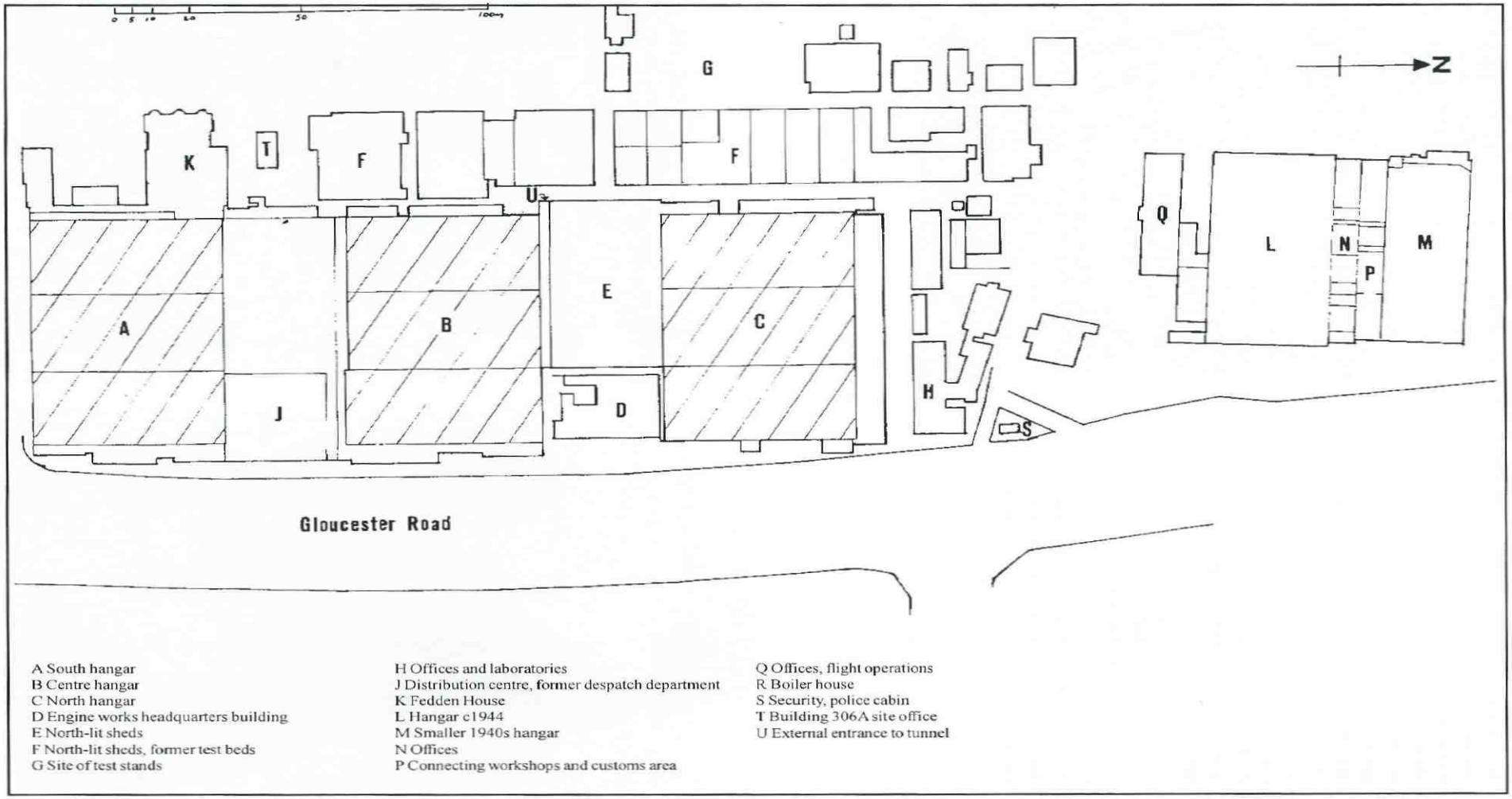

Plan of Rolls Royce West Works 1995. Drawing based on site plan date 4 March 1994
The Original hangar structures of c1915 are shown hatched

Rolls Royce West Works

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Introduction

The focus of this paper is the former West Works, originally the aero-engine works of the Bristol Aeroplane Company Ltd and latterly occupied by Rolls Royce Military Aero Engines Ltd. Research and fieldwork was carried out between January and December 1995, by which date the site had been levelled.[1]

Development of the Aircraft Industry

Aviation at the beginning of the twentieth century was still at an experimental stage, following the American Wright brothers' first flight in 1903, with little prospect of commercial viability. Most of the early manufacturers of aeroplanes were engineers or enthusiasts, concerned principally with experimentation.[2] It was not until about 1906 that others in France, Germany and Britain began to follow the Wrights' example, Bleriot's flight across the English Channel in 1909 being an important achievement.[3]

Early aeroplane production was on a small scale, construction being of lightweight steel or wood frames with fabric covering, requiring little skill in assembly; aero-engines being assembled by skilled engineers.[4] Triplanes, biplanes and monoplanes were all represented. However, wing failures on monoplanes in 1912 caused the British authorities to ban the monoplane completely, although it remained popular in Europe.[5]

Wooden construction continued to be standard practice until around 1922. Official prejudice against the monoplane, combined with a lack of knowledge and materials for the construction of an unbraced cantilevered mainplane, ensured that manufacturers were held to biplane configuration. There was a gradual development of engine power and by the mid-1920s all-metal aircraft began to be specified. However, it was not until the advent of Alc1ad in the early 1930s that improved methods of stressed skin construction permitted development of monop1anes.[6]

Early in 1936 it became clear that, even with expansion, the aircraft industry was unable to meet the demands of the 1935 re-armament programme. The assistance of the automobile industry was again enlisted, through a programme of 'shadow' factories built beside car works at government expense, to manufacture aero engines. The scheme was further enlarged in 1937 to include complete aircraft.[7]

Aircraft construction after the 1939-45 war continued to comprise riveted assembly on manual lines, using metal or concrete jigs. However, as the size and speed of airliners developed, machined integral panels began to replace fabrication. Military aircraft also became more sophisticated, especially with the advent of those capable of carrying nuclear warheads. Further technical developments in materials and construction have involved computer-controlled milling machines and the use of titanium and copper alloys.

Former engine HQ building (D on plan) from south-east, during demolition (2 November 1995).

Despite the importance of the aerospace industry to technological and economic development in the UK and the wealth of material available about its products, comparatively little has been published on aircraft production itself.[8] Industrial archaeologists are only recently beginning to pay attention to twentieth-century industries, including aircraft.[9] The standard regional texts, produced some time ago, do not include the significant Bristol works.[10]

The British and Colonial Aeroplane Company
The precursor of the Bristol Aeroplane Company Ltd was founded in 1910 and was the first British aeroplane manufacturer established on a proper commercial basis. Sir George White (1854-1916), founder and chairman of the Bristol Tramways and Carriage Co Ltd, became convinced of the potential of aviation having observed Farman and Voisin biplanes in France in 1909.

The company began producing biplanes under licence from the French company Société Zodiac in the tramway company's depot at its northern terminus in Filton (ST60l79l). By June 1910 the company had begun producing an aeroplane to its own design, based upon one by Henri Farman. This was a '*curious contraption built of sticks and string, with cotton covered wings which had to be pasted with potato starch before every attempted flight*'.[11] Nevertheless the Bristol Boxkite, powered by a Gnome 50hp rotary engine, was a success being produced at a rate of two a week.

Although the company produced successful monoplanes, the War Office ban led to their accepting a contract to build BE2a biplanes and their own single-seat biplane Bristol Scout. But the aeroplane which most made the Bristol name famous at this time was the two-seater fighter F2B, or Bristol Fighter. Originally powered by a Rolls Royce Falcon water-cooled engine, over 3,500 'Brisfit' biplanes were produced between 1916 and 1927.

Up to the end of 1916 construction had been of wooden structural members with steel fittings. In 1917 the firm produced its first all-metal plane, the MR1 or Type l3 two-seater biplane. The fuselage was a tubular girder framework of high-tensile steel covered in aluminium sheet. The wings had a steel framework covered in fabric and power was provided by a l40hp Hispano-Suiza engine.

In order to avoid the punitive effects of the excess profits duty, for which the Treasury claimed payment in 1920, the British and Colonial Aeroplane Co Ltd was wound up and transferred its business to the Bristol Aeroplane Co Ltd. In this way much of the wartime profits were retained.[12]

The Cosmos Engineering Company
The motor car firm of Brazil Straker and Co Ltd at Fishponds, Bristol, was engaged in 1915 on the production of Rolls Royce and Renault designed aero engines as part of the war effort. Part of the agreement with Rolls Royce was that Brazil Straker were not permitted to design a liquid-cooled engine until seven years after ceasing to manufacture Rolls Royce engines. In 1917, at the invitation of the Air Ministry, they built an air-cooled radial engine with 14 cylinders arranged in two rows. The Mercury, designed by A.H. Roy Fedden, (later Sir Roy Fedden), delivered 300hp and was successfully tested in a Bristol Scout.[13] The prototype nine-cylinder 450hp Jupiter engine was completed in 1918. There was close technical liaison between Fedden and Frank Barnwell (1880-1938), chief aircraft designer of British and Colonial and in 1919 the Bristol Bullet plane was designed specifically for testing the Jupiter. Aero engine production was reorganised and renamed the Cosmos Engineering Company, but went into liquidation in February 1920 due to the bankruptcy of Brazil Straker. After some persuasion Bristol Aeroplane agreed to take over Cosmos, complete with Fedden and 35 members of staff. Housed in one of the hangars at Filton aerodrome, they became the nucleus of the Bristol's aero-engine department.[14]

Bristol Aeroplane Company
When the Bullet finally appeared at the Aerial Derby in July 1920 it was the first aeroplane to combine a Bristol airframe with Bristol engine.[15] The Jupiter was the first air-cooled engine to pass the Air Ministry type test.

The aero-engine department was not dependent on Bristol airframes to carry its products, and was thus able to maintain the company through an otherwise lean period with worldwide sales of the Jupiter. This income helped to develop manufacturing facilities for both engines and aircraft, especially improved methods for metal airframe construction.[16]

In 1926 Fedden and his team had begun working on alternatives to the standard poppet valves and in 1932 the aero-engine department produced the first sleeve valve radial, the nine-cylinder Perseus.

The Air Ministry's shadow industry programme of 1936 to increase capacity resulted in the erection and equipping of an assembly and testing factory for the construction of Bristol engines. The factory was situated on company-owned land at Patchway to the east of Gloucester Road (ST 606 804), the freehold of which the Air Ministry acquired. The East Works then became the main aero-engine production shop, covering four and a half acres and housing over 1,000 machine tools.[17]

The merger of Bristol Aero-Engines and Armstrong Siddeley Motors in 1959 crested Bristol-Siddeley Engines, whilst in 1960 Bristol aircraft Ltd became a partner in the British Aircraft Corporation, now part of British Aerospace.[18] Further change took place in 1968 when Rolls Royce acquired Bristol-Siddeley engines.[19]

West Works
The origins of the West Works were three sets of hangars built c1916 and first used as an acceptance park for test-

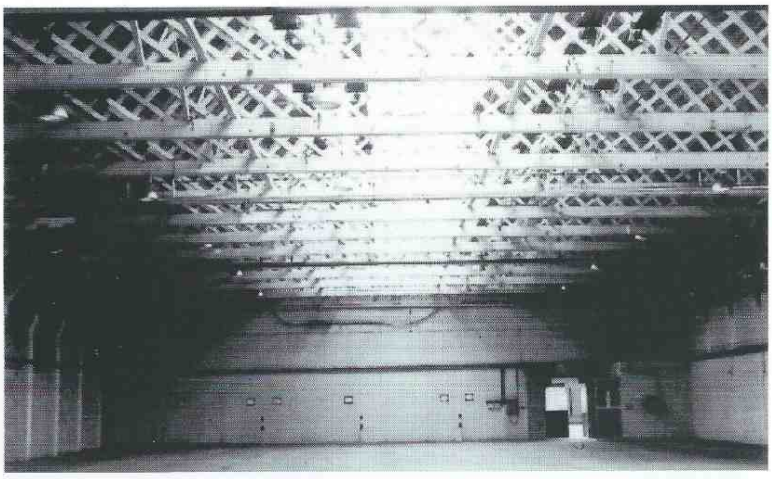
ing aircraft produced by British & Colonial, Bristol Tramways and Parnalls for the Royal Flying Corps and Royal Naval Air Services.[20] The hangars were reputedly built by German and Austrian internees, but no conclusive evidence of this has yet been found. The hangars were located to the west of the Gloucester road within the parish of Filton (ST604804). Indeed, nearly all of Bristol's aircraft industry has been located outside the city boundary.

The hangars, each of three bays, had brick piers and arches supporting wooden roof trusses of lattice construction, said to be of Canadian pitch pine. The arched roofs were of wood and reportedly leaked badly throughout most of the building's existence. The structures could be compared with those at Duxford and Hendon. Full height sliding doors opened to the south of each hangar. The hangars were 52.5m long and each bay had a span of 24.7m, providing some 3,890 square metres per hangar. A smaller building was erected to the west of the centre range by 1927.

Aero-engine construction began in 1920 when the former Cosmos operation relocated from Fishponds. Assembly and testing of airframes continued until at least September 1925 within the Experimental Flight Shed.[21] By the early 1930s the engine works had expanded to occupy both centre and north hangars with new buildings between and around the original structures.[22] Most imposing of these was a two-storey office block providing headquarters accommodation facing onto the Gloucester Road. The two engine motifs which subsequently adorned the added third storey of this building have been saved, believed to be for re-location on the Royal Mail sorting office being constructed on the site.

Behind the head office building a three-ridge range of north-lit sheds filled the gap between the hangars. A further range of north-lit sheds was erected to the west of the complex, all of which survived until final demolition. West of these sheds, at the edge of the aerodrome, were engine test stands. To the north a two-storey office block, which survived with later additions, also housed laboratories.

A 1930s company guide to the works shows a fitters' shop within the centre hangar, '*used for the fitting and assembly of engines and their accessories*'[23]. Fedden insisted on high standards of engineering and the introduction of new machining methods and tooling led to improved tolerances. The interchangeability of parts was tested in 1923 when six Jupiter engines were stripped down, the components mixed and the engines re-assembled.[24] A despatch department, consisting of three north-lit ridges, was built between the south and centre hangars, in which engines were inspected, Weighed and despatched.



Above, Interior of south hangar (A) looking north, showing timber roof trusses (7 October 1995).

Engine Testing

The north hangar accommodated the experimental department, which was '*not open to visitors, but ... one of the best equipped in the country*'.[25] A great deal of research work was undertaken on both single-cylinder test rigs and with full-size dynamometer test-beds. Engine testing in the 1930s was carried out day and night, the facilities providing '*one of the largest testing plants in the world*' consisting of both outside hangars and inside sections for running-in and dynamometer tests. Engine endurance

Right, Interior of centre hangar (B) showing roof trusses and original arrangement of brick piers (7 October 1995).

tests took place outside. They included a tilting stand to simulate flight conditions and spraying with water to recreate tropical storms.[26] The outside stands were built of wood with nets to provide some protection in the event of a propeller becoming detached. The site of the outside test stands was occupied by later buildings at demolition, housing mostly stores at closure.

On completion of the East Works in 1936 the original engine works were devoted to the following functions: engine experimental; engine developmental; engine research; engine strip and rebuild; engine service and repair; engine test; bonded stores; spares; packing and despatch; Air Ministry stores; quarantine stores; metal airscrew shop; pattern makers shop and the foundry. A tunnel was constructed beneath the Gloucester road, access from the West Works being from behind the head office, at the northern edge of the centre hangar. A fleet of Lister Auto Trucks ferried engines and components between the two sites.[27] New engine test facilities developed from the late 1930s at East Works and later in the 1950s at Gypsy Patch Test Site rendered those at West Works obsolete.[28]

At closure the hangars and associated buildings were used principally as offices and finished parts stores, including 'Concorde Stores', the former engine test sheds accommodating electricians, partition and jig stores, pallets, casemaking and pack store. By this time the original hangars were heavily disguised by modern cladding and ancillary structures.

Fedden House

The south hangar continued in the 1930s as the flying school, in which was conducted the *ab initio* training of Royal Air Force pilots and experimental test flights for Bristol Aeroplane Company. A single-storey building was constructed c1934 to the west of the south hangar. A roof top observation point was reached by a cast iron spiral staircase. By 1945 a second-storey and other extensions had been added, in which form the building survived as Fedden House. In later years the redundant observation tower had been used as a repository for old papers, including copies of correspondence from the general sales manager concerning exports to Australia, Czechoslovakia and Japan, dated 21 May 1965. Fedden House latterly provided office accommodation and conference facilities for Rolls Royce and was the first building to be demolished when the site was vacated.

Flight Development Shed

A further hangar complex was erected in the mid-1940s in Patchway, north of west works (ST 603 807). The main hangar, steel framed with brick panels, had load bearing Belfast trusses supporting asbestos roof panels. Each truss spanned 36.9m and was able to carry loads up to 5,080kg at any one of five lifting points. The 71.1m hangar faced west, the entrance being spanned by two sliding concertina-type doors. Previously the flight development shed, the structure was last used by European Aviation Air Charter Ltd for repairing and servicing their fleet of BAC One-Elevens. It had been used for testing Vulcan and Argosy aircraft. A smaller hangar (68.55m long, 23.8m wide) to the north side, with a non-load bearing lightweight roof structure opened north through sliding doors. Separating the two flight sheds was a workshop and customs area (67m by 7.65m). A two-storey office and workshop are was built into the north side of the

North hangar (C) from north-east, showing arched roof (15 March 1995).

Fedden House (K), from north-west, building 306A (T) extreme left, immediately prior to demolition (7 October 1995).

larger hangar. This 7m wide structure housed a ground floor battery charging room at the east or Gloucester road end,

Along the south wall of the flight shed was a boiler house and immediately south of this the two-storey, brick flight operations building. Substantial, roller mounted fire-doors were provided to the battery room and between the flight shed and adjacent offices. These doors carried steel plaques indicating construction by Mather & Platt Ltd, Park Works, Manchester, and were dated October and November 1944. A later door to the battery room, with less ornate brackets, was manufactured by Gardiner Sons & Co Ltd, Bristol, and carried a cast-iron plate dated May 1955.

Demolition

Clearance of the entire West Works site was carried out on behalf of Royal Mail Property Holdings by TR Demolition (Bristol) Ltd. Demolition commenced on 9 October 1995 and was completed on schedule eight weeks later by the week ending 8 December. Large quantities of re-usable and re-cyclable materials were removed, as well as rubble and waste. Much of the concrete foundation was crushed on-site to provide hardcore for the new sorting office construction.

One of the last structures to be demolished was the security cabin at gate 9, whilst a single-storey, wooden shed adjacent to Fedden House continued in use as the site office and, therefore, the last remaining part of West Works.

Conclusion

The failure to secure protection, through listing, of any part of the site and the rapid levelling of West Works resulted in the loss, with little opportunity for adequate recording, of a significant aircraft industry site. The many phases of development with additional buildings, infilling and modem accretions made it difficult to identify the original structures, which were adapted to suit changed manufacturing requirements.

Despite the loss of the site, after only 75 years' use for aero-engine manufacture, there are many opportunities for further research, making use of company archives, photographic and documentary evidence, and the oral evidence of current and former employees.

North-lit sheds (E) from west (7 October 1995).

North-lit sheds (E) from south-west during demolition (2 November 1995).

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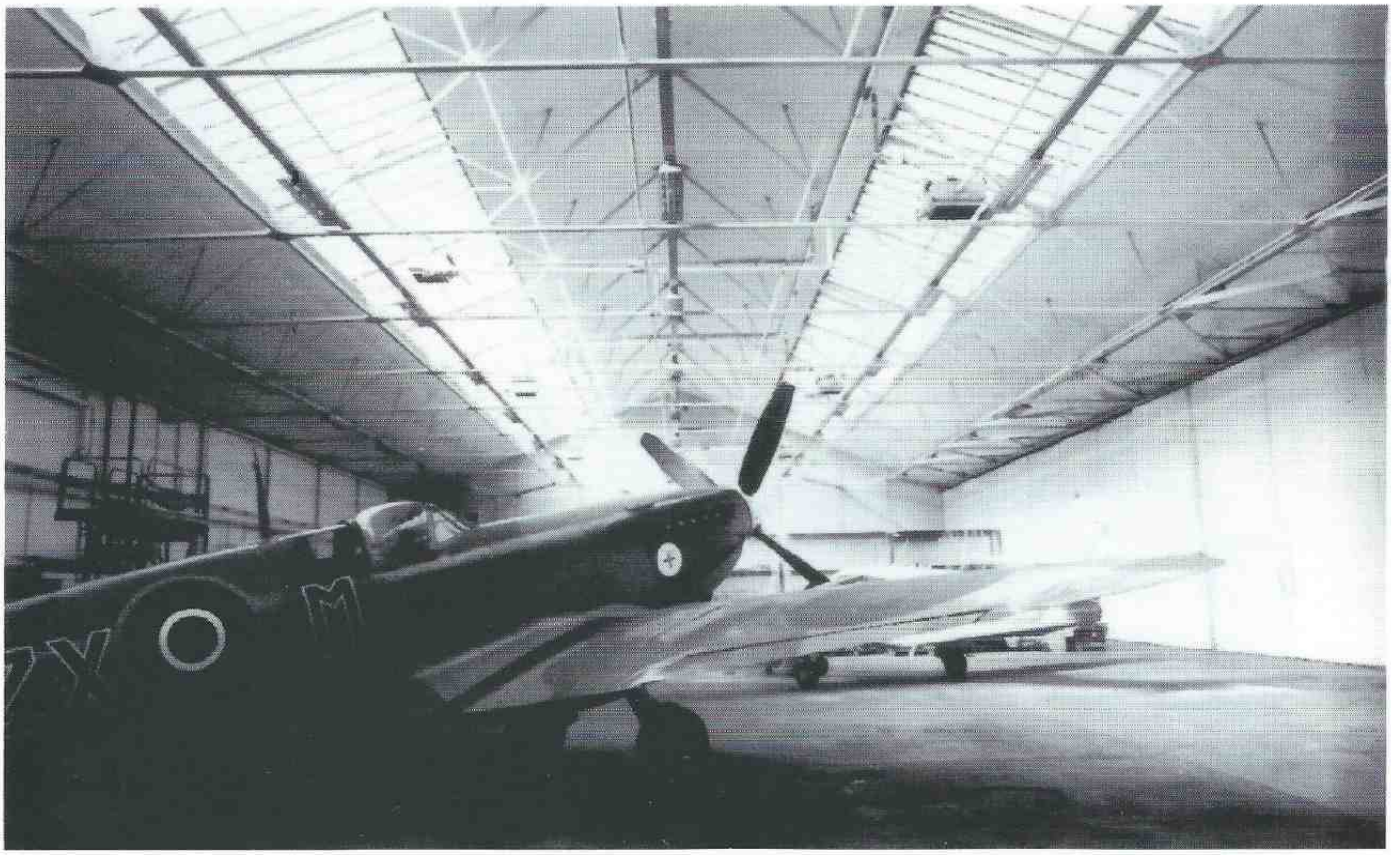

Interior of smaller 1940s hangar (M) looking west, showing light steel roof and full-length sliding doors to right. Occupied by MkVIII Spitfire MT928 (15 March 1995).

Entrance to c1944 hangar (L) from south-west. Below, interior of hangar, looking west, with BAC One-Eleven aircraft being stripped down (15 March 1995).

Flight operations offices (Q) from south-west (15 March 1995).