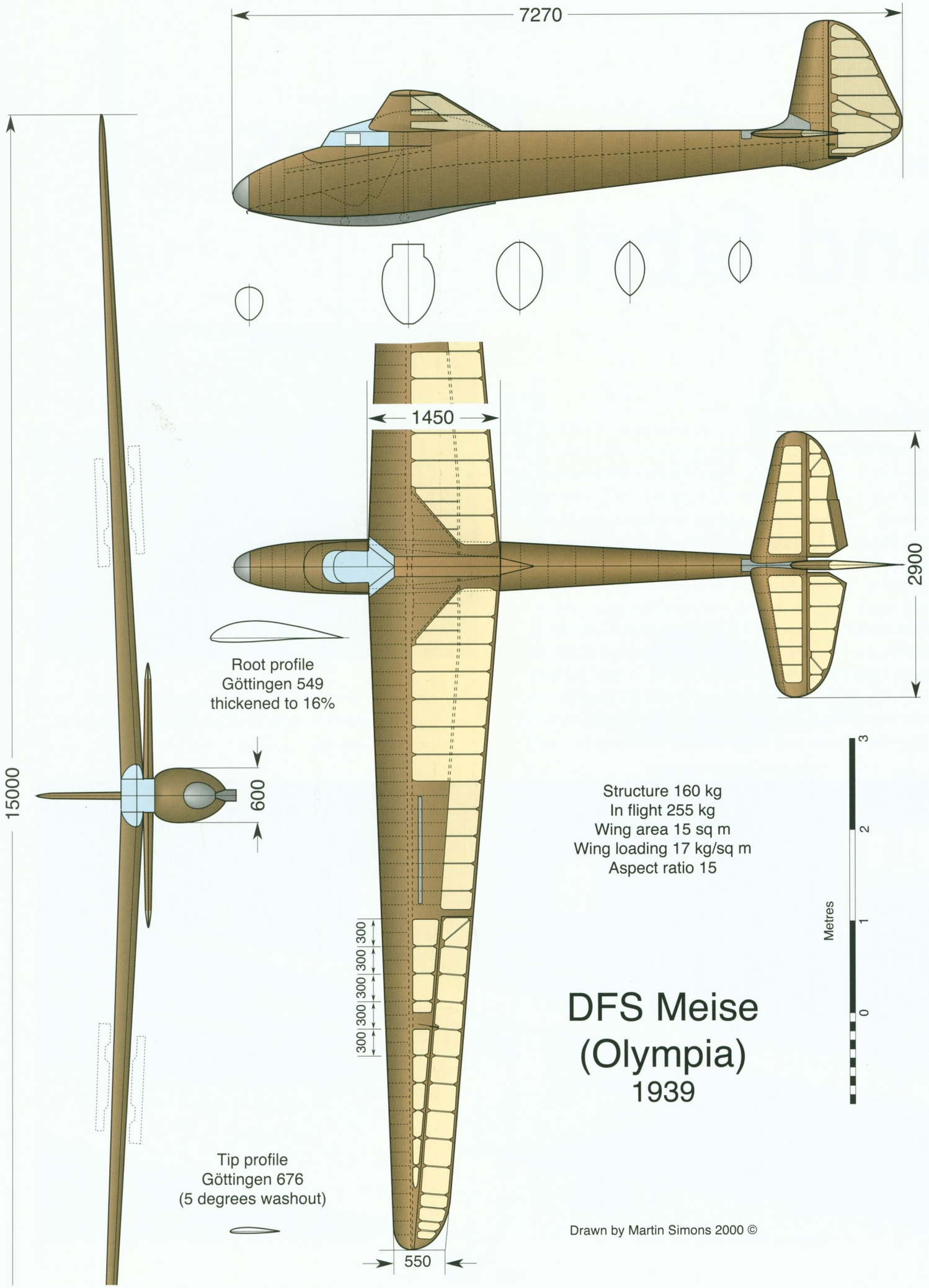
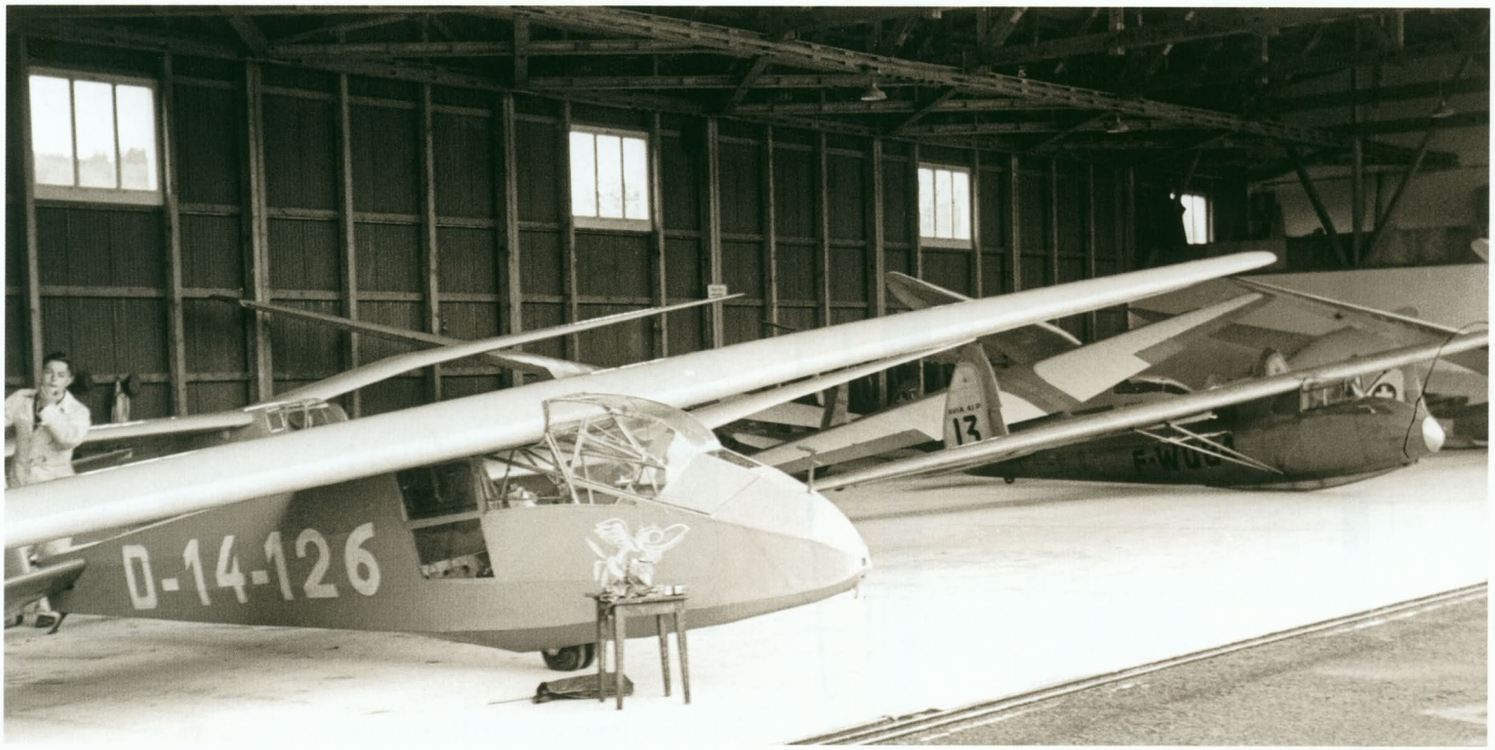

7270
15000
1450
2900
600
550
300
300
300
300
300
Root profile
Göttingen 549
thickened to 16%
Tip profile
Göttingen 676
(5 degrees washout)
Structure 160 kg
In flight 255 kg
Wing area 15 sq m
Wing loading 17 kg/sq m
Aspect ratio 15
Metres
0
1
2
3
DFS Meise
(Olympia)
1939
Drawn by Martin Simons 2000 ©

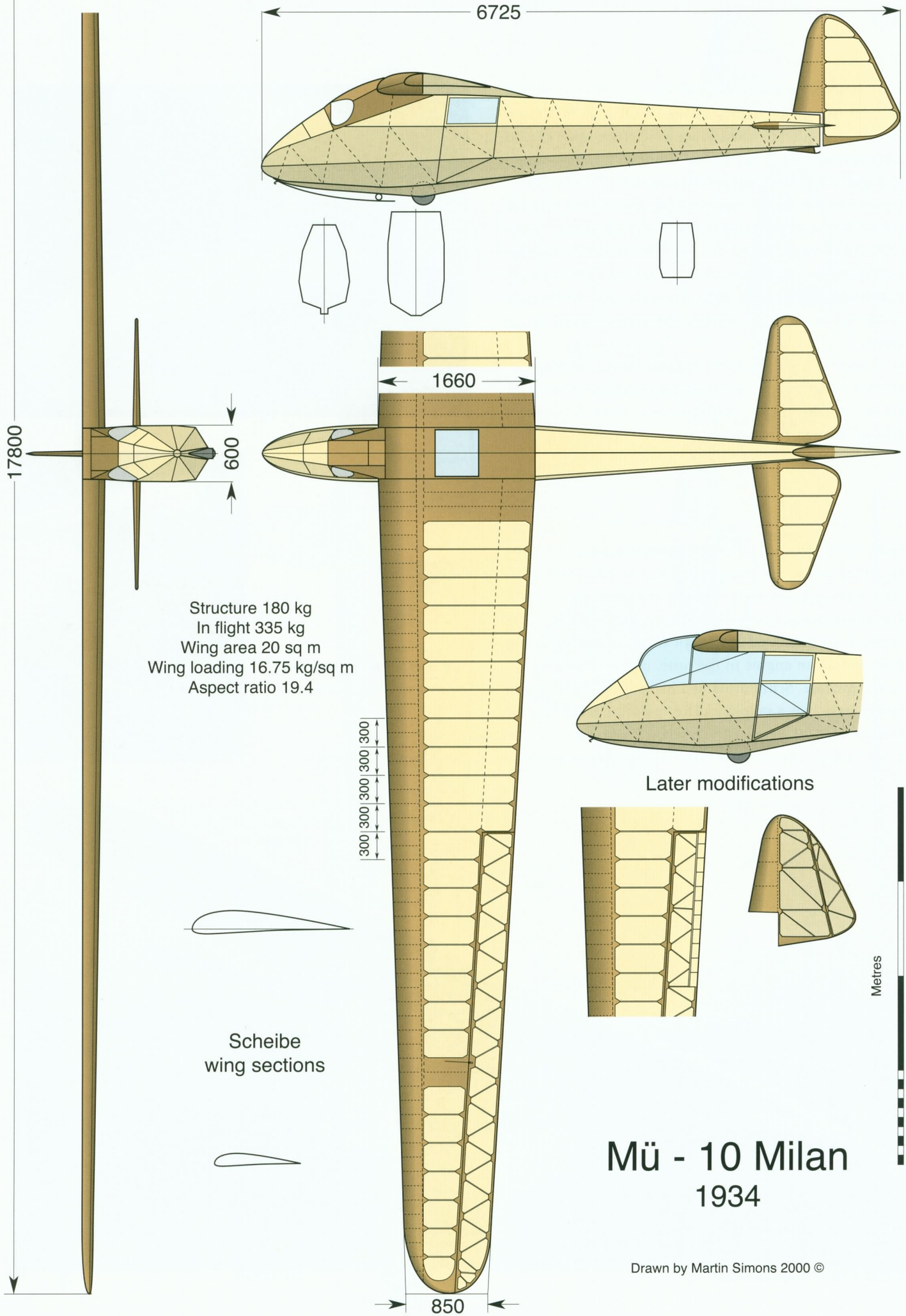
Chapter 11 Steel tubes and fabric

Münich Mü 10 'Milan'

The student Academic Flying Group at Münich was founded in 1924. In 1933 under their leader, Egon Scheibe, they set about the design and production of a two seat sailplane, the Mü 10 Milan. This was very original. The fuselage was a welded steel tube frame covered with fabric, not very unusual for powered aircraft but, apart from the gigantic Obs of Lippisch, the first time it had been applied to a sailplane. The second pilot had a cabin under the wing, with access door and windows not only at the sides but above. The front pilot was enclosed in a wooden hood with portholes. This was soon replaced by a fully transparent canopy. The wing was of orthodox wooden construction. The aerofoil sections used were of Scheibe's own devising, most of the camber concentrated at the leading edge with the upper surface, aft of the maximum thickness point, almost flat. The NACA in American were currently developing and testing

Above and below: The Mü 10 'Milan' D - 14 - 126 at Salzburg in 1937. Other sailplanes visible include a Condor 2A. the Rheinland. a Swiss Spyr 3 and the French Avia 41P and others unidentified.





Structure 180 kg
In flight 335 kg
Wing area 20 sq m
Wing loading 16.75 kg/sq m
Aspect ratio 19.4

Later modifications

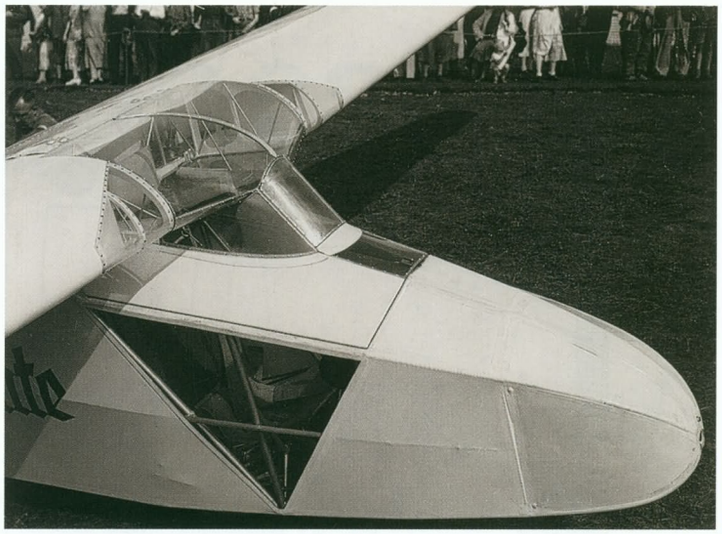
Scheibe
wing sections

Mü - 10 Milan
1934

the 'five digit' series of profiles which had similar reasoning behind them, reduced twisting and pitching moments and high maximum lift coefficients. The ailerons and rudder were given servo tabs to lighten the forces required on the control column.

The first flight was in 1934 and proved successful. The Mü 10 set a world distance record for two seaters of 180 km in 1935 and was one of several sailplanes participating in a soaring tour or safari covering 700 km in stages round Germany. At the ISTUS International meeting at Salzburg in May 1937, the Mü 10, flown by Ludwig Karch, made an outstanding flight across the Alps, achieving a distance of 195 km and a height gain of 2980 metres, a world record for two seaters.

The Mü 10 spent some time in the Munich Deutsches Museum after World War 2, but was rescued from there and flown again for some years before returning to the Museum at Oberschleissheim where, perfectly restored, it remains.



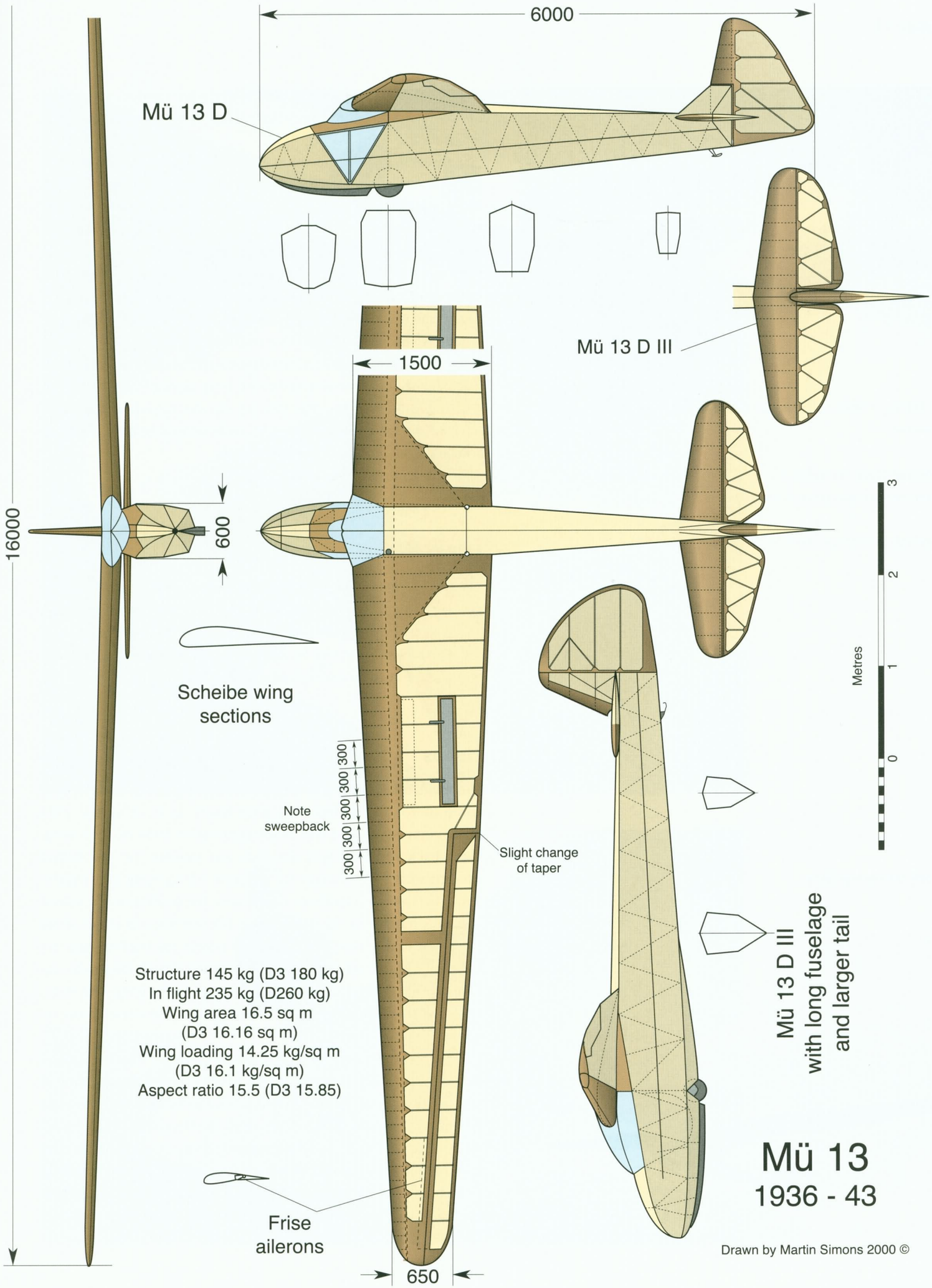
Above: Cockpit canopy and transparencies of the Atalante.

Right: Kurt Schmidt in the Atalante cockpit. Vision sideways was almost nil.

Mü 13

Kurt Schmidt, Tony Troeger and Egon Scheibe, who had designed the Mü 10 Milan two seater, decided in 1935 to build two lightweight single seat sailplanes using the same construction methods: welded steel tube fuselage covered with fabric, and wooden flying surfaces. Troeger was interested in a motor sailplane and his Merlin was designed to take an engine in the nose, with a retracting two wheeled undercarriage. Schmidt named his aircraft Atalante and was content to have it as a sailplane. They used the same Scheibe profiles as for the Mü 10. Because the fuselage was so light and the tail short, for balance the seat was under the leading edge of the

Below: The Mü 13 'Atalante'



Mü 13
1936 - 43

Above: The Mü 17 'Merle', one of the two German entries in the Olympic sailplane design contest.

Opposite page above: The cockpit and canopy of the Mü 17. Unlike the earlier Mü series, the main spars joined on the centre line.

Opposite page small picture: Reiner Karch was the test pilot for the Mü 17

wing, which created difficulties for the pilot's vision. Large windows were provided in the cockpit sides. There were camber flaps for landing.

In the 1936 Rhön competition, Schmidt took advantage of the very light soaring conditions that prevailed that year and won against all the much more expensive and refined sailplanes. Some modifications were made in the following year and by 1938 the Mü 13D appeared. The flaps had been eliminated and replaced by air brakes, the wing was slightly swept back, and a tailplane with elevator was used rather than the all moving surface. The Mu 13D was put into production at the Black Forest Aircraft factory. At the 1939 Rhön fifteen of the type were entered. Production reached about 150.

The Mü 13D was not considered easy to fly because lateral control was sluggish, despite the addition of 'Frise' type ailerons. After further trials, in 1943 the Mü 13D - 3 was developed, which had a longer fuselage of more triangular cross section behind the wing and larger rudder. Control was improved.

Several of both types survive.

Mü 17

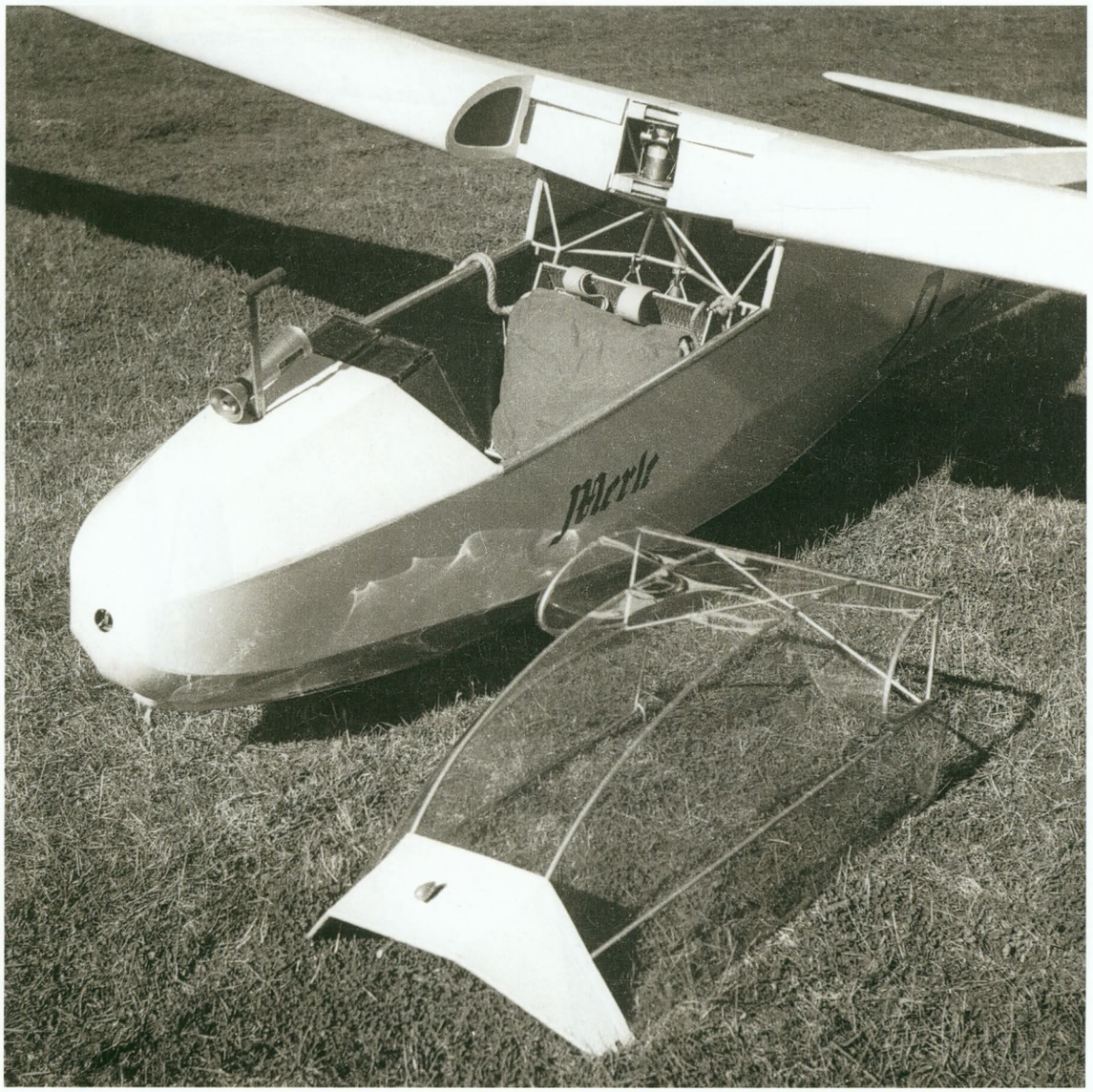
The Mü 17 was the Munich group's design entry for the Olympic sailplane design competition which, in 1939, was won by the DFS Meise. It failed to impress the judges sufficiently, but it had some success and was produced in some numbers after the end of World War 2. About two dozen were produced in total.

Helios

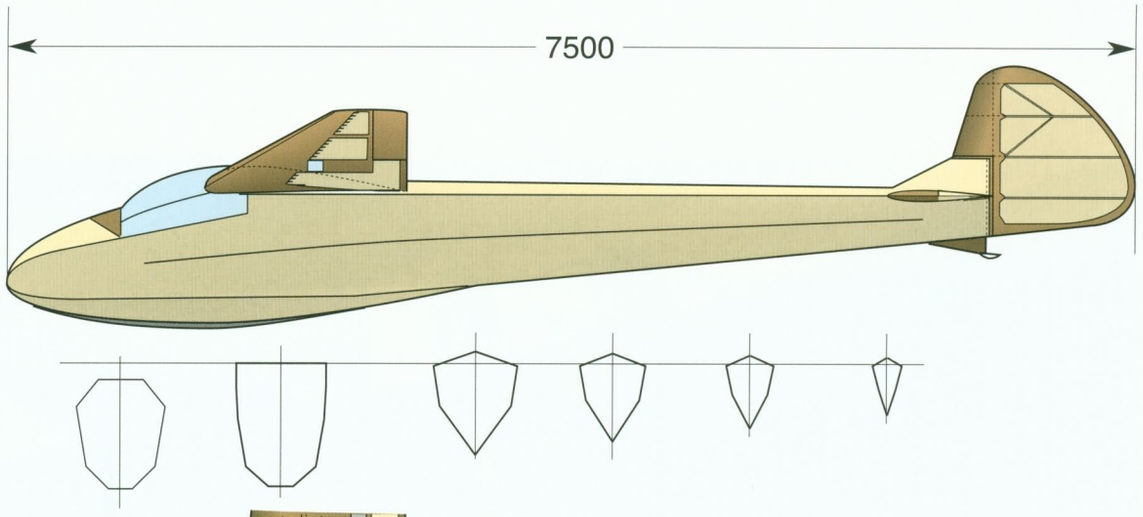
Below and opposite page below: Helios

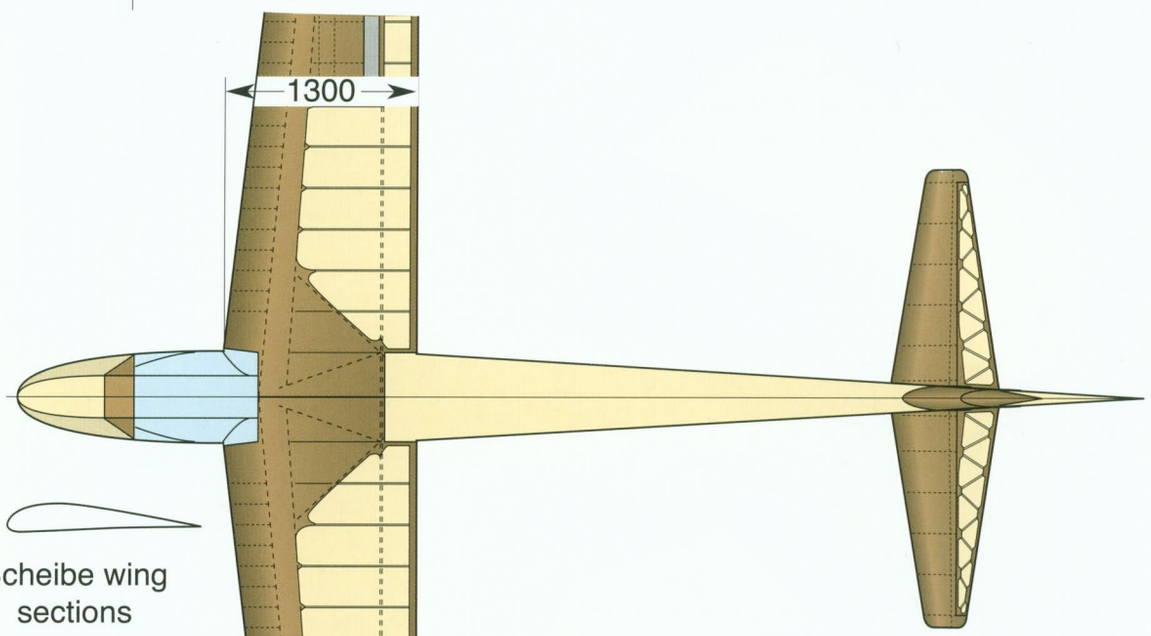
The small and inexpensive Helios was designed and built by a group of young Berliners in a great hurry, in time for the 1934 Rhön competitions. It had many innovative features. The wing, swept back and with gull dihedral, was wooden but the slotted ailerons were very unusual for the time, being framed in duralumin. There were no spoilers or air brakes. The fuselage was a welded steel tube frame with fabric covering. The seat was just ahead of the main spar so that the pilot's head was within the leading edge. An enclosed transparent canopy, with the plastic panels sewn onto the frame with leather strips, faired the fuselage to the wing with minimal disturbance of the airflow. View outwards was nonetheless extremely limited.

In the competitions the Helios, flown by Heinz Kensche, one of its youthful designers, was assigned to the junior division. Most of the pilots in this section were flying Grunau Babies, but there were a few Rhönbussards and Condors, and the first of the Horten tailless sailplanes, the H - 1 (which made only one scoring flight). The Berlin group were pleased with their results. They had put together a small and inexpensive sailplane in a matter of weeks, and had flown it across country. Kensche in 1937 was the German representative on the Olympic sailplane design jury.

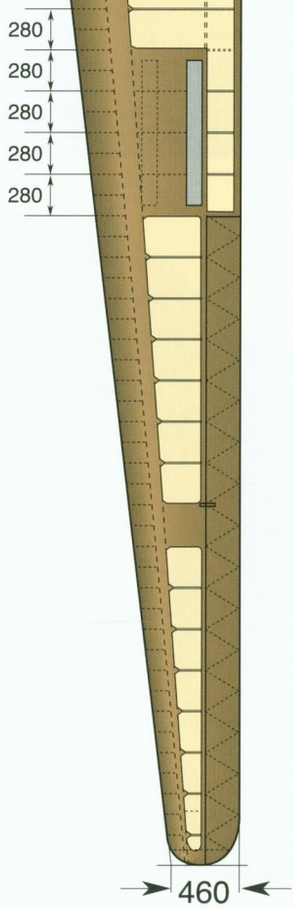

Merle

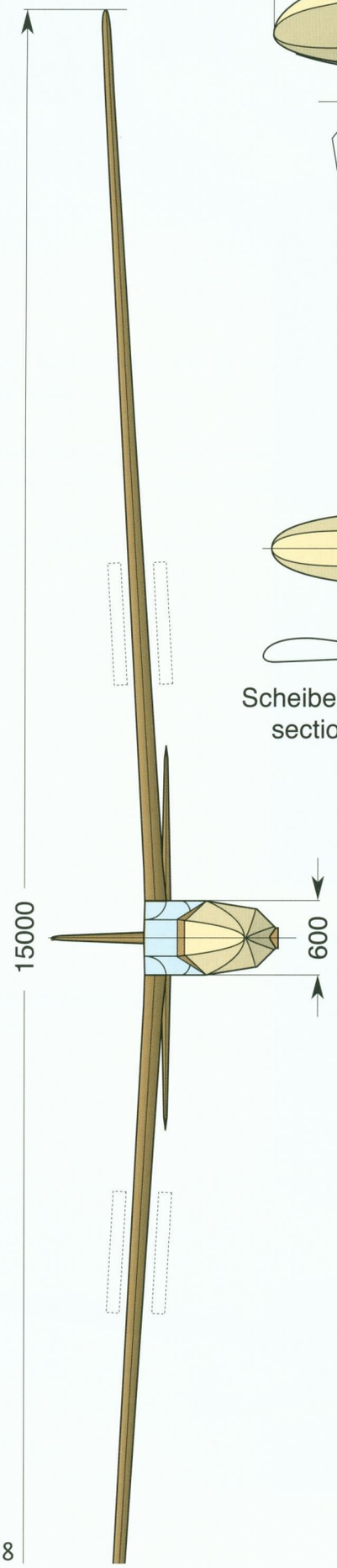

D-HELIOS





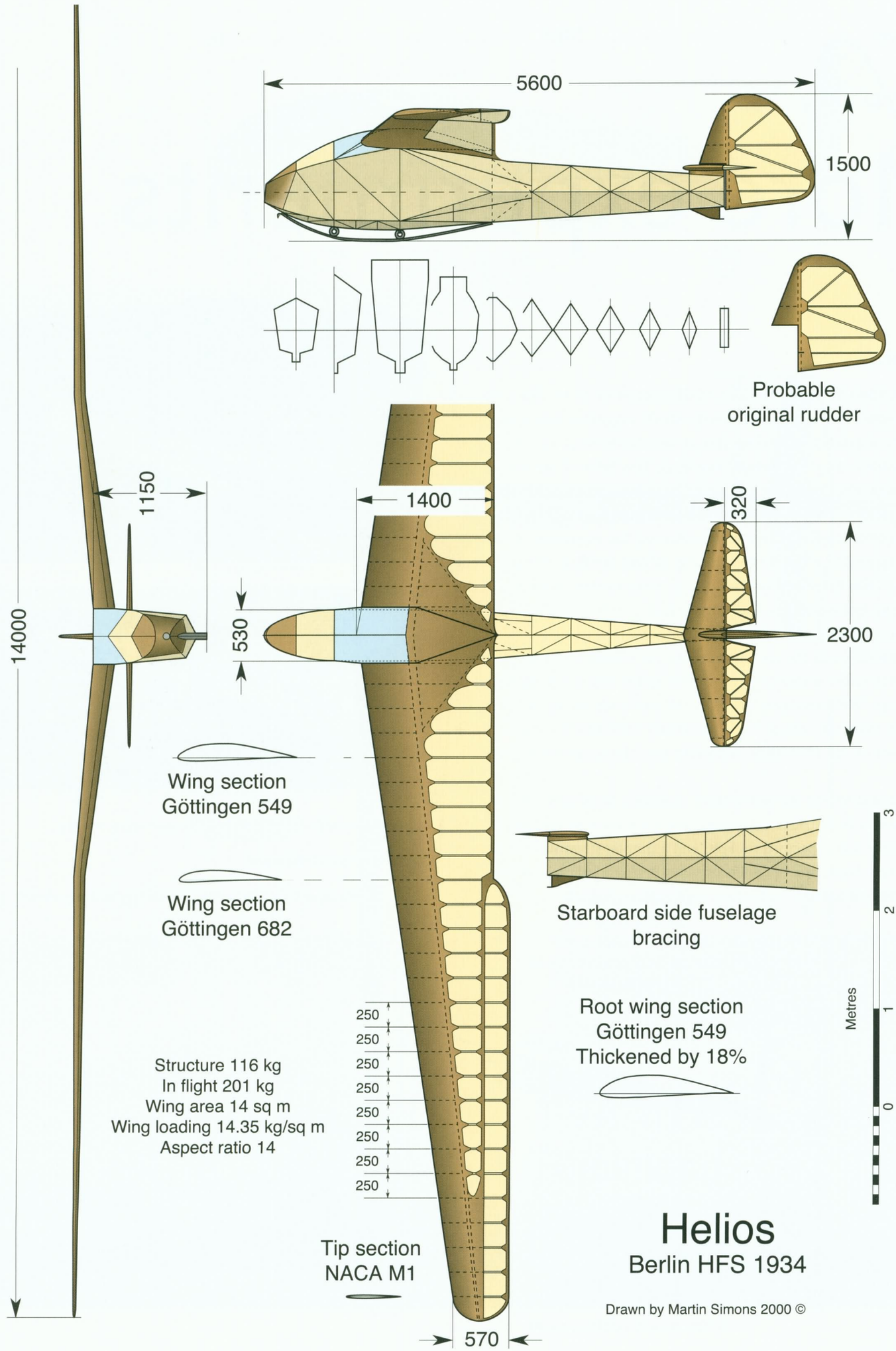
Scheibe wing sections





Structure 160 kg
In flight 255 kg
Wing area 13.3 sq m
Wing loading 19.2 kg/sq m
Aspect ratio 16.9

Mü 17 'Merle'
1939



Helios

Berlin HFS 1934

CHAPTER 12

More experiments

Rheinland

Akaflieg Aachen designed the FVA 10 Rheinland in 1935. The students were impressed by wind tunnel results which suggested that drag could be saved by shaping the fuselage like an aerofoil section, to conform as far as possible to the flow around the wing. The belly of the fuselage in side elevation was almost flat and would have been vulnerable to damage on rough ground. Led by Felix Kracht, they therefore designed a semi retracting wheeled undercarriage which also had the advantage of increasing the wing angle of attack when taking off and landing. The prototype was named Theo Bienen in honour of one of the earliest chairmen of the Akaflieg who had flown the Schwatze Düvel and the Blaue Maus. It was built in the workshop of Ferdinand Schmetz and flew in 1936.

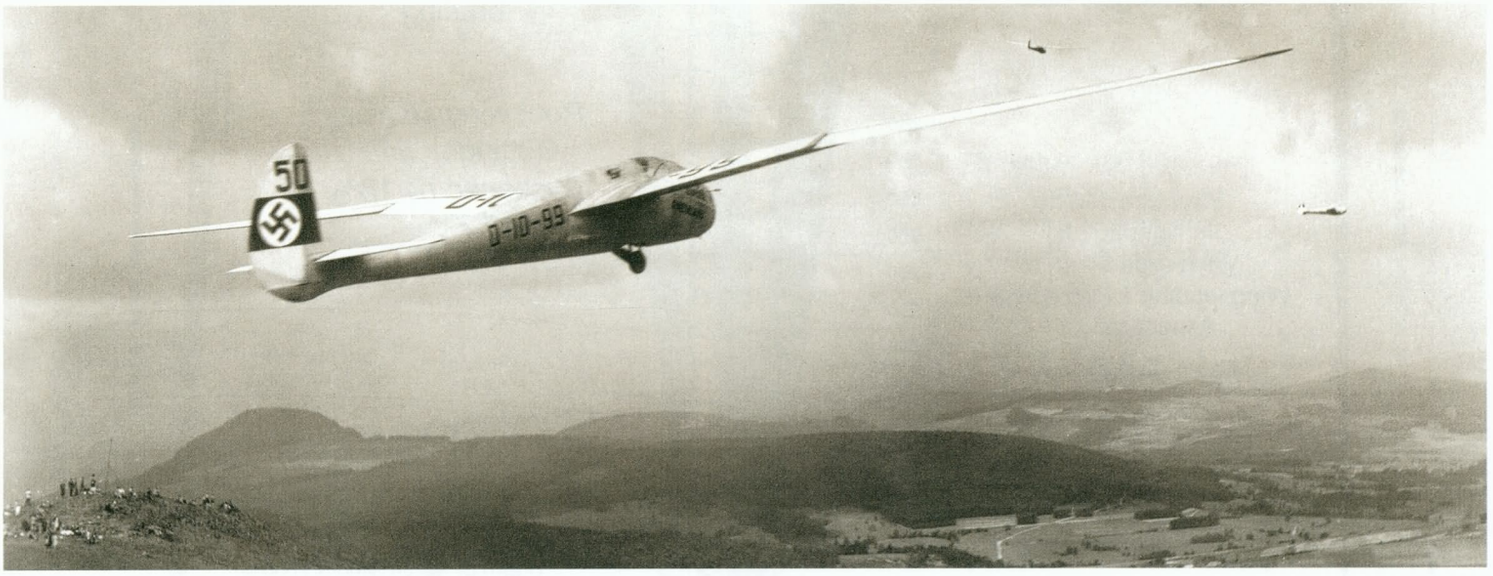
The performance in the air was excellent but handling was less satisfactory and the stalky undercarriage proved rather too easily damaged in bad landings. With changes, the FVA 10A was ready for the 1937 ISTUS meeting in Salzburg, where it did extremely well and Kracht also took second place at the 1937 Rhön competitions. The sailplane won the design prize.

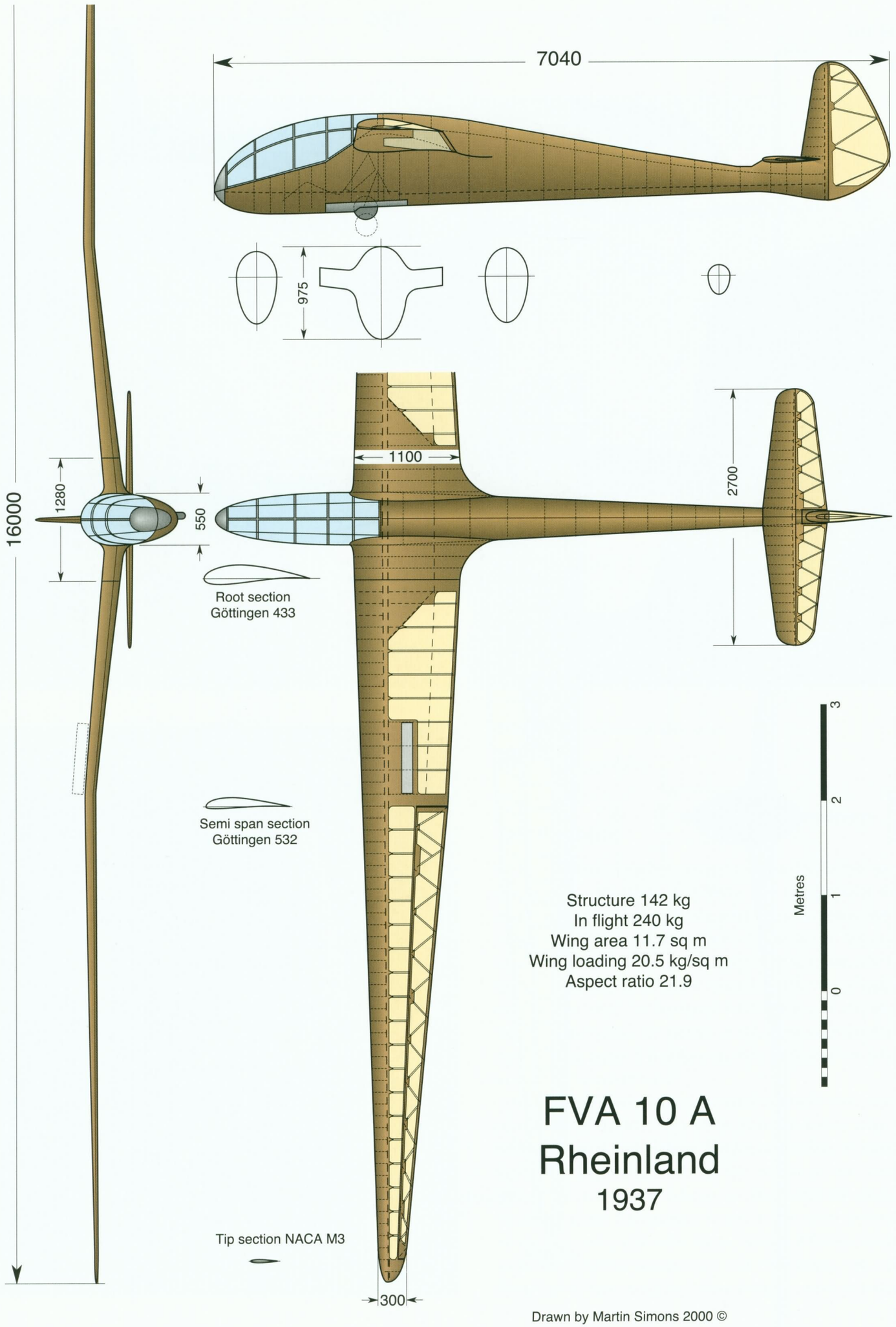
Schmetz and Kracht started a small company to produce the Rheinland. However, its distinctive fuselage shape was abandoned. The FVA 10 B had a rather more spacious cockpit, and a simpler streamlined fuselage. About 30 were built, one of which survives. A single example of the earlier, flat bottomed types, is in a museum in Krakow, Poland.

Above: Rheinland D - 12 - 99 at the Salzburg international meeting.

Middle: The FVA 10B Rheinland

Below: The Rheinland D - 12 - 99 competing in the 1937 Rhön competition.

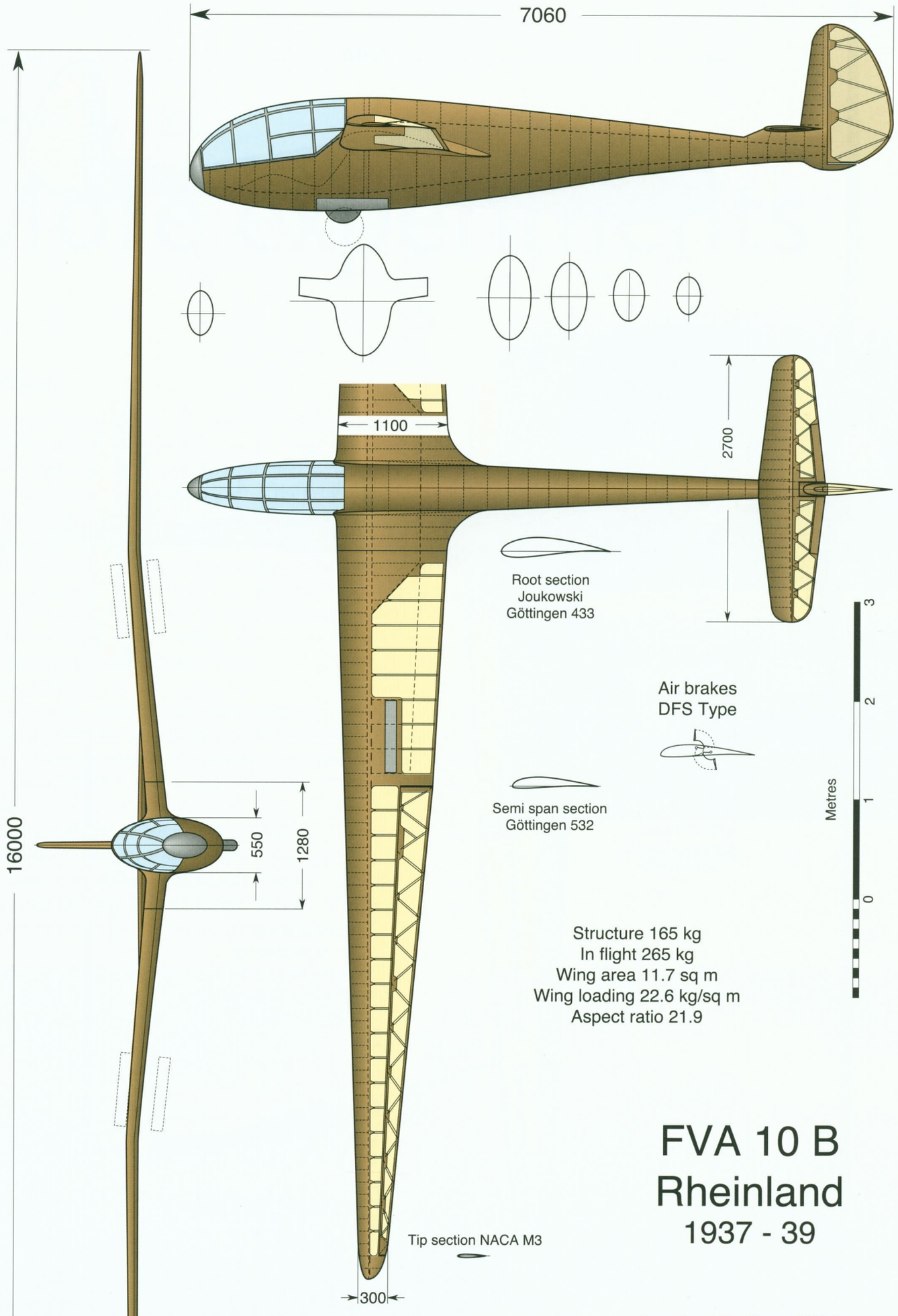




Structure 142 kg
In flight 240 kg
Wing area 11.7 sq m
Wing loading 20.5 kg/sq m
Aspect ratio 21.9

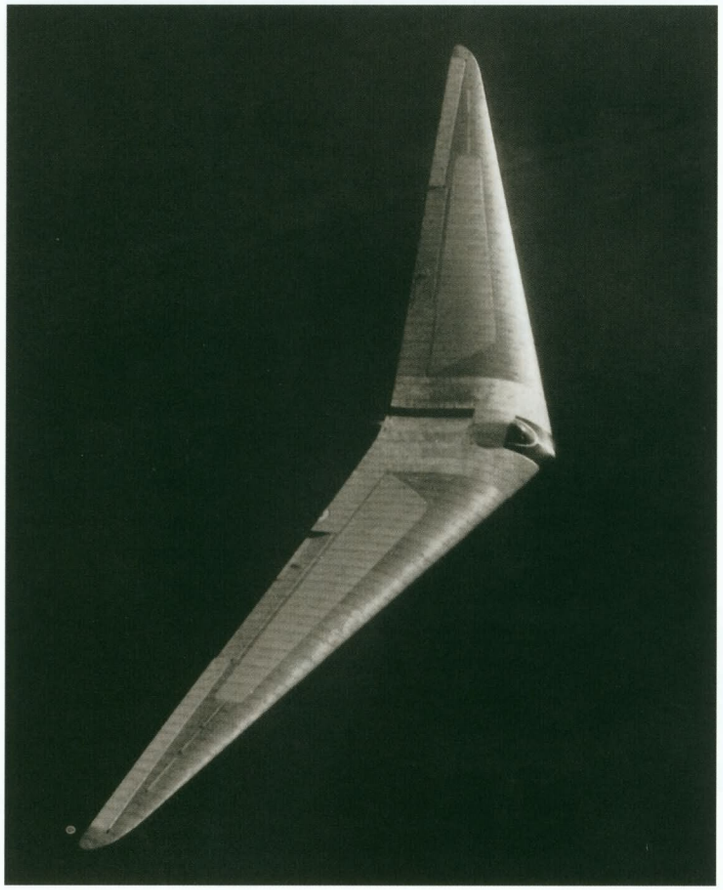
FVA 10 A Rheinland
1937

Drawn by Martin Simons 2000 ©



Structure 165 kg
In flight 265 kg
Wing area 11.7 sq m
Wing loading 22.6 kg/sq m
Aspect ratio 21.9

FVA 10 B Rheinland
1937 - 39



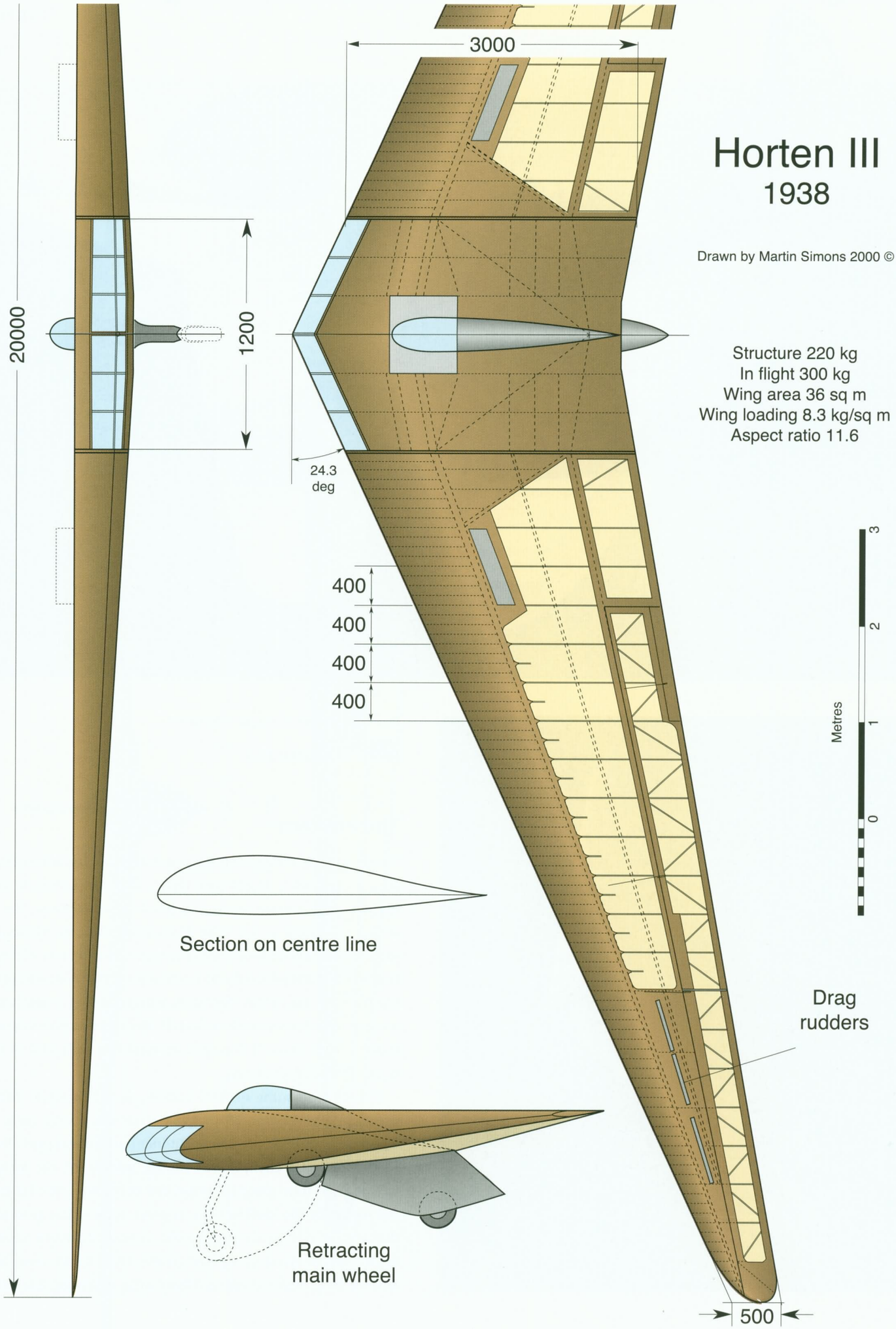
Above: Two Horten III in 1938 Rhön contest.

Left: Horten IIIf (prone pilot)

The Hortens

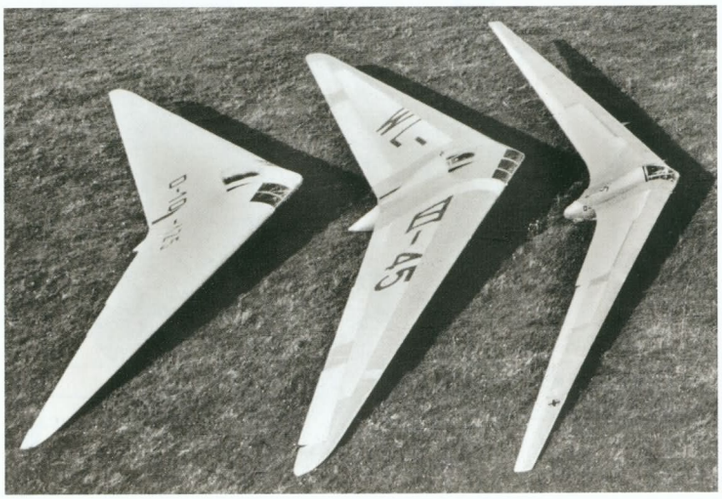
Walter and Reimar Horten became interested in tailless aircraft after seeing Lippisch's Storch and Delta, and like Lippisch they tested many models before beginning a full scale sailplane, the Horten I, which they took to the 1934 Rhön competitions. Although it flew for a total of about seven hours it recorded only one official contest flight. They abandoned and burned it on the Wasserkuppe, returning home to build the Horten II, which flew as a sailplane in 1935 and was much more satisfactory. It was fitted experimentally with a motor. Three more H II sailplanes were built and two of them flew in the 1937 competitions.

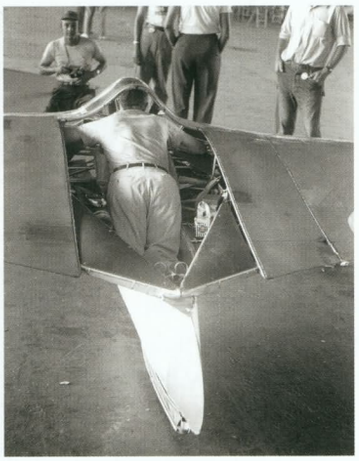
Able to find some official backing for their work, the brothers produced the Horten III in 1938. This was a very large sailplane which flew most impressively. Rudder control was provided by wing tip brakes. The cockpit was in the middle of the wing, with a streamlined transparent canopy, but there were also large transparent panels in the leading edge to give a view of the ground. The undercarriage was partly retractable. Several different versions were built. Two of these competed in the 1938 Rhön, one, designated Horten III C, had a small auxiliary wing mounted just ahead of the



Horten III
1938

Structure 220 kg
In flight 300 kg
Wing area 36 sq m
Wing loading 8.3 kg/sq m
Aspect ratio 11.6



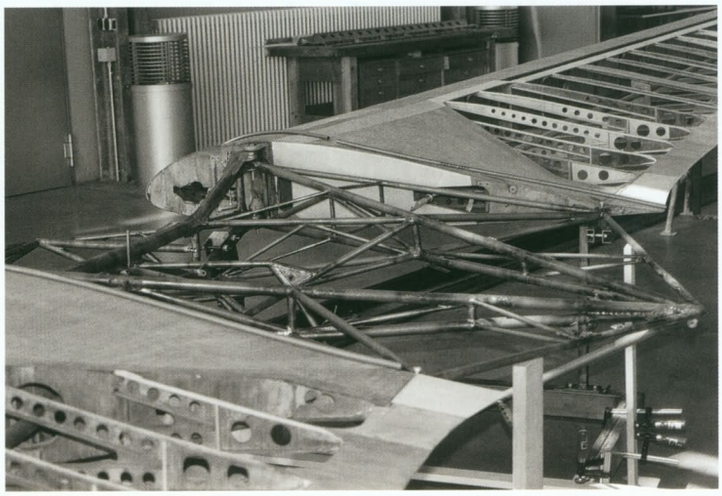


Above: The only known photograph showing Hortens II, III and IV together.

Middle: The pilot's position in the Horten IV.

Left: Horten IV in flight.

Below: The centre section of the Horten IV under reconstruction.



cockpit. Unfortunately, Blech, the pilot of one of these aircraft, was killed on impact in a mid air collision in cloud. His automatic parachute brought his body to earth. The Horten III D had a motor with a folding propeller.

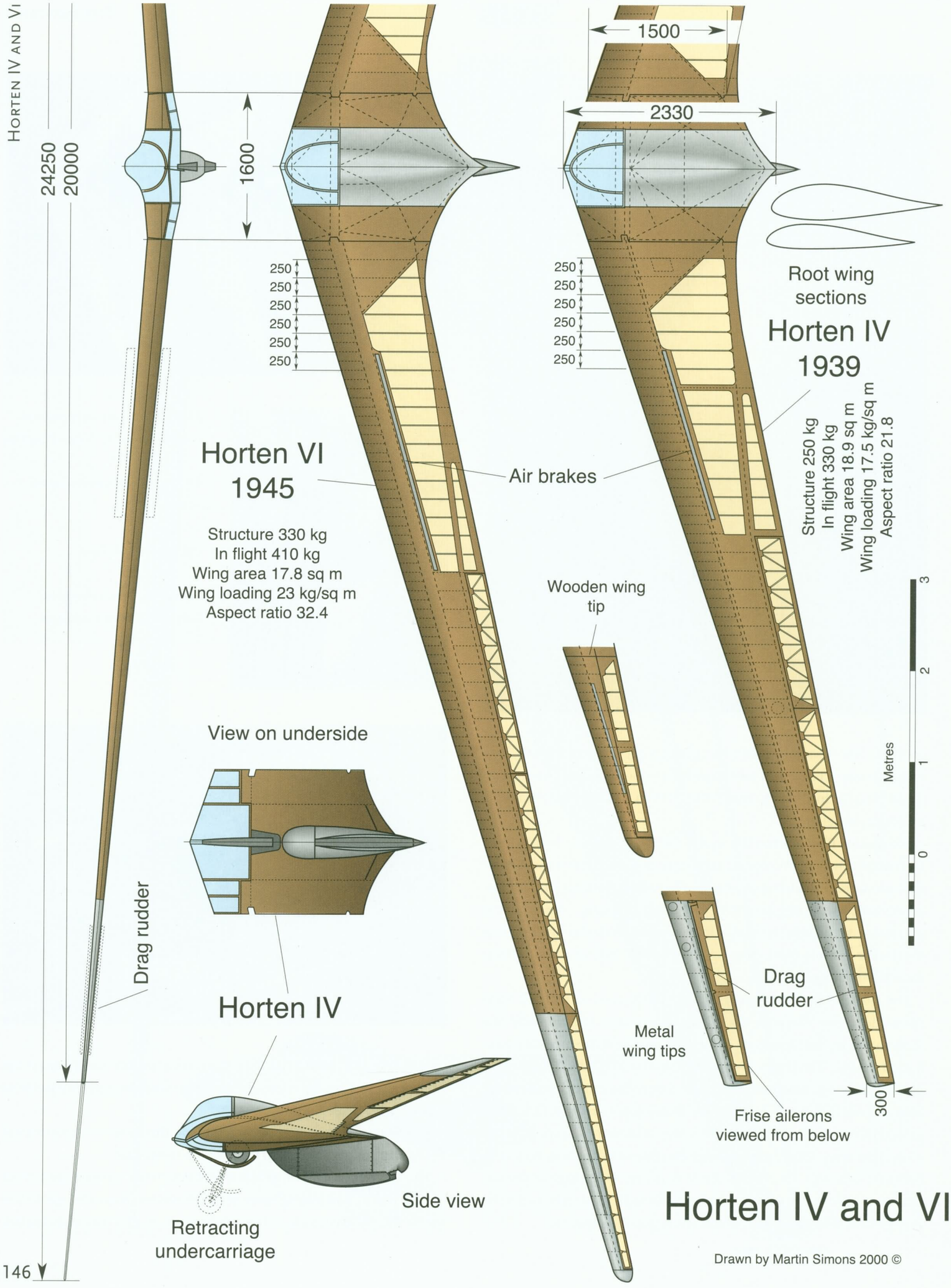
Four pilots flew Horten IIIs in the 1939 competition but did not do remarkably well. As contest sailplanes these aircraft were considered too lightly loaded and slow. Higher wing loadings and higher aspect ratios were required for cross country flying. The type was also used extensively in further experiments with motors, one was tried with a prone pilot, and there was a two seat version. Sixteen were flown altogether.

The Horten IV of 1941 incorporated all the lessons learned from the earlier types. The wing had a high aspect ratio, the pilot was in a semi prone or half kneeling position faired with a smoothly contoured canopy. The controls were operated by a yoke and there was a padded chin rest, essential if the pilot was to look directly ahead for long periods. The undercarriage was retractable to reduce all sources of parasitic drag. The wing tips, very thin and narrow, were fabricated in light alloy. Flight tests showed that the sailplane was fully controllable although no one described it as easy to manage in the air. Centre of gravity placement, as usual with tailless aircraft, had to be very precise. The performance was not as good as expected.

A Horten IVB, with a 'laminar' flow wing profile copied from the American P - 51 fighter, was flown but proved dangerously liable to flutter, and crashed killing its pilot.

The Horten V was a powered aircraft and there was an experimental flying wing of parabolic plan form which never flew.

The Horten VI, two of which were built in the closing months of World War 2, had a wing span of 24.25 metres in an attempt to improve the performance. A best glide ratio of 43:1 was anticipated.



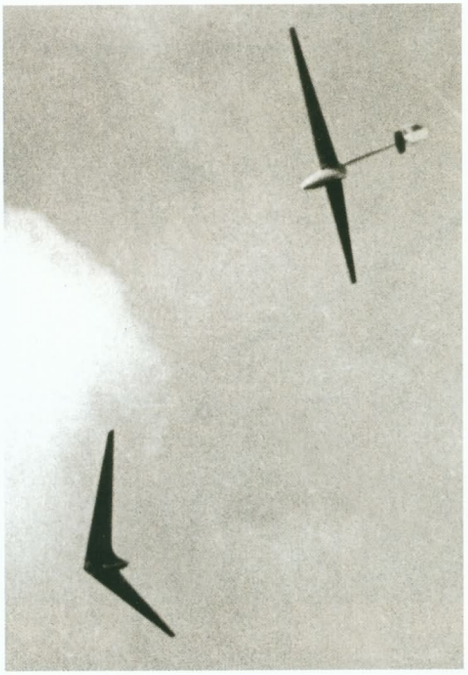
Horten IV and VI

Drawn by Martin Simons 2000 ©

Flight tests were started but had to be curtailed as the American armies captured Göttingen where the tests were going on. One of the Horten VIs was taken to the USA for study by the Northrop Company, but did not fly again.

One Horten IV survived in Germany to be flown by the British Air Force until damaged seriously in a landing accident at Scharfoldendorf. The wing tips had been at some time replaced with wooden tips. A Horten IV was extensively flown in the USA in post war times and was the subject of a thorough study at the Mississippi State University in 1959, and reported to the OSTIV Congress in 1960. The results were not as good as expected. In recent years, one of the surviving Horten IVs, probably the one used by the British in 1946 - 8, has been completely restored at the Oberschleissheim division of the Deutsches Museum in Munich.

The Horten brothers continued to design tailless aircraft after the war, producing both sailplanes and powered aircraft.

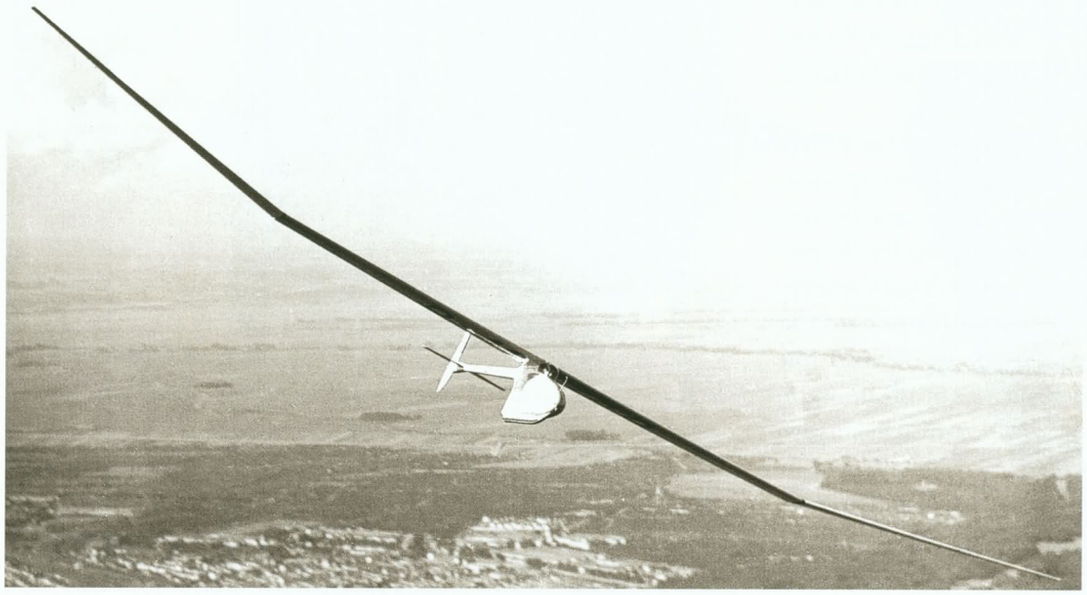


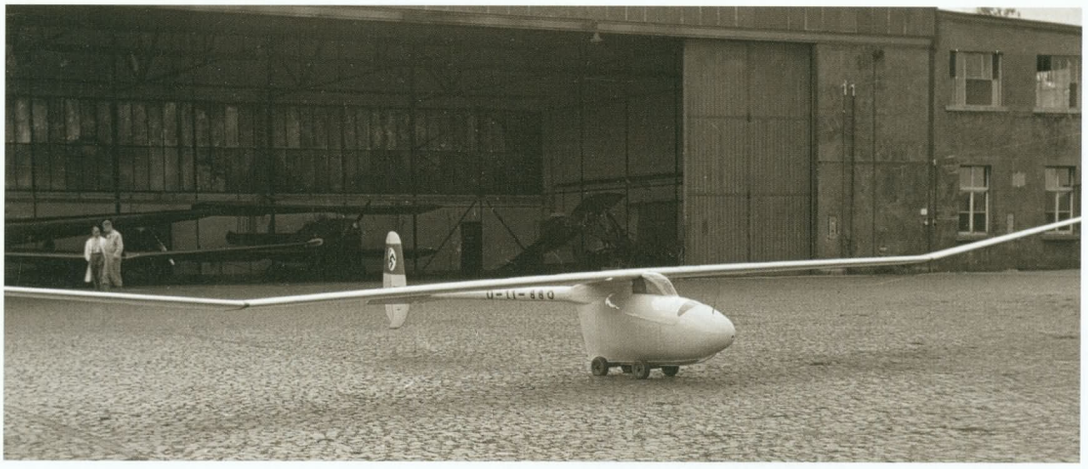
Above: Horten IV and D - 30, in comparison tests.

Below: The D - 30 in it's original form, with Bernhard Flinsch.

D - 30 Cirrus

The Darmstadt Akaflieg began paper work for the D - 30 in 1933, intending to use all the latest discoveries in aerodynamics and structural design to obtain the best possible gliding performance. The aircraft they produced was a record breaker in every sense. The wing had the highest aspect ratio ever employed until that time, 33.6. This could not be built in wood. A broad main spar of duralumin alloy was built up from corrugated sheets, the overlying skins flush riveted and curved to conform to the aerofoil shape. Behind and in front of the spar, wooden wing ribs were attached with plywood skins. The joins between wood and metal skins were carefully filled and smoothed for a good quality painted finish. Ailerons and flaps were fitted, and there were air brakes.





Above: The original D-30 in flight with positive dihedral.

Below: The D - 30, now repaired and with a new registration D-11-880. Note the improved transparent canopy.

The wing profiles were chosen from the recently published American NACA 4 digit series, 2412 (12% thick, 2% cambered) at the root, tapering to the 4412 (4% cambered, 12% thick) at the tips. The increase of camber at the tips reduced the risk of tip stalling since, measured from the zero lift position, a more cambered form stalls at a high lift coefficient and at a higher aerodynamic angle of attack. (This, in 1933 was the reverse of the usual technique but is almost universally followed in modern sailplane design.) Since the wing was tapered, some 'wash in', positive twist, was introduced over the inner wing, with washout thereafter, to increase the lift slightly over the middle portion, approximating the ideal elliptical load distribution.

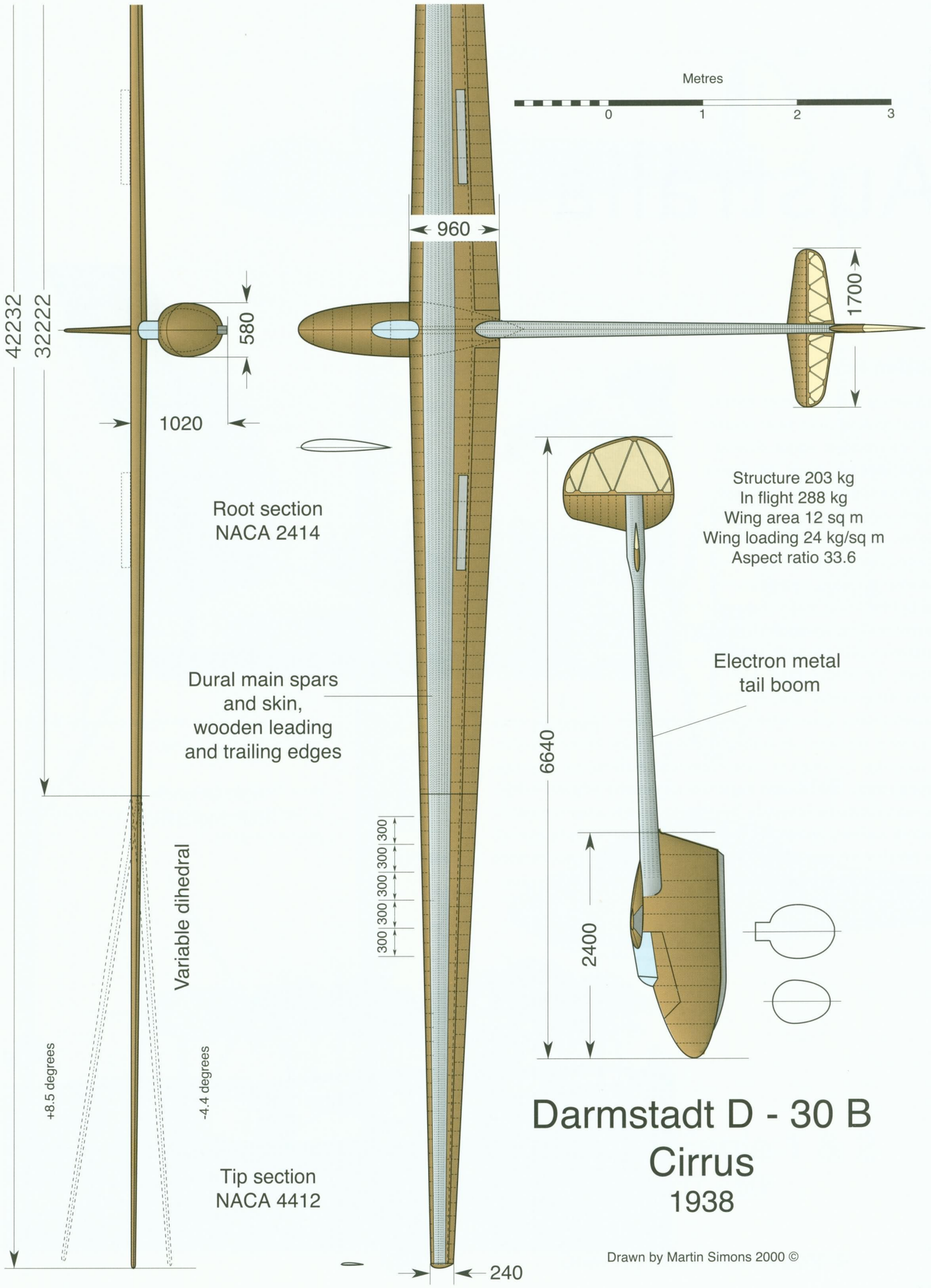
Most unusual of all, at the mid span point the wing had a pivot which allowed the dihedral to be changed in flight. This was for an investigation into the effects of dihedral on handling. The design and fabrication of the necessary mechanism, which had to fit within a wing of only 72 mm thickness, was very difficult.

The fuselage was of the 'pod and boom' type, a small streamlined plywood shell housing the pilot, with a tubular tail boom fabricated from electron alloy. The cross sectional area of the pod was small, and skin friction was saved by reducing the area of surface exposed to the airflow. The Horizontal tail surface was small, stability in pitch being determined mainly by a centre of gravity well forward. But the vertical tail could not be reduced too much since control in yaw, with such a large span, would become marginal. As it was, after test flights, the rudder was enlarged. Take off was by means of a 'drop off' wheeled dolly, landings on the skid.

The sailplane was not completed until 1938 but, flown by Bernhard Flinsch, it very soon broke the World 'out and return' record, 305.6 km from Bremen to Lübeck and back. (For such a flight to count as a record, it had to be declared fully before take off.) The performance was carefully measured in flight. The best glide ratio was 1:37.6, a figure which was not exceeded until the advent of new, low drag aerofoil sections.

Regarded, rightly, as an 'orchid', the D - 30 was not a very practical sailplane for the rather irregular terrain of the Wasserkuppe and was never really intended for the rather 'rough and tumble' conditions prevailing in competitions. The D - 30 was badly damaged in a bungee launching accident on the Wasserkuppe. Flinsch was lucky to escape without serious injury.

The D - 30 was rebuilt, with an improved shape for the fuselage pod. Flinsch in June 1939 made a 406 km flight in it after the repairs. Controversy and doubt surrounds its eventual fate. Most probably it was destroyed, as, under orders from above, most German sailplanes were when the Allied forces occupied the country in 1945. It is certain only that it did not survive. A two seat version, the D - 31, was planned but never completed.



Darmstadt D - 30 B Cirrus
1938

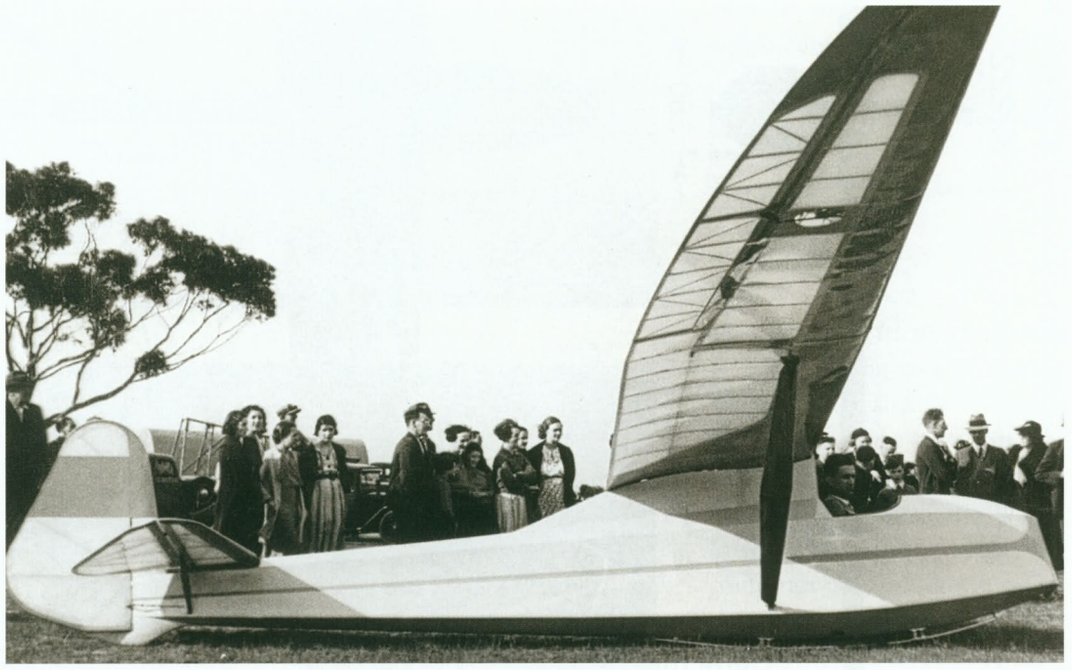
Drawn by Martin Simons 2000 ©

CHAPTER 13

Australia

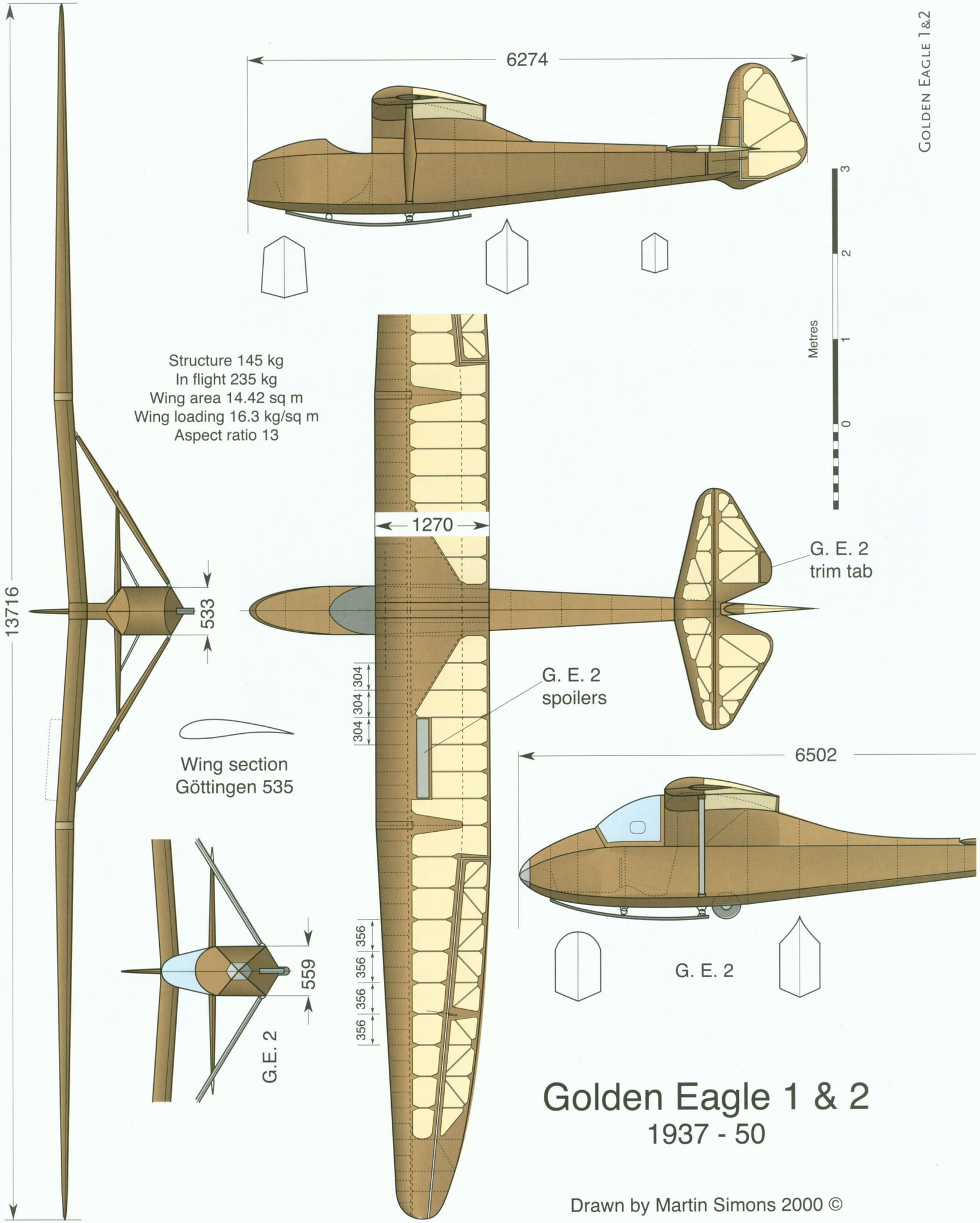
Golden Eagle

In Australia in the nineteen thirties several gliding clubs were operating. Information about developments overseas could be found only occasionally in imported magazines. Geoff Richardson, a Melbourne boy in his teens, began construction of a sailplane in 1934 but after attending a gliding meeting in New South Wales and some further reading, scrapped his original plans and began work on a new design. His Golden Eagle, built at home using casein glue he made himself from a Swiss recipe, flew in September 1937, on the same day and at the same site as the first Grunau Baby 2 to be imported to Australia. Although in some respects resembling the prototype Grunau Baby, The Golden Eagle was an entirely original design, having a similar performance. In 1950 the front fuselage was rebuilt with an enclosed canopy and landing wheel. Spoilers and a trim tab for the elevator were added. In this form the Golden Eagle remains in service, still held together safely by the same, home made, glue.



Above: In its original form the wing was mounted high on a narrow pylon, with open cockpit.

Below: The Golden Eagle was designed and built in Australia by Geoff Richardson in 1937, after seeing reports of German gliders in a magazine.



Structure 145 kg
In flight 235 kg
Wing area 14.42 sq m
Wing loading 16.3 kg/sq m
Aspect ratio 13

Wing section
Göttingen 535

Golden Eagle 1 & 2
1937 - 50

Drawn by Martin Simons 2000 ©

CHAPTER 14

Austria

Kronfeld's Austria II. Cabin with door under the wing.

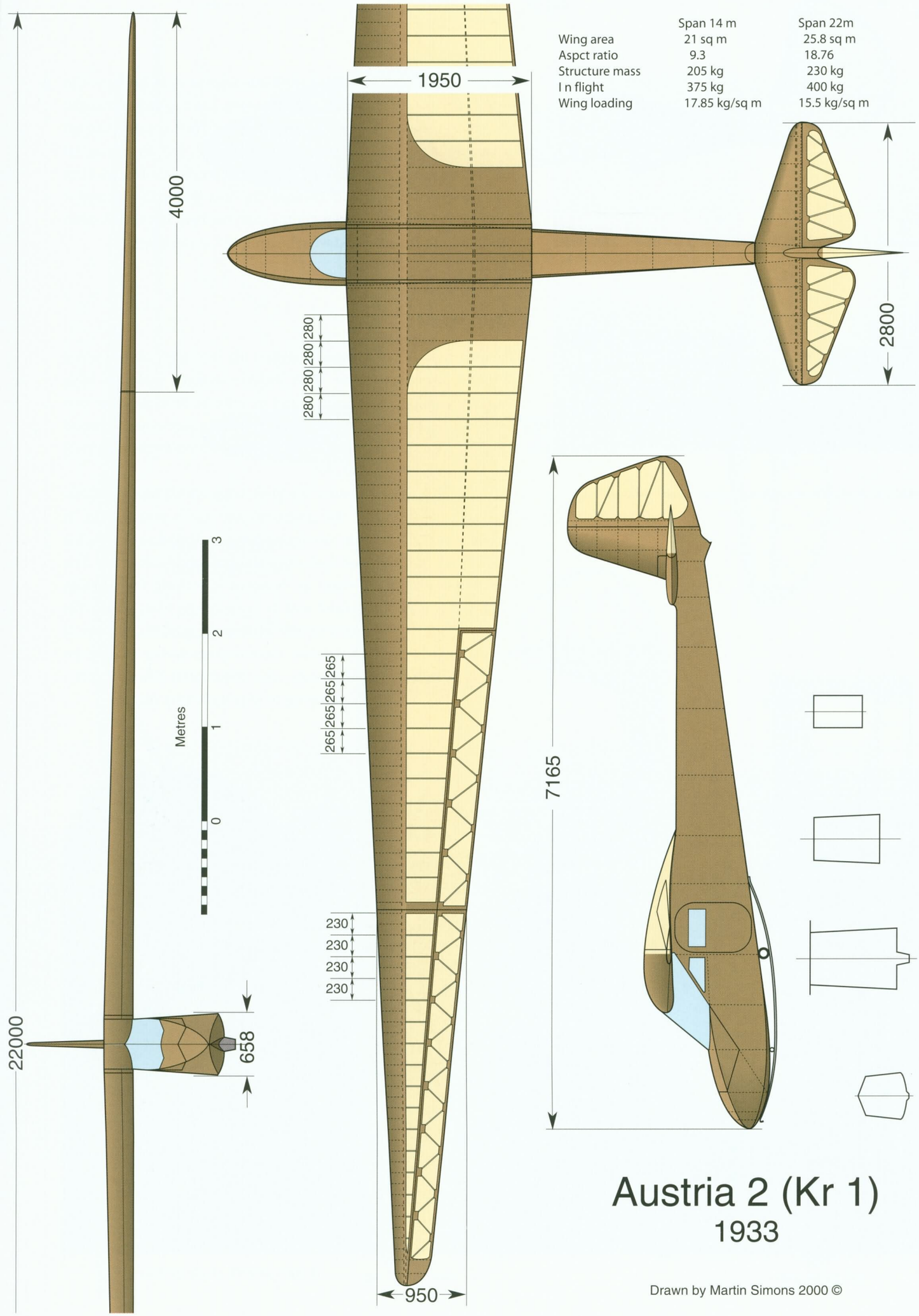
Austria 2 and 3

The very large two seat sailplane Austria 2 was designed by Dr Küpper in Munich, to the specification of Robert Kronfeld. On the plans it was described as the Kr 1, presumably short for Kronfeld 1. Parts of it were displayed at the Rhön in 1932 and the first flights were made in the autumn of the same year. It seems to have been intended from the first as a passenger carrier. Behind the fully enclosed cockpit was a cabin with a hinged entry door with an oval window. The rear cabin was described by an English observer as 'dim'. There were no dual controls. The structure was orthodox.

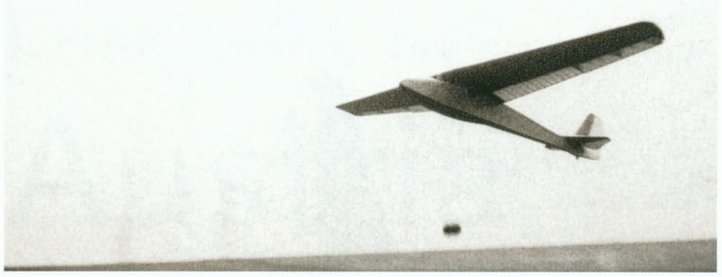
The most unusual feature other than sheer size was that the outer wings, each 4 metres long, could be removed to permit flight with a span of only 14 metres. In this configuration Kronfeld, flying solo, did aerobatics. More extraordinary still, the outer sections could be housed entirely inside the inner wings. Ahead of the main spar, inboard, was a padded tunnel into which the outer ailerons, removed from their hinges, could be slipped. Behind the spar was a similar housing into which the tips, less ailerons, went. It was then possible to re-assemble the sailplane with the 14 metre span wing and fly it normally.

The reason for this unusual arrangement was that Kronfeld intended to use the sailplane for displays and tours to publicise the sport of soaring. The Austria 2 was aero towed, with wings inside wings, from city to city, landed, re-rigged, gave its displays, carried its influential passengers, was disassembled, wings put inside the wings again, towed to the next place, re-rigged, flown, and so on. In January 1933 the Austria 2, parked on the airfield at Semmering, was badly damaged in a wind storm but was repaired. Kronfeld demonstrated his aircraft very widely throughout Europe during 1933, visiting Vienna, Naples several times (he soared over Vesuvius), Rome, Milan, Turin, St Quentin, Frankfurt, Budapest, Graz, Salzburg, Paris, Strasbourg, Rennes and other places. Finally the Austria 2 was taken to Cairo at the time of the FAI Congress. There it was sold, to be re-christened the Fasold. It was reported to be still in operation in 1937.

Meanwhile Kronfeld had bought the Kr 1a, Austria 3 ,which was similar in all respects although, doubtless, there were minor improvements. He was already flying this in August 1933 at the Bannes d'Ordanche meeting in France, competed again at Vin-



Austria 2 (Kr 1)
1933



The only known photographs of the Austria 3 flying in England with the short wing.

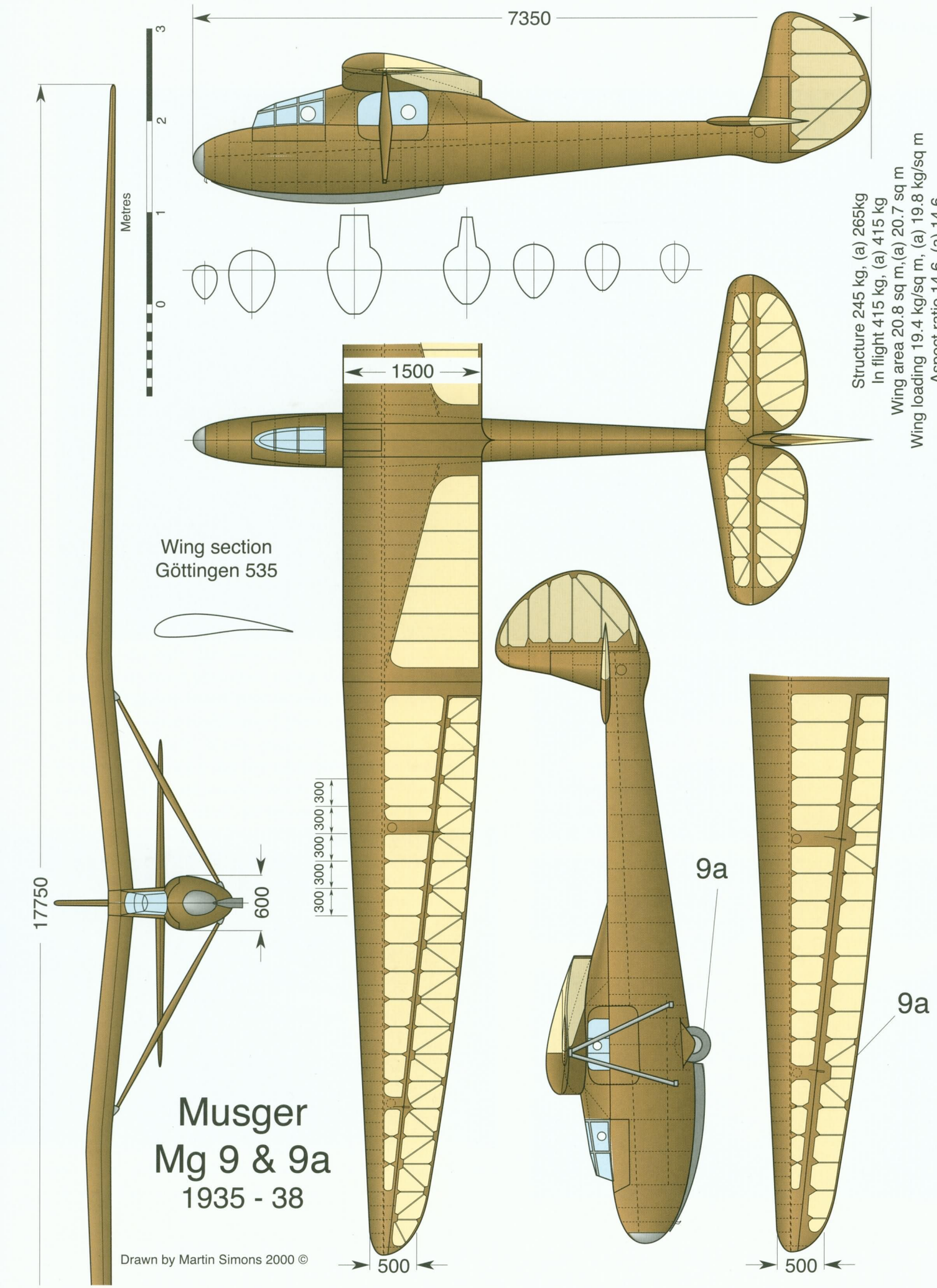
cennes in May and put on an aerobatic display at Le Bourget. On June 11th, during an aero tow to Limoges, the tug engine caught fire. After release both aircraft landed safely. The tug pilot escaped as the aeroplane burned and finally exploded. Still in France, in July 1934 Kronfeld received the Grand Prix du Puy-de-Dome. After this, he settled in England. He took the Austria 3 with him and it was flown at the Southdown gliding club site near Itford Hill. After this it did not fly again and what became of it is not known.

Musger MG - 9

The engineer Erwin Musger designed his first high performance sailplane, the Mg - 1, in 1932. Further designs included both sailplanes and light aeroplanes and in 1936 he developed the two seat, dual controlled Mg 9, the prototype being formally christened OE - Kamerad. It was intended for training and performance flying and was stressed for aerobatics.

The second seat was under the high wing, which had gull dihedral and single struts. The undercarriage was a simple skid. It proved successful and was developed further to produce the Mg 9a. The front cockpit was enlarged and a landing wheel was added. The struts were divided to make an inverted V, joining the fuselage frames at two points behind and in front of the wheel, but with only one attachment point to the wing main spar. Production of ten of the MG 9a was undertaken, most of them having an Austrian OE - registration with the name of a planet after the dash, OE - Merkur, Mars, Venus, etc. A few more were built after this.

The Musger MG 9 at the 1936 ISTUS meeting.



Structure 245 kg, (a) 265kg
In flight 415 kg, (a) 415 kg
Wing area 20.8 sq m,(a) 20.7 sq m
Wing loading 19.4 kg/sq m, (a) 19.8 kg/sq m
Aspect ratio 14.6, (a) 14.6

Wing section
Göttingen 535

Musger Mg 9 & 9a
1935 - 38

The pilot Toni Kahlbacher used the Mg 9a to break many Austrian records. Also with co - pilots Tauschegg and Josef Führinger on two separate occasions in 1938 he broke the World two seat duration record with flights respectively over 23 hours and 40 hours. The prototype MG 9 and the Mg 9a OE - DUO were taken to the ISTUS meeting in Salzburg in 1937. At the Rhön competition in 1938, flown by Toni Kahlbacher and Tauschegg, the Mg 9a did very well in the two seater contest, placing third in a field mostly of Kranichs.

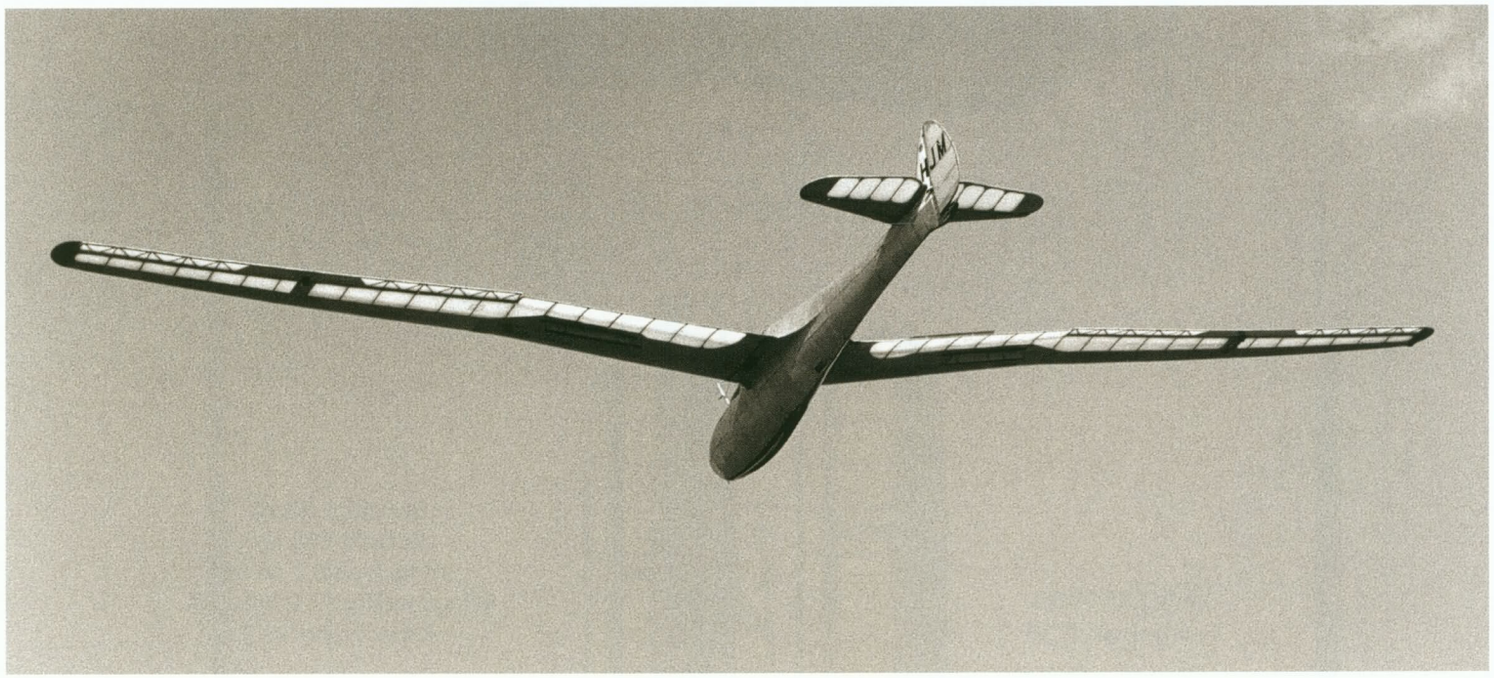
Musger continued to design sailplanes, the very successful Mg 19, 19a, b and c series of two seaters beginning in 1951, to the MG 23 which continued in production till 1966.

Above: The Mg 9a, with wheel and inverted V struts. Austrian markings after the Anschluss.

Below: The Hütter 17 at Dunstable.

The Hütters

For flying in the Austrian Alps, the brothers Wolfgang and Ulrich Hütter of Salzburg designed a small, 10 metre span single seat sailplane which they expected to achieve a glide ratio of 17:1. Hence it was named the Hütter 17 or H - 17. It resembled a small Grunau Baby, with high wing of Gö 535 profile, strut braced, above a hexagonal box fuselage with open cockpit. However, the ailerons were slotted to ensure good response at all times and everything possible was done for easy building.



As soon as the prototype had been proved satisfactory, plans were published and about a dozen sets were sold quickly. After this, the Hütters joined the Schempp - Hirth Company in Göppingen, as designers. The H - 17 became the Göppingen 5. A landing wheel and canopy, with a windscreen, were added. A few were built in the factory and many more plans were sold.

After World War 2, production at Göppingen resumed and the H - 17B was developed, with a fully enclosed canopy, longer fuselage, air brakes and other modifications. More plans were sold.

How many of the H - 17 were completed and flown over the years is not known but in England at least two more have been built in recent years and there remain others in service throughout the world. The H - 17 will soar well once it is in lift but reaching the next thermal after a climb is not easy. The glide ratio probably does not reach 17.

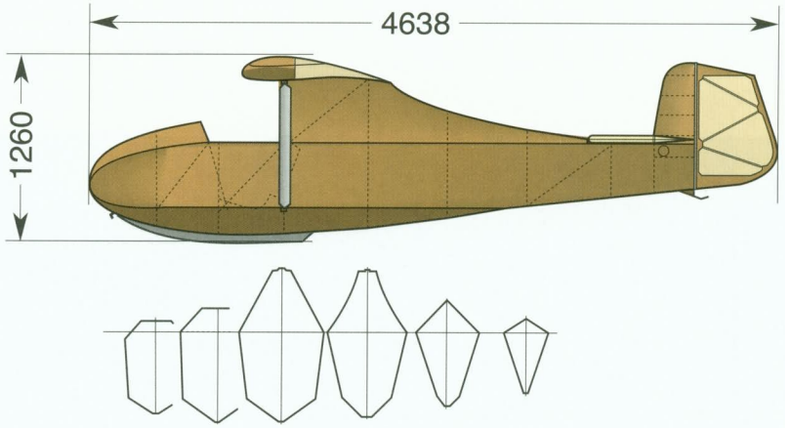
Still believing that sailplanes should be small, but recognising that their little H - 17 did not satisfy ambitious pilots, the Hütters went on to develop a high performance sailplane which they calculated would have a glide ratio of 28:1, hence, the H - 28. Great ingenuity went into the 12 metre span design. A special feature was the large one-piece moulded transparent canopy, specially produced at the Darmstadt Technical University where plastics were being actively studied. On this prototype the wings were straight although gull wings had been intended originally. Flight tests were satisfactory but the measured glide ratio was found to be a somewhat disappointing 23.4.

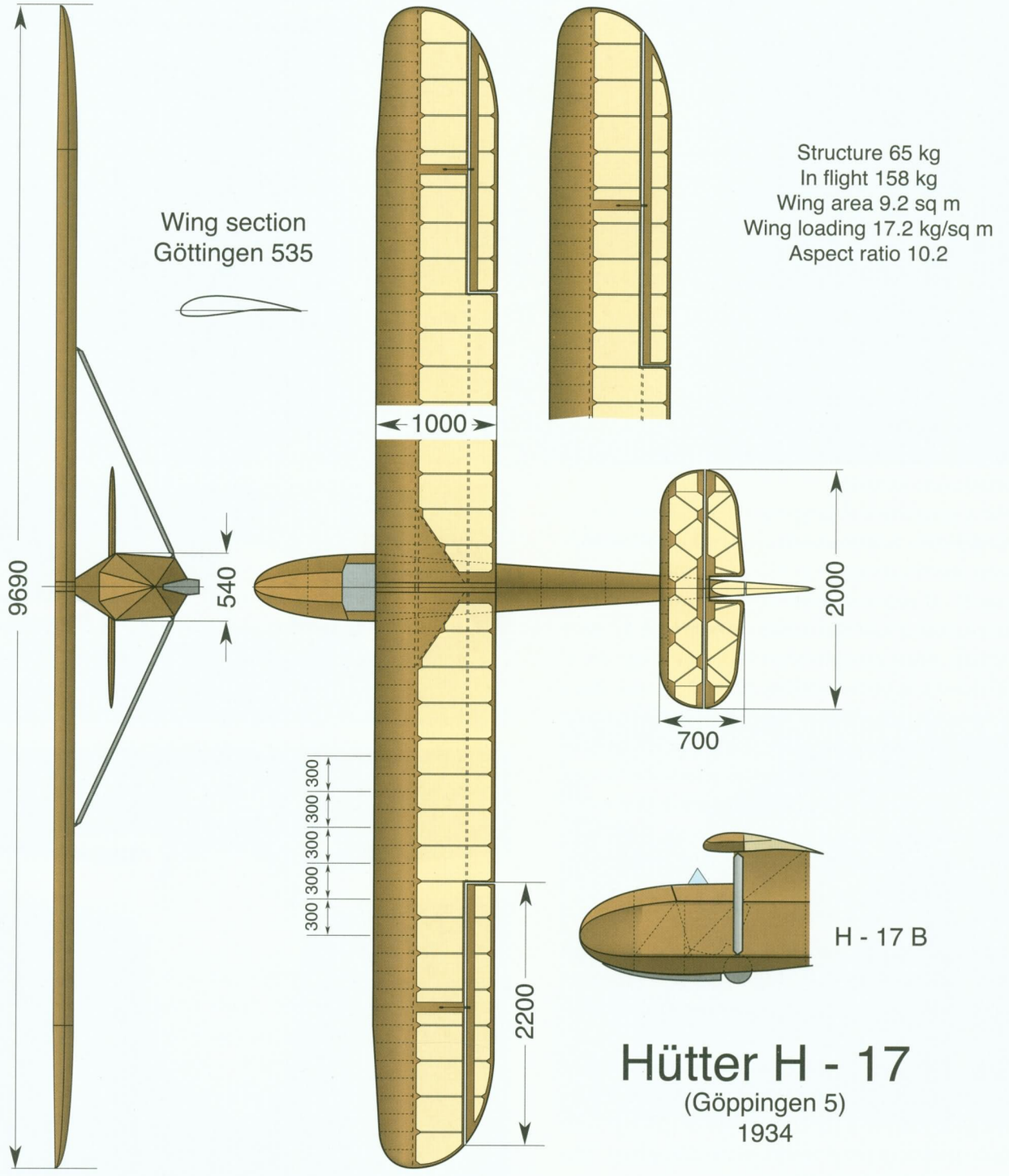
The H - 28 II had gull wings and a canopy built up from separate pieces of plastic. A single H - 28 III was built, in Denmark, which had an improved glide ratio of 27.2. One replica H - 28 was built and flown by Earle Duffin in more recent years, in England. This did not follow the original design exactly.

Above: The Hütter 28 replica by Earle Duffin.

Middle: The Hütter 28 II in 1974, flown by Herr Aeberle of Switzerland.

Below: The wing roots gave the pilot elbow room.





Wing section
Göttingen 535

Structure 65 kg
In flight 158 kg
Wing area 9.2 sq m
Wing loading 17.2 kg/sq m
Aspect ratio 10.2

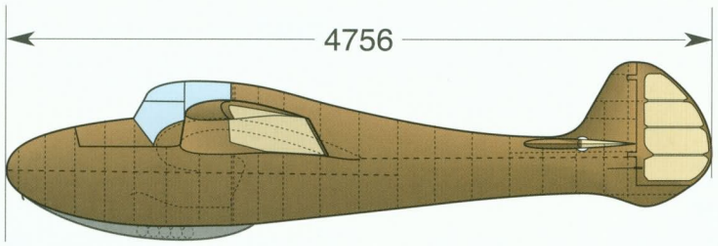
H - 17 B

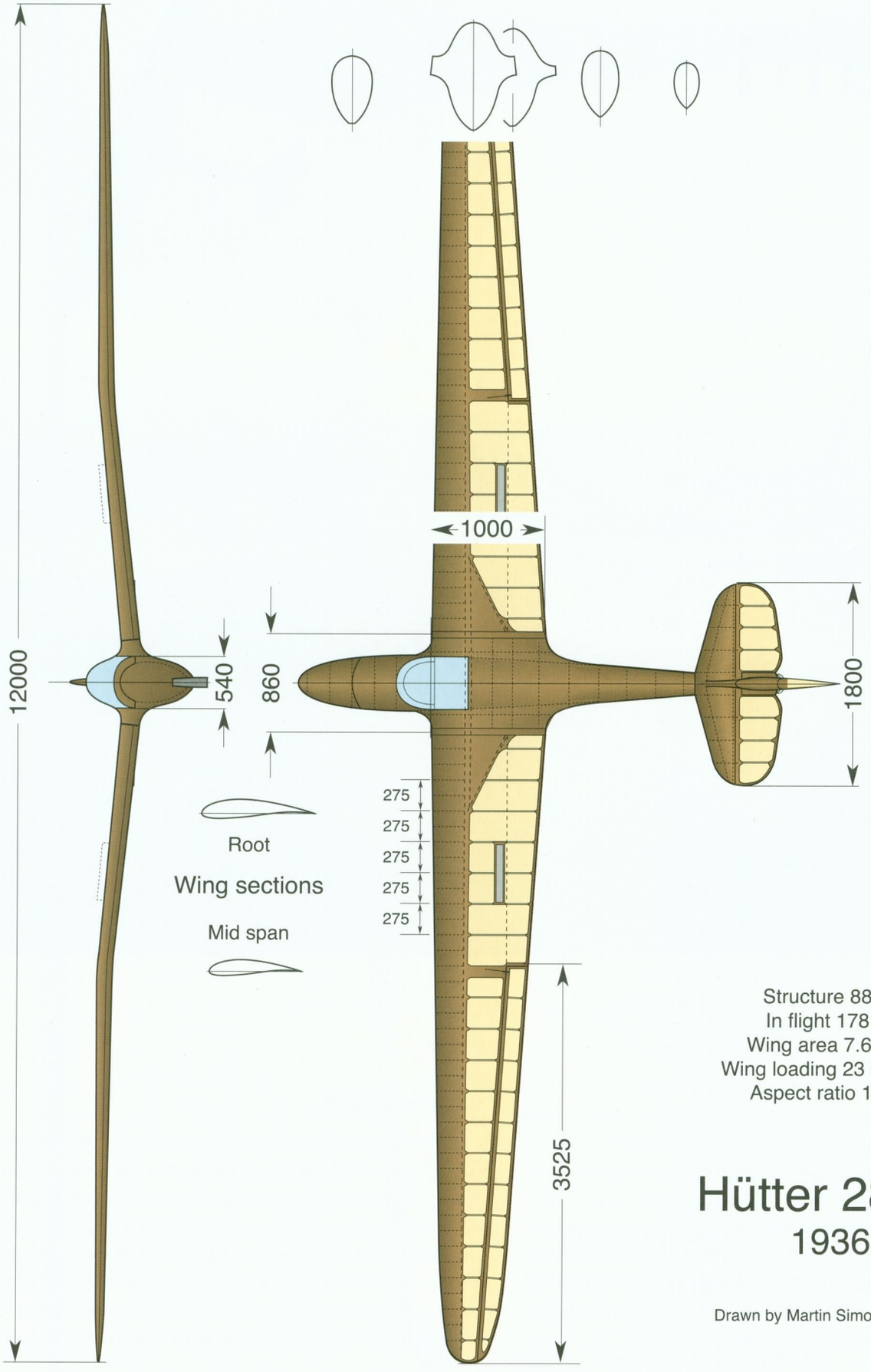
Metres
0 1 2 3

Hütter H - 17

(Göppingen 5)
1934

500



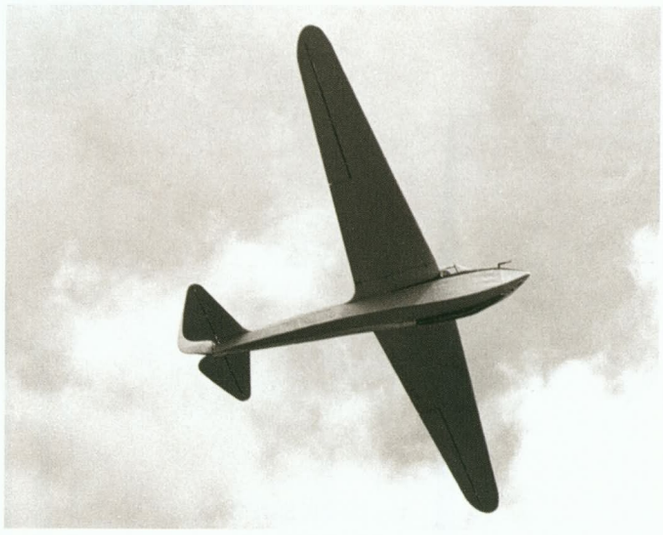


Structure 88 kg
In flight 178 kg
Wing area 7.6sq m
Wing loading 23 kg/sq m
Aspect ratio 18.46

Hütter 28 - II
1936

CHAPTER 15

Britain



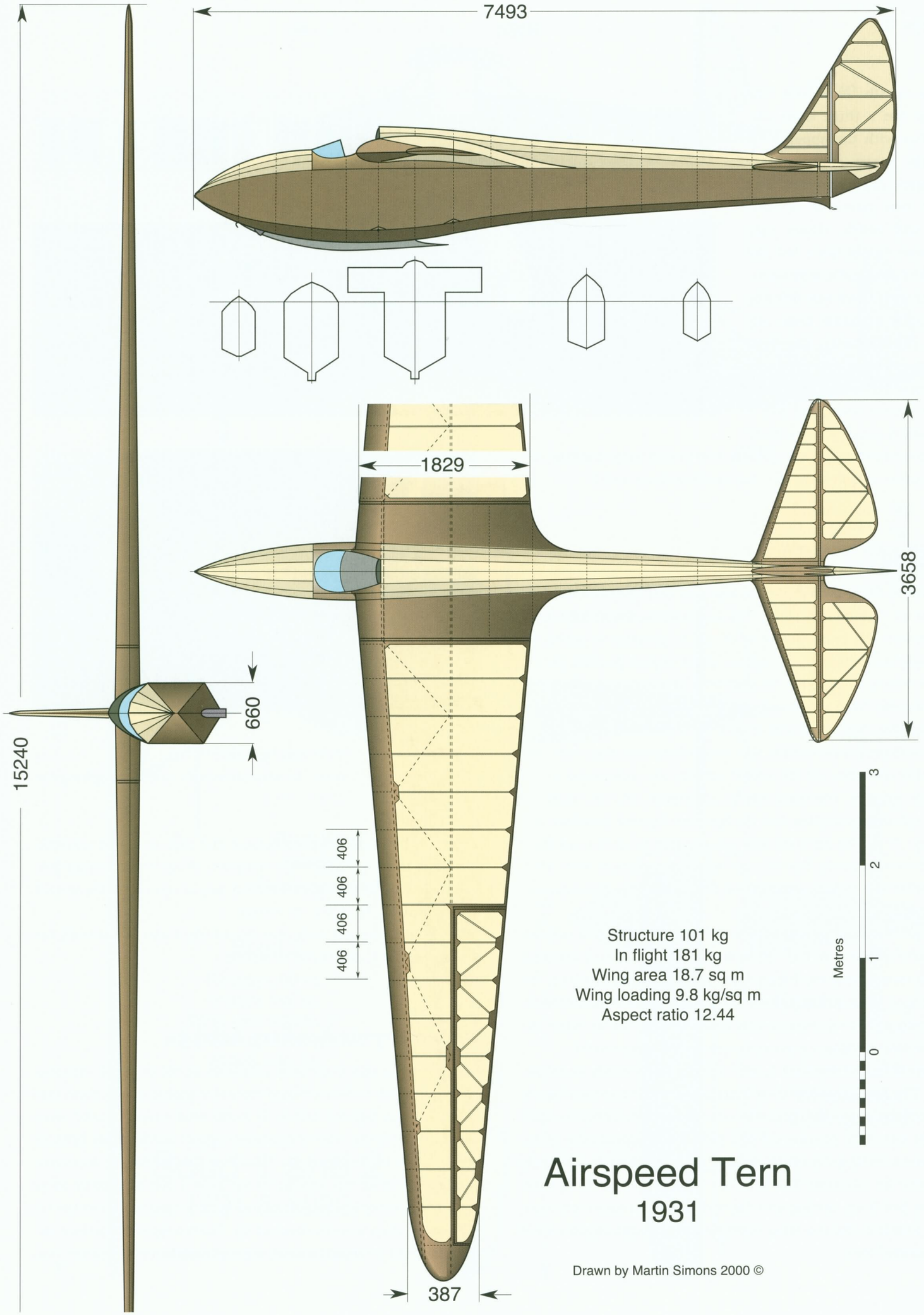
The Tern soaring

Major Petre in the Tern cockpit at Balsdean on the South Downs in 1931

The gliding movement in Britain, following a false start with the Itford meeting in 1922, began after a preliminary gathering in December 1929, with the formation of the British Gliding Association. There was no government interest, and nothing in any British University or college like the German Academic flying groups. Where something of the sort did exist, for example at the De Havilland Technical School from 1928, the chief preoccupation was with racing aircraft. British gliding therefore had to be self supporting. A subsidy was granted to the BGA in 1935 but it amounted to only £5000 annually for a few years.

Airspeed Tern

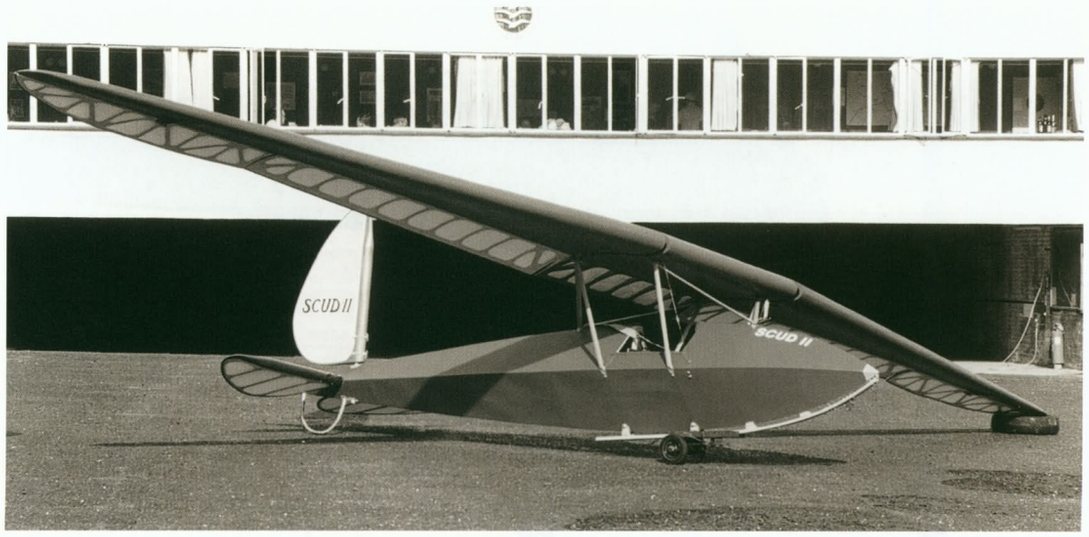
The Airspeed Company, founded in England in 1930 by Hessell Tiltman and Neville Shute Norway (later famous as a novelist) urgently needed a product to sell. The sudden interest in soaring stimulated by developments in Germany, suggested that an inexpensive sailplane would find a ready market. Tiltman was an aeroplane designer who turned briefly to gliders. The Airspeed Tern, first flown in 1931, had a fabric covered, two spar, tapered cantilever wing without dihedral. The plywood leading edge was only a fairing,



Airspeed Tern
1931

playing no structural role. The fuselage was a three sided plywood box with the upper decking, like many contemporary aeroplanes, fabric covered. The cockpit was generous in both depth and width, which may have been comfortable but did not reduce drag to the minimum.

At the time there was nothing comparable available from any British manufacturer. The Tern had some success, but only one was completed by Airspeeds. Parts for the second were sold but it was never finished. The original Tern was reconstructed, using the prototype and parts from the second example, in post war years, but little was done with it.



Above: The Scud 2, light and compact, first marketed in 1932

Below: The author in the Scud 2 cockpit. A struggle to get in.

The Scuds

L. E. Jeffrey - Baynes was a talented engineer who had been involved with the aircraft industry since 1916. In designing the original Scud his approach was quite radical. It should be possible to produce a cheap sailplane which, if not capable of the highest possible performances, would at least give the pilot a lot of pleasure in safety. The 7.7 metre span Scud was advertised in 1931 and buyers were found for about five. Plans were sold to amateur builders. The fuselage, of diamond shaped cross section, was suspended below the small, one piece wing on struts. For the pilot to get into the cockpit was a considerable struggle. The wing was of low aspect ratio and approximately rectangular in plan, but the tips were tapered to reduce vortex drag a little. The plywood skin was required to carry a full share of the torsional loads. The all - moving tail members were interchangeable, the rudder could be used for one of the elevators and vice versa.

In flight the Scud proved very sensitive and required a delicate touch. Edward Mole, an RAF officer and pilot, succeeded in soaring a Scud for an hour and was happy to be quoted in advertisements. Inexperienced pilots tended to over control and there were accidents. In Australia a Scud was burned after a very few trial flights, when the owner-builder decided it was too dangerous for anyone to fly.

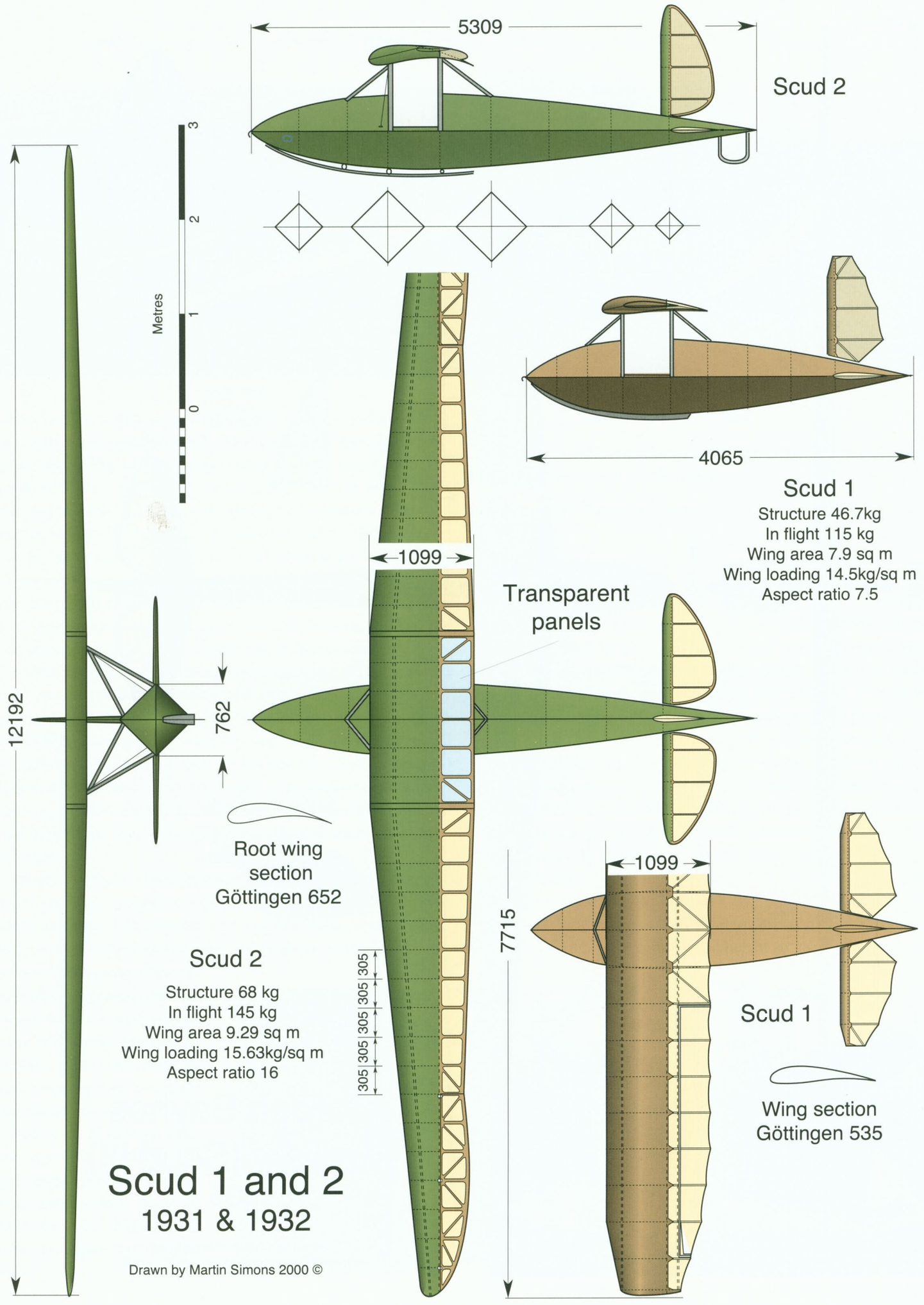
Baynes designed the Scud 2, which proved very much more successful. The fuselage was slightly lengthened without increasing the cross sectional area. The wing was extended to over 12 metres span with the currently popular Gö 652 profile and aspect ratio of 16. There was a rectangular centre section with the outer panels easily detachable for transport. The structure weight was only 30 kg more than the first Scud. Getting into the cockpit was no easier but transparent panels in the rear wing covering gave a slight improvement to the upward view.

Four of the Scud 2 were completed and sold. One had a lengthened nose to accommodate the tall pilot, Philip Wills. Mungo Buxton, an RAF officer, broke the British height record in this aircraft with a climb in cloud to 2537 metres.

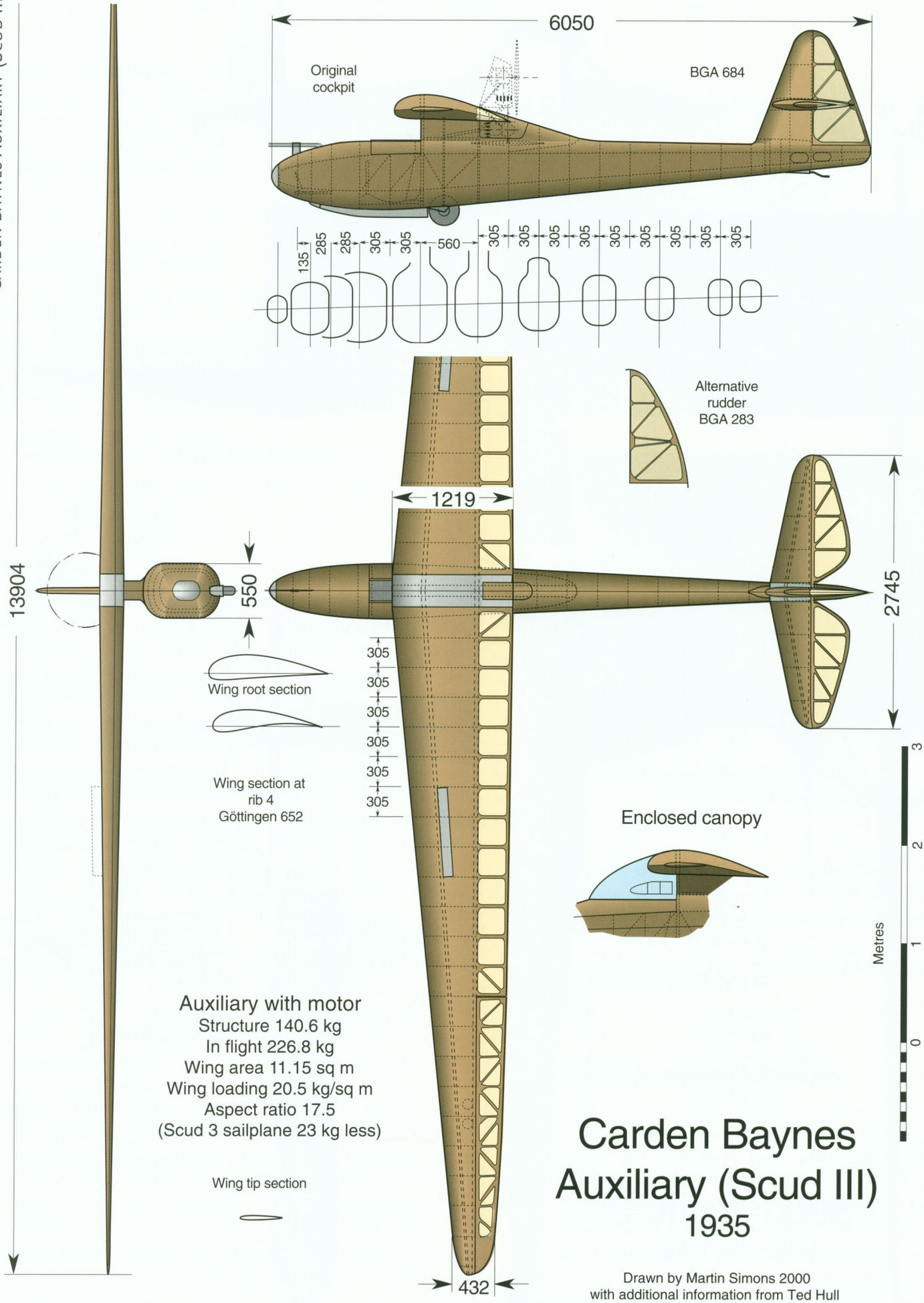
One Scud 2 survived to fly after World War 2 and this aircraft, fully restored, is still extant and airworthy.

Carden Baynes Auxiliary, Scud 3

Baynes foresaw that eventually sailplanes would be fitted with motors, equivalent to the outboard motors of yachts, to get them into the air without helpers, and to fly home after a cross country soaring flight. With the offer of financial support and an order from Sir John Carden he designed the Scud 3 or Carden Baynes Auxiliary. The tapered wing was similar to the Scud 2 but of slightly more span. The root section was simplified but changed rapidly to the Gö 652 profile, then to a symmetrical tip. The fuselage frames were rectangular with rounded corners, a good compromise between sim-



Scud 1 and 2
1931 & 1932



Carden Baynes Auxiliary (Scud III)
1935

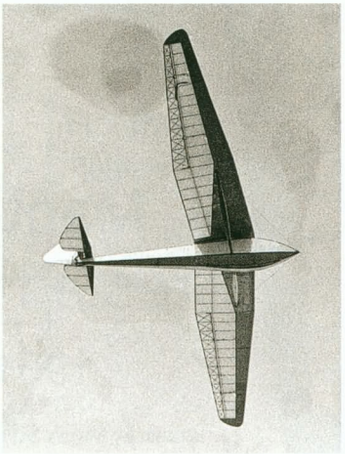
Drawn by Martin Simons 2000
with additional information from Ted Hull

plicity and the a fully rounded form. The wing was mounted high on a streamlined pylon behind the cockpit. In a special compartment behind the main fuselage frame was the power unit. The small, 9 PS 250 cc engine, with its propeller, could be raised above the wing to allow the sailplane to take off under power and climb to soaring height. Then it was fully retracted. Fuel for about 30 minutes was allowed. To make operations as simple as possible, a throttle operating cable was run through the wing to a handle at the tip. The pilot, having started the motor by swinging the propeller, could then walk to the wing tip, control the throttle and taxi the aircraft to any suitable point, get into the cockpit and take off.

It all worked quite well. The Auxiliary could and did launch itself from suitably smooth airfields, and climbed away without any problems, though slowly. To operate from rough surfaces was not so easy. The motor was, after some few trials and an accident caused by turbulent air soon after take off, deemed too small for practical operations. Carden himself was killed in an airliner accident and never took delivery of his Auxiliary. Baynes removed the motor and sold the repaired Scud 3 as a sailplane. One more was built, without an engine.

Baynes was ahead of his time but, like many others, he over estimated the likely demand for sailplanes in Britain in the 'thirties. Had there been a better market, with a slightly more powerful motor and a few related minor changes, the Auxiliary might have been a highly successful self launching sailplane. The original motor was for many years exhibited in the Science Museum in London, as the smallest power unit ever to get an aeroplane into the air and sustain flight.

Both Scud 3s survive. They are operated regularly, as sailplanes, and are popular with their pilots. Built in 1934, they are probably the oldest sailplanes still in operation.



Above: The Scud 3. Both survive and are still flying.

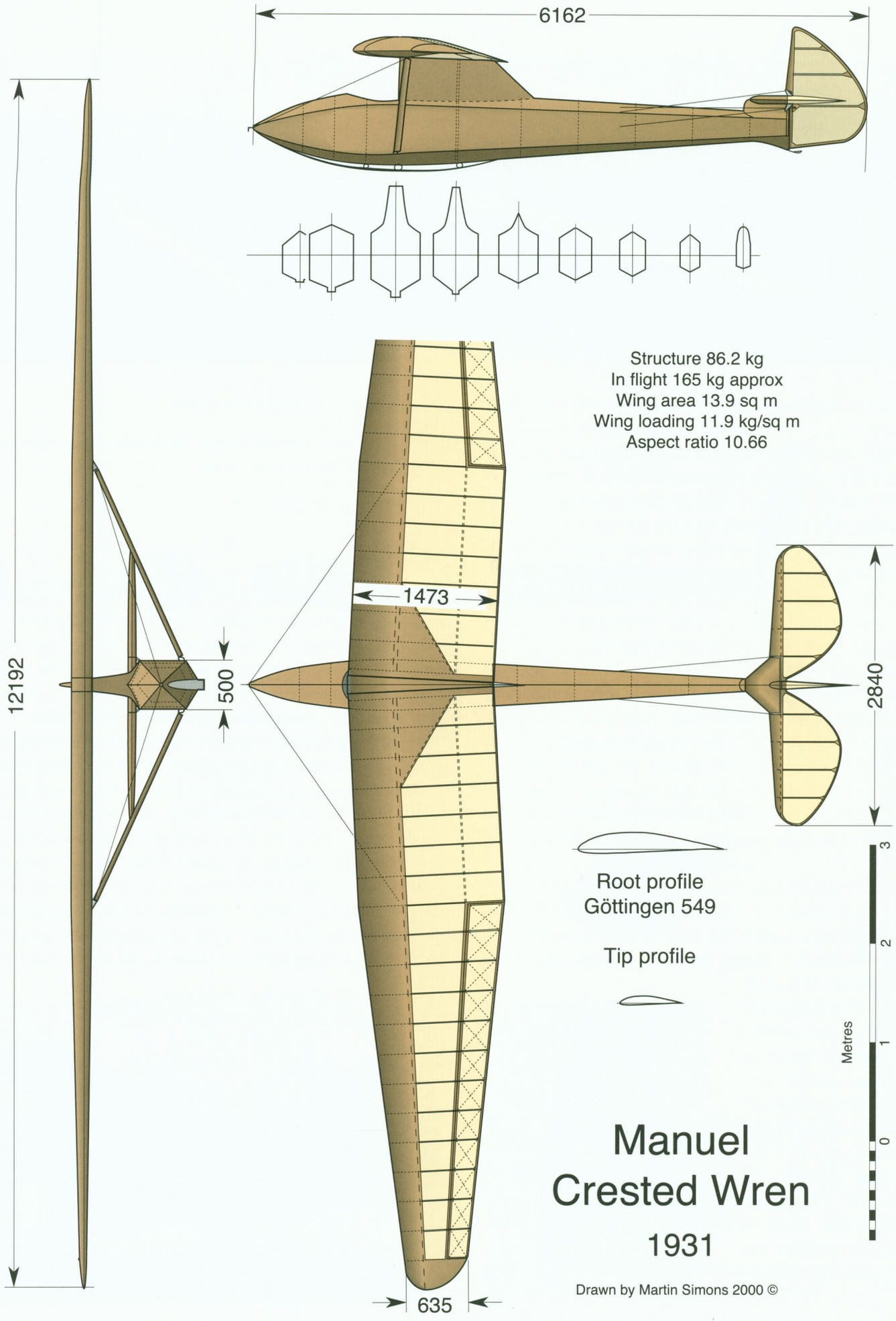
Left below: The Willow Wren, flown in 1932 in England and built from plans by amateurs in Britain, Australia and New Zealand.

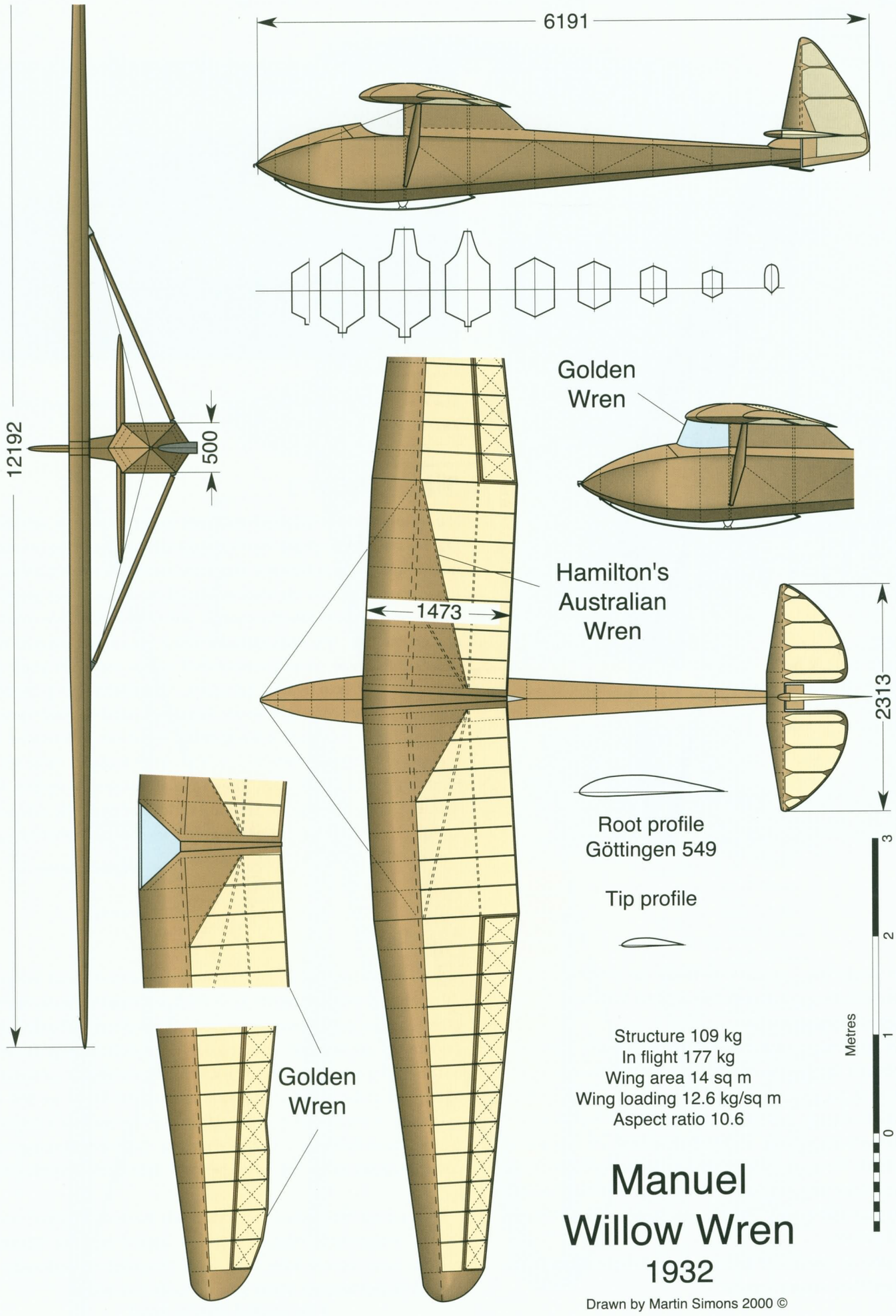
Right below: The Willow Wren, restored.

The Wrens

Bill Manuel was a corporal in the RAF in 1930 when he became fascinated by soaring and decided to design and build his own small sailplane. With limited tools, money and workshop space, he produced the Crested Wren, 12.2 metres span. It was of the simplest possible design and construction and easy to build, yet flew well. Manuel was encouraged to develop it further and sell plans.

He did so, producing in 1932 the Willow Wren which had a deeper fuselage and improved tail surfaces, additional stiffening in the fuselage and wing, and other minor changes. The Blue Wren, completed 1934, had some further redesign of the wing to prevent wing tip stalling at low speeds. Meanwhile, plans had been sold to amateur groups. In England the Golden Wren was built with an enclosed cockpit, and others were built in Australia and New Zealand. At least seven of the Willow Wren type were flown altogether. All flew successfully. The Golden Wren in particular showed itself capable of 'Silver C' cross country and height gain flights, and survived

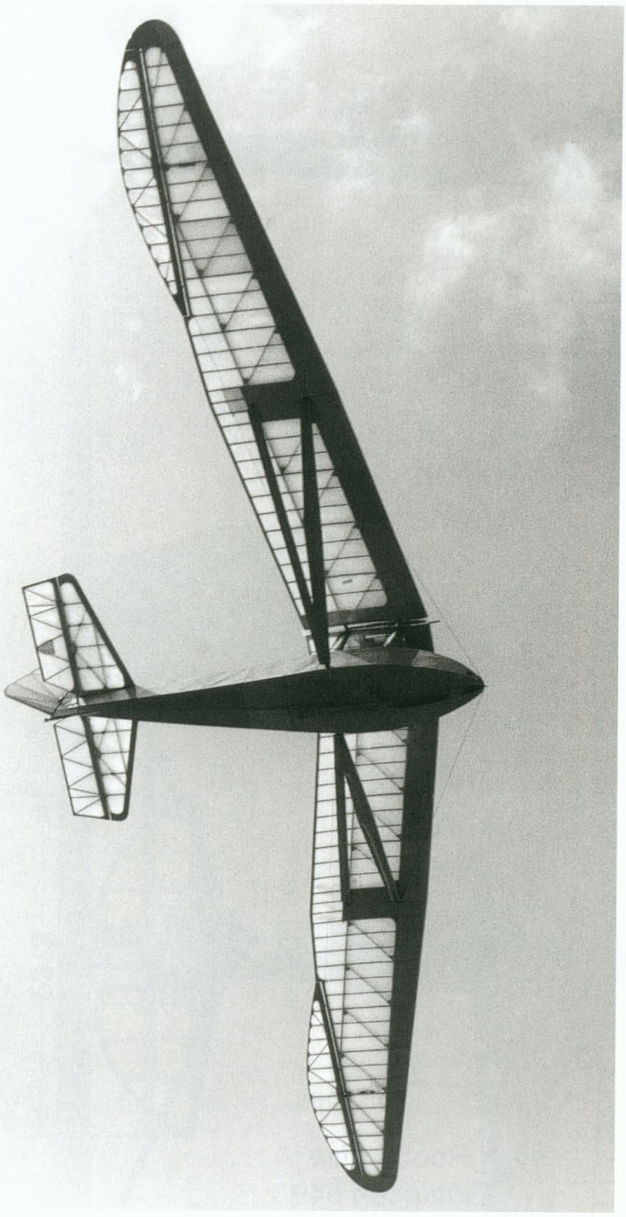

6162
12192
500
1473
2840
635
Structure 86.2 kg
In flight 165 kg approx
Wing area 13.9 sq m
Wing loading 11.9 kg/sq m
Aspect ratio 10.66
Root profile
Göttingen 549
Tip profile
Metres
0
1
2
3
Manuel
Crested Wren
1931
Drawn by Martin Simons 2000 ©



Structure 109 kg
In flight 177 kg
Wing area 14 sq m
Wing loading 12.6 kg/sq m
Aspect ratio 10.6

Manuel Willow Wren
1932

Drawn by Martin Simons 2000 ©



The Falcon III.

into the post World War 2 period to be flown until 1947 when glue failure caused it to be condemned. The original Willow Wren still exists, though not now airworthy.

Manuel in association with the Dunstable Sailplane Company went on to design the Kestrel, which was a Willow Wren with improvements such as a larger cockpit and generally more robust structure. The Company completed only one, but plans were sold. Another was built in England, which crashed fatally in a spinning accident in 1939. Three others were constructed in Australia. These continued in service for some years and although no longer capable of flying, they are still extant. One also was built in the USA but its history is not known.

Manuel , after an interval of decades, in 1986 built a non-flying replica Crested Wren, from memory.

Murray and Fox at the Wasserkuppe in 1937, with the Falcon III, when they broke the duration record.

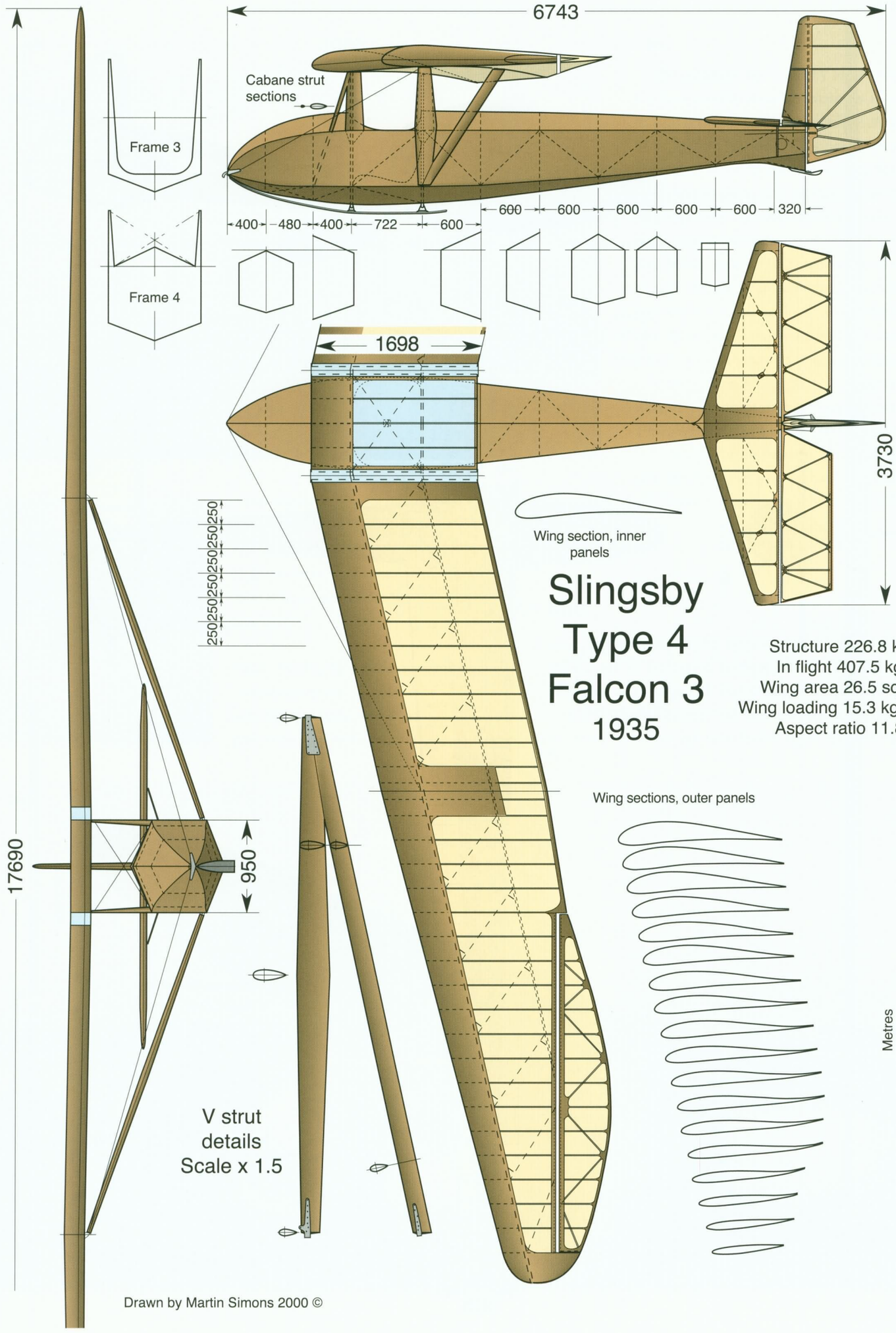
Slingsby Falcon 3

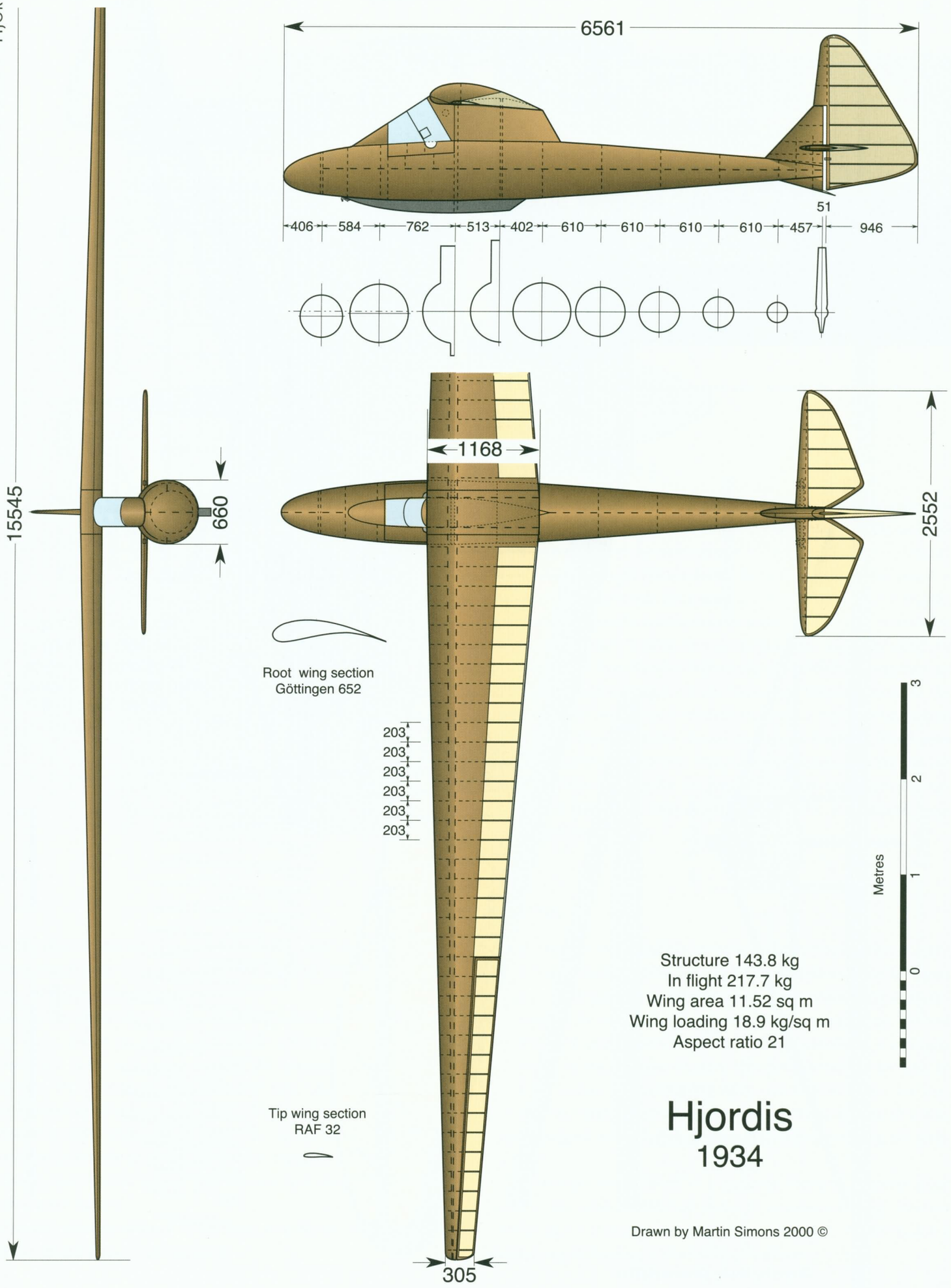
Hardly any two seat sailplanes had been built with side by side seating. For training purposes there are some advantages in the arrangement. Conversation between instructor and pupil is more natural, the instructor can see the student's facial expressions, can point to things outside or inside the cockpit, and both pilots have an adequate view. The only drawbacks are some loss of performance because of the greater frontal area of the fuselage, and if the pupil, or any other pilot, is to fly solo, ballast must be added to bring the balance point to its correct location. Slingsby's Falcon 3, built to the order of Espin Hardwick, a stockbroker, was a two seat version of the original Lippisch Falke. It was popular in England. Nine were built and flown extensively. They were all taken over by the Air Training Corps during the Second World War and only one survived to fly afterwards. This was wrecked in 1947 in a ground looping accident on landing.

Hjordis

Mungo Buxton was a RAF officer who designed the Hjordis as a private venture, with his friend Philip Wills interested from the beginning as a likely partner and buyer. Buxton was aware of German developments but was not content to copy any existing type. He laid out the wing using the very thick, strongly cambered Göttingen 652 profile at the root, but changed this progressively to the RAF 32 at the tip, in such a way that the wing could be built on a flat surface without elaborate and costly jigging. Plywood skinning was continued back to the light rear spar, with fabric covering the trailing edge.

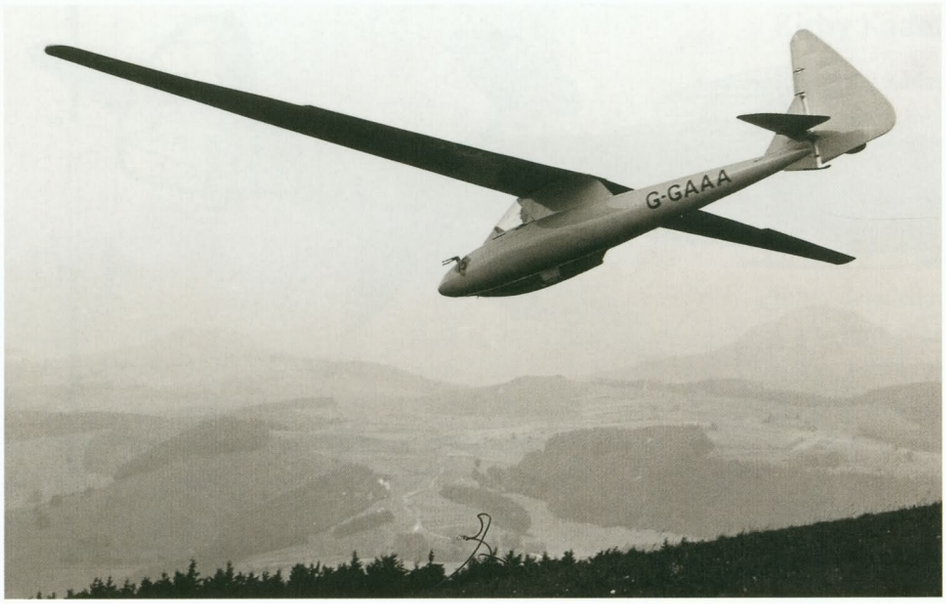
The fuselage was reduced to a cigar like form of minimal cross section, with a tall and narrow pylon to support the wing. The two vertical main frames were very stout, intended to withstand a ground looped landing. There were no spoilers or brakes.


6743
Cabane strut sections
Frame 3
Frame 4
400
480
400
722
600
600
600
600
600
600
320
1698
3730
250
250
250
250
250
250
250
Wing section, inner panels
Slingsby Type 4 Falcon 3
1935
Structure 226.8 kg
In flight 407.5 kg
Wing area 26.5 sq m
Wing loading 15.3 kg/sq m
Aspect ratio 11.8
17690
950
V strut details Scale x 1.5
Wing sections, outer panels
Metres
0
1
2
3
Drawn by Martin Simons 2000 ©



Structure 143.8 kg
In flight 217.7 kg
Wing area 11.52 sq m
Wing loading 18.9 kg/sq m
Aspect ratio 21

Hjordis
1934



The sailplane was built by Fred Slingsby who was just establishing his business as a sailplane manufacturer. It was flown by Wills at the 1935 British National Competitions and Wills later used it to set British records for distance and height gain, and competed with success again in 1936. The aircraft had many small defects. It was most uncomfortable for a tall pilot. Wills had to cut holes in the cockpit canopy for his shoulders, and the ventilation was very poor. The lack of spoilers ensured that there were many mishaps on landing in small fields. Repairs were often needed.

Nevertheless when the first recognised International Championships were announced in 1937, Wills elected to fly the Hjordis in preference to the King Kite, also designed by Buxton. (For his reasons, see below.) He placed about half way down the field, learned a great deal and sold the Hjordis in 1938 to buy a Minimoa.

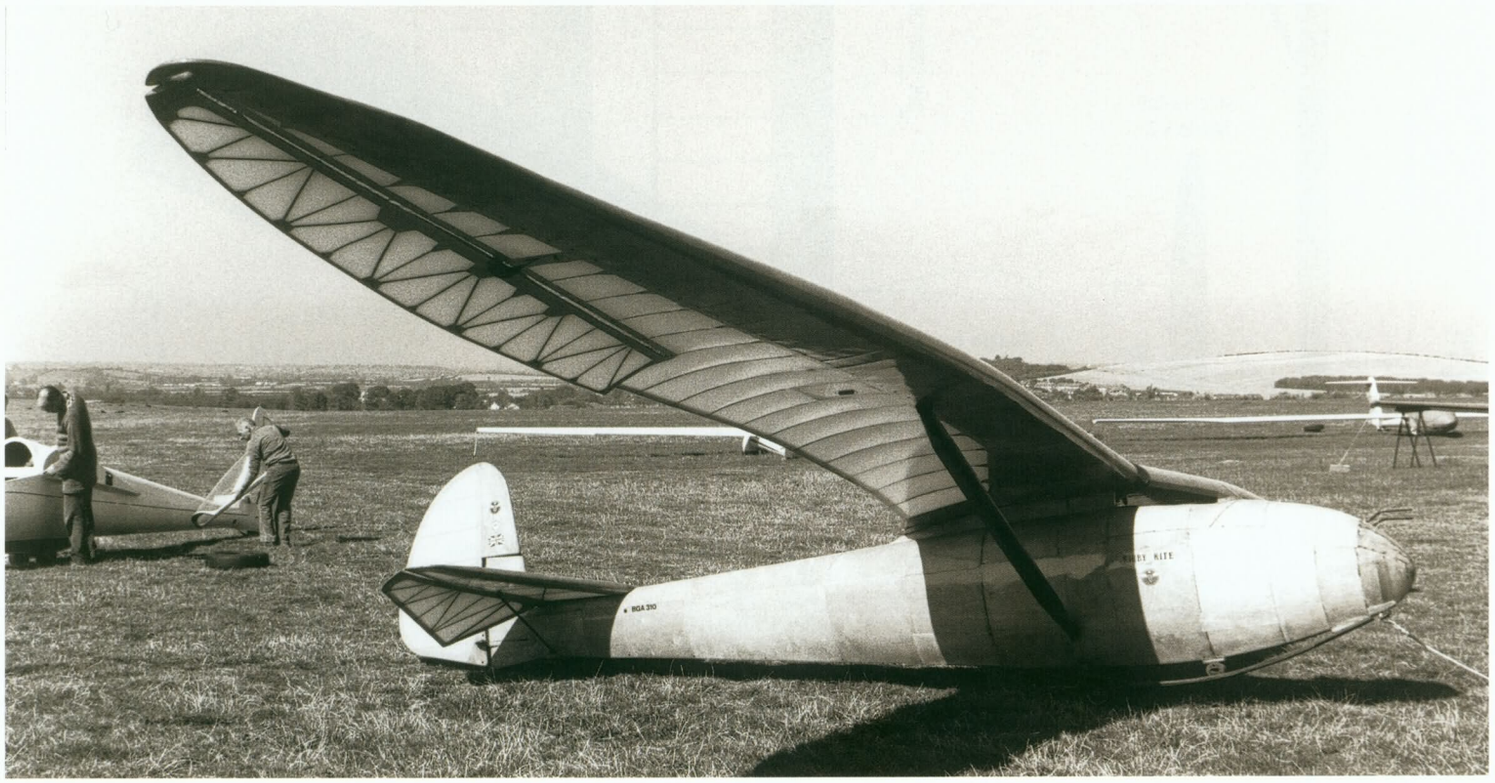
Above: Hjordis launched at the Wasserkuppe Internationals in 1937.

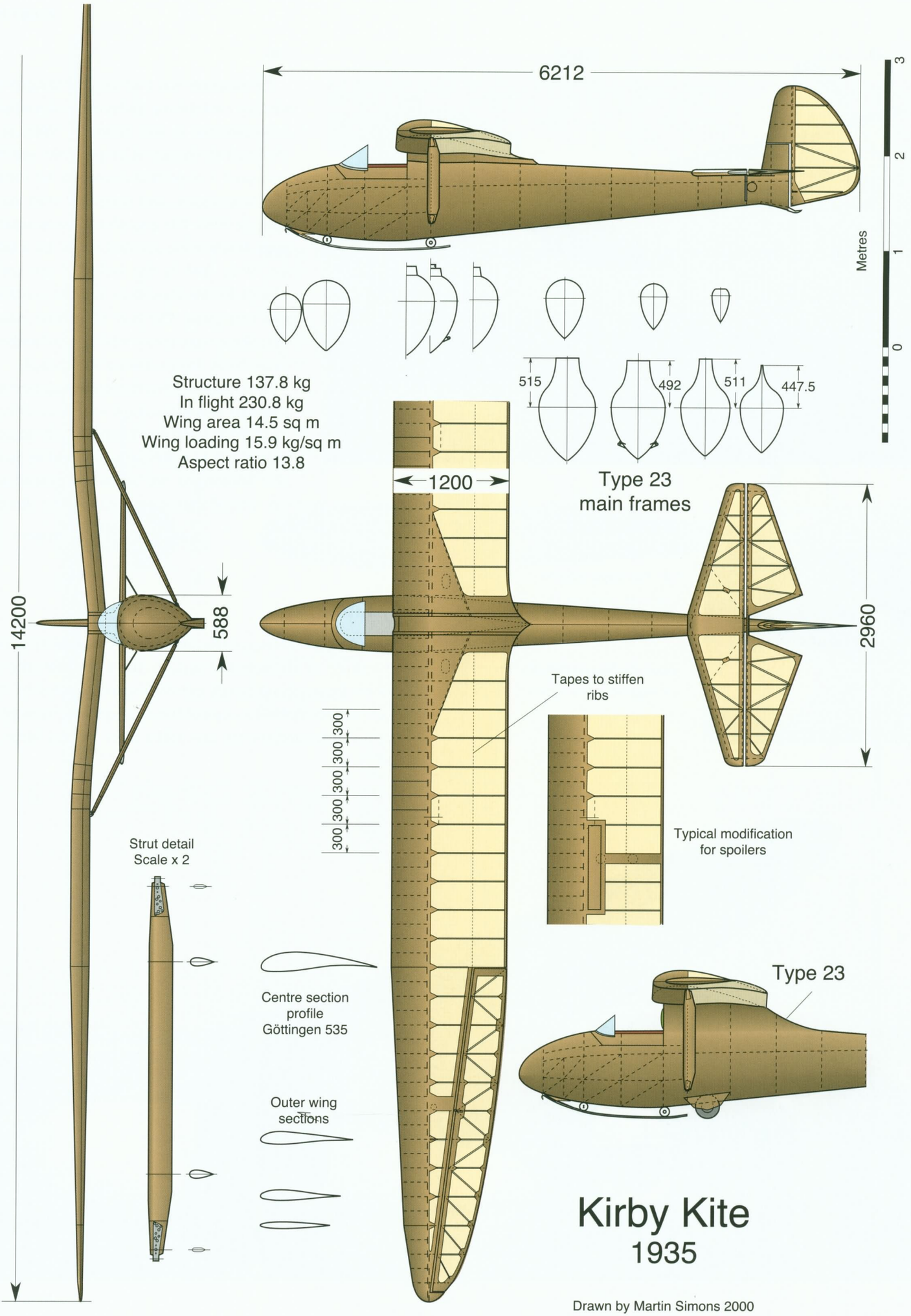
Left: The cockpit of the Hjordis required holes to be cut for the Philip Wills' shoulders.

Below: The Slingsby Kirby Kite was not much more than a Grunau Baby 2 wing slightly extended, with a 'gull' form and a more streamlined fuselage.

Kirby Kite

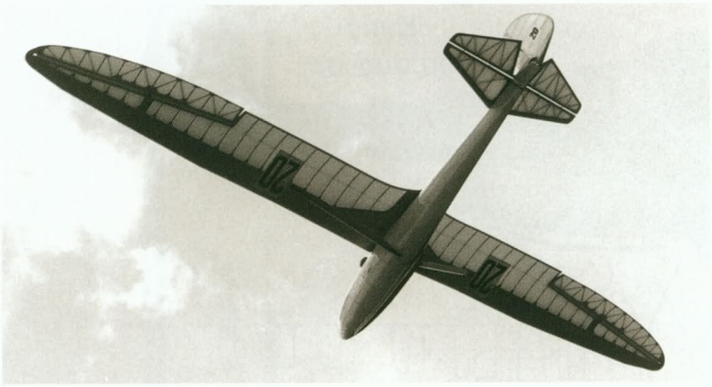
Fred Slingsby built fifteen of the Grunau Baby 2 under licence but in 1935 produced an improved version, the Kirby Kite. The wing was almost the same as the GB, but with span extended by 70 cm and 'gull' dihedral. The hexagonal box fuselage was replaced by a streamlined form and the tail unit had a more elegant shape. The





Kirby Kite
1935

Drawn by Martin Simons 2000



Kite became popular and twenty five were built, with one constructed from plans in the USA. It was used for cross country flying and competitions.

Four or five remain in service. A further development, Slingsby's Type 23 Kite 1A, appeared in 1945 but only one was built. The Type 26 Kite 2 of 1946 - 7 had a completely different wing and, in competition with the new EON Olympia sailplane, proved a disappointment.

Above: The Kite was popular with British pilots and competed in the National Championships in the late nineteen thirties.

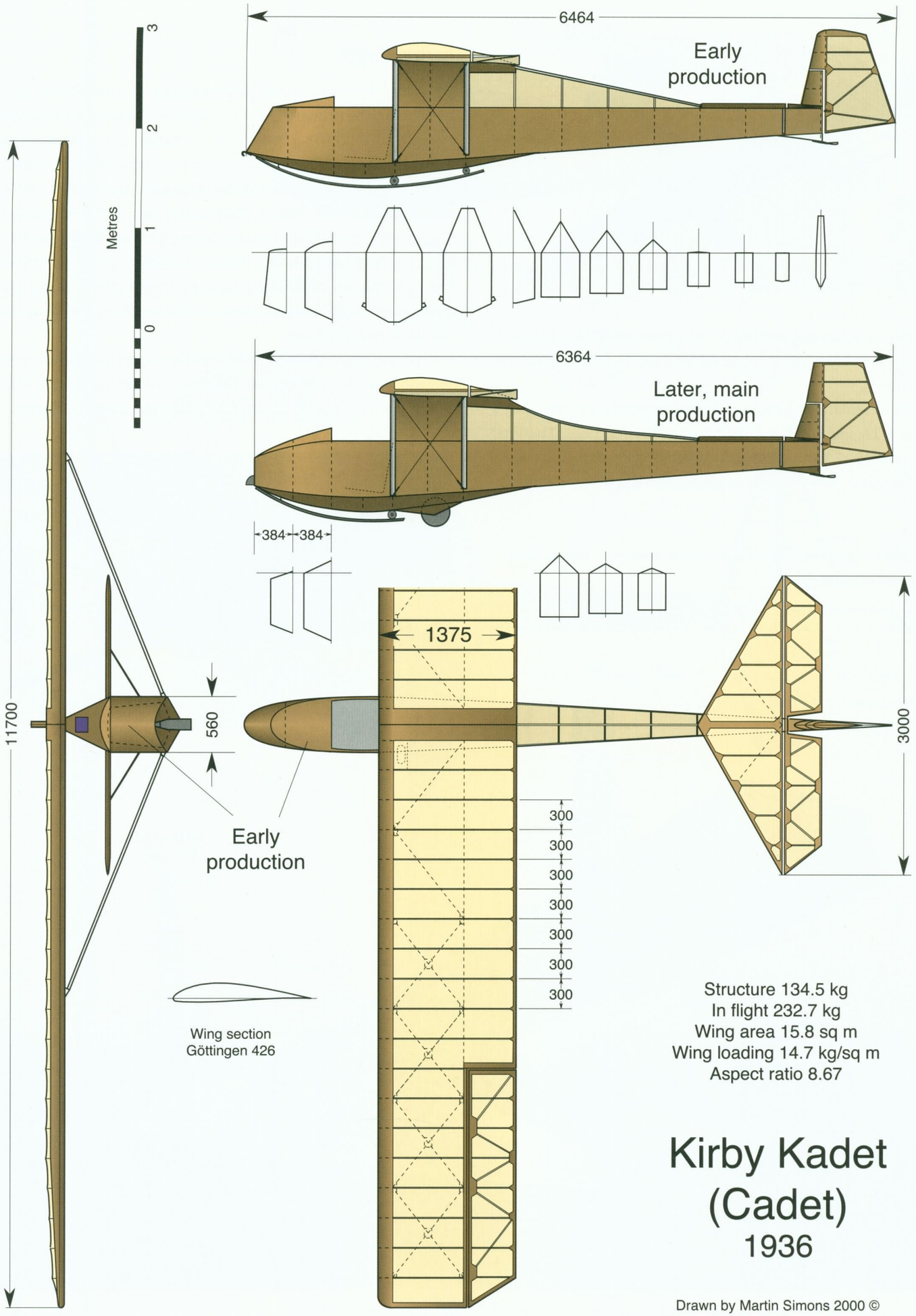
Right: The Kirby Tutor was a Kadet with extended wing to improve the performance.

Below: The Slingsby Kadet was mass produced in England as a trainer one step better than the Dagling primary. It owed more to the German Prüfling and Hols der Teufel than to the Grunau Baby.

Kirby Kadet

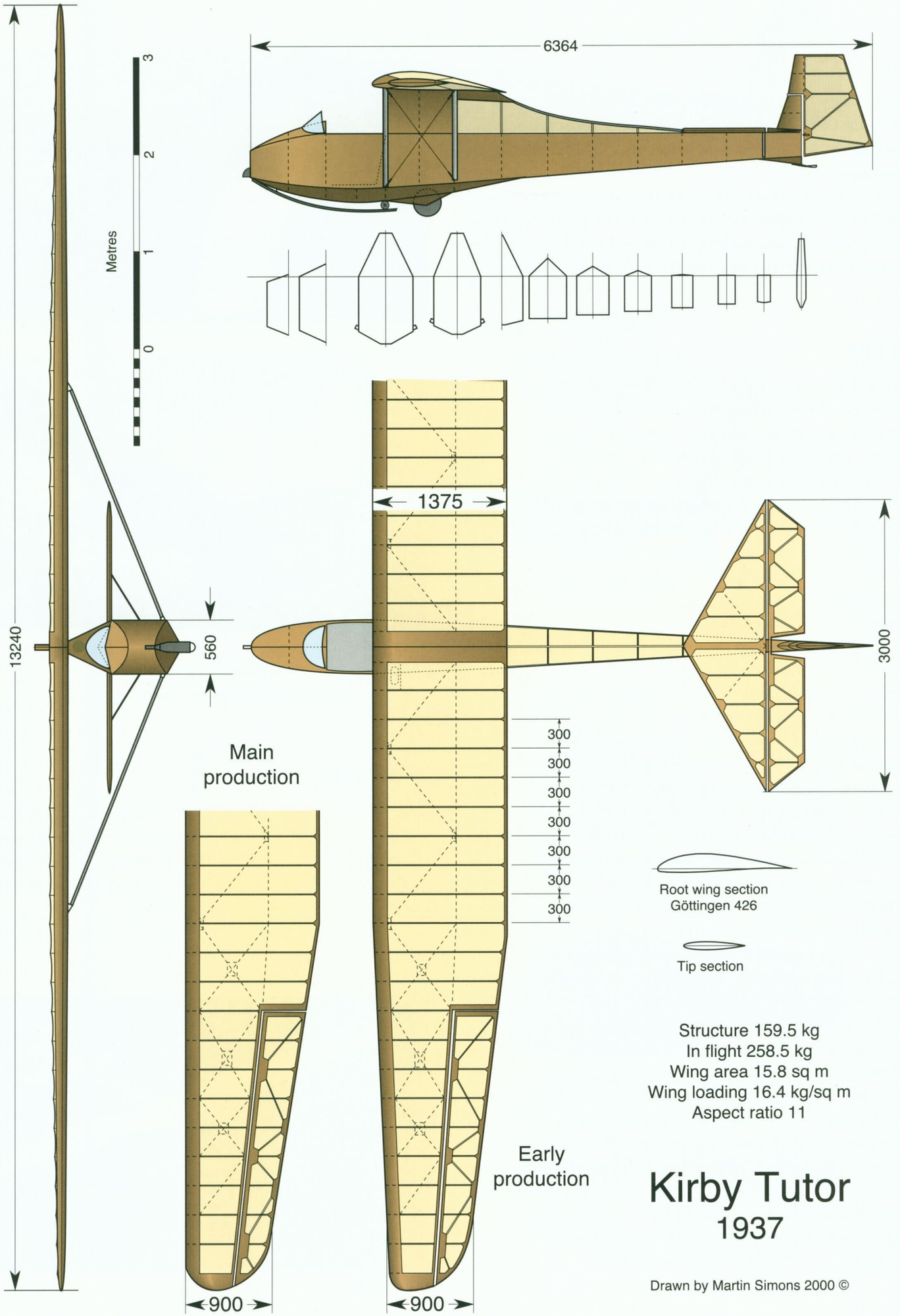
The Kirby Kadet was produced by Slingsby as a trainer just one step better than the primary Dagling, capable of soaring well enough for inexperienced pilots to gain their 'C' badges. John Stanley Sproule was the designer. The Kadet came up to expectations. A few were sold to English clubs and a kit was exported to Australia, before the outbreak of World War 2. During the war it was adopted, with many detailed modifications and strengthening, by the Air Training Corps and, renamed Cadet, used as a primary glider for solo training up to circuit and landing standard. One was built in the USA for Army evaluation. Over 430 were built altogether, the most numerous of all British gliders.

The Australian example still survives complete and is certainly the oldest Kadet in existence. Like the very earliest model, it has no wheel and is of lighter construction than the later ATC Cadets.



Structure 134.5 kg
In flight 232.7 kg
Wing area 15.8 sq m
Wing loading 14.7 kg/sq m
Aspect ratio 8.67

Kirby Kadet (Cadet)
1936

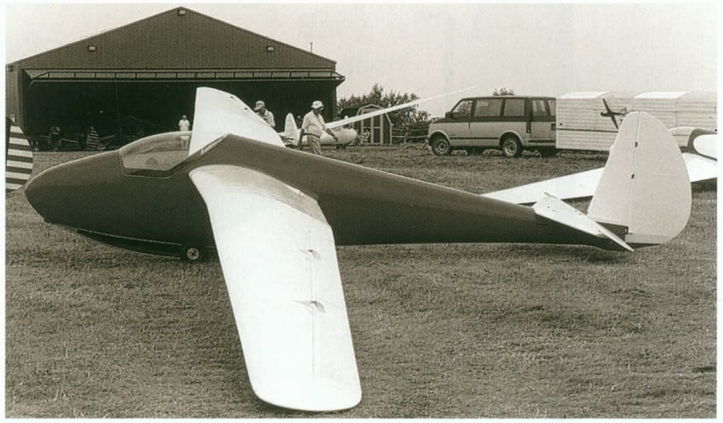


Structure 159.5 kg
In flight 258.5 kg
Wing area 15.8 sq m
Wing loading 16.4 kg/sq m
Aspect ratio 11

Kirby Tutor
1937

Tutor

To improve the soaring performance, new, extended wings were designed for the Cadet, interchangeable with the original wings. The result was called the Kirby Tutor or, in the ATC, Cadet Mark 3. Many Cadets were converted to Tutors. In post war years the type was often used as an early solo aircraft after preliminary training in a two seater. Although the performance was not as good as a Grunau Baby, the Tutor was capable of good soaring flights and one of the few survivors has been used for extended cross country flying in recent years.



King Kite

The King Kite was a very promising design which went badly wrong. Mungo Buxton foresaw the need for pilots to select only the stronger thermals for circling, with high speed flying to penetrate sinking air. The strongly cambered wing profiles of previous times should be replaced by modern sections. In particular the new five digit series from the NACA seemed to offer many advantages. A modern sailplane should have flaps, to enable it to vary the section for slow and fast flight. Gyro instruments for cloud flying were necessary and, to achieve flights to nominated goals, navigational calculations would have to be done.

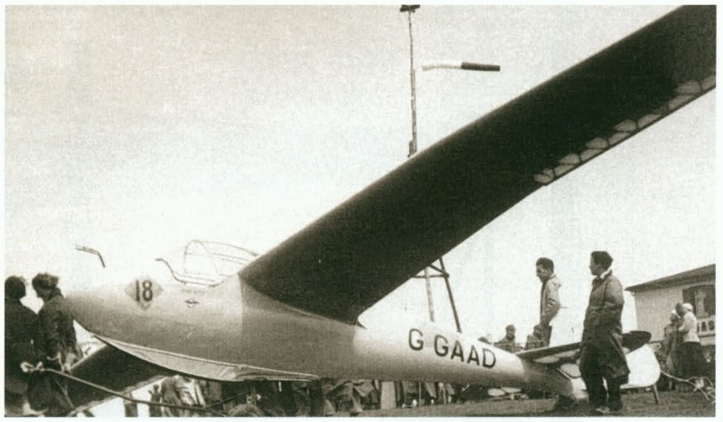
Buxton announced that he was working on a new design, initially called Hjordis 2, at about the same time as the British Gliding Association decided to send a team to the 1937 International Championships on the Wasserkuppe. The Hjordis 2, re-named King Kite, was the only British sailplane that looked capable of competing on roughly equal terms with the German and Polish types but it did not yet exist. Even on paper the details had not all been worked out.

The design was hastened and Slingsby was commissioned to build three. The prototype was flown in April 1937 by Philip Wills, who was highly impressed at first but was nearly killed when the King Kite refused to recover from a test spin. He tried to bail out but was repeatedly forced back into the cockpit by centrifugal forces. Fortunately his last violent effort to jump brought the King Kite out of the spin and he was able to land safely, though badly shaken.

For the competition he preferred the Hjordis but the three completed King Kites were taken to Germany, with hugely increased rudder areas, and flown there. One span in immediately after a bungee launch, with no injury to the pilot. The other two survived.

It was discovered years later, by Slingsby himself, that a serious and almost unbelievable error when setting up the jigs in the workshops, had resulted in the King Kites having washout built the wrong way round, as 'wash in', thus encouraging wing tip stalling and creating a very dangerous situation for any pilot trying to fly the aircraft.

The two King Kites were returned to England and used for some time, one in 1946 finally failing in flight because of glue deterioration, the other being condemned in 1950. A modern replica, with a redesigned wing, was built by David Jones and flown with perfect safety in 1988.

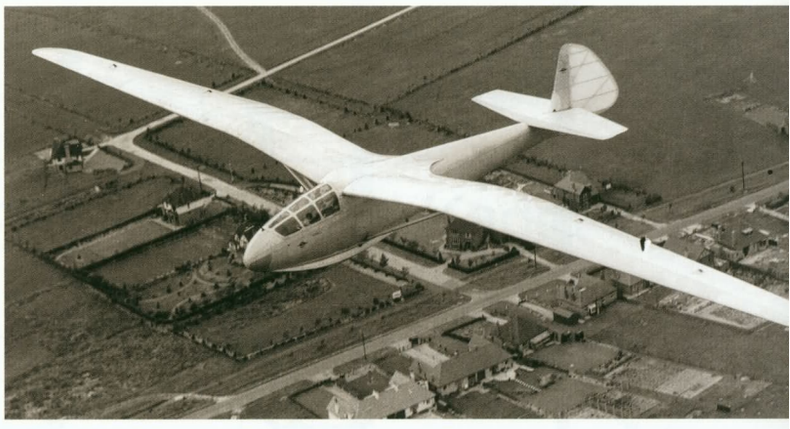


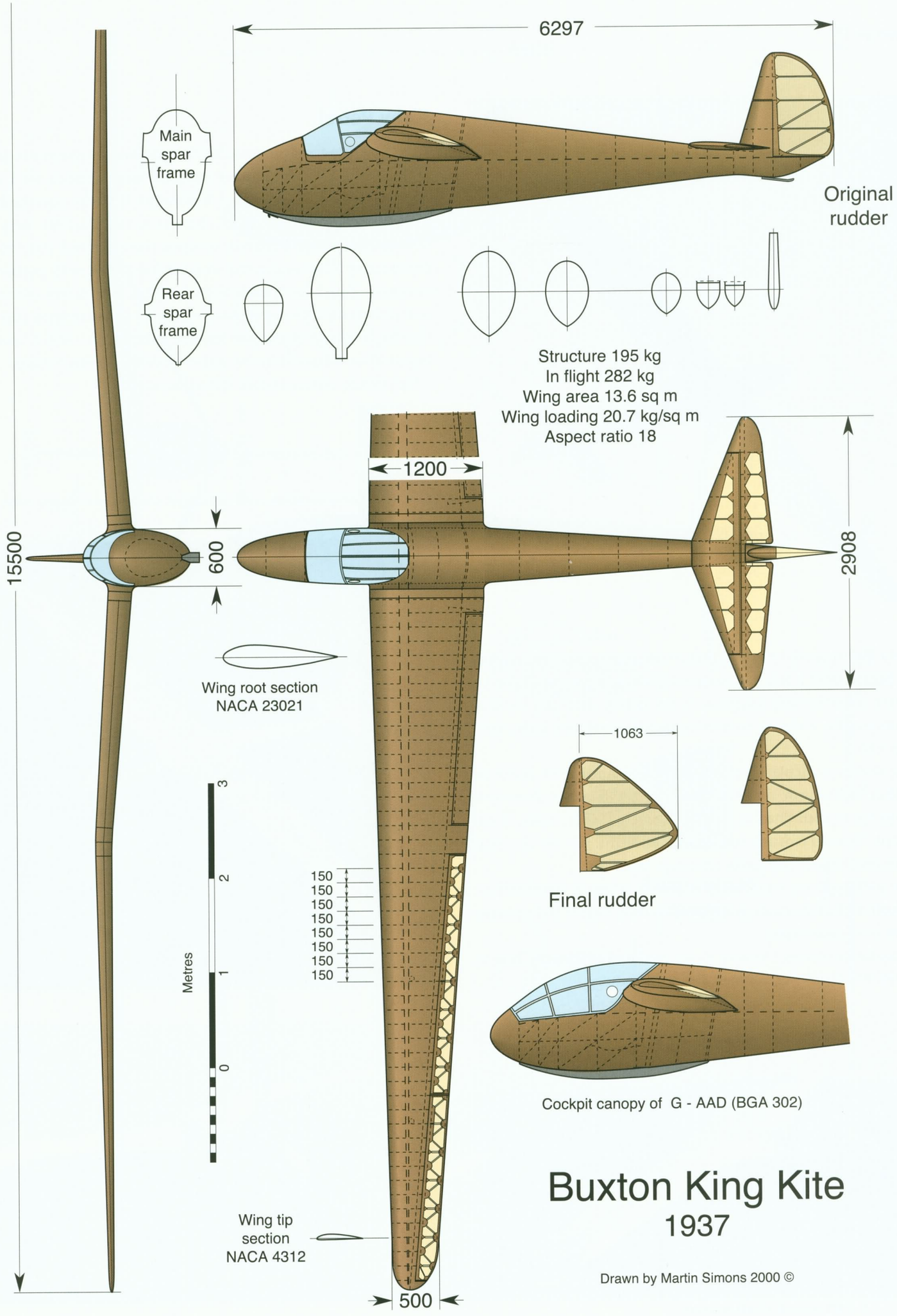
Above: The new King Kite, built with a modern wing profile.
Below: The King Kite, ambitious but spoiled by errors in building.

Kirby Gull

The Gull was Slingsby's development of his earlier, successful Kite. He used more modern wing profiles and extended the span, but retained the strut braced wing. He had visited the Wasserkuppe in 1937 and there saw the Reiher. The cockpit canopy impressed him and he adopted a similar design for the Gull.

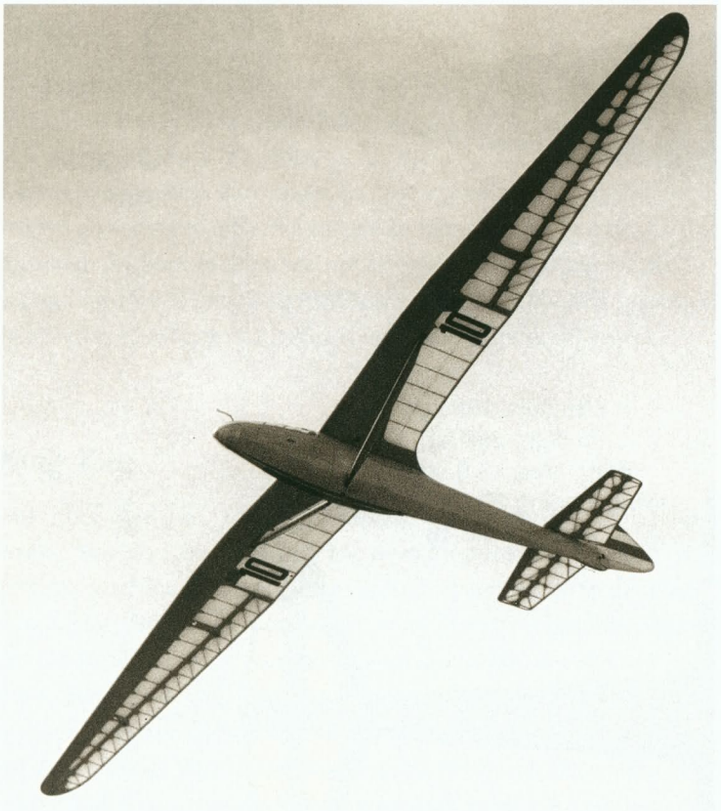
The Kirby Gull by Slingsby, at Dunstable.





Buxton King Kite
1937

Drawn by Martin Simons 2000 ©



Kirby Petrel

The Kirby Petrel was produced by Slingsby in response to a request, by the English Speedway rider and pilot Frank Charles, for a 'gull winged' version of the German Rhönadler. Slingsby used the Rhönadler drawings with minimal changes to construct the wing, although the fuselage-wing root junction was improved. The canopy preferred by Charles was the wooden hood type with portholes. Two more Petrels were built and sold, with transparent canopies, one with a tailplane and elevator instead of the all moving surface. Charles, in the prototype, was killed at Camphill in a winch launching accident witnessed by the author in 1939. (See the Preface.)

Two Petrels survive and are still in service.

Left above: The Gull competed in the 1939 British Championships.

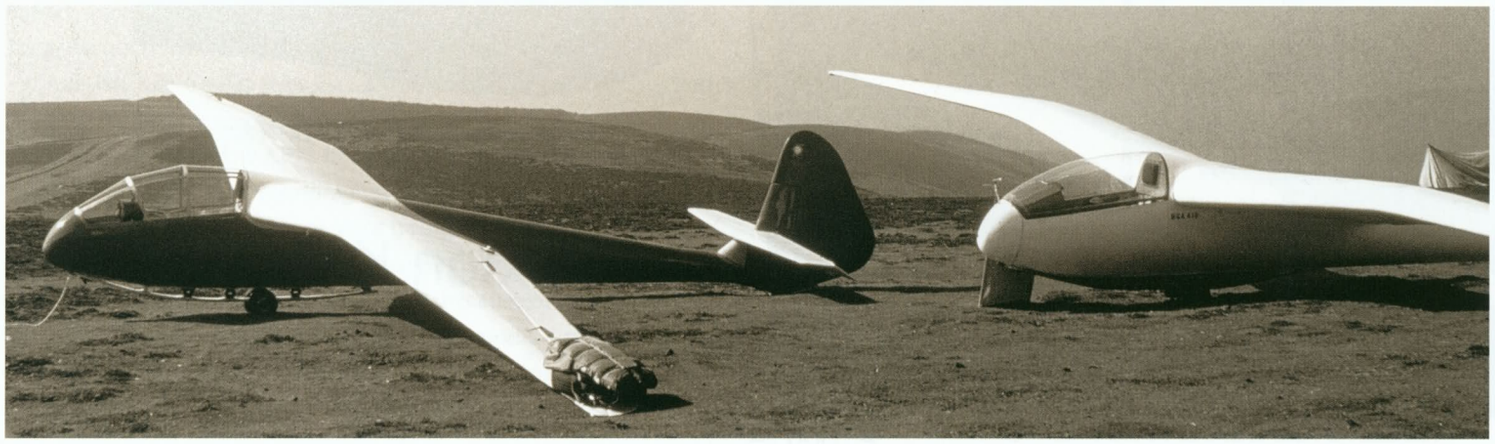
Below both: Known sometimes as the 'gull winged' Rhönadler, the Slingsby Petrel.

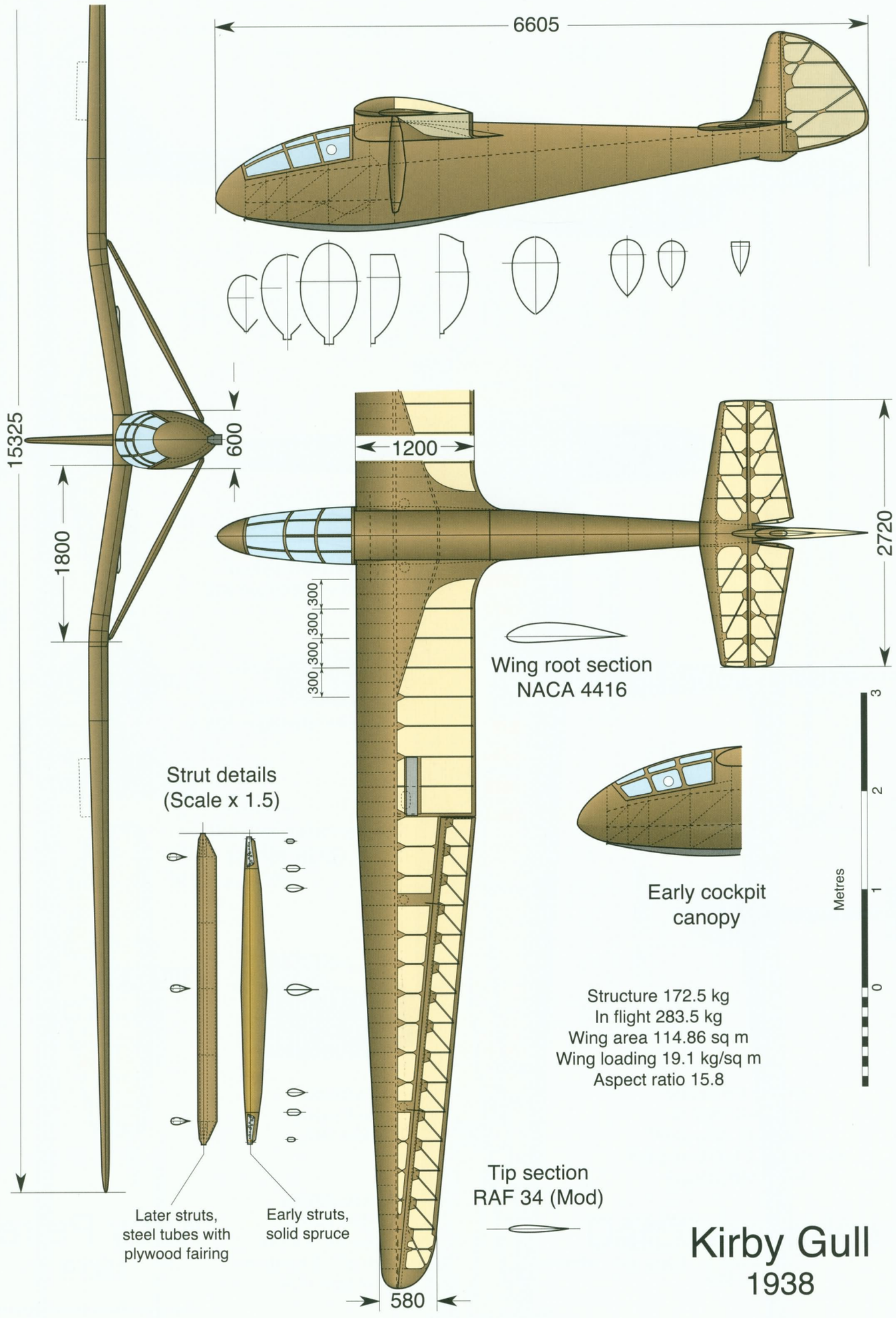
Early flights proved the Gull performed as expected, and production began. After a few had been sold, Slingsby increased the tip washout since the Gull was prone to tip stalling. After this the type became popular and nine were built, an additional one, from plans, in the USA.

The Gull is particularly famous because in April 1939, flown by Geoffrey Stephenson, one flew from a winch launch at Dunstable to cross the English Channel, landing near Le Wast in France. It was the first Channel crossing in true soaring flight. (Earlier crossings by Kronfeld were simple glides after high aero tows.)

The prototype was exported to Australia, where it was flown extensively and made many good cross country flights before being retired to museum status.

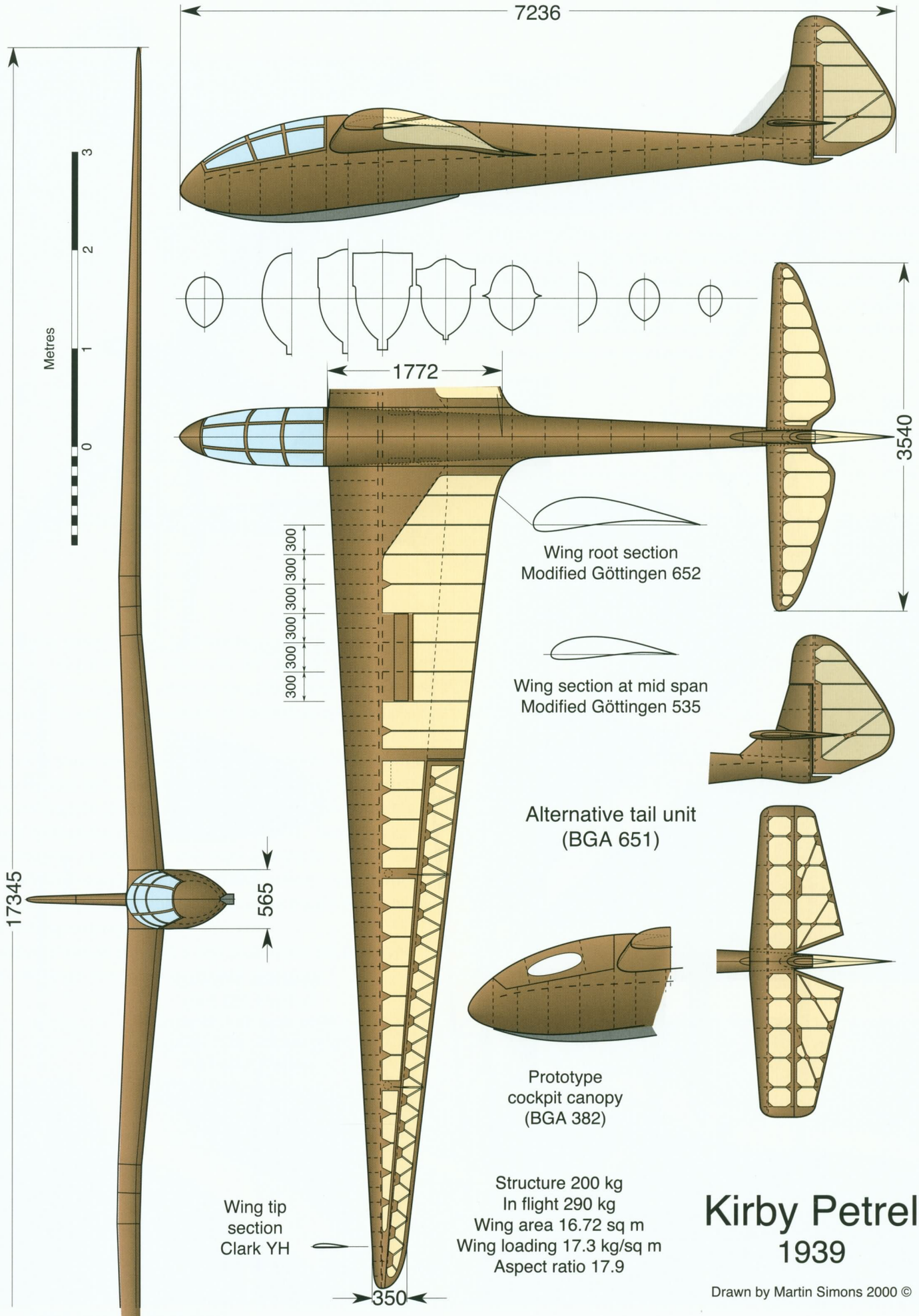
A cantilever version, the Gull 3, was produced as Slingsby Type 15 in 1940. It still survives, restored, in good condition.

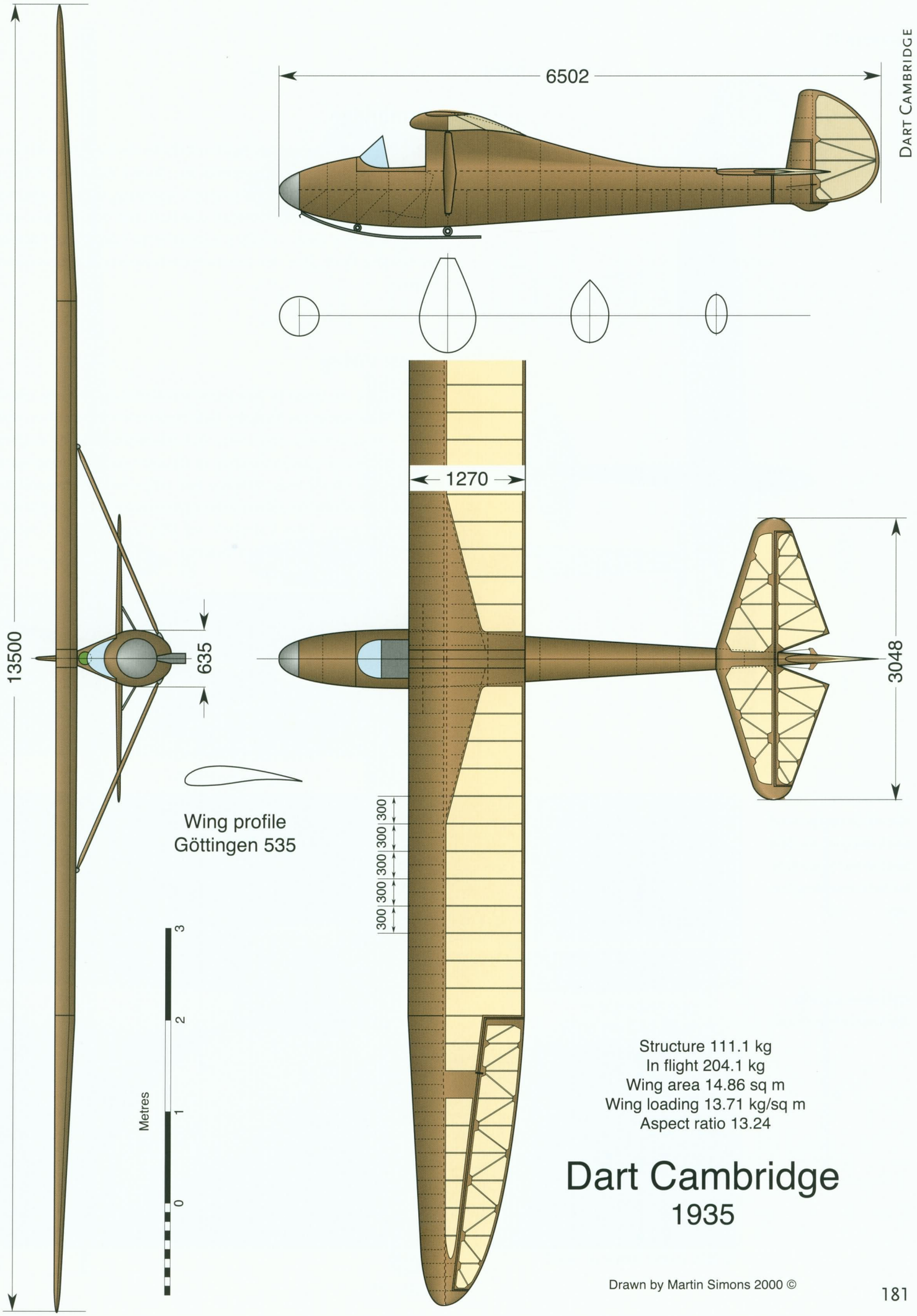




Structure 172.5 kg
In flight 283.5 kg
Wing area 114.86 sq m
Wing loading 19.1 kg/sq m
Aspect ratio 15.8

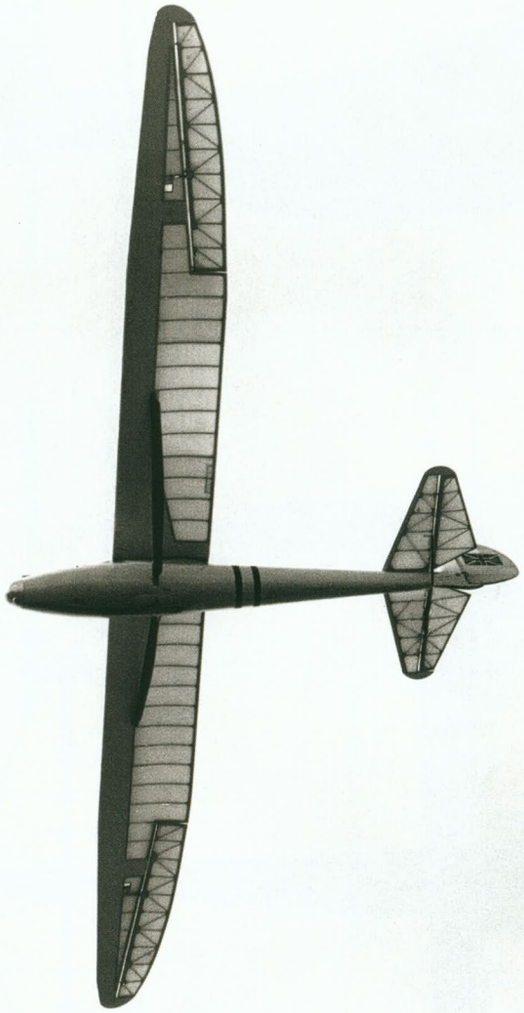
Kirby Gull
1938


7236
Metres
0
1
2
3
17345
565
1772
3540
300
300
300
300
300
300
Wing root section
Modified Göttingen 652
Wing section at mid span
Modified Göttingen 535
Alternative tail unit
(BGA 651)
Prototype
cockpit canopy
(BGA 382)
Wing tip
section
Clark YH
350
Structure 200 kg
In flight 290 kg
Wing area 16.72 sq m
Wing loading 17.3 kg/sq m
Aspect ratio 17.9
Kirby Petrel
1939
Drawn by Martin Simons 2000 ©



Structure 111.1 kg
In flight 204.1 kg
Wing area 14.86 sq m
Wing loading 13.71 kg/sq m
Aspect ratio 13.24

Dart Cambridge
1935



Cambridge

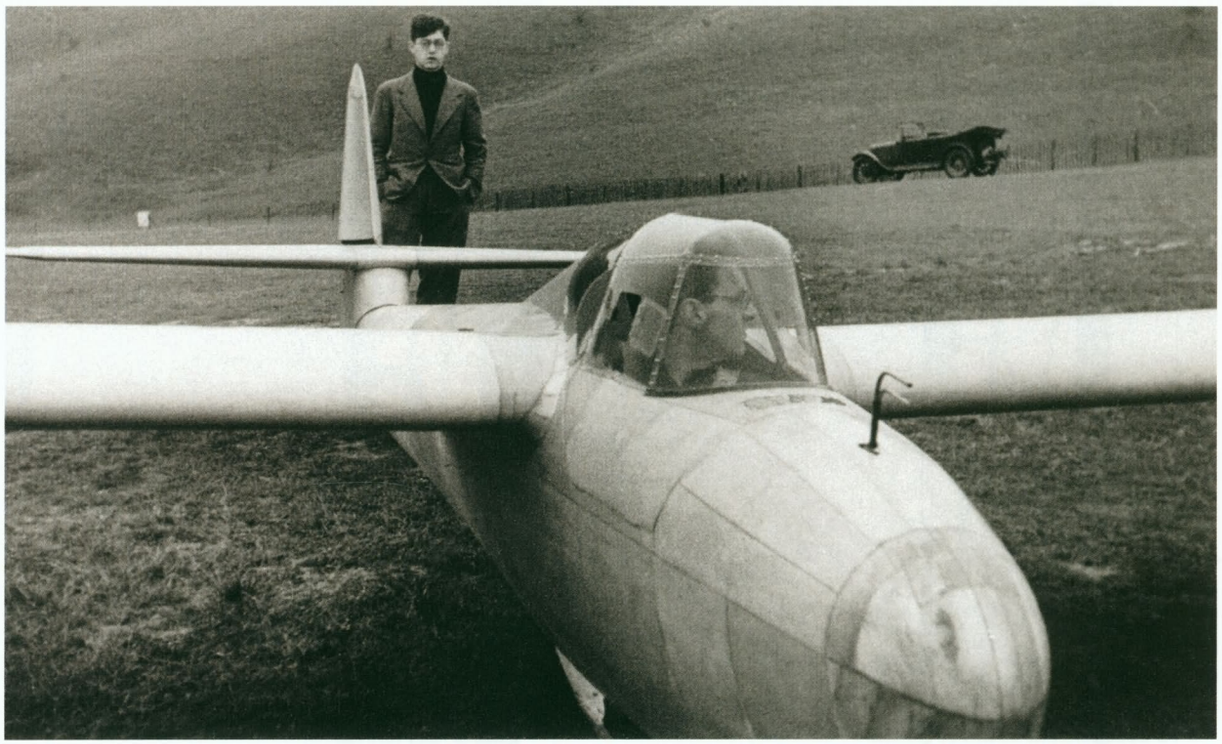
The idea of the Cambridge, built in 1935 by the Dart Aircraft Company of Dunstable was to improve the Grunau Baby by giving it a fully streamlined fuselage. Slingsby's intention with his Kite was the same. Two of the Cambridge were built and were popular with those who flew them, chiefly members of the Cambridge University Gliding Club. One, for some obscure reasons, was nicknamed 'Pons'.

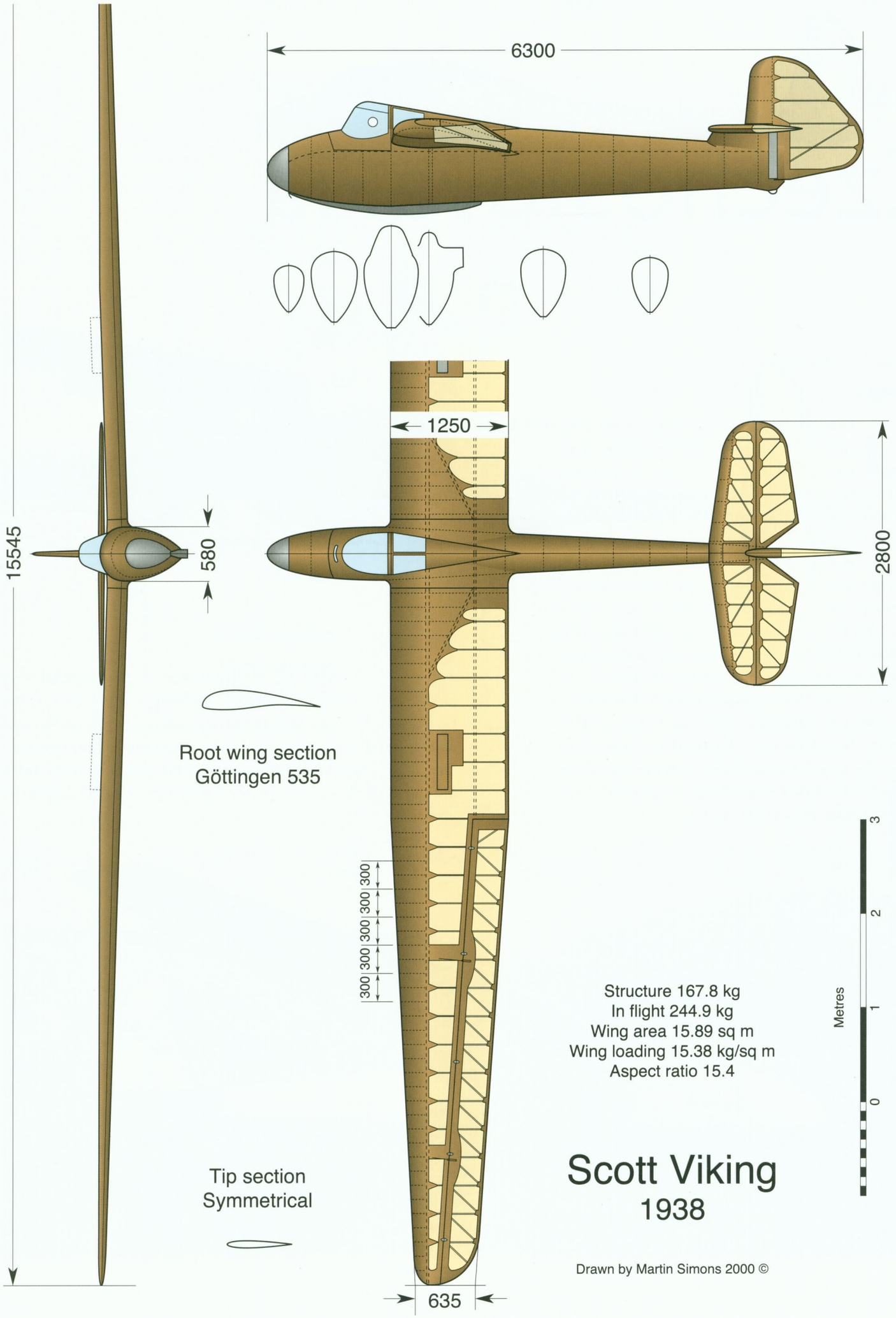
Scott Viking

The Viking, designed by Roy Scott, was aimed at the same, rather limited, market as the Slingsby Gull. Four were completed in 1938. One was exported to Argentina. The others remained in England and were flown quite extensively in the one year remaining before the Second World War. After the war only one survived and was flown a good deal by a succession of private owners. It achieved a height in wave, from Camphill, of 4721 metres after a bungee launch. It remains extant and flyable.

Left above: Like the Kirby Kite, the Cambridge, two of which were built, was closely based on the Grunau Baby but had a streamlined fuselage.

Right above and below: Roy Scott's Viking of 1938





Scott Viking
1938

CHAPTER 16

Czechoslovakia

Gliding in Czechoslovakia began in the early twenties. More than two dozen different glider types were designed and built before 1925. As elsewhere, interest faded for a time, in particular because a violent wind storm during the national competition meeting in 1925, destroyed or seriously damaged many of the gliders assembled on the ground.

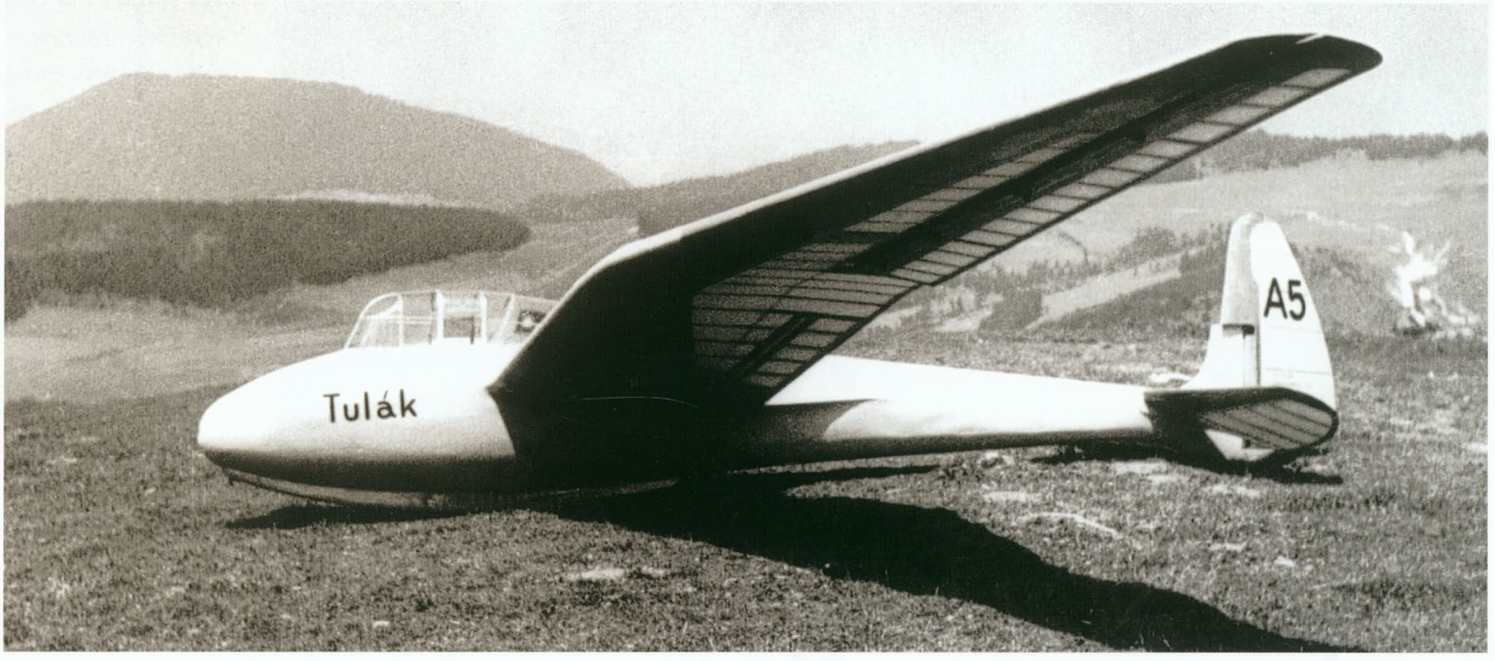
There was revival after 1930, and by 1936 about 60 sailplanes of various types were flying. These included some successful designs, such as the Racek , a 15.2 metre span single seater with a best glide of about 1:22. As tensions in Europe increased and war threatened, activity was seriously reduced. In what was, for this country, the last year of independence before the German occupation, a team of five pilots went to the Wasserkuppe for the International Championships, with four sailplanes. Two of these were of the type Tulak 37, one VSB - 35 and one Ch - 2 Duha., all of Czech design and construction. The poor final scores were probably due to inexperience on the part of the pilots, none of whom, apparently, had achieved the 'Silver C' badge prior to the meeting.

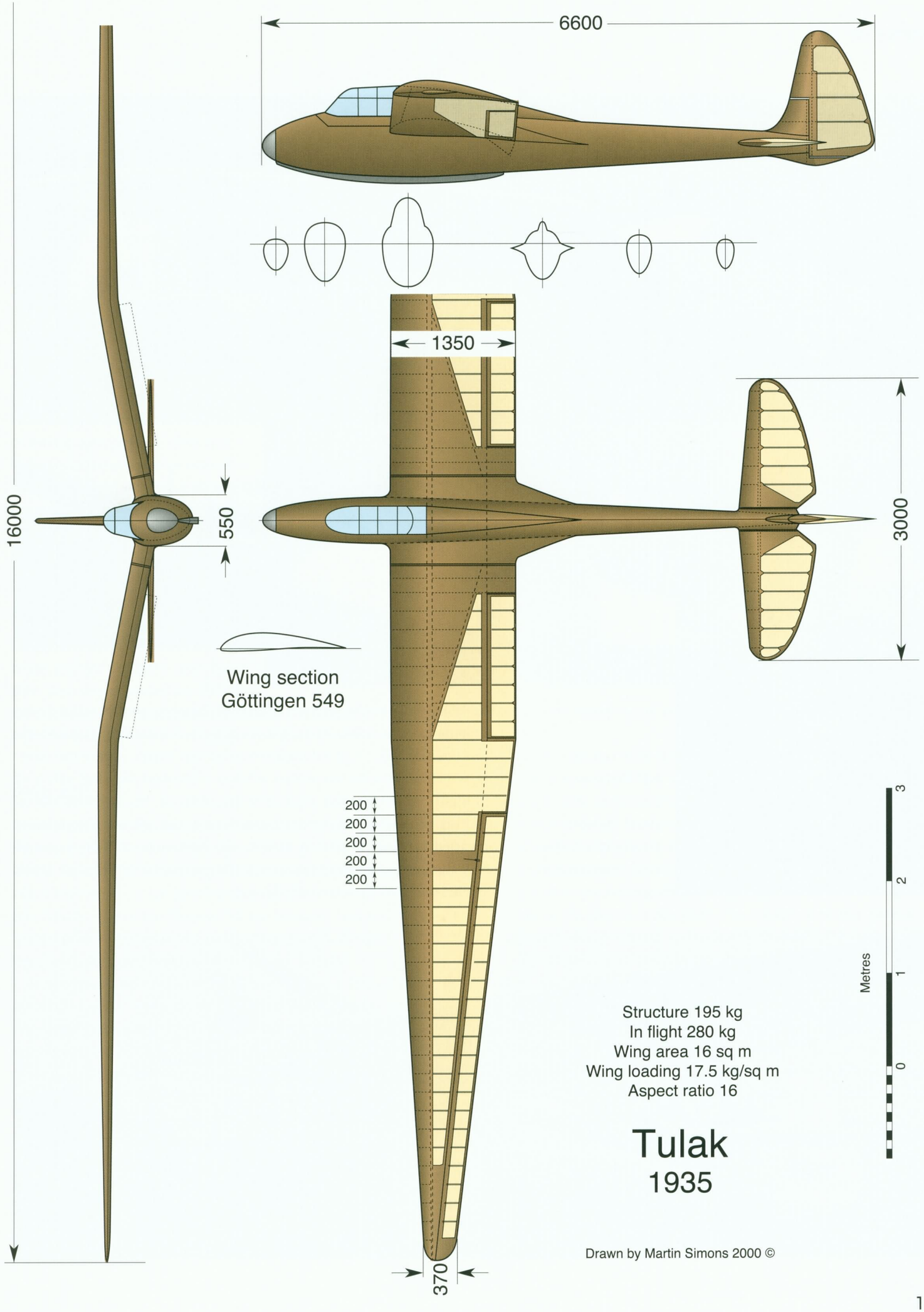
Above: The Tulak had large Fowler type flaps.

Below: The Czechoslovakian 'Tulak'.

Tulak 37

The Tulak was remarkable chiefly because it was equipped with large slotted flaps to assist landing. The wing profile at the root was Gö 549. A wide centre section was built integrally with the fuselage and the wings attached to the reinforced and extended main fuselage frames. Against the German and Polish competitors the Tulak did not show up well. No scoring flights were recorded during the competition.

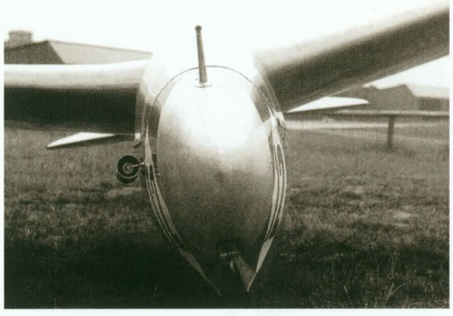




Structure 195 kg
In flight 280 kg
Wing area 16 sq m
Wing loading 17.5 kg/sq m
Aspect ratio 16

Tulak
1935

Above and right: The Duha 2, OK - Mario, designed and flown at the Internationals by J Chlup, was a much changed version of the Duha 1. It was a fifteen metre sailplane with a wing of pronounced 'gull' form, and a contoured transparent canopy. Chlup did not make a score. It has not been possible to make an accurate drawing of this type.



Left: The Racek.

Below: The VSb 35 flown by Karel Prachar at the Internationals in 1937.

VSB 35

The VSB 35, flown by pilots Prachar and Steyskal, was the only Czech sailplane to score points in the Internationals. Prachar achieved a 91 km cross country flight and a duration of over four hours, during the meeting, which suggests he was at least at Silver C standard, Steyskal, with a 40 km flight, fell short of the required 50 km distance. The sailplane was interesting because it had interchangeable wing tips, allowing the span to be varied between 14 and 18 metres. The horizontal tail was mounted above the fuselage on small pylons in a manner similar to the Polish CW 5. Detailed drawings have not been found.

Chpater 17 France

The Avia 40P, superbly restored, at St Auban s. Garonne.

After the successes of French sailplanes and pilots in the early twenties, a centre for the sport was set up at Combegrasse, but as in Britain, after a flurry of interest there was little activity for several years. A few pioneers such as Georges Abrial continued to build gliders and visited Germany to observe developments. Competitive soaring was revived at Vauville in 1928. Wolf Hirth, in his Württemberg, demonstrated how far things had advanced. French interest revived in 1930 and the firm Avia was founded to build motorless aircraft. The first products were training gliders of various types, including a useful two seat primary glider, the Avia 10a.

Avia 41P

It was significant that in 1931 the French still held contests at the Vauville coastal site. Kronfeld arrived there with the Wien. The Avia design team, led by Raymond Jarlaud, were much impressed and decided to produce a high performance sailplane along similar lines. Eric Nessler, one of the founders of the company and already a well known pilot with experience of building aircraft, designed the fuselage, Jarlaud himself took responsibility for the rest.

Although strongly influenced by the Wien, the French sailplane differed in many ways. It was slightly smaller, though no lighter. The wing, braced with V struts made from streamlined section duralumin tubing, divided in the centre. Jarlaud thought the three-piece structure, as used on the German Professor type, was not the best arrangement. With struts, the maximum bending loads occur where the struts join the wing. A wing joint just outboard of the strut attachments required quite substantial steel fittings to carry the load through the spar. With a two piece strutted wing the root carries no bending at all so the main spar can be very light here to join the fuselage with very simple and light fittings. In the most highly stressed area at the strut ends, the spar is continuous and suitably reinforced.

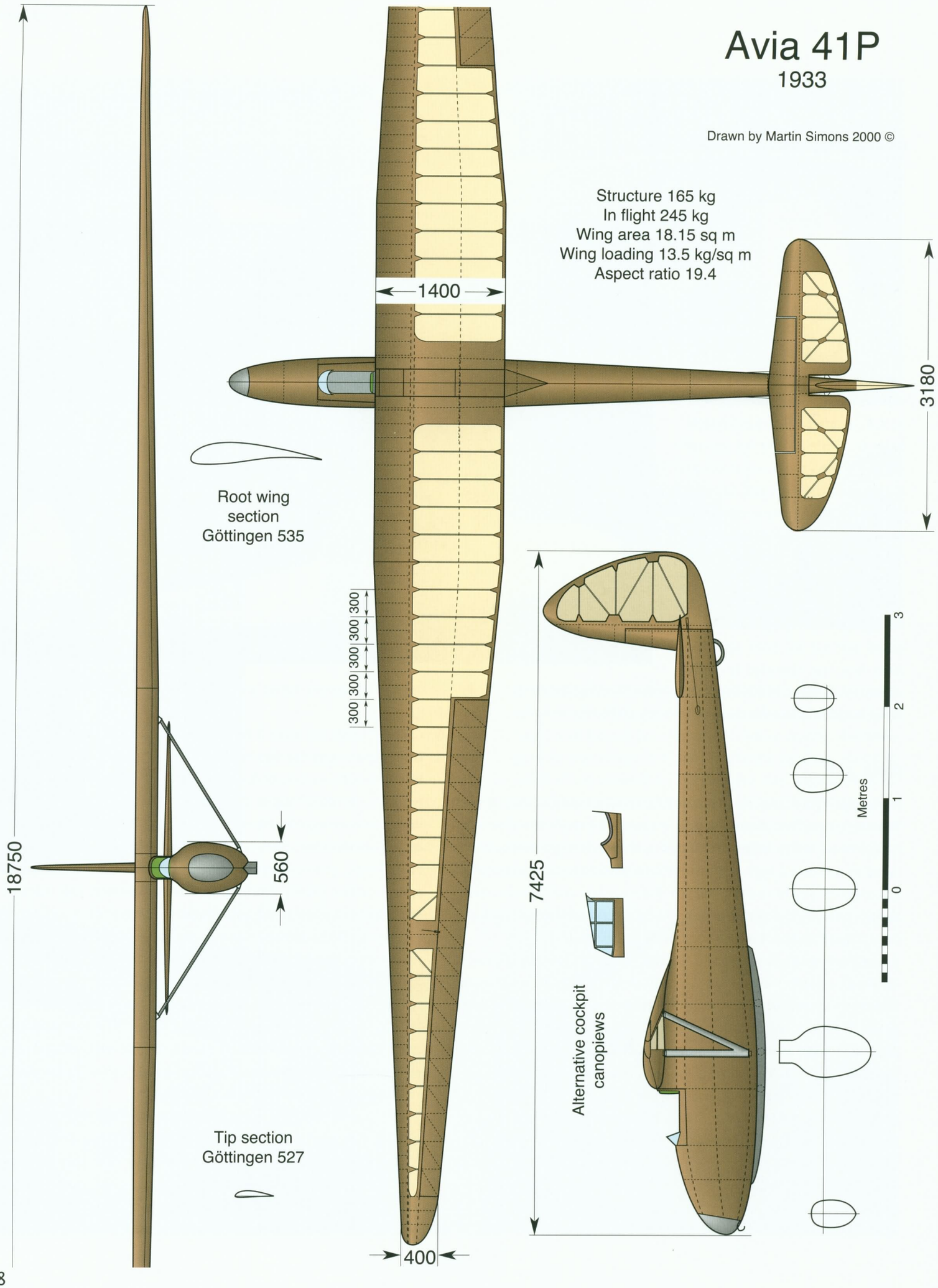
The profiles too were different, Göttingen 535 for the centre section, tapering at the tips to Gö 527, a section of similar thickness but with little undercamber, making the construction of the outer wing much easier. The ailerons, fabric covered but with numerous diagonal bracing ribs, were divided into two sections to reduce distortion under load. They had particularly large and elaborate operating horns, probably to ensure that they did move accurately in response to the pilot's commands. The cockpit was very narrow, restricting sideways hand movements. Instead of a simple stick, Nessler devised a control column like that in some powered aircraft. At the top was a rocking yoke with hand grips for the ailerons, the whole moving fore and aft to control the elevator.

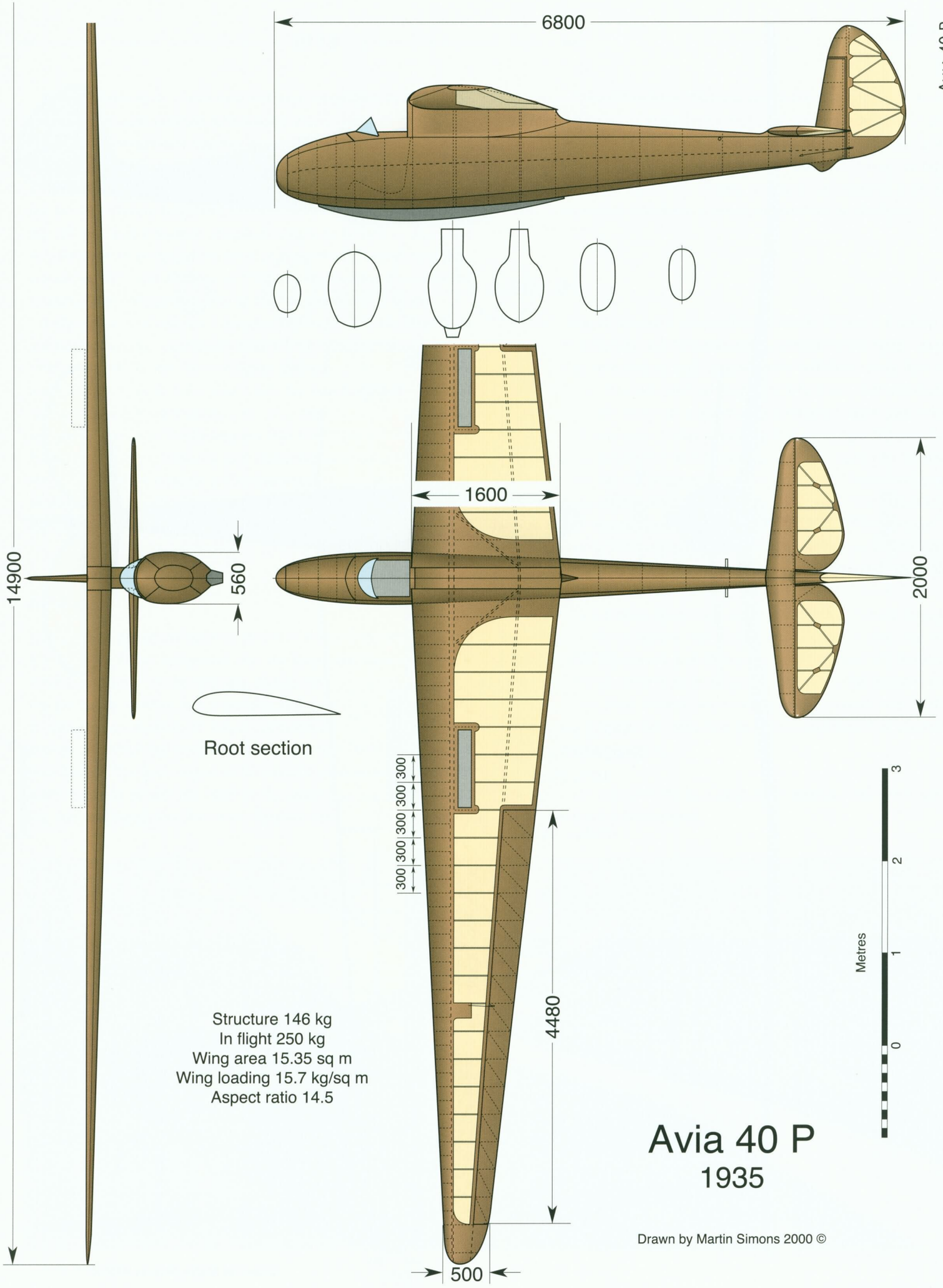
The central pylon wing mounting was lower and the pilot's seat much closer to the wing than on the Wien. The rear fuselage was less slender. There was a small fixed tailplane with hinged elevator and generous aerodynamic balances ahead of the hinge line. The cockpit was open and without a windscreen.

The prototype made its first flight late in 1932 and after further tests in the new year, was taken on tour, making demonstration flights throughout France. It was flown at first only by Georges Bouvier. Eric Nessler took over after a while and made numerous duration and distance flights, becoming the first French pilot to achieve the 'Silver C' badge.

Avia 41P
1933

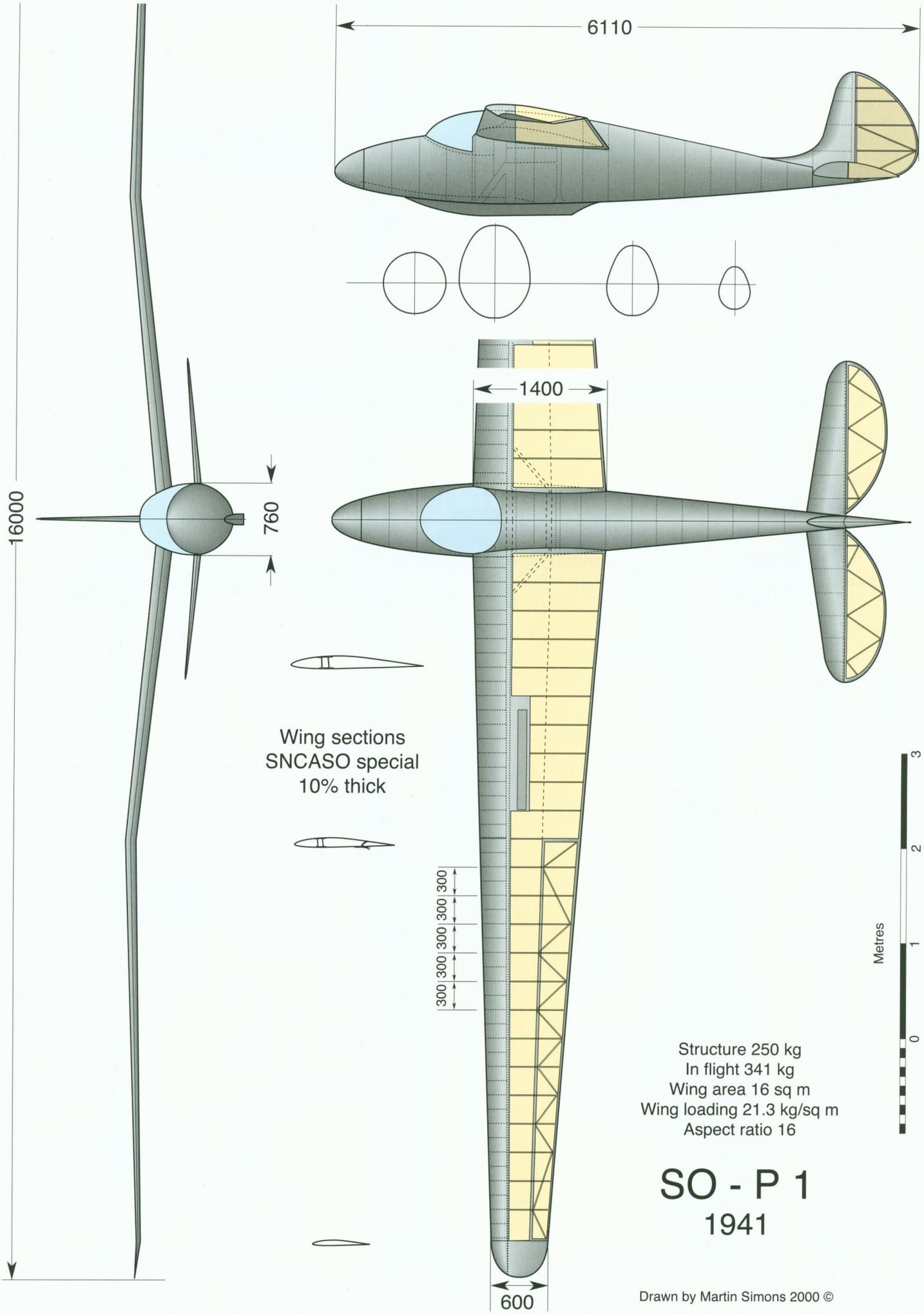
Structure 165 kg
In flight 245 kg
Wing area 18.15 sq m
Wing loading 13.5 kg/sq m
Aspect ratio 19.4





Structure 146 kg
In flight 250 kg
Wing area 15.35 sq m
Wing loading 15.7 kg/sq m
Aspect ratio 14.5

Avia 40 P
1935



Structure 250 kg
In flight 341 kg
Wing area 16 sq m
Wing loading 21.3 kg/sq m
Aspect ratio 16

SO - P 1
1941

Drawn by Martin Simons 2000 ©

A second example of the Avia 41P was completed in 1935. The ailerons were now skinned with plywood and only one central operating horn of ordinary size was necessary. There were other minor changes, especially to the cockpit canopy which after several modifications was at last fully enclosed. Nessler became the chief pilot at the Banne d'Ordanche gliding school. He made this sailplane virtually his own and it became known as L'Aigle de la Banne (The Eagle of la Banne). In it Nessler set most of the French National records, achieving 382.4 km distance in 1938. He represented France at the Salzburg International meeting in 1937 and at Berne in 1938.

Although considered too complex and expensive for large scale production, several more of the Avia 41P were built during the years 1935 to 1939, mostly for the Army gliding section. The precise number is not sure but the most likely figure is five, making a total of seven. Minor modifications were incorporated. Some had a small amount of dihedral, including the third built which was rescued from store in 1950, restored and preserved as a museum exhibit. Nessler's 'Eagle' was taken to Germany by the occupying forces in 1942 and, presumably, destroyed. (A photograph of the Avia 41P appears on page 132 with the Mü 10)

Avia 40P

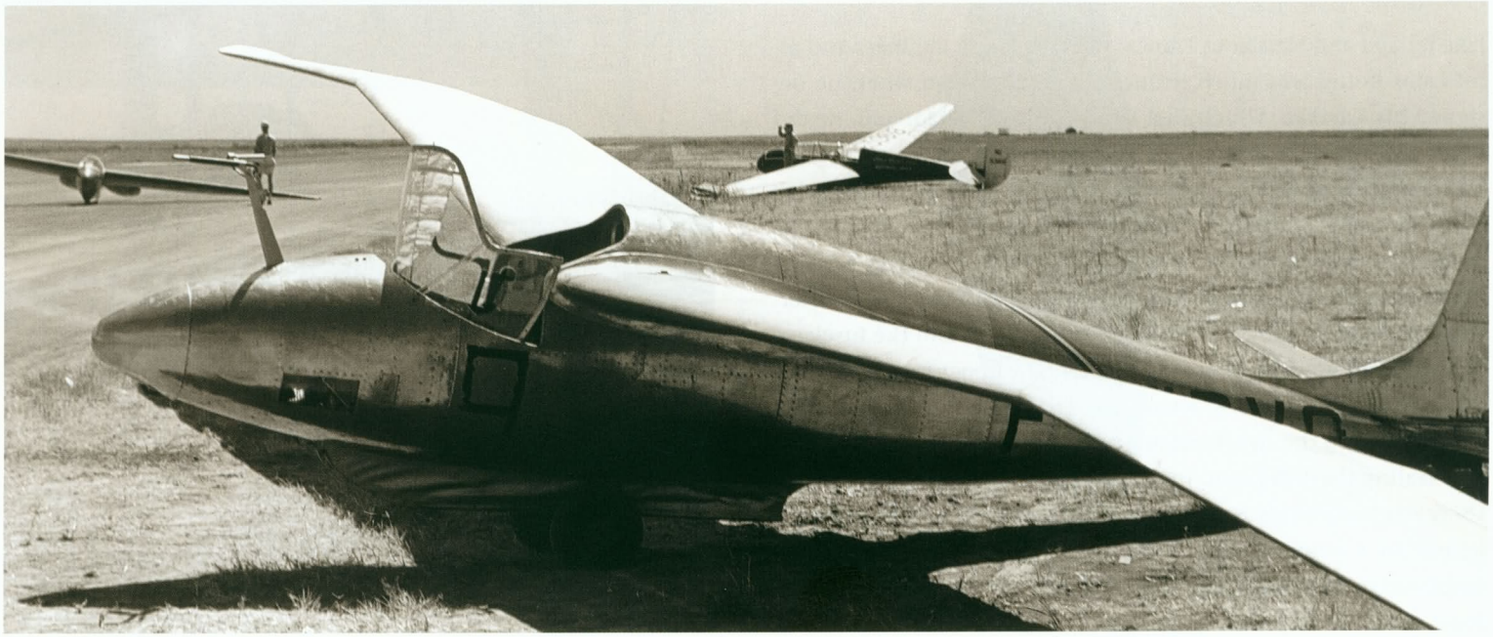
The Avia 40P, despite its number, first flew several years later than the 41P, in 1935. It was recognised that the larger sailplane was too advanced and costly for the ordinary gliding clubs in France, so the 40P was produced, smaller, less expensive and more within the capacity of inexperienced pilots. It was an orthodox, simple design which proved successful and became the most popular sailplane in France for a decade. The type was used for cross country flying and height gains. National records not taken by the larger Avia 41P usually fell to the 40P, including the feminine distance record of 139.24 km by Marcelle Choisnet in June 1944 and the duration record of 16 hours 44 mins by Suzanne Melk in October 1946. The total built is not certain but exceeded forty. Production continued in France during the Second World War and at least ten were also built and flown in Algeria. Fourteen were taken to Germany during the occupation. One survives in airworthy, restored condition, at St Auban sur Garonne.

SO - P 1

In 1941, despite German occupation of most of France, a group of engineers at the SNCASO aircraft works, without other work, decided to design and build a high performance sailplane using light alloys. The SO - P1 made its first flights in June 1941. Full advantage was taken of the material to produce a strong but light 'gull' wing of only 10% thickness. It had a built up metal box spar with torsion resisting, metal sheet covered leading edge and light ribs behind. The ailerons, carried on a light auxiliary spar, were slotted and mass balanced. Air brakes were fitted. The fuselage was intended to conform to the airflow around the wings, so had a cambered shape in side elevation. The tailplane was mounted low on the rear fuselage but had slight dihedral to avoid touching the ground when the sailplane was at rest with one wing down.

When the whole of France was taken over by the German occupation forces, the sailplane was hidden, to re-emerge after the war when it was re-covered and flown again. When the US National Championships were held in Texas in 1947, it was taken there and among other good flights, set a new French National record distance of 354 km. It was returned to France and stored, apparently never to be flown again.

The French SOP 1, one of the first successful all metal sailplanes, visited USA in 1947 to fly in the National Championships.

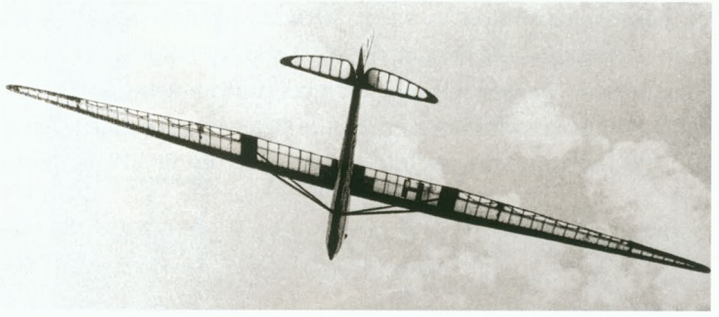


CHAPTER 18

Hungary

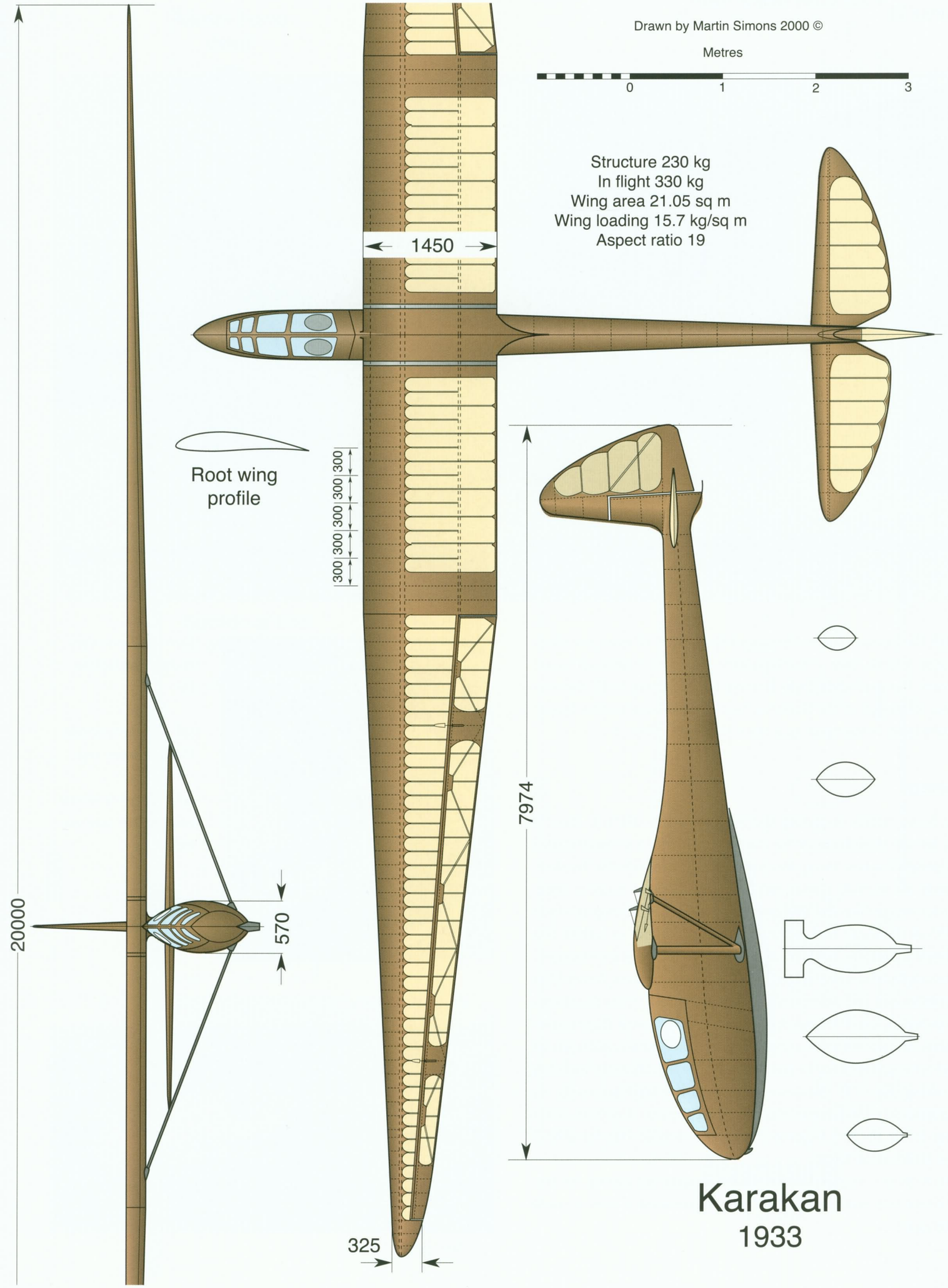
Above: Winter bungee launch of the Karakan.

Right and below: The Hungarian Karakan of 1935.

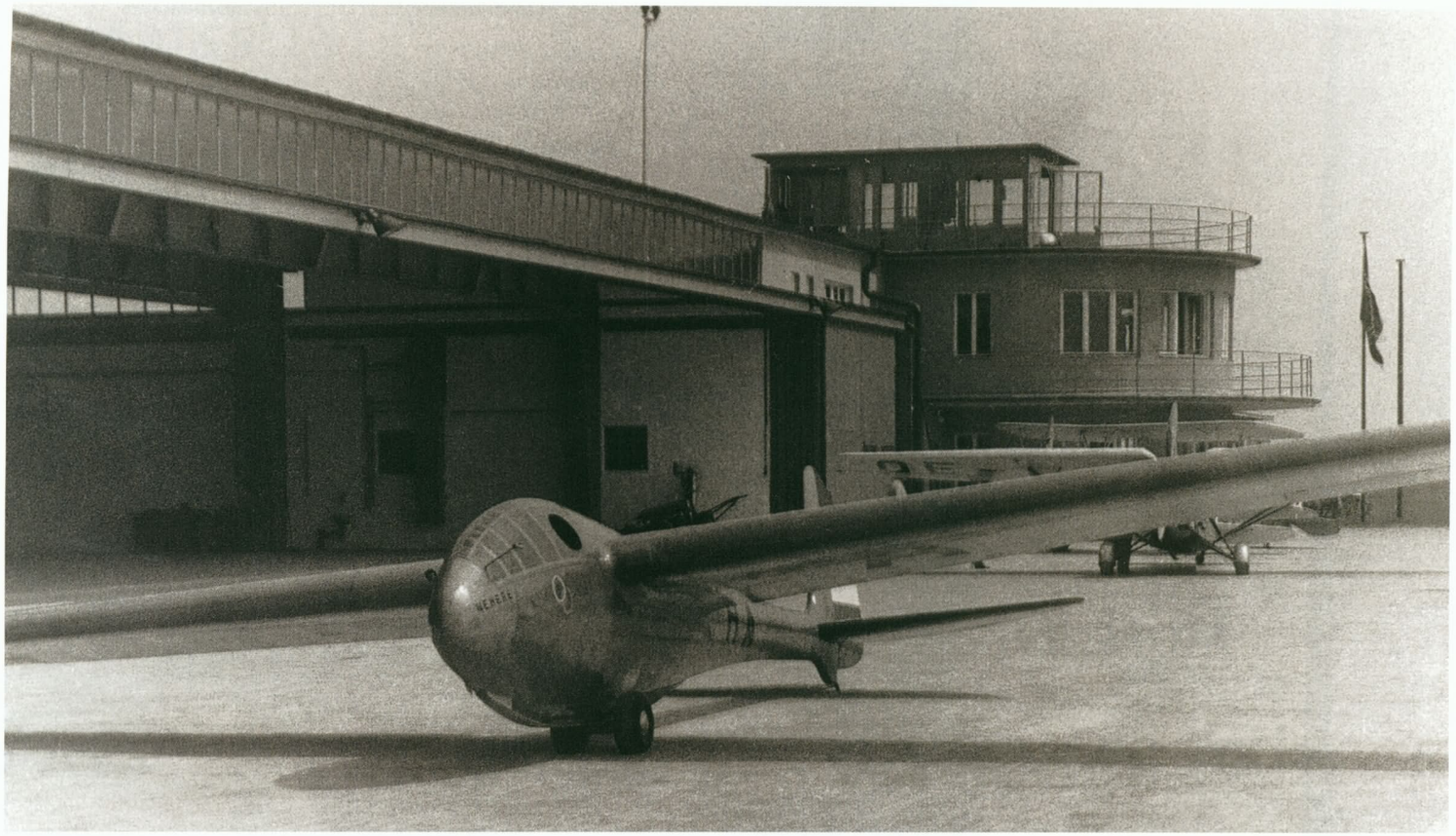


Karakan

Like Jarlaud and Nessler in France, the Hungarian engineer and pilot Lajos Rotter was much influenced by the Wien when he designed his Karakan, which first flew in 1933. Like Jarlaud, he did not merely copy Kronfeld's sailplane. He too used a two piece wing, but of slightly more span, with original wing profiles, 15.5% thick at the root, and V struts. The fuselage was a slender form with a lens or almond shaped cross section, reducing the width of the pylon as much as possible in the hope of avoiding drag caused by interference between the flow over the wing and that round the fuselage. The wing did not join on the centre line. The upper fuselage frames were extended outwards to form a fixed centre section or stub wing. This simplified the structural and aerodynamic problem of fairing and sealing the wing root. Instead of the traditional open cockpit there was a smoothly contoured canopy built up with transparent panels in a wooden frame. The Karakan was one of the first sailplanes to have this. Large unglazed portholes remained. In other respects the Karakan was of orthodox wooden construction.



Karakan
1933



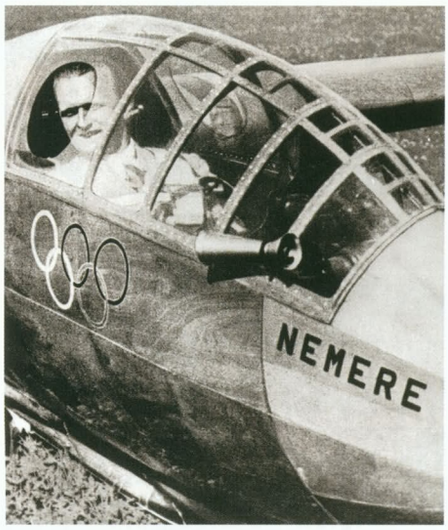
With his Karakan Rotter, Hungary's first 'Silver C' pilot, set many National records. Two of the type were built and continued in use for years. The second one was lost in a hangar fire in 1942, the prototype, displayed in the National Transport Museum in Budapest, was destroyed in the fighting at the end of World War 2.

Nemere

Lajos Rotter began designing the Nemere late in 1935, to have it ready for the 1936 Berlin ISTUS soaring contest held in parallel with the Olympic Games. Using the experience gained with the Karakan, he made the span 20 metres, but used a cantilever, shoulder wing. The root section was the 19% thick Göttingen 646 changing to the Gö 535 at the inner end of the ailerons and thence to a thin, less cambered tip profile. For take off, a drop-off wheeled dolly was used.

The sailplane was completed in the Royal Hungarian Aircraft Repair Works and test flown only a few days before it was due to appear in Berlin. Once arrived there, Rotter made several flights to familiarise himself with the aircraft, then in favourable conditions set off across country to try to reach Kiel where the Olympic yachting was taking place. To the astonishment of the German pilots, he completed this 336 km goal flight linking the two divisions of the Games. It was the best flight in Europe that year and he was awarded the ISTUS Gold medal.

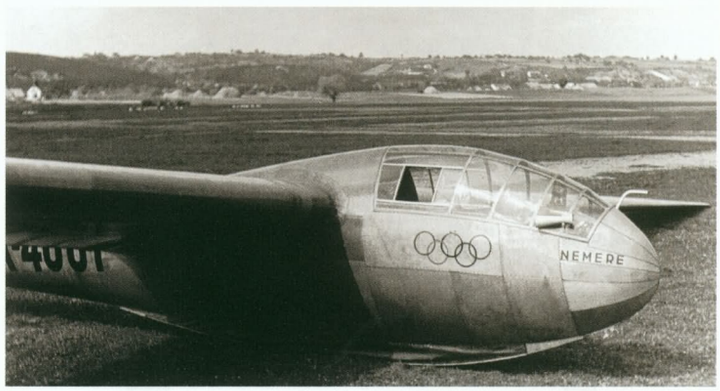
The Nemere continued in service in Hungary but during the Second World War was stored badly and deteriorated so that it could not fly again.

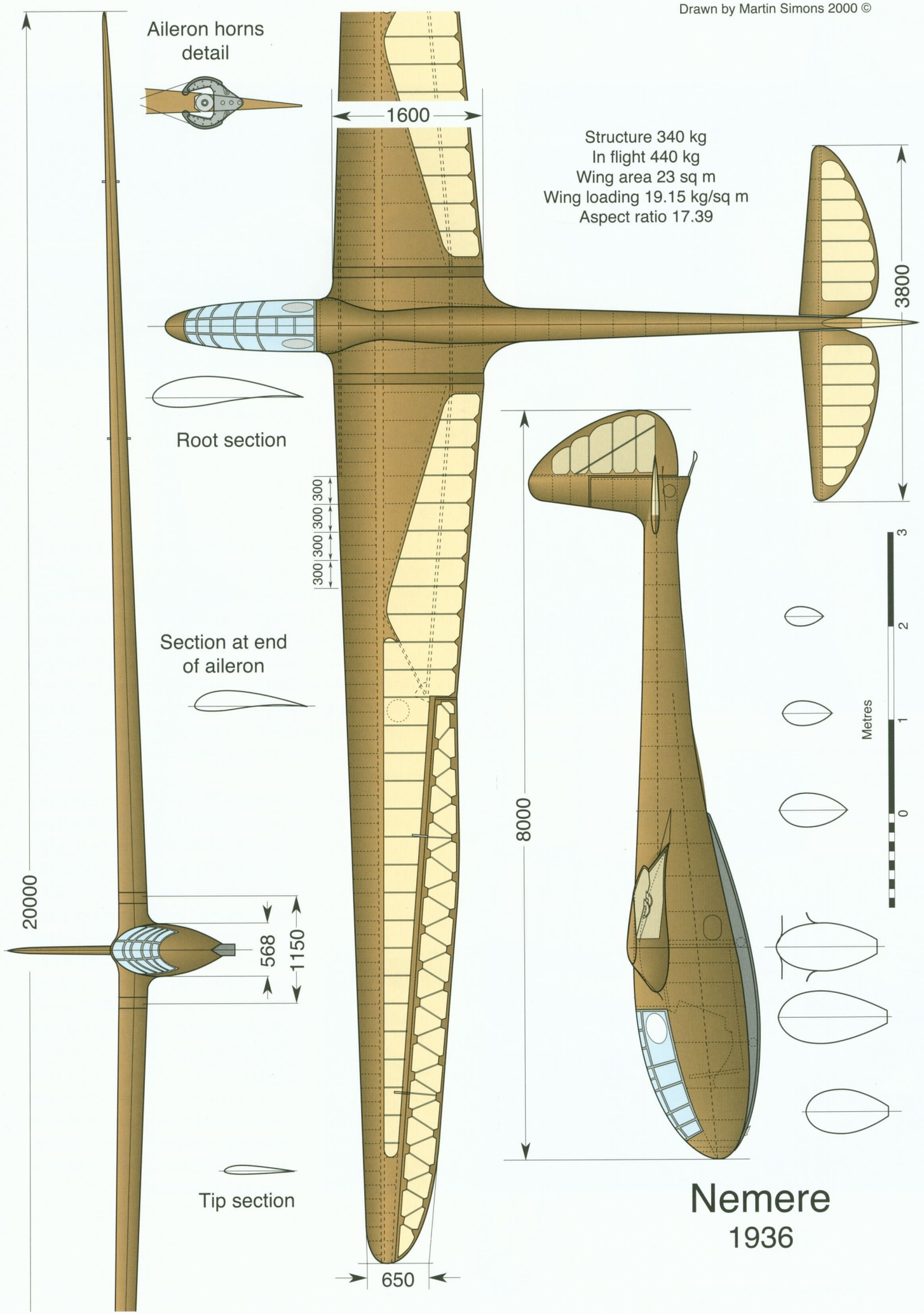


Above: The Nemere after the flight from Berlin to Kiel.

Left: Rotter in the cockpit. Note the Olympic rings.

Below: Two of the Nemere were built. HA - 4001 was the second one.

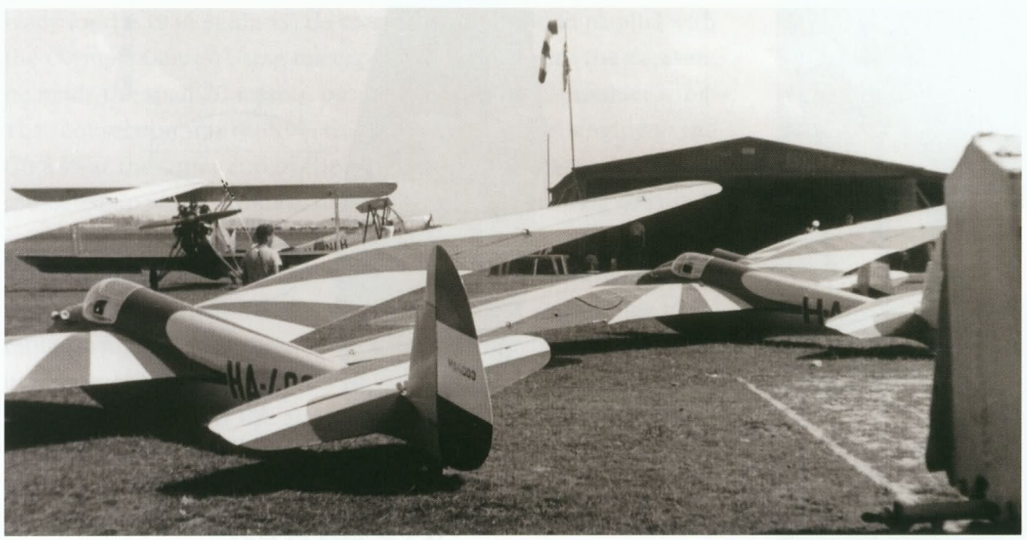


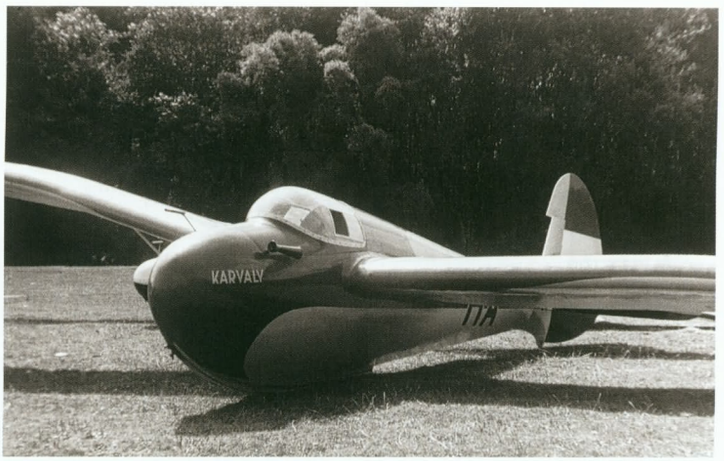


Nemere
1936

Left: The Hungarian M - 22 began construction as a Rhönbussard but was redesigned when the students heard of the Rhönsperber.

Below: The M - 22 was produced in quantity and became very popular.



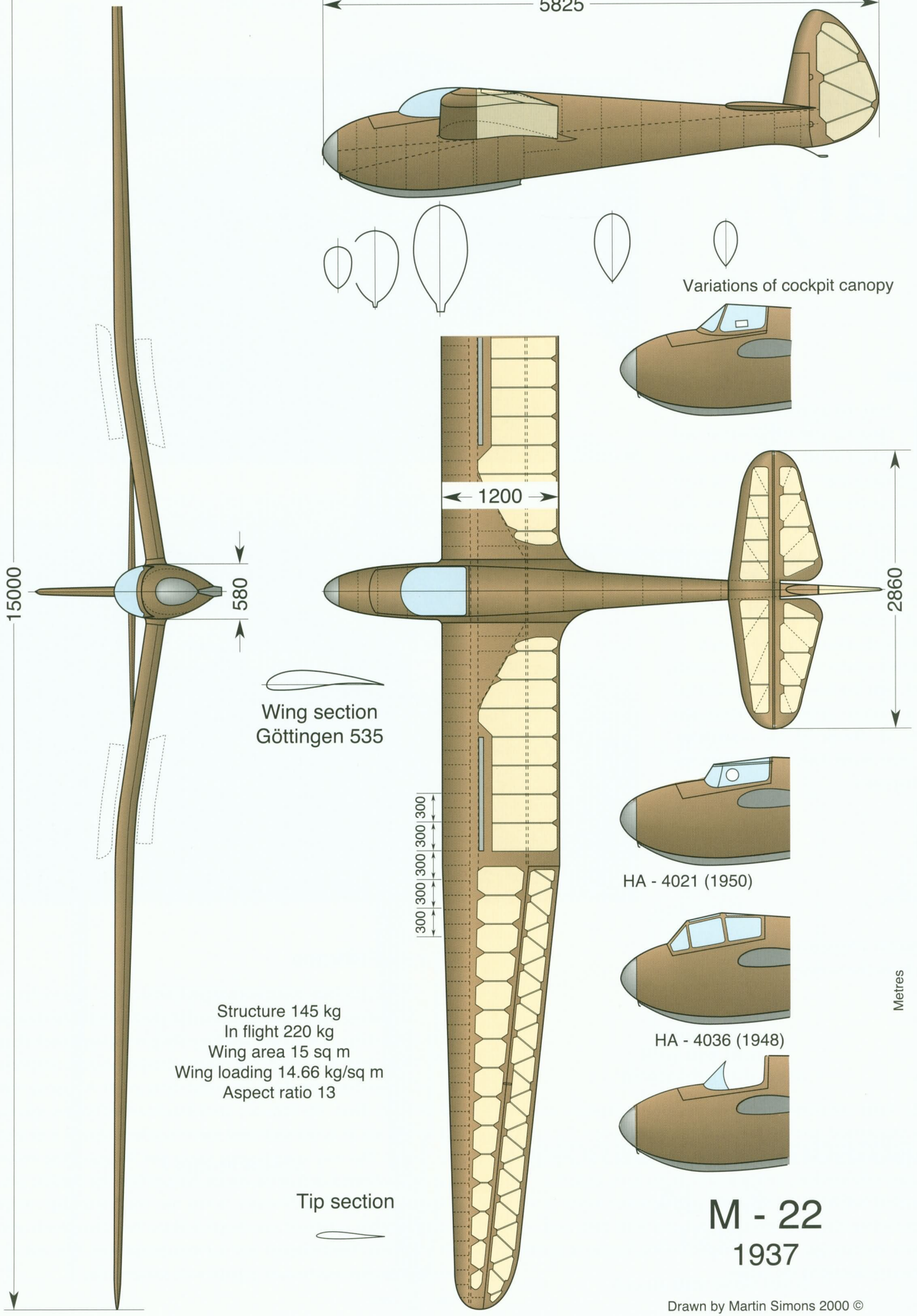


Right above: The M - 22 had a variety of cockpit canopies, some fully moulded in plasic.

M - 22

The M - 22 began as Rhönbussard which was being built from German plans at the Budapest Technical University. When some of the components, such as wing ribs and some of the fuselage frames, had been finished the students heard of Hans Jacobs' new sailplane, the Rhönsperber. András Szokolay and Endre Jancsó, leading the team, decided to develop their own design using the parts they had already made. Most of the Bussard wing was retained but moved down to a mid wing mounting on the short fuselage, and given a 'gull' bend. The main spar joined on the centre line inside the fuselage. The fuselage was essentially the same as the Bussard but with redesigned main frames.

The prototype flew well and from 1937 the M - 22 entered production in the University workshops. An early change to the design was the addition of Schempp Hirth dive brakes. Either an open cockpit or a closed canopy could be used. About fifteen were built and became very popular for cross country flying and aerobatics. An M - 22 broke the Hungarian national distance record with 335 km and the height record with 3770 metres. The prototype M - 22, named Turul was exported to Egypt where, in 1938 the English Group Captain Edward Mole used it for aerobatics, performing slow rolls and outside loops, and, after a tow by an RAF biplane fighter to 4700 metres, he performed 147 consecutive loops on the way down.



Structure 145 kg
In flight 220 kg
Wing area 15 sq m
Wing loading 14.66 kg/sq m
Aspect ratio 13

M - 22
1937

Chapter 19

Italy

There was an international glider meeting at Monte Sisemol near Asiago in 1924 with teams coming from Germany to demonstrate such sailplanes as the Geheimrat, Konsul, and Moritz. Martens broke the world distance record with a 21 km flight. Among the Italians present was Luigi Frederico Teichfuss who had built a successful glider called Condor. As elsewhere, there was something of a hiatus for several years.

A gliding school was started at Pavullo in 1927 with Teichfuss, who himself became a profilic sailplane designer and builder, in charge of the workshops. There were many Italian designs in the following years.

Above: The AL - 3.

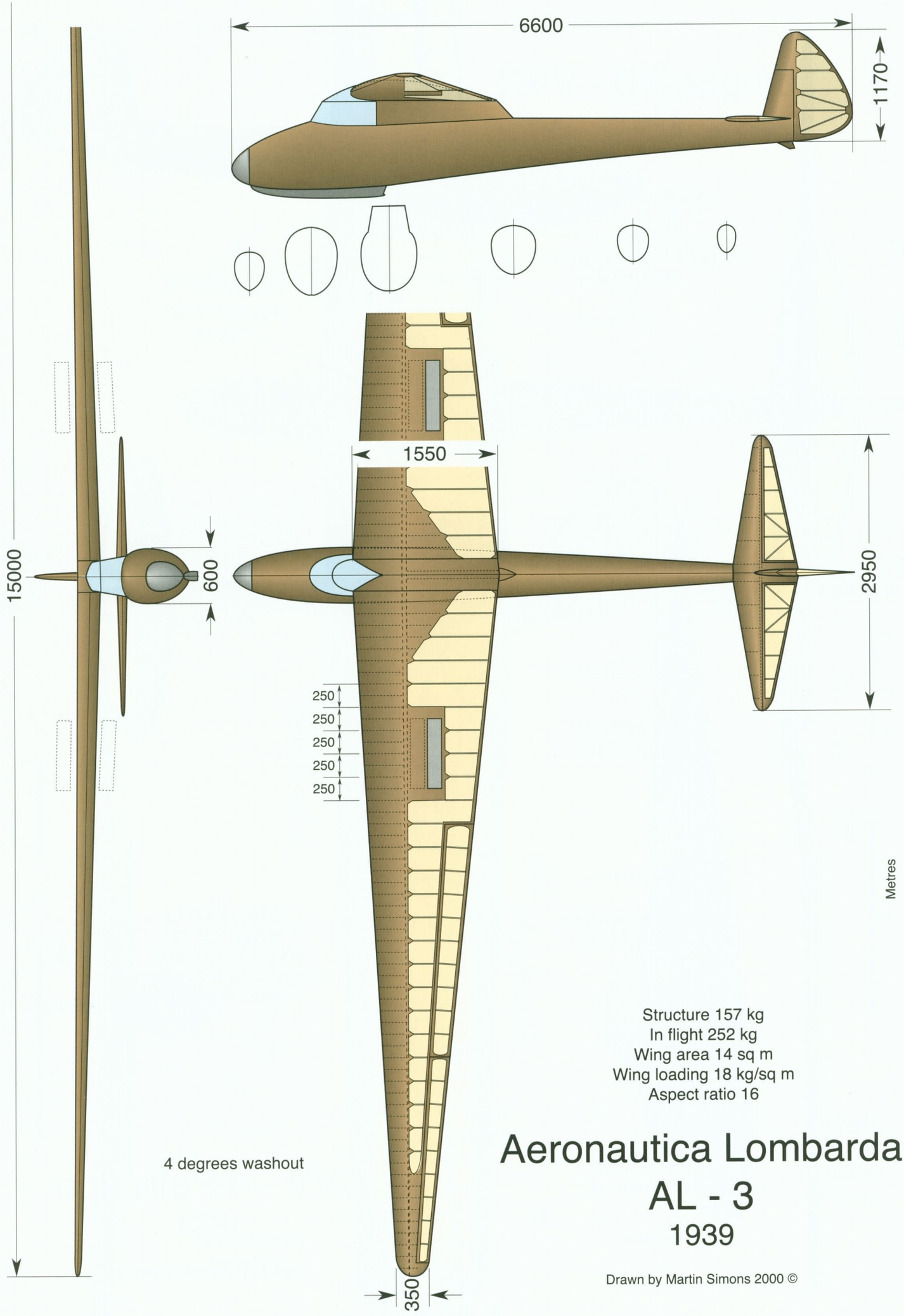
Below: The CVV 4 Pellicano, one of the Italian entrants for the Olympic design contest.

AL 3

The AL - 3 was one of two Italian entries for the Olympic Sailplane design competition in 1939. It was, as the specification required, of straightforward wooden construction. The wing was strongly tapered and used the NACA 4514 profile at the root, tapering to the symmetrical NACA 0012 at the trips, with generous washout to prevent tip stalling. the wing was mounted on a fairly high neck or pylon above the fuselage. In other respects it was similar to the Meise which was preferred by the judges.

CVV - 4 Pellicano

The CVV, Centro Studi ed Ezperienze per il Volo a Vela, (Centre for research in soaring flight) was established at The Milan Polytechnic in 1934 and a series of excellent sailplane designs emerged, including the CVV - 4 Pellicano which was entered for the Olympic Sailplane design competition in 1939. The chief designer of the group was Ermenegildo Preti. The Pellicano conformed to the Olympic specification and was an orthodox fifteen metre wooden sailplane typical of the period. The only complicating factor was the gull wing which may have counted against the design. Rather than the familiar Göttingen aerofoils, the CVV chose to use the NACA four digit series which were less cambered and therefore faster than the sections used for the Meise. The Pellicano was not abandoned after 1939 but entered production and became popular with Italian pilots.

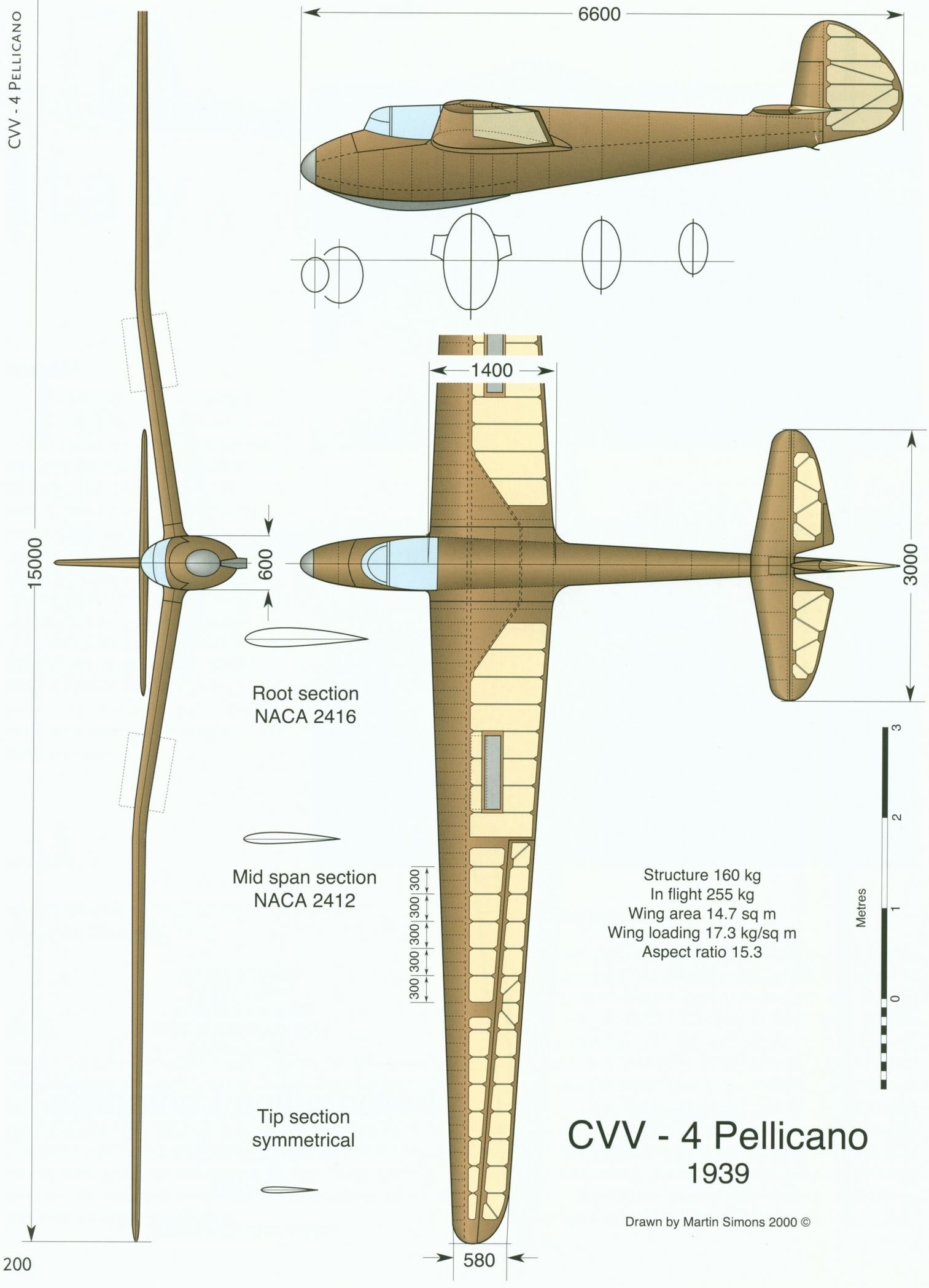


Structure 157 kg
In flight 252 kg
Wing area 14 sq m
Wing loading 18 kg/sq m
Aspect ratio 16

4 degrees washout

Aeronautica Lombarda AL - 3

1939

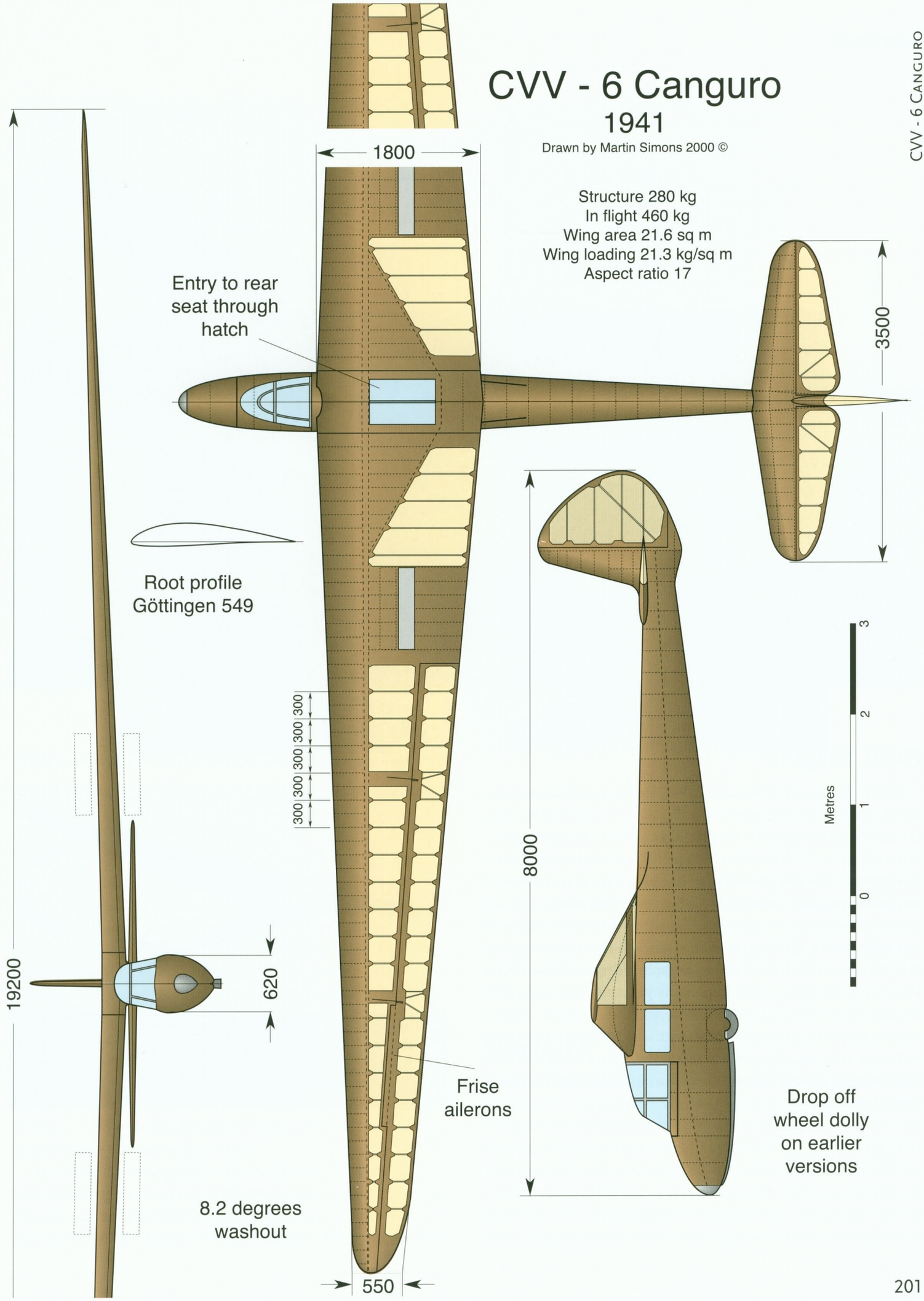

CVV - 4 Pellicano
6600
15000
600
1400
3000
Root section
NACA 2416
Mid span section
NACA 2412
Tip section
symmetrical
300
300
300
300
300
Structure 160 kg
In flight 255 kg
Wing area 14.7 sq m
Wing loading 17.3 kg/sq m
Aspect ratio 15.3
Metres
0
1
2
3
200
580
CVV - 4 Pellicano
1939
Drawn by Martin Simons 2000 ©

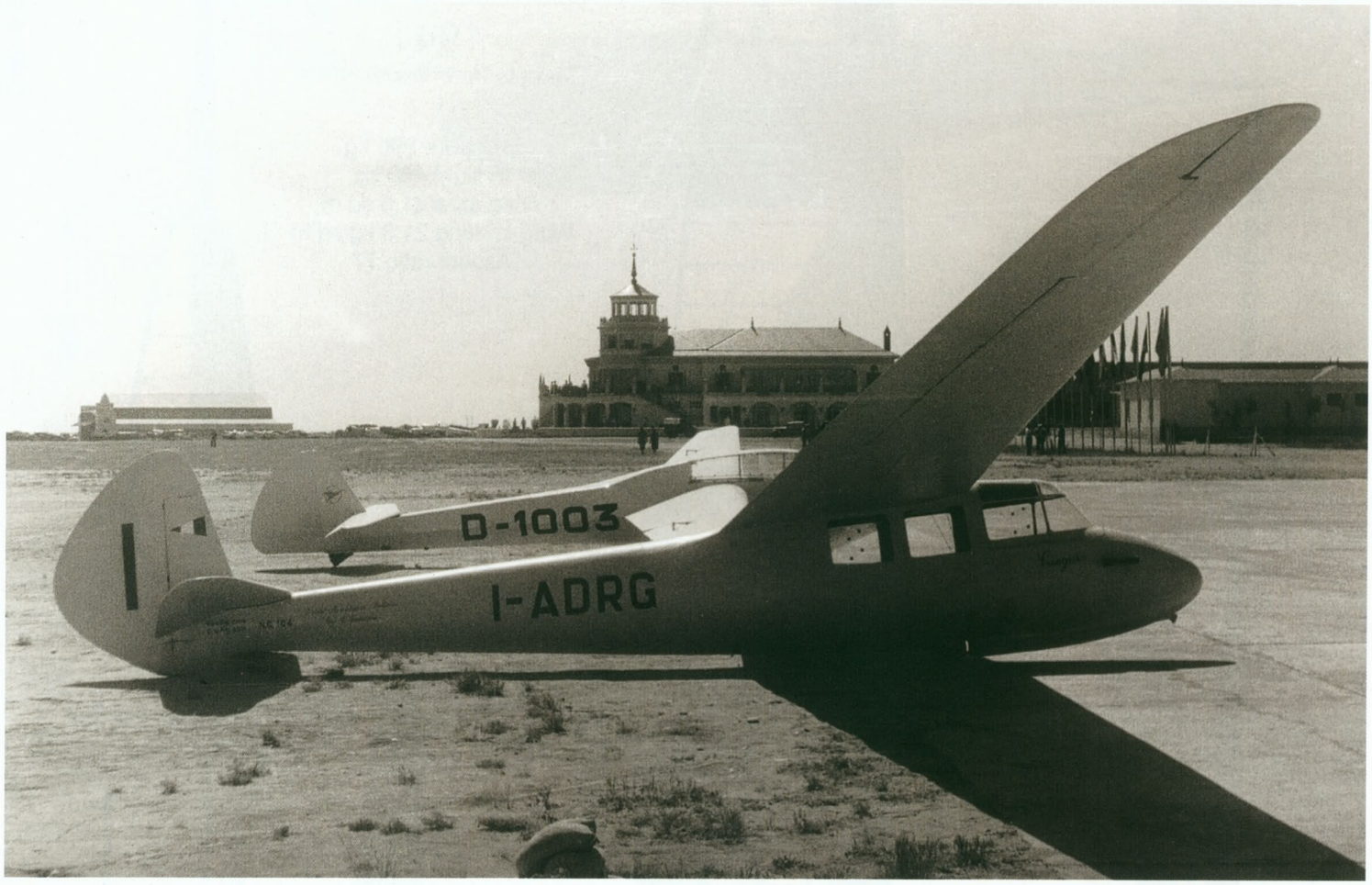
CVV - 6 Canguro

1941

Drawn by Martin Simons 2000 ©

Structure 280 kg
In flight 460 kg
Wing area 21.6 sq m
Wing loading 21.3 kg/sq m
Aspect ratio 17



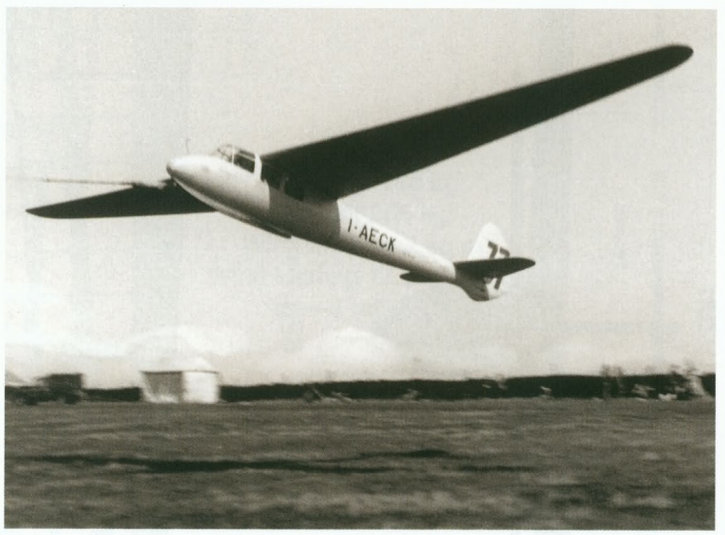


The CVV 6 Canguro continued in service until the nineteen sixties.

CVV 6 'Canguro'

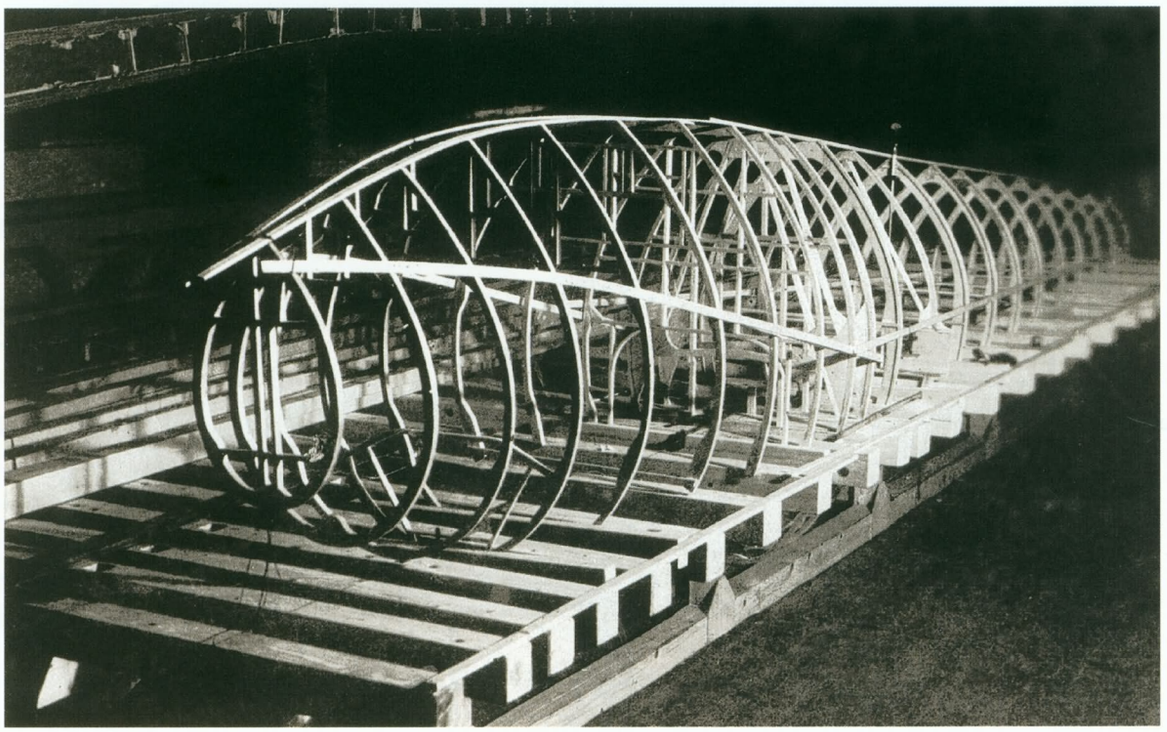
The CVV 6 Canguro first flew in 1941. It was one of the most elegant two seat sailplanes of its time. The seats were in tandem with the second pilot under the wing with, as usual, restricted outlook, especially upwards. The span of 19.2 metres and the generally clean aerodynamic design ensured that it had an excellent performance. Handling was good. The wing, with the Gö 549 section at the root, was broadly similar to that of the German Weihe. The estimated best glide ratio of 30:1 was probably close to the true figure and the maximum permitted airspeed was 220 kph. Thirty three were built. The type continued in service for many years after the end of the Second World War and one was entered in the World Championships in 1954. A powered version with a 22 HP motor on a pylon above the wing, was developed in 1955. The Canguro Palas, of 1964 had a Turbomeca Palas jet turbine motor in the fuselage in place of the rear cockpit.

The Canguro takes a winch launch at Camphill during the 1954 World Championships.



Chapter 20

Japan



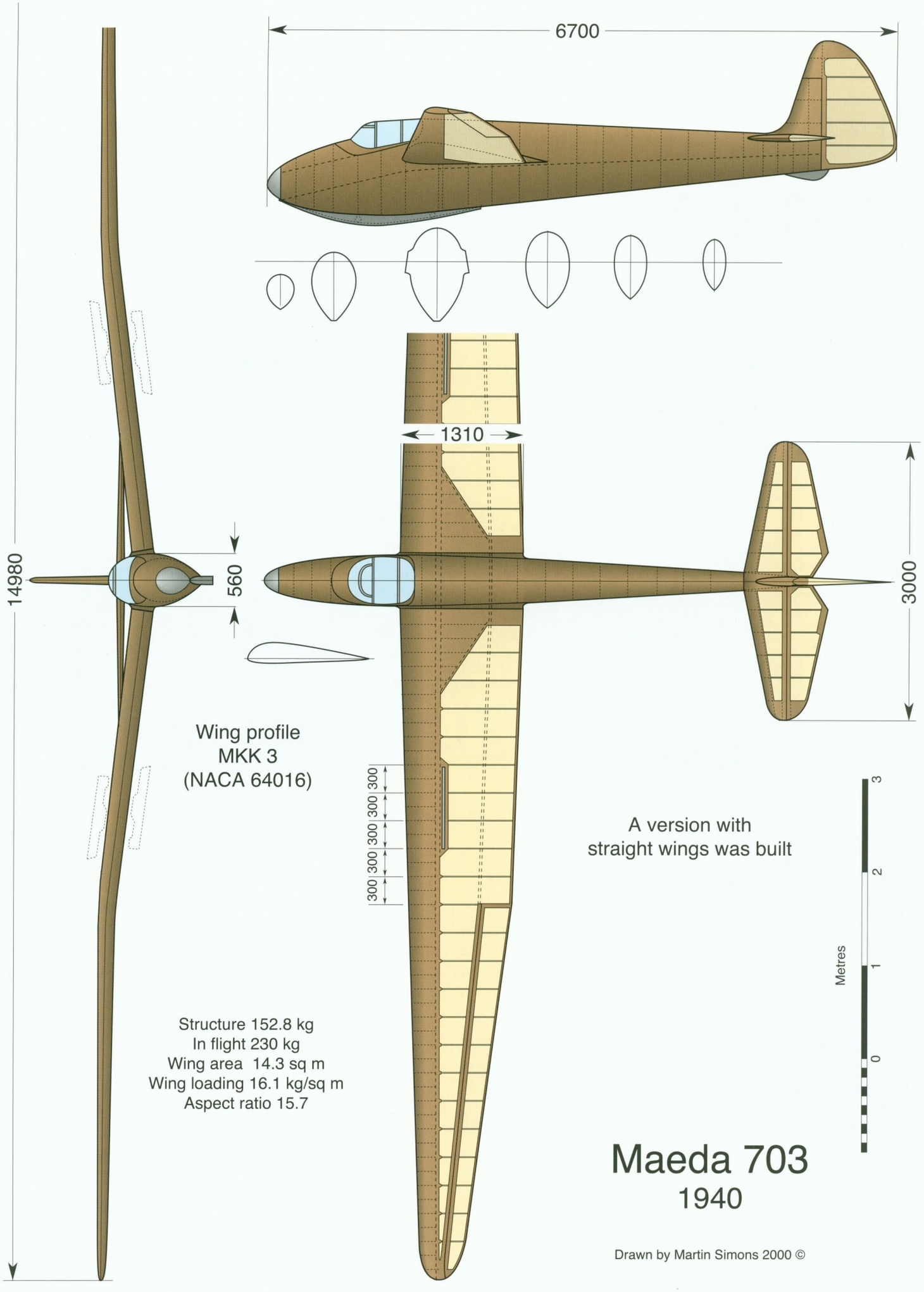
The Maeda 703 fuselage under construktion.

Gliding in Japan began in a very small way in 1930 and until 1935 survived mainly by copying what little was published in Japanese about German aircraft and methods. A very few soaring flights had been made by 1935 when the pioneers decided to try to get an expert German pilot to visit their country, perhaps bringing some modern sailplanes to demonstrate and arouse interest. After failure to gain support from the government or the army, financial backing was obtained from a newspaper, Osaka Mainichi. Wolf Hirth was invited and, to the delight of the Japanese enthusiasts, he arrived in Tokyo on October 2nd 1935 with a Schempp Hirth Wolf, the prototype Minimoa and a Klemm L - 25 tow plane. He also brought plans for the Grunau 9 primary glider and a launching winch.

During the following three months Hirth toured the country demonstrating the new sport and attracted great interest. Japanese glider design and construction were enormously stimulated. Apart from some further imports of the Minimoa and Wolf, Japanese copies of these German sailplanes were built and a great many original designs were worked out, constructed and flown successfully. Almost no news of these developments filtered through to the rest of the world but, as was also true of military aircraft, Japanese sailplanes were very soon capable of matching the rest.

Maeda 703

The Maeda 703 was built in the small factory in Fukuoka by Kenichi Maeda with his engineer friends Kimura and Kurahara in 1940. Their first product had been a primary glider but Maeda made contact with Professor Hiroshi Sato, an engineer with first hand experience of developments in Germany, now teaching at the Kyushu Imperial College. With advice from Sato, careful study of the plans of the German Olympia Meise, and a good deal of argument with his staff, Maeda determined on building three advanced sailplanes to



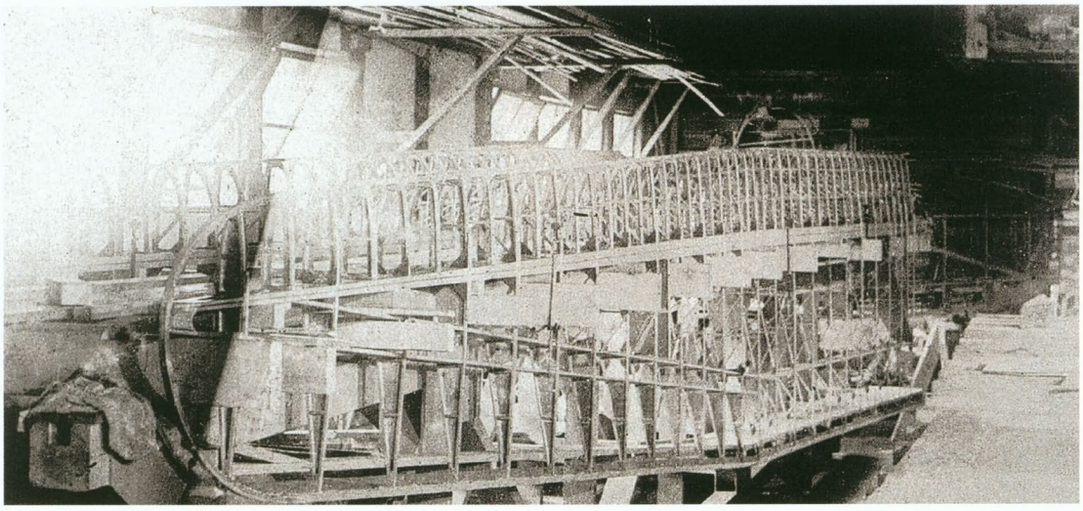
Wing profile
MKK 3
(NACA 64016)

A version with
straight wings was built

Metres
0
1
2
3

Structure 152.8 kg
In flight 230 kg
Wing area 14.3 sq m
Wing loading 16.1 kg/sq m
Aspect ratio 15.7

Maeda 703
1940



Above: The Maeda 703 prototype ready for test flying.

Below: The Madea 703 was built in two forms, with gull wing and straight wing. Here the straight wing version is shown on the jig.

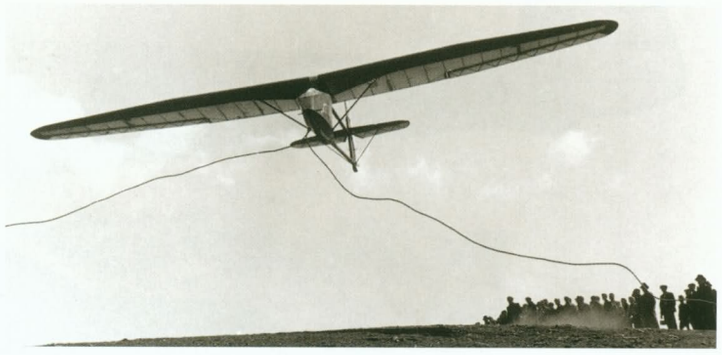
the same plan except that two were to have gull wings because these were fashionable in Europe. The third was to have a straight wing, perhaps simply to find out what, if any, difference it made.

Far from being a mere copy, the Maeda 703, 15 metres span, was an original design with a double tapered wing, mid wing fuselage junction, and a wing profile developed by the Japanese group from the American NACA five digit formula, the NACA 64016. This was 16% thick with the camber concentrated in the first 10% of the chord. As with all this series of profiles, the negative pitching moment was small and the maximum lift coefficient high. Special care was taken to control the wing tip stall with change of profile and washout.

The test flights showed the new sailplane to be very satisfactory with excellent handling and good performance. In February 1941 the pilot Kawabe established a new Japanese duration record of 13 hours, 41 minutes in a Maeda 703, landing in the dark by the light of flares on the airfield.

Further flying and manufacture was prevented by the demands of war, and in 1945 all gliders in Japan were destroyed. Maeda and Sato survived to produce further sailplanes in the post war period.

Chapter 21
Poland



Above: The Salamandra, designed in 1936 by Waclaw Czerwinski in Poland, filled the same role as the Grunau Baby but was an entirely original design.

Below: The Salamandra was produced in large numbers both before and after the Second World War.

Gliding in Poland, as in most countries outside Germany, began in a small way during the early nineteen twenties but became more popular after thermal soaring was discovered in 1928. There was considerable support from the State after 1930. Subsidised gliding centres were established and official specifications for a range of training and high performance sailplanes were issued.

Salamandra

Training methods in Poland followed the German style but the importation of German aircraft was discouraged. Design and production contracts were agreed with Polish aircraft companies. A specification drafted by the Ministry of Transport was met by the Salamandra of the WWS, Wojskowe Warszaty Szybowcowe (Military Aviation Workshops). The designer was Waclaw Czerwínski, already one of the leading Polish designers.

The Salamandra first flew in 1936 but was really much older in conception. In general layout and appearance it resembled the strut and wire braced CW - 2, a nacelled primary glider produced by Czerwinski in 1929. This had made the first soaring flights and duration records in Poland and had been developed and improved since. The Salamandra had a superior wing to give it a better soaring performance. It proved successful in its training role and became very popular. About 140 were built before 1939, with exports to the Baltic Republics, Finland and Yugoslavia.

After 1945 the Polish gliding movement, with the rest of the country, was devastated. Apart from sheer physical destruction and enormous casualties, the eastern and western frontiers were shifted some 200 kilometres westwards, displacing about half the population.

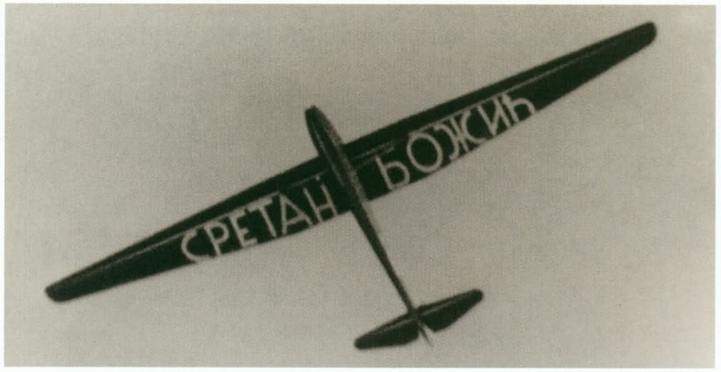
The gliding movement recovered and was given high priority by the State. The only surviving Salamandra was used as the basis for new drawings. Production began again, 223 being built. Fifty of these were exported to China and more were built there under licence. Meanwhile Czerwinski, the designer, forced to leave Poland during the war, had settled in Canada. There he produced the Sparrow and the Robin, almost unaltered from the original Salamandra.

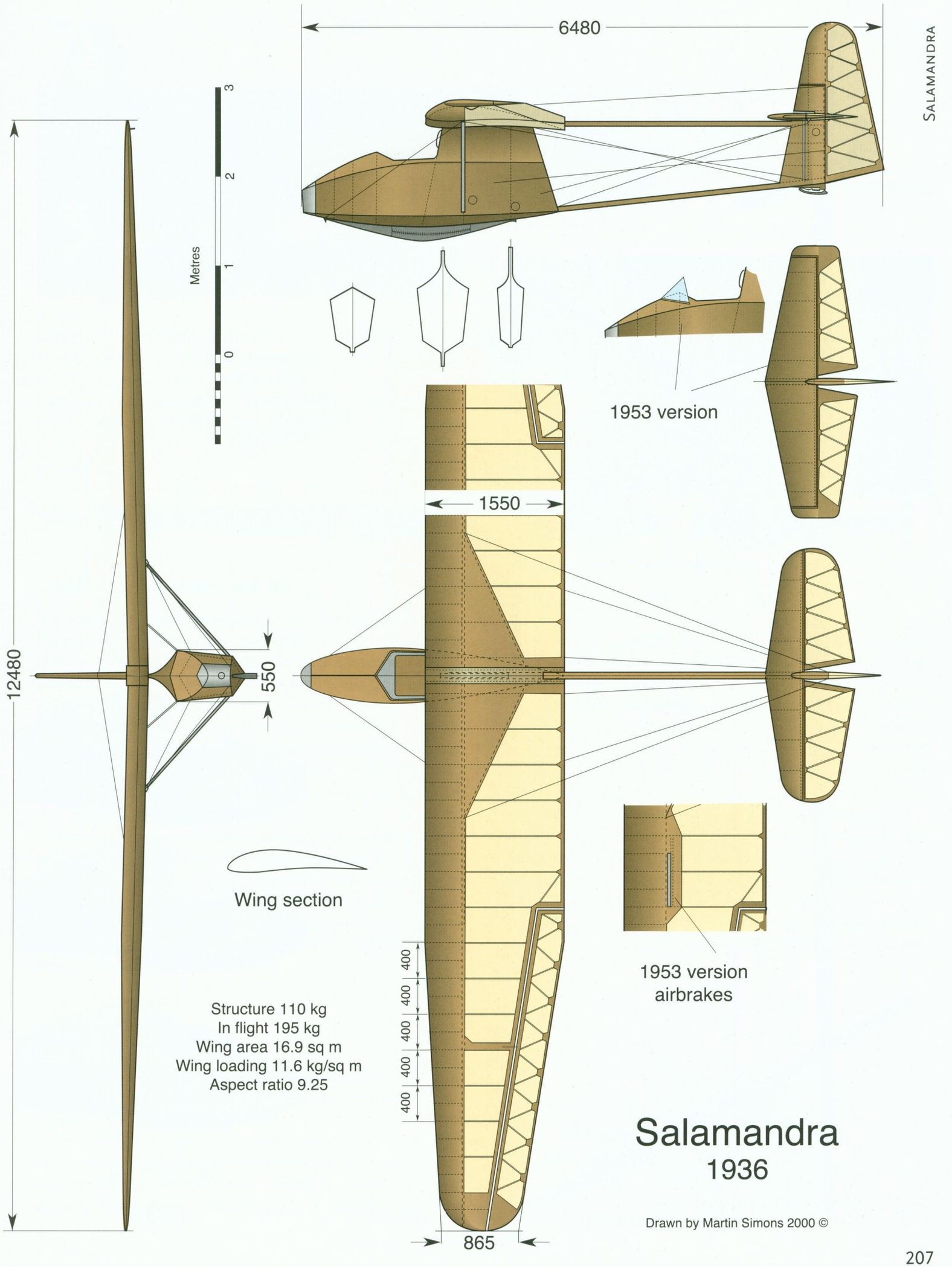
Although never approaching the production figures of the Grunau Baby, total production numbers for the Salamandra exceeded 500.

Komar

The Komar, first flown in 1933, was the Polish equivalent of the Professor or ESG 31. It was designed by Antoni Kojcan, using the Gö 535 wing profile tapering to Gö 549 at the tips. The fuselage was of the hexagonal box form with an open cockpit. The performance was good enough for cross country flying in thermals but structural deficiencies were discovered at high airspeeds. The structure was strengthened to produce the Komar bis. After this the Komar be-

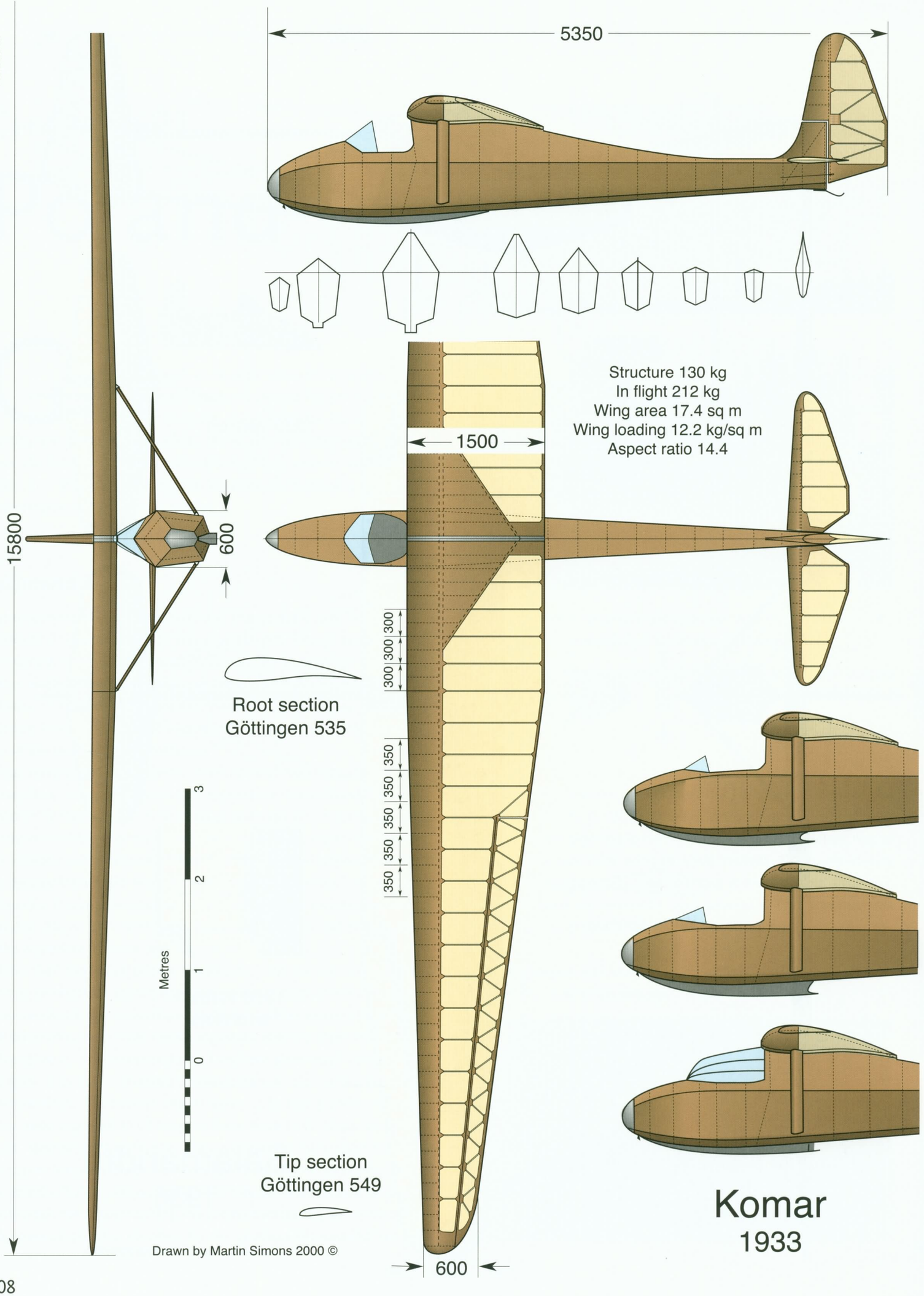
Below: Komar flying over Vrsac town in 1939. The inscription under the wing reads 'Merry Christmas' in the Serbian Language.





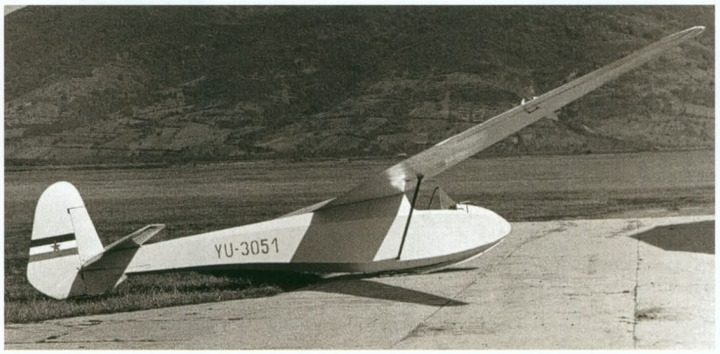
Structure 110 kg
In flight 195 kg
Wing area 16.9 sq m
Wing loading 11.6 kg/sq m
Aspect ratio 9.25

Salamandra
1936



Structure 130 kg
In flight 212 kg
Wing area 17.4 sq m
Wing loading 12.2 kg/sq m
Aspect ratio 14.4

Komar
1933



came the standard Polish sailplane for early cross country flying up to and beyond Silver C standard. The type was used to break records too. A Komar made the first flight across the Gulf of Finland in 1934, after a high aero tow from Estonia to glide 60 km to Helsinki. There were exports to Estonia, and in Yugoslavia the type was built under licence. Yugoslavian pilots in the 1937 International championships, flew Komars.

After World War 2, production of the Komar restarted in Poland, using a surviving set of drawings found in Yugoslavia.

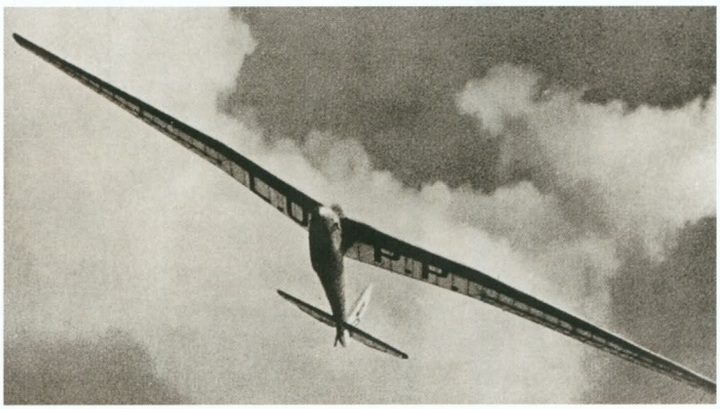
The SG 21 Lwow and the SG - 3

The association of aviation students at the Technical University of Lwow, ZASPL, were equivalent to a German University Akaflieg. In 1931, led by Stefan Grzeszczyk they designed a high performance sailplane, the SG - 21 Lwow. Influence from across the border was relatively slight. It soon broke all the important national soaring records and also undertook some long aero towed flights. The design was officially approved and an improved version, the SG - 28, was built. Both these sailplanes were taken to Germany to fly at the 1932 Rhön competitions and did well, though their performances were overshadowed by the German aces.

Following the success of these sailplanes Grzeszczyk developed the SG - 3 and SG - 3 bis/36. These became the most popular sailplanes in Poland and about 25 were built, with many successes in contests, cross country and record flights. They continued in use until 1938 when new airworthiness requirements required them all to be strengthened. The labour required was considerable and most were scrapped rather than modified.

Czerwinski CW 5

Waclaw Czerwinski, responding to an official requirement for a high performance sailplane designed the CW 5, which first flew in 1933. Although he was aware of the latest German developments, Czerwinski's design was original. He decided against using the extraordinary Gö 652 profile which Lippisch adopted for the Fafnir. The profile used was much thinner and less cambered, tested in a wind tunnel at the Warsaw Aerodynamic Institute. The wing had a 'gull' form



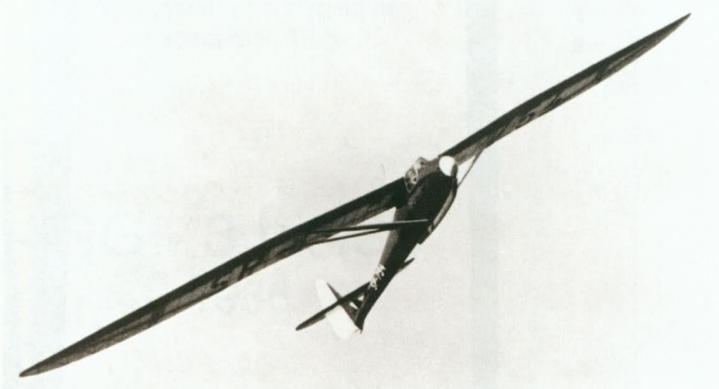
Left above: Komar bis on the airfield at Vrsac.

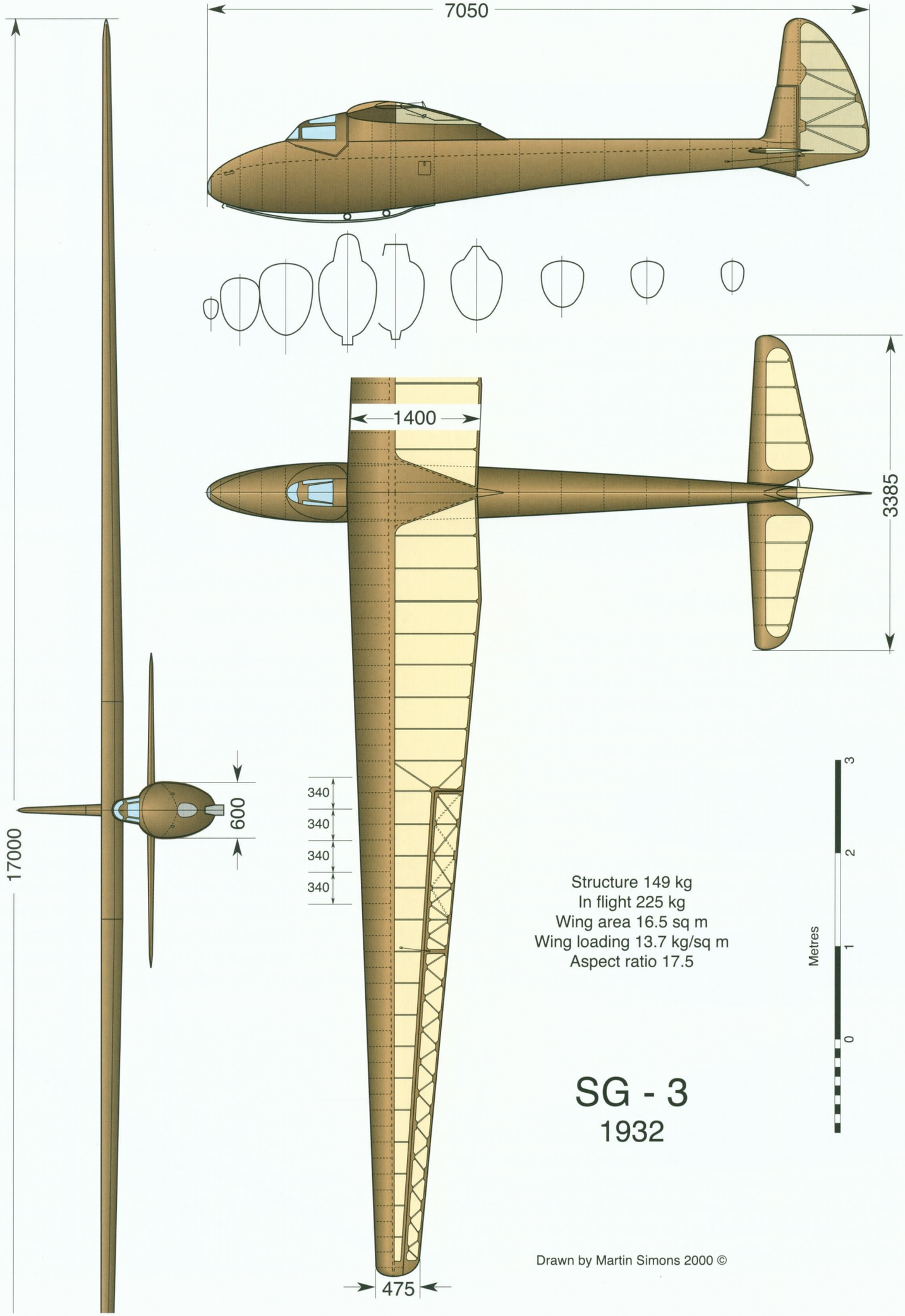
Right above: The Polish SG 28 above and below the SG - 3 bis/36.

Below on this page: The polish CW 5 bis/35.

of dihedral and a very high aspect ratio for its period, over 18. With elliptical taper of the outer panels only, the root was quite thin, leaving little room for a strong main spar. V struts were necessary. The ailerons tapered to almost nothing at their inner ends, to reduce turbulence and drag when deflected. The tail unit was particularly unusual. The all moving elevator was mounted on twin pylons, well clear of the ground, ahead of the fin. The fuselage had a high, narrow pylon to support the wing, and the cockpit was open.

The CW 5 was successful but was modified and developed to produce the CW5bis/35, which had an entirely new fuselage with elliptical cross section and a fully enclosed cockpit. This was produced in quantity and was one of the main types used in Poland for advanced flying until the outbreak of war in 1939. A single example was entered for the 1937 International Championships. The pilot, Zbigniew Zabski, made some excellent flights, placing eighth in the final list.

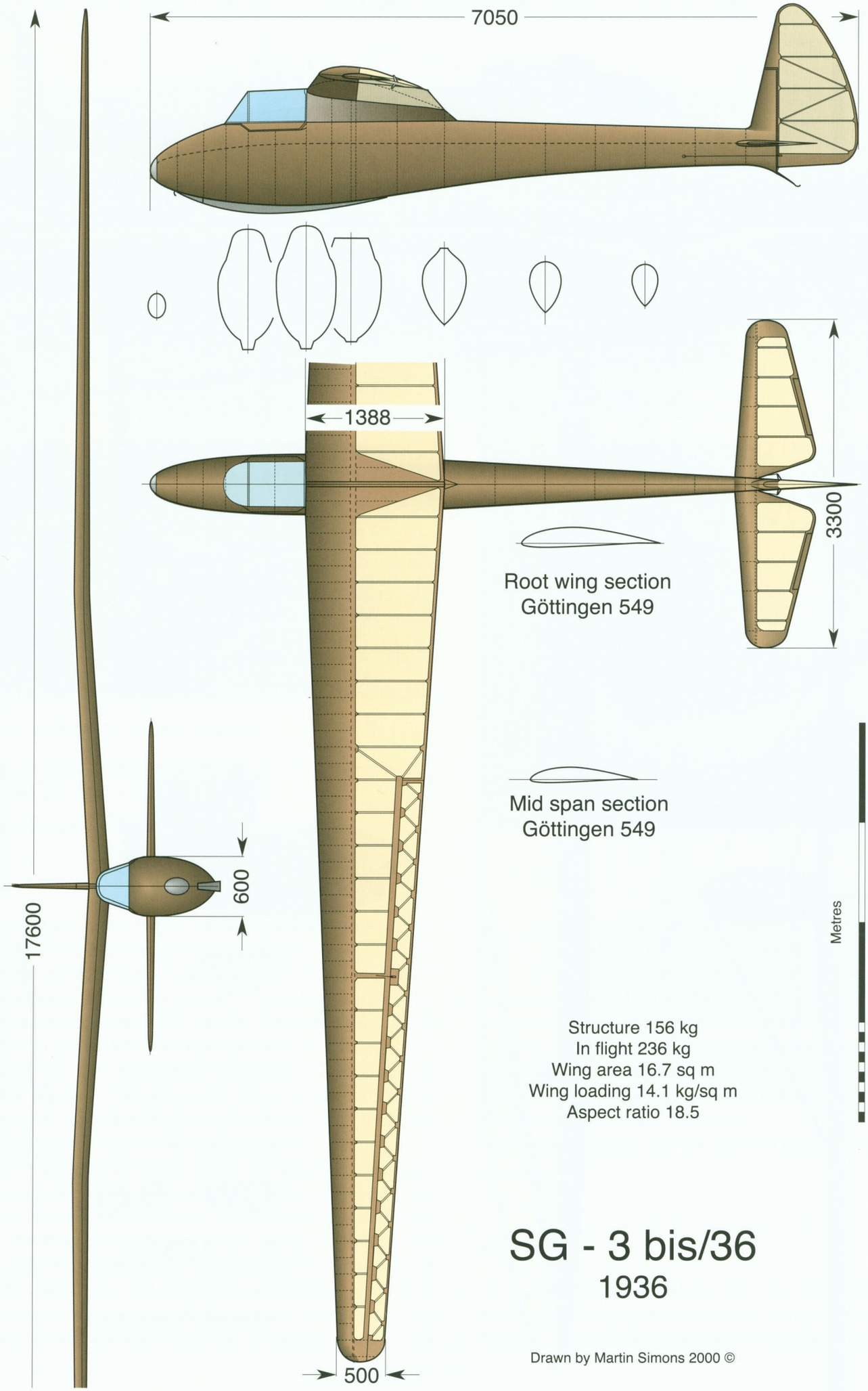




Structure 149 kg
In flight 225 kg
Wing area 16.5 sq m
Wing loading 13.7 kg/sq m
Aspect ratio 17.5

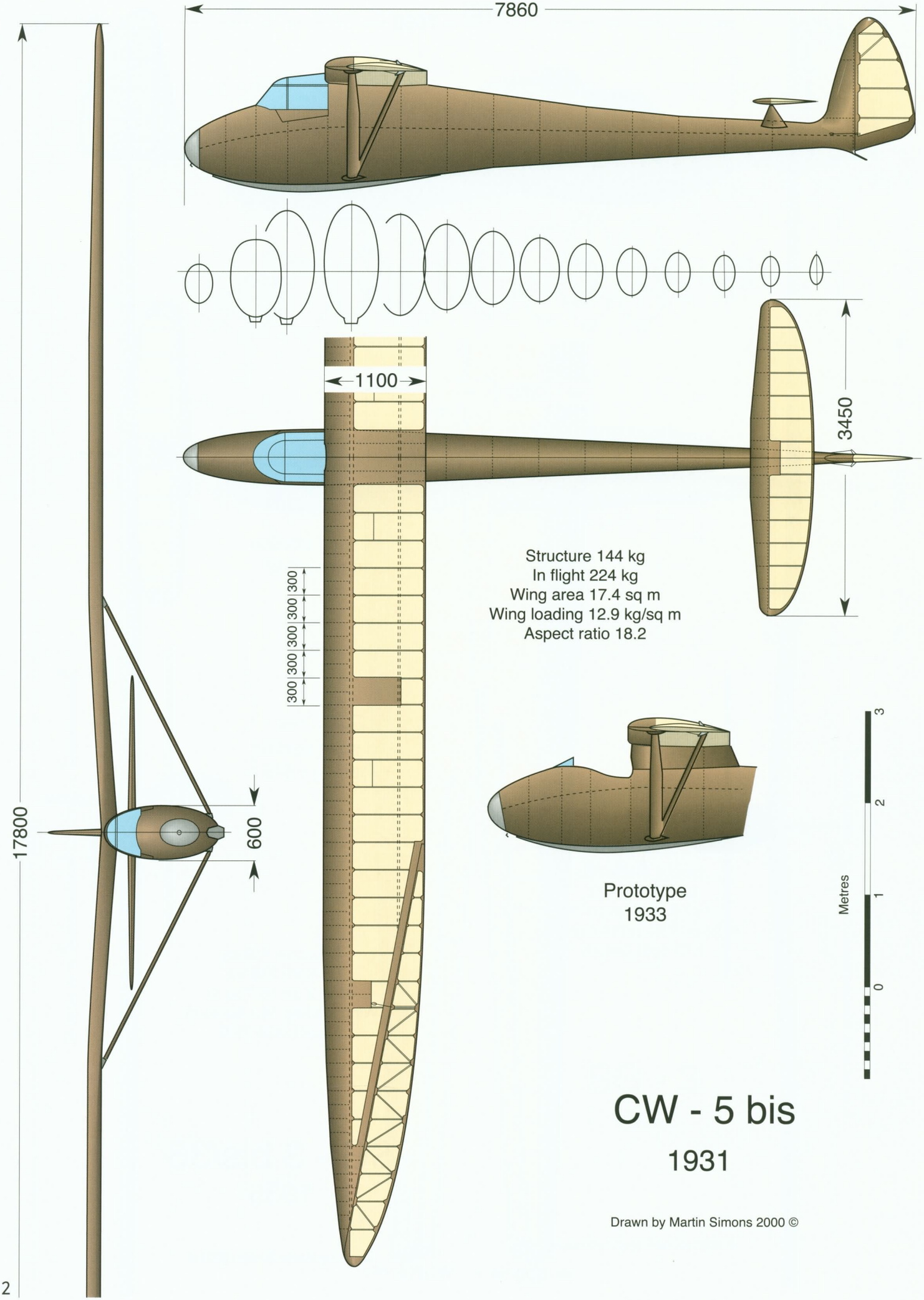
Metres 0 1 2 3

SG - 3
1932



Structure 156 kg
In flight 236 kg
Wing area 16.7 sq m
Wing loading 14.1 kg/sq m
Aspect ratio 18.5

SG - 3 bis/36
1936



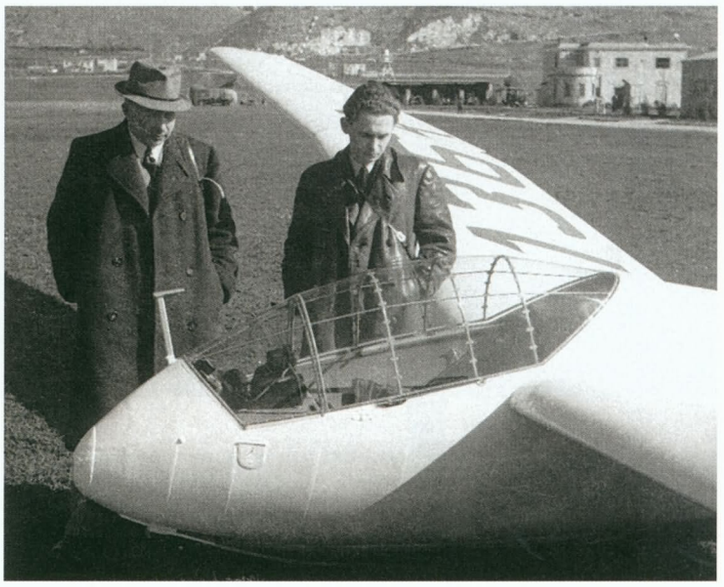
Structure 144 kg
In flight 224 kg
Wing area 17.4 sq m
Wing loading 12.9 kg/sq m
Aspect ratio 18.2

Prototype
1933

CW - 5 bis

1931

Drawn by Martin Simons 2000 ©



Above: The Orlik in America, soon after arriving there.

Left: Two of the Orlik (Numbers 1 and 3) and a PWS 101 (No. 4) in line at the 1937 Internationals with a Condor and the Mü 13 (No. 20).

Right: The Olympic Orlik at Sezze.

Orlik

Unlike the other entries for the Olympic sailplane design competition in 1939, the Orlik, designed by Antoni Kocjan, had existed for some time and was already in production, well proved and successful before the sailplanes were required to assemble for judgment at Sezze in Italy. Two of the earlier version, which had span slightly less than 15 metres, were entered and flown by Baranowski and Brzezina at the 1937 International Competition in Germany and surprised everyone, especially perhaps the German pilots, by scoring very well. Baranowski made a flight over 300 km to land near Berlin and placed seventh in the final score sheet.

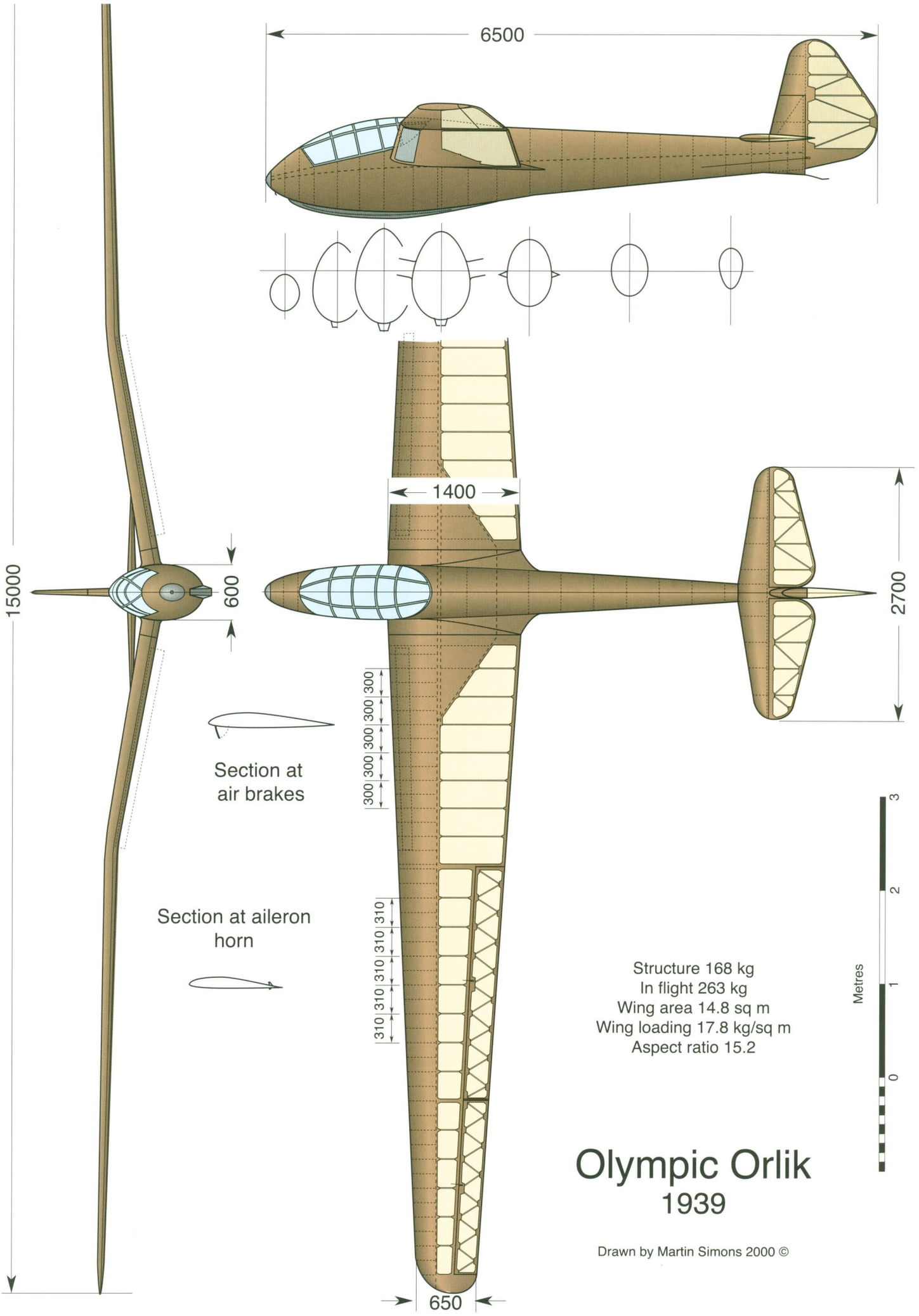
The Olympic Orlik or Orlik 3 was the full fifteen metres in span, with a carefully designed contoured canopy built up on a light metal frame. In terms of glide ratio the Orlik was almost certainly superior to the winning design, Hans Jacobs' Meise, but performance was not the main criterion for the Olympics. Everyone would be flying the same design, so a point or two off the glide would not affect the results. Construction of the Orlik was complicated by the gull wing and the mid wing mounting. In addition, the type of air brakes used, hinged to open downwards and backward under the leading edge of the wing near the root, was unfamiliar.

A single Orlik 2 was sent to the USA for the New York World Fair in 1939. It remained in the USA during the Second World War and afterwards was sold there to Paul MacCready. He used it to win the 1948 and '49 US National Championships and made a climb in wave to more than 9000 metres on the last day of 1948. This world record was broken the next day by John Robinson with a climb to 10211 metres in the RS - 1 (See below).

This Orlik 2 survives and was flown at the 1995 vintage sailplane meet at Elmira.

PWS 101

Waclaw Czerwinski moved to the PWS (Podlaska Wytwornia Samolotow, Podlasian Aeroplane Plant) as chief designer in 1937. Sailplane production was regarded as a minor interest of the compa-



Olympic Orlik
1939

ny but Czerwinski produced the PWS 101 in time for two examples to be sent to the International Competitions in 1937. They were equal to best German sailplanes and performed very well indeed. On the first day, the pilot Mynarski was one of three to achieve a flight to Hamburg, 351 km, the others being Hanna Reitsch in the new Reiher and Heini Dittmar, eventual champion, in the Fafnir 2.

Several more of the PWS 101 were built in Poland after this. In 1938 Tadeusz Gora made an outstanding distance flight of 577.8 km, which was a Polish national record and the longest flight by a sailplane in Europe that year. It was not a world record because 652 km had been achieved in the USSR by Rastourgyev in the GN - 7 (see below) the previous year.

Above: PWS 101 launched from the Wasserkuppe, 1937.

Below: PWS 101, showing the well shaped cockpit canopy.

PWS 102

Czerwinski followed the PWS 101 with the PWS 102 Rekin (Shark) in 1939. Two prototypes were built. It was very advanced, fitted with large camber flaps over the inboard wing panels, mass balanced ailerons, and automatic coupling of all controls when rigging. Light alloys were used for the main fittings. The maximum permitted airspeed was 300 kph. Test flying was not completed before the outbreak of World War 2. The immediate occupation of the whole of eastern Poland by the USSR late in 1939, brought all sport flying and manufacture to an end. The two completed Rekins were taken to the USSR and their fate is unknown.

PWS 101
1937

Structure 270.6 kg
In flight 354.5 kg (with 50 kg ballast)
Wing area 18.9 sq m
Wing loading 18.76 kg/sq m
Aspect ratio 19

Slotted alerons
(Schematic)

Airbrakes open
(Schematic)

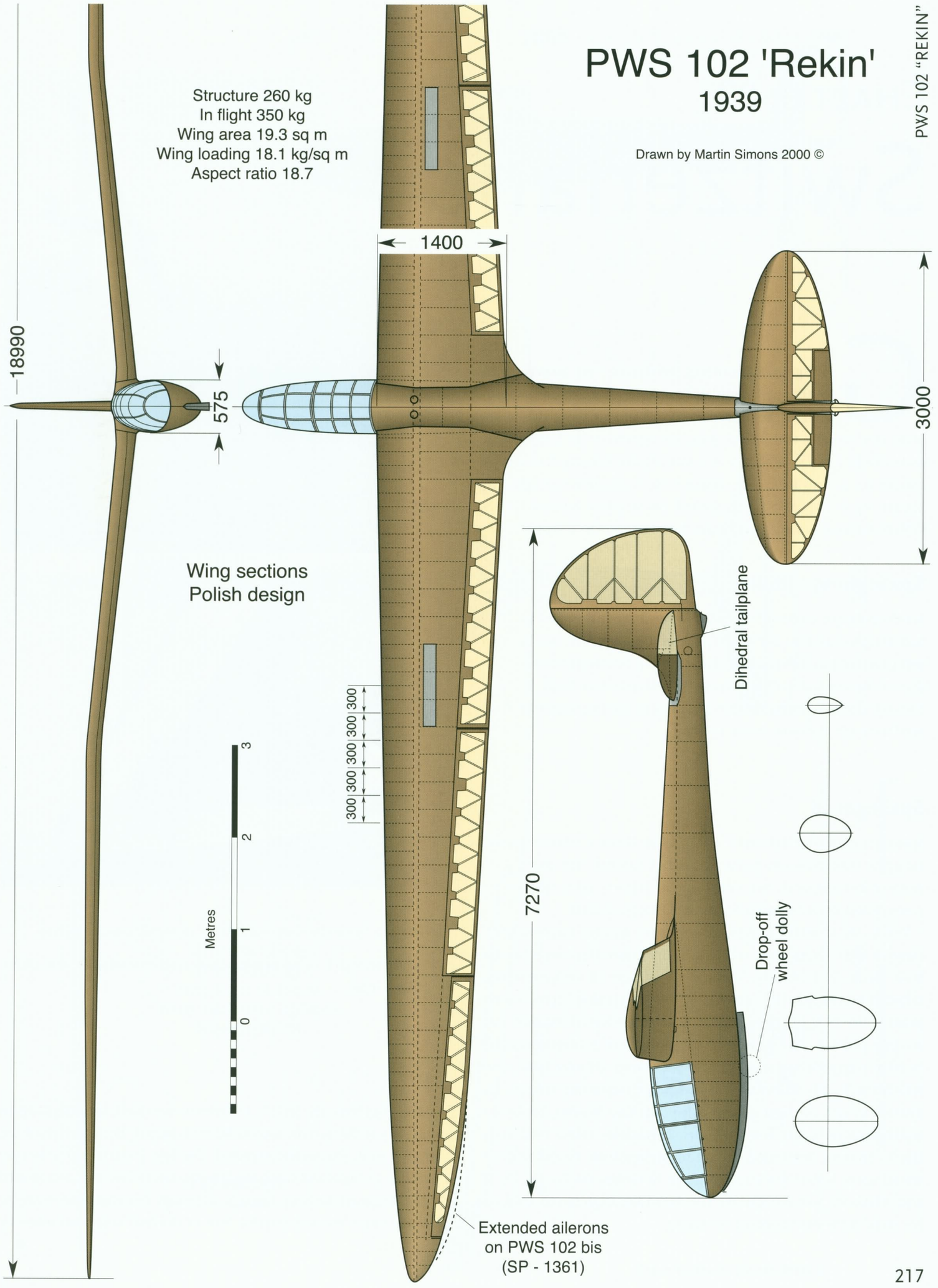
Root section
Göttingen 549
thickened to 16%

Mid span section
Göttingen 549
13.85%

Tip section
Göttingen 564
(G 549 thinned to 8%)

PWS 102 'Rekin'
1939

Structure 260 kg
In flight 350 kg
Wing area 19.3 sq m
Wing loading 18.1 kg/sq m
Aspect ratio 18.7



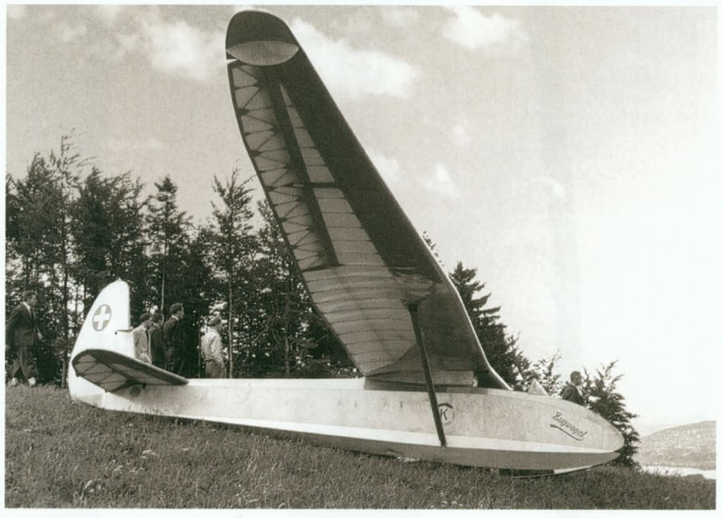
CHAPTER 22

Switzerland

Gliding in Switzerland developed very slowly until 1930. It was stimulated greatly by the German expeditions to the Jungfrau in 1932 and after this the movement grew steadily, with some encouragement from the government and military interest in gliding as a part of pilot training. The special conditions prevailing in the Alpine valleys required special techniques but as experience was gained, Swiss pilots became highly skilled and local designers and manufacturers were well supported.

Spalinger 15

Jakob Spalinger attended the 1920 Rhön competition and by 1930 had designed and built a dozen different gliders. The Spalinger 15 was produced in 1934. It fulfilled a role in Switzerland similar to that of the Grunau Baby and more than twenty were built. In experienced hands it proved capable of excellent soaring flights and was used for some duration record flying.



Above: The S - 15 was extensively used for alpine soaring and cross country flying.

Below: The Spalinger S - 15 was an original Swiss design intended for the same roles as the Grunau Baby.

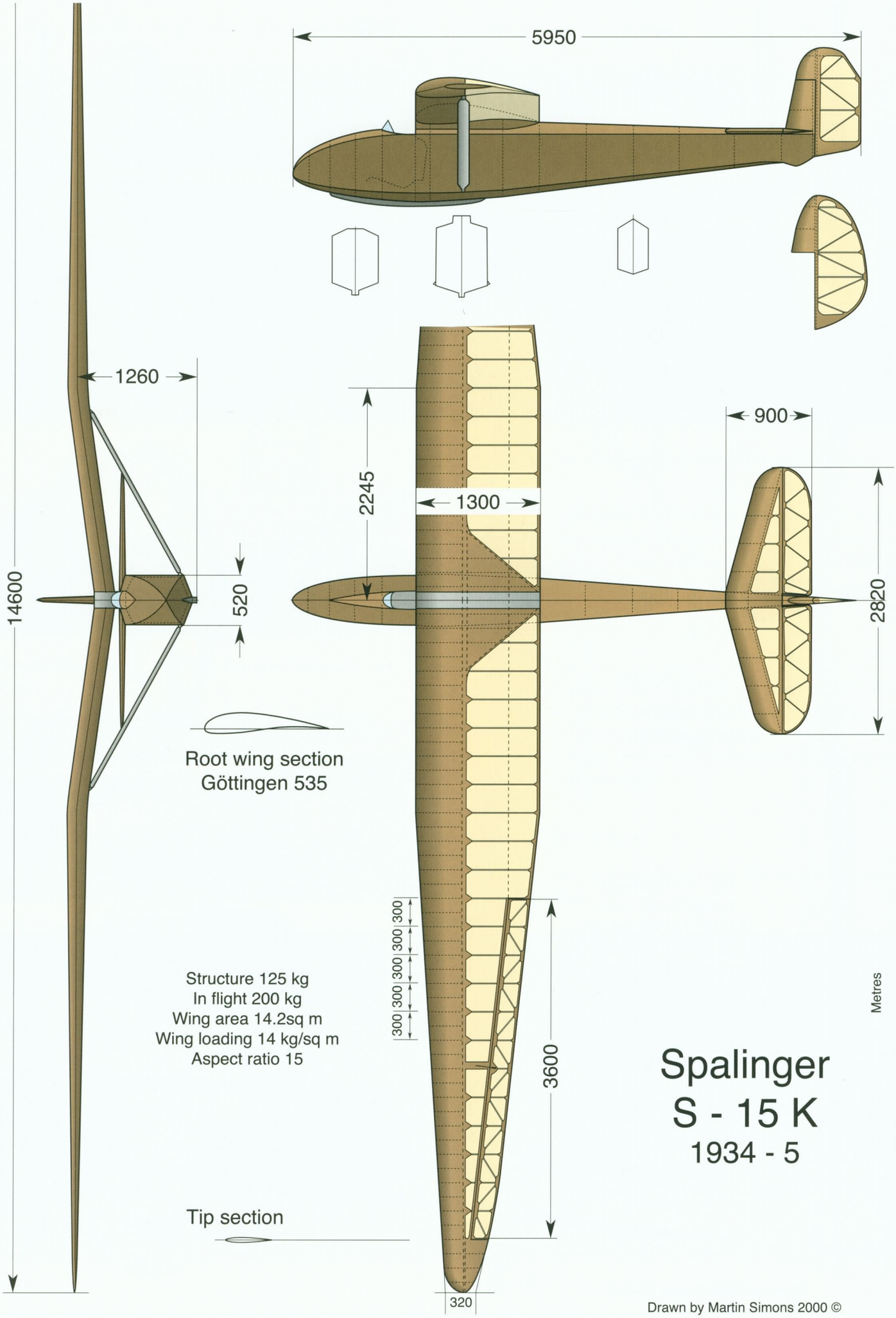
Spalinger 18

Spalinger produced the first S - 18 in 1936. It was a relatively small sailplane with moderate performance but handled well and was capable of development. Two were taken to Berlin to participate in the competition there in parallel with the Olympic Games.

The S - 18 - II with a larger span and other detailed improvements came in 1937. Using plans supplied by Spalinger, Herman Schreiber built the S - 18 T Chouca. This was a Spalinger 18 with additional dihedral for the sake of improved stability in circling flight. It competed in the 1937 Internationals in Germany, where it did well. Production of the S - 18 - II continued and the type became dominant in Swiss competitions and record flying. About 25 were built, after which the S - 18 - III, with air brakes and a contoured canopy, appeared. In one of these the French pilot, Eric Nessler, broke the world duration record with 38 hours, 21 minutes. Other versions of the S - 18 were developed, including an aerobatic model with reduced span, before Spalinger went on to design the S - 19, 21, 22 and others. He was awarded the FAI Tissandier Diploma in 1969, for his work in the development of soaring.

Spyr 3

August Hug built the Spyr 1, a fifteen metre single seat sailplane, in 1931. It was flown with success by Willi Farner, taking off from the Jungfraujoch. Two were completed. The Spyr 2 was found to be over sensitive in flight and had a tendency to tail flutter. Hug abandoned it and designed the Spyr 3 which, although still somewhat tricky to fly, was much more successful. Two of the four sailplanes taken by

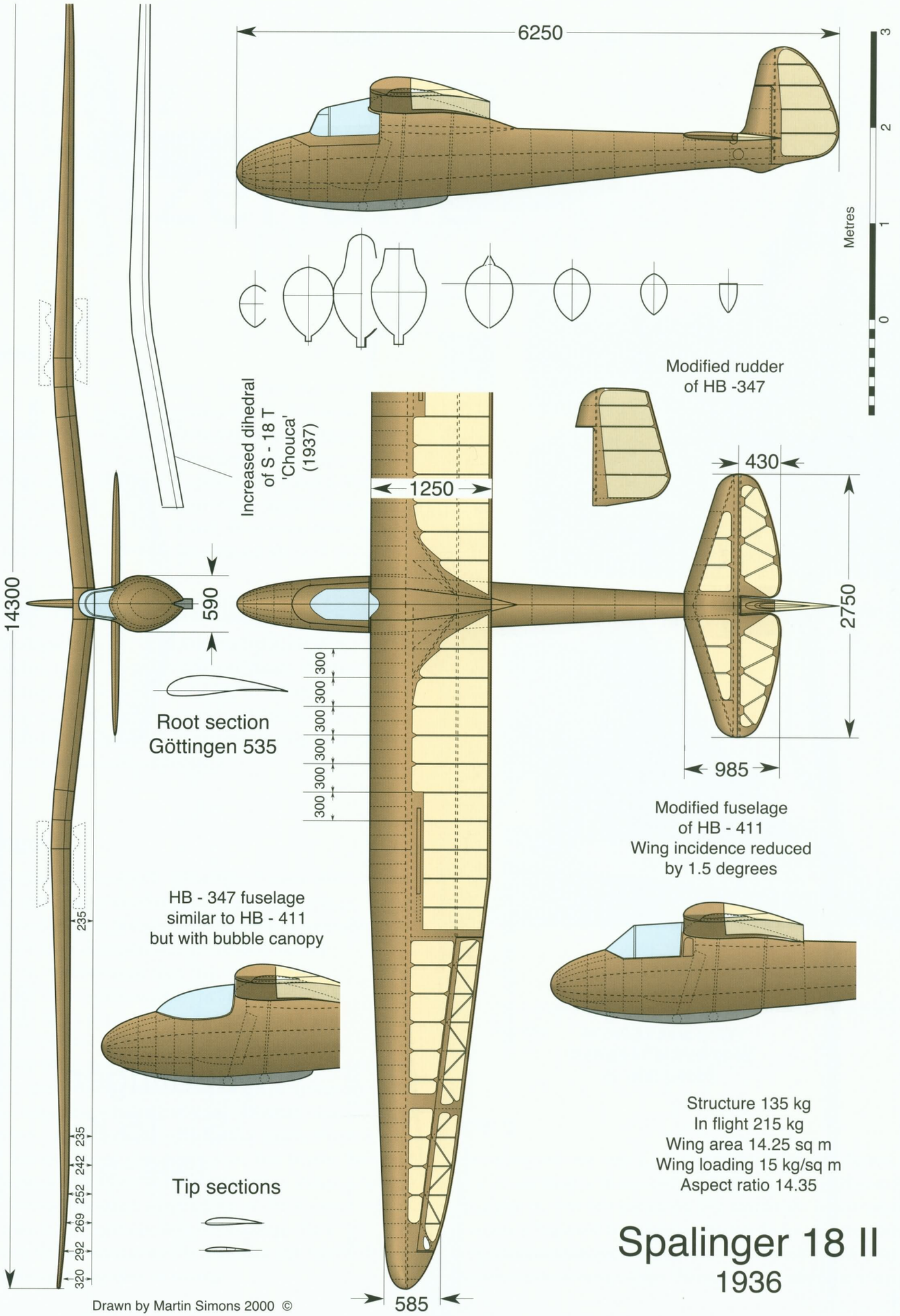


Root wing section
Göttingen 535

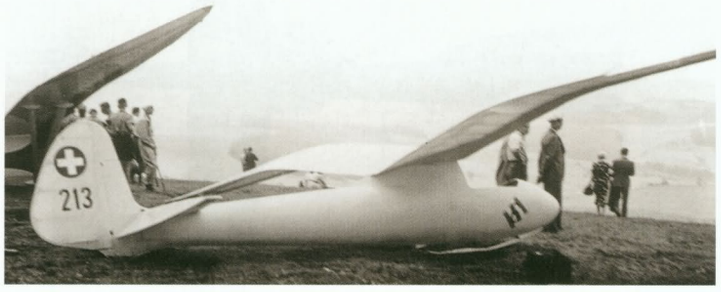
Tip section

Structure 125 kg
In flight 200 kg
Wing area 14.2sq m
Wing loading 14 kg/sq m
Aspect ratio 15

Spalinger
S - 15 K
1934 - 5


6250
Metres
0
1
2
3
Modified rudder
of HB -347
Increased dihedral
of S - 18 T
'Chouca'
(1937)
14300
1250
430
2750
590
985
300
300
300
300
300
300
Root section
Göttingen 535
Modified fuselage
of HB - 411
Wing incidence reduced
by 1.5 degrees
HB - 347 fuselage
similar to HB - 411
but with bubble canopy
235
235
242
252
269
292
320
Tip sections
585
Structure 135 kg
In flight 215 kg
Wing area 14.25 sq m
Wing loading 15 kg/sq m
Aspect ratio 14.35
Spalinger 18 II
1936
Drawn by Martin Simons 2000 ©

Above: Sparlinger S18T 'Chouca' in the Rhön with Marcel Godinat, 1937.



Above: The Special Spalinger 18T, 'Chouca', with extra dihedral, at the Internationals in 1937

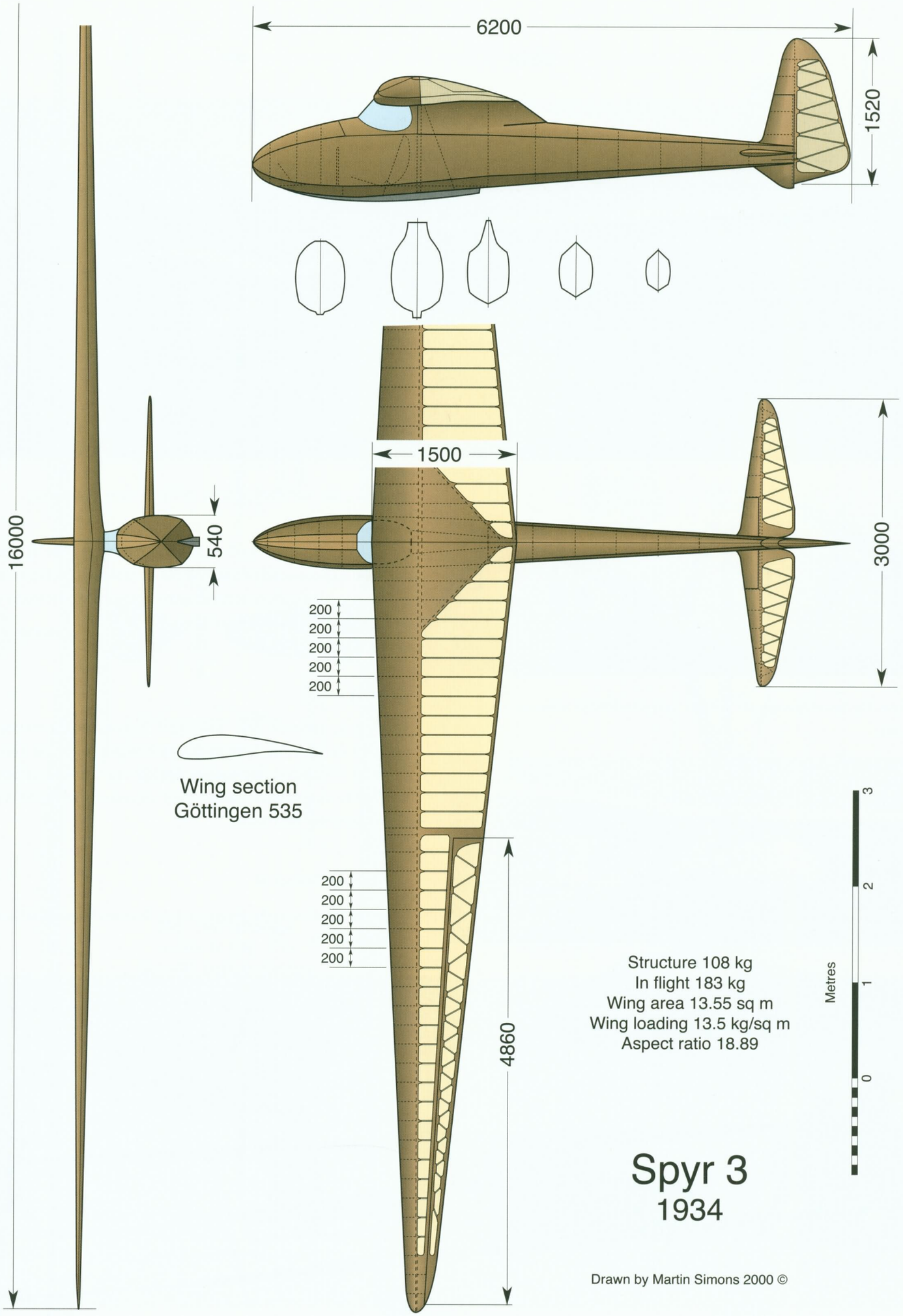
the Swiss team to the 1937 Internationals, were Spyr 3s. Sandmeir, the most experienced of the four pilots, finished fourth in the final scores, an outstanding achievement against the Germans in their much larger and more refined aircraft.

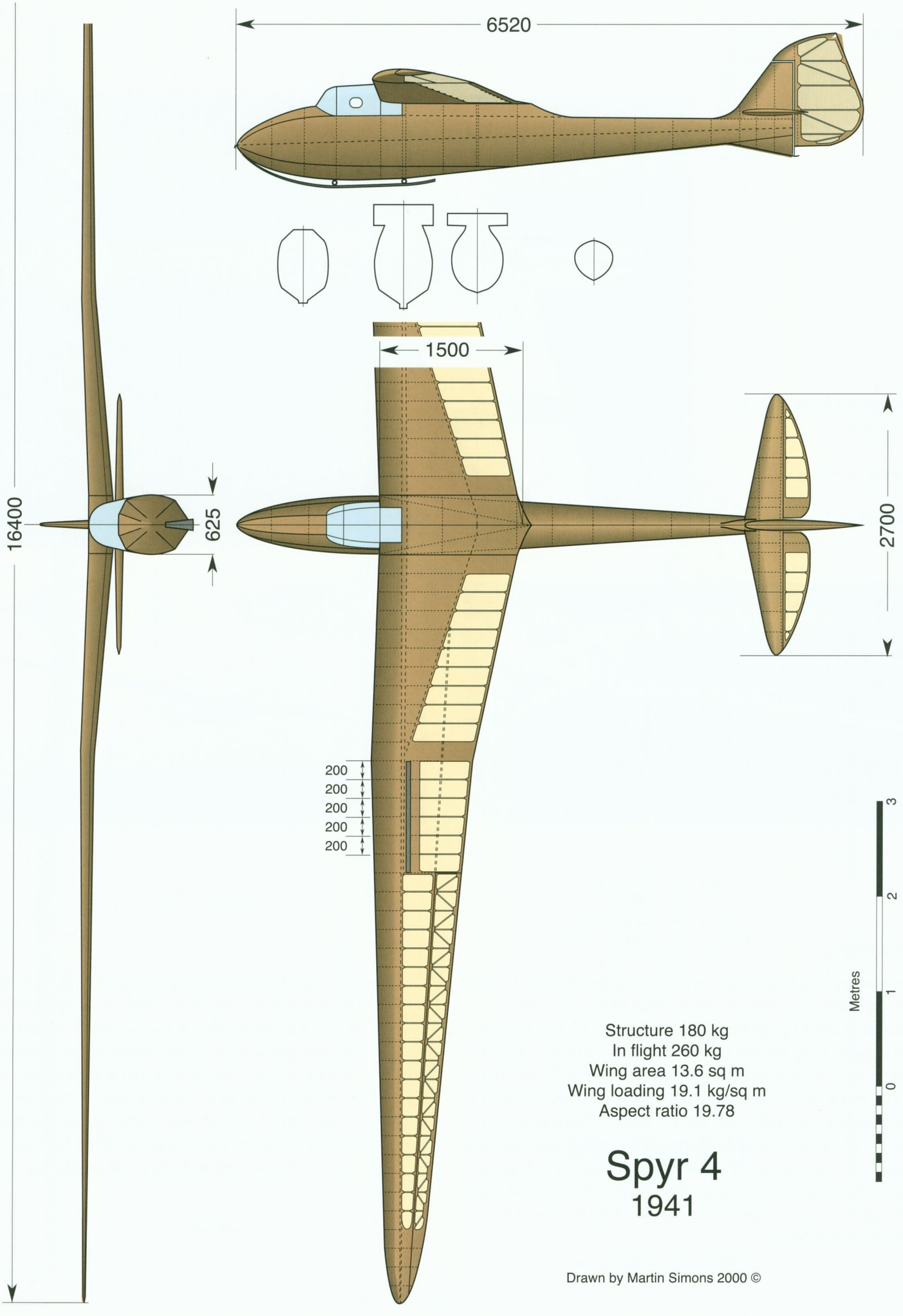
Spyr 4

The Spyr 4, flown in 1941, was larger, heavier and faster than Hug's previous design and, with its swept forward gull wing, was greatly admired. It handled well and if political conditions had been more favourable, might have proved itself a good cross country sailplane. In fact very few were built.

Left: A standard Spalinger 18 - 1

Below: The Spyr III on the Jungfraujoch in 1935. Snow and high altitude made operations difficult.


6200
1520
16000
540
1500
3000
200
200
200
200
200
Wing section
Göttingen 535
200
200
200
200
200
4860
Structure 108 kg
In flight 183 kg
Wing area 13.55 sq m
Wing loading 13.5 kg/sq m
Aspect ratio 18.89
Metres
0
1
2
3
Spyr 3
1934
Drawn by Martin Simons 2000 ©



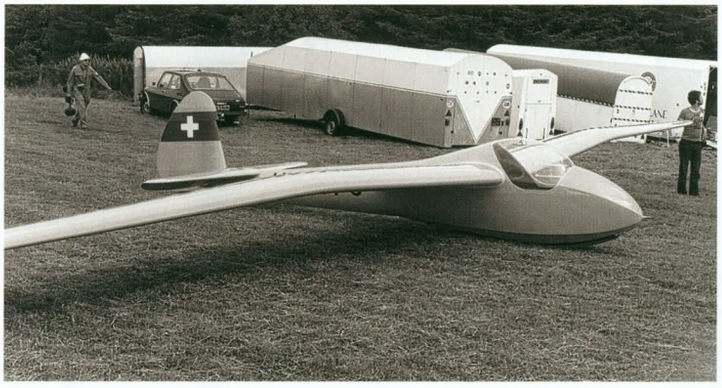
Structure 180 kg
In flight 260 kg
Wing area 13.6 sq m
Wing loading 19.1 kg/sq m
Aspect ratio 19.78

Spyr 4
1941

Right above: The Moswey 2, restored to fly in recent times.

Left below: The Moswey 3.

Right below: The Moswey 2A had the wing span extended to 15.5 metres.

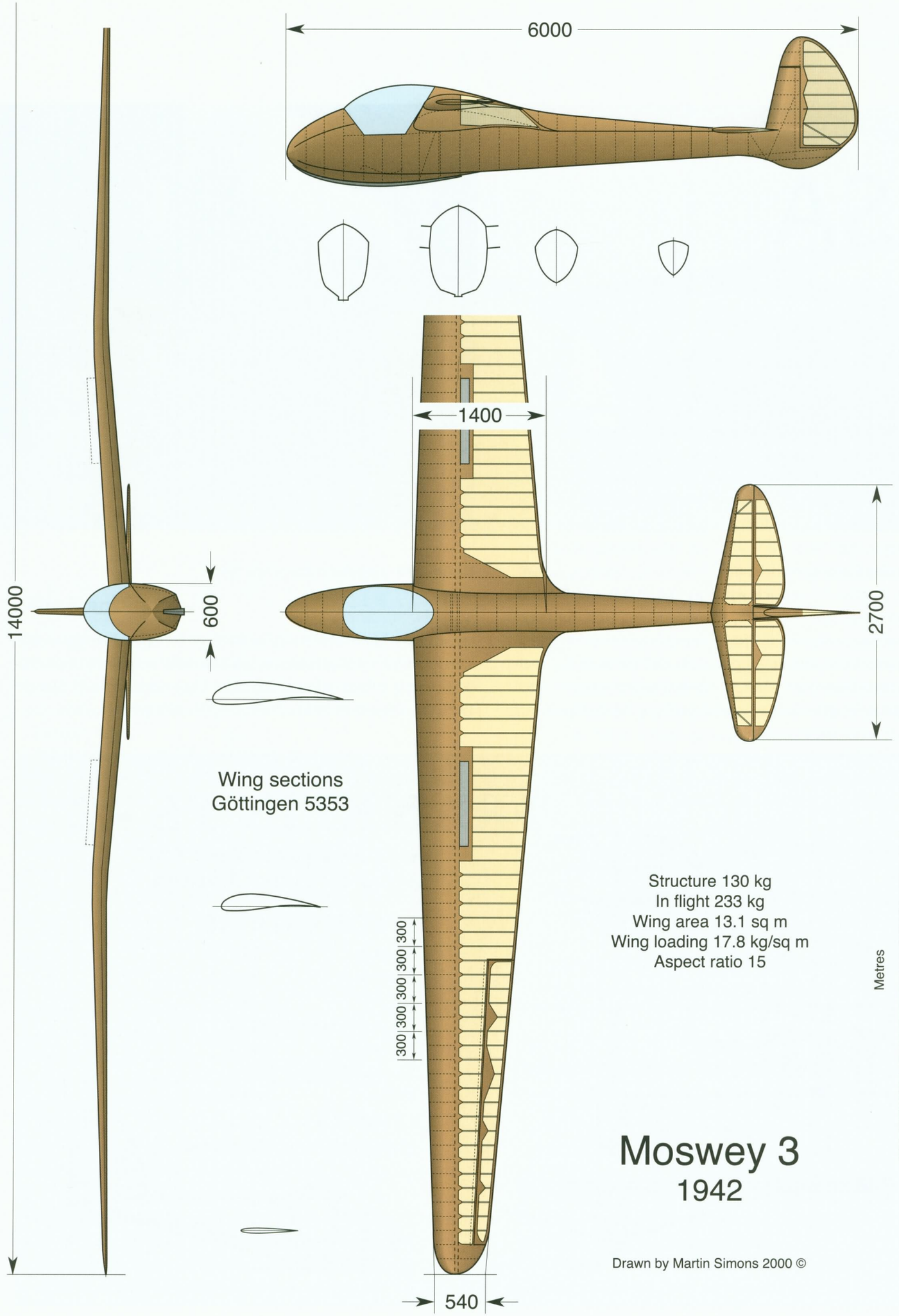


Moswey

The Moswey sailplanes began in 1930 with the Moswey 1 which was a primary glider, built by the brothers Müller. They worked for some years building sailplanes for August Hug but in 1935 Georg Müller alone designed and built his Moswey 2. It was a very neat, small sailplane which performed and handled well. It was stressed to a 'g' factor of 12 and was aerobatic. The very high standard of workmanship achieved by Müller was greatly admired and distinguished all his later products. The metal fittings in particular were made with utmost precision and fitted like the parts of a high class watch. The woodwork was equally good. One of the Swiss sailplanes entering the International Competitions in 1937, was the Moswey 2 flown by Heiner Müller.

The Moswey 2A of 1939 had the span increased to 15.5 metres, with an improvement in performance but some deterioration in handling. It was followed in 1942 by the Moswey 3, which reverted to a smaller span. There were various detailed improvements, including a moulded cockpit canopy in two halves joined on the centre line, and improved fairing at the wing root. The type went into production after 1945. Fourteen were built. The first world record for speed round a 100 km triangle was set by Sigbert Maurer.

Two or three of the Mosweys and a post war version, the Moswey 4, survive.


6000
14000
600
1400
2700
Wing sections
Göttingen 5353
300
300
300
300
300
540
Structure 130 kg
In flight 233 kg
Wing area 13.1 sq m
Wing loading 17.8 kg/sq m
Aspect ratio 15
Metres
0
1
2
3
Moswey 3
1942
Drawn by Martin Simons 2000 ©

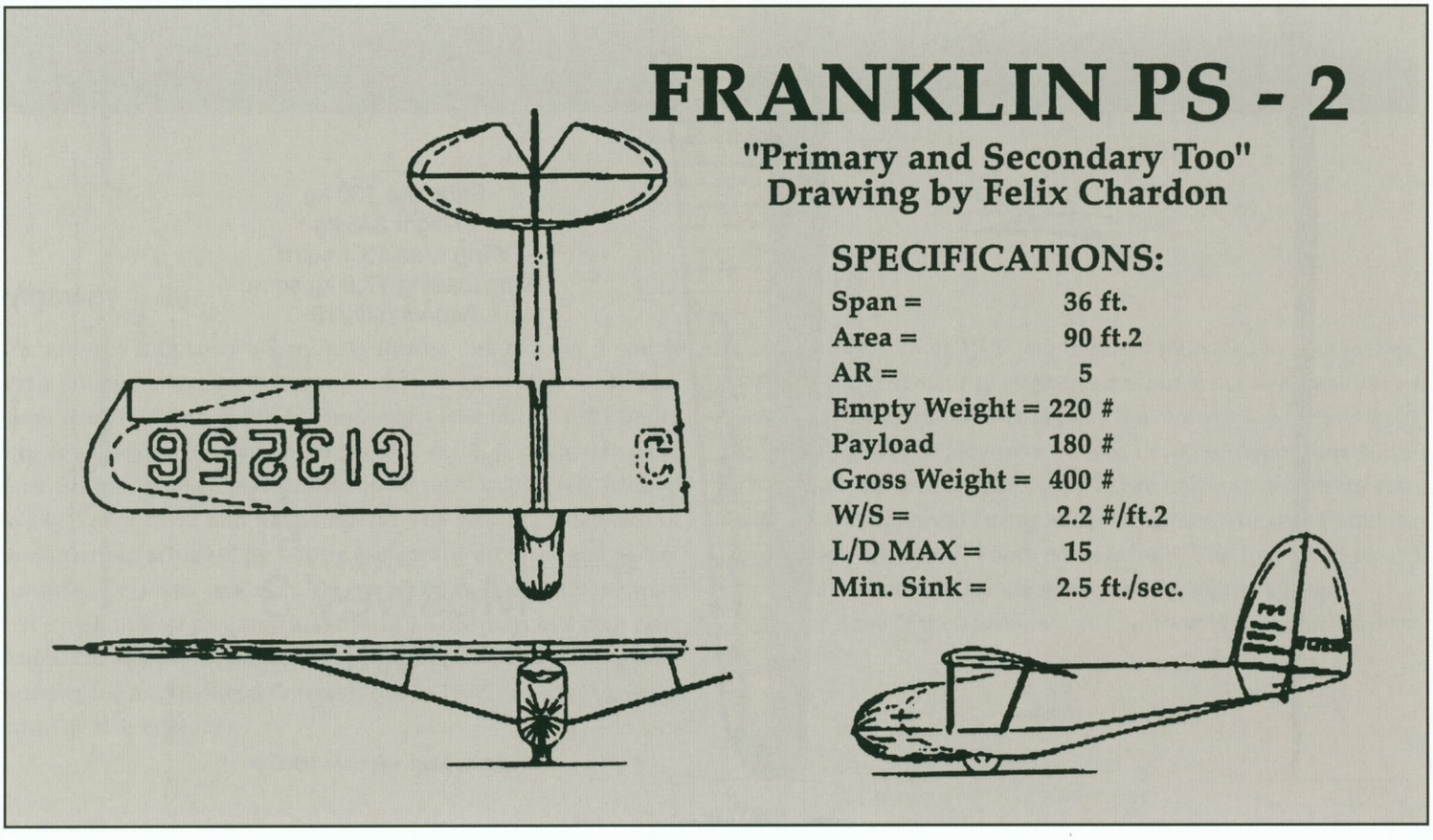
Chapter 23

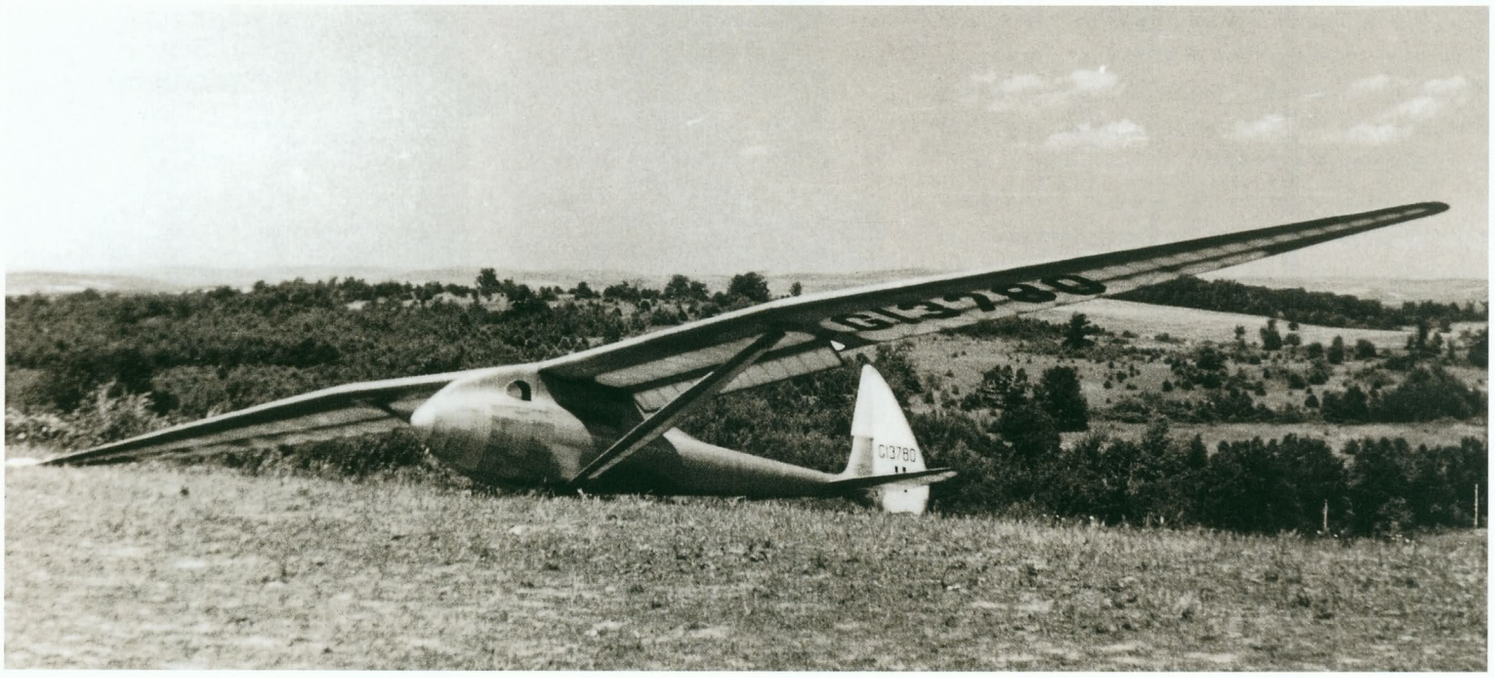
USA

The Franlin PS - 2 launched at Elmira, New York.

The Wright Brothers flew gliders at Kitty Hawk in order to solve the problems of controlling an aircraft before they ventured to instal a power plant. Their success in flying the first aeroplane in 1903, is largely due to these early gliding trials. Apart from one brief season in 1911 when Orville returned to the sand dunes to fly a glider again, with some soaring, there was little interest in the USA in gliders, except for a handful of enthusiasts like Hawley Bowlus (see below).

The visit of Peter Hesselbach with the Darmstadt and Prüfling sailplanes to Cape Cod in July 1928, aroused interest, with front page stories in national newspapers. The National Glider Association was formed early in 1929, with ambitious plans. In June of that year an article 'On the wings of the wind' by Howard Siepen was published in the National Geographic Magazine, describing the developments in Germany. The arrival from Germany of Wolfgang Klemperer was a further important stimulus. Ralph S Barnaby soared the imported Prüfling for fifteen minutes over the Cape Cod dunes in August 1929, the first American to achieve the 'C' soaring badge.





The Bowlus Albatross owed something the Wien but had many original features.

The Franklin PS – 2

Many gliding clubs in the USA, as elsewhere, began in the late nineteen twenties by building primary gliders from German plans. Local amateurs and some professional producers modified the design in various ways but the basic principles were not changed at first.

Dissatisfaction with German methods was soon felt. The objections were not to solo training as such but to the bungee launching method requiring a hill site and so much hard physical work with such slow progress. The auto towed launch from flat ground was adopted before it was used in Europe. The Americans also used aero towing. An earlier Franklin glider, the 50 foot span Texaco Eaglet, was towed by a WACO 10 aeroplane in stages across the continent from San Diego to New York as early as 1930. For both methods of operation, and for easier handling of the glider on the ground, a wheel was essential.

An influential article in the November Aero Digest by A P Artran, President of the Franklin Glider Corporation, set out the arguments and announced the development of a new glider, intended for basic training and yet capable of soaring and aerobatics. This was the Franklin PS – 2, standing for ´Primary and Secondary too'. The designer was R E Franklin.

The span was a modest 36 feet. It was a very robust glider with steel tube framed, fabric covered fuselage and a wheel. The wooden wings, of two spar construction, were braced with struts rather than the numerous wires of the Zögling. Rigging and de-rigging were much easier. The structure was very light to keep the flying speed low. For early ground slides and hops the seat could be fully exposed like an orthodox primary glider but a light fairing was usually fitted to enclose the pilot and improve the airflow.

The Franklin proved itself fully up to expectations and was very popular. Some 54 were built, by far the largest number of any single type of glider in the USA at that time. They were used not only for training but for aerobatic displays and trials with the so-called Lustig Sky Train, which was intended to demonstrate the practicality of using gliders to transport goods and mails. Three Franklins were towed together in line astern, to release in sequence to glide down to their various destinations. The idea did not catch on.

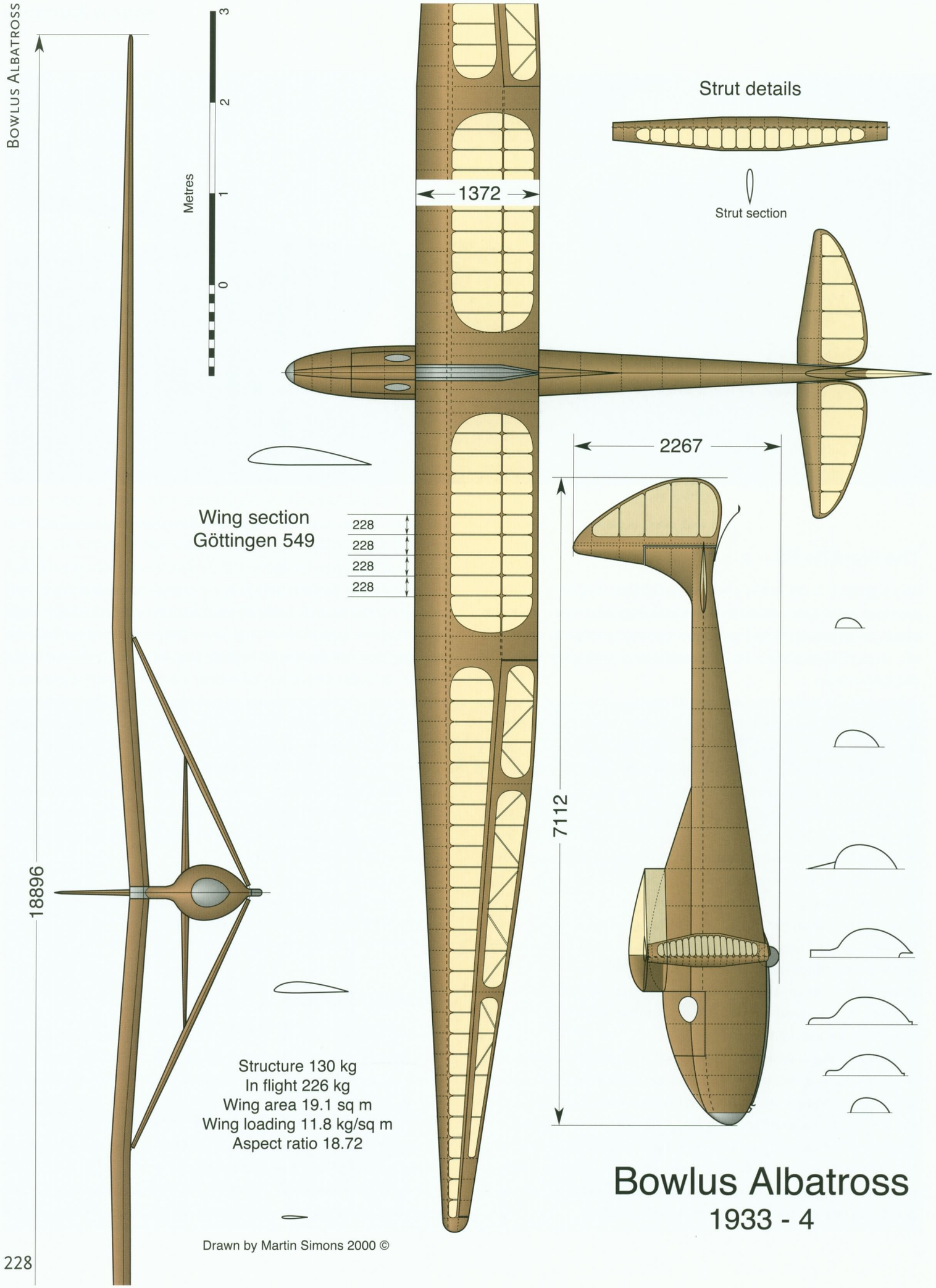
It was a Franklin PS – 2 piloted by Jack O`Meara that flew over New York City in 1930, a few weeks before Wolf Hirth`s soaring flight after a bungee launch from the banks of the Hudson (See Chapter 2), and Stan Smith won the National Soaring Championship in 1933 with a PS – 2.

Only one PS – 2 survives in flying condition now. It was restored by Charles Franklin, Joe Feather, Jack and Dorothy Wyman in time for the 1995 Vintage Glider Meet at Elmira.

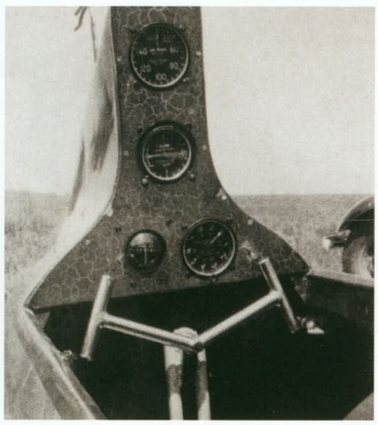
Bowlus Albatross

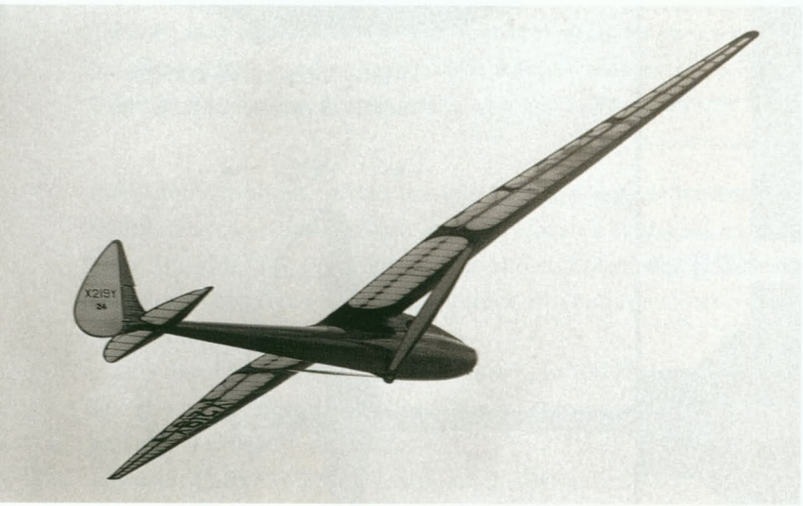
Hawley Bowlus, born in 1896 in Illinois, built and flew a glider modelled on a Wright Brothers type in 1912. He moved to the west coast. His interest in gliding was revived by the news from Germany and in October 1929 he became the second American citizen to achieve the 'C' soaring badge, flying a 14.3 metre span sailplane of his own design and construction. He followed this with a US record duration of one hour, twenty minutes.

In 1930 he visited Elmira for the first US National Soaring Contest and met Gus Haller, Wolf Hirth and Martin Schempp who were at



Bowlus Albatross
1933 - 4





Left above: Portholes for the pilot were considered adequate.

Right above: The cockpit layout was unorthodox, with a type of 'handle bars' for lateral control. The instrument panel was verical.

Below: The Bowlus Albatross soaring.

this time associated in the Haller Hirth Sailplane Manufacturing Company. With Hirth, in 1931 Bowlus started a training school using auto towed launches, a method invented in the USA. It enabled training flights, and soon thermal soaring, to be done from flat ground.

The training school closed when Hirth went back to Germany, taking these new ideas with him. Bowlus returned to California where he designed and built, with the aid of students from the Curtiss Wright Technical Institute, the Bowlus Super Sailplane. This was strongly influenced by the Wien, with similar aerofoil sections and general arrangement, single spar wing with plywood skinning, but Bowlus was not content to make a slavish copy. The wing, in two pieces, had a rectangular centre section with the tips tapering, but with a slightly curved outline to the ailerons to come closer to the ideal elliptical form. On this prototype there was no dihedral.

To have a wheel on a glider was unusual in Europe but when cars were used to move the new generation of large and heavier gliders about on the ground, wheels were almost a necessity. Wheeled dollies and carts were used, but these had to be removed before flying and replaced after landing. (The idea of a 'drop off' dolly came later.) In the USA, towing gliders with aeroplanes was becoming quite common, while in Germany still this was regarded with distrust. It had been done as early as March 1927 by Gerhard Fieseler and Gottlob Espenlaub as a stunt in air shows. For the glider to take off behind an aeroplane or tow car, a proper undercarriage was a sensible development. The earliest American 'primary' and 'secondary' sailplanes such as the Franklin PS - 2 usually had wheels.

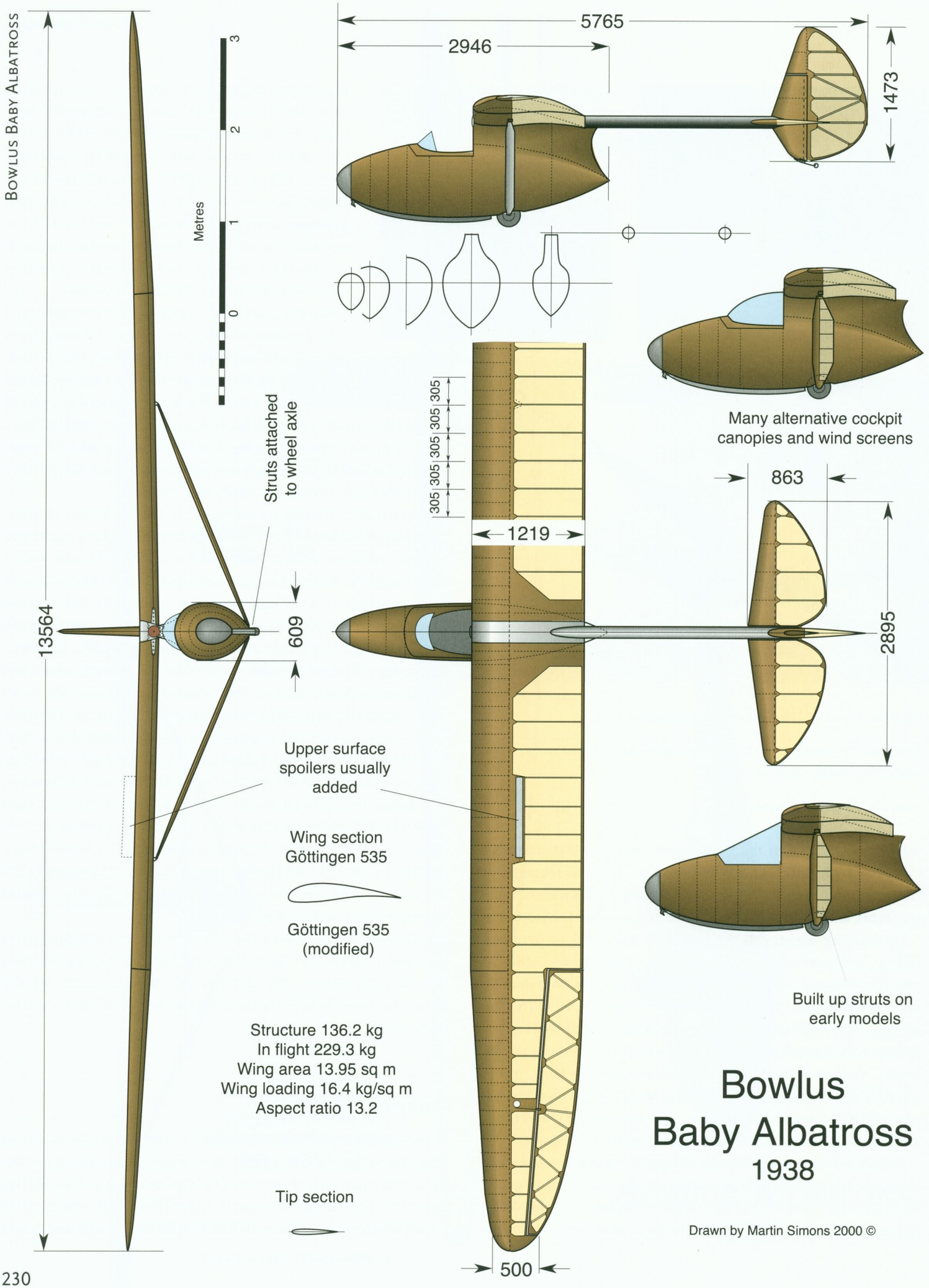
Bowlus was the first designer to fit a wheel on a high performance sailplane. Instead of V struts there was a single strut which, at the lower end, was attached to the wheel bearing plates rather than to separate fittings on the main fuselage cross frame. The struts were much wider in chord than usual, with a streamlined cross section built up like a small wing with fabric covering. Like the Musterle, which Bowlus had seen at Elmira, the cockpit was fully enclosed and faired with a plywood canopy , except for portholes at the sides.

Warren Eaton, a founder member of the Soaring Society of America, ordered a sailplane from Bowlus and the Albatross 1, christened Falcon, was built, with slightly more span and this time with a 'gull' wing. The structure was strengthened. Bowlus fitted split trailing edge flaps under the inner wing as a landing aid. The plywood skinning was not birch as in Europe but mahogany which, when varnished, gave the Falcon a dark, reddish colour and a luxurious appearance. Richard Dupont ordered the Albatross 2, which was completed without the flaps and skinned with spruce ply. In his new aircraft Dupont took off from Harris Hill, Elmira, on 25th June 1934, soared in thermals eastwards until within sight of New York city. He landed after 247 kilometres, a world distance record although technically disallowed because it did not exceed the previous figure by the requisite 5%. Later Dupont set the US height record at 1897 metres and became the second American to gain the Silver C badge, No. 32 on the international list (after Jack O'Meara, No 12). In 1935 he won the American Championship again in the Albatross, which was then sold to Chester Decker who became Champion with it the following year.

Both these sailplanes survive, Falcon in the Smithsonian collection and Albatross II at Harris Hill in the National Soaring Museum. Bowlus built more of the Albatross type but how many actually were completed is not certain. Efforts to restore at least one have been made.

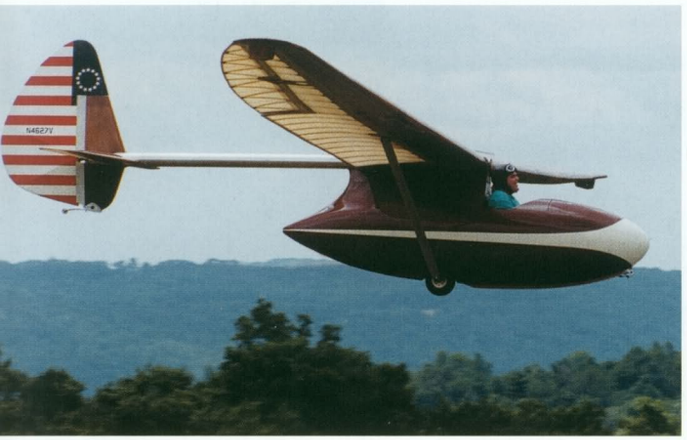
Baby Albatross

The Bowlus Baby Albatross first flew in 1938. It was intended from the beginning as a kit sailplane to be assembled by amateurs. The wing was essentially the same as the Grunau Baby 2. The fuselage and tail unit were highly original. A streamlined pod was moulded in mahogany plywood as a shell to contain the cockpit, and a light



Bowlus Baby Albatross 1938

Drawn by Martin Simons 2000 ©



The Bowlus Baby Albatross was virtually a Grunau Baby wing with a highly original pod and boom fuselage and tail. It was produced in kit form and about 100 were sold, but not all were completed. After restoration, several are now flying in the USA.

metal tubular boom carried the tail. Like the larger Albatross, the struts were of aerofoil section and the elevator of the all moving type. The kits were well thought out and complete, the pod being supplied in two halves, the spars, frames, ribs and metal parts ready for assembly.

Advertised at an attractive price, more than 100 kits were sold and many were completed and flown. Many others were never finished and very few remain in service.

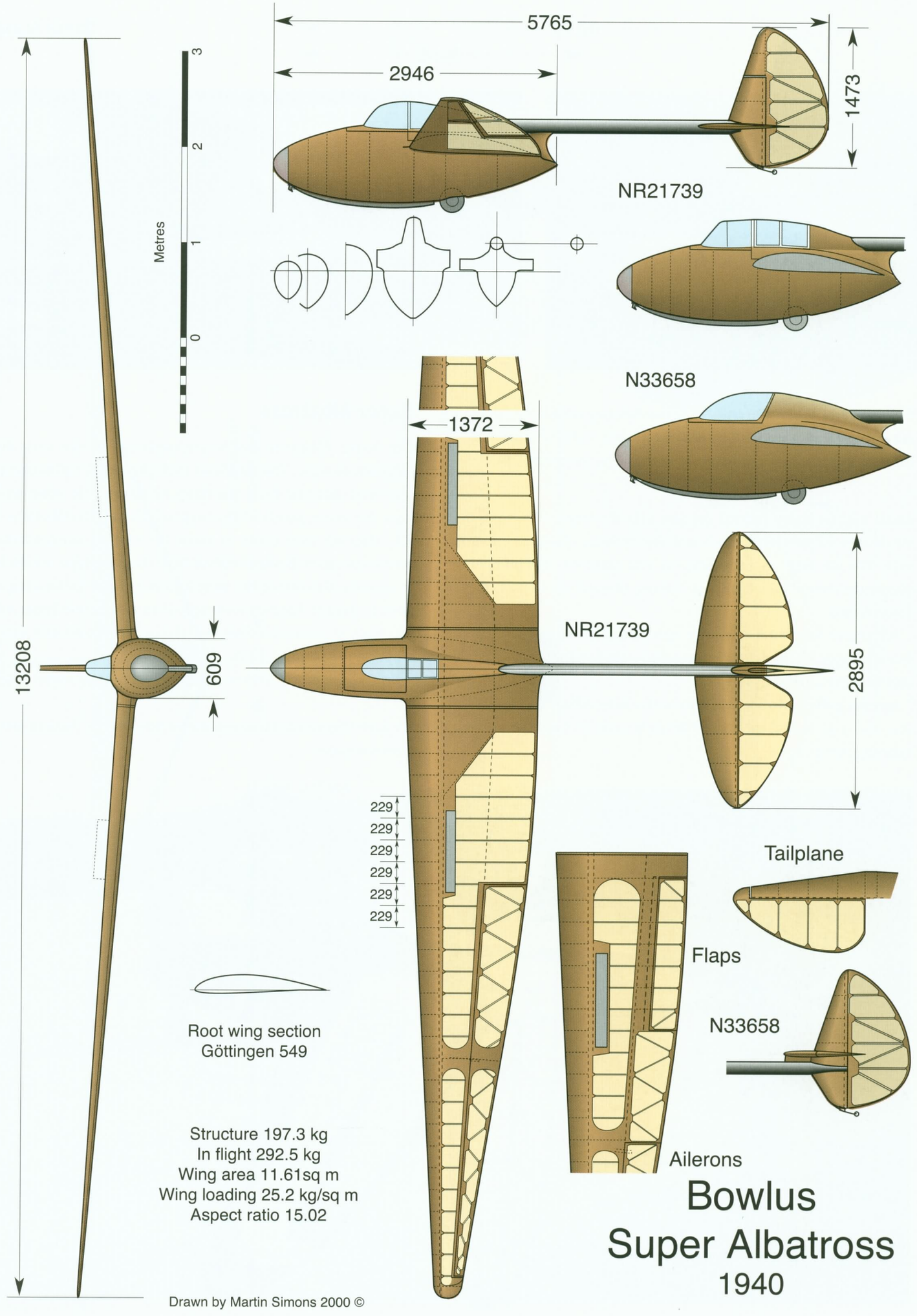
Bowlus built a two seat version of the Baby Albatross, and there was also a successful motorised development, but neither entered quantity production.

Super Albatross

The Super Albatross was a combination of two very different sailplane designs. The moulded shell pod, alloy tail boom and tail unit were adapted from the Baby Albatross. The wing was taken from the outer panels of the original 18.9 metre Albatross. Necessary changes were made to allow the various components to be combined safely. Bowlus himself built the prototype, which had the all moving elevator of the Baby and large flaps for landing and approach control. Spoilers were added later. A second Super Albatross was built by Howard Kelsey, which had a tailplane and elevator of elliptical plan and no flaps.

Both these aircraft survive, but not in airworthy condition.

The Super Albatross was a development of the Baby Albatross. Two were built, with different tailplanes.


5765
2946
1473
NR21739
Metres
0
1
2
3
N33658
1372
13208
609
NR21739
2895
229
229
229
229
229
229
Tailplane
Flaps
N33658
Ailerons
Root wing section
Göttingen 549
Structure 197.3 kg
In flight 292.5 kg
Wing area 11.61sq m
Wing loading 25.2 kg/sq m
Aspect ratio 15.02
Bowlus
Super Albatross
1940
Drawn by Martin Simons 2000 ©

Above: The back view of the Super Albatross.

Laister Yankee Doodle

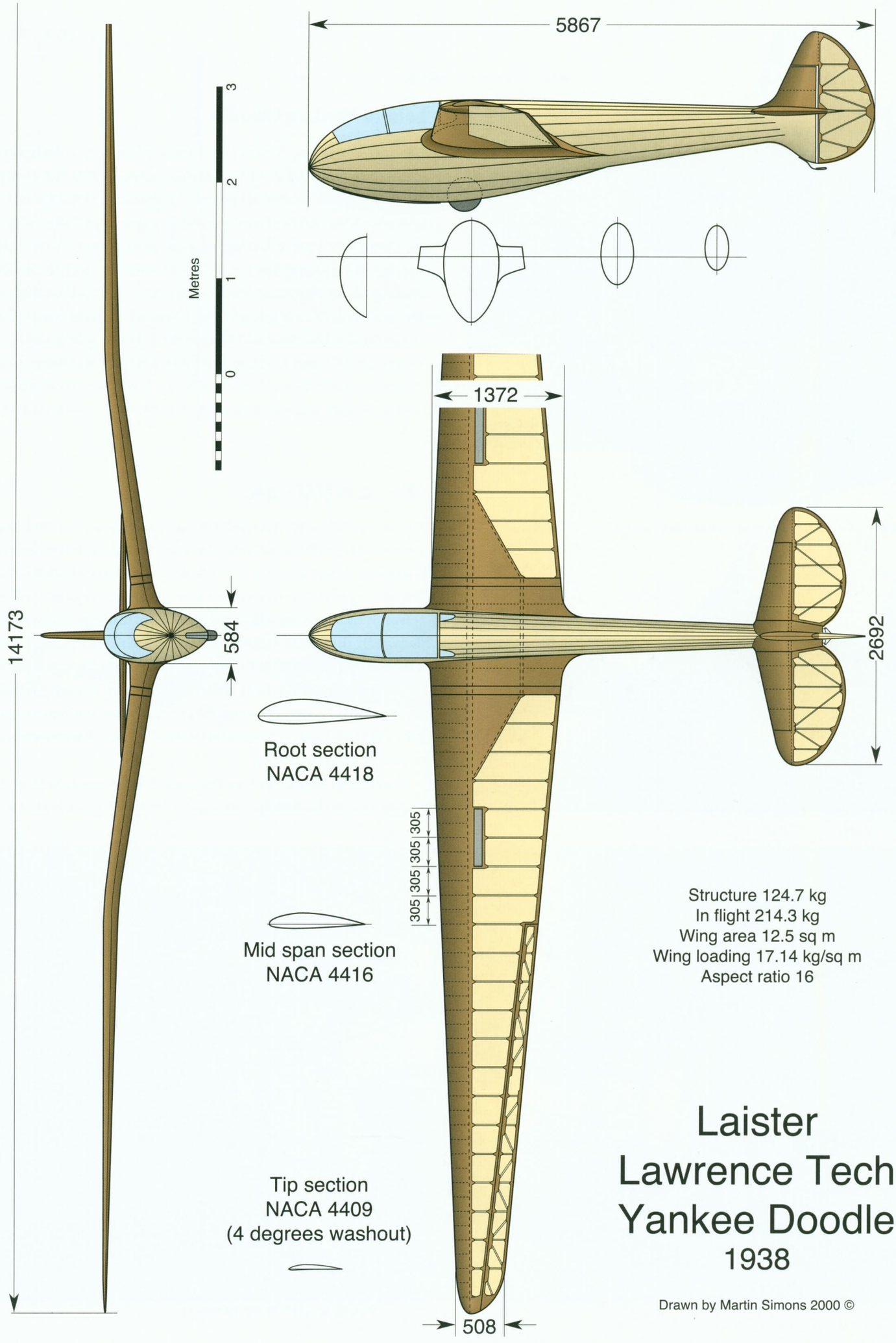
Jack Laister was a student at the Lawrence Institute of Technology in Michigan in 1935 and with financial support from the college designed and built his own single seat sailplane. This, called at first the Lawrence Tech Sailplane, had a wooden, tapered, gull wing with spoilers, a steel tube framed fuselage of good aerodynamic shape with light wooden stringers and fabric covering, a contoured cockpit canopy and landing wheel. The wing profiles were from the NACA 4 digit series, 4% cambered, thinning from 18% at the root to 9% at the tip. Painted in spectacular red white and blue fashion, the sailplane was renamed Yankee Doodle and taken to France to perform aerobatics in an air show conducted by the Paris Aero Club. It was slightly damaged in a landing mishap and returned to the USA for repair and further flying.

Both below: Jack Laister's Lawrence Tech sailplane, later called 'Yankee Doodle'.

LK - 10 A (TG - 4A)

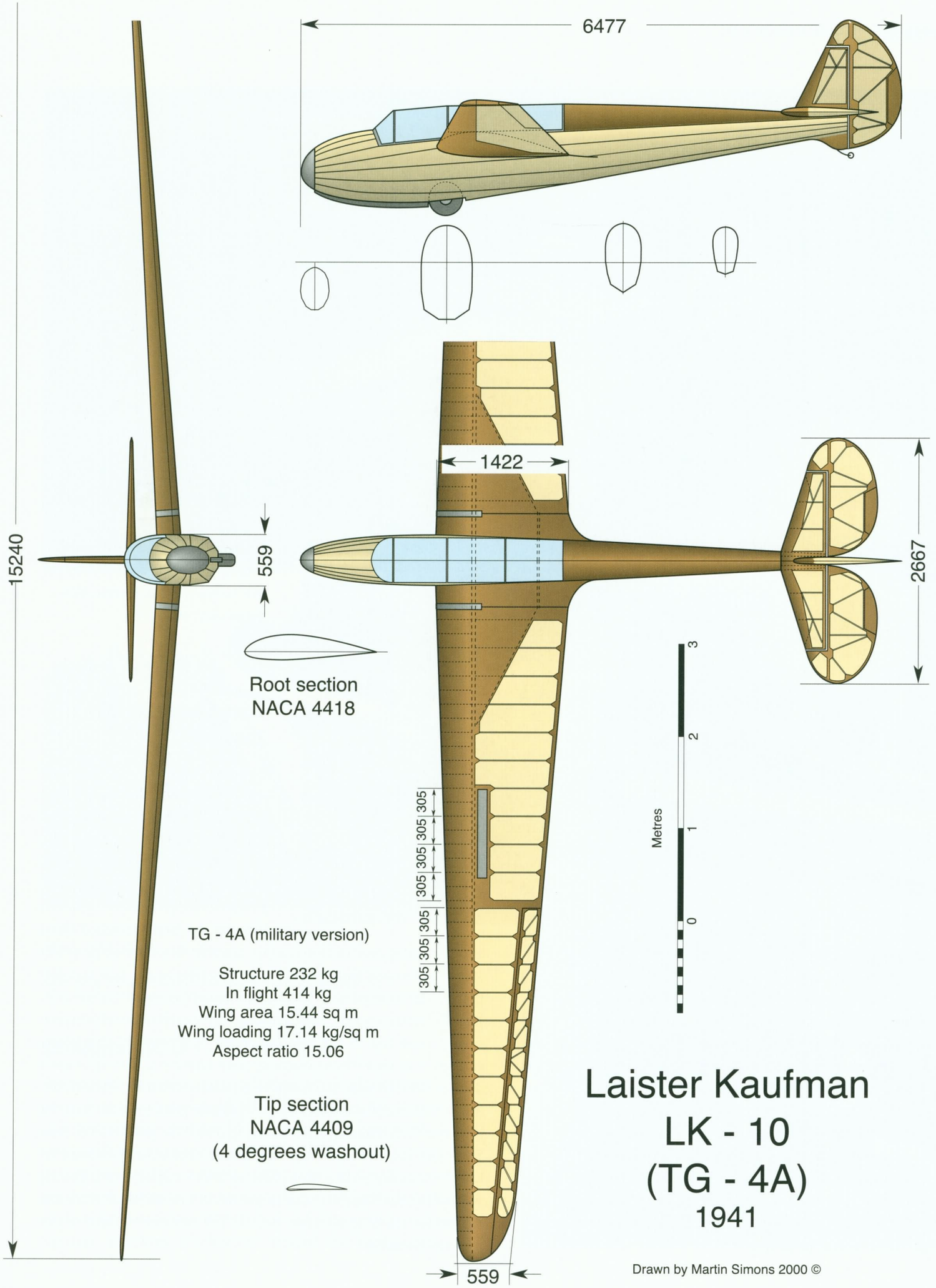
When the US Army needed two seat sailplanes for the wartime training programme, Laister offered his services and was commissioned to design a two seat version of the Yankee Doodle. This he did, calling it at first the Yankee Doodle 2. Like its single seat predecessor, it had wooden wings and steel tube fuselage, the seats in tandem with the usual vision problems for the rear pilot. The wing, with straight dihedral for simplicity of manufacture, was extended to 15.24 metres. After static and flying tests the aircraft was adopted by the army. Laister, in partnership with John Kauffmann, put the type into production in St Louis as the Laister - Kauffmann LK - 10 or, to the military, TG - 4.

Production began early in 1942 and 156 were completed. Minor improvements including a stronger wheel axle and tail skid to with-



Structure 124.7 kg
In flight 214.3 kg
Wing area 12.5 sq m
Wing loading 17.14 kg/sq m
Aspect ratio 16

Laister Lawrence Tech Yankee Doodle
1938



Laister Kaufman LK - 10 (TG - 4A) 1941

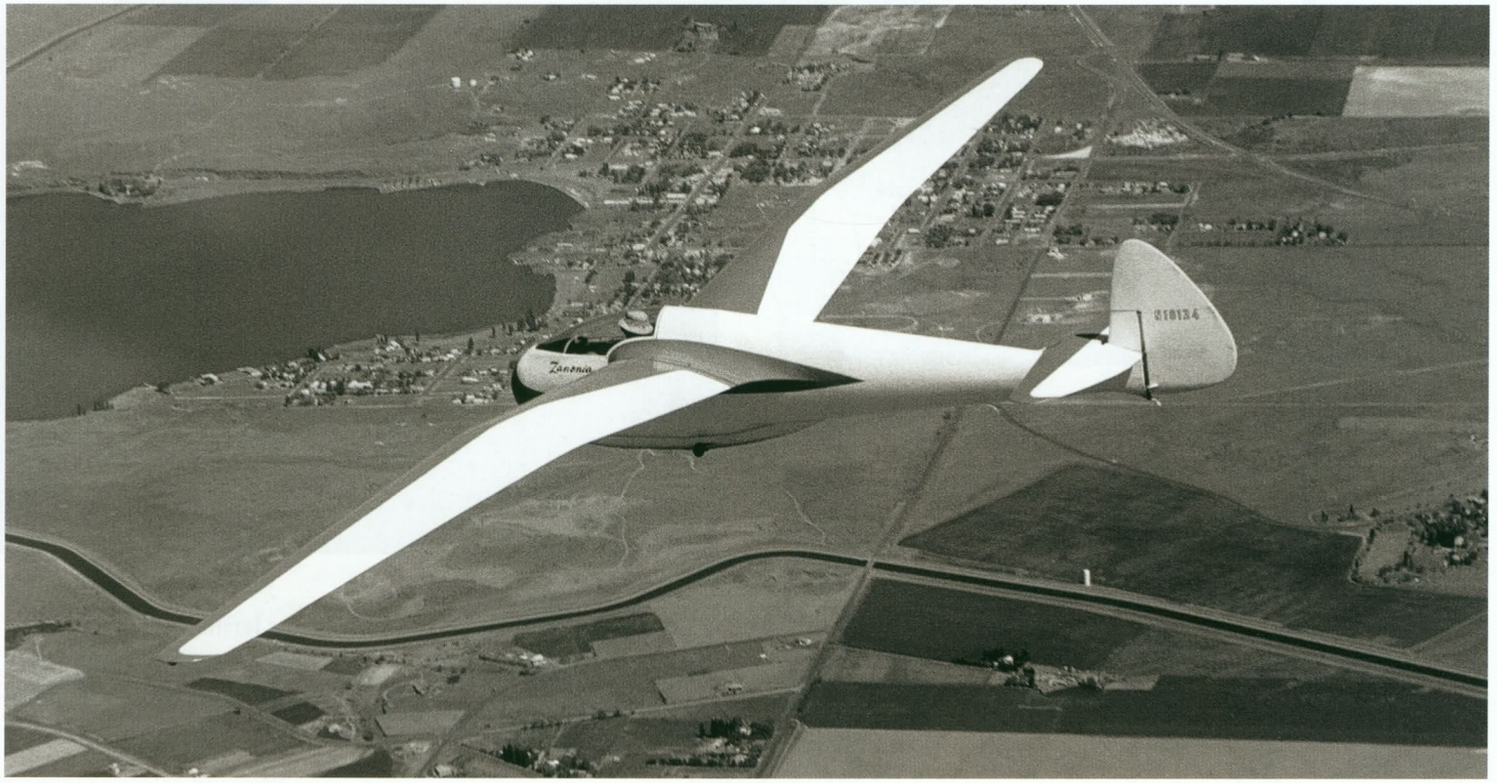
Above and left: The Laister Kauffman LK - 10, called the TG - 4 by the US military, was often modified, post war, to the so called 'flat top' configuration.

stand rough landings by trainee pilots, a moulded nose cap and turtle deck behind the cockpits, resulted in the TG - 4A.

After the war, surplus sailplanes were sold cheaply and became popular sporting sailplanes. Second and third places in the 1946 US Nationals were taken by pilots flying the LK - 10A. A very thorough study by August Raspet of Mississippi State College in 1948 revealed many ways in which the performance could be improved, including removal of the rear cockpit and decking, removal of aerodynamic control balances, fairing of the wheel and all round sealing of gaps and reduction of protuberances. The end product, called the Flat Top, was measured in flight and shown to perform rather better than the Olympia, which was, currently, the best available fifteen metre sailplane in Europe. Many national records were broken in the type. A few remain in service.

Ross Stephens RS - 1 Zanonia

Harland Ross was an engineer commissioned in 1936 to design a high performance sailplane for the actor, Harvey Stephens. The Ross - Stephens 1 Zanonia competed in the 1937 American National Championships and did well but was badly damaged when another glider crashed into it when landing. Repairs were done but Stephens himself damaged the sailplane later in the year and further repairs were needed, including a modification to the tail unit. The all moving elevator was replaced with a conventional tailplane mounted on top of the fuselage ahead of the fin. The sailplane came into its own when bought by John Robinson, who did a great deal of work to seal, smooth and generally clean up the aircraft, improving the best glide to 29:1, extremely good for that time. He won the US Nationals three times, in 1940, '41 and '46. On New Years Day 1949 he broke Paul MacCready's world height record set the previous day, with a wave climb to 10210 metres. The following year he became the first pilot in the world to achieve all three diamonds for his Gold C badge. He sold the Zanonia in 1952. It still survives complete.

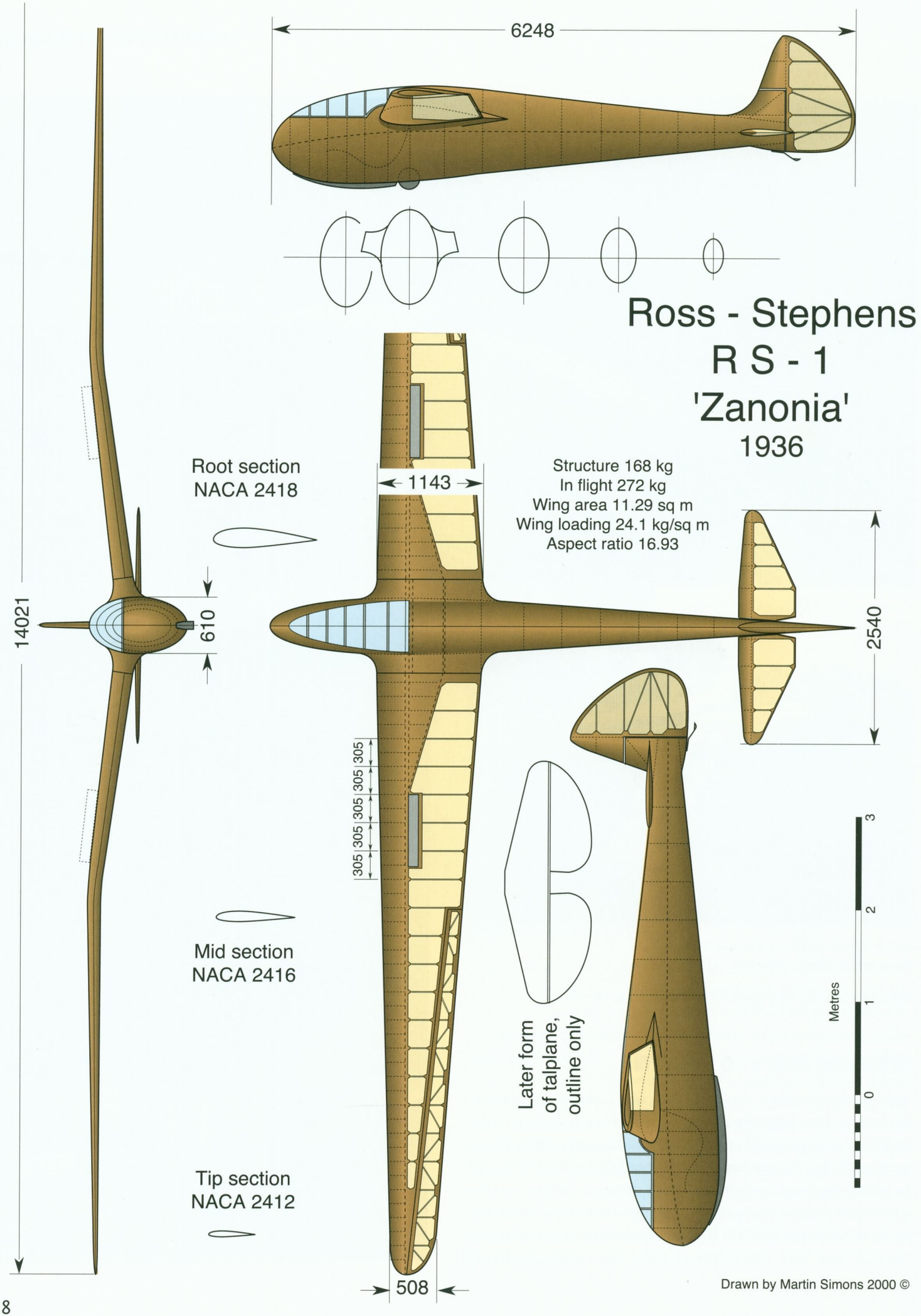


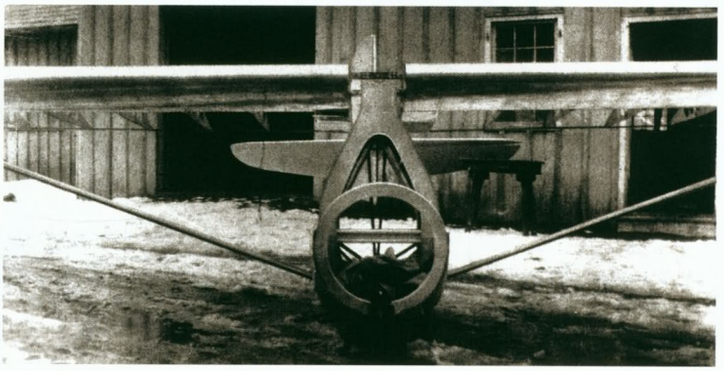
Above and left: The RS - 1 Zanonia

Right: Ernie Schweizer explains the SGU 1- 6 to a youthful admirer.

Schweizer SGU 1 - 6 Boom Tail

The Schweizer brothers, Ernie and Paul, who had graduated as engineers from the Guggenheim School of Aeronautics in New York, and their younger brother Bill, after building and flying several wooden gliders, became convinced that sailplanes should in future be built from metal. In 1936 a sailplane design competition with a worthwhile cash prize was announced, the sailplanes to be presented for test flying at the 1937 National Championships at Elmira in 'up state' New York. The brothers worked very hard to design and





Left: The SGU 1- 6 flown without the cockpit canopy.

Right: The 1 - 6 under construction, showing the pressed aluminium alloy cross frames.

built their first all metal aircraft, the so called Boom Tail SGU 1 - 6. According to the numbering system they had adopted, the figure 1 indicate it was a single seater, the 6 was the number of the design, and the SGU stood for Schweizer Glider, Utility. Everything was done to ensure that the aircraft could be built with the basic equipment at their disposal. The light alloys chosen did not need heat treatment. Self tapping, plated screws were used to fasten the skins to the wing. The lack of vibration in a glider made these quite safe. Solid rivets were required only for the heavily stressed areas.

The boom tail layout was chosen for simplicity in construction, allowing the use of a plain metal tube for the boom. Open framed areas were covered with doped fabric.

As far as the brothers knew, this was the first all metal glider in the world. They were delighted when it was awarded third prize in the design competition. The first prize went to the ABC Sailplane which had a steel tube fuselage and strutted wooden wings. Second place was taken by the Harland - Ross RS - 1 Zanonia (See above).

The Schweizers made no attempt to put their Boom Tail glider into production, having become aware that it required too many hours of work to be a marketable proposition. The glider was sold to the Harvard Glider Club and used for some years before being retired.

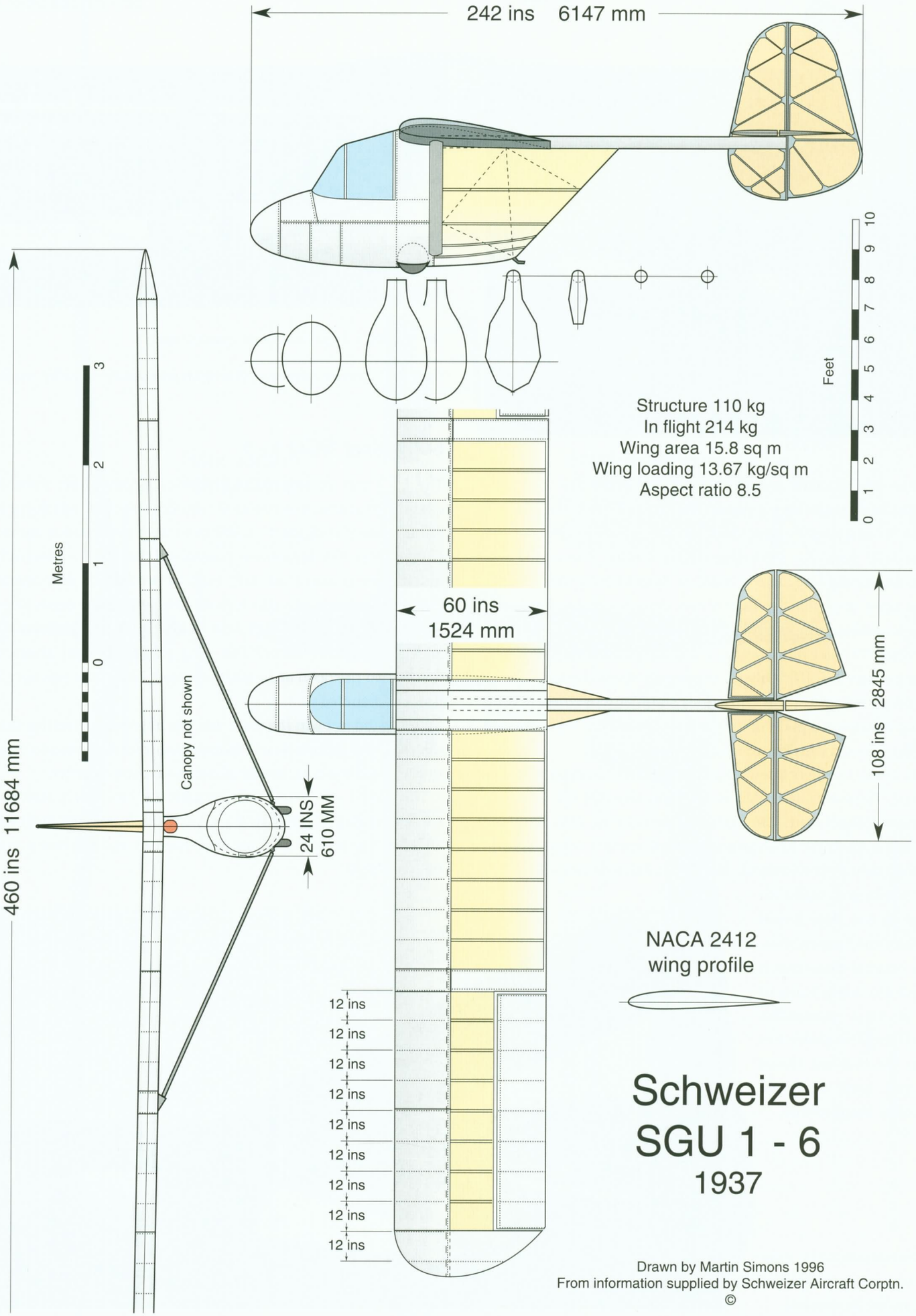
Schweizer SGU 1 - 7

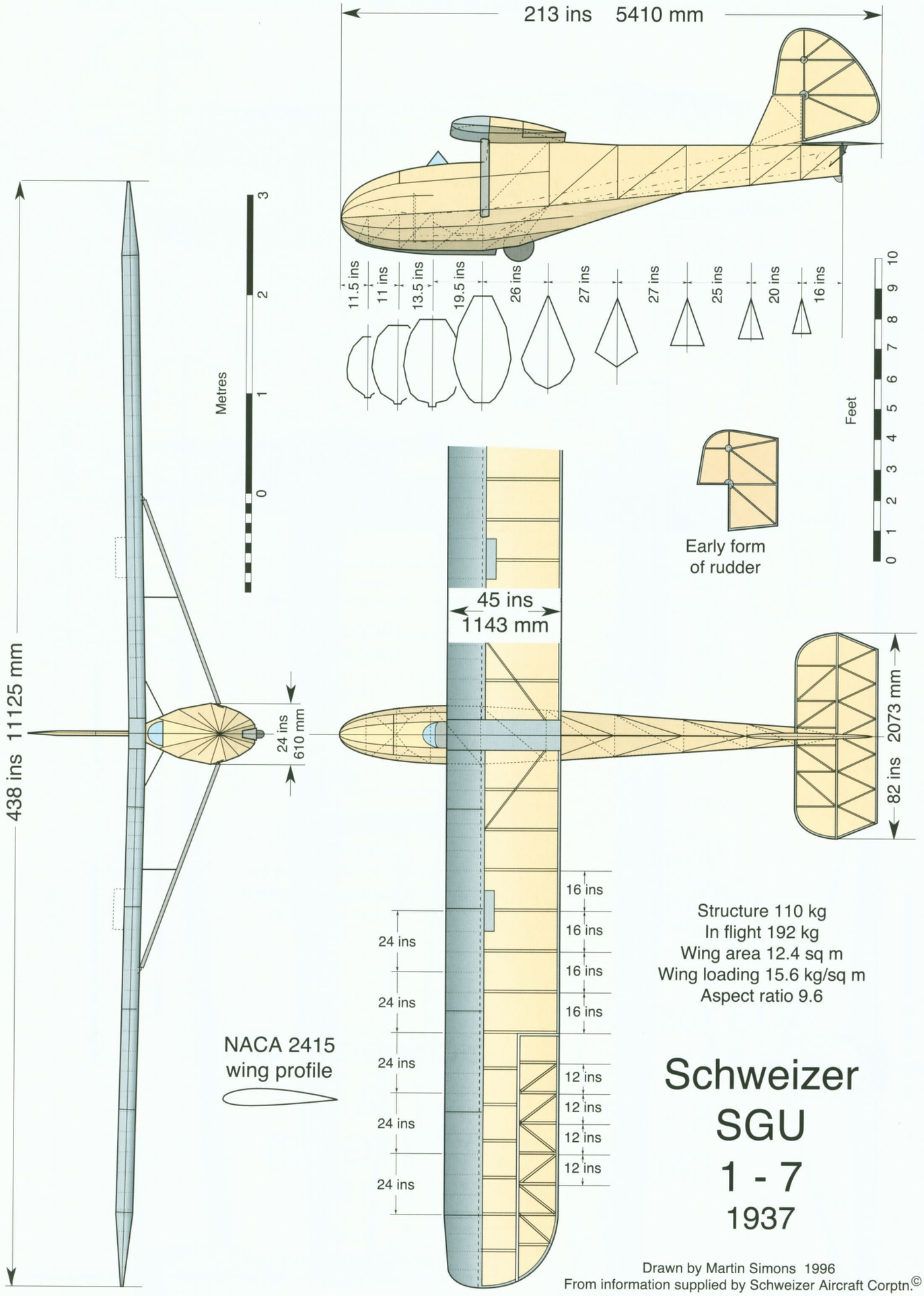
The 1 - 7 was an attempt to produce a utility glider suitable for quantity production at minimal cost. Construction was going on simultaneously with the 1 - 6 and both were presented at the design competition. The Schweizers considered that the 1 - 7 was in fact a much more practical aircraft, both in production and operation, than the 1 - 6, and thought it more deserving of the prize. The fuselage frame and the tail unit were welded up from light steel tubing and covered with fabric. The wing was from light alloys, strut braced and the open areas fabric covered. The glider was very light, flew and handled well.

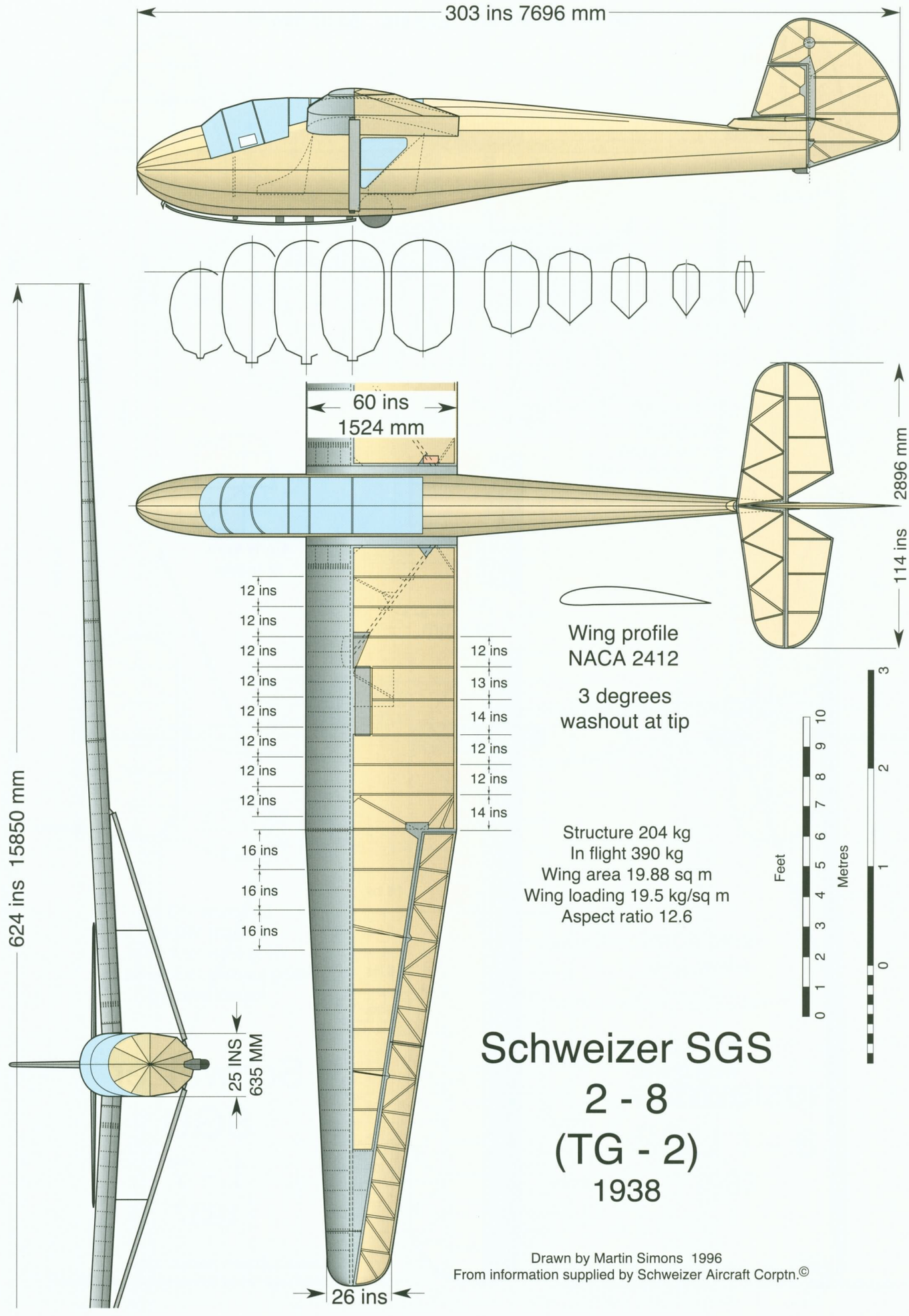
That it did not win the prize was less important than the fact that they sold the prototype and received an order for a second one, and thus entered the commercial glider production industry.

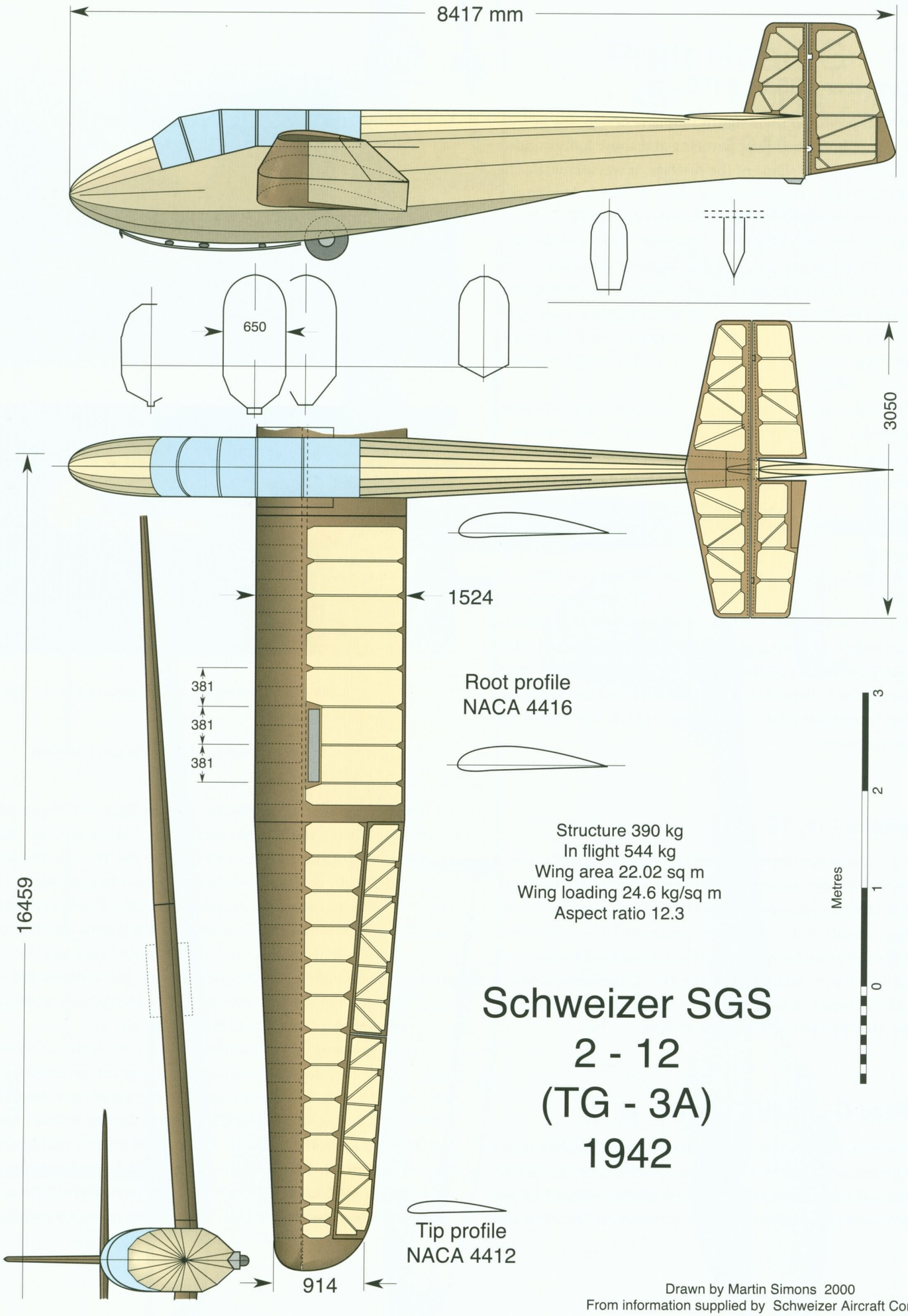
The SGU 1 - 7, years later, became the basis for a new design, somewhat larger, the SGU 1 - 19, of which 50 were built during 1944 - 6. The second 1 - 7, restored, survives and was flown again in the year 2000.

Right: The Schweizer SGU 1 - 7 had a metal wing and steel tube framed fuselage and tail, fabric covered.


242 ins 6147 mm
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
Structure 110 kg
In flight 214 kg
Wing area 15.8 sq m
Wing loading 13.67 kg/sq m
Aspect ratio 8.5
60 ins
1524 mm
108 ins 2845 mm
460 ins 11684 mm
Canopy not shown
24 INS
610 MM
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
NACA 2412
wing profile
Schweizer
SGU 1 - 6
1937
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©


213 ins 5410 mm
11.5 ins
11 ins
13.5 ins
19.5 ins
26 ins
27 ins
27 ins
25 ins
20 ins
16 ins
Metres
0
1
2
3
Feet
0 1 2 3 4 5 6 7 8 9 10
Early form of rudder
438 ins 11125 mm
24 ins 610 mm
45 ins 1143 mm
82 ins 2073 mm
16 ins
16 ins
16 ins
16 ins
24 ins
24 ins
24 ins
24 ins
24 ins
12 ins
12 ins
12 ins
12 ins
NACA 2415 wing profile
Structure 110 kg
In flight 192 kg
Wing area 12.4 sq m
Wing loading 15.6 kg/sq m
Aspect ratio 9.6
Schweizer SGU 1 - 7
1937
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.©


303 ins 7696 mm
60 ins
1524 mm
2896 mm
114 ins
624 ins 15850 mm
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
13 ins
14 ins
12 ins
12 ins
14 ins
16 ins
16 ins
16 ins
25 INS
635 MM
26 ins
Wing profile
NACA 2412
3 degrees
washout at tip
Structure 204 kg
In flight 390 kg
Wing area 19.88 sq m
Wing loading 19.5 kg/sq m
Aspect ratio 12.6
Feet
Metres
Schweizer SGS
2 - 8
(TG - 2)
1938
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.©



Structure 390 kg
In flight 544 kg
Wing area 22.02 sq m
Wing loading 24.6 kg/sq m
Aspect ratio 12.3

Schweizer SGS 2 - 12 (TG - 3A) 1942

Drawn by Martin Simons 2000
From information supplied by Schweizer Aircraft Corptn.

The Schweizer SGS 2 - 8 (TG - 2)

The Schweizers produced their eighth sailplane design, the SGS 2 - 8 in 1938. Apart from the fabric covering and some light wooden stringers to improve the shape of the fuselage, it was all metal. The aluminium alloy skin over the leading edge was fastened to the ribs and main spar with plated self tapping screws as with the 1 - 6 and 1 - 7. In service this proved entirely satisfactory. The fuselage was a light steel tube frame, the tail unit also, covered with fabric. The seats were in tandem. With the wing at shoulder level the rear pilot had a limited view but was aided by transparent panels in the fuselage sides below the wing. There was a landing wheel and the relatively thin wing, using the NACA 2412, 12% thick profile, was strut braced.

After the prototype was crashed in a spinning accident, the nose was lengthened to move the balance point forward. After this the 2 - 8 was very successful as a sailplane and made some very good cross country and altitude flights. The world height record climb by Lewin Barringer in 1940, 4556 metres, was not recorded by the FAI in Paris, presumably because Paris at the time had been occupied by the German army.

When the US Army began its glider pilot training programme in 1941, the SGS 2 - 8 was adopted as the TG - 2 (Training Glider - 2) and a total of 57 was reached before Schweizers were instructed to change to a wooden training glider, to conserve aluminium alloy. Still remembered mainly as the TG - 2, the military versions were offered for sale very cheaply after the end of the war and were used extensively by civilian pilots and gliding clubs. A very few of the type remain in service.

Above: Schweizer's SGS 2 - 8 was a sporting two seat sailplane, called the TG - 2 when order in quantity for the US Army.

Below: The Pratt Read G - 1, LNE 1 to the US Navy, had the seats side by side.

Schweizer 2 - 12, TG - 3

The SGS 2 - 12 was developed to meet the US Army's requirement for a two seat trainer without aluminium alloy in its structure. There were other military requirements which resulted in a somewhat heavy aircraft, but with the wing mounted low on the fuselage, the instructor in the rear cockpit had a reasonably good view. 114 of the TG - 3 were built. As with the TG - 2, those remaining at the end of hostilities were sold cheaply. Stripped of their military equipment they proved useful to gliding clubs.

Pratt Read G - 1, LNE - 1 or TG - 32

The G - 1 was originally a civilian design but, making its appearance early in the Second World War it became absorbed into the military glider pilot training programme. From the official viewpoint it had the advantage of not requiring any scarce resources. The wing plan form resembled that of the famous Grunau Baby, but the aerofoil sections were from the Sikorsky series, GS - 4 at the root, GS - M at the inner end of the ailerons and GS -1 at the tip. The two seats were side by side, enclosed within a large steel framed, fabric covered nacelle, with capacious transparent canopy. The wing, slightly swept back to improve balance after early test flights, was of orthodox wooden construction. The tail was carried on a circular sectioned plywood boom. In the training role the performance was quite adequate and the G - 1 was adopted by the US Navy as the LNE - 1. A few were also taken by the Army as the TG - 32.

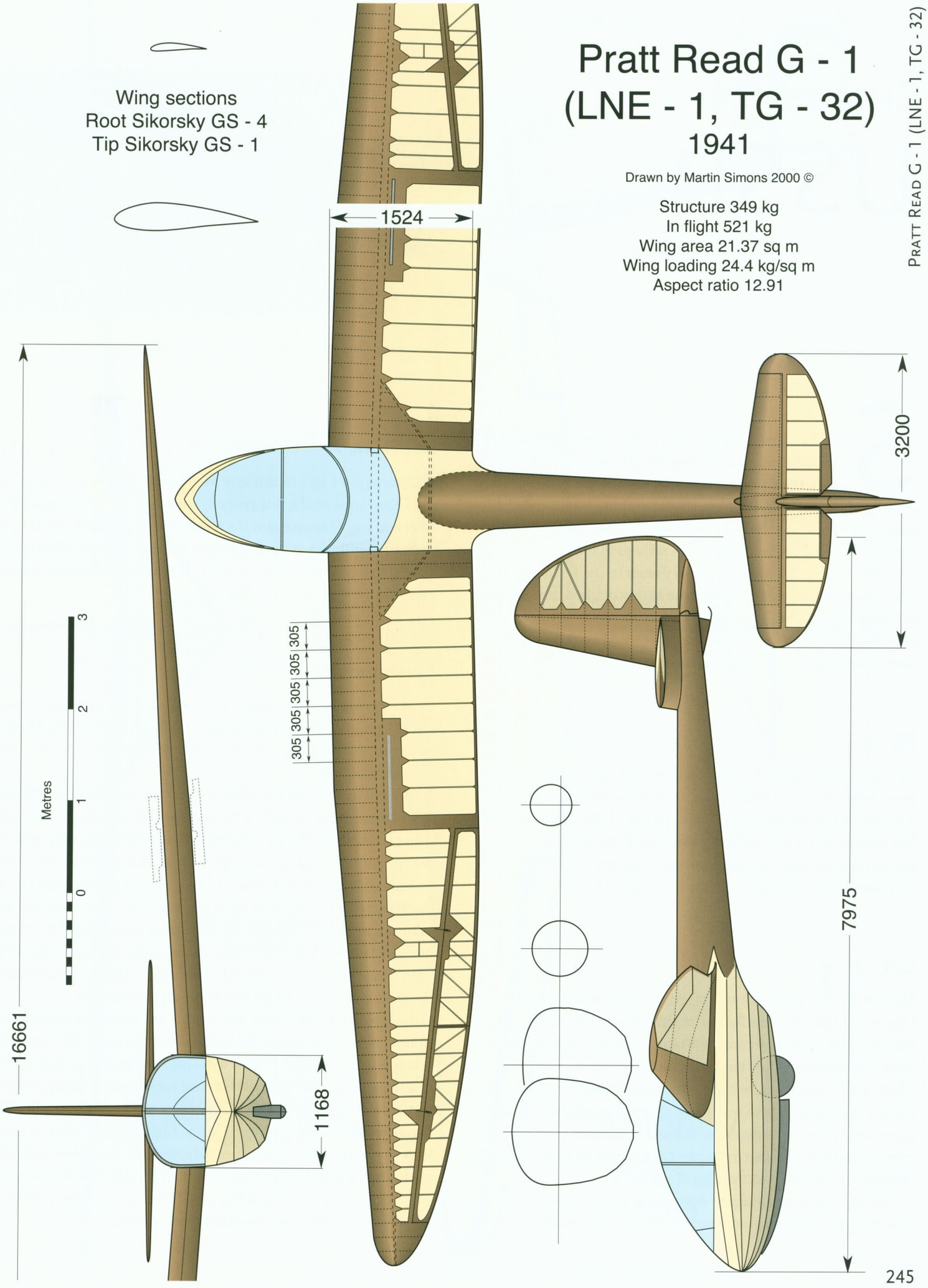
A total of 75 were built. Like other military two seaters, they were sold cheaply after the war. Most notably, two were used in the scientific research work on standing waves in the lee of the Californian Sierra Nevada. The world height record was broken by Larry Edgar and Howard Klieforth in March 1952, 13849 metres, during these studies. In April 1955 one of the Pratt Reads, flown by Edgar, was destroyed at 4500 metres altitude in severe turbulence in the rotor of a wave. Edgar was thrown clear and was able to use his parachute.

Pratt Read G - 1 (LNE - 1, TG - 32)

1941

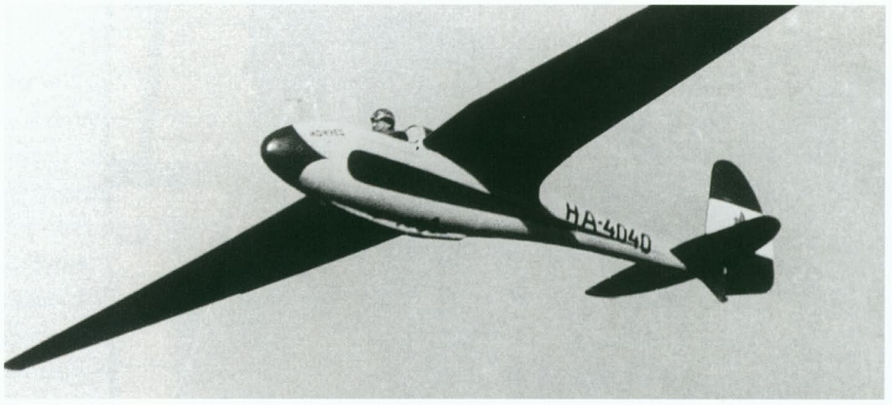
Structure 349 kg
In flight 521 kg
Wing area 21.37 sq m
Wing loading 24.4 kg/sq m
Aspect ratio 12.91

Wing sections
Root Sikorsky GS - 4
Tip Sikorsky GS - 1



Chapter 24

USSR



Photographs of Russian sailplanes are rare. This GN - 7, HA - 4040 flew in Hungary.

Since the Soviet pilots' visit to the Wasserkuppe in 1925 and the reciprocal visit of the Germans to the soaring site in the Crimea, gliding in the Soviet Union attracted government support. In the west, almost nothing was learned of developments there until Soviet pilots began to break world records in the late thirties. Only gradually was it realised that there had been a very diverse programme of sailplane design in the USSR since that time. Scores of different designs, some highly original, had been developed. It is still almost impossible to obtain detailed information or photographs of any of these aircraft. Some very sketchy three view drawings and a few leading statistics exist.

PS - 2

The same needs arose for intermediate sailplanes in the USSR as elsewhere and, in the mid thirties, O. A. Antonov produced the PS - 2 which, like the Salamandra, was developed from a primary glider but with a much improved wing and nacelle for the pilot. Antonov produced a booklet showing how this sailplane could be built by amateurs. How many were actually flown is not known.

GN - 7

The GN - 7 was designed by the engineer Groshev, a 16.8 metre sailplane based on an earlier, successful design. The most unusual feature was the centre section, built integrally with the fuselage at a steep dihedral angle, so that when the wings were joined to it the effect was a gull form without the usual trouble of building a curved main spar. There was some quantity production but how many were flown is not known. The GN - 7 became particularly famous because it was used by Victor Rastorguyev to break the world distance record with a 652 km flight in 1937.

One was taken to Hungary during the second World War and flew there for some time until written off in a bad landing.

Rot Front 7

Rastorguyev's record distance stood for a year until broken by Olga Klepikova in the Rot Front 7, with 749 km. This stood until 1939 and was of course also the feminine world record. Apart from the basic outline, hardly any details are known about Klepikova's aircraft except that it had a span of 16.3 metres and aspect ratio of 22.5. The designer was O.K. Antonov.

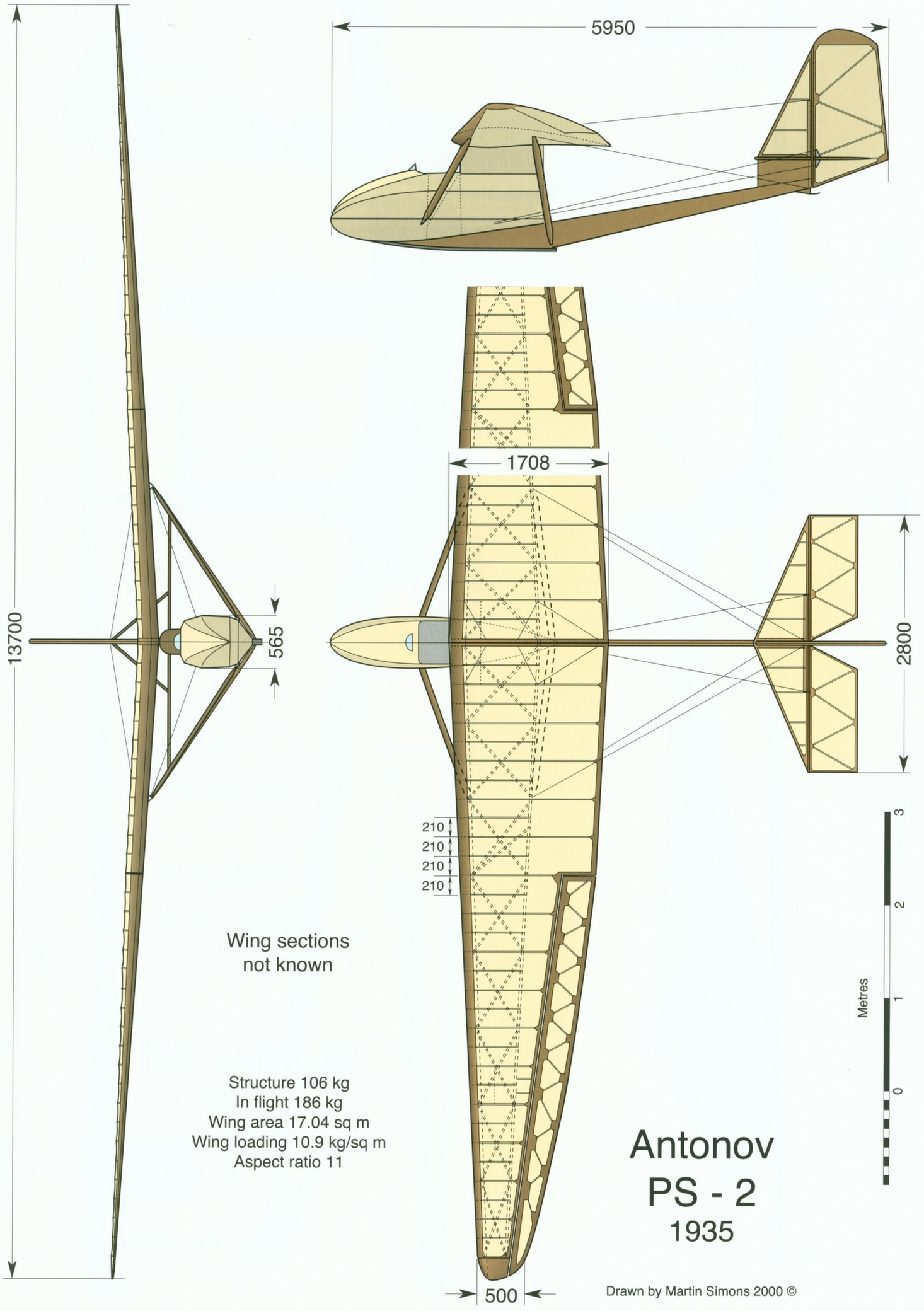
Stakhanovetz

A. G. Stakhanov was a miner who, in the USSR, was made a hero in 1935 for his great output of coal. In 1936 at the Paris Air Show, a large two seat sailplane, the Stakhanovetz, named in his honour, was exhibited.

The problem of visibility from the rear seat of a tandem sailplane was solved by the strongly swept forward wing. This ensured that the rear seat could be placed close to the centre of gravity and yet the second pilot had an excellent view in all directions. The sweep forward also helped to prevent wing tip stalling and spinning, reducing the need for wing twist or 'washout' and enabling the sailplane to fly fast without the outer wing being forced to a negative angle of attack and so 'lifting' downwards. The same layout has been used on many two seat sailplanes since 1936. In other respects the Stakhanovetz was of orthodox wooden construction.

Designed by V. Emilyanov, the aircraft was extremely efficient. Assuming it handled reasonably well, in its day it must have been the best two seat sailplane in the world. This is supported by its breaking and re-breaking international two seat cross country flying records. In 1938 pilots Kartachev and Savtov flew 619 km distance, in 1939 Kartachev and Gorokhova made a goal flight 0f 393.7 km and a year later Kartachev with Petretschenkova, 495 km. Female records also fell to this sailplane, Olga Klepikova with Bordina flew a distance of 443.7 km in 1940, and a goal flight of 223.6 km was made in 1939

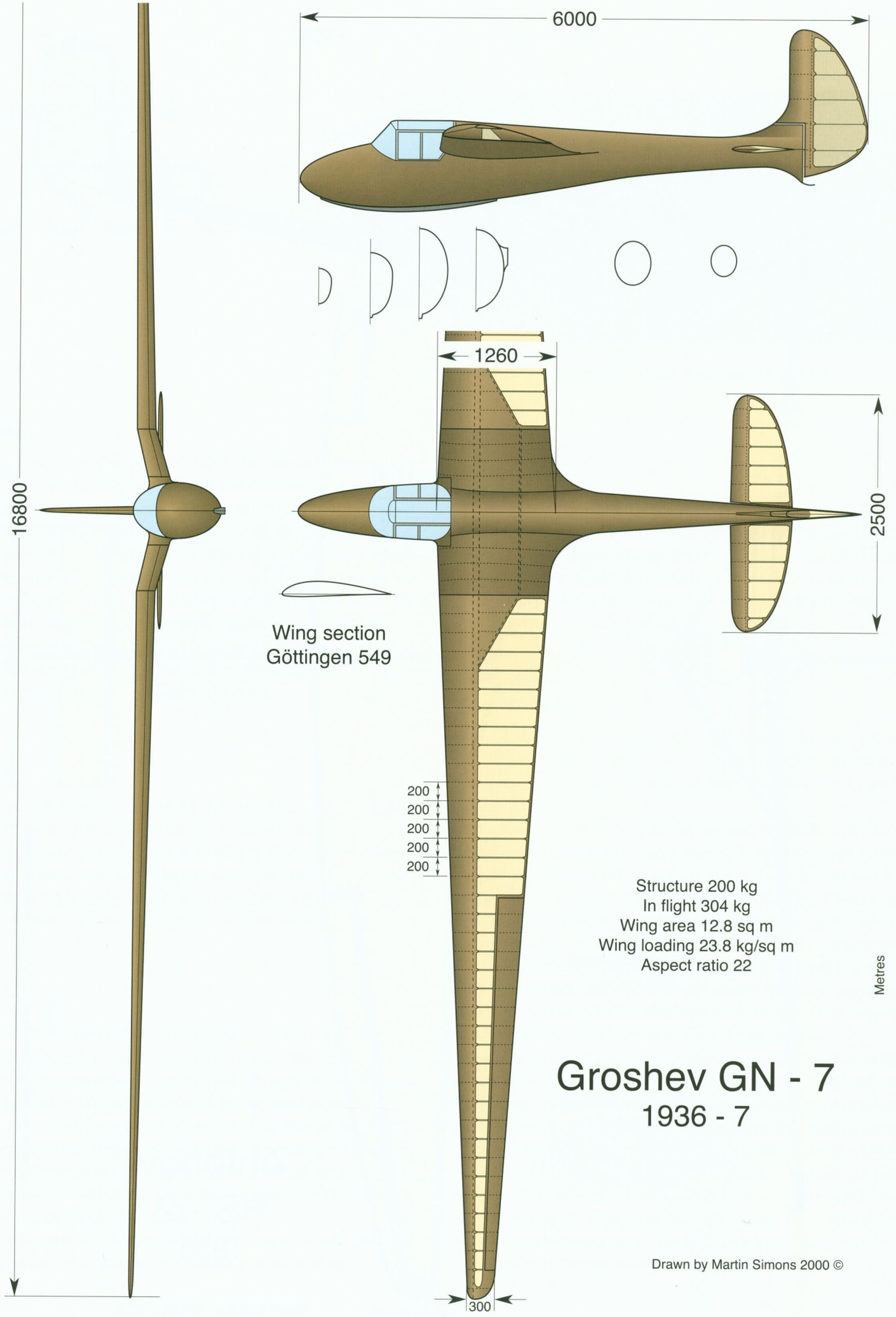
How many of the type were built is not known.



Wing sections
not known

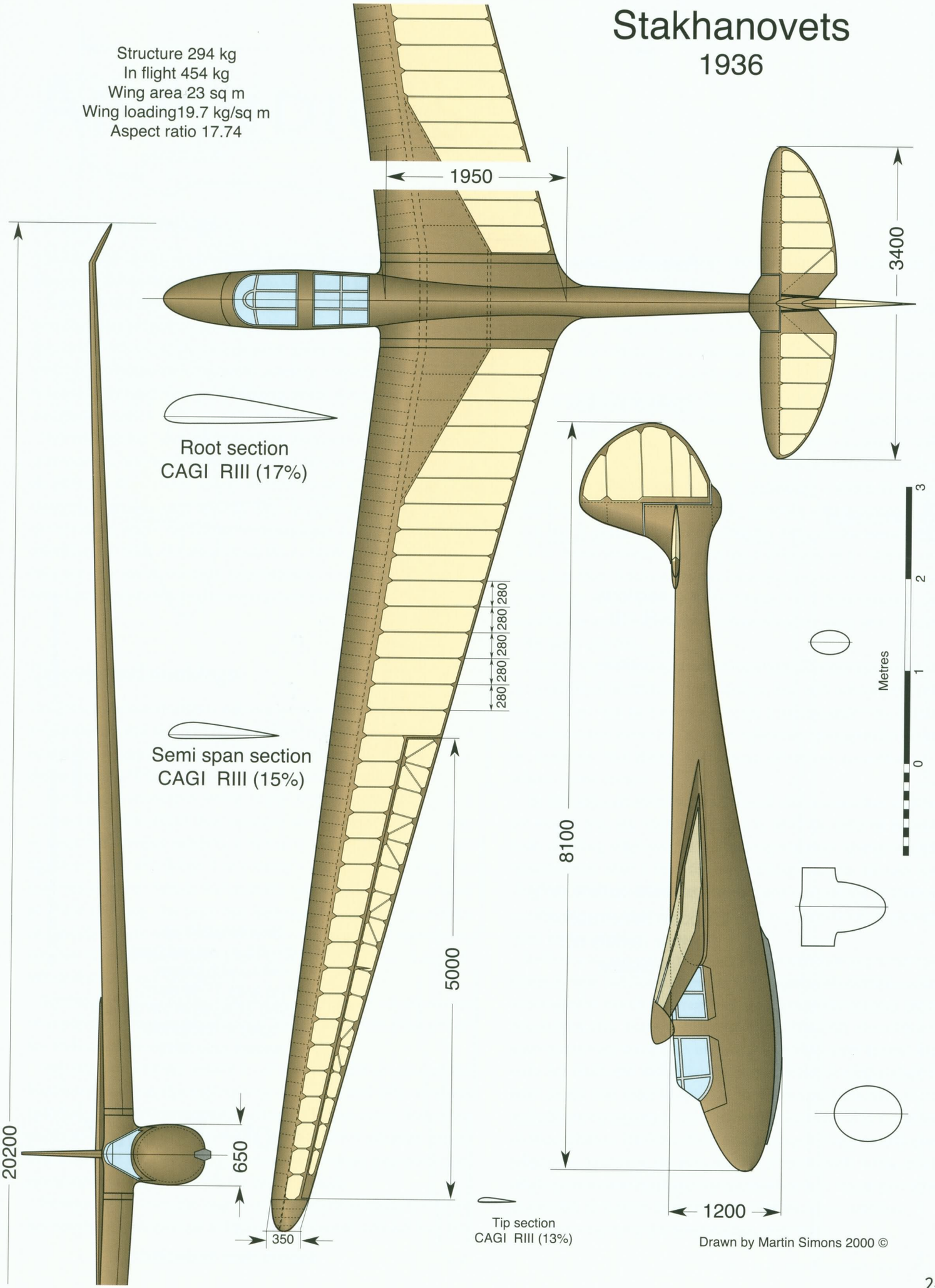
Structure 106 kg
In flight 186 kg
Wing area 17.04 sq m
Wing loading 10.9 kg/sq m
Aspect ratio 11

Antonov PS - 2
1935

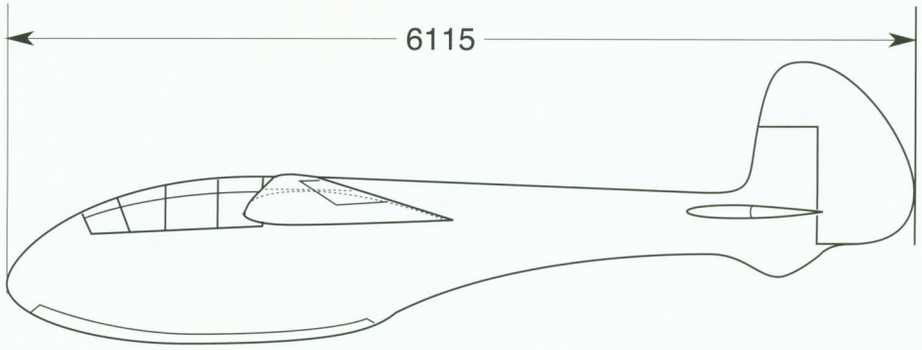

6000
16800
1260
2500
Wing section
Göttingen 549
200
200
200
200
200
300
Structure 200 kg
In flight 304 kg
Wing area 12.8 sq m
Wing loading 23.8 kg/sq m
Aspect ratio 22
Metres
0
1
2
3
Groshev GN - 7
1936 - 7
Drawn by Martin Simons 2000 ©

Stakhanovets
1936

Structure 294 kg
In flight 454 kg
Wing area 23 sq m
Wing loading19.7 kg/sq m
Aspect ratio 17.74



Drawn by Martin Simons 2000 ©



Retracting wheel

Centre section not demountable

Wing sections
CAG R - III

Approximate outline only
Wooden construction
Further details not available

Structure 245 kg
In flight 325 kg without ballast
448 kg with ballast
Wing area 11.86 sq m
Wing loading 27 kg/sq m (no ballast)
37 kg/sq m (ballasted)
Aspect ratio 22.2

Rot - Front 7
1938

APPENDICES

About the drawings

The drawings in this work were all done by the author using Adobe Illustrator Version 8 on various Apple Macintosh Computers.

Some of the small general arrangement drawings published in contemporary magazines and even those issued by manufacturers in brochures, etc, on close examination prove to be inaccurate and even self contradictory. Wherever possible, in preparing the drawings for this book, original workshop plans, actual measurements and photographs have been used to produce the best possible result.

No attempt has been made to show items of equipment such as instruments, externally mounted pitot tubes, venturis, etc., because in practice these were often moved to different locations or changed from season to season. Also, as photographs show, there were a great many variations to items such as cockpit canopies, windscreens, skids and other small items. Model makers and others who are anxious to establish exact details, have no recourse other than careful study and measurements of an actual aircraft.

Colours and markings

Until the nineteen thirties it was almost unknown for a sailplane to be painted. It was thought vitally important to save every fraction of weight. A pigmented paint would add several kilogrammes, increase the rate of sink and make soaring more difficult.

The normal treatment was to brush into all the fabric covered surfaces several coats of clear cellulose dope. This sealed the pores to make the covering airtigtht, at the same time shrinking the cloth to the tautness of a drum. The material used was fine quality cotton, 'madapolam', which was perfectly white, or unbleached linen of a light buff hue. The cloth had approximately the feel and weight of a good summer shirt. Exceptions were the French Peyret Tandem, covered in rubberised fabric, and in a very few cases, pure silk, which did not prove satisfactory.

Sewing the fabric to the ribs was not usually necessary except with strongly undercambered wings. The covering was glued on, often with un-thinned dope.

The shrinking fabric tended to distort the lighter parts of the framework, such as the trailing edges of wings and tails, so it was common to find these members warping to some extent after a few weeks in use. Wing ribs were often braced against sideways distortion with light secondary spars or lengths of cotton tape woven laterally, zig zag fashion between the ribs internally.

Plywood skins were also doped to prepare the surfaces for the final treatment, several coats of high quality marine varnish over fabric areas as well as the plywood. The end result was a very high gloss over the entire external surface.

In all cases, the varnish changed colour and darkened greatly, especially after a season or two in the sun.

It was very common for manuafacturers, clubs and sailplane owners to add 'logos', names, national or regional emblems, cartoons and even advertisements, to their sailplanes, simply painting these onto the surface before or after the final coat of varnish. These could be changed easily, and often were. A few sailplanes, such as the Schloss Mainberg, had highly elaborate and detailed paintings on the rudder or elsewhere. In competitions, numbers could be added by painting with distemper, removed after the contest, or by sticking on sheets of paper carrying the figures, also removed later. It was therefore very common for a sailplane to be altered in appearance from one week to the next. Any repairs or modifications would also cause alterations. For instance, a new plywood panel would have a markedly lighter colour than the older skin. The same with fabric patches.

Formal registration letters and numbers were not always required for sailplanes. In Britain, for example, the only identifying marks might be a small BGA number on the fuselage under the tailplane, sometimes not even this. In other countries the registration might be required, but always with local variations according to the whims of the owners.

In the early nineteen thirties, when it was realised that a little extra weight did not matter very much, or could even be an advantage, painting sailplanes become more common. Unpainted fabric would perish after a very few seasons exposure to the sun. Complete re-covering was expensive and time consuming so it became normal to use a pigmented dope, red or aluminium, to provide a basis for the paint.

In Germany, at various times after 1933, officially approved colour schemes were laid down, together with registration numbers and letters related to the various regional divisions of the country (including Austria after the Anschluss of 1938). However, the official requirements were not always met, especially with older aircraft which were not repainted immediately, or ever, when the official decrees were issued. The rules in any case were changed from time to time, and gliders belonging to the Luftwaffe had their own registration system, different from the NSFK and the remaining privately owned sailplanes. As always, the only way to establish with certainty what colour scheme and markings are appropriate for a restoration project or a model, is to study photographs of the particular sailplane.

In other countries the same applies, only more.

Acknowledgements

This book owes much to the following sailplane designers, constructors and pilots. Some are now deceased. The author thanks them for their assistance in correspondence and conversations, and for their kindness in supplying photographs, drawings and correcting errors.

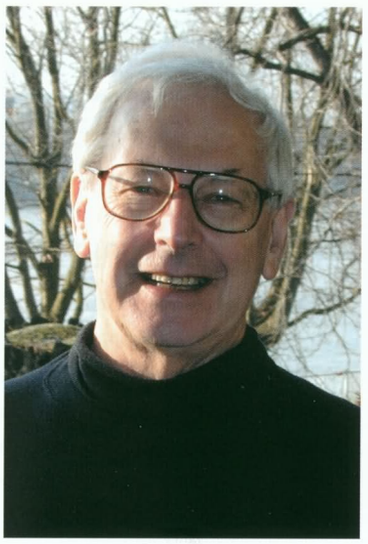
L.E. Baynes, Waclaw Czerwinski, Klaus Heyn, Harold Holdsworth, Walter Horten, August Hug, Hans Jacobs, Richard Johnson, Jack Laister, Reiner Karch, Alexander Lippisch, Geoff Richardson, Peter Riedel, John Robinson, Lajos Rotter, Hans Sander, Martin Schempp, Harry Schneider, Willi Schwarzenbach, Paul, Ernie and Bill Schweizer, Fred Slingsby, Jacob Spalinger, John Sproule, Geoffrey Stephenson, Chris and Philip Wills.

A great many other people have helped by supplying photographs, drawings and advice. Those not already mentioned are listed below:

Allan Ash, Ray Ash, Geoff Bailey Woods, Ted Baker, Mike Beach, Otto Bellinger, Richard Benbough, Raul Blacksten (VSA), A.J.R. Brink, R. Buettner, George Burton (Vickers Slingsby Ltd), Hollis Button, Jeff Byard, Ary Ceelen, Dave Craddock, Jerzy Cynk, Louis de Lange, Martin Deskau, Hans Disma, James Ealy, Norman Ellison, Georgio Evangelisti, Helen Evans (S & G), Berndt Ewald (Tech Hochschule Darmstadt) Jochen Ewald (Akaflieg Aachen), Flight International staff, Hans Folgmann, Nathan J. Frank, Thorsten Fridlizius, Mike Garnett, Paul Gibson, Andrjé Glass, Nick Goodhart, James Grantham, Jim Gray, F R Hamilton, Bertrand A Handwork, Arthur Hardinge, Theo Heimgartner, Ted Hull, F. Mitter Imre, Brigitte Keane, Max Kroger, Doug Lamont, Peter Layne, Mita Levin, Forester Lindsley, Paul MacCready, Dean R. McMillian, Tony Maufe, J.R.C. (Rodi) Morgan, Richard K. Ng, George Nuse, Alan, Ian and Tighe Patching, Vincenzo Pedrielli, Marici Phillips, Theo Rack (Wasserkuppe Museum), Christian Ravel, Roger Reffell, Chris Riddell, Mike Russell, Michael Rutter (Slingsby Aviation Ltd), Gunter Schapka, Paul Serries, Eva and Willy Simo, Simine Short, Patricia Simons, Alan E. Slater, Louis Slater, Shirley Sliwa, Bob Slusarev, Tom Smith, Geoff Steele, Bob Storck, Gary Sunderland, Marton Szigeti, George Thompson, Knut Uller, Niels Visser, Wolfgang Wagner, Doc Walker, Ernst Walter, Per Weishaupt, Reiner Willecke, Paul Williams, Hans Zacher and Walter Zuerl.

Among the public institutions whose services have been gratefully employed are the British Library, The State Library of South Australia, the libraries of Cambridge, London and Adelaide Universities, the USSR National Public Library for Science and Technology and The Lenin State Library, Moscow (as they were), the Technical Information Service of the American Institute of Aeronautics and Astronautics, the Archives of the Verkehrshaus Swiss Transport Museum, Lucerne, the Wasserkuppe Museum and the National Soaring Museum, Elmira. Help has also been given by the Vintage Glider Club, the Vintage Soaring Association of the USA and Vintage Gliders of Australia.

The Author



The author, Martin Simons, born in 1930, has been involved in gliding for more than fifty years. With the Gold C badge and two diamonds, he has flown about one hundred different types of sailplane, including twenty of those described in this work. He is also a keen model sailplane designer, builder and flier.

English by birth, he is now based in Adelaide, South Australia, with dual citizenship. His previous books include Slingsby Sailplanes, a standard reference work on the famous British glider manufacturing company, and he collaborated with Paul Schweizer to produce Sailplanes by Schweizer, a companion book about the leading American manufacturer. His book, The World's Vintage Sailplanes 1908 - 45, was published in 1986. He also wrote Model Aircraft Aerodynamics, the only work of its kind in English, and a great many shorter articles and books, some not actually about aviation!

BIBLIOGRAPHY

Books and monographs

Akaflieg München, 50 Jahre Akaflieg München (Zuerl).

Andrews, J P, Gliding and Soaring (McBride, New York, 1944).

Antonov, O K, Texnicheskoe Opisante Planerov, YS-3 & PS-1 (Moscow, 1933).

Antonov, O K & Shashaorin, A, Texnicheskoe Opisante i Akspluatadivah Planerov YC-4 & PS-2 (Moscow, 1936).

Apostolo, G, Centro Studi ed Esperienze per il Volo a Vela (Politecnico di Milano 1998).

Army Air Forces, Air Service Command, Technical Orders, Pilot's Operating Instructions, Erection and Maintenance Instructions, Parts Catalogue, for TG-3 and TG-4 gliders, Tech Order Numbers 09-15-AA-1 to 4 and 09-30 AB-1 to 4 (January to March 1943).

Ashwell Cooke, J R, (Ed), Motorless Flight (John Hamilton, London, 1932).

Barnaby, R S, Gliders and Gliding (Ronald Press Co, New York, 1930).

Barnaby, R S, A History of American Soaring (American Soaring Handbook, Vol 1, Soaring Society of America, 1963).

Barringer, Lewin B, Flight Without Power (Pitman, New York, 1940).

Bohdan, Aret, Poles Against the V Weapons (Interpress, Warsaw, 1972).

Brütting, G, Segefflug Erobert die Welt (Knorr & Hirth, München Ulm, 1952).

Brütting, G, Die Berühmtesten Segelflugzeuge (Motorbuch, Stuttgart 1970).

Brütting, G, Die Geschichte des Segelflugzeuges (Motorbuch, Stuttgart 1972).

Brown, E, Wings of the Weird and Wonderful Vol 1 (Airlife, 1983)

Butler, P H, British Gliders (Merseyside Aviation Society, Liverpool, Ist edition, 1970, 2nd edition, 1975).

Castello, C, Castel Mauboussin Planeurs et Avions.

Coates, A M, Jane's World Sailplanes (Macdonald & Janes, London, 1978).

Coggi, I, Fabrizio, J, Mantelli, A, Bignozzi, G, SAI Ambrosini CVV 6 (Monografie Aeronautiche Italiane, 1982).

Csandi, N, Nagyvaradi, S, Winkler, L, A Magyar Repules Toertenete (Müszaki Könyvkiadó, Budapest, 1977).

Cummings, M M, The Powerless Ones (Frederick Muller, London, 1966).

Cynk, J B, Polish Aircraft 1893 - 1939 (Putnam, London, 1971).

Czerwenka, Dr, 50 Jahre Akademische Fliegergrappe Braunschweig 1922-1972 (Akaflieg Braunschweig, 1972).

Douglas, A C, (Welch, A,) Gliding and Advanced Soaring (John Murray, London, 1947).

Edmonds, A C, (Welch, A,) Silent Flight (Country Life London, 1937).

Ellison, N, British Gliders and Sailplanes 1922-1970 (A & C Black, London, 1971).

Eyb, R, Fliegerhandbuch (Richard Carl Schmidt, Berlin, 1926).

Frati, S, L'aliante (1946 reprinted Libraria Gatti Editrice, 1991).

Gabor, J, Magyar vitorlázó Repülögépek (Müszaki Könyvkiadó, Budapest 1988).

Galé, F, Tailless Tale (B2 Streamlines, Olalla, Washington State, USA)

Gibbs - Smith, C H, The Aeroplane (HMSO, London, 1960).

Gibbs - Smith, C H, The Invention of the Aeroplane (Faber and Faber, London, 1966).

Glass, A, Polske Konstrukcie Lotnice 1893-1939 (Wydawnietwa Komunikacjii Lacznosci, Warsaw, 1976).

Goodyear, H R R, (Ed), Gliding Yearbook 1931 (Dorset Gliding Club, Weymouth, 1931).

Groesbeek, W J & Osinga, N, Voor den Oorlog (Self published).

Gymnich, A, Der Gleit und Segelflugzeugbau (Richard Carl Schmidt, Berlin, 1925).

Haanen, K T, Robert Kronfeld (Walter Zuerl, Munich, 1962).

Hakenjos, R, & Goebel, H, Der Weg zum Klippeneck (Sportfliegergruppe Schweningen, 1977).

Heidler, K, FVA, (Flugwissenschaftliche Vereinigung Aachen 1980).

Heiss, L, Hirth, Vater, Helmuth, Wolf (R A Muller, Stuttgart, 1949).

Hirth, W, Die Hohe Schule des Segelfluges (Stuttgarter Vercinsbuchdruche, Stuttgart, 1938, translated as The Art of Soaring Flight by Naomi Heron Maxwell).

Hirth, W, Handbuch des Segelfliegens (Frank'sche, Stuttgart, 1938).

Hirth, W, Gmbh, Betriebshandbuch Kunst Segelflugzeug Habicht (Nabern Teck, 1942).

Hoinville, F, Halfway to Heaven (Angus and Robertson, Sydney, 1961).

Horsley, T, Soaring Flight (Eyre and Spottiswoode, London, 1944).

Howard Flanders, L, and Carr, C F, Gliding and Motorless Flight (Pitman, London, 1932).

Humen, Wlodzimierz, Soaring in Poland (Polonia, Warsaw, 1957).

Ilchenko, V, Parahschtchie Polet (DOSAAF, Moscow, 1964).

Imré, Mitter, A Magyar Vitorlázórepülés Képes Története 1929 - 1999 (Mitter, 1999).

Jacobs, H, Werkstattspraxis fur den bau von Gleit und Segelflugzeuge (Otto Maier, Ravensburg, 1930?).

Jacobs, H, Leistungs Segelflugmodell, Spiel & Arbeit 115 (Otto Maier, Ravensburg 1930?).

Jacobs, H, Schwanzlose Segelflugmodelle, Spiel & Arbeit 114 (Otto Maier, Ravensburg 1930?).

Jabrov, A A, Kak i Pochemu Letaet Planer (Moscow, 1938).

Kawakami, H, Nihon no Glider 1930 - 1945 (Japanese Gliders 1930 - 1945) (1998)

Kens, K, Flugzeugtypen 1953 (Carl O Lange, Duisberg, 1953).,

Krasilschkov, A P, Planersi SSSR (Mashinostroi, Moscow 1991).

Kronfeld, R, Kronfeld on Gliding and Soaring (John Hamilton, London, 1932).

Langsdorff, W von, Das Segelflug (J F Lehmanns, Münich, 1923).

Latimer-Needham, C H, Sailplanes, their design, construction and pilotage (Chapman and Hall, London, 1932).

Lilienthal, Gustav, Vom Gleitflug zum Segelflug (Volckman, Berlin, 1923).

Lippisch, A, The Delta Wing (Iowa State University, 1981).

Maresch, G, Erwin Musger Flugzeug- and Fahrzeugkonstrukteur (Blätter für Technikgeschichte 48 Heft, Wien, 1986).

Mason, H Molloy, The Rise of the Luftwaffe (Cassell, London, 1975).

Mazzaron, A G F Il Volo a Vela Italiano (Tecna, 1991).

Miller, R, Soaring 1965 Yearbook (Soaring International, San Francisco, 1965).

Miller, Richard, Without Visible Means of Support (Miller, Los Angeles, 1967).

Modellsport Verlag, Flugzeugtypen (Segelflugzeuge). Band 1, Band 2 (Modellsport Verlag 1998, 9).

Mrazeck, James E, Fighting Gliders of World War 2 (R Hale, London, 1977).

National Advisory Council for Aeronautics,Technical Memoranda numbers 59, 100, 140, 166, 181, 186, 265, 433, 434, 471, 514, 560, 623, 637, 666, 762, 780

Nickel, K & Wohlfahrt, M, Trs Brown, E, M, Tailless Aircraft (AIAA 1994).

Nimführ, Raimund, Mechanische and Technische Grundlagen des Segelfluges (Richard Carl Schmidt, Berlin, 1919).

Organisation Scientifique et Technical de Vol a Voile, The World's Sailplanes, Volume 1, 1958, Volume 2, 1963.

Organisation Scientifique et Technical de Vol a Voile, Publication VI, 1960.

Pagé, V W, Henley's A B C of Gliding and Sailflying (Chapman and Hall, 1930).

Peter, Ernst, Segelflugstart (Motorbuch Verlag Stuttgart, 1981).

Pilcher, Percy S, Gliding (Aeronautical Classics Number 5, Aeronautical Society of Great Britain, 1910).

Raunio, Jukka, PIK-Sarjan Lentokoneet (Forssan Kirjapaino Oy, Forssa 1995).

Ravel, C, Histoire des Planeurs SA 103, 104 Émouchet (Le Musee de l'air et de l'espace 1996).

Reitsch, H, The Sky my Kingdom (Bodley Head, London, 1955, translated by Lawrence Wilson from Fliegen mein Leben).

Riedel, P, Start in den Wind (Motorbuch, Stuttgart, 1977).

Riedel, P, Vom Hangwind zur Thermik (Motorbuch, Stuttgart, 1984).

Riedel, P, Über Sonnige Weiten (Motorbuch, Stuttgart, 1985).

Riegels, F W, Aerofoil Sections (Butterworth, London, 1961, translated by D G Randall).

Ross, M, Sailing the Skies (Macmillan, New York, 1931).

Rovesti, P, Ali Silenziose del Mondo (Dalla Rivista 'Volo a Vela', 1975).

Royal Aeronautical Society, Handbook for Aeronautics Vol 1 (Pitman, London, 1961).

Rozanov, A M, Stoklitskia, C L, Antonov, O KTecnika i Practika Planerisma (Moscow, 1934).

Rutschi, H, Segelflug (Switzerland, 1944).

Sato, H, (Ed Kimura, H) Nihon Glider Shi (History of Japanese Gliding) (ISBN 4 87415 272 4)

Schneider, E, Flugzeugbau Schneider Catalogues 1931, 2

Schneider, H, Flugzeugtypenbuch 1944 (H Beyer, Leipzig, 1944).

Schnippenkötter, Josef, und Weyres, Theobald, Physik der Luftfahrt (Ferd Duemmlers, Berlin Bonn, 1937).

Schweizer, P A, & Simons, M, Sailplanes by Schweizer (Airlife, Shrewsbury, England 1998).

Schweizer, P A,Wings Like Eagles (Smithsonian, 1988).

Schweizer, W, Soaring with the Schweizers (Rivilo, 1991).

Selinger, P, Segelflugzeuge von Wolf zurn Mini-Nimbus (Motorbuch, Stuttgart, 1978).

Serjeant, Richard, and Watson, Alex, The Gliding Book (Nicholas Kaye, London, 1965).

Sheremetev, B N, Planery (DOSAAF, Moscow, 1959).

Sigurdsson, A, Annálar Íslenkra Flugmála (Reykjavik 1987)

Simons, M, The World's Vintage Sailplanes 1908 - 1945, (Kookaburra Tech Publications, Australia, 1986).

Simons, M, Slingsby Sailplanes (Airlife, Shrewsbury, England 1996).

Simons, M, German Air Attaché (Airlife, Shrewsbury, England, 1997).

Smith, J R, & Kay, A, German Aircraft of World War 2 (Putnam, London, 1972).

Stamer, F, Zwölf Jahre Wasserkuppe (Reimar Hobbing, Berlin, 1933).

Stamer, F, and Lippisch, A, Gliding and Sailplaning (Bodley Head, London, 1930, trs G E Startup and F Kinnear).

Taylor, H A, Airspeed Aircraft since 1931 (Putnam, London, 1963).

Teale, Edwin H, The Book of Gliders (E P Dutton, New York, 1930).

Thomas, F, Fundamentals of Sailplane Design (College Park, 1999).

Visse, C & Ravel, C, Histoire des Planeurs Avia (Musee de l'air et de l'espace, 1993).

Volmar, J, I learned to Fly for Hitler (Kron Publications, 1998).

Wenham, F W, Aerial Locomotion (First Annual Report, Aeronautical Society of Great Britain, London, 1866).

Welch, A, Happy to Fly (Murray, London, 1983).

Welch, A, and Welch, L, The Story of Gliding (Murray, London, 1965).

Weyl, A R, Fokker, the Creative Years (Putnam, London, 1965).

Wills, P, On Being a Bird (Max Parrish, London, 1953).

Wright, L, The Wooden Sword (Paul Elek, London, 1967).

Zacher, H, Studenten forschen, bauen & fliegen (Akademische Fliegergruppe Darmstadt, 1981).

Zanrosso, G, Storia ed Evoluzione dell'Aliante (History and Evolution of the Glider). Volumes 1, 2 & 3 1996, Egida Edizioni, Vicenza

Zbiorowa, P, Konstrukcje Lotnicze Polski Ludowej (Wydnawnictwa Komunikasji i Lacmosci, Warsaw, 1965).

Zipper, G, Falkenhorst (Weishaupt, 1999).

Zumyatin, V M, Gliders and the Art of Gliding (Moscow, 1974, translated from Planery i Planerizm, NASA).

Zuerl, W, Günther Grönhoff und die Goldenen Jahre des Deutschen Segelflugs (Walter Zuerl, 1976)

Periodicals

Aeronautics (UK)
Aeroplane (UK)
Aeroplane Monthly (UK)
Aero Revue (Switz)
Aerokurier (Germany)
Aircraft (Australia)
Aircraft Engineering (UK)
Air Enthusiast (UK)
Australian Gliding
Bungee Cord (USA)
Der Segelflieger (Germany)
Flieger (Germany)
Flight (UK)
Flight International (UK)
Flugsport (Germany)
Gliding (UK)
Jahrbuch des Deutschen Luftfahrtforschung
Journal of the R Ae Soc (UK)
L'aerophile (France)
Luftfahrtforschung (Germany)
Modellismo (Italy)
Modelist Konstructor (USSR)
National Geographic Magazine (USA)
NSM (National Soaring Museum, USA)
Planeur (Belgium)
Quiet Flight International (UK)
Sailplane and Glider (UK)
Sailplane and Gliding (UK)
Soaring (USA)
Technical Soaring (OSTIV,USA)
Tekhnika Vozdushchiogo Foma (USSR)
Thermik (Germany)
Vintage Aircraft (UK)
VGC News (UK)
ZFM (Zeitschrift für Flugtechnik und Motorluftschiffahrt)

INDEX

bold page numbers reffer to drawings

This book, Volume 1 of a projected series, describes and illustrates more than 120 types of sailplane, designed, built and flown in many countries during the quarter century following the first organised gliding competition on the Wasserkuppe in 1920. The astonishing achievements of designers and builders, lacking modern materials and production methods, and the flights made by the pilots of those times, deserve to be recorded and remembered.

New scale drawings, produced in digital form, show structural details with colour shading to indicate the materials used. Exact dimensions, cross sections and profiles are included. There are more than 300 authentic photographs, many previously unpublished. The textual commentary draws attention to significant trends and developments in sailplane design.

This book will prove a rich source of accurate information for scale modellers, who were much in mind when making the drawings and selecting photographs. To fly most of the sailplanes described here, the only way now is to build a large scale radio controlled model.

ISBN 3-9806773-4-6
9 783980 677349