

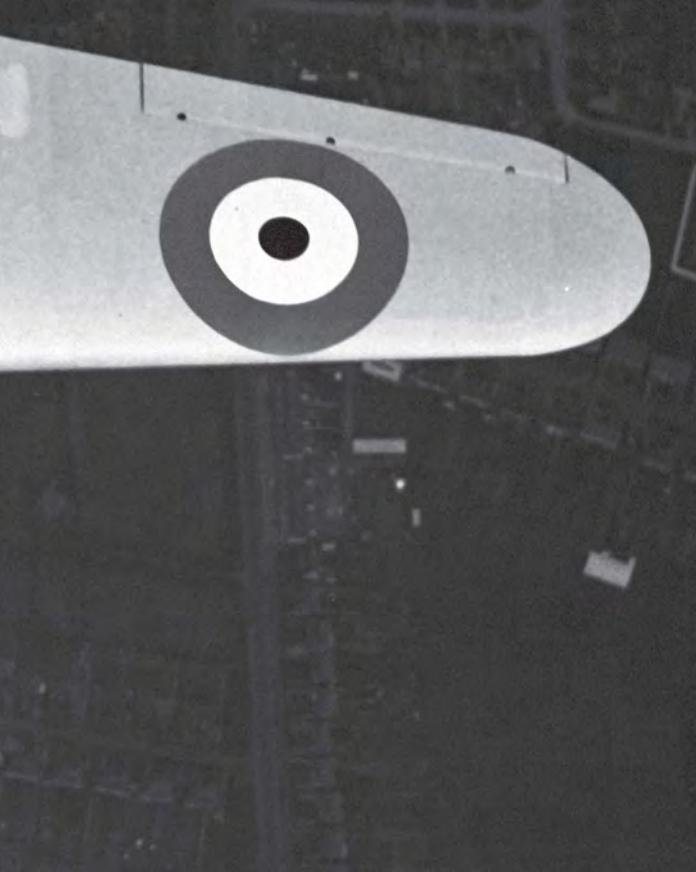
The Great Monoplane Gamble



Test pilot P. W. S. 'George' Bulman flying Hawker's as yet unnamed F36/34 fighter from Brooklands in November 1935, the month of its maiden flight. ALL PHOTOS AEROPLANE

It may have borrowed from the company's biplane experience, but the project that became the Hurricane represented quite a risk for Hawker. Would the Air Staff accept a monoplane fighter? Would fighters even be felt necessary to protect the latest breed of bombers? As official documents show, these and other questions made the new fighter's large-scale availability in time for war a close-run thing — and compromised its design

WORDS: JOHN SWEETMAN



After Louis Blériot sensationally crossed the English Channel, the monoplane soon lost favour in Britain. Fatal crashes were officially caused by 'structural failure to the wing' and the Sopwith Tabloid biplane proved faster than monoplanes during the Schneider Trophy competition. Sydney Camm explained too that, "from the fighter point of view, the biplane had the great advantage of a more straightforward structure as well as being more manoeuvrable". Undoubtedly biplanes provided a stable gun platform during the First World War.

However, even as Hawker's Hart and Fury biplanes enjoyed acclaim, thoughts were once more turning to the monoplane. During the 1920s, technical advances strengthened the wing structure and speeds began to exceed those of the biplane. In 1925, the first Westland-Hill Pterodactyl impressed the Secretary of State for Air. The Air Ministry had "no doubt" in 1927 that the speed of RAF fighters was too slow. When the Supermarine S6 won the 1929 Schneider Trophy with a top speed of 328.64mph, it prompted a supporter in the ministry to declare it "definitely proved the supremacy of the monoplane for pure performance."

That was the background to the Chief of the Air Staff, ACM Sir John Salmond, in July 1931 seeking replacement of tractor biplanes by "novel types", even tail-less monoplanes. Strong Air Staff support for the biplane remained, though. As Air Marshal Sir Ralph Sorley recalled, "The whole outlook towards the monoplane was suspect on the grounds of strength during aerobatics and rigidity as a gun platform". Nevertheless, it emerged that, based on the success of the Supermarine racing monoplanes, R. J. Mitchell had been encouraged to design the Type 224 cantilever monoplane to specification F7/30. It was expected, one document said, to be "considerably more efficient than the ordinary biplanes."

Hawker now came on the scene. Camm had long been impressed by monoplanes: to him, the Blériot was a "most beautiful aircraft" and a pre-war Martin & Handasyde machine "magnificent". When he joined Hawker in 1923, the Duiker high-wing reconnaissance aeroplane was under consideration, and two years later Camm himself sketched a monoplane fighter, a

cantilever-winged machine with a Bristol Jupiter engine. With his Air Ministry contacts, he would have been aware of the positive thoughts about this type of design.

In August 1933, Camm discussed a plan, which had evolved over three years, with the Directorate of Technical Development (DTD) for a single-seat 'Fury Monoplane' comprising a "low cantilever wing with tapered leading and trailing edges culminating in rounded tips" and armed with four machine guns. He insisted that in the search for "a high-speed fighter, the monoplane is the only answer. We must get rid of struts and wires and every other form of drag". Camm was warned that the cost of his "revolutionary" proposal would cause vigorous opposition, not least because doubts were also being raised about the worth of a single-seat machine with only forward-firing capacity. Post-World War One experience had exposed "certain tactical limitations", by lacking the capacity for all-round fire.



Possibly because he knew Mitchell had been forced to redesign his "cranked thick wing and fixed undercarriage" Type 224, Camm did not give up. On 2 January 1934, he outlined the 'Hawker High Speed Interceptor Monoplane' and, critically, obtained the financial support of T. O. M. Sopwith and the Hawker board as a private venture. Allegedly, Sopwith merely advised him, "don't let the wing loading get too high."

Four days later, Camm submitted to the DTD his scheme involving a machine with a retractable undercarriage and capable of 264mph at 15,000ft. "The fuselage and tail unit in general follow standard Hawker methods, modified where necessary to suit the special conditions caused by fitting the monoplane wing... The principal stressed members of the fuselage are high tensile steel tubes joined together by stainless steel fittings... The covering of the engine mounting and fuselage forward of the cockpit is by light alloy panels attached by quick release clips. The rest of the fuselage and also the tail unit are covered with fabric."

In forwarding this submission to his superior, Maj J. S. Buchanan confirmed that the concept "arises out of discussions we have had with Mr Camm on high





TOP: The new 'Interceptor Monoplane' about to taxi out for a test flight, the Brooklands circuit banking just visible in the background. Of note are the configuration of the canopy glazing, the lower-hinged undercarriage doors and the shape of the under-fuselage air scoop, all altered on production aircraft.

ABOVE: The prototype approaches the early Hurricane I configuration: tailplane bracing removed, radio mast and machine gun ports — plus gunsight — added.

ABOVE RIGHT: 'George' Bulman (left) demonstrates a Hurricane I's Merlin engine to the Secretary of State for Air, Sir Howard Kingsley Wood (middle), while Hawker company director Frank Spriggs looks on.

speed development'. Buchanan was concerned, however, that Camm's machine was "a new type of interceptor fighter", not "a true high speed monoplane" designed for experimental purposes. On the contrary, "the Supermarine F7/30, if successful, may offer an opportunity to proceed with the work."

So, Hawker received a discouraging response. Its submission had been "carefully considered", but "at the present time the Department is unable to give active encouragement to the scheme proposed". A review was promised, which prompted Hawker on 26 March 1934 to hope that this process would be expedited "and will result in a favourable decision". The Air Ministry was waiting for evaluation of Mitchell's machine.

In the meantime, Hawker went ahead with the 'Interceptor Monoplane'. Work in the experimental drawing office was supplemented by a 1/10-scale model of the proposed aircraft undergoing "extensive" wind-tunnel tests at the National Physical Laboratory in Teddington. Hence, on 4 September 1934, Camm submitted a revised design to the DTD proposing a Rolls-Royce PV12 — later the Merlin — engine instead of the intended

Goshawk and other improvements, to achieve a speed "close to 300mph". Six days afterwards, the Air Ministry reopened "the high speed monoplane order question."

Hawker was therefore invited to bid for a prototype, "against the money provided in the estimates for high-speed development". Still without government financial backing, preliminary production work commenced on 17 October

and in two months a full-size mock-up of the proposal had been completed.

Scepticism among the Air Staff lingered about a pilot's ability to handle the high wing loading, while some wondered whether any existing engine would be powerful enough to get a monoplane airborne. If it did, they felt, lack of manoeuvrability would be a perilous drawback. These issues could be resolved by Mitchell: no further experimental project was needed. Despite the optimistic exchanges with the director of contracts in October, Camm's design remained firmly a private venture.

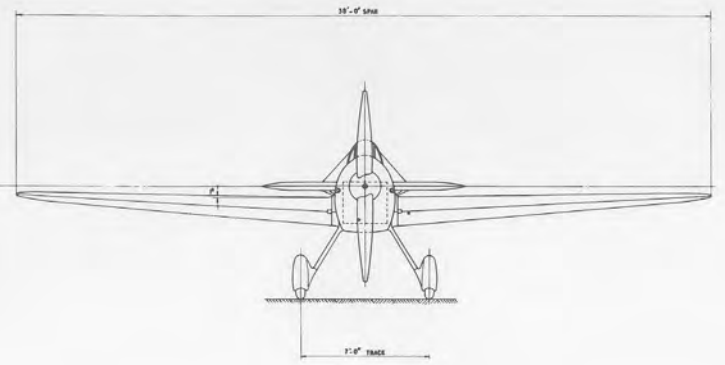
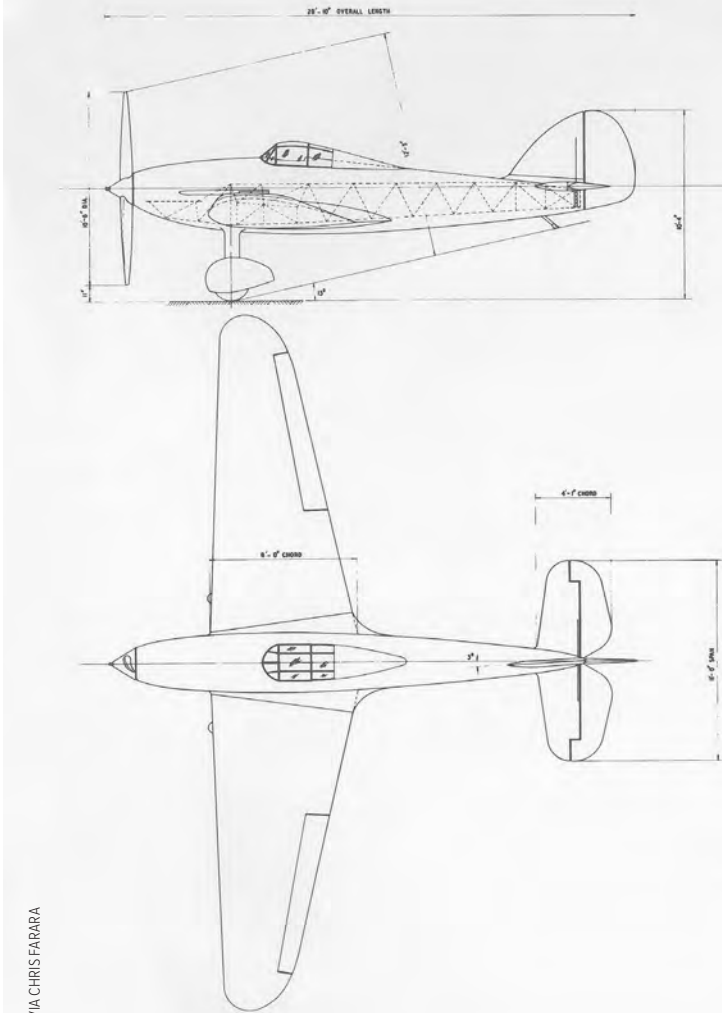
“Despite the optimistic exchanges, Camm’s design remained firmly a private venture”

Multiple planning meetings nevertheless took place between representatives of the Air Ministry, the Royal Aircraft Establishment, and firms like Rolls-Royce and Hawker. At length, on 21 February 1935, a contract was drawn up for "One High Speed Monoplane K.5083, to design submitted 4 September 1934, known as F36/34 Single Seat Fighter" at a cost of £8,000. In this instance, F36/34 was not, contrary to some

histories, a formal specification number. Two fuselage-mounted Vickers and two wing-mounted Browning machine guns were planned, but this was soon

changed to four Brownings in the wing and two Vickers MkV machine-guns in the fuselage. A complication was that none of the American Brownings were yet available, so Hawker was advised to construct "a wooden mock-up of a Browning gun from Air Ministry drawings already supplied."

Crucially, though, the nature of the armament remained unresolved and Air Marshal Sir Robert



AREA OF WING (INCLUDING AILERONS)	200 SQUARE FEET
AREA OF TAILPLANE (INCLUDING ELEVATORS)	32.8 SQUARE FEET
AREA OF FIN	10.5 SQUARE FEET
AREA OF RUDDER	12 SQUARE FEET
WING LOADING	30 LBS./SQ. FT. 18-5 LBS./SQ. FT.
ENGINE LOADING (NORMAL H.P.)	0-33 LBS./H.P. 0-15 LBS./H.P.
FUEL CAPACITY	MAXIMUM 80 GALLONS 80 GALLONS NORMAL 50 GALLONS 50 GALLONS
OIL CAPACITY	MAXIMUM 6 GALLONS 6 GALLONS NORMAL 4 GALLONS 3 GALLONS
TOTAL WEIGHT (NORMAL FUEL & OIL CAPACITY)	3807 LBS. 3708 LBS.

HAWKER MONOPLANE
R-R GOSHAWK

HAWKER AIRCRAFT LTD., KINGSTON-UPON-THAMES, ENGLAND.	
DRAWN BY - H. TUFFEN	RETRACED BY - H. TUFFEN
CHECKED BY - L. SHIPLEY	APPROVED BY - L. SHIPLEY
D51644	

VIA CHRIS FARARA

THE FURY MONOPLANE

A direct line can be traced from the Hurricane back to the aircraft Hawker dubbed the 'Fury Monoplane', shown here as drawn by Harold Tuffen on 5 December 1933. This illustration depicts it with a Rolls-Royce Goshawk in-line engine, but an alternative was the Bristol Mercury IV radial. The design had an unbraced, low, tapered wing with dihedral from the root, long ailerons of half semi-span and circular-arc tips. The tapered tailplane and aerodynamically balanced elevator were notched to clear the rudder. There was a prominent wing-fuselage fillet. A slender, elliptical-cross section fuselage carried the closely cowled upright engine, which was equipped with a two-blade propeller and spinner faired into the fuselage. The cockpit, situated over the wing, had a two-piece windscreen and quarter-lights; the canopy was equipped with arch and longitudinal glazing bars, and had a short fairing behind it. A spatted undercarriage with faired struts was

mounted on the fuselage just behind the wing root leading edge, and the aircraft used a tailskid. Machine guns were installed to port and starboard in the fuselage beside the cockpit. **Chris Farara**

CONCEPTS COMPARED

	Fury Monoplane	High Speed Interceptor Monoplane (became Hurricane)
Wingspan	38ft	40ft
Wing area	200 sq ft	231.2 sq ft
Length	28ft 10in	31ft 3in
Weight	3,807lb with Goshawk, 3,708lb with Mercury	5,416lb (prototype K5083)

Brooke-Popham, commander of the Air Defence of Great Britain, complicated the matter. According to Brooke-Popham, "Most people" in his command wanted guns in the fuselage for fear of lack of reliability with wing-mounted ones, while it was felt a 45° upward-firing attack should be considered. Independently, the deputy Chief of the Air Staff, Air Marshal Sir Edgar Ludlow-Hewitt, referred to a trial in 1933 to examine the impact of six or eight guns on a target and the operational requirements committee agreed that eight guns

should be aimed for. On 12 June 1935, the Air Ministry's director of contracts modified the provisions of the 21 February Hawker contract: two fuselage guns were deleted and provision for eight wing-mounted guns substituted.

That was fine, in theory, but Brownings were not readily available. Sydney Camm, who considered "hitting power of secondary importance" to an aeroplane's structure, reacted strongly to having yet again to

modify his design. Furthermore, Hawker complained of a list of components still not received. Not until 10 July did the company confirm a Merlin engine had been delivered. Non-arrival of the reflector gun sight necessitated "a mock-up in wood" and, on 3 September, supplies of components remained "well behind". None of this was Hawker's fault. Most of the missing items did reach Kingston before 23 October 1935, when the fuselage was dismantled for transportation by road to Brooklands and reassembly there. ➤



ABOVE: Early production of Hurricane Is at Brooklands during 1937. At this point, an initial 600 examples of the mark had been ordered by the Air Ministry.

Even before it flew, the fighter's future was threatened by the government's fiscal caution. In May 1935, the Chancellor of the Exchequer, Neville Chamberlain, sought "to reduce any likelihood of waste" in the context of new aeroplane contracts. Chamberlain also accepted the inter-war strategy of building "a striking force sufficient to hit very hard" an enemy's industrial base. Therefore, he emphasised, "our defence measures for the protection of England did not have the same kind of deterrent effect as possession of a strong striking force". This did not bode well for fighter acquisition. Another cabinet minister declared, "our bombing aircraft had good defensive qualities", negating the need for fighter escort.

Hawker's F36/34 aeroplane, which chief test pilot 'George' Bulman took up for a half-hour flight on 6 November 1935, had an 890hp Merlin C engine, a Watts two-blade, fixed-pitch wooden airscrew and retractable undercarriage. Its high cockpit gave it a distinctive silhouette and the pilot good all-round vision. AVM Peter Wykeham noted, "it was remarkably manoeuvrable for a monoplane, having a wing-loading of only 23lb per sq ft". Its wide-track undercarriage made it easier to land than other fighters, rather fortuitously because it had initially been designed to accommodate the two fuselage-mounted guns.

That maiden flight was the overture to a rigorous testing

programme before the machine could enter service. Flying from Brooklands, Hawker test pilots discovered that the hood proved difficult to open at high speed, and the undercarriage hard to retract and lock home using the hand-operated, hydraulic pump. After 10 flights totalling eight hours five minutes, on 7 February 1936 K5083 reached Martlesham Heath for service evaluation, its arrival delayed by a waterlogged grass runway at Brooklands.



Browning guns were still not available and, as at Brooklands, ballast in the fuselage compensated during the service trials. K5083 was also being flown with its original wings, not those being designed for the eight-gun set up. On 11 February 1936, F. E. Cowlin from the Air Ministry pressed as a "matter of urgency" not only for completion of the strengthened wings but the provision and fitting of eight Brownings, without which "limited clearance only [was] intended at Martlesham Heath". He revealed that acceptance of the Hawker machine was by no means assured, although trials "on the aeroplane in its present state show that it exhibits promise and there is, therefore, a likelihood that it will be seriously considered for adoption for service use."

In fact, further doubts were expressed in exchanges between the Air Ministry and Hawker. During February, the RAE reported that using "the more recent methods of

estimating flutter speed", the F36/34 "has not a sufficient margin over the operation specifications [and] wing stiffness may have to be increased". On 14 February, H. Grinstead rang Camm about this problem and discussed with him "a strength test specimen representing the skin-covered wing which Hawker's are now designing for this aeroplane" to replace the fabric.

Following vibration tests at RAE Farnborough early in March 1936, the F36/34 machine returned to Martlesham Heath. There, the chief technical officer reported discouragingly, "so many defects have developed since the machine arrived at the Establishment, that little progress has been made". Furthermore, on 30 March neither the Brownings nor the strengthened wing were yet available.

Nevertheless, encouraged by progress such as modifications of the airframe to accommodate eight — not the intended four — machine guns, the heavier Merlin engine and the removal of bracing struts from the tailplane, during March the Hawker board authorised "planning, jigging and tooling" for 1,000 airframes. It was rewarded on 3 June 1936 with an order for 600 of what was now dubbed the 'Fury Interceptor Monoplane', to be delivered by 31 March 1939.

On 27 June 1936, the Air Ministry approved the Hurricane I designation, later claimed to be "Camm's name for it". Negotiations over the price proceeded slowly until £4,475 for each of the initial 300 was agreed on 30 August 1938. The first production Hurricane, powered by a 1,035hp Merlin II engine rather than the intended F-version Merlin I, had made its maiden flight at Brooklands on 12 October 1937. Hawker complained, "there is no doubt that this engine change slowed up production very much more than was at first anticipated", requiring among other adjustments "cylinder blocks, the cowling shape and fairing lines" to be "considerably altered."

Once the prototype returned to Brooklands on 17 August 1937, further flights by Hawker test pilots led to still more modifications such as the fitting of ejector exhausts, a larger fin and rudder, and a fixed rather than retractable tailwheel. Yet more trials took place at Martlesham Heath in March 1938, and on 1 November that year a contract for another 1,000 Hurricane Is was agreed.

Even then, the issue of metal rather than fabric-covered wings, discussed during the autumn of 1935, had not been settled. In May 1938, an Air Ministry official heading up research and development asserted that there was “no difference in maximum horizontal speed of Hurricanes fitted with either fabric-covered or skin-covered wings”. He did, though, accept that there was “a big difference in maximum permissible diving speed”: fabric 380mph, metal 450mph. In November, AVM Arthur Tedder, director-general for research, was much more positive: “I cannot stress the point too strongly”, he wrote, that adopting metal wings was “not merely a refinement... It is essential that every endeavour be made to introduce the stressed-skin type of wing at an early date”. However, in order to equip squadrons quickly with the new fighter, he reluctantly agreed to “an absolute maximum of 500” fabric-covered machines being delivered. The Air Ministry learned on 17 July 1939 that the first Hurricane with metal wings would be ready “some time this week.”

The first operational Hurricanes had reached No 111 Squadron at Northolt in December 1937. The following month, based on 60 hours of flying “by about fifteen pilots”, its commanding officer, Sqn Ldr John Gillan, produced an encouraging assessment. The Hurricane was “completely manoeuvrable throughout its whole range”, he declared. At high speed, Gillan went on, “the turning circle is large”, although it did take “some time” to come out of a dive. Crosswind landings were “particularly easy”, and the pilot’s view during taxiing, take-off, landing and when flying in formation was superior to existing RAF fighters. Gillan continued, “The Hurricane is a simple aircraft to fly at night. There is no glare in the cockpit, either open or closed, from the cockpit lamps or luminous instruments”, and he praised the “large and comfortable” cockpit. Air Cdre R. H. Verney, director of technical development, was delighted. “What a very welcome relief from some reports we are accustomed to get... Hawker’s are a good firm.”

On 10 February 1938, with a favourable tailwind, Gillan flew 327 miles from Turnhouse near Edinburgh to Northolt on the outskirts of London at an average

speed of 408.7mph, having touched 550mph. *The Times* dubbed the Hurricane “the world’s fastest fighter”. Douglas Bader remarked that such an enthusiastic press response made “the British public become dramatically aware of their new super-fighter.”

As the drift towards war gathered pace, political pressure to make more Hurricanes operational mounted. Since cabinet ministers Anthony Eden and Sir John Simon had returned from Germany in April 1935 with reports of a Luftwaffe front-line strength of 1,375 machines and “already considerable reserves”, concern had risen about Britain’s aerial defences. Alarm was heightened after the devastating raid on Guernica by bombers from Germany’s Condor Legion during the Spanish Civil War. On 12 May 1938, Liberal MP Sir Hugh Seely — later to become Under-Secretary of State for Air in the wartime government — addressed the lack of Hurricanes in service. “On 3 June 1936, we were told that an order had been given for 340 or more. That is some two years ago... Can the Minister deny that there are only 28 in service?”

When placing the order with Hawker for an additional 1,000 examples, the Air Ministry had described it as “the very best machine we have at the present time and available to go into production forthwith”. This was because Sopwith and the board had consistently backed the project as a private venture. Sydney Camm reflected that the firm had embarked on the monoplane “with some fear as there was a natural reluctance to leave the biplane on which we had accumulated so much experience, particularly as we were using for the first time a retractable undercarriage which in those days was not always reliable... The extent to which we were able to depart from the standards of the biplane was rather a gamble”. Harrier chief designer John Fozard observed, “it used an unbraced monoplane wing with retractable undercarriage and wide-span flaps and carried eight .303in machine-guns”, all ‘firsts’ for the RAF.

As of September 1939, 497 Hurricanes were in RAF service. In retrospect, Sydney Camm regretted there had been no time to make the wing thinner, “yet, if we had not gone ahead, we should have had nothing when we went to war with Germany.”



BELOW: No 111 Squadron Hurricane Is in formation from Northolt on 20 April 1938, led by unit CO Sqn Ldr John Gillan. By service entry the type’s retractable tailwheel had been replaced by a fixed one.

