DANISH

AIRCRAFT MANUFACTURE

Military aircraft construction and production is as old as aviation in Denmark. In the early stages of aviation it was not difficult to construct airframes from scratch as both materials and craftsmen were readily available. Woodworkers, carriage makers, sail makers and watchmakers could quite easily make what was necessary. The crucial engine was another matter and the construction of reliable engines continue to plaque early military aviation in Denmark as elsewhere.

The first aircraft constructor in Denmark was J.C.H. Ellehammer who was also the first European to fly an aircraft heavier than air by making a flying hop of 42 meters (on 12 September 1906) in his own constructed aircraft powered by the world’s first (self-designed) radial engine. Later in 1912 he also flew Europe’s first helicopter. Ellehammer built only aircraft for his own use and tests, but a 80 HP radial engine was evaluated by the navy in 1916 without being accepted.

Several copies of French Farman models later to be used by the armed forces saw the light during 1910-11 (1 used by the Navy), but the first Danish aircraft designed was the Berg & Storm Monoplan which was used in late 1911 to train the first Danish Army aviators. It had a 40 HP air-cooled Danish designed engine (it is preserved at Tøjhusmuseet in Copenhagen).

A major reason for aircraft manufacture in Denmark was the inability of the two newly established military aviation forces the Navy Flying Service (25 March 1912) and the Army Flying Troops (2 July 1912) in obtaining suitable equipment after the outbreak of the 1st World War in September 1914. Until the late nineteen-thirties with exception of four aircraft (2 Farman Jabiru and 2 Fokker F.XII built by Orlogsværftet) the Danish aircraft production became a military one. Until 1940 about three hundred military aircraft were delivered mostly based licences acquired in England, Germany and The Netherlands. It says something about the rivalry of the two forces that after the construction of the H-Maskine in 1917-18 only the Avro 504K and the D.H.60G/M could be agreed upon to serve both services, and they were NOT built in Denmark!

Manufacturers covered in this account

Burmeister & Wain Shipyards (Berg & Storm) (1909-1911)
Orlogsværftet Flyvemaskineværksted (1913-1943)
Tøjhusværkstederne (1915-24), Flyverkorpsets Værksteder (1924-32)
Flyvertroppernes Værksteder” (1932-1943)
Manufacturers covered in separate articles

A/S Nielsen & Winther-Aeroplanafdeling (1916- summer 1919)
Rohrbach Metal Aeroplane Co. A/S (1922-1928)
Cub Aircraft Co. Ltd (1937-1940)
Skandinavisk Aero Industri A/S S.A.I. (Kramme & Zeuthen)

**Burmeister & Wain Shipyards (Berg & Storm) (1909-1911)**

The Berg & Storm aircraft were designed by the two engineers R. Berg and L. Storm both working for the Danish shipbuilding and diesel engine company “Burmeister & Wain” (the first to build a diesel powered ship) who let them use the workshops to fabricate the parts and later assembled it at the Refshaleøen facility (at Copenhagen harbour), initially a 35HP Anzani engine was used, but later an air-cooled 40HP engine was used constructed by N. Petersen (also known as the “Engine Doctor). So one would call the company “Burmeister & Wain” the first Danish aircraft company. It didn't last long, however, as no aircraft was built after the BS III.(in 1911)

**Orlogsværftet Flyvemaskineværksted (1913-1943)**
A first real concentrated aircraft construction was initiated by the Naval Shipyards in 1914. The Navy had acquired two Donnet-Leveque Flying boats in 1913 which soon showed to have a disappointing performance. Consequently a new wing was designed as well as other improvements which resulted in overall amazing improvements of performance. This became the start of **Orlogsværftets Flyvemaskineværksted** (The airplane construction shop of the Naval Shipyards)

which got the distinction of being the second aircraft company in Denmark. Encouraged by this a totally new construction was made of a new type of flying boats retaining the new wing but with a new slimmer fuselage with the 2 crew members in tandem instead of side by side seating. The first of altogether 8 aircraft powered by imported 80 HP Gnome engines, was test flown on 26.September 1914. They were kept in service until 1919. Later this type received the type designation F.B.II (Flying Boat type 2). The success of these flying boats resulted in a whole series of similar outlook, but varying in size and engine power (F.B.II-V) with a total of 25 aircraft built. Although the Navy was satisfied with its small flying boats their sea going characteristics were not the best. A German Friedrichshafen F.F. 29 floatplane (293) which in 1917 had become stranded in Denmark was The

**Construction of early floatplanes and flying boats**

impressed, measured and a copy was manufactured (called Mågen 17). Tests were now made between flying boats and floatplanes and these fell out to the advantage of the floatplanes. Subsequently four more copies were made under the designation H.B.I (Hydro Biplane 1). Initially they used 160HP Curtiss engines or 150HP Benz engines, but in 1921 they all got a newly designed 160HP called O.V.160 engine developed in house of which 18 were manufactured. They proved excellent engines and they were not withdrawn until 1931.

Initially **Orlogsværftet Flyvemaskineværksted** concentrated on keeping the flying boats and floatplanes flyable and took over seven German Friedrichshafen F.F. 49 floatplanes which had been procured by the Ministry of Interior affairs for post flying. When the initial test for this was over the aircraft were given to the Navy. Named H.B.II they were re-conditioned, an 8mm machine-gun and a Telefunken radio installed. Already in 1919 the Navy had bought, in an obscure deal, a single Hansa-Brandenburg W 29 aircraft and from 1921 onwards it was measured and drawings for a production made. In the years 1921-25 13 of these aircraft were built and in 1927 another 2. All were equipped with the reliable O.V.160 engine. The aircraft also got new pontoons with aluminum skinning. After this only foreign designed aircraft have been built by Orlogsværftet. In 1920 the Navy had procured 6 Avro 504K trainers to be followed by a single Avro 504N in 1925, a modernized version with a 180HP Lynx engine. Orlogsværftet from 1926-29 build three 504Ns under license and two of the older 504K were updated to N standard. The aircraft were given the type designation L.B.I the first land based aircraft of the service.
After the “Marinens Flyvevæsen” on 7 August 1922 became an independent unit under the Navy the next major event was in 1925 with the designation of the workshops as a separate Section under Orlogsværftet called “Flyvemaskineafdelingen” (the Aeroplane Section) having its own Manager. At the same time it was realized that the workshops had an over capacity and a contract was in 1925 signed with “Det Danske Luftfartsselskab” (DDL now a part of SAS) for the building of two Farman Jabiru 4-engined 9 passenger airliners under license. The aircraft delivered in 1926, however, was an ill-conceived design (of no fault of Orlogsværftet) and was taken out of service already in 1929. By 1925 Marinens Flyvevæsen had realized that in the future they needed land based fighters as the floatplanes could not take the stresses of air fights. Having had good experience with the business of the Avro 504s an English type was selected, a Hawker fighter later named “Dankok” (Danecock) powered by an Armstrong Siddeley Jaguar engine (in reality a well known double Lynx engine with two cylinder rows). New for the navy was oxygen mask installation and parachute. Three British built aircraft arrived in 1926 and from 1927 to 28 another 12 given designation L.B.I were built. As a replacement for the H.M.I a type designed by the same constructor, Ernst Heinkel was chosen, the 2-seater H.E. 8. The Navy, however required a 3-seater housing a pilot, a radio-operator and an observer who also manned the rear 8mm machine gun. Besides it was required that the aircraft be powered by a newly designed Armstrong Siddeley Jaguar engine of 460HP with a geared propeller for increased reliability. This type was the first aircraft built by Orlogsværftet which was not made of wood in that the whole fuselage and undercarriage was made of welded steel tube. In 1928 Heinkel delivered 6 aircraft (He.313-316, 323) and from 1929 to 31 another 13 were built by Orlogsværftet.

Further in 1938 three more aircraft were built as attrition replacements. For Marinens Flyvevæsen the H.M.II, as the Heinkel was designated became until 1940 the maid of all work for the service. Hundreds of hours were also flown in opening Greenland up for aviation from 1932-38. With the war clouds forming in Europe the aircraft were camouflaged and tests were made with war time deployments to small lakes and fjords. After April 9th 1940 the surviving 13 aircraft were stored and finally sabotaged in October 1943. In 1928 an important change established Marinens Flyvevæsen’s own maintenance workshops in charge of periodic checks. This new organization also established a quality control office checking the production at Orlogsværftet. Since the latter did not design aircraft engines any more all testing and maintenance of engines went to the new organization.

The experience made with the welding of the fuselage of the H.M.II came into good use when Orlogsværftet in 1933 and 1935 made two Fokker F.XII 3-engined airliners for DDL. As a replacement for the Dankok fighter the Navy in 1933 bought two Hawker Fury fighters being named Nimrod in Danish service, with 525HP Rolls-Royce Kestrel III engines. Designated L.B.V the new fighter was given a larger fuel capacity and as something new for the navy a radiotelephone for the pilot. With a license to built the type 10 aircraft were made from 1934-35. Once more the workshops had to change procedures as the fighters were made of steel tube being riveted together. After the Navy had bought three Avro Tutor trainers (L.B.IV) in 1932 a further three were built under
The last types constructed by the O.V. Hawker Nimrod and Fairey P.4/34

license by Orlogsværftet one in 1935 and two in 1937. Both the Nimrods and the Tutors were in service when Germany invaded Denmark in 1940 and their fate was equal to the H.M.IIs.

In the late thirties Denmark was almost desperately trying to renew its military aircraft fleet and a committee established. Without buying a prototype or pattern aircraft a contract was signed for the license building of 12 Fairey P.4/34 two-seat reconnaissance/bomber aircraft powered by a single 1030HP Rolls-Royce Merlin II engine (almost a look a like to the ill-fated Fairey Battle bomber and developed further into the Navy’s successful Fulmar shipboard bomber). The aircraft displayed for the time a very powerful armament of one 20mm fixed canon and four forward firing 8mm machineguns and well as a moving rearward firing 8mm machinegun. Again something new was introduced to the workshop that of a monocoque aluminum construction. The project made it necessary the building of a new assembly hall at Copenhagen Naval Air Station and the fabrication of parts started in late 1938. Given the designation L.M. I as the first monoplane land based aircraft of the Navy the aircraft got the O.V.building numbers 93-104, but none were completed before April 9th 1940. The new assembly hall served a storage place for all the Navy’s aircraft until they were destroyed in 1943.

A recent photo of Copenhagen Naval Aviation Station
The Army had in June 1912 received the B & S Monoplan as a gift and this was placed in a rented hangar at Kløvermarken airfield just outside Copenhagen. For the maintenance of the aircraft a well known aviator and mechanic was hired and under them served the army aviators and a small number of tradesmen from the Army’s Tøjhusværkstedene (Depot). By 1915 the staff was 15, but during the next 3 years this increased to the ten-fold. The first aircraft to be constructed was the D.K. I (Danish Konstruktion 1) a 2-seat Farman look-a-like first flown 8 June 1916. It was not a good design and after it crashed 2 months later the engine (70 HP Renault) was used to power a (reverse engineered) Maurice Farman (plane no.2) . Meanwhile, however, D.K.II a one-seater had already flown on March 10, 1916 (plane no.3). Then things happened fast and in 1916 three more Maurice Farmans were started upon and the Army obtained a license right to build 12 Vickers F.B.5’s which were started upon in the spring. The first F.B.5 was completed in April 1917. Unfortunately, the from England supplied 100HP Gnome Monosaupape engines were very unreliable and although the Gunbus was a well flying airplane it was flown little and they were grounded in April 1919. The lack of suitable powerful engines hampered the design of new types and it was first at the end of 1916 progress was made with the permission to buy nine 140HP Argus engines in Germany. In collaboration with Orlogsværftet a two-seat reconnaissance aircraft for the army named H-Maskine (after H in Danish Hær=Army). The first of these flew in July 1918. Orlogsværftet built 4 and Tøjhusværkstedene 5 of these aircraft which unfortunately were grounded after the April 1919 law which stopped flying with unreliable engines (the Argus engines came under this). They were scrapped in 1924.

Army aircraft construction

It was first by the new defense law in 1922 that an within the Army an independent “Hærens Flyverkorps” (Army Flying Corps) on 1.February 1923 was established. Consequently in 1924 the previous Tøjhusværkstedene was subordinated under it with the name “Flyverkorps Værksteder” (The workshops of the Flying Corps) with the task of providing maintenance and building of new equipment. Initially a German L.V.G. B III aircraft was copied in two examples, before in 1924 personnel from the workshops went to the Netherlands for by Fokker to learn to make aircraft their way, fuselage of welded steel tube and wings of wood (the Army workshops were less used to welding than the personnel at the Navy shipyard!). Two Fokker C.I trainers were bought and with those as pattern aircraft 3 more examples (F.V.31-33) with 160HP Mercedes engines were built in 1925. Meanwhile the Fokker C V had been selected as the Army’s future reconnaissance aircraft (it later served as such until the German occupation in 1940) and five with 400HP Lorraine engines were
initially bought from Fokker. A license for building an additional 7 aircraft was obtained. From 1927-29
those seven aircraft were built as a combined effort with Fokker, who delivered the fuselages and
Flyverkorpsets Værksteder who delivered the wings and assembled the aircraft. Then in 1931 six
more aircraft (F.V.49-54) were built solely by the Danish workshops. From 1929 onwards the Lorraine
engines were replaced with Bristol Jupiter 440HP engines both in the already built ones and the new.
In between this Cpt. C. Førslev (later Commander of the Air Force) had developed the design of the C
I into a basic trainer named “O-Maskine” (after Overgang = transformation) with a 220HP BMW
engine. The prototype flew first in 1926 and in 1928-29 14 additional aircraft were built (F.V.34-48).
Later in 1932-33 a new single-seater version with a 160HP Mercedes engine was constructed in 8
examples. It is amazing to note that in the time 1925-30 31 aircraft were built by a staff of only 65.
Meanwhile Fokker had made a new version of the C V with a new undercarriage and the more
powerful Bristol Pegasus 550HP engine. The license agreement was changed to include this version
and a test aircraft, with initially a four bladed propeller, was delivered from Fokker in 1933. From 1934-
35 23 (F.V.63-85) of this version were built and the old versions were modernized. Since 1932 when a
new defense law was implemented the workshops had changed name to “Flyvertroppernes
Værksteder” as the flying service had changed name to “Hærens Flyvertropper”. A C V named III R
(R-49) in Danish service was the only Danish aircraft shot down in the German attack on Denmark on
April 9th 1940, both crew members were killed.

(as an epilog: The Danish C Vs were stored and impressed by Luftwaffe. Some or all were deployed
as light attack aircraft on the Eastern front by Estonian cooperative forces in the unit N.S.Gr.11
carrying the codes 3W+O. In the autumn 1944 two 3W+OL ex.R-42, 3W+OD ex.R-23) with Estonian
crews escaped to Sweden, here they were later scrapped as after the war the Danish military had no
interest in the aircraft).

The new defense law stipulated an inventory of 2 fighter squadrons for which the army could only
muster four Bristol Bulldog fighters having been procured in 1931. As those were quickly proven behind
current developments another British type, the Gloster Gauntlet biplane fighter with a 605HP Bristol
Mercury engine, was chosen as its replacement. Meanwhile the workshops had come to get used to the
British construction methods of the time, a skeleton of steel tubes riveted together with a multitude of
small metal plates covered with canvas. They were thus well prepared for the new challenge. One
Gauntlet (K4081) was delivered on-covered in 1935 and from 1936 to 38 17 aircraft
were manufactured (F.V.86-102). The Gauntlet fighters had been difficult to built, with no less than
3200 technical drawings needed, so it was welcomed when the Army decided to order for its second
fighter squadron a “normal” Fokker construction as its first monoplane fighter. The Fokker D.XXI with a
825HP Bristol Mercury engine was built in 10 units from 1939 to 40. The Danish army was not
satisfied with the armament so it was decided to equip the fighter with 2 Danish Madsen 20mm canons
in gondolas under the wings, a work which was not finished on the 9th of April. Four aircraft were
written of in the German attack on Værløse Air base and it has been revealed that the six survivors
were in 1944 used by Luftwaffe by “Sonstigen Einheiten” until withdrawn in August 1944. The next
project was the building of the Fokker G. I reconnaissance-bomber. In 1939 personnel went on training
with Fokker and a series of 12 aircraft was started. At this time the works had been hugely enlarged by the new workshops at Værløse Air base covering 6500m² in addition to the old facilities at Kløvermarken which had grown to 3000m², the workforce had grown to 175 workers and 20 staff. The G I’s were planned to be delivered in August 1941, but building stopped after April 1940. After the German invasion the Danish Army and Navy remained in uniform and their aircraft went into storage under Danish control. In order to keep flying proficiency the two services were allowed to practice glider flying. For this purpose Flyvertroppernes Værksteder in 1941 built five S.G.38 gliders and in 1942 four Grunau Baby IIB’s. The last of these received building number HFV 123 the last ever to be built by the workshops as they were sabotaged both in 1943 and 44.

During and after the war “Skandinavisk Aero Industri-SAI” see separate story became the aircraft company in Denmark which has produced most aircraft (186) However, In 1963 SAI stopped its aircraft business and moved from its hangar in Copenhagen Airport. At the same time the rights to the designs, tools and spare parts were sold to ScanaViation. Thus after having built 186 aircraft of own design aircraft construction, apart from hobby design and building came to a halt in Denmark.
List of manufactured aircraft:
Burmeister & Wain Shipyards (Berg & Storm) (1909-1911) (3 aircraft)
B&S I (1) 1909 for civil use

B&S II (1) 1911 for civil use

B&S III (1) 1911

Orlogsværftet Flyvemaskineværksted (1913-1943) (96+12 not finished)
F.B. II (8) 1914 (O.V.1,2,4,5,8,10,14,19)   F.B. III (10) 1915-1917 (O.V.3,6,7,9,11,13,16-18,20)

F.B. IV (3) 1917-1918 (O.V.15,21,23) Friedrichshafen F.F.29 (copy of aircraft) (1) 1917 (O.V.12)

F.B. V (3) 1919 (O.V.26,28,29)   H-Maskine (constructed and partly built for the Army) (4) 1918
H.B. I (4) 1918-1919 (O.V.22,24,25,27)

H.M.I (Hansa-Brandenburg W29 copy) (15) 1922-27 (O.V.30-42, 51,52)

L.B. I (Avro 504N license/copy) (3+2 rebuilt Avro 504K) 1925-1926 (O.V.43,49,50)

Farman Jabiru (2) for civil use 1926 (O.V.44,45)

L.B. II Dankok (Hawker Danecock license) (12) 1927-1928 (O.V.46-48, 53-61)
H.M. II (Heinkel H.E.8 license) (13+3) 1929-1931, 1938 (O.V.62-74, 90-92)

Fokker F.XII (License) (2) for civil use 1933-1935 (O.V.75,87)

L.B. V (Hawker Nimrod license) (10) 1934-1935 (O.V.76-85)

L.B. IV (Avro Tutor license) (3) 1935-1937 (O.V.86,87,89)

L.M. I (Fairey P.4/34 license) (12 not completed) 1938-1940 (O.V.93-104)

Below: The O.V. J-1 fighter project.
Tøjhusværkstederne (1915-24), Flyverkorps Værksteder (1924-32)
Flyvertropperne Værksteder” (1932-1943) (124+12 not finished)

D.K.I (1) 1916 (D.K.1)  
D.K.II (1) 1916 (D.K.2)

Vickers F.B.5 (License)(12) 1917 (T.V.1-12)

L.V.G. B III (Copy) (4) 1920-1926 (L.V.G.2-5)

H-Maskine (Designed by Orlogsværftet)(5) 1918 (H.1-9)

Fokker C.I (License)(3) 1925 (F.V.31-33)
I O-Maskine (14) 1926-1929 (F.V.34-48)

II O-Maskine (8) 1932-1935 (F.V.55-62)

I R (Fokker C V M/26 license)(7+6) 1927-1930, 1931 (F.V.49-54)

II R, (Fokker C V M/33 license)(11) 1934 (F.V.63-73)

III R (Fokker C V M/33 license)(12) 1935 (F.V.74-85)
II J (Gloster Gauntlet license)(17) 1936-1938 (F.V.86-102)

III J (Fokker D. XXI license)(10) 1939-1940 (F.V103-112)

(IV R) (Fokker G. I license not completed) (12) 1939-(1941)

S.G.38 School gliders (5) 1941 (HFV 115-119) Grunau Baby gliders (4+5 for civil use) 1942, 1943 (HFV 120-123)