, consequently, Soviet ground crews started to remove the Brownings. Retaining only four or six of the 12 machine guns two 12.7 mm Berezin UBs or two or even four 20 mm ShVAK cannons were substituted, but overall performance deteriorated.^{[70][71]}

Burma, Ceylon, Singapore, and the Dutch East Indies

Following the outbreak of war with Japan, 51 Hurricane Mk IIs were sent in crates to Singapore, with 24 pilots, the nucleus of five squadrons. They arrived on 3 January 1942, by which time the Allied fighter squadrons in Singapore, flying Brewster Buffalos, had been overwhelmed in the Malayan campaign. The Imperial Japanese Army Air Force's fighter force, especially the Nakajima Ki-43, had been underestimated in its capability, numbers and the strategy of its commanders.^[72]

Arriving by sea in crates, 51 Hurricanes were assembled in 48 hours and ready for testing. Twenty-one were ready for service within three days, thanks to the efforts of the 151st Maintenance unit. The Hurricanes suffered in performance. The crews equipped them with 12, rather than eight, machine guns. This made them slow to climb and unwieldy to manoeuvre, although they were more effective bomber killers.^[73]

The recently-arrived pilots were formed into 232 Squadron. In addition, 488(NZ) Squadron, a Buffalo squadron, converted to Hurricanes. On 18 January, the two squadrons formed the basis of 226 Group. 232 Squadron became operational on 22 January and suffered the first losses and victories for the Hurricane in Southeast Asia.^[74]

Between 27 and 30 January, another 48 Hurricanes (Mk IIA) arrived with the aircraft carrier HMS *Indomitable*, from which they flew to airfields code-named P1 and P2, near Palembang, Sumatra in the Dutch East Indies.

Because of inadequate early warning systems, Japanese air raids were able to destroy 30 Hurricanes on the ground in Sumatra, most of them in one raid on 7 February. After Japanese landings in Singapore, on 10 February, the remnants of 232 and 488 Squadrons were withdrawn to Palembang. However, Japanese paratroopers began the invasion of Sumatra on 13 February. Hurricanes destroyed six Japanese transport ships on 14 February, but lost seven aircraft in the process. On 18 February, the remaining Allied aircraft and aircrews moved to Java. By this time, only 18 serviceable Hurricanes remained out of the original 99.

After Java was invaded, some of the pilots were evacuated by sea to Australia. One aircraft which had not been assembled, was transferred to the RAAF, becoming the only Hurricane to see service in Australia, with training and other non-combat units.

The RAF Hurricanes of No 30 Squadron also saw action in Ceylon when Japanese Zero fighters and bombers from Admiral Nagumo's fleet attacked Colombo on 5 April 1942 and Trincomalee harbour on 9 April 1942. Some twenty RAF Ceylon Hurricanes were pitted against 120 Mitsubishi A6M Zero fighter aircraft commanded by Captain Mitsuo Fuchida of the Imperial Japanese Navy, who led the attack on Pearl Harbor.



Hawker Hurricane Mk.II of 232 Squadron shot down on 8 February 1942 during the Battle of Singapore



Hurricane aircraft V7476, which was evacuated from Singapore and was the only Hurricane based in Australia during the Second World War. Note the tropicalised air filter which was fitted to many types operating in the Pacific

Epilogue

The battles over the Arakan in 1943, represented the last large-scale use of the Hurricane as a pure day fighter. But they were still used in the fighter-bomber role in Burma until the end of the war and they were occasionally caught up in air combat as well. For example, on 15 February 1944, Flg Off Jagadish Chandra Verma of No 6 Sqdn of Indian Air Force, shot down a Japanese Ki-43 Oscar: it was the only IAF victory of the war.^[75] The Hurricane remained in service as a fighter-bomber over the Balkans and at home as well where it was used mainly for second-line tasks and occasionally flown by ace pilots. For example, in mid-1944, ace Sqdn Leader 'Jas' Storrar flew No 1687 Hurricane to deliver priority mail to Allied armies in France during Normandy invasion.^[75]

Aircraft carrier operations

The Sea Hurricane became operational in mid-1941 and scored its first kill while operating from HMS *Furious* on 31 July 1941. During the next three years, Fleet Air Arm Sea Hurricanes were to feature prominently while operating from Royal Navy aircraft carriers. The Sea Hurricane scored an impressive kill-to-loss ratio,^{[76][77]} primarily while defending Malta convoys, and operating from escort carriers in the Atlantic Ocean. As an example, on 26 May 1944, Royal Navy Sea Hurricanes operating from the escort carrier HMS *Nairana* claimed the destruction of three Ju 290 reconnaissance aircraft during the defence of a convoy.^[78]

Hurricane aces

The top scoring Hurricane pilot was Squadron Leader Marmaduke Thomas St. John "Pat" Pattle, DFC & Bar, with 35 Hawker fighter victories (out of 50 and two shared) serving with No. 80 and 33 Squadrons. All of his Hurricane kills were achieved over Greece in 1941. He was shot down and killed in the Battle of Athens. Wing Commander Frank Reginald Carey claimed 28 air victories while flying Hurricanes during 1939–43, and Squadron Leader William "Cherry" Vale DFC and Bar, AFC totalled 20 kills (of 30) in Greece and Syria with No. 80 Sqdn. F/Lt Karel M. Kuttelwascher achieved all of his 18 air victories with the Hurricane, most as an Intruder night fighter with No. 1 Sqdn. Pilot Officer V.C. Woodward (33 and 213 Squadrons) was another top-scoring ace with 14 (out of 18) plus three shared, while F/Lt Richard P. Stevens claimed all of his 14.5 enemy aircraft flying the Hurricane.^[79] Richard "Dickie" Cork was the leading Fleet Air Arm Sea Hurricane ace with nine destroyed, two shared, one probable, four damaged and seven destroyed on the ground.^[80] Czech pilot Josef František, flying with 303 Polish Squadron, shot down at least 17 enemy aircraft over south-east England during September–October 1940.

Variants

Hurricane Mk I

First production version, with fabric-covered wings, a wooden two-bladed, fixed-pitch propeller, powered by the 1,030 hp (768 kW) Rolls-Royce Merlin Mk II or III engines and armed with eight .303 in (7.7 mm) Browning machine guns. Produced between 1937 and 1939.

Hurricane Mk I (revised)

A revised Hurricane Mk I series built with a de Havilland or Rotol constant speed metal propeller, metal-covered wings, armour and other improvements. In 1939, the RAF had taken on about 500 of this later design to form the backbone of the fighter squadrons.

Hurricane Mk IIA Series 1



Hurricane Mk I (R4118)

Hurricane Mk I powered by the improved Merlin XX engine. This new engine used a mix of 30 per cent glycol and 70 per cent water. Pure glycol is flammable, so not only was the new mix safer, but the engine also ran approximately 70°C cooler, which gave longer engine life and greater reliability. The new engine was longer than the earlier Merlin and so the Hurricane gained a 4.5 in "plug" in front of the cockpit, which made the aircraft slightly more stable due to the slight forward shift in centre of gravity.^[81] First flew on 11 June 1940 and went into squadron service in September 1940.



Hawker Hurricane Mk IIA at the National Museum of the United States Air Force

Hurricane Mk IIB (Hurricane IIA Series 2)

The Hurricane II B were fitted with racks allowing them to carry two 250 lb or two 500 lb bombs. This lowered the top speed of the Hurricane to 301 mph (484 km/h), but by this point mixed sweeps of Hurricanes protected by a fighter screen of Hurricanes were not uncommon. The same racks would allow the Hurricane to carry either two 45-gallon (205 l) drop tanks, more than doubling the Hurricane's fuel load.^[82]



Hawker Hurricane Mk IIB Z5140

Hurricane Mk IIA Series 2 was equipped with new and slightly longer propeller spinner and new wing mounting 12 x .303 in (7.7 mm) Browning machine guns. The first aircraft were built in October 1940 and were renamed **Mark IIB** in April 1941.

Hurricane Mk IIB Trop.

For use in North Africa the Hawker Hurricane Mk IIB (and other variants) were tropicalised. They were fitted with Vokes and Rolls Royce engine dust filters and the pilots were issued with a desert survival kit, including a bottle of water behind the cockpit.^[83]



Hurricane Mk IIC (BE500) of 87 Sqn RAF, 1942

Hurricane Mk IIC (Hurricane Mk IIA Series 2)

Hurricane Mk IIA Series 1 equipped with new and slightly longer propeller spinner and new wing mounting four 20 mm (.79 in) Hispano Mk II cannons. Hurricane IIA Series 2 became the Mk IIC in June 1941, using a slightly modified wing. The new wings also included a hardpoint for a 500 lb (**operator: u'strong' kg**) or 250 lb (**operator: u'strong' kg**) bomb, and later in 1941, fuel tanks. By then performance was inferior to the latest German fighters, and the Hurricane changed to the ground-attack role, sometimes referred to as the **Hurribomber**. The mark also served as a night fighter and "intruder."



Hawker Hurricane Mk IV KZ321 (The Fighter Collection)

Hurricane Mk IID

Hurricane Mk IIB conversion armed with two 40 mm (1.57 in) AT cannons in a pod under each wing and a single Browning machine gun in each wing loaded with tracers for aiming purposes. The first aircraft flew on 18 September 1941 and deliveries started in 1942. Serial built aircraft had additional armour for the pilot, radiator and engine, and were armed with a Rolls-Royce gun with 12 rounds, later changed to the 40 mm (1.57 in) Vickers S gun with 15 rounds. The outer wing attachments were strengthened so that 4G could be pulled at a weight of 8,540 lb (3,874 kg).^[84] The weight of guns and armour protection marginally impacted the aircraft's performance. These Hurricanes were nicknamed "Flying Can Openers", perhaps a play on the No. 6 Squadron's logo which flew the Hurricane starting in 1941.

Hurricane Mk IIE

Another wing modification was introduced in the **Mk IIE**, but the changes became extensive enough that it was renamed the **Mk IV** after the first 250 had been delivered.

Hurricane Mk T.IIC

Two-seat training version of the Mk. IIC. Only two aircraft were built for the Persian Air Force.

Hurricane Mk III

Version of the Hurricane Mk II powered by a Packard-built Merlin engine, intending to provide supplies of the British-built engines for other designs. By the time production was to have started, Merlin production had increased to the point where the idea was abandoned.

Hurricane Mk IV

The last major change to the Hurricane was the introduction of the "universal Wing", a single design able to mount two 250 lb or 500 lb (110 or 230 kg) bombs, two 40 mm (1.57 in) Vickers S guns, drop tanks or eight "60 pounder" RP-3 rockets. Two .303 in Brownings were fitted to aid aiming of the heavier armament.^[85] The new design also incorporated the improved Merlin 24 or 27 engines of 1,620 hp (1,208 kW), equipped with dust filters for desert operations. The Merlin 27 had a redesigned oil system that was better suited to operations in the tropics, and which was rated at a slightly lower altitude in keeping with the Hurricane's new role as a close-support fighter. The radiator was deeper and armoured. Additional armour was also fitted around the engine.^[86]

Hurricane Mk V

The final variant to be produced. Only three were built and it never reached production. This was powered by a Merlin 32 boosted engine to give 1,700 hp at low level and was intended as a dedicated ground-attack aircraft to use in Burma. All three prototypes had four-bladed propellers. Speed was 326 mph (525 km/h) at 500 ft, which is comparable with the Hurricane I despite being one and a half times as heavy.^[86]

Hurricane Mk X

Canadian-built variant. Single-seat fighter and fighter-bomber. Powered by a 1,300 hp (969 kW) Packard Merlin 28. Eight 0.303 in (7.7 mm) machine guns mounted in the wings. In total, 490 were built.



Hurricane Mk IV, armed with RP-3 rockets



Canadian-built Hurricane Mk XII painted to represent Hurricane Mk IIB Z5140 of 126 Squadron RAF



Fleet Air Arm Sea Hurricane

Hurricane Mk XI

Canadian-built variant. 150 were built.

Hurricane Mk XII

Canadian-built variant. Single-seat fighter and fighter-bomber. Powered by a 1,300 hp (969 kW) Packard Merlin 29. Initially armed with 12 0.303 in (7.7 mm) machine guns, but this was later changed to four 20 mm (.79 in) cannon.

Hurricane Mk XIIA

Canadian-built variant. Single-seat fighter and fighter-bomber. Powered by a 1,300 hp (969 kW) Packard Merlin 29, armed with eight 0.303 in (7.7 mm) machine guns.

Sea Hurricane Mk IA

The Sea Hurricane Mk IA was a Hurricane Mk I modified by General Aircraft Limited. These conversions numbered approximately 250 aircraft. They were modified to be carried by CAM ships (catapult armed merchantman), whose ships' crews were Merchant Marine and whose Hurricanes were crewed and serviced by RAF personnel, or Fighter Catapult Ships, which were Naval Auxiliary Vessels crewed by naval personnel and aircraft operated by the Fleet Air Arm. These ships were equipped with a catapult for launching an aircraft, but without facilities to recover them. Consequently, if the aircraft were not in range of a land base, pilots were forced to bail out or to ditch.

Both of these options had their problems - there was always a chance of striking part of the fuselage when bailing out and a number of pilots had been killed in this way. Ditching the Hurricane in the sea called for skill as the radiator housing acted as a water brake, pitching the nose of the fighter downwards when it hit the water, while also acting as very efficient scoop, helping to flood the Hurricane so that a quick exit was advisable before the aircraft sank.^[86] Then the pilot had to be picked up by the ship. More than 80 modifications were needed to convert a Hurricane into a Sea Hurricane, including new radios to conform with those used by the Fleet Air Arm and new instrumentation to read in knots rather than miles per hour.^[83] They were informally known as "Hurricats".

The majority of the aircraft modified had suffered wear-and-tear serving with front line squadrons, so much so that at least one example used during trials broke up under the stress of a catapult launching. CAM Sea Hurricanes were launched operationally on eight occasions and the Hurricanes shot down six enemy aircraft for the loss of one Hurricane pilot killed.^[87] The first Sea Hurricane IA kill was an FW 200C *Condor*, shot down on 2 August 1941.^[88]

Sea Hurricane Mk IB

Hurricane Mk I version equipped with catapult spools plus an arrester hook.^[89] From July 1941 they operated from HMS *Furious* and from October 1941, they were used on Merchant aircraft carrier (MAC ships), which were large cargo vessels with a flight deck fitted, enabling aircraft to be launched and recovered. A total of 340 aircraft were converted. The first Sea Hurricane IB kill occurred on 31 July 1941 when Sea Hurricanes of 880 squadron FAA operating from HMS *Furious* shot down a Do 18 flying-boat.^[90]

Sea Hurricane Mk IC

Hurricane Mk I^[89] version equipped with catapult spools, an arrester hook and the four-cannon wing. From February 1942, 400 aircraft were converted. The Sea Hurricane IC used during *Operation Pedestal* had their Merlin III engines modified to accept 16 lb boost, and could generate more than 1400 hp at low altitude.^{[91][92]} Lt. R. J. Cork was credited with five kills while flying a Sea Hurricane IC during *Operation Pedestal*.^[93]

Sea Hurricane Mk IIC

Hurricane Mk IIC version equipped with naval radio gear; 400 aircraft were converted and used on fleet carriers. The Merlin XX engine on the Sea Hurricane generated 1460 hp at 6,250 ft and 1435 hp at 11,000 ft.

Top speed was 322 mph at 13,500ft and 342 mph at 22,000 ft.^[87]

Sea Hurricane Mk XIIA

Canadian-built Hurricane Mk XIIA converted into Sea Hurricanes.

Hillson F.40 (a.k.a. F.H.40)

A full-scale version of the Hills & Son Bi-mono slip-wing Biplane/monoplane, using a Hawker Hurricane Mk I returned from Canada as RCAF ser no 321 (RAF serial L1884). Taxi and flight trials carried out at RAF Sealand during May 1943, and at the Aeroplane and Armament Experimental Establishment, Boscombe Down from September 1943. The upper wing was not released in flight before the programme was terminated due to poor performance.^[94]

Hurricane Photo Reconnaissance

In Egypt, the Service Depot at Heliopolis converted several Hurricanes Is for the role. The first three were converted in January 1941. Two carried a pair of F24 cameras with 8 inch focal length lenses and the third a vertical and two oblique F24s with 14 inch focal length lenses mounted in the rear fuselage, close to the trailing edge of the wing and a fairing was built up over the lenses aft of the radiator housing. A further five Hurricanes were modified in March 1941 while two were converted in a similar manner in Malta during April 1941. During October 1941 a batch of six Hurricane IIs was converted to PR Mark II status and a final batch, thought to be of 12 aircraft, was converted in late 1941. The PR Mark II was said to be capable of slightly over 350 mph (563 km/h) and was able to reach 38,000 ft (11,600 m).^[82]

Hurricane Tac R

For duties closer to the front lines some Hurricanes were converted to Tactical Reconnaissance (Tac R) aircraft. An additional radio was fitted for liaison with ground forces who were better placed to direct the Hurricane. Some Hurricane Tac R aircraft also had a vertical camera fitted in the rear fuselage, so to compensate for the extra weight either one or two Brownings or two cannons would be omitted. Externally these aircraft were only distinguishable by the missing armament.^[82]

Operators

The Hawker Hurricane, due to its rugged construction and ease of maintenance, enjoyed a long operational life in all theatres of war, flown by both the Axis and Allies. It served in the air forces of many countries, some "involuntarily" as in the case of Hurricanes which either landed accidentally or force-landed in neutral countries.



Hawker Hurricane Mk IV RP with Yugoslav Air Force markings, Museum of Aviation in Belgrade, Belgrade, Serbia

- Australia
- Belgium
- Canada
- Egypt
- France
- Finland
- Germany
- Greece
- British India
- Iran
- Ireland
- Italy
- Japan
- Dutch East Indies
- New Zealand
- Norway
- Poland
- Portugal
- Romania
- South Africa
- Soviet Union
- Turkey
- United Kingdom
- Kingdom of Yugoslavia
- Yugoslavia

Survivors

Of the more than 14,500 Hurricanes that were built,^[95] only 12 survive in airworthy condition worldwide, although other non-flying examples survive in various air museums worldwide. Two Canadian built Hurricanes were acquired by aircraft collector Lynn Garrison for display in Calgary, Alberta. One of these made its way to the United Kingdom where it now flies at G-HURI.

Specifications (Hurricane Mk.IIC)

Data from Jane's Fighting Aircraft of World War II^[96]

General characteristics

- **Crew:** 1
- **Length:** 32 ft 3 in (9.84 m)
- **Wingspan:** 40 ft 0 in (12.19 m)
- **Height:** 13 ft 1½ in (4.0 m)
- **Wing area:** 257.5 ft² (23.92 m²)
- **Empty weight:** 5,745 lb (2,605 kg)
- **Loaded weight:** 7,670 lb (3,480 kg)
- **Max. takeoff weight:** 8,710 lb (3,950 kg)
- **Powerplant:** 1 × Rolls-Royce Merlin XX liquid-cooled V-12, 1,185 hp (883 kW) at 21,000 ft (6,400 m)



A Hawker Hurricane on display at the National Air and Space Museum of the Smithsonian Institution

Performance

- **Maximum speed:** 340 mph (547 km/h) at 21,000 ft (6,400 m)^[97]
- **Range:** 600 mi (965 km)
- **Service ceiling:** 36,000 ft (10,970 m)
- **Rate of climb:** 2,780 ft/min (14.1 m/s)
- **Wing loading:** 29.8 lb/ft² (121.9 kg/m²)
- **Power/mass:** 0.15 hp/lb (0.25 kW/kg)

Armament

- **Guns:** 4 × 20 mm (.79 in) Hispano Mk II cannons
- **Bombs:** 2 × 250 or 500 lb (**unknown operator: u'strong'** or **unknown operator: u'strong'** kg) bombs

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Notes

- [1] Green 1957, p. 24.
- [2] Bader 2004, p. 36.
- [3] Cacutt 1989, pp. 204–212.
- [4] Bader 2004, pp. 37, 40.
- [5] *Flight* 1938, pp. 467–472.
- [6] "Best of Battle of Britain." (http://www.airspacemag.com/issues/2008/february-march/spits_and_canes.php?page=4) *Air & Space* February–March 2008, p. 4.
- [7] Hiscock 2003, p. 12.
- [8] Postan, chapter IV, footnote 89.
- [9] Bader 2004, p. 41.
- [10] *Air International*, July 1987, p. 34.
- [11] Shacklady p47-49
- [12] Holmes 1999, p. 12.
- [13] Beamont January 1994, pp. 17, 18.
- [14] Beamont January 1994, p. 19.
- [15] Holmes 1999, pp. 15–16.
- [16] Mould was shot down on 1 October 1941 by Italian Macchi MC.202s north of Malta and declared "Missing in Action".
- [17] Holmes 1999, p. 18.
- [18] Burns 1992, pp. 56–57.
- [19] Holmes 1996, p. 24.
- [20] The Heinkel He 112 was never operational in France.
- [21] Holmes 1996, pp. 41-42.
- [22] Holmes 1996, p. 47.
- [23] Australian ace Les Clisby was credited with 16 individual air victories, one shared and one not confirmed. Postwar research reduced his score to nine individual kills and three shared. According to some sources, he was killed on 15 May 1940.
- [24] Holmes 1996, pp. 48–49.
- [25] Holmes 1996, p. 49.
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- [27] Holmes 1996, p. 51.
- [28] Holmes 1996, p. 52.
- [29] Holmes 1996, p. 55.
- [30] Homes 1998, p. 47.
- [31] Holmes 1996, p. 23.
- [32] Holmes 1996 p. 58.
- [33] Holmes 1996 p. 57.
- [34] Bader 2004, pp. 50–55.
- [35] Weal 1996 p. 57.
- [36] Burns 1992, pp. 165–167.
- [37] Wood and Dempster 1990, p. 87.
- [38] "10/282 Minutes of Oil Policy Committee meetings." (<http://www.nationalarchives.gov.uk/catalogue/displaycataloguedetails.asp?CATLN=6&CATID=4223197&FullDetails=True&Gsm=2008-02-12&j=1>) National Archives AVIA, 2 April, 18 May, 7 August 1940. Retrieved: 15 June 2009.
- [39] Gleed 1942, p. 61.
- [40] Harvey-Bailey 1995, p. 155.
- [41] This was the pilot's term for the Boost Cut-Out Control which was adjacent to the throttle lever.
- [42] Gleed rose through the ranks to become a Wing Commander flying Spitfire VBs over North Africa; he was shot down and killed by Oblt. Reinert on 16 April 1943. Gleed was credited with 15 victories.
- [43] Donald 1999, p. 38.
- [44] Bywater, Michael. "Our forgotten freedom fighter: Why the unsung Hurricane is the true ace of the Battle of Britain." (<http://www.independent.co.uk/news/uk/this-britain/our-forgotten-freedom-fighter-why-the-unsung-hurricane-is-the-true-ace-of-the-battle-of-britain-2022105.html>) *The Independent*, 17 January 2011.
- [45] Bungay 2000, pp. 264–267.
- [46] Ramsay 1989, pp. 415, 516, 526, 796.
- [47] Mason 1991, pp. 279, 300.

- [48] Bungay 2000, p. 82.
- [49] Bungay 2000, pp. 77, 197–198.
- [50] Bungay 2000, p. 198.
- [51] Bungay 2000, pp. 200–201.
- [52] Ramsay 1989, p. 306.
- [53] Ramsay 1989, pp. 306–313, 362.
- [54] As far as can be determined, no Messerschmitt Bf 110 crashes on land for 16 August 1940 can be attributed to Nicholson, although Nicholson himself believed the 110 crashed into the sea. Ramsay 1989, p. 311.
- [55] Marchant, p.53-54
- [56] Thomas 1996, p.550-554
- [57] Glancey 2006, p. 165.
- [58] Snedden 1997, p. 51.
- [59] Bader 2004, pp. 165–167.
- [60] Shores et al. 1987, pp. 43–47.
- [61] This was code-named Operation *Hurry*. These aircraft were flown off the carrier HMS *Argus*.
- [62] Bader 2004, pp. 125–127.
- [63] Bader 2004, pp. 147–155.
- [64] Morgan 1999, p. 55.
- [65] Yefim 2008, p. 480.
- [66] Drabkin 2007, p. 11.
- [67] Bader 2004, pp. 135–137.
- [68] Jacobs 1998, pp. 84–85.
- [69] Yefim 2008, p. 482.
- [70] Yefim 2008, pp. 483–484.
- [71] Soviet pilot Nikolai G. Golodnikov remembered: "The Hurricane's engine was powerful, but it couldn't stand long periods of work at maximum regimes and would quickly break down. The engine worked very clean, it had exhaust stacks and flame suppressors, mounted like mufflers. Soviet Hurricanes were fueled with 95 octane avgas, not the 100 Octane fuel that the Merlin XX was designed to use. This was very comfortable as the flames did not blind the pilot. Our planes were much worse in this respect. But at negative G-forces the engine chocked. There was no compensating tank. This was very bad because we had to execute any manoeuvre with positive G-forces. It had a very thick wing profile and poor acceleration characteristics. It was not slow in responding to the control stick, but everything happened smoothly, slowly. It had good lifting strength and was very good in horizontal manoeuvrability. But the Hurricane was very poor in vertical manoeuvre, due to thick wing profile. We mostly tried to impose a battle in the horizontal plane and would not go into a vertical one. The Hurricane burned rapidly - and to cinders like a match - as it had dural covering only on the tail and wings, the rest was percale." Drabkin 2007, pp. 127–128.
- [72] Cull and Sortehaug 2004
- [73] Shores 1992, p. 297.
- [74] Printer: Fosh and Cross Ltd, London. "Your Planes and Your Work Defend Your Empire (Poster)." (<http://www.iwm.org.uk/collections/item/object/32022>) Imperial War Museum. Retrieved: 17 November 2011.—
- [75] Thomas 2003, p. 81.
- [76] Shores et al., 1987
- [77] Malta: The Spitfire Year 1942 records 28 Sea Hurricane victories against eight losses during Operation Harpoon and Operation Pedestal.
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- [80] Thomas 2007, p. 87.
- [81] Hiscock 2003, p. 16.
- [82] Hiscock 2003, p. 18.
- [83] Hiscock 2003, p. 19.
- [84] Hiscock 2003, p. 17.
- [85] Mason 1991, p. 285.
- [86] Hiscock 2003, p. 20.
- [87] Brown 1980, p. 112.
- [88] Brown 1980, p. 109.
- [89] Brown 1980, p. 114.
- [90] Thetford 1994, p. 228.
- [91] Brown 1980, p. 115.
- [92] Data on the Merlin III engine and 16 lb boost. (<http://www.wwiaircraftperformance.org/merlin3-rating.jpg>)
- [93] Thetford 1994, p. 231.
- [94] Jarrett Aeroplane Monthly January 1991, pp. 18–23.

[95] "Hawker Hurricane - Great Britain." (<http://www.aviation-history.com/hawker/hurricane.html>) *The Aviation History On-Line Museum*.

Retrieved: 17 January 2011.

[96] Bridgman 1946, pp. 128–129.

[97] 320 mph (514 km/h) at 19,700 ft (6,000 m) with two 250 lb (**unknown operator: u'strong'** kg) bombs

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