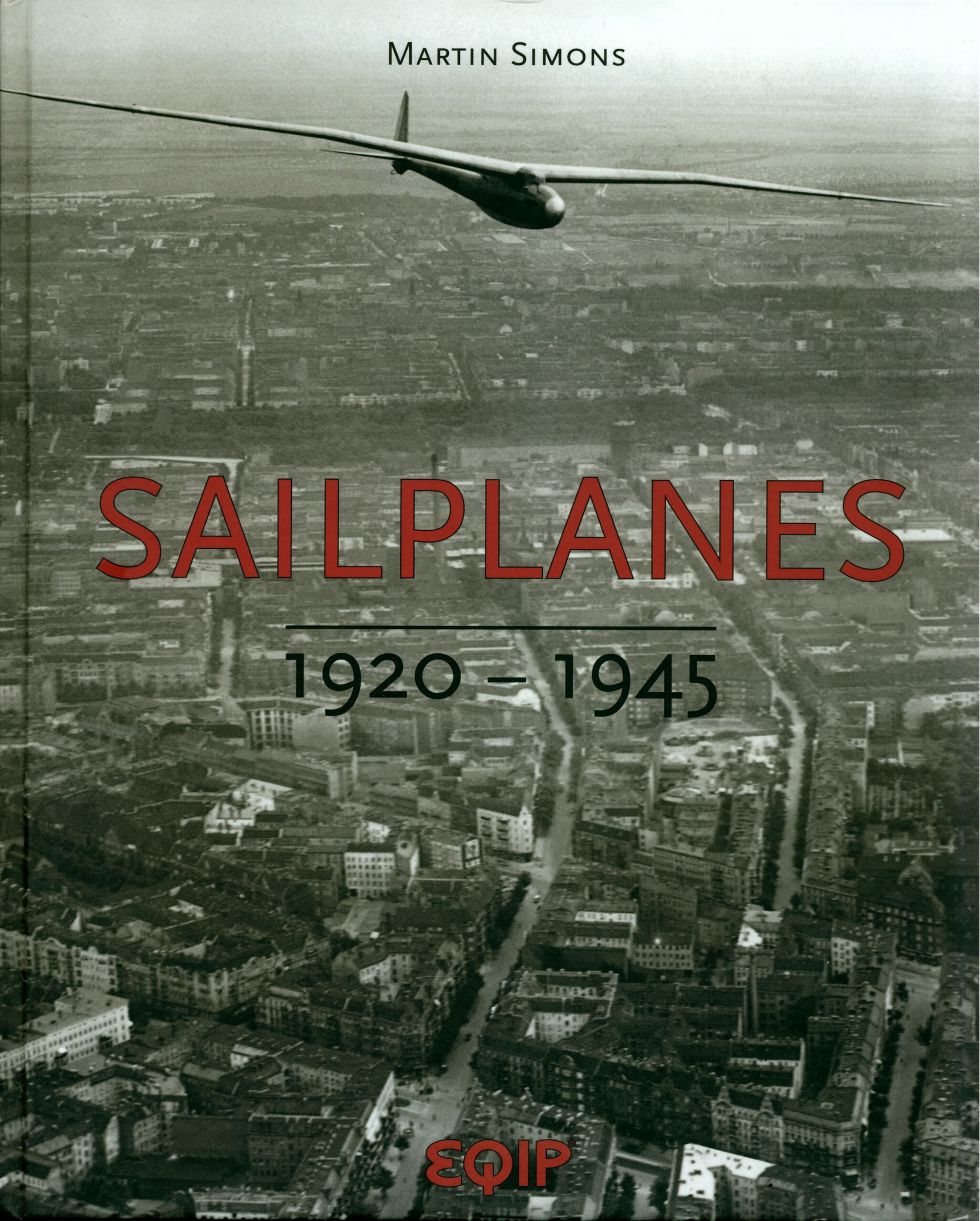
MARTIN SIMONS



SAILPLANES

1920 – 1945

EQIP®

„Their slim shapes are smooth to touch and slippery like ice. Their rounded backs catch the light and reflect it like polished glass. Their curves are symmetrical, continuous, and blended into one another as geometrical designs which are happily married. When their wings are against the sky they are transparent, and you can see their ribs against the light beyond. No bird has better-shaped wings, no wings were ever spread in such a challenge. To see them is to know that they can fly. It is clear that they belong to the wind and the sky and that they are part of it as much as the clouds of a summer day."

Terence Horsley, Soaring Flight, 1944

2nd Revised Edition, 2006

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.

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Contents

PREFACE

My first experience of sailplanes was on 15th July 1939 when, as a child of nine years, I visited the British National Gliding Competitions, held at Camphill in Derbyshire. The indulgent father of my friend Brian possessed a small car. He took us boys out for the day to this bare, exposed stretch of upland some 24 kilometres south west of Sheffield where we lived. I had always been fascinated by the idea of flying, as many were. I had seen occasional biplanes passing over our suburb and all the kids in the school yard had once watched a sky writer advertising washing powder.

Gliding was a mystery to all of us. I thought it must be something like sledging which, when there was snow, we did in the streets near home. We could pay a halfpenny, or sometimes a full penny, in the sweet shop for little aeroplanes made of card. These flew well when catapulted into the air with the rubber band (supplied), but they always came down quickly. Today, it seemed, we were to see big gliders, carrying grown men, being thrown off the top of a hill with big rubber bands.

Within minutes of arriving at the flying field, I was enraptured. There began an obsession which has continued for the rest of my life. Not catapults and mere toboggan rides down to the valley floor, but steep, swift ascents like kites pulled up on wires, wings spread against the sky, then long, floating, graceful flight, flute like sounds, smooth turns and gentle landings.

Long afterward I learned that this summer day had been poor for soaring. Only three pilots were able to scratch away from the site in weak thermals. The best distance for the day was a mere 20 km. I didn't see any soaring, or if I did, failed to understand. All I observed were winch launches and circuits hardly longer, though much more beautiful, than those of my halfpenny toys.

Brian and his dad were soon bored and wandered away from the action. They did not see, as I did, one of those beautiful, bird like aircraft with arched translucent wings and gleaming, varnished skin, flying away from the winch with the cable still hanging on. It stopped with a jerk, dived and slammed into the ground to disintegrate in a cloud of dust a few hundred metres from where I stood. I hardly needed to be told the pilot was dead. Later I stared long and sadly at the wreckage, stacked against a wall behind the hangar. That lovely wooden shell was splintered and crushed, bits of fabric still gleaming but torn and flapping wretchedly in the breeze.

How could such a thing have happened to such a wonderful craft? Gliding, so lovely to see, was evidently not without dangers. Such beauty and grace were not achieved easily. A few weeks after that visit, war came. All civilian flying in Britain was forbidden for six years.

I read everything I could find about gliding and soaring. There was little within the comprehension of a child, but I learned and began to collect pictures, drawings, articles, books. One of the most inspiring books about gliding I ever discovered was Soaring Flight by Terence Horsley, published when I was fourteen. I read it avidly and met the author soon afterwards. I still find his writing admirable. The quotation on the title page here comes from Terence's book. It captures in a few words all the sense of awe I felt when I watched sailplanes performing gentle, almost silent, circuits above my head, and when I stared and even touched them on the ground. I did not imagine I should ever be able to fly in one myself. Men who did that, I thought, must be demigods. My parents were strongly opposed to such ambitions.

I did learn to fly as soon as I could. No demigod, I have continued ever since. I have flown about a hundred sailplane types and my archive of books, articles and photographs has never ceased to grow. There is much more literature available now, as the bibliography shows.

In preparing this book, and my earlier writings, I have had help from innumerable people and organisations. As many as possible are listed in the Appendix. For the present volume special thanks are owed to Marici Phillips for translations from Japanese, Brigitte Keane for help with German texts, Vincenzo Pedrielli for advice, photographs and drawings from Italy, Raul Blacksten, archivist for the Vintage Sailplane Association of the USA, Chris Wills, old friend and President of the Vintage Glider Club, Marton Szigeti, who provided several photographs and my publisher, Klaus Fey of EQIP GmbH, whose idea it was to make a new book and who has supported and encouraged me at all stages.

The book is about sailplanes, much less about designers, pilots and advanced techniques. This is no doubt a fault, but it was the aircraft themselves that fascinated me at the beginning. For those whose interest is chiefly in the people involved, or the influence gliding has had on other aspects of aviation and history, or competition strategies in modern soaring, the bibliography lists many references to be followed up.

Martin Simons
Adelaide, 2001

Introduction

The early history of flight has been written many times by other authors and will not be repeated here. A question still requiring an answer is, why did gliding not begin sooner than it did? Controllable kites for sporting combat were flown in ancient China where there are legends of men being carried aloft by them. There were sailing ships and windmills all over the world. No one could doubt the power of the moving air to raise roof shingles, drive boats, pump water and grind corn. Superstition and fear of the gods did not prevent people trying to fly. They usually injured or killed themselves by jumping off towers or cliffs. All the necessary materials and techniques needed to build simple gliders were available, yet not even the genius of Leonardo da Vinci produced anything remotely airworthy.

The first successful gliders were designed and built by the Yorkshire baronet, George Cayley in 1804. He flew 'free flight' models based on a simple kite and built one big enough to carry a boy, probably a household servant, for a few metres. After a long interval, Sir George's man - carrying glider flew in 1849 - 53. The coachman who had been persuaded to act as pilot, survived the flight but resigned at once. Despite Cayley's publications, no one showed any interest. A modern replica of the glider has been flown and proves that Cayley understood the essentials.

Otto Lilienthal began to fly hang gliders in 1891. It was his successes that led directly to the inspired, but business-like, work of the Wright Brothers. They made many gliding flights to develop methods of controlling their aircraft before the extremely brief 12 second powered flight in 1903. It was not until 1905 that they could measure their aeroplane flights in minutes. Not till 1908 did they fly for an hour and were confident enough to demonstrate their success fully in public.

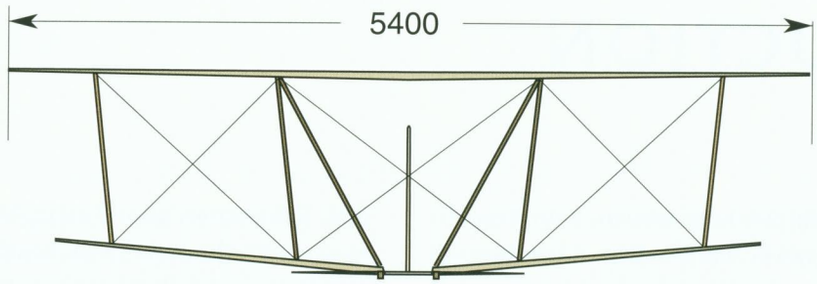
Early pioneers thought of gliding as a mere preliminary to powered flight, but Lilienthal himself had noticed that sometimes he would gain a little height from the wind blowing up a slope. In 1909 E.C. Gordon England, flying a tailless glider built by José Weiss, made a brief soaring flight at Amberley Mount. More significantly, Orville Wright at Kitty Hawk in 1911 soared over the steep dunes for more than nine minutes and afterwards wrote that there was no reason why a duration of several hours could not be achieved. When, at the age of 68, he was asked about the purpose of these experiments he remarked that the brothers had always known it was more fun to fly gliders than powered aeroplanes.

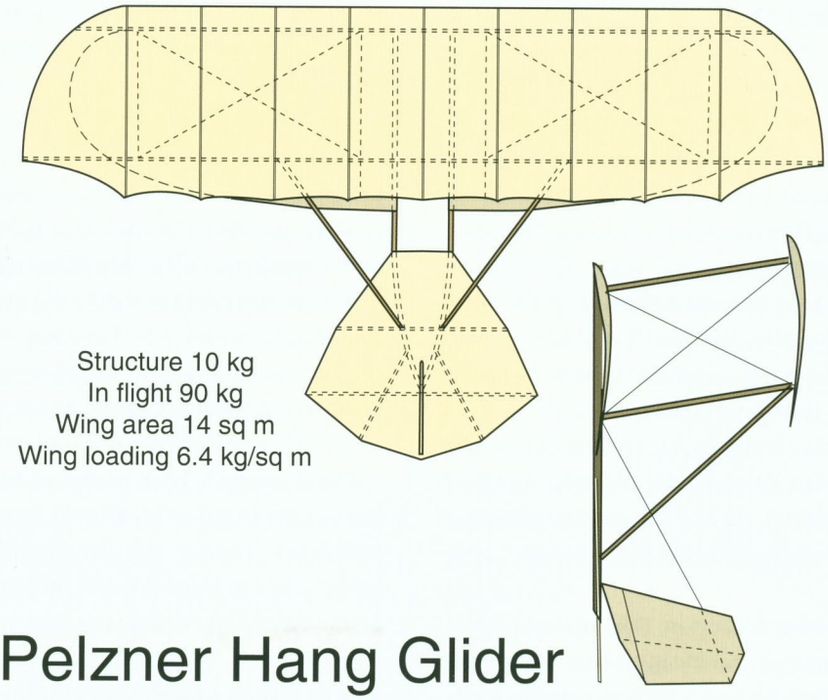
In 1909 a group of schoolboys from Darmstadt formed a club, the Flugsport Vereinigung Darmstadt, and began a systematic and well organised series of trials. Needing more space than they could find near home, they chose in 1911 to continue their gliding on the Wasserkuppe in the Rhön district of central Germany, near Gersfeld. The pastures on and around the summit were made available to them by the local cattle breeders. The land was (and still is) swampy in some places, for here were the springs of the Fulda River, but slopes free from obstructions could be found facing any wind direction. The boys spent the summers of 1911 and 1912 camping there. Their best flight was about 800 metres distance. Their club then was absorbed into a Darmstadt powered flying group and dissolved. World War came soon afterwards. Half the original members of the FSV were killed.

By their choice of the Wasserkuppe, the Darmstadt club had a profound and unanticipated influence on the future development of soaring. Reports of their flights had been published in the magazine Flugsport. After the armistice, Germany plunged into the depths of economic and political crisis which threatened to destroy the nation entirely. The Versailles treaty, finalised in 1919, forbade the construction and flying of aeroplanes. The armed forces of the victorious powers occupied the country, ensuring that this ban and many other restrictions, were enforced.

The Darmstadt boys were now remembered. Erich Meyer, a student at the Dresden Technical University, with his friend Wolfgang Klemperer, another Dresden engineering student, discovered that gliders, in the official mind, were not aeroplanes and so were not forbidden. Meyer published a series of articles in Flugsport, showing how such craft could be built easily at minimal cost. It was a way of getting into the air without running foul of the distasteful law. In March 1920 Meyer and Klemperer published an invitation for a gliding competition, to run from the second week of July till the end of August. It would be on the Wasserkuppe where the schoolboys had proved the ground. No one ever seems to have questioned the choice of site. This was probably not the best possible place in Germany, the weather was often bad with low cloud settling on the top, there was no road, no shelter, no facilities except an isolated tavern, little more than a hut for hikers, on the very summit at 950 metres above sea level, the Baude. This opened only in the summer. To search for another location would take too long. The Wasserkuppe it was to be and the Wasserkuppe it was. The Baude was a very necessary refuge but even to find it in the all too common bad weather, was not easy.

The editor of Flugsport was the enthusiastic Oskar Ursinus who threw all his weight and influence behind the young men's proposal and offered to help organise the event. He knew where to look for financial support, Karl Kotzenberg, a wealthy businessman in Frankfurt. A generous cheque was written, a managing committee was formed and Ursinus set to work. When the time came, tents and small huts were erected on the mountain, and from 20th July the first competitors began to arrive.

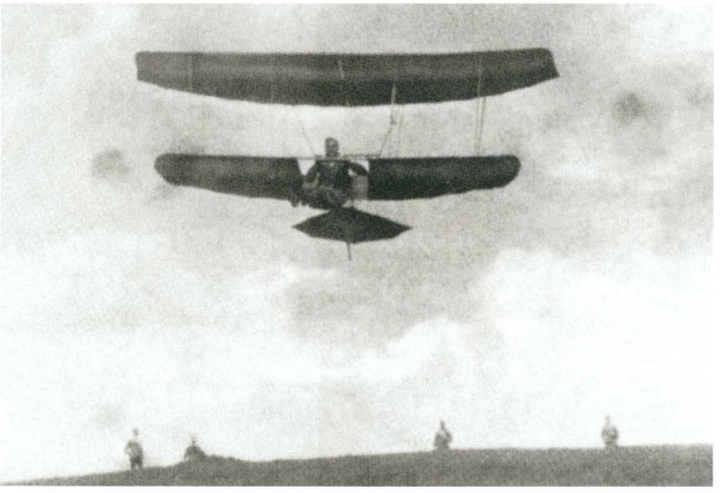


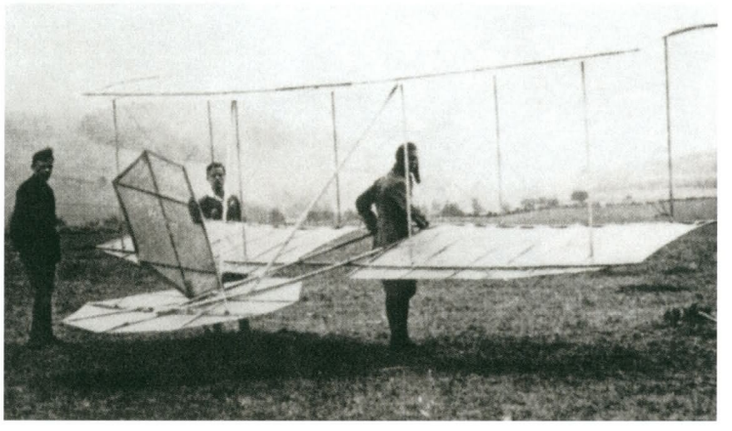


Structure 10 kg
In flight 90 kg
Wing area 14 sq m
Wing loading 6.4 kg/sq m

Pelzner Hang Glider
1920 - 22

Chapter 1 The discovery of soaring





Pelzner with his hang glider

By most standards the first Wasserkuppe meeting was not successful. Aeroplanes had been flying reliably for more than ten years and, partly under the pressures of war, a great deal of theory and good practice in construction and pilotage had been worked out. But some of those arriving at the first gliding contest lacked understanding. They produced strange and even dangerous contraptions which either would not fly at all or, if they did get into the air, collapsed almost at once through structural failure or mishandling, or both.

There was, and perhaps still is, a type of ambitious person so determined to demonstrate the validity of some half mystical belief that they are prepared to stake everything, including life itself, on their convictions. Rather than proceeding by careful and methodical trials and learning from other people's experience, they try to fly instantly like birds without the many millions of years of evolution which brought birds to their present condition. Not much better than the ancient tower jumpers, they failed. This kind of thing continued to some extent for years.

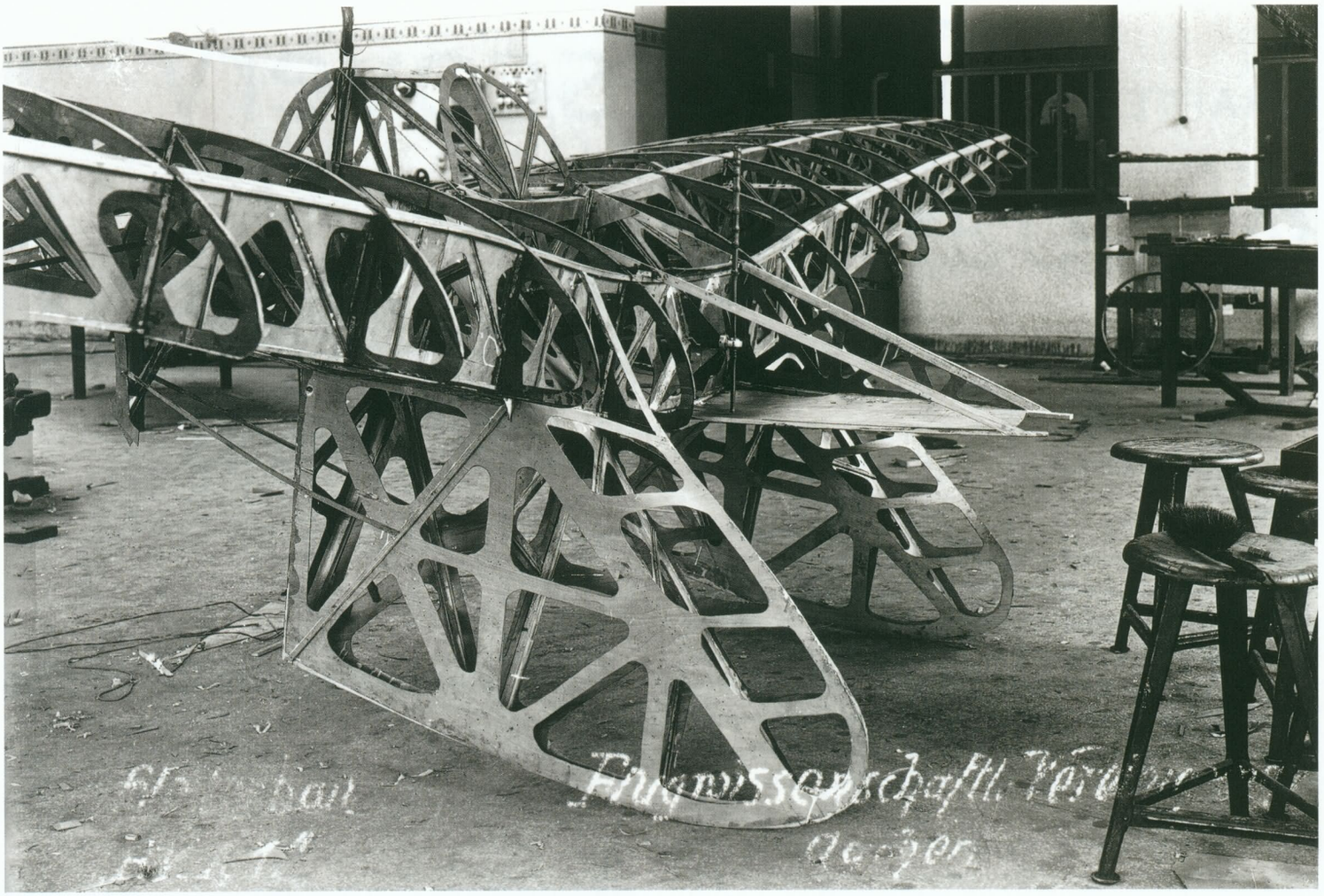
It was recognised that for a glider to make long flights it would be essential somehow to extract energy from the air. No less a person than Gustav Lilienthal, brother and helper of the great Otto, devised a 'rams-horn vortex' theory which, he claimed, would keep a glider aloft by trapping a rotating mass of air below the wing, to drive the aircraft forward. This amounted to a belief in perpetual motion. Quite a lot of hopeful constructors, even skilled craftsmen, lacked the education to see through these claims, and were misled. Some wasted years and small fortunes. Even when regular scheduled airliners were operating outside his shed on the airport in Berlin, Gustav was still trying to build a weird and impractical flying machine.

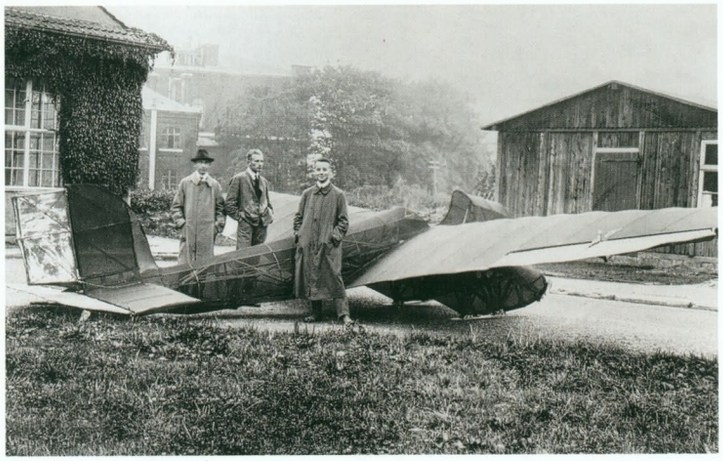
Only about ten gliders actually made flights at the Wasserkuppe in 1920. Most of these took off only once, usually landing with serious damage. One aspirant who had expended weeks of work, in despair at the end of the meeting, smashed his creation to bits with a hammer and then sat down weeping.

More distressing than the numerous failures to get off the ground at all, one of the more promising aircraft, the biplane of Eugen von Loessl who did achieve one good, controlled flight, lost its elevator on the next attempt after covering about 800 metres. It crashed and Von Loessl died.

Pelzner

For most of that first Rhön meeting, it seemed that the only way forward was through hang gliding. Willy Pelzner built himself a very light biplane hang glider of 5.4 metres span, weighing only 10 or 15 kilogrammes but well braced, the wings and tail unit covered with





Above: The FVA - 1 Schwatze Düvel under construction in the workshop of the Aachen Technical University. The deep wing profile at the root allowed the strong but very light spars to be fully enclosed without external struts or bracing wires.

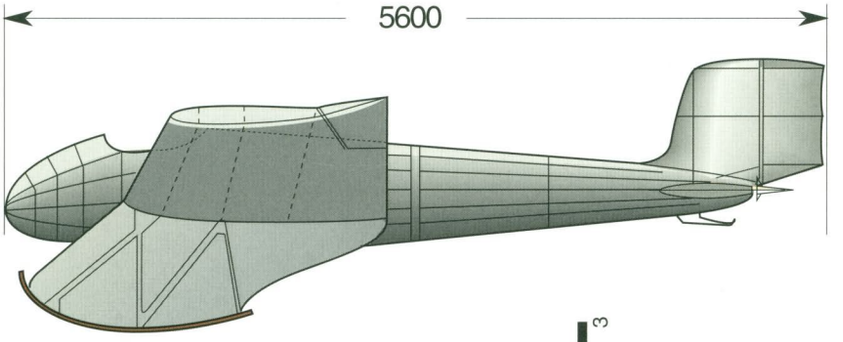
Below: Completed, the Schwatze Düvel was prepared for the railway journey to Gersfeld. On the left is Wolfgang Klemperer, the designer, on the right Peter Terkatz who had the job of riding secretly with the glider in the railway truck, hidden under tarpaulins.

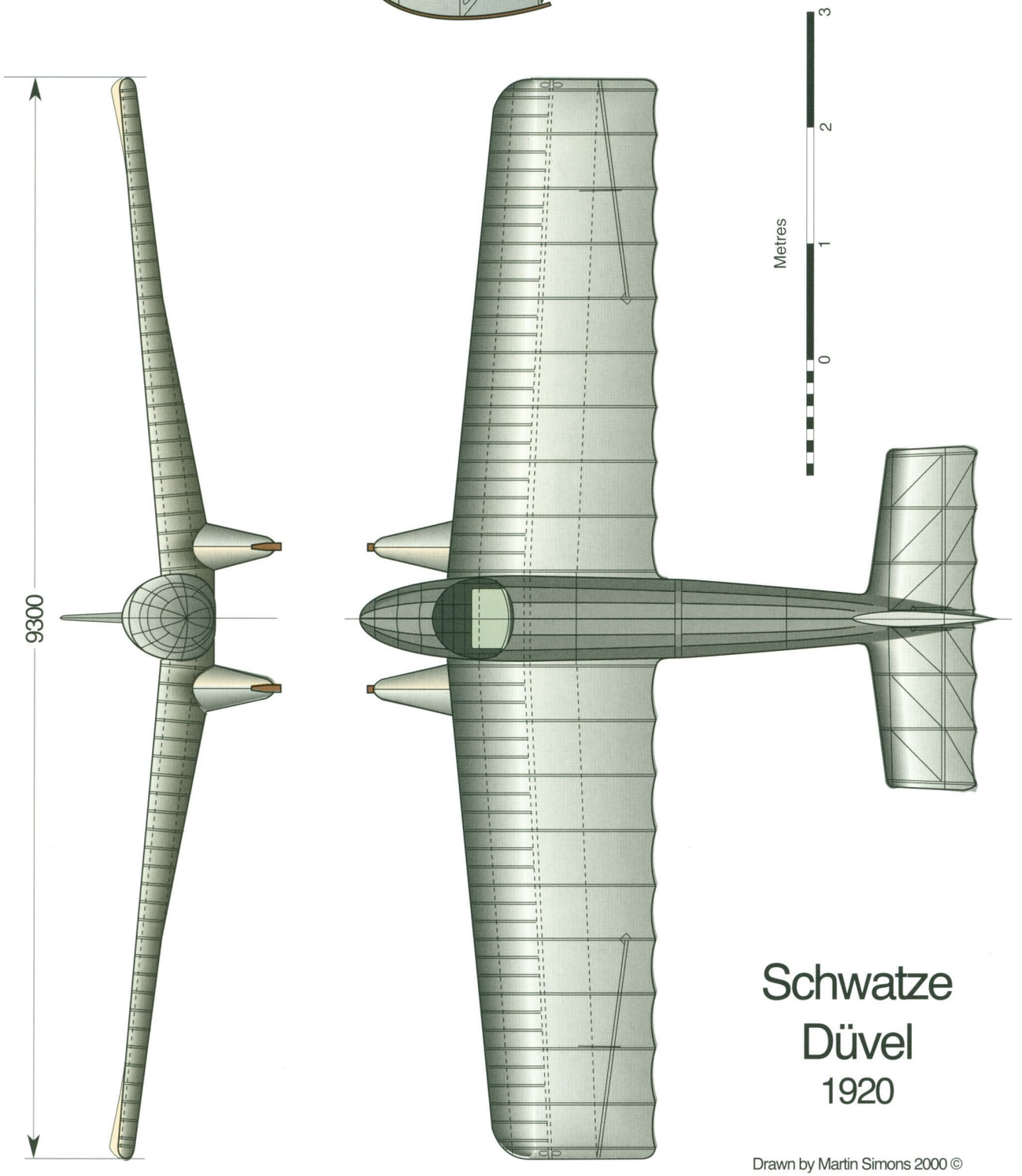
oiled paper. Almost tirelessly, he repeatedly carried his glider to the top of the hill facing the wind, ran forward, took off, controlled the flight by swinging the weight of his body and legs this way or that as needed, and glided to land somewhere down the slope. Pelzner's best flight covered 452 metres distance and lasted 52 seconds. Altogether he achieved 16 recorded flights for a total of 2728 metres, an average of 170 m. This, it seemed, was the best anyone could do.

Schwatze Düvel

It had been a very depressing month. The situation was saved at the last moment. Bad weather ruined the last few days of August so the meeting was extended for another week. Belatedly, from the Technical University of Aachen, came the FVA - 1 Schwarzer Teufel or in the dialect form Schwatze Düvel, the Black Devil. It had been built in a great hurry by members of the Flugwissenschaftlichen Vereinigung Aachen , a student club, one of the academic flying groups or Akafliegs which were to play, and still play, a crucial role in the development of soaring. Wolfgang Klemperer, who at the beginning with Meyer had formulated the idea of the gliding contest, was now a lecturer at Aachen Tech under the outstanding Professor Von Kar-

Structure 62 kg
In flight 136 kg
Wing area 15 sq m
Wing loading 9.07 kg/sq m
Aspect ratio 6.02





Schwatze Düvel
1920

Drawn by Martin Simons 2000 ©

Above: Several examples of the FVA - 2 Blaue Maus were built to order by the FVA. This one was flown by its owner, Mr J. Jeyes, at the 1922 Itford Hill meeting in England, but after take off he drifted into the hill slope, touched a wing tip, cartwheeled and reduced the glider to matchwood. Another of the type was used by Klemperer in experiments to launch gliders from a balloon.

Left: One of very few photographs of the Schwatze Düvel in flight, immediately after launching. The rubber bungee method of launching was invented by Wolfgang Klemperer.

Below: The Blaue Maus after landing in the valley near Gersfeld in 1921. Klemperer stands at the nose.

man. Klemperer designed the FVA 1, a simple monoplane with cantilever wings and orthodox controls, elevator, rudder and ailerons, lightly built but stressed properly and braced internally to withstand high air and landing loads. It was covered in a light, black muslin fabric donated by the girl friend of a student, whose father owned a textile shop. Some cardboard was used to stiffen the covering along the wing leading edges and fuselage nose, the group having insufficient money for aircraft quality plywood. The name Schwatze Düvel was a natural choice, for in ancient myth Aachen had once been plagued by a monster of this name.

The Weltensegler prepares for flight. Disaster followed.

When the weather cleared on 3rd September Klemperer made three successful glides. For the first time a rubber bungee was used for the launches. The third flight duration was 2 minutes, 22 seconds, ending near a village in the valley, 1830 metres from the start. Pelzner's best effort was far exceeded.

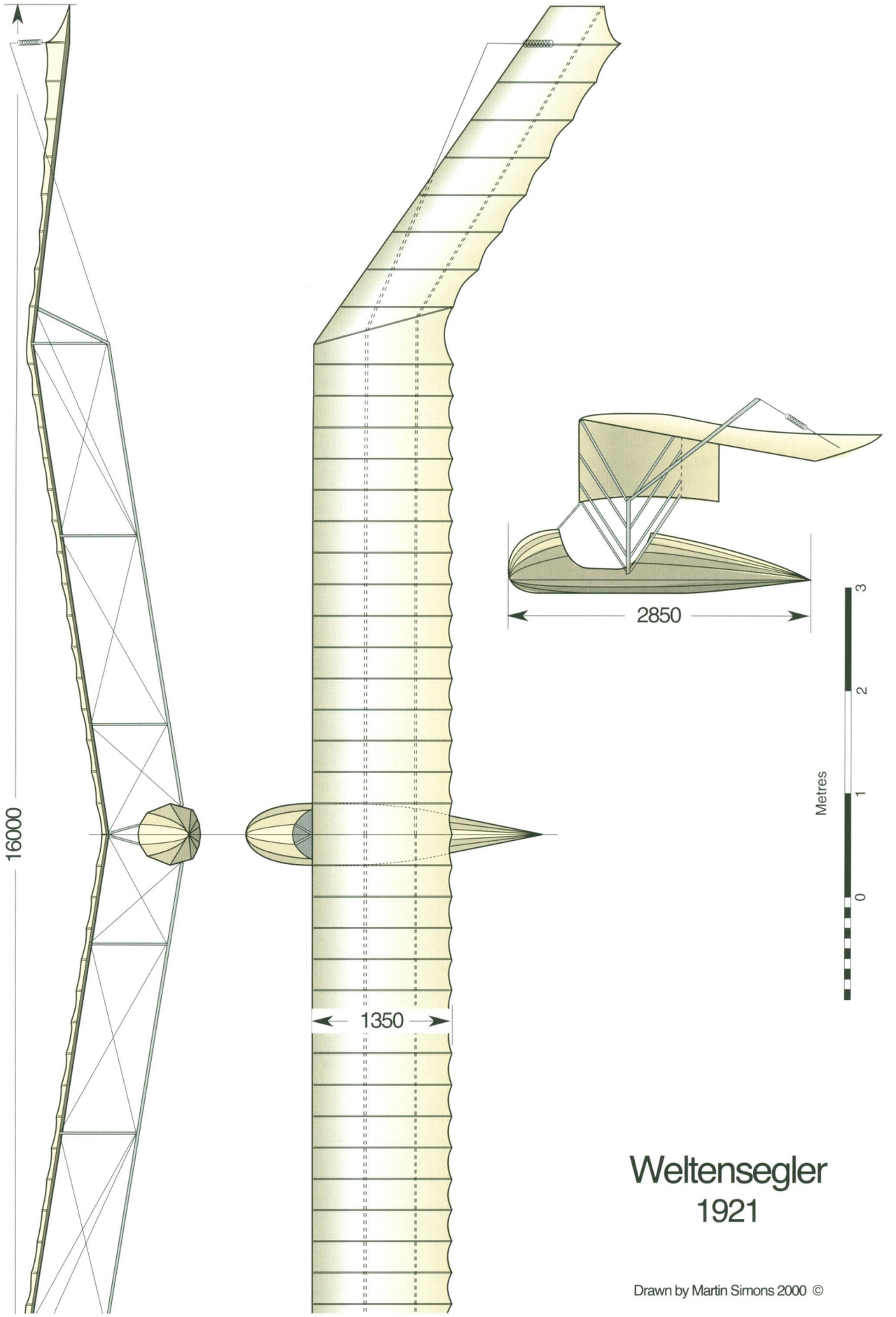
Bad weather returned but on September 7th Klemperer, who knew of Orville Wright's dune soaring of 1911, did succeed in gaining about 30 metres height after launching into a wind of 30 knots, hovering for a minute or so before gliding down to land. Two more flights were made by other FVA pilots, ending in a spectacular stall and crash. This effectively ended the first Rhön competition. There was no question that the FVA - 1 had won but Pelzner's hang gliding gained him second prize.

Despite the poor results, the second Rhön meeting began on August 10th 1921, Willy Pelzner and a new hang glider making the first flight. Some forty-five entries had been received but only a couple of dozen gliders arrived. Several of these were quite unairworthy but there were six hang gliders and five apparently more promising aircraft. Klemperer and the Aachen group came with the Schwatze Düvel repaired and a new glider, the Blaue Maus (Blue Mouse).

Weltensegler

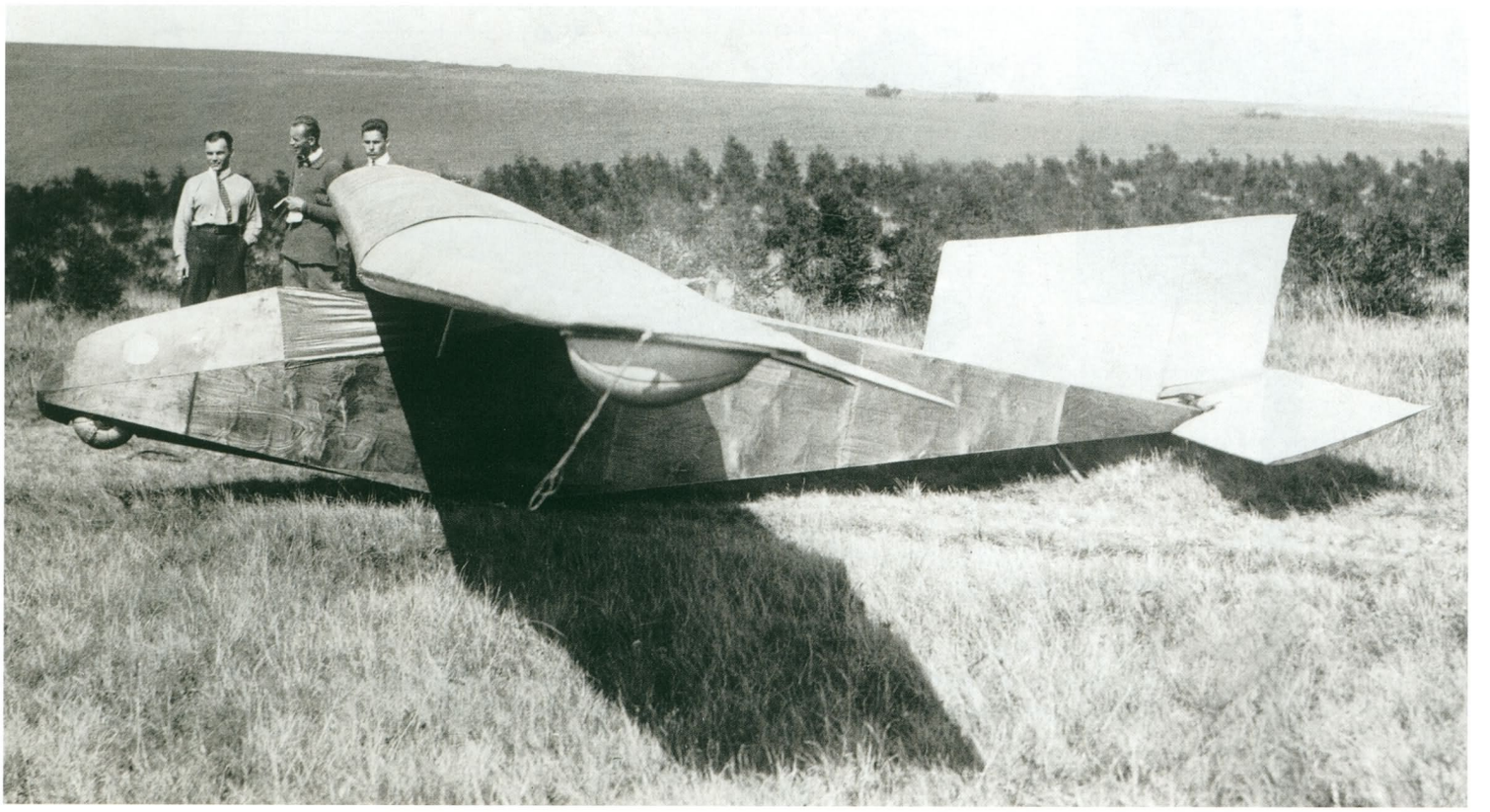
Sadly, within a few days the competition was again almost brought to an end by another fatal accident. Friedrich Wenk had been experimenting with flying since his teen age and had discovered that a tail-less monoplane would fly if the wings were swept back and the centre of gravity was well forward. The outer panels of the swept wing performed the same balancing and stabilising function as a tailplane, providing they were set or twisted to a negative angle relative to the central mainplane. After some limited successes he found generous financial backing, launched a company called Weltensegler GmbH, and established a workshop on the Wasserkuppe. In the new shed the 16 metre Weltensegler was built. The tailless glider was controlled by a curious and quite unorthodox arrangement of cables and springs. Moving the control column forward would bring both wing tips together to a higher angle of attack. The resulting increase of lift behind the centre of gravity would cause the glider to pitch nose down. To return to level flight the pilot would move the stick back but there was no positive link between the pilot's hand and the wing tips. The springs in the control circuit were expected to provide the necessary corrective warp. Moving the stick to left or right would pull one wing tip down but not the other, to bank and turn, and again the springs, not the pilot's hands, should return the wings to the neutral position. Why Wenk adopted this system is not clear but it may be that, like many others at this time, he hoped to extract energy from gusts of wind, a kind of dynamic soaring. A gust would cause the springs to compress slightly. The wing tips would yield under the extra pressure, pitching the glider nose up. The gust passed, the springs would return automatically to neutral, all before the pilot could react. There would be a kind of flapping motion which would transmit some gust energy to the glider and perhaps enable it to gain height. It remained to be tested in practice.

The glider was ready for trial on 14th August. The company test pilot, Willy Leusch, was experienced in powered aircraft. The glider, with him in the cockpit, was lifted bodily by the crew, carried forward at a gentle trot and thrown off into the breeze coming up the slope. At first all went exceptionally well. The Weltensegler, after a momentary hesitation, flew forward and smoothly climbed to about 80 metres above the launch point. But a turn to the left became a steepening spiral dive and the airspeed increased rapidly. In aerodynamics, loads generated by an airflow increase according to the square law: twice the speed means four times the force. The springs could not provide sufficient corrective power. Within sec-



Weltensegler
1921

Drawn by Martin Simons 2000 ©



onds the wing fluttered and collapsed, the nacelle fell down the slope with the remnants of the flimsy wing trailing like a banner. Leusch was killed. Gloom descended over the camp.

Nonetheless, Leusch had soared. However briefly, a glider had gained altitude in flight after a gentle launch. Recovered from their shock, the witnesses remembered but at the time, not many understood. It was still supposed by some that gust energy and instant changes of the wing's angle of attack to the airflow, were responsible for this, drastically limited, success. The idea of gust soaring was not abandoned; even Klemperer was attracted by it, other leading scientists supported the notion. The proposed solution was, not to rely on dubious springs and automatic controls, but to let the pilot alter the wing angle of attack instantly on feeling a gust, riding it up, then gliding forward anticipating another surge and ready for it.

Probably today it would be recognised that Leusch was carried up simply by slope lift, the air rising up the hill. Perhaps a thermal was passing through as he took off.

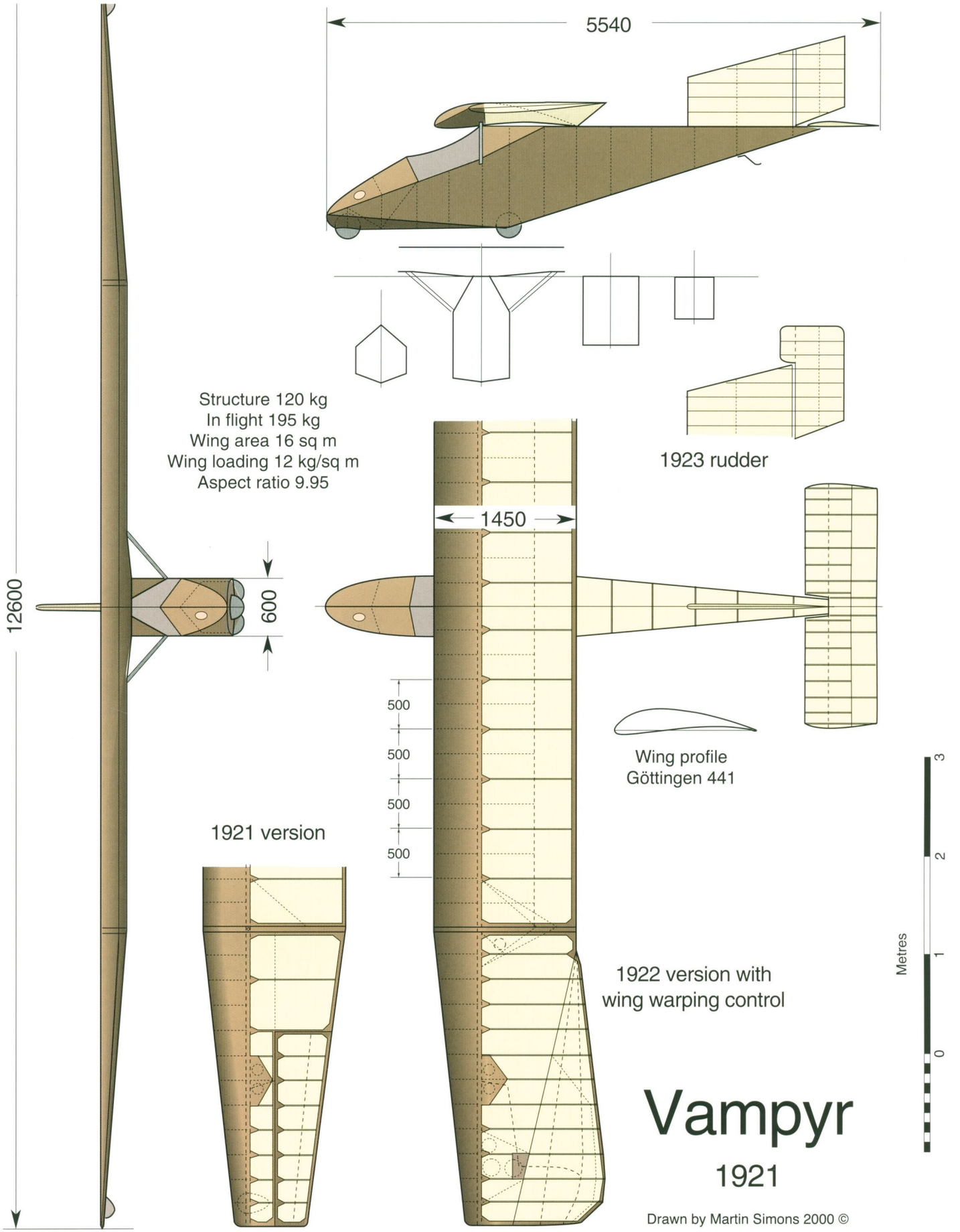
The Vampyr, showing the pneumatic, tricycle undercarriage and the leather cockpit cover which was fastened over the pilot's shoulders, leaving only his head exposed. The pilot here is Hentzen.

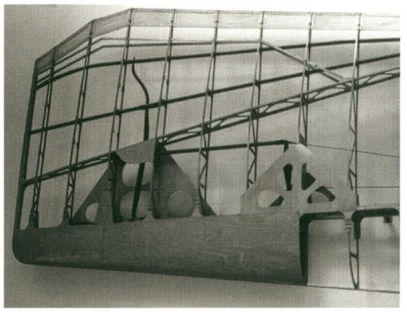
Vampyr

On August 21st the Akaflieg from Hannover arrived with their new glider, the Vampyr. This was revolutionary. Designed by lecturer George Madelung working under Professor Arthur Proell, of Hannover Technical University, the Vampyr was built professionally at a Hannover coachworks. The box-like fuselage, skinned with plywood and varnished, was not particularly refined, though the cockpit was almost fully enclosed by means of a leather cover, leaving only the pilot's head exposed. The wing, in three pieces, a centre section mounted simply on top of the fuselage with detachable outer panels, was superior to anything seen before at the Wasserkuppe and, indeed, was more advanced in some ways than the wing of any other type of aircraft.

The Vampyr had a stressed skin.

Almost all aircraft in 1921 had wings with multiple spars and cross bracing. The most usual layout for powered aeroplanes at this time, and for another ten years, was the biplane with exposed struts and numerous diagonal wires. These formed a strong truss to resist


5540
12600
600
1450
500
500
500
500
Structure 120 kg
In flight 195 kg
Wing area 16 sq m
Wing loading 12 kg/sq m
Aspect ratio 9.95
1923 rudder
Wing profile
Göttingen 441
1921 version
1922 version with
wing warping control
Metres
0
1
2
3
Vampyr
1921
Drawn by Martin Simons 2000 ©



Left: The Vampyr soaring.

Right: The Vampyr wing, as displayed in the Deutsches Museum, showing the complicated wing warping mechanism adopted for the 1922 Rhön competition. It was in this form that the long soaring flights were made.

both bending and twisting. The high penalty in terms of air resistance was accepted. There was enough engine power available to permit flight, the structures were light so useful loads could be carried although speeds were low. If the engine failed, the glide angle was steep and the rate of descent rapid.

The Vampyr wing had only a single spar. There was a very short strut near the root, to relieve some of the high bending moment and transfer the stress there to the fuselage. All the other loads, especially torsion which would tend to twist the wing, were resisted by a thin plywood skin wrapped completely round the leading edge, glued to the ribs which formed the forward third of the aerofoil section. A tube of D shaped cross section was formed. The wings behind the spar were the lightest possible framework of ribs covered with fabric. (The idea of stressed skin construction was published first by Adolph Rohrbach, a designer for the Zeppelin - Staaken Company, but was not widely adopted until long after sailplanes had demonstrated its benefits.) Aerodynamically the Vampyr also had another great advantage. Because of the stressed skin, the wing could have a high aspect ratio, a large span in relation to its total area. This, as new theories developed in the University of Göttingen showed, had a most important effect in reducing drag at gliding airspeeds.

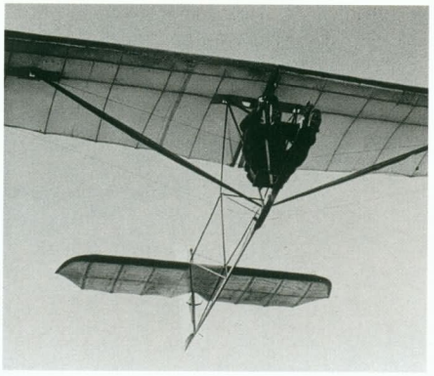
The Vampyr quickly demonstrated a performance much better than anything earlier. Arthur Martens, the pilot, made several long gliding flights into the valley, though not yet soaring. After several flights, the Vampyr was damaged in a launching mishap. The competition was almost at an end so Martens did not win, but the excellence of the Hannover design was recognised with a special award.

The Hannover and Aachen students stayed on after the others dispersed. Klemperer's Blaue Maus, not blue but covered in ordinary white fabric, was an improvement on the Schwatze Düvel, with the pilot's seat lower in the fuselage and a slightly larger wing, but it represented no substantial advance in design. The Blaue Maus was not a very efficient sailplane but Klemperer was a trained engineer who now had some gliding experience. On 30th August he again made a brief soaring flight over the windward slope, performed a well controlled 360 degree turn in the rising air, then glided down into the valley to land 4.6 kilometres away, the duration being over 13 minutes. It was a record surpassing Orville Wright's flight of 1911, though Klemperer had been gliding down most of the time. The principles of hill soaring were understood now by some, but full public demonstrations were still lacking.

The Vampyr, when repaired, began to show its potential and Martens achieved a 7.5 kilometre flight early in September, still without soaring.

Harth and Messerschmitt

Almost unknown to the Wasserkuppe people, Friedrich Harth with a young boy assistant, Willi Messerschmitt, had been working for years on gliders. Harth was one of those who was convinced that soaring required the use of gusts. The Harth gliders were controlled in pitch by changing the angle of incidence of the mainplanes, the tailplane being fixed. The pilot sat within a light framework below the wing with two control sticks, one to change the angle of wing



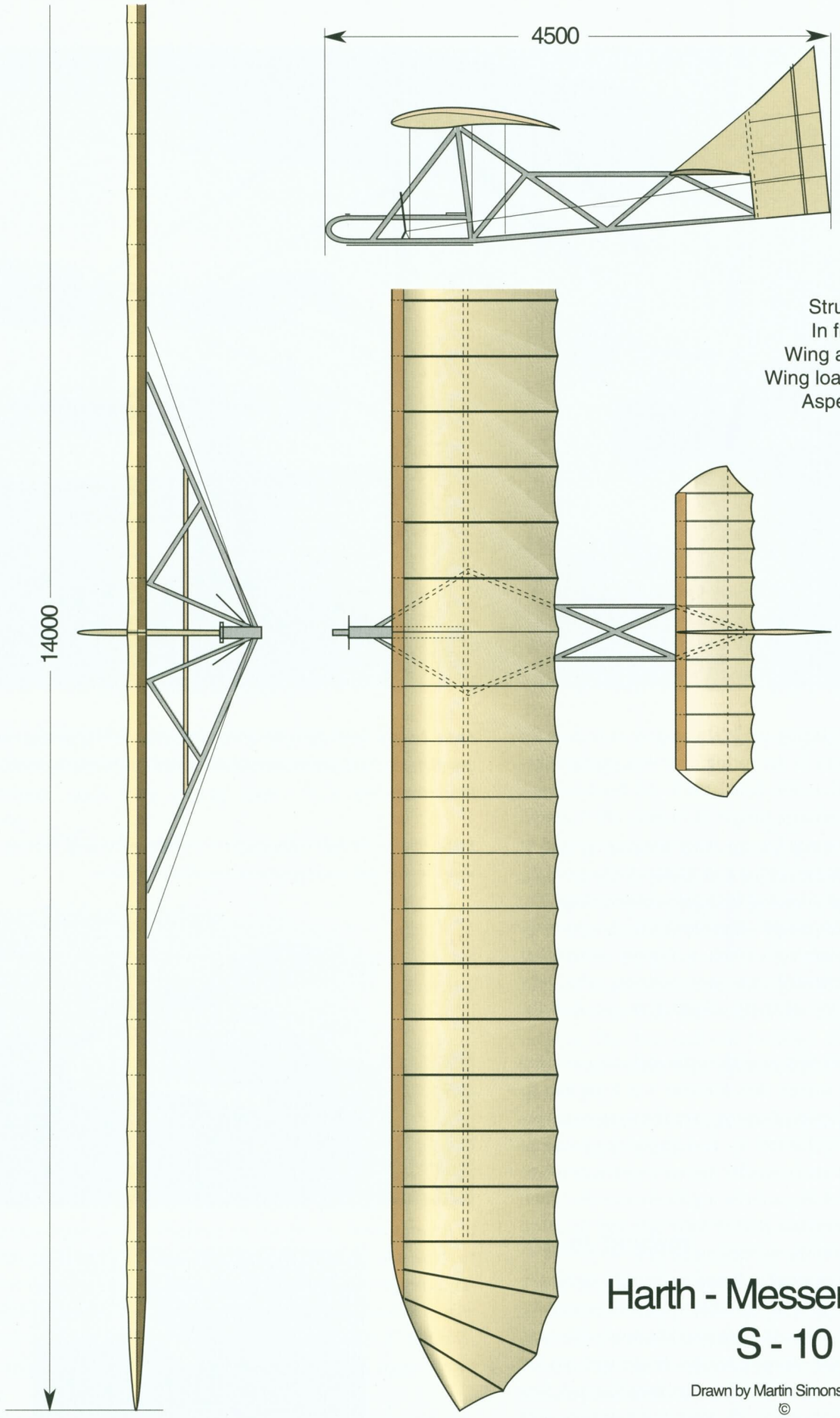
Left and right: The Harth Messerschmitt S - 10 in flight. Control in pitch was achieved by pivoting the mainplane on its transverse axis, a method of control which Messerschmitt used on several later sailplanes, and which was tried also by the Darmstadt students for their Geheimrat.

Below: Wolf Hirth at the controls of the S - 10.

incidence and the other to warp the tips for lateral control. From a standing start in a gusty wind the pilot, on feeling a sudden rush of air, pulled the wing up to a high angle of attack. The glider ought to take off. Once off the ground the machine would start to descend again but, if another gust came in time, the pilot would feel it, pull the stick back and ride up further. It sometimes seemed to work. It did prove possible to take off this way.

Harth and Messerschmitt did not join the early Rhön meetings but took their glider to Heidelstein, where there was a relatively gentle slope on the flanks of the main valley. They were actually within sight from the Wasserkuppe, but preferred to keep their efforts secret and discouraged investigation. On September 13th, in their glider called S - 8, Harth was able to take off in a gust, gained height and flew under full control back and forth, rising to about 150 metres. This was undoubtedly a soaring flight. Messerschmitt was the only witness and took a hasty photograph but Harth suddenly lost control of the glider and crashed, with serious injuries. The cause was probably a jammed control pulley. The duration was over 21 minutes, a record, but whether gust energy was the explanation seems doubtful. A gust is normally followed by a lull. Energy gained is almost immediately lost and any short term advantage is discounted by the subsequent loss of airspeed and height. Possibly Harth was, after the take off, assisted by some slope lift and thermal. Whatever the explanation, the flight drew little attention although the idea of controlling the sailplane by altering the wing angle of incidence rather than using an elevator, was not abandoned. Messerschmitt himself used this system on several further gliders, before he moved to powered flying and more orthodox controls. Harth recovered but was never the same again.

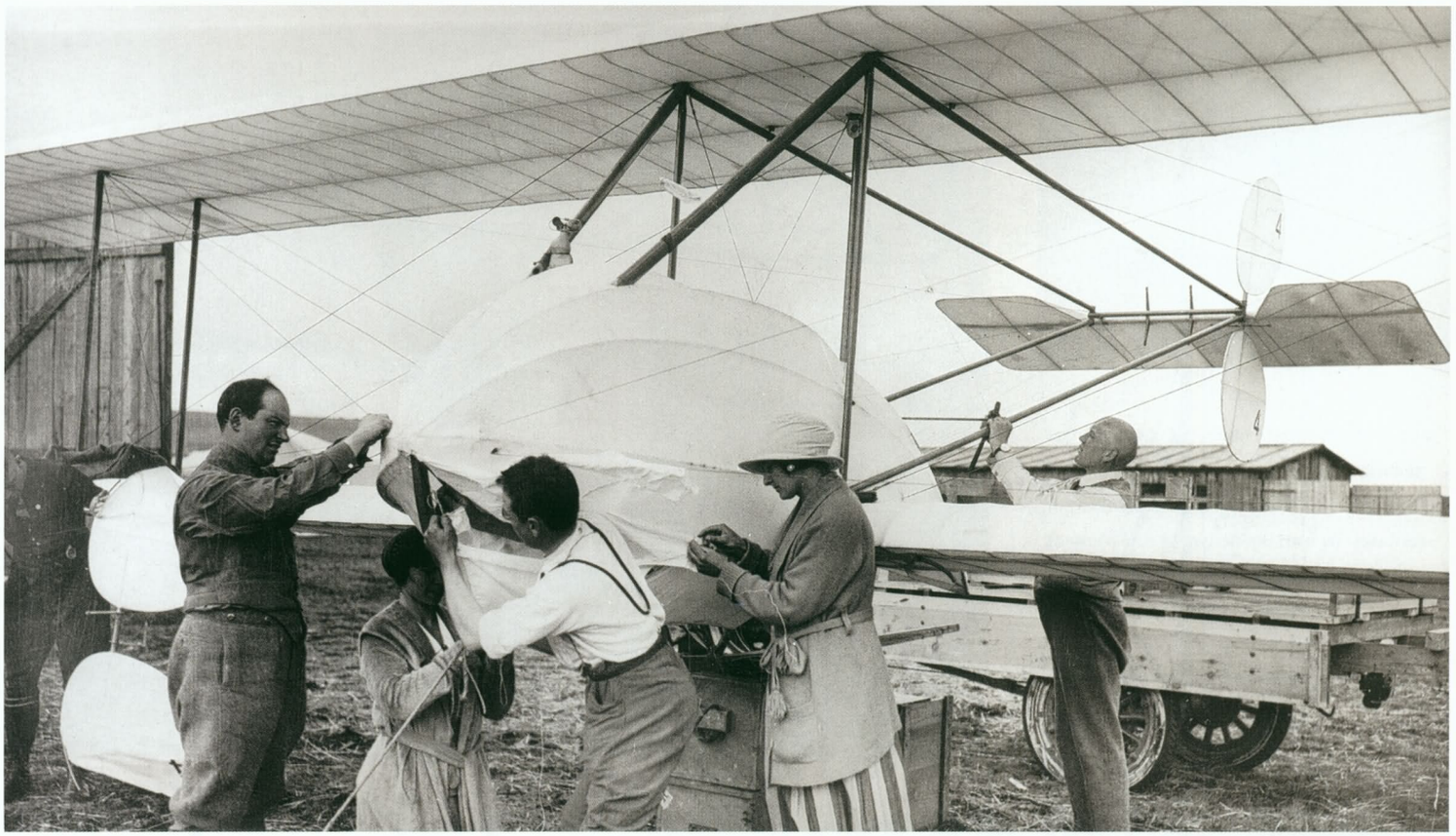
In 1922 activities on the Wasserkuppe began early in the year with several new designs built and flown before the third Rhön competition officially began. Alexander Lippisch and Gottlob Espenlaub had even spent the winter on the mountain, sleeping at first in a crude 'A frame' shack and, when this blew away in a snowstorm, breaking into the Weltensegler sheds and making do there on the floor. Lippisch was a well qualified aerodynamicist who had been employed by Dornier during 1918 but because of the restrictions on German aviation, was now unemployed and living in penury on the Wasserkuppe. He carried out experiments with large, tailless models. Espenlaub, a skilled woodworker, having taken the theories about aspect ratio to heart, began to construct a sailplane



Structure 80 kg
In flight 150 kg
Wing area 10.3 sq m
Wing loading 7.9 kg/sq m
Aspect ratio 10.3

Harth - Messerschmitt
S - 10

Drawn by Martin Simons 2000



with a 17 metre wing span, raiding the Weltensegler workshop for materials. Messerschmitt came in the spring, erected a shed and began work on the S - 9 and, when this failed, the S - 10. Small barrack huts were built. When the contest proper did begin, the Vampyr, with the outer wing reconstructed to use wing warping instead of ailerons, arrived from Hannover. Other new gliders followed Hannover's lead towards stressed skins and high aspect ratio wings, the Edith and Geheimrat from Darmstadt, Espenlaub's E - 3, a new tailless and more practical design from Wenk, a 'canard' or tail first type from Klemperer, intended for gust soaring, the new Messersmitt and more. Many of these gliders flew successfully, some did not.

The great events of the meeting were the extended slope soaring flights by the Vampyr. On August 18th Martens was launched by bungee and at once soared up confidently over the western slopes as the crowd on the summit cheered. He had no instruments and not even a watch. The spectators signalled his achieved duration to him by lying on the ground in patterns; eighteen minutes, then thirty. He achieved his immediate goal of forty minutes duration and turned to glide down into the valley. Late in this descent he realised that with a little more careful flying he could extend the glide to achieve a full hour. This he was able to do and landed 7.5 kilometres from the launch point. The next day Martens' colleague, Heinrich Hentzen, soared the Vampyr for two hours with a long glide down to land 9 kilometres away. A few days later Hentzen flew for three hours. All previous duration, distance and height records were eclipsed.

Above: Anthony Fokker (left) with assistants, stitching the fabric covering onto the nacelle of his biplane two seater. Behind Fokker a workman attends to one of the double disc shaped rudders.

Below: Fokker in his biplane prepares for a solo flight and takes off. Note the rudders were later extended by adding extra sections above and below.

The Peyret takes off, dropping the rubber bungee as the glider passes over the heads of the launching crew.

Others were quick to learn. Not only Martens and Hentzen but other student pilots, especially those from the Technical University of Darmstadt, made long soaring flights with the Edith and Geheimrat.

Anthony Fokker's biplane

Anthony Fokker visited the Wasserkuppe first in 1921, with his cine camera. In August 1922 he arrived with a biplane two seater which had been hastily built at his factory. He test flew it, solo. Area was added to the rudders and he then made the first passenger carrying, soaring flight. It lasted thirteen minutes. There were times during the closing days of the 1922 Wasserkuppe meeting when four or five sailplanes were flying simultaneously. These flights, though not always fully understood, stimulated interest around the world.

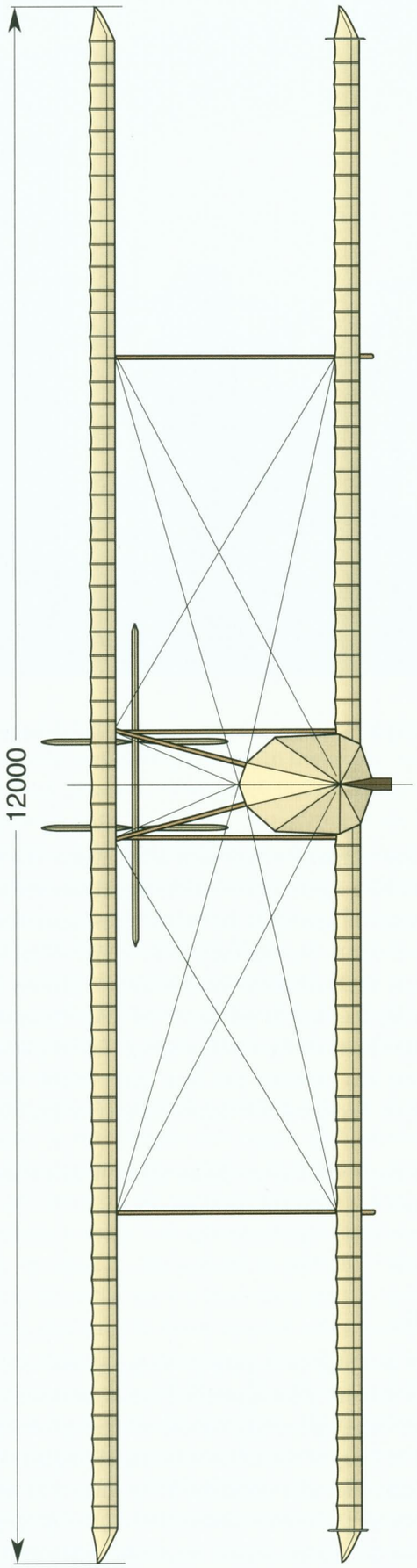
Partly as a publicity stunt by the Daily Mail newspaper, a glider meeting was organised in England on the South Downs north of Newhaven, at Itford Hill and Firle Beacon, during the week of 16th - 21st October 1922. A prize was offered for the longest duration over 30 minutes. Fokker took his biplane and raised the soaring record to 37 minutes. He then allowed his aircraft to be flown by an Englishman, Captain Olley, who set the new figure at 49 minutes.

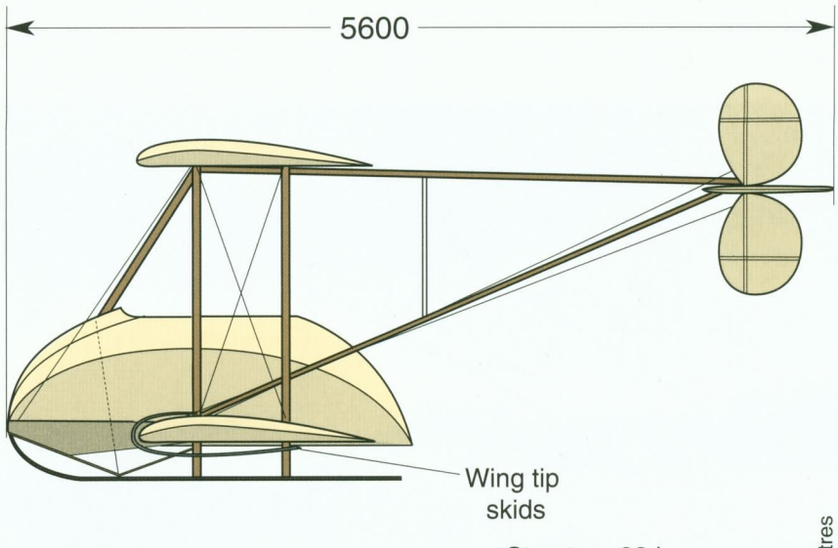
That Fokker was able to fly his biplane both solo and dual, was significant. The dilemma facing all designers of two seat sailplanes is that, lacking any concentrated weight such as an engine, the human beings on board have a great effect on the location of the balance point. If the centre of gravity is too far back, the aircraft becomes dangerously unstable. Having the centre of gravity far forward is less dangerous but can lead to lack of elevator control, especially important when landing or taking off. In Fokker's biplane the two seats were one behind the other in a large fabric covered nacelle. The rear seat was between the twin spars of the lower wing. With both seats occupied the centre of gravity probably moved aft.

Fokker also built a single seat biplane glider but he does not seem to have flown it often.

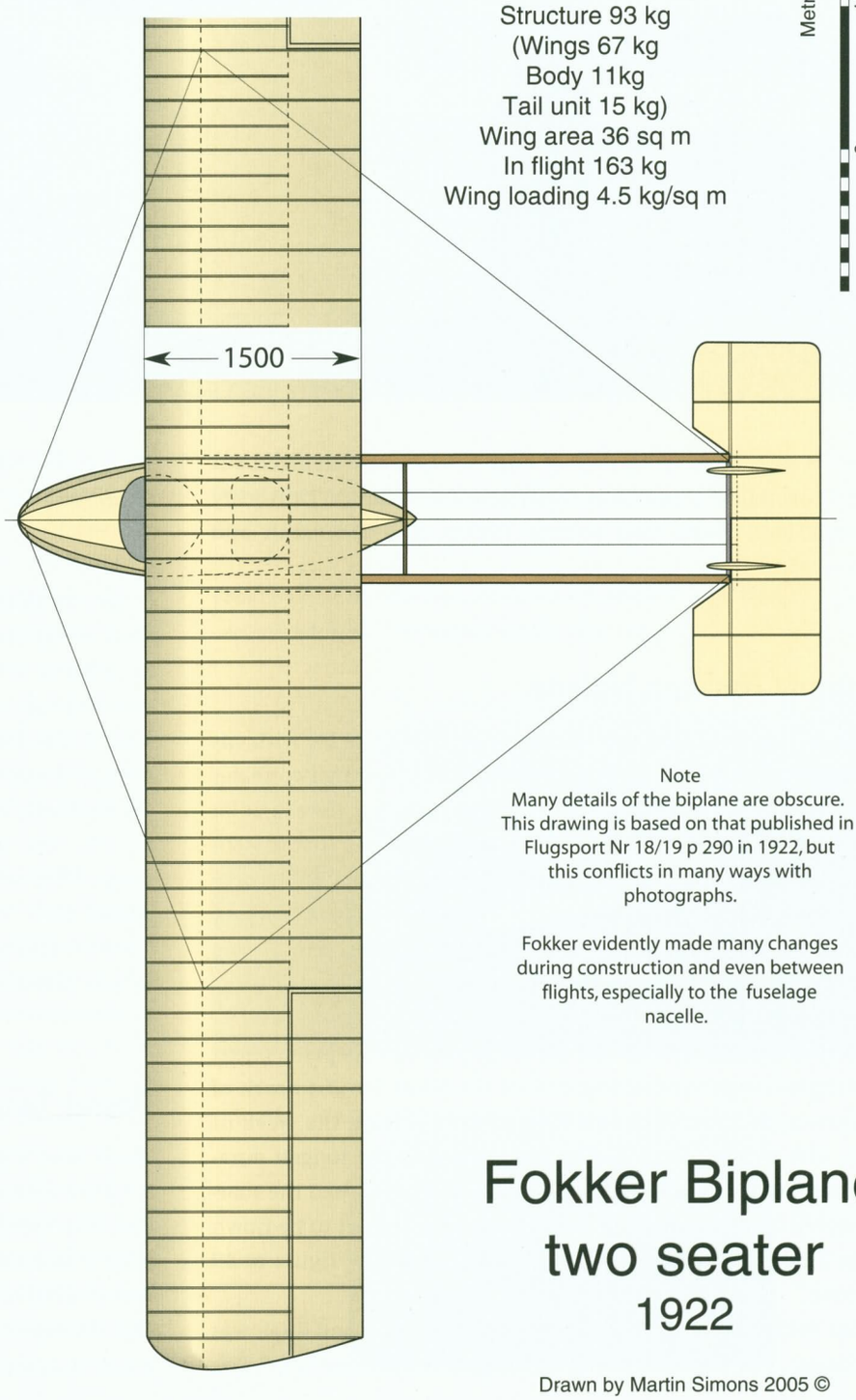
Peyret Tandem

There was a glider meeting in France at Combegrasse which achieved little except that one pilot apparently soared, unintentionally, in a thermal for three full turns. No one recognised this for what it was. On the last day of the Itford meeting in England the French pilot Alexis Maneyrol set a world record of 3 hours 21 minutes. Maneyrol was flying the Peyret Tandem. Peyret, the designer, was enthusiastic about the tandem layout. By dividing the total lift-





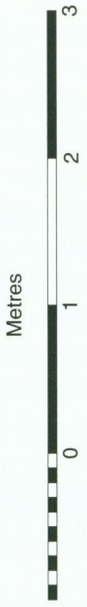
Structure 93 kg
(Wings 67 kg
Body 11kg
Tail unit 15 kg)
Wing area 36 sq m
In flight 163 kg
Wing loading 4.5 kg/sq m



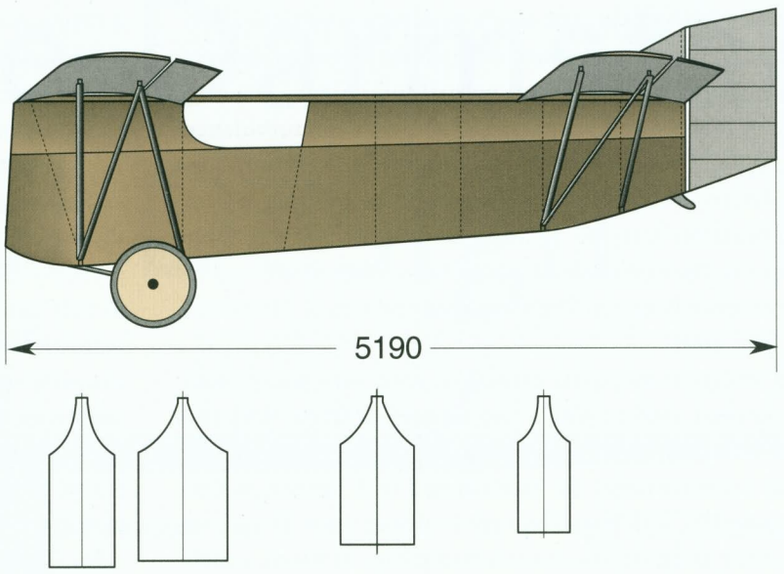
Note
Many details of the biplane are obscure. This drawing is based on that published in Flugsport Nr 18/19 p 290 in 1922, but this conflicts in many ways with photographs.

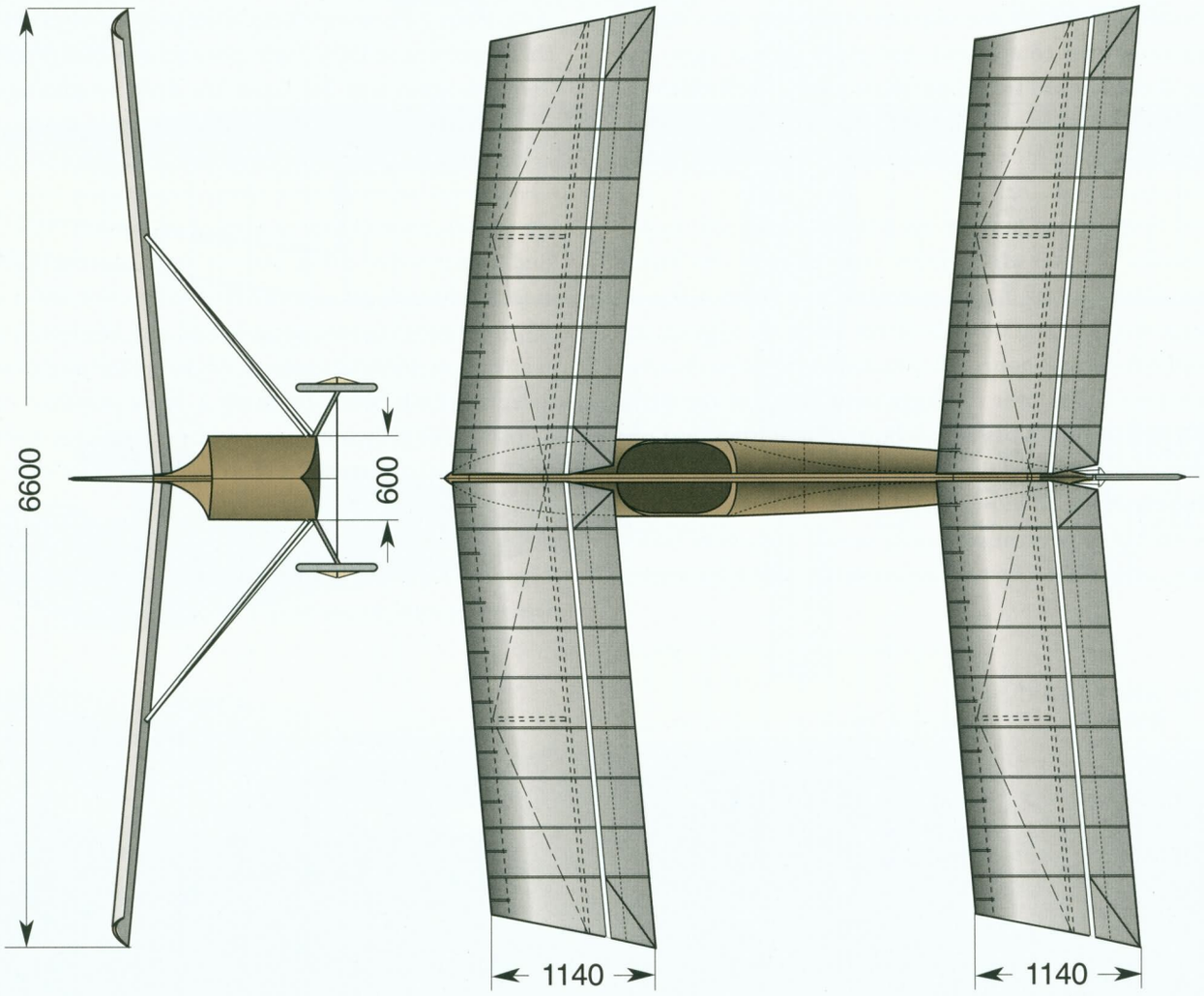
Fokker evidently made many changes during construction and even between flights, especially to the fuselage nacelle.

Fokker Biplane two seater
1922



Structure 67.5 kg
In flight 138 kg
Wing area 14.2 sq m
Wing loading 9.7 kg/sq m
Aspect ratio 6.22 (each wing)





Peyret Tandem

Drawn by Martin Simons 2005

ing area into two equal, narrow chord wings, one behind the other, the benefits of a high aspect ratio might be achieved without a vast wing span and consequent structural and control problems. However, as with the usual biplane layout, mutual interference between the two planes reduced this advantage. Downwash and turbulence from the foreplane adversely affect the flow over the rear surface. The Peyret design suffered from another important defect. Where the wings joined the fuselage, there were gaps through which air would pass from the underside of the lifting surface to the upper, almost like an extra wing tip. The extra drag and loss of lift caused by this was very great.

The wing structure was quite orthodox, with twin spars, cross braced and strutted, covered with a grey rubberised fabric. With the very large N struts and rather basic fuselage, a clumsy though effective wheeled undercarriage, the Tandem had very limited performance. Nonetheless, it flew well enough in strong slope lift against the other hastily designed and constructed gliders at Itford, which included a Blaue Maus imported from Aachen. Maneyrol won the prize, not because his aircraft was superior but because the other pilots, feeling somewhat complacent, had given up too soon. The Englishman Raynham had soared his glider, called the Brokker because it was cobbled together from an F2 - B Bristol Fighter fuselage and a Fokker D - 8 wing, for two hours earlier in the week. He had thought that was enough.

The Peyret flew again in January the following year, soaring the cliffs at Vauville for over eight hours, only to have this figure topped within the week by Barbot in a Dewoitine glider. A second Peyret tandem was built and flown in North Africa. By 1924 the duration record was set at 8 hours, 42 minutes by the schoolteacher Ferdinand Schulz flying over the huge sand dunes of the Baltic Coast in East Prussia, near Rossitten. Schulz's 'Broomstick' was one of the crudest and cheapest gliders ever to get off the ground. It was not permitted to fly at all at the Wasserkuppe, where a technical committee existed to prevent obviously unsafe craft from taking off. Rossitten, nevertheless, became an important centre for soaring after this.

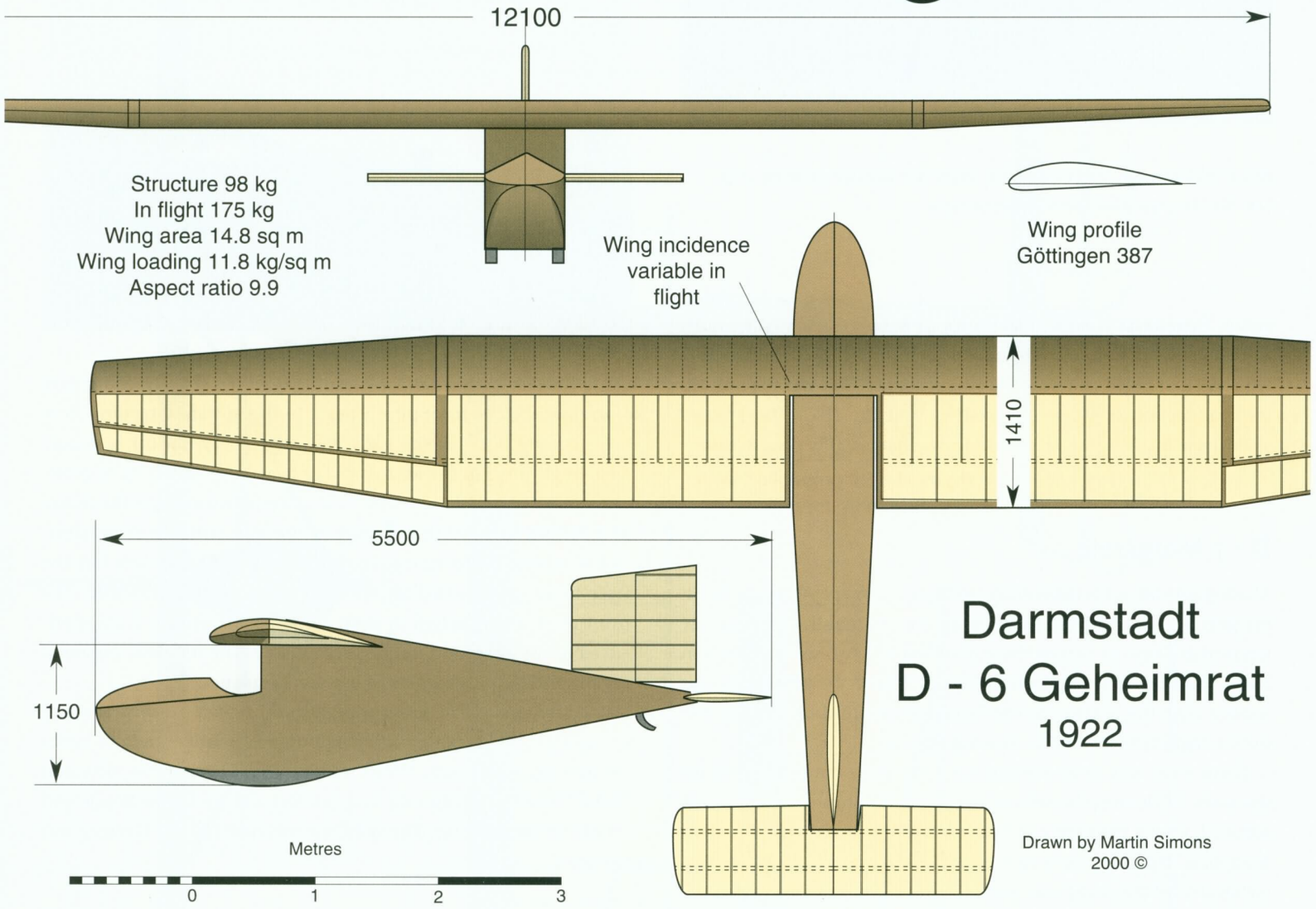
It was now evident that, providing there was a suitable slope and a breeze blowing up it, even an unrefined sailplane, flown with some skill, could remain airborne almost indefinitely. Following the Vampyr, the Strolch and the Moritz were built for Martens by Karl Bremer. They were, in all important respects, copies of the Vampyr but the wing spans were extended for higher aspect ratio and consequent improved performance, with orthodox ailerons on the tapered outer panels. They had considerable success when flown by experienced pilots. Martens won the 1923 Rhön and later, in Italy, broke the distance record in Strolch, but this sailplane, like many others of the time, had dangerous spinning characteristics. It was written off early in the 1925 Rhön when Karl Bedall span in soon after the launch on the Wasserkuppe. He was badly injured. Martens in the Moritz won in 1925 and Schulz set a new duration record of just over 12 hours flying in the Crimea during a famous visit to the USSR that year by a German group.

For many of the German enthusiasts, soaring was no more than a legal way into the air that would enable them to improve their skills, ready for powered flight when the Versailles bans were lifted. This happened in 1924. Light powered aeroplanes were allowed in Germany again and, for many, the need for gliding disappeared. The movement went through a bad period as many of the experienced pilots and engineers moved on.

For others, especially the young, soaring was a new sport, offering adventures and experiences of an entirely new and different kind from powered flying, and less expensive. For students and staff in technical colleges and universities this was also a way of learning, experimenting and, in a practical way, improving the efficiency of aircraft at minimal expense. An aeroplane might be made to fly faster or climb better by using a more powerful engine. For a sailplane, the only way to improve performance was to refine the aerodynamics and structure. This was the way forward.

Dragging the Peyret Tandem to the launching point on Itford Hill in 1922. At this stage, nothing much was expected of it.

CHAPTER 2 The Darmstadt School of Design



The Akademische Fliegergruppe Darmstadt or Akaflieg was founded in January 1921. The students at the Technical University included many who had survived the First World War and were now anxious to complete their interrupted education. They were more experienced, dedicated and serious than some of the younger boys straight from school. Most who chose to study aeronautics were pilots or had been trained to rig, repair and maintain fighting aeroplanes and their engines.

They established a tradition which continues to the present day. The Akaflieg was conducted along democratic lines, decisions were made collectively after open discussion. Membership was free but subject to strict rules. Each applicant was required to work hard at the agreed projects before being accepted. Full membership required great sacrifices of time, money and social life. Akaflieg students often took longer than non-members to complete their formal qualifications. The practical experience in design and construction was more than adequate compensation for a year or two's delay.

It was of great importance that their college supported the group. A design office, workshop, academic and practical assistance were pro-

Above: The Darmstadt Margarete of 1923. Second pilot well back below the wing.
Left: The Margarete flown solo at the Wasserkuppe.

vided. Geheimrat (Councillor) Professor Max Friedrich Gutermuth was the father of Hans Gutermuth, one of the original Darmstadt boys who had first flown gliders at the Wasserkuppe. (This was the only direct connection between the Akaflieg and the FSV.) The group's sailplane of 1922, the D - 6 Geheimrat, was named after the Professor.

D - 7 Margarete

The biplane layout is inherently inefficient, except when the lightest possible weight with large wing area is required. When the Darmstadt students turned their attention to a two seat sailplane in 1923, they chose a monoplane layout. The D - 7 Margarete was named after the Margarete von Loessl whose husband Eugen had been killed at the first Rhön meeting in 1920.

There were very good reasons for adopting a tandem layout for the seats. With one pilot behind the other, the frontal area could be reduced, saving the drag of a wide fuselage. To avoid an excessively long nose, the rear pilot's rudder pedals and feet were arranged on either side of the front seat, so the width of the cockpits was more than in a normal single seater but this small additional drag was acceptable. The rear seat then could be placed immediately on the balance point. This allowed the sailplane to be flown solo, from the front cockpit, without the need for additional trimming ballast. It was easy to arrange for dual controls. The cockpits were open with no windscreen, as usual for the time.

There remained the difficulty of providing the rear pilot with an adequate view. In the Margarete, the wing was mounted above the second cockpit. The main fuselage frame, behind the seat, required a forward extension above to carry the central wing mountings. Large V struts braced the wing so the bending and torsional loads at the centre were relatively light. The rear pilot had a perfectly adequate view to the sides and, by leaning sideways slightly, could look ahead beyond the front pilot's head. In the upward direction there was no view at all. In the early days when very few other gliders were likely to be in the air this did not seem to matter. As skies became more crowded, it became vital to keep looking into the centre of a banked turn. With the wing in the way, this was impossible. The rear pilot could turn to look sideways and backwards but the large blind spot created by the wing was a serious difficulty. The front pilot was required to keep a good lookout but, if inexperienced in the air, might not be very reliable. The problem remained for all subsequent designers of two seat sailplanes.

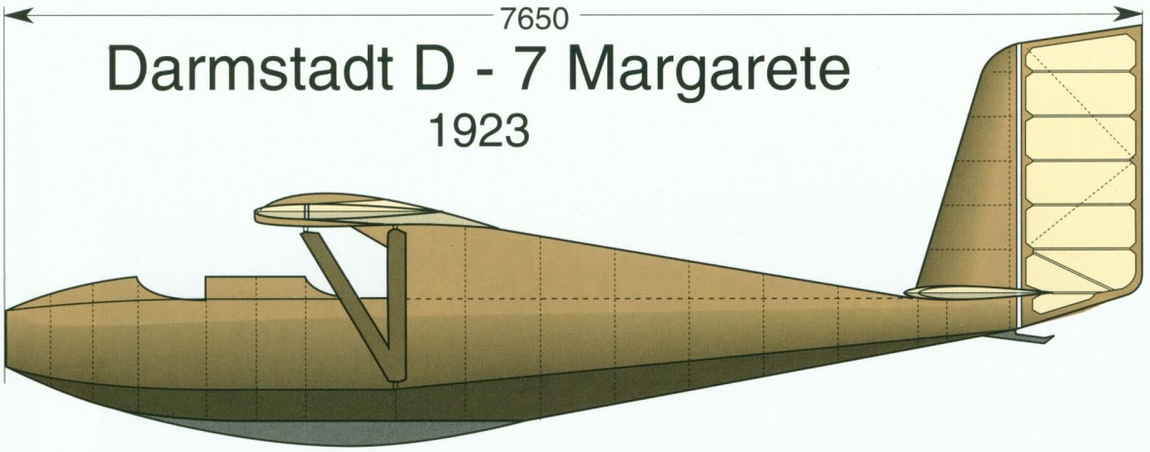
The Margarete gave outstandingly good service for several years. It was used for passenger carrying but, apparently, rarely or never for training new pilots. It was written off in 1927 when Johannes 'Bubi' Nehring, flying solo, was landing on the Wasserkuppe and an aileron cable broke. The sailplane was wrecked but Nehring was not hurt.

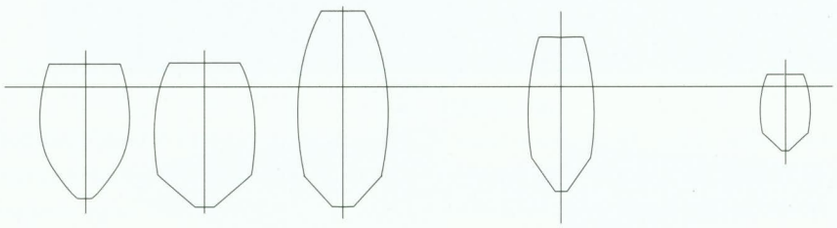
Konsul

The D - 9 was designed chiefly by Albert Botsch and Rudolf Spies, with advice from the best aerodynamicist of the student group, Fritz Hoppe. Financial help came from Karl Kotzenberg, the wealthy 'uncrowned king' of Frankfurt, who had funded the first Wasserkuppe competition. He had been Consul General to Norway and the new sailplane became, in his honour, Konsul.

The Konsul flew in 1923, the most advanced sailplane of the time. It established all the main features required for an excellent soaring performance. The wing span, 18.6 metres, was far greater than any

Darmstadt D - 7 Margarete
1923



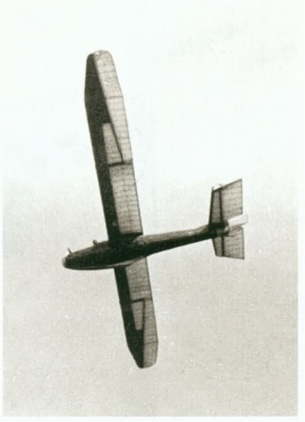


Structure 180 kg
In flight 320 kg
Wing area 25 sq m
Wing loading 12.8 kg/sq m
Aspect ratio 9.36

Profile
Göttingen 533

Tip profile

Original
ailerons



previous sailplane and the resulting aspect ratio, 16.66, more than any preceding aircraft of any kind. There was a single strong, cantilever wing spar, with stressed plywood skin leading edge, now the obligatory structure for any advanced sailplane. The fuselage was a carefully streamlined semi-monocoque shell of lozenge shaped cross section, enclosing the pilot except for his head and shoulders. The tail surfaces were very large to provide stability. The best materials available were used, high grade timber and plywood, steel fittings and bolts, rubber blocks for springing the landing skid, cables running over pulleys for the controls and light linen fabric to clothe the open framework areas, behind the spar on the wing, and the entire tail unit. Clear dope made the fabric taut and airproof, then everything was varnished to a brilliant gloss to reduce skin friction in the air.

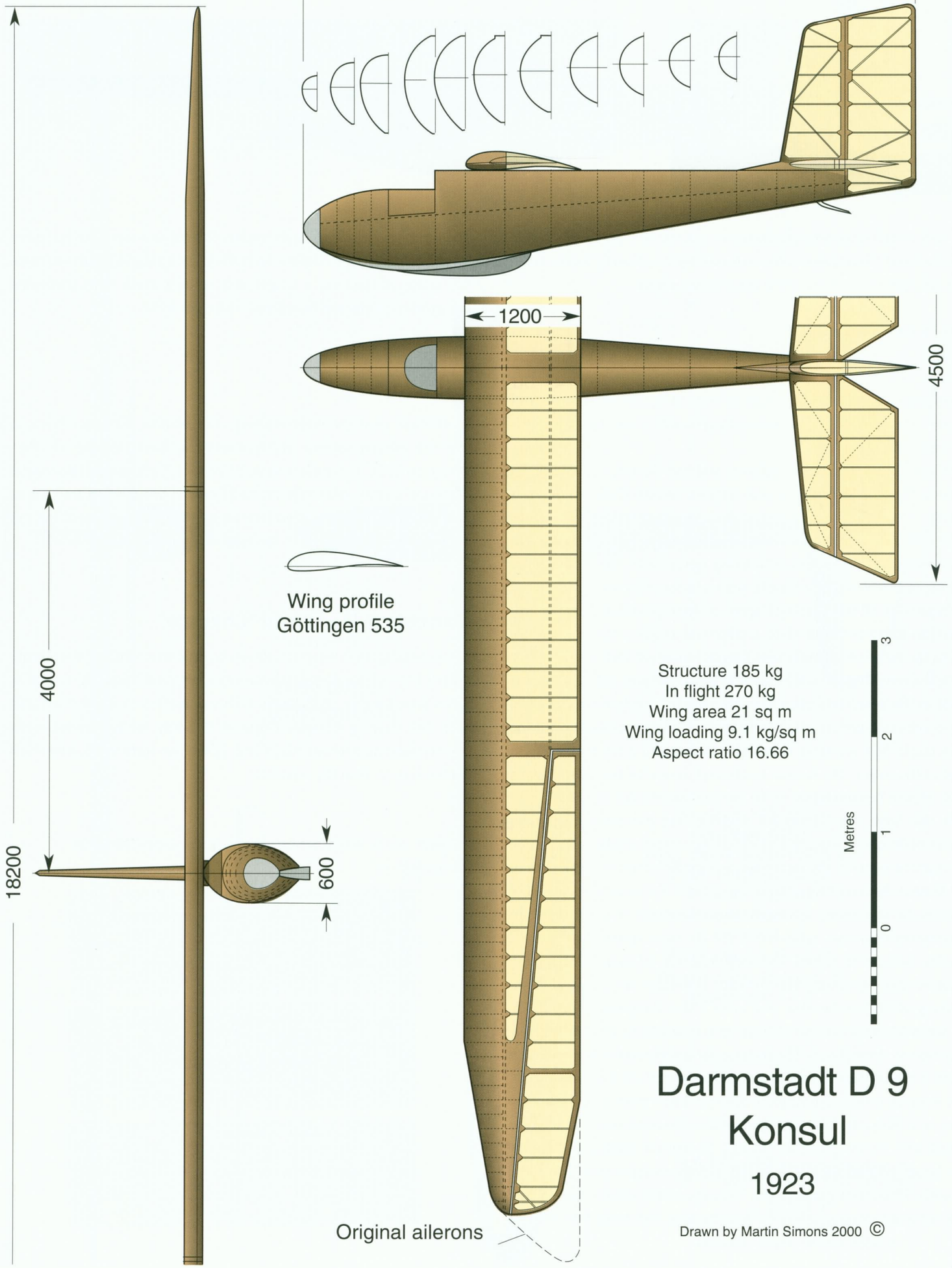
The aerofoil section chosen for the mainplane was the Göttingen 535, a shape recently developed and tested in the wind tunnel at Göttingen where the world's leading aerodynamicist, Ludwig Prandtl, headed the University Department of Aeronautics. This profile, developed along mathematical lines suggested by the pioneer Russian theorist Nicolai Joukowsky, had a streamlined teardrop form of 16% thickness (relative to the chord) curved around a camber line of 5.75%. The large camber ensured low profile drag at soaring trim. The Gö 535 became, for at least another fifteen years, a most popular sailplane wing section.

The Konsul was expected to have a very low minimum rate of sink and would be capable of using even weak slope lift. The huge control surfaces were heavy to operate but they were effective. On the ground the extended aileron tips were vulnerable to damage. After early tests they were reduced in size, cutting the total wing span down to 18.2 metres and the aspect ratio to 15.8.

An altimeter and airspeed indicator were mounted face up on the fuselage decking ahead of the cockpit. Variometers were unknown.

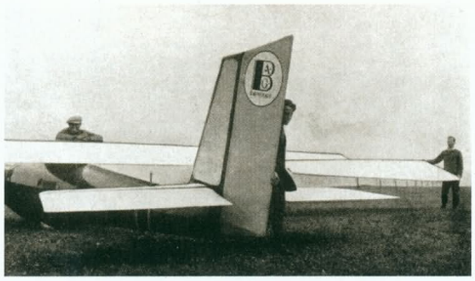
Above: Otto Fuchs flying the Konsul in 1924.

Below: Getting the sailplanes up to the Wasserkuppe was not easy. A large team of helpers drags the Konsul up the track on its trailer.



Darmstadt D 9 Konsul

1923



Left: Such a long wing needed a large vertical tail to provide some 'weathercock' stability for the Konsul. The very large rudder, which must have been heavy for the pilot to operate, was needed to counteract adverse yaw of the vast ailerons.

Right: The Württemberg in flight.

Pilots judged their rates of ascent or descent by reference to the hill slopes over which, and sometimes perilously close, they were expecting to fly.

All the hopes of the Akaflieg were realised. Botsch, one of the designers, flew the Konsul to a new distance record of 18.7 kilometres at the 1923 Rhön. The sailplane won the distance prize again in 1925 with a new, brilliant young pilot, Johannes 'Bubi' Nehring. On the excursion to the Crimea Nehring again broke the record, only just set by Martens in the Moritz, with a flight of 24.4 kilometres.

These were all hill soaring flights. A slope producing lift was followed as far as possible, then a glide was made across the gap towards the next hill. If sufficient height remained and the wind still blew, the new slope would be used to regain height, then a glide was made to the next likely place arriving usually far below the crest, and so on, often skimming within a few metres of trees or rocks until the pilot could find no more favourable slopes and must turn away to land in the valley. The Konsul continued in use for two further years until broken beyond repair by an inexperienced pilot in 1927.

By this time, the Darmstadt students had established a regular school of design producing a whole string of new sailplanes, each one an improvement on the last in some respects but all owing a debt to the Konsul. By accepting orders from private individuals or clubs, the Akaflieg became partly self supporting financially. In the interests of manoeuvrability and lightness on the controls, spans were reduced usually to about 16 metres. The Westpreussen, Schloss Mainberg and Starkenburg were designed by Heinrich Hofmann, the Lore and Württemberg by Paul Laubenthal, and so on. Other designers copied them. All followed the same basic layout with a cantilever wing of high aspect ratio in three pieces. The rectangular centre section was mounted above a streamlined fuselage, sometimes raised on a narrow pylon. The wing tip panels, carrying the ailerons, had a more or less elliptical plan, and were attached with steel bolts to the centre section, any gap closed with simple plywood fairings. To control stalling and reduce the danger of spinning at the stall the profile changed gradually to the tip with washout (negative twist). The tail control surfaces were generally of the all moving type, avoiding the drag associated with hinges. There were no trim tabs or air brakes. The cockpit was open but often fitted with a canopy to leave only the pilot's goggled head exposed. The undercarriage was a simple skid, usually made from laminated ash, rubber sprung and faired with strips of canvas.

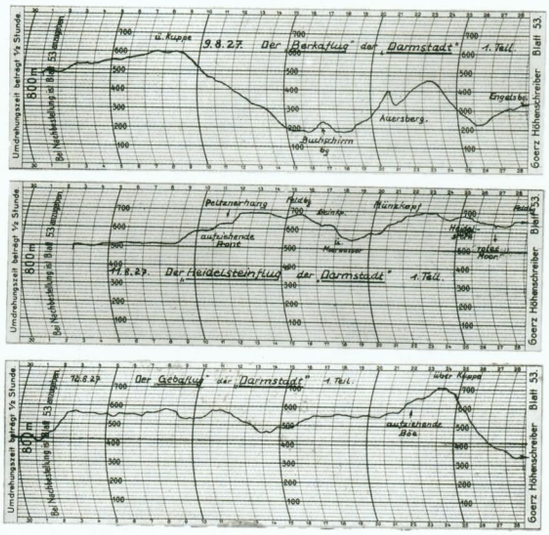
Württemberg

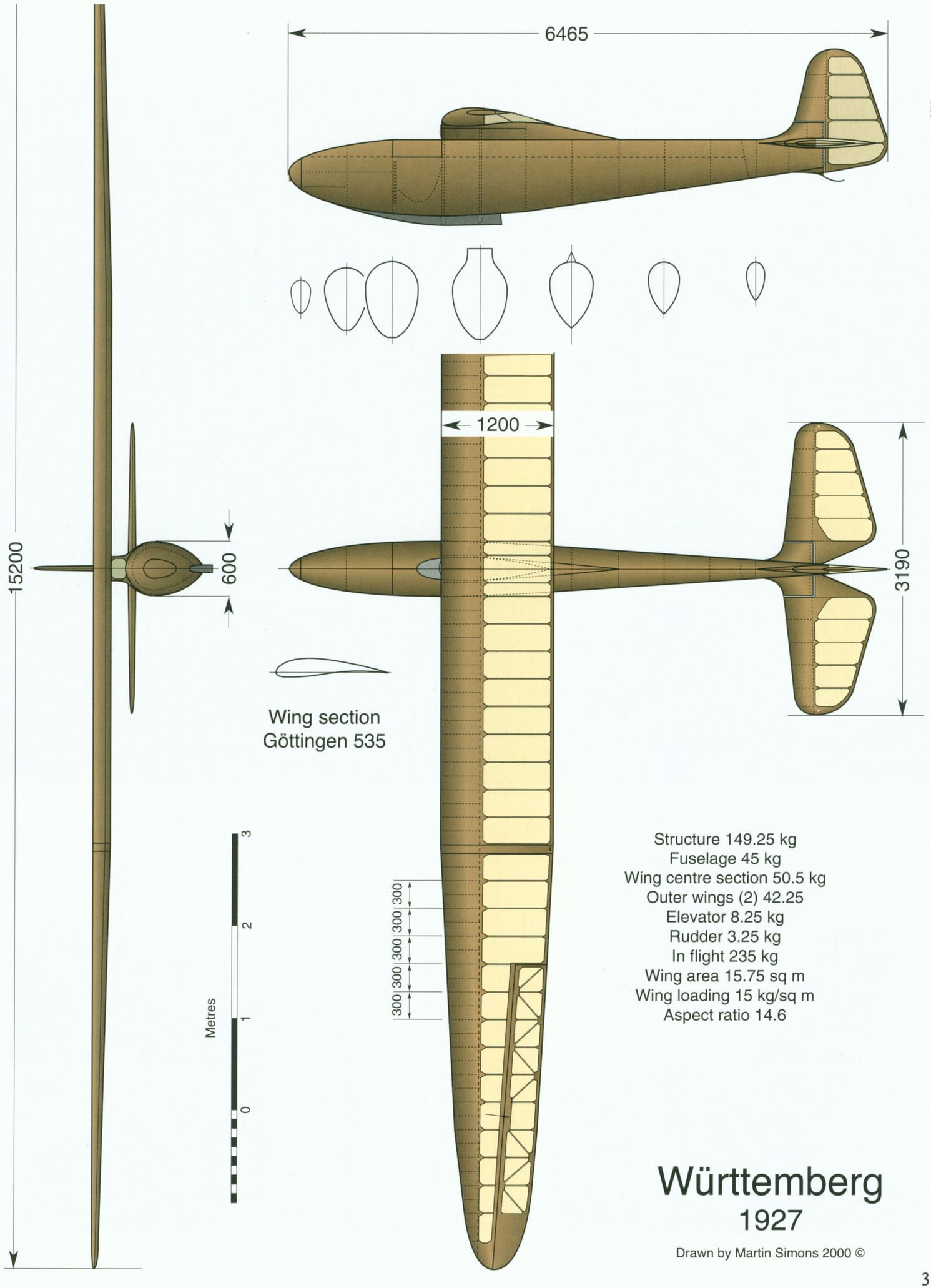
Wolf Hirth used the Württemberg, named after his home town, to win the French contest in Normandy, at Vauville west of Cherbourg, in 1928. He made a record distance flight along the coastal cliffs and dunes. After take off he climbed through 'sea fret' fog to re-enter clear air above, then flew along the coast, even pushing out over the sea, to a landing in sunlight on a public bathing beach.

Darmstadt D - 17 and 'Chanute'

The new sailplanes were not always built in the Akaflieg workshops. Volker's D - 17 Darmstadt was constructed professionally. Completed in time for the 1927 Rhön, Nehring used it to make a remarkable, hill soaring distance flight of 51.8 km. He had spent many hours studying contour maps and, given the right wind, knew just where to go to find the next lift.

Barograph trace for three of Nehring's hill soaring cross country flights in the Darmstadt D - 17.



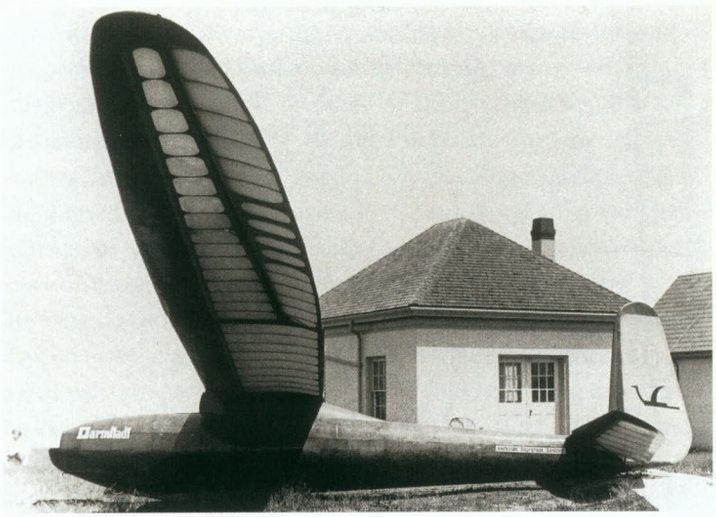


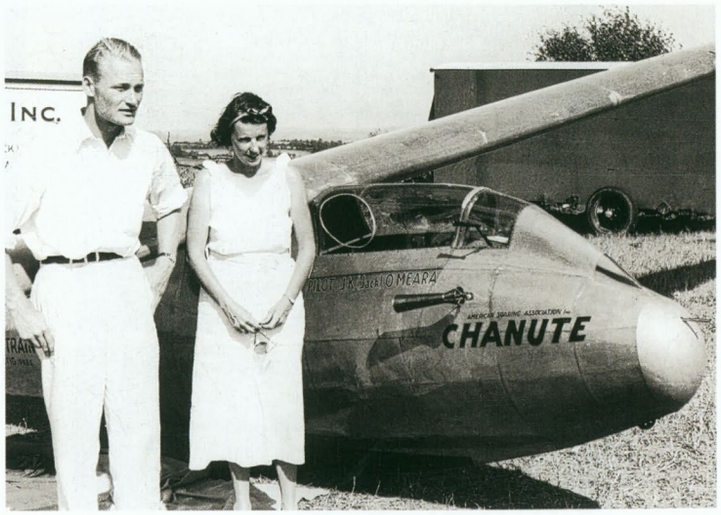
Structure 149.25 kg
Fuselage 45 kg
Wing centre section 50.5 kg
Outer wings (2) 42.25
Elevator 8.25 kg
Rudder 3.25 kg
In flight 235 kg
Wing area 15.75 sq m
Wing loading 15 kg/sq m
Aspect ratio 14.6

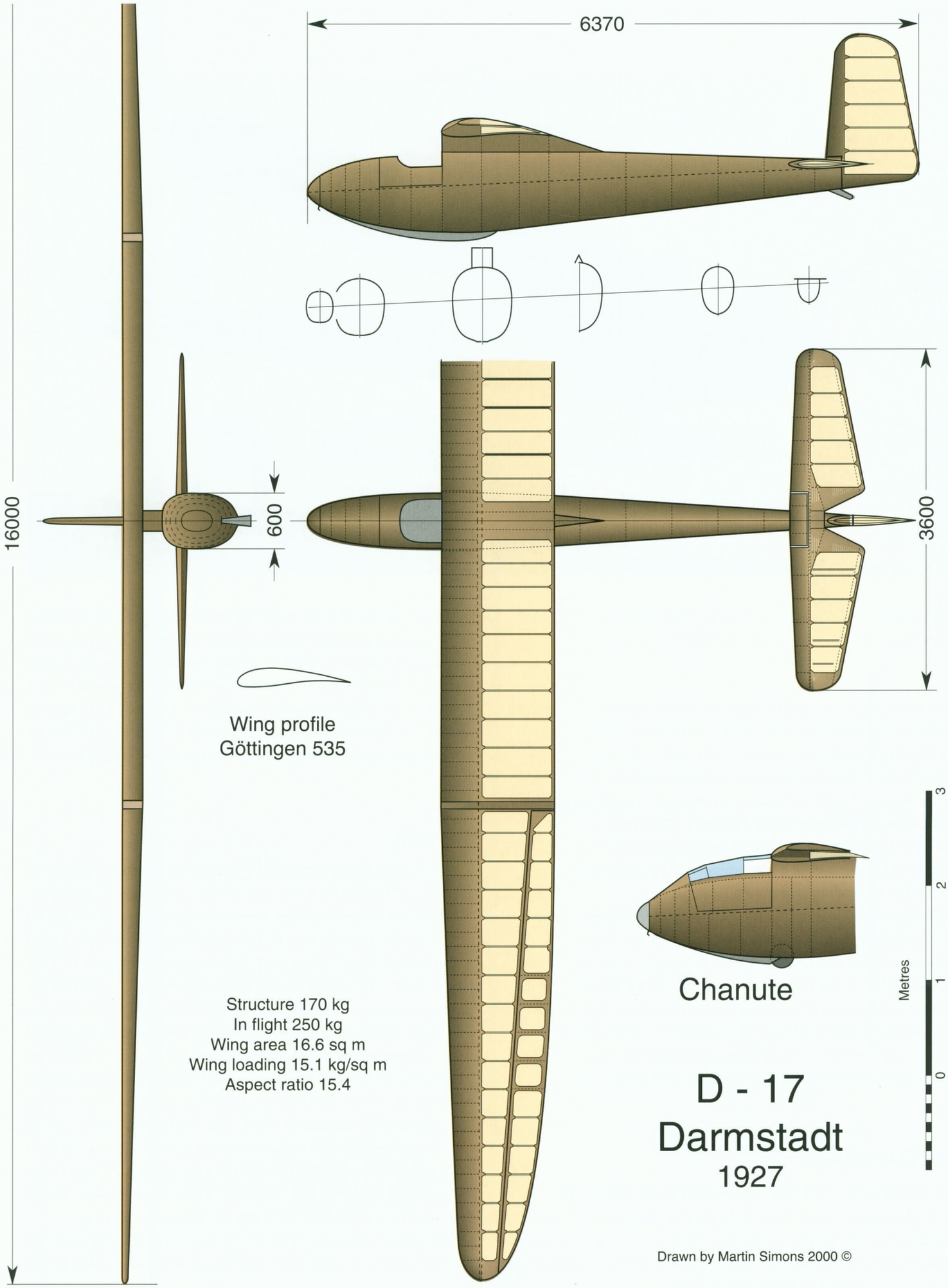
Württemberg
1927

Above and left below: The D - 17, Darmstadt 1, showing the structure of the wing and ailerons, large vertical, all-moving rudder carrying the Darmstadt school's emblem. It made its contest debut at the Wasserkuppe in 1927 after the destruction of the Konsul.

Right below: After the demonstrations at Cape Cod in April - May 1928 and serious damage to the sailplane there, the Darmstadt 1 was rebuilt and re-named 'Chanute'. It was given an enclosed cockpit. The pilot who flew it most was Jack O'Meara. The photograph here shows Richard du Pont and Mrs Holderman.





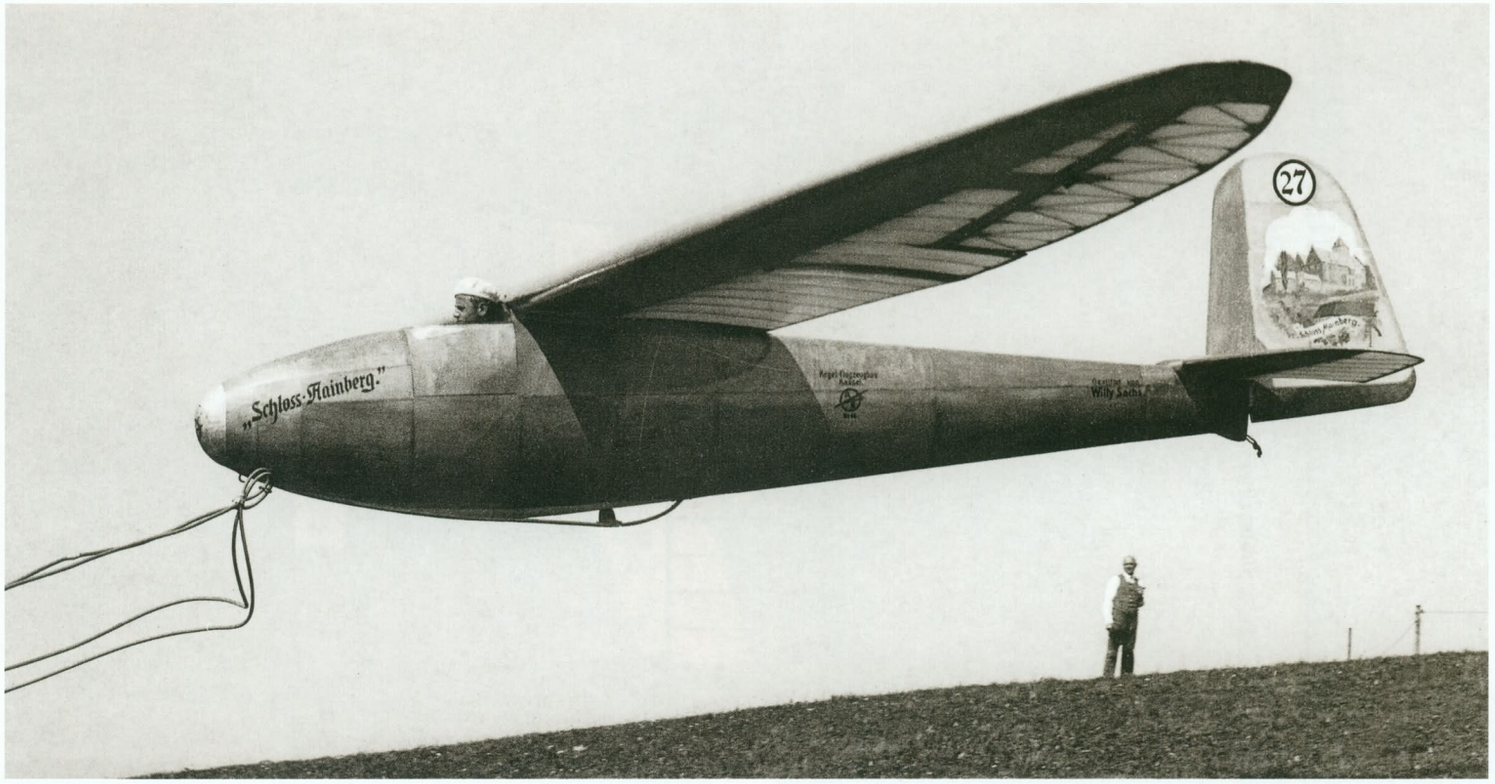


Wing profile
Göttingen 535

Chanute

Structure 170 kg
In flight 250 kg
Wing area 16.6 sq m
Wing loading 15.1 kg/sq m
Aspect ratio 15.4

D - 17
Darmstadt
1927



The Schloss Mainberg, a typical sailplane of the Darmstadt school. It went to the USA where, after being used for some years, it was destroyed in an accident.

A few months later, in 1928 the Darmstadt was taken to Cape Cod where Peter Hesselbach soared the dunes, on a flight extending to four hours. This attracted much attention in the USA, including that of the young Schweizer brothers who began to think seriously of building a glider themselves. The D - 17 was badly damaged in a mishap at Cape Cod, Hesselbach striking an unseen flagpole. The wreck was sold and rebuilt with improvements to the cockpit and an enclosed transparent canopy. Re-named Chanute, it was subsequently flown extensively by Jack O'Meara, the leading American pilot at the time.

The Westpreussen was originally built with a small span of 14 metres for Ferdinand Schulz who used it to explore the Baltic coast of East Prussia around Rossitten north of Königsberg, making distance by following the sand dunes, often almost touching the slopes with his wing tip, sometimes forced to land if confronted with fence posts or beached yachts with masts in the way. With the span increased to the more usual sixteen metres Westpreussen type was built in some numbers for sale, one being flown in England for several years.

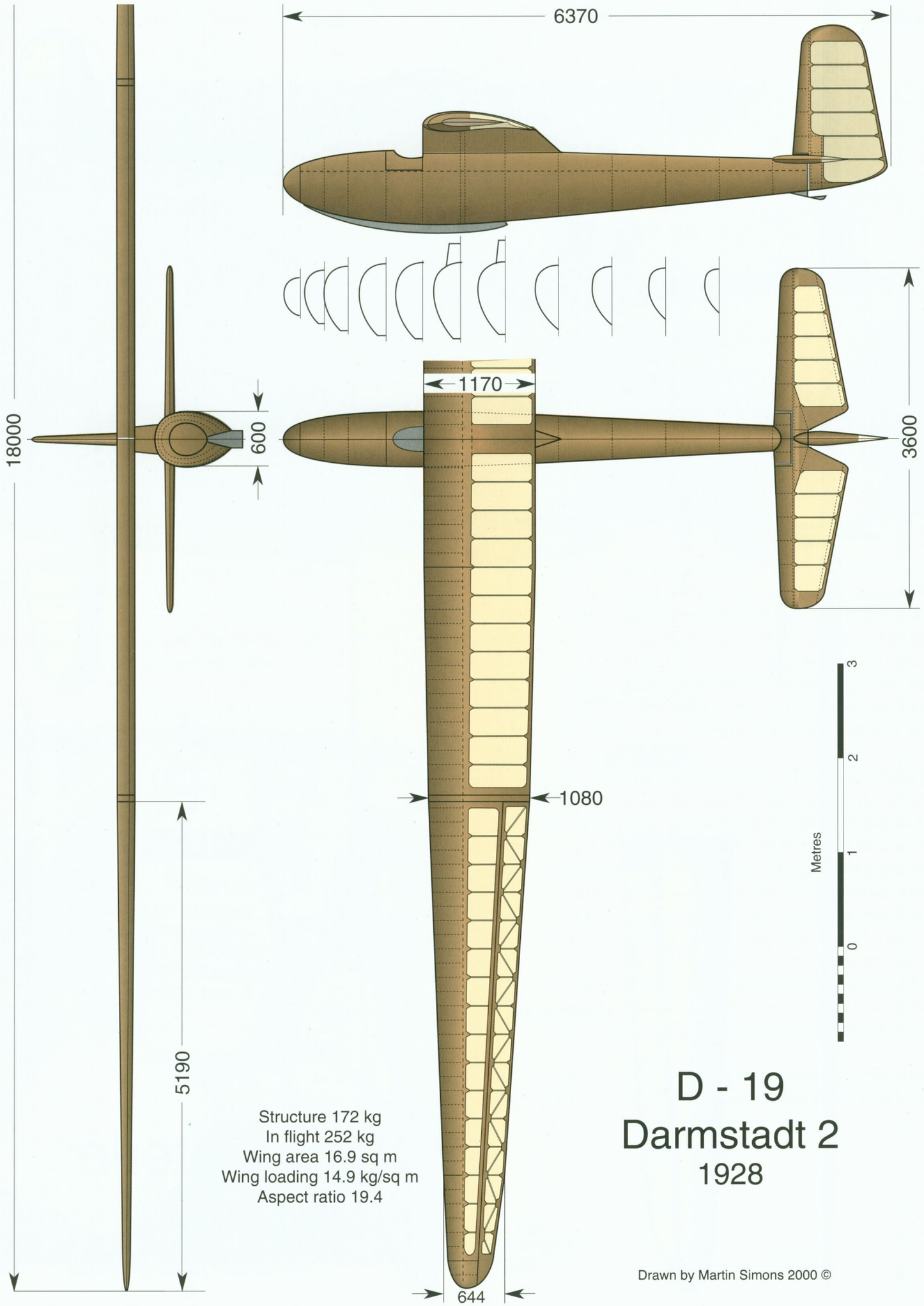
D - 19 Darmstadt 2

The D - 19 Darmstadt 2 of 1928 reverted to the large wingspan of 18 metres. The aspect ratio was 19.2, very impressive and rarely equalled even in the following decade. With new Joukowsky wing profiles which had less camber, and hence a smaller pitching moment than the Gö 535, the wing tapered in thickness from 15 at the ends of the centre section, to 8% at the wing tips. Nehring used this very superior aircraft to compete in the French championships and, at the next Wasserkuppe meeting, made a distance record of 71.2 Kilometres, still skimming over the slopes. The following year he managed 72.3 kilometres. The Darmstadt 2 continued in service until wrecked during an expedition to Sweden and Finland in 1934.

Musterle

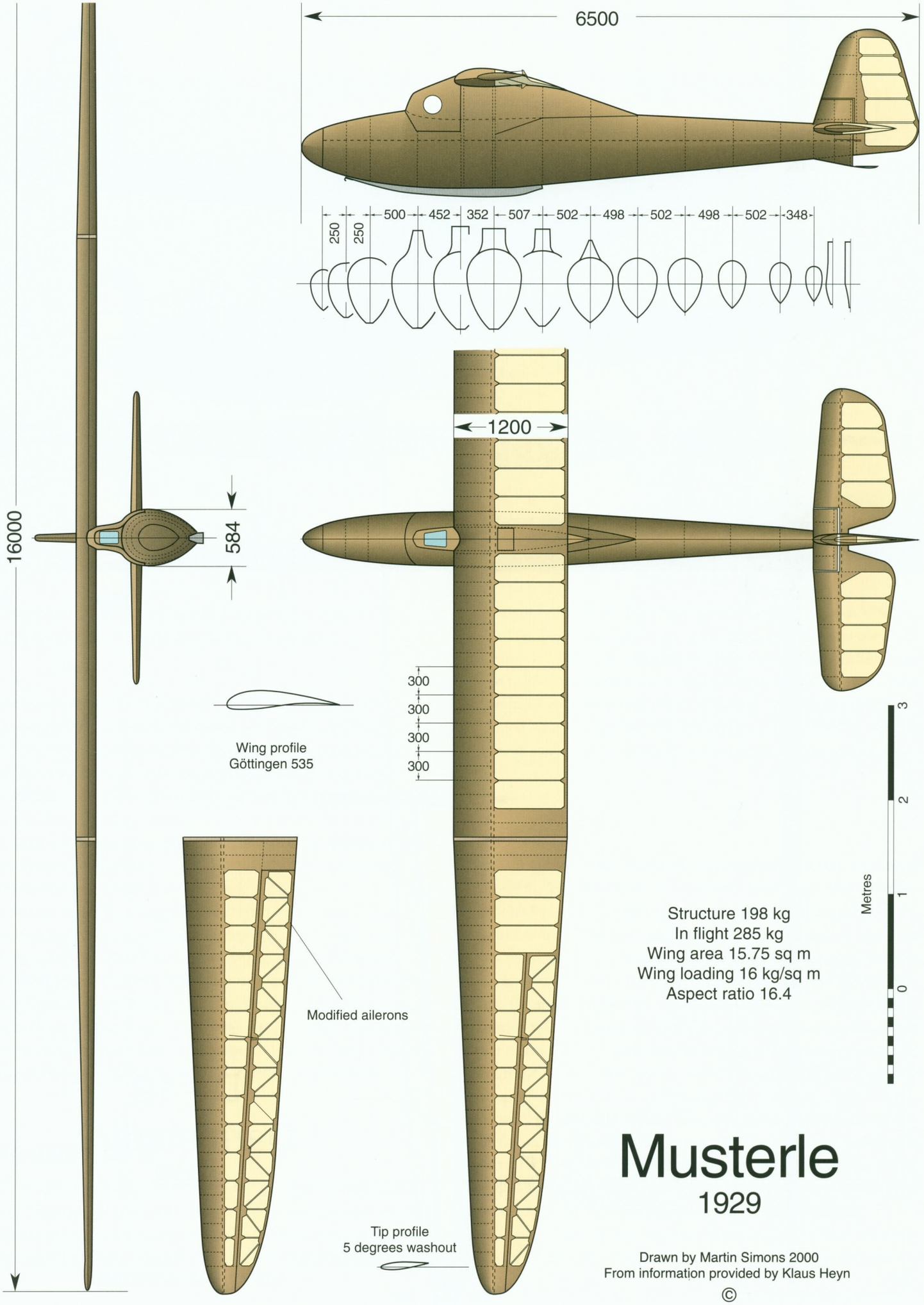
Most famous of all the Darmstadt types was the Musterle. This, built in Kassel for Wolf Hirth, was a copy of the Lore designed by Laubenthal. It had an enclosed canopy of wood, with minimal portholes for the pilot to see through, a small transparent windscreen in front and a tiny window above. Hirth took the Musterle to America in 1930 and competed in the US National Championships at Harris Hill, Elmira in 'upstate' New York. Unknown to the other pilots, he had a variometer. On October 5th 1930 he made a thermal soaring flight under a cloudless sky across country. Such a thing was unheard of. Up currents under, and inside, cumulus clouds had been used in Germany for several years before, but the existence of 'blue' thermals was hardly known even there. The Schloss Mainberg (which once flew a duration over 9.5 hours at the Wasserkuppe, landing in the dark) was also at Elmira for this contest, imported by Gus Haller who had established his own sailplane factory in Pittsburgh. He did some work on the Musterle for Hirth, extending the ailerons.

Hirth remained in the USA for several months and with the Musterle made a soaring flight over New York City on 10th March



Structure 172 kg
In flight 252 kg
Wing area 16.9 sq m
Wing loading 14.9 kg/sq m
Aspect ratio 19.4

D - 19
Darmstadt 2
1928



Structure 198 kg
In flight 285 kg
Wing area 15.75 sq m
Wing loading 16 kg/sq m
Aspect ratio 16.4

Musterle
1929

Drawn by Martin Simons 2000
From information provided by Klaus Heyn

Above: The Musterle, most famous of the early Darmstadt series, launched from the Wasserkuppe.

Below: Wolf Hirth displays the rudder of the Musterle, on which some of his earlier successes were listed. Not all were flown in this sailplane.

1931. He was bungee launched from a grassed area of Riverside Park, near the end of 161st Street, into a good north westerly wind. The Hudson River bank here was 30 to 35 metres high and gave adequate slope lift, which Hirth used to climb, at his best, to about 300 metres. He cruised over the river bank for half an hour but landed when the police signalled that he was creating serious traffic disruption. (He was not the first to fly a glider over the city for Jack O'Meara had done so, in a Franklin Utility, from an aero tow, a month before [see chapter 23].)

Darmstadt school sailplanes survived well into the 'thirties. At the 1934 Rhön the D - 19 Darmstadt 2 competed for the last time, two of the Westpreussen type and both the Musterle and the Lore were there. Musterle, no longer flown by Hirth, was broken badly in a misjudged landing, but repaired overnight. Another survivor was the original Württemberg. By the 1934 meeting, having passed through various hands and now suffering from serious glue failure, it was patched up by Tassilo Proppe, who used numerous external 'tack strips' of plywood with small steel nails to reattach the plywood skin on the wing to the ribs from which it had separated. In this condition he flew the sailplane successfully until, after a heavy landing, the damage was too extensive to repair.

By this time the sport of soaring had been entirely transformed by the discovery of thermals and new design trends were well established.

CHAPTER 3

Learning to Fly

If the sport of soaring was to flourish, new pilots must be taught to fly. Almost all successful flights in the early years on the Wasserkuppe were by pilots already experienced in powered aircraft, most of them veterans of wartime. Some youngsters such as the Darmstadt students who achieved fame, including Laubenthal, Nehring and Hesselbach, learned to fly in powered aircraft first. The Akaflieg had two aeroplanes and a very skilled instructor, Otto Fuchs, was available.

Germany was going through a disastrous period of runaway inflation and political instability. Ordinary folk could afford nothing beyond the bare necessities, a good many of the old and unemployed were truly starving. The only flight training scheme that had any chance of success, even with limited government finance, must be as inexpensive as possible.

To begin with, training was totally unorganised, haphazard and casual. Peter Riedel, a schoolboy of fifteen, in 1920 was towed along in his little biplane gently into wind by two helpers with ropes a metre long attached to the wing tips. Instructions were called to him by his volunteer instructor, Theo Suchla: Pull! Push! Pull, Right! Left, Pull! and so on. He made fourteen flights in this way.

Wolf Hirth had made a few tentative hang glider hops at the Wasserkuppe in 1920. From Messerschmitt's plans he built the S - 10. By a slow process of trial and error, towed off by helpers with ropes, he taught himself to fly. When confident enough, he undertook to teach others. A school was established by Messerschmitt with Hirth, and the S - 10 became the first glider used for systematic pilot training, solo. Messerschmitt soon closed his workshop on the mountain and left to build powered aeroplanes.

Kurt Student (who was later to become head of the German airborne forces in World War 2), also undertook to train pilots solo after the 1921 Rhön meeting, in cooperation with the Weltensegler Company. He was badly injured in a spinning accident and also departed. Among his earliest pupils had been Fritz Stamer who became a central figure in subsequent developments. Arthur Martens, with support from his wealthy father-in-law, also established a training school on the Wasserkuppe and took on Stamer, after Student had gone, as the chief instructor. The school had a two seat sailplane, the Deutschland, as well as the Strolch and Moritz for soaring. But Stamer was convinced that glider pilots could, and should, be taught to fly solo from the beginning, as he himself had been.

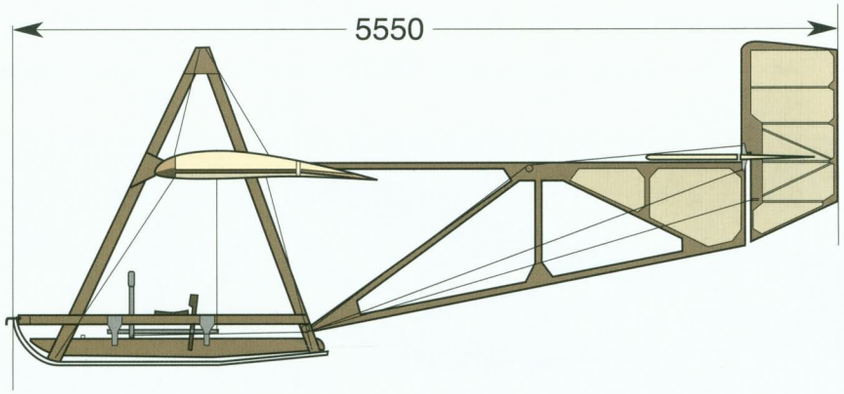
The original 'Djävlar anamma' or 'Hols der Teufel' designed by Lippisch. This was the basis of the Grunau 9 primary glider. Later versions by Schleicher and Jacobs also named Hols der Teufel, were really quite different.

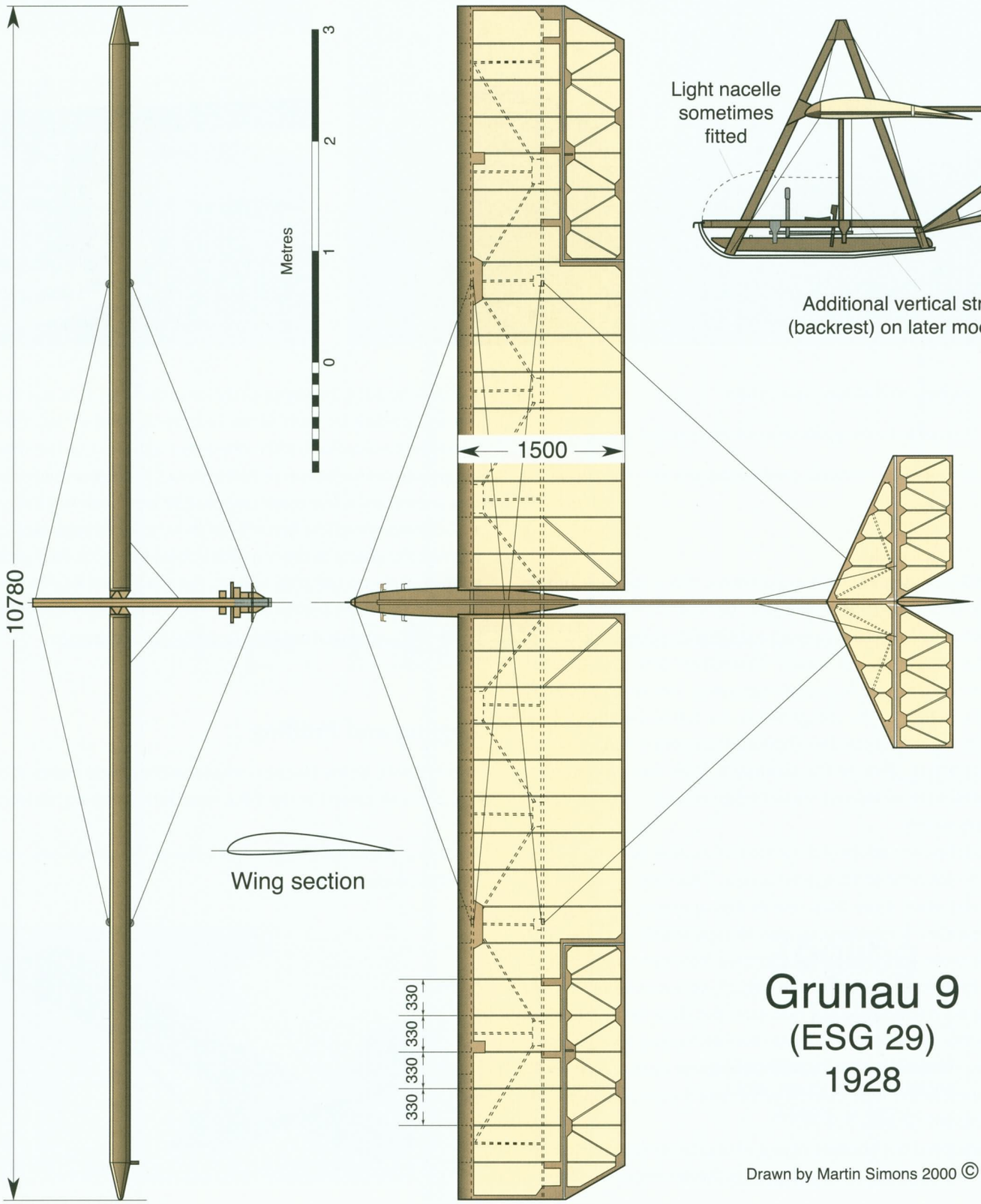
Djävlar Anamma (Hols der Teufel) and Grunau 9

In 1923 Alexander Lippisch had designed a very simple glider called Djävlar Anamma. This was an expression used frequently by two Swedish students who worked in the Weltensegler workshop and swore 'Devil take it' when anything went wrong. The name was daubed on the Lippisch glider. In German, the equivalent phrase was Hols der Teufel. The Djävlar had a simple two spar, rectangular wing, fabric covered, braced with wires to a very light but strong central 'A frame' structure which was extended rearwards with two cross braced longerons to take the tail. There was a simple wooden seat under the wing, within the A frame. The forward strut, promptly named 'skullsplitter', was immediately in front of the pilot's face. Lippisch designed a light fabric covered nacelle to enclose the cockpit and reduce drag.

Espenlaub, the woodworker, had designed and built several gliders and repaired many more. In 1923 he was invited to Grunau, a small village in Silesia, to help the growing gliding movement based there. Accompanied by Edmund Schneider he took with him the design for his own 'primary' glider, closely modelled on the Djävlar Anamma.

Structure 86 kg (approx)
In flight 150 kg (approx)
Wing area 16.06 sq m
Wing loading 9.3 kg/sq m
Aspect ratio 7.2
(Figures from 1930
Schneider catalogue)

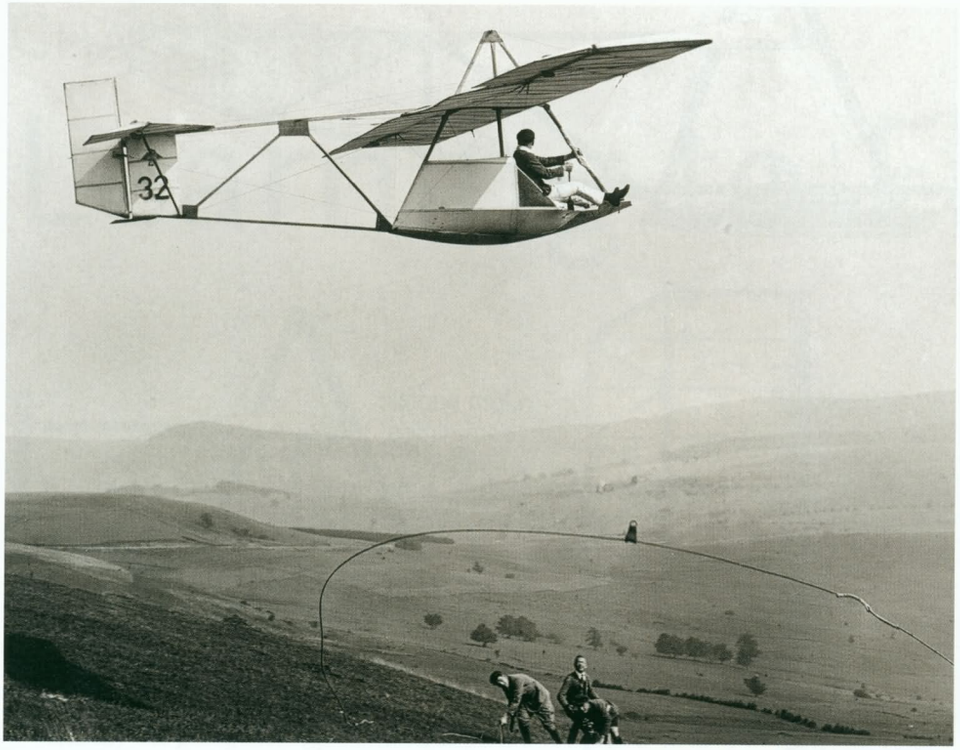


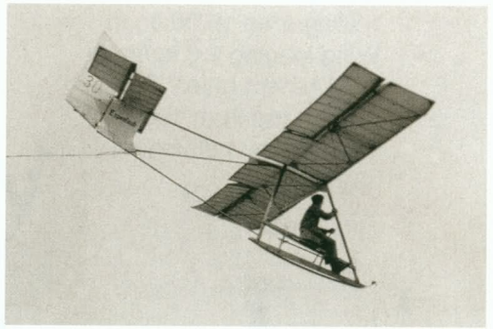


Additional vertical strut
(backrest) on later models

Wing section

Grunau 9
(ESG 29)
1928





Left: Pegasus, the father of all the later Primary gliders

Right above: The Espenlaub training glider which led directly to the Grunau 9

Right below: Later versions of the Grunau 9 had a vertical strut behind the pilot, with a back rest.

Edmund Schneider, a skilled woodworker, was a member of the Luftpolizei, an organisation responsible for security, safety and aircraft maintenance at the few operational airfields remaining in Germany. After a couple of years, Espenlaub left Grunau for Segelflugzeugbau Kassel. Schneider remained, married a local girl and set up a factory in the village below the hill where the gliding club was. He produced the ESG (Edmund Schneider, Grunau) primary glider which became the Grunau 9. This was produced in quantity and, with numerous small improvements over the years, was sold very widely.

It seems Schneider adopted a method of numbering his designs according to the year of their production. This still causes confusion. In some years more than one design appeared, so both had the same number. Sometimes an aircraft type which was produced over two or more years, would be allocated different numbers. The Grunau 9 itself was later called the ESG 29, various changes in detail having been introduced in that year. But there were other designs with the same number. These were also often given names. (Much later, in the nineteen thirties, a complete change in the system of nomenclature took place. The Grunau 6 and Grunau 8 were not related to the Grunau 9 or 29.)

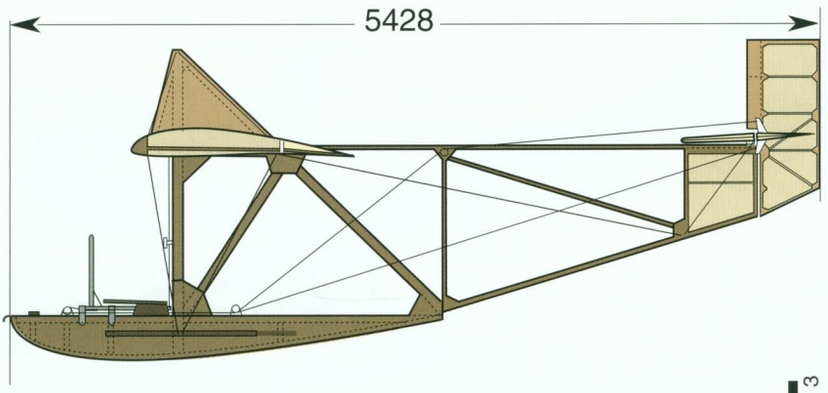
Stamer equipped the Martens school with primary training gliders called Pegasus, also based on the Lippisch Djävlar. Six of them were available by 1924. In August of this year the body that was to govern German gliding for most of the next decade was set up, The Rhön-Rossitten Gesellschaft, RRG. (Rossitten appeared in the title to acknowledge developments in East Prussia.) With government backing this organisation was made responsible for research, pilot training and competitions. The first official move towards organised training was to offer places at the Martens school for about fifty promising young people for the 1925 season. The school ran into financial difficulties. By the end of the year Martens was bought out completely by the RRG, who retained Stamer as the chief instructor.

Zögling and Prüfling

At this point, Oskar Ursinus, whose self-imposed duties as contest director now passed to the RRG, once more took an initiative. The

The Prüfling, in effect a primary glider with a fuselage. The type was built in quantity by Segelflugzeugbau, Kassel.

Structure 86 kg
In flight 170 kg
Wing area 15 sq m
Wing loading 11.3 kg/sq m
Aspect ratio 6.7
(Figures quoted
by Gerhard Fieseler 1930)




Wing section

Zögling

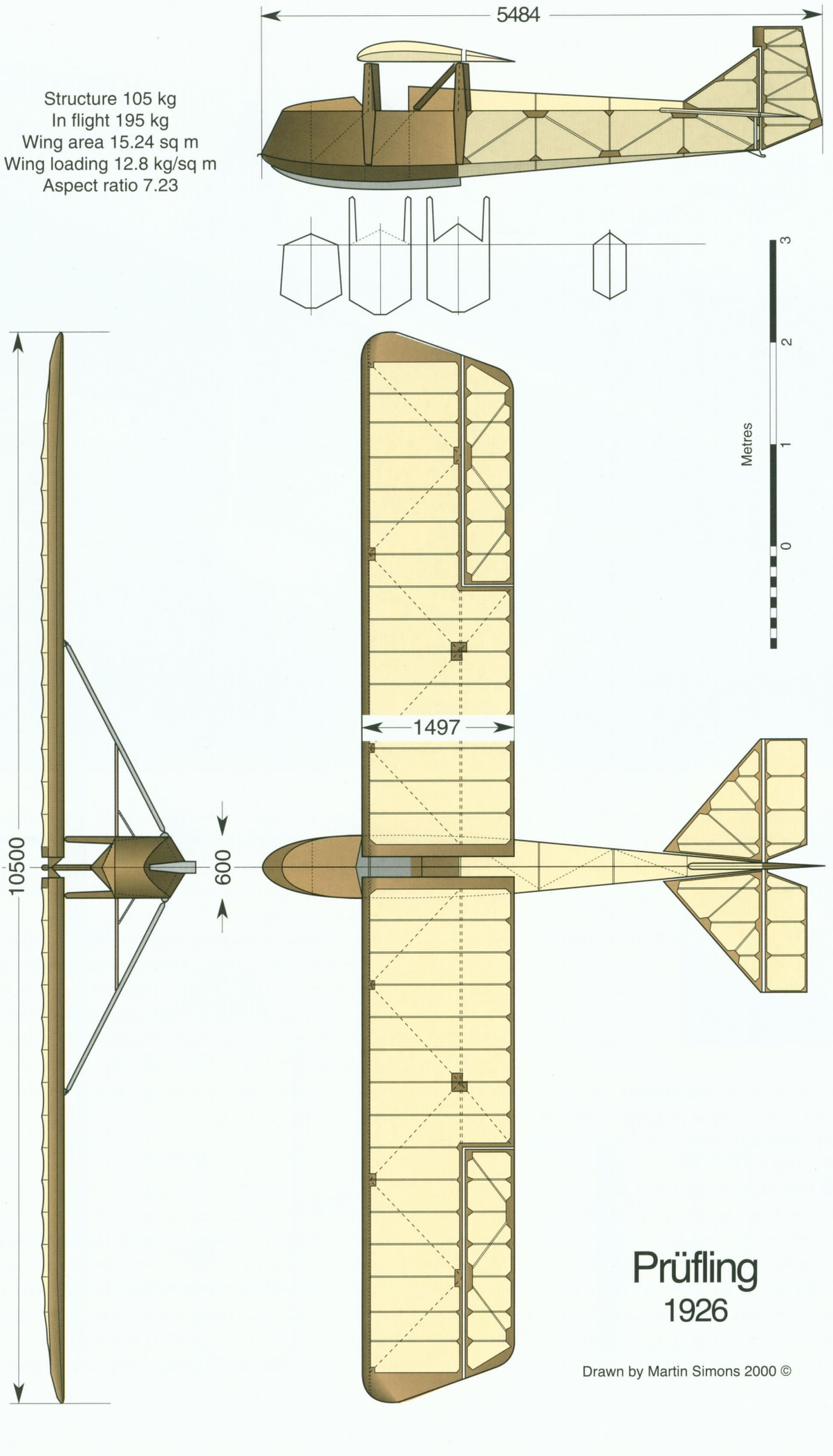
1926

(Segelflugzeugbau Kassel)
Note: many other versions
differed in detail

Above: In England the London Gliding Club bought a Prüfling, seen here flying in a demonstration at Ivinghoe Beacon before the club found its permanent site nearer to Dunstable.

Right and below: The Zögling primary glider, widely copied all over the world.

Structure 105 kg
In flight 195 kg
Wing area 15.24 sq m
Wing loading 12.8 kg/sq m
Aspect ratio 7.23



Prüfling
1926

Above: The original English primary glider, the 'Dagling' marketed by the R.F. Dagnall company. The tail was carried on steel tubes.

Left: The 'Karpf' Zögling developed in Switzerland, with steel tube frame and enlarged tail. The light fairing behind the pilot improved the glide by reducing flow separation.

Pegasus gliders were not entirely satisfactory. The structure was somewhat flimsy and damage on a heavy landing frequent. Stamer did not like the skullsplitter strut, believing it was dangerous. Moreover, a future soaring pilot needed something better to fly once the basic skills had been learned. There should be a 'secondary' type after the primary, and beyond this, some cheap soaring sailplanes, 'intermediate' between the secondary and the advanced types. Ursinus invited Lippisch and Stamer to visit him in the offices of Flugsport in Frankfurt. Once there, they found themselves more or less kidnapped. Drawing office and accommodation were provided. They must agree on the design of a good primary trainer, then a 'secondary' which would lead later to an intermediate sailplane.

The result, within a few days, was the Zögling primary and the Prüfling secondary. The Zögling (Pupil) differed from the Pegasus chiefly in that the skullsplitter had gone, but it was stronger all round with a solid wooden keel, more able to stand the rough and tumble of training.

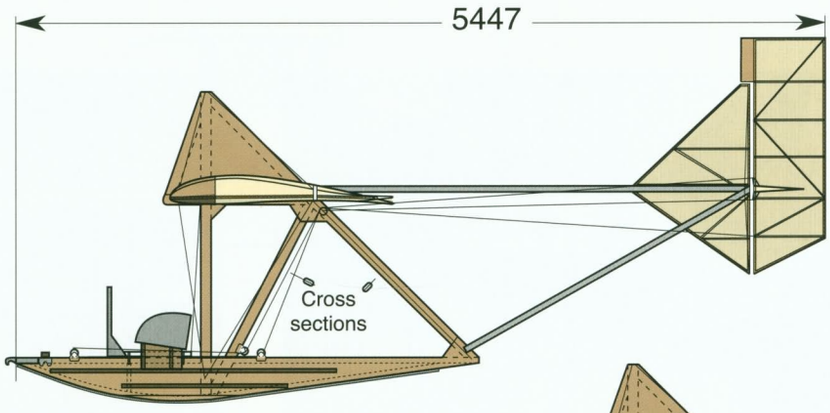
The Prüfling (Examinee), which emerged at the same time from the Flugsport offices, had almost the same wing as the primary, but a simple, plywood and fabric covered fuselage with cockpit underneath the wing. In 1926 the RRG accepted both the Lippisch gliders. Not only were they used in the schools on the Wasserkuppe and at Rossitten, but the plans were published and sold all over Europe and, before long, the world. Anyone could, with suitable materials and skill, build one.

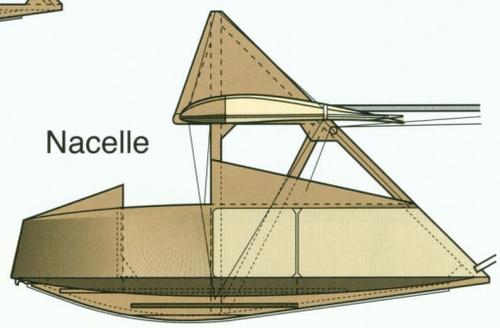
Dagling

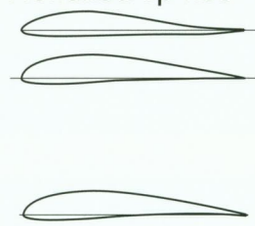
When, in the late 'twenties and early thirties, gliding aroused the enthusiasm of aspiring aviators everywhere, innumerable imitations of the Zögling were designed and built. Plans for a version with steel tubes to support the tail were produced by Wolf Hirth. This design was taken up in Switzerland, America and England where it was called the Dagling. Plans for a Dickson Primary were

Slingsby Type 3 Primary
(Dagling)

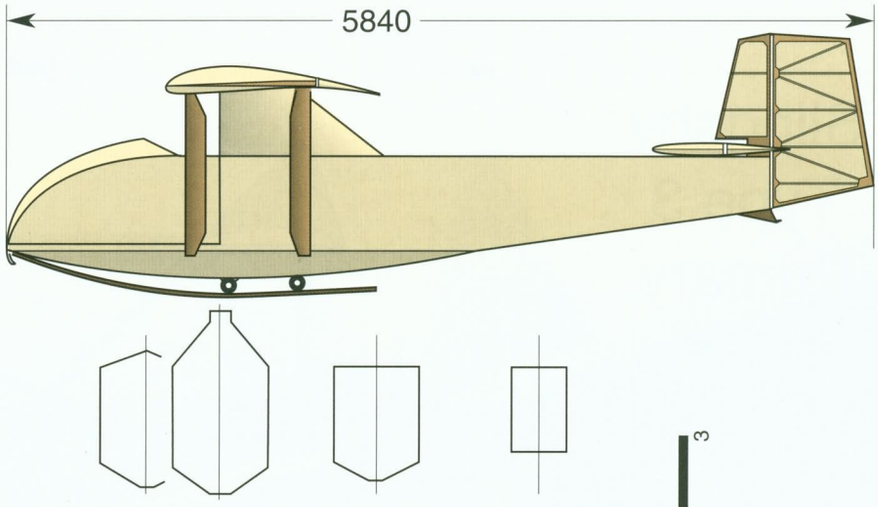
Drawn by Martin Simons 2000 ©







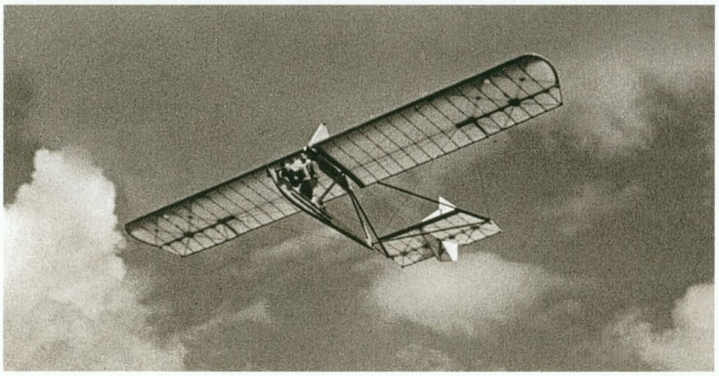
Structure 82 kg
In flight 173 kg
Wing area 15.06 sq m
Wing loading 11.5 kg/sq m
Aspect ratio 7.1



Wing section

Structure 110 kg
In flight 200 kg
Wing area 13.5 sq m
Wing loading 14.8 kg/sq m
Aspect ratio 7.4

Grüne Post
1932 - 3



Left above: The Dickson primary glider was popular with home builders who got the plans from magazines. As they soon discovered, the drawings contained errors but many examples were built and flown.

Left below: After Dagnall withdrew from glider manufacture, the Dagling was produced by Slingsby. Rounded wing tips were an option.

Right above: Grüne Post on display in Michelstadt/Odenwald.

printed with instructions in magazines. These were used by many clubs in the English speaking world, and so it went. For many years, if a newspaper needed a photograph to illustrate some story such as a great soaring distance or height record, the picture, ludicrously, would usually be a primary glider.

Grüne Post

In 1932 Lippisch designed for the sporting newspaper Grüne Post a small secondary glider very similar in size and appearance to the Prüfling and with similar performance. Plans could be obtained from the newspaper and many were built by amateur groups.

SG - 38

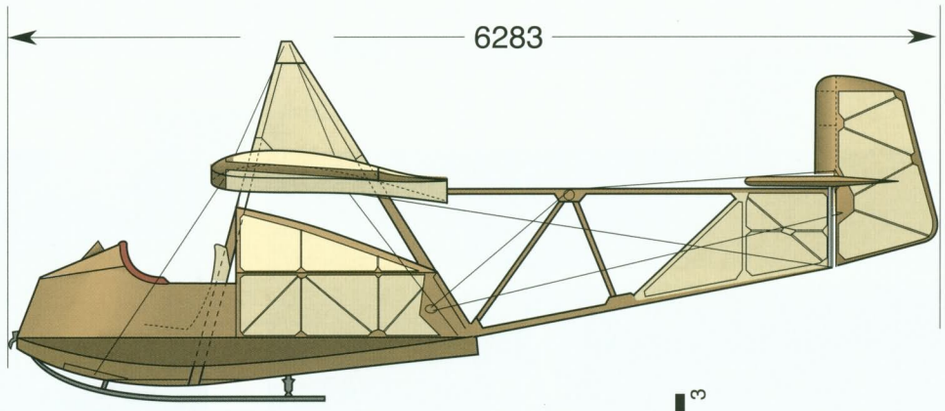
In 1933 the RRG was absorbed by the Deutsche Luftsport Verband, DLV. In association with the Hitler Youth movement, there was a vast expansion of glider training. Following lengthy discussions between the DLV and all the main glider manufacturers, a new standard primary trainer was designed, chiefly by Edmund Schneider, the Schulgleiter SG - 38. This was a considerable advance on the Zögling, with a larger tail for improved stability, a better seat and large shock absorbing springs under the keel. Manufacture, once begun, ran into many thousands. Every district of the Third Reich soon had its gliding unit and pilot training programme.

Along with the Zögling plans, went ideas and methods of solo pilot training worked out in detail by Fritz Stamer. Booklets and notes for instructors were published, Stamer's own book, Gleit und Segelflugschulung became a standard text and was translated into other languages.

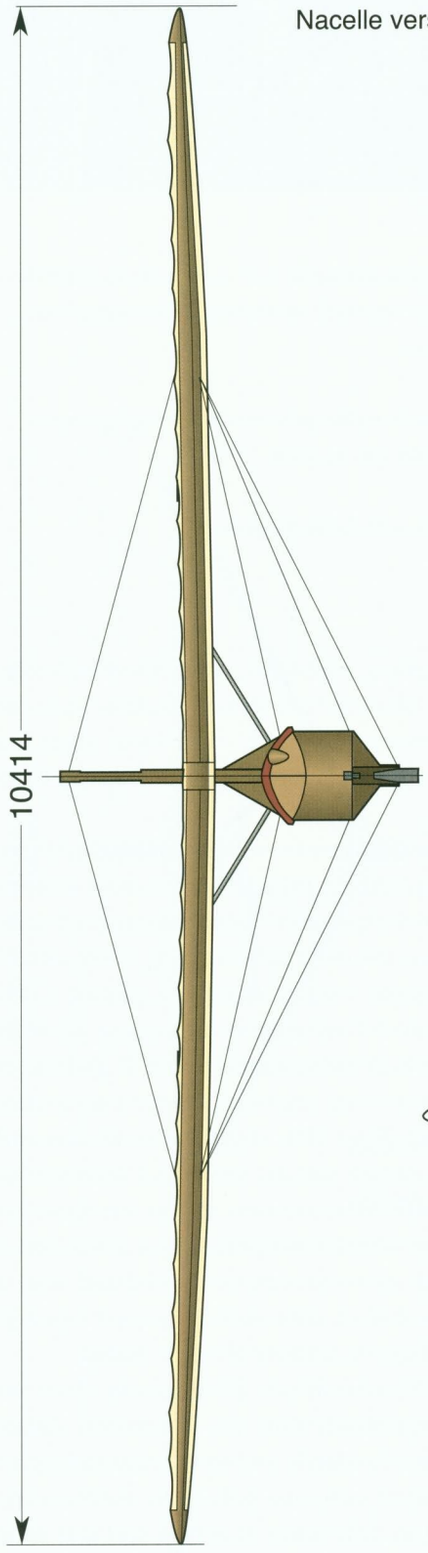
Solo training was used almost universally until after the Second World War. Stamer reported that in 1929, the RRG school accepted 269 student pilots. They were expected to spend their entire holiday of several weeks at least, on the mountain, working every suitable day with the Zöglings and the bungee, launching, gliding a little way, landing, dragging up the hill again, launching and so on. At the end of summer, 121 of the beginners completed the 'B' gliding certificate. That is, 45%, less than half, reached this minimal standard. From these successful ones, 30 or 11%, stayed for an extra month and achieved the 'C' five minute soaring, test. What became of all the others? A few might have returned next season. Most did not. These results were achieved with the best professional instructors in the world, with proper back up, workshops with skilled staff, and, all around for the students to observe, advanced aircraft and expert pilots demonstrating what might be achieved if they persisted.

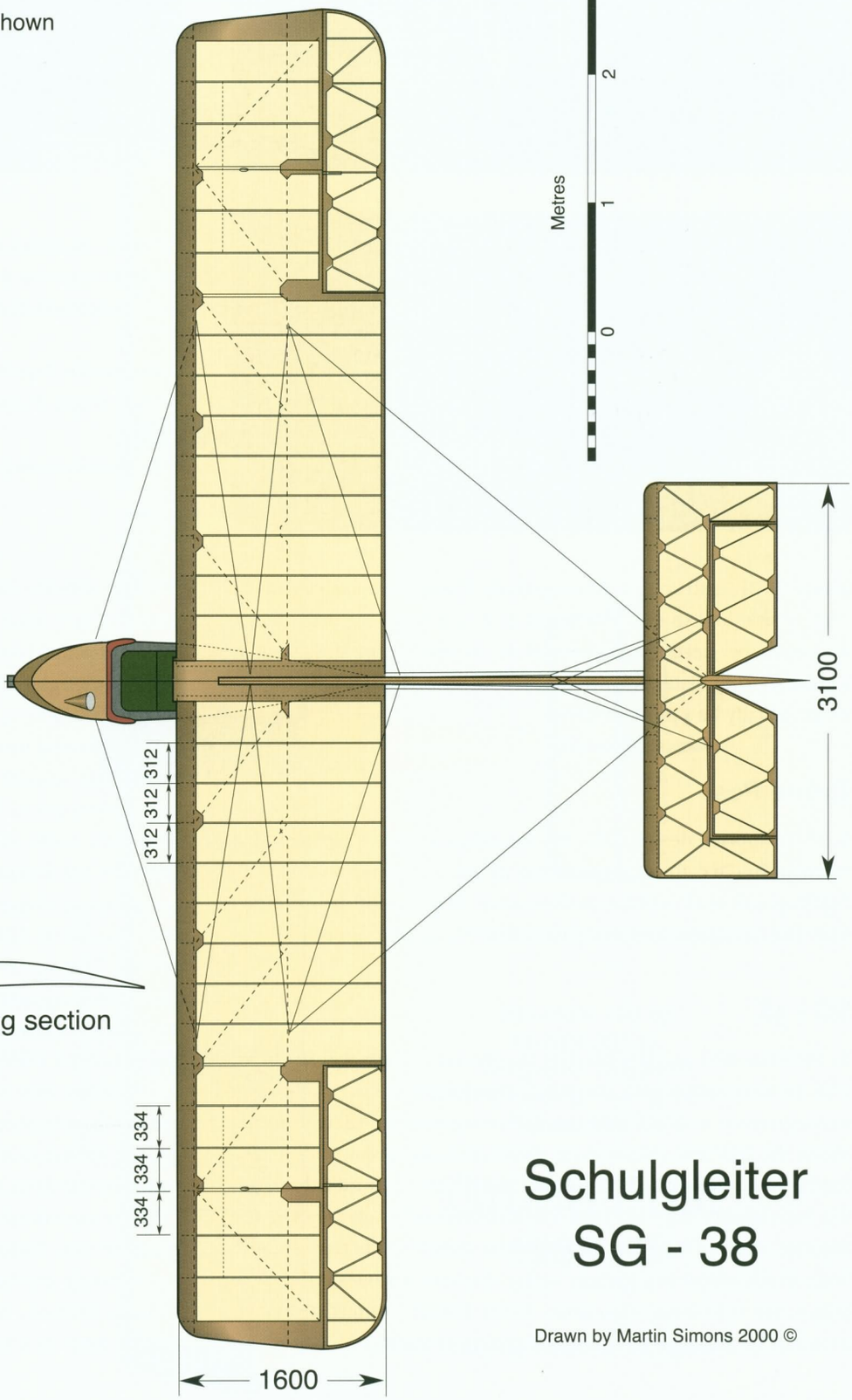
In the enormous majority of ordinary gliding clubs, there was none of this. Progress was pitifully slow. The instructors usually knew hardly any more than the pupils and were sometimes gravely misinformed. To mention only one point, the author's first flights were in a Dagling in 1947 when this type was still being

Structure 105 kg
In flight 210 kg
Wing area 16 sq m
Wing loading 6.6 kg/sq m
Aspect ratio 6.77



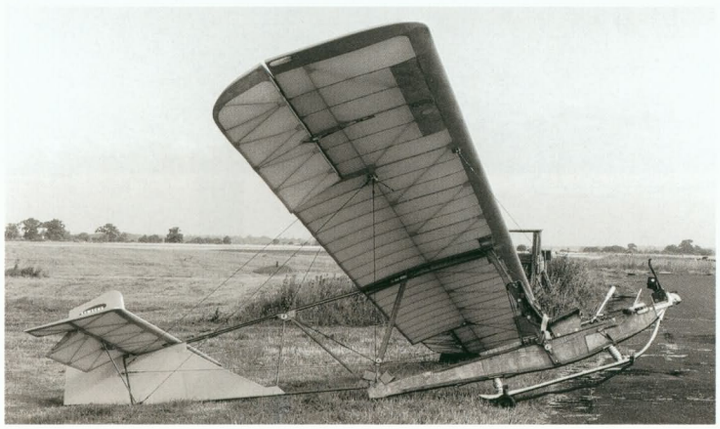
Nacelle version shown





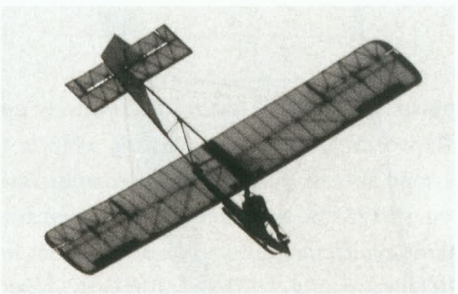
Wing section

Schulgleiter SG - 38



Above: A light nacelle was fitted to the S.G. 38 for the more advanced students. Note the crash helmet: standard wear for the NSFK.

Left and right below: The SG - 38, which entered mass production in 1938, was a great improvement on the Zögling. This restored example shows the large shock absorbers below the keel, the contoured seat, enlarged tail unit for increased stability, provision for basic instruments and attachment points for ballast to suit different weights of pilot.



used widely in English clubs. A lightweight schoolboy or girl would often get into, or rather, onto, the seat immediately after a fully grown, hefty adult. No one mentioned, no one even knew, that the resulting shift of the centre of gravity would make a very significant difference to stability and above all to the sensitivity of the elevator. The Dagling had no provision for trimming ballast anyway. There were many accidents, some of them fatal, some less serious, but all involving damage to the aircraft followed by long periods spent in repairs. The work usually was done by the, unskilled, club members themselves. (I taught myself to scarf plywood!) Minor crashes were not documented or investigated. Costs not only for materials and labour but revenue lost to the clubs, was extremely high.

Many potentially good pilots departed in sheer frustration. There were back and even neck injuries, not always immediately recognised. People left the gliding site with a pain and didn't come back. In England in a sudden wave of enthusiasm, nearly sixty gliding clubs were formed in 1930, all using solo training methods. A year later there were four or five. In Australia of nine clubs listed, one survived.

It is easy to be wise in retrospect. In power flying no one dreamed of solo training. Dual instruction was well established and understood. What would have happened to the soaring movement if, instead of the Zögling, Lippisch and Stamer had designed a training glider, just a little larger, with a second seat and controls for an instructor? It would have cost a little more than the single seater but would have lasted longer to earn its keep. Accidents would have been fewer, less time and money would have been spent on repairs, fewer students would have been frustrated, discouraged, frightened, injured, killed. More would have learned to fly. More would have learned to soar.

Was the Zögling a mistake from the beginning?

CHAPTER 4

The Rhön Ghost

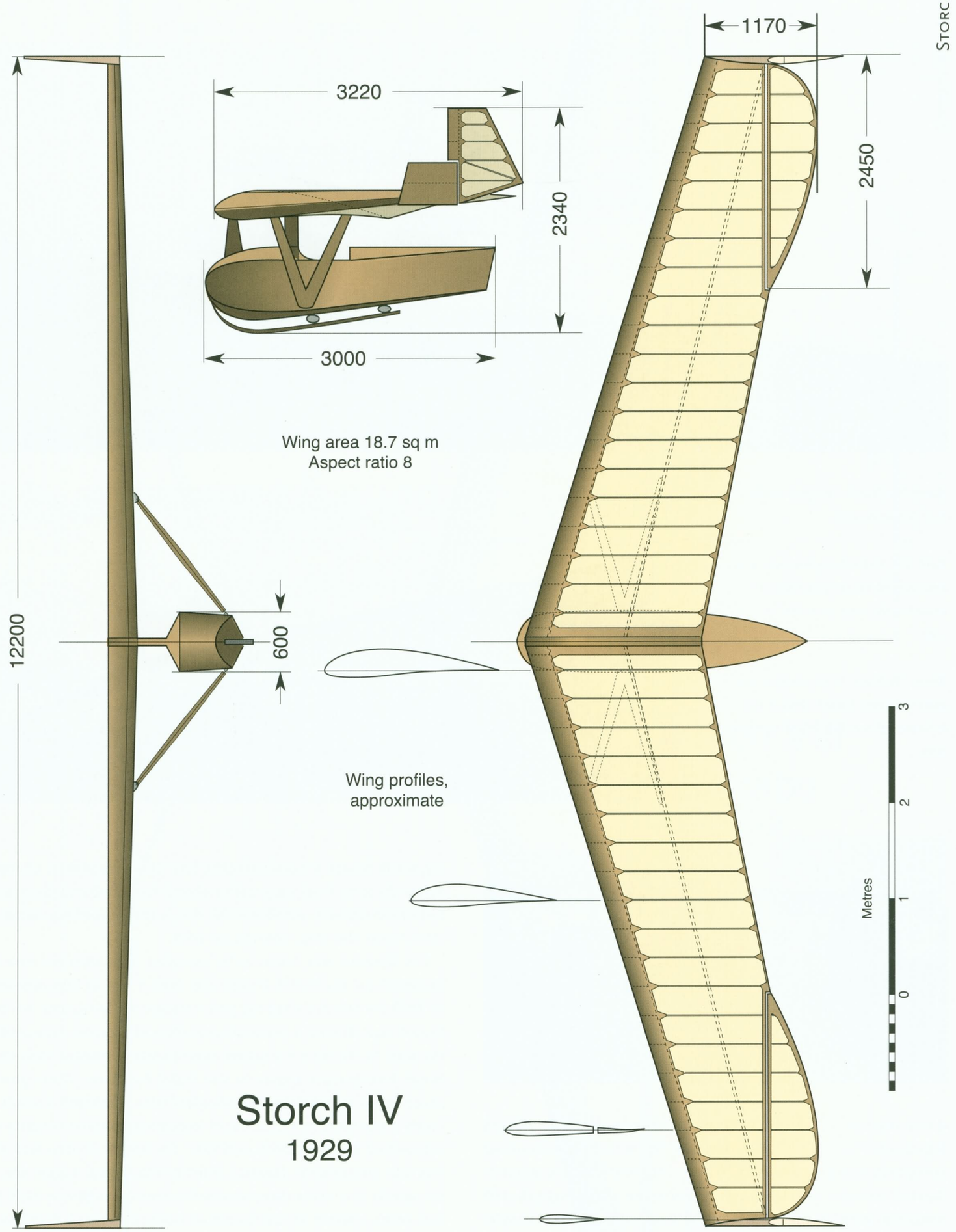
The Storch IV flew successfully over the sand dunes at Rossitten.

Alexander Lippisch had carried out research into wing profiles while working for Dornier during 1918 but when the German aircraft industry collapsed after Versailles, he was unemployed. In 1921 he answered an advertisement by a clerk in the Benz automobile factory, for an aircraft designer to produce a glider for the 1921 Rhön contest. The monoplane, called Falke, which Lippisch designed with the aid of some wind tunnel tests, was built in a furniture works in Fulda where Alexander Schleicher, a boy from the village of Poppenhausen, was an apprentice. The Falke went to the Wasserkuppe but crashed there, probably due to the inexperience of its pilot though Lippisch himself admitted that while the aerodynamic form was good, he had no experience of stressing. For both Lippisch and Schleicher nevertheless this was the beginning of a new career. Schleicher became a professional sailplane manufacturer in his home town, where the factory he established is still in business.

Lippisch was present when Wenk's Weltensegler crashed but was impressed by its apparent stability in the first minutes of its disastrous flight. He resolved to carry out systematic research into tailless aircraft. During the next year or two he spent so much time on the mountain alone that he was nicknamed the Rhöngeist (Rhön Ghost or Spirit). He built and tested many large tailless and some 'canard' models, often more than four metres wing span, using a simple catapult to launch them. He then designed a glider which was constructed by his friend Espenlaub, the Espenlaub E 2. It was of 10 metres span with swept back wings and 'elevons' for both lateral and pitch control. The wing profile was symmetrical to bring the pitching moment to zero. End plates were fitted under the wing tips after early flights, but the performance was disappointing and the plates were too readily damaged. They were changed to the upper side with better results.

Storch

Lippisch then was employed briefly by the Weltensegler firm, producing the famous Djävlar Anamma and working on other designs until the company failed in 1924. In 1925 he became head of the technical division of the RRG, with the old Weltensegler workshop at his disposal and accommodation in the Ursinus House, newly built on the foundations of the abandoned Messerschmitt shed. Work for the RRG diverted him from research, but in 1927 he pro-



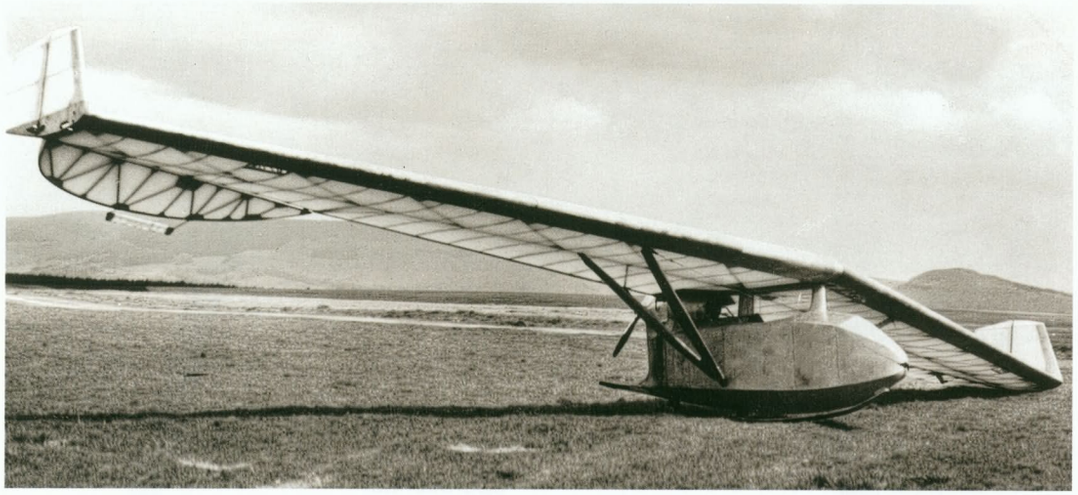
Storch IV
1929

Drawn by Martin Simons 2000
©

Above: The Storch II in flight - briefly - with Fritz Stamer the pilot.

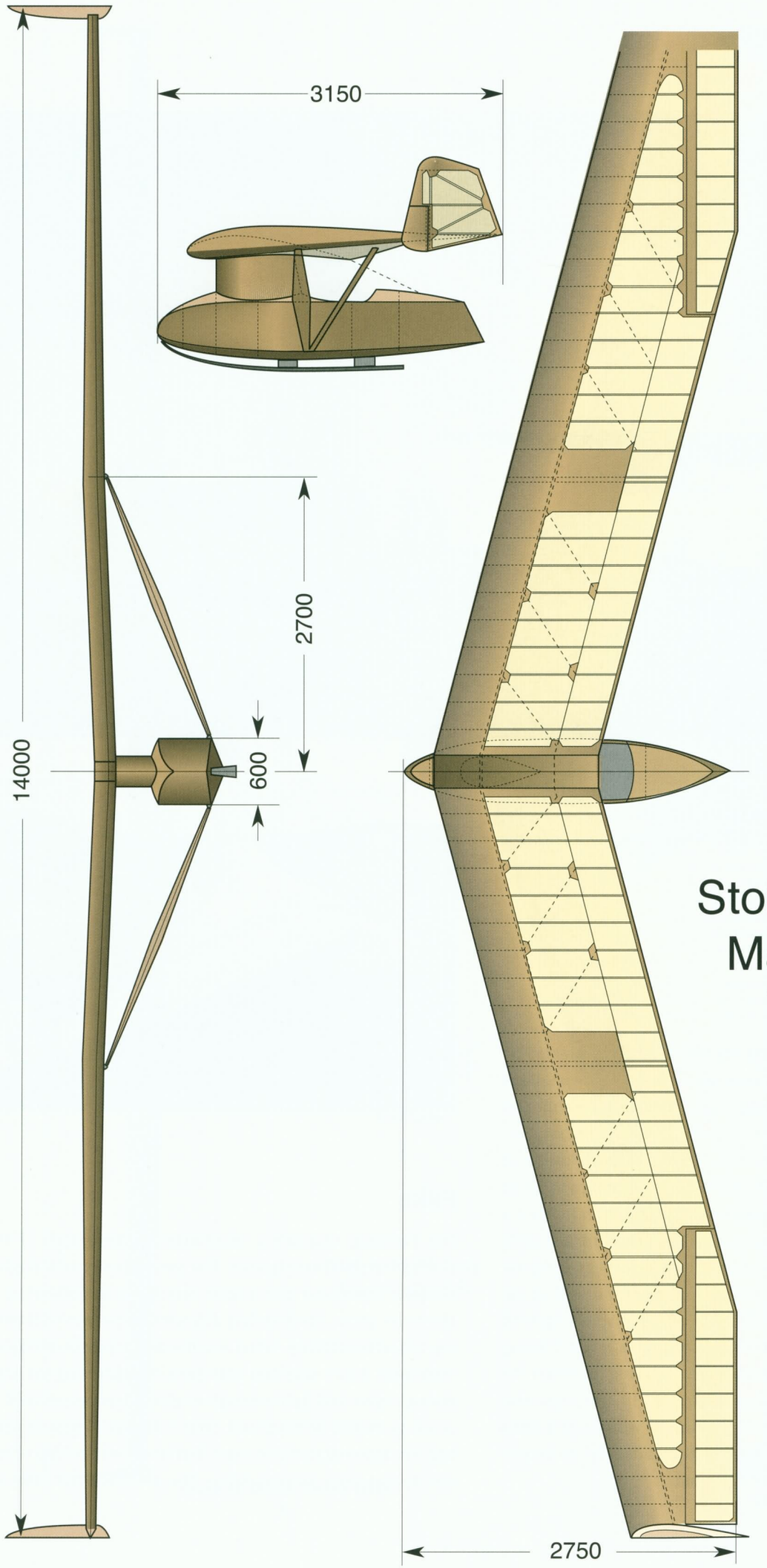
Right: The Storch V was fitted with a motor and flew well, encouraging Lippisch to continue with further work on tailless and delta aircraft.

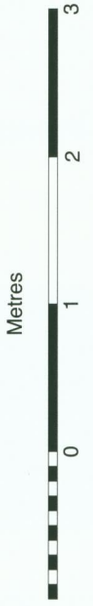
Below: The Storch IV was the most successful glider of Lippisch's storch series. It was flown by Groenhoff, seen here on the right of the nose.



duced the first of the Storch tailless series, very similar to the old Espenlaub 2 but with 12.15 metre span. The wing had pronounced sweepback and generous dihedral, with tip end plates or winglets 'toed in' to assist stability in yaw. A yaw to the left brought the left winglet to aerodynamic zero, reducing drag, while the right winglet met the flow at a large angle, creating more resistance. The resulting forces tended to counteract the yaw. The wing profiles changed across the span from a normal cambered form in the centre to a reflexed section with washout at the tips. A streamlined pod hung on struts under the wing, housing the pilot.

The dihedral was found to be excessive. The winglets were redesigned and the Storch II appeared, which was an improvement. In 1928 the Storch III had the pod replaced by a hexagonal box sectioned capsule with a rearward extension to provide some central fin area. In the Storch 4 lobate ailerons were arranged with their hinge line at right angles to the flight direction. These proved much more satisfactory. The winglets were cambered inwards to create a side force (anticipating by decades the similar winglets developed by R T Whitcomb at NASA). The Storch IV flew well and was fully controllable. Lippisch fitted it with a small engine and, as the Storch V, it made many successful powered flights in 1929 before being crashed on Darmstadt aerodrome during a demonstration in very turbulent conditions.





Storch VIII Marabu
1932

Wing area 15 sq m (approx)
Aspect ratio 13 (approx)

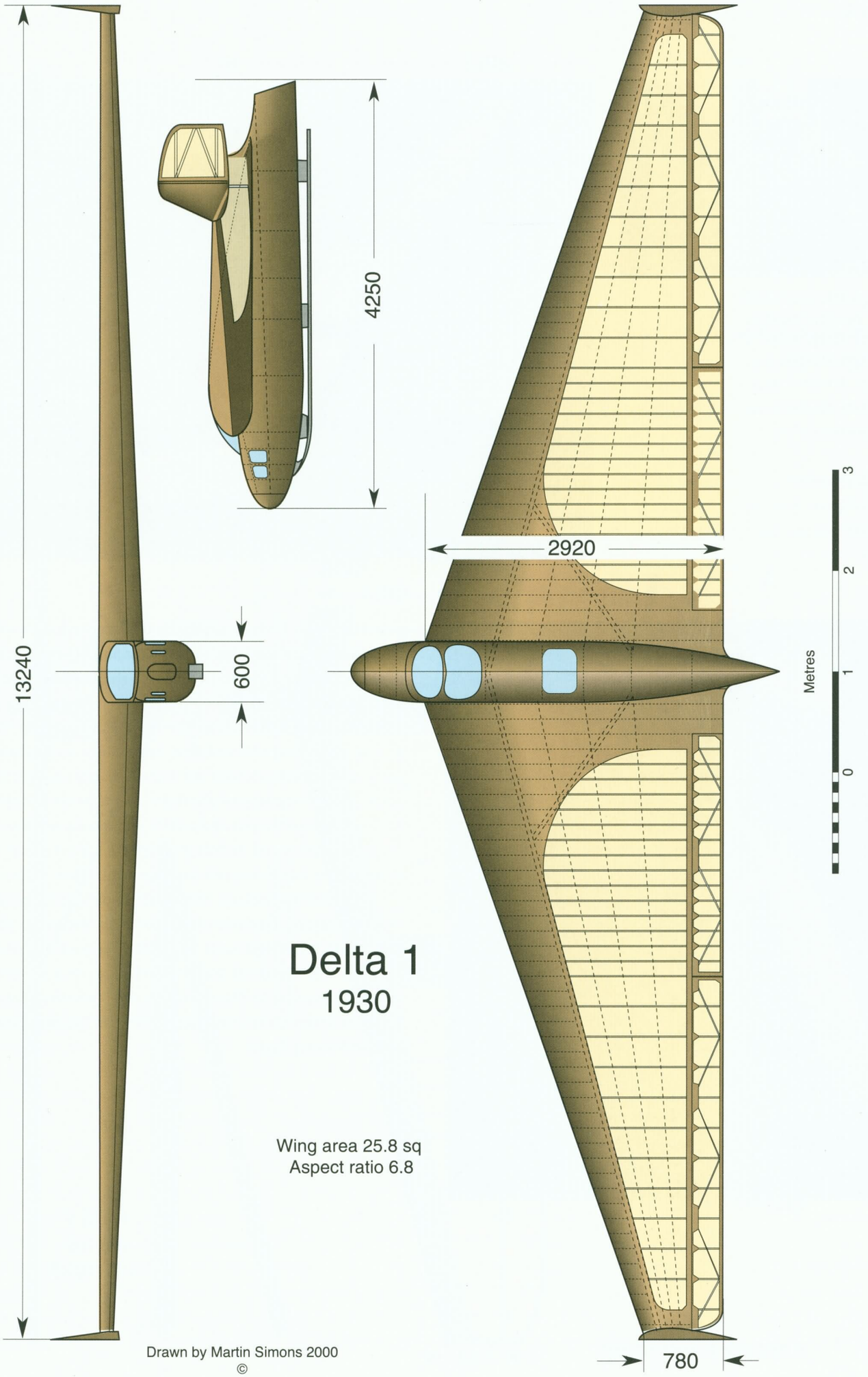
Above and right: Lippisch went on to develop many more tailless aircraft. The Delta I was test flown as a glider by Günther Groenhoff at the 1930 Rhön, though not competing. It was subsequently converted to power and flew in 1931. It was difficult to handle on take off and crashed severely in 1933.

Storch VIII 'Marabu'

A young trainee pilot, Ernst Philipp, had been much impressed by the flights of the Storch IV and determined to build his own tailless sailplane. With technical advice from Lippisch's office, he built and flew his Marabu or Storch VIII. Although this proved quite satisfactory in the air, the technical committee on the Wasserkuppe in 1932 would not let him fly it in any winds strong enough to allow hill soaring. In time for the following year's competition he built a detachable tailplane on an extended fuselage. The tail assembly could be removed easily and the Marabu flown in either configuration. Probably because adding the tail caused a rearward shift of the centre of gravity, the Storch VIII was more prone to spinning with the tail than without it. Nevertheless in this aircraft Philipp achieved his 50 km 'Silver C' distance flight. In trying to stretch the last few hundred metres of distance he arrived in tree tops, and clambered down a rope kindly thrown to him by workers in a nearby factory who had watched his arrival. The glider had to be rescued by the fire brigade but was little harmed.

Falke

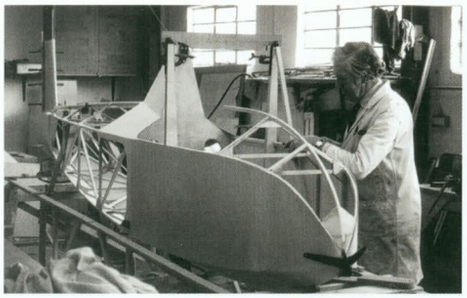
The Prüfling, Lippisch's 'secondary' glider design of 1926, had proved less than satisfactory. The performance of a Zögling when the pilot was faired with a light nacelle, as was often the case, was almost as good. The Prüfling did not handle very well either, lacking inherent stability. What was needed, Lippisch thought, was an extremely stable sailplane with very safe handling yet with a large enough span and light enough to give a low rate of sink. Nothing could be better, he supposed, than a Storch IV type of wing which had been proved stable in itself, but fitted with a fully orthodox tail unit to give even more stability. The result was the Falke which ap-



Delta 1
1930

Wing area 25.8 sq
Aspect ratio 6.8

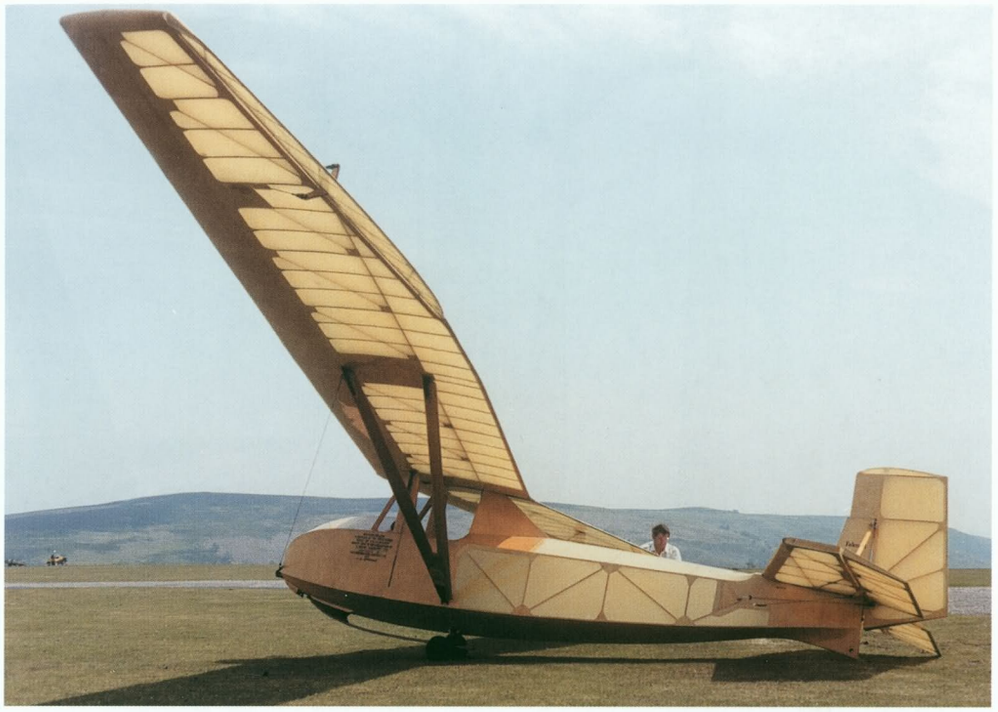
Drawn by Martin Simons 2000

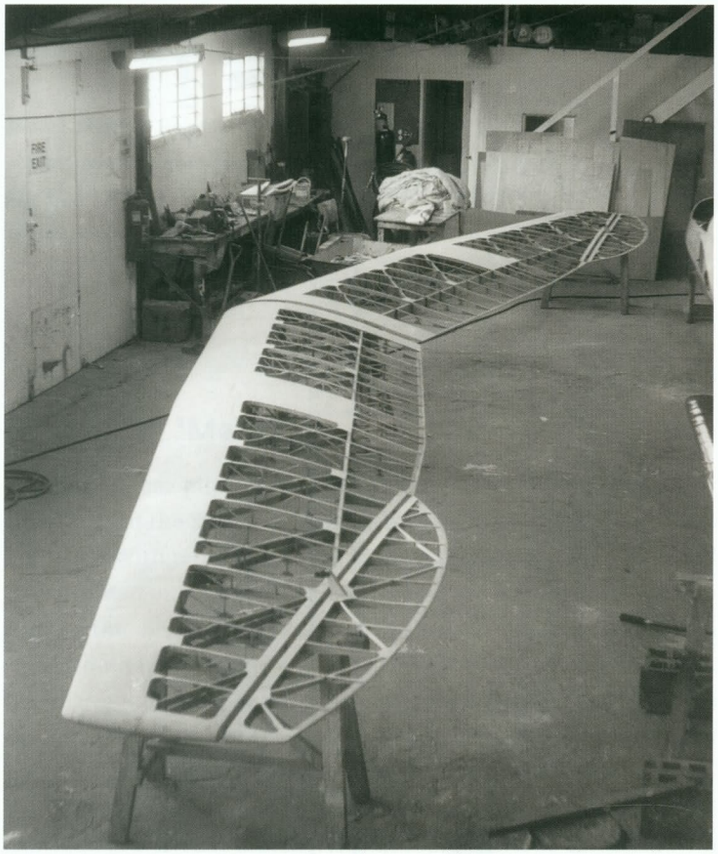


Above: Constructing a replica Falke in Ken Fripp's workshop at Lasham, England.

Right: The Falke, designed by Lippisch to be stable and slow for inexperienced pilots.

Below: Although intended as a simple trainer, building the Falke was difficult. It had swept back wings and a slightly cranked main spar. Even the fuselage had few straight lines.

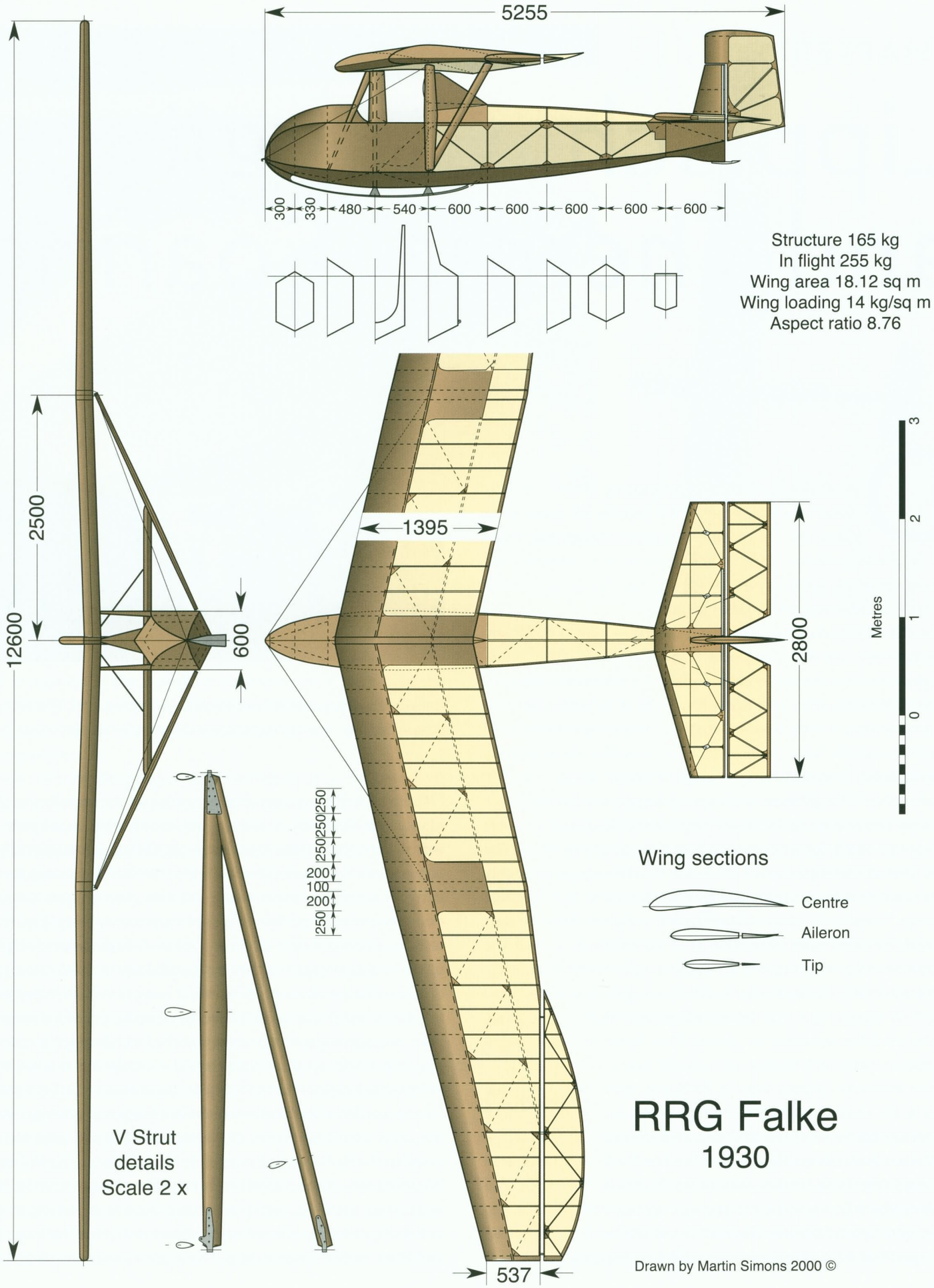




peared in 1930. It was accepted by the RRG and, as was the custom, plans were made available for amateur and other constructors. The RRG itself before long had a dozen of the Falke type on call for the Wasserkuppe training school.

Among those who took up the Falke drawings, was Fred Slingsby in England, who produced nine under licence and, later, enlarged the design to make the two seat Falcon III. Schneider in Grunau and Schleicher also produced the Falke. An improved version, the Falke RVa with span enlarged and a different arrangement of the cabane struts, was developed in 1931. Still later, a Super Falke with a span of 16.88 metres was flown, but the type was by then quite out of date.

From these beginnings, while still involved with more orthodox sailplane design, Lippisch continued with research into tailless aircraft. With his design team he left the Wasserkuppe in 1934 when the RRG was dissolved and the technical section, which he still headed, removed to Darmstadt. It was henceforth the Deutsche Forschungsanstalt Für Segelflug, DFS, the German Research Institute for Soaring flight.



Structure 165 kg
In flight 255 kg
Wing area 18.12 sq m
Wing loading 14 kg/sq m
Aspect ratio 8.76

RRG Falke
1930

Drawn by Martin Simons 2000 ©

Chapter 5

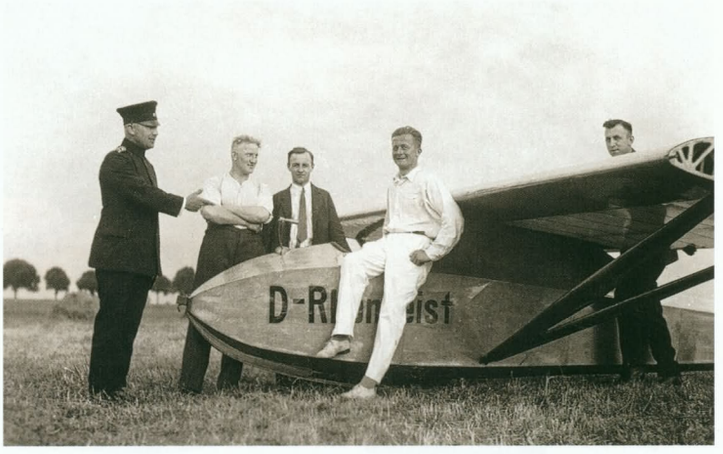
Lippisch, Georgii and Thermal Soaring

Discoveries in 1928 changed soaring entirely and resulted in widespread interest. Despite the opinions of many eminent people, it was proved beyond doubt that sailplanes could use convection currents to soar. Gliding clubs and organisations sprang up all over the world. The developments also led gradually to a new breed of sailplane.

It had been supposed by many that if sailplanes were to fly for any length of time away from hill slopes, it must be by dynamic soaring. It is generally accepted that birds, especially the wandering albatross, carry out dynamic soaring in the lowest levels, or boundary layer, of the atmosphere, mostly below 30 metres. The bird gains energy by repeatedly passing from the slow airstream near the sea surface, up into the faster flow above and back again following a more or less circular orbit, diving downwind, turning steeply near the surface to face upwind again using the excess airspeed to pull up into the faster stream and climb, turning again to dive downwind and so on. The same kind of soaring is quite common with relatively small, highly manoeuvrable radio controlled model gliders, usually on the lee side of sharp, 'hogs-back', ridges where there is a sharply defined shear between two airstreams. The style of flying required, so near the ground, would be extremely dangerous for a full scale sailplane.

At greater heights, occasionally, it has been possible to maintain height by extracting energy from a shear layer where winds above and below differ markedly in velocity. This, however, is not a regular practice, because detecting such a wind shear is very difficult.

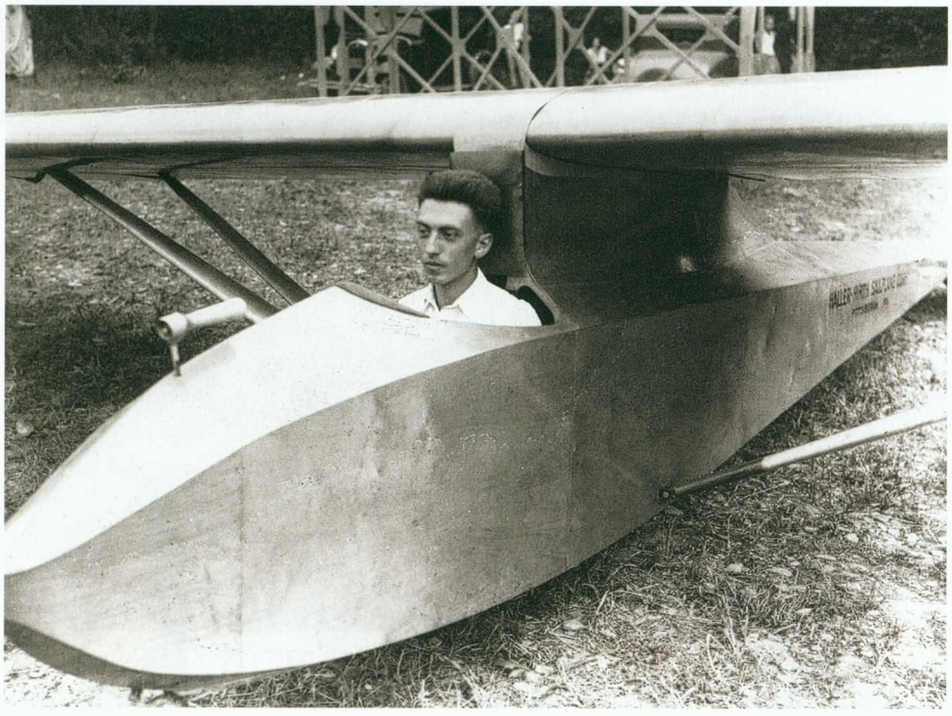
Even Professor Georgii, who in 1926 was appointed simultaneously to the chair of Flight Meteorology at the Darmstadt Technical University and head of the RRG Research Institute, had argued in 1922 that thermals must be too small and feeble for sailplanes. Had these opinions been correct, soaring would for ever have been confined to the hills, coastal cliffs and sand dunes. The entire movement would probably have vanished in the late twenties, especially since practical light aeroplanes were becoming popular.

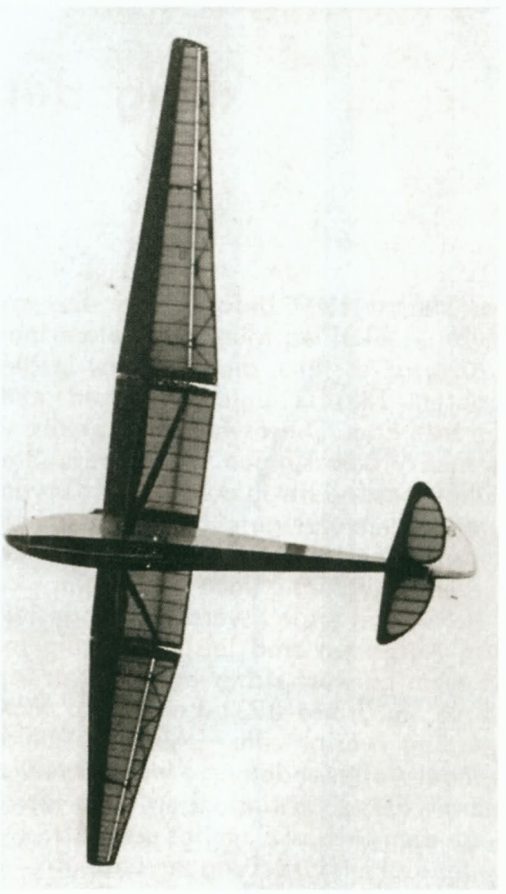


Peter Riedel, posing proudly here, used the prototype Professor, called 'Rhöngeist' after Lippisch, for his first cross country flight, from Darmstadt to Frankfurt in 1932.

Yet there had been clear evidence of strong thermals before 1928. Many acute observers, ornithologists, meteorologists and plain folk with eyes in their heads, had seen birds gliding, circling and rising. Some scientific writers rightly deduced that they were using thermal currents. Cumulus clouds were good indicators of what was going on in the atmosphere. The published reports describing these things were missed or ignored. Like many others Georgii supposed that dynamic or gust soaring was the only possibility over level country.

At the Rhön contest in 1926, flying one of the earlier Darmstadt sailplanes, the D - 12 Roemryke Berge, Nehring soared for almost an hour over the Wasserkuppe after the wind had dropped to nothing. This was surely not slope lift although he treated it as such, flying beats up and down over the hill. Had he thought to make a few circles he would surely have astonished himself and everyone else. A few days later Max Kegel, an experienced power pilot flying a sailplane he had designed and built, very similar to the Darmstadt Westpreussen, found himself drawn rapidly up into a thunder cloud amidst rain and hail, barely in control. He was extremely relieved and lucky to be thrown out of the cloud at a height between 1500 and 1800 metres, landing, after a long glide down, in a field 55 km





Above: In the USA, two examples of the Professor were built under licence, and marketed under the name 'Haller Hawk' They remained in use for many years. Here Martin Schempp, who was living in America at the time, is in the cockpit.

Right: After the Prüfling came the Professor, capable of good soaring flights when flown skilfully.

from his take off. It was a world record distance but flown quite unintentionally. He was known afterwards as Gewitter Max (Thunderstorm Max). His account of the experience did not encourage others to emulate him.

It was not until the spring of 1928 that Georgii, based at Darmstadt Griesheim aerodrome, began to make systematic studies of convection. Johannes Nehring, under the professor's direction, flew a light aeroplane fitted with recording instruments under a series of promising cumulus clouds. With the engine throttled back or even switched off entirely, up currents of 4 and 5 metres per second were found. Georgii at last announced that convection soaring must be possible.

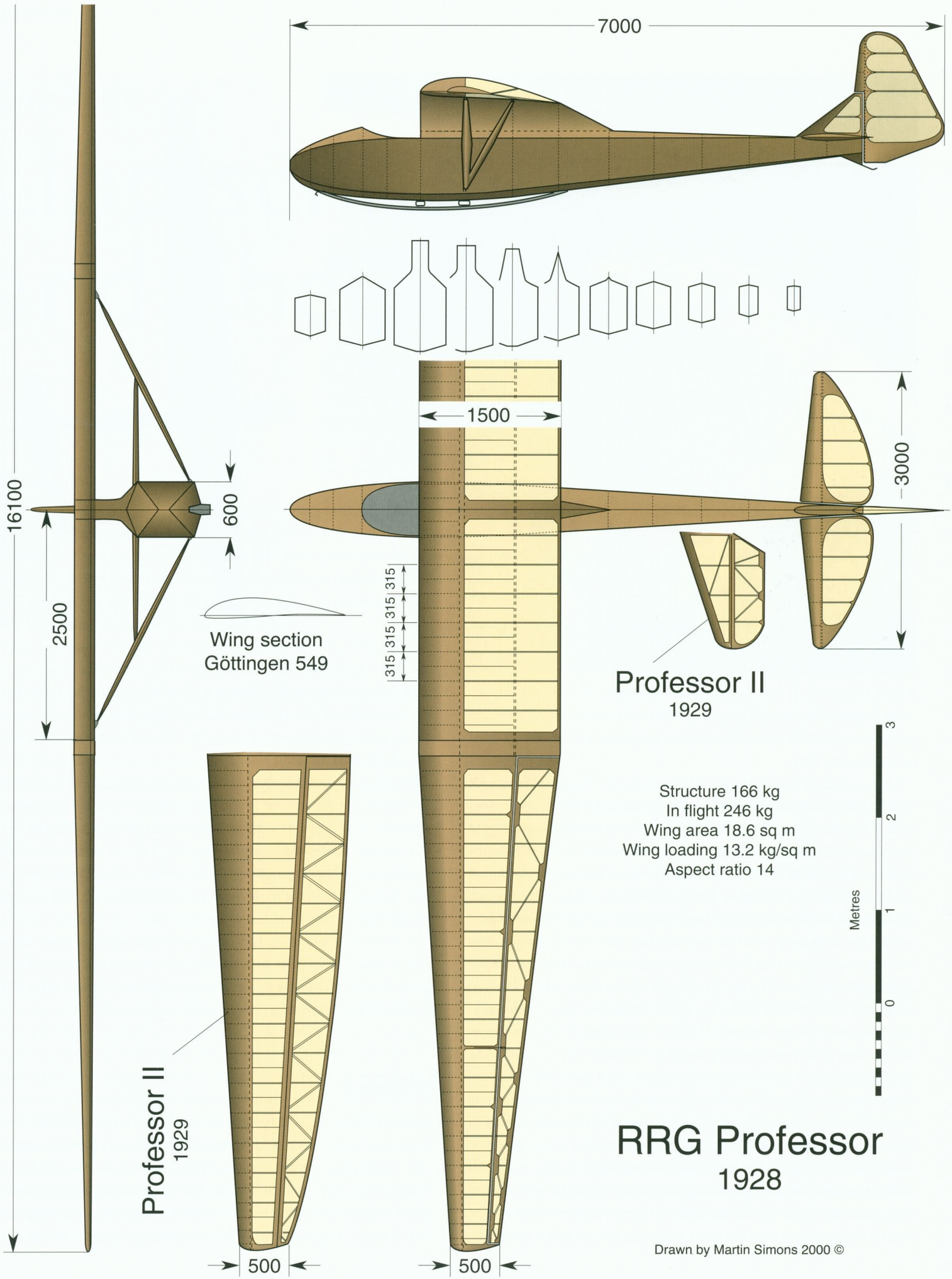
Another important development was the introduction into sailplane cockpits of the variometer, that is, a very sensitive rate of climb and descent indicator. The origins of the device went back to nineteenth century ballooning. Lippisch had used one when working with Dornier on Zeppelins. It had not been realised till now that soaring pilots needed such a thing. So long as they were flying near slopes, they could judge their gains and losses of altitude by observing the ground, how far above or below the hill crests they were, whether the trees were getting closer or further away, and so on. But from any considerable height, especially over flat land, small gains or losses of altitude are undetectable by eye. Pilots far away from any slope might feel bumps, but could not know what they signified, up or down currents, or merely random turbulence. Standard altimeters were far too sluggish to be useful for detecting small air movements. If sailfliers were to rise under clouds and even into them like Kegel, they needed a reliable reference which would continue to work when they were far away from the ground, or out of sight of it.

A pilot was needed who could take advantage of the new ideas and the new instrument. It could have been 'Bubi' Nehring but he seems to have been reluctant to abandon the slopes, despite being the person Georgii had employed to explore lift under clouds. His loyalties may have been divided. He was a Darmstadt Akaflieg man, not dedicated to the RRG. He was soon to take up a permanent position as a meteorological flier in Berlin.

In his stead, the most recent promising pupil from the Wasserkuppe, Robert Kronfeld, an Austrian, was given the opportunity. His great talent as a pilot was already apparent and he started working for Georgii at Darmstadt in May 1928.

Professor

Meanwhile Alexander Lippisch had designed a new sailplane for the RRG, the Professor. It was intended for pilots who had trained on the 'secondary' Falke. It must be capable of soaring flights, but cheaper to build than the Darmstadt types that had dominated the last few years. The RRG hoped it would be produced in large numbers. Nearly all previous high performance sailplanes had been 'one



RRG Professor
1928

Drawn by Martin Simons 2000 ©

Many gliding clubs in Germany used the Professor type. The photo shows the original Rhöngeist fitted with the madified ailerons of the Professor 2. But the tail is still unchanged.

off' designs. Plans of the Professor would be made available for clubs and others to build it under licence.

The wing, in three pieces, rectangular centre section and strongly tapered outer panels, was mounted on a high pylon with V struts. It was the single spar type, with plywood-skinned forward torsion box and light ribs behind with fabric covering. The wing profile was a relatively new one, Göttingen 549, thinner and less cambered than the now well known Gö 535. The prototype was flown on the Wasserkuppe in mid May 1928, and christened after Lippisch, Rhöngeist..

No doubt both Georgii and Lippisch were very anxious that the new sailplane, competing in the 'intermediate' class, should do well. The existence and use of the variometer was not made known to the other pilots. The secret was well kept by all those concerned. Kronfeld had a vacuum flask in a box with him when getting into the cockpit. He said it was his coffee. In fact this was the essential insulated air bottle which was connected with tubing to the dial of a sensitive flow meter. As the sailplane rose and the external atmospheric pressure fell, air would flow out of the bottle through the instrument to record a rate of climb. On descent the reverse happened, air flowed in, showing descent. It was not for another two years that anyone outside the very small circle around Georgii, Lippisch and the elite pilots they worked with, knew of the existence of the variometer and understood what it was for.

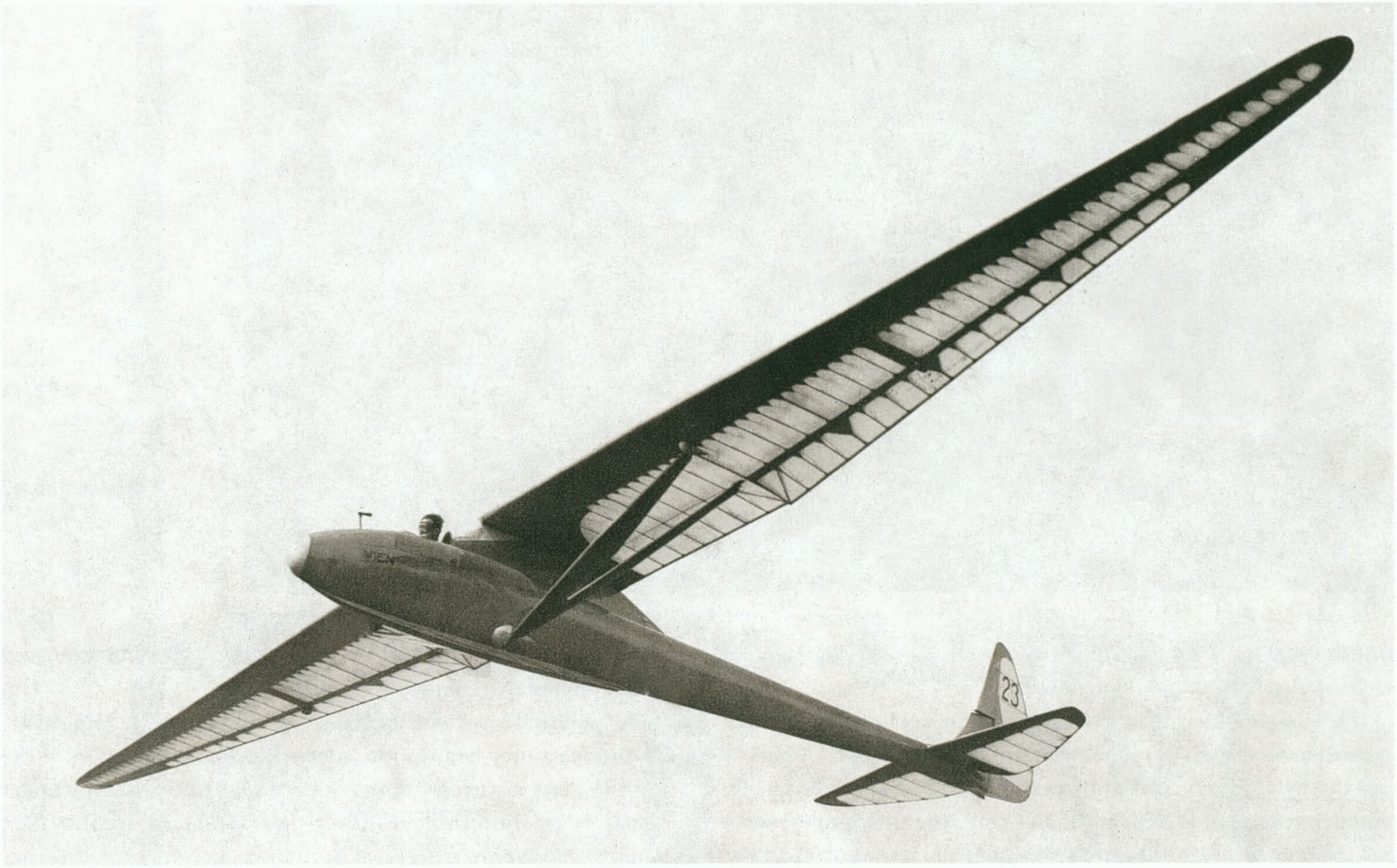
On 6th August 1928, the Rhöngeist joined the competing sailplanes over the slope. When the variometer indicated the additional lift beneath a useful looking cloud, Kronfeld began to circle gently. The Professor climbed away, leaving the other pilots far below, and drifted back. When high enough Kronfeld left the cloud and headed for the Himmeldunkberg, the peak which had been his 'target' for the day. He spent some time there slope soaring. When a cloud approached, he gained height beneath it and set out to fly back to the Wasserkuppe. On the return journey against the wind he passed through more lift below a series of clouds and arrived back with hundreds of metres to spare.

The significance of what he had done was recognised immediately. Although they had no variometers, several other pilots in the next few days discovered they could gain height by circling under clouds. Edgar Dittmar broke the official world height record with a climb to 775 metres and glided from there for 33.5 km to his chosen goal at Bad Kissingen. Wolf Hirth too used lift below clouds to fly across country. By the end of the meeting there were no pilots who did not know of this new development, but very few who understood how it had been done.

Wolf Hirth was the first pilot, after Kronfeld, to grasp the significance of the variometer. He fitted one in his Musterle and took it to the American competitions. It seems extraordinary that no one there asked what the strange dial, with its bottle and tubing, was for. The fact is, variometers were not widely used outside Germany for another two or three years.

Sets of plans for the Professor were taken up by clubs and some professional manufacturers. Segelflugzeugbau Kassel, now owned by Gerhard Fieseler, advertised the type for sale. One went to England where Philip Wills used it for his first cross country flights. In the USA, Gus Haller built two of the type, marketing them as the Haller Hawk. Copies, sometimes with minor changes, were built in several other countries, how many altogether is not recorded.

Despite Kronfeld's success with it, the Professor was not easy for inexperienced pilots. It was very sluggish when straightening out from turns. The strong taper of the wing also made it prone to tip stalling. There were some spinning accidents. These problems were not unique. Many sailplanes of the time suffered from limitations of this kind. Lippisch redesigned the ailerons, broadening the chord by curving the trailing edge. The all moving elevator was replaced by a tailplane with elevator, with consequent detailed alterations to the fuselage. The Professor 2 appeared in 1929.



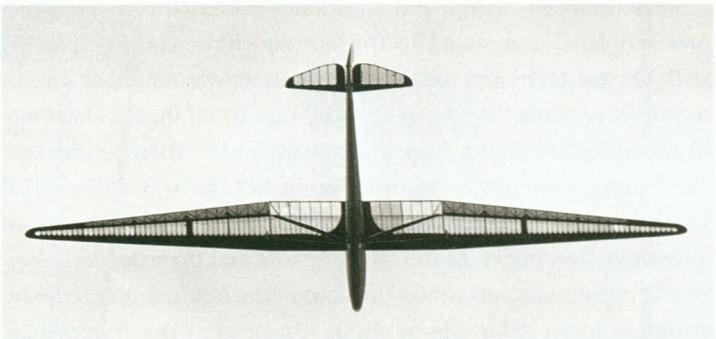
The most succesful sailplane of its time, the Wien, flown by Robert Kronfeld with consistent brilliance.

Wien

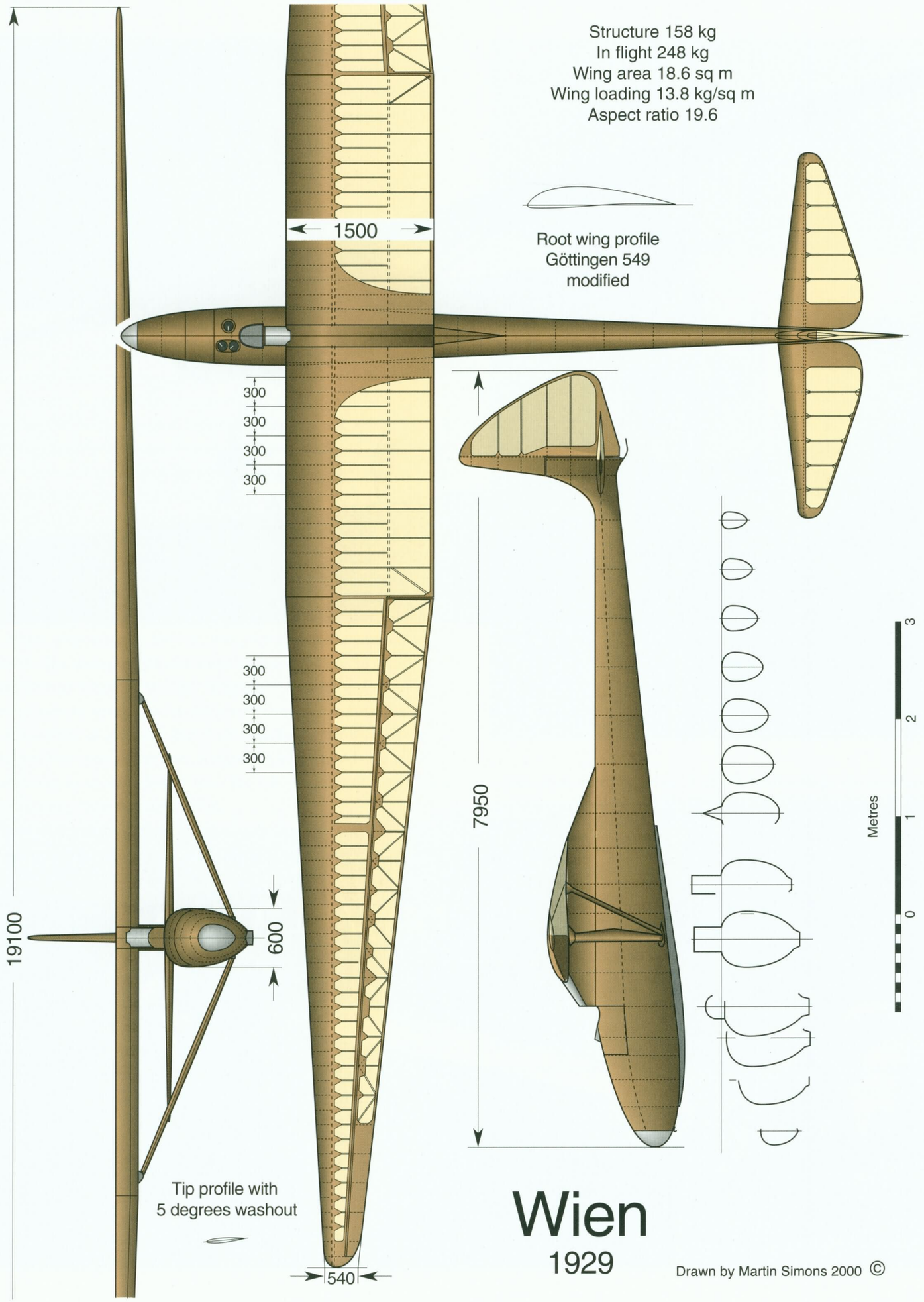
Kronfeld was not content and asked Lippisch to design for him a new sailplane which would be capable of competing with the best available from the Akafliegs. When it was ready he named it after his home city, Wien. Built by Fieseler it was a development and refinement of the Professor, with a much better performance and superior handling. The main features were the same, pylon mounted, strut braced wing with strongly tapered tips, all moving tail plane, Göttingen 549 wing profile with slightly increased camber.

It was well known now that a good glide ratio and low minimum rate of sink required a very high aspect ratio, implying a large wing span relative to the total wing area. In fundamental terms, the sailplane wing supports the aircraft by deflecting or turning a mass of air downwards. For a given weight and airspeed, either a small volume of air may be turned through a large angle, or a larger mass turned through a smaller deflection. The latter is much more efficient. The larger the span, the greater the mass of air coming under the influence of the wing in each unit of time. The span of the Wien was more than 19 metres, exceeding that of the Darmstadt 2.

The fuselage was a fine streamlined shape, the cockpit canopy designed so that only the pilot's head protruded into the airflow ahead of the pylon. The instruments, including a variometer, were mounted face up on the external decking, as was becoming the fashion.



This was a beautiful and impressive sailplane which Kronfeld used to very great effect. He made the first ever 100 kilometre flight, following the slopes along the Teutoburger Wald ridge, but using thermals to bridge gaps whenever necessary. Thermal soaring then became the norm for him. The Wien broke the world distance record time and again, achieving 164 kilometres in 1930, and height records of 2025 and 2560 metres in July 1929. On some occasions Kronfeld climbed into huge clouds, without any blind flying instruments, and emerged out of their tops to fly above them. At the invitation of the newly formed British Gliding Association he toured England with the Wien, giving demonstrations. On one of his flights Kronfeld flew from Hanworth, near Richmond, to



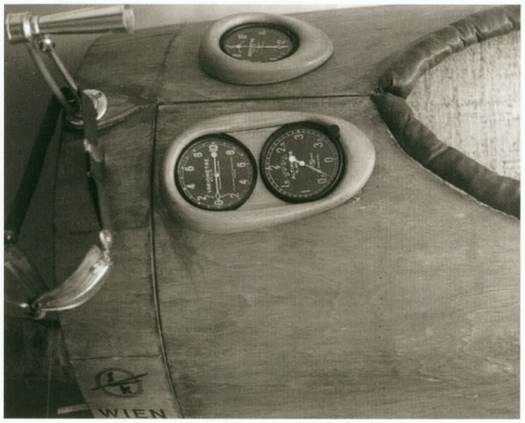
Wien

1929

Drawn by Martin Simons 2000 ©

Above: Bungge launch of the Wien at the Wasserkuppe.

Below: Rigging the Wien before its demonstration flights in Yorkshire.



Left: The Wien instruments mounted on the fuselage decking. A replica by Klaus Heyn

Right: Groenhoff prepares to fly the Fafnir.

Chatham on the Thames Estuary, passing over the city of London itself. Next day he soared back again taking a more southerly route via Croydon, a pre-declared goal flight. This would have been a world record except the goal flight category was not yet recognised and launching by aero tow, a method only very recently developed, also prevented Kronfeld's flights from being officially accepted.

Kronfeld also used the Wien to glide twice across the English Channel. This won him a prize from the Daily Mail newspaper, but was not a soaring flight. He was towed by a Klemm monoplane up to about 3000 metres and glided across from there, and the same on the return journey, late in the evening of the same day.

For Walter Georgii, the most significant flight Kronfeld made in the Wien, a distance of 164 km, was probably at the end of August in 1931. The distance did not break any previous record but afterwards Georgii wrote „this flight offered the first important scientific information about the frequency of convection currents. They are apparently so plentiful that if the weather is favourable and the sailplane has enough altitude, a short gliding flight leads again to an effective up current zone." Thus the whole future of soaring as a cross country sport was opened up.

News of the great thermal flights in Germany spread quickly. In other countries, the soaring movement began to develop rapidly. Naturally, when designers learned of Kronfeld's successes, they were influenced by the sailplane he had used for most of his great flights and demonstrations, the Wien.

Fafnir

Lippisch in 1929 began the design of a new high performance sailplane, which was called the Fafnir after the legendary dragon. The RRG had a new test pilot. Günther Groenhoff had learned to fly under Ferdinand Schulz on the dunes at Rossitten. His great abilities became apparent and he joined the RRG school on the Wasserkuppe as an instructor in July 1929. He was made aware of the variometer but kept the secret even from Peter Riedel, with whom he worked on the development of aero towed launching. Riedel now was a trained power pilot but had not, as yet, done much gliding himself since his youthful endeavours in 1920 and 22.

The cross sectional area of the Fafnir fuselage was as small as it could reasonably be, designed around Groenhoff. Not a large man, he only just fitted. The cockpit canopy, of wood, fitted closely round his head and he had only two portholes to look through, lacking even the small transparent windows of Hirth's Musterle.

The wing had no supporting struts, to save drag. The cantilever main spar, accordingly, had to be very strong, requiring a thick wing at the root to allow depth for this member. It spanned 19 metres, tapering to very narrow tips and with a slightly arched or 'gull' form when seen from the front. Reasons for the shape have been variously given. Wenk's tailless aircraft remained in the mind. Lippisch's Falke and the Storch VIII Marabu had a very slight 'gull' bend, visible in the front elevation. Most earlier sailplanes had no dihedral but it was now recognised that some was useful in circling flight. Perhaps influenced by sea birds, it was thought that the cranked form must be particularly good. Also the Fafnir had no central pylon like the Wien to carry the wing high off the ground. To slant the inner wing up gave the tips extra clearance. Such a bend in the spar, which had to be laminated to form the curve, made construction more difficult but it was thought worthwhile. The Fafnir was, for many years, considered to be the most beautiful of

Considered to be the most beautiful sailplane of its time, the Fafnir, flown by Groenhoff, at the Wasserkuppe.

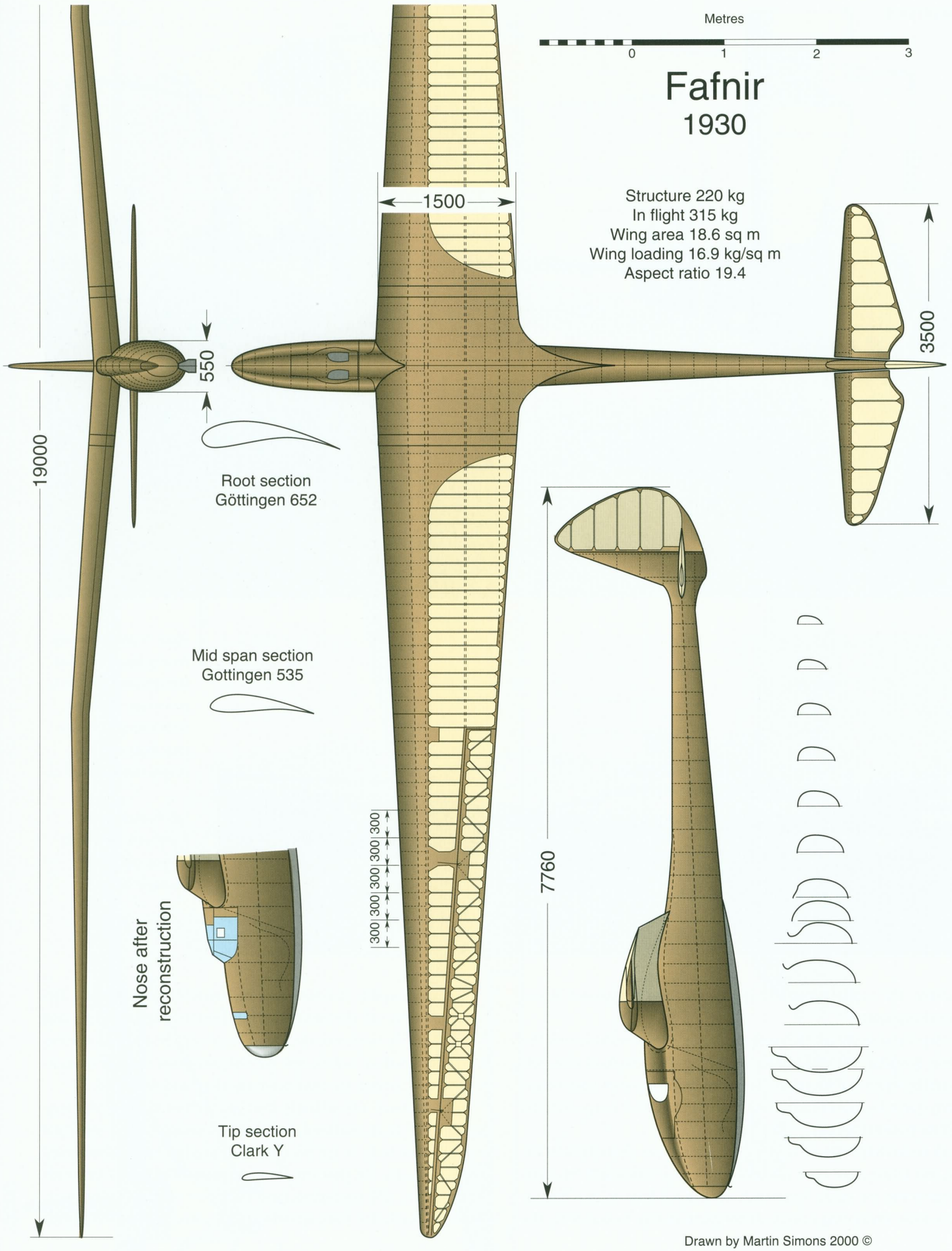
all sailplanes and set a fashion for 'gull wings', without any real evidence in support of the trend.

The wing root was faired to the carefully streamlined fuselage at the level of the pilot's head. Numerous small strips of plywood were scarfed together to make the complicated, three dimensionally curved form. The wing profiles also were complex. The profile chosen for the root was the very thick and strongly cambered Göttingen 652, which Prandtl's wind tunnel had shown as very promising at the low speed, minimum sink trim. This changed progressively to the familiar Gö 535 at the gull bend, and thence to the well proved and well behaved American Clark Y at the tips, with washout to control tip stalling. The ailerons were not tapered, the width at the tips intended to give them greater power. The wing ribs were closer spaced than was usual on earlier sailplanes, Lippisch extending the intermediate ribs to the trailing edge. The tail unit was of the usual all moving type, the elevators mounted about the mid line of the narrow rear fuselage and the rudder horn lower still, in fact close to the ground when the sailplane was at rest.

The Fafnir turned out heavier than expected but this was found to be no serious disadvantage. It was only just ready for test flying on the first day of the 1930 Rhön meeting. Groenhoff was disappointed. The performance was not as good as expected. He could, probably, hear that the airflow was very turbulent over the centre of the wing just behind his head. With blocks of balsawood glued on and hastily carved to a less complex shape, the fairing was modified. The result was satisfactory and the performance now clearly very good. Following the competitions, Groenhoff, after an aero towed launch, became the first pilot to exceed 200 km in soaring with a 278 km cross country flight from Munich. Because aero towing was still not officially accepted for records, it was only when he made 220 km from a bungee launch that the official distance record was deemed broken.

The Fafnir joined an expedition to the High Alps of Switzerland in 1931. Here a design fault was revealed which nearly cost Groenhoff his life.

Launching by bungee from the snow fields on the Jungfrau was difficult. The crew, slithering and sliding, could barely stretch the rubber rope sufficiently and at high altitude the speed required for take off was greater than low down because of the reduced air density. The Fafnir slid forward, not having gained flying speed. The starboard elevator struck a snow mound and was broken off. The sailplane careered down slope, eventually pitching over the edge of a cliff. Fortunately now it had enough speed to fly. Without half his elevator, Groenhoff managed to keep control and landed without further damage in the valley. A new elevator was hurriedly made in the RRG workshops in Germany and rushed to the Jungfrau. After two more flights there was further damage, this time to the rudder. The low mounted rudder horn was proving vul-



Drawn by Martin Simons 2000 ©

Above: To save a little drag, the pilot was fully enclosed with only small portholes to see through. Behind the Fafnir among the crowd is Peter Riedel. with arms akimbo, dark jacket and tie.

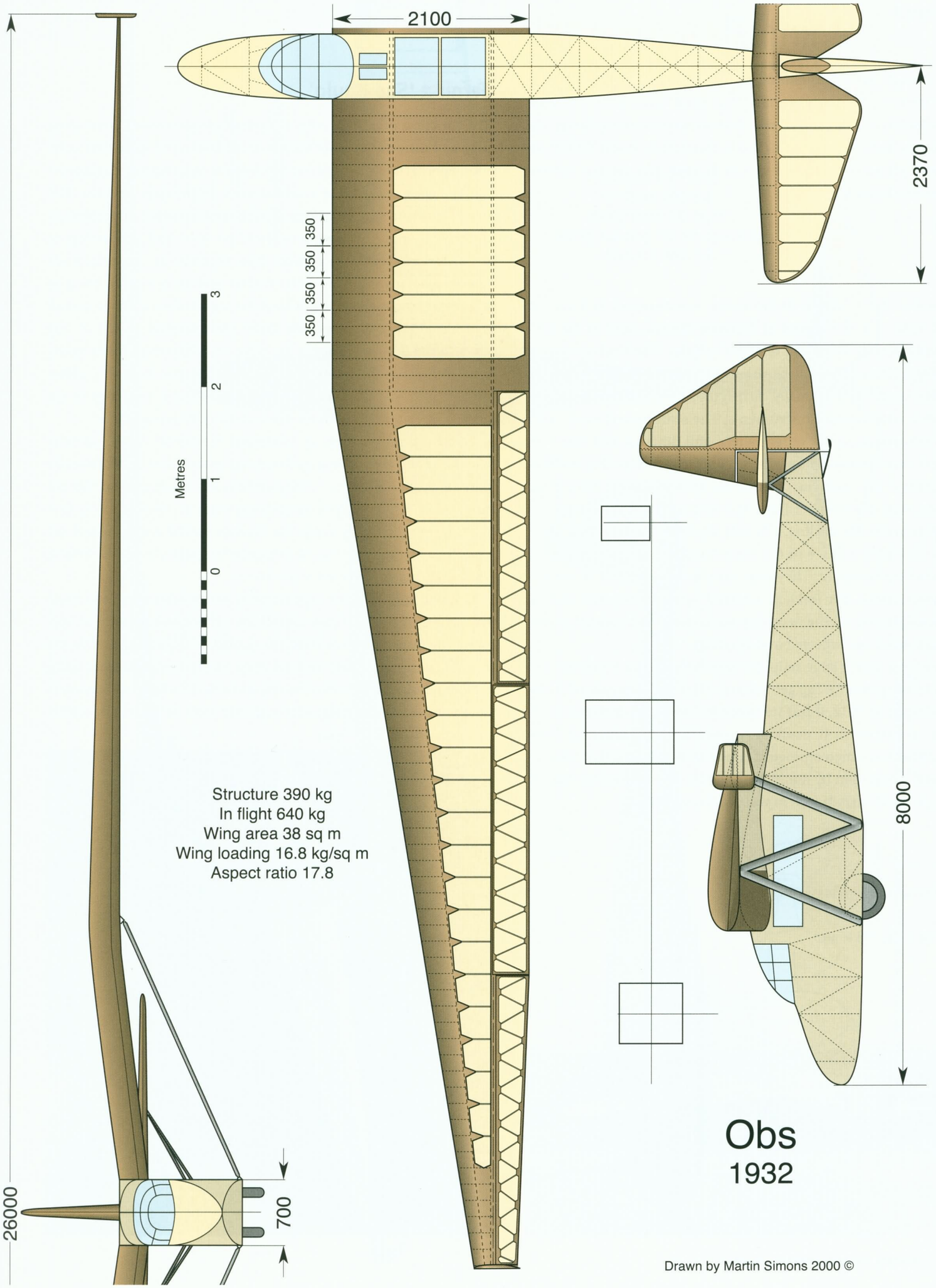
Left: Ready for take off, Riedel in the Fafnir on El Palomar airfield, the Moazagotl behind.

nerable. The rudder hinge and sternpost had to be repaired before launching again.

After these mishaps, 1931 was the Fafnir's year. At the end of the Rhön meeting, the usual order was reversed, Groenhoff first, followed by Hirth and Kronfeld. He became something of a hero especially when he made outstanding flights in Lippisch's experimental tailless powered aircraft.

All ended tragically on March 1932 when Beate, Peter Riedel's sister, was killed in an open car being driven by Groenhoff. His carelessness was the cause. Afterwards he suffered from serious depression, even attempting suicide. At the Rhön in July, he was to fly the Fafnir. Once again, in a bungee launch the tail was damaged. The sailplane took off, the rudder horn hit something on the ground and the whole rudder broke loose, jamming the elevator. Groenhoff succeeded in bailing out but the parachute did not open in time. He fell among the trees down the slope and was killed.

The Fafnir was very seriously damaged but was rebuilt with a larger cockpit and an enclosed, transparent canopy. Now it was Peter Riedel's turn to fly it, for his star was rising and he had discovered the variometer. He flew the Fafnir in June 1933 from Darmstadt into France, 228 kilometres, and took part in a publicity stunt, soaring over Berlin from aero towed launches. The following year



Structure 390 kg
In flight 640 kg
Wing area 38 sq m
Wing loading 16.8 kg/sq m
Aspect ratio 17.8

Obs
1932

when Georgii led an expedition to Latin America, Riedel and the Fafnir were in the party. He accomplished some good distance flights and on one day soared over Buenos Aires for seven hours. After this, the Fafnir remained in use at Darmstadt. It was finally retired and placed in a Berlin museum in 1938, but did not survive the wartime bombing.

Obs

The Urubu Obs, to give it its full name, was designed by Lippisch during 1931 - 2 at the request of Professor Georgii, head of the RRG meteorological division, as a research vehicle. (The Urubu is an Argentinian vulture.) The cabin behind the pilot was large enough for two passengers but it normally carried only one, a scientific observer, with a large array of instruments. The strut-braced wing, with slight sweepback on the outer panels, gull dihedral and small tip winglets, was reminiscent of the tailless Storch series, but the Obs had normal tail surfaces. The inner section of the very long ailerons, were also camber flaps. It is not known if these were intended as brakes for landing. The Obs is reported to have had spoilers on the upper surface of the wing but these are not shown on any published drawing. They may have been fitted as a retrospective modification. The fuselage was built up in welded steel tubing, wide enough to carry the necessary equipment, and covered in fabric. There was a two wheeled undercarriage.

Launching such a large sailplane was difficult and it proved necessary to use powerful tug aeroplanes. After one appearance at the Wasserkuppe in 1932, it was stationed at Darmstadt and used in research, as intended. It made an appearance at Munich in 1934 when there was a meteorological conference. It is said that, on this occasion, it was seen by Adolf Hitler and it may be that the idea of using gliders to carry troops in war, was born then.

Right: The Fafnir 2 in 1934 at the fifteenth Rhön

Below: The Urubu Obs in 1932

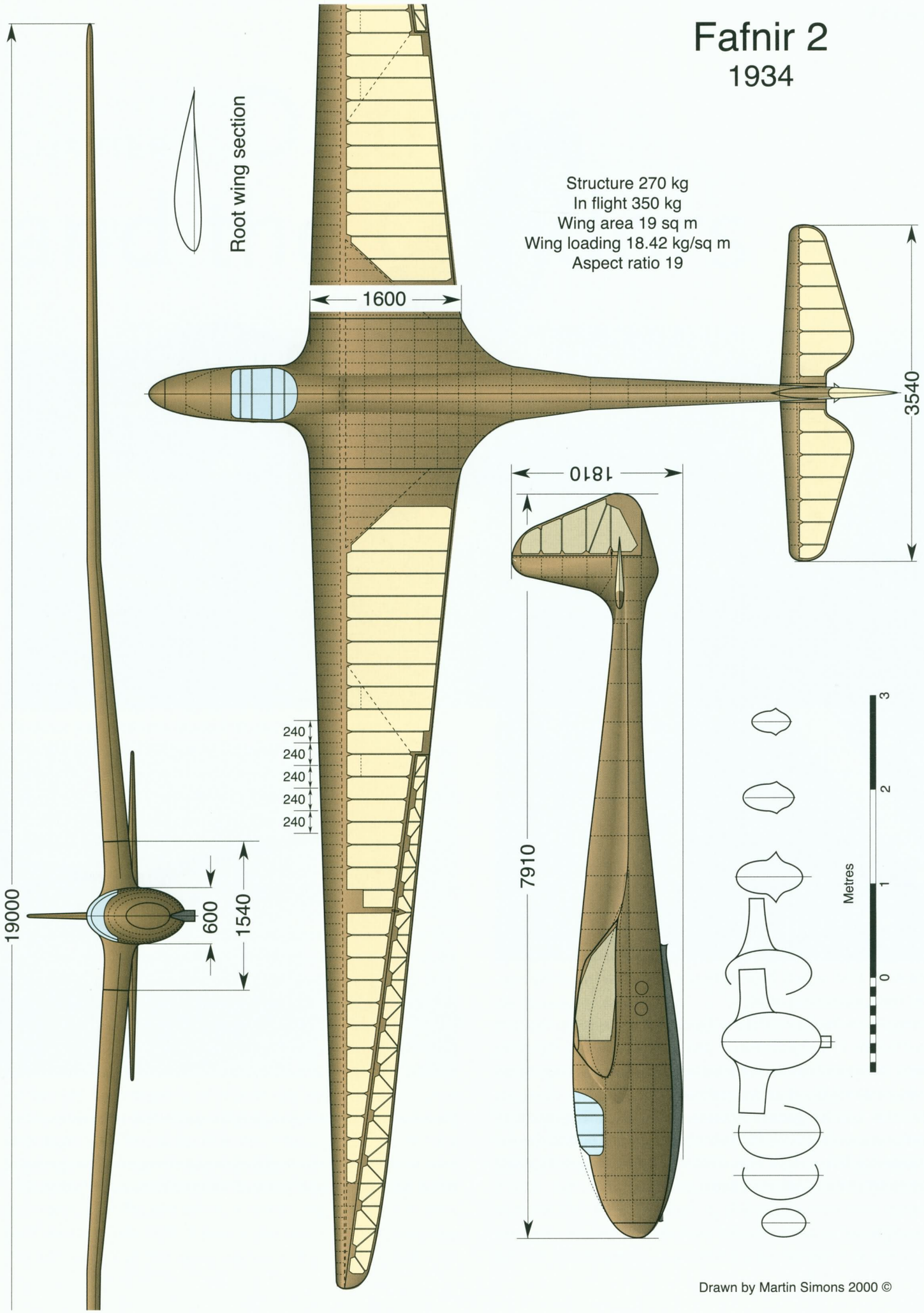
Fafnir 2 'Sao Paulo'

The junction of a wing with a fuselage always creates some extra drag and distorts the distribution of lift across the span. One common approach to this problem has been to suspend the fuselage below the wing on struts or a narrow neck, in the hope that the flow over the lifting surface will be undisturbed. Another attempted solution is to mount the wing in a mid position and add fairings to fill awkward corners to prevent flow separations. A compromise chosen by many sailplane designers has been to mount the wing on top of the fuselage, leaving at least the upper surface unobstructed, and then doing what can be done with fairings to fill in and smooth the flow underneath the wing root. To mount the wing below the fuselage has rarely been favoured because, even with elaborate fairings the lift is seriously reduced and the underside of the wing is vulnerable to damage when landing or taking off.

Wind tunnel research at Göttingen University by H. Muttray showed that the mid wing position was measurably better than the parasol, high, shoulder or low positions, but also suggested that the fuselage should be shaped to conform as far as possible to the flow pattern over the lifting wing. The fuselage should not be treated as a parasitic item with fairings to minimise the harm, but should blend with the wing and give some useful lift.

Lippisch applied this to the Fafnir 2, which was named Sao Paulo in honour of the Brazilian city which offered some financial support. The fuselage in side view was cambered like a wing profile, the form blending gradually into the wing. To create such a shape using timber required elaborate framing and a skin built up of numerous small pieces of plywood scarfed together piece by piece. Lift distrib-

Fafnir 2
1934



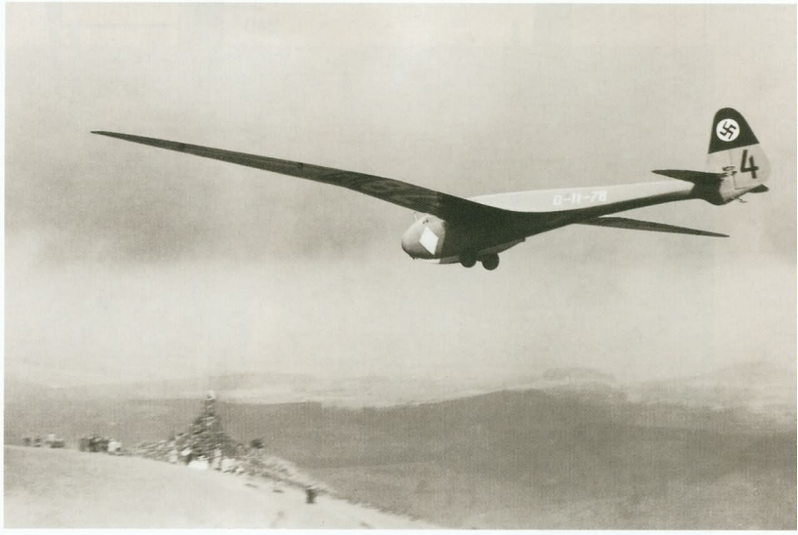
Drawn by Martin Simons 2000 ©

ution calculations were carried right through the fuselage. The main wing section was a special design by Lippisch, much less cambered and thinner than he had used on the Fafnir 1, because it was understood now that a cross country sailplane needed to fly fast when not actually climbing in a thermal.

Design began in March 1934 and the Sao Paulo was completed in time for the 1934 Rhön. It was the best sailplane available at the time. With it Heini Dittmar broke the world distance record, 375 km, landing in Czechoslovakia. The original cockpit canopy did not blend fully into the fuselage. By the time of the international competitions in 1937, which Dittmar in the Fafnir 2 won, a fully contoured canopy had been fitted.

When the performance of the sailplane was measured in flight, it proved to have a best glide ratio of 26:1. Although a good figure for its time, the improvement was relatively small considering the effort required both in design and construction.

After this, Lippisch turned again to the development of tailless aircraft, eventually leaving the DFS altogether for a post in the aircraft industry. His work for Messerschmitt in Augsburg culminated in the rocket powered Me 163 fighter.



Above: The cockpit canopy originally (1934) was not fully faired to the fuselage.

Below: By 1937, for the International Championship, the Fafnir 2 had been painted and the canopy fully contoured. A 'drop off' wheeled dolly was used for launches.

Chapter 6 Dittmar and the Condors

Condor

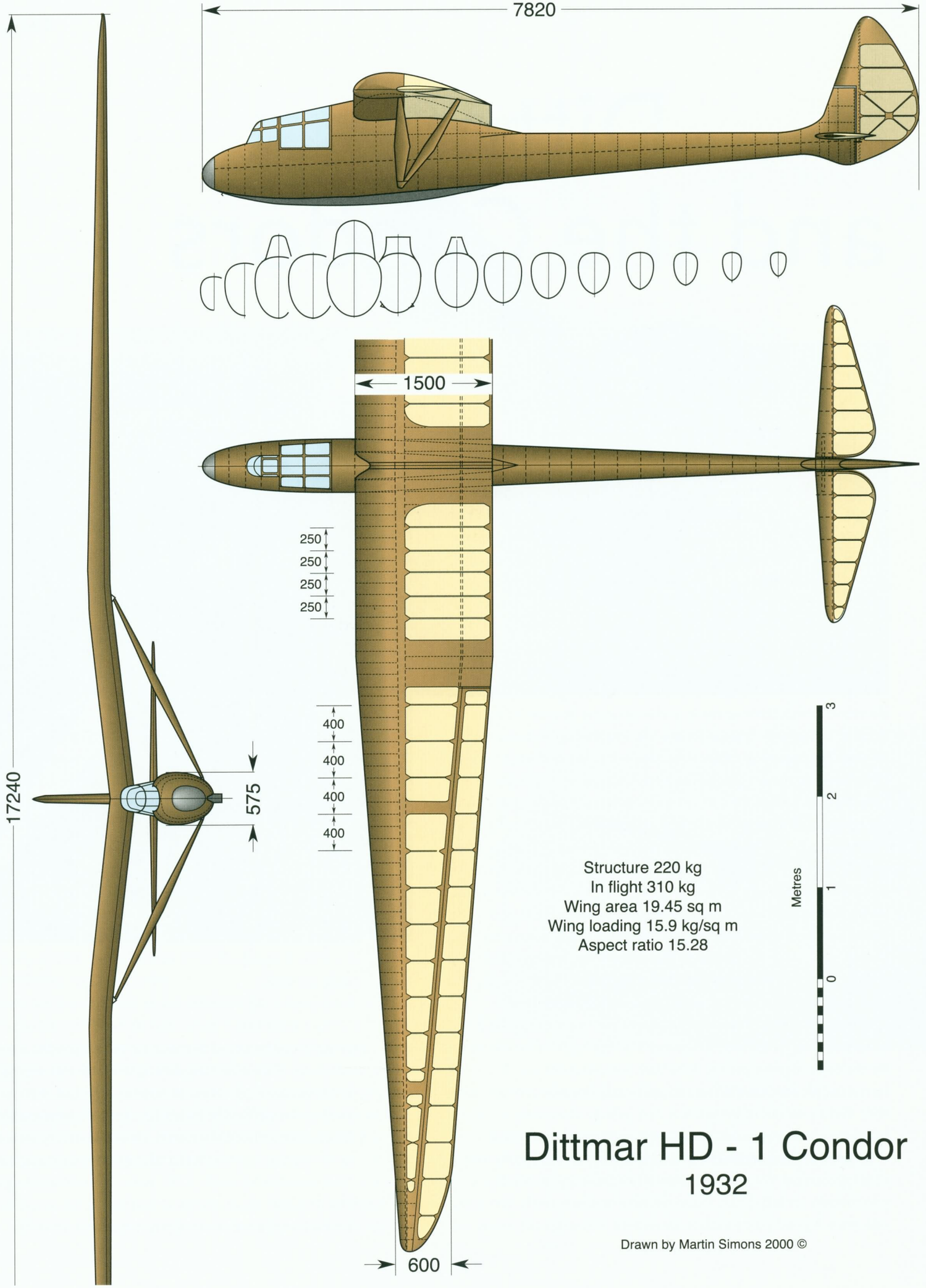
Edgar Dittmar, who had broken the height record in 1928, had a younger brother, Heinrich or 'Heini'. While still a schoolboy he learned to fly gliders, paying his costs by working for Lippisch in his spare time, building models of tailless aircraft for testing. While launching one of these in 1932 he injured his knee by stepping into a hole. While recovering in hospital he began to design his own sailplane, the Condor. In it he tried to copy the best features of the Wien and Fafnir, with improvements. Fritz Kramer, a qualified RRG stress man, checked the strength of the structure for him.

The fuselage and tail unit were taken almost directly from the Fafnir, using, wherever possible, the same frames and components. Jigs and tooling for them were available in the RRG workshops. One important alteration which Dittmar made at the tail arose because of the accidents to Groenhoff. The rudder horn was moved up well clear of the ground. The operating cables were conducted, through fairleads, out of the fuselage ahead of the tail and externally above the elevator. Heini's other alterations were in the forward areas. Airflow problems at the wing junction with the fuselage had affected the Fafnir. The very thick, strongly cambered wing profile was replaced by a modified form of the Gö 652, still very thick but less strongly cambered. Like the Wien, the Condor wing was raised on a narrow central pylon, where flow interference would be less, and braced with V struts. The Fafnir had been somewhat heavy. The struts saved weight, but the arched 'gull' form was retained. The cockpit was enlarged and fully enclosed, except for the usual small viewing panels and portholes. The pilot, as with the Fafnir, still had barely room to turn his head.

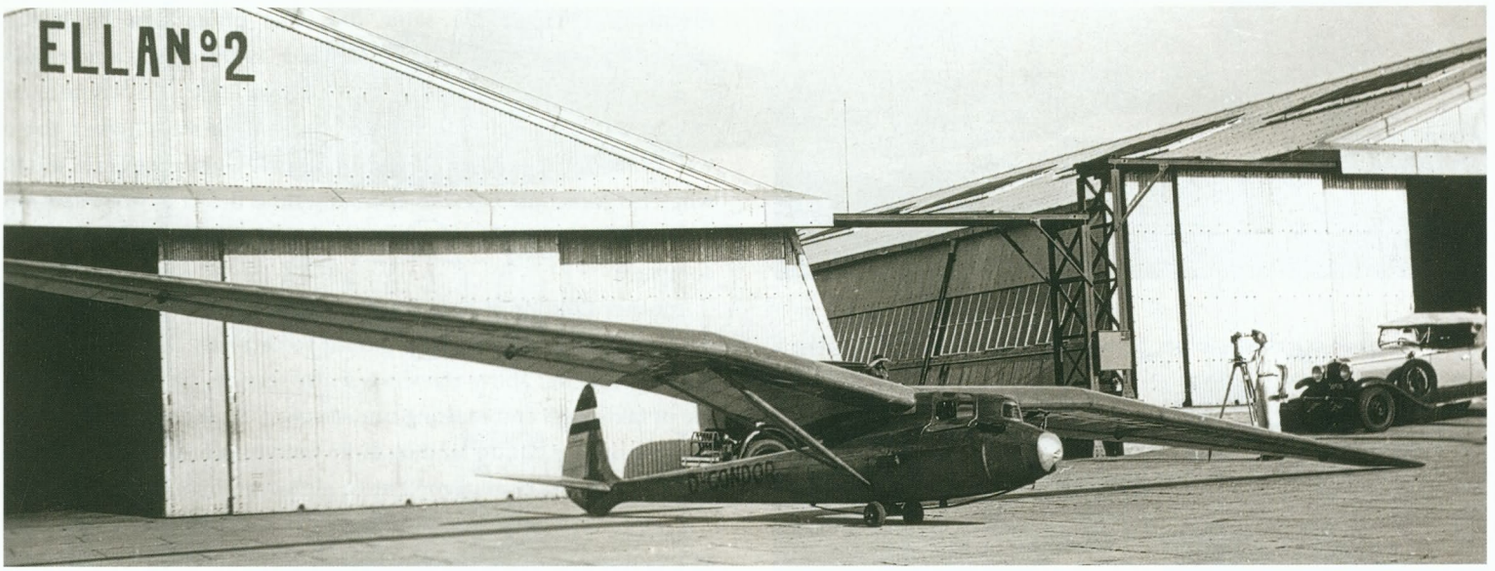
In plan, the wings resembled those of the Wien but had a more modest span of 17.24 metres. Dittmar had understood the necessity for the outer, tapered panels, to be built with washout and change of section to prevent tip stalling and spinning. The ailerons increased very slightly in chord toward the tips, which experience with the Fafnir indicated was preferable to tapering them like the Wien.

Heini built the Condor in the RRG workshops, taking 2000 hours of his spare time. The new aircraft was test flown by his brother with good results in July 1932. It proved easy and safe to fly, handling well with a good performance, especially at low speeds when circling. Heini immediately began to make his mark as a pilot, winning the junior division of his first competition. For him this was the beginning of an outstanding career in soaring. He and the Condor were included in Georgii's 1934 expedition to Latin America where, flying in cloud, he reached 4350 metres above his release from aero tow. He had no oxygen but had had a very brief blind flying course at home. This sensational result, 1790 metres more than the previous figure by Kronfeld, made his name and that of his sailplane. He and the Condor joined a successful Alpine expedition in 1935.

The Condor flying over Berlin



Dittmar HD - 1 Condor
1932

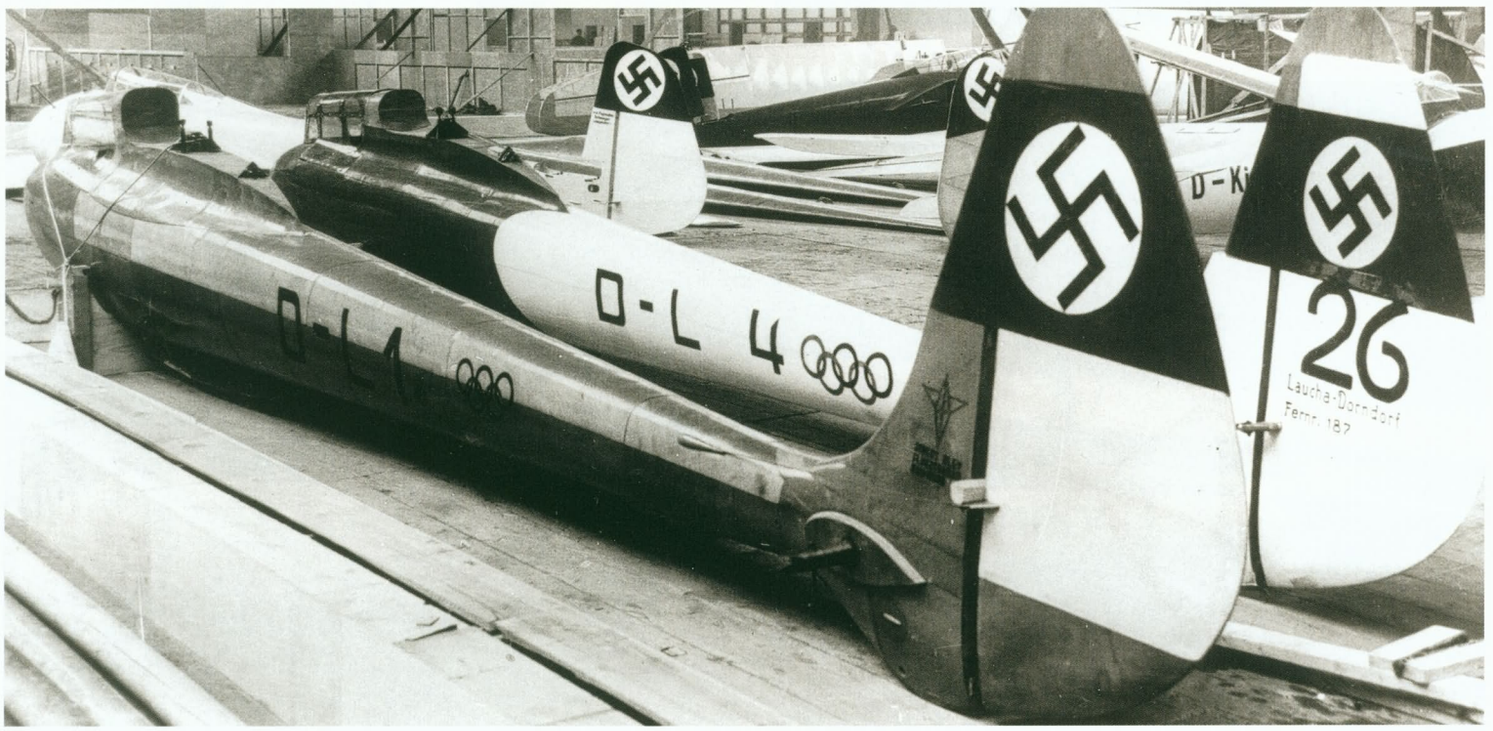


Meanwhile the Condor was put into serial production by Robert Bley of Naumberg. The wooden cockpit canopy was replaced with a built up, transparent one which was much more practical, but no other important changes were made. It was noticeable, however, that less care was taken with the plywood skin. Rather than scarfing the joints to make them almost invisible, they appear always to have been simply overlapped. There was probably no detectable effect on performance but the appearance suffered.

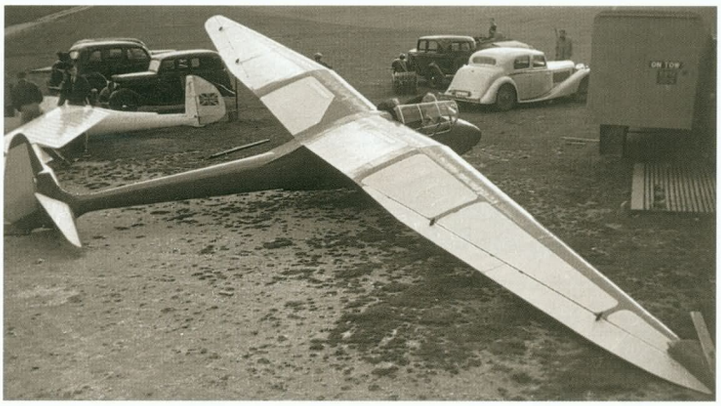
At the 1934 Rhön ten of the type competed and in 1935 a Condor was one of four sailplanes to achieve a 504 kilometre, world record

Above: The Condor on El Palomar airfield, Buenos Aires.

Below: March, 1936. At an aviation and water sport exhibition in Berlin, Condors carrying the Olympic rings were displayed. Note the high rudder horns and cables passing above the all-moving tailplane.



La Falda was flown as a 'pure' sailplane. The intention was to use the motor to bring it home after an outlanding.



Above: The Condor 2 in England

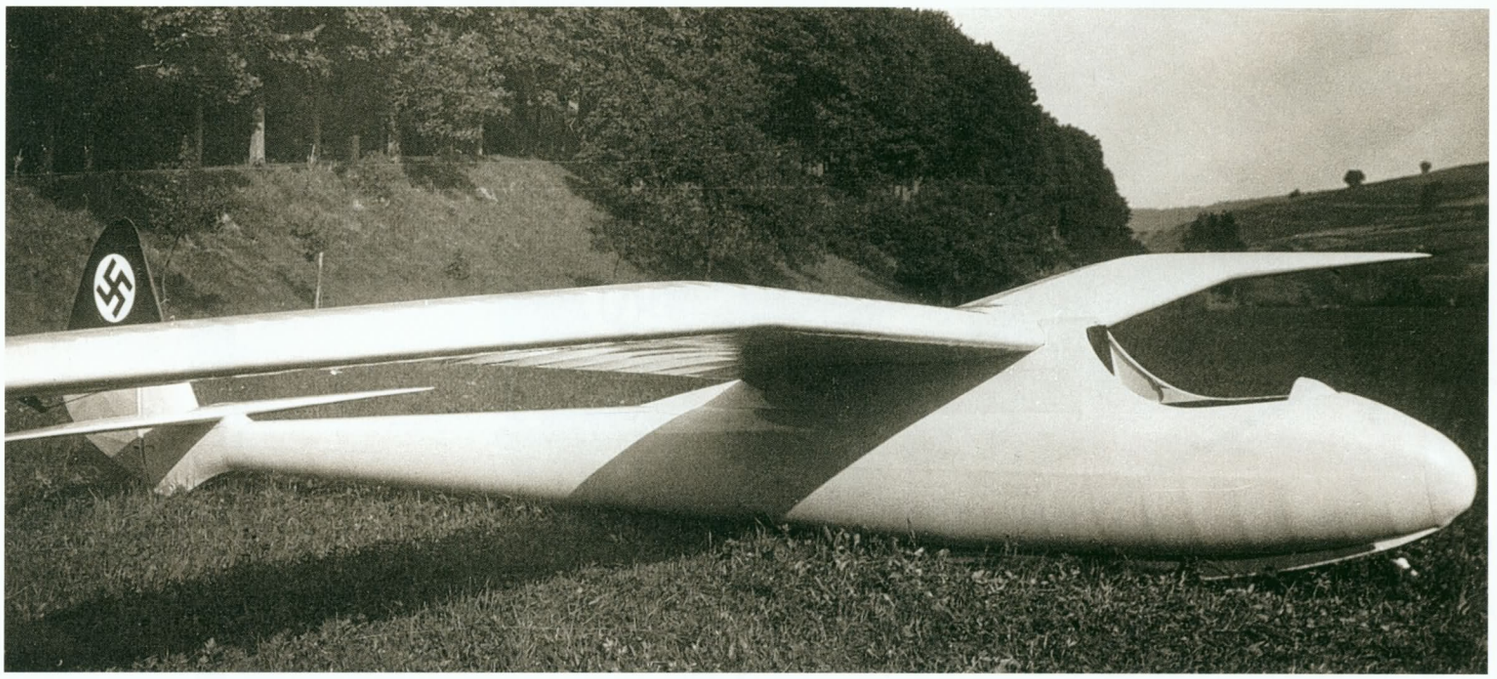
distance flight on the same day. The pilots flew from the Wasserkuppe to Brno in Czechoslovakia. Sadly, on the aero towed journey home, the Condor fuselage failed in flight. The whole front portion, including the cockpit and the seat, broke off when there was a jerk in the towline. The pilot, Rudolf Oeltzchner, was killed when his parachute failed to open. A serious defect in workmanship was established as the cause, which led to the demise of the Bley company.

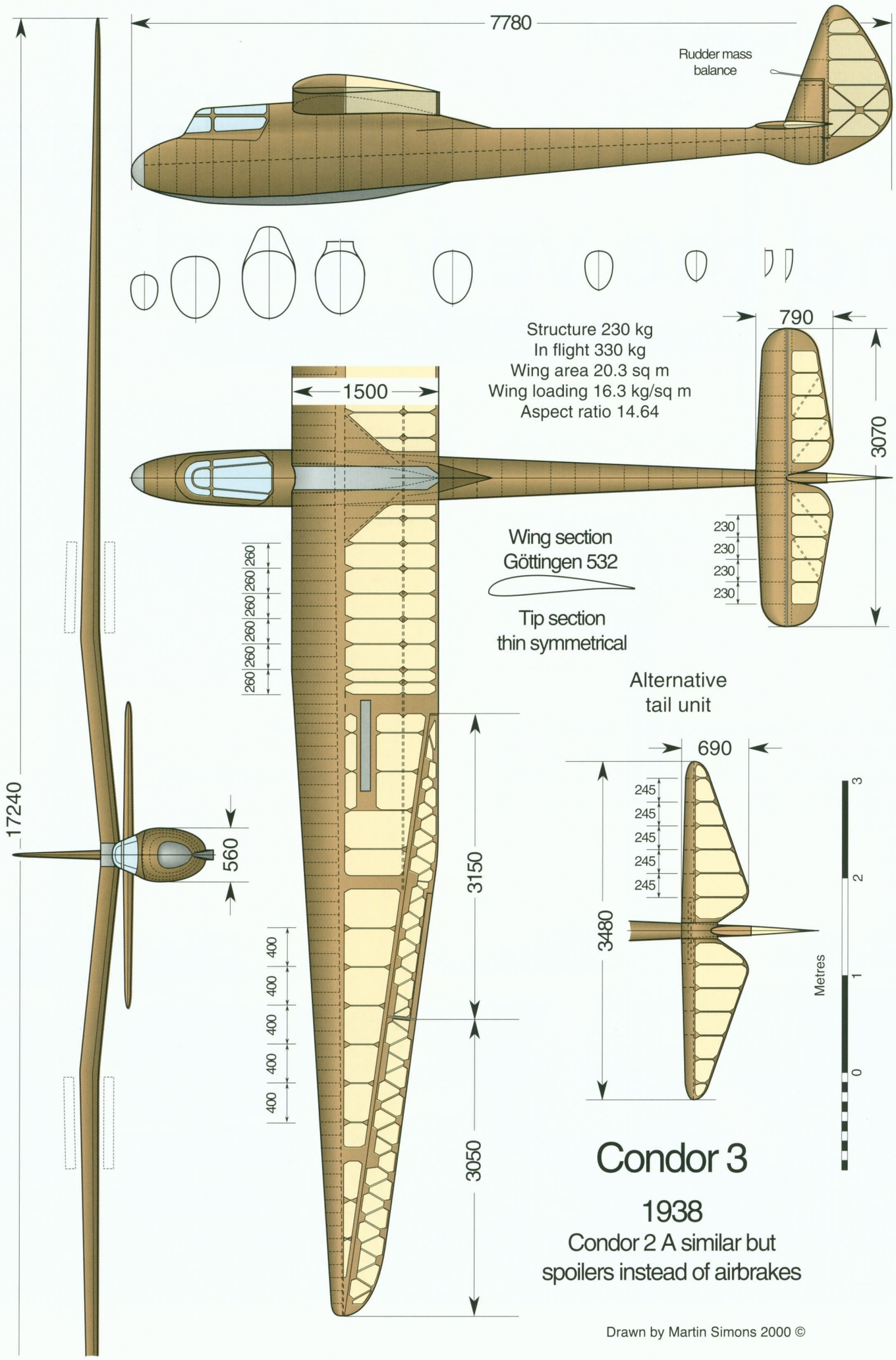
Another Condor of note was Peter Riedel's La Falda. For this he designed a detachable pylon mount to carry an 18PS motor with pusher propeller above the wing centre section. La Falda was capable of taking off and cruising under power. Riedel's idea was to use it as a sailplane but on landing away from home, rather than needing a road trailer or an aeroplane to retrieve it, his crew would bring the motor and pylon, bolt it in place and then he would fly home. In practice it took far too long to get the engine fixed securely and, after many trials, the project was abandoned.

By this time Heini Dittmar was working on a new design, the Condor 2, which had a more modern wing profile, the Göttingen 532, much thinner and less cambered than before, and spoilers. The all-moving elevator was raised to a less vulnerable position. The V struts were retained but before long the Condor 2A was offered with a fully cantilever wing and with a choice of horizontal tail, either all moving or fixed tailplane with elevator, and airbrakes rather than spoilers. Further changes of detail led to the Condor 3, which became a popular contest sailplane just prior to the outbreak of World War 2. The Condor 4 two seater came in post war years.

Left: Edgar Dittmar elder brother of the designer, with a Condor III.

Below: Condor III with cockpit canopy removed.





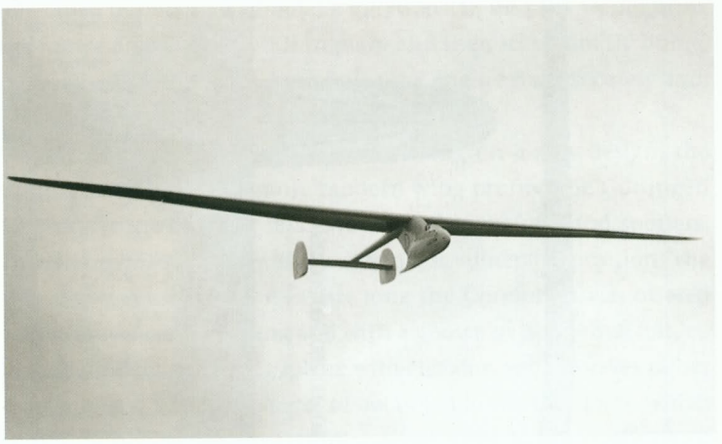
Condor 3

1938

Condor 2 A similar but spoilers instead of airbrakes

Chapter 7 The very large and the very small

Granted, thermal soaring was possible. But what kind of sailplane would be best? The existing high performance sailplanes had developed from hill soarers. Now pilots were venturing into clouds and finding turbulent air hardly dreamed of before. Surely a radical change in flying techniques should be reflected in a new breed of sailplane. Large or small? Fast or slow? Light or heavy? Responsive to delicate handling, or stable and steady?



Above: The mighty Austria in flight.

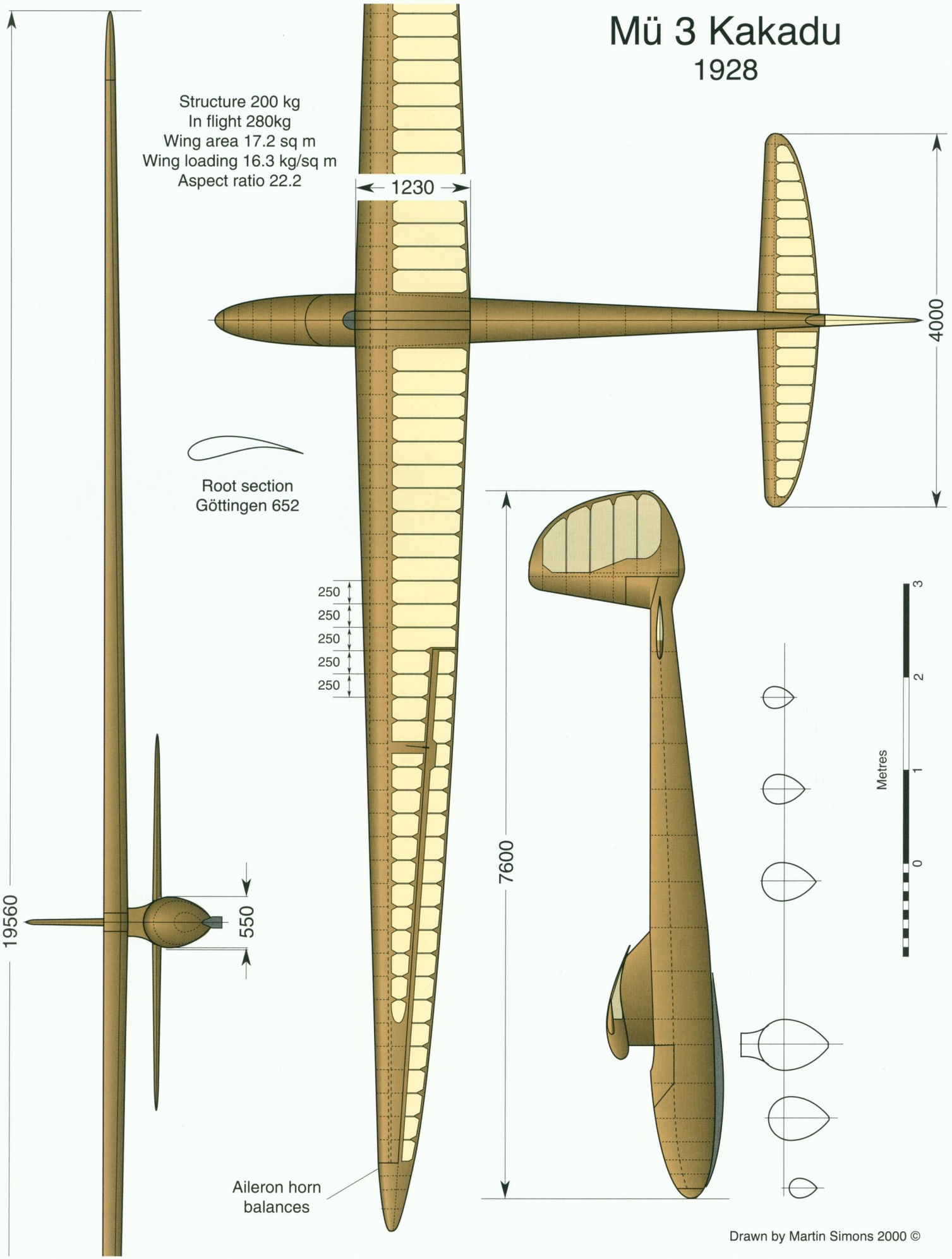
Austria

Robert Kronfeld had been much impressed by finding that he could sometimes fly straight for significant periods by following cloud streets. He had done this on the first ever thermal cross country flight and repeated it on other occasions. If he had a sailplane with

Below: The Austria at Hanworth in England, June 1931.

Mü 3 Kakadu
1928

Structure 200 kg
In flight 280kg
Wing area 17.2 sq m
Wing loading 16.3 kg/sq m
Aspect ratio 22.2



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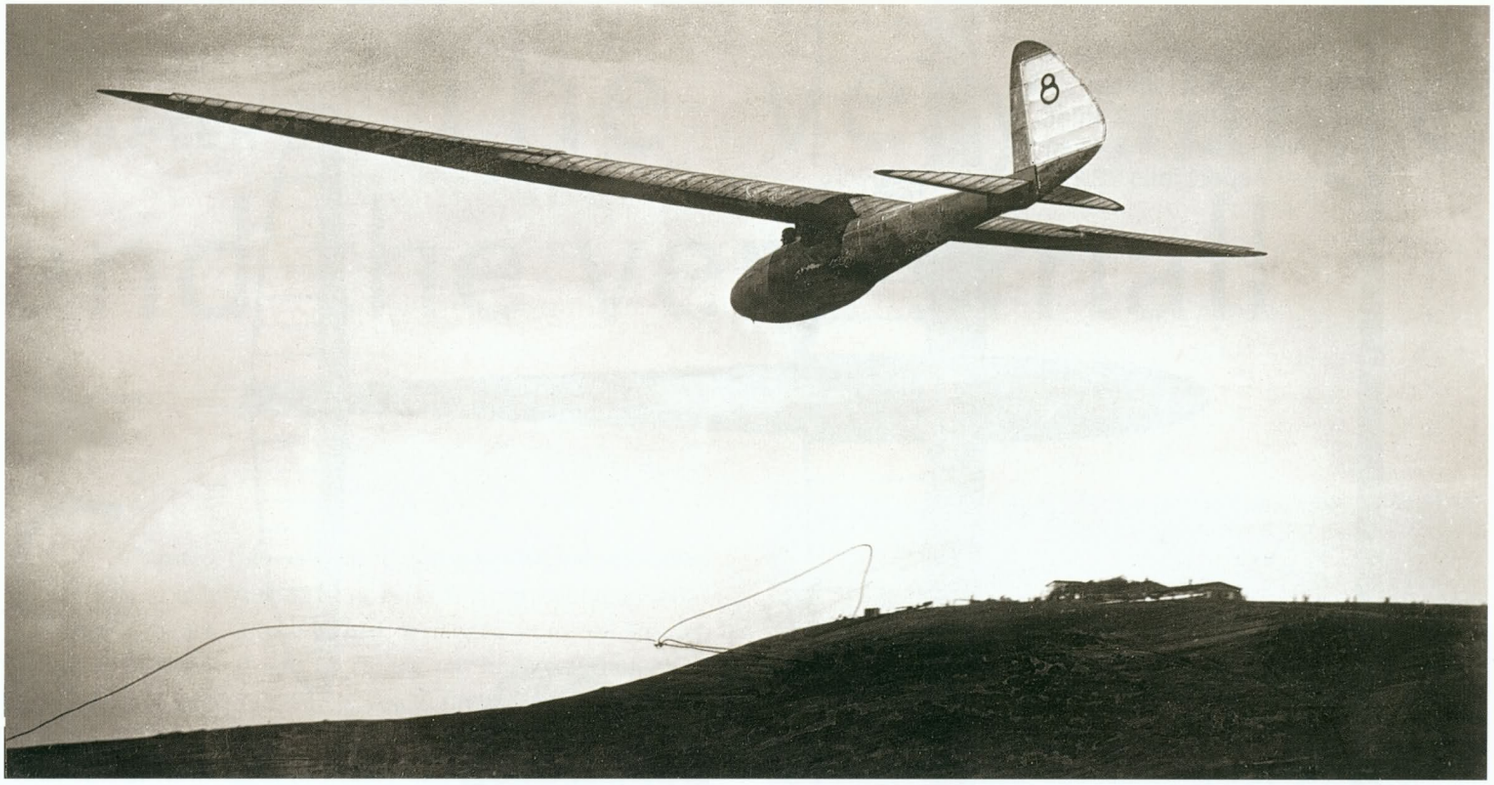


Küpper's Mü 3 Kakadu launched from the Wasserkuppe.

a sufficiently flat glide angle and a very low sinking speed, it ought to be possible to make long distances with only the occasional need to circle in a thermal. This is now well recognised as 'dolphin soaring' but Kronfeld imagined it long before that term was invented.

Kronfeld approached the Munich Akaflieg, where Dr August Küpper was the leader. Among the notable sailplanes he had designed was the Mü 3 Kakadu , an outstanding sailplane of 1928 with span of 19.56 metres and aspect ratio 22.2.

The outcome of the consultation was the mighty Kü - 4, Austria. The logic of the aerodynamic argument always led to a large span and high aspect ratio. The Austria spanned 30 metres, far greater than any other sailplane at the time. Only in the year 2000 with the flight of the Eta of 30.9 metre span, has the Austria been surpassed in size. The aspect ratio was 25.7. (The figure for Eta is 51)

The Austria cost more than four times as much as the Wien. To achieve sufficient strength and stiffness the huge wing was entirely skinned with plywood, filled, painted grey and polished to reduce skin drag. The Göttingen 652 section, chosen by Lippisch for the inner wing of the Fafnir, was used for the whole span of the Austria. But Küpper realised that such a form would be a handicap for gliding between thermals. He fitted the sailplane with 'flaperons', ailerons which could also be used as flaps to reduce camber in the glides. These principles are fully accepted now although the extraordinary 652 profile is regarded only as a curiosity.

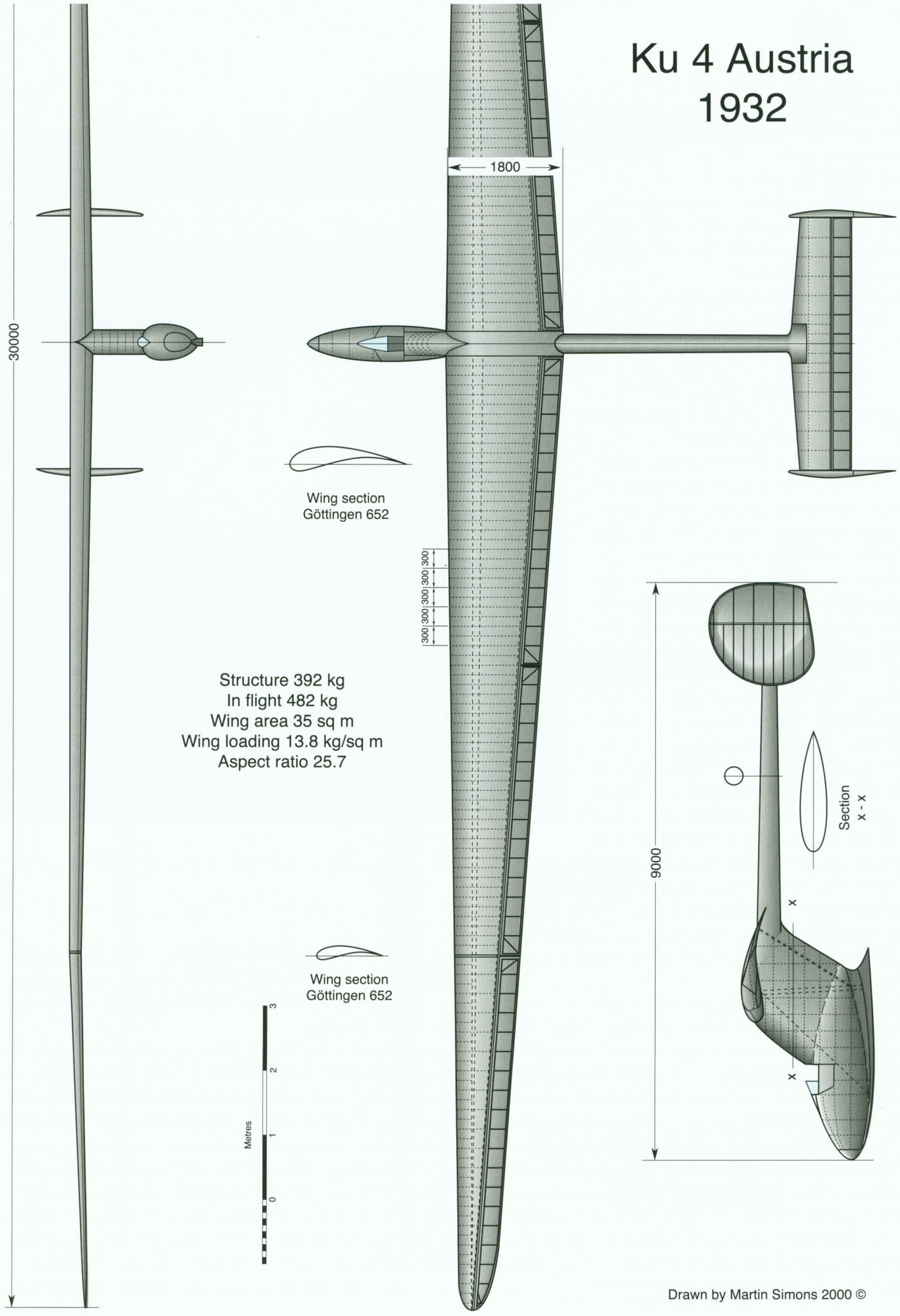
Such a long, narrow wing would bend upward under load. The tip panels were set at a slight anhedral angle so that they would take a more or less horizontal position in flight. To prevent binding at the hinges the flaperons were made in six sections, three on each side. Despite this, they gave trouble and required further work before test flights.

To give the long wing a reasonable ground clearance at the tips for landing in hilly terrain, a very tall fuselage pylon was necessary. The pilot was housed in a narrow, streamlined pod a full metre below the wing. The tail was carried on a tubular boom not much less in cross section than an ordinary fuselage. For structural efficiency this was attached at the front end directly to the main supporting structures at the wing root.

The vast wing required large tail areas for stability and control. The vertical surfaces were split into two, with outward camber, mounted on the ends of the large tailplane. Kronfeld had realised that landing an efficient sailplane was difficult and the Austria was the first ever to have a form of air brake. By pushing forward with both feet on the pedals, the two rudders could be turned outwards together, creating additional drag. These did not prove very effective and, when most desperately needed at high airspeeds, were quite useless.

To launch such a monster was difficult. For the first flights the Klemm towing aeroplane had to be assisted in the first stages of the ground run by a Mercedes truck with a 300 metre cable to get the combination moving. Once the glider was airborne the truck cable was released. Kronfeld took the Austria to England for demonstration flights at Hanworth in 1931, and was late arriving for the Rhön contest in August. When it did appear at the Wasserkuppe, because of its size and colour, it acquired the nickname Kaltgezogener Elephant.

Ku 4 Austria
1932



Drawn by Martin Simons 2000 ©

The Austria had a brief operational life. At the Wasserkuppe on 22nd July 1932 it broke up in the air. Kronfeld was lucky to escape by parachute. He had been soaring and entered a cumulus cloud, flying blind. He had a gyroscopic turn indicator but despite this became disoriented and entered a spiral dive. The airspeed rose beyond his control and the wing failed. Kronfeld survived, shaken and disappointed. The Austria was reduced to small fragments.

This was Kronfeld's last Rhön competition. He was Jewish and after 1933 forbidden to compete in Germany.

Windspiel

The Darmstadt students had not been idle after building their D - 20 Starkenburg sailplane but had turned their attention to powered aircraft. In 1933 they decided to build a thermal soaring sailplane. They supposed that good results would come from a very small, very light and manoeuvrable but efficient, aircraft that would be capable of turning very tightly in narrow and feeble thermal cores, gaining height more easily than the large span monsters. The outcome was the D - 28 Windspiel.

The span was 12 metres. The wing was tapered, with full span 'flaperons' to vary the camber for different speeds. The basic aerofoil was Göttingen 535 but thinned to reduce drag. The rudder was of an ingenious double action type. The front portion of the vertical tail was not a fixed fin but moved as a rudder. To it was hinged the rear portion, geared in such a way that it moved twice as much as the front segment. The rudder was also linked mechanically to the ailerons so that the two controls always worked together in harmony. The fuselage was reduced to the minimum possible cross sectional area with a narrow pylon to carry the wing. The cockpit was enclosed by a curved transparent piece of celluloid.

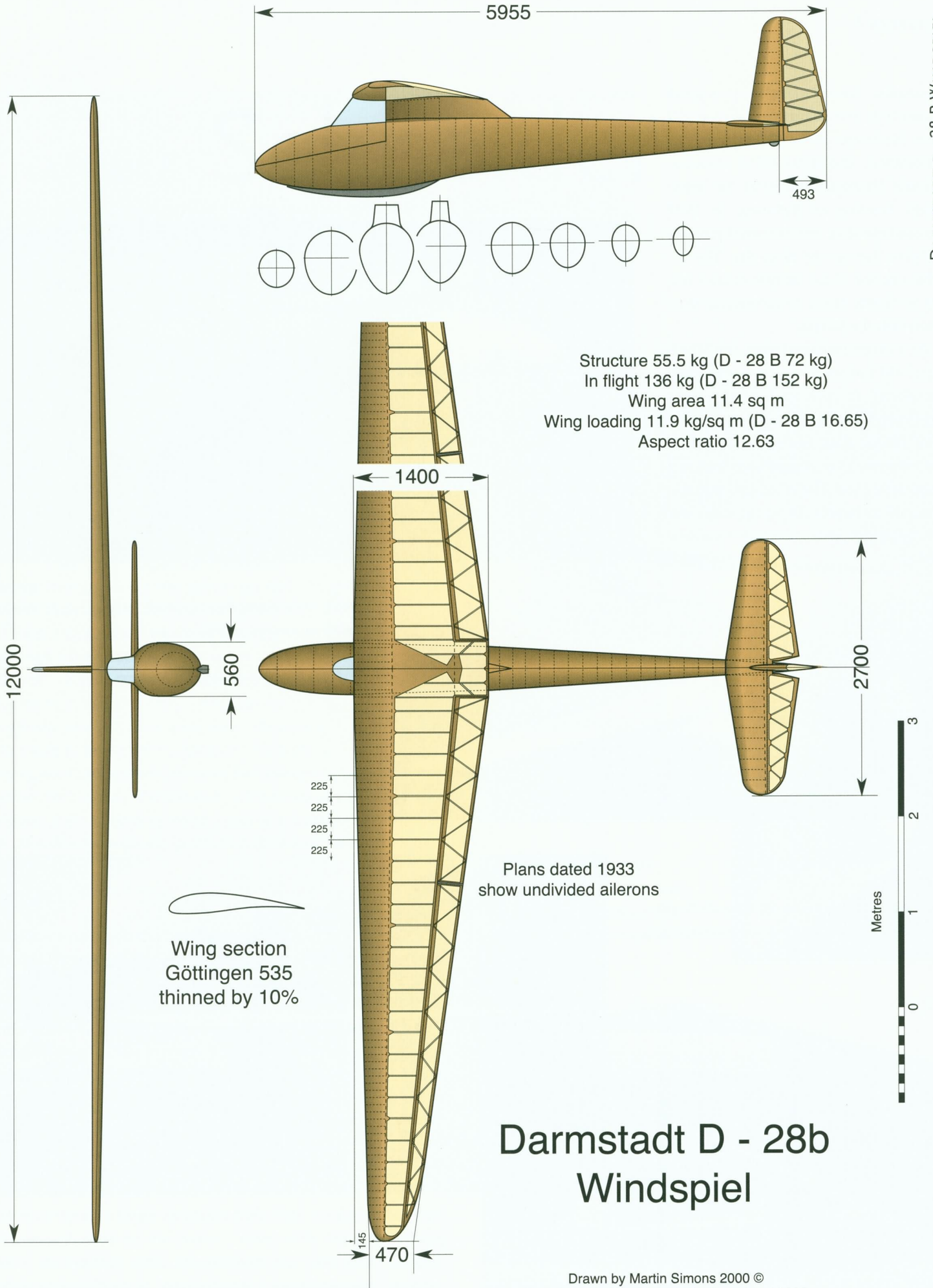
Everything conceivable was done to reduce weight. The main spar was stressed only for 4 g, the nose of the wing skinned only with 1.0 mm plywood. There was no spar to carry the ailerons, which were hinged to a few specially stiffened ribs, the gap along the hinge line sealed with 0.5 mm plywood shrouds. All wing rib members and fuselage frame outlines were spindled out to U cross section to remove waste wood and there were no fuselage longerons. Measurements were checked at every stage, dimensions kept within 0.1 mm of the calculated figures. All joints were carefully wiped before the adhesive set, to remove excess glue. Selected timber was used and metal fittings were made from light alloys. The open framework was covered with silk rather than the usual cotton or linen fabric.

Windspiel ready for launching. The horizontal bar on the mast gave the pilot a guide to the trim attitude

The students took 7000 working hours to complete the little sailplane which weighed 55.5 kg, considerably less than the pilot. It flew as expected. A shallow bank angle of 25 degrees gave a circle radius of only 80 metres.

In March 1934 the Windspiel, flown by Hans Fischer, broke the world distance record, flying 240 kilometres from Darmstadt into France, although this figure was exceeded within the month by Richard Du Pont in the USA flying the Bowlus Albatross, which represented the other school of thought. Du Pont's flight was in turn exceeded by Wolf Hirth's 352 km in July, with the 20 metre Moazagotl.

Fischer was in the cockpit on Griesheim aerodrome one day in 1935 when a powered aircraft landed on the Windspiel. He escaped with bruising, but the sailplane was wrecked. It was rebuilt, with the ailerons divided now from the flaps. The repaired structure was heavier, but the D - 28B, as it was called, suffered very little in per-



Darmstadt D - 28b Windspiel

Drawn by Martin Simons 2000 ©
Based on Akaflieg Darmstadt plans dated 1936

formance. Hans Osann made a good flight in it from Darmstadt to land just over the border of the Netherlands, 275 kilometres, and at the ISTUS (Internationale Studienkommission für Segelflug) meeting in Salzburg in 1937 crossed the Alps, one of several pilots to achieve this on the same day. The D - 28B was one of the sailplanes later taken to North Africa to investigate thermals over the Sahara.

An interesting experiment, the Windspiel did not set a trend towards small sailplanes. To build such a lightweight was very difficult, costing more in time and labour than the large sailplanes, and the results in competition were not especially good. The Windspiel was also delicate to handle on the ground, and probably not strong enough for cloud flying.

Above: The Windspiel about to take off. The figure 7 on the nose is evidently not a contest number.

Left: The D - 28B on the airfiled at Griesheim.

Right: The divided ailerons identify this as the D - 28B. Note the removable cockpit cover and the wheeled dolly for ground handling.

Chapter 8 Schneider and Grunau

Each individual sailplane coming from the Edmund Schneider, Grunau works was given an ESG number according to the year in which it was built. Every aircraft emerging during the year 1929 was an ESG 29 and so on for 1930 and 1931. This caused little confusion at the time because except for the primary trainers, hardly any two sailplanes were alike. They usually acquired individual names from owners, sponsors or advertisers, such as Donnerstag-Klub, Burkbraum, Senator, Bad Warmbrunn (two seater), Condor (two seater), Wiesenbaude 1, Wiesenbaude 2. Which year numbers were applied to which types is not always discoverable but the names were usually painted on the aircraft in large letters.

Above: The ESG - 31 in flight, Sweden 1946.

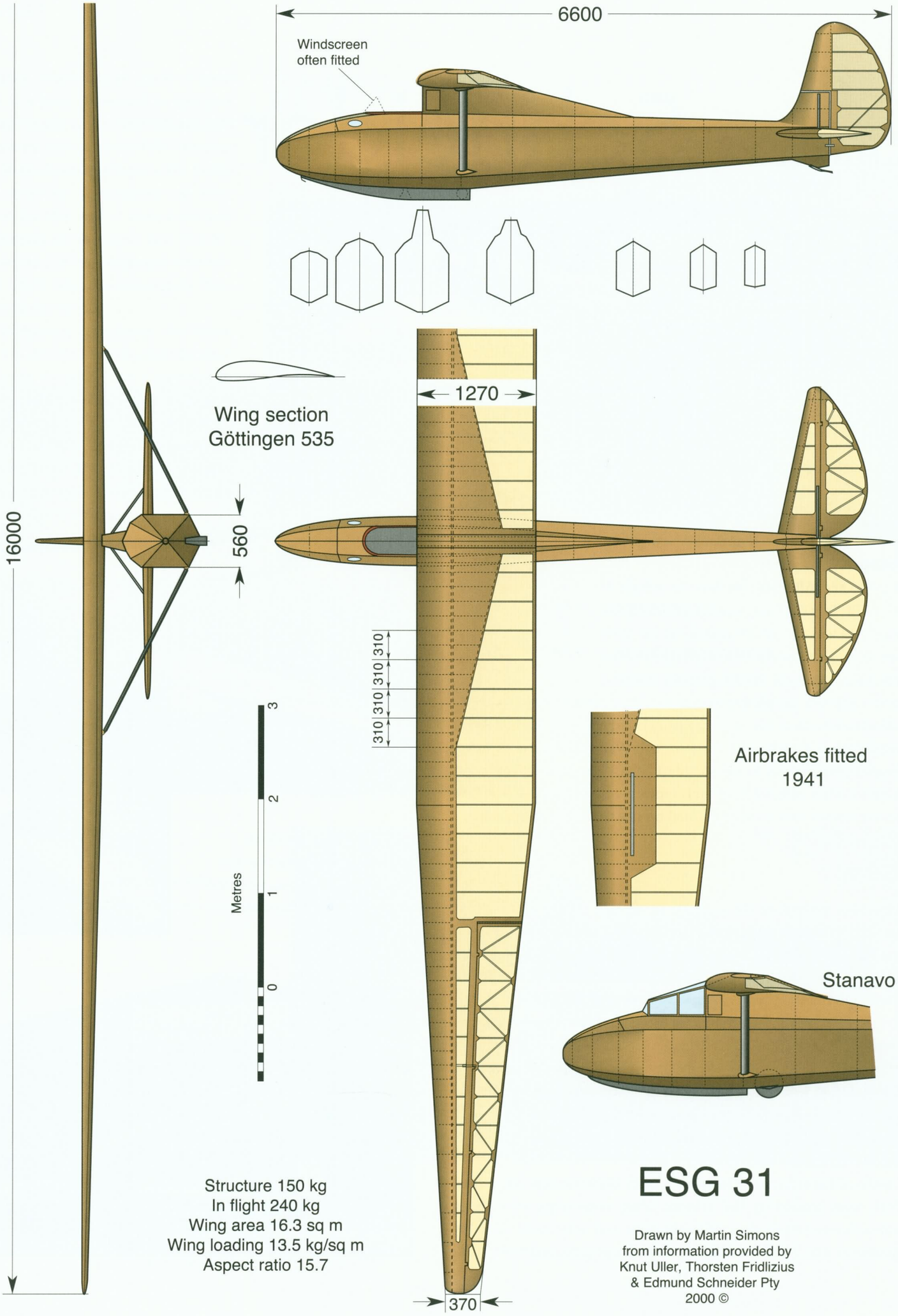
Right: Details of strutted tail of the ESG - 31 (Fridlizius).

Below: The ESG - 31 outside the Sailplane Museum Aarhus in Sweden. This is the only survivng example of the type, manufactured by Schneider in Grunau (Fridlizius).

ESG 31

Schneider recognised the need for a sailplane in the same class as the RRG Professor, capable of towed launching but easy to build and safe to fly. Among the Schneider products was a single seat, 16 metre span, strut braced sailplane which in appearance and layout resembled the Professor, with a very similar performance and role. Schneider's design was original, with a simplified wing structure, a single strut instead of the V struts of the Lippisch type, Göttingen 535 wing profiles instead of the Gö 549. The ailerons were very broad at their inboard ends and strongly tapered. With various detailed improvements this type continued in production for several years although there was no such thing as a production line. Each aircraft was custom built to order.

Most of these 16 metre sailplanes from 1929 through till at least 1931, were named by the owners, often with some advertising and/or sponsorship deal. Wiesenbaude was one such, possibly numbered ESG 29 or 30. Wiesenbaude 2 was presumably built for



Structure 150 kg
In flight 240 kg
Wing area 16.3 sq m
Wing loading 13.5 kg/sq m
Aspect ratio 15.7

ESG 31

Drawn by Martin Simons
from information provided by
Knut Uller, Thorsten Fridlizius
& Edmund Schneider Pty

Above: The Grunau Baby 1 had a straight backed fuselage and tall rudder.

Left: Wolf Hirth at the Rhön, preparing to take off in the ESG - 31 'Frankenstein'.

the same club at about the same time. Schlesierland was another but there was also a two seat Schlesierland which was of course quite different.

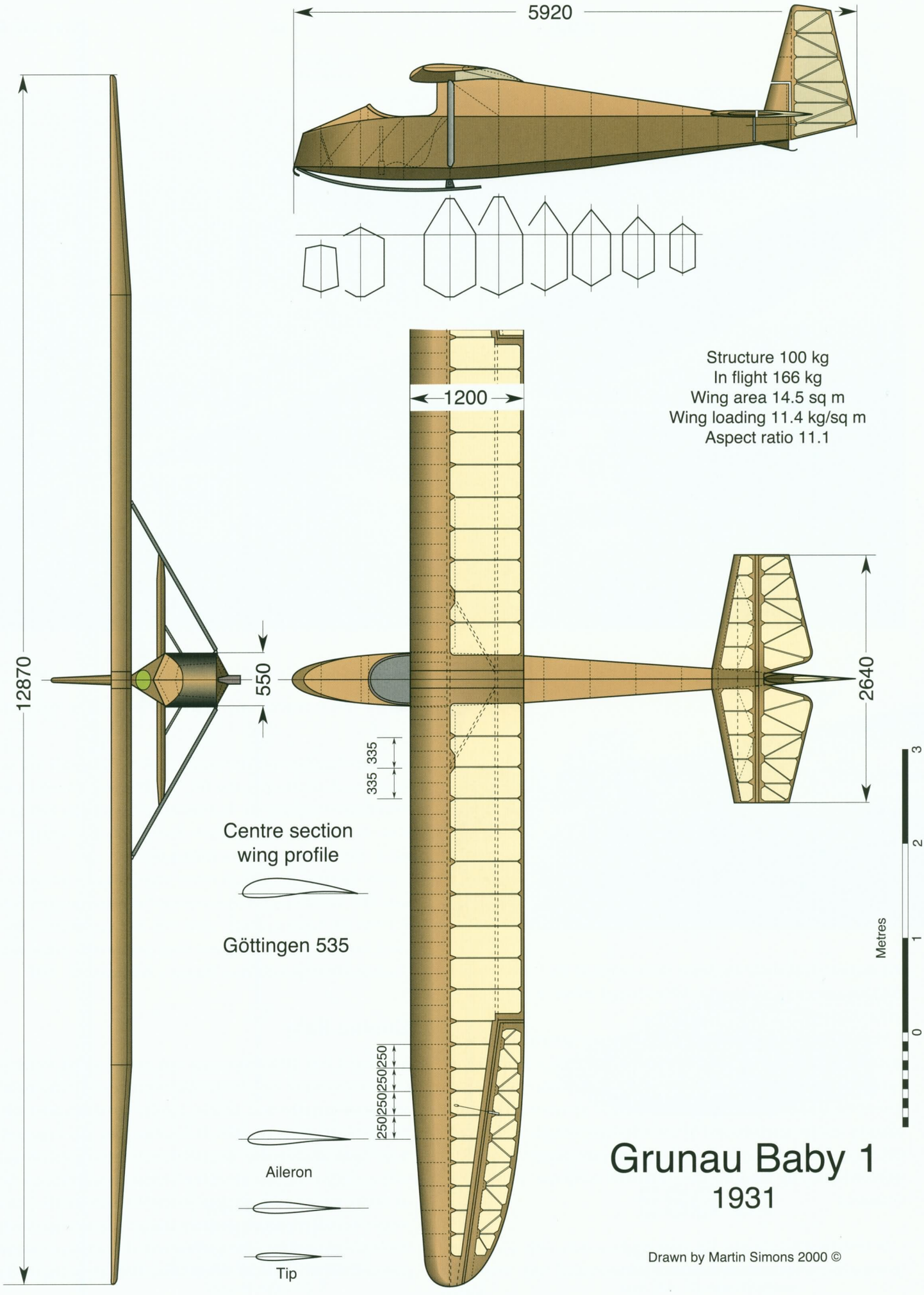
Wolf Hirth flew and liked the Schlesierland. Probably at his suggestion the next ESG 31 was the Stanavo. The wing was the same but there was a landing wheel and an enclosed cockpit similar to that of the Musterle. (Stanavo was the name of an aviation fuel marketed by the German division of the American Company, Standard Oil of New Jersay. It may be that the oil company bought it for their representative in Europe, the American sailplane pilot, Jack O'Meara.)

In 1931 the ESG 31A and 31B, both single seaters, were advertised in Schneider's brochure as 'improved Schlesierland' type. They had the same familiar strutted 16 metre wing. The new tail unit was braced with struts up to the fin. The 31B was offered with a fully sreamlined fuselage, the 31A retained the simpler hexagonal box form. At the Rhön in 1932 Hirth flew an ESG 31A named #Frankenstein', belonging to a police gliding club.

How many of the ESG 31 series were produced altogether is not recorded, but at least one was exported and this survives in Sweden. The ESG 31 'Läkerolplanet', delivered to a customer in Sweden in 1933, was used there for many years and is now preserved in the Swedish Ållebergs Sailflying Museum, registered SE - ADP.

Grunau Baby

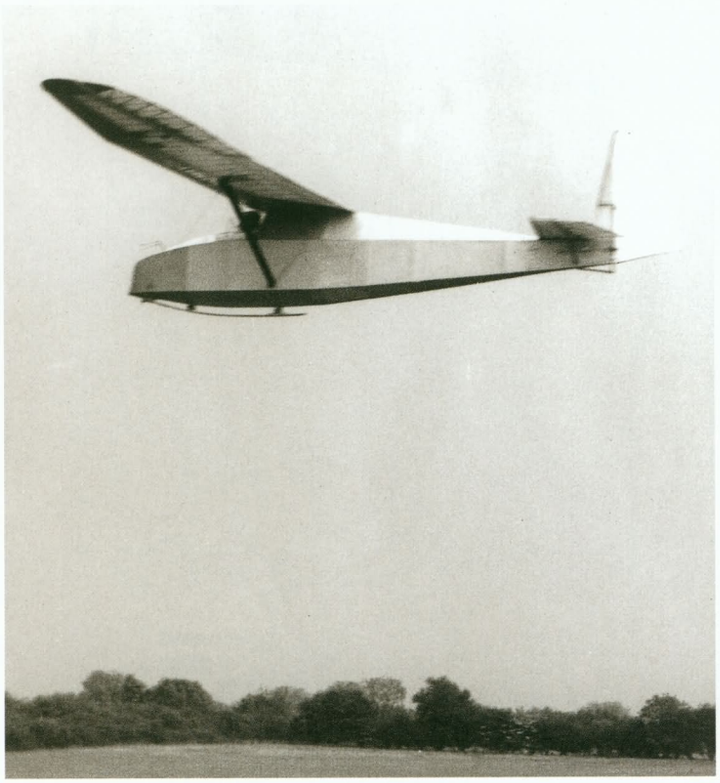
A new and very different design was started in the winter of 1930 and the prototype flew in the following year. Confusingly, it was numbered after the year, ESG 31, but did not much resemble the 16 metre ESG 31 type. The ESG 31 Grunau Baby was a modest, 12.87 metre span single seater. In plan form the two piece wing, braced with a single strut, resembled the Darmstadt sailplanes, a rectangular centre section with elliptically tapered outer panels. The Gö 535 section blended to a thin symmetrical profile, strongly washed out to control tip stalling. The fuselage was of hexagonal cross section, plywood skinned with a straight spine from the wing trailing edge



Structure 100 kg
In flight 166 kg
Wing area 14.5 sq m
Wing loading 11.4 kg/sq m
Aspect ratio 11.1

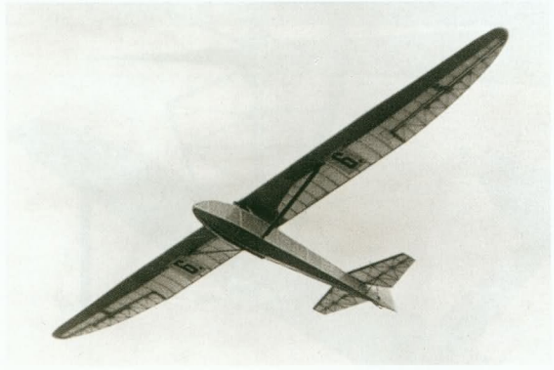
Grunau Baby 1
1931

Drawn by Martin Simons 2000 ©

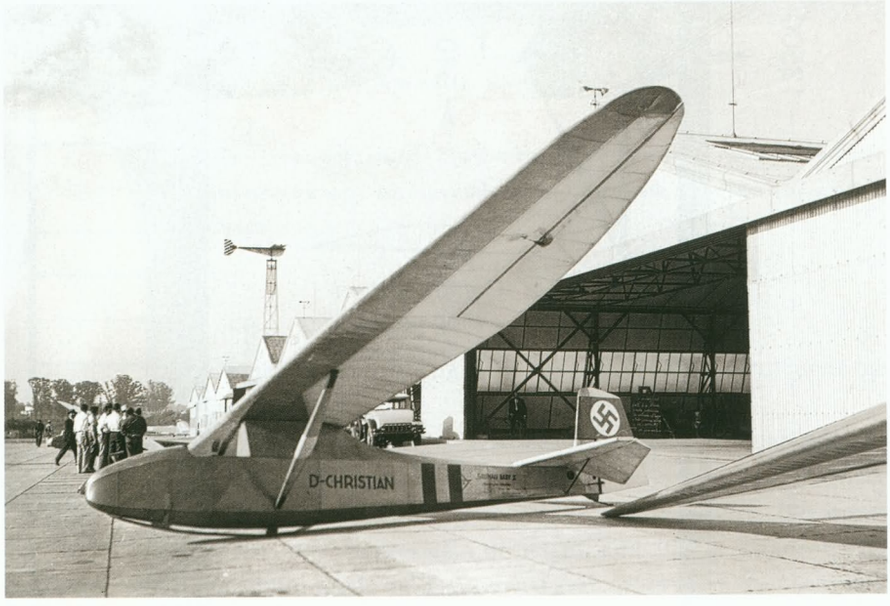


Left: In England, A GB 1 was built at Dunstable by Louis Desoutter, who died in a Dagling accident in 1934 before it was complete. Slingsby finished it and it proved very popular with members.

Below: Hanna Reitsch went to Latin America with Georgii's expedition in 1934. She flew a Grunau Baby 2, D - Christian, which had a rounded decking to the front fuselage.



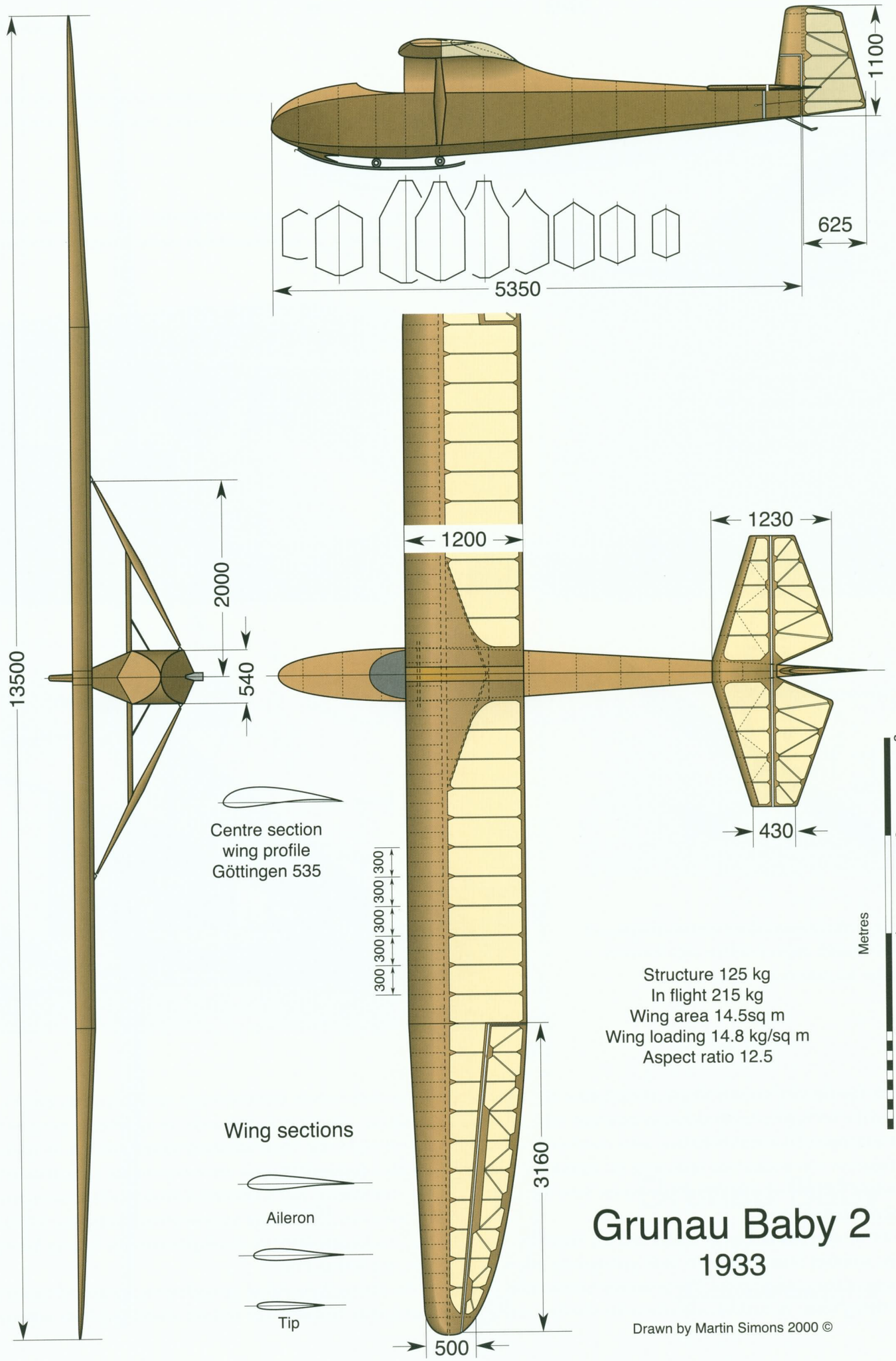
Above: Plans for the GB 2 were sold and numerous examples were built all over the world. Slingsby built fifteen under licence, one which is shown here. Note the broad ailerons.



to the tail. The tail unit was very simple, the tailplane struts underneath and the tall rudder aerodynamically balanced. Gaps, 25 mm wide, at all hinges of the control surfaces were closed with strips of fabric doped on. The cockpit was open with no windshield. A skid was provided for landing. Flight tests proved the Baby was exactly what Schneider had hoped.

Wolf Hirth, after his success at Elmira and the flight over New York city, returned from the USA in 1931 and went to Grunau to take charge of the gliding school. The prototype Grunau Baby was already flying when he arrived and saw it for the first time. At Schneider's request, Hirth endorsed the type and allowed his name to appear, somewhat ambiguously, in advertising brochures. The legend began that Hirth was the designer, which he himself never claimed. Further confusion was caused by the association of Hirth with the Stanavo, and Schneider's system by which the Stanavo and the much smaller Grunau Baby were both numbered ESG 31. The Stanavo actually made its first flights after the Grunau Baby prototype, but both in 1931.

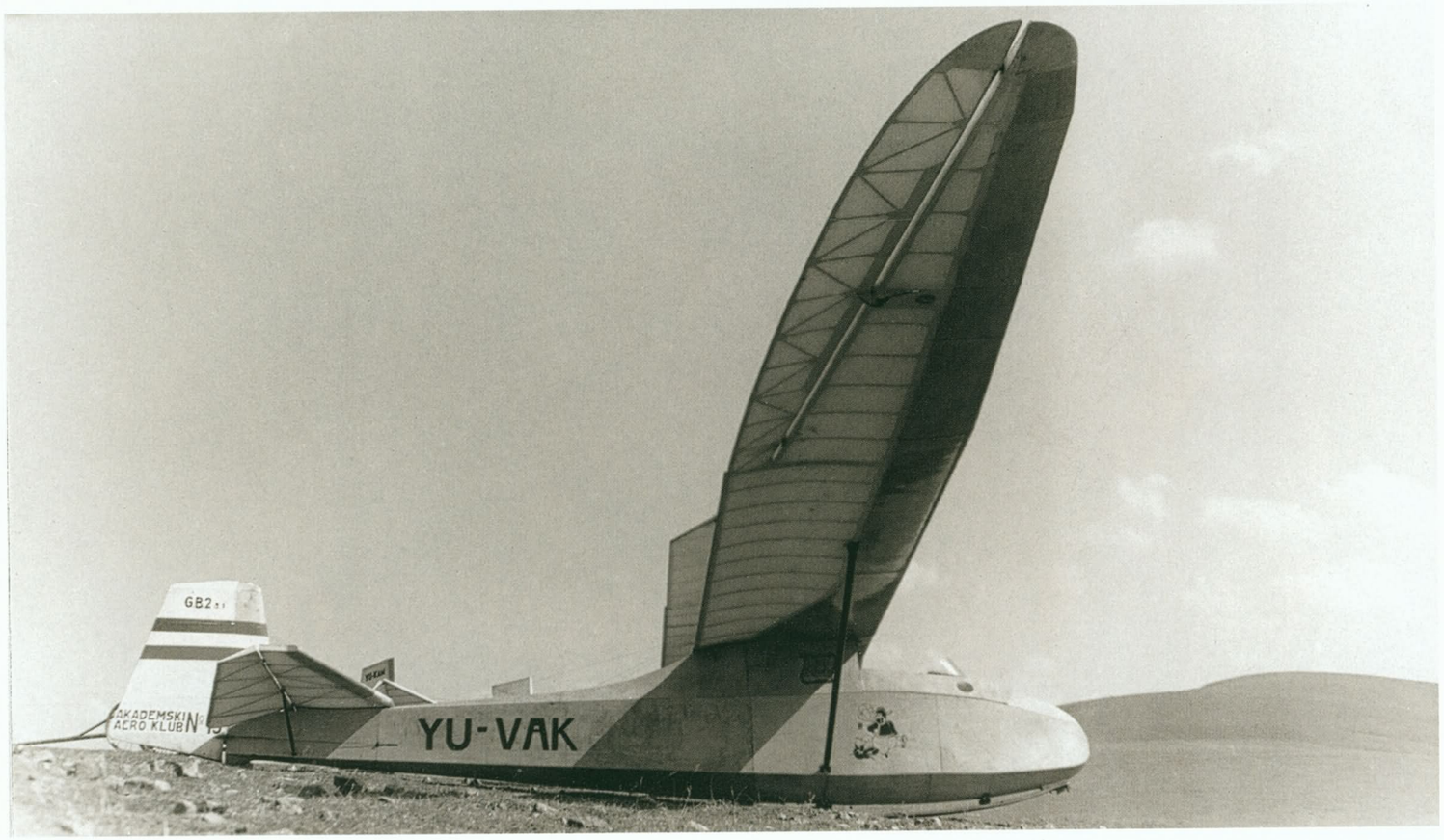
The Grunau Baby was an immediate success and Schneider began production. Not only the Grunau school but clubs all over Ger-



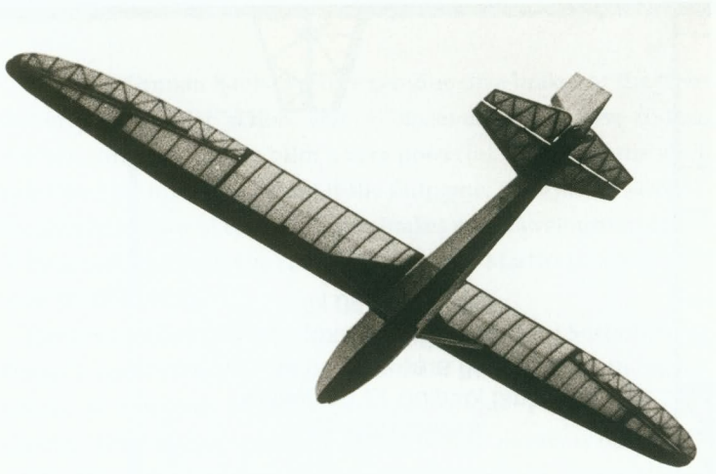
Structure 125 kg
In flight 215 kg
Wing area 14.5sq m
Wing loading 14.8 kg/sq m
Aspect ratio 12.5

Grunau Baby 2
1933

Drawn by Martin Simons 2000 ©



Above: A Grunau Baby 2A in Yugoslavian markings.



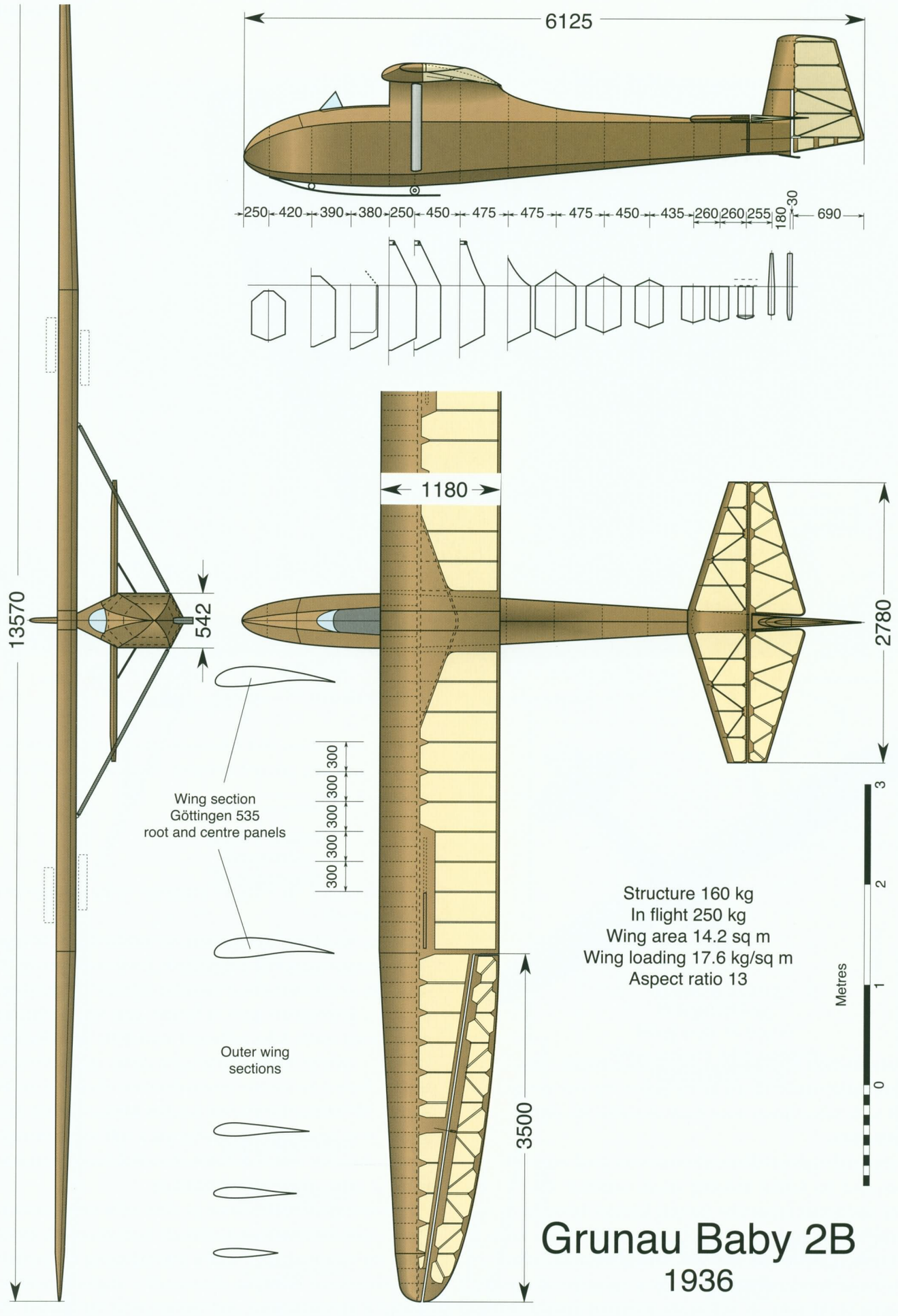
Left: The Grunau Baby 2A, which had narrower ailerons, a revised elevator shape and spoilers above the wing, was widely distributed. The example shown here was exported to Australia in 1937.

many and elsewhere placed orders. Six Grunau Babies entered the Rhön competitions in 1932 and by the end of the year twenty two had been sold. Sets of plans were made available for amateur and other production.

Schneider, although a skilled craftsman with good experience of sailplanes, had no formal training as an engineer. One of his sailplanes, the Senator flown by Herbert Rüdiger, broke up in the air over the Wasserkuppe in 1932, with fatal results. It was suspected that the wing was under strength. Taking warning, Schneider employed Emile Rolle, an engineer, to carry out essential stressing and redesign of the Baby. As well as the necessary strengthening, Rolle extended the span, improved the fuselage shape by curving the spine behind the wing, enlarged the cockpit and produced the Grunau Baby 2.

The success of this type exceeded all expectations. Its appearance on the market came at the right time. It was inexpensive. The handling was adequate for beginners yet 'Silver C' flights (five hours duration, 1000 metres gain of height, and 50 km distance) were quite within reach. Sales improved even more when Kurt Schmidt, above the famous Baltic coastal sand dunes at Rossitten, soared a Grunau Baby 2 for a world record duration of more than 36 hours. At the 1933 Rhön, thirty three Grunau Babies entered. By the end of that year Schneider was producing a GB2 every three days. Licence production was undertaken in several countries and amateurs in many distant places started building.

Further improvements came in 1935, with the Grunau Baby 2A. The ailerons were increased in length and reduced in chord, lightening the stick loads for the pilot but improving their effectiveness. The elevator was reshaped, the cockpit was given a semi-enclosed canopy with windscreen, and spoilers were introduced. The need for these to help landing had now been recognised.



Grunau Baby 2B
1936

Drawn by Martin Simons 2000 ©

With the Grunau Baby 2B came genuine dive brakes of the 'scissor' or 'parallel ruler' action. Vertical blades extended above and below the wing, giving the pilot a very powerful control of the glide and also limiting the airspeed if the sailplane, in cloud or aerobatics, should get out of control. These brakes were developed originally by Schempp Hirth, the company set up by Martin Schempp and Wolf Hirth in 1935.

The Grunau Baby 2B was taken up by the National Socialistische Flieger Korps (NSFK), the flying division of the Hitler Youth organisation. At hundreds of small gliding schools the 2B became the standard intermediate sailplane. Whatever the numbers before, the production figures of the GB 2B ran into thousands. Harry Schneider, son of Edmund, estimated about 4000 to 5000 Grunau Babies were built, worldwide. Wolf Hirth suggested twice these figures. The exact total is not known but (excluding the innumerable primary trainers) there is no doubt that more of the Grunau Baby were built than any other type of sailplane before or since.

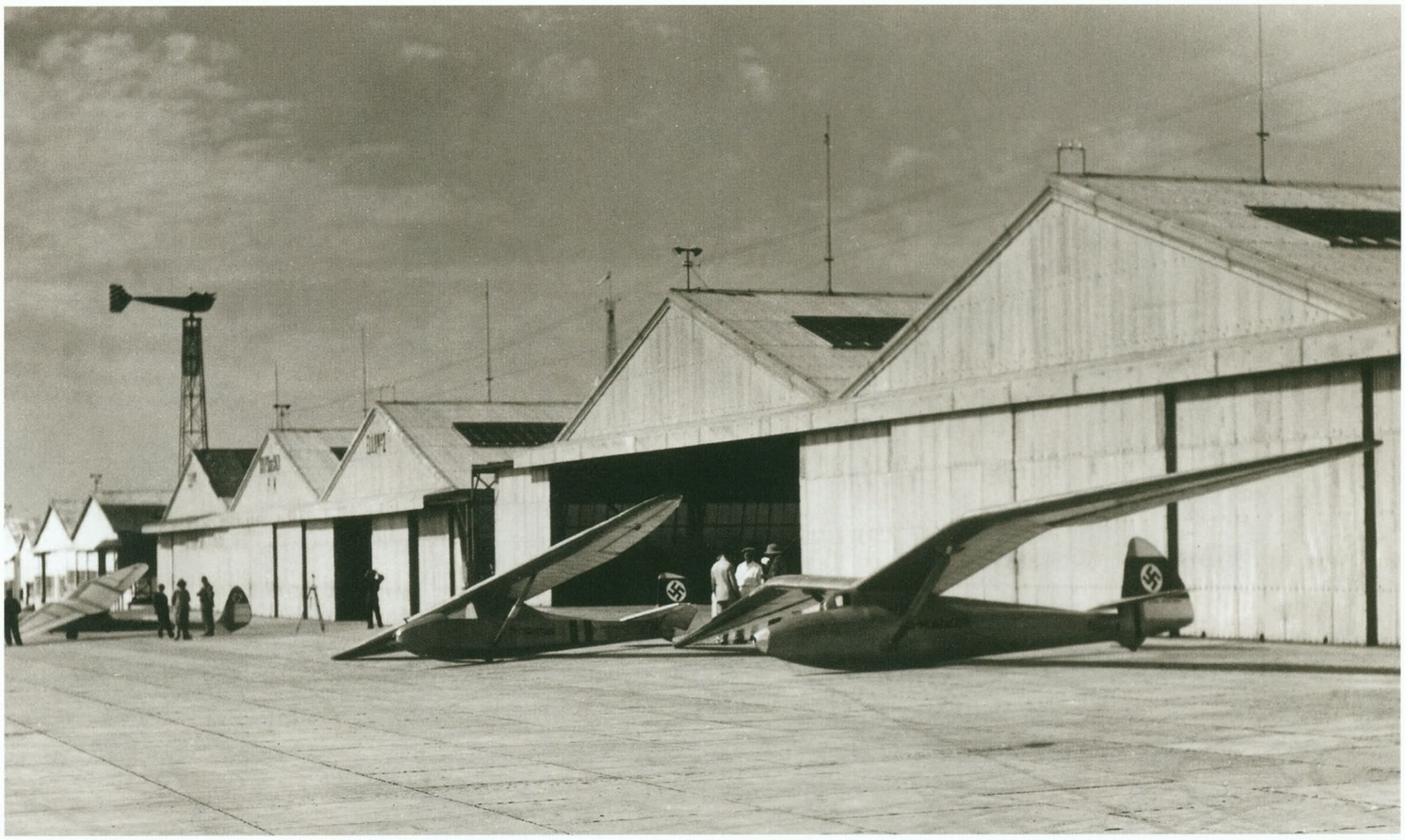
The Grunau Baby had a great influence on sailplane design and production throughout the world. It was widely copied and production outside Germany continued after World War 2, with various minor alterations. In Germany the Grunau Baby 3 was later built in some numbers, with a wheel, a more robust and rather less elegant fuselage and simplified wing mounting arrangement. Many Grunau Babies of different marks remain in service and there are 'Baby Treffens' (meetings) for enthusiasts.

Above: A Grunau Baby 2B in wartime colours, the upper surfaces camouflaged, prepared for take off.

Right: The Grunau Baby 2B was equipped with dive brakes and was mass produced in Germany and other countries. Many remain in use, carefully maintained and restored by their owners, in many countries.

Moazagotl

Wolf Hirth understood before most others that stability was a necessity especially in steep circling flight. The Musterle was sensitive in pitch and had no dihedral so was difficult to handle in thermals. He wanted a sailplane which would be capable of long continued circling, in clear air and in cloud, without constant corrections, strong enough to withstand violent turbulence, and with a good performance, meaning large span and high aspect ratio.

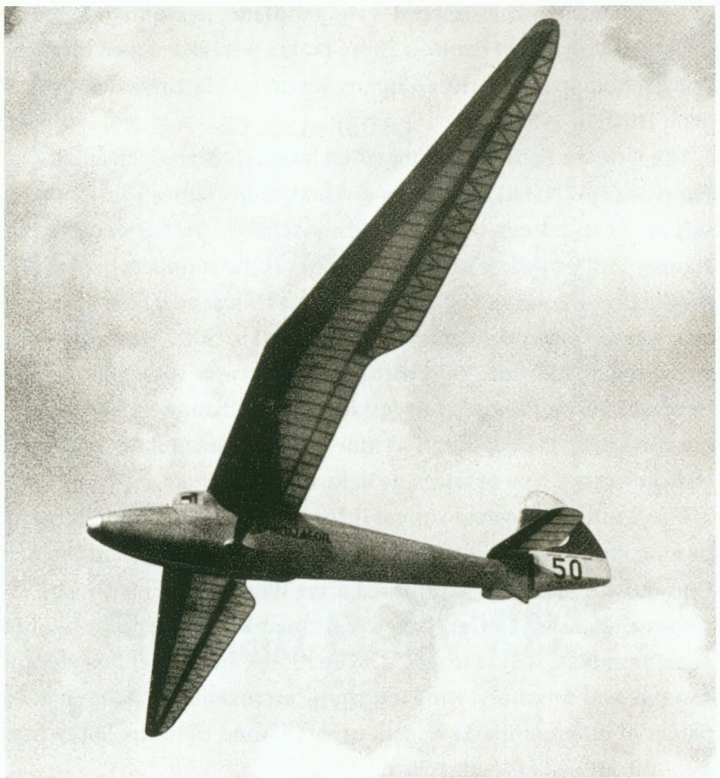


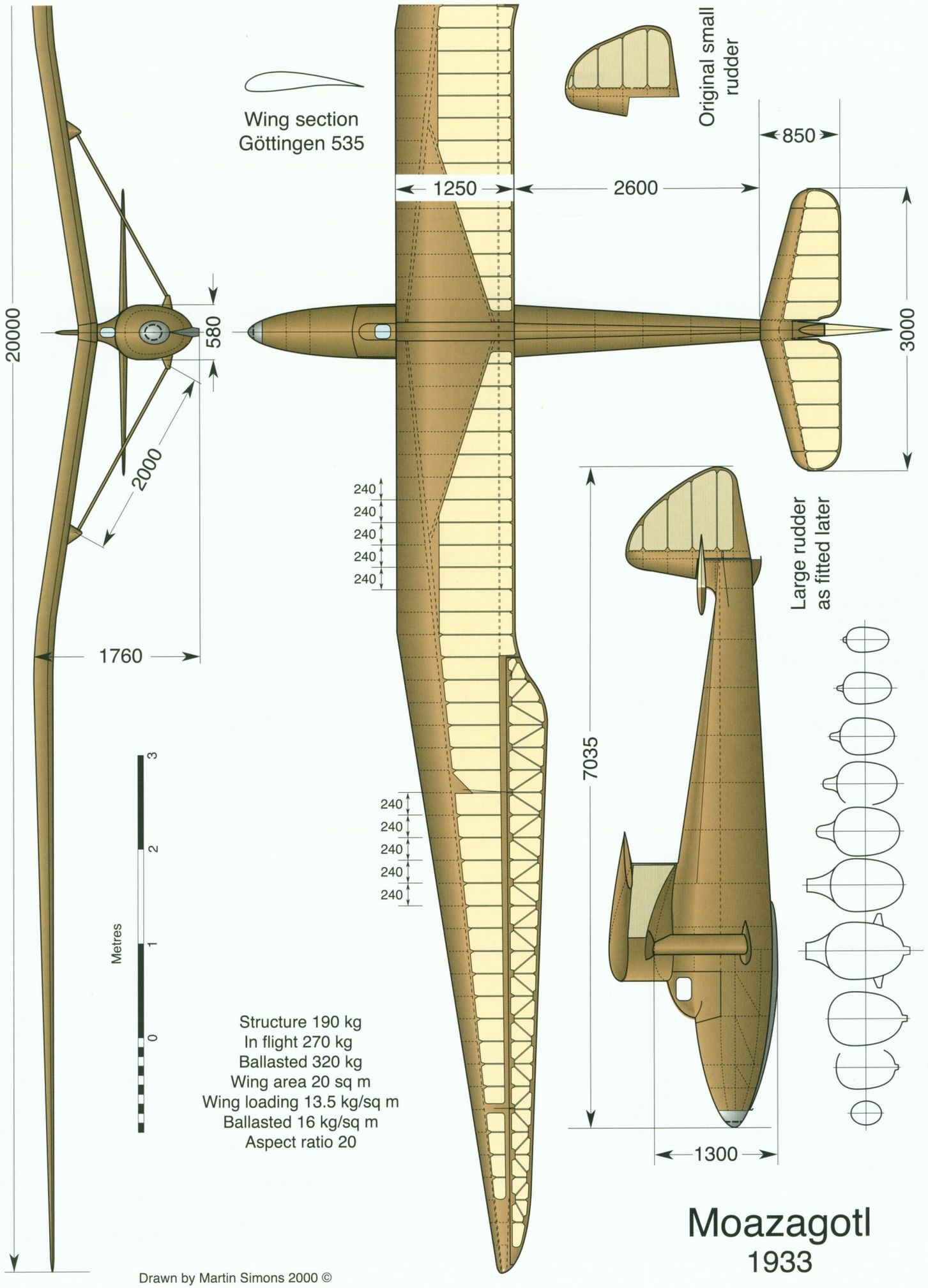
Hirth had also realised that on the best soaring days, when there were plenty of strong thermals, it paid to move fast through sinking air. Even if this caused some sacrifice of height in the short term, the faster sailplane would reach the next thermal and be climbing while the slower competitor was still wallowing in the sink far behind. His new sailplane must be capable of carrying ballast. A tank taking 50 kilograms of water was to be fitted behind the pilot's seat. A valve would allow him to jettison the water if conditions became difficult.

In 1932 Hirth commissioned Friedrich Wenk to design, and Schneider to build, the Moazagotl. The name came from a local legend. A Silesian peasant called Gottlieb had noticed and wondered about a strange, stationery cloud, Motz Gottlieb's cloud, corrupted to Moazagotl, that formed sometimes over the valley where his farm lay. The south west wind blew hard all day but the cloud remained where it was. Hirth's attention was drawn by the director of the Krietern Meteorological Observatory near Breslau, to the phenomenon. Grunau pilots in March 1933 were the first anywhere to use wave lift for soaring.

Completed in time for the 1933 Rhön competitions, the sailplane had a strongly arched 'gull' form wing with sweep back over the outer panels, which harked back directly to Wenk's tailless Weltensegler of 1921. Much had been learned in the intervening decade. With a span of 20 metres the wing was strong, strut-braced and had a high degree of inherent stability, combined with an excellent performance. The most difficult feature of its construction

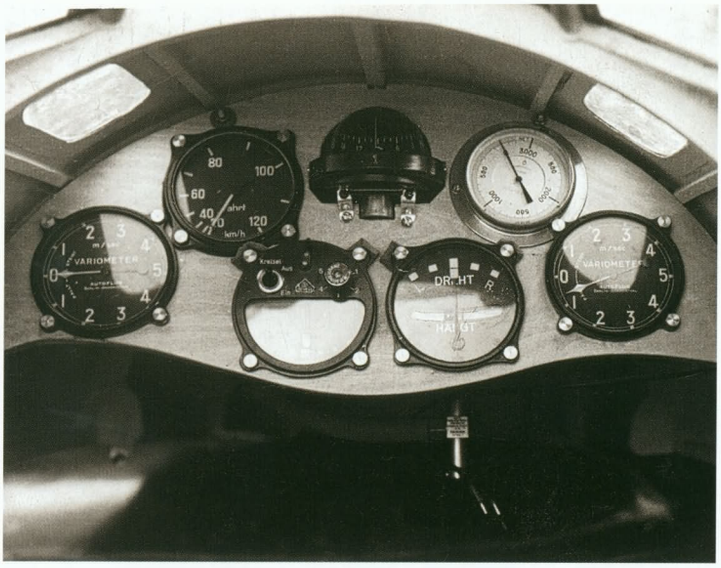
Above: The Moazagotl in Latin America, El Palomar airport, Buenos Aires, with the Grunau Baby.
Below: The Moazagotl in flight

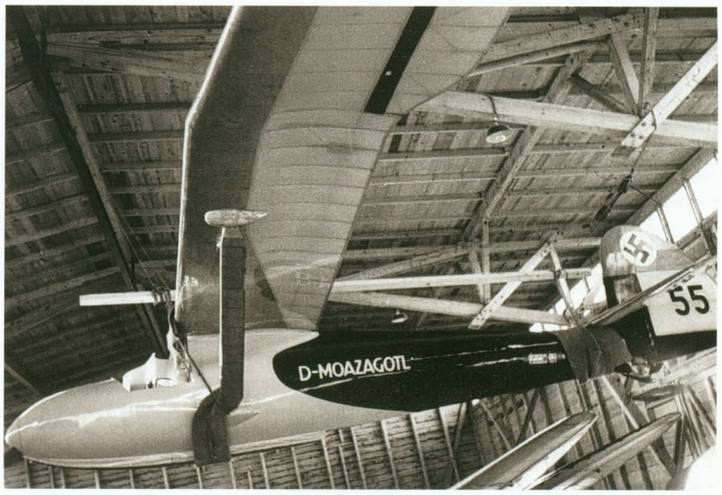




Moazagotl
1933

Drawn by Martin Simons 2000 ©





was the pronounced bend in the main spar at the inner end of the ailerons, just at the point where the sweepback began. Wenk avoided the awkwardness here by continuing the main spar in a straight line, when seen in plan view, all the way to the root. Thus, only a simple bend was required. Together with the diagonal sub-spar and the struts a very strong, yet light, trapezoidal frame resulted. The wooden cockpit canopy, like that of the Musterle, was provided with portholes and small windows. Hirth found the aircraft up to his expectations, except that the original rudder proved inadequate. The long wings with the very large ailerons required greater control power in the yaw plane. A larger rudder was built and fitted.

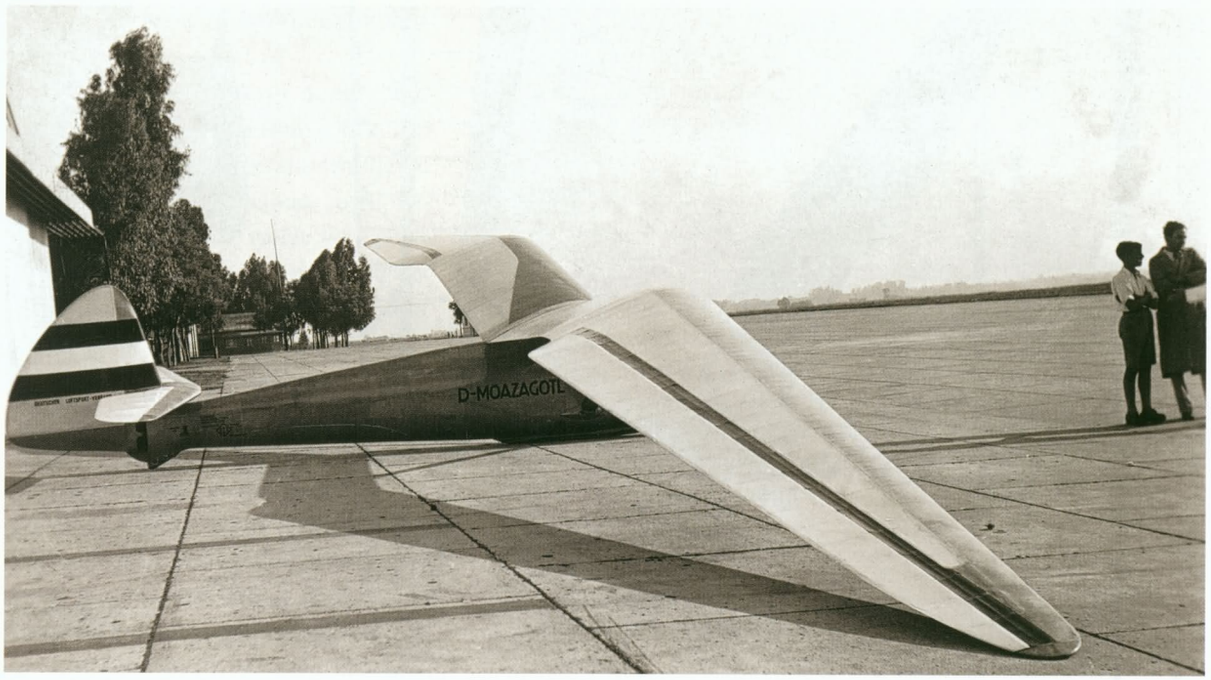
The performance was good and with it Hirth made the longest flight of the 1933 competition, 180 kilometres, and the following year he was the second sailplane pilot to achieve a distance flight of 300 kilometres. Ludwig Hofmann flew the Moazagotl in the 1937 International Competition, recognised as the first World Championship. He placed second. The Moazagotl was deliberately burned at the Hornberg in 1945, to prevent it falling into the hands of the advancing American armies.

The Schneider family, Edmund, his wife and two sons Edmund Jr and Harry, were compelled to leave Silesia in 1945. Production of some of their designs, including the Grunau Baby, continued there under Polish rule. The family eventually re-established their business near Adelaide, in South Australia. The ES Grunau Baby 4, several of which were built there, was only distantly related to the original.

Left above: The Moazagotl instrument panel. Top row: airspeed indicator, compass, altimeter. Bottom row: variometer, electrically driven turn indicator, venturi-driven turn indicator, variometer.

Above: The Moazagotl suspended in the roof of the hangar on the Hornberg. It carries its later colour scheme.

Right: The Moazagotl in Latin America, El Palomar airport, Buenos Aires



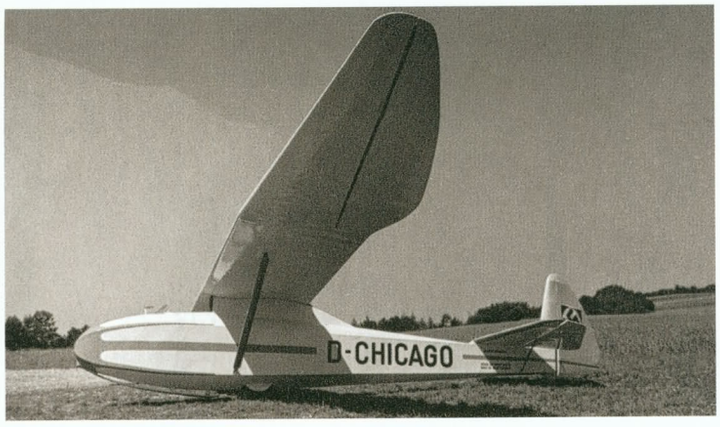
CHAPTER 9

Schempp Hirth

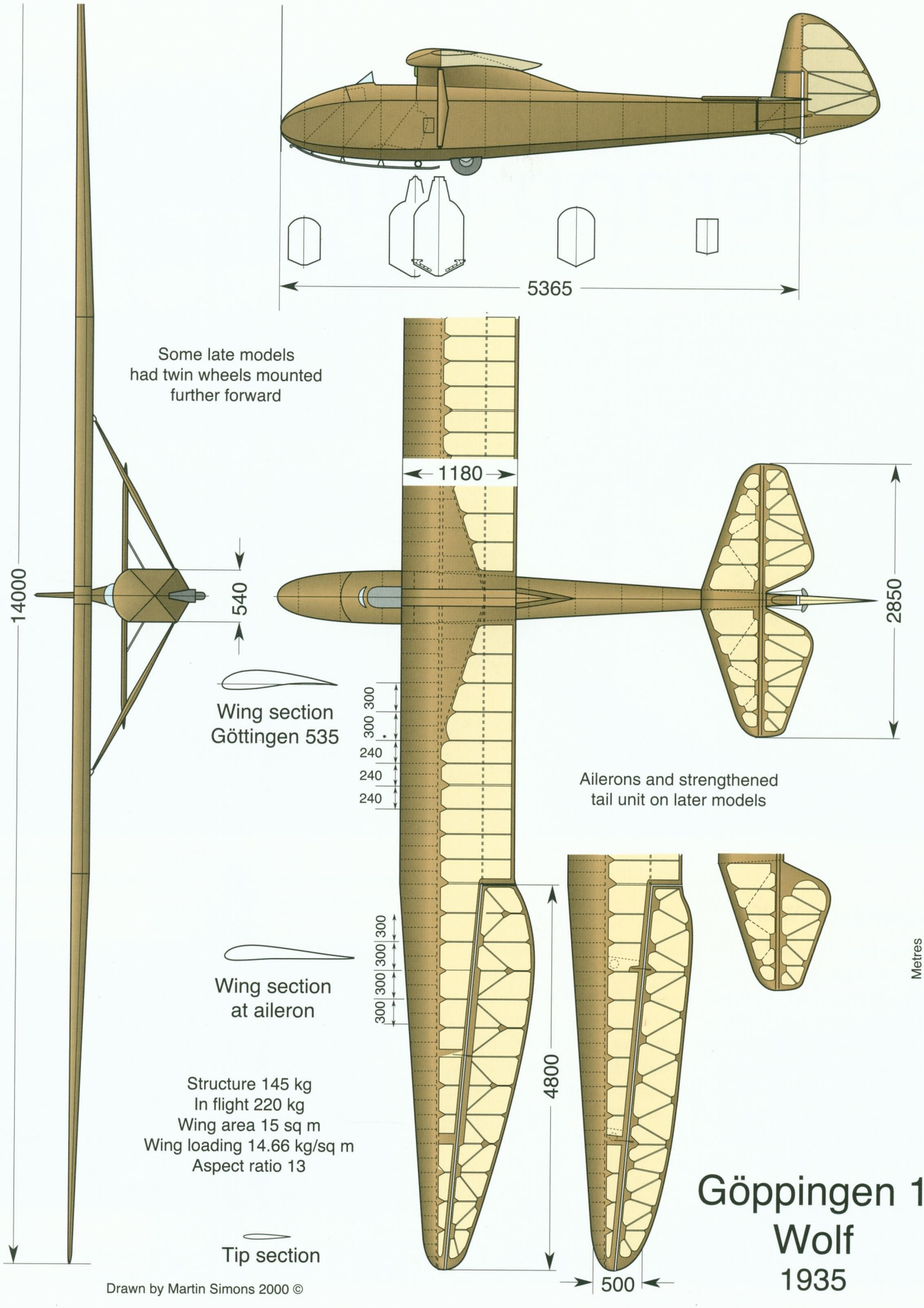
For aerobatic displays, the Wolf often had a 'sunburst' colour scheme. The narrow chord ailerons are fitted here.

Göppingen 1, Wolf

In 1935 Wolf Hirth decided to set up, with Martin Schempp, his own manufacturing Company in Göppingen, about 50 kilometres east of Stuttgart. Their first product was the Göppingen 1 Wolf. It was aimed at the same market as the Grunau Baby and was very similar, but with improvements. The fuselage, with narrow neck and rounded decking ahead of the cockpit, resembled that of the Stanavo, and there was a wheel. Hirth and Schempp, during their American experience, had appreciated the need for this as an aid to ground handling, aero towed and winch launching, which were now the norm. The ailerons were large with lobate form in plan view. The tail unit was given a rounded shape. The Wolf was stressed for aerobatics and could, if required, be fitted with V struts to give extra stiffness to the wing, allowing higher airspeeds. The first Wolf was sold to England and toured with Alan Cobham's Air Circus for some years, putting on aerobatic displays. Joan Meakin

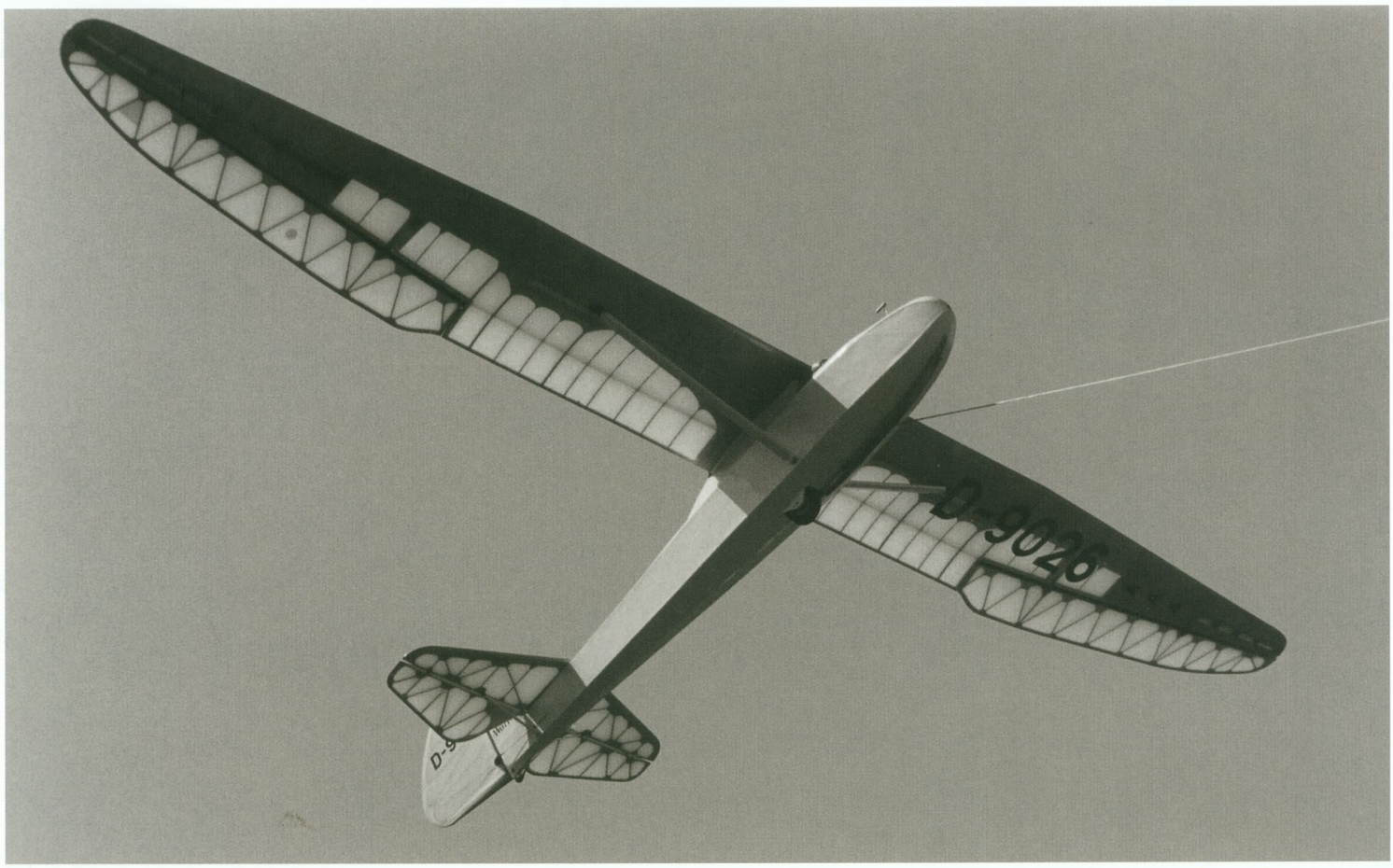


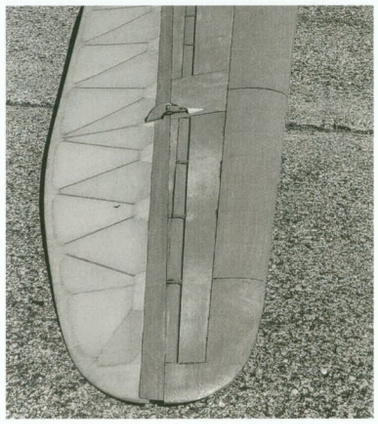
The Göppingen 1 Wolf was a rival to the Grunau Baby but was different enough to prevent confusion. The example shown here had the original broad ailerons.



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

Göppingen 1 Wolf
1935





Above: To improve the stalling and spinning behaviour of the Wolf, slotted wing tips were introduced. D-9026 is a replica built by Otto Grau, seen here at Oberschleissheim in 1995.

Left: Wing tip showing the slotted ailerons.

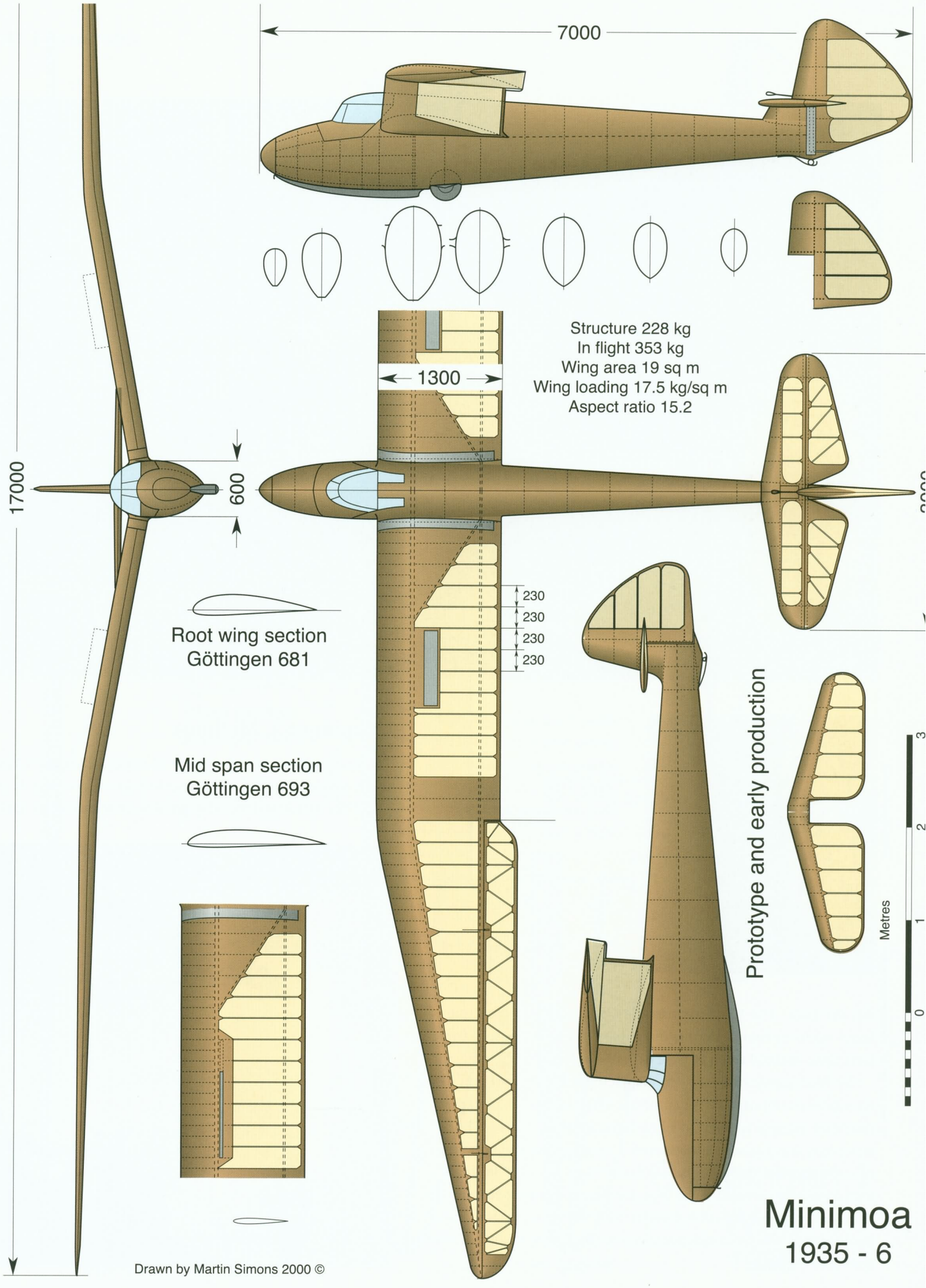
Right: Minimoa bungee launched.

was the pilot. The third went to the USA and Hirth took one to Japan when he toured that country in 1935 and it was sold there. Later three more of the type were exported to Japan.

The Wolf never succeeded in displacing the Grunau Baby. The type gained a reputation for spinning dangerously. In 1936 a version with redesigned ailerons of narrower chord appeared. The bad reputation was probably undeserved, a result of construction errors in some factories building the Wolf under licence. In 1938 the German authorities grounded the type, pending a complete redesign of the outer wings with slotted ailerons. This was done but the cost of modification was too much and most of them were scrapped. Very few survive today.

Göppingen 3, Minimoa

The Göppingen 2 was a two seat training sailplane. Schempp and Hirth needed to offer a high performance sailplane of moderate price. The Moazagotl was very good but twenty metres span was too



Minimoa
1935 - 6

Minimoa launched from the Wasserkuppe.

large and costly for the expected market. Seventeen metres seemed more reasonable but the possibility of offering the aircraft with alternative spans, 16, 17 and 18 metres, was considered seriously. With a cantilever wing there would be a worthwhile saving in drag. For cloud flying the structure was stressed for a load factor of 10 instead of the usual 8. The extra weight of material required would be useful for faster flying on good days. The main spar was required to curve in two planes where the sweep back and the dihedral bend coincided. This presented difficulties in construction, overcome with special jigging.

To retain the stability and safe handling of the Moazagotl, the new sailplane had the same general features, a swept back wing with pronounced gull dihedral, large ailerons and strong washout, mounted high on the fuselage. When seated, the pilot's head was inside the wing, so outward vision was not good. A window in the roof helped a little. Landings would be on a skid. Split flaps were installed beneath the wing to aid landing in small spaces.

Because of his artificial leg, Hirth had the controls set up with an overhanging control column working a torque tube which passed over his right shoulder to bell cranks in the wing root. The entire top front of the fuselage lifted off to allow him to get in and out. This was not expected to continue with production aircraft.

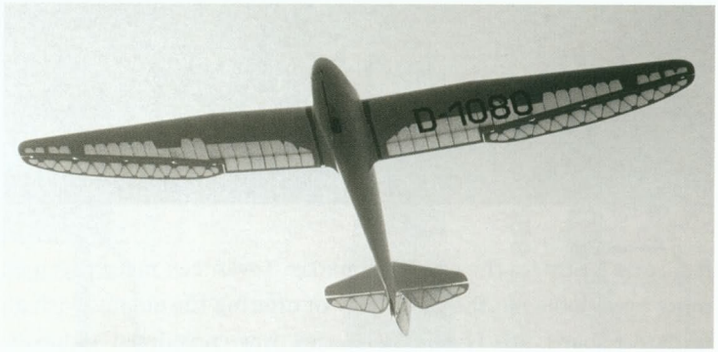
This unusual prototype flew in 1935 and was taken to the Rhön meeting. Perhaps it was inevitable that the Göppingen 3 , a smaller version of the Moazagotl, should be called the Minimoa. The first Minimoa accompanied Hirth when he visited Japan to demonstrate and promote soaring later in 1935, and was sold there.

A second prototype was built, with a landing wheel and normal controls. This too went to Japan later. One more of the high winged version was built and sold to a Romanian pilot.

After this there was some substantial redesign before production began. The wing was mounted lower on the fuselage with a new, much improved cockpit canopy giving the pilot a better view. The tail unit also was redesigned with a fixed tailplane instead of the all moving elevator of the prototypes. Various sizes and types of rudder were tried at different times. The landing flaps were replaced by spoilers and eventually, on later models, air brakes.

A Minimoa was exported by Zeppelin to Argentinia, seen here unloaded from the airship.

Right: The long fuselage Gövier D - 1080, restored was flying at Elmira, USA, in 1995.



Production began in 1936. There is no doubt the Minimoa was everything Hirth had hoped for, stable and strong with a good performance. The best glide ratio was measured at 25.7:1 in 1938. This was probably no better than contemporary sailplanes of similar span from other designers and factories, but, because of its very distinctive and graceful shape, the Minimoa became very well known and admired. Minimoas were exported, two to England, two at least to America, another to South America, one to South Africa, others to France as well as Japan. The inherent stability was a popular feature. In one of his record breaking height climbs in cloud, Philip Wills in England, beginning to feel disoriented, recited to himself 'Mini Moa is always right!', took his hands and feet off the controls and the sailplane settled down to fly itself perfectly. Records and competitions were won, orders continued to come in and a total of 100 Minimoas was reached by 30th June 1938. More were built after this, stopping only late in 1939.

A two seater was produced in 1938 but not put into production, and later there was an 18 metre experimental version with no landing wheel, in an effort to gain a little more performance.

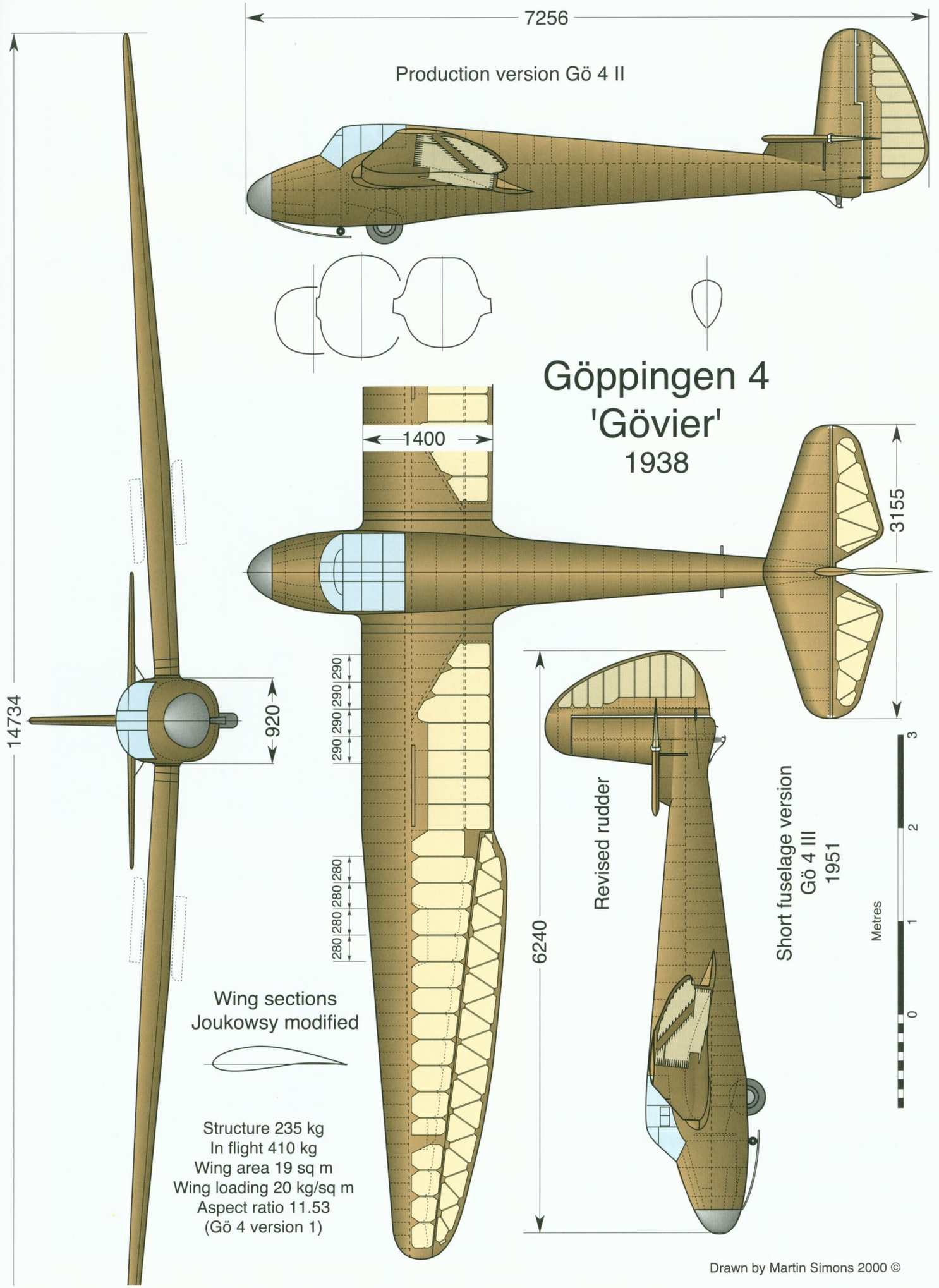
Several Minimoas survived the Second World War and most of these are still flying or at least preserved in museums.

Göppingen 4, 'Gövier'

The Gövier a two seater with side by side seating, designed by Wolfgang Hütter and Hirth together, came from the Göppingen factory in August 1938 and entered production in October. Company records suggest that more than 100 were built, there may have been more.

In the Gövier the fuselage width was reduced slightly because the wing root fairings gave a little more room for the shoulders. It was in any case intended as a training aircraft so the glide ratio of about 20:1 was acceptable. A Gövier was used as test aircraft when Schempp Hirth were developing their 'parallel ruler' type airbrakes which in the long run became almost universal for all sailplanes.

A modified version, the Gövier V2 was produced, with a much shortened fuselage, in 1941 and this led to the Gövier 3, some 20 or so of which were produced after the end of World War 2. A few remain in service.

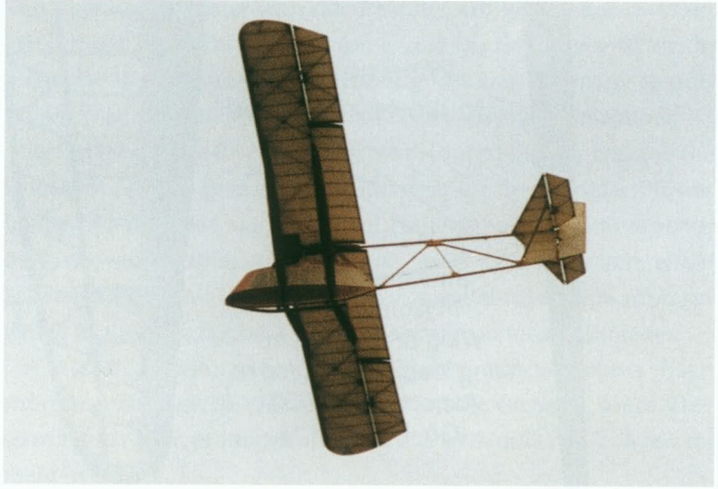


Chapter 10 Hans Jacobs and the factory sailplanes

The old organisation of the Rhön Rossitten Gesellschaft was dissolved in 1933 and replaced by the DFS (Deutsche Forschungsanstalt Für Segelflug), under the control of the central government. Georgii, who had headed the RRG, opposed the change but his resignation was refused and he was placed in charge of the reorganised research institute at Darmstadt Griesheim airfield. Among those working for the RRG, was Hans Jacobs. He had come as a young assistant to Lippisch in August 1927 and was involved closely with the experiments leading to the tailless sailplanes. He helped with the design of the Wien and the Fafnirs. Lippisch and Jacobs were compelled to leave the Wasserkuppe to join the DFS. Darmstadt became their base for the next few years. Lippisch soon handed over control of sailplane development to Jacobs.

There were factories building sailplanes before 1930 but although these produced quite large numbers of primary trainers and some secondary and intermediate sailplanes, there was no attempt at mass production of high performance sailplanes. The first move in this direction was taken by Alexander Schleicher, whose location in the valley below the Wasserkuppe enabled him to keep in close touch with the leading pilots, instructors and technical people.

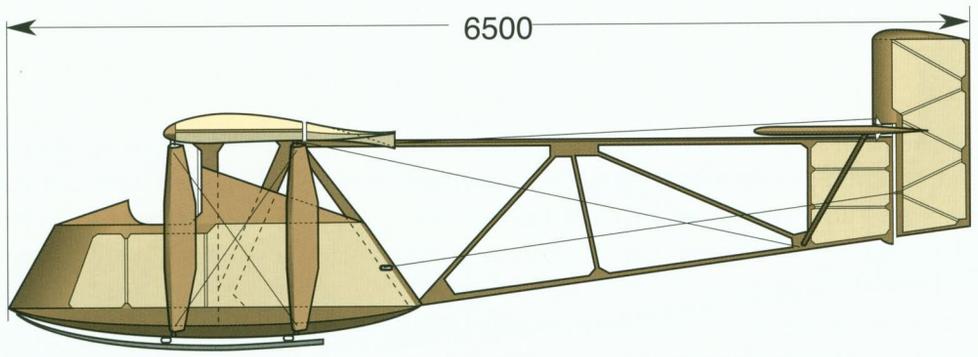
Using the original drawings produced by Hans Jacobs, Mike Beach constructed and flew this perfect example of a Hols Der Teufel in 1990. It is shown here on the ground and in the air at Dunstable.

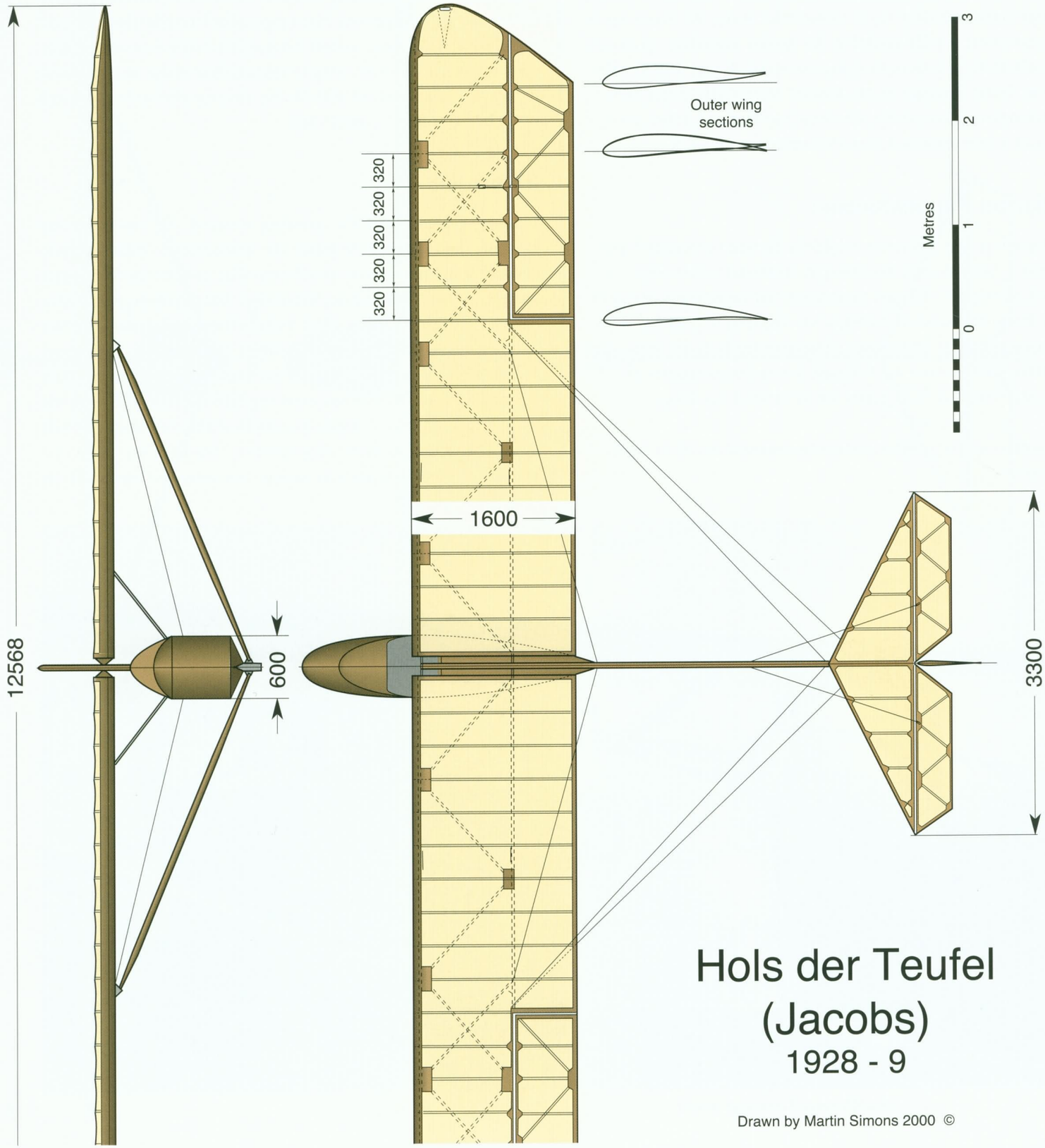


Jacobs 'Hols der Teufel'

Jacobs wrote several small books about flying models with construction plans, including tailless sailplanes. The book Segelflugzeug, issued by publisher Otto Maier of Ravensburg as Number 138 in the hobby series, Spiel und Arbeit (Play and Work) explained how to build a full scale glider. In a pocket at the back on four large sheets, were plans for a 12.56 metre glider, described as developed from the original design of Lippisch and built now by Alexander Schleicher.

Wing area 19.52 sq m
Aspect ratio 8.1





Hols der Teufel (Jacobs)
1928 - 9

The Djävlar Anamma of Alex Lippisch, usually called Hols der Teufel in German, bore little resemblance to the type so named and advertised after 1928. This was really an enlarged Zögling with struts instead of wire bracing, with a fabric and plywood nacelle for the pilot. There was no 'skullsplitter' strut. How closely Schleicher had worked with Jacobs and Lippisch on this design is not known. The plans included in Jacobs' book differed again in some details from the drawing in Schleicher's brochure; rounded wing tips, slightly different span, rudder area, altered cross bracing of the rear fuselage frame, tailplane struts rather than wires, etc. Since the Jacobs plans were readily available, his design was taken up and examples built by amateurs in many countries. It was usually called Hols der Teufel although Jacobs himself did not give it this name. A modern replica was built by Mike Beach in England, flown successfully, and is now preserved in the Wasserkuppe museum.

Luftkurort Poppenhausen

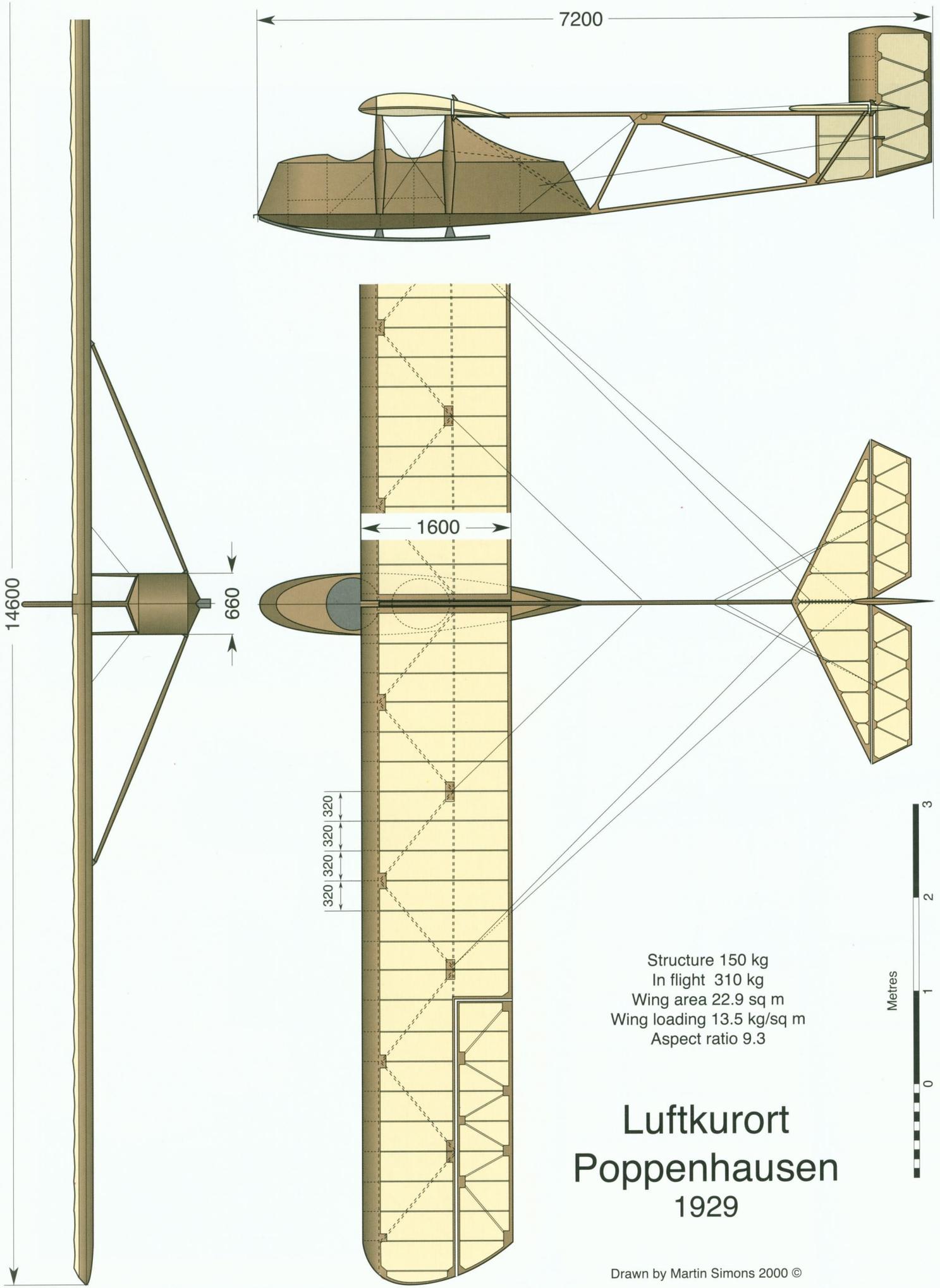
The Poppenhausen two seater, originally marked Luftkurort Poppenhausen a.d. Wasserkuppe was flown by Alexander Schleicher in 1928. He took passengers and gave them their first experiences of soaring flight. It was thereafter included in the Segelflugzeug Rhön factory catalogues alongside Schleicher's versions of the Hols der Teufel, Zögling, Falke, Professor and the Anfänger, a strut-braced primary glider. It is almost certain that Hans Jacobs was involved in the design.

The Poppenhausen, Alex Schleicher's two seat development of the Hols der Teufel, with dual controls.

The two seater, considerably modified for production, was in all respects an enlarged version of the Hols der Teufel. The seats were in tandem, enclosed by a nacelle. The best glide ratio was claimed as 16.4 and the minimum rate of sink at 0.88 m/sec. Schleicher showed it was capable of good soaring flights, carrying two persons. Fitted with dual controls, the Poppenhausen was described as suitable for advanced pupils in clubs. The price quoted in 1931, f.o.b. London, was $439 (US) dollars. The Zögling cost $227, the Anfänger $220. In other words, this two seater soaring sailplane cost twice as much as a primary solo glider. The argument that a pupil pilot could be trained 'ab initio' in such a two seater, at least twice as effectively as in the Zögling, does not seem to have occurred to anyone. How many were produced in total is not known but at least one was exported to England and flown by the London Gliding Club.

Rhönadler

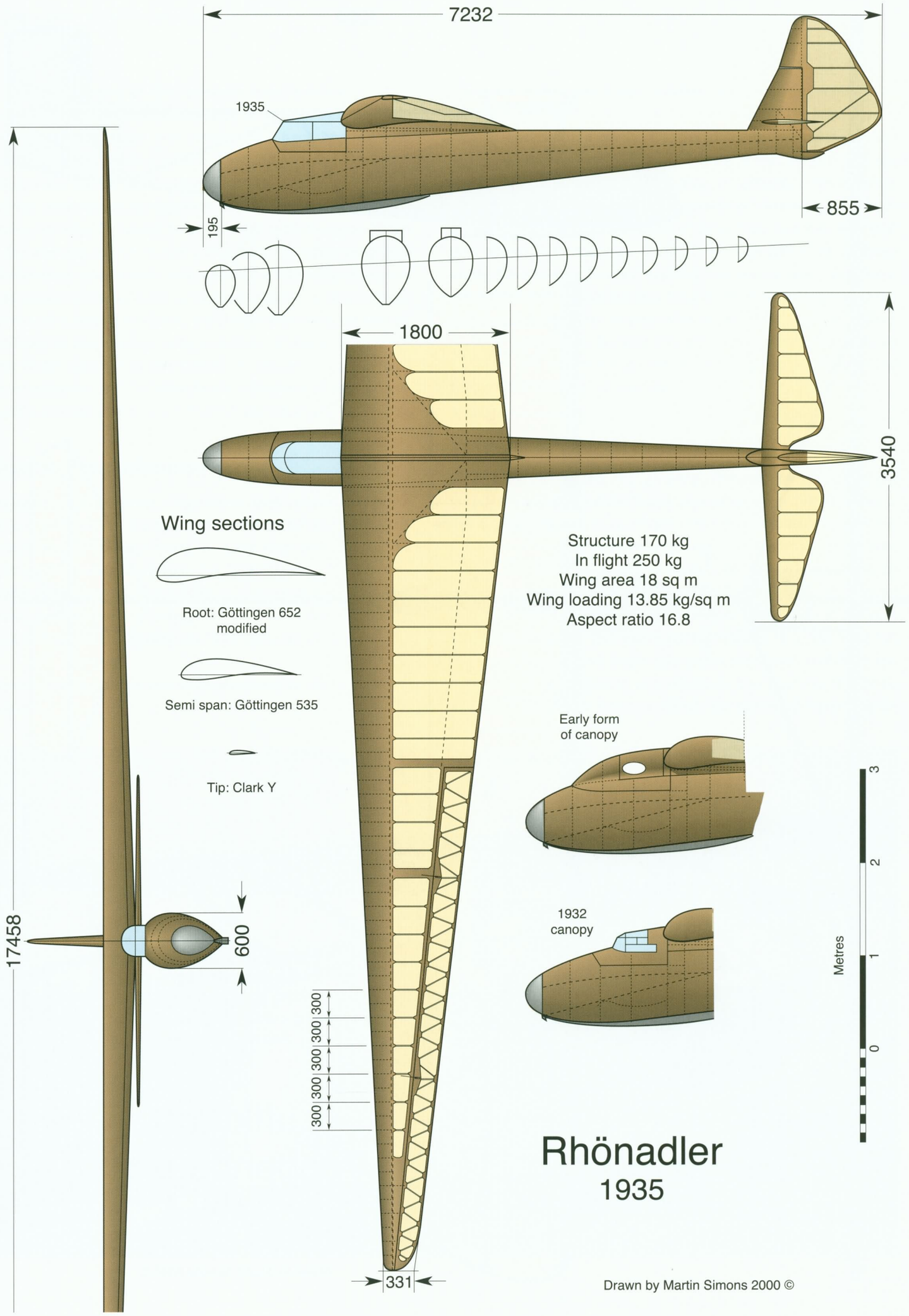
Schleicher recognised the growing demand for cross country sailplanes and admired the Fafnir. He commissioned Hans Jacobs to design a simplified version which would be suitable for factory production and not prohibitively expensive. The prototype, called Rhönadler, was ready for the 1932 Rhön. (There had been an earlier Rhönadler, a record breaking two seater.) The wing was raised above the streamlined fuselage on a narrow neck to try to avoid the flow separation problems that had beset the Fafnir at first. The wing was straight tapered to give ample spar depth at the root, and there was no gull bend for simplicity in production. The span was 18 metres. The root wing profile was a modified, less cambered version of the

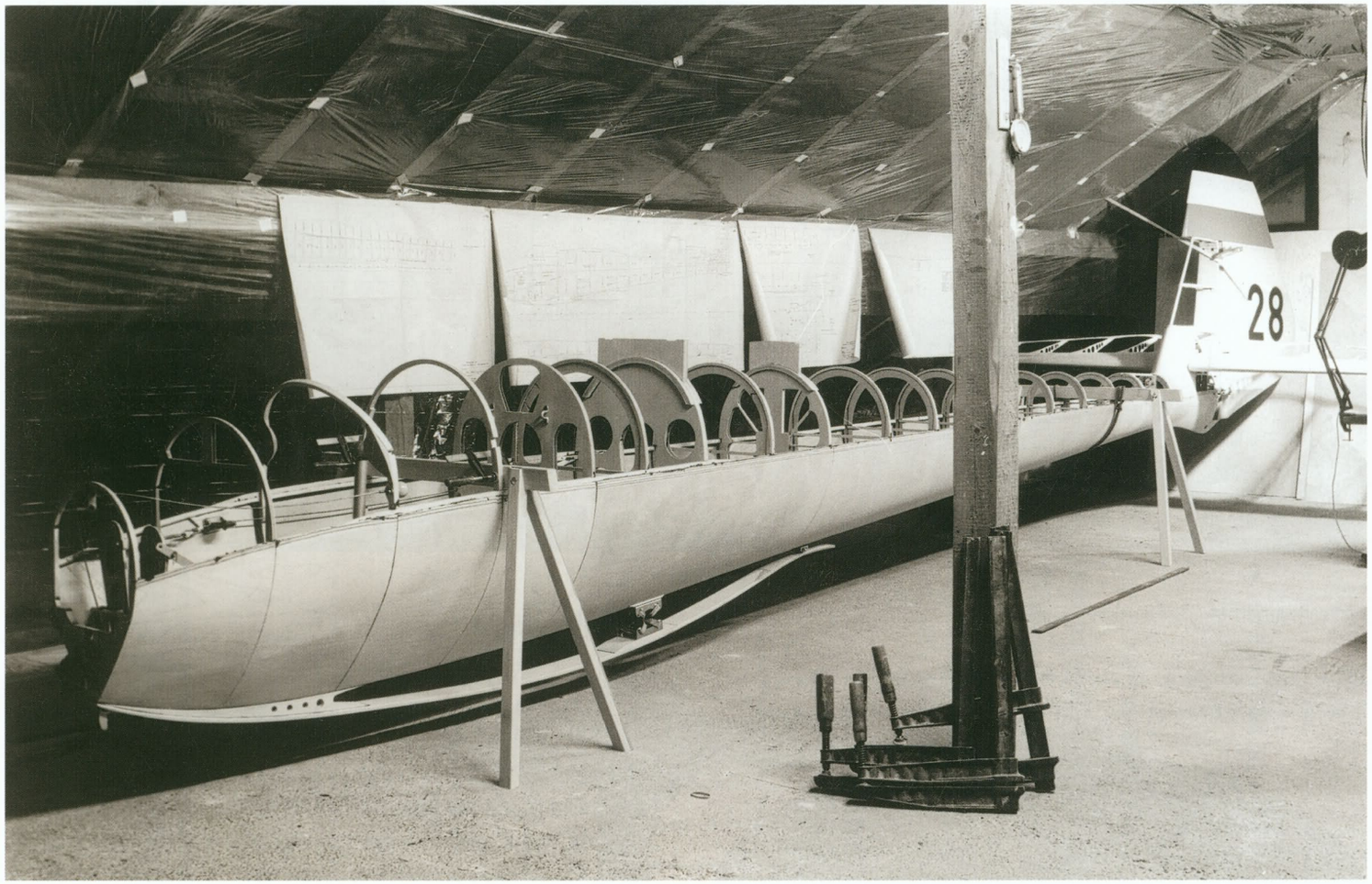


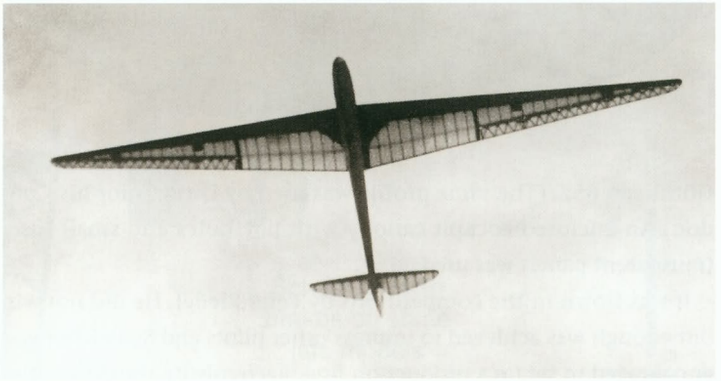
Structure 150 kg
In flight 310 kg
Wing area 22.9 sq m
Wing loading 13.5 kg/sq m
Aspect ratio 9.3

Metres 0 1 2 3

Luftkurort Poppenhausen
1929


7232
1935
855
195
1800
3540
17458
600
331
300 300 300 300 300
Wing sections
Root: Göttingen 652 modified
Semi span: Göttingen 535
Tip: Clark Y
Structure 170 kg
In flight 250 kg
Wing area 18 sq m
Wing loading 13.85 kg/sq m
Aspect ratio 16.8
Early form of canopy
1932 canopy
Metres
0
1
2
3
Rhönadler
1935
Drawn by Martin Simons 2000 ©

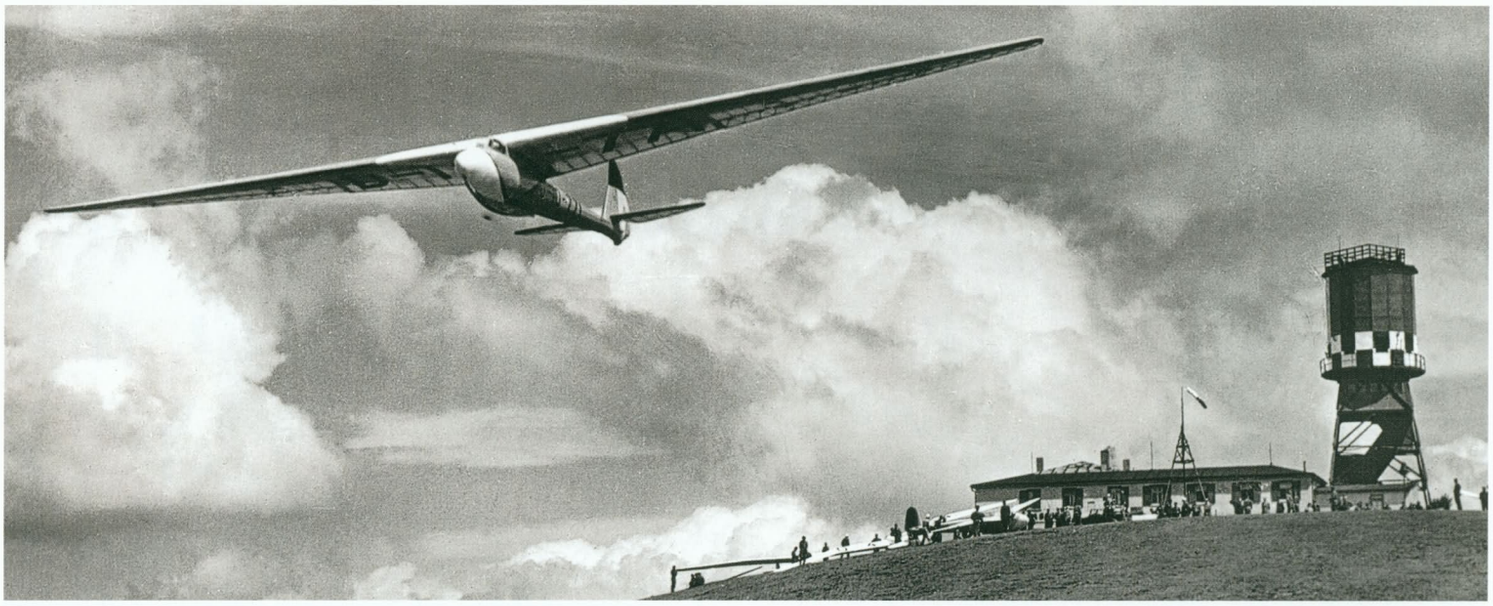




Above: Klaus Heyn, using original plans for the Rhönadler 35, built a perfect replica during the 1980s, now in the Wasserkuppe Museum. Here is the fuselage partly completed, showing a typical 1935 sailplane structure.

Right below: The Rhönadler overhead, showing the strongly tapered wing.

Left: The original Rhönadler had a span of 18 metres. This was reduced for the production model.



Above: Rhönadler launched from the Wasserkuppe.

Below: The Seeadler was a version of the Rhönadler with a flying boat hull and strongly 'gulled' wings to keep them clear of the water. Hanna Reitsch was the test pilot.

Göttingen 652. (The same profile was used by Dittmar for his Condor.) An enclosed cockpit canopy with portholes and small inset transparent panels was used.

It was flown in the competitions by Peter Riedel. He did not win but enough was achieved to impress other pilots and Schleicher was encouraged to set up a production line. Recognising the difficulties caused by the Fafnir's low mounted tailplane, on the production version of the 'Adler this was re-positioned higher and the vertical tail simplified in shape. The span was reduced slightly. The Rhönadler 32 was advertised and sold well. In 1935 further changes of detail were made, including now a fully enclosed transparent canopy. The Rhönadler 35 became the most popular high performance sailplane in Germany. Schleicher built 65. At the 1935 Rhön meeting, 23 Rhönadlers competed in a total field of 60. Examples were exported, including one to England where it was flown by Eric Collins, the leading British pilot of the day. Spoilers were often fitted, retrospectively, on the upper side of the wing.

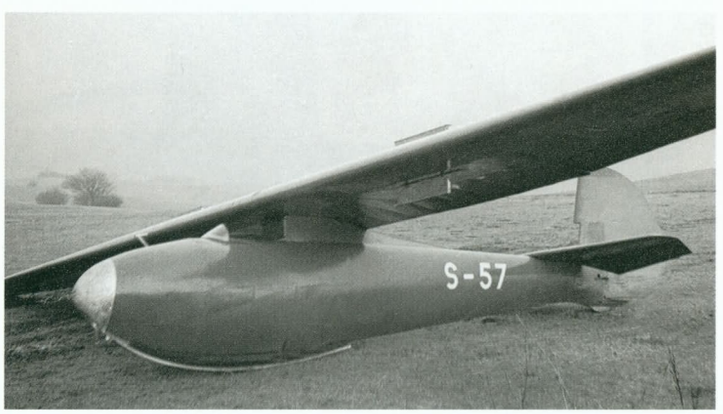
Klaus Heyn in the 1980's completed a new Rhönadler 35 from a set of the original plans. This aircraft is now in the Wasserkuppe Museum.

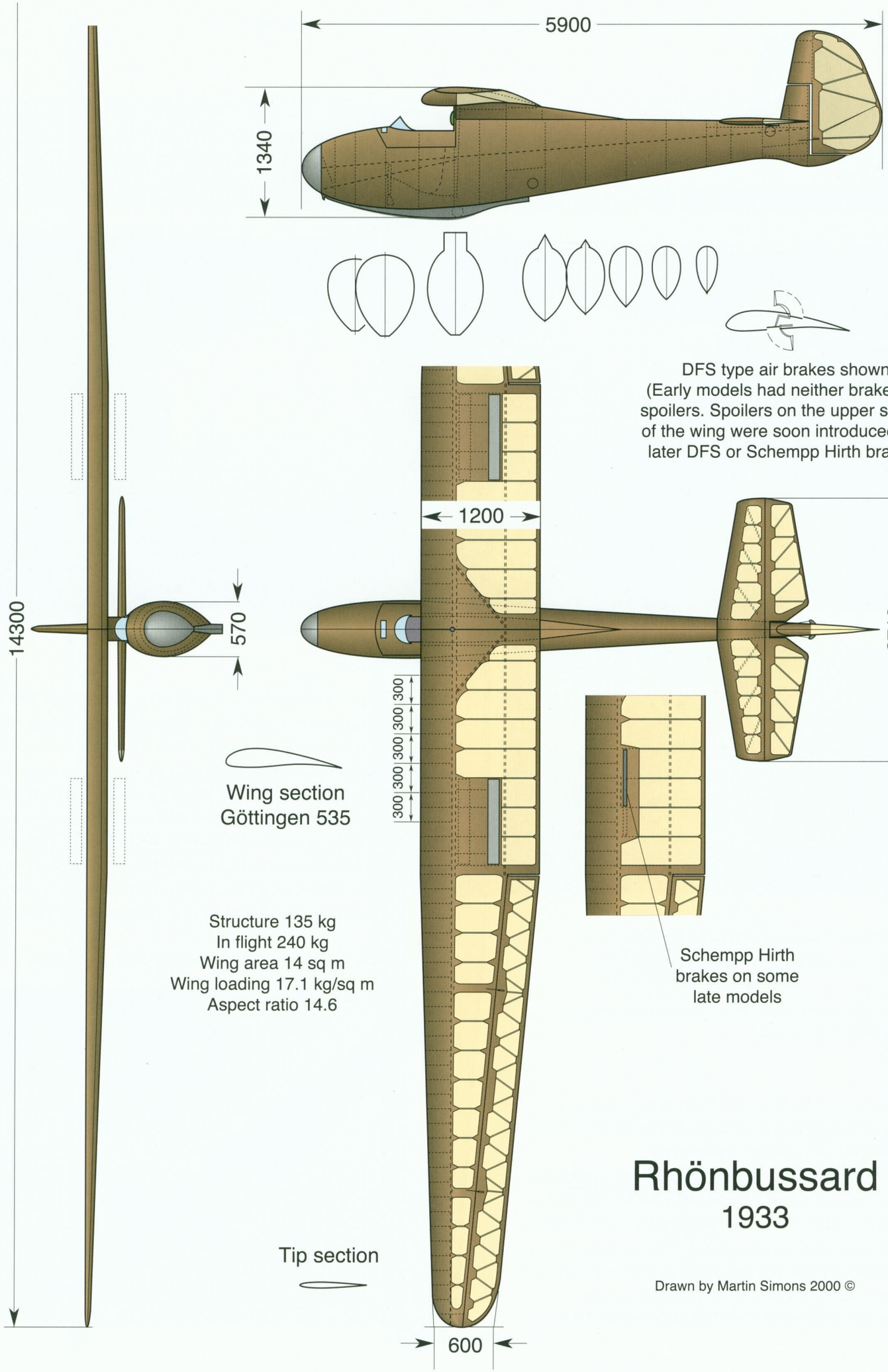
Rhönbussard

Many gliding instructors felt the Rhönadler was too advanced for inexperienced pilots. They required something better than the Grunau Baby but smaller and cheaper than the 'Adler. Schleicher asked Jacobs to design a sailplane to fit this requirement. The outcome in 1933 was the Rhönbussard. This had a span of 14.3 metres, a streamlined if rather dumpy fuselage, and a cantilever wing, ensuring a better performance than the Baby. The short fuselage required the pilot's seat to be under the wing for reasons of balance. This restricted the upward view, especially important in banked turns. Despite this the type proved successful. Over 200 were built. At the 1934 Rhön, sixteen Bussards competed, outnumbered only by the Grunau Baby.

The most unusual feature was that when rigging the wing was joined in the centre before raising the entire assembly onto the fuselage, to which it was held by two crosswise steel rods. The lifting was not difficult providing enough people were available. The early models had no spoilers but these were incorporated later, of-

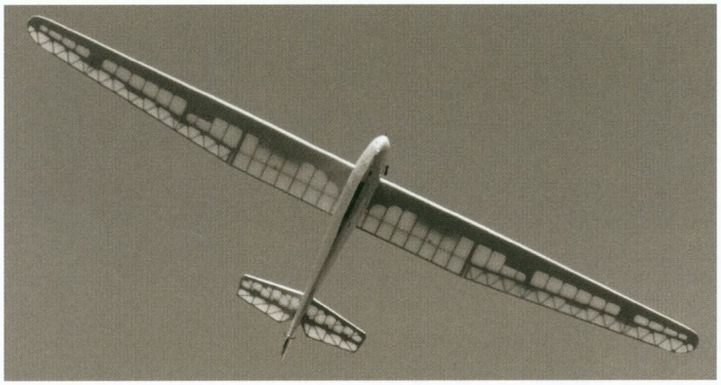
A small number of Bussards were equipped with Schempp Hirth type air brakes. This example was flown by the British Air Force of Occupation at Scharfoldendorf in 1948 - 50.





Rhönbussard
1933

Drawn by Martin Simons 2000 ©



Above: The Rhönbussard. This example, imported to England in 1934, was flown in aerobatic displays by Joan Meakin for Alan Cobham's Air Circus

Middle: Overhead, this restored Bussard has only spoilers on the upper side of the wing. Later versions had DFS type brakes.

ten by retrospective modification. When brakes were added, they were usually of the DFS type but some late production examples had the more effective Schempp - Hirth brakes.

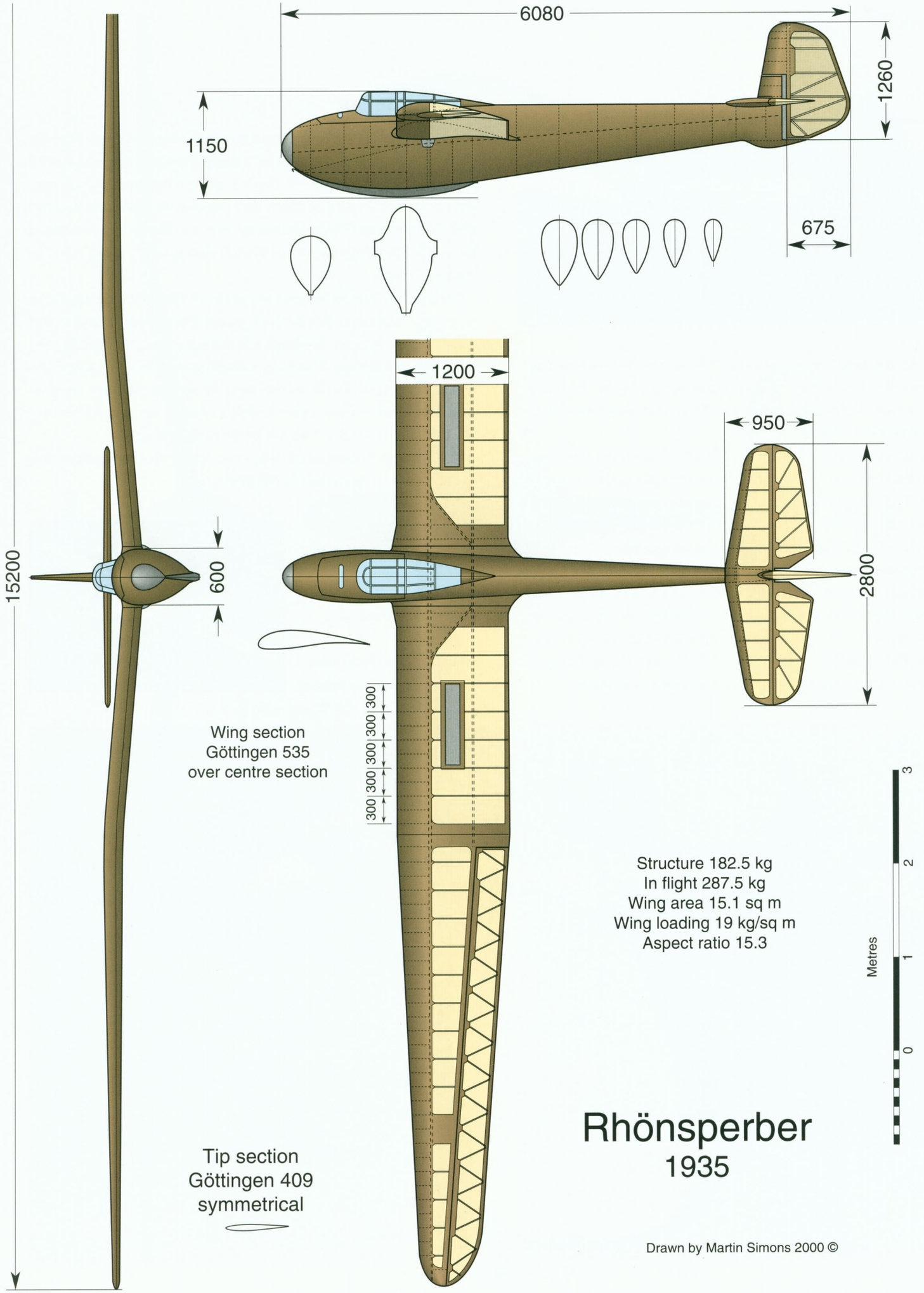
Many good flights were done in Rhönbussards, including aerobatic displays. It was strong and highly manoeuvrable. A world height record should have gone to Hermann Seele in 1936 when he reached more than 5000 metres in cloud. Unfortunately, in hail and severe turbulence he lost control. The Bussard broke up. He was saved by parachute but the recording barograph was lost.

At least one Rhönbussard survives in airworthy condition.

Rhönsperber

Jacobs developed the Rhönbussard to produce the Rhönsperber in 1935. This entered production with Flugzeugbau Schweyer, who built about one hundred. The wing, with gull dihedral, was moved down to shoulder height with an increase in span. This greatly improved the pilot's view into turns. There was an enclosed, streamlined transparent canopy but in many other ways the 'Sperber was simply an enlarged Bussard, with a better performance chiefly because of the greater span, now slightly over fifteen metres. The type became popular and was used for some outstanding cross country flights, especially notable being Ludwig Hofmann's 1935 world

Ernst Udet's Rhönsperber, D - Commandant, carried the Olympic rings in 1935 - 6.



Rhönsperber
1935

record, 474 km into Czechoslovakia. This was the first soaring flight to exceed 400 km but the record lasted only a week. A 'Sperber flown by Hans Heinemann was one of the four which exceed 500 km. on July 29th with 504 km.

Ernst Udet, the famous display pilot who later was to become a chief officer in the Luftwaffe, flew his own personal Rhönsperber, marked D - Kommandant, from the Jungfrau in 1935. Peter Riedel used one for aerobatic displays at the Winter Olympic Games at Garmisch in 1936, taking off and landing on the ice.

Rhönsperbers were exported to the USA and England. The English example was restored and rebuilt to fully airworthy condition after decades of neglect. It flies today with a Rhönbussard tailplane. The original tail was lost. The Bussard tailplane fitted exactly without modification. Another perfect replica has been built and flown in Germany by Otto Grau in 1997. Others survive in museums.

Sperber Senior

In 1936 Jacobs designed an improved and enlarged version of the Rhönsperber, the Sperber Senior. Despite the name this was really a new design with a different, double tapered wing of greater span, less cambered aerofoil sections and entirely new fuselage and tail unit. Only one was built. Hofmann flew it in the 1936 competition but was forced to withdraw for family reasons and did not figure in the final results.

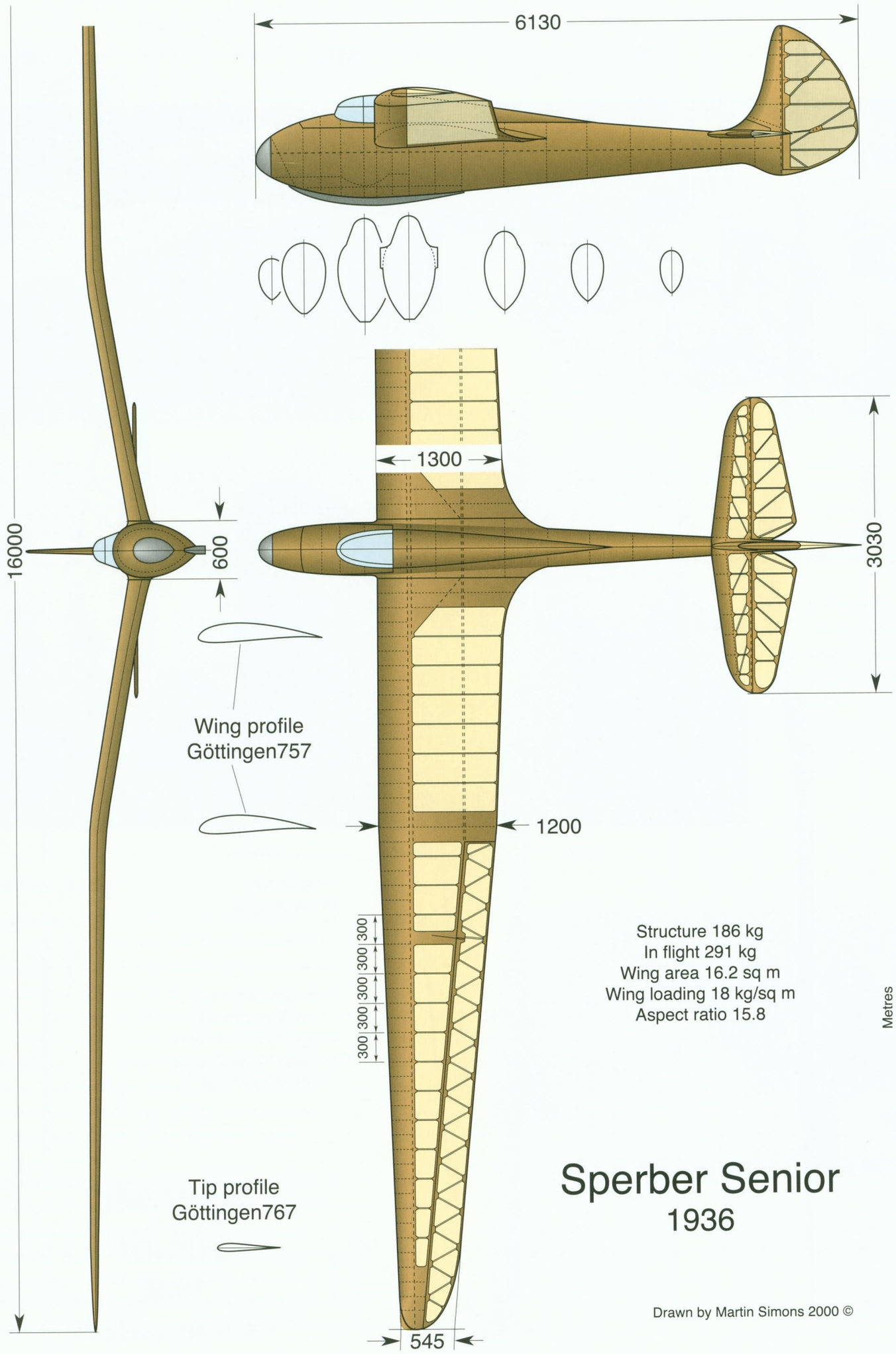
The Sperber Senior became available in 1937 for Peter Riedel to fly in the American National Competitions at Elmira and it was shipped there for him. He made a seven hour soaring flight in thermals over central New York City, including Manhattan and New Jersey, after an aero towed launch from Roosevelt Field on Long Island. In the contest he scored higher than any American pilot but, as a German national, could not be declared champion.

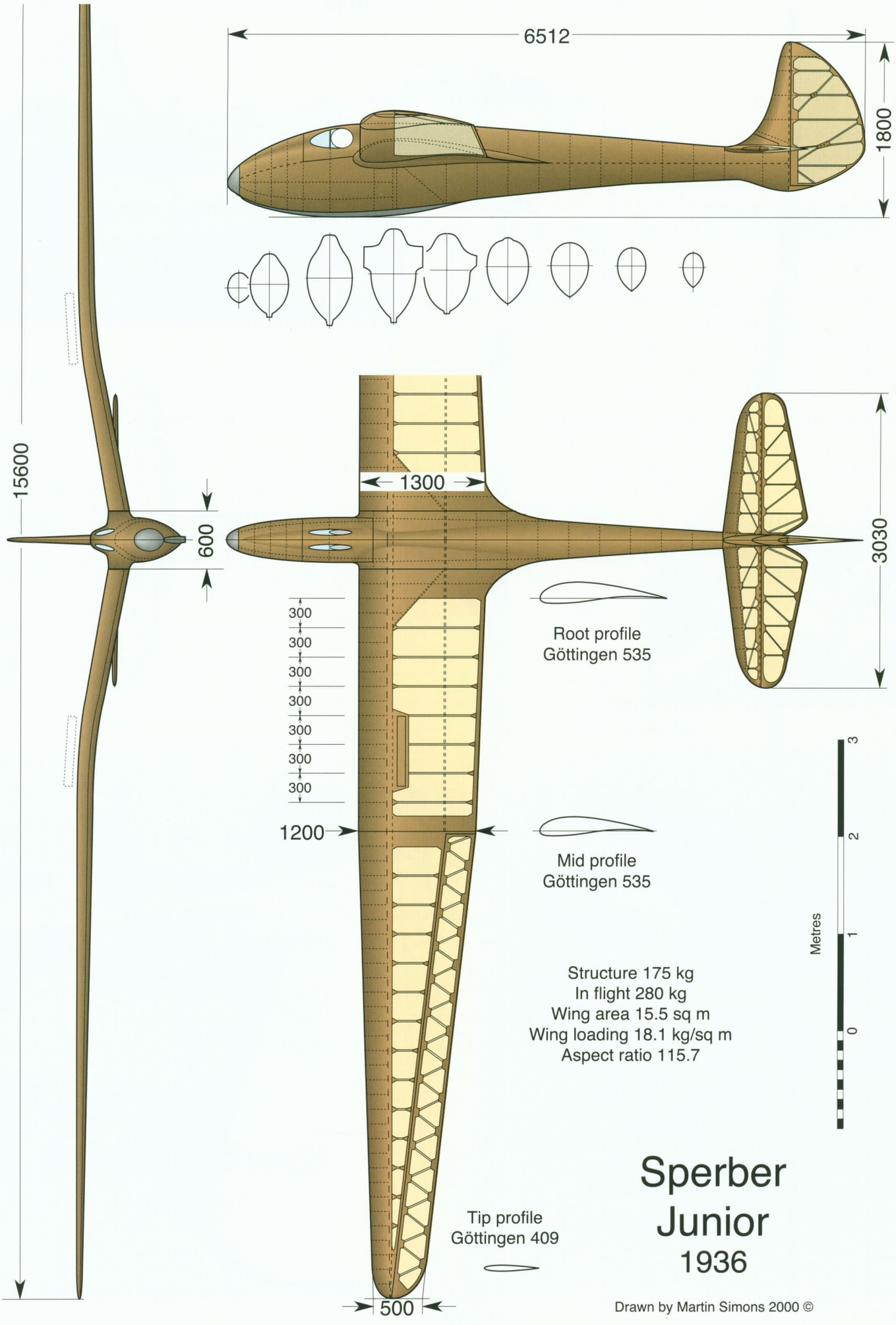
On its return to Germany the Sperber Senior was apparently withdrawn from use and its fate is unknown.

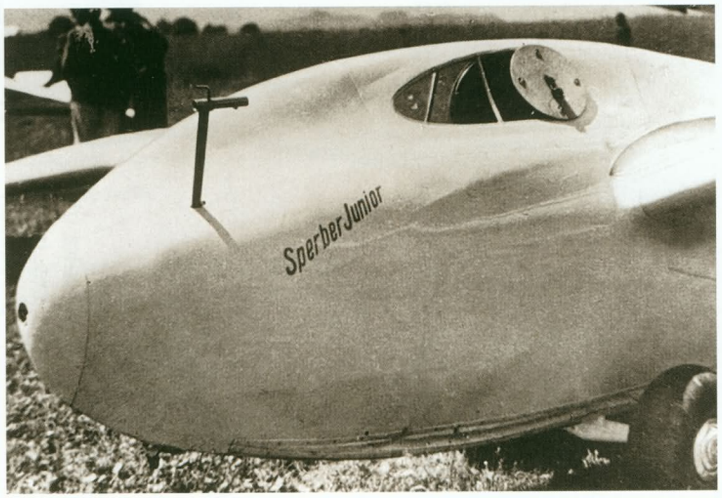
Left above: D - Urubu was displayed at the 1936 ISTUS meeting

Right: Riedel soared the Sperber Senior over central New York.

Below: The Sperber Senior, Riedel with parachute preparing to board.


6130
16000
600
1300
3030
1200
545
300
300
300
300
300
Wing profile
Göttingen757
Tip profile
Göttingen767
Structure 186 kg
In flight 291 kg
Wing area 16.2 sq m
Wing loading 18 kg/sq m
Aspect ratio 15.8
Metres
0
1
2
3
Sperber Senior
1936
Drawn by Martin Simons 2000 ©


6512
1800
15600
600
1300
3030
300
300
300
300
300
300
300
1200
500
Root profile
Göttingen 535
Mid profile
Göttingen 535
Tip profile
Göttingen 409
Structure 175 kg
In flight 280 kg
Wing area 15.5 sq m
Wing loading 18.1 kg/sq m
Aspect ratio 115.7
Metres
0
1
2
3
Sperber
Junior
1936
Drawn by Martin Simons 2000 ©



Left above: For drag reduction the cockpit canopy reverted to the old Fafnir type, but with transparent plastic covering part of the portholes.

Right above: For Hanna Reitsch, Jacobs designed the Sperber Junior, the cockpit just big enough for her. No one else could fit into it.

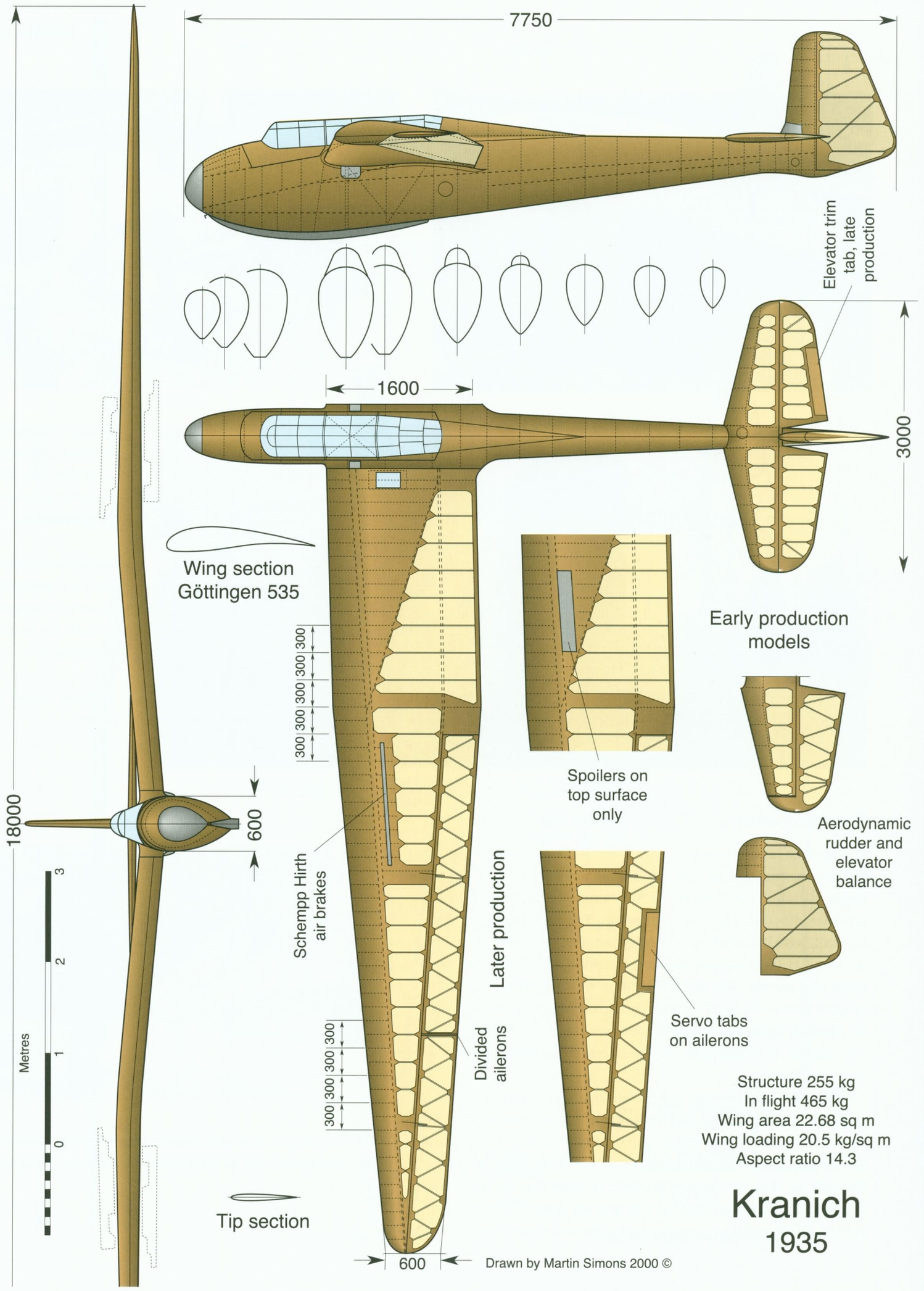
Left: In side view, the shape was perfect.

Sperber Junior

The Sperber Junior, probably one of the most beautiful sailplanes ever flown, was built specially for Hanna Reitsch. The fuselage was designed around her small frame. She herself found it a tight fit and no other pilot could get into the cockpit. The wing in plan, and the tail unit, were like the Sperber Senior but the aerofoil sections were the same as the standard 'Sperber. The gull wing form was much more pronounced. The cockpit canopy was similar to that of the original Fafnir with portholes partly enclosed with transparent plastic, carefully faired to the fuselage and wing root. The Sperber Junior was painted in a spectacular blue and cream 'sunburst' pattern on the upper surfaces.

After a fierce quarrel with the rule makers who, following political guide lines, attempted to exclude women, Hanna entered the 1936 Rhön contest and placed fifth in the final tally. In May 1937 she was one of five pilots who crossed the Alps in soaring flight, to land in Italy 415 km from her take off in Salzburg. After this she became involved in military flight testing work and the Sperber Junior was neglected. All trace of it was lost during the Second World War.

The airbrakes came just at the curve of the gull wing and had to be shaped to close neatly. A vivid blue and white sunburst colour scheme was used on the upper surfaces.



Structure 255 kg
In flight 465 kg
Wing area 22.68 sq m
Wing loading 20.5 kg/sq m
Aspect ratio 14.3

Kranich
1935

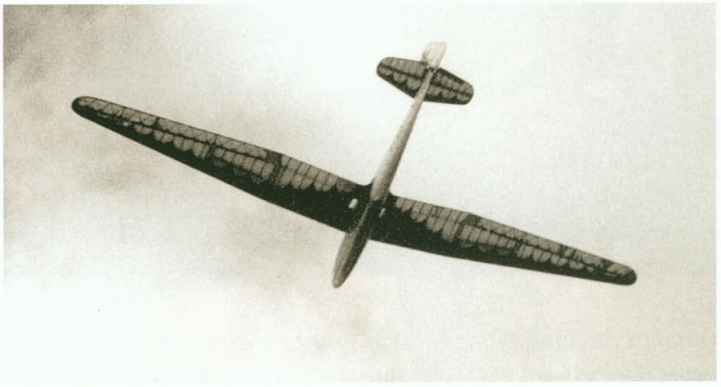
Right: The rear pilot of the Kranich sat between the wings, the main spar crossing the fuselage in front.

Middle right: The Kranich, Hans Jacobs' famous two seater.

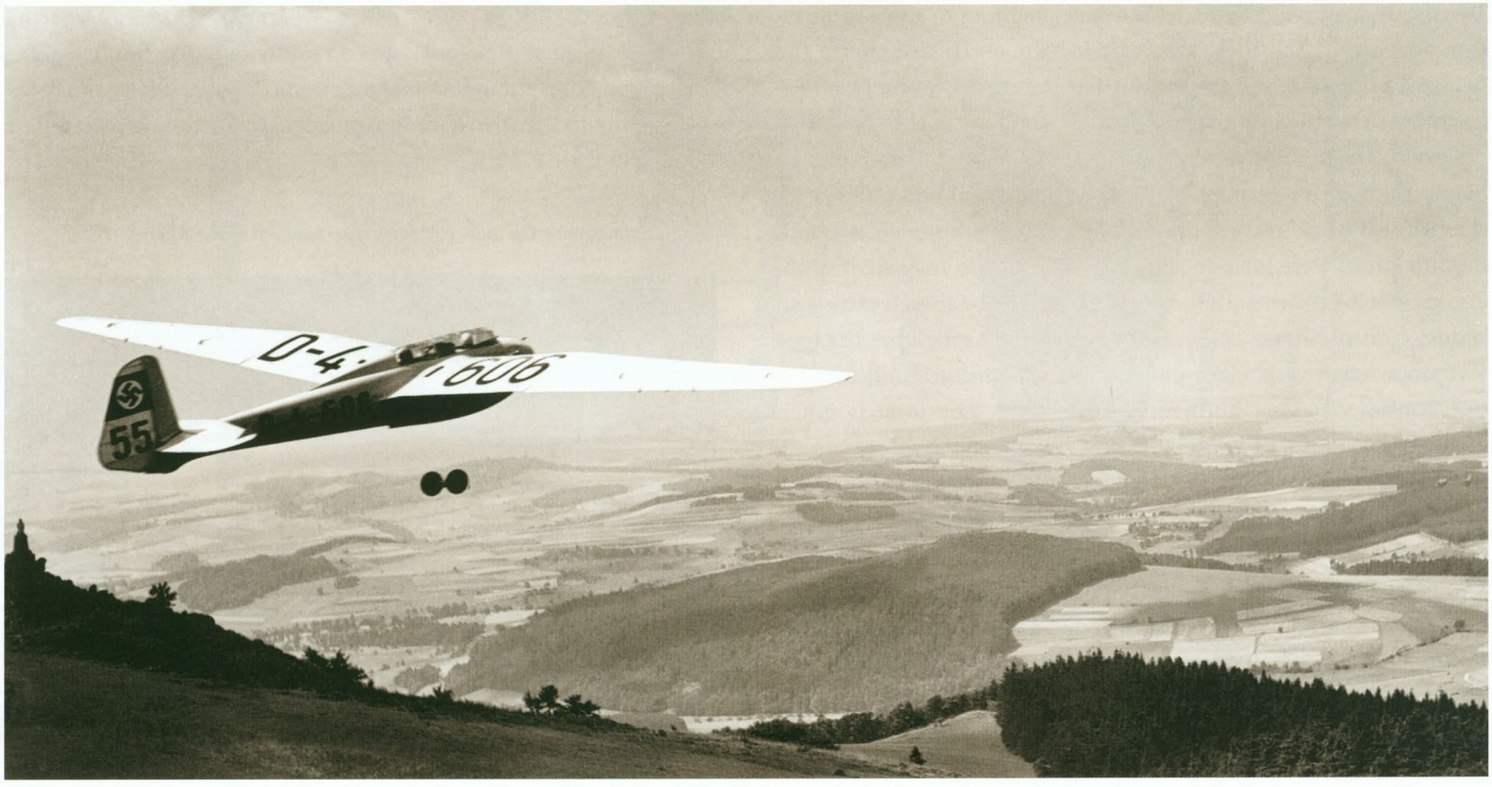
Below: The two wheeled dolly was dropped after take off.

Kranich

The need for some high performance two seat sailplanes prompted Hans Jacobs to design what was at first described as a two seat Rhönsperber. This became the Kranich. It was in most respects an enlarged 'Sperber with similar aerodynamic layout but, necessarily, larger wing area and a span of eighteen metres. The seats were in tandem to keep the fuselage cross sectional area as small as possible. To achieve satisfactory balance the wing was slightly swept back so that the rear seat was close to the centre of gravity. The Kranich could then be flown safely solo from the front seat. The prototype flew with open cockpits but in production a long, enclosed, transparent canopy was fitted.



With the wing mounted at shoulder level, and the slight gull wing, the rear pilot had vision seriously restricted. In front, seen



Left: The Kranich at Elmira in 1938. Two competed in the American Nationals on this occasion.

Left below: Kranichs were flown by the British Air Force of Occupation in Germany after World War 2.

through the long canopy which formed a sort of tunnel, was the other pilot's head. On either side the gull wing rose up to limit the lateral outlook. Only upwards and backwards was there a clear view. Two transparent panels were let into the wing root to allow some vision downwards, but these were very inadequate. Instructors in the rear seat often removed the rear part of the canopy entirely, allowing them to see directly ahead by leaning sideways in the cockpit.

Despite these disadvantages the Kranich had a better performance than any comparable two seat sailplane and broke almost all the two seat world records at some time. Many improvements and modifications were introduced, such as air brakes instead of spoilers, servo tabs on the ailerons and variations of the elevator and rudder control surface balances. Taking all marks together the type was produced in very large numbers. Available records indicate that one contractor alone built more than 1300. The total is much greater since Kranichs became involved in expanded pilot training schemes for the Luftwaffe and were built in factories in various German occupied countries during World War 2, and a few afterwards.

A modified Kranich was used for experiments with a prone pilot. The front fuselage was completely redesigned to take a pilot lying face down. Kranichs were also involved in some desperate efforts to re-supply troops isolated by advancing Russian armies on the eastern front during 1944 - 5. After the war, there was further, limited production in Spain and Czechoslovakia.

Several survive in flying condition, and others are preserved.

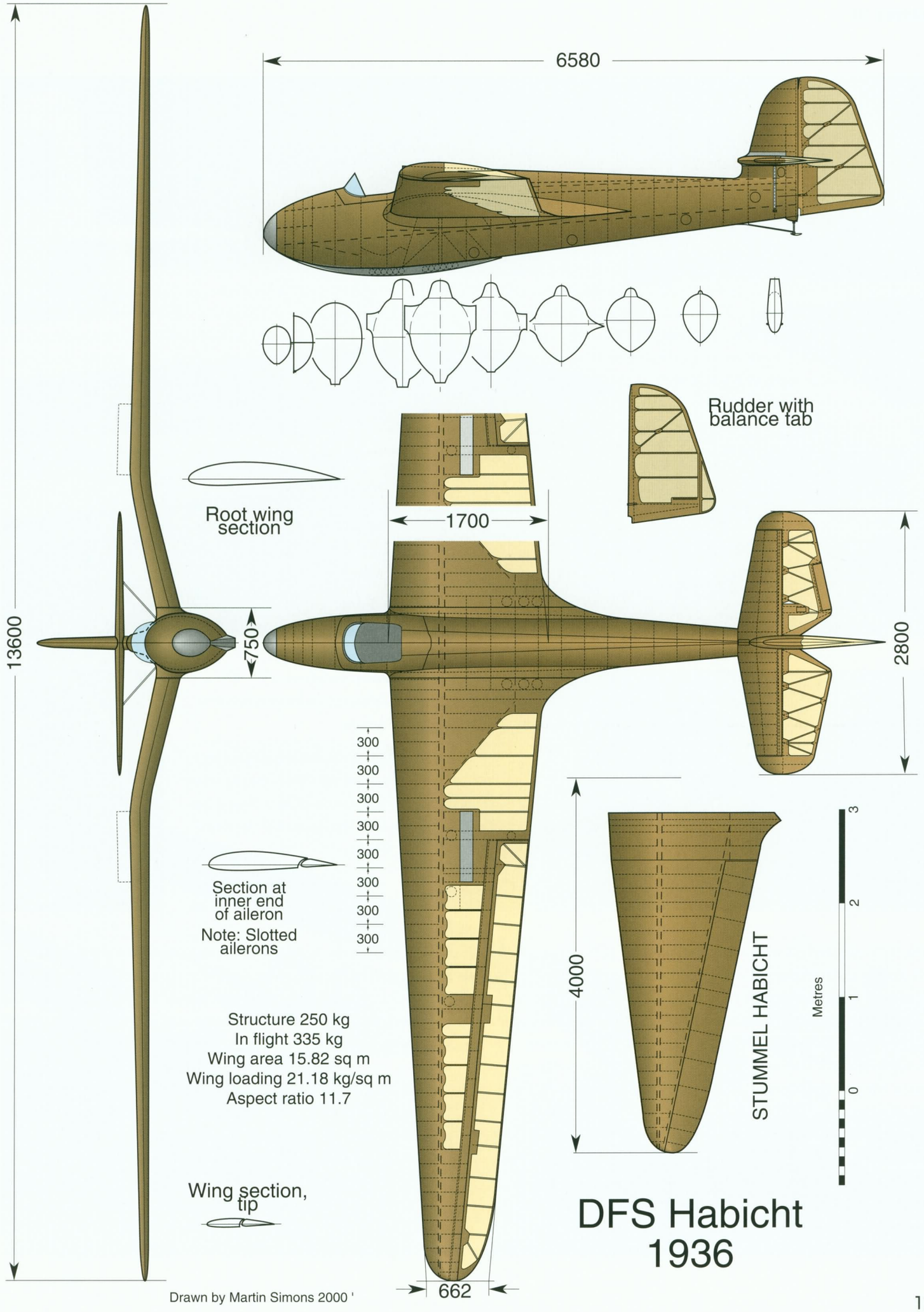
Habicht

Aerobatics in gliders are, inevitably, wasteful of energy since every manoeuvre sacrifices altitude. Pilots who have worked hard to gain height by soaring, do not often want to throw it all away. Occasionally at the end of a successful flight which leaves them with some height to spare, they might perform a few loops, stall turns or other simple high spirited stunts. For most, that is enough.

There has always been, however, some interest in glider aerobatics at air shows and it is often argued that every pilot should learn how to retain control in unusual attitudes, so all should master the necessary skills.

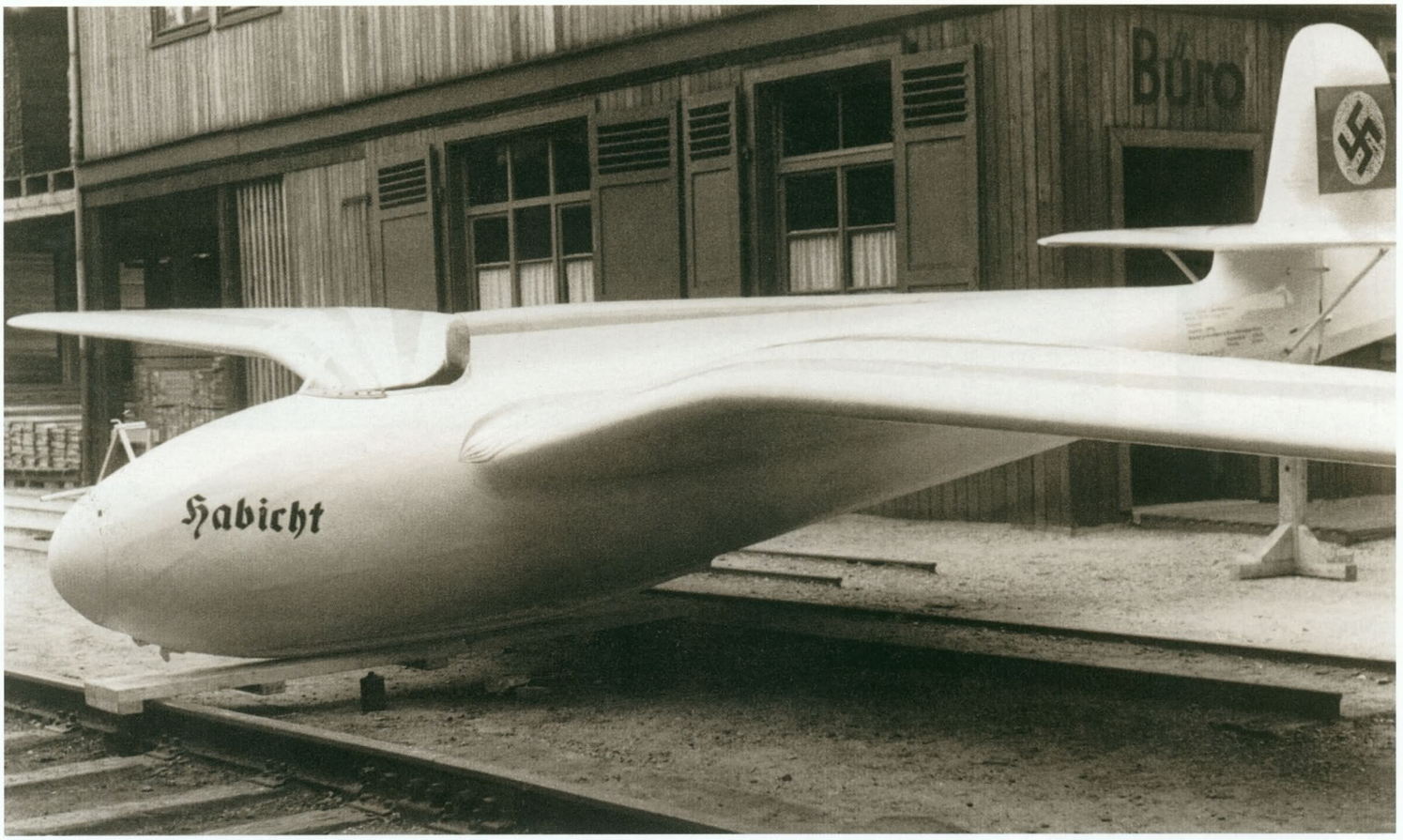
Hans Jacobs designed the Habicht as a fully aerobatic sailplane for the air displays planned in connection with the 1936 Olympic Games in Berlin. It had to be capable of all possible manoeuvres, including inverted flight, slow rolls and flick rolls. It would also need a good gliding performance. Apart from use as a soaring sailplane, it must pick up airspeed rapidly in a dive and conserve this energy long enough to make a reasonably extended display before having to land. An aerodynamically crude glider would not be capable of this.

The Habicht showing the usual blue and cream sunburst colour scheme.



DFS Habicht 1936

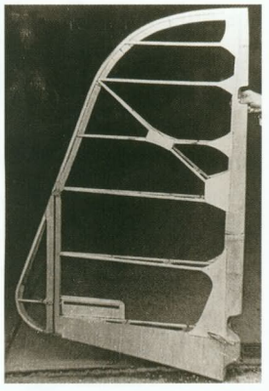
Drawn by Martin Simons 2000 '



Above: An early Habicht built by Schweyer. Note the small vertical tail surfaces.

Left: The Habicht was designed for aerobatics. D - 8002 is the new Habicht built from the old plans, flown in 1995 at the Wasserkuppe and Oberschleissheim.

Right: Detail of the Habicht rudder with balance tab to reduce the pilot's loads.



The DFS carried out many calculations and performed special tests on the main structural components of the proposed design. These were fully reported in the academic press. The wing, only 13.6 metres span for the sake of rapid rolling ability, was stressed for a normal load factor of 12 g. The plywood skin on the leading edge was 1.5 mm thick laid with the grain running diagonally for increased torsional stiffness. The ailerons were slotted to improve their effectiveness.

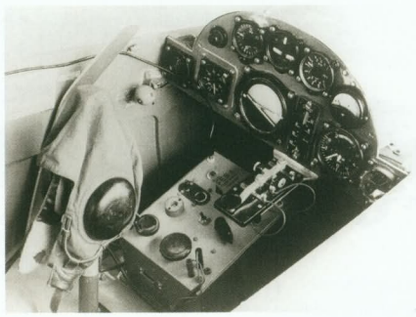
The prototype had an enclosed canopy but the open cockpit with windscreen was preferred, allowing the pilot to feel the airflow directly as an aid to accuracy in flight. Early tests proved the Habicht capable of all that was required. Four were ready in time for the Olympics and were flown over the stadium in Berlin, and even down into it, diving below the level of the spectator stands, pulling up and flying away to land outside the arena. The pilots were Hanna Reitsch, Ludwig Hofmann, Otto Brautigam and Heinz Huth (the same who became World Champion soaring pilot in 1960). The sailplanes were painted on their upper surfaces with the 'sunburst' scheme in blue and cream like that used for Hanna's Sperber Junior.

Small scale production of the Habicht was undertaken and the type was used widely for advanced pilot training and displays. Hanna Reitsch flew one at the Cleveland Air Race displays in the USA, in 1938. A larger rudder was found desirable and most of the aircraft had this after the first few were completed.

Jacobs and his team had not imagined that even more extreme versions of the Habicht would be demanded. These were to be used for training glider pilots to fly the extremely fast, and highly dan-

gerous, Messerschmitt Me 163 rocket propelled fighter which Lippisch, after departing from the DFS, had developed. The Stummel Habicht was produced in two sizes, 8 metres and 6 metres span. These stalled at about 75 to 80 kph and were said to handle somewhat like the Me 163. The work for this programme was contracted out from the DFS. The Wolf Hirth factory at Kirchheim built 35 of the Stummel Habicht and others were built elsewhere.

Pilots who had flown the Grunau Baby were selected, taught to fly the Habicht, then the Stummel Habicht. A few gliding flights in the Me 163 without fuel, towed up by a Messerschmitt 110, followed. The young men were then sent into action against the American bombing forces. If the engine did not blow up they would reach 35 to 40,000 ft in a matter of three or four minutes and were expected to open fire on the bombers. A very few managed to do so, but not many then survived the subsequent gliding descent and landing on a skid at a speed of about 260 kph. Hirth also experimented with Habichts fitted with machine guns and bombs. These were intended for training only.



Left: The instruments, including a radio, in the Reiher cockpit for the expedition to North Afrika.

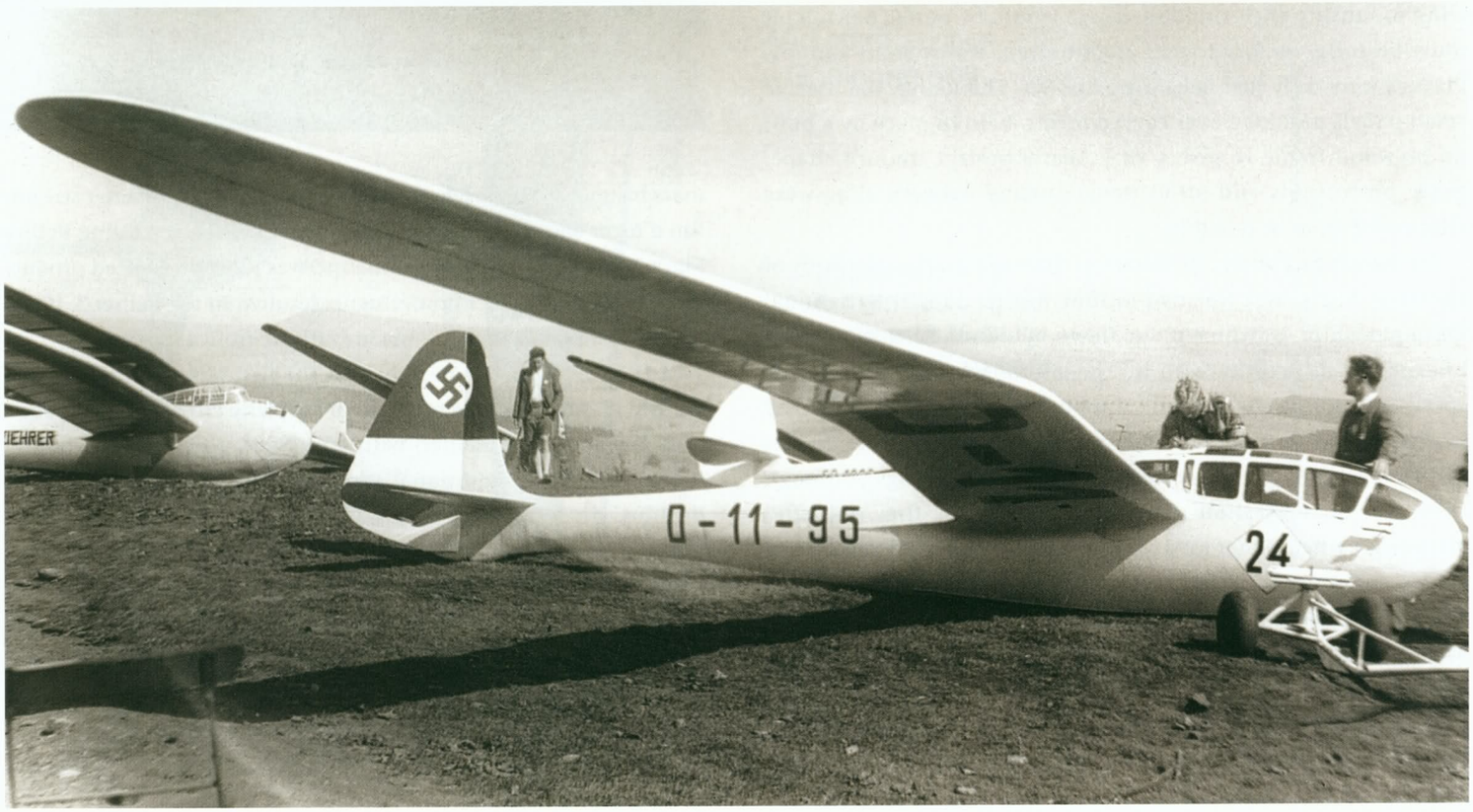
Below: The Reiher prototype was flown by Hanna Reitsch in the internationals of 1937.

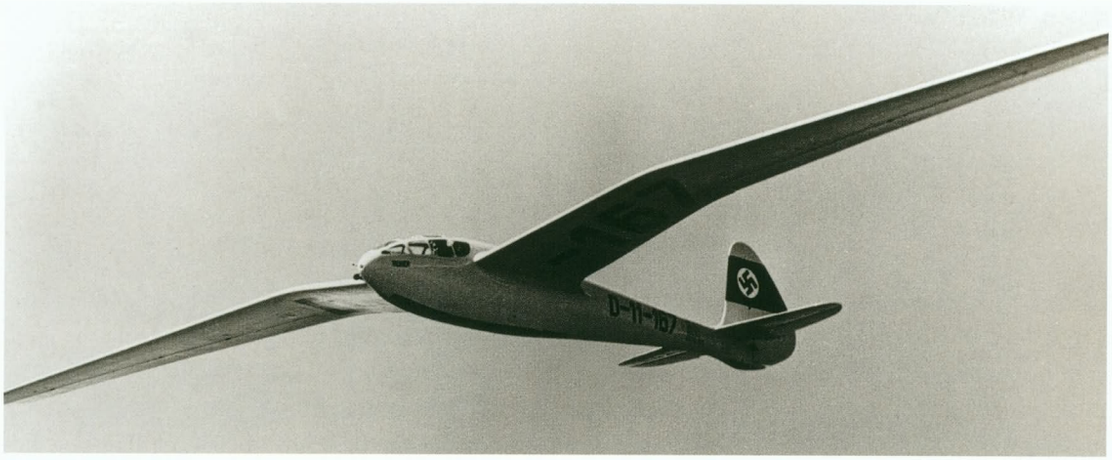
One Habicht survived the war and was preserved in a Paris museum. A completely new Habicht, the 13.6 metre span version, has been built by the Old Timer Group at the Wasserkuppe, and flown. It is now preserved in the Wasserkuppe Museum.

Reiher

By 1936 the practice of cross country soaring in thermals had become better understood. The leading pilots knew now that the mere ability to drift along in a downwind direction, using every thermal to extract the smallest gain of height, was not good enough. To achieve the greatest distance, in the limited hours of thermal activity, demanded a high average speed. The pilot must not waste time in weak lift but should straighten out on course when the variometer began to show reduced rates of climb. Between thermals, sinking air must be penetrated as quickly as possible. What was required was a sailplane which would climb well enough, but which would also fly fast without sacrificing too much height. In the past, designers had tended to concentrate everything on climbing ability, saving weight, using strongly cambered and thick wing profiles, aiming always for a minimal rate of sink. Now it was apparent that heavier wing loadings could be tolerated, providing the high speed glide was improved. The pilot with a faster, heavier sailplane would then be able to search more widely for strong thermals. The penalty of not being able to use the weak ones, was acceptable.

After some ten years of experience designing sailplanes, Hans Jacobs doubtless felt the time had come to bring everything to-





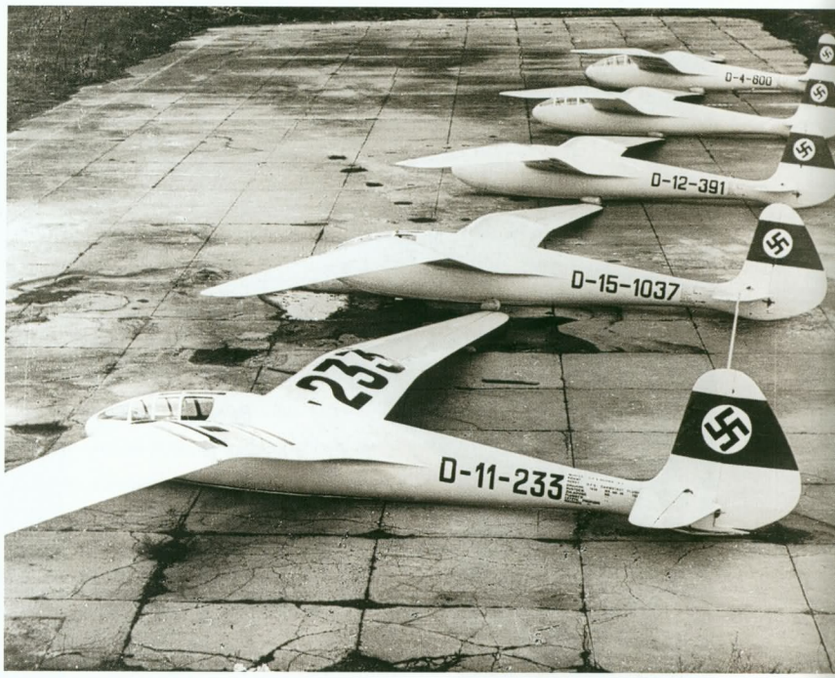
Left: D-11-167 was a Reiher II off the production line.

Below: A rare photograph showing five of the production Reihers together.

gether to produce a masterpiece. All the resources of the DFS were called upon. Wind tunnel tests established that the most promising wing profile for the new sailplane was the Göttingen 549. This had been used before on Kronfeld's Wien, so it had a good record in practice. The emphasis on high speed gliding as well as low sinking speed required every possible aerodynamic refinement. The wing must have a high aspect ratio even at the cost of added weight. To vary the wing camber in flight would be useful, so there should be flaps. The wing spars were to be built of selected spruce, rather than the slightly heavier pine on which most German designers had previously relied. Airbrakes now were a recognised necessity. The fuselage must be as perfectly streamlined as possible. Jacobs did not believe, however, that elaborate calculations and highly complex forms, such as Lippisch had used for the Fafnir 2, yielded any real advantage. A mid wing mounting with simple fairings would be best. The cockpit must be fully enclosed with a contoured, transparent canopy. Plastics were only just becoming known. The Reiher had twelve small panels moulded over curved forms, held in place by a built up plywood frame to give a very nearly perfect smooth shape. Gaps, protrusions and other items causing parasitic drag were eliminated as far as possible.

The Reiher prototype, 19 metres in span and by the standards of the time, heavy, was finished in time for the 1937 International Championships, in which it was flown by Hanna Reitsch. She had unexpected difficulties with it. The ailerons were heavy at high speeds and in rough air would sometimes snatch the stick out of her hand. The flaps did not seem to do much good. The air brakes had strange characteristics causing some heavy landings. Although there was no suggestion the wings could break, they did bend alarmingly when under load in steep turns. Despite all this Hanna set a new feminine distance record of 351 km and placed sixth, beaten by older and less refined sailplanes including the humble Mü 13 of Kurt Schmidt and the little Moswey of the Swiss, Sandmeier.

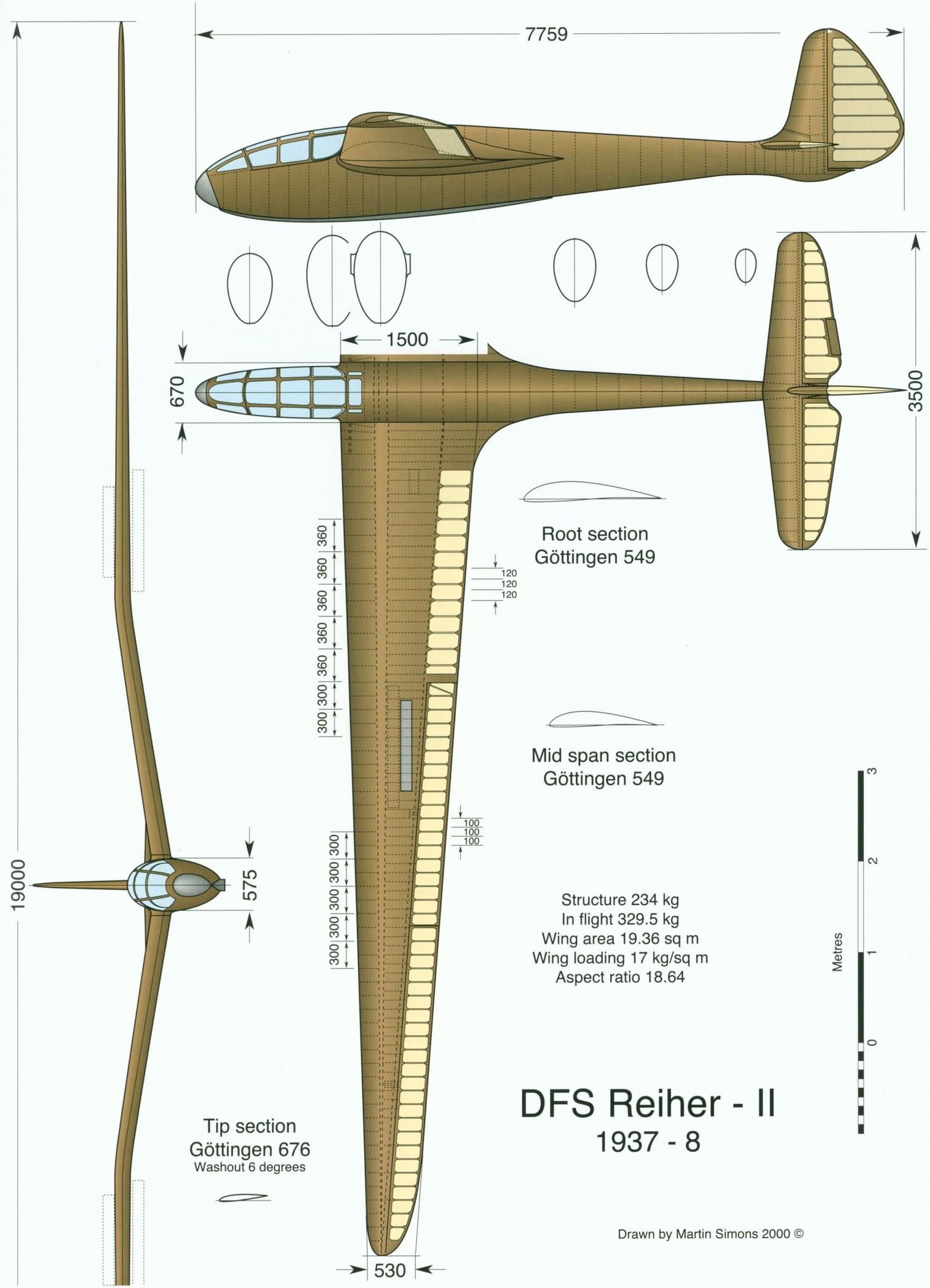
In reviewing the design, Jacobs decided that the wing should be stiffer, which could be achieved by using a more pronounced taper. The flaps were eliminated, the air brakes redesigned, the ailerons



mass balanced. The fuselage was reshaped to an even better streamlined form and the vertical tail was enlarged. The resulting Reiher Mark 2 was a great improvement and was put into limited production. Further detailed improvements resulted in the Reiher 3. It was the best sailplane ever to be made available from a factory.

In 1938 Wolfgang Späte, who was the first pilot to apply mathematical reasoning to the problem of sailplane cross country speeds, used the prototype Reiher, with structural stiffening and hence, more than 90 kg additional weight, to win the Rhön championships. His theoretical work was vindicated. In 1939 Erwin Kraft won the championships with the Reiher 3.

No Reiher survived the Second World War although it is said one was taken to England for examination at Farnborough. Apparently nothing was ever done with it and it was eventually scrapped there. In recent years, a new Reiher has been built by the Wasserkuppe Old Timers Group. Calculation and redrafting to replace lost drawings had to be done, but the finished aircraft is as perfect a replica as it is possible to build.



Root section
Göttingen 549

Mid span section
Göttingen 549

Tip section
Göttingen 676
Washout 6 degrees

Structure 234 kg
In flight 329.5 kg
Wing area 19.36 sq m
Wing loading 17 kg/sq m
Aspect ratio 18.64

Metres
0
1
2
3

DFS Reiher - II
1937 - 8

Weihe

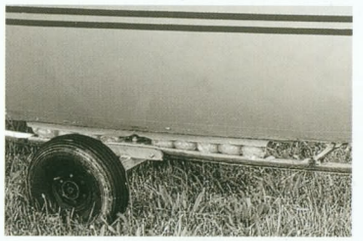
Jacobs recognised that the Reiher was far too costly for general use but pilots everywhere now needed superior sailplanes for cross country distance and goal flights. Without compromising the performance too much, an 18 metre span sailplane with a greatly simplified structure would satisfy the demand. The Gö 549 profile was used at the root, slightly increased in thickness. Jacobs considered that a mid wing mounting, with necessary heavy frames to carry spar bending loads through the fuselage, as on the Reiher and his earlier Rhönsperbers, added structural complication yet did not guarantee a smooth airflow in this important region. Mounting the wing above the fuselage on a slight neck might not be aerodynamically ideal but saved a great deal of cost. In turns, any slight slipping or skidding would not upset the flow too greatly on the vital upper surface, which was entirely clear of obstructions.

The air brakes, of DFS type, were set rather far back on the wing and proved less effective than desired. This was mainly because the geometry of their drive arms prevented them opening far enough for the paddles, above and below the wing, to meet the airflow at a full right angle. Sideslipping on the approach to small landing fields was necessary. Otherwise the Weihe handled well, was stable, strong and relatively easy to fly, both normally and blind in cloud.

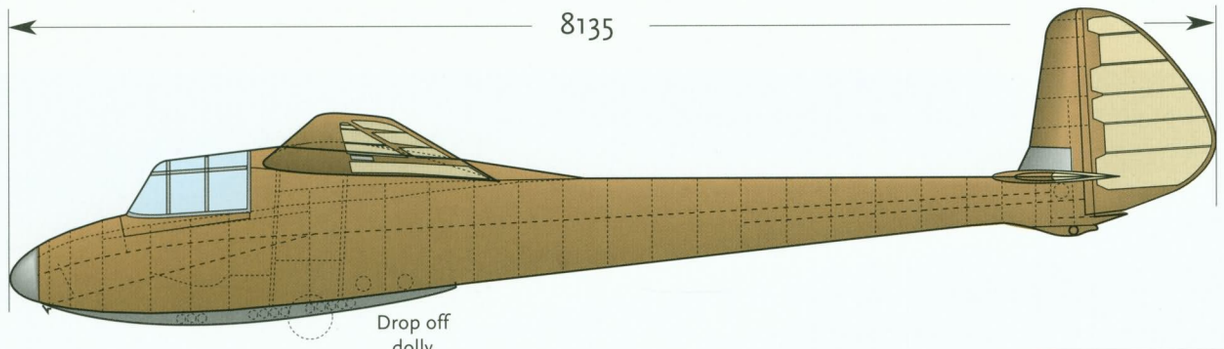
Particular attention was given to the system of rigging. Each wing was attached to the fuselage with two steel pins, one at the main spar and one close to the leading edge where there was a short sub spar. These two pins were in line axially and were inserted simultaneously by means of a toggle lever. There was no attachment to the fuselage aft of the main spar. When both wings were mounted, the

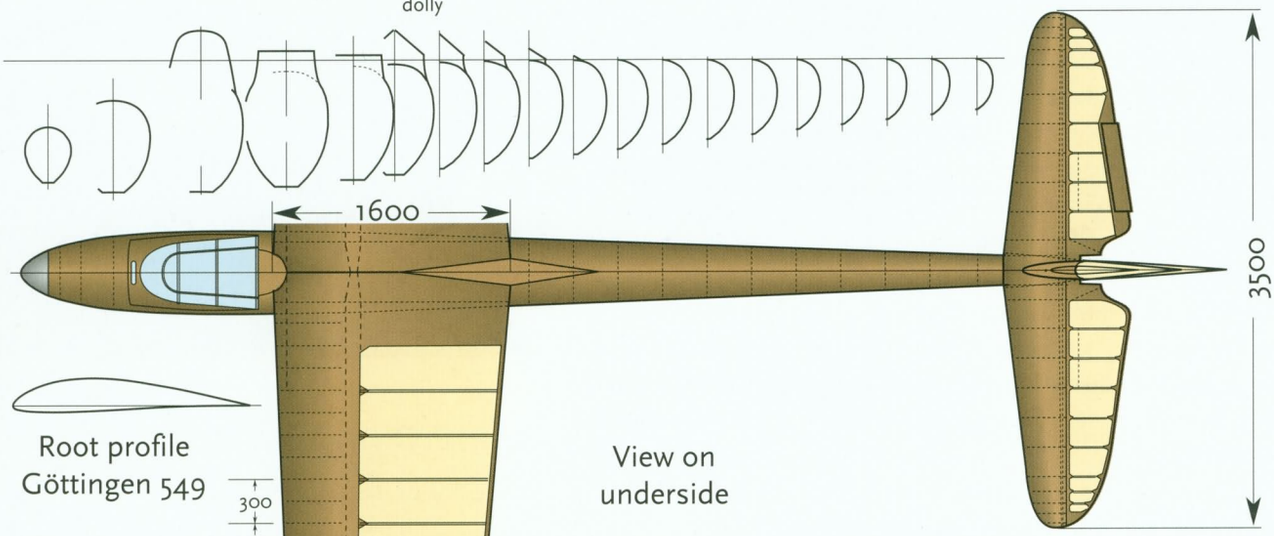
Above: This Weihe belonged to the Surrey Gliding club in England in the Post World War 2 period.

Right: Typical of its time, the Weihe skid was sprung with rubber balls. The gap was usually closed with canvas.

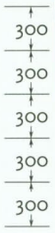


Below: The Weihe dominated competitions in the years immediately after World War 2.

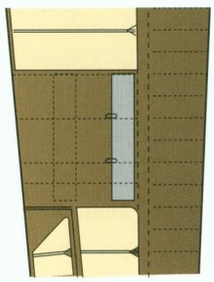


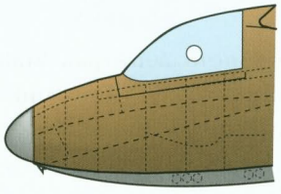


Root profile
Göttingen 549



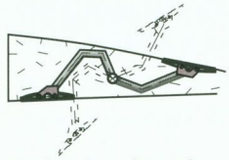
View on
underside





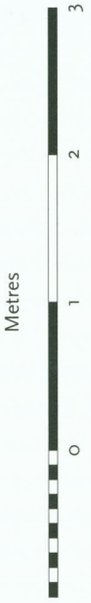
Focke Wulf Weihe 50

Mid span
profile
Göttingen 549



Air brake detail

Tip profile
M 12



Structure 215 kg
In flight 335 kg
Wing area 18.2 sq m
Wing loading 18.4 kg/sq m
Aspect ratio 17.8

Jacobs - Schweyer Weihe
1938

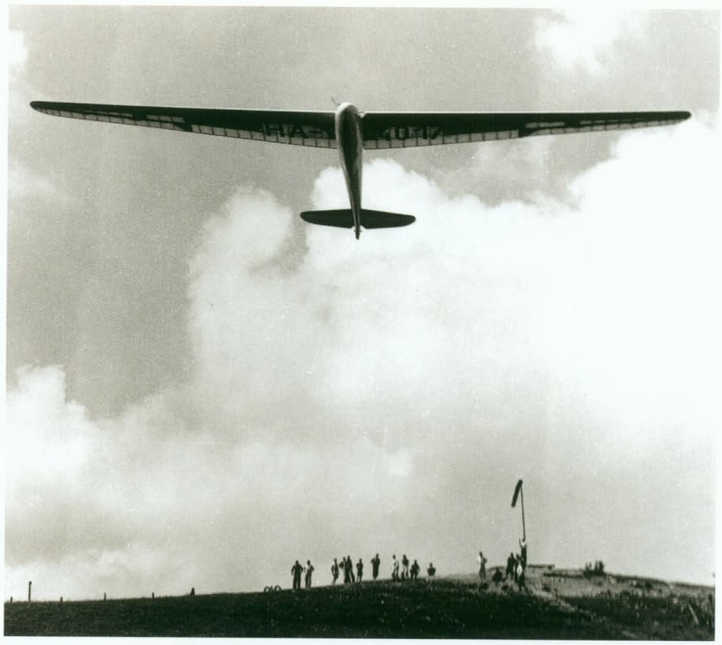
tips could rest on the ground without straining the fittings. To complete the rigging, the wing tips were raised until the top pin, joining the upper flanges of the main spar, could be inserted. The whole job could be done in a few minutes by a crew of two or three. The gap between wing and fuselage aft of the spar, was usually sealed with tape.

The Weihe first flew in 1938 and performed well. Otto Brautigam and Ludwig Hofmann in the Rhön contest that year placed fourth and sixth respectively, both in Weihes. The type was chosen by the NSFK for mass production. About 280 were built by Jacobs' own company, Jacobs - Schweyer, and many more under licence elsewhere. To speed production, many simplifications of the structure were made. In some factories plywood skin joints were simply overlapped and filled before painting, rather than the usual time - consuming smoothly scarfed joints. Any loss of performance was not apparent.

After the end of the Second World War, surviving Weihes captured in Germany and some built in Sweden and France (known there as the VMA 200 Milan) and Spain, were widely used and set a standard for designers for at least a decade. The type dominated competitions. Per Axel Persson of Sweden won the World Championship in 1948. Two other Weihes were in the top five. Billy Nilsson's Weihe, also from Sweden, won in 1950 with Paul MacReady's Weihe second. This was the occasion when MacCready demonstrated, in practice, his refined cross country speed flying theory which had, essentially, been anticipated by Späte in 1938. (MacCready's most welcome contribution was the MacCready ring which, mounted on the variometer, gave the pilot the best speed to glide between thermals of any given strength and in sinking air, without the need for slide rules, graphs and charts in the cockpit.) There were seven Weihes in the top ten that year. Even in 1954, sixteen years after the first flight, the Weihe was still competing in World Championships, three in the top ten. By this time some small production of a new version, the Weihe 50, had been undertaken by the Focke Wulf Company. The Weihe 50 had a landing wheel, a blown plastic cockpit canopy and, in some examples, ailerons of reduced length.

Many record flights were made in Weihes, including durations of 45 hours 28 minutes by Vergens in Austria in 1942, and 55 hrs 51 mins by Ernst Jachtmann in 1943 over the sand dunes of the Baltic coast. These records were officially disallowed by the FAI (Federation Aeronautique Internationale) because made in wartime, but they were genuinely flown. Axel Persson broke the world height gain record with 8050 metres in 1947 and Karl Bauer exceeded 9665 metres in 1959, both in Weihes. To list all the national records achieved in this aircraft would occupy several pages.

The Weihe's influence on sailplane design is clearly evident in such types as the Italian CVV 6 Canguro, French Air 100 and the British Slingsby Gull 4 and Sky. When designing his post war Kranich 3 two seater in 1952 Jacobs himself used what was essentially a Weihe wing. The most significant of all developments was probably that of the DFS Meise, which followed the Weihe in 1939



Meise/Olympia

Led by Professor Walter Georgii and backed by ISTUS (International Studienkommission für Segelflug), there was a strong move during the nineteen thirties for soaring to be recognised as an Olympic sport. ISTUS arranged a series of international meetings and competitions, at Berlin in 1936 coincident with the Games, at Salzburg in May 1937 and the International Championships at the Wasserkuppe in July of that year. The Olympic Committee eventually accepted the sport but it was important that no pilot should have an advantage in equipment. The next Games were scheduled for 1940. All pilots in the Olympic competition should fly the same type of sailplane. Plans for a standard design, not too complicated or costly, must be made readily available so that any nation would be able to build aircraft for their team. A design competition was arranged. The specification was simple. The span must not exceed 15 metres, the structure weight no more than 160 kg, with a 102 kg allowance for the cockpit load. Permitted materials were spruce or pine, plywood and mild steel. The maximum permitted airspeed should be 220 kph. The load factor was to be 10g. No complicated fittings, no flaps, skid for landing, no wheel. An international jury was appointed with six members, one each from France, Germany, Britain, Netherlands, Italy and Poland. The completed 'Olympic' sailplanes were to be ready for test flying and assessment at Sezze in Italy, in February 1939.

The DFS entered the Meise. In most important respects this was a smaller version of the Weihe. The wing, with simple taper and no forward or backward sweep, was aerodynamically similar except that the root was again thickened slightly for greater spar depth. The large Schempp Hirth type brakes were much more effective than those of the Weihe. The fuselage aft of the wing had almond or lozenge shaped cross section for greater ease in applying the plywood skin. For balance, the pilot's seat had to be just ahead of the

Opposite page: The Meise, winner of the 1939 design contest. This example was flying in Hungary.

Above: An Olympia flown by the British Empire Test Pilots' School.

Left: The prototype British Olympia built by Chilton Aircraft Co, finished in clear dope and varnish.

main spar. This necessitated a slightly awkward design of cockpit canopy, which fitted into a cut out between the two wings and gave the pilot a fairly adequate view upwards and to the sides. It was not then possible to use the simple rigging system of the Weihe which involved a connection close to the leading edge. There was an orthodox rear attachment point with a short diagonal spar to carry the torsional loads. For simplicity, there were no fairings around the wing roots.

By good judgment and, perhaps, an element of luck, the Meise proved to have excellent handling qualities, so much so that Philip Wills, the English champion pilot, described the Meise as a piece of poetry, perfectly balanced in all senses and a delight to fly. At Sezze it was judged to be the best of the five sailplanes in the design competition. The DFS accordingly published the plans and these were widely distributed. The name Olympia was applied.

The 1940 Olympic Games never took place. By then Germany, Britain and France were at war and, in a separate conflict, Finland where the Games should have been held, was also struggling desperately in the so called 'Winter War' against the USSR. The Meise was nevertheless adopted by the NSFK and produced in large numbers in Germany.

After the war, the plans being available, a few were built by amateurs, at least one in the USA and one, known as the Yellow Witch, in Australia. Quantity manufacture was undertaken in France (as the Nord 2000), the Netherlands, Switzerland, and eventually in Germany again as the Olympia Meise 51. In Britain, after some restressing and strengthening (probably unnecessary), about 150 were built in batches by Elliotts of Newbury. The EON Olympia 2B with a blown plastic cockpit canopy and a landing wheel was, from 1947, the backbone of the club sailplane fleet in Britain and examples were exported. Many remain in service.

The Meise was Hans Jacobs last pre-war contribution to sailplane development. In post war times he produced only one further design, the two seat Kranich 3. The book he had first written in 1932, Werkstatt-Praxis Für den bau von Gleit und Segelflugzeugen (Workshop practice for building gliders and sailplanes) expanded and updated in new editions, became and remains the standard work on the subject of building and repairing wooden sailplanes.

A famous photograph of an Olympia, used by Elliotts of Newbury for their advertising brochure. Photographer, Charles E Brown.