THE DESIGN OF A BRITISH CLASSIC

THE FORGOTTEN Spitfire DESIGNER

THESE FEATURES aim to bring lesser-known historic aviation stories to a wider audience through the pages of *Aeroplane*. If *you* have such a story to tell, get in touch with us!

Just over two years ago in *Aeroplane*, important Spitfire documents, some belonging to a mysterious "Mr Faddy", were revealed. Here, DAVID FADDY puts the record straight regarding the contribution his father Alfred made to the design of the iconic British fighter


Unseen Spitfire Doc uments Revealed

INSET ABOVE The article from the April 2006 issue of *Aeroplane*, in which the documents signed "Mr Faddy's copy" first appeared. LEFT Alfred Faddy served in the Royal Navy during World War One and worked for Parnall before joing Supermarine *circa* 1930.

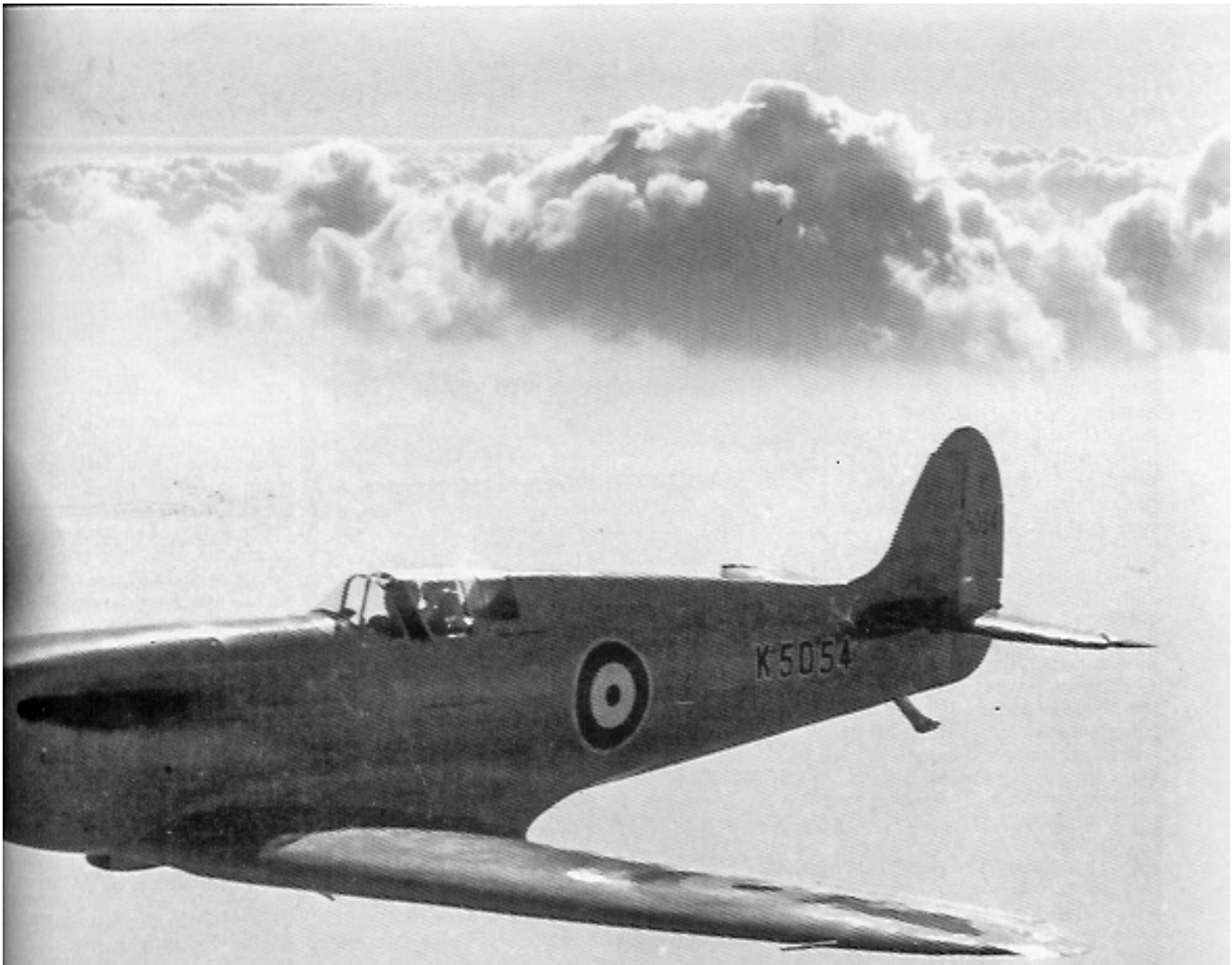
IN THE APRIL 2006 issue of *Aeroplane*, Ian Frimston's article *Birth of the Spitfire* celebrated the 70th anniversary of the first flight of the Supermarine Spitfire in March 1936. This included some drawings and a report of the first flight which had been emptied out of a filing cabinet on to the lawn outside Hursley House, to which the Supermarine design staff had moved after it was bombed out of its offices at Woolston, Southampton, in September 1940. The house had been taken over by IBM in 1958.

It seems probable that the filing cabinet had come originally from Alfred Faddy's office, since, in the *Aeroplane* article, one of the captions read: "Some of the documents are marked 'Mr Faddy's copy'; sadly, no-one has been able to trace who he was".

It was this caption that made me realise that I really ought to say something publicly about my father's contribution to the Spitfire. This is best summed up in an obituary of him published in the February 1956 issue of *Vickers News* and earlier, in a slightly different form, in both *Flight* and *The Aeroplane*.

Mr Faddy's contribution

The *Vickers News* obituary states: "It is certain that his own choice of a memorial would be the Spitfire, for the detail design of that famous aeroplane was very largely the work of his hand". The obituary in the January 6, 1956, issue of *Flight* adds that he was section leader in charge of Spitfire design and that "had he achieved nothing else, he would have been assured of his place in aeronautical history by his contribution to that remarkable fighting aircraft".



The Aeroplane's obituary, in the January 13, 1956 issue, credits him with having "much influence over many of the Supermarine designs" and says that both Joe Smith and R. J. Mitchell "placed great faith in his judgment and ideas". It adds that, at the time of his death, he was overseeing the design of the N.113 naval fighter, to become the Scimitar.

Perhaps the oddest thing is that there is very little mention of him in the many books written about the Spitfire. Yet when he *is* briefly mentioned, as in books by Jeffrey Quill, Gordon Mitchell, Eric Morgan and Edward Shacklady, as well as in his obituaries, he is credited with having made a major contribution to the famous fighter's development.

Unsung Spitfire heroes

Reginald Mitchell's achievements were undoubtedly remarkable but it is also true that the emphasis on him has arguably been rather at the expense of others in the design team. This was the view of Jeffrey Quill, Supermarine's chief test pilot, who requested the compilation of a Supermarine Spitfire Memorial Book to record as many names as possible of those who were responsible for the design and development of the Spitfire between 1932 and 1945. *The Spitfire Book*, as it is called, is held at Solent Sky, formerly the Southampton Hall of Aviation.

MAIN PICTURE A thoroughbred from the very first, the prototype Type 300, K5054, shows off its fine lines in 1936.

ABOVE In marked contrast, its forerunner was the unlovely, clumsy-looking Type 224, with its distinctive thick cranked wing.

A short biography of Mitchell published on the internet by John Dell says that "part of Mitchell's genius was his ability to get an aircraft to a certain point in development and then hand responsibility to others". In this way he achieved a prodigious output of 24 aircraft designs in only 16 years. Indeed, it appears that in the two years before his death in April 1937, he handed over design responsibility for the Spitfire to the team while he became preoccupied with the company's B.12/36 bomber, R.1/36 flying-boat and F.37/35 four-cannon fighter.

Head of detail design

In his biography of his father, *Schooldays to Spitfire* (The History Press Ltd, 2006), Gordon Mitchell records that Alfred Faddy was "in charge of detail design of the Spitfire with an influence on its layout" and in the same book

Jeffrey Quill is quoted as saying that "the links between the test pilots and the design team were Ernest Mansbridge and Alf Faddy, and R.J. would join the discussions, often without comment."

A family affair

In his book *Spitfire: A Test Pilot's Story* (Crécy Publishing, 1998), Quill records that my father was part of the Supermarine "family affair" that greeted Joseph "Mutt" Summers on completion of the first flight of K5054 (the prototype) on March 5, 1936.

He also records the following on the occasion of his own first flight in K5054 on March 26: "also there was Alf Faddy who, under Joe Smith, was largely responsible for the detail design of the structure and was thus deeply interested in the engineering and functional aspects of the testing".

Referring later in the book to flight development testing, Quill says that he worked "through Alf Faddy on the 'nuts and bolts', or functional engineering matters".

TOP Surprisingly few photographs of the prototype were taken during the preparations for its first flight, making this shot of it in a hangar at Eastleigh in the first few days of March 1936 extremely rare.

ABOVE Another of the rare Brownie box camera images, this one showing Capt "Mutt" Summers about to enter the cockpit of K5054.

A number of photographs of K5054 were taken on the day of its first flight, unfortunately only with a Brownie box camera, but the first of these shows my father in front of the leading edge of the wing smoking a cigarette. The next one, probably taken by my father, shows Summers about to climb into the cockpit and the other two are of K5054 being prepared a day or two before.

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The engineers of Mitchell's and Alf Faddy's generation, who had served railway or shipbuilding apprenticeships, needed support from people with more academic skills, i.e. aerodynamics, structural design and metallurgy.

Experience and flair

There are similarities between the backgrounds of Mitchell and my father. The former was apprenticed to a firm of railway locomotive makers in Stoke-on-Trent and attended night school.

My father served his apprenticeship with Parsons of Newcastle-on-Tyne, then one of the most famous companies in the world, having developed the all-conquering steam turbine. Both Mitchell and my father were, in the words of Alf Faddy's Vickers obituary, products "of the time when aircraft engineering was largely a matter of experience and flair".

Having said that, only a team could design an aircraft as sophisticated as the Spitfire, and it is worth trying to identify who would have comprised such a team; obviously Mitchell, Joe Smith, Beverley Shenstone (who proposed an elliptical wing), Eric Lovell-Cooper, Ernie Mansbridge, Alan Clifton, Arthur Black (in charge of metallurgy) would have been members.

In *Schooldays to Spitfire*, Gordon provides a list of senior members of Mitchell's team, but my concern here is with the drawing office team which actually carried out the detail design. Unfortunately, it has proved impossible to identify all of them with certainty. In a letter to the *Daily Mail* in September 2003, Colin MacEke provided a list that he had found among his late father's papers. I believe that both this and the list in *The Spitfire Book* are incomplete. The accompanying list (see page 22) is the best I can do but I cannot be absolutely sure of its accuracy.

A special mention

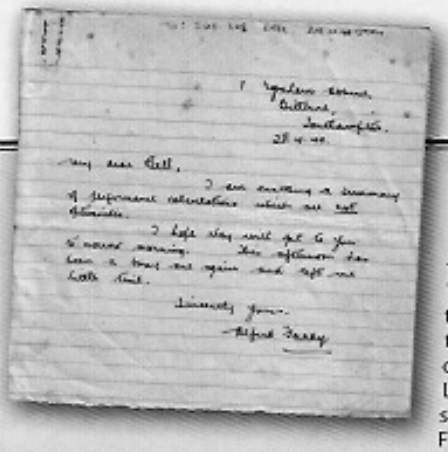
One of those on the list deserves special mention on personal grounds, since he saved the lives of both my mother and myself in about 1941.

We were bathing in a stretch of the old Itchen Navigation Canal

The author's father, Alfred Faddy, stands in front of the leading edge of K5054 on the day of its maiden flight; March 5, 1936. Remarkably, the potential danger of smoking alongside the new prototype appears to have been of little concern!

Alf Faddy's PR design

IN 1940, ALF Faddy became involved in the design of a high-speed photographic-reconnaissance (PR) aircraft which could very easily be adapted to become an efficient fighter. It seems to have been very much his own design, judging by the letter he wrote to Sqn Ldr Cedric Arnold Bell at the Air Ministry at the end of April 1940. He met Sqn Ldr Bell several times in March and, on April 1, 1940, flew to Heston to have dinner at the Buckley Arms Hotel with Wg Cdr Sidney Cotton, Wg Cdr Geoffrey Tuttle, Sqn Ldr Bell and Flt Lt Maurice "Shorty" Longbottom.

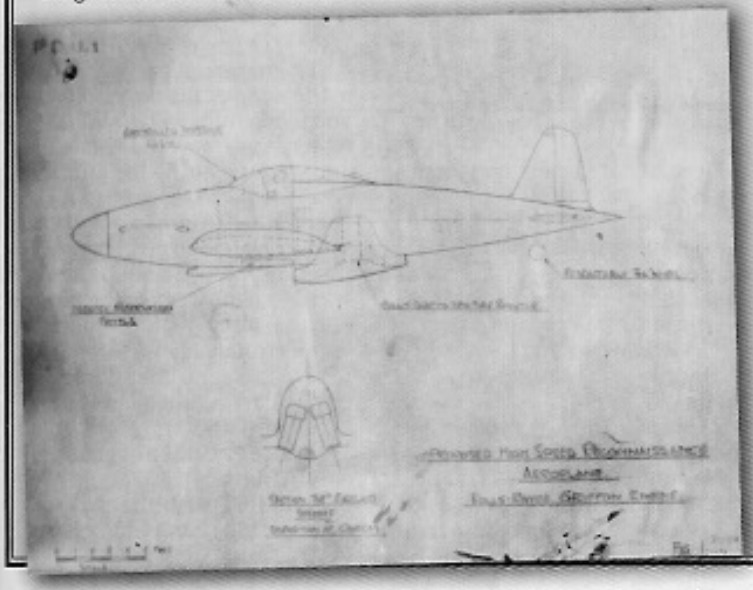


ABOVE One of the letters that passed between Alfred Faddy and Sqn Ldr C.A. Bell regarding a radical design for a new fast PR aircraft.

The photo-reconnaissance gurus

Cotton had been a dynamic entrepreneur before the war, enthusiastic about the value of PR. He ran a small firm at Heston – the Aeronautical Research and Sales Corporation – which was a cover for the Secret Intelligence Service Flight. From March 1939 Cotton had made clandestine reconnaissance flights over Germany in a Lockheed 12A equipped with hidden cameras. Cotton was recruited into the RAF at the outbreak of war, given the acting rank of Wing Commander and, on September 22, 1939, was put in charge of the Heston Flight of No 11 Group Fighter Command, which was renamed the Photographic Development Unit (PDU) on April 17, 1940.

Longbottom had realised that the best aircraft for PR purposes would be a single-seat very-high-speed aircraft. Together, Cotton and Longbottom persuaded the Air Ministry to lend them two suitably converted Spitfire Mk Is, and Longbottom made his first successful PR Spitfire sortie on February 10, 1940.



BELOW Drawings of Faddy's proposed design, with its Mustang-like radiator.

So what had been discussed at that dinner on April 1, 1940? It seems likely that they discussed my father's ideas for a new high-speed PR aircraft, the performance details of which were attached to the letter sent to Sqn Ldr Bell at the end of the month, following another meeting with him at Heston on Sunday April 7. The aircraft was expected to have a maximum speed of 470 m.p.h. at 25,000ft, and a range of 1,050 miles at 330 m.p.h. at 32,000ft. Faddy claimed that it would have a performance that could not be equalled by any fighting aircraft for at least three years.

A design ahead of its time?

The engine was to be the Rolls-Royce Griffon, then not yet in production, providing 1,445 h.p. at 15,000ft, to be maintained up to 20,000ft, and the aircraft was to have almost 20 per cent less drag than the Spitfire. Notable on the side view is the "fully ducted new type radiator", similar to that adopted for the North American Mustang, designed at about the same time to a British Air Ministry requirement. Other interesting features are the bubble canopy not introduced on the Spitfire until much later.

The conversation at dinner on April 1 must have included the changes to the Spitfire advocated by Cotton and Longbottom as required to make it an effective PR aircraft. Indeed, they may well have preferred converted Spitfires to my father's proposal for a brand new aircraft and they did eventually succeed in acquiring a number of modified Spitfires for No 1 Photo-Reconnaissance Unit, as the PDU was renamed. Following Longbottom's successful sorties over Germany, the Air Ministry accepted that his and Cotton's ideas were correct and Spitfires were either converted for PR work or built from scratch.

Much to his disappointment, my father's new design was never built. In any case it would probably have fallen victim to Lord Beaverbrook's decision to concentrate on the progressive development and production of a few existing designs; probably the right decision, given the limited resources available. **DF**

known as the Shawford Lock. I was swept out of my depth by a back current and my mother tried to rescue me, but neither of us could swim. There was nobody on the bank who could swim except "Bert" Axtell who was in charge of wing design at Supermarine. He was changing back into his clothes behind a hedge. Someone ran round and alerted him and he dived in fully clothed to save us both. I can still remember the sight of him standing soaking wet on the bank, rather forlornly pulling a sodden pipe and tobacco pouch from his trouser pocket!

The famous elliptical wing

The development of the elliptical wing is particularly interesting. An aerodynamicist friend of mine tells me that an elliptical planform may ensure an elliptical lift distribution having minimum induced drag at all speeds. Beverley Shenstone, a Canadian born aerodynamicist, proposed such a wing for the Spitfire, but Mitchell was reluctant to accept his advice — partly, it seems, because he perceived Shenstone as young and lacking in experience. This may be evidence of the suspicion felt by engineers of that generation for men with academic qualifications but who had not been engineering apprentices – who had not, as it were, got their hands dirty.

Hidden HISTORY

Mitchell may have been right. That an elliptical spanwise distribution of lift resulted in minimum induced drag had been known since Lanchester's work before 1900 but by the 1930s Prandtl in Germany and Glauert in England had developed means of calculating induced drag for an arbitrary planform.

It was this that enabled Messerschmitt to design a wing for the Bf 109, which was much easier t

produce and had an induced drag within one or two per cent of the (elliptical) minimum.

Working at Supermarine

Alf Faddy joined the Supermarine design team in 1930 at the age of 38. He worked on the Type 224, designed to Ministry Specification F.7/30, with a cranked wing and fixed undercarriage.

Most of the work seems to have been done by my father, alongside R. J. Fenner and Bill Fear. Mitchell decided that the concept was all wrong and gave instructions to the Stress Office and Drawing Office to produce something more aggressive.

Fenner recorded in Eric Morgan and Edward Shacklady's definitive tome — *Spitfire: The History* — that "in conjunction with H. Holmes, Ernie Mansbridge, Alan Clifton and 'the three Fs', a number of different designs were produced — all as F.7/30 development aircraft. Drawing 30000, Sheet 11, was drawn by Faddy, who, with me [Fenner] and Bill Fear, did all the general arrangement drawings, while the others supplied the various schemes for the different parts of the aircraft, under direct supervision from RJM. We also had considerable advice from Beverley Shenstone on his return from the USA".

Fenner credits Alf Faddy with persuading Mitchell to adopt the elliptical wing proposed by Shenstone because "this gave greater depth for the retracted landing gear and the outer ammunition boxes" — sound advice given the choice of an aerofoil section of low thickness/chord ratio.

Refining the design

This was not the final shape of the wing. When Mitchell went to the Air Ministry on December 5, 1934, the Sheet 13 drawing showed a distorted elliptical wing with the mainspar at right angles to the fuselage. By pulling the tips of the original elliptical planform forward, it was possible to achieve a planform in which the mainspar was at right angles to the centreline of the fuselage and at 25 per cent of the chord — the ideal position, resulting in no twisting moment, with no effect on the elliptical lift distribution.

During the 30th Mitchell Memorial Lecture to the Southampton Branch of the Royal Aeronautical Society on March 4, 1986, E. J. "Jack" Davis stated that "no detail design skill can rectify a poor basic layout, but a good project loses its edge if succeeding detail work is not of the highest standard. This stage was led by Alf Faddy, who joined the firm *circa* 1930. He was a little older than the others and had played his part in the design of the six-engined flying-boat".

He continued: "He was meticulous to the extreme and was not satisfied with anything less than the best. He used to say 'draw with the pencil but design with the rubber'. Schemes prepared with his guidance were always revised once but usually more often. Thus the care and attention given to the basic design was matched by the effort in the drawing office. Other disciplines played their part. For example, Joe Smith was always pressing for drawings to be issued to the works. Thus between the desire for perfection and the need to build the machine a fair compromise resulted".

Production difficulties

It is well known that putting the Spitfire into production for the first time proved difficult. It is less well known that hard-worked RAF engineers did not initially know how to maintain a stressed-skin aircraft in wartime.

I recall my father telling me, after the war, that at one point he and others had to make rush visits to fighter stations to make it clear how Spitfires should be repaired. Those returning from operations often had bullet holes in the wing or fuselage. Fitters and mechanics were familiar with canvas-covered aircraft, and were repairing the aircraft by covering the holes with flattened biscuit-tin lids, pop-riveted to the skin. They had to be persuaded that this practice undermined the structural integrity of the aircraft and that a safe repair scheme had to be introduced.

What is clear is that the detail design carried out by the team led by my father transformed an aesthetically beautiful general design into an aeroplane with outstanding performance and which could be manufactured in large numbers.

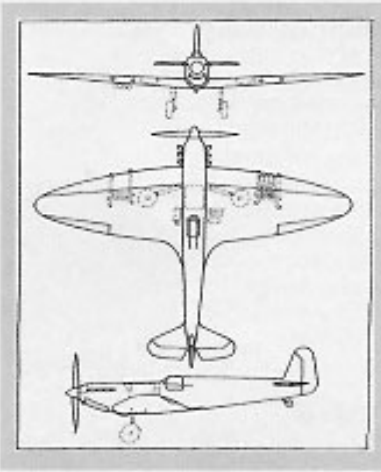
The Spitfire drawing office

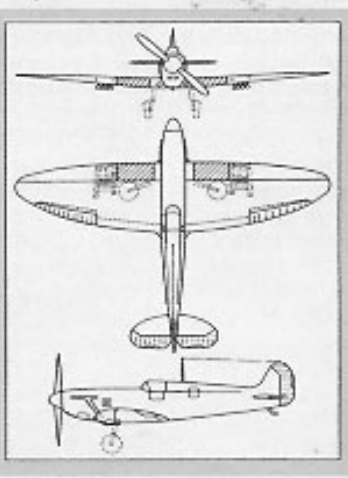
SEVERAL ATTEMPTS have been made to recognise all the members of the Supermarine Spitfire drawing office team, and this may be the most accurate yet. They are, in alphabetical order:

H. Axtell (wings), C. Childers, R. Conley (engine installation), W.G. Cox, E.J. Davis (wings), R.S. Dickson, J.O. Eke, A. Faddy (in charge of team), W. Fear, R.J. Fenner, J. Harris, J. Jupp, G. Kettlewell (detail design), G. Kimber (armament), T. Lardman, W. Munroe, W. Musselwhite, H.J. Noble (fuel systems), J.R. Rice (electrics), R. Rodgers, T. Walker, W.J. Westbrook.

The Technical Office Support team comprised: R.S. Dickson, T. Dixon, J. Hammond, W. Hennessey, H.H. Holmes, R. Horrocks, C.W. Labette, R. Mansfield, A.H. Shirval.

ABOVE This 1921 photograph of Supermarine's drawing office shows several members of the later Spitfire team including Shirval (far left) and Kettlewell (second right).





FAR LEFT Drawn by the author's father, Drawing 30000, Sheet 11, illustrates an early concept of the elliptical wing, more in the mould of Germany's Heinkel He 70. LEFT The much more familar shape of the classic Spitfire wing, with its instantly recognisable elegant wing shape.