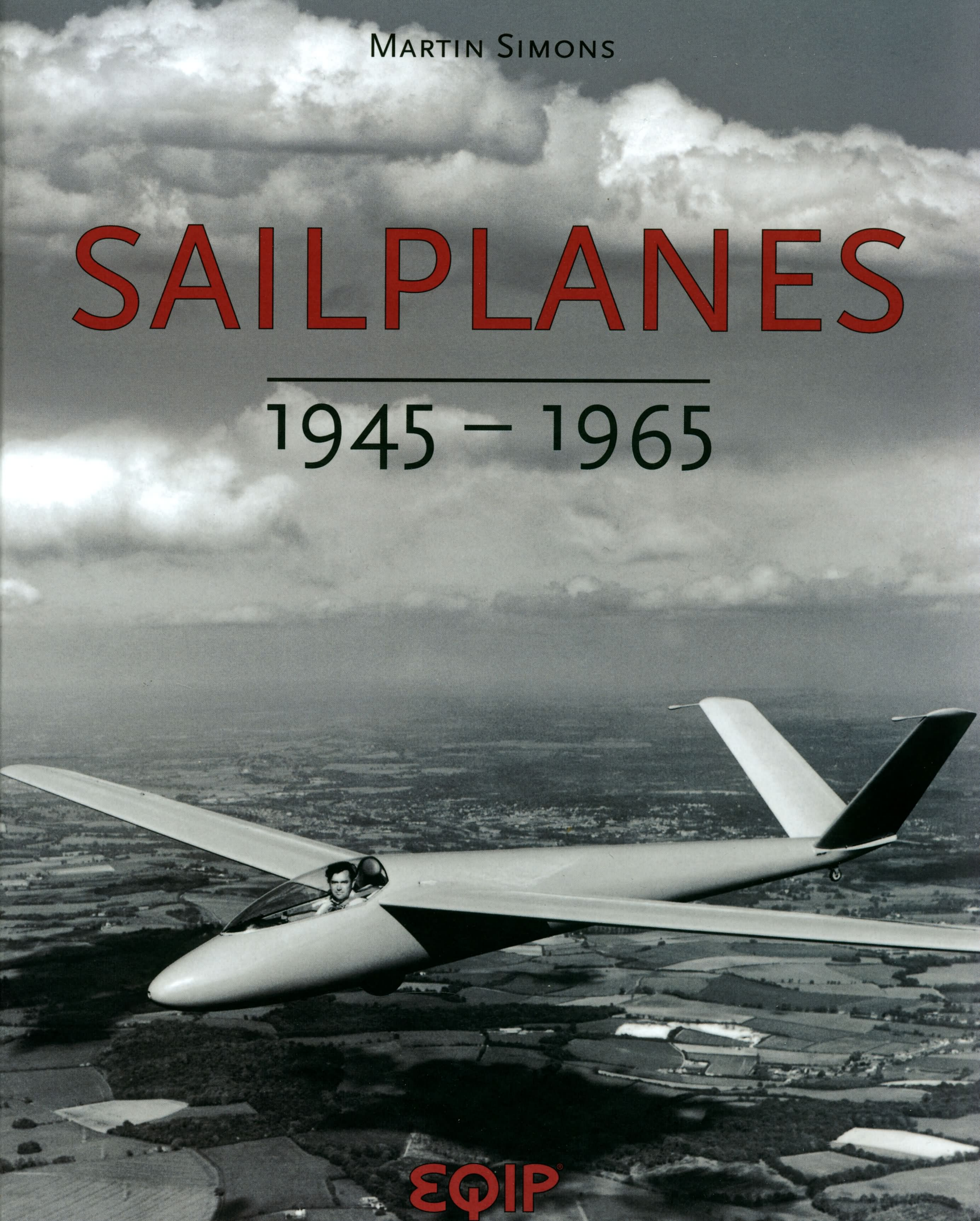
MARTIN SIMONS

SAILPLANES

1945 – 1965



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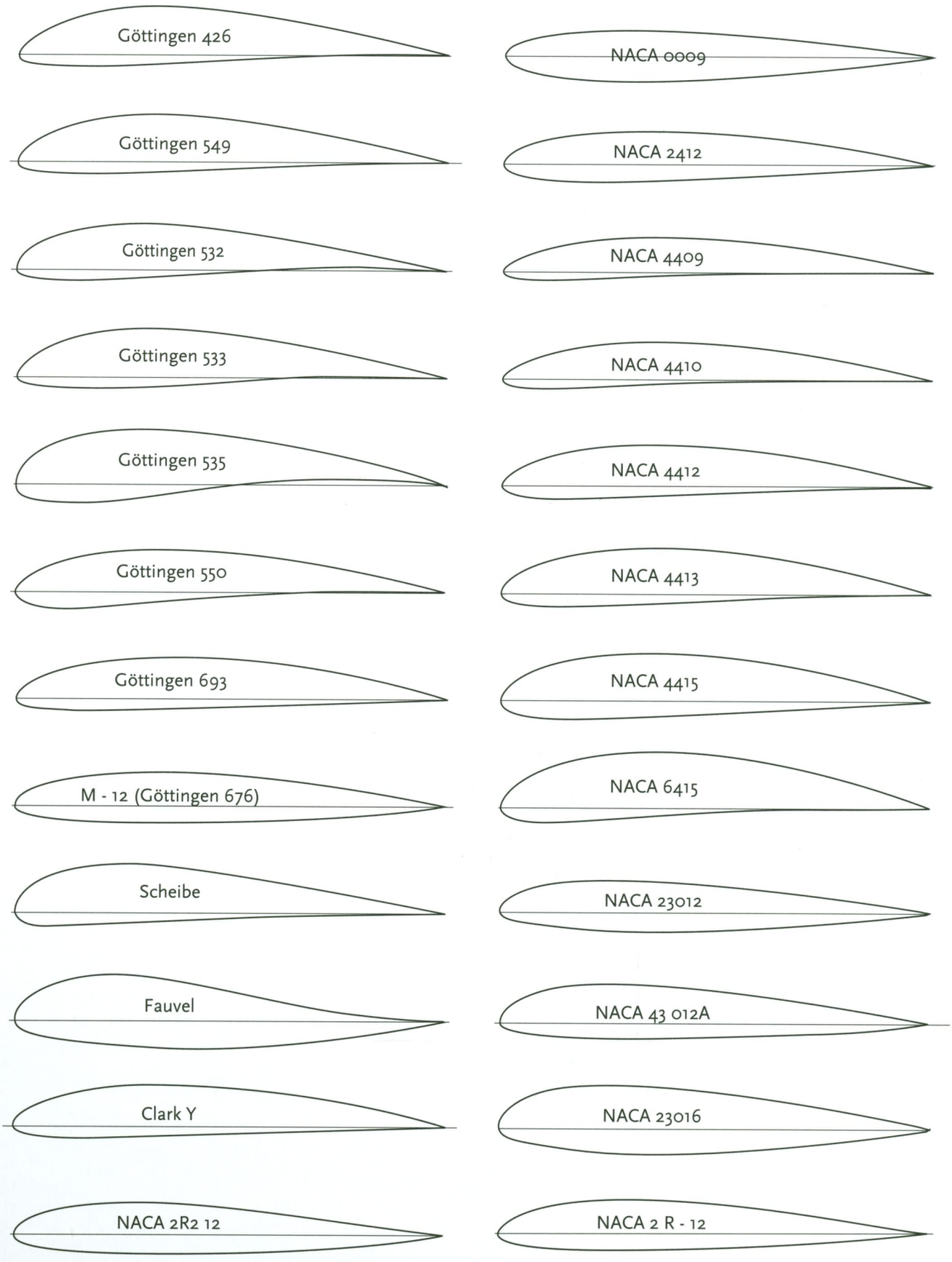
Wing profiles

The old tradition



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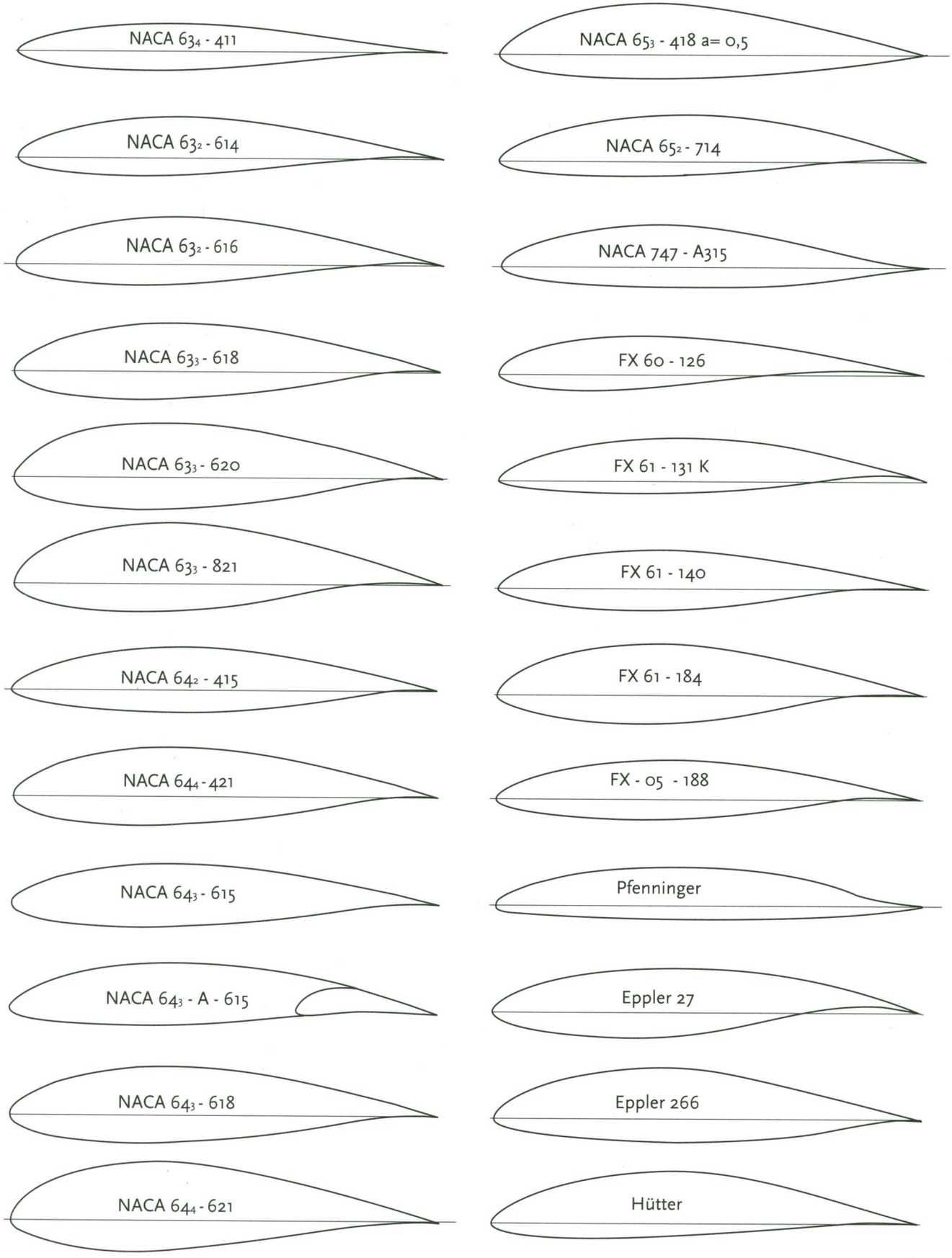

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The publishers seek unusual photographs and documents from the early days of aviation. We would like to hear from anyone owning such materials, who would wish to have them published.

2nd Revised Edition, 2006

EQIP Werbung & Verlag GmbH
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Königswinter · Germany
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Website: www.eqip.de · e-mail:
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Printed in Czech Republic by Graspo CZ, a. s. Zlin

ISBN 3-9807977-4-0

Cover:
© Royal Air Force Museum Hendon, Charles E Brown, reference number 6867-1
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PREFACE

New Year's Day in 1946 was extremely cold on Camphill. I had first seen sailplanes there in the summer of 1939. I was there again but now there was frost on the ground and a biting wind of 25 knots. After a six-year wartime ban on all sport flying this was the first day that gliding clubs in England were legally permitted to re-start operations. The Derbyshire and Lancashire Gliding Club Committee had survived the war and kept the club alive. They were ready with a serviceable winch and two sailplanes. There was a Grunau Baby II and a Kirby Kite which, somehow, had survived military requisitioning. Both were built of wood, the open-framed parts of their wing and tail covered in clear-doped fabric. The plywood skin areas of the Kite were varnished, showing the intricate grain of the outer veneers and all the skillfully made scarf joints. Nothing, I thought, could ever surpass the dream-like image and sound of a wooden aircraft with translucent wings passing through the air.

On that day there was no chance of soaring but ten launches were done before all retreated to shelter in the old farmhouse which was the club headquarters. It was a new beginning but with old aircraft and equipment. It was not at all clear, that there was to be a technical and theoretical revolution.

By 1965 we had experienced things quite beyond the imagination of those who had gathered on that chilling hill top two decades earlier. Those were exciting years. There were discoveries in aerodynamics and meteorology. New materials, adhesives and methods of aircraft construction were proposed, tested and adopted or discarded. New instruments were invented. There were new, tougher sorts of competition, new tasks and records to be achieved. Pilots learned new techniques; methods of training were transformed. The old hilltop gliding sites, although still used, began to seem out of date. New clubs and large gliding centres developed on flat land. Everything changed.

There remained the fascination and beauty of soaring, but it was beauty now of a very different kind. The best sailplanes competing in the 'Open Class' World Championships of 1965 were large, sleek and fast, heavy, complex and expensive. Wings had flaps, undercarriages retracted, there were tanks for water ballast. Powerful air brakes were essential. Cockpits were narrow, crowded with equipment and enclosed by moulded transparent canopies. In some cases the pilots lay on their backs rather than sitting. Everyone had radios, glide calculators, audio instruments. External surfaces were smooth, almost free of bumps or wobbles, and kept clean. Joints and control surface hinges were airtight. Internal structures and external skins were often of metal or plastic. Even the so-called 'Standard Class', supposed to be smaller, cheaper and more practical, had not escaped the transformation. In the struggle to get the most from a limited wing span of fifteen metres, designers had adopted extreme measures. In this class wheels did not retract but were often so deeply buried in the fuselage that they defeated their purpose. Where plywood was still used, it was often in the form of a sandwich with plastic foam filling and always primed and painted.

Following directly from the first volume, 'Sailplanes 1920 - 1945', I attempt here an account of the revolution in soaring by describing sailplanes that made their first flights in the twenty year period, 1945 - 65. 1965 was not the end of the revolution but marked a turning point. For this reason, and because a pause is necessary somewhere, that year makes a convenient end point for this book. The most fundamental technical developments in sailplane design and construction had been made or were foreseeable. When I began this ambitious project, a preliminary list of aircraft deserving to be included contained more than four hundred types. A drastic reduction was inevitable. Many fine aircraft have therefore been omitted or reduced to a mere mention in the text, or sometimes a single photograph. The criteria used to make the cuts are not fully defensible although they are not arbitrary. It proves very difficult to obtain accurate information about some significant and important aircraft. In old magazines and books indistinct photographs, rough outline drawings or sketches of contemporary gliders are to be found. Often it has proved impossible to get beyond these to discover the kind of detail that a work of this kind requires. The groups or companies concerned are sometimes no longer in existence. Designers and constructors have moved into other fields, retired or died. Records have been destroyed or buried in forgotten archives and lost for practical purposes. Political upheavals and wars have done enormous harm. This applies unfortunately to some entire countries where enquiries, have failed to uncover the desired material. Sailplanes were designed and built in China, Bulgaria and Romania but other than their names and general outlines, sufficient details have not been found. East Germany, the USSR and Brazil get quite inadequate coverage. India and Japan are entirely omitted.

On the other hand, sometimes more information is available than can be accommodated. Many friends have offered generous help and are formally thanked in the Appendix. Some will probably feel that the space allocated to the material they provided is inadequate. Some important items have been left out and the space given to others. There could be and should be more books covering the same period but one author cannot pretend to have the competence and energy to attempt all of them. In making any final selection there is admittedly an element of bias, subjective judgment and personal preference. What followed after 1965 requires at least another volume. It should cover the further discoveries in aerodynamics, structural materials and instrumentation, and the adaptation and absorption of the new craft and practices into general and routine operations.

Introduction

Starting Over

When the Second World War ended much of Europe was devastated. In Germany where the sport of soaring had begun, every major city was reduced almost entirely to rubble. The country was divided into occupation zones, British, American, French and Russian. The Allied armies had captured hundreds of motorless aircraft. Many were taken as spoils of war or shipped off for technical examination. Others were requisitioned for recreational gliding clubs set up by the occupying forces. Most were deliberately destroyed. As in 1919, German nationals were forbidden to engage in aviation, with the difference that gliding was this time specifically included in the ban. Local glider pilots hid a few precious sailplanes in secret barns and sheds. Austria, like Germany, was occupied and divided.

The soaring movement in Poland had rivaled that of Germany. There was now a drastic, forced change of political frontiers. The effect was to shift the whole of Poland westwards. Lost entirely to the USSR were all the eastern territories. Gained were the former German provinces of Pomerania, Upper Silesia and half of East Prussia. The famous Grunau factory of Edmund Schneider was in Silesia. The Schneider family was among the millions of displaced people contributing unwillingly to a vast refugee problem. In what remained of pre-war Poland, there were only two complete sailplanes.

In neutral Switzerland, soaring had been interrupted for months but was later allowed in limited areas. The companies established by Spalinger, Hug (Spyr) and the Müllers (Moswey) continued to design and build sailplanes. In Sweden also flying continued more or less normally. There was no shortage of aircraft quality timber and over a hundred sailplanes were built to German plans, Grunau Babies, Weihes, Kranich two-seaters and a few Olympias. There was some indigenous design activity. A central gliding school for instructors was established, with government money, at Alleberg. There were said to be about 3000 glider pilots. In Spain, a National Gliding School had been established in 1940 at Monflorite, with official support. Sailplanes were built from German plans and pupils' costs were generously subsidised.

It had been expected by many that as soon as the fighting ended, thousands of former pilots demobilised from vastly reduced airforces would wish to continue flying. Soaring, relatively cheap and entirely peaceful, would be highly attractive to them. At the same time, many young cadets who had expected to be flying military aeroplanes within a few months, would find this exciting prospect gone and would turn, or turn again, to gliding. There would be rapid expansion with greatly increased demand for new sailplanes. Designers and factories would be sure of employment. Plans were made accordingly.

There was indeed rapid growth in some countries. In France some gliding and glider manufacture had been allowed by the short-lived Vichy government but was stopped when the Germans occupied the whole country. When soaring began again after 1944, there were very substantial government subsidies. National Centres were established at chosen sites, with professional staff. Over 450 captured sailplanes of all types came from Germany and 1000 new two seat and single seat trainers were ordered, the types chosen dating back several years. Manufacturers were encouraged to develop some new designs. It was estimated that by 1947 there were at least 50,000 active sailplane pilots in France.

In the Netherlands no soaring had been possible for five years. After the war a government subsidy allowed the establishment of a national soaring centre at Terlet near Arnhem. The Fokker Company undertook some manufacture using German drawings.

Following the 1945 Potsdam conference, eastern Europe, including the Russian occupation zone of Germany, was taken into the communist block controlled from Moscow. By 1948, Czechoslovakia was also drawn in. Yugoslavia broke away, though remaining communist under Marshal Tito. Finland, with a subsidised National Gliding Centre at Jamijärvi, struggled to maintain a quasi independence. In all the communist countries there was substantial state backing for sport, especially when international prestige was at stake. In the case of soaring, there was additional interest because, as in pre-war Germany, this was a way of encouraging young people to pursue careers in aviation and the air forces. Vigorous efforts were made to rebuild the movement. In association with this, new design and manufacture of equipment was encouraged. There was also the possibility of exporting sailplanes. State-owned companies were freed of the intense commercial pressures experienced in capitalist countries but there were checks of other kinds. If, but only if, a new project could be justified to the political and economic overseers, it could proceed.

In Britain a large wartime industry had been set up manufacturing military transport gliders. In addition the Air Training Corps used hundreds of 'Cadet' and 'Tutor' trainers. The chief manufacturer, Slingsby, was ready immediately to produce again for the civilian market. Other firms had appeared, notably Martin Hearn in association with Slingsby, and Elliotts of Newbury, a former furniture manufacturer turned aircraft builder. Horace Buckingham, the proprietor, hoped to find new markets in the revived civilian flying clubs. But the expected growth was much smaller than anticipated. There was no subsidy and little or no official interest. The clubs could hardly cope with the numbers that did appear for they were desperately short of aircraft and equipment. The London Gliding Club based at Dunstable was forced to turn newcomers away at first. Elliotts began to produce the 'Olympia' and Slingsby's order books became very thin.

In the USA sport flying suffered when materials and men were called into military service, but there was no devastation. The

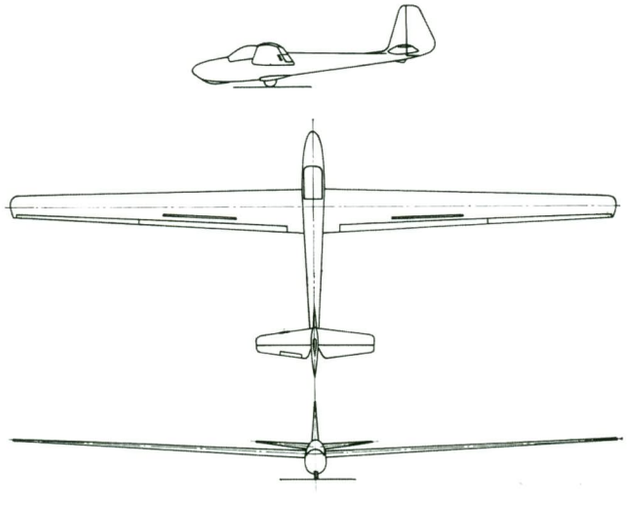
Schweizer Aircraft Company after 1945 was able to turn attention again to sporting sailplanes. But they too, ran into difficulties. The North American market was flooded by two-seaters, including some of their own products now made available cheaply as surplus to military needs. The end of war also freed numerous skilled engineers, designers and constructors who, taking advantage of liberal airworthiness laws, could contribute as before to a vigorous home-design and building movement. Why buy, when you could design and build?

The small Canadian gliding movement had almost collapsed in 1940 but was reawakened by the arrival of several well-qualified and energetic Europeans, among them the outstanding designer, Waclaw Czerwinski, who had escaped when the Germans conquered Poland. He settled in Canada. By 1944 a new sailplane, a version of his famous 'Salamandra' re-named 'Robin', was flying.

Elsewhere, gliding in Australia almost ceased for several years when war broke out in the Pacific region. A few small, scattered clubs struggled on. A revival began during and after 1944 and there was always some amateur design and building. In Argentina, Brazil and South Africa there were active clubs but apart from some homebuilding, little in the way of new design.

In Japan all gliders were destroyed. The soaring clubs in that country vanished.

In Germany, where the interest and desire to go soaring was as strong as ever, there was nothing but frustration until the bans were removed. This did not happen in West Germany till 1951. In Eastern Germany some limited soaring was permitted before this date. Subsequently there was design and manufacture by VEB Apparatebau Lommatzsch. The small drawing shown on this page illustrates one East German type, the Libelle Laminar, a 16.5 metre span sailplane of wooden construction. It has not been possible to find detail sufficient to make a better drawing. This illustrates a very common problem for the author of a book such as this.



The cutting edge

One of the first important post-war decisions by the gliding division of the Federation Aeronautique Internationale, concerned international soaring competitions. There had been one such championship in 1937. The International Olympic Games Committee thereafter accepted soaring. In 1948 the Games were to be held in England. After consideration the Olympic Committee decided against soaring because there was insufficient time for preparations. This decision was not intended to apply to the next Games, due for 1952, but the FAI decided nevertheless to stage an independent championship. It was intended to hold this meeting in England in parallel with the Olympics. Despite organising a successful national competition as a rehearsal in 1947, the British Gliding Association, lacking financial support and sponsorship, were unable to act as hosts. Instead, Switzerland offered to run the Championships at the Alpine site of Samedan. For one reason and another, after 1948 soaring never did become part of the Olympic Games. This had a significant side effect.

The principle of Olympic competition had always been competition of person against person or human team against team. Had soaring been included, all pilots would have flown the same type of sailplane. (That was the purpose of the 'Olympia' design in the first place.) The new Internationals, held from now regularly every two years or so, were always a competition between pilot and sailplane in combination. At the Championships designers and manufacturers could display their latest products, not only sailplanes but all the ancillary equipment, instruments, parachutes, oxygen apparatus, radios, trailers, towing vehicles, materials, adhesives, tools, clothing, everything and anything that had some relevance to the sport. They arranged, as far as possible, that outstanding pilots would use their products. They would often provide crews and cars. By winning or at least doing well, they hoped to ensure that they would succeed in the market place. The Internationals became much more than a test of soaring skill. They were, and remained, also a biennial commercial show. The same applied only slightly less to the numerous national and regional competitions that multiplied and grew in size and complexity year by year.

One thing that remained and still remains almost unknown in soaring, is the large cash prize that, in some other sports, has come to be such an important factor. There were always a few professional gliding instructors. A few of these have extended their courses to advanced soaring for contest aspirants. But there has never been anything comparable with the golf or tennis circuit where star performers make fortunes while being cheered and even mobbed by adoring supporters. Soaring has never been and probably never can become a spectator sport. Television cameras are rarely seen at gliding sites. As soon as they can, the aircraft fly out of sight and become visible again only for a few minutes at the end of a contest day, if then. There is nothing in the game for 'couch potatoes' and precious little for advertising agencies.

The rivalry that grew up around the competitive sport, was one of the powerful influences that caused sailplane design and construction to advance as it did. If the Olympic principle had prevailed, there might have been stagnation in design. Everyone might still be flying sailplanes designed in 1939. That did not happen. Soaring, after 1945, acquired a hard commercial edge that had not been apparent before. Something was lost. Something else, the modern sailplane, was gained.

Part 1
The old tradition

New sailplanes appearing in the immediate post war period owed much to tradition. In many cases design work had begun years before. Something must be said about the pilots for whom these aircraft were designed. Beyond the elementary stages the first important achievement was the 'Silver C' badge which required a duration flight of five hours, height gain of 1000 metres, and a 50 kilometre cross-country flight, with outlanding. The kind of sailplane used would often be of the Grunau Baby class. Given an adequate wind blowing against a slope, the duration task was easy, though not very interesting. Often the hardest part of the flight was the seat the pilot had to sit on. The gain of height could be done with one good thermal. The cross-country required more than one thermal and a degree of self-confidence. Often the most difficult thing was to turn away from the home site and glide away knowing that the landing would be in unfamiliar surroundings.

The 'Gold C' badge, introduced in 1937, required a distance flight of 300 km and a height gain of 3000 m. This often required cloud flying except in regions where cloud bases were very high. Up till the end of June 1945 the total number of pilots who had ever officially completed the Gold C was 48, of whom 36 were German nationals. There were four Hungarians, three Americans and one each from Britain, Egypt, France and Yugoslavia.[1]

In soaring competitions some points were given for height gains but on a given day the tendency was for all pilots to achieve about the same maximum altitudes. The decisive task was then cross-country flying, either 'free distance' or to a pre-declared destination. Reaching the goal gained large bonus points. A harder task was for a pilot to pick a goal, reach it and attempt to return without landing. This would gain an even larger bonus. Some kind of observation had to be arranged at the turning point. The first time a camera was used to establish successful rounding of such a turn was probably in July 1951 at the British National Championships, but it was years before turning point cameras and film scrutiny became standard practice. Pilots chose their own goals and their own take off times. There was a good deal of 'start time juggling' as the more experienced competitors deliberately changed their ostensive decisions to confuse those who would attempt to follow them.

1 - Hirth, W. Handbuch des Segelfliegens, p 412. It is surprising that neither Poland nor the USSR appears in the official list. There were certainly pilots who had completed the requirements but apparently they did not register their achievements with the FAI in Paris.

At first the flying techniques were unsophisticated. The pilot after launch would search for a thermal and, if finding it, circle to gain as much height as possible, perhaps continuing the climb in cloud. When the greatest possible height had been achieved course would be set directly downwind. All going well more circling climbs and further glides followed until towards the end of the soaring day, or meeting an adverse change of weather, a landing became necessary.

The usual instruments were an altimeter and airspeed indicator, compass and variometer. Total energy compensation for the variometer to smooth out 'stick thermals' caused by changes of airspeed, was generally adopted at this time. The 'static' pressure connection for the variometer was replaced by a small venturi, usually mounted adjacent to the pitot head. Carefully placed 'blisters' on the fuselage nose could, if correctly shaped, give the same effect. In principle, a change of airspeed and height caused by the pilot's actions would produce a rise or fall of pressure in the 'static' connection, compensating for the altitude change. Later, flexible diaphragms were introduced into the plumbing to approximate the same effect.

The principles of the electric variometer depending on a Wheatstone bridge electrical circuit were recognised before 1940. Such instruments came into widespread use only after transistors and thermistors became available in the late 'fifties.

Clockwork drum barographs using inked nibs on paper charts, or smoked metal foil, were required for badge, competition and record flights. Gyro instruments for cloud flying were often fitted, usually a battery-driven turn and slip indicator modified for gliding use. Some owner-pilots and clubs were able to afford an artificial horizon. Oxygen breathing equipment was rare but not unknown. Radios suitable for sailplanes were not yet easily obtained but became so with the development of the transistor. Parachutes were not always carried but rules requiring them in competitions were soon introduced.

The end of solo training

Arguments continued for some time about the best way to train beginners. Some textbooks published as late as 1952 still included substantial sections on learning to fly solo. Primary gliders of the SG - 38 type continued in production and in the USSR a textbook published in 1974 described solo training as one of the normal

Above, the Tiny Mite before and, right, after the transformation. The best glide ratio was increased from less than 20:1 to more than 30.

methods.[2] The advantages claimed for solo training were doubtful and the success rates low. Those who did continue beyond the stage of 'hops', 'high hops' and full circuits would advance to intermediate and high performance sailplanes. They had only verbal advice about stalling, spinning and spin recovery. They would be briefed on thermal soaring, cross-country flying, outlandings and aerotowing before doing them but rarely or never given two-seater experience of them. Cloud flying and aerobatics were largely self-taught.

The argument that two seat gliders with dual controls were not available or too expensive, if it had ever been valid, was never so after 1945. From 1950 Dual training was almost universally adopted. Some of the sailplanes described in later pages were two-seaters intended for basic training. These were sometimes little more than primary gliders with a second seat and they performed hardly any better. (There were others, not included.) More years passed before it became accepted that a pilot might, from the start, learn to fly a two seat sailplane with good cross-country performance.

The speed to fly

Given that good soaring conditions have limited duration, the sailplane achieving the best average ground speed will travel furthest in the available hours. A cross-country pilot, even if not in a competition, should not waste time. Articles and textbooks from 1945 onward explained mathematically how the best speed to fly in the glides between thermals depended on the characteristics of the sailplane and the expected rates of climb. Pilots developed tables, charts, small slide rules and calculators enabling them to determine quickly in the cockpit how to vary the airspeed. Most widely adopted of the devices for this purpose was the ring calculator, used first in 1947 by Paul MacCready. This fitted as a ring on a dial type variometer.

Thermals can be narrow and weak. To use them a sailplane should be light with a high aspect ratio. (The span large for a given total area.) But on any given soaring day, some thermals are stronger than others. A pilot who can find strong thermals when others are climbing slowly in feeble ones makes a much better average speed. Using the MacCready ring, a pilot confident of finding strong lift sets the expected rate of climb high and, following it, flies fast between thermals and circles only in the best ones. For this style of flying there are important advantages in having a heavy sailplane. The rates of climb suffer to some extent but the expert compensates for this by using only strong lift. With extra weight the glide ratio is better at high speed, more air can be explored and there is then an improved chance of finding the necessary good thermal.

There had been some upward trend in wing loading from around 15 or 16 kilogrammes per square metre in the late 'twenties to a little over 18 for contest sailplanes of 1938 - 9. This trend continued as pilots demanded better glides at high speeds.

The requirement for climbing in weak lift nevertheless remained. There were always occasions when the strong thermal could not be found, or perhaps an entire contest day would be conducted in difficult weather. What was required was a sailplane with good performance over a wide range of airspeeds. It should be capable of flying slowly to use weak lift, but able to accelerate and glide fast at a shallow angle of descent.

The idea of carrying ballast was not new. Sailplanes with water tanks had been built as long ago as 1934. In 1939 the Russian pilot, Olga Klepikova, had set the world distance record in a 'Rotfront 7' sailplane which, tanks full, had a wing loading about twice that of contemporary sailplanes in Germany or Poland. This was quite exceptional but after 1945 ballast tanks began to appear more often in contest sailplanes, especially in countries where climatic conditions ensured strong thermals on many days. In good soaring weather the tanks would be filled before take off. If conditions deteriorated the water would be dropped.

A more attractive theoretical solution to the speed range problem was to fit flaps. With flaps down, increasing the camber of the wing, the stalling speed would be less and profile drag at low flight speeds much reduced. Tighter turns in narrow thermals would be possible with smaller rates of sink relative to the air. Better climbs would result. To go fast the flaps could be raised for a flat glide. Also promising was the wing with variable area, which could be accomplished by using large, extensible flaps of the 'Fowler' type. Howev-

2 - Fox Geen, The ABC of Gliding, Allen & Unwin, London, 1952. V.M. Zamyatin, Planëry I planërizm p 236.

er, flaps sometimes proved less successful than hoped, creating more drag than they saved because of the almost inevitable discontinuities and breaks of the wing surface, air leakage through hinges, protruding outriggers and supports.

Sealing the gaps

During the late 'forties in the USA, under the direction of Professor August Raspet at Mississippi State College, systematic tests were carried out on various unrefined ex-military training gliders and in particular the Laister Kauffman LK - 10. A thorough programme of aerodynamic cleaning up began. Gaps and leaks were sealed; the form and skin drag of the fuselage reduced by removing all the non structural parts of it above the wing. A blown plastic bubble replaced the crude canopy, the wheel was faired and many other detailed improvements made. The performance was brought to equal some of the better sailplanes of comparable size currently flying in Europe.

A small sailplane of only 10.36 metres span called 'Tiny Mite', built by Ray Parker, was also investigated. Dick Johnson extensively modified it in 1948. Large external flaps on outriggers were fitted. The wing loading was 36 kg/sq. m, comparable with the famous Rotfront 7 fully laden. Johnson was disappointed when the reconstructed Tiny Mite was flown. The best glide ratio was less than 1: 20. Extension of the wingspan to 12.3 metres had not made much improvement. Co-operating with Raspet, Johnson undertook an extensive programme of aerodynamic improvement. The out-rigged flaps were removed, the fuselage re-shaped, the badly shaped canopy was replaced with a bubble, gaps and hinge lines were smoothed and sealed. By 1950 Raspet reported that the best glide ratio was now 26.7: 1. Work on the Tiny Mite continued and by 1954 the best glide ratio was slightly better than 30: 1. Lessons learned from this exercise had profound effects on the sailplanes described in Part 2 of this book.

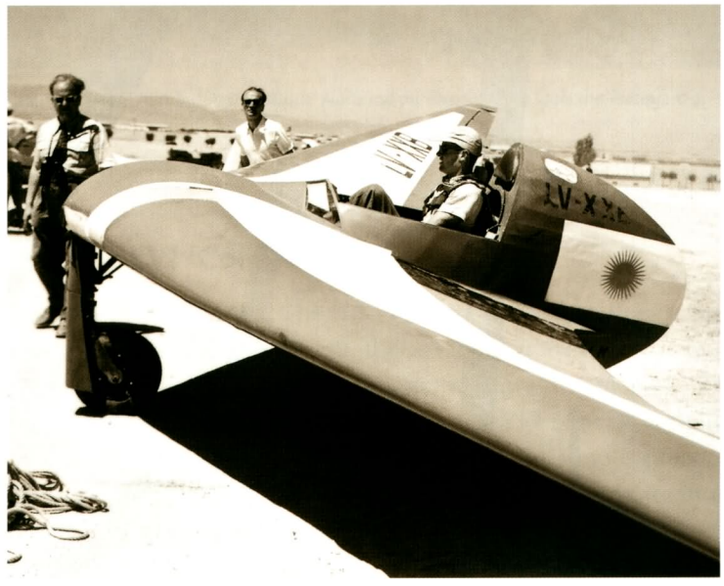
In this section the sailplanes are listed alphabetically by nationality. There is some flexibility. Some prominent designers had migrated: from Germany, Reimar Horten to the Argentine and Edmund Schneider to Australia. From Poland Waclaw Czerwinski went to Canada. The date 1945 also is not applied very strictly. Sometimes there was continuous line of development so that new 'marks' of old originals were still being developed and this kind of thing continued also into much later years.

ARGENTINA

The soaring movement in Argentina began in 1931 and was much encouraged by the visit of the German group under Walter Georgii in 1934. New sailplanes were imported, including a Dittmar Condor 1 and English Scott Viking. A Spalinger 18 came from Switzerland. Kits for several Kranich two-seaters were bought from Germany and some at least of these were completed, as was at least one Hütter H - 17 and an Olympia. The 'Albatros' club near Buenos Aires in 1944 owned five German Rhönbussards, five Grunau Babies and four primary gliders. About forty smaller clubs existed, some building their own aircraft. A state subsidy for gliding was introduced in late 1945. There was fairly firm official supervision and standards were high. Experiments were carried out with radio to allow instructors to speak to solo trainee pilots. Storm fronts as well as normal thermals were used for cross-country flights.[3] There was, however, little or no sailplane design activity until the arrival of Reimar Horten.

The Horten XV

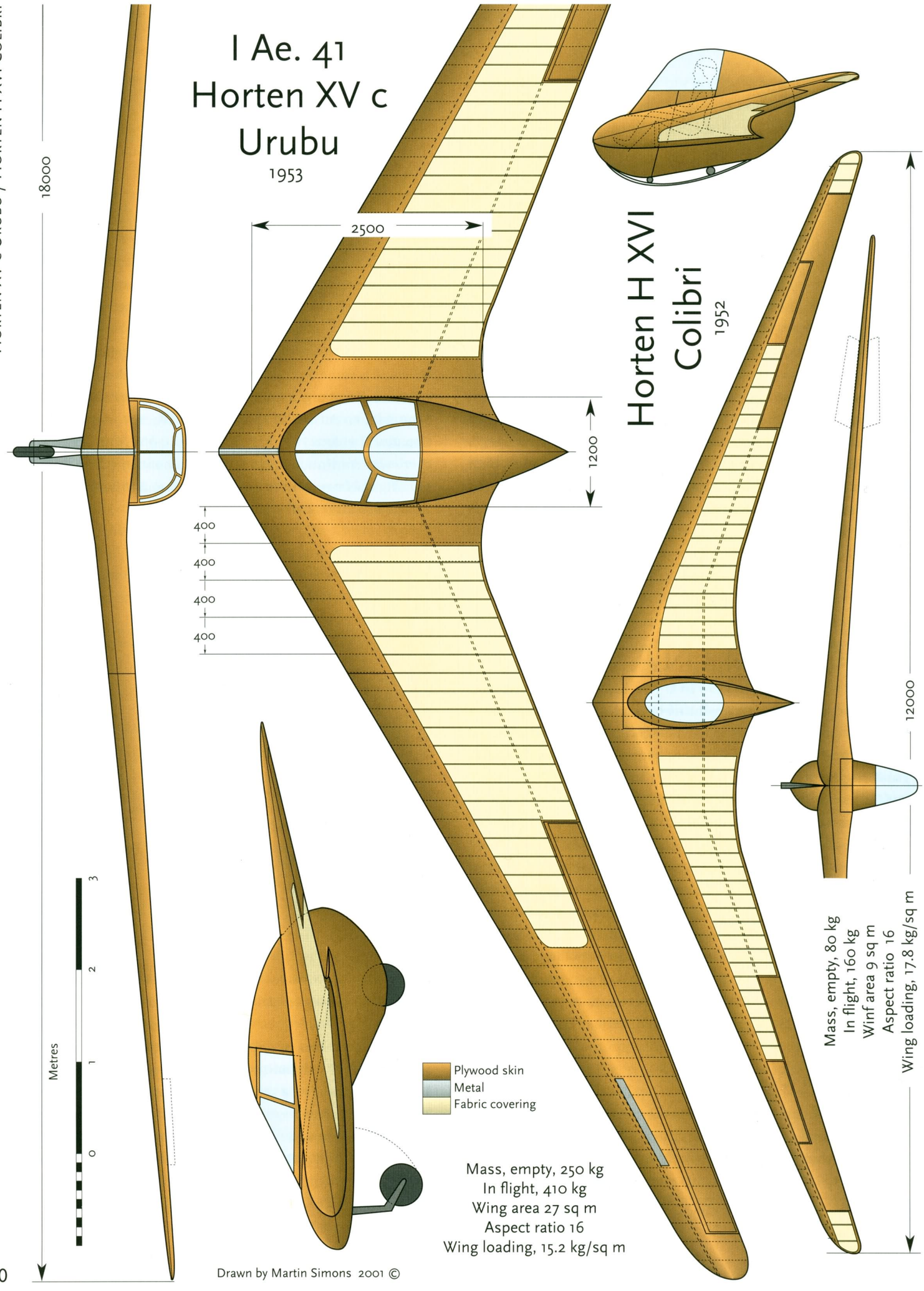
The brothers Reimar and Walter Horten had developed the famous 'all wing' sailplanes, Horten I, II, III and IV in pre-war Germany. While also engaged in wartime work on powered, tailless aircraft,



One of the two Horten XV single seaters at the World Championship, Madrid 1952.

they produced two examples of the extraordinary 24.25 metres span Horten VI sailplane, which flew briefly in 1945. After the war Reimar Horten, after a short time studying at Göttingen and tutoring at Bonn University, obtained a post at the Instituto Aerotécnico (I Ae) in Cordoba and emigrated to Argentina. His brother remained in Germany and pursued a distinguished career independently. Among other activities Walter developed a powered version of the Horten 3 sailplane, the Ho 33, which flew successfully but was not produced in quantity.

3 - Veronica Platt, Roberto Madsen, Uli Gallusser, San Martin, Robert Lucas, Chourout, Leo Follman, Sailplane and Glider, 1944 - 46



Reimar was able to resume development of all-wing sailplanes but working conditions were bad at first. Aircraft quality materials were unobtainable and locally produced glues proved unsafe. Despite these problems a new two seat tailless sailplane, the I Ae 34 'Clen Antú' (Sunray) or Horten XVa was designed and three were completed during 1948 - 9. The span was 18 metres, the pilots sitting in a central nacelle one behind the other. The rear seat was raised 30 cm to give a forward view over the head of the front pilot. The wooden, single spar wing was reminiscent of the Horten IV. It was entirely skinned with plywood, swept back with the necessary twist or 'washout' to provide stability in pitch, and dihedral. Elevons for pitch and roll control extended over the outer wing panels with large camber flaps inboard. Drag rudders were set into the outer wings, with large airbrakes near the centre, mounted at right angles to the aircraft centre line. A twin-wheeled tandem undercarriage was faired into the central nacelle, with a small nose skid.

There was extensive study of the H XVa in flight, with wool tuft tests on the wing to observe the stalling behaviour. A best glide ratio of 28: 1 was claimed. Some pilots reported that the Ho XVa was difficult to fly because it was very sensitive in pitch. This was probably because they had not checked the balance. For a pilot of less than average weight a small forward adjustment of the centre of gravity would have stabilised the aircraft and reduced the sensitivity of the elevator.

For the World Soaring Championships of 1952, in Spain, two single seat versions, the H XVb (or I Ae. 34 m) were built and rather hastily transported to Madrid without much testing. They had retractable nose wheels instead of the front skid. During practice for the contest one of the H XVbs was written off after the wheel collapsed and it rolled over forwards. The other was badly damaged on the fourth contest day and was withdrawn. Other Argentinean pilots did much better, José Cuadrado, flying the orthodox Slingsby T - 34 Sky, placing fourth in the final list.

The Horten XVc (I Ae 41) 'Urubu' (Vulture) was developed from the H XVa as a two-seater with pilots side by side in a wide streamlined capsule. Covering much of the wing with fabric saved weight. There were no flaps. Handling was reported to be very good and safe. The best glide, 24: 1, was inferior to that of the XVa, probably because of the drag of the wide nacelle. Four of this type were built and flown extensively. One was used by Heinz Scheidhauer, Horten's test pilot, to make a flight across the Andes in October 1956, in company with a Slingsby Sky.

Interest in the H XVc was aroused in Germany and four copies were built there in the 'fifties. They did not succeed mainly because they were constructed from incomplete sets of plans.

The Hortens made much of what they regarded as their discovery of the 'bell-shaped' lift distribution. By combining sweep back and taper with negative twist (washout), the lift load in straight flight was adjusted so that the central part of the wing produced more lift in proportion to its area, than the outer. The outer parts of the wing were under-worked. Hence the stall always developed first in the centre. Dangerous tip stalling, causing violent nose up pitching and rolling, was avoided.

In addition, lightening the lift load at the tips was intended to prevent adverse yaw when ailerons were applied. In orthodox sailplanes the fin and rudder are necessary to counteract this. Sailplanes with bell-shaped lift distribution, according to the Hortens, needed no vertical tail. Pilots who flew the 'wings' reported nonetheless that there was adverse yaw and the tip drag rudders were necessary to counter it.

The bell-shaped lift curve entails considerable increases in drag. Ideally, no part of a wing should be parasitic, creating resistance without contributing its proper share of lift. An ideal lift load distribution would make each segment of the wing area work equally. This can be approached closely by an un-swept, untwisted wing with nearly elliptical outline in plan. The Hortens knew this but accepted the performance penalty for the sake of stability and control.

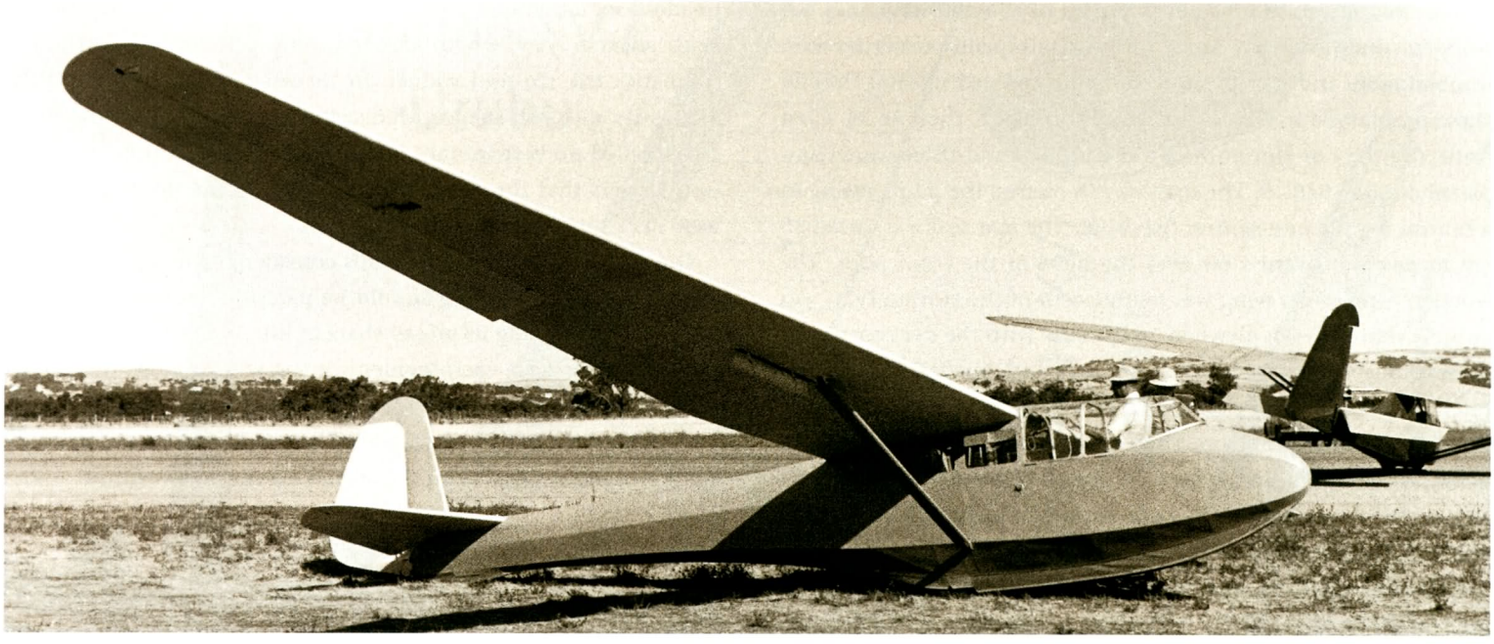
The Horten XV 'Urubu' in the Museo National du Buenos Aires with the Piernifero 2 above.

Horten XVI 'Colibri'

Reimar Horten designed The H XVI as a small, light sailplane for the Buenos Aires 'Condor' club. It was intended for amateur construction. With a span of 12 metres, the wing was in one piece for the sake of structural simplicity and lightness. The pilot sat upright in a small nacelle and the undercarriage was a simple rubber-sprung skid. The Condor club instructor, Waldemar Sturm, built a prototype. When he did preliminary test hops no serious problems were found. In January 1953 the Colibri was prepared for an aerotowed launch with Heinz Scheidhauer. No one had better experience of flying Horten sailplanes than Scheidhauer but he lost control immediately. The sailplane bounced up to 50 feet, stalled, rolled and hit the ground inverted. Fortunately the pilot was unhurt but the Colibri was never repaired.

Loss of control is almost certain in any aircraft if the centre of gravity is too far aft. Tailless aircraft are always very sensitive to small errors in this respect. Scheidhauer thought it likely that this had caused the demise of the Colibri.

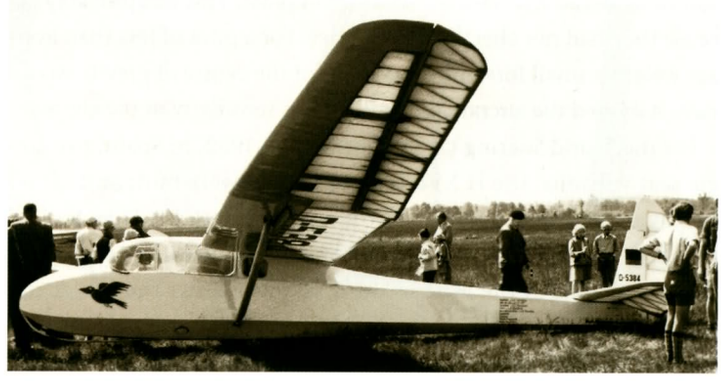
One of the Ho XVc "Urubu' survives in the Museo National du Buenos Aires, with the 10 metre Piernifero 2 in incomplete state.



AUSTRALIA

In the (southern hemisphere) summer of 1948 - 9, the gliding Club of Victoria, most of whose members lived in Melbourne, were operating at Benalla, a small country town with an aerodrome some 160 kilometres north east of the city. On 9th January Keith Chamberlin in the club's Grunau Baby II hoped to complete his five-hour duration flight for the Silver C badge. After a couple of hours, including some low spots, he flew toward a large cumulus cloud, which gave very strong lift. People on the ground realised it was rapidly developing into a thunderstorm. Another GB soaring nearby had a radio but it did not work well. The pilot misunderstood the warning from base, believing he was advised to go towards the cloud but he was sufficiently experienced to realise that this would be dangerous and flew clear.

There was no way of warning Chamberlin who did not appreciate his situation until he was at cloud base and still going up very rapidly, soon enveloped. He had no blind flying instruments or experience and the Grunau Baby II lacked air brakes and oxygen apparatus.[4] Despite his trying to steer out by compass the sailplane was quickly out of control in violent turbulence. Chamberlin could do nothing but hold the stick and wait, the airspeed fluctuating wildly. Hailstones were soon hammering him in the open cockpit and there was lightning. He was prepared to use his parachute but resolved not to jump as long as the glider did not break up. The altimeter wound up to more than 14,000 feet and then, with the pilot almost unconscious, came down as fast as it had gone up. Chamberlin at last saw the ground again, 1000 ft below. He was able to land in heavy rain, badly bruised and suffering from exposure. Helped by the farmer, who had seen him come down, he recovered quickly in hospital. Analysis of the barograph chart showed that he had reached 15,300 ft above sea level. A rate of ascent of 106 m/sec (350 ft per second) was measured, and the descent was equally rapid. Chamberlin claimed Australia's first Gold C climb.

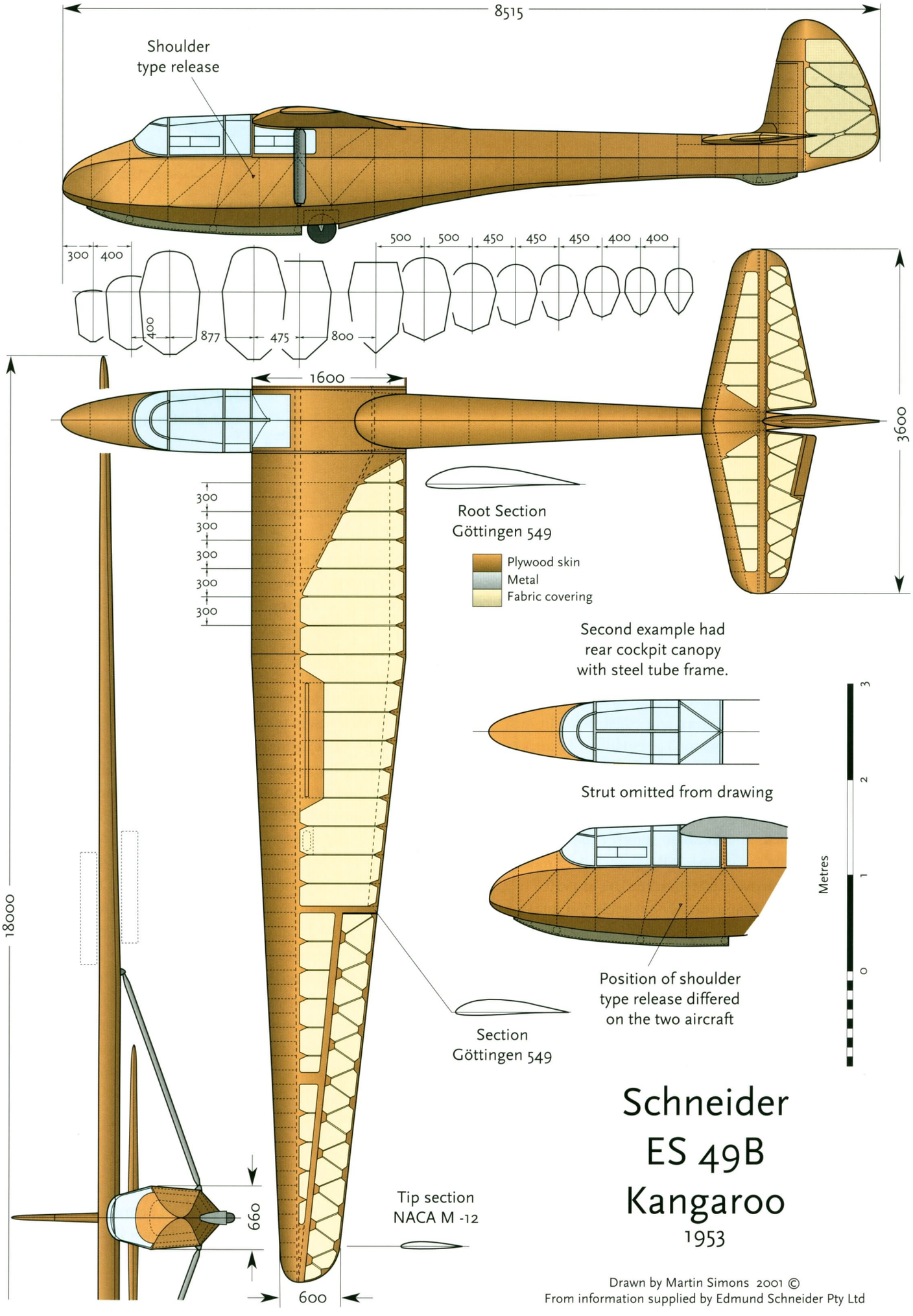


Above: The ES 49B "Kangaroo" two seater designed and built by Edmond Schneider in South Australia in 1953. Below: One of the original Schneider ES 49 type built under licence by Alexander Schleicher in Germany.

The Grunau Baby, apart from dents in the aluminium fairing over the centre section, was undamaged.

There was a wholly unexpected outcome. In February Chamberlin's story was printed in the English magazine, Sailplane and Gliding. From there other magazines reprinted it. Among those who read it was Edmund Schneider. Forced to leave Grunau, with sons Harry and Edmund he was trying to establish a boat building business on the shores of the Bodensee (Lake Geneva). The post-war bans on flying were in place but he did some sailplane design work, producing plans for the Grunau Baby III and a strut-braced two-seater, the 16.03 metre span ES - 49. As soon as the restrictions were lifted in 1951 eight examples of Schneider's ES - 49 and several of the GB III were built under licence by Alexander Schleicher at Poppenhausen.

4 - The Grunau Baby II had neither brakes nor spoilers. The IIa had spoilers but it was not until the GB IIb appeared that brakes became standard.



Schneider ES 49B Kangaroo

1953

Above: The later Grunau Baby 4 had a blown plastic canopy and rounded front decking. This example was restored and flown in 1997.

Left: Schneiders Grunau Baby 4 of 1953 bore little resemblance to the original Grunau Baby. This example was flying in Waikerie in South Australia in 1957.

It delighted Edmund that a Grunau Baby he had shipped to the Gliding Club of Victoria before the war had brought Keith Chamberlin safely back to earth in such a storm. The Australians even had a record of the factory work number, 767, and the date of its test flight, 25th June 1937. After twelve years it withstood the storm, a testimony to the quality of work at Grunau.

Schneider wrote to the Gliding Club of Victoria to ask if there was any opportunity for a sailplane designer and constructor in Australia. It was not an easy question. The total population of Australia was about 7.5 million; most living in half a dozen widely separated coastal cities. The gliding movement, though growing, was small and scattered. After further correspondence the Gliding Federation of Australia, recently formed, undertook to sponsor the family as immigrants. President of the Federation, Bill Iggulden, lent money for the fare. The Schneiders arrived in Melbourne late in 1950.

Work on sailplanes was not immediately available but another immigrant glider pilot, John Wotherspoon, had established a successful tile manufacturing business in Adelaide, the capital of the State of South Australia. In 1952 he offered the Schneiders a workshop adjacent to his own plant, if they would design and build a two-seater for him. They moved to Adelaide, at that time a city of about 400,000 people.

The ES - 49B Kangaroo

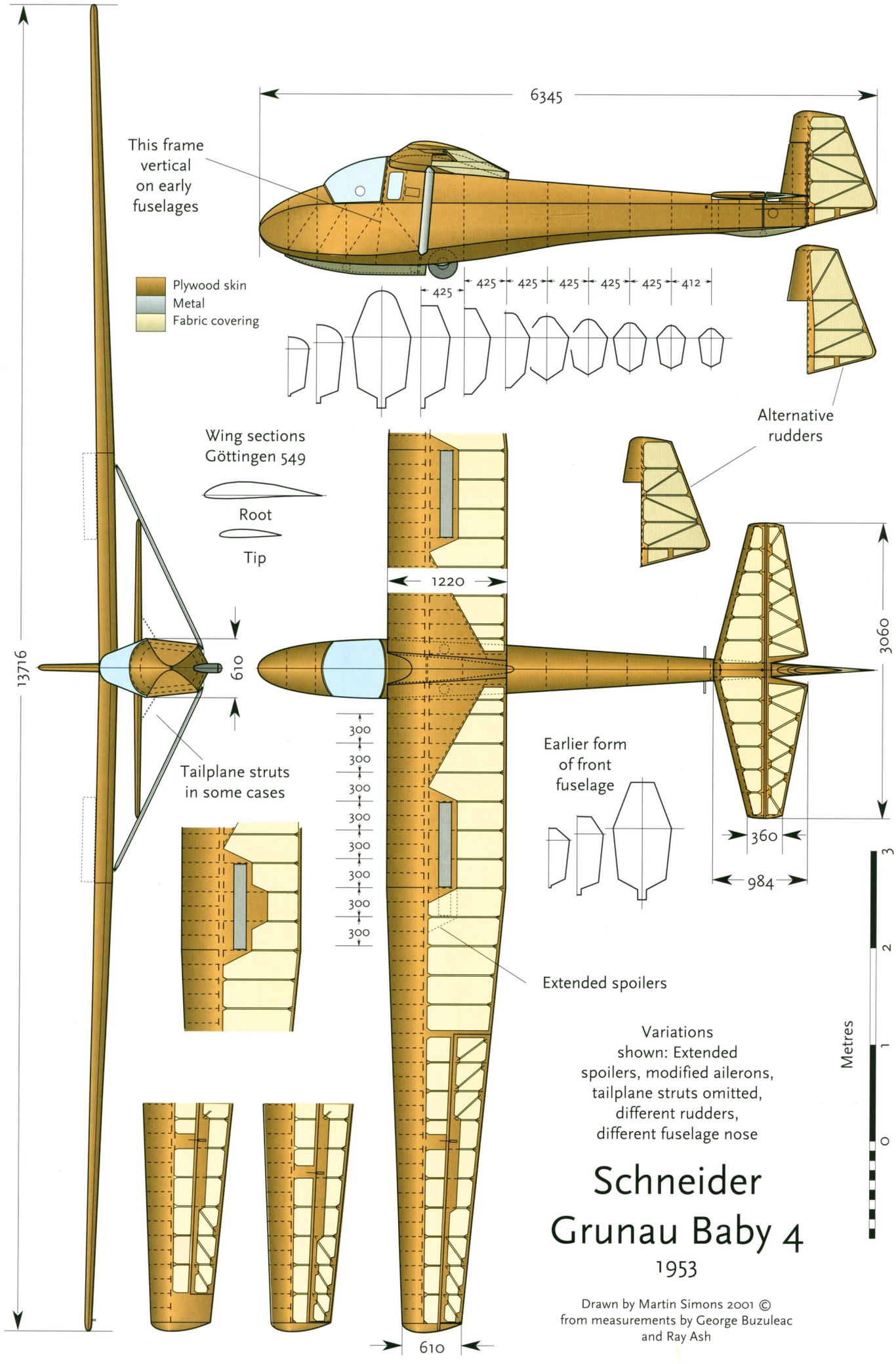
Although Edmund Schneider gave the new two-seater the ES - 49B designation, as if it was merely a new mark of the ES - 49 he had designed in Germany, the 'Kangaroo' was really a new type. The wing, strut braced, was 18 metres in span with a rectangular centre section and strongly tapered outer panels. The original ES - 49 fuselage had been severely practical with a bluff front and octagonal cross sections throughout. The Kangaroo was more elegant. The shape at the front was improved with a long transparent canopy over the two seats in tandem. Behind the wing the fuselage contracted to a relatively narrow tail boom. Only the tail unit could be identified directly with that of the ES - 49.

The Kangaroo was ready for its first flight in February 1953. It was much superior to the few existing Australian-designed and built two-seaters which had been in use hitherto. It was displayed at several air pageants in the State, and used for passenger joy flights. Harry Schneider, now acting as test pilot for his father as well as helping in the workshop and at the drawing board, on one occasion even found room in the rear seat for two adults. After a few weeks Wotherspoon sold the sailplane to a farmer in New South Wales. He and Harry Schneider began the aerial delivery with a 327 kilometre goal flight from Parafield Airport in suburban Adelaide to Mildura in the State of Victoria, establishing a new national record for two-seaters. The rest of the distance was made in stages by aerotow.

Encouraged by this success the Schneiders registered a new company, Edmund Schneider Ltd., and became firmly established in Adelaide. One more of the Kangaroo type was built and delivered to the Dubbo Gliding Club in NSW in 1954. Meanwhile, Schneider sold plans for the original ES - 49. With the Australian name 'Wallaby', three were built by various clubs. (One of these was still flying in 2002.)

Grunau Baby 4

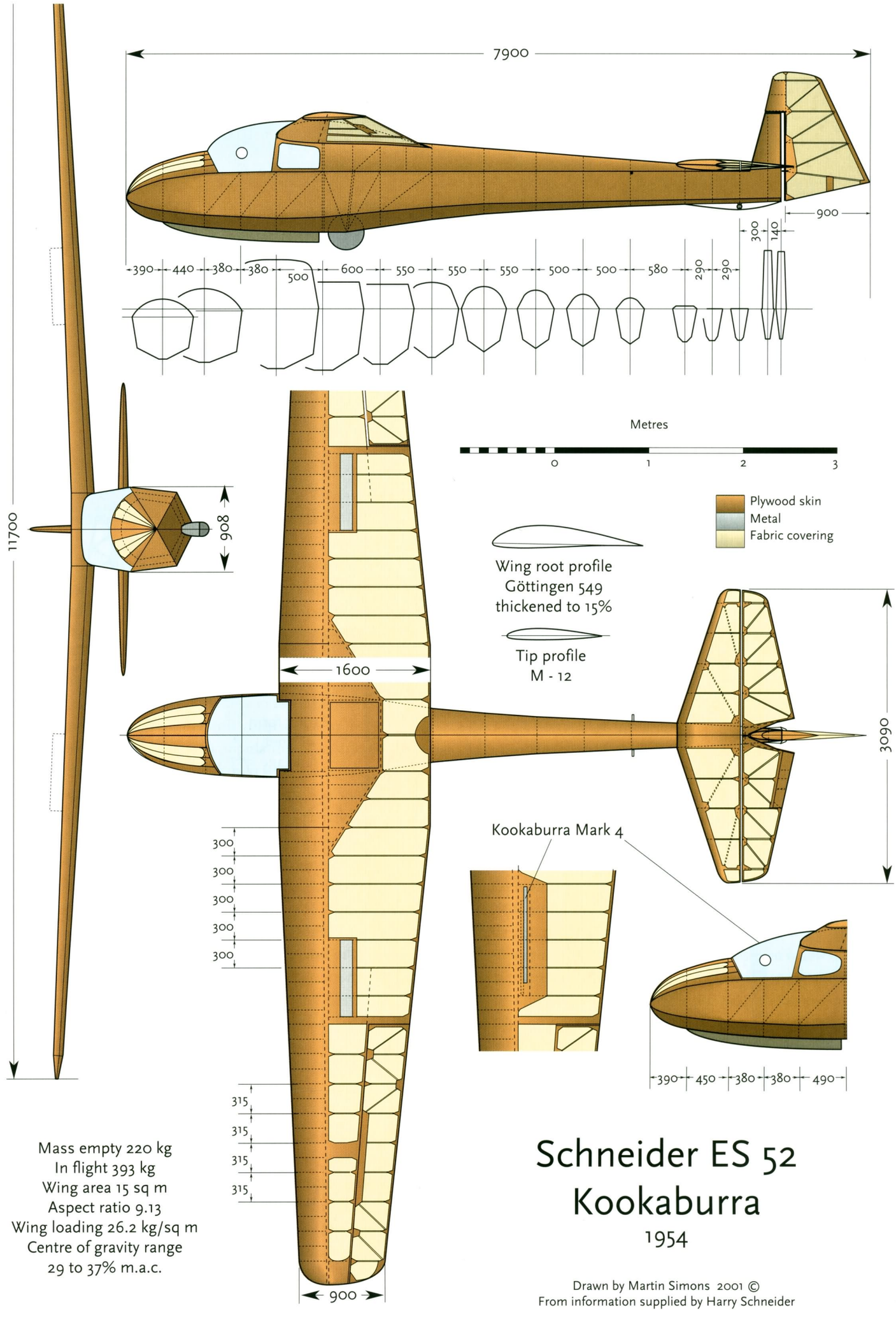
Probably because he hoped the reputation of his older products would carry over to new designs, Edmund Schneider named his next sailplane the Grunau Baby IIIB. First flown in 1953 it had little resemblance to the Grunau Baby III still offered in Germany by



Variations shown: Extended spoilers, modified ailerons, tailplane struts omitted, different rudders, different fuselage nose

Schneider Grunau Baby 4

1953

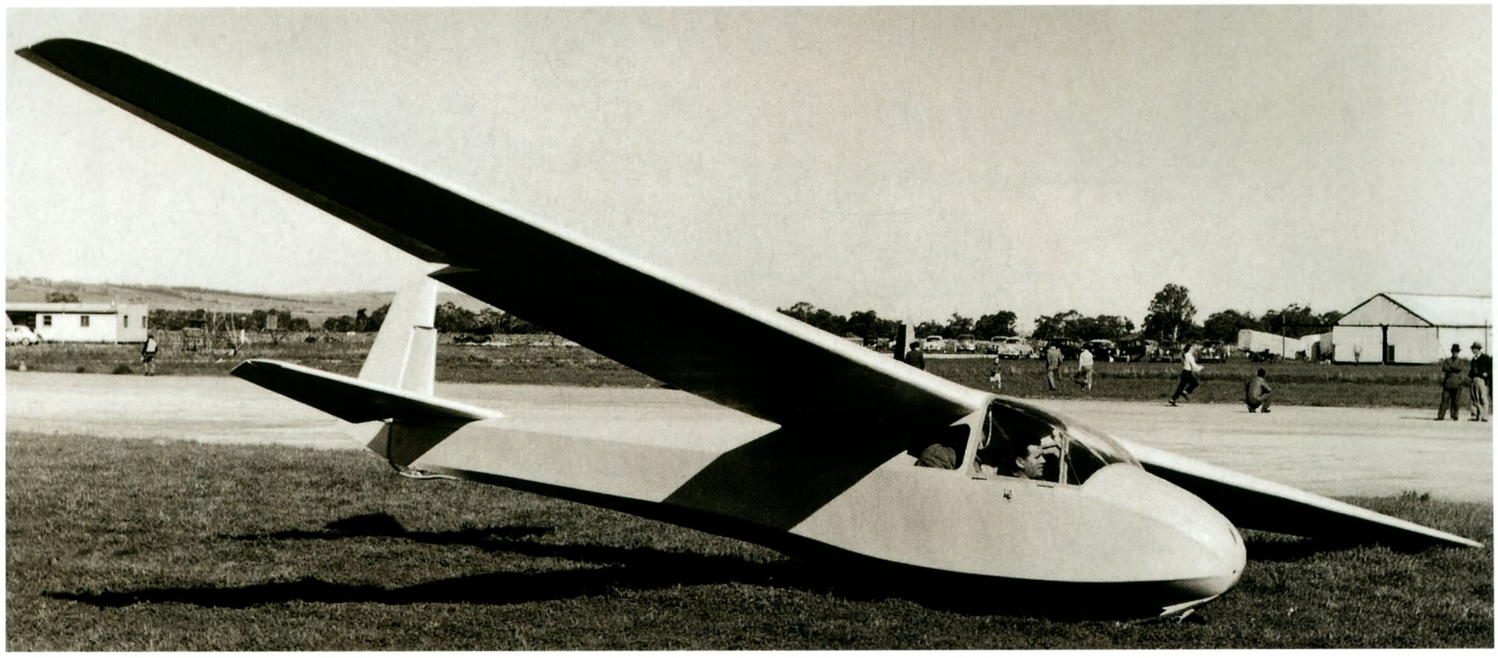


Mass empty 220 kg
In flight 393 kg
Wing area 15 sq m
Aspect ratio 9.13
Wing loading 26.2 kg/sq m
Centre of gravity range
29 to 37% m.a.c.

Schneider ES 52 Kookaburra

1954

Drawn by Martin Simons 2001 ©
From information supplied by Harry Schneider



The Kookaburra 'Shortwing' was followed by the Marks 2, 3 and 4, production continuing until 1966. Thirty six were built altogether with exports to New Zealand. Two were built in Brazil

This photograph shows the staggered seating arrangement with the instructor behind and to one side of the pupil.

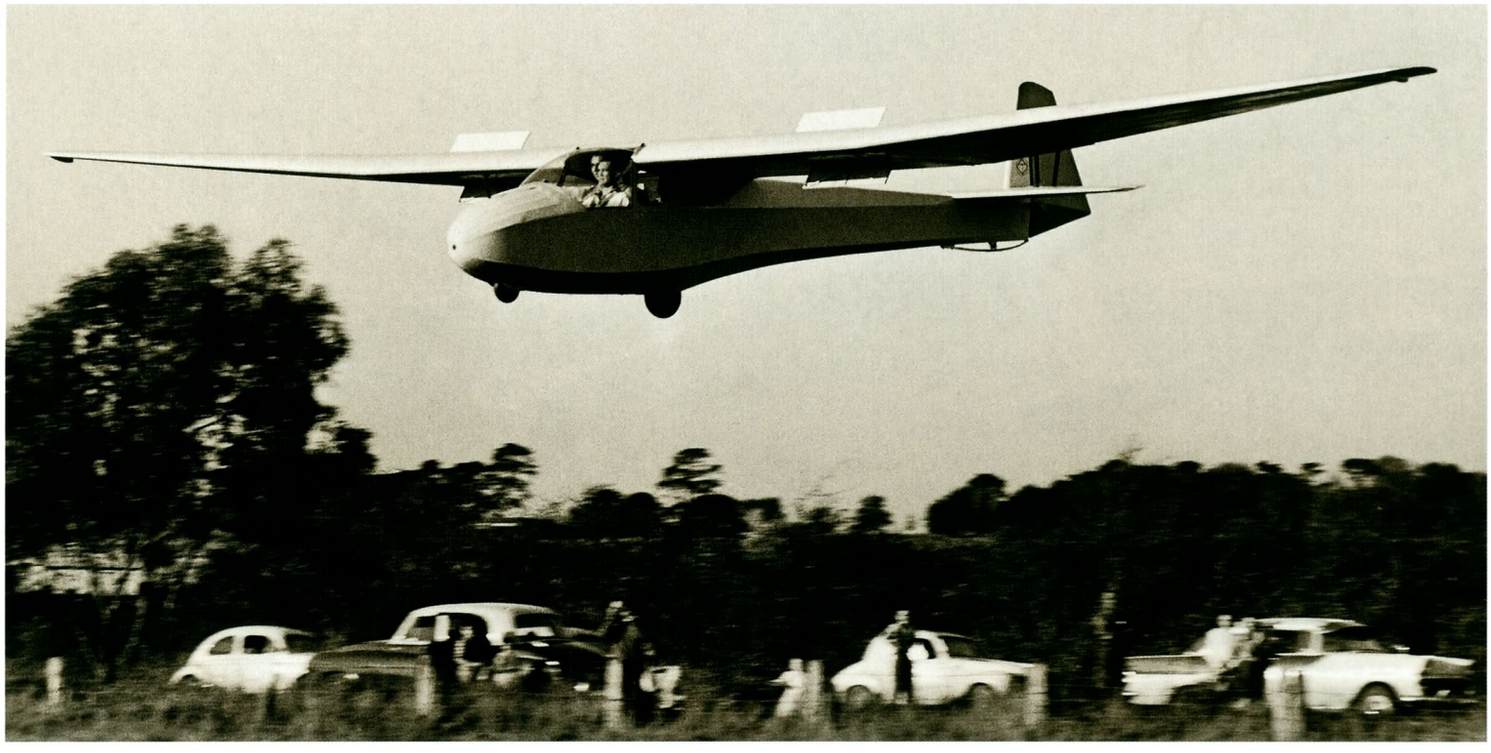
Above: The prototype ES 52 Kookaburra was first flown on 26th June 1954 at Gawler north of Adelaide

Schleicher. To make the distinction clearer, the new sailplane was re-named Grunau Baby IV and, like the Kangaroo, it was a completely new type. It could be regarded as a smaller, single-seat version of the Kangaroo, with the same wing profiles and general wing plan and struts. The fuselage too was similar. Only the tail revealed its ancestry. The factory produced three. In accordance with his usual custom, Schneider sold plans and kits, and an amateur built a GB 4 in Adelaide. All four sailplanes differed in detail from one another and all proved satisfactory. With thinner and less cambered wings than the original Grunau Baby, they performed better at high speeds yet lost nothing in the climb. Two survived into recent years.

ES - 52 Kookaburra

Except for a few small, struggling country clubs, solo training had been abandoned in Australia and there was need for a strong and reliable two-seater. Schneider had some difficulty establishing with the Gliding Federation and its numerous affiliated clubs, exactly what was required. The first attempt, the ES - 50, failed to attract customers although, it seems, the GFA had suggested something of the sort was required. The emphasis of the 'Club two-seater' was on low cost. The rectangular wing, a little over 10 metres span, was no better than that of a primary glider. The tandem seats were in a nacelle and a triangular sectioned, plywood-skinned boom carried the tail. The ES - 50 flew in 1953 but was soon abandoned. Schneider grumbled, "It seems we did the wrong thing, because clubs began to ask for tapered wings, enclosed canopies and other luxuries". The prototype did in fact serve several country gliding clubs as a basic trainer for some years afterwards. Although no longer flown, the ES - 50 still survived intact in 2002.

Further discussions with clubs produced an unrealistic specification for a two-seater that would do everything for everybody and still be very cheap. After a good deal of heart searching the Schneiders went ahead with the design of the ES - 52, named Kookaburra after the common, and noisy, Australian laughing kingfisher.



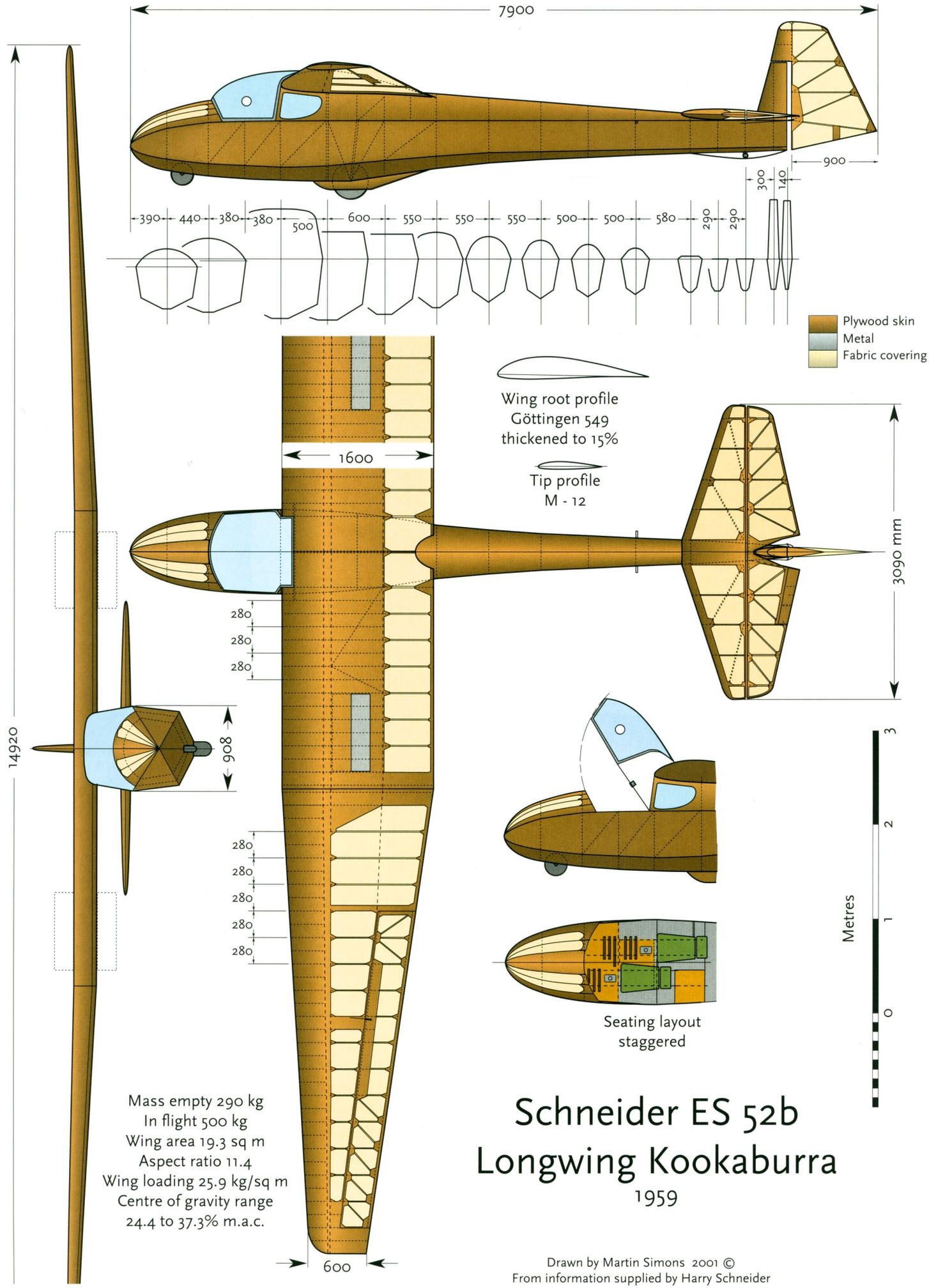
The first flight was in June 1954. The wing, 11.7 metres span, was built in one piece because it was thought the trainer would not be used for cross-country flying and would rarely or never need to be de-rigged for transport. There was a considerable saving in weight and cost. The seats were arranged en echelon with dual controls, the instructor behind and to one side of the pupil. This reduced the width of the fuselage yet gave ample elbowroom and retained most of the advantages of side by side seating. A large transparent bubble canopy enclosed the cockpit. Both pilots had a good view. Handling was very good and performance more than adequate. The ES - 52 after all proved capable of soaring flight and even cross-country flying, with great benefit to trainee pilots.

After trials a respectable number of orders came in. Over the next few years the ES - 52, with various minor improvements, became the standard club training two-seater in Australia. Twenty-two were built for the Australian market, continuing in production until the last Mk 4 was produced in 1966. One was exported to New Zealand. Two of the Kookaburra Mark IV were built under licence in Brazil but plans to manufacture the type there were eventually abandoned. One of the Brazilian Kookaburras survived in 2002.

Above: Longwing Kookaburra making an approach to landing.
Below: The ES 52 B 'Longwing' flew first in 1959. Four were built. The one shown here has been restored recently.This aircaft was fitted with DFS vertical type air-brakes.

ES - 52b Longwing Kookaburra

There was always pressure on the Schneiders to improve the performance of their two-seater. The most straightforward way of doing this was to increase the span but this entailed dividing the wing, to permit more frequent transport by road. Accordingly, when the ES - 52B, or as it was popularly known, the 'Longwing Kookaburra' appeared in 1959, it had a three-piece wing. There were detailed improvements in the cockpit layout but the main change for the fuse-



Mass empty 290 kg
In flight 500 kg
Wing area 19.3 sq m
Aspect ratio 11.4
Wing loading 25.9 kg/sq m
Centre of gravity range
24.4 to 37.3% m.a.c.

Schneider ES 52b Longwing Kookaburra

1959

From information supplied by Harry Schneider

lage was the adoption of a nose wheel in place of the forward skid. The all round performance, as expected, was better but pilots accustomed to the faster control response of the 'Shortwing' found the ES - 52B rather cumbersome. The ailerons in particular seemed heavy and the rudder somewhat less adequate because of the longer wing. More importantly in the long run, two seat sailplanes of superior performance were by this time being imported from Europe. Only four of the Longwing Kookaburra were sold. The last was built in 1961.

ES - 57 Kingfisher

As the name may have been intended to imply, the ES - 57 was intended as an early solo and cross-country flying sailplane to follow on directly from the Kookaburra. There had been for some years a vigorous campaign led by the prominent Australian pilot Fred Hoinville, for sailplanes to be made smaller. Big sailplanes such as those flown by most of the competitors at the World Championships in 1952 and 54, were costly to build, required large road trailers and towing cars, plenty of crew, powerful launching apparatus and, in short, more money than most Australians could afford. Small sailplanes were more practical, cheaper and, with care in design, should have a good enough performance to satisfy most pilots. Being more easily manoeuverable they should also be able to centre more readily in the strong but often very narrow thermals found over the semi-arid plains of the continent. Several attractive small sailplanes had been designed and built in Australia by amateurs; the Joey, The EP - 1, and others. In the USA Schweizers were doing well with the SGS 1 - 26, a little over 12 metres span. Schneiders had already experimented with their ES - 54 of 7.6 metres span (See Part 2). This proved to be going too far but there was much support for the idea of a small sailplane with safe handling and good performance.

The Kingfisher prototype flew in 1956. Modifications needed included stiffening the tailplane with a greater area of plywood skinning and raising it to a higher mounting, clear of the wing wake.

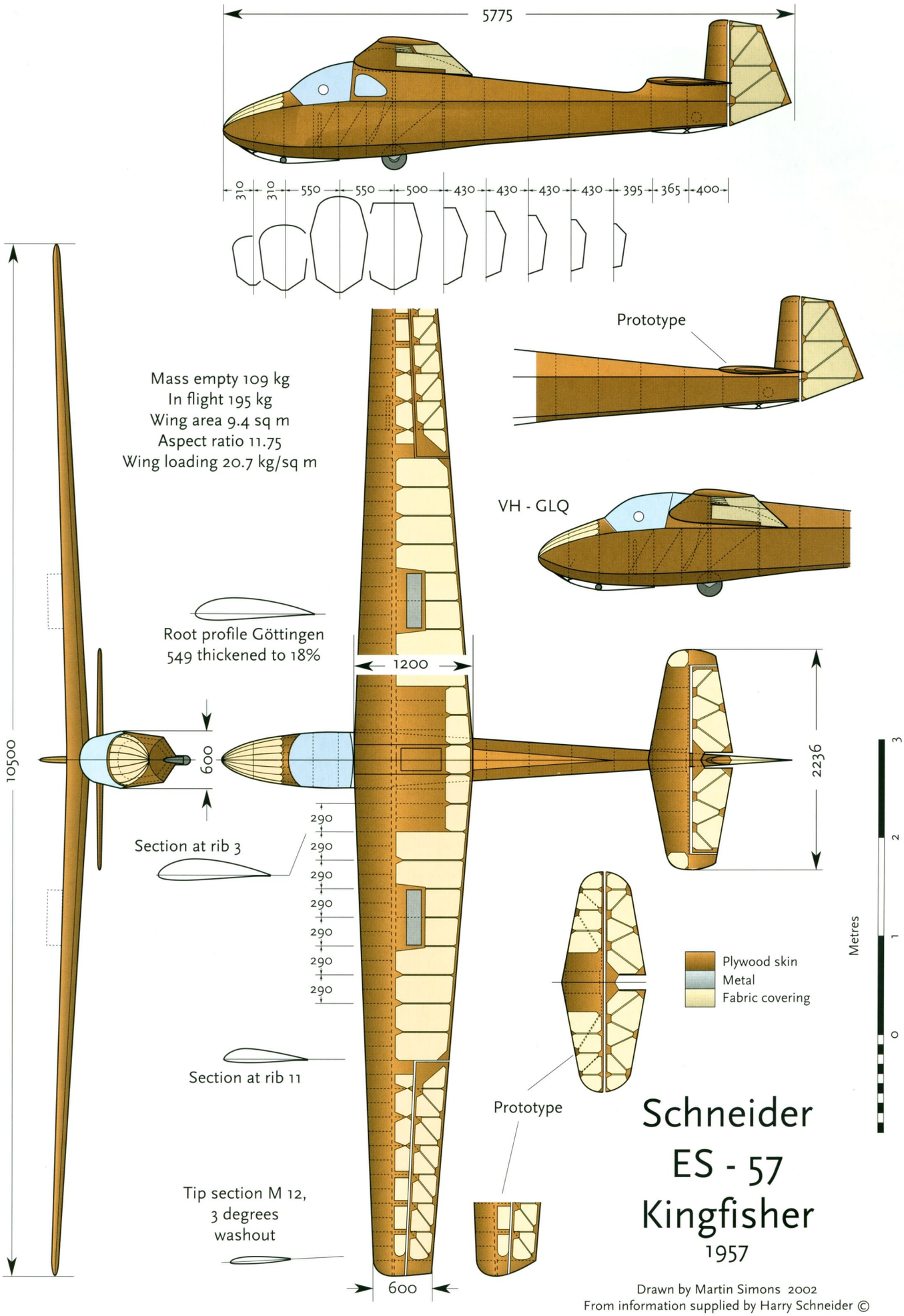
The ES 57 'Kingfisher' retained the older Göttingen profiles. Eleven were built and used extensively for cross-country flying.

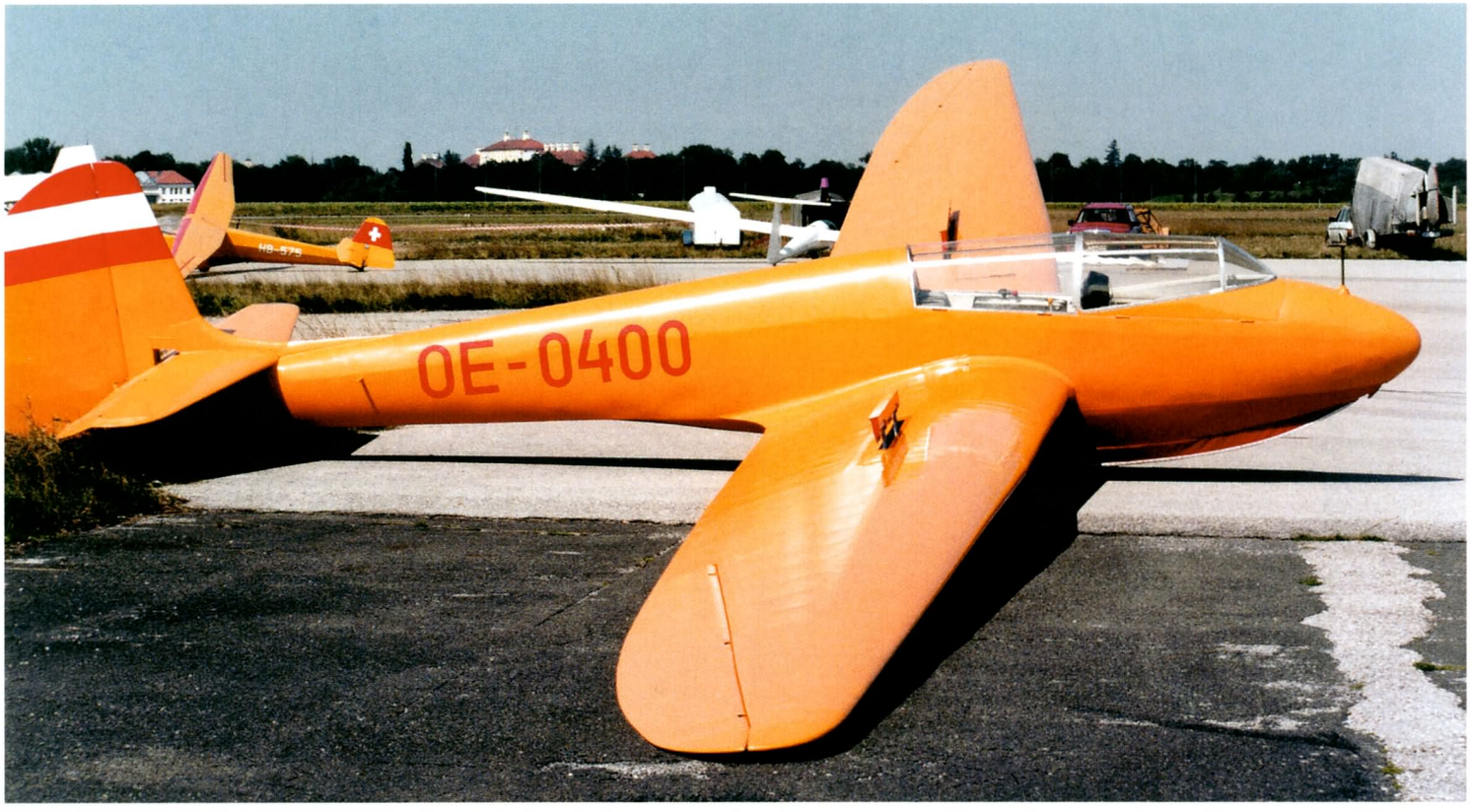
After this it was very favourably received. Harry Schneider, who by now was assuming an increasing role in design and construction, made a cross-country flight of 217 km to demonstrate the Kingfisher's capabilities. He later did a 300 km distance flight. A total of eight were built in the factory up till 1957, with small modifications to the later ones in the series. Amateurs built three more, one with a modified wing position.

John Fisher finished building his Kingfisher in 1964. He lived in a caravan on Mount Elliot, a 935 metre summit near Corryong west of the Great Dividing Range in Victoria. Here he established a one-man soaring operation. From the clearing on the ridge top he would launch himself by bungee, having tethered the glider by the tail and stretching the rubber with his four wheel drive vehicle. After getting into the cockpit he released the tail with a tug on a line and enjoyed soaring among the mountains, sometimes landing back in the ridge-top clearing or descending to the valley where there were better fields.[5]

The Kingfishers proved popular and successful. They performed creditably in competitions against imported sailplanes of greater span and cost. Harry Schneider, now effectively directing the Company, had plans for something better still.

5 - Australian Gliding, August 1964 & October 1964.


5775
310
310
550
550
500
430
430
430
430
395
365
400
Prototype
Mass empty 109 kg
In flight 195 kg
Wing area 9.4 sq m
Aspect ratio 11.75
Wing loading 20.7 kg/sq m
VH - GLQ
Root profile Göttingen
549 thickened to 18%
1200
10500
600
2236
290
290
290
290
290
290
290
Section at rib 3
Section at rib 11
Tip section M 12,
3 degrees
washout
600
Prototype
Plywood skin
Metal
Fabric covering
Metres
0
1
2
3
Schneider
ES - 57
Kingfisher
1957
Drawn by Martin Simons 2002
From information supplied by Harry Schneider ©



Austria

In Austria there was relaxation of the bans on aviation in 1949, two years before this happened in Germany. Soaring clubs restarted. Erwin Musger turned his attention again to sailplane design. He established contact with the woodworking company of Josef Oberlerchner in the town of Spittall-an-der-Drau, in Kärnten about 60 km west of Klagenfurt. During the war Oberlerchner had been producing wooden parts for Messerschmitt and building SG - 38 and Grunau Baby gliders. He was ready to build new sailplanes.

Musger Mg - 19 Steinadler

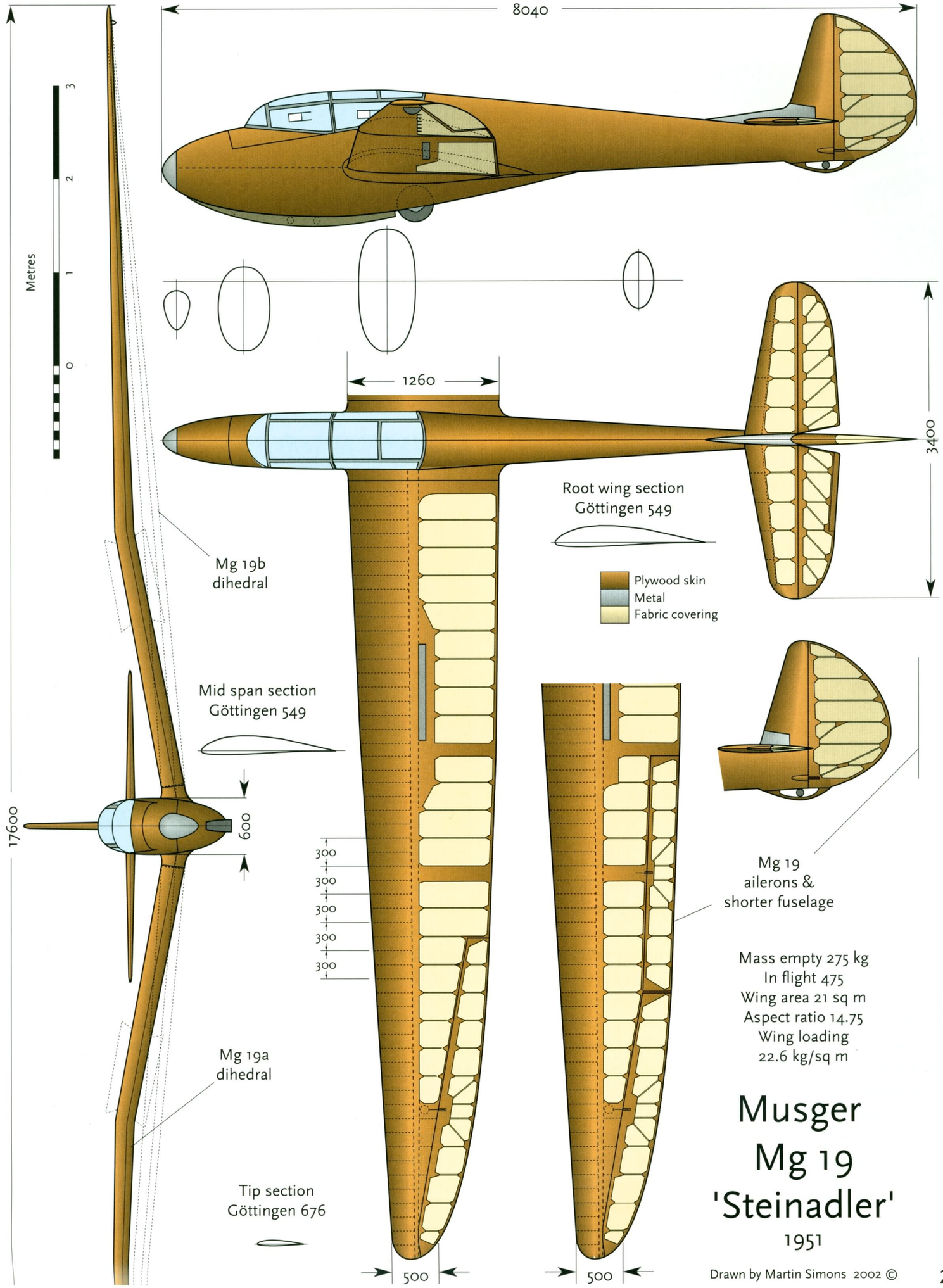
The best known of Musger's pre-war designs was the Mg - 9, a high-winged, strut-braced two-seater with the second pilot housed under the wing. The problem of such a layout was the severely restricted view from the rear seat. For the new Mg - 19 'Steinadler' (Golden Eagle), he recognised the need for radical changes. The wing would be generally similar in plan to the Mg - 9 but would have the Göttingen 549 profile, proved successful on many earlier high performance sailplanes. There would be no struts. The weight and wing loading would be greater but the high-speed glide would be much improved.

To solve the problem of vision he decided to mount the wing low on the fuselage. The possibility of some airflow separation from the wing root could be tackled by careful aerodynamic fairing. By re-

Top: The orange Mg 19 at Oberschleissheim, 1995.

Middle: Chris Wills (rear cockpit) and the author ready for a winch launch in Chris's 'Steinadler' at a Camphill vintage rally.

Below: The Musger Mg 19 'Steinadler' made a favourable impression at the 1954 World Championships in England. It was the lightest of the two - seaters flown there. The straight winged version, however, brought the air brakes very close to the ground when landing.



Mass empty 275 kg
In flight 475
Wing area 21 sq m
Aspect ratio 14.75
Wing loading
22.6 kg/sq m

Musger Mg 19 'Steinadler'

1951

Two of the Mg 19, with straight and gull wings, together at Oberschleissheim in 1995.

taining the strongly 'gulled' dihedral, the wing would be well clear of the ground in the centre. The main spar was positioned so that the load carrying structure passed through the cockpit behind the rear seat. To allow this the wing leading edge was swept back slightly. The outlook for the second pilot upward and backwards would be excellent. The rear seat was slightly raised to give some view directly ahead, above the front pilot's head.

Normal methods of wooden construction were used. The fuselage was plywood skinned over cross frames of oval outline and light longerons. The cockpit canopy, transparent Plexiglas over a light steel tubing frame, was in two pieces. There was a landing wheel with a skid in front and at the tail. The wing, dividing in the centre, had a nearly elliptical outline. Ahead of the main spar, plywood skinning round the leading edge provided torsional stiffness with fabric covering behind. Large two-piece ailerons extended from the bend in the wing to the tip. The air brakes, mounted inboard of the gull bend, were of Schempp-Hirth type.

First flights were made in November 1951. All proved satisfactory. Oberlerchner began production and twelve of the Mg - 19 were built. In the Austrian soaring championships at Zell am See in 1952, six Steinadlers competed, doing well.

Walter Hesse in 1953 won the National Championship in a Mg - 19 and, with co-pilot E Neumann, competed in the 1954 World Championships at Camphill in England. Very poor weather made this contest difficult for all. In the two-seater class the Mg - 19 placed fifth out of nine entries. The championships were particularly sad for the Austrians. Their pilot entered for the single seat class, Alois Hasenkopf, flying a Scheibe Zugvogel, was killed during the practice period when the sailplane broke up in a cumulo-nimbus cloud. He was found with his parachute partly opened.

The large ailerons of the Mg - 19 were very heavy for the pilot to operate and not especially effective. For the Mg - 19a the inner section was removed. The result was much lighter loads on the stick and no loss of effectiveness. The fuselage was lengthened slightly.

The Mg 19a, with gull wings, has slightly improved ground clearance.

Twenty-one of the 19a were built. For the Mg - 19b straight dihedral was adopted, making for simpler construction. The wing tips were no nearer the ground, when landing, than the gull winged version. A dozen of the Mg - 19b entered service.

For the 1956 World Championships at St Yan in France, Musger produced the Mg - 19c. Sailplane aerodynamics had moved on (see part 2) and he took advantage of this. The total for all Marks of the Steinadler thus reached 46. (The so-called Mg - 19s, with a steel tube welded fuselage frame and a very different wing, was developed by the student flying group at Graz during the years 1956 - 60. It was not really a Mg - 19 at all.)

Most Austrian two seat records were broken by various marks of the Steinadler during the period up to 1963. Several were still fully airworthy and flying fifty years after completion of the prototype.

BRAZIL

There was a small but active soaring movement in Brazil, encouraged in 1934 by the Georgii expedition from Germany. A report from a single club attached to the Varig Company was published in 1946. The club operated at Porto Alegro and had three pilots who had completed the Silver C requirements. In a six-month period the club logged a total of 43 hours flying time from 103 aerotowed launches. In the same period 1222 primary glider training flights were logged without timing.[6]

Two Brazilian pilots competed in the 1956 World Championships, flying BN - 1 sailplanes designed by José Carlos de Barros Neiva and manufactured by the Sociedade Construtora Aeronautica Neiva. The BN - 1, four of which were built, had a span of 16 metres with NACA 4 digit wing profiles. Its first flight was in 1953. Pilot George Munch placed 16th. He had not done so well in 1952, flying a Weihe in Spain. Apart from the general dimensions and a small outline drawing showing it to be a well proportioned but simple sailplane with a straight tapered wing, little more is known of the BN - 1.[7]

HW - 4 Flamengo

At the Brazilian Soaring Championships in 1956, twenty-four pilots flew in a variety of aircraft. In the minor league were ten Grunau Babies and three of the Neiva B Monitor, a locally produced training two-seater. The 'A' league included four of the BN - 1, two Olympias, a Weihe, Kranich, an American LK - 10, a homebuilt Fauvel Av 36 and the Flamengo or as it was later re-named, 'Flamingo'. Of the pilots, two held the Gold C and seven the Silver.

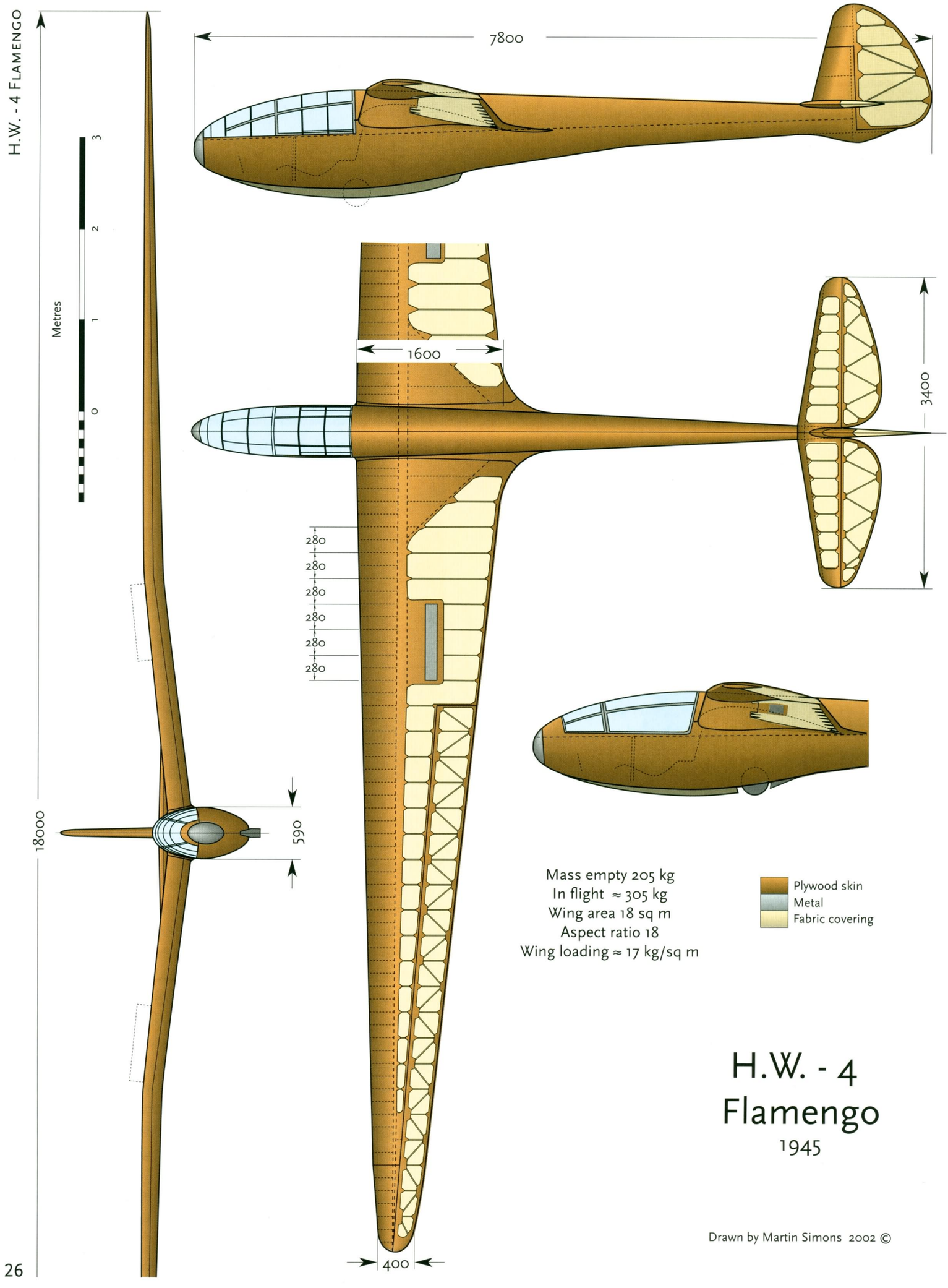
6 - Sailplane and Glider February 1946.
7 - OSTIV World Sailplanes Vol 1.

Above: The beautiful Brazilian Flamingo showing its elegant lines. (Photo D. Hundsacker)

Below: A close-up of the Flamingo with its constructor Kurt Hendrich standing on left with Sr Luiz Bevilliasquea, the Director of the Aero Club. (Photo D. Hundsacker)

Hans Widmer and Kurt Hendrich, sailplane pilots from Switzerland who had settled in Brazil, produced the Flamengo. The design was started in 1944 and construction was completed in 1946. Widmer was credited with the design work and calculations. Construction was by Hendrich. Brazilian timbers were used throughout, doubtless because imported materials would have been expensive. The general design followed European practice. The result was an elegant, gull winged sailplane of eighteen metres span and a relatively light wing loading. The wing profiles were apparently strongly cambered. Lighter than the contemporary German Weihe, though of similar general proportions, the low speed performance would have been very good but the Flamengo could never have been considered a racing sailplane.

The Flamengo continued to fly in Brazilian competitions in the nineteen-sixties and in 2002 was undergoing restoration.

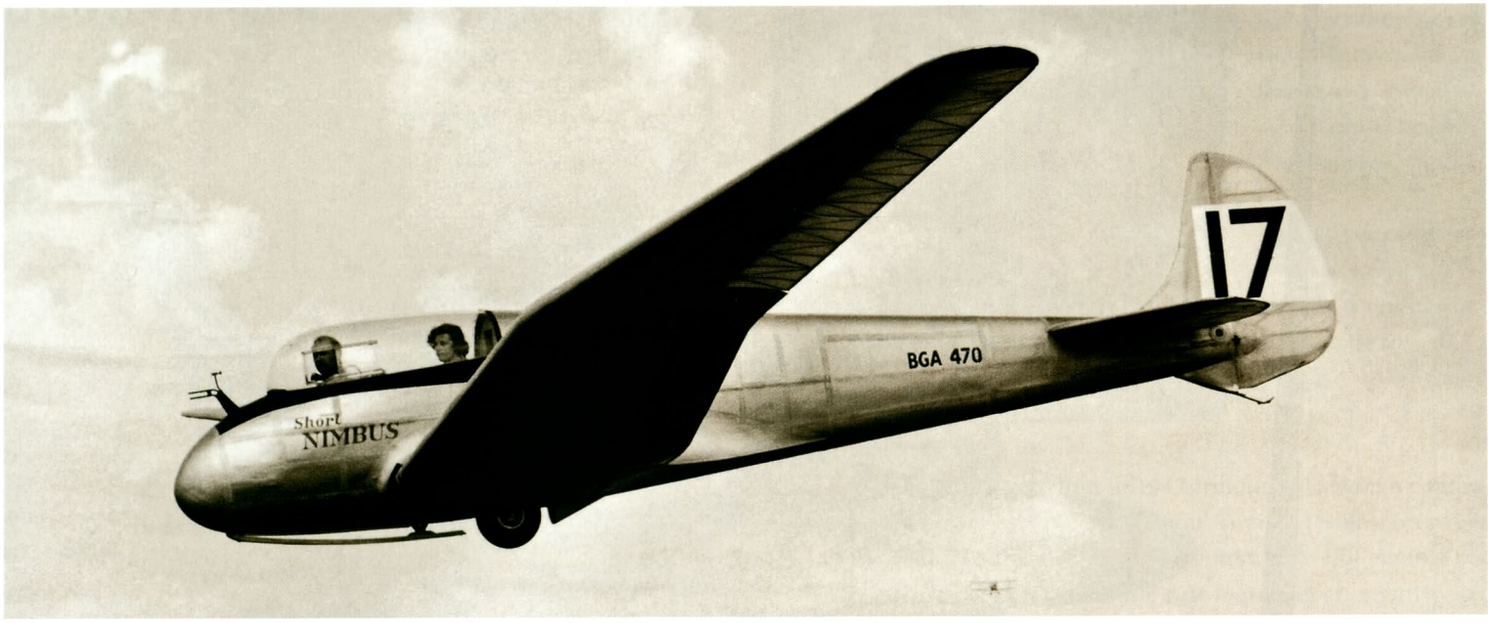


Mass empty 205 kg
In flight ≈ 305 kg
Wing area 18 sq m
Aspect ratio 18
Wing loading ≈ 17 kg/sq m

Plywood skin
Metal
Fabric covering

H.W. - 4 Flamengo

1945



BRITAIN

The soaring movement in Britain, thanks to farsighted negotiations during the nineteen thirties, is administered by the British Gliding Association, an association of clubs intended to serve, advise and promote the sport. One result is that British glider pilots have never been required to possess government licences or to undergo tests and examinations devised by some central ministry. BGA personnel do any testing required. Most of those elected by the membership to positions of importance have been well qualified to take responsibility for such matters as airworthiness, safety and training, while leaving the clubs largely to manage their own affairs. In the post war period attempts were made by the government to impose new regulations. For example, for a few months in 1949 British sailplanes were required to be registered and display large official letters as all other aircraft did. The BGA negotiated with the authorities and the letters disappeared almost overnight. The BGA necessarily becomes involved in negotiations with external bodies when soaring is an issue of public concern, such as airspace and air traffic control. To enable British sailplanes to be exported or even to be flown abroad, an official British Certificate of Airworthiness is often required. The Air Registration Board, an arm of the national government, accepted the BGA's airworthiness standards which then became incorporated as 'Section E' of the British Civil Airworthiness Requirements, and recognised internationally.

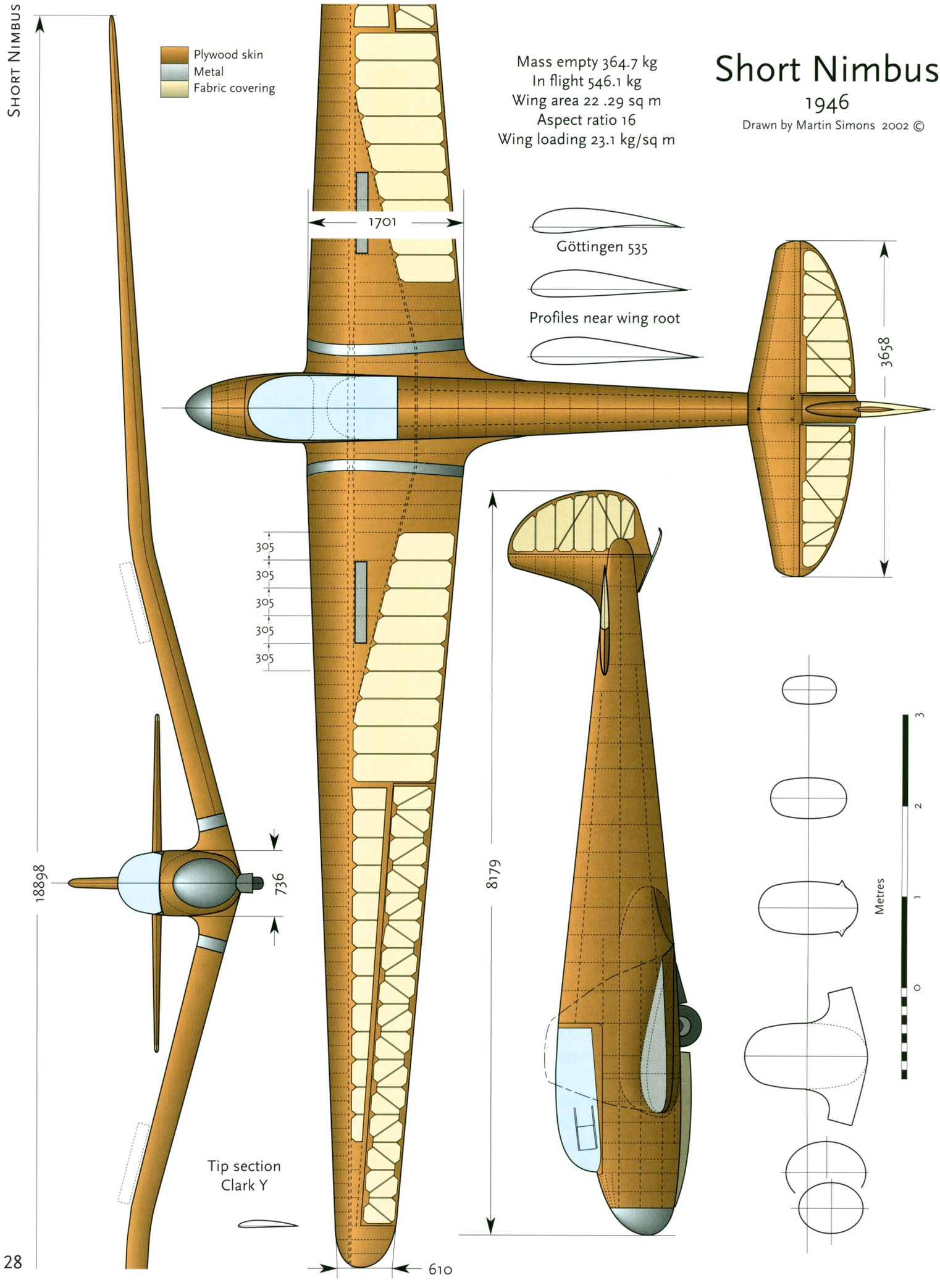
The chief manufacturer of sailplanes in England had always been Slingsby, whose factory was near the Yorkshire village of Kirbymoorside. From 1945 on there appeared several rivals, the Chilton Aircraft Co, the Hawkridge Aircraft Co of Dunstable and Elliotts of Newbury. There were also individuals and small groups who became involved in design and construction.

Above: The Nimbus in flight, showing the landing wheel and the deep fuselage Right: The Short Aircraft Co 'Nimbus', after some years of neglect, was flown in the British National Championships in 1957 at Lasham.

Short Nimbus

The Short Aircraft Company, with factories at Rochester in Kent and Belfast, Northern Ireland, produced many successful aircraft and flying boats. Members of the design staff at Rochester started a gliding club in 1946. They felt the lack of a high performance two seat sailplane and resolved to design and built their own. The chief designer was A. O. Mattocks and club members undertook construction. As the project advanced and began to look attractive, the Short Company became interested. Some financial and other help was made available and plans were made for the type to be produced in quantity.

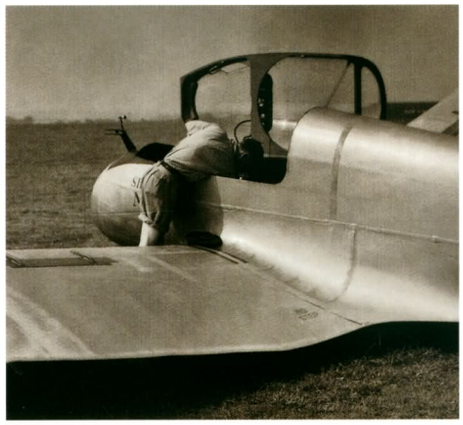
The most unusual feature of the Nimbus was that it had a low wing with a pronounced 'gull' form intended to keep the underside clear of the ground. Aerodynamically this was later described as a 'good old fashioned wing' with the Göttingen 535 profile at the root tapering outboard to the Clark Y. The construction was orthodox; the I section main spar being laminated in spruce where it was required to follow the gull bend. Each wing joined the fuselage about 0.7 metres from the centre line. The stub wing roots were carefully faired. Spoilers, rather than airbrakes were fitted and there was no means of trimming the elevator. There was a large landing wheel slightly aft of the centre of gravity when fully laden.


Plywood skin
Metal
Fabric covering
Mass empty 364.7 kg
In flight 546.1 kg
Wing area 22 .29 sq m
Aspect ratio 16
Wing loading 23.1 kg/sq m
Short Nimbus
1946
Drawn by Martin Simons 2002 ©
1701
Göttingen 535
Profiles near wing root
3658
305
305
305
305
305
18898
736
8179
Tip section
Clark Y
610
Metres
0
1
2
3

A substantial internal beam passed through the cockpit to carry the spar loads. The second seat was actually on this main 'carry-through' member, an unusual feature. The pilots sat upright under the large plastic canopy. The view from both positions was excellent but the fuselage was higher and also a little wider than for most other tandem seat sailplanes.

The first flight was in December 1946. Moderately encouraging reports were published. The Short Company began advertising for orders, claiming a best glide ratio of 25.8: 1.

The prototype was taken to the Midland Gliding Club for evaluation. The members were pleased with both handling and performance but some buffeting of the tail was noticed in slow turns. This indicated the need for some further study of the airflow around the wing root. The Nimbus went back to Rochester for this to be done. A proposed modification for the production model was to sweep the wings back slightly to improve the balance. Air brakes were to be fitted instead of spoilers.



Left: A spectacular sight in the air, the Nimbus was, in the long run, a disappointment. It survives but is very rarely flown now.

Right: Elaborate wing root fairings were not wholly successful in preventing turbulence at the tail

The British Gliding Association in 1947 announced a design competition for a high performance two-seater. Twenty designs, on paper only, were submitted. Technically the Nimbus was not eligible because it was already known and the rule requiring anonymity was broken. It was also slightly over the specified 18 metres span. Nonetheless the judges admitted the Nimbus to the competition and it was placed third. It was considered heavy, at 365 kg unloaded. The Nimbus would probably be difficult for the ordinary club to manage. Most of the winches in common use, adapted from wartime barrage balloon winches, would barely cope with launching it. Slingsby's existing two-seater, the Gull 2 of 1939, not entered in the competition but of comparable size, scaled under 300 kg. The weights claimed for the other competition entries were only estimates and the judges considered that all would probably be heavier if and when completed.

By the standards of the period, the Nimbus was costly and, even if the flow separation problem had been solved, it was not what most clubs required. Insufficient orders came in and the Company abandoned the production plans. In 1957 after being neglected for years, the only Nimbus ever built was rescued and reconditioned to fly in League 2 of the British National Championships. Against both two seat and solo aircraft of much later design, it placed 33rd out of 44 entries, having failed to score on two of the seven days. Although remaining intact, it has rarely been flown since.

Slingsby Type 21 Sedbergh

Slingsby was thinking ahead of many of his potential customers when, in 1944, he foresaw that in future glider pilots would be trained in two-seaters. He completed two prototypes, his Types 20 and 21. The T - 20 had the seats in tandem below a high, strut-braced wing. It was offered to the Air Training Corps but not adopted. (The ATC was a pre-service youth organisation for the Royal Air Force, much involved in glider training since its formation early in World War 2.) In 1945 the T - 20 was used for some extraordinary wake trials with aircraft carriers and eventually fell into the sea by accident. After the pilot had been rescued the T - 20 was deliberately rammed by a destroyer to prevent its becoming a hazard to shipping. It was the only sailplane ever to be sunk by the Royal Navy.

Above: The Slingsby Type 21 was built in quantity and was the most popular training glider in British gliding clubs for more than a decade.

Left: A T - 21 restored in the Netherlands, seen on a visit to Tibenham in the year 2000.

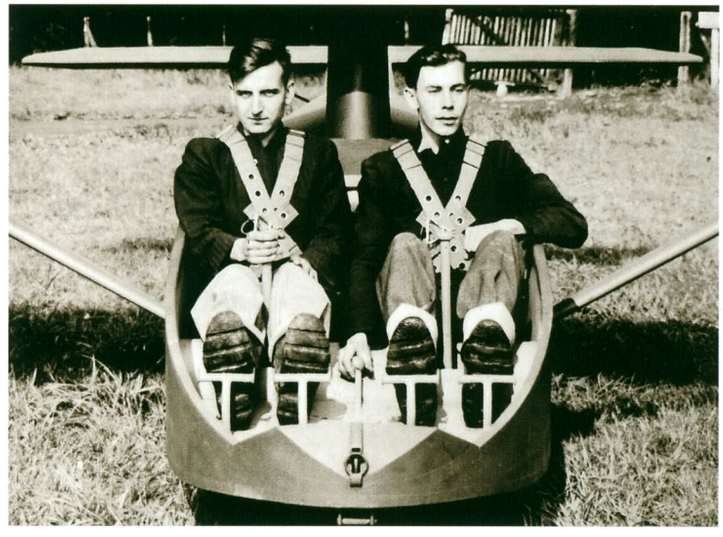
The Type 21 prototype, with a span of 15.24 metres (50 ft) also was rejected by the ATC at first and was saved only when bought by the London Gliding Club. It was soon found it to be extremely useful and the club ordered another, with suggested improvements. Slingsby lengthened the wings to 16.5 metres and improved the fuselage. The new two-seater was demonstrated at the British National Competitions in 1947 and attracted orders.

The T - 21 was in most respects an enlarged Grunau Baby. The two seats were side by side in the open cockpit. Instructors generally preferred this arrangement because it enabled them to converse normally with the student and observe facial expressions. That there was some inescapable drag penalty hardly mattered in a trainer. The small windscreens were very effective in deflecting the airflow away from the pilots' faces. If the airspeed was not well controlled this became obvious immediately in the cockpit.

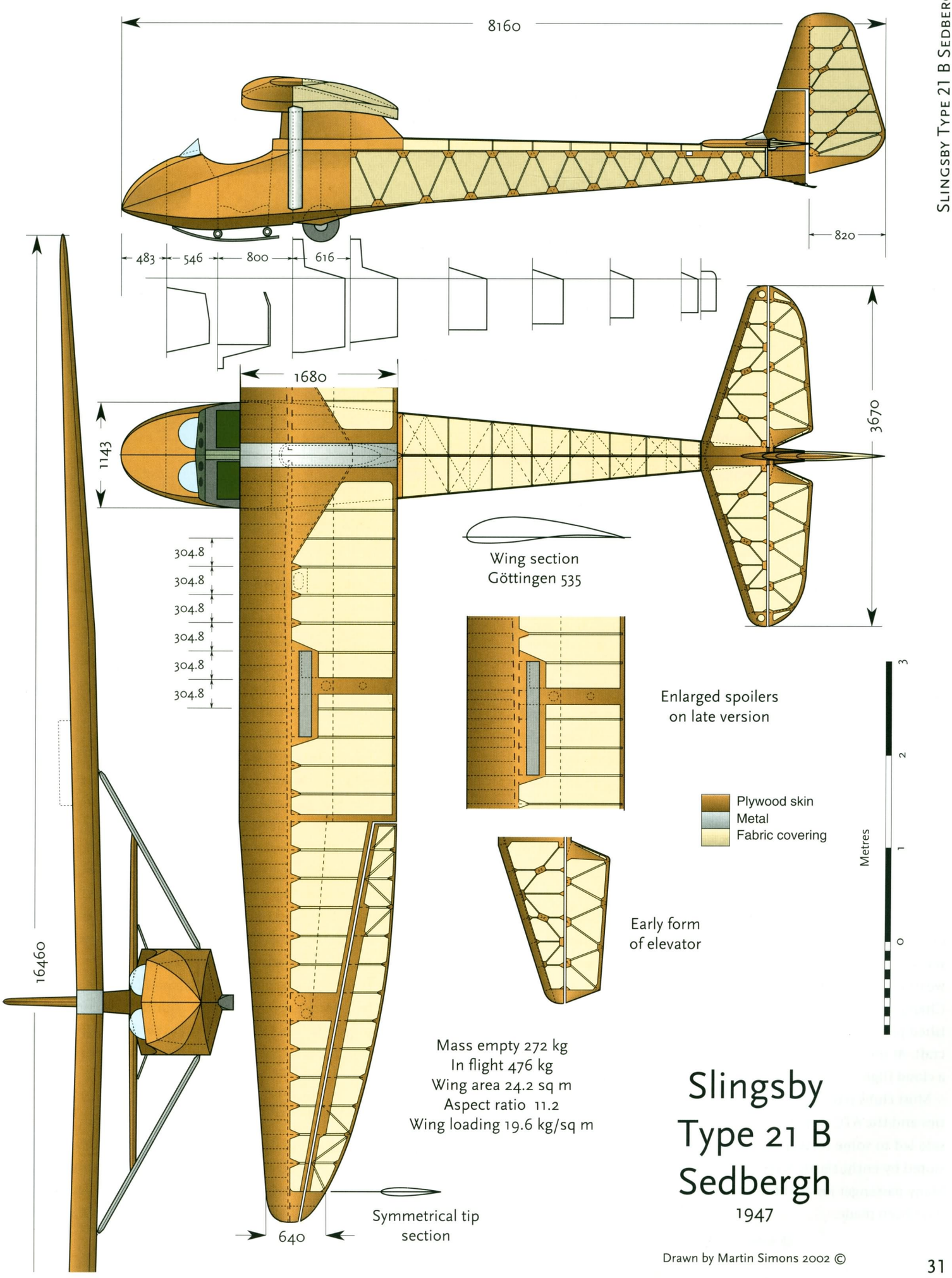
The fuselage aft of the wing was a triangulated timber frame covered in fabric except underneath where plywood skin was used to protect against damage on rough ground. The wing, like the Grunau Baby, had a single main spar, with a single strut. The leading edge was the usual kind of plywood skinned 'D-sectioned' torsion tube with fabric covering behind. Spoilers were fitted on the upper side. These, though not very effective, were powerful enough for a pupil to sense the difference when they were opened or closed.

For reasons of balance the seats had to be set back under the leading edge of the wing. The view from the cockpit upwards and into a banked turn was limited, which was the only important disadvantage of the sailplane. Since the wing was mounted high on a narrow pylon, it was easy to look sideways and aft under the wing, so despite the wing overhead, in practice the all round vision was acceptable.

The T - 21B entered production. It became the standard training sailplane for British civilian gliding clubs and remained so until well into the 1960s. The ATC had second thoughts and also ordered the type, giving it the name Sedbergh, which was rarely used by the



Above: The Type 21 prototype in 1944 as it was originally intended to be. For early flights it was thought the pupil must feel the airflow, as with a primary glider. Below: At a later stage in training, the cockpit could be partly enclosed. Note the redundant bracing wire from the nose to the wing strut fitting.



Slingsby Type 21 B Sedbergh

1947

Drawn by Martin Simons 2002 ©

Above: Named 'Cadet Mark 3', the Type 31 was extensively used by the Air Training Corps.

Left: The Type 31 was a two-seat version of the Type 8 'Tutor'. This example flew at Berwick in Australia.

civilian clubs. A total of 218 were built, including a few by amateurs from kits, and nineteen under licence by Martin Hearn. The ATC took over ninety.

The T - 21B was an excellent soaring sailplane. In weak slope lift or thermals it climbed readily and although the high-speed glide was not good, this did not prevent cross-country flying in suitable weather. It was not unusual for T - 21s to compete in national Championships during the 'fifties and the results sometimes astonished pilots who were flying much more refined and expensive aircraft. At the 1953 nationals Derek Piggott, with an ATC cadet, made a cloud flight to 17,000 ft above sea level in a Sedbergh.

Most clubs retired their aging T - 21s in the late sixties and seventies and the ATC disposed of their remaining fleet after 1983. This sale led to some revival of interest in the type. Taken over and restored by enthusiastic 'vintage' glider groups, some remain in use. Many passenger joy flights and some excellent cross-country flights have been made.

Slingsby T - 31, Tandem Tutor (Cadet Mark 3)

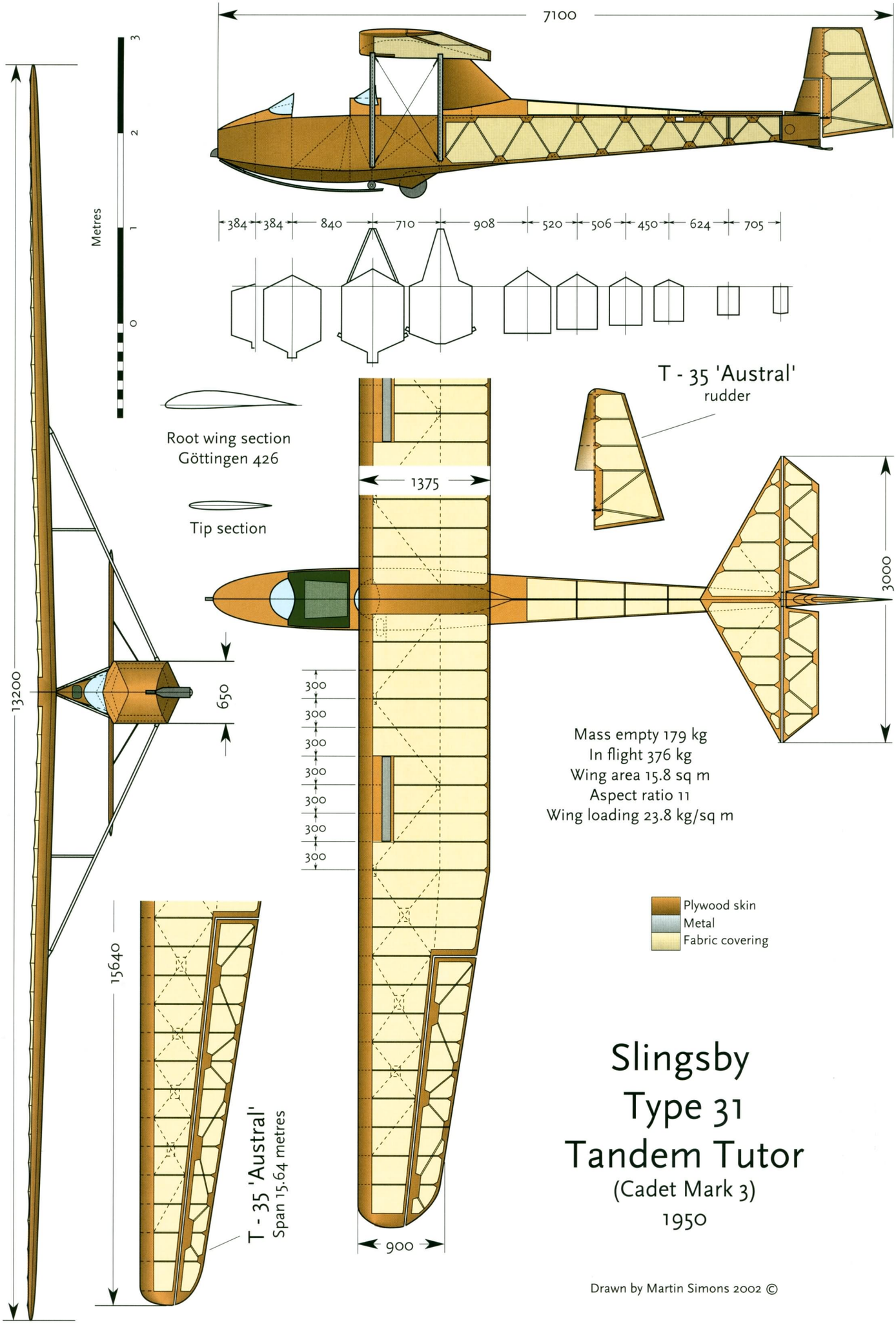
When Slingsby introduced the Type 31 it was called the Tandem Tutor. The original Tutor flew first in 1937. It was a single-seater intended for early soaring flights by pupils who had progressed to the Kirby Kadet and were ready to move on. The Tutor, or Cadet Mark 2, was built in quantity for the ATC and more were produced after 1946 for civilian use. In 1949 although the T - 21 was already becoming accepted as an excellent trainer, some clubs, particularly where the landing field was relatively rough, required a robust two-seater with a performance and handling like the solo Tutor.

A powered version of the Tutor was already in existence, with strengthened wings and some additional bracing of the struts. To develop a two seat glider from this involved very little work, requiring only that a front cockpit should be spliced onto the fuselage instead of engine bearers. To fit the engine in the nose the fuselage had been widened. This made room for the rear pilot's feet and rudder pedals to be placed on either side of the front seat.

The Tandem Tutor was tested by the BGA and came on the market from 1951. There were exports to many countries of complete aircraft and kits of parts. The ATC took 131 as the Cadet Mark 3. More than 200 were built. Some are still flying as vintage gliders.

Slingsby Type 26 Kite 2

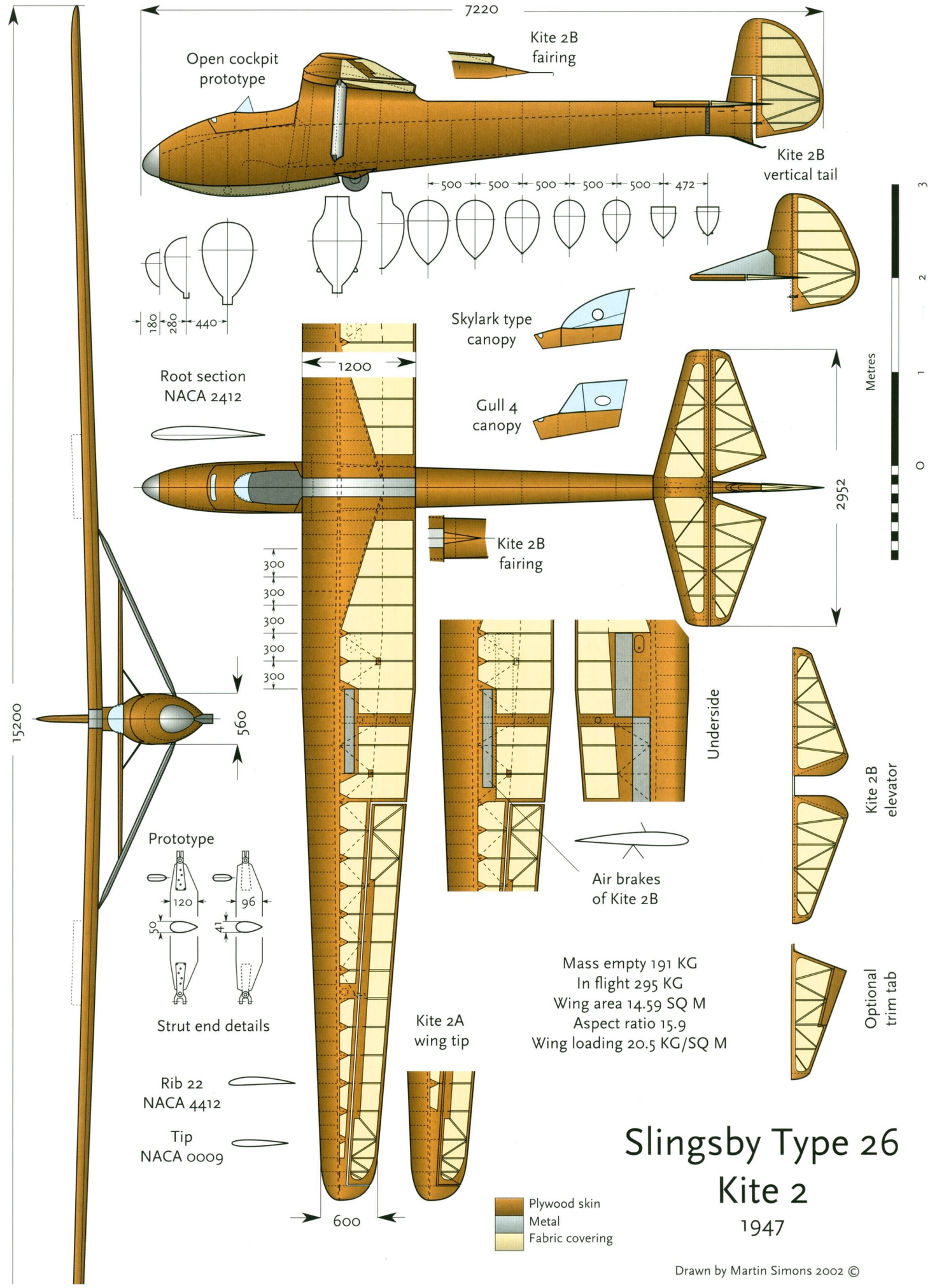
The successful Kirby Kite of 1935 was essentially a Grunau Baby with a streamlined fuselage and gull wing. In 1948 Slingsby produced what he hoped would be equally popular, the Kite 2. Construction, in wood, was entirely orthodox. The tail unit was taken



Slingsby Type 31 Tandem Tutor

(Cadet Mark 3)

1950



Slingsby Type 26
Kite 2
1947

Right: This Kite 2, restored by Peter Warren and named 'Percy' after the pioneer aviator Percy Pilcher, was finished in the original Slingsby colours

Below: The Kite 2A has been modified with extra fin area and large air brakes instead of spoilers

from the earlier Kite but a new fuselage with a comfortable cockpit was designed and a wheel added for ground handling.

The wing was entirely new, using NACA 4 digit profiles only 12% thick.[8] This thin wing would compensate for the drag of external struts. The rigging angle on the fuselage was unusually large. This allowed landings to be made with the tail well down and hence at the lowest possible airspeed. It caused the fuselage to present itself to the airflow in a distinctly nose down attitude when flying. At high airspeeds this effect was more pronounced and resulted in considerably higher drag.

The outer wing tapered from the NACA 2412 section to 4412 at the tip. As indicated by the first digit, the tip profile had 2% more camber and hence could develop a higher maximum lift coefficient. The higher lift would be reached at a smaller geometrical angle of attack. To avoid the tip stalling before the wing root, a small amount of washout was required. Over the last few bays of the wing the section changed progressively again to a thin symmetrical form but with wash-in angles instead of washout. It is hard to understand the thinking behind this layout.

The prototype Kite 2 flew in 1947 and was taken on a promotional tour of English gliding clubs. It met with lukewarm approval until it was written off in a spinning accident at Camphill. The cause was undoubtedly the outer wing design, which promoted tip stalling and spinning. It was the worst possible start for a new sailplane type, especially since deliveries of the Olympia, produced by Elliotts, were already taking place The Olympia, little changed from the German Meise of 1939, was viceless, handled exceptionally well and had a better performance. Unfavourable comparisons were made.

After modifications to the wing which cured the tip stalling, the Kite 2A was marketed. Eleven were built by Martin Hearn, some not being sold until several years later at special prices. Experiments were made with one Kite 2; to produce the Kite 2B, which had much, enlarged air brakes and increased fin area. This and one other were still in use in 2002.

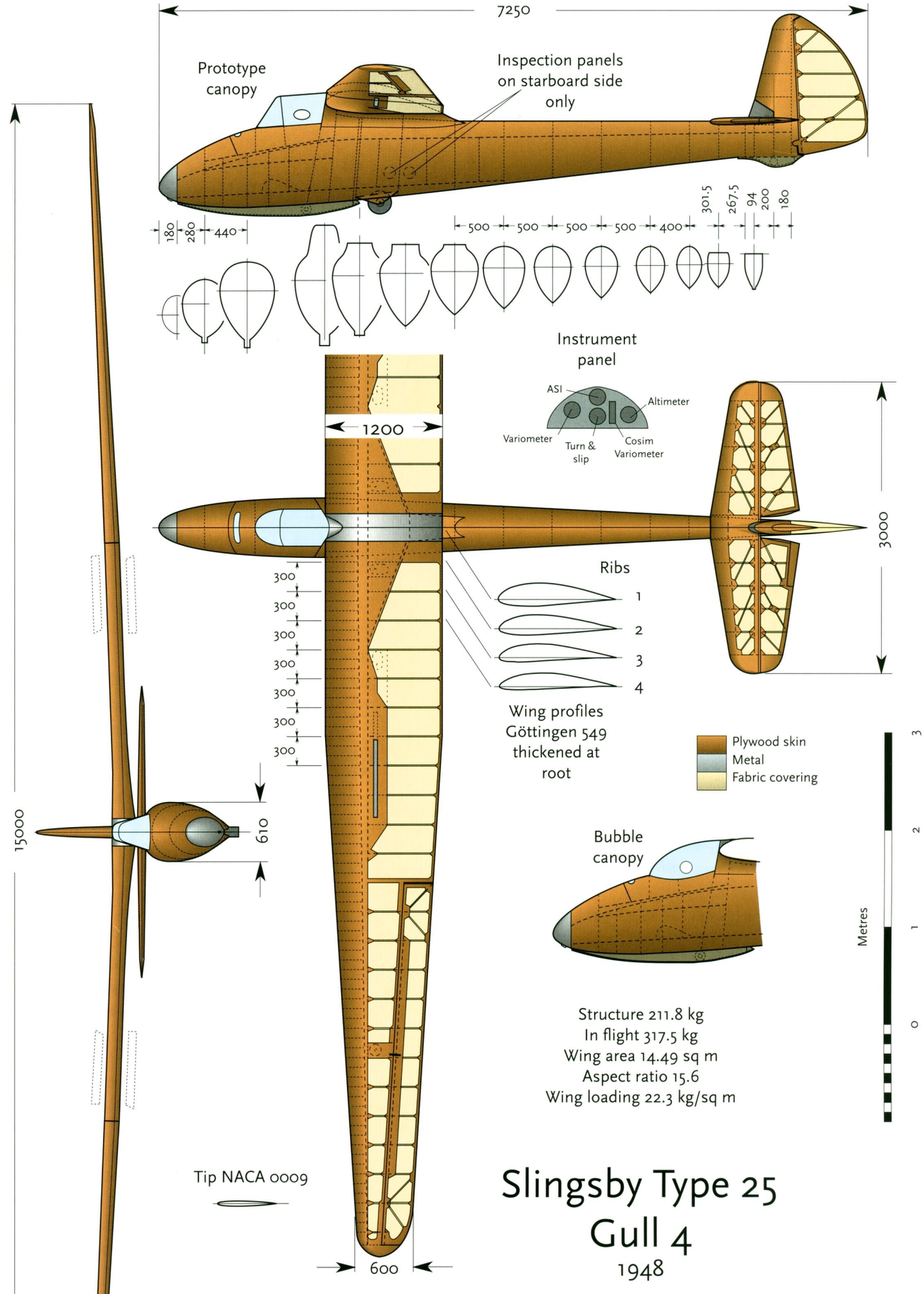
Slingsby Type 25 Gull 4

Although the type number suggests otherwise, the T - 25 Gull 4 flew after the T - 26 Kite 2. It was intended as Slingsby's answer to the Olympia. The wing had a rectangular centre section with tapered outer panels. Schempp-Hirth type air brakes were fitted. The same profile as the Olympia, Göttingen 549, was used at the root but required thickening to allow a deeper main spar. The necessary lessons had been learned from the Kite 2 and there was no tip-stalling problem. The fuselage was almost identical to that of the Kite 2, using the same frames, undercarriage and cockpit, except for the narrow neck where the wing was mounted. The tail unit was entirely new, with an elevator trim tab.

Although the Gull 4 was reckoned by those who flew it to be slightly superior to the Olympia in performance, it appeared on the market too late and sales were disappointing. Only four were built.

The World Soaring Championships in July 1948 were held at Samedan in Switzerland. Two Gull 4s were entered, the British team also including two Olympias and, from RAF clubs in occupied Germany, two Weihes. For the first time, one of the contest tasks was for speed round a 100 km triangular course. Philip Wills in a Gull 4 set a National record, taking a little more than two hours, while the Swiss pilot Sigbert Maurer set the World record with 1 hour 36

8 - The 12% relates the thickness to the chord of the wing.



Structure 211.8 kg
In flight 317.5 kg
Wing area 14.49 sq m
Aspect ratio 15.6
Wing loading 22.3 kg/sq m

Slingsby Type 25 Gull 4

1948

Left: Ann Welch flew the prototype Gull IV during its test flights at Redhill in Surrey.

Above: The only surviving Gull IV has a Kite 2 fuselage adapted.

Left: The Gull IV was bought by the London Gliding Club and gave good service until damaged in a spinning accident.

minutes. Six days later the British suffered two fatal accidents. The Olympia flown by Donald Greig hit a steel cable suspended across the valley along which he was flying. Christopher Nicholson in a Gull 4 was drawn into cloud, or suddenly caught when it formed around him, and crashed close to the 3000 m high summit of a ridge.

The Gull used by Wills was sold subsequently to Australia. In 1950 it achieved a climb in a storm to 23,500 ft (7050m) above sea level. The pilot, Martin Warner, had no oxygen. He became semi-conscious and descended out of control, with air brakes open. Emerging from cloud low over bush country he was forced to crash into trees, fortunately without injury to himself. The Gull was repaired and flew again but after a winch launch spinning accident was not rebuilt. The other two Gulls remained flying in England, one being entered for the 1950 Internationals at Orebro in Sweden. One only survived in 2002, with the original fuselage replaced by that of a Kite 2.

Slingsby Type 34 Sky

Recognising that the Gull 4 had not achieved the successes Slingsby had hoped, he decided to develop the type into a sailplane to rival the Weihe which, although designed in 1938, was still considered the best all round competition sailplane. In the 1950 World Championships in Sweden, Billy Nilsson and Paul MacCready, in locally built Weihes, placed first and second. Seven of the top ten scores went to Weihes and Wills in his old German Weihe won the British Nationals in the same year.

The most practical and quickest way of improving the Gull 4 was to increase the span to equal the Weihe, eighteen metres. This resulted in the Type 34, simply an enlarged Gull 4. Many of the components were identical and were built in the same jigs. The cockpit had originated with the Kite 2. Two extra rib bays were added to the centre section of the wing and the outer ribs were more widely spaced. The lengthened ailerons were divided into two to prevent

Above: Slingsby's answer to the Weihe was an eighteen metre span version of the T 25 Gull IV. The T - 34 'Sky' flew first in 1950. This one is at Sutton Bank in Yorkshire
Left: The name 'Sky', is said to have come from the initial letters, Slingsby, Kirbymoorside, Yorkshire. Several of the type survive and are capable of excellent flights

binding of the hinges when the wing flexed in flight. To accommodate the additional bending loads, the spar required considerable reinforcement and the root was thickened locally. This had been done for the Gull, but the T - 34 wing root required an even deeper spar. Air brakes resembling those of the Weihe, which were of the DFS type and somewhat less effective than the Schempp-Hirth brakes of the Gull, were used. The wing tip profile was changed to a NACA reflexed form. Stretching the wing made it necessary to increase the tail moment coefficients by lengthening the fuselage and there was need for some additional stiffening. A simple skid and drop-off wheeled dolly could be used for take off, but in production a landing wheel became standard.

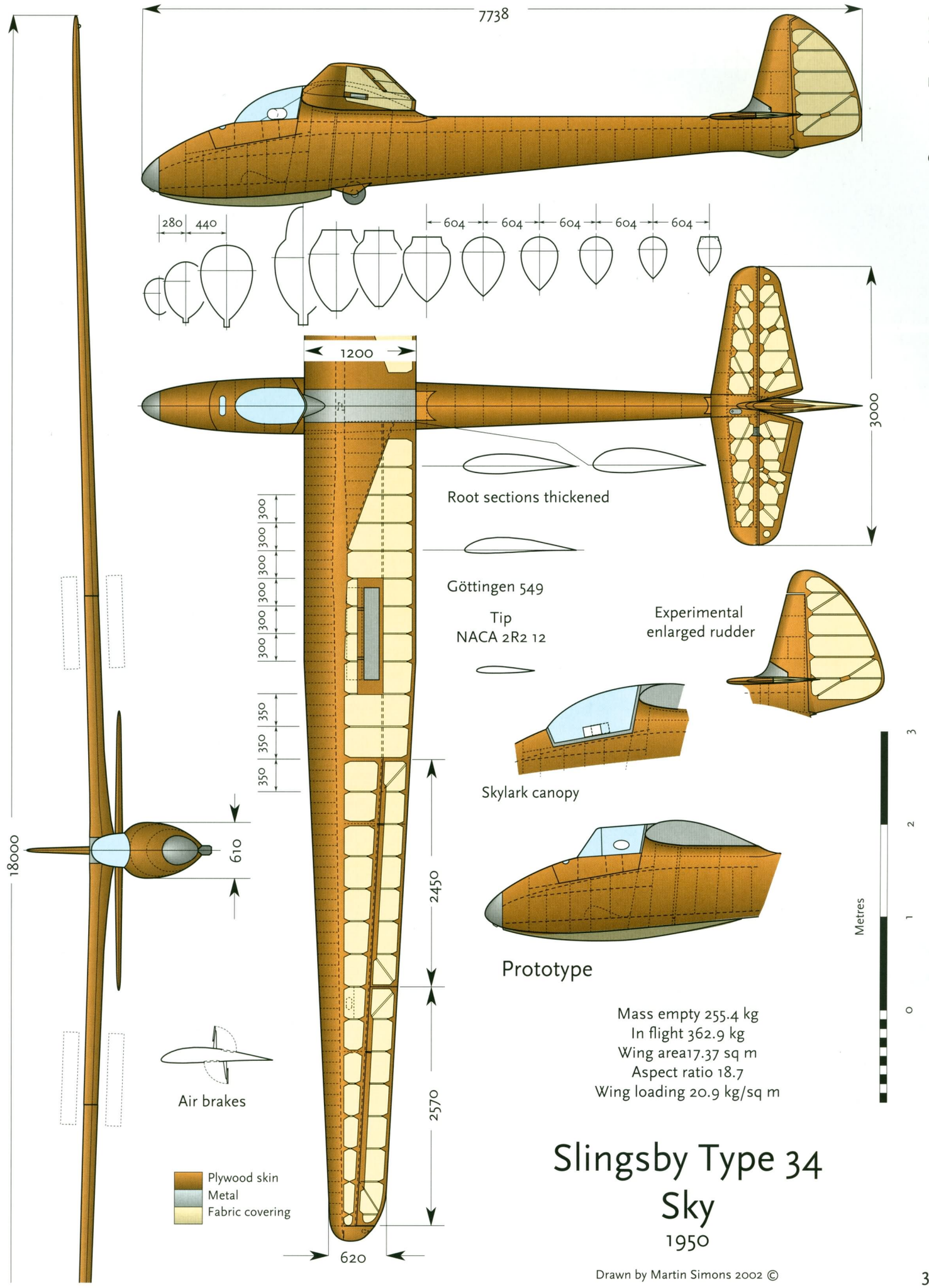
The prototype, named Sky, an acronym from Slingsby, Kirbymoorside, Yorkshire, flew in September 1951. Comparison flights against the Weihe showed that there was an improvement in the high speed glide, which could be explained chiefly by the fact that the Sky in flight was heavier by about 30 kg. At low speeds, in weak thermals, the Weihe would still climb better but as the emphasis in competitions and cross-country flying was shifting to speed, it was accepted that the T - 34 was superior.

In partial confirmation of this, the first two places in the 1951 British nationals were taken by Skys, the issue being decided, remarkably, by a very poor but just legible turning point photograph taken by Jock Forbes, the eventual winner. This gave him a margin of four points over Geoffrey Stephenson. Third and fourth places went to Weihes flown by Philip Wills and Lorne Welch.

In 1952 the World Championships were held in Spain at Cuatro Ventos near Madrid. Four British pilots, equipped with Skys, competed. Five contest days were achieved. There were only two of the old 'free distance' tasks and one 'pilot's choice' goal flight. On the other two days, speed tasks were set in the form of set straight-line races to a goal. On the final day Philip Wills achieved an average of 84.38 km/h, which was enough to give him the World Championship, although both Dick Johnson and Paul MacCready made better speeds on this last day. Johnson, flying the RJ - 5[9], achieved 107.5 km/h.

The Championship success encouraged a few customers. Sixteen Skys were built. Exports went to Argentina, Spain, Switzerland, the Netherlands and Spain.

9 - See Part 2



Mass empty 255.4 kg
In flight 362.9 kg
Wing area17.37 sq m
Aspect ratio 18.7
Wing loading 20.9 kg/sq m

Slingsby Type 34 Sky

1950

Above: The Harbinger, designed by Czerwinski and Shenstone, built at home by Fred Coleman, remains airworthy and attends vintage meetings.

Right: The Harbinger fuselage was slightly curved longitudinally to conform to the airflow over the wing. The multiple paddle or 'dragons teeth' brakes are a notable feature and very effective. Compare these with the Italian M - 100S and M - 200 sailplanes.

CANADA

Waclaw Czerwinski had worked for the Podlaska Wytwórnia Samolotów (Poldlasian Aeroplane Factory) and was responsible for several important powered military aircraft as well as outstanding sailplanes such as the PWS 101 and 102. In 1940 in Canada he met Beverley Shenstone, another highly qualified aeronautical engineer who, born in Canada, had worked for the Junkers Company in Germany and for Supermarine during the development of the Spitfire. He was now working for Avro Canada. He was a glider pilot and past President of the Soaring Association of Canada. So began a fruitful collaboration.

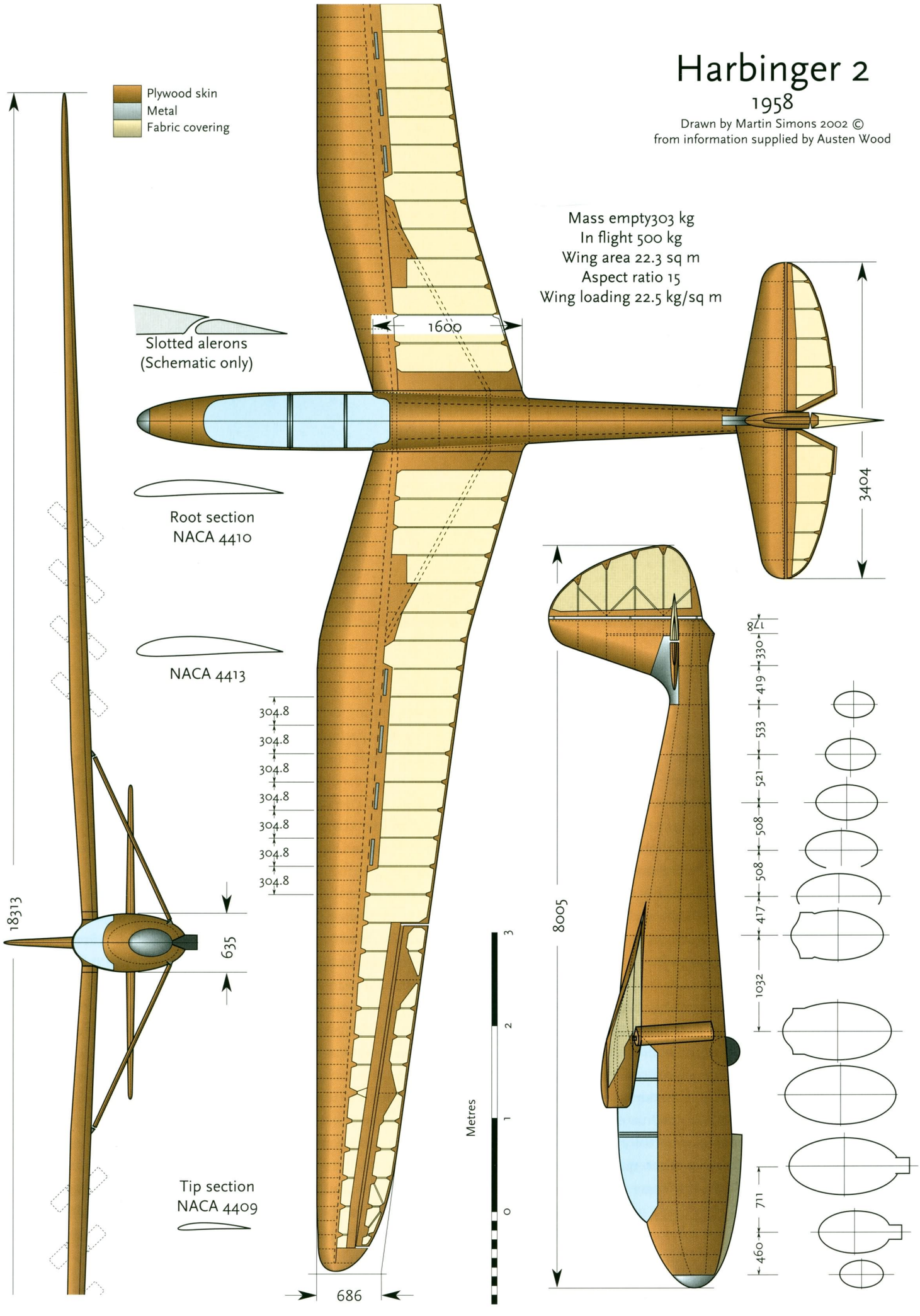
The Harbinger

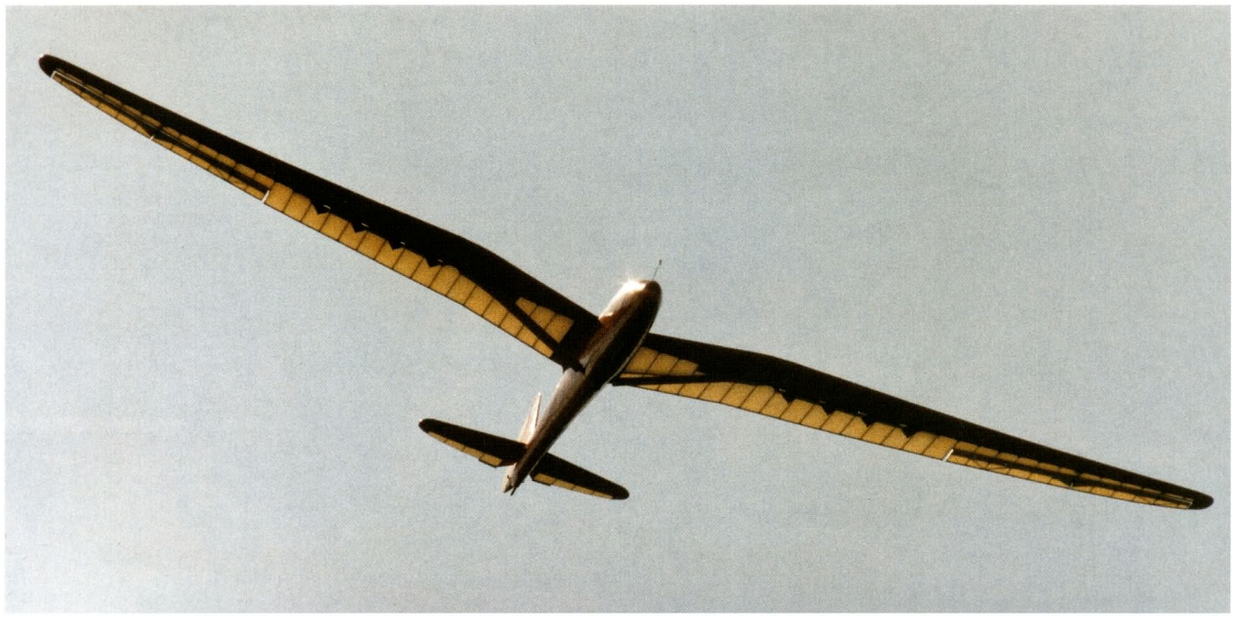
When the British Gliding Association announced, in 1947, a design competition for two seat sailplanes, Czerwinski and Shenstone decided to enter. Their design was the Harbinger. In articles published subsequently they explained in detail the reasoning behind their work. The seats, they believed, must be in tandem to reduce the cross sectional area of the fuselage. This presented the usual difficulties. Correct balance of the aircraft required the rear seat to be close to the centre of gravity, placing the second pilot near the wing's aerodynamic centre. If the wing was straight, the seat must be either immediately above, as in the Short Nimbus, or below the

Harbinger 2

1958

Drawn by Martin Simons 2002 ©
from information supplied by Austen Wood





The Harbinger looks impressive in flight.

main spar. In the latter case the view from the rear cockpit was seriously restricted. The famous German Kranich design had a swept back wing which allowed the pilot to be seated behind the spar, but from this position there was hardly any view forwards or downwards. A better answer, it seemed, was to sweep the wing forward. This could be done in a simple fashion, as became the accepted practice in later years with such sailplanes as the Ka 2, Ka 7 and Blanik. In 1947 however, the Canadian pair decided to sweep the wing sharply forward over the centre section while keeping the outer panels straight. Unknown to them, the Swiss, Jacob Spalinger, had adopted a similar layout for the S - 25.[10]

Such a layout, with a pronounced change of the planform at the 'elbow' of the wing, required a complicated load bearing structure. To turn the main spar sharply backwards seemed impractical and clumsy. For the Harbinger a solution was adopted involving substantial steel tubular structures forming, with the external struts, two tripods. The main spar could then be straight in plan but relieved of the main bending stresses by the struts, need not be very deep. This allowed the wing to be made very thin where it joined the fuselage. The drag of the struts would thus be offset by reduced flow interference at the junction. A strong but light steel frame in the fuselage connected the various wing attachment points to make a rigid structure.

In other respects the Harbinger was of orthodox wooden construction, although there was an additional refinement in the shape of the fuselage, which was slightly curved longitudinally to conform as far as possible to the curved airflow over the wing. The air brakes were of the 'dragon's teeth' type.

Much care was taken to arrive at a fair estimate of the final mass. This proved optimistic, the Harbinger eventually turning out much heavier than expected, with unfortunate consequences.

In the BGA design competition the Harbinger was placed fifth.

Fred Coleman had built a Grunau Baby 2 in 1936. He was licenced by Czerwinski in 1949 to build a Harbinger, while construction of another was started in Canada. Coleman, working alone and in very limited accommodation, overcame many difficulties. He did most of the work in the bedroom of his small house. He built the fuselage in two halves, splicing them together later. It was not until 1957 that the sailplane was completed. It then became apparent that the weight and balance estimates were wrong. After much correspondence with Czerwinski the nose was lengthened, moving the front seat forward by 380 mm. Even then an additional 11kg of ballast was needed in the nose. After this the aircraft was flown in July 1958, nine years after it had been started.

Czerwinksi decided that Coleman's sailplane should be called the Harbinger 2, yet the Canadian prototype Harbinger 1 had made even slower progress. It was completed only in 1975. As a result of Coleman's experience the wing sweep was reduced by three degrees to achieve the correct balance. In this form, it flew well but was not much used. It was soon retired and preserved in the Canadian National Aircraft Museum in Ottawa. The Harbinger 2 was badly damaged after a mid air collision in June 1959, and it was another three years before it flew again, but in 2002 it was still airworthy.

The Harbinger was not Czerwinski and Shenstone's last design. In 1949, the Canadian soaring movement had urgently needed new sailplanes and Professor Loudon of the Civil Engineering Department of Toronto University considered that his students needed practical experience. Czerwinkski and Shenstone together designed the Loudon, a small sailplane of quite good performance, which the students built over a period of two years. It flew well and broke the Canadian distance record, but was written off after two years when it was blown over on the ground by a several squall.

In England, the BGA design competition winner, the Kendal K 1, seemed promising but the plans were changed almost beyond recognition before construction began. A serious attempt was made to use asbestos fibre-reinforced moulded plastics for the wing but the material proved totally unsuitable. The K 1 was completed in wood in 1954. Partly because of the design changes, it proved incurably dangerous in the spinning mode and was abandoned.

10 - See below

In appearance not unlike a Grunau Baby, the Zlin - 24 Krajanek was stronger and stressed for inverted flight. The surviving Krajanek has made regular appearances at vintage rallies in recent times.

CZECHOSLOVAKIA

In September 1946 a group of pilots from England visited Czechoslovakia. The general impression they gained was of enthusiasm tempered with professionalism and good organisation. All these persisted after the political upheaval that occurred within two years. At Kralupy airfield north of Prague they were shown a well equipped school with a fleet of twelve sailplanes, all German designs, some having been built in Czechoslovakia during the occupation. Launching was by winch and aerotow. There were also four primary gliders. The group next visited a hill soaring site at Rana, 38 km north-west of Prague, where bungee training with SG - 38 primaries was going on. The fourteen sailplanes there were all of German design. At other sites yet more German aircraft were seen and flown.

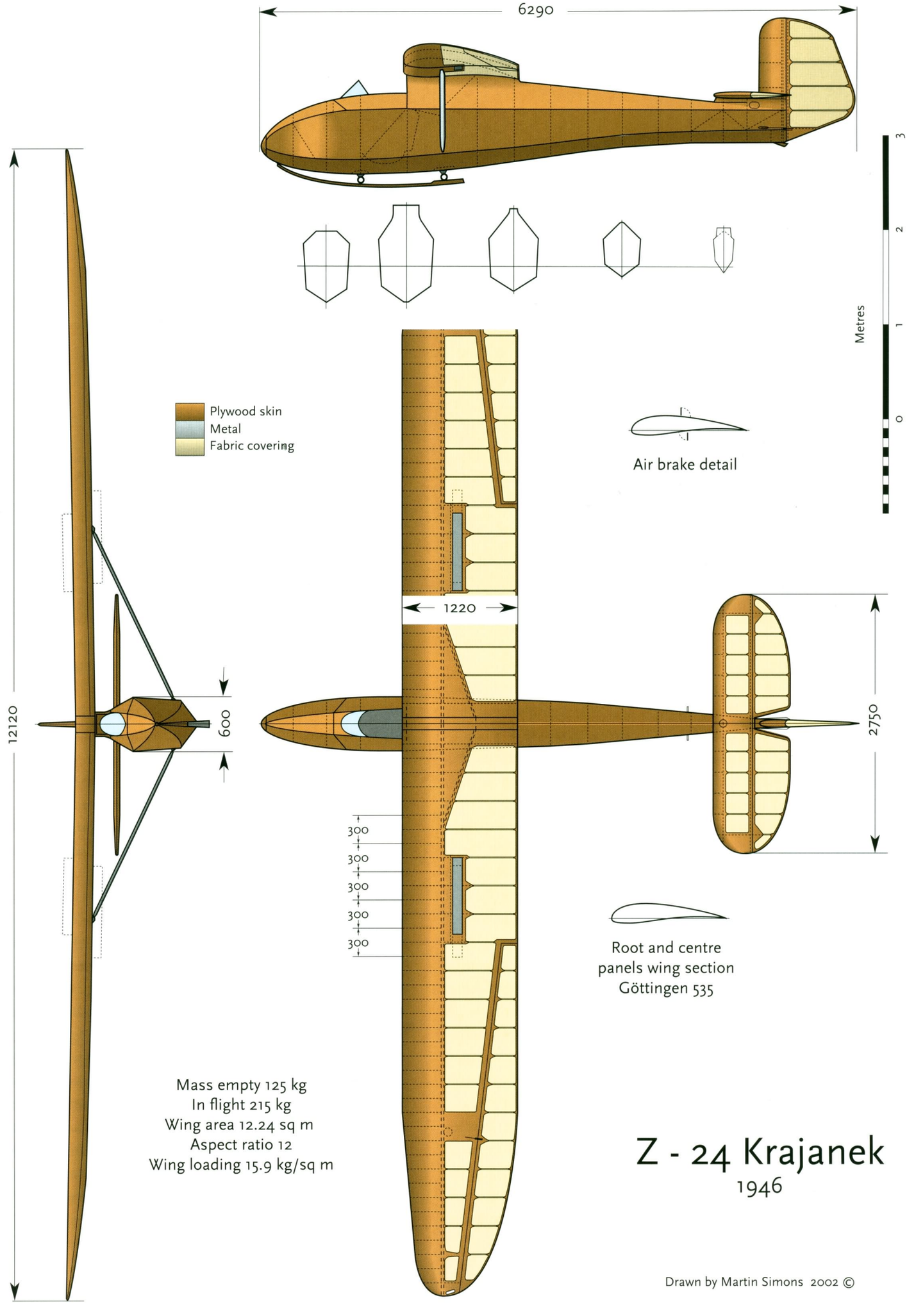
The delegation also visited the Zlinavion aircraft factory. Here, as well as some Kranich two-seaters with Czech modifications, new locally designed sailplanes were being built and more were planned.

When solo training was finally abandoned, the most important two-seater used was the LF 109 Pionyr, of which some 500 were built in Czechoslovakia. Large numbers of this type were also manufactured in the USSR as the KAI 12.

Zlin - 24 Krajanek

Like the Grunau Baby, the Krajanek was intended as a club training sailplane for relatively inexperienced pilots. The prototype was flying in 1945 and entered production as soon as testing had been completed. It closely resembled the Grunau Baby in appearance and construction but had smaller span and was lighter, although stressed for aerobatics including inverted flight. Handling in the air was exceptionally good. Aerobatics were included in the regular training schedule but soaring duration and cross-country flights up to Silver C standard were quite possible. The Z - 24 became standard equipment in training schools and there were some exports. More than 300 were built.

One Krajenek arrived at Dunstable by aerotow in October 1947, flown by Ladislaw Marmol, who, after releasing from the tow plane, performed aerobatics including a slow roll and a bunt into the inverted position. After landing he joined the London Gliding Club immediately. Within a month he broke the Czech National solo duration record with a flight over Dunstable Downs of 25 hours, 5 minutes, remaining airborne over the night of November 20th - 21st. Becoming bored with the ordinary hill 'beat' and perhaps to relieve pressure on his seat, he spent some of the time soar-



Mass empty 125 kg
In flight 215 kg
Wing area 12.24 sq m
Aspect ratio 12
Wing loading 15.9 kg/sq m

Z - 24 Krajanek
1946

Above: In World Championships in both 1952 and 54, Belgian pilots competed in the Czech Sohaj sailplanes.

Right: 'There is no substitute for wool', was the message carried on the Sohaj at Camphill in 1954.

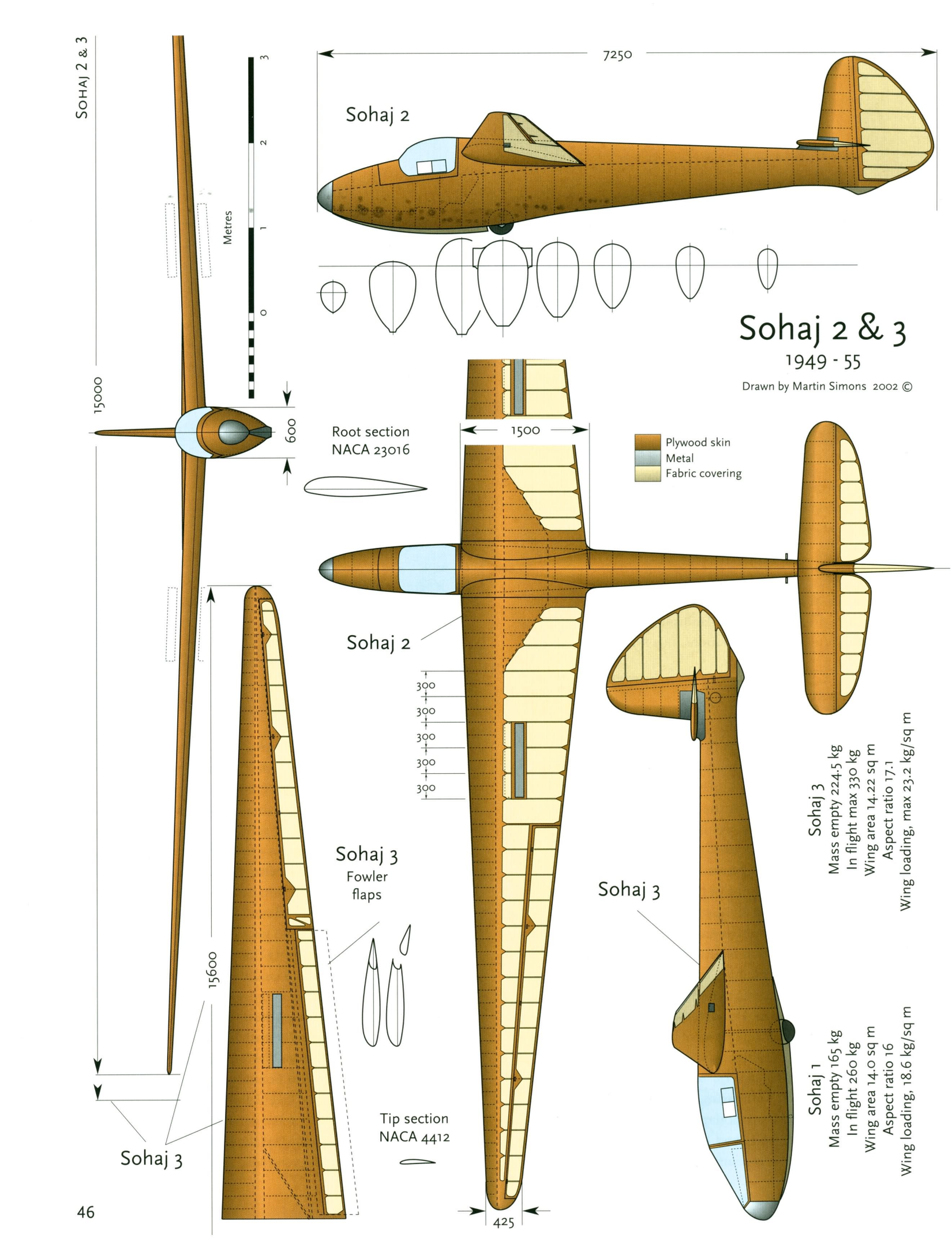
ing inverted. His Krajanek remained in Britain. Marmol, an expert aerobatic pilot, gave many spectacular displays with it in following years. In 2002, after several restorations, this Krajanek was still airworthy.

Zlin - 25 - LG 425 Sohaj

The Z - 25 Sohaj (Laddy), which flew first in 1947, was designed originally as a replacement for the aging German Meise (Olympia) sailplanes that equipped many Czech clubs. Resembling the Meise in general appearance and with the same span, the designers attempted to improve on the old type in many ways. There was more emphasis now on speed in the inter-thermal glide and accordingly the wing profiles chosen came from the NACA 5 digit series, much less cambered than the Göttingen 549 of the Meise and other contemporary sailplanes. These NACA profiles had the point of maximum camber well forward which enabled them to develop a high maximum lift coefficient. This reduced the stalling airspeed, an advantage when circling in thermals, and for take off or landing. Another important advantage was that the pitching moment of these profiles was relatively small. The necessary balancing down loads on the tailplane at high airspeeds were therefore much less than with the older profiles. Structures could be lighter. Other designers of this period made similar choices.

The Meise fuselage aft of the wing had an almond shaped cross section and a rather awkward air trap under the wing root. The Sohaj wing was mounted lower and had a clean junction with the fuselage, which was of fully rounded cross section. There was no landing wheel, only a skid undercarriage. The airbrakes were of the older DFS rather than the vertical parallel ruler form of the Meise brakes. Construction methods in timber were normal throughout. A best glide ratio of 27: 1 was originally claimed but this was reduced to a more realistic figure of about 24: 1. This was nevertheless a worthwhile improvement on the Meise which claimed 25: 1 but had been measured at a little better than 22: 1.

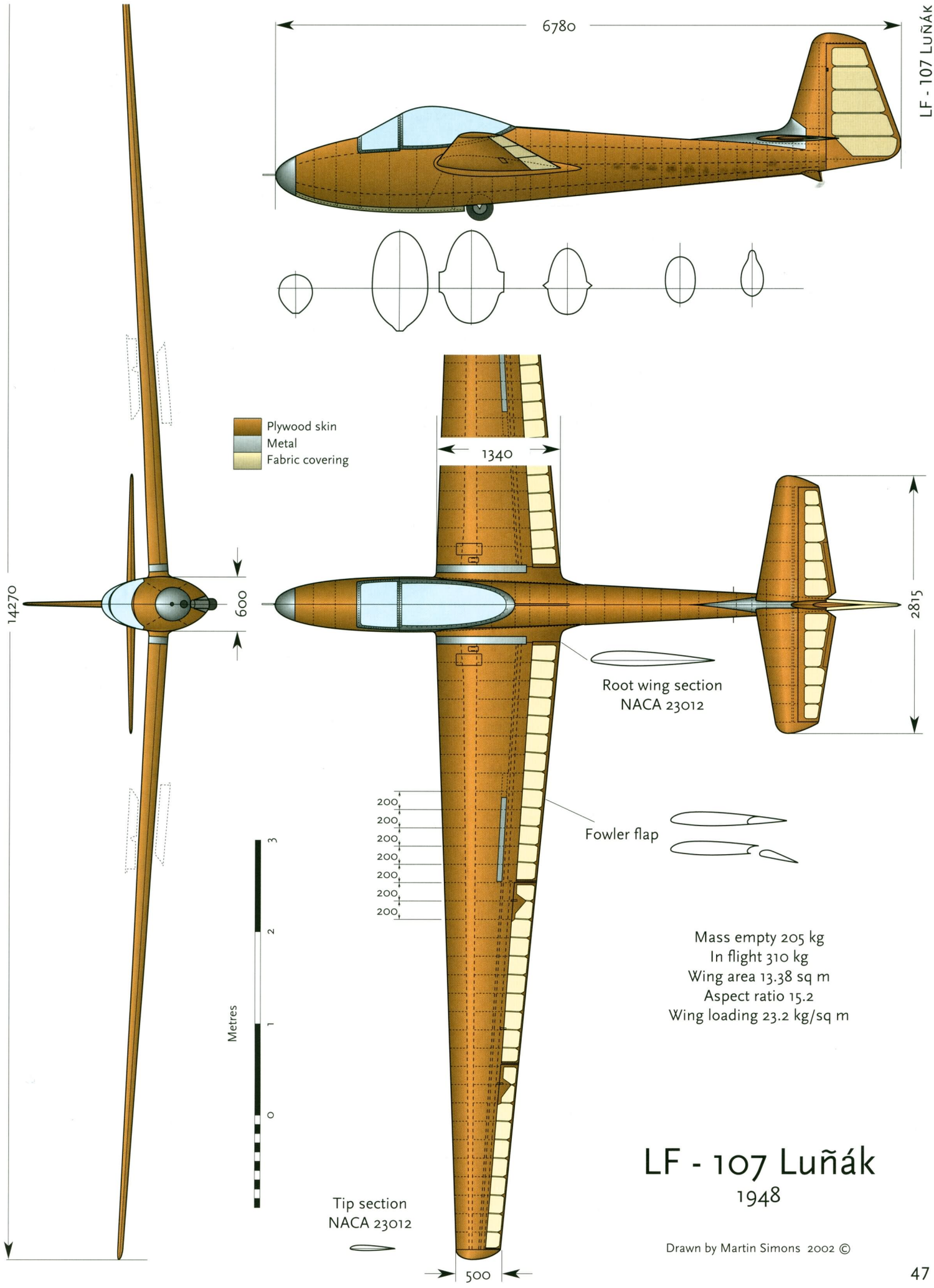
From the Z - 25 further Sohaj variants were developed, the L 125 Sohaj 2 and L 425 Sohaj 3, sometimes called the 'Super Sohaj'. (In some references these types are still referred to as Z - 125 and Z - 425. All came from the old Zlin factory.) The Sohaj 2, of which 126 were built, differed chiefly in having a landing wheel.. The Sohaj 3 had a slightly greater wing span and to improve the useful speed range further, Fowler type flaps in-board of the ailerons. There was a penalty in terms of weight and some additional drag from the inevitable air leakages and discontinuities along the flap leading edges when they were retracted. With an improved front fuselage shape and contoured canopy, the best glide was now claimed to be 26: 1. The flaps, when deployed, reduced the stalling speed considerably. When retracted, the increased wing loading improved the high speed glide. A total of 160 Sohaj 3 were produced and continued in service for many years.



Sohaj 2 & 3

1949 - 55

Drawn by Martin Simons 2002 ©



Mass empty 205 kg
In flight 310 kg
Wing area 13.38 sq m
Aspect ratio 15.2
Wing loading 23.2 kg/sq m

LF - 107 Luñák

1948

LF - 107 Luñák

Few soaring pilots have shown much interest in sailplane aerobatics. To most it has seemed that the difficulty of getting a glider up to some altitude is such that throwing the height away in a series of extraordinary manoeuvres is wasteful. The height should be converted to cross-country distance. This may be an unnecessarily puritanical attitude. A pilot can learn a great deal about handling the aircraft by performing aerobatics and from the ground there is great beauty in the sight of a sailplane making graceful patterns in the sky. The DFS Habicht, which was displayed over the Olympic Stadium in Berlin in 1936, was probably the first sailplane to be designed from the first with aerobatics in mind. It was also expected to be capable of good soaring flight. The same motives lay behind the design of the Luñák (Sea Buzzard). It originated in a project of Vladimir Stros who in 1943 was working at the Letov factory in Prague. Because of wartime conditions and the confused political situation afterwards, construction did not begin until 1947.

Two prototypes were flying by July 1948 and demonstrated excellent aerobatic capability. The soaring performance was also very satisfactory, being aided by the large Fowler flaps. The wing profile was the NACA 5 digit series 23012, thinner at the root than usual for a sailplane but very suitable for aerobatics and inverted flight because of the small camber. No special precautions were taken against tip stalling and spinning. A pilot skilful in aerobatics was expected to understand and use such characteristics when required.

In construction the Luñák was orthodox. There was a main box spar of timber in the wing and an auxiliary spar to carry the flaps and ailerons. The plywood skin was carried back to the secondary spar, to give sufficient torsional strength and stiffness. The cockpit

Left: The Lunak at Wachtesburg.

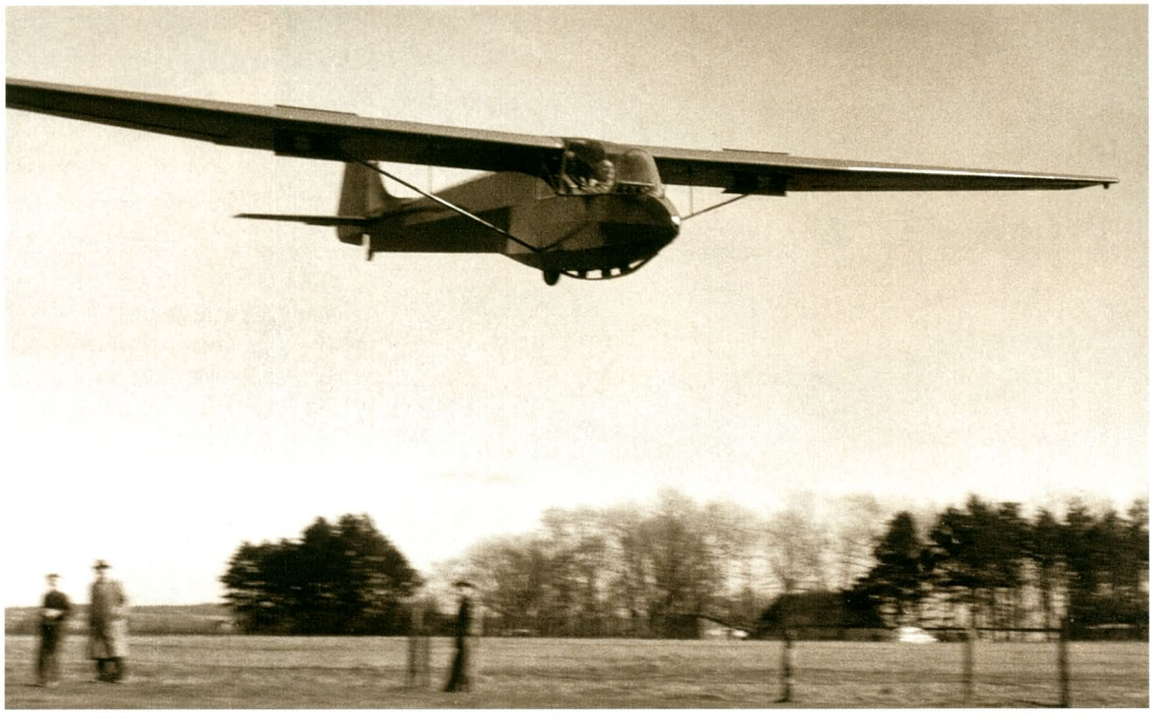
Right: The Lunak, a fully aerobatic sailplane, displayed here by Graham Saw.

Below: The Lunak, showing the flaps in fully deployed position.

was probably designed deliberately to resemble that of a jet fighter aircraft, and the canopy slid back or forward as required, on runners, also like a fighter. There was a landing wheel.

Satisfied with the Luñák prototypes, the Ministry of Defence ordered 50, intending them for training air force pilots in aerobatics. Some small changes were made to the production version, including a slight extension of the span to 14.27 from the original 14 metres. The cockpit and fuselage nose were enlarged and a taller vertical tail fitted.

There was considerable interest from outside Czechoslovakia and the Letov factory received many orders. Luñáks were exported to most countries in Eastern Europe. Ladislaw Marmol in England (see under Krajanek, above) bought one and another went to the USA. It was proposed to build a total of 200. After 70 were completed, however, the factory was ordered to cease production in order to make way for the jet fighter, Mig 15, built under licence from the USSR. In 1997 it was estimated that about ten of the Luñák remained in existence. One of these was restored and taken to England, where it has performed at many displays, aerobatic competitions and vintage glider meetings, flown usually by Graham Saw.



The Polyt III two seater was designed and built by students of the Polytechnic flying club in Denmark. The instructor's seat was raised to improve the forward view. Later modifications included a shortened fuselage

DENMARK

Soaring in Denmark made a new start in 1945. By 1947 there were some forty clubs with a total of about 1000 members, but only fifteen sailplanes of Grunau Baby type and a single Meise (Olympia). There was general dissatisfaction with the primary glider training method. In an attempt to break the log jam of new student pilots wanting instruction, the engineers Knud Høgslund and Traugott Olsen designed a two seat primary glider, the 2 G, which flew in 1946. Eight were built. Results were so encouraging that two seat training became accepted in Denmark before it was generally adopted elsewhere in Europe. One of the 2 G gliders survived in 2002. Danish design and construction did not stop there.

Polyt 3

The Polyteknisk Flyvegruppe (Polytechnic Flying Club) was one of the largest flying clubs in Denmark, most of the members being students, staff and alumni of the college. In 1952 the club set about designing and building a two seat trainer. Like many other club ventures, completion took a long time. The fuselage was a welded steel tube framework covered with fabric, the two seats being in tandem. There was a landing wheel. The wing was of wooden construction, with a single strut and airbrakes. The second one built, Polyt IIIB, incorporated some improvements and flew in 1960. The Polyt was a satisfactory basic training sailplane but as more up to date types became readily available, there was no further development or production.

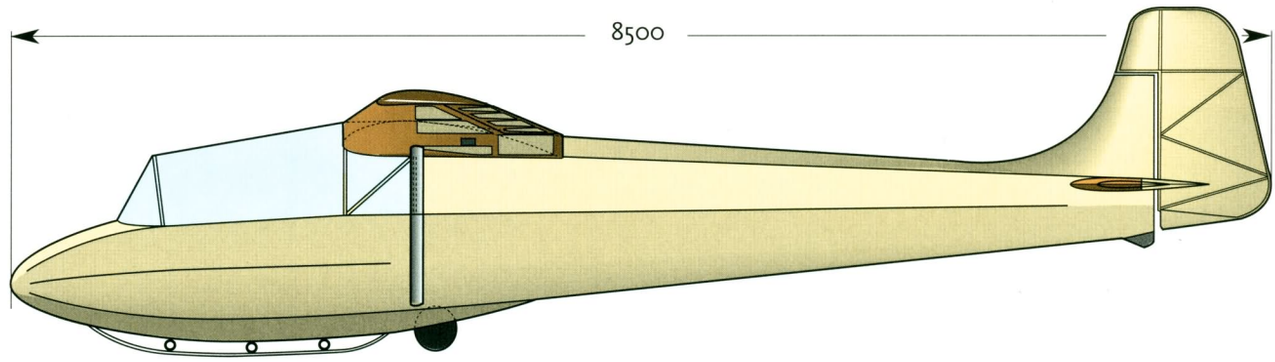
FINLAND

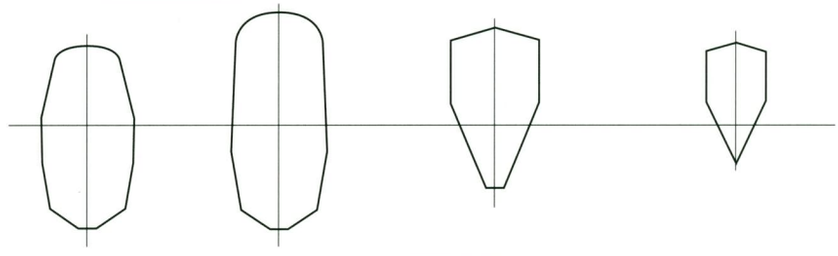
Finland should have been the host nation for the Olympic Games of 1940, which would have included soaring. Two wars, the so-called Winter War against the USSR and the Second World War, caused the Games to be cancelled. After 1945 the soaring movement revived, using SG - 38 primary gliders and Grunau Babies, many built locally, with a few imported Rhönbussards, Weihes and Kranichs. The National Aeronautical Association distributed kits and plans for clubs to build gliders during the long winters. Members who helped with the work were credited with free flying time when summer came. Some Meises were built at Jamijarvi, the soaring centre where courses were organised for advanced student pilots coming from the various clubs.

When indigenous design activity began again, it was largely inspired by the Helsinki Polytechnic, the Polyteknikkojou Ilmailukerho, commonly abbreviated to PIK. Types with this prefix might be built by students and flying clubs or, if proving popular, professional aircraft construction companies.

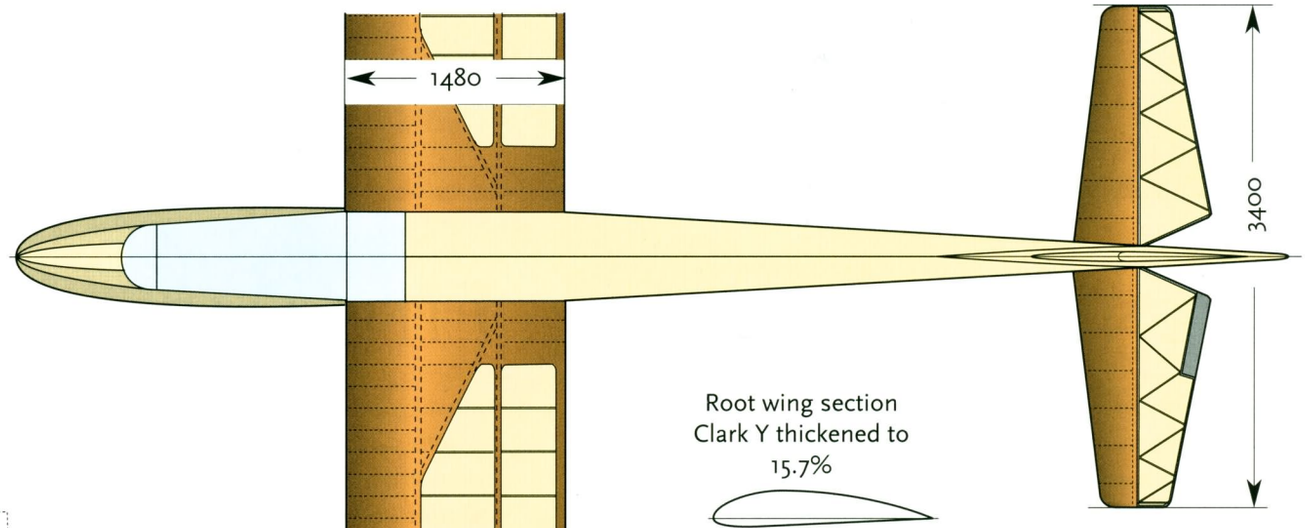
PIK 3C Kajava

The original PIK 3 flew on 1st July 1950. It was a 13 metre span sailplane with a straight tapered wing, using the Göttingen 693 profile. The wing was mounted on a narrow neck above a clean, streamlined fuselage. Although performing well for its size it was not competitive at World Championships level. It was in any case completed too late for the Internationals that year which started on 5th July at Orebro in Sweden. The Finnish pilots flew Weihes;

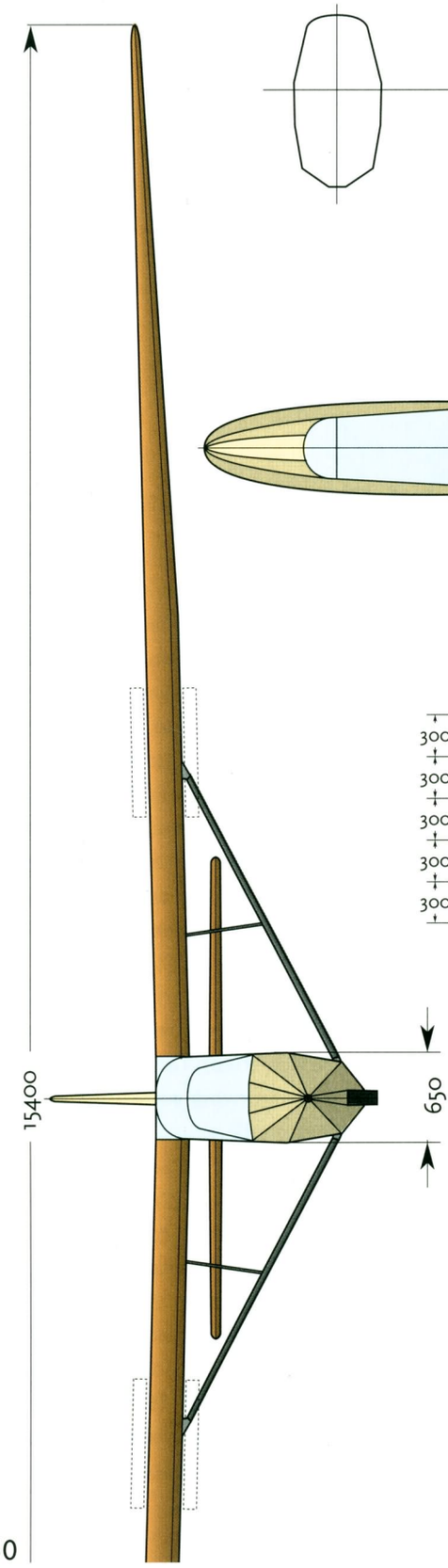


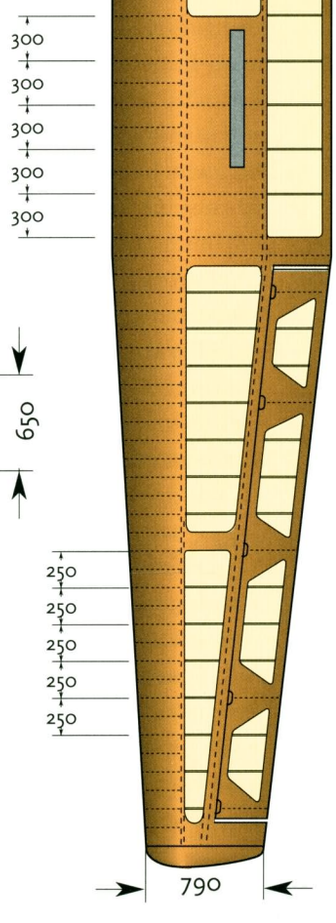


Plywood skin
Metal
Fabric covering

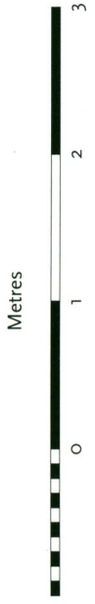


Root wing section
Clark Y thickened to
15.7%





Mass empty 280 kg
In flight 460 kg
Wing area 19 sq m
Aspect ratio 12.5
Wing loading 24 kg/sq m
Centre of gravity range
25 - 37% m.a.c.



Tip section
NACA 6412

Polyt IIIB
1960

Right: The PIK 5, a successful training sailpane built in Finnish timber. The wing was based on the Polish Salamandra. Winter operations on frozen lakes are normal in Finland.

Below: PIK-3a at take off. Now on display at the Finnish Aviation Museum as OH-PCA. This picture from collection Stig "Stick-an" Engström, Stockholm.

Temmes placed 11th and Haltiala 14th in a field of 29. The Pik 3 was entered for the Madrid Internationals two years later but proved the limitations of small span, placing 36th. Other Finnish pilots flying Weihes did much better.

In 1955 a new version, the PIK 3B, was flown. The fuselage neck was removed, the wing now mounted directly on the fuselage. The span remained at 13 metres but the performance was reckoned to be superior to the Meise (Olympia) at high airspeeds. The limitations of the small span were shown up again when the PIK 3 flew in the 1956 World Championships in Argentina. It was competing now against sailplanes with modern wing profiles. Five of the type were built. They remained in use for many years.

By 1956 it was time for a new design. A PIK judging panel compared rival submissions for 15 metre sailplanes. They decided, after consideration, that a new version of the PIK 3 would be satisfactory. All that was required was a new wing, using the same fuselage and tail. The well-proved Göttingen 549 profile was retained at the root grading to one of the new 'laminar' profiles at the inner end of the aileron and then to Gö 693 at the tip. The fuselage and tail were altered only very slightly. The first flight of the PIK 3C Kajava (Gull) was in May 1958. In June that year the World Championships were held at Leszno in Poland during June. The Kajava fitted neatly into the new Standard Class, which had now been established and, flown by J. Horma, placed 4th in the final list of 24.

Twenty of the Kajava were built, two of them by amateur constructors in Canada.

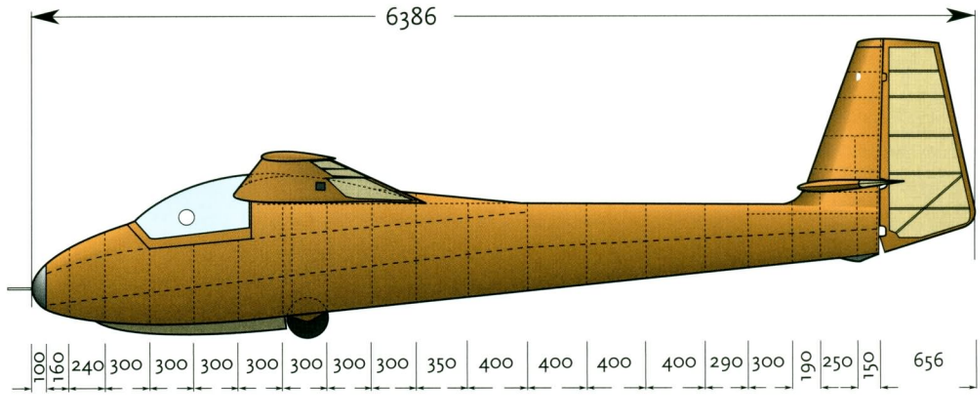
Pik 5 Cumulus

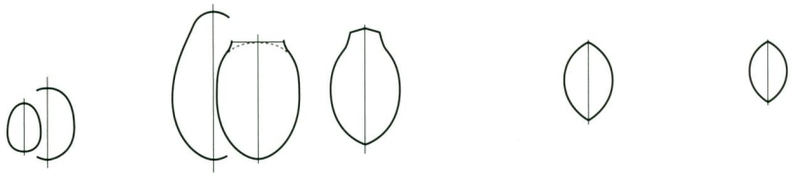
Pine and birch timbers grown in Finland are some 10 - 15% heavier, though stronger in proportion, than the corresponding Central European materials. Wooden sailplanes built following imported plans with local materials, always came out heavier than specified. This adversely affected both handling and balance. In 1946 Kaarlo Temmes, an engineer with a high technical position in the Finnish Aeronautical Association, decided to design a training sailplane. The new type should be cheap and of the simplest possible construction so that it could be built by the clubs, using readily available Finnish timber.

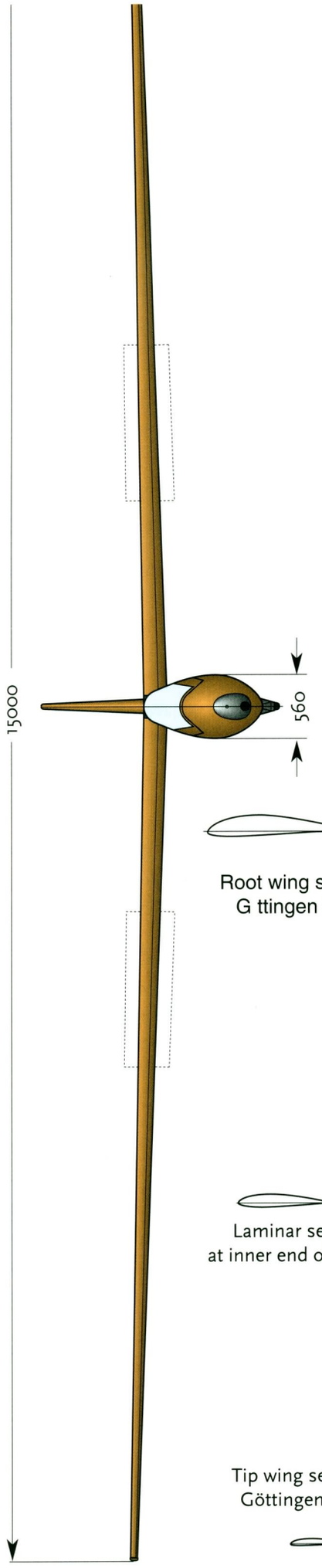
The wing was modeled on that of the Polish Salamandra and the fuselage was basically that of a primary glider. The light shell or nacelle could be removed altogether if required, or retained with an open cockpit, or fully enclosed with a transparent canopy. The tail was carried on a light box spar boom with wire bracing.

First flights were in September 1946 and all came fully up to expectations. Handling in the air proved very good and the PIK 5 was capable of simple aerobatics. Its performance was better than expected. It was very light and able to turn tightly in the core of small thermals, out-climbing the Grunau Baby and even the famous Weihe. The clubs adopted the type readily. About 34 were built, including one in Sweden.

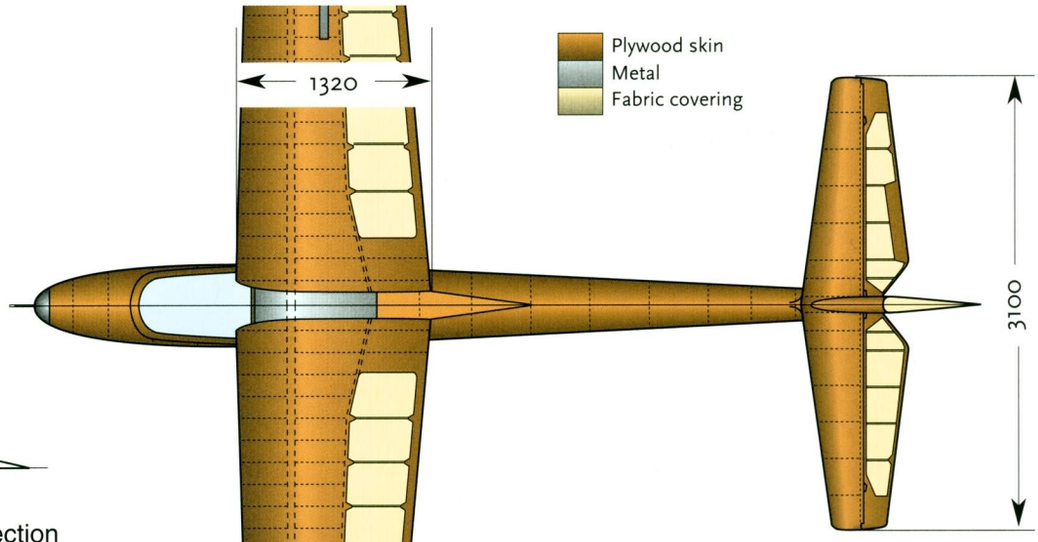
A notable flight in a PIK 5 was achieved in 1951 by Antti Koskinen, who flew 188 km from Parola to Jamijarvi.







Root wing section
G ttingen 549

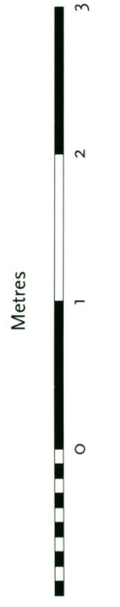


Plywood skin
Metal
Fabric covering

Laminar section
at inner end of aileron

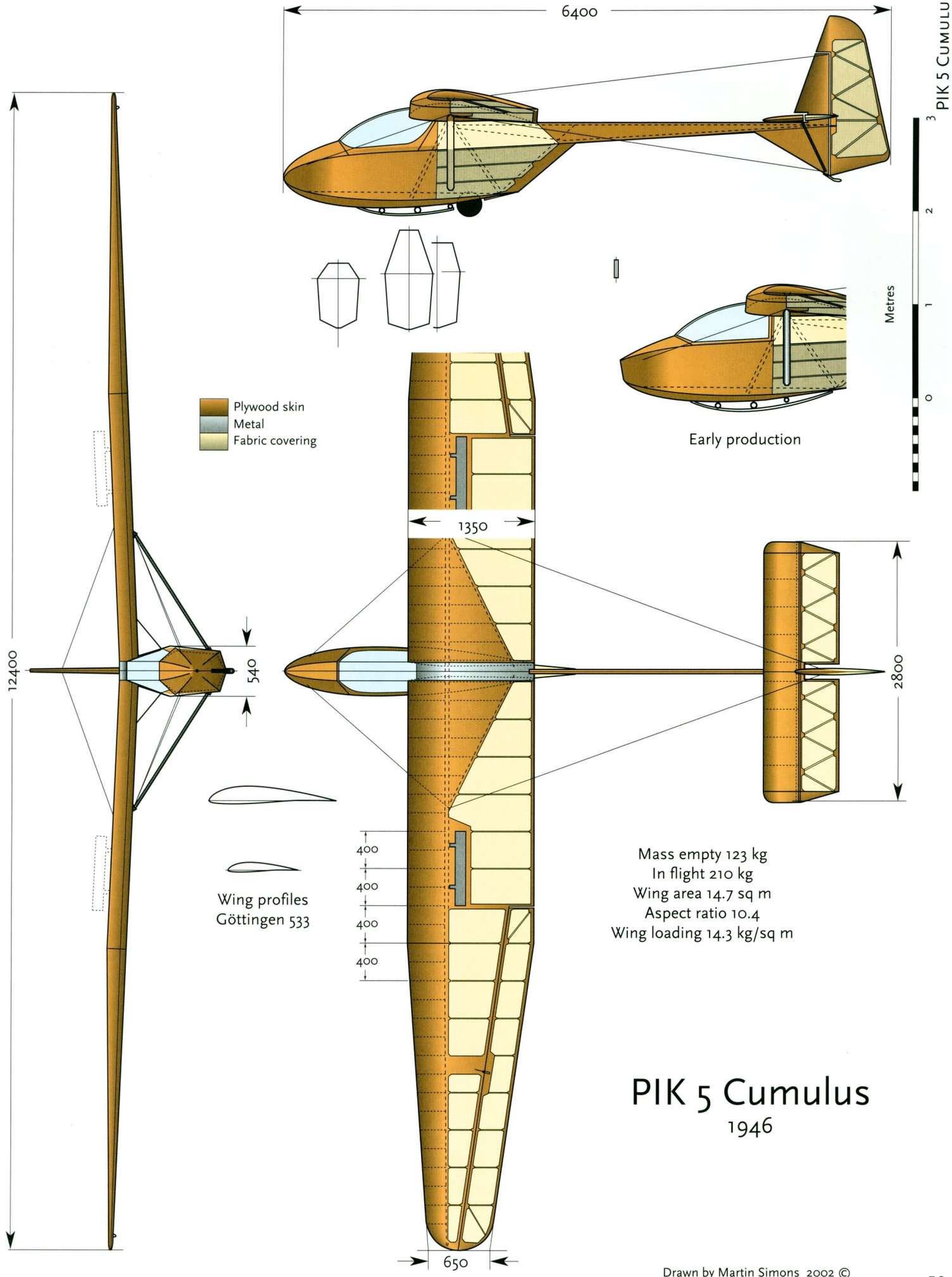
Tip wing section
Göttingen 693

Mass empty 170 kg
In flight 280 kg
Wing area 13.1 sq m
Aspect ratio 17.1
Wing loading 21.4 kg/sq m
Centre of gravity range
27 to 39% m.a.c.

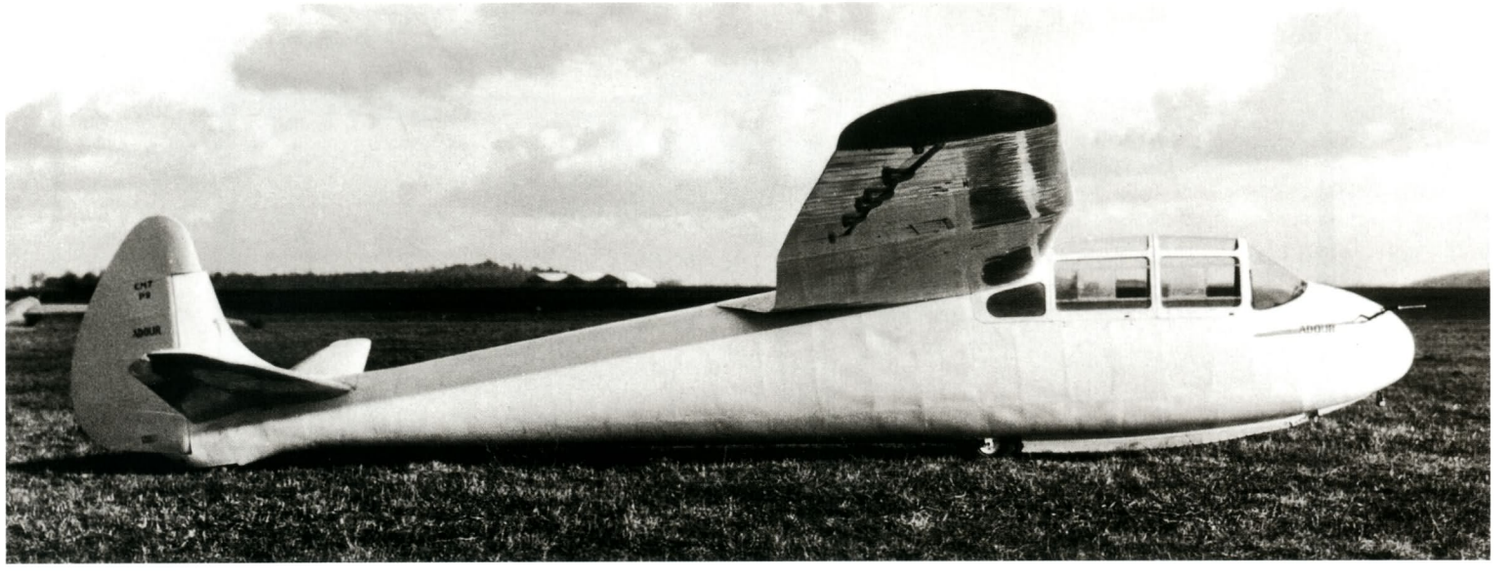


PIK - 3C Kajava
1958

Drawn by Martin Simons 2002 ©



PIK 5 Cumulus
1946



Above: The CM - 7 prototype, F - CAFE, named 'Adour'.

Right: Although the contest score sheets show a CM - 71, the two seater F - CBGL flown by the French pilots Max Gasnier and Louis Trubert at the 1954 World Championships was the CM - 7, number 2.

France

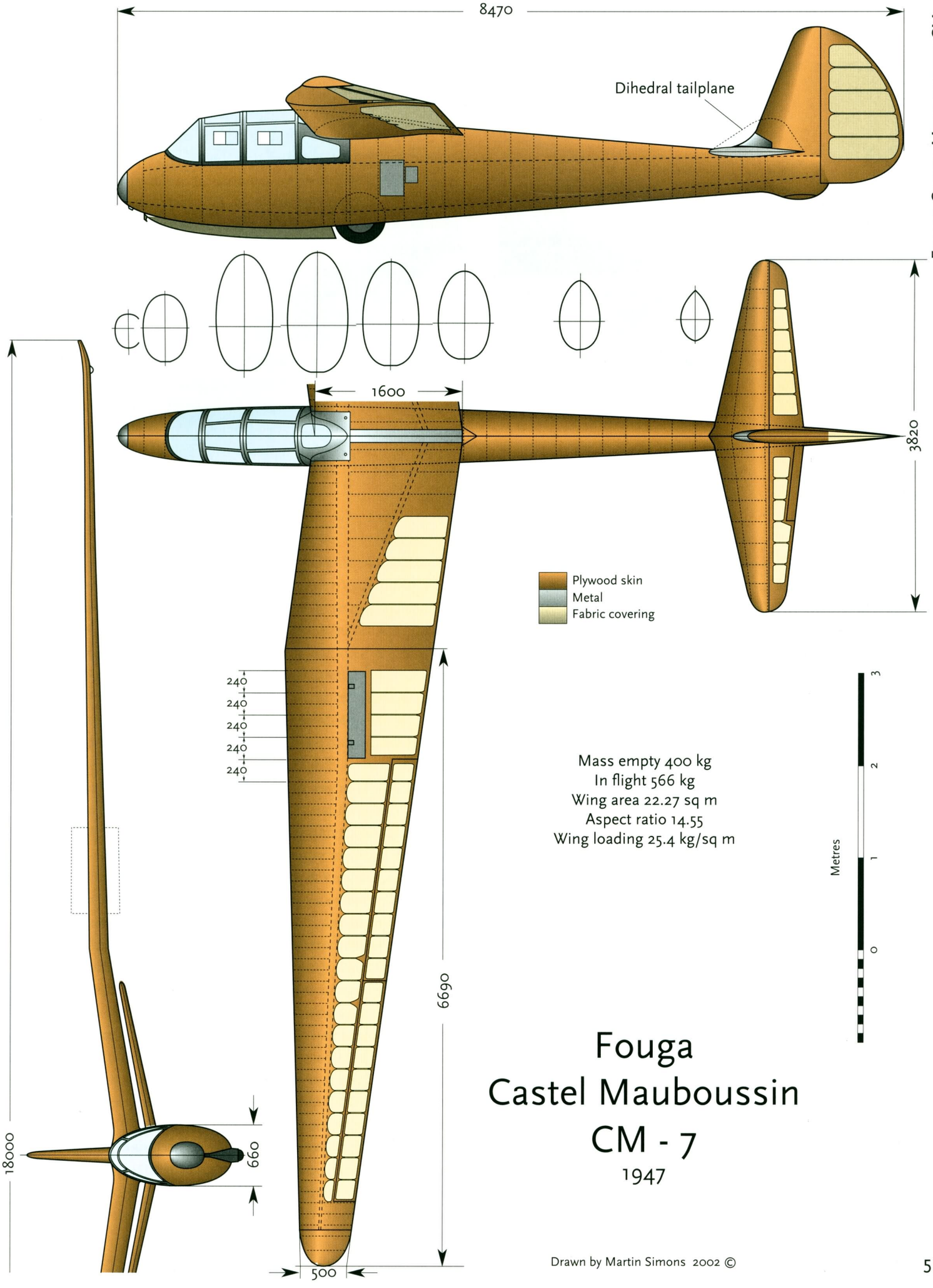
With a good deal of government support, soaring in France entered a period of rapid expansion and development after 1945. The movement relied at first on old aircraft and the newer ones built during the Vichy period. Many captured sailplanes were brought from Germany and some built from German parts and plans. Soon, a commentator referred happily to the "splendid equipment of soaring sites existing in every part of France."

French designers and manufacturers were developing new types, which began to make their impression internationally. Three French pilots placed in the top ten at the Samedan World Championships in 1948 and a Swiss pilot flying a French sailplane placed second.

Castel Mauboussin CM - 7

Robert Castello was one of the earliest in France to become involved in sailplane design and production. He worked with Dewoitine and built several gliders for the pioneer meeting at Combegrasse in 1922. His first high performance sailplane was the Castel 34 in 1933. More followed, several of them very large two-seaters. The Casoar of 1936, with a cantilever wing of 18.6 metres span, was comparable with Kronfeld's Austria 2 & 3. There was no large production of any of these early designs. Only one or sometimes two examples of each were built. After 1940 there was a great demand for single seat training sailplanes. Over 300 of the Castel 301S, a strut-braced, 12.28 metres span glider, were produced, many of them by Fouga et Cie.

In association with Pierre Mauboussin, an aircraft engineer whose designs had been built by Fouga, in 1941-2 Castello made a design study for a high performance two-seater, to be called the Castel Mauboussin CM - 7. As originally conceived, this had a strutted gull wing of 18 metres span, with the seats in tandem. There was no opportunity to build the sailplane until after the war, by which time Castello had made important alterations. The wing was now fully cantilevered, retaining the gull dihedral. The centre section was swept forward with the outer panels straight, a similar wing plan to that of the Canadian Harbinger and Swiss Spalinger



Fouga Castel Mauboussin CM - 7

1947

The prototype CM 71, with V tail, crashed during test flights and failed to arrive at the 1954 World Championahips.

25, but these were strut-braced. Castello carried the main spars through to join on the centre line of the aircraft. This created some awkward structural problems requiring the spar to bend round the gull angle and there was a slight bend in the horizontal plane outboard of the air brakes. The spar was very substantial. The fuselage was of near elliptical cross section. The tailplane had a slight dihedral angle to keep it clear of the ground when the aircraft was at rest. In other respects the CM - 7 was of orthodox wooden construction. At 400 kg without the crew, it was considered very heavy. Two prototypes, built by Fouga, were completed in 1947.

During the next few years the CM - 7 established many National and International records, including a duration record of just over 53 hours by Carraz and Brunswyck at St Remy de Provence.[11] The performance in the air was good but only the two prototypes were completed. It was both too expensive and too heavy for general use. A new version, the CM - 71, was planned and a prototype was built. The orthodox tail was replaced by a V - tail and there were many other refinements. The CM - 71 was entered in the 1954 World Championships in the two-seater class. Unfortunately, the prototype crashed during tests. Its place was taken at the Championships by one of the CM - 7s. The weather was notoriously bad, earning the title of 'Damphill' for the Camphill site. It was certainly not weather suitable for the ponderous CM - 7, which scored on only two of the four soaring days. Two further prototypes of the CM - 71 were built, the last with an orthodox tail unit. They were somewhat lighter than the CM - 7 but there was no further production.

Castello, with Fouga, continued in sailplane design, producing, during the next few years, the CM 8 - 13 and CM 8 - 15. The last two figures indicate the wing span in metres. They had mid wings, V - tails and 'tear drop' shaped cockpit canopies. Gerard Pierre used the CM 8 - 15 to place second in the World Championships of 1952. After this, the interests of Fouga et Cie passed wholly to turbo-jet powered aircraft. The later CM series were fitted with small jet motors mounted above the fuselage behind the cockpit. They could not be termed self launching sailplanes but were experimental light aeroplanes. Only one or two of each were built. They led, eventually, to the development of military jet powered trainers and fighters.

11 - See below under Air 100.

Arsenal Air 100 & 102

As with many of the post war sailplane designs in France, preliminary work on the Air 100 had begun years before construction could start. A small group calling themselves Groupe l'Air was involved. The intention was to develop a sailplane that would be superior to the German Weihe. The basic wing design required little attention. Wind tunnel tests carried out long before had shown the Göttingen 549 wing profile to be particularly good compared with more cambered and thicker profiles like the Gö 535. The straight tapered wing, of 18 metres span, was a fair compromise between the demands of performance, light structure and ease of handling. The rate of roll would be improved by using 'slotted' ailerons. There were some other points capable of improvement, especially the rather awkward junction of the wing and fuselage. The pylon of the Weihe could be done away with if the wing was mounted slightly lower on a more fully rounded fuselage. The cockpit canopy of the German aircraft could be replaced with a plastic bubble, improving the view and also giving the pilot more generous headroom. The Weihe air brakes were not effective enough. They were replaced with the more powerful Schempp-Hirth type. Other changes of detail and structure could not disguise the fact that the Air 100 very much resembled the Weihe.

Two prototypes were produced, at the Chatillon Air Arsenal, just in time for them to be taken to the USA for a French team to fly as guests in the American National Championships. These were held at Wichita Falls, Kansas, in July 1947. An informal British team, equipped with Elliott Olympias, also attended. It was a highly successful meeting with many record-breaking flights. Twelve pilots completed the qualifications for the Gold C badge. The two Air 100s finished in fifth and eighth places.

At this contest it became obvious that competition scoring systems must be changed in future. It had once seemed marvelous to stay aloft in a glider at all. In traditional contests, points were awarded for flight duration and this was still the case. Now, if two sailplanes flew the same distance or arrived at the same pre-declared goal, the one that took longer scored higher. This seemed ridiculous. In future a goal flight should be a race and the pilot taking the shortest time should win. Mere flight duration should no longer be rewarded.

Home in France again, there was some detailed redesign of the Air 100 by Raymond Jarlaud and plans were made for sixty to be built by the Victor Minié Aviation Company. In the event only fifteen were completed, the Company running into financial difficulties. With some improvements, a landing wheel and some stiffening of the structure, the Air 102 was developed and 25 were built during 1952, also by Victor Minié. (There was a solitary Air 101, built by the original Groupe L'Air.)

In 1953 France held its first post-war National Championship, which was won by Gerard Pierre flying an Air 102.

The flight for which the Air 100 is best remembered is the World Duration Record by Charles Atger in April 1952. The French pilot, Eric

Left: The Arsenal Air 100 of 1947 was similar in general design and appearance to the German Weihe of 1938, but it had many detailed improvements and was slightly heavier.

Below: The Air 100 at Brienne le Chateau in 1978.

Nessler, had set the record at 38 hours in 1942 in a Grunau Baby. This broke the previous figure of 36h 36m by Kurt Schmidt in Germany, also in a Grunau Baby. But Erich Vergens, a Berliner, flew 45h 28m later in 1942 and in 1943, within one week, there were three new claims. One came from F. D. Nelson in the USA for 50h 03m, one a few days later from Vladimir Monenchenko in the USSR for 51h 24m. Finally on 22 - 24 September the German pilot Ernst Jachtmann, flew 55h 51m hours in a Weihe over the Baltic coastal dunes.[12] Nessler's record was totally eclipsed. The Fédération Aeronautique Internationale disallowed all these claims because they were made during the hostilities. But no one could pretend that Jachtmann had not done what he did. Whatever the official ledger said, the real record was over 55 hours. The French decided to break it.

The site chosen was at St Remy de Provence, near Tarascon on the Rhone, where a steep east-west ridge called Chaine des Alpilles confronts the cold Mistral wind that blows strongly, sometimes for weeks on end, down the valley from the north. The airfield was at the foot of the north facing slope. With government finance, a series of powerful floodlights was erected at intervals to illuminate the slope at night.[13] Charles Atger, a local farmer who had accumulated over 400 hours soaring, prepared for the task with a series of long practice flights and, he claimed, many overnight sessions ploughing or harvesting on his tractor. The sailplane was equipped with a battery powered two-way radio, navigation lights and a searchlight in the nose in case he had to land at night. He made

his first attempt in March but had to land after 27 hours. The Mistral was blowing again in early April and he was ready for it. The first 24 hours were extremely rough and he was airsick, but he continued and broke not only Jachtmann's record, but the official two seat duration record too. Atger landed after 56h 16m and honour was satisfied.

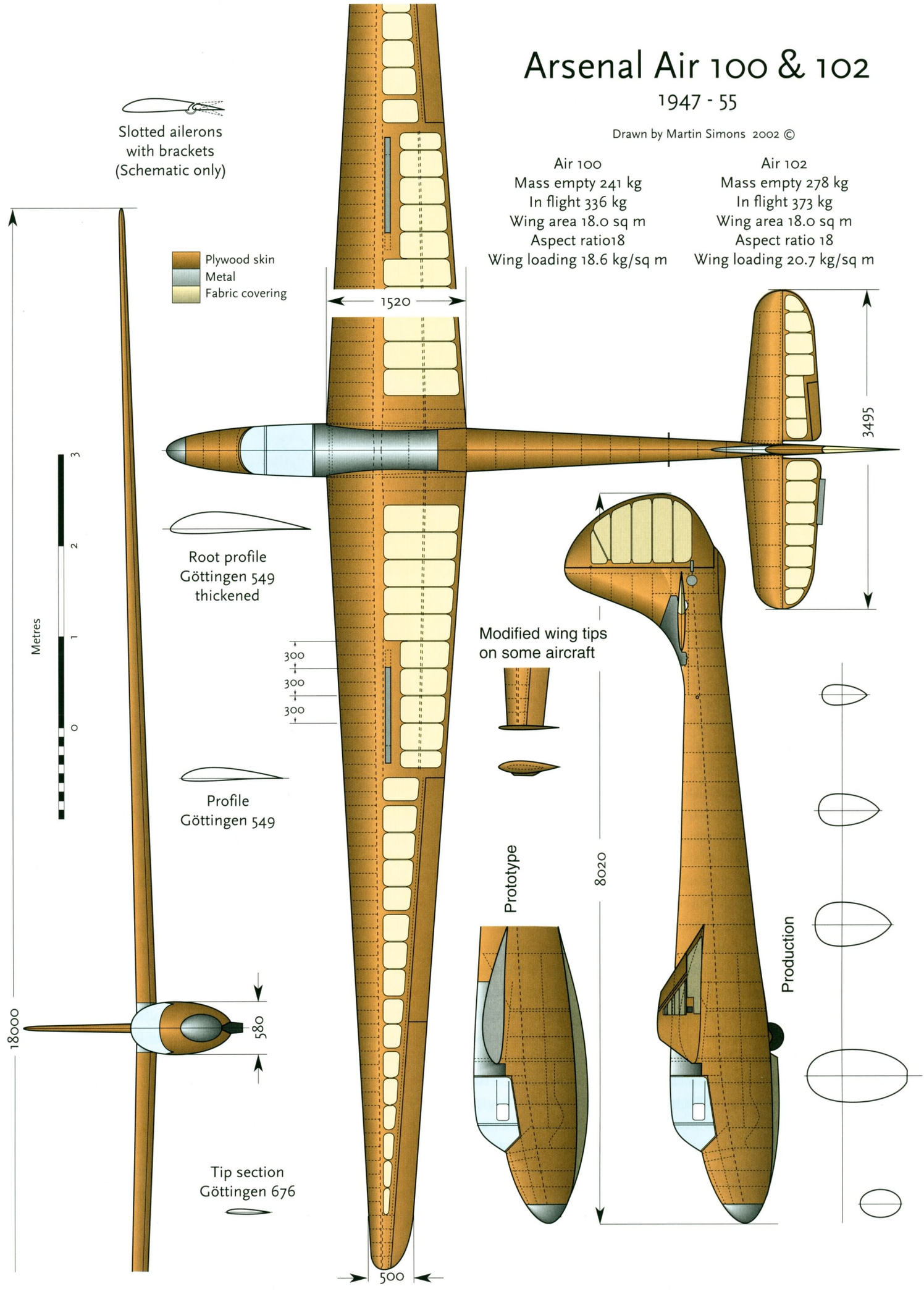
What such flights prove other than demonstrating extraordinary fortitude and determination is hard to discern. The two seat record was raised to 57h 10m hours by Bertrand Dauvin and co-pilot Couston in April 1954, also at Les Alpilles. In December 1954 Dauvin prepared for an attempt on the solo record and took off in his Kranich III[14] on 24th December. On 26th after 44 hours, radio contact ceased. The sailplane was found later, crashed on the lee side of the ridge, with his body in the cockpit. It was assumed he had fallen asleep in the air. After this, duration record claims were no longer accepted by the FAI or any national soaring organisation. Atger's figure for solo duration and Dauvin's for the two-seater, stand.

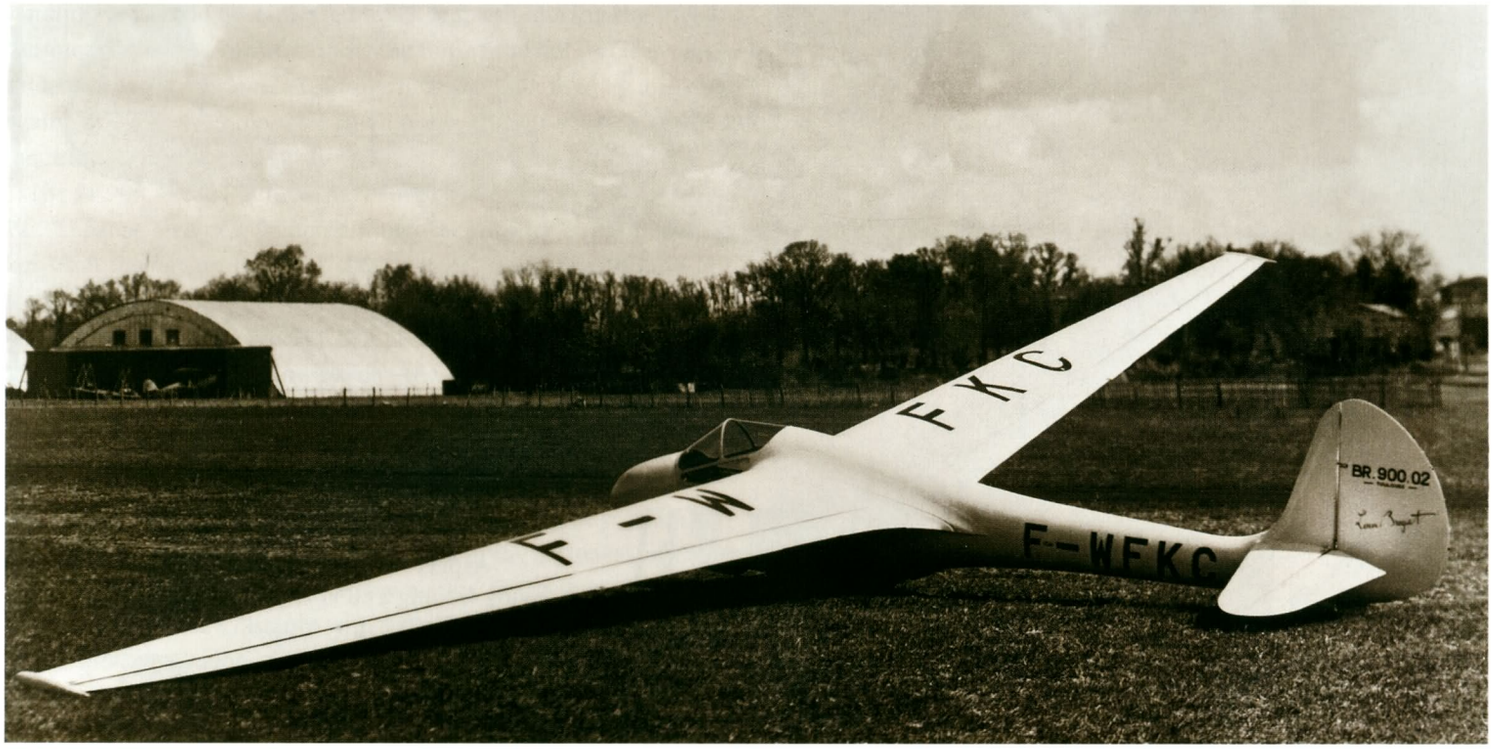
12 - Jacques Marceau writing in Vielles Plumes No 10, Summer 1999, p 61.
13 - The author saw these installations, long since gone to ruin, in 1964.
14 - See below

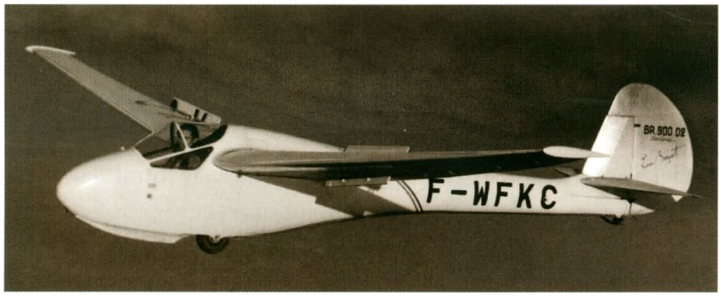
Arsenal Air 100 & 102

1947 - 55

Air 100	Air 102
Mass empty 241 kg	Mass empty 278 kg
In flight 336 kg	In flight 373 kg
Wing area 18.0 sq m	Wing area 18.0 sq m
Aspect ratio18	Aspect ratio 18
Wing loading 18.6 kg/sq m	Wing loading 20.7 kg/sq m







Above: The Breguet 900 appeared in 1950, the first sailplane produced by the Breguet Company. Six were built.

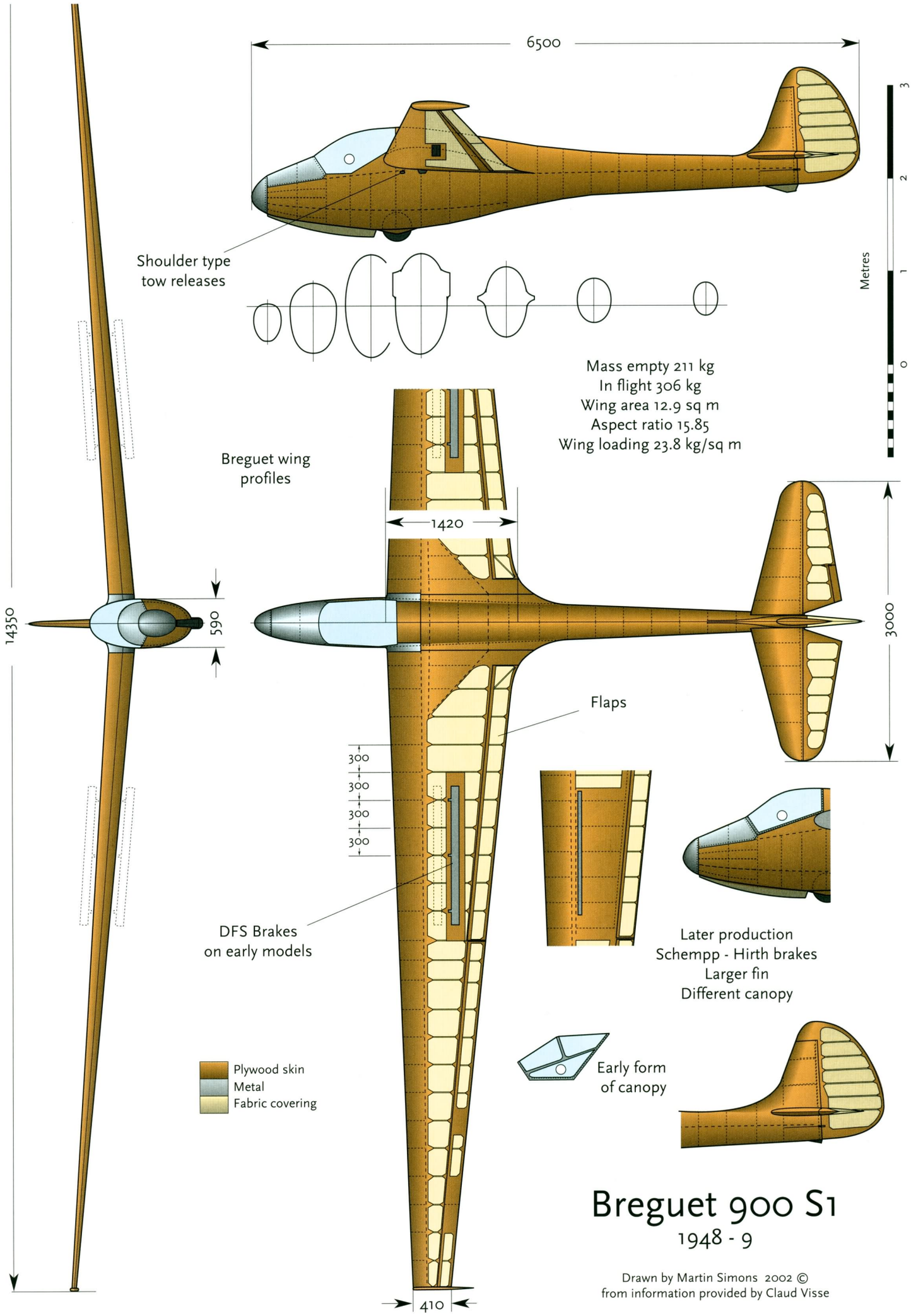
Right below: F - WFKC was the second Breguet 900 flown in 1950 and still airworthy in 2002.

Left: The surviving Breguet 900, fully restored, re-registered and owned in 2002 by Claude Visse. It is shown here on Tallard Airport in 1989

Breguet 900

The Breguet 900 sailplane was the first ever produced by the firm of Louis Breguet. The Company was formed in 1905, at first to experiment with helicopters, but later became highly successful with large production of military and civil powered aircraft. After World War 2, the Company found itself with a staff of skilled woodworkers and pattern makers who had been involved, among other duties, in making wind tunnel models. They were not trained in metalwork of the kind that would be needed in the future aircraft industry. At this time, the official Societée de l'Aviation Legere & Sportive (SALS, Association for Light and Sporting Aviation) expressed the need for some new small, high performance sailplanes. To produce these seemed to Breguet & Co a suitable and profitable way of occupying their workforce.

The chief designer of the Bregeut 900 was Georges Ricard. The structure, in wood, was straightforward, with a span of a little more than 14 metres, a mid wing layout, a gracefully shaped fuselage of oval cross section, and wing profiles designed by a Breguet method (of which no details are available). Although comparable in general appearance to the Moswey 3 of 1942, there is no reason to supposed that Ricard was much influenced by the Swiss design. The prototype Br 900 flew in June 1948. It had a simple wing with spoilers for landing but no flaps. Results were sufficiently encouraging to prompt further development. The second prototype, which had flaps and DFS type airbrakes, flew in March 1949. Best results in thermals were obtained with the flaps down 12 degrees. When



Breguet 900 S1

1948 - 9

landing they could be depressed to 35 degrees reducing the speed for touch down. For road transport the horizontal tail surfaces were folded vertically upwards, a feature which was later used by Breguet again. Two release hooks were fitted under the wing leading edge, requiring a forked end to the towline.

The Br 900 - 2 was immediately successful. Within a few weeks Paul Lepanse set a new French distance record with a flight of 470 km from Beynes on the west side of Paris, southwest to land at Hourtin after crossing the Gironde Estuary north of Bordeaux. Lepanse entered the 1950 World Championships at Orebro in Sweden but on the penultimate contest day the airbrakes malfunctioned and the sailplane was seriously damaged in the resulting unplanned arrival among small trees and rocks.

Six further examples were built, with modifications, to produce the Br 900 S - 1, - 2, -3 etc. Each, it seems, was slightly different from the one before it. There were changes to the air brakes, and to the cockpit canopy, the fin and the wing tips. In the 900 S - 2 Roger Biagi broke Lepanse's distance with a flight of 525 km, and in 900 S - 4 the speed record for a 100 km triangle was broken by Robert Delhoume. Br 900 S - 5, built in 1951, was entered for the World Championships in Spain in 1952. In an entry list dominated by large span sailplanes, Jules Landi placed 21st out of 39. In the same aircraft René Branciart soared above Mont Blanc at a height of 5900 metres (19,360 ft).

Of the eight Br 900s of all marks built, two remained in 2002, one, Br 900 S - 6, stored in the museum at le Bourget. The other, Br 900 S - 1, built in 1949, was restored by Claude Visse and in 2002 remains airworthy. The drawing here shows this aircraft.

Fauvel AV - 36 & 361

There will probably always be controversy about the sailplanes of Charles Fauvel. When the AV - 36 (Aile Volante, i.e., flying wing) first flew in 1951, it was hailed enthusiastically. It would transform the entire soaring movement. It was said to have "absolutely classical" handling, excellent stability in yaw and pitch. It was completely safe for beginners to fly. It would accommodate, without any changes, a range of pilots of any weight between 50 and 100 kg. Skilled instructors were unable to make it stall or spin, but it was capable of simple aerobatics. It was light, could be taken on a simple trailer without de-rigging for road journeys, and was inexpensive. Despite its small wing span and low aspect ratio, it was a good cross-country sailplane. In July 1952, Eric Nessler made a flight of 460 km in an AV - 36 at an average speed of 71 km/h. A polar curve was published indicating that "While it does not pretend to be a super sailplane... it is definitely superior to the Olympia. At 100 km/h it equals the performance of the Weihe and the Air 100; above this speed it improves on their performance."[15] "The Fauvel AV - 36 seems to bring a completely new trend to the soaring world."[16]

15 - G. A. Beron, Sailplane & Glider October 1953.
16 - Guy Borgé, writing in Sailplane & Glider, December 1952.

The AV - 36 in flight.

There was immediately great interest. More than 100 AV - 36s were built worldwide and plans for many more were sold. In 1951 an improved version, the AV - 36 Mark 2 was advertised. The AV - 361 followed in 1960 with a more streamlined central nacelle, a nosewheel, better airbrakes and other detailed improvements. Another 50 or more were built of this version.

The transformation expected by the enthusiasts did not happen. Why not? It seems unlikely that mere prejudice or diehard conservatism on the part of competitive glider pilots throughout the world prevented the flying wing from gaining the kind of recognition it was thought to deserve. If the AV - 36 had really proved to be remarkably superior to the best ordinary sailplanes of the time, leading contest and cross-country pilots would certainly have adopted it, won trophies and broken records. They did not.

The chief advantage claimed for the tailless aircraft is that the parasitic drag of the tail and fuselage is eliminated. This unfortunately is not acceptable at face value. A vertical tail, fin and rudder usually provide control and stability in yaw. Fauvel's flying wings had vertical fins and rudders mounted as far aft as possible on the wing. Because they were on a very short moment arm they were, taken together, larger than an orthodox vertical tail and so productive of more drag. The AV - 36 had a nacelle to house the pilot. This, too, created parasitic drag, although a little less than a long fuselage. Taking vertical surfaces and nacelle together there was probably only a very little drag saving, if any, compared with a fuselage and vertical tail of ordinary kind.

The prototype Fauvel AV 36 shortly after its first test flights.

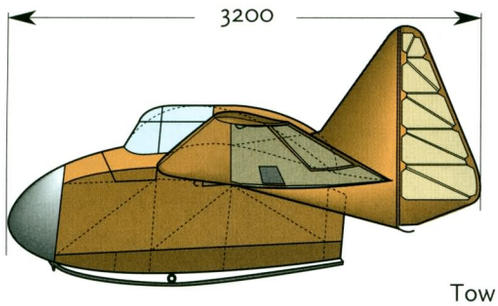
This directs attention to the wing. The claims made for the AV -36's handling in the air were apparently quite true. A tailless aircraft can be made safe and controllable in pitch providing stability is provided in some other manner. The usual method is to sweep the wing back and build a negative twist or washout into the outer panels, as with the Horten series. The outer wings then become the stabilising surfaces.

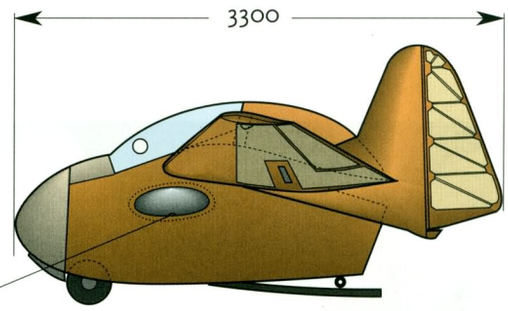
The approach used by Fauvel was to employ a wing profile with a pronounced reflexed camber. Such a profile has a positive, rather than a negative pitching moment. In a somewhat older terminology, the centre of pressure of such a wing section moves forward, instead of aft, as the angle of attack is reduced, the reverse of a normally cambered profile. A disturbance, either nose up or nose down, automatically produces a desirable corrective force. With such a profile the wing need not be swept back. The elevator control surface may then be mounted on the trailing edge of the wing. Response to control column movement is normal.

The reflexing must be equivalent in stabilising power to that of an orthodox tailplane. The AV - 36 reflex profile extended across the entire span from tip to tip. A large proportion of the total wing area thus functioned as stabiliser. Area for area, this part of the wing cannot produce its full share of the total lift and becomes parasitic.

With no tail, the aerodynamic centre of the AV - 36 was close to the quarter chord point of the un-swept wing. The distance of the centre of gravity ahead of the aerodynamic centre is termed the stability margin. If the aircraft balances aft of the aerodynamic centre it becomes dangerous.[17] Hence, to make a flying wing safe it is critically important that, in flight, it balances ahead of the quarter chord point by a suitable margin. The range of pilot weights tolerated by the AV - 36 indicate that the pilot's seat was at or very close to the aerodynamic centre. Changing the cockpit load made little or no difference to the balance, it was stable in flight with all pilots. It follows that the centre of gravity was always ahead of the aerodynamic centre by a satisfactory margin. This being so, there was always a nose down pitching tendency caused by the forward balance point. This was necessarily balanced by a constant nose up force

17 - See also the account, above, of the Horten XVI Colibri.





Fauvel AV 36 & 361

1951 - 1960

Glass plastic moulding
Plywood skin
Metal
Fabric covering

Fauvel wing profile

AV 361

Mass empty 125 kg
In flight 258 (max)
Wing area 14.6 sq m
Aspect ratio 11.4
Wing loading 17.7 kg/sq m

Tow hooks under wing

AV 36

Mass empty 120 kg
In flight 225
Wing area 14.2 sq m
Aspect ratio 10
Wing loading 15.8 kg/sq m

Later versions of the AV - 36 had improved cockpit canopies. This is number 111.

generated by the reflexed part of the wing. That is, the entire rear part of the wing was contributing a downward force at all times in flight. Another way of putting this is to say that the AV - 36 did have a tailplane but it was attached directly to the mainplane and extended across the whole wing span from tip to tip.

In the orthodox layout, the entire cambered wing, area for area, yields its full share of lift. The aircraft is then balanced and stabilised by a small tailplane. The stabilising and balance forces it provides act on a long moment arm and are also relatively small. The drag penalty of such a tail is not great. The entire reflexed part of the AV - 36 wing, which was a large proportion of the whole area, created a proportionately large share of parasitic drag, at least as great as, and probably more than the penalty of having a small tailplane at the distant end of a long fuselage. The net effect is that the flying wing cannot be expected to perform better than any other sailplane of equivalent span and total mass, and may be worse.

A pilot who probably gained more experience then anyone else in flying the AV - 36, was Jack Lambie in the USA.[18] After buying one in 1960 he operated it over a period of ten years and did a total of nearly 5000 km of cross-country soaring in it, including some excellent long distance flights. He wrote that he never had any problems in the air, despite having deliberately put the AV - 36 into some quite extraordinary attitudes. He did, however, have trouble with it when taking off and landing. It was directionally unstable during the slow part of the take off run and when landing, needing great care. Dragging a wing tip at the start of a launch could lead to serious trouble and the same when landing. Lambie had several spectacular ground loops. "Once started, it (the ground loop) was split second fast and totally uncontrollable". Also if the glider touched down at any airspeed above the stall, it would bounce, nose up, and required a good deal of skill and experience to prevent this becoming a series of severe oscillations and heavy impacts. This could happen even more dangerously at the start of a launch. As the aircraft started to move forward, but before any of the aerodynamic control surfaces were effective, it would at first tilt nose down because the pull of the launching rope, with a Y end attaching to twin releases either side of the nacelle, was high. The pilot would try to counteract this by moving the stick back, by which time the flying wing would have picked up some airspeed so that the elevator would become operative, raising the nose sharply. The AV - 36 would lift off suddenly and jump into the air, at which the relatively inexperienced pilot would naturally move the stick forward, beginning an oscillation that might easily precipitate disaster. This characteristic was noted in England too and prevented the British Gliding Association from granting the original AV - 36 a Certificate of Airworthiness, until Fauvel was persuaded to change the undercarriage. The nose wheel fitted to the AV - 361 was at least a partial answer to this, but it came rather late.

In performance, Lambie compared the AV - 36 to the Schweizer 1 - 26, remarking that they were certainly in the same range. The flying wing, he said, "was so stable and easy to fly that it made the 1 - 26 feel like flying a unicycle" and the Fauvel outpaced the Schweizer at speeds above 140 km/h. But the 1- 26 out-climbed it in thermals. At low speeds the tail of the 1 - 26 holds it easily in a high lift attitude, "whereas the flying wing elevator is along the centre section of the trailing edge of the wing, thus greatly reducing the lift. At slow speed, pulling back the stick actually pushed the plane down."

It seems after all that the AV - 36 did not perform a great deal better than other sailplanes of similar size. It was safe in the air but not easy to manage during critical phases of landing and take off, even after modification. It had certain advantages; simplicity, cheapness and lightness, but these were evidently not enough to convert the soaring movement to the flying wing. Of the many built, very few remained in use for as long as Jack Lambie's aircraft.

Fauvel also developed a large two-seater, the AV 22, which flew in 1956. This had a swept forward wing with the pilots, in tandem, housed in a large central nacelle. Only a few were built but they performed aerobatics readily and were widely demonstrated. They did not, in the long run, prove at all popular for soaring. Fauvel continued, fitting some of his flying wings with engines to produce a series of satisfactory light aeroplanes. In 1971 he discontinued commercial manufacturing but plans to build his aircraft remained available. Aged 75 in 1979, he was killed in an accident when flying a powered aircraft.

18 - J. Lambie, Soaring, August 1970, p 27

Above: The prototype Doppelraab on its first public appearance at the Wasserkuppe in August 1951. The instructor reaches over the pupil's shoulder to grasp the control column.

Right: The Doppelraab has a place of honour in the Deutsche Museum at Oberschleissheim.

GERMANY

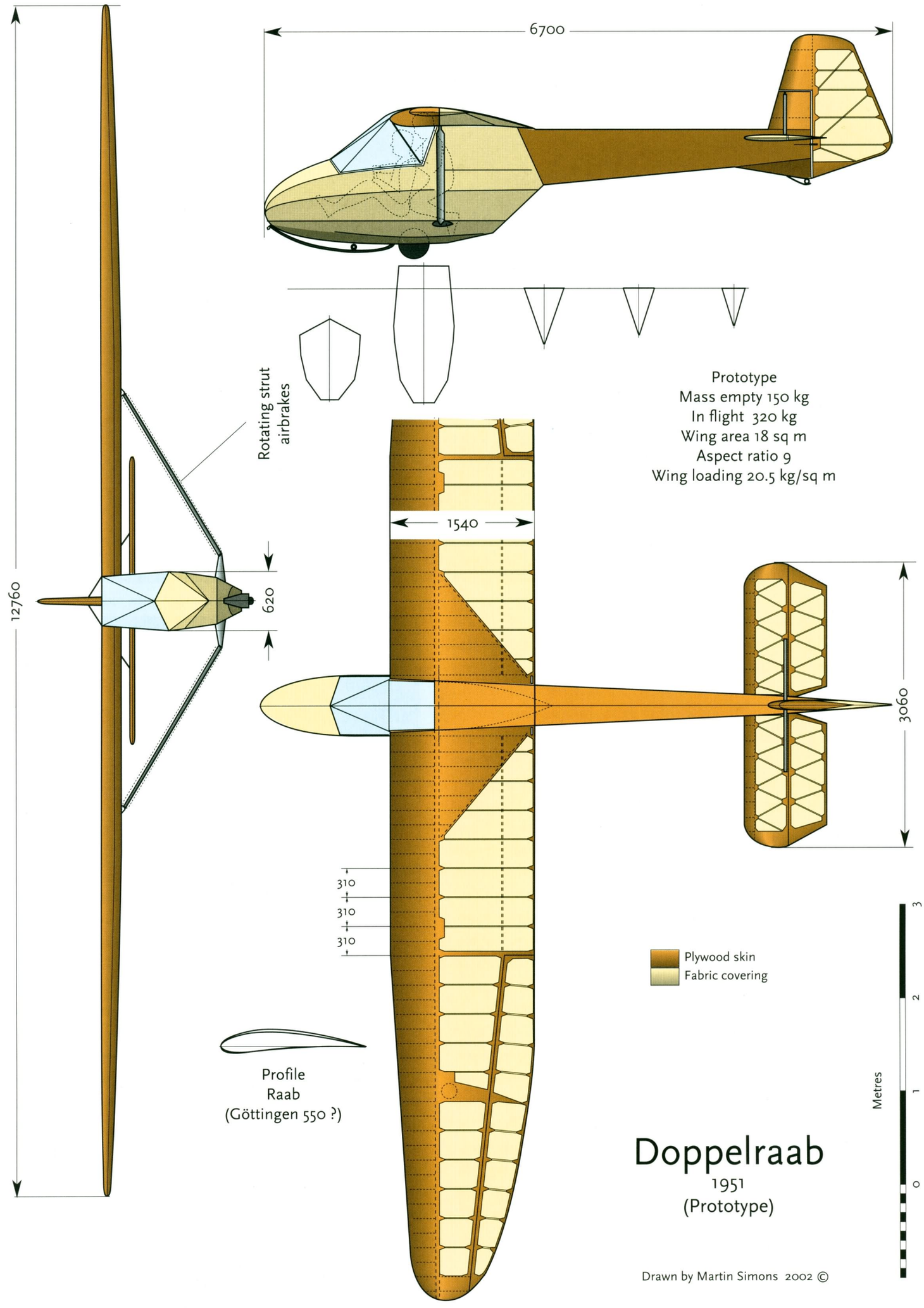
The bans on aviation in Germany were lifted in April 1951. There had been preparation and planning before this. Every year after 1947 there was a re-union on the Wasserkuppe and at the 1950 meeting the opportunity was taken to re-establish the German Aero Club. Wolf Hirth, elected President, spent most of the next twelve months in negotiations and lobbying. Rather to Hirth's surprise, it became possible to transform the annual Wasserkuppe party into a flying meeting, which was held on the weekend of 25th and 26th August 1951. It was extraordinarily successful. Apart from the pilots and a dozen airworthy sailplanes it was estimated that on the Sunday there were over 30,000 spectators. Within nine months it was reported that there were 750 clubs with 35000 members, and four companies manufacturing sailplanes. Interest in soaring had not diminished in Germany.

It was also evident that there had been much activity in designing and construction before flying started again. Several new sailplane designs were exhibited and flown for the first time in public at the 1951 meeting. They were the first of many.

Doppelraab

To describe the Doppelraab as a two-seater is perhaps a misnomer. It carried two persons, but one of them, the instructor, was perched on a saddle in a cramped position under the wing. Access to the control column was by reaching over the pupil pilot's shoulder. Contact between the two was almost intimate. Advice could be conveyed by quiet whispers into the ear. Even to get the instructor into place required a good deal of suppleness. Practice made it easier.

Fritz Raab recognised that the old solo method of training would not persist for long. A cheap two place glider would be urgently needed as soon as flying began again in Germany. There would be no factory production of sailplanes for some time so the Doppelraab should be capable of being built quickly and easily. Kits must



Prototype
Mass empty 150 kg
In flight 320 kg
Wing area 18 sq m
Aspect ratio 9
Wing loading 20.5 kg/sq m

Profile
Raab
(Göttingen 550 ?)

Doppelraab

1951
(Prototype)

Above: The rounded fin and rudder show the earliest form of the Mu 13E. The photo was taken at Porta Westfalica near Minden.
Below: A Mu 13E in clear doped fabric.

be provided. Welding could not be trusted to amateurs so sub-assembly work of this kind should be included in the kits. The fundamental need was for a glider not much inferior in performance to the ubiquitous Grunau Baby, but with a place for an instructor. When a pupil was ready for it, solo flights could be done in the same aircraft as the elementary training, and soaring would be possible for the early badge flights. A club just beginning would need only one aircraft.

Construction was carried out at the Dachau Aero Club near Munich. The first flight of the prototype was on 5th August 1951. Great interest was aroused when the aircraft flew at the Wasserkuppe later that month. The Doppelraab fulfilled all the designer's expectations. The wing, tail and rear fuselage were of wood, the forward fuselage was a light steel tube frame covered with fabric. There was a single wheel and forward skid. The prototype had an unusual air braking system. The struts could pivot ninety degrees on their mountings to present their length broadside to the airflow. This feature did not prove successful. The braking was inadequate and the mechanism quite complicated. All later versions had orthodox spoilers.

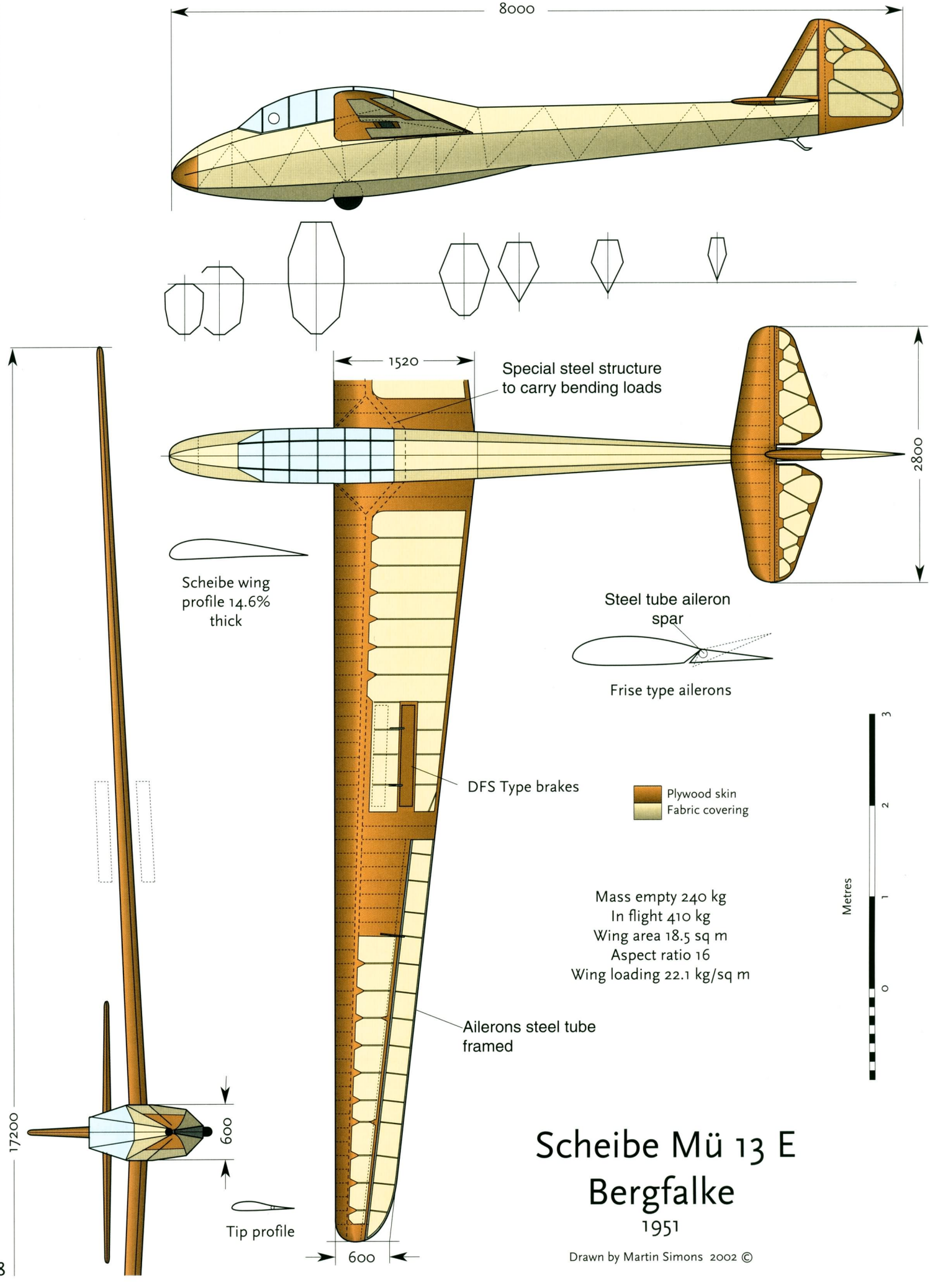
Within a year of its debut, a dozen Doppelraabs were flying and fifty were under construction. Wolf Hirth, who had turned his factory again to sailplanes after years surviving by doing other work, undertook serial production. Kits and finished aircraft were made available. Various improvements were incorporated as time went on, the Doppelraab Mark VII being the final version, with a span extended to 13.4 metres. In total it is estimated that 360 were flown, including some in the Americas. A few of them survived to attend Vintage Glider Meetings in recent years.

Scheibe Mü 13 - E Bergfalke

The first high performance sailplane to appear from a German designer after the war was the Mü 13 - E two-seater of Egon Scheibe. The new type deserved a new number. Scheibe evidently hoped to remind potential customers of his very successful single seat Mü 13 - D. The name Bergfalke (Mountain falcon) probably made the distinction clear enough. The two-seater was actually registered in Austria and built at Jenbach in the Tyrol while the general bans on civil aviation were still in force in Germany. It was completed and taken to Innsbruck for its test flight, with a winch launch, and was thus ready to appear and fly at the Wasserkuppe weekend meeting later that month.

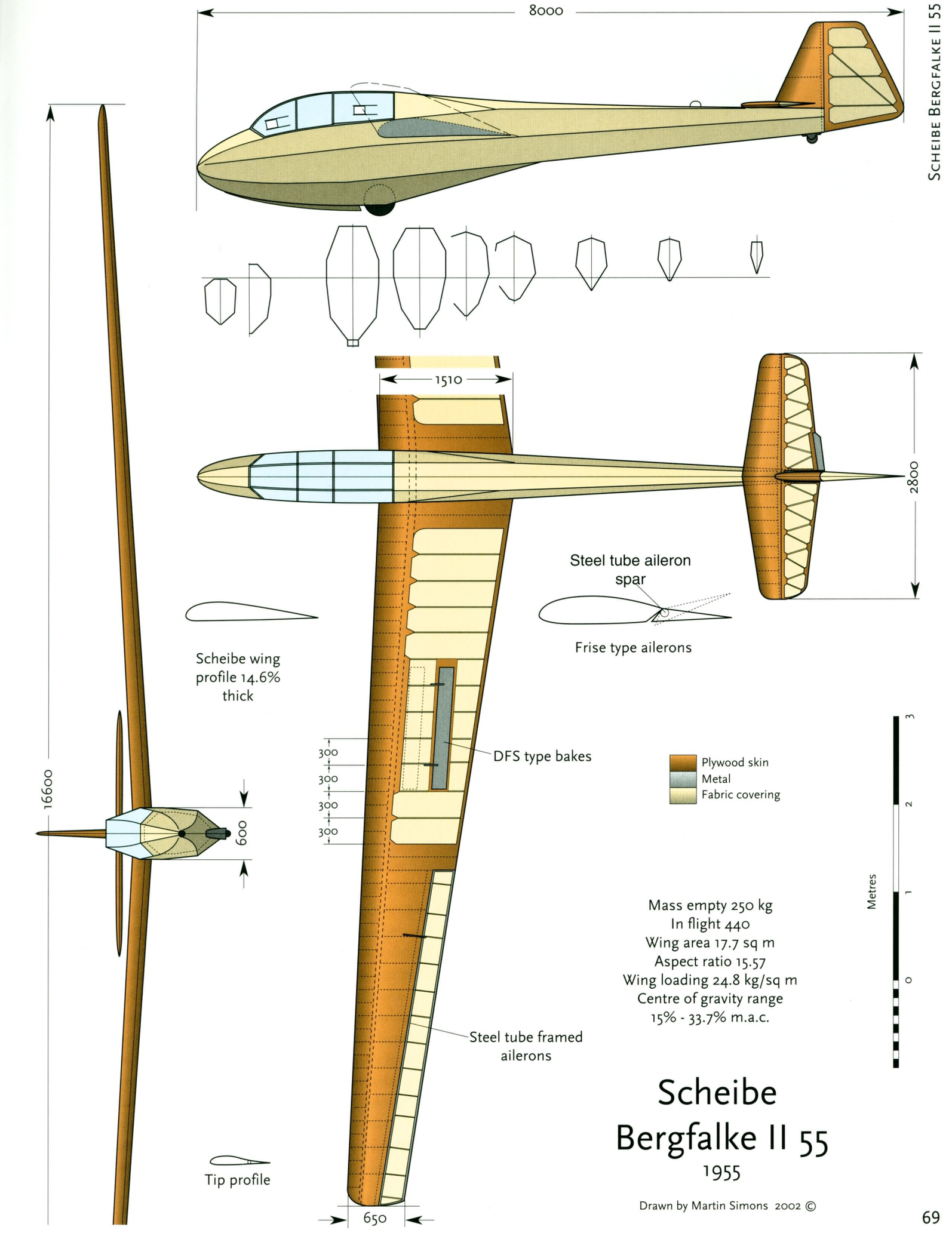
Scheibe's association with the Akaflieg Münich went back to the famous two-seater, Mü 10 Milan, which he and the Munich students had designed in 1934. This had been retired and stored in the Deutsche Museum in Munich, but when flying began again it was rescued and restored. It arrived at the Wasserkuppe in flyable condition. The Mü 10 and the Mü 13 - E were at the Rhön together late in August 1951.

Scheibe had been closely involved in the development of sailplanes with welded steel tube framework for the fuselage, combined with wooden wings and tailplanes. In these respects the



Scheibe Mü 13 E Bergfalke

1951



Mass empty 250 kg
In flight 440
Wing area 17.7 sq m
Aspect ratio 15.57
Wing loading 24.8 kg/sq m
Centre of gravity range
15% - 33.7% m.a.c.

Scheibe Bergfalke II 55

1955

Bergfalke revealed its ancestry. The fuselage and tail unit in general shape followed that of the Mü 17 of 1939. The two seats were in tandem. There was a single wheel ahead of the laden centre of gravity. With both pilots in the cockpit, the tail normally remained on the ground, so it was not considered necessary to provide a deep forward skid. The belly of the fuselage was reinforced.

Scheibe swept the wing forward to align the leading edge at right angles to the centre line. This was to ensure proper balance when the sailplane was flown solo from the front seat. A similar layout was used by Jacobs for the Kranich III, but there was an important difference. The Bergfalke wing joined the fuselage at a high mid position. If the main spar had been carried through the fuselage at this level, it would have crossed the rear cockpit at chest height, leaving no space for the pilot. Scheibe's solution was to design a very ingenious steel frame within the wing root, bolted to the wooden spar, to transfer the spar loads aft to substantial cross members in the fuselage behind the seat, with a corresponding attachment point near the leading edge. The rear cockpit was thus clear of obstructions. The steelwork in the wing added some weight but the Bergfalke was a light sailplane and could accept this addition without difficulty.

The wing had Scheibe's own profile, a form that had been designed and preferred by him from the start of his career. It had both camber and thickness well forward. Behind the highest point the upper surface was virtually a flat, inclined plane to the trailing edge. The underside had a very slight undercamber. This was essentially a profile suitable for slow flight. All Scheibe's sailplanes using

Above: This Bergfalke II was built in Sweden. A winter flying scene.
Below: Bergfalke at Oberschleissheim in 1995. An Australian visitor was responsible for the kangaroo on the rudder. In the background is a Czech Sohaj and a Slingsby T - 21.

it, or its various close relatives, were characterised by excellent soaring ability in weak thermals. To minimise adverse yaw and ensure good aileron control, Scheibe adopted Frise ailerons of a type similar to those used on later versions of the Mü 13 single-seater.

Scheibe was sufficiently encouraged by the success of the Bergfalke to establish his own factory at Dachau near Munich, and production of the Mü 13 - E began there in November 1951. The price was as low as he could make it. Even the Doppelraab training two place glider was not yet readily available. Scheibe had the market for high performance but relatively inexpensive two seat

Kranich III in 1995 at Oberschleissheim

sailplanes almost to himself and there were plenty of orders. Groups from all over Germany and elsewhere visited the factory and were much impressed. Thirty five Bergfalkes were built in the first year and production continued to a total of about 170, some of these built under licence by Wolf Hirth. Sadly, the Bergfalke flown by Rudolf Ziegler at the Madrid Internationals in 1952, was destroyed when, on a landing approach, a violent downburst from a nearby thunderstorm caused an abrupt, total reversal of wind direction, a sudden stall and dive into the ground. Ziegler, a Münich Akaflieg veteran who in 1935 had broken the World Distance record in the old Mü 10, died later of his injuries. His co-pilot was uninjured.

Troubles appeared later when there was an accident caused by failure of the unusual wing root structure. A special routine of frequent inspection was laid down after this, with a transparent panel built into the wing root to allow frequent checks for cracks or corrosion. In 1977 the registration authorities eventually decided that the Mü 13 - E, in its original form, must not fly unless the wing span was reduced by surgery, to 15.66 metres. Some of the surviving old Bergfalkes were modified. Others were simply retired.

Meanwhile, Scheibe in 1953 produced the Bergfalke 2. The wing span was reduced to 16.6 metres and the sweep angle increased, making the central junction of the main spars quite simple. There were other changes with a different shape for the vertical tail and improved, moulded cockpit canopy. The Bergfalke II 55 followed. Of these two models about 300 were built, many assembled from kits and 70 produced under licence in Sweden. The Bergfalke III appeared in 1962, incorporating some moulded glass plastic components although the main structure and layout remained the same. The structure was generally stronger and the weight accordingly greater. The final member of the series, the Bergfalke IV with Wortmann wing profiles and span increased again to 17.2 metres, appeared in 1969.

Focke - Wulf Kranich III

Hans Jacobs had made his career as a sailplane designer first in the nineteen twenties working with Lippisch and later with the DFS (Deutsche Forschungsanstalt für Segelflug) in Darmstadt. In 1951 his Weihe design was still the standard by which other competition sailplanes were measured. The Focke - Wulf Company, able once again to engage in aircraft work, approached Jacobs for a licence to build the Weihe in a slightly improved version, the Weihe 50. The most important changes were to replace the cockpit canopy with a plastic bubble, and to add a landing wheel. Some of the Weihe 50s had the ailerons shortened, making the control forces lighter and hardly affecting the rate of roll.

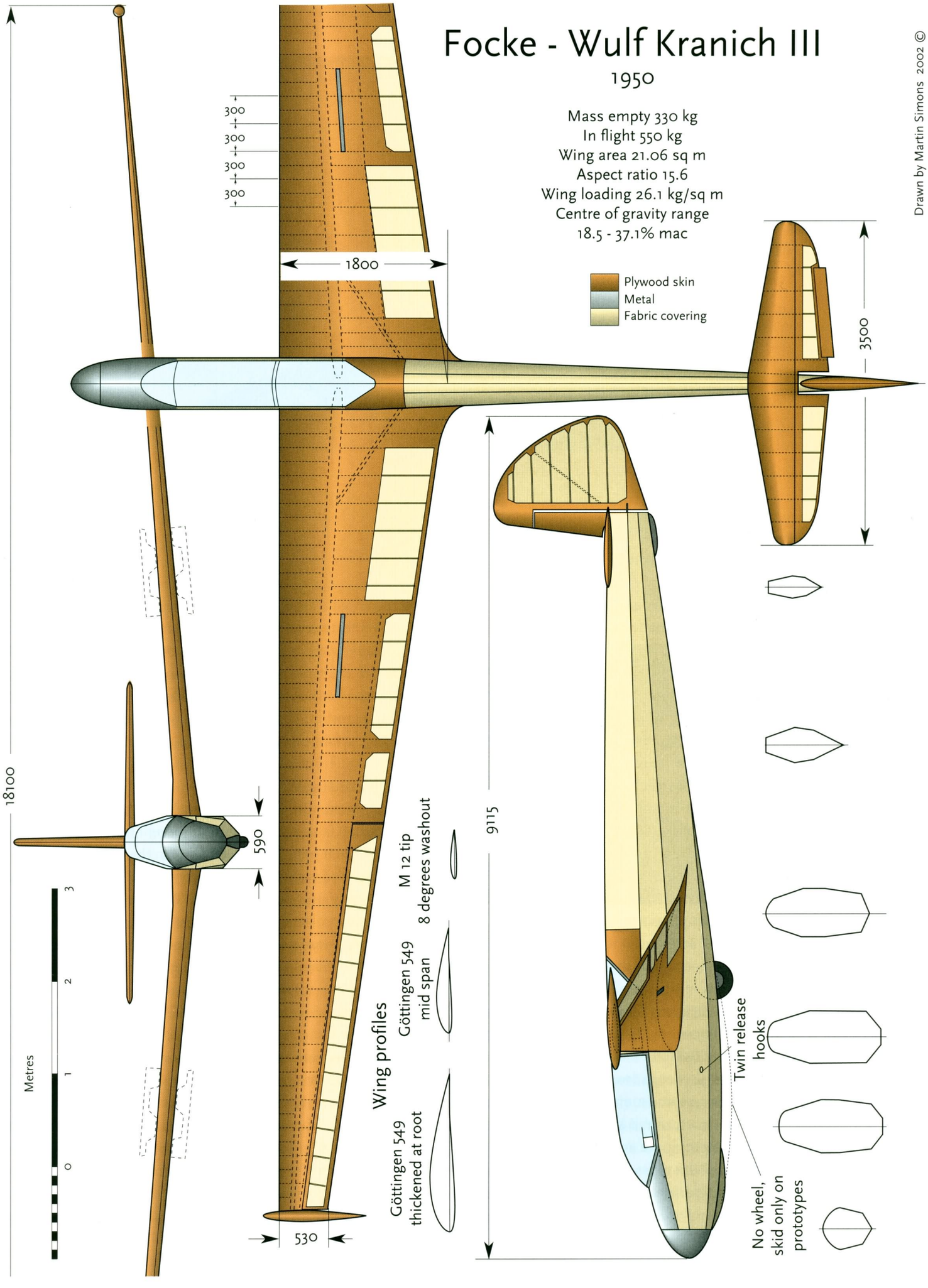
Recognising the potential demand for a modern high performance two-seater, Jacobs also produced a design study, which he called the Kranich III. It bore little resemblance to the earlier Kranich II, but the name carried great prestige. The new Kranich, with seats in tandem, was slightly over 18 metres span. The wooden wing, slightly swept forward to produce a leading edge at right angles to the centre line of the aircraft, was mounted low on the narrow fuselage. The rear pilot had a clear view and the main spar could be carried through behind the seat. The fuselage, somewhat narrower than usual for a two-seater, was a welded steel tube frame, fabric covered with light wooden longerons to improve the shape. A long transparent canopy in two sections enclosed the cockpit. There was some metal skinning at the nose. The undercarriage was a simple skid.

Aerodynamically the wing was almost unchanged from the Weihe, except for the forward sweep. The rather feeble DFS air brakes of the Weihe were replaced with the Schempp-Hirth type. Streamlined tip bodies were fitted in an effort to reduce the strength of the wing tip vortices. Probably their main value in practice was in protecting the ailerons from contact with the ground. Jacobs himself did not

Focke - Wulf Kranich III

1950

Mass empty 330 kg
In flight 550 kg
Wing area 21.06 sq m
Aspect ratio 15.6
Wing loading 26.1 kg/sq m
Centre of gravity range
18.5 - 37.1% mac



The Condor IV, as it first appeared with a narrow fuselage neck to support the wing. Several of the type were flown at Madrid in 1952.

Below: The revised form of the Condor IV fuselage as produced by Schleicher.

carry out the detailed design which was completed by the Focke - Wulf engineers to his satisfaction.

Some difficulties were found during the early test flights. Hanna Reitsch, probably the smallest and lightest test pilot ever, required 15 kg of ballast in the nose of the Kranich III to cure a serious tail heaviness when she was in the front seat. The prototype also suffered from an over-balanced rudder which, in a side slip, locked over and defeated the pilot's attempts to centralise it. The size of the aerodynamic balance was reduced. After final successful test flights the Kranich III entered production in 1952 and immediately established itself as an outstanding two seat sailplane, although no lightweight. The production version had a wheel and small nose skid, making it much easier to handle on the ground..

Three Kranich IIIs were entered in the Madrid World Championships, flown (P1) by Ernst Frowein, Hanna Reitsch and Heinz Kensche. They placed respectively second, third and seventh. Ironically, Frowein was beaten by the Spanish pilot Luis Vicente Juez. He was flying one of the old Kranich IIs.

Bertrand Dauvin chose the Kranich III for his attempts on the World Duration record, which took place in 1954 and ended disastrously. Focke - Wulf built a total of 40 Kranich IIIs. Of these, a high proportion were still airworthy in 2002.

Dittmar Condor IV

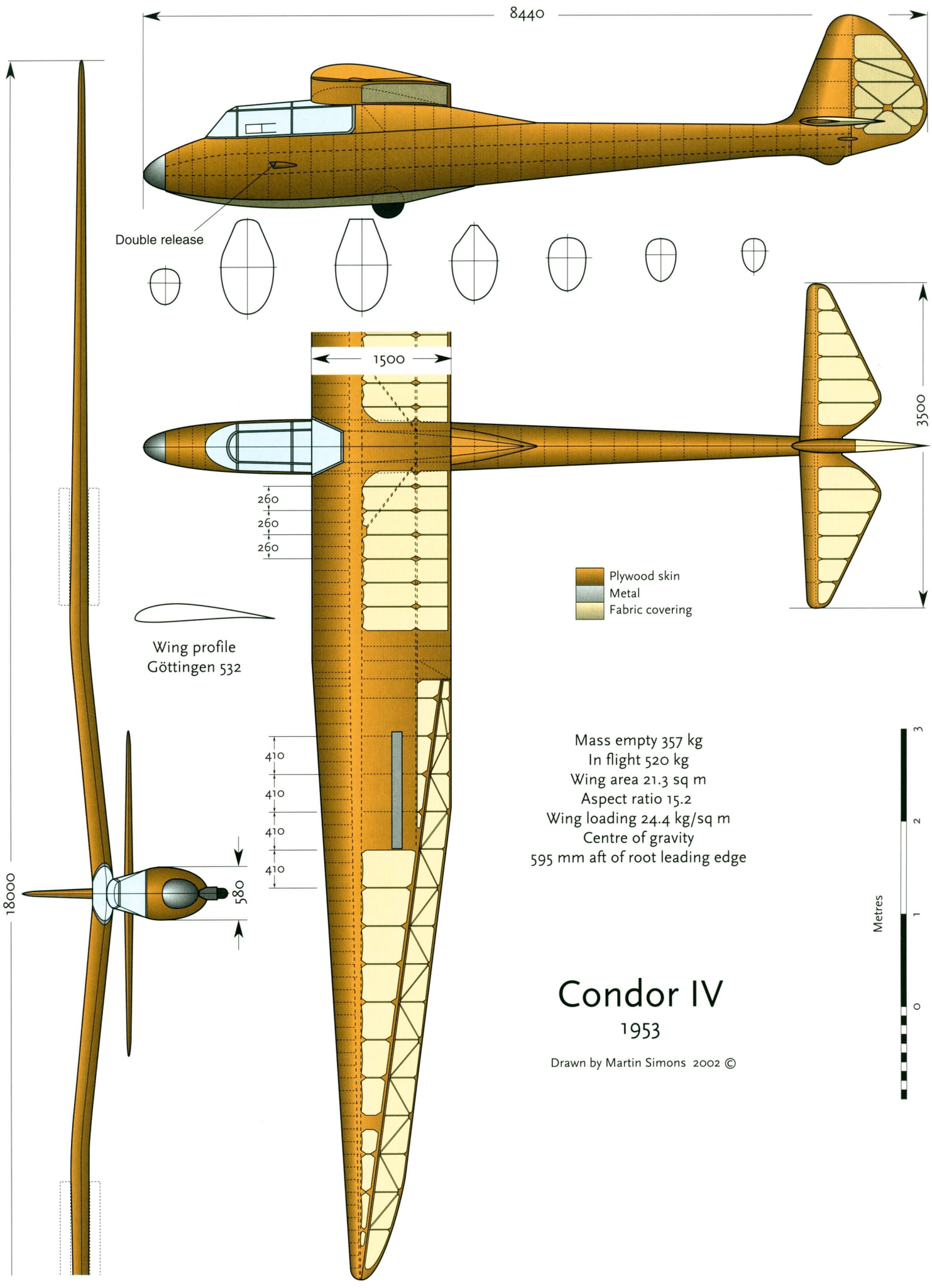
Heini Dittmar designed and built his original Condor in 1932. During the nineteen thirties he developed the design further, the Condor III appearing in 1938. Dittmar also broke height and distance records and won the first World Championship in 1937. Like Hans Jacobs, after the war he produced a new sailplane design.

The Condor IV was built by Dittmar himself and was in all respects a direct development of the Condor III, with the necessary adaptations to take a second seat in tandem. The span was increased from 17.24 metres to 18, with slightly greater wing area and aspect ratio, but the same general plan. The wing profile, as with the Condor III, was the Göttingen 532. This, only 12.5% of the chord in thickness, was one of the thinnest profiles ever used for a wooden sailplane. Most other designers would have chosen a thicker profile and then probably have further increased its thickness at the root of the wing, to permit a deeper main spar to be used. Dittmar preferred to make the spar strong enough by widening it. The result was a good deal of extra weight. Each wing weighed about 100 kg., which presented ground crews with some problems. The total weight, without crew, was 357 kg. The allowable maximum in flight was 520 kg, which put a fairly severe restriction on the cockpit load. If one pilot scaled 90 kg with parachute, the other must not be more than 73kg.

The problem of giving the rear pilot some view was solved by mounting the wing high on a pylon with transparencies in the leading edge as well as on either side. The fuselage followed usual practice, a streamlined semi-monocoque structure with light longerons cross frames and plywood skin. For launching, twin releases at shoulder height were provided, requiring a Y forked end to the towline. The prototype Condor IV had no wheel but used a dolly for handling on the ground and take off. This presented more difficulties for ground handling. A wheel was fitted as a retrospective modification.

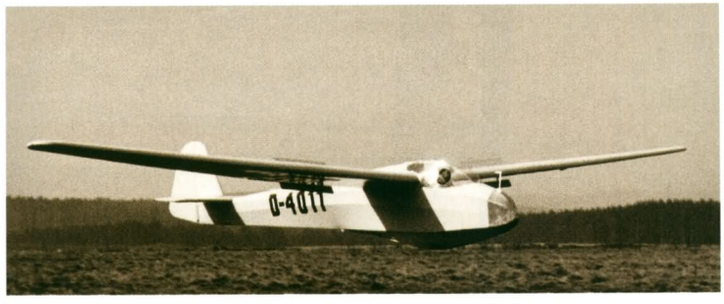
The all moving or 'pendulum' elevator which some, but not all, of the pre-war Condors had used, was retained for the two-seater. Pilots unaccustomed to this found it somewhat difficult to manage, the control column tending to move unexpectedly during the take off run and in turbulent air. The aileron forces also were heavy.

Two prototypes were constructed, one of these being for the Egyptian pilot, Hassan Kamil, who competed with it in the World Championships at Madrid in 1952. He placed 10th in the two-seater class of 17 entries. Ernst Gunther Haase, the only German pilot to



Condor IV

1953



Top: The L - Spatz 53 (L for Leistung, performance) was flown at Camphill in 1954, where it was described as a 'Superspatz '
Above: The 'A' Spatz with air brakes open for landing.
Left: L Spatz 55 with Swiss registration

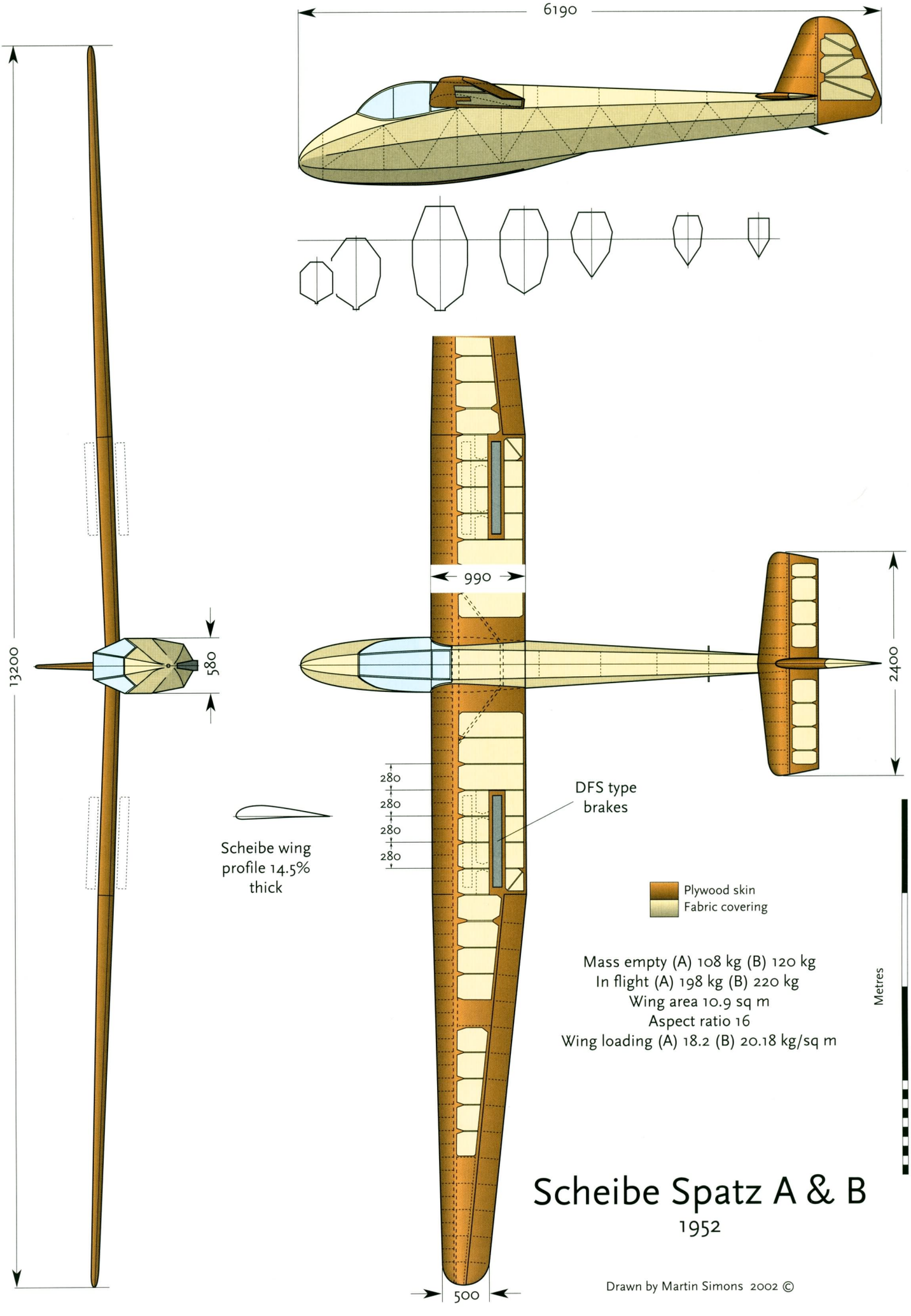
fly in the single seat class, flew the other Condor solo, placing 12th in 39. On his return to Germany in August Haase used the Condor to break the World Record for flight around a 100 km triangle, achieving a speed of 80.9 km/h.

Ferdinand Schmetz undertook to build more and five were produced to Dittmar's plans. After this Alexander Schleicher built a further seven. The Schleicher Condors had a redesigned fuselage, eliminating the high, narrow neck. There were numerous other changes, which reduced the weight. The first flight of the Schleicher Condor IV was in June 1953. Seven of these were built and there was a further small production under licence in Argentina. The Argentinean team of J Ompre and C J Dori entered the Camphill World Championships in 1954, in the two-seater class, flying one of the new Condor IVs. They placed sixth of the nine entries. (The Argentinean pilots had been selected after a special competition in their own country, where a dozen selected pilots competed against one another, all flying Grunau Baby sailplanes to equalise their chances. The two winners, Ortner and Cuadrado, flew Slingsby Skys at Camphill, Ompre and Dori had come third and fourth.) In 1956, the Argentineans did much better, J Sadoux and R Bazet placing third at St Yan. There was further research in Argentina, where a Condor Fuselage was married to an experimental wing of 19 metres span, with a thicker profile, Frise ailerons, flaps and trailing edge airbrakes.

Heini Dittmar himself became interested in developing ultra-light powered aircraft but was killed in April 1960, while flying one of these. In 2002, only a couple of the original Dittmar Condors but several more of the Schleicher variant survived in airworthy condition.

The Scheibe Spatz series

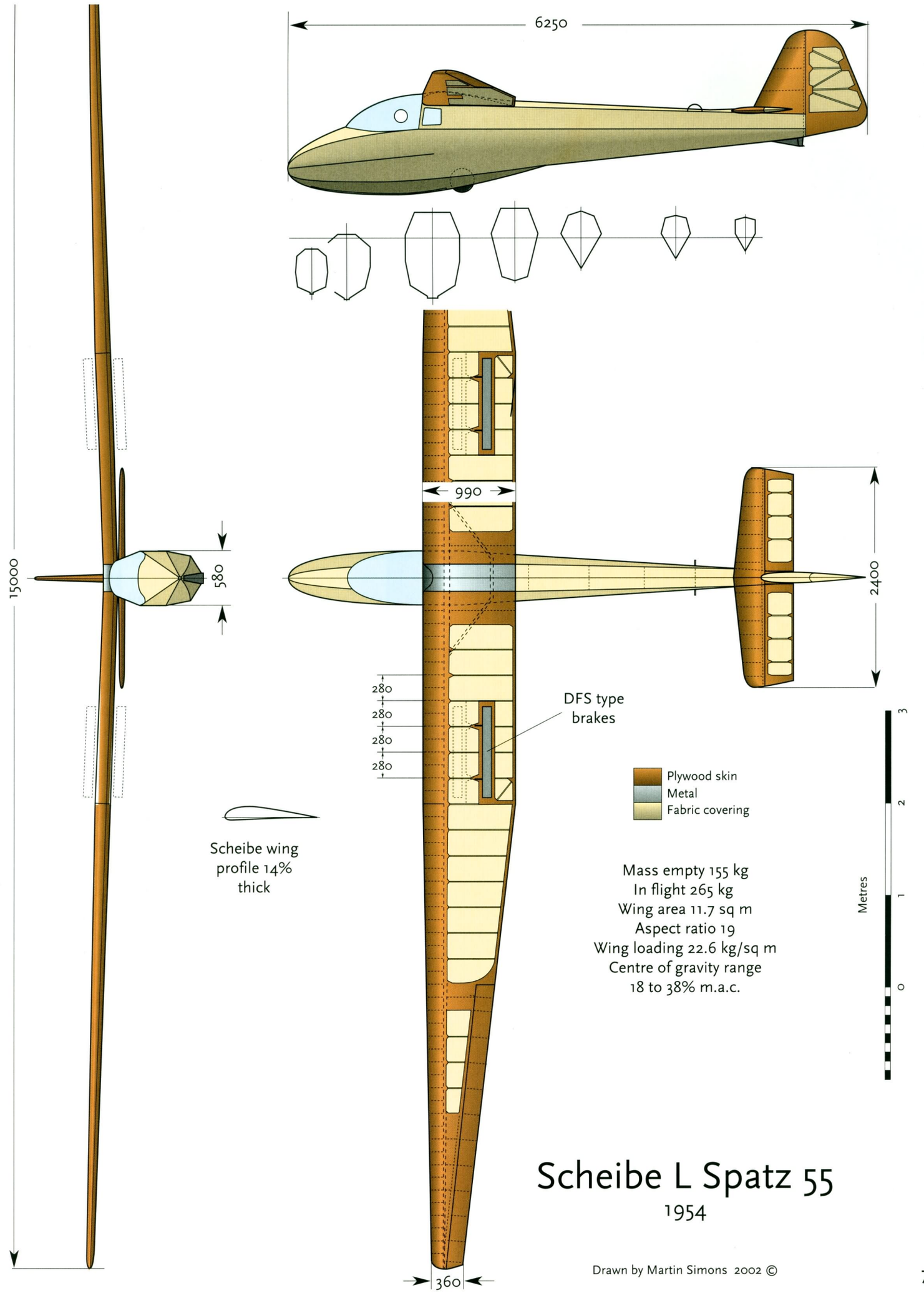
With the Spatz, first flown in March 1952, Scheibe aimed to produce a small, light and inexpensive sailplane that would be capable of good performance. He followed his well established methods, a light steel tube frame for the fuselage and a wooden wing with his own wing profiles. The wing, of 13.2 metres span, was mounted slightly below the top of the fuselage but attaching directly to the



Mass empty (A) 108 kg (B) 120 kg
In flight (A) 198 kg (B) 220 kg
Wing area 10.9 sq m
Aspect ratio 16
Wing loading (A) 18.2 (B) 20.18 kg/sq m

Scheibe Spatz A & B

1952



Scheibe L Spatz 55

1954

Above: The Ka - 3 was similar to the Ka - 1 but had a welded steel tube fuselage frame, marketed as a unit with the kit.

Below: The Kaiser Ka 1 began as a private venture by Rudolf Kaiser in 1952. It was marketed by Alexander Schleicher mostly in kit form.

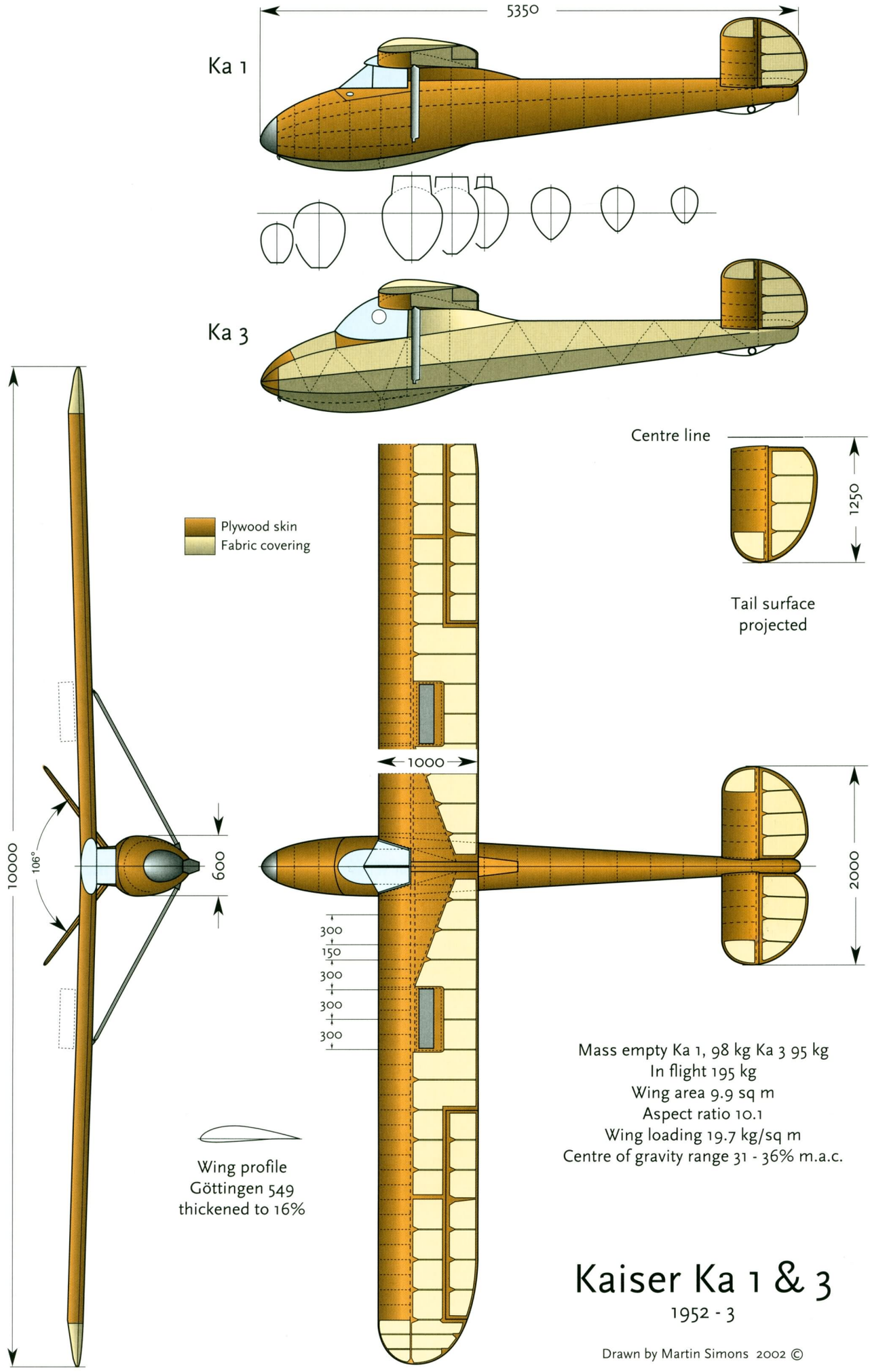
main longerons. All above this, including the upper part of the cockpit canopy was non load bearing. There was no wheel, provision being made only for a 'drop off' dolly.

In December 1952 a version known as the Spatz B was produced, slightly heavier and stronger than the Spatz A, but virtually indistinguishable from it externally. About 35 of these two early models were produced. At this time Rudolf Kaiser, becoming recognised as a very able designer in his own right, was sharing his time between Scheibe in Dachau and Schleicher at Poppenhausen. This accounts in part for the close similarities between the Schleicher Ka 4 Rhönlerche, and Scheibe's Specht. Both were two seat training sailplanes of about the same size, layout and type of construction. Kaiser was involved in both designs and worked with Scheibe on further development of the Spatz. The limitations of the small span were apparent and it was decided to develop, from the Spatz B, a new model, the L Spatz (L for 'Leistung', performance). This flew in 1953, type approval being granted in June 1954. With the same fuselage and tail, the wing span was increased to 15 metres, with appropriate strengthening and there was some thinning of the wing profiles to encourage better performance at high speeds. To increase the airspeed between thermals, it was possible to insert 6 metre long steel rods into the wings in tubes set just ahead of the spar. This increased the flying weight by 70 kg. The name 'Superspatz' was sometimes applied and the Austrian pilot F Linher entered the 1954 World Championships with one. In the prevailing conditions it is doubtful if he felt the need of the ballast, finishing in 22nd place. Like many others, on two days of the four, he could not score at all.

The L Spatz 55 followed, with the wing now mounted high on a new fuselage with a built in wheel undercarriage. Baptist Hofmann made a flight of 679 km in an L Spatz 55 in Germany. The type proved highly popular and was built in hundreds, not only in Dachau but also under licence in Italy, France and Spain. Production continued until 1962 and many remained in regular use in 2002. The final Spatz of the long series appeared in 1966, the L Spatz III. Scheibe died in 1997 soon after his 89th birthday.

Kaiser Ka - 1 & 3

Rudolf Kaiser designed and built the original Ka 1 in his parent's house, in order to have a small sailplane to fly. He had not trained in aeronautics but gained his Civil Engineering Diploma in 1952 when he was 30, his career having been disrupted by the war and

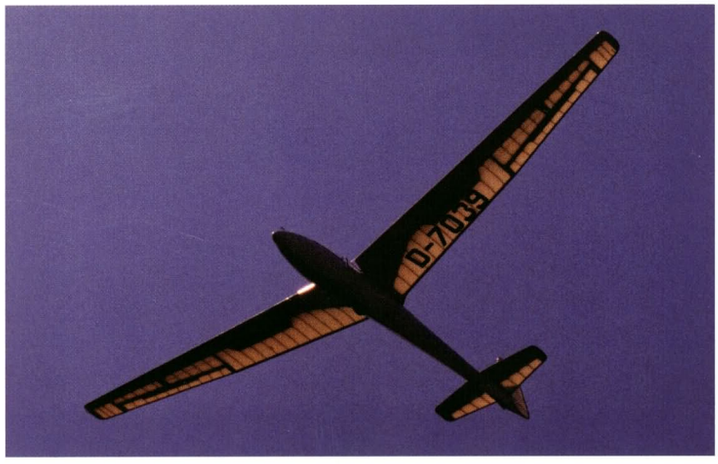


Kaiser Ka 1 & 3

1952 - 3

Right: Ka - 2 at the Wasserkuppe in 1995. This example flies regularly in England.

Below: Swept forward wings, a simple solution to the balance problem in two-seat sailpnaes.



service in the Luftwaffe. He taught himself what he needed to know about sailplane design, but was much helped by Walter Stender who had trained at Berlin and was a well known sailplane engineer.[20] The Ka - 1 flew in 1952. It had a simple, strut-braced wing of rectangular plan, with rounded tips. The plywood skin ahead of the spar did not extend to the tips, which were fabric covered, like the wing behind the spar. Spoilers were fitted on the upper surface. The fuselage was fully streamlined and skinned with plywood. A V - tail was used. The Ka - 1 flew very well and Kaiser used it to gain his Silver C badge.

Recognising that the Ka - 1 would find a market, Erwin Köhler produced some kits under licence in Fulda. About ten of these were completed by amateur builders. Kaiser was now working with Egon Scheibe at Dachau and recognised, when considering the Scheibe Spatz and Bergfalke, that amateur constructors found it very useful to have a welded fuselage frame provided. The Ka - 3 resulted. The first flight of this new small sailplane was in 1953. Alexander Schleicher undertook to manufacture and market the Rhönlaus, as the Ka - 3 came to be called. The main spar and fuselage were sold as sub-assemblies with the kits. Some twenty of the Ka - 3 were completed.

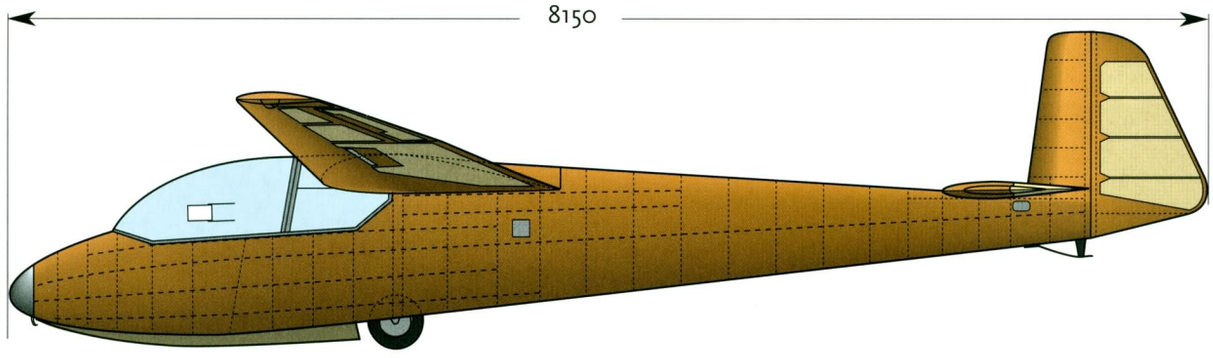
Kaiser Ka - 2 Rhönschwalbe

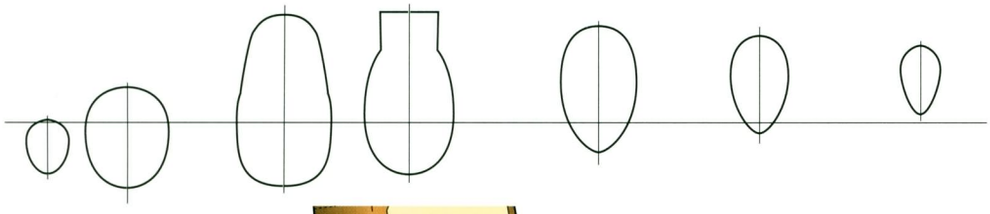
Kaiser began working for Schleicher on a more or less permanent basis in 1953, though this did not prevent his making 'guest appearances' at Scheibe's works, in particular to design the Ka - 5 Zugvogel of 1954.[21]

The demand for advanced two seat sailplanes was still high, and Schleicher, who built several of the Condor IV, had recognised the limitation of this design. Kaiser was commissioned to work on a new two-seater which became the Ka - 2, Rhönschwalbe (Swallow). This was a high winged, tandem seat wooden sailplane with the problem of the second pilot's view solved, as simply as possible, by a straight tapered, swept forward wing. (There was a precedent. The record-breaking 20.2 metre span Russian Stakhanovetz of pre war years had used this plan.) The rest of the construction was straightforward.

The Ka - 2 made its first flights at Easter in 1953. It was highly satisfactory and fitted well into the general gliding club scene, a robust aircraft with a 15 metre span, not too large, heavy or costly. The Schempp-Hirth air brakes were effective, the wheel made handling on the ground easy. The view from the front cockpit was perfect

20 - Björn Stender, designer of the BS - 1 sailplane, was his son.
21 - See below.





Root profile Göttingen 533 modified, 16%

Göttingen 533

Tip profile Göttingen 532

Plywood skin
Metal
Fabric covering

Ka 2, span 15 m

Metres 0 1 2 3

Mass empty:	Ka 2, 254 kg,	Ka 2B, 278 kg
In flight:	Ka 2, 460 kg,	Ka 2B, 480 kg
Wing area:	Ka 2, 16.8 sq m,	Ka 2B, 17.5 sq m
Aspect ratio:	Ka 2, 13.4,	Ka 2B, 14.63
Wing loading:	Ka 2, 27.4	Ka 2B, 27.4 kg/sq m

Centre of gravity range 28.6 to 46.4% m.a.c.

Kaiser Ka 2 & 2B Rhönschwalbe

1953 - 55

Drawn by Martin Simons 2002 ©

Above: An Australian Ka - 7. Plans for the type to be built by Schneider in Adelaide did not go ahead. All Ka - 7s in the country were imported.
Left: Ka - 7 flying over Harris Hill, New York State.

and that from the rear at least adequate. A club need not feel it had invested a great fortune in this aircraft and it could serve several purposes. It was capable of good cross-country performance and a trainee who had received instruction to a suitable standard, could fly it solo to complete the Silver C badge. Schleicher sold thirty eight within two years.

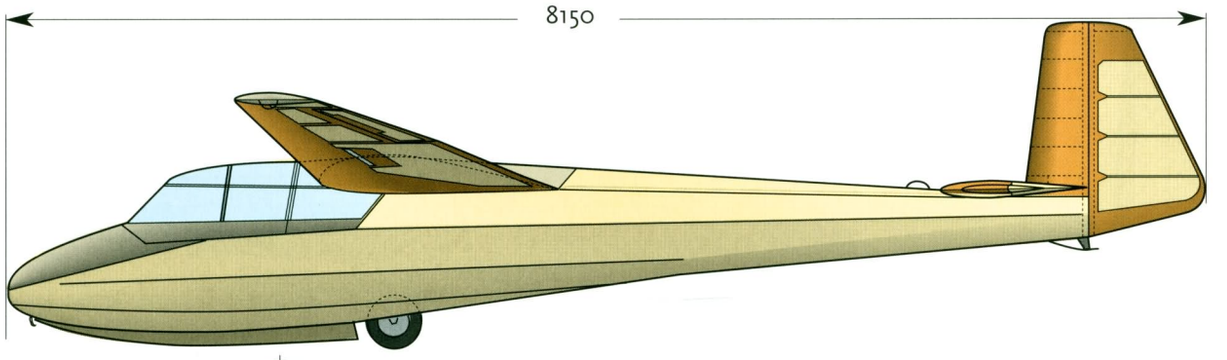
In 1955 came the Ka - 2B. The span was extended to 16 metres, yielding a slight improvement in performance. This was done in the simplest possible way by adding extra rib bays at the tips. Some strengthening raised the total structure mass by 24 kg. The dihedral was increased from 2.5 degrees to 4 to improve handling in circling flight, and the washout (negative wing twist) was increased from 1 to 4 degrees, reducing any tendency toward tip stalling.

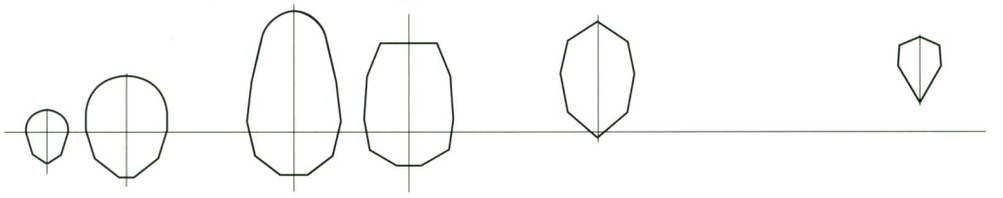
Production of the Ka - 2B continued until 1957, by which time 75 had been built. There were some kits supplied to amateur builders and some exports. A single Ka 2B was built in Australia from scratch, by an amateur group. In 1959 Dieter Schmidt and Karl Pummer broke the German National altitude record in a wave flight at Fayence in France, with a climb to 6907 metres in the Ka - 2. At the St Yan Internationals in 1956 the Turkish pilots A Yaykin and Z Argun flew their Rhönschwalbe to 7th place in the two seat class.

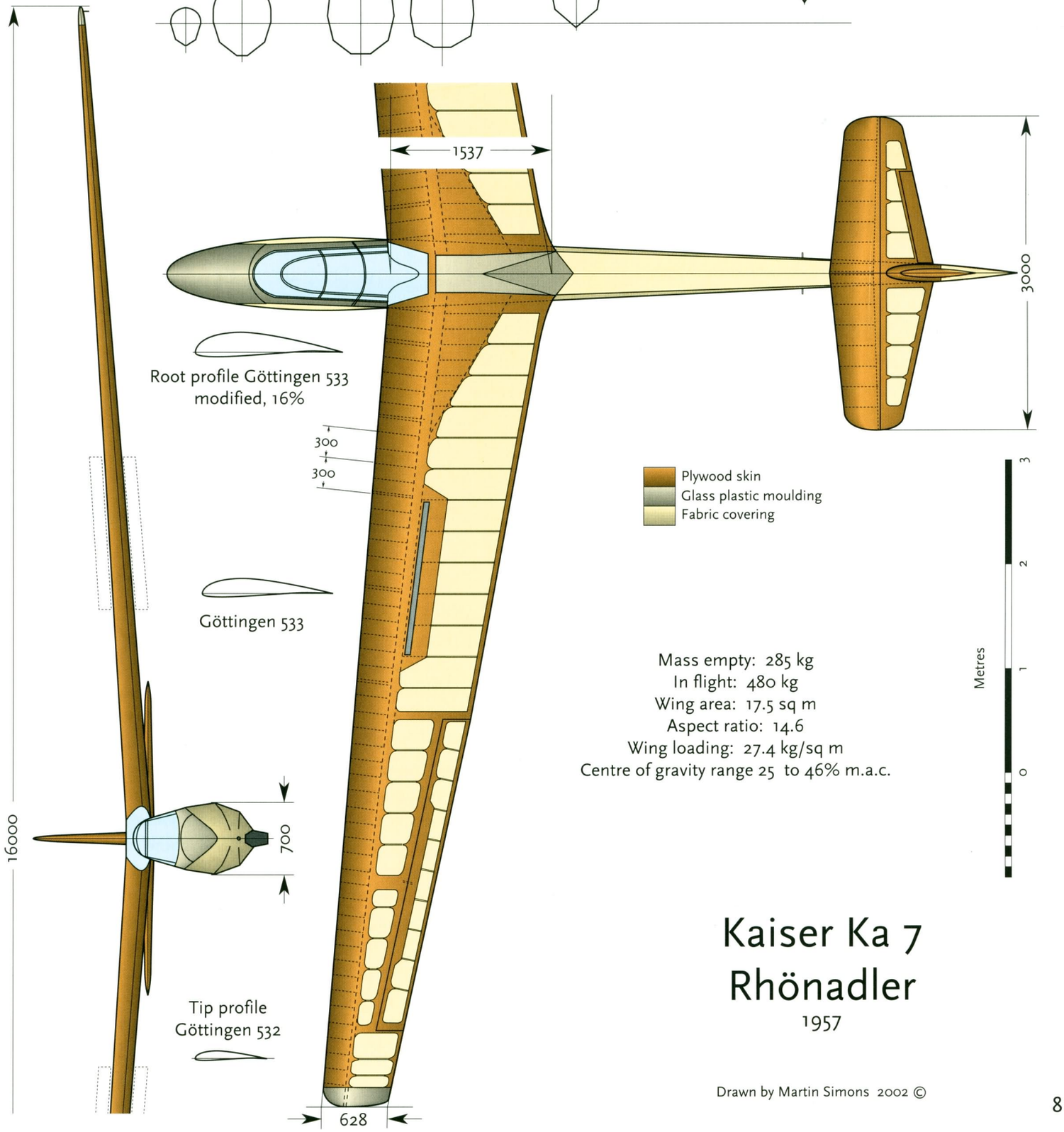
Kaiser Ka - 7 Rhönadler

With the Ka - 2 and Ka - 7 in 1957 Kaiser did the same as he had done with the Ka - 1 and 3. Using an identical wing and tail unit, a new fuselage was designed as a steel tube frame with fabric covering. It was feasible now to use some small glass plastic moulded components for wing tips and the fuselage decking in front of the cockpit. Otherwise all the important dimensions were the same. The Ka - 7 was structurally a few kilogrammes heavier but this made no effective difference in every day operations. The original cockpit canopy, built up in steel tubing and covered with separate pieces of transparent plastic, was soon replaced with a moulded bubble. Production began as soon as the new type had been tested and proved. By 1966 over 500 of the Ka - 7 had been built and they were exported all over he world. There was production under licence in Switzerland, Belgium, the Netherlands and Italy.

A great many of the Ka - 7 remain in use in many countries. It has often been pointed out, and experience confirms, that a sailplane with steel tube fuselage and wooden wings is likely to last for a long time. When the Ka - 7 was finally replaced on the production line it was with another of the same type, but with a wing mounted lower on the fuselage. This was the Ka - 13.



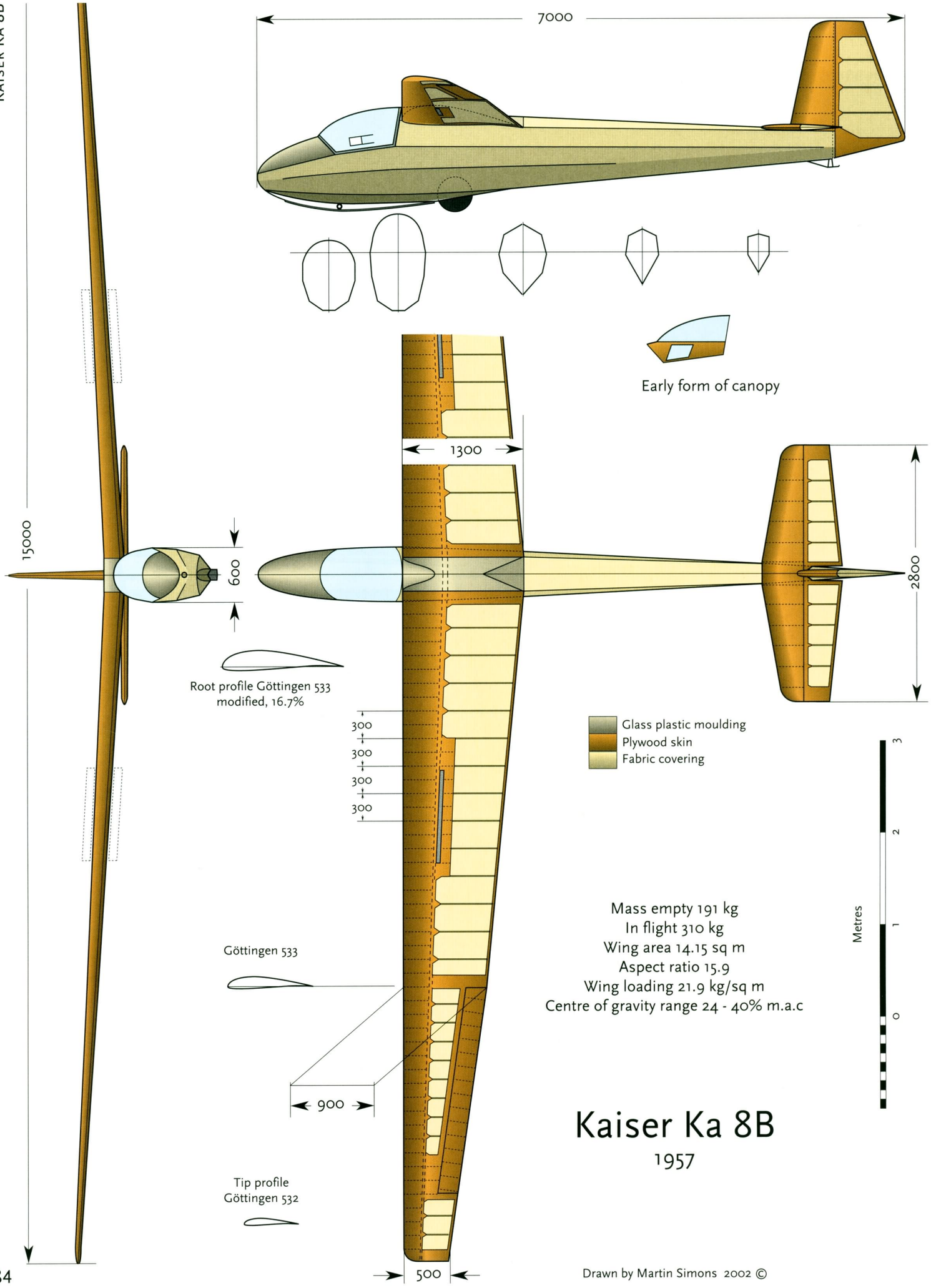




Mass empty: 285 kg
In flight: 480 kg
Wing area: 17.5 sq m
Aspect ratio: 14.6
Wing loading: 27.4 kg/sq m
Centre of gravity range 25 to 46% m.a.c.

Kaiser Ka 7 Rhönadler

1957



Mass empty 191 kg
In flight 310 kg
Wing area 14.15 sq m
Aspect ratio 15.9
Wing loading 21.9 kg/sq m
Centre of gravity range 24 - 40% m.a.c

Kaiser Ka 8B

1957

Right: The Ka - 8 became a very popular club sailplane for early solo flights. This is at Sutton Bank in Yorkshire.

Below: Ka - 8 at Terlet in the Netherlands.

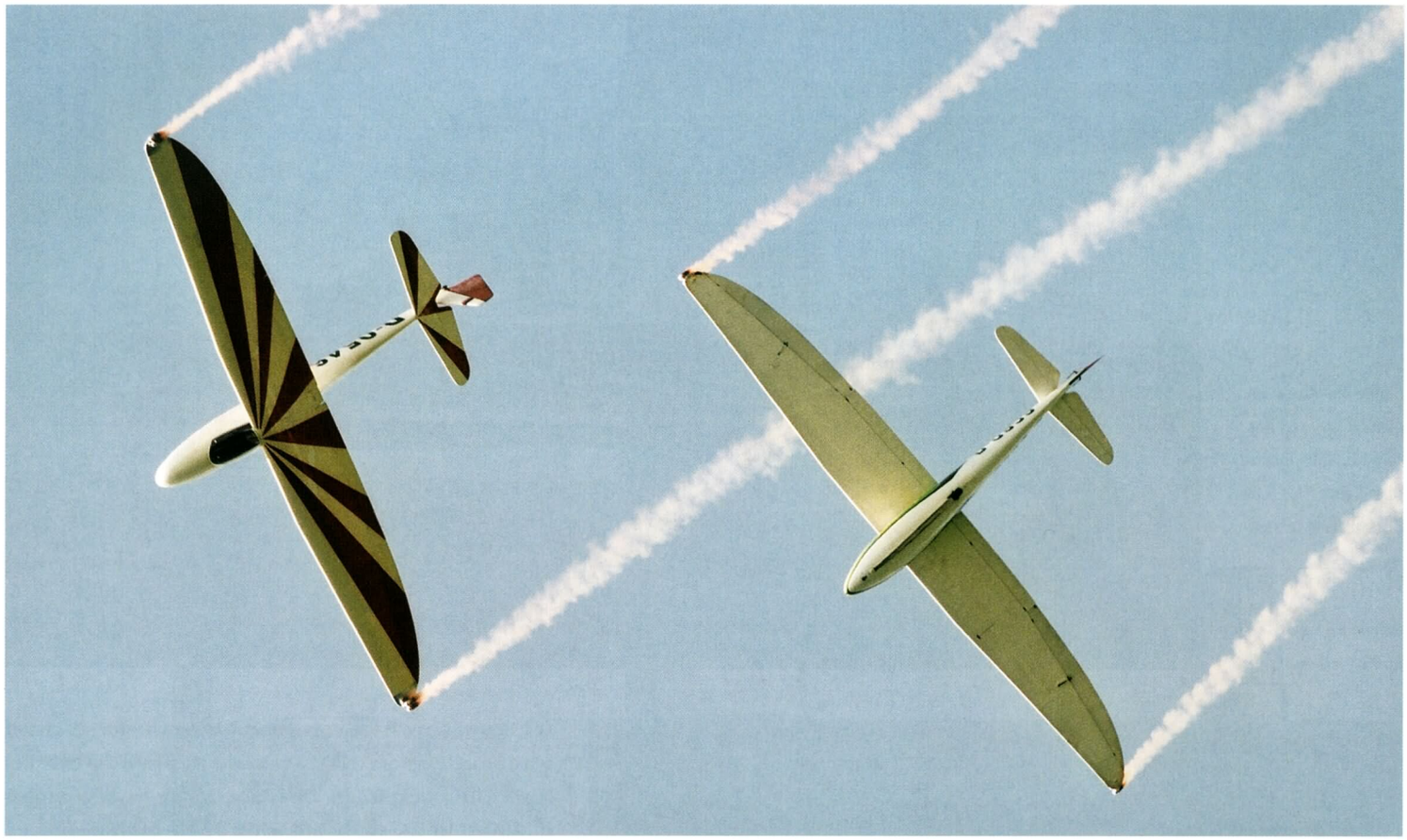
Kaiser Ka 8

The Ka - 8 may be regarded as a single seat version of the Ka - 7. It flew first in November 1965 but only half a dozen were built of this version. Improvements were made to the ailerons and the cockpit canopy, resulting in the Ka - 8B, which entered production in March 1958. It proved very popular with clubs as an early solo sailplane but was capable of cross-country flights, up to and beyond Silver C standard. The Ka - 8 established a reputation for soaring in weak thermals that few other sailplanes could match. Both Wolf Hirth at Nabern Teck and Schempp-Hirth in Göppingen undertook licence production, and kits were made available for amateur building. More than 1180 examples were completed, worldwide, and a few more of the Ka - 8C version of 1973, which had minor improvements to the front fuselage, tail unit and undercarriage. Schleicher decided not to proceed with this after ten were completed. Kaiser went on to a more radical development, the ASK - 18 of 1974 - 5. There was also a Ka - 9, which had a reduced wing span of 12 metres. Kaiser produced this privately for amateur builders, but only two were completed. Various experiments in self-launching were carried out with the Ka - 8 fitted with small motors, either in the nose or on a pylon behind the cockpit, in one case even with a motor mounted in the starboard wing. None of these proved very satisfactory.

Vogt Lo 100 & 150 Zwergreiher

The Lo 100 Zwergreiher (Dwarf Heron) was designed and the prototype built by Alfred Vogt. When he was in his teens in 1935 he had helped his brother, Lothar, to build a 10.5 metre span aerobatic glider, the Lo 105. Lothar was killed in 1938 (not in the glider, which was not finished at the time) and when Alfred began work on the new design in 1951, he retained the Lo in memory of him. From the first it was intended that the sailplane should be fully aerobatic. For this reason it had the small span of 10 metres, the 100 in the name relating to this measurement.

The wing was thin, using a Clark Y profile fitted with flaps. The ailerons were coupled to the flaps so that they could be moved together up or down. The reflexed position allowed prolonged inverted flight. There were neither spoilers nor air brakes, the flaps being lowered for landing. The construction was in wood and quite orthodox. Care was taken to make sure the structure would withstand high speeds and high loads during flight. The wing was built in one piece, thus saving much weight at the roots where no large metal fittings were required to carry the bending loads from the spar. The final structure weight without load was 155 kg. For the full aerobatic routine the allowed cockpit load was 90 kg, enough for most pilots to carry a parachute. If aerobatics were not intended, a heavier pilot could fly the Lo 100.



Above: The Lo 100, designed by Alfred Vogt, was fully aerobatic and widely used for air displays. © Messe Berlin, Chris Sorensen
Below: The Lo 100 at another kind of airshow, in Friedrichshafen.

The first flights were in August 1952 and the aerobatic capability of the small sailplane attracted much attention. Series production was undertaken by Wolf Hirth at Nabern Teck. During the year 1953 - 1957 some fifty were built. The Lo 100 became a familiar and very popular item at air displays, some specialist pilots staging very spectacular shows, including 'mirror image' performances with two Lo 100s flying together, one inverted immediately above the other.

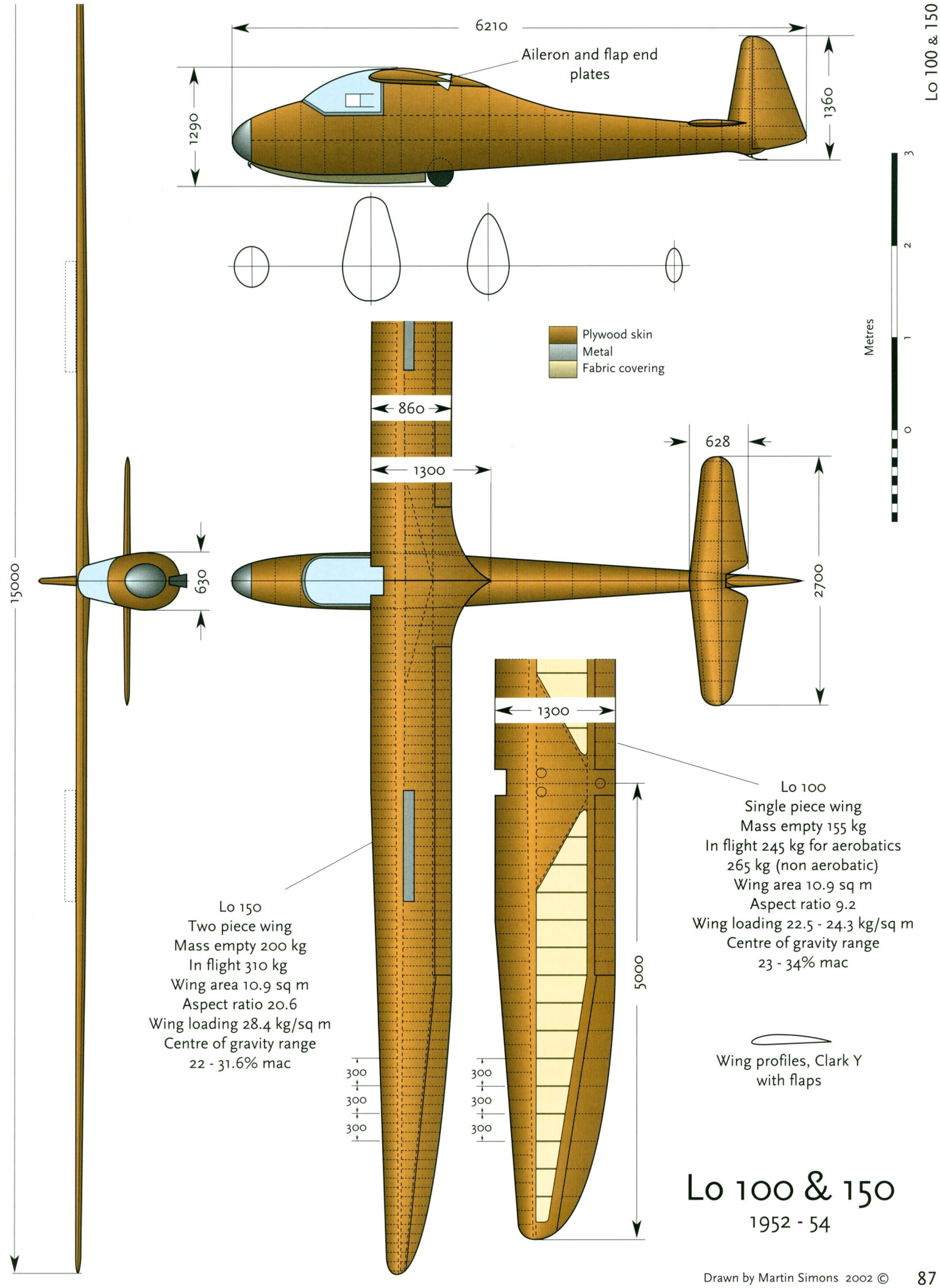
In 1953 Vogt decided to adapt the Lo 100 for soaring and designed a wing of 15 metres span to produce the Lo 150. The fuselage and tail were retained, the wing roots being extended in width so that it was not even necessary to change the fuselage attachment points. The wing was now divided into two. The aspect ratio was over twenty, considered very high, and the wing loading was also much greater than most contemporary sailplanes.

The Lo 150 showed itself capable of very fast cross-country flights in good conditions, some of the greatest successes being in countries where thermals were strong and pilots could take advantage of the Lo 150's fast glide. In Australia, Tony Goodhart,[22] a British Navy officer on secondment to the Australian Navy, took delivery of an Lo 150 in December 1955. On 9th January of 1956 he made a world record for speed round a 300 km triangle, the average being fractionally under 75 km/h. He won the Australian National Championships. Goodhart found fault with the directional stability but the Lo 150 was a very good performer in Australian conditions. It was, he said, a fast cross -country aircraft, not for the pilot who wanted only to do some local soaring. The flaps were especially useful in reducing the stalling speed and allowing tight turns in some of the strong, but narrow, thermal cores.

In the USA A.J. Smith won the National Championships with his Lo 150 in 1961, and Harold Jensen made a distance flight of 700 km to win the Barringer Trophy in that year.

Wolf Hirth himself flew a Lo 150 in his home area and it was in this aircraft that he suffered the heart attack, which caused his death in the ensuing crash, in July 1959.

22 - Brother of Nick Goodhart



Lo 150
Two piece wing
Mass empty 200 kg
In flight 310 kg
Wing area 10.9 sq m
Aspect ratio 20.6
Wing loading 28.4 kg/sq m
Centre of gravity range
22 - 31.6% mac

Lo 100
Single piece wing
Mass empty 155 kg
In flight 245 kg for aerobatics
265 kg (non aerobatic)
Wing area 10.9 sq m
Aspect ratio 9.2
Wing loading 22.5 - 24.3 kg/sq m
Centre of gravity range
23 - 34% mac

Wing profiles, Clark Y
with flaps

Lo 100 & 150

1952 - 54

HUNGARY

There was a lively soaring movement in Hungary and a strong tradition of local design and production of sailplanes, exemplified by the Karakan and Nemere of Louis Rotter, and the M - 22 aerobatic sailplane which was built in some quantity and remained popular. The most prolific sailplane designer was Ernö Rubik.[23] Born in 1910 he produced more than thirty designs of his own, beginning in 1935 and continuing well into the 1980s. Post war, Rubik was head of the design office of the Alagi Központi Kiserleti Üzem Dunaakeszi, in Esztergom, which was later taken over by the MME, Müzseripari Müvek Esztergom. In this position he acted as adviser to other, younger designers.

Rubik R - 22 SV Super Futár

The Rubik R - 22 series of single seat, cantilever high performance sailplanes had a long history of development. The prototype Futár (Courier) flew in 1944, the R - 22 S 'Junius 18' (June 18th) in 1950. The V - tailed Junius 18 and the R - 22 SV Super Futár followed and finally the Super Futár C and Standard Futár came in 1958. All were of wooden construction with spans 15.7 or 15.8 metres (15 for the Standard Futár). Except for the experimental R - 22 S Laminaris, all had the basic Göttingen 549 wing profile slightly thickened at the root.

The SV version had a semi-retracting wheel and plywood skin covering all the wing except the Frise type ailerons. The wing was double tapered to approach as closely as possible the ideal elliptical plan with Schempp-Hirth air brakes. Streamlined wing tip bodies were fitted. The tailplane had a slight dihedral angle and when the sailplane was dismantled for road transport, the tail folded upright against the fin.

The most unusual feature was the elevator arrangement. The tailplane itself was of symmetrical section as normal but coming to a sharp trailing edge at the point where, usually, the elevator is hinged. The elevator was a separate small wing, also with a full symmetrical profile with a gap between it and the tailplane. At each end of the elevator an extension projected forward to pivots in corresponding internal positions close to the upper surface of the elevator. There may have been some small saving of drag when the elevator was deflected.

The Futár series seem to have made little impact on the International Competition scene. Hungary did not compete at all in the World Championships until they were held in Poland in 1960. On that occasion the Standard Futár, flown by Nándor Opitz, placed 11th in the Standard Class. This was the occasion when the OSTIV Design Prize for the Standard Class was first awarded. The winner

Above: The R - 26 Gobé on a winch launch. Photo by Joachim Ewald
Below: The Super Futar in 1996 at the Vintage Glider Club rally in Hungary. Photo by Chris Wills

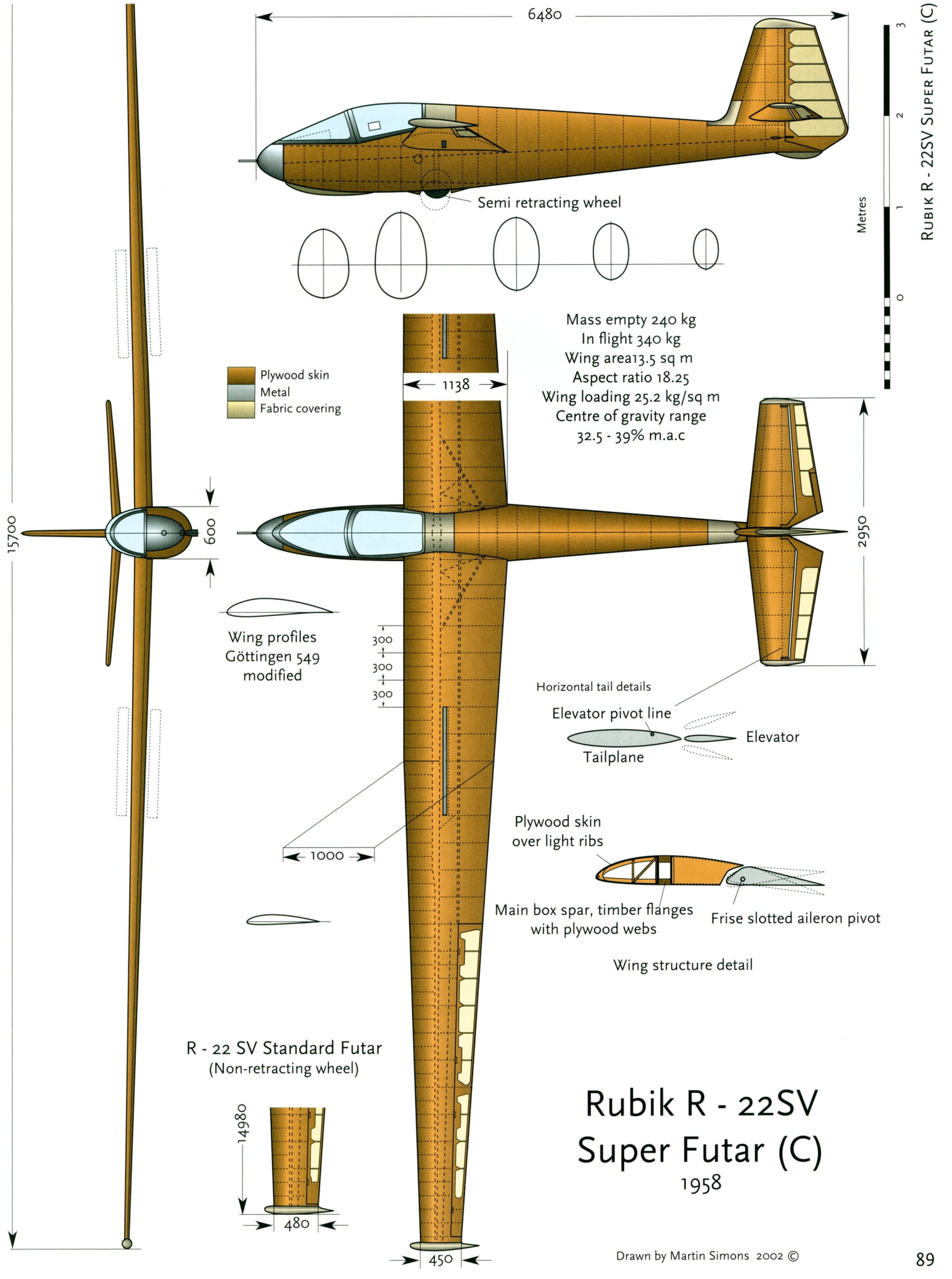
was the Kaiser Ka - 6. Probably it counted against the St Futár that it weighed about 50 kg more than the German design, but so did the winner of the soaring competition, the Polish Mucha Standard.

Rubik R - 26 Gobé

A training two-seat sailplane must be safe to fly, stable yet responsive to controls in a normal and predictable manner, and strong enough to withstand inevitable rough landings. It is also very important that the instructor, invariably in the rear seat of a tandem, should have an excellent view. The R - 26 Gobé (Chieftain) met all these criteria. It was all metal except for fabric covering on the wing behind the main spar, the rudder and elevator, and the sides of the fuselage. The wing skins forming the D sectioned wing-nose torsion tube were unusual for a sailplane, being gently corrugated to increase their stiffness without adding unnecessary weight. This was not Rubik's first metal sailplane, nor the first with corrugated skins. This type of structure was developed for the R - 23 Gébics, and was to be used further for several other sailplanes of various types.

The Gobé prototype flew first in 1960 with a V - tail mounted on a tapered, built up metal tail boom. This was considered unsuitable

23 - Father of the Rubik who devised the famous puzzle, Rubik's Cube



Rubik R - 22SV Super Futar (C)

1958

Rubik R - 26 Gobé

1961