Brush Aircraft: the production of aircraft at the Brush Electrical Engineering Company Limited

by Tony Jarram

Introduction

My grandfather and my father, both who worked 'at the Brush,' often spoke of the products that had been built there over the years. Whilst I could relate to the rail products as they were still being produced, aircraft intrigued me.

There seemed to be little information available and memories had been lost or distorted over the years. A few records, in the form of official photographs had survived and had found their way to Leicestershire Records Office but these were without descriptions.

The research undertaken between 1976 and 1978, with the help of fellow enthusiasts, aviation professionals and publishers followed many routes and enough material was collected to publish a small book on the subject.

The following year was the official centenary of the Brush Electrical Engineering Company and I was working for one of its constituents - Brush Fusegear Ltd - and was selected as one of three local historians to research the company history for the celebrations.

These notes are a precis of the research information accumulated from the book, centenary research and since.

Origins of the Brush Electrical Engineering Co Ltd

To study the history of the Brush Electrical Engineering Company Ltd it is necessary to follow two different paths. One originating in England in the Leicestershire town of Loughborough and the other on the other side of the Atlantic Ocean in the USA city of Cleveland, Ohio.

The origin of the Loughborough operation was a small woodyard c.1851, owned by a Mr Capper, situated between the Derby Road (A6) and the Loughborough Navigation near Regent Street. This was acquired by Henry Hughes and known as the Falcon Works.

There are a couple of theories of why the name Falcon was used. One theory is that it was the name of a canal fly boat that served the works wharf and the other is that Falcon House was the name of Hughes wife's former home. The Falcon Works manufactured coachwork including 'dobbin carts'and small steam locomotives with boilers locally manufactured by Huram Coltman.

Expansion of the business required a larger site and Hughes transferred his works in 1865 to a new location, alongside the Midland Railway. The Falcon Works name was retained.

Hughes, trading as Henry Hughes and Company Locomotive Engineers, soon acquired a good reputation for quality of the coachwork products. The steam locomotive business also continued, although not at the rate of other competitors. Steam tramway engines were also built. The coachwork part of the business was soon building a steady stream of horse tramcars, railway wagons and horse drawn wagons, but in the 1870s there was a slump in trade and the company was over capitalised.

At this time there were great developments in the fledgling electrical industry and one of the pioneers in this field Charles Francis Brush was developing dynamos and arc lamps and had completed a number of electric lighting installations.

In 1879 he established a UK company in Lambeth London known as the Anglo-American Brush Electric Light Corporation. Here his company continued to make a variety of electrical products, to Brush's own design or those of his chief of test William Mordey. These including dynamos, alternators, transformers, arc-lamps, regulators and even set up an incandescent light bulb manufactory at Portpool Road manufacturing to the designs of Lane-Fox. The Brush products were also used to illuminate many buildings and the Thames embankment was lit by electricity generated from the Brush factory in Belvedere Road.

Back in Loughborough Hughes' company was taken over by Norman Scott Russell in 1883 and renamed The Falcon Engineering and Car Co Russel continued to build steam tram engines and extended the coachwork production.

By 1889 thoughts turned to the widespread introduction of electric tramcar systems and coincided with the expansion of local electricity schemes replacing gas lighting.

The Brush factory in Lambeth was restricted by the expansion of the railways on the eastern part of its site and was looking for a new home and saw the opportunity to amalgamate with Falcon at Loughborough. In 1889 The Brush Electrical Engineering Co Ltd Was formed with Brush and its workers moving to Loughborough. New workshops, 'The London Shops' were built on the Nottingham Road, or southern, side of the site to house the Lambeth production.

The following years saw Brush becoming a major supplier of both electrical engineering and coachwork. The latter saw Brush as the second largest producer of tramcars in the UK and the biggest producer of tram trucks (bogies or wheelsets).

Aircraft production at Brush in WW1

When war broke out in 1914 aircraft manufacture - at first a fledgling industry - rapidly became an important element in the war effort.

Early in 1915 Winston Churchill, the First Sea Lord, approved a paper for the expansion of the Royal Naval Air Service. The expanded requirement of aircraft for naval aviation required work to be undertaken beyond the capacity of existing aircraft manufacturers. Private factories were approached where there was already an established reputation for similar and high-quality workmanship. Brush, with a good reputation for the workmanship standard of their tramcars and other coachwork products, must have made them an obvious choice. The fact that they had a wide area of flat meadow alongside their works that could be utilised as a flying field, gave Brush an additional attribute.

Brush received their first contract in 1915 for twelve Maurice Farman S.7 'Longhorn' aircraft for reconnaissance, bombing and training duties. The S.7 was a slow aircraft and received its nickname 'Longhorn' from its outriggers protruding from the aircraft like the horns of longhorn cattle. By coincidence (or otherwise) this type of cattle had been bred by pioneer farmer Robert Bakewell in his nearby farm at Dishley a century before.

The first of these initial batch of aircraft, now nicknamed 'Birdcages' by Brush employees, was completed in late 1915. This aircraft with the military serial 3001 was photographed on Loughborough Meadow before taking off for its acceptance trials at Hendon.

This first batch (3001-3012) were equipped with 70hp Renault engines.

A second batch of twenty aircraft followed (8921-8940) and these were delivered in 1916.

It is known that aircraft from these primary batches served at the RNAS aerodromes at Chingford, Eastchurch, Hendon and Redcar and at least three (3004, 3007 and 3008) were transferred to the Romanian Government.

By the end of 1916 the Avro 504 was replacing the S.7 and Brush were contracted to use up the existing parts and spares from their own stocks and those of two other subcontractors, Robey and Company Ltd of Lincoln and Phoenix Dynamo Manufacturing Co of Bradford, to complete as many aircraft as possible. This resulted in a further twenty-five aircraft being completed (C9311-9335 and C4279).

Strangely, this was not the end of production of the type as another batch of thirty were ordered (N5030-N5059) and built in 1916/17, with an order for an additional thirty (N5720-N5749). There is no record of this last thirty ever being built.

Brush flaunted the official requirements for the aircraft to have the serials marked on the nacelle of the aircraft in 8' digits and had them displayed on the tail. Brush then added their own makers mark, a 'Falcon crest', at the front of the nacelle.

Aircraft were flown from Loughborough by the ferry pilot Mr Teddy Barrs.

The next contract was for the Avro 504 that had first flown in prototype form at Brooklands in July 1913, the first of over eight thousand built by Avro and its sub-contractors, the last ones not being withdrawn from military service until 1933.

Most of the type were built as two-seat trainers, but Brush were the only sub-contractor to build the single-seat Avro 504C version for the Royal Naval Air Service. This variant had initially been designed to

combat Zeppelin attacks. It is ironic that Loughborough was one of the places that was attacked by these airships.

The Brush Avro 504C aircraft were powered by 80hp Gnome engines and the first contact was for thirty aircraft (1467-1496), followed by twenty more (3301-3320).

It is known that Brush Avro 504Cs served in both the UK and France and whilst the first batch were mainly combat aircraft, the second batch were mainly used in the training role.

All other Avro 504s built at Brush were two-seat basic trainer aircraft for the Royal Flying Corps which, before the contracts were completed, became the Royal Air Force.

The first of the two-seat 504 contracts was for one hundred and fifty aircraft, a mix of 504A, 504K and 504J variants (D6251-D6400).

This order was followed by a further hundred type Avro 504K (F2233-F2332) and a final order for another two hundred and fifty (H2946-H3195) was later reduced to a hundred and built between 9th August 1918 and Spring 1919.

A number of this batch were to form the nucleus of the Royal Australian Air Force as Imperial Gift machines.

In 1916 the RNAS required a twin-engine bomber. One contender was a Farman design and Brush was selected to build it. The design was powered by two Anazi engines of opposite tractor (both propellers turning outwards). It was known as the Astral and was given the serial no 9251. The project was top secret and the finished aircraft appeared in Loughborough bearing no serial or national markings. Brush being Brush did however put a Falcon crest on the nacelle.

The Astral was not successful and a contract for a further nine was cancelled, with a Handley Page design being chosen to meet the requirement.

Brush also built two types of seaplane for the Royal Naval Air Service. The Short Type 827 and the Short 184. The 827 was a two-seat reconnaissance and bomber aircraft, and the 184 was one of the major seaplanes of WW1 and can be compared with the Fairey Swordfish of WW2.

Brush built twenty of the 827s (3321-3332), each powered by a 150hp Sunbeam engine.

The orders for the 184 were much larger and Brush utilised the production line adapted for tramcar production. Assembly shops - parallel with each other and the Midland Railway - ran south to north. Midway and at the north end (Meadow Lane) were traversers that could move the vehicle (or aircraft) sideways to align with the production line in the adjoining assembly shop.

Of a total of nine hundred Short 184s built, Brush received orders for two hundred and forty, though only one hundred and forty-two of these were built. The first batch of twelve ordered in 1916 (N1660-N1671) were fitted with 240hp Renault engines and the remaining eighteen delivered by November 1917 (N1672-N1689) received 260hp Sunbeam engines. This batch suffered problems with the required modification to the engine bearers from the previous engine type.

The Air Board then standardised on the 260hp Sunbeam Maori. Sixty more aircraft were ordered, mainly for use in the Mediterranean, but only thirty (N2630-N2659) were completed. In 1918 a further thirty (N2790-N2819) were delivered, followed by another twelve, reduced from an original order for thirty

(N9260-N9289). Two further orders were received, one for forty (N9060-N9099) and another for fifty, which was cancelled.

After the war, Brush carried on where it had left off with a mix of electrical and coachwork products.

Aircraft production at Brush in WW2

World War Two found Brush again involved in aircraft production, with the added task of repair work. Between March 1941 and December undertook sub-contract work from the LMS Derby Locomotive Works for the repair of Hampden light bomber fuselages. These arrived on 'Queen Mary' transporters to both Brush and Willowbrook Coachworks in Loughborough. After being repaired, the fuselages were transported to Nottingham Tollerton Aerodrome for re-assembly and return to the RAF. One hundred Hampden fuselages were repaired at Brush (really ninety-nine, as one was repaired twice).
The repair of Lancaster wing sections and fabricated fuel tanks was also carried out, again subcontracted from Derby Locomotive works.

A contract for nose sections for the Armstrong Whitworth Albemarle bombers was started but abandoned due to constant specification changes. Production of the Albemarle was sub-contracted to Hawkesley at Brockworth and it is highly likely that some Brush parts were fitted to some aircraft.

The major aircraft product for Brush in WW2 was production of the De Havilland DH.89 Dominie. The aircraft was a smaller version of the DH.86 known as the DH.89 Dragon Six, later renamed Dragon Rapide. The prototype first flew on 17th April 1934 and was followed, over a ten-year period, by seven hundred production models. During World War Two the military version of this twin-engine bi-plane transport was known as the Dominie.

Brush assembled the fuselages and wings at the Falcon Works but final assembly was carried out in a purpose-built facility at Loughborough Derby Road airfield. The fuselages were towed tail first by road to this facility, which was situated adjacent to Swingbridge Lane next to the Grand Union Canal. The site is now the Kinchbus depot.

Brush built the following examples between March 1943 and July 1946:

HG644-HG674 Total 31
HG689-HG732 Total 44
NF847-NF896 Total 50
NR669-NR701 Total 33
NR713-NR756 Total 44
NR769-NR815 Total 47
NR828-NR853 Total 26
RL936-RL946 Total 11
RL947-RL968 Total 22
RL980-RL986 Total 7, and
TX300-TX319 Total 20
Grand Total = 335

Aircraft were air-tested and flown to their destination directly from the Derby Road Airfield, which had previously been Loughborough racecourse.

Although a few aircraft were retained for military service, most were civilianised and converted to the Dragon Rapide standard.

A small number of Brush built Domine/Rapides survive but none of the aircraft built in Loughborough in World War I are known to be extant.

Aircraft production at Brush – some interesting facts

Representative Aircraft
Here are a few interesting notes relating to some of the aircraft built at Brush

Avro 504C
1485 – Tested on the Isle of Grain
1489 - Written off in Dunkirk, France
1492,1493 and 1494 – Served at RNAS Cranwell
3302 - Served at Chingford

Avro 504K

Short 184
N1648 - Operated from HMS Riviera and dropped a 100lb from 3,000' and another from 1.000' on a cream-coloured submarine on 3rd December 1917.
N1661 - Served at RNAS Dundee and attacked a diving submarine off Bell Rock on 14th October 1917. Landed on the water after dropping its bombs and was towed back to Scapa Flow by HMS Offa.
N1662 - Stationed at Scapa Flow, sighted the conning tower of a diving U-boat and dropped a 100ld bomb ahead of it during Spring 1916
N1675 - Served from RNAS Great Yarmouth, sighted a submarine and dropped three bombs on a submarine on 8th December 1917
N1682 - Attacked a submarine off Fishguard, 22nd March 1918
N2652 - Operating from Houlton Bay, attacked a submarine 31st August 1918
N2795 - Attacked a submarine off Fishguard, 29th April 1918

Short 827
3323 and 3326 - Served at RNAS Great Yarmouth
8237 - Served at RNAS Lee on Solent and rebuilt at Calshot.

Handley Page Hampden (repaired)
P1355 - Aircraft in which Sgt John Hannah won his Victoria Cross during a night attack on Antwerp on 15th September 1940. The repair at Brush would seem to be the result of later damage, with the fuselage arriving at Loughborough on 23rd December 1942 and the work completed on 24th March 1943.

De Havilland Dominie (Dragon Rapide)
At the last count 30 of the type survive in preservation worldwide.

References
JARRAM A.P. Brush Aircraft Production at Loughborough: Midland Counties Publications (1978)
JARRAM A.P. (as Tony Jarram) Charnwood Heritage in Exile – The Brush Electrical Company Limited and its Constituent Companies: Friends of Charnwood Museum (2002)

Photographs

TJ001 Site of or near to the original Falcon Works in 1978. All buildings have since been demolished. (Brian Hope for the Brush Transport Enthusiast's Club – Tony Jarram Collection)

TJ002 The coachwork paint shop at the Brush works pre-dating aircraft production. In this photograph the products are railway carriages and horse buses. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ003 The Falcon Works before the outbreak of World War One. Loughborough Meadows in the foreground were used as an airfield to despatch aircraft built at the works. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ004 The first Brush built aircraft was this Maurice Farman S.7 Longhorn (3001). It is seen here on Loughborough Meadows in 1916 prior to its delivery flight. Note the Great Central Railway in the background. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ005 A Farman Longhorn (8939) from the Brush second batch. Clearly visible are the out-riggers that gave the type its name. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ006 A line up of eight Avro 504C fuselages with 1489 nearest. The small emblem seen on the black engine cowling above the wheel contains the Brush Falcon.1489 was written off at Dunkirk in February 1917.
(Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ007 The 45th single-seat Avro 504C (3315) outside the assembly shops complete with dummy armament. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ008 Avro 504K two-seat trainer (F2242) is seen here on Loughborough Meadows prior to delivery to the Royal Flying Corps. The pilot is thought to be Teddy Barrs the Brush ferry pilot. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ009 The sole Henry Farman Astral bomber (9251) on Loughborough Meadows. The 'top-secret'aircraft is devoid of serial and national identification, but Brush have still added their Falcon logo on the nose. The photograph was taken in March 1917. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ010 Short 184 seaplane N9089 on the tramcar traverser at the Brush works. This allowed movement between the assembly bays enabling a production line flow. The aircraft is fitted with a 260hp Sunbeam Maori III engine. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ011 Another view of Short 184 N9089 on the tramcar traverser at the Brush works. The seaplanes would be disassembled and crated for despatch by rail. The Meadow Lane road bridge can be seen in the left background. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ012 Short 184 N9089 part of the last batch to be built by Brush in 1918. Seen here on the tramcar traverser looking towards Loughborough Meadows. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ013 Avro Lancaster wing and fuel tank repair and fabrication in the Brush works during World War II. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ014 Another view of Lancaster wing and fuel tank repair and fabrication at the Brush works during World War II. Note to use of female labour. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ015 A Handley Page Hampden light bomber fuselage under repair at the Brush works in World War II. There is some speculation that this is P1355 the aircraft in which Sgt John Hannah won his Victoria Cross. P1355 was certainly one of the ones repaired at the Brush works.
(Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ016 A general view of Handley Page Hampden fuselages under repair at the Brush works in World War II. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ017 De Havilland D.H.89 Dominie aircraft under construction at the Brush Falcon Works during World War II. The fuselage with inner wings and engines, as seen, would be towed tail first to a specially built assembly facility at Loughborough Derby Road Airfield where they would be fitted with their wings and completed prior to their air test and delivery flight. The nearest aircraft HG719 was delivered on 1st March 1944, via 18MU (Maintenance Unit), to the Staff College Flight at Bracknell. After service at White Waltham and Halton it was sold commercially to Walter Westoby and received the civil registration G-AKMH on 16th June 1948. It served with Westair Flying Services, Bees Flight Ltd, and Mr S.G. Newport before being sold to Zaire in 1964 probably as 9Q-CJK. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ018 Another view of the Dominie Assembly line at the Brush Falcon Works in 1944. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ019 The last Brush built aircraft D.H.89 Dominie TX319 at Loughborough Derby Road aerodrome on 2nd July 1946 prior to despatch to De Havilland's D.H. Whitney airfield. The aircraft was sold commercially to Peru. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ020 Another view of Brush built D.H.89 Dominie TX319 at Loughborough Derby Road aerodrome. (Brush official photograph/Leicestershire Records Office – Tony Jarram collection)

TJ021 De Havilland D.H.89 Dragon Rapide G-AGTM (built as a military Dominie. NF875, in May 1944) seen here at East Midlands Airport on 4th September 1978. Later in the day the aircraft gave a display over the Brush Electrical Machines Gala Day at the Nanpantan Road Sports Ground, Loughborough. The display was organised by the Brush Transport Enthusiast's Club. (Brush Electrical Machines/Brush Transport Enthusiast's Club – Tony Jarram Collection)

TJ022 Dragon Rapide G-AGTM, seen at Duxford, on 28th April 1984, in its former military Dominie livery as Royal Navy NF875 built at the Brush in 1944. (Tony Jarram)

TJ023 HG691 (G-AIYR) One of the surviving Brush built D.H.89 Dominie aircraft seen here at Duxford in 2011 (Tony Jarram)