SAILPLANES BY SCHWEIZER

A HISTORY

PAUL A SCHWEIZER

MARTIN SIMONS

SAILPLANES BY SCHWEIZER

A HISTORY

SAILPLANES BY SCHWEIZER

A HISTORY

PAUL A. SCHWEIZER
with
MARTIN SIMONS

Airlife
England

First published in the UK in 1998
by Airlife Publishing Ltd

British Library Cataloguing-in-Publication Data
A catalogue record for this book
is available from the British Library

ISBN 1 84037 022 X

Typeset by Servis Filmsetting Ltd
Printed in England by Bath Press Ltd, Bath

Airlife Publishing Ltd
101 Longden Road, Shrewsbury, SY3 9EB, England

Acknowledgements

This book, essentially a co-operative effort, owes much to the advice of Ernie and Bill Schweizer, Les, Stuart and Paul H. Schweizer, and to many other people including Howie Burr, Walter Cannon, Jim Gray, Ginny Schweizer and Dave Welles, who have commented on parts of the text and contributed to it, and amplified or corrected the drawings. Many others, including staff of the Schweizer Aircraft Corporation and the National Soaring Museum on Harris Hill, have searched for plans and photographs. Special thanks are due also to Judy Slates, who generously made time available on her computing apparatus and gave willing help in the late stages of editing and collating the material.

Unless otherwise noted, all the photographs come from the Schweizer archives or from the National Soaring Museum, plus a few from M. Simons' personal collection. It has not been possible to trace all the individual photographers, and apologies are offered to anyone who has not been given due credit.

Contents

Introduction

The three Schweizer brothers, Ernest, then aged 18, Paul (16) and William (12), completed and flew their first glider at Peekskill, New York, in June 1930. After they had designed, built and flown four further gliders, and following their graduation in aircraft engineering, Ernie and Paul in partnership founded the Schweizer Metal Aircraft Company in 1937. Bill joined the company after his own studies in science were completed in 1941, by which time Ernie and Paul had moved to Elmira, NY, and the Schweizer Aircraft Corporation had been incorporated. In 1996 this was the only American aircraft design and production company with a continuous record of operations under the same family ownership and management.

The text of this book, written by Paul Schweizer and edited and expanded by Martin Simons, who also made the drawings, brings together the combined recollections and knowledge of the three brothers to tell the story of the gliders and sailplanes Schweizers designed and built over a period of sixty-five years. Data, accurate three-view drawings and photographs supplement and illustrate the text.

This book may be seen as a companion volume to Bill Schweizer's *Soaring With the Schweizers* (Rivilo Books, 1991), which explains how the Schweizer Aircraft Corporation developed over the years and how the gliders and sailplanes provided the foundation from which all the company's activities evolved. The general history of the gliding and soaring movement in the U.S.A. is covered in Paul Schweizer's book *Wings Like Eagles* (Smithsonian Institution Press, 1988). Martin Simons is the author of *The World's Vintage Sailplanes 1908–1945* (Kookaburra, 1986) and *Slingsby Sailplanes* (Airlife, 1996). An explanation of the Schweizer aircraft numbering system is given in Appendix 1.

The Schweizer Family

We three Schweizer boys, and our sisters Helen and Emily, were the children of Paul Schweizer and Emma Bader. Paul Senior immigrated to the U.S.A. in 1906 from the town of Reigoldsville in Switzerland. Emma arrived in the U.S.A. in 1908, and before marriage was a governess at a family estate called Bonnie Brook near Tuxedo Park, New York. Father, or Papa as we called him, was a chef. His first job in the U.S.A. was at the Hampton Hotel in Albany, but he moved to different positions in New York City and Philadelphia as he worked his way up in the restaurant business. In 1915 he and a Swiss friend, Herman Schneider, established a Swiss restaurant and pastry shop in Carnegie Hall, the world-famous concert hall at the corner of 7th Avenue and 56th Street, New York City. Business was good, so we children had the benefit of growing up under favourable circumstances. We moved to Elmhurst, Long Island. Papa bought a Hudson Super Six car, but did not take to driving after his first attempt. Joe Heimers, a young fellow from College Point, was hired as a chauffeur and handyman. We soon moved up to a 1916 Packard Twin Six touring car and a Cadillac town car. At weekends the family would go touring in the Packard with the top down.

The Schweizer home, 'Bonnie Brook', with, on the left, the barn where the early gliders were built.

Our first exposure to aviation came when we saw barnstormers operating from various hayfields around Long Island. On one memorable ride past Mitchell Field on the Vanderbilt Highway, also called Motor Parkway, a pilot in a Curtiss Jenny saw us driving along. As there was no other traffic, he decided to give us a buzz. I can still see his wheels just above the open car as he roared by, his helmeted and goggled head looking over the side of the cockpit, and a fiendish grin on his face.

In 1919 the British R34 had just made the first airship crossing of the Atlantic from England. It made a short flight to New York City from its temporary moorings at Roosevelt Field, and passed right over our house at only a few hundred feet. We could see the crew and passengers looking out of the gondola and waving to us. Its large size made a lasting impression on us. We were becoming increasingly air-minded.

Papa wanted to get out of the city and into the country, to a place where he hoped eventually to have his own restaurant. We moved in 1924 to a large house with a barn on a ten-acre lot on East Main Street in Peekskill, a small village about forty-five miles up the Hudson from New York City on the New York Central Railroad, within commuting distance. Papa continued to run the restaurant at Carnegie Hall, leaving home early each day and not returning until after dark. To the family's great distress, our mother, aged only 40, died of cancer the next year. After this the children and house were looked after by Joe and his wife, Pauline. A brook ran through our land, and Papa named our place 'Bonnie Brook' in memory of mother's first home in the U.S.A.

Todd Field, which was used by barnstormers, was

A rear view of 'Bonnie Brook'.

only a mile away. Whenever we heard an aeroplane we would run outside to see if we could identify the type, and speculate as to whether it was going to land. One morning, while we were still in bed, we heard an aircraft overhead. Suddenly its engine stopped. We rushed to the window to see where it would glide, and, as expected, it headed towards Todd. We quickly dressed and ran to the field. The aeroplane was a cute little Commandair biplane, and the feature that attracted us most was its spot-burnished cowling. We learned from others who had also been drawn there that the pilot had telephoned Roosevelt Field for a new magneto. We spent the morning hanging around and asking the pilot endless questions while he waited. The magneto was delivered by car after a few hours, and was quickly installed by our hero, who took off and continued on his way to Buffalo.

In 1926 the family took a trip to Philadelphia to attend the Sesquicentennial Exposition. The most exciting exhibit to us was the huge Curtiss NC-4 biplane flying boat which in 1919 had been the first aeroplane to fly the Atlantic, which it had done in stages. The NC-4 was mounted on a large launching dolly and parked on the ramp at the edge of the river. Its top wing was almost 50 ft from the ground, and it was a really impressive giant.

Barnstormers such as the famous Gates Flying Circus came to Todd Field, selling joyrides in Jenny biplanes. We had not yet been able to persuade Papa to pay for a ride for each of us, so we could only watch. A few years later Capt. Arnold arrived with his 'banana-winged' Standard sesquiplane, with four passenger seats in the open front cockpit and the pilot in his own cockpit behind. This time we had financial support, and we three boys and our sister Emily, and our fox terrier, went up for our first flight. We were thrilled.

At about that time an incident occurred that switched our interest temporarily to boats. The editor of the magazine *Motor Boating* suffered a puncture outside our home, and Joe repaired it for him but refused payment. A few days later he received a copy of *Motor Boating* and was advised that he now had a year's free subscription. Joe was not interested, so he passed the magazines to us. We started to make model boats, visited boat shows in the Grand Central Palace in New York, and built a rowing boat, although our pond proved too small for it. We dreamed of sailing the sleek class yachts that we had seen at the shows.

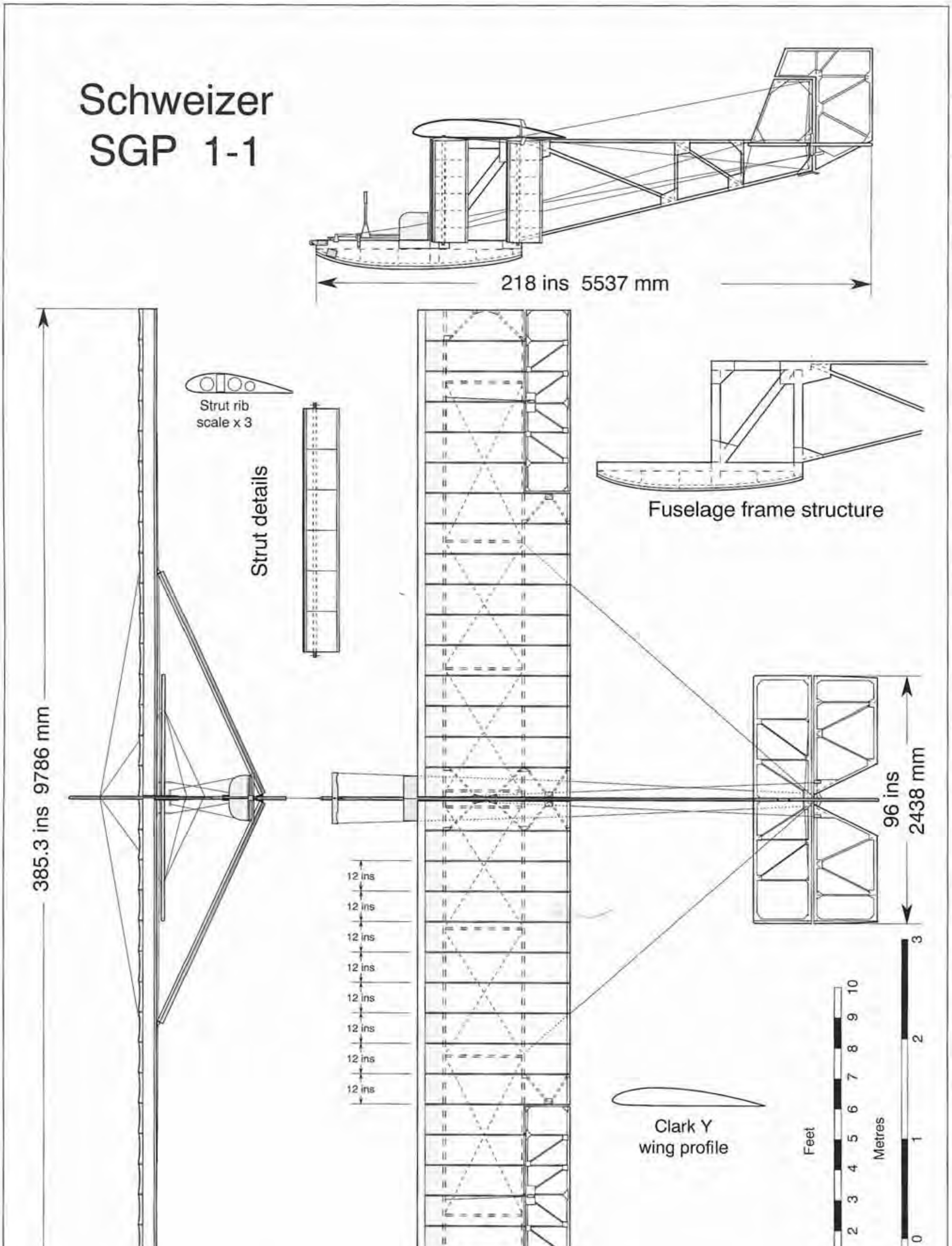
In 1927 there was much publicity about a proposed non-stop flight across the Atlantic to Paris. Lieutenant-Commander Clarence Chamberlain and Capt. Charles Lindbergh made preparations, and our interest in aviation was again aroused. When 'Lindy' reached Paris our enthusiasm turned again to aviation. There was little chance for us to fly in view of the high cost, so we turned to model aeroplanes. *American Boy* magazine published an article by Merril Hamburg on how to build a Baby ROG. The ROG (rise off ground) was a 12 in. model that could take off from the floor and fly for half a minute or so in a living room. Ernie made a 5 ft version which flew well outdoors.

We three brothers, with some school friends, formed the Mercury Model Airplane Club, and acquired balsa wood from the discarded insulation of ice cream trucks. We started a small business, buying a small circular saw and cutting strips and sheets from the scrap insulation and some bulk balsa we bought, and selling them to other modellers. This was our first trading venture.

Although model flying was fun and kept us up to date in aviation, it was not flying. One day we saw a report in the *New York Times* of a record soaring flight made above the sand dunes of Cape Cod. Peter Hesselbach, a German instructor at the Glider School founded by J.C. Penny Jr remained aloft in his sailplane for over four hours. But the thing that really got us hooked was an article entitled 'On the Wings of the Wind', in the June 1929 *National Geographic Magazine*. It told how young German students about our age were learning to fly inexpensively in gliders. We quickly converted our model aeroplane club into a glider club.

The great financial crash of 1929 had an impact on our home life, as Papa suffered losses on his investments and business at the Carnegie Hall restaurant was much reduced. The Cadillac had to be sold, and the Packard was put on blocks in the barn. We ended up with a Ford model T, a 'Tin Lizzy'!

Ernie and I were not allowed to have bicycles, which Papa thought too dangerous, so we walked the two miles to and from school to save the bus fare. (School buses were not available at that time.) With the money we saved, by combining all our assets we were able to start building a glider. It was a tough time to try to get into aviation, but we were enthusiastic and willing to work.


Schweizer
SGP 1-1
218 ins 5537 mm
Strut rib
scale x 3
Strut details
Fuselage frame structure
385.3 ins 9786 mm
96 ins
2438 mm
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
Clark Y
wing profile
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
60 ins
1524 mm
Drawn by Martin Simons 1996
from information supplied by Schweizer Aircraft Corp
©

SGP 1-1 Primary

The first Schweizer glider, usually referred to as the Primary, was a single-seat primary trainer generally similar to the Zögling type used in Germany. Its original designation was HG-1, to tie in with our club name, the Mercury Glider Club, as Hg is the chemical symbol for mercury, but soon, in a fit of optimism, we established the numbering system that is still used today. The primary became our SGP 1-1. The club had eight members: the three Schweizers, Ernie, Paul and Bill, plus five school friends, Atlee Hauck, Ernie Whidden, and Aaron, Bill and Bob Yellott. There was also a group of eager young camp followers.

Ernie, a senior in High School, was the oldest, and it was he who designed the SGP 1-1, using such general information on gliders as we could find in books and magazines. He chose the Clark Y aerofoil section used on Lindbergh's Ryan monoplane, the *Spirit of St Louis*. The unusual thing about the Schweizer primary was that it had parallel wooden struts to support the wings, rather than the wire bracing with a cabane of the Zögling and most other primaries. Ernie felt that the struts would simplify the assembly and dis-assembly of the glider and would make it more rugged, eliminating frequent replacement of wires that would break in hard landings. As shown on the drawing, these struts were later made into lift struts similar to those used on the efficient Bellanca aeroplanes, which we greatly admired.

We started building the glider in the barn behind the family home. In view of Papa's attitude to bicycles, we feared that he would object to us trying to fly. Except on Sundays he was not at home during daylight hours, so we worked on the glider only when he was not there. We hoped that if he did not see it until it was nearly complete, he would not then have the heart to stop us from trying it. He never came to the barn.

Producing the wing ribs was the first project. They were made of white pine strips with 1/16 in. mahogany gussets. Casein glue was used. The wing spars were made from aircraft-quality spruce, and the tail surfaces were a wooden truss construction. The fuselage followed the typical primary glider design, using spruce for the frame and plywood reinforcements at all the joints.

Most of the metal fittings were of commercial mild steel, and were formed at a local blacksmith's shop where some welding was also done for us. (Some of the welding turned out to be less than adequate, as we found later.) To save costs we made whatever parts we could for ourselves, even the pulleys. The pulley sheaves came from a discarded aluminium kick plate from the kitchen door of Papa's Carnegie Hall restaurant. We used shoe leather for the centre of the pulleys, all riveted together. We also used the kick plate aluminium for the seat back. Stranded, flexible aircraft cable was very expensive, so we used short lengths of cable to go round each pulley, then joined it to hard wire for the straight runs. The drag bracing in the wing was also hard wire, purchased from Karl Ort, the First World War surplus aircraft supply dealer in York, Pennsylvania.

The wing and tail surfaces were covered with unbleached muslin sewn on the family sewing machine by our sisters, Helen and Emily. The fabric was tautened and made airtight with uncoloured dope.

The total cost of the materials was about $135, with a few more dollars required for a launching

First assembly of the SGP 1-1 in the barn loft.

Top: *The SGP 1-1 being bungee-launched with Aaron Yellott on board.*
Above: *Assembling the SGP 1-1 at Todd Field. From left to right: Aaron Yellott, Ernie Schweizer, Bill Schweizer (in the seat), Paul Schweizer, Atlee Hauk.*

shock cord, or bungee. A glider launching bungee consists of a multitude of rubber strands making a rope a little less than an inch in diameter and 150 ft long, enclosed and protected against wear in a braided cotton covering that extends with the rubber as the cord is stretched. A 2 in. steel ring is fastened at the centre of the cord and attached to an open hook on the nose of the glider, free to fall off as soon as all the tension has gone from the rubber.

Papa surely must have known, from Joe, what we were up to, but probably neither of them expected that we would finish the glider. When at last he did come to the hay loft in the barn, when the glider was almost completed, he said nothing at all. We took this to mean that if he did not actually support us, at least he had no objections. We completed the glider and took it out for our first flights on 19 June 1930. Quite a large crowd of local people came to watch, and our adventures were reported in the local newspaper, the *Peekskill Evening Star*.

With the bungee stretched out in the form of a V, three or four kids took hold on each side and one or two held the rope attached to the tail of the glider. At a signal, those pulling on the cord started to walk out and then ran, stretching the shock cord. At the appropriate time the pilot called for the tail holders to release, and the glider would shoot forward, like a slingshot. The pilot had to brace his head against the headrest so that it would not jerk back when the tail was released. On the early launches the shock cord was only stretched sufficiently to enable the glider to slide along the ground on its skid for a short distance, maybe rising into the air very slightly. This gave enough airflow over the control surfaces for them to work, and the learner developed some feel for them. The ailerons could be used to keep the wings level and the rudder for keeping straight. Since all of us did a lot of sleigh riding, it took a while to get used to the reverse action of the rudder bar compared with the sleigh steering bar.

As we learned to control the glider in a ground slide, each launch was increased in tension so that we would get five or ten feet off the ground, flying forward a hundred feet or so. We then had to master the elevator.

All of these early flights were made from a small field on the Enoch J. Tompkins estate near the Schweizer home. Successful hops were made, but one resulted in some damage, without harm to the pilot. Bill Yellot had urged his more conservative brother Aaron to pull up higher. Aaron did so and the glider stalled, descended sharply to the ground and had to be returned to the barn for repair. After the mishap, Ernie put a restraint on the elevator control to prevent the less experienced from getting the stick too far back during their early flights.

As our skill improved we moved operations to Todd Field. None of the club members had a driving licence, so to transport the dismantled glider we built a wooden framed dolly with motorcycle wheels, and dragged it by hand. The trailer had no licence, but a sympathetic policeman who was passing helped us to tow it to the field. Now we were able to make higher and longer flights, but it became difficult to get enough kids to pull the shock cord. Todd Field was farther from town, and the novelty was wearing off. It was hard work for the bungee crew, who began to lose interest at the very time we needed them more, since we wanted to be launched to higher altitudes.

Ernie then got his driving licence and the rest of the club members learned to drive on the flying field, so we changed to a combination of shock cord and auto-tow, using the car to stretch the rubber. Flights of 50 ft altitude and 500 to 700 ft in length were possible. It took a lot of effort for a short time in the air, but it was flying, it was fun and our enthusiasm continued. To pay for using the field we helped the farmer, Les Sebold, take in his hay that summer.

On one flight one of the welded joints holding the main controls failed and Ernie, who was flying at the

Top: *Paul Schweizer in the SGP 1-1 Primary. Note the rope on the tail for holding the glider back during the first phase of shock-cord launching.*
Above: *The Schweizer SGP 1-1 after it was repaired and the fuselage faired with fabric in 1931*

TOP: *Bill, Paul and Ernie with the replica SGP 1-1 in 1989.*
ABOVE: *Paul A. Schweizer flying the replica SGP 1-1 at Elmira/Corning (Chemung County) Airport.*

The replica SGP 1-1 in its final resting place in the National Soaring Museum on Harris Hill.

time, suddenly had neither ailerons nor elevator. Fortunately he was able to get the glider down safely. He was anxious after this to learn how to weld.

When the summer vacation ended, Ernie entered the Guggenheim School of Aeronautics at New York University (N.Y.U.) to study aeronautical engineering. Before the economic crash Papa had talked about sending us boys to the Zürich Technical Institute, the leading engineering school in Switzerland, but his losses in 1929 made this impossible.

The rest of the club members returned to high school or grade school. We did not fly the primary again until the Thanksgiving Day weekend. The day after Thanksgiving was very windy and we should have stayed at home, but we were so eager to fly that we went anyway. The wind was so strong that we could fly the glider like a kite on strings, not needing the bungee, but on one of these flights a side gust caused a wing to strike the ground and the glider broke up around me. I was unhurt.

We rebuilt the primary during the winter and spring. To improve its performance we enclosed the fuselage with some light structure and fabric covering. It became a secondary glider, and we designated it SGU 1-1A. We flew it in the summer of 1931, making flights from Todd Field over a stone wall into a nearby pasture that was about 50 ft lower. Flying ended for the year after the second time we hit the wall, and the damaged 1-1A was put in the barn loft. It was left there, and was still there when father sold Bonnie Brook in 1945. Soon after it was destroyed when the barn burned down.

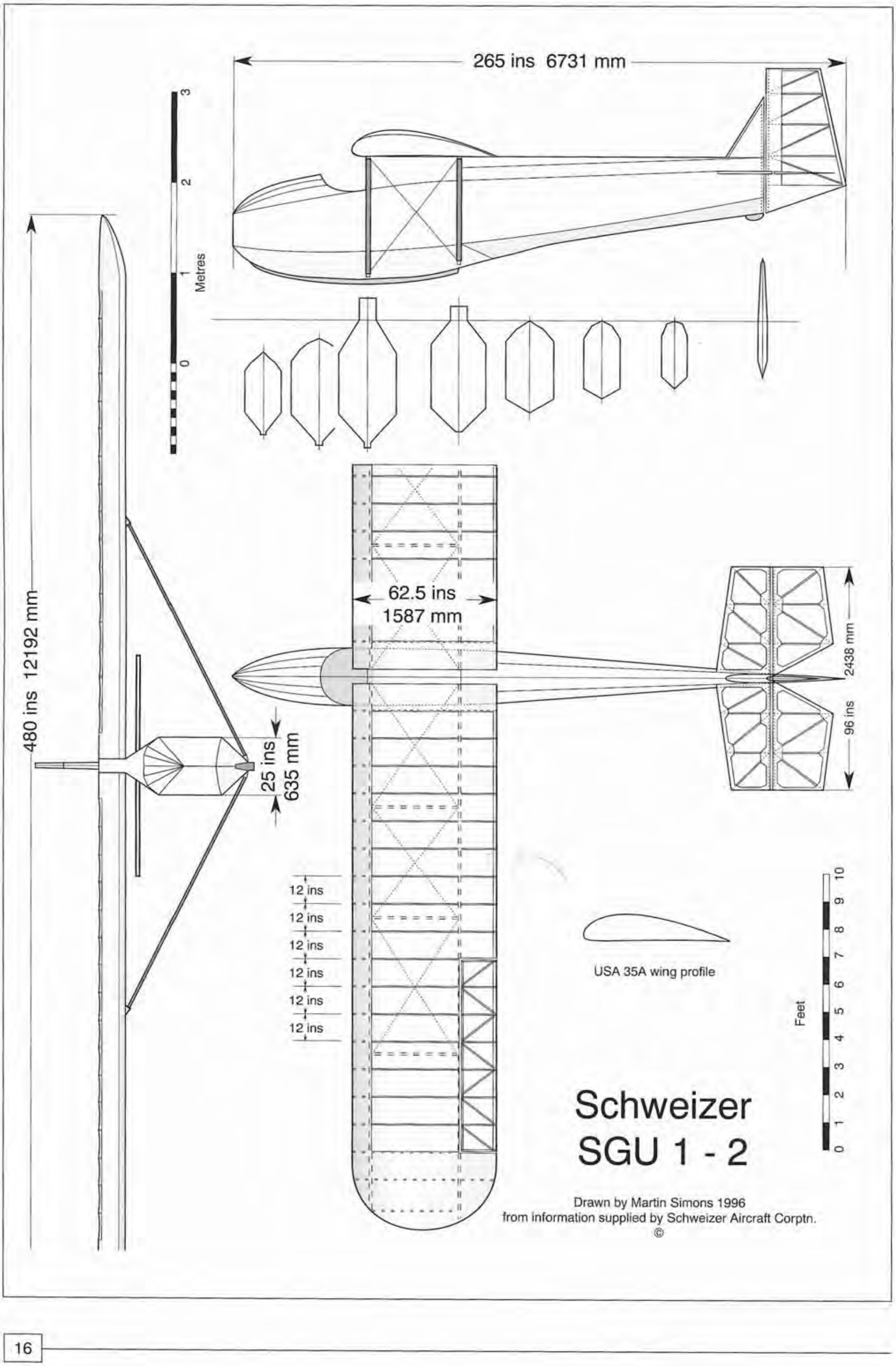
That is not quite the end of the story of the SGP 1-1. In 1989 Schweizer Aircraft Corporation celebrated fifty years since incorporation, and fifty-nine years after the first few hops of the Schweizer's primary glider, a full-scale flying replica was built. The original plans had been lost, but Ernie redrew them from memory and the second SGP 1-1 was constructed by a group of fifty volunteers from the Schweizer plant, which stands now on the edge of Elmira/Corning Airport. After completion the new primary was granted an experimental licence by the Federal Aviation Administration (F.A.A.) and was flown on the airport by myself and Bill, who had helped make the original, and afterwards by three younger members of the family. It was then taken to Harris Hill and hoisted into position in the National Soaring Museum, where it remains on exhibition.

Schweizer SGP 1-1

Total number built: 2

Specification

Span	32.1 ft	9.78 m
Length	18.17 ft	5.54 m
Wing area	160.5 ft^2	14.9 m^2
Aspect ratio	6.44	
Aerofoil section	Clark Y	
Empty weight (est.)	200 lb	90.7 kg
Pilot weight	180 lb	81.6 kg
Flying weight	380 lb	172 kg
Wing loading	2.30 lb/ft^2	11.23 kg/m^2


265 ins 6731 mm
Metres
0
1
2
3
480 ins 12192 mm
25 ins
635 mm
62.5 ins
1587 mm
2438 mm
96 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
USA 35A wing profile
Feet
0
1
2
3
4
5
6
7
8
9
10
Schweizer
SGU 1 - 2
Drawn by Martin Simons 1996
from information supplied by Schweizer Aircraft Corptn.
©

SGU 1-2
'Yellow Peril'

We missed the first National Soaring Contest held at Elmira in 1930, because we did not hear about it in time. We learned later how the famous visiting German pilot, Wolf Hirth, had made a flight of 33 miles using thermal upcurrents, but at the time very few people understood how this had been done.

In the summer of 1931 the second national meeting was organised, again at Elmira. We were eager to go, and drove the 230 miles in the family Ford. The event was based at Caton Avenue Airport, where there were facilities for auto-towed launching, but most soaring flights were done from sites high on the various ridges in the surrounding district. Sailplanes and bungee launching crews were taken to whichever slope faced the wind at the time. The South Mountain ridge, a mile south of the airfield, was the most used.

The contest gave us our first chance to see other gliders. Five of them were true sailplanes capable of extended soaring flights, and the rest were 'secondaries' and 'utilities' which could soar quite well in favourable conditions. We talked with enthusiasts, soaring pilots and designers, and attended the many informal discussions held by the pilots when the wind was not on any of the ridges or was not blowing strongly enough.

There were several accidents. The first occurred a few minutes before our arrival at Caton Avenue, and the ambulance was leaving as we drove up. The wings of a Bowlus sailplane flown by Capt. Phillips had parted from the fuselage as he was trying to land on the airfield after being launched from the south ridge. On his approach Phillips decided to dive to get under some electric wires, and upon pulling up the wings failed. He broke both legs. This, and two later incidents causing serious injuries, impressed on us the need for structural integrity, stability and pilot protection. Ernie took the lead and became the chief proponent of safety in American glider design.

Some ridge-soaring flights of over 7 hrs. endurance were achieved by American pilots, and a cross-country distance of 15 miles was covered by Martin Schempp flying the Schloss Mainberg, a very superior sailplane designed by a graduate of Darmstadt Technical University. Schempp was a German who at this time resided in the U.S.A.[1] These flights increased our enthusiasm, and we returned home eager to get on with our second glider. By this time Ernie had completed his first year at N.Y.U. and was better qualified to design it.

We started the SGU 1-2 as a larger primary, but having seen some of the German types we were impressed with the Haller Hawk's construction. We decided to enclose the basic open fuselage with a mahogany plywood structure to streamline it and to give it the better performance of a 'secondary'. The 1-2 had a 40 ft-span wing with the U.S.A. 35A aerofoil section as used on some of the Bowlus sailplanes. It was an 18%-thick section, which enabled us to use a built-up I-beam spar. This saved weight and material cost but added many hours of work. The fuselage was also more complicated, and was quite heavy because it had the strong primary frame within the enclosing plywood shell.

In September 1931 I started the same aeronautical engineering course as Ernie, commuting daily to the Guggenheim School in the Bronx of New York City. The journey by train took about an hour each way, and we rode in first-line New York Central coaches which had upholstered, comfortable seats so that we were able to do school work *en route*. The pleasant N.Y.U. Heights campus was separated from the surrounding apartment buildings of the Bronx and included the original Hall of Fame with its colonnade around the Gould Memorial Library, where we could study when not in classes.

There was an N.Y.U. Glider Club. Ernie and I were not members, but we joined in some of their activities. The club, operating from fields around the outskirts of the city using bungee and auto-tow launching, had an Evans all-steel primary glider. On the ROTC Field Day the club flew the Evans primary from the Ohio Field football field. Although the club had bought a Bowlus Paper Wing sailplane, only one flight was made before it was crashed, without injury to the pilot.

Papa did not remarry, and was anxious to start his own restaurant in the country so that he could spend more time with his children. In 1932 he sold his interest in the Carnegie Hall restaurant and started the Bonnie Brook Restaurant on the ground floor and large verandah of our home. All of the Schweizer children, when available, were expected to help with the work there. The economic depression was still on, and we learned to do without many things.

Progress on the SGU 1-2 was very slow, partly because we had little time to spare but mainly because the structure was so complicated. It was still unfinished by the summer of 1932, when the third national contest was held at Elmira. We made our pilgrimage but had nothing ready to fly. On

The only surviving reproducible photograph of the SGU 1-2 'Yellow Peril', in 1935.

returning home we decided to build something easier, since we felt that we could finish it much sooner than going on with the 1-2. This proved a wise decision. We returned to the 1-2 after completing and flying the 1-3, and flew it at last in the summer of 1934. Having the other aircraft now, we did not use the 1-2 much until we took it to the Nationals. The contest had by now been moved to a permanent location on Harris Hill, but we flew the 1-2 at the old Caton Avenue Airport, which was not being used and was soon to become a housing development. We used auto-towing for launching. Herb Sargent, a classmate at N.Y.U. and a member of the N.Y.U. Glider Club, did the test flying, and the results were not encouraging. The ailerons were not effective enough and the general handling was sluggish. We never did determine the reason for the poor flying qualities, but each one had his theories. We all took turns carefully flying it, and confirmed Herb's reactions. Furthermore, the 1-2 did not have a wheel. It was hard work dragging it back to the take-off point after each flight.

We had used war-surplus Navy Yellow dope to paint the glider, with black registration numbers. Someone called the 1-2 the 'Yellow Peril', and the name stuck. When we returned to Peekskill it became a 'hangar queen'. The 1-3 was a lot more fun to fly and easy to handle on the ground, so we used it much more. The 1-2 was given to Doug Warner, a young soaring enthusiast from Middletown, New York, but he did not do much flying with it.

[1] Schempp and Hirth in Germany later founded the Schempp-Hirth Company, which is still one of the world's leading producers of motorless aircraft.

Schweizer SGU 1-2

Total number built: 1

Specification		
Span	40 ft	12.19 m
Length	22.08 ft	10.43 m
Wing area	197 ft^2	18.3 m^2
Aspect ratio	8.12	
Aerofoil section	U.S.A. 35A	
Empty weight (est.)	275 lb	125 kg
Pilot weight	180 lb	81 kg
Flying weight	455 lb	206 kg
Wing loading	2.31 lb/ft^2	11.28 kg/m^2
Estimated best L/D	1 to 10	

SGU 1-3 'Brick'

At the third National Soaring Contest, in 1932, we had been impressed by the Franklin and Baker McMillan Cadet utility gliders, which were simple and practical. We learned a lot about how to make a glider lighter without losing strength. Back at home we decided to go ahead with a small, light and practical glider. We could complete the 1-3 in much less time than the 1-2.

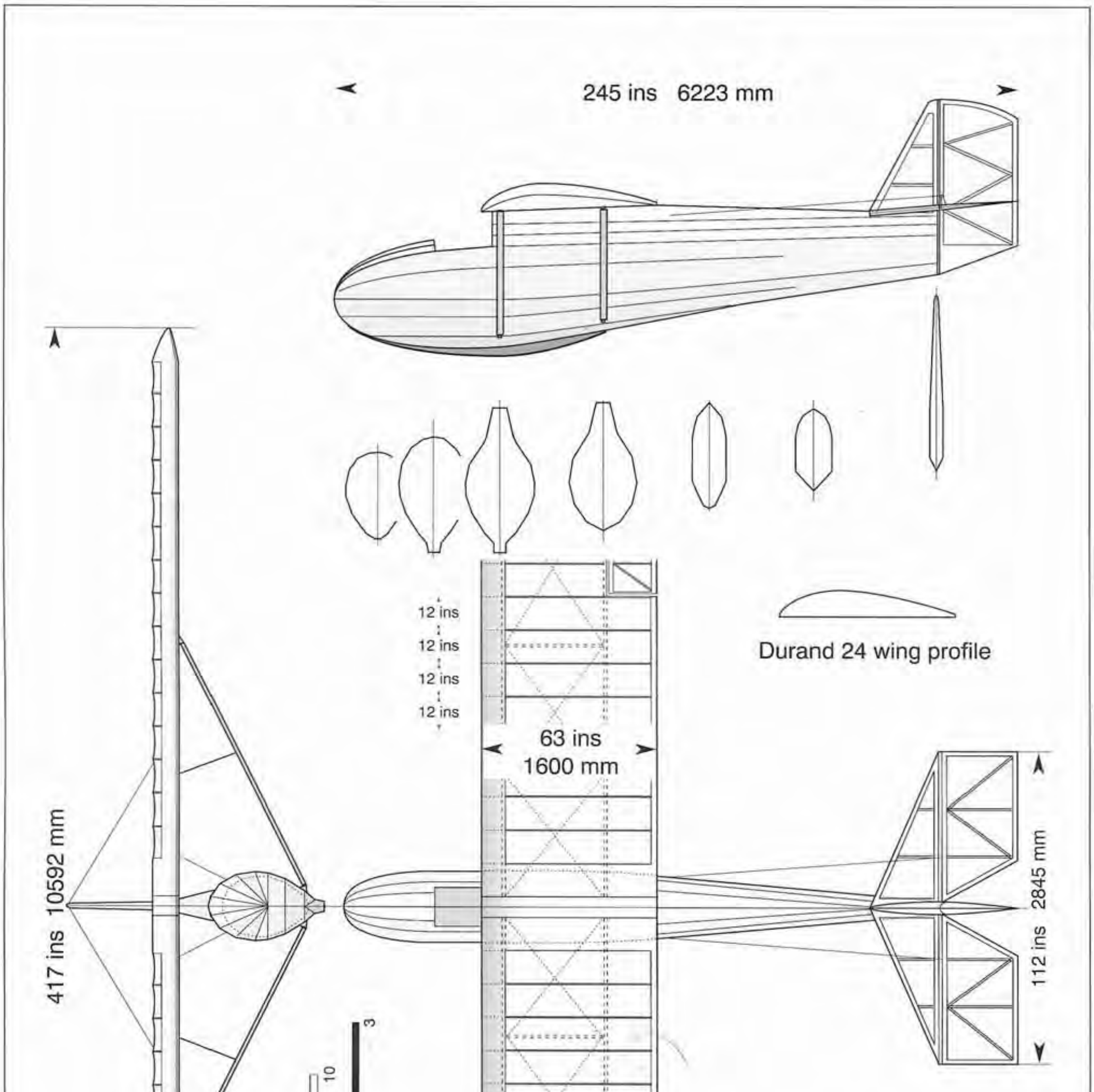
We decided on a span of 34 ft 9 in. and an area of 180 sq ft. This would give us a wing loading a little less than the 1-2 and save about 50 lb, so the new glider should be easier to drag around the field, even though it lacked a wheel. Ernie chose the Durand 24 aerofoil section for the wing, the same profile used on the Mead glider. It was intended for propeller blades and had a flat bottom, which made the ribs easier to build. Ernie now had a welding torch and had learned how to use it, so we could employ more welded parts and simplify the design further. We used more standard aircraft hardware, since we now knew what was available and where to get it.

The 1-3 had twin wing struts, since these had worked well on the SGU 1-1. The fuselage was basically similar to that of the primary, but we enclosed it with a light fabric-covered fairing that was much lighter than the plywood skinning we were using on the 1-2. We painted the fuselage red with a wide silver stripe along each side. The leading edge of the wing was red, and aluminium dope was applied to the fabric-covered areas.

We first flew the 1-3 in the summer of 1933, and it flew nicely and handled well in the air. To get higher and longer flights we took it to the old Poughkeepsie Airport and later to Stormville Airport. We built a trailer so we could easily tow the glider with the family car. By using auto-towing we were now able to launch to heights of 400 or 500 ft and make 360-degree circuits, landing in the same direction as we had taken off. We had a lot of good flying with it.

The 1-3 handled well, but if flown too nose-down it descended like a brick, without picking up much forward airspeed. The sharp leading edge of the

The SGU 1-3 at the Tompkins estate at Peekskill, New York.


245 ins 6223 mm
417 ins 10592 mm
12 ins
12 ins
12 ins
12 ins
63 ins
1600 mm
Durand 24 wing profile
112 ins 2845 mm
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
Schweizer SGU
1 - 3
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©

Durand section no doubt caused a lot of drag, so we named the SGU 1-3 the 'Brick'. We wished we had put a wheel on it, for it would then have been about equal to the Utilities we had seen at Elmira. Finally we sold it to the Hudson Valley Glider Club, which we had formed and of which we were members. For three years the club flew the 1-3 at Wurtsboro Airport, New York, where there was a ridge and where we hoped to get our first soaring flights.

Ernie graduated from N.Y.U. as an aeronautical engineer in June 1934. He endeavoured to find a job in aero-engineering, but the depression continued, the U.S. aircraft industry was very small and nothing was available. He therefore stayed at home and worked in the restaurant, continuing design and construction work in the barn when he could. Papa needed all the help he could get, so gliders and gliding did not get much attention for a time.

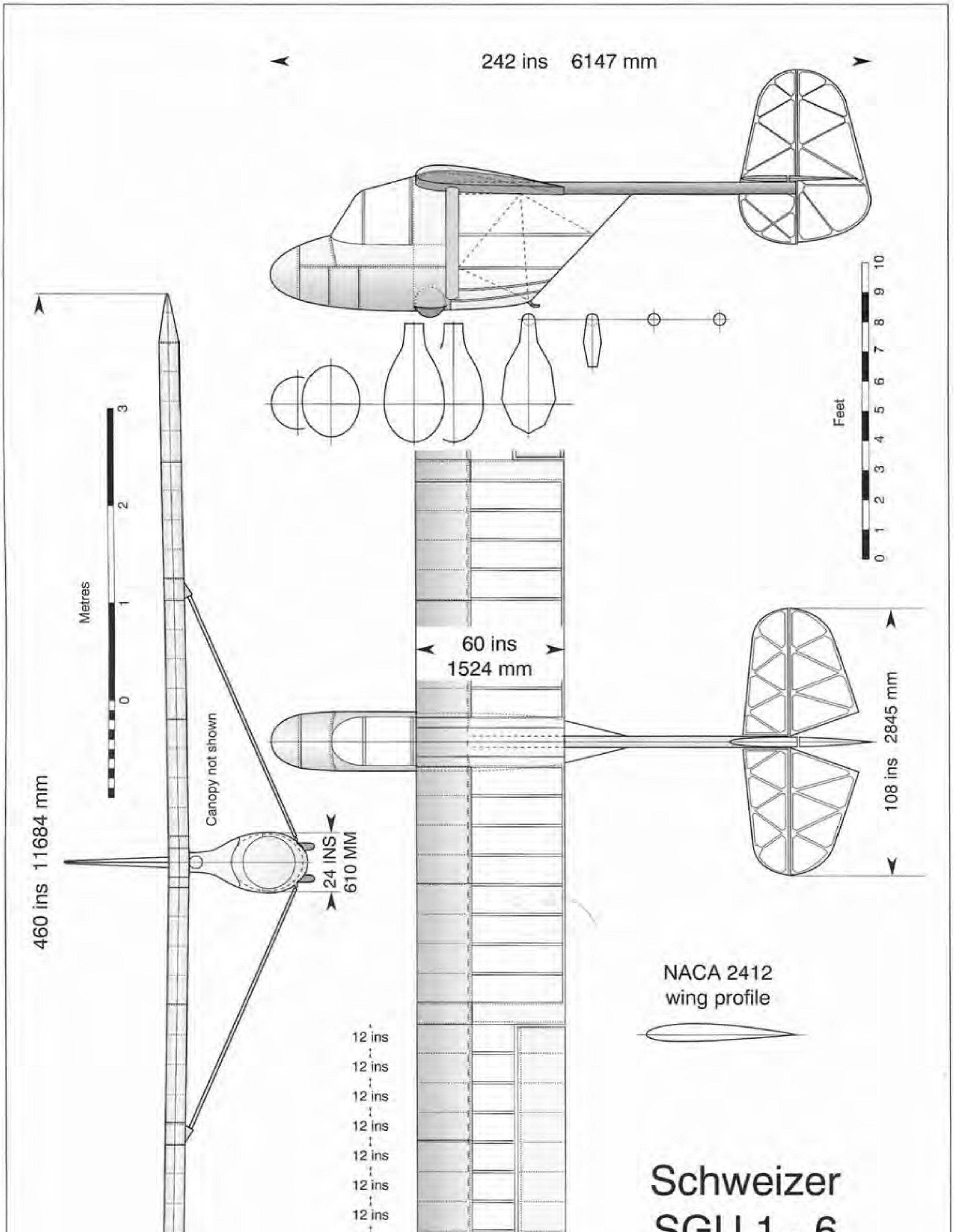
Schweizer SGU 1-3

Total number built: 1

Specification

Span	34.75 ft	10.59 m
Length	20.42 ft	6.22 m
Wing area	180 ft^2	16.7 m^2
Aspect ratio	6.7	
Aerofoil section	Durand 24	
Empty weight (est.)	225 lb	102 kg
Pilot weight	180 lb	81 kg
Flying weight	405 lb	183.6 kg
Wing loading	2.25 lb/ft^2	10.98 kg/m^2
Estimated best L/D	1 to 10	

Top: *The 1-3 at Todd Field at Peekskill.*
Above: *The 1-3 at Wurtsboro.*



242 ins 6147 mm
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
60 ins
1524 mm
108 ins 2845 mm
Canopy not shown
460 ins 11684 mm
24 INS
610 MM
NACA 2412
wing profile
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
Schweizer
SGU 1 - 6
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©

SGU 1-6
'Boom-Tail'

By 1935 both Ernie and I had graduated as aeronautical engineers. With no prospect of jobs in the aircraft industry, we started to think about producing gliders commercially. We knew that we would have to improve on the 1-2 and 1-3 if we were to have something that would sell. We made a yearly pilgrimage to Elmira to attend the National Contests and keep up to date on sailplane development. It seemed to us that the soaring movement needed a good, low-priced utility glider. Ernie did some preliminary work on what would have become the SGU 1-4 and SGU 1-5, if we had ever built them, but we never did. Little information on these two designs, which never left the drawing board, was preserved.

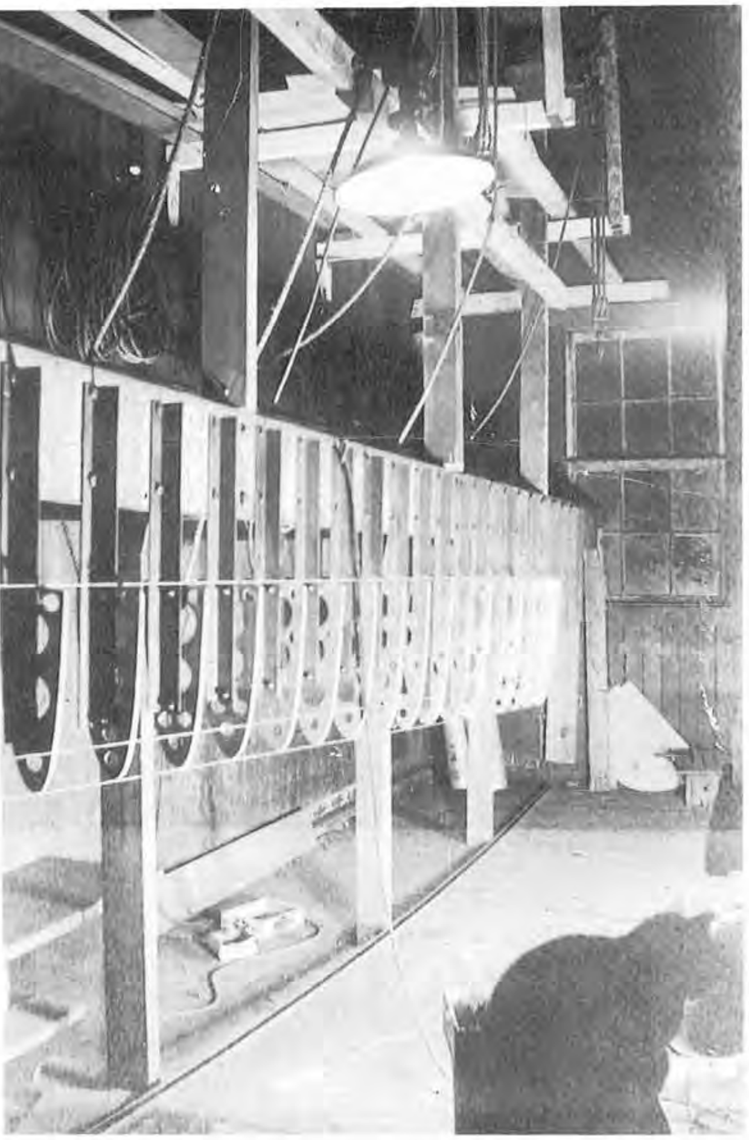
During our time at N.Y.U. we had the opportunity to visit a number of aircraft manufacturing plants, including the EDO plant which produced all-metal floats for seaplanes. This was our first opportunity to see an aircraft sheet-metal production shop and the heat treatment of aluminium alloy in a vertical salt bath. A while later, when the Douglas company sold some DC-2s to the Dutch airline KLM, we saw the insides of the aircraft while they were being dismantled at the old North Beach Airport to be sent by ship to Holland.

Our exposure to all-metal construction, and the experience we gained at college in our senior year project, designing a single-engine transport metal aircraft, convinced us that metal construction was the way to build gliders. Wood and glue, we decided, were not what the soaring movement needed for the future. Aluminium technology was advancing. We studied the newest techniques carefully, but they required big investments in machinery and tooling, making it unlikely that we could use them.

Ernie began to work out ways of constructing metal aircraft without heat-treating and other expensive equipment. By building our own simple drop hammer we would be able to form metal parts such as wing ribs and fuselage frames from sheet metal. This was made possible by the new aluminium alloy 52 S in 'quarter-hard' form that did not require heat treatment, since it became work-hardened in forming.

Instead of using rivets, which required a compressor and rivet guns, we decided to use Parker Kalon plated-sheet-metal self-tapping screws for attaching skins to the wing structure. The lack of vibration made these screws practical for gliders, and later they were approved by the Civil

Ernie Schweizer and the SGU 1-6 sailplane at the 1947 National Contest at Harris Hill where it was entered in the Eaton Design Contest.

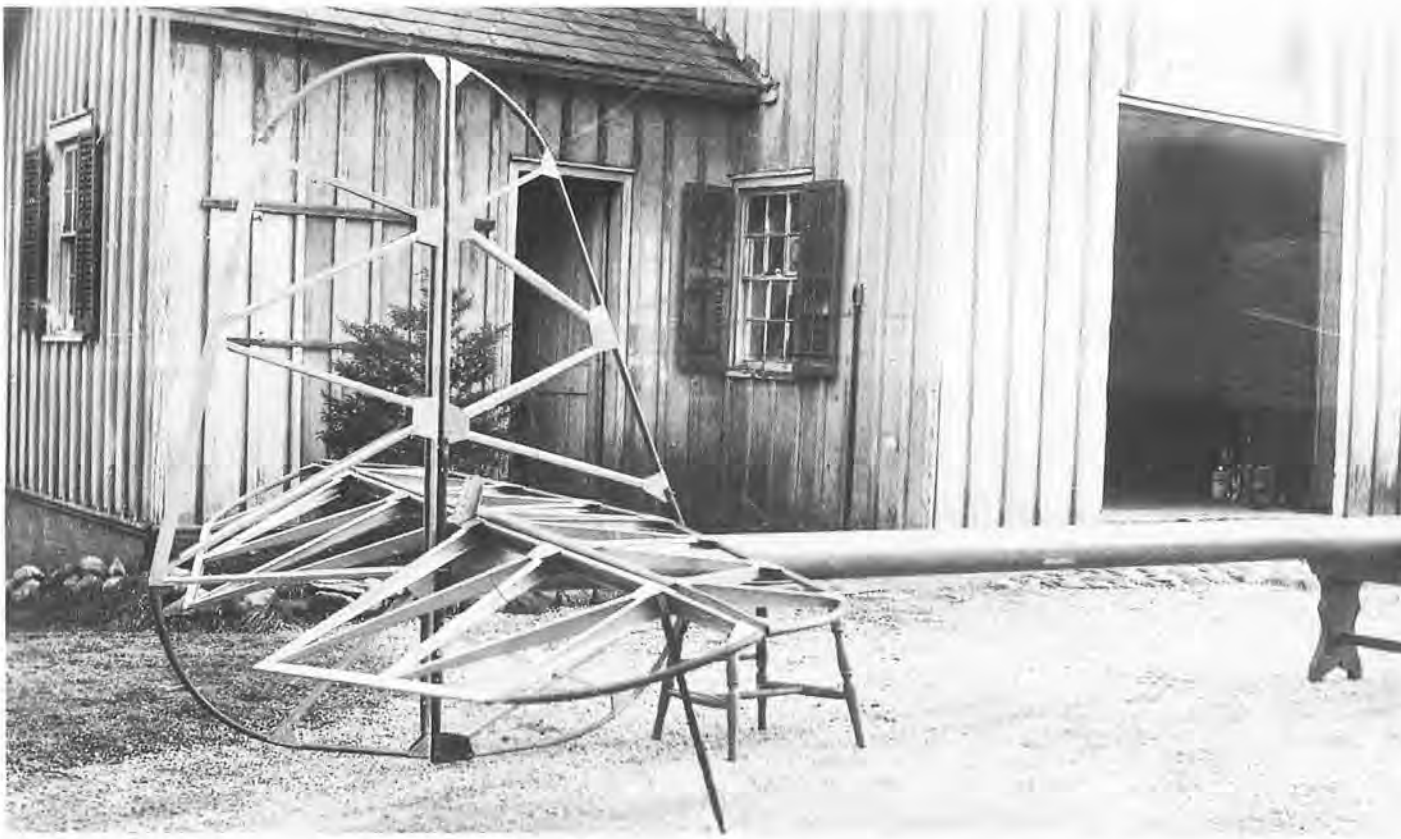


Aeronautics Administration (C.A.A.). For heavily stressed joints we could use hand-set 53 SW rivets, or steel aircraft bolts. Space framing of welded steel Chrome Moly 4130 tubing with fairings and fabric covering would make a practical, easily repaired fuselage structure.

In late 1936 we learned that Mrs Warren Eaton, the widow of the founder of the Soaring Society of America (S.S.A.), was sponsoring a design contest with $1,500 in prizes for the best three sailplane designs. Any aircraft entered had to be flying in the Nationals in July 1937, when the judging would be done. The formal requirements of the competition were announced at the January S.S.A. directors' meeting. Drawings and stress calculations were required to be presented with the sailplane, which also had to compete in the Nationals, and 40% of the marks would be allocated on the basis of success in the flying contest. This naturally gave a big advantage to higher-performance aircraft. Although not entirely encouraged by this rule, we understood that the S.S.A. was looking for an easily-built kit sailplane for training and club flying, and we reckoned our likely market lay there. Such an aircraft could form the basis for the growth of soaring in the U.S.A., replacing the old Franklin Utility gliders which had, so far, been in most wide-

LEFT: *The SGU 1-6's wing-leading-edge jig in the horse stall of the barn..*

BELOW: *The centre-section of the 1-6 fuselage outside the barn.*



The SGU 1-6 tail-boom and uncovered tail surfaces.

spread use but were now out of production.

The design competition gave us the incentive to go ahead with an all-metal utility sailplane along the lines we had been thinking about. We proceeded full speed with the SGU 1-6. This was all metal except for fabric covering on the tail surfaces and some portions of the wing and fuselage. As far as we knew, it was the first all-metal sailplane in the world. It had a 'pod-and-boom' fuselage layout, and a wing of rectangular plan with rounded tips. There was a single main spar, braced with a strut on each side. Ahead of the spar, sheet ribs, formed by the drop hammer, supported the aluminium sheet skin forming the 'D-tube' nose. The aft section of the wing and the ailerons were fabric covered. After much study of official wind tunnel reports, Ernie chose the NACA 2412 aerofoil section. The fuselage pod containing the cockpit was of sheet metal, with a rear section of welded steel tubes to which the aluminium tailboom was attached and braced. We expected that the metal nose section would provide good protection for the pilot in the event of an accident.

The availability of aircraft aluminium from warehouse stock was very limited when we came to place our order, but the Aluminum Company of America was very co-operative in running 53 ST alloy extrusions for our one little aircraft, a set of wing spar caps, the tubular tailboom and the struts. We also needed small quantities of 52 S material sheet in quarter-hard, half-hard and fully-hard tempers.

As construction progressed we were pleased with the way the metal design worked out, but we realised as we went along that the 1-6 was too complex and labour intensive to be a successful production or club kit sailplane. Before we had gone very far we had already begun to think of the 1-7, which had to be simpler and cheaper. Could we get two entirely new gliders built by July?

An unusual feature of the 1-6 fuselage was the two-wheeled landing gear mounted within the fuselage shell. It was expected that this would simplify ground handling by enabling the 1-6 to be moved about without anyone holding the wingtip. This undercarriage worked well with a pilot in the cockpit, but because the contact points of the two wheels and the skid at the rear end of the pod were too close together, the empty glider waddled like a duck when towed. Someone had to be at the wingtip after all.

The 1-6 was completed ahead of schedule in May. All the metal skin was left in natural aluminium finish, and the fabric areas were painted in aluminium dope. Eight gliders had been entered in the design contest, including our 1-6 and the 1-7, which we hurried along. Both were taken to Wurtsboro Airport, across the river from Peekskill, and successfully test-flown by Emil Lehecka. They returned to Peekskill for final adjustments to get them ready for Elmira.

Ernie and I had done little soaring at that time, so we we wanted an experienced pilot for the 1-6 in the Nationals. Jack O'Meara, the 1932 Champion, did not

Emil Lehecka takes off in the SGU 1-6 without the cockpit canopy, at Wurtsboro.

have a glider and was looking for something, although he wanted a sailplane with better performance than the 1-6. Nonetheless, he came to see it and mentioned that Hawley Bowlus in California was also working on a boom-tail sailplane. He wanted us to know that Bowlus was not copying our ideas.[2] We were able to get Charlie Tubbs to pilot the 1-6 in the Nationals. Points were scored for all kinds of flying, including duration achieved by simple hill soaring, gains of height above the launch, and cross-country distance. With a simple handicapping system there really was a chance for everyone to score, even in a glider of moderate performance. This was the contest in which Peter Riedel, another well known German pilot, scored the highest number of points in the very fine Sperber Senior that was sent to him from Germany, but we were pleased that Charlie was placed ninth, a good result for a training type of sailplane competing against some much more advanced aircraft.

To our pleasure the 1-6 won third place in the Eaton Design Competition. The $300 that we received gave us a big boost and helped us on our way into the glider manufacturing business, but we really thought the 1-7 was a better, more generally useful, utility sailplane.

The winning design was the ABC sailplane entered by Art Schultz. It had a steel-tube-framed fuselage with fabric covering, but the strut-braced wing was of orthodox wooden construction with beautifully curved tapering tips, like those of some of the well-known European sailplanes. Built by the ABC Glider Club in Detroit, it was larger, with a span of 48 ft 6 in., and much more complicated than the 1-6, with a better performance, and was never intended as an elementary trainer. Second place went to Harland Ross for the high-performance Ross-Stephens RS-1, all wooden and of advanced aerodynamic design.[3] It had a gull-shaped wing of high aspect ratio and high wing loading, was fast and was certainly the best sailplane produced in America at that time, perhaps as good as some of the German imports. Both of these were excellent sailplanes, but not the type needed to expand the sport of soaring at club level.

We had no intention now of trying to produce the 1-6 in quantity because we knew it would be too costly. The SGU 1-6, which was called the 'Boom Tail', was sold to the Harvard Glider Club. The last we heard of it was that when the Second World War started it was stored in a barn somewhere in New England. Perhaps it is still there!

[2] This Bowlus design was the Baby Albatross, which flew in the following year, became very well known later and was produced as a kit in some quantity. O'Meara flew the prototype in the 1938 Nationals.

[3] It later became known as the Zanonia and still exists.

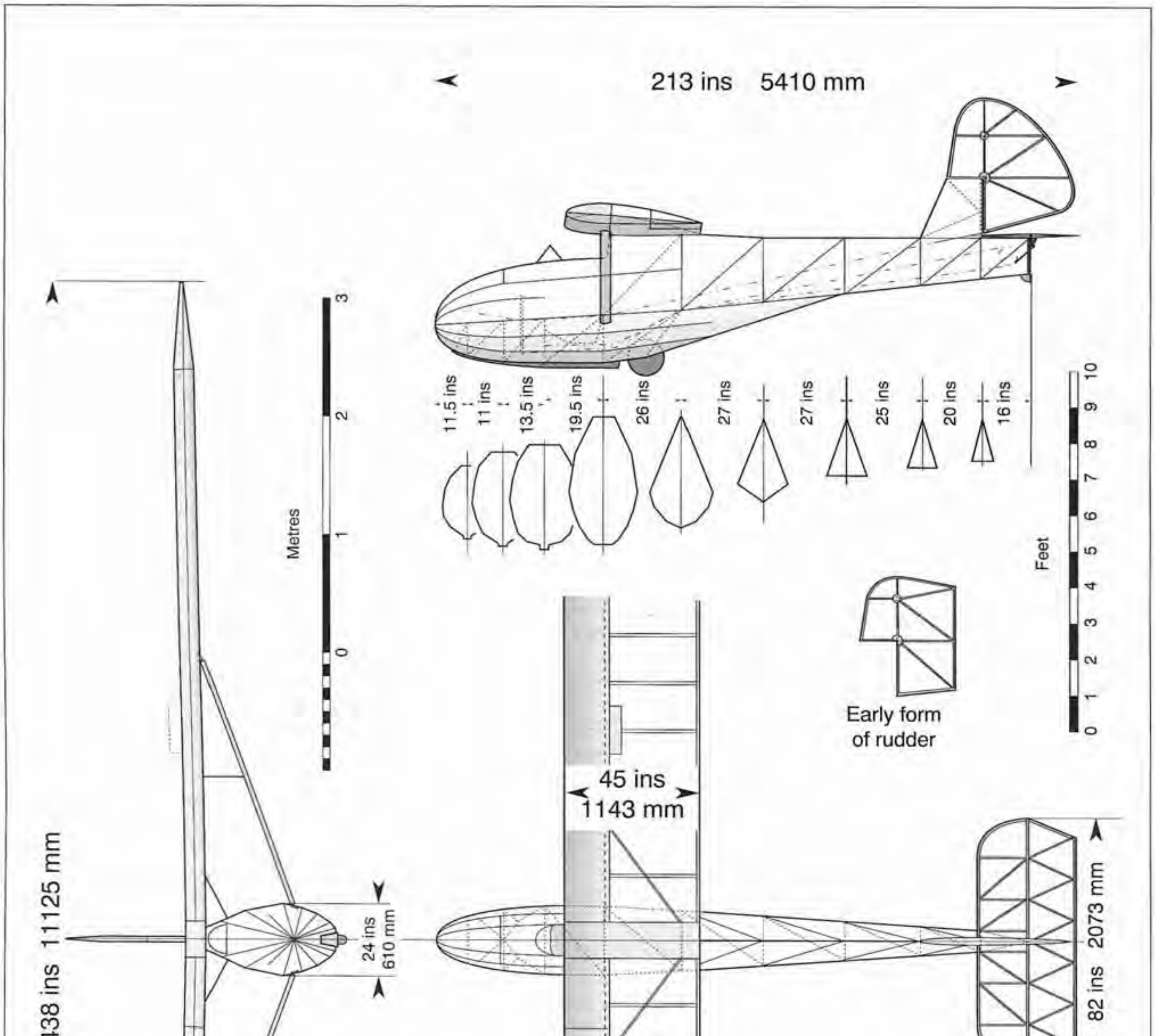
Schweizer SGU 1-6

Total number built: 1

Specification

Span	38.33 ft	11.68 m
Length	20.17 ft	6.15 m
Wing area	170 ft^2	15.8 m^2
Aspect ratio	8.5	
Aerofoil section	NACA 2412	
Empty weight (est.)	243 lb	110.2 kg
Pilot weight	180 lb	81 kg
Flying weight	473 lb	214.5 kg
Wing loading	2.8 lb/ft^2	13.67 kg/m^2
Estimated best L/D	17:1	
Minimum sink rate	3 ft/sec	0.9 m/sec

Ernie thinks things over after a young spectator asks a question.


213 ins 5410 mm
438 ins 11125 mm
24 ins
610 mm
Metres
0
1
2
3
11.5 ins
11 ins
13.5 ins
19.5 ins
26 ins
27 ins
27 ins
25 ins
20 ins
16 ins
Feet
0
1
2
3
4
5
6
7
8
9
10
Early form
of rudder
45 ins
1143 mm
82 ins 2073 mm
16 ins
16 ins
16 ins
16 ins
12 ins
12 ins
12 ins
12 ins
24 ins
24 ins
24 ins
24 ins
24 ins
NACA 2415
wing profile
Schweizer
SGU
1 - 7
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©

SGU 1-7

While building the 1-6, Ernie became convinced that he could do better still. The SGU 1-7 was much simpler to make, and we felt that we should be able to finish both aircraft in time for the Eaton design competition in July 1937. Time was very short, but with the help of brother Bill, who was still in high school, and friends Atlee Hauck and Ernest Whidden, former members of the Mercury Glider Club, we managed to finish both gliders in good time.

The 1-7, which made its first flight in June, established the design philosophy that was to be used in many later Schweizer aircraft. It had a welded-steel-tube fuselage and a strut-braced rectangular wing of higher aspect ratio than the 1-6, with aluminium skinning for the torsion-resisting D nose. The fuselage, tail surfaces and the aft portion of the wing were fabric covered.

The 1-7 weighed only 230 lb and had a small wheel aft of the skid for easy ground handling. It was a delight to fly, light on the controls and very responsive, and easy to manage on the ground owing to its small size and lightness. The leading edges of the wing were left in natural aluminium finish, and the rest of the sailplane was painted royal blue except for the rudder, which was doped aluminium.

With only 133.5 ft^2 of wing area there was quite a difference in the performance when flown with a light rather than a heavy pilot, and we felt that a 10% increase in area would have been better, but it stayed up well for a utility, and many of us later earned C and parts of the Silver C soaring badges in it.

When the competition judging came at Elmira, the 1-7, which we thought met the aims much better than the 1-6, was not placed. It did not escape all notice, however. Lewin Barringer had become general manager of the S.S.A., and he encouraged his friend Eliot Noyes to get his Altosaurus Ski Club members to take up soaring. Eliot requested a quotation on a 1-7. We offered it at $595, and he was able to get the ski club to order one. This was a big event for us, as it was the first order we had received for a new glider. We were now truly in the aviation business.

Delivery was made to the Altosaurus Soaring Club the following spring, and they named their 1-7 *Pterodactyl*. The members were all Harvard students and first-class skiers, and they taught themselves to fly using the single-seat training method prevalent at

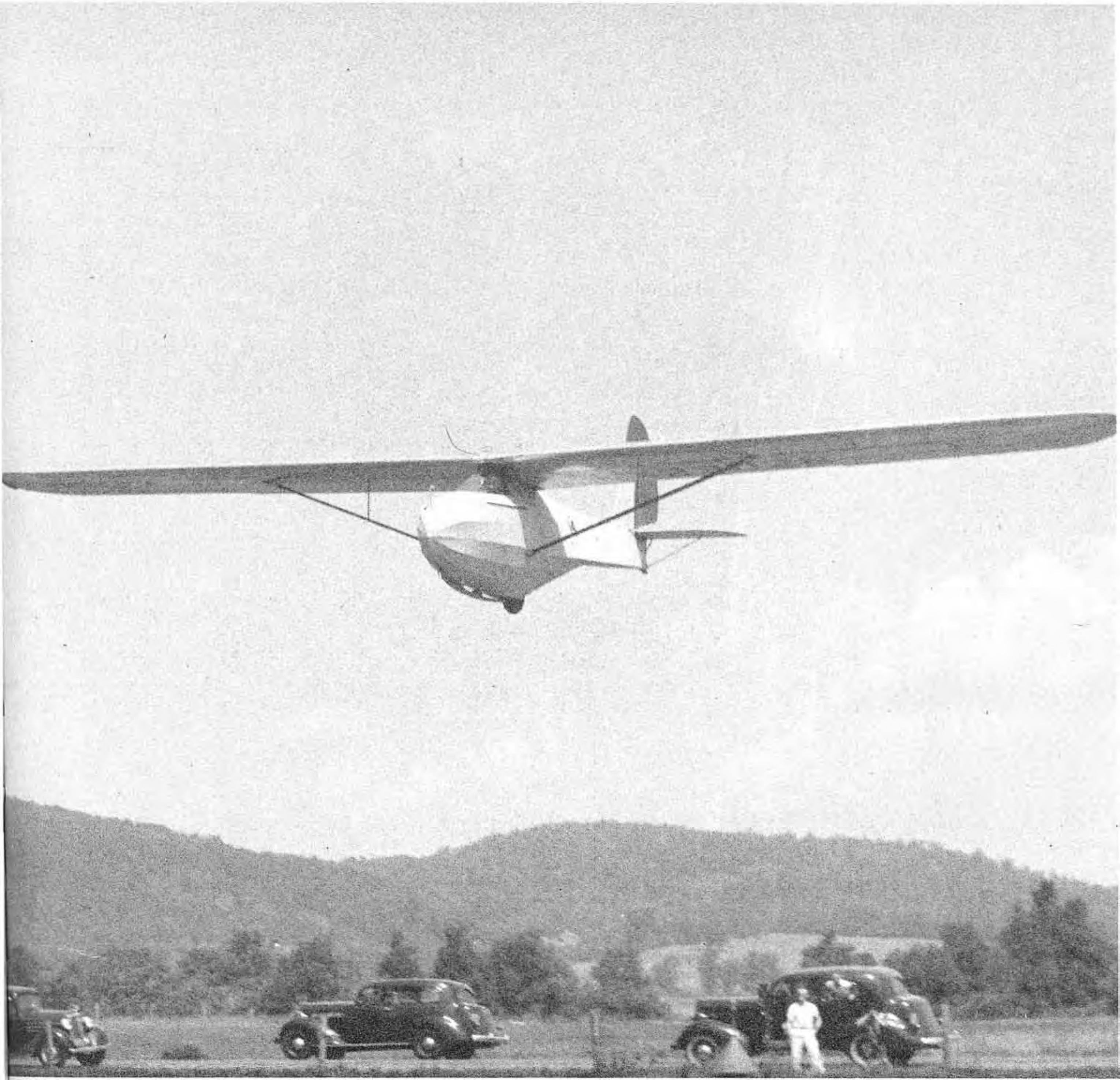
The SGU 1-7 prototype with Paul Schweizer at the 1937 National Competitions at Harris Hill. We felt the 1-7 was a more practical utility glider even than our own 1-6, but it did not win the Eaton design prize.

that time. One of the members was Henry Hyle, who was studying to be a surgeon. He had the misfortune to land *Pterodactyl* in a chicken yard. He brought it back to our barn for repair and stayed with us until the work was completed. He helped us to stitch the fabric on the nose section using his curved surgical needles. *Pterodactyl* had its leading edges in natural aluminium and the rest of the sailplane was doped light cream. The Altosaurus Club had one of their members paint a pterodactyl on each side of the fuselage. They loved the 1-7 and did a great deal of flying with it, but as the members graduated and left university they scattered to the four winds, the club dissolved and *Pterodactyl* was sold. It has passed through many different hands since, but it still exists complete in California. It needs only to be re-licensed in order to fly.

The prototype 1-7, which was named *Cruller*, was sold to the Hudson Valley Glider Club and was successfully used by them for many years. The need for a two-seat training sailplane prevented any further development or production of the 1-7.

Since we had no company status, in 1937 Ernie and I in partnership formed the Schweizer Metal Aircraft Company. It was still during the depression, and we were not paid much for working in the family restaurant. In addition we were still repaying Papa for financing our college education. Nevertheless, we went to the bank to open an account. The vice-president who dealt with us had a wry smile on his face when we gave him our savings of a few hundred dollars to start the company.

TOP: *The fabric-covered, steel-tube-framed fuselage and the metal skinning of the wing leading edge are shown clearly here.*
ABOVE: *The Altosaurus Soaring Club became our first genuine customer, taking delivery of the second SGU 1-7, which they named Pterodactyl. Note the revised rudder shape, which was also used on the prototype after some flying experience.*



The SGU 1-7 landing at the American Airlines Field in Big Flats, N.Y in 1940. (S.A.C.).

Schweizer SGU 1-7

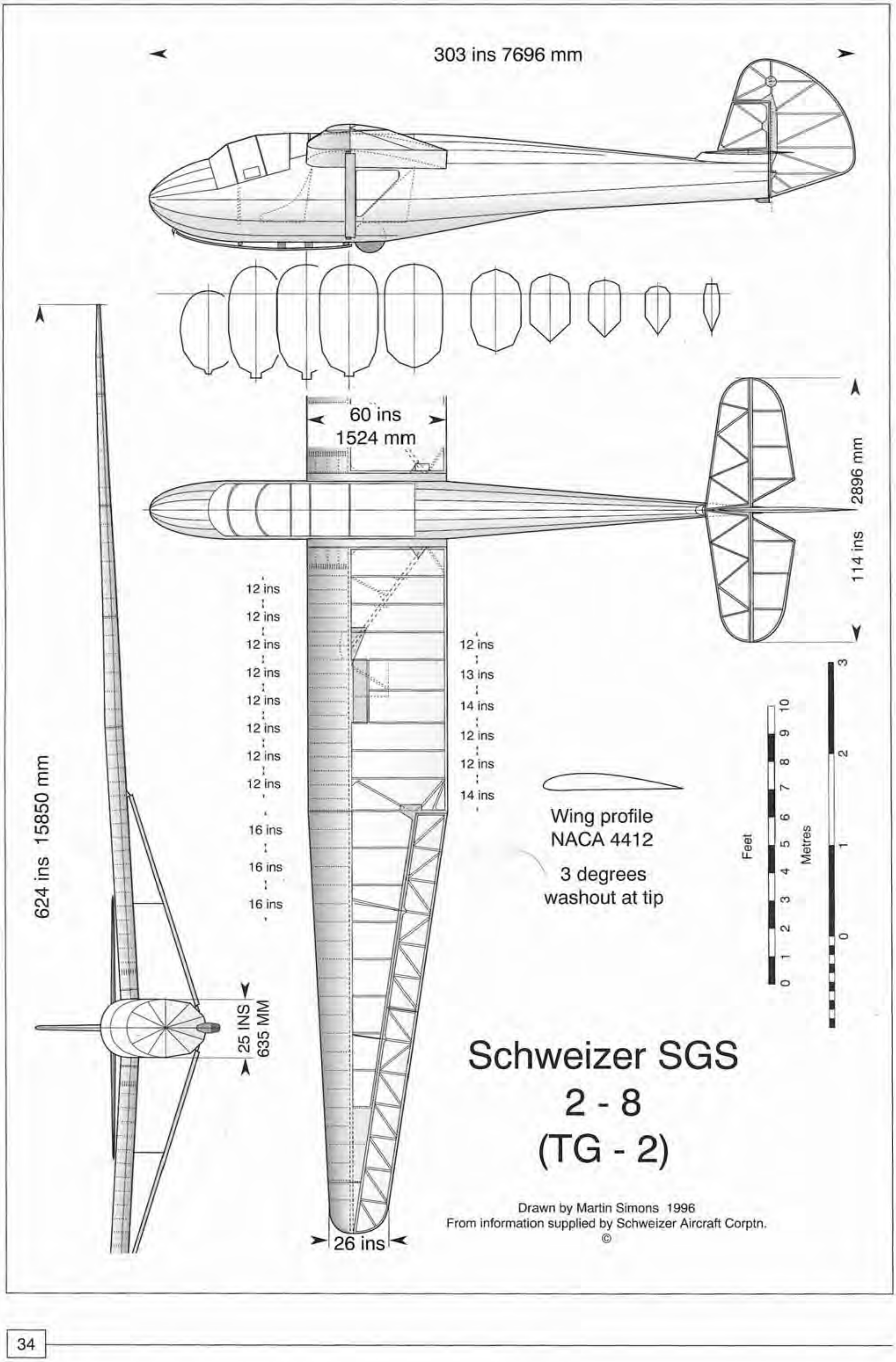
Total number built: 2

Specification

Span	36 ft	10.97 m	Pilot weight	180 lb	81 kg
Length	17.75 ft	5.41 m	Flying weight	423 lb	191.8 kg
Wing area	133.5 ft^2	12.4 m^2	Wing loading	3.2 lb/ft^2	15.62 kg/m^2
Aspect ratio	9.6		Estimated best L/D	17.5:1	
Aerofoil section	NACA 2415		Minimum rate of sink	3.5 ft/sec at 40 mph	1.06 m/sec at 64.4 km/h
Empty weight (est.)	243 lb	110.2 kg			

Above: *Herbert Sargent submits the 1-7 wing to a practical test. It passed safely!*
Below: *The SGU 1-7 sailplane with Herb Sargent on board takes off from a New Jersey gliderport. (Walter B. Lane)*

Above: *The SGU 1-7 at the 1937 Nationals. Note the angular rudder, later replaced.*
Below: *One of the SGU 1-7s at a post-war soaring meeting. In the background are several of our 1-19s, which owed a good deal to the 1-7. A Schweizer 2-12 (TG-3) is also present.*


303 ins 7696 mm
60 ins
1524 mm
2896 mm
114 ins
624 ins 15850 mm
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
12 ins
16 ins
16 ins
16 ins
12 ins
13 ins
14 ins
12 ins
12 ins
14 ins
Wing profile
NACA 4412
3 degrees
washout at tip
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
25 INS
635 MM
26 ins
Schweizer SGS
2 - 8
(TG - 2)
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©

SGS 2-8 (TG-2)

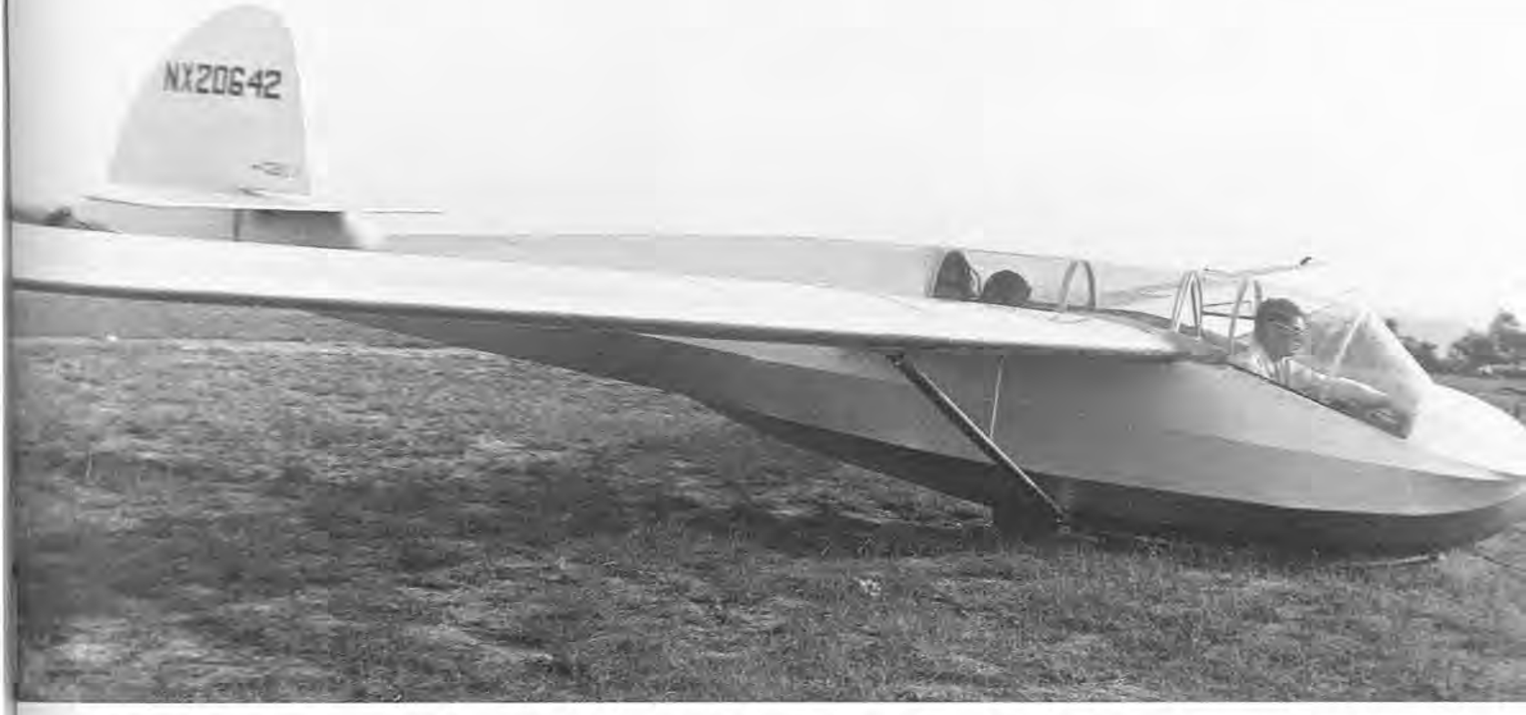
Glider flight training in the 1930s, following the German custom, was mainly done in single-seat trainers. (The methods are outlined in the account of our early days with the SGP 1-1, earlier in this book.) There were a few 'one-of-a-kind' two-seat gliders in the U.S.A., but little routine training was done with them. In the early thirties Frank Gross created the Sky Ghost, a two-seat intermediate sailplane which made a number of excellent duration flights with two people aboard. Other two-seaters flew at Elmira Contests; Stan Smith's *City of Utica* and the Buxton Transporter.

Peter Riedel borrowed a Kranich sailplane from Germany to fly in the 1938 Nationals, and his expert flying showed that two-seat sailplanes could perform almost as well as single-seaters. Once again he earned the most points in the contest, but could not be crowned National Champion because he was not a U.S. citizen. The best flight of the meeting was his goal flight from Harris Hill to Hoover Airport in Washington, D.C. For many of his contest flights he flew solo, the rear seat being empty. A two-seat sailplane has this option, and is in this sense more adaptable than a single-seater.

In the summer of 1937 the Airhoppers Soaring Club from the New York City area asked us to tender a design for a two-seat sailplane for their club. The draft specification we offered was for a moderate-performance sailplane, in effect a two-seat 'utility'. The club, however, wanted to use the aircraft for contest flying as well as training.

We went back to the drawing board. What became the SGS 2-8 was an all-metal, shoulder-wing sailplane with the pilot's cockpit in front and the instructor's seat behind, close to the centre of gravity between the main and rear spars. Solo flying from the front seat was possible without any need for ballast to keep the balance right. The cockpits were fully enclosed by a long, transparent canopy, with hinged portions to allow access. Because the rear pilot had a restricted view, transparent panels were set in the fuselage sides under the wing, which helped a little.

We were influenced by the German practice at that time of using deep-chord ailerons and a large rudder with a small fin. We learned later that this arrangement was not the safest, since clumsy handling of the controls could induce a spin, but it had adequate recovery characteristics.



The prototype SGS 2-8 sailplane owned by the 'Airhoppers' Club. The nose was later lengthened. On this aircraft there was no window below the wing. This was added to later aircraft.

ABOVE: *Schweizers moved to Elmira and occupied the top floor of the Knitting Mills building. At first, components had to be lowered by rope from the upper level, but soon a long wooden ramp was constructed, making things much easier and safer.*
BELOW: *Jack Brookhart after a test flight of the short-nose Airhopper SGS 2-8.*

The wing was of 52 ft span, with a rectangular centre section and tapered outer panels supported by single streamlined steel struts on each side, plus small jury struts for added stiffness. The spars were built up from simple 1.25 in. L-shaped extrusions of 17 ST alloy for the flanges, tapered to reduce weight over the outer sections, with sheet metal shear webs. Reinforcements were added in critical places for the root fittings and strut attachments. The ribs were formed, using our drop hammer, from .020 in.-thick 52 S alloy with vertical stiffeners and lightening holes. Ahead of the spar the torsion-resisting D nose was metal skinned, with fabric covering behind and for the ailerons.

All major structural joints were riveted using 53 SW rivets or aircraft steel bolts. The ribs and metal skins were assembled using many No. 2 PK screws instead of rivets, since they had proved very satisfactory on the SGU 1-6 and the SGU 1-7. The fuselage was a welded-steel-tube space frame, fabric covered, and the tail unit was metal-framed with fabric covering.

Above: *The U.S. Navy version of the SGS 2-8, known as the LNS-1. In the cockpit is Capt. Ralph Barnaby, and standing by are Ernie, Paul and Bill Schweizer with Johnny Robinson and Capt. Brown.*

Below: *The line-up of TG-2 sailplanes at the 29 Palms Military Glider School, California.*

The Airhoppers placed an order, and construction was started in the autumn of 1937, with delivery promised for the 1938 Nationals. The price we settled for was a bit over $1,000, for which we had to design, tool and build the sailplane: a tight budget.

The 2-8 was test-flown by Emil Lehecka at Wurtsboro, New York, in June, and taken back to the Schweizer barn for final finishing. The prototype wing had natural aluminium leading edges and the fabric-covered areas were painted red. Aluminium dope was used on the fuselage and tail.

Unfortunately the new glider arrived at Elmira a little too late to compete in the Nationals, but the Airhopper pilots flew it during the later days of the contest and gave rides to many other pilots. It was very well received. It had good performance, handled quite well in the air and was strong, altogether a practical club sailplane.

LEFT: *A restored TG-2 over the Chemung County Airport. The Schweizer Aircraft Plant is seen just above the sailplane. (G. Steele)*

After the Nationals the Airhoppers took it to their base at Hicksville, Long Island, New York, and did a lot of training and soaring with it using winch launching. In the autumn one club member, an experienced aeroplane pilot, was flying it solo. When he was high on his final approach, instead of applying spoilers and sideslipping to lose excess height, he decided to make a 360-degree turn and, as often happens under these circumstances, he let his nose rise, lost airspeed, stalled and spun into the ground. He was killed.

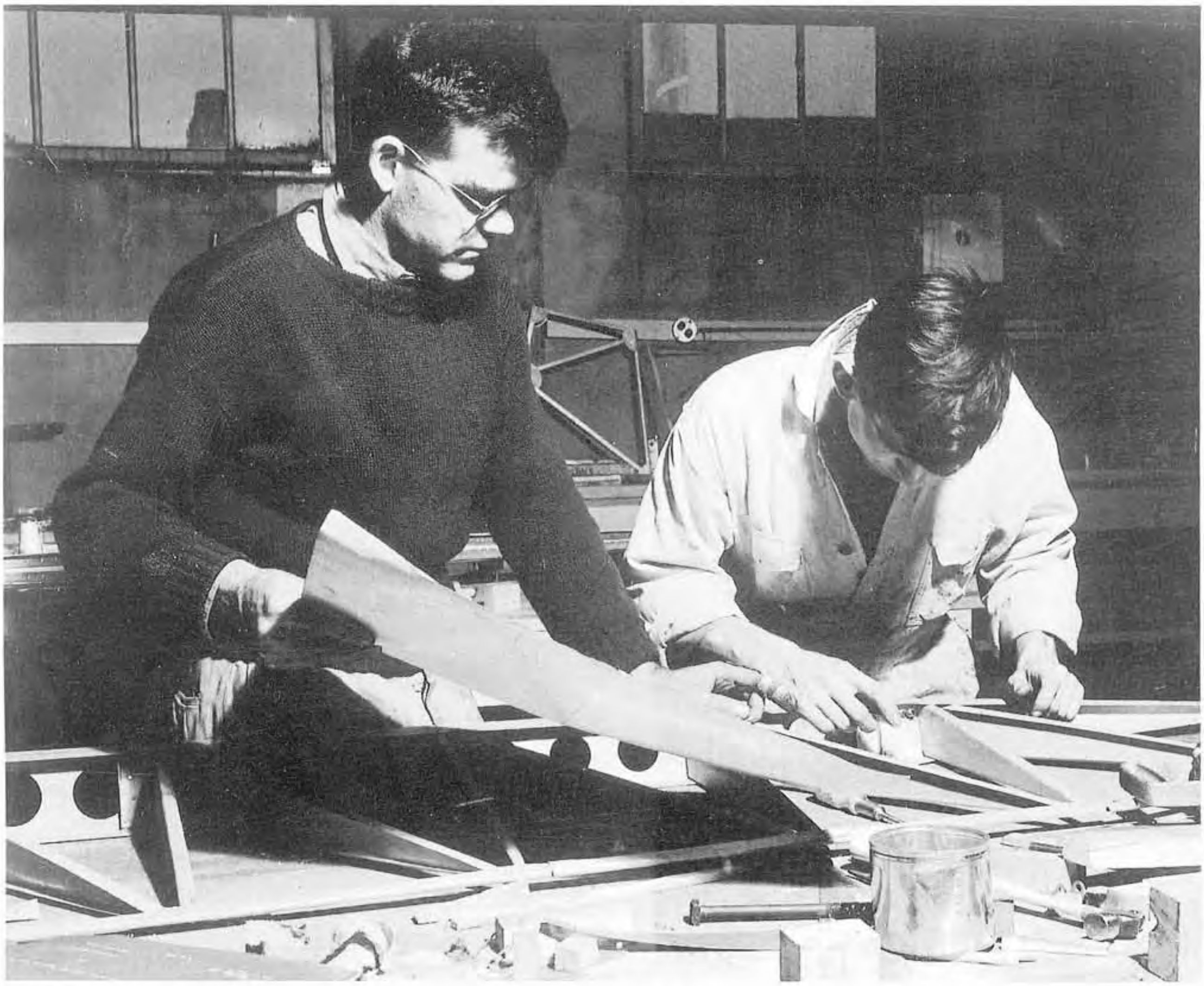
This was a serious blow to the Airhoppers and to us. At that time shoulder harnesses were not used in gliders, as only expensive military types were available. Only a lap strap was used. It was felt that a full harness might have saved the pilot in this accident, and we decided to add shoulder harnesses to our sailplanes as soon as they became available.

The Airhoppers liked the SGS 2-8 so much that they asked Schweizer to repair it and to reduce its tendency to spin. More washout (negative twist of the outer wing panels) was built into the wing, and the fuselage was extended to allow the front seat to be moved forward. This shifted the centre of gravity to a safer location, and the longer nose structure gave more pilot protection. The size of the spoilers was increased. The repairs were carried out during the winter, and the test flying took place, with excellent results, in the spring. The Airhoppers entered the 2-8 in the 1939 Nationals, and on July 4 Lewin Barringer used it to make a fine distance flight of 101 miles with a record two-seat sailplane height gain of 6,558 ft. Barringer had been the third American pilot, after Jack O'Meara and Richard Du Pont, to gain the international Silver C badge. For two years he was general manager of the S.S.A., but he resigned to take a post in industry at the end of 1938.

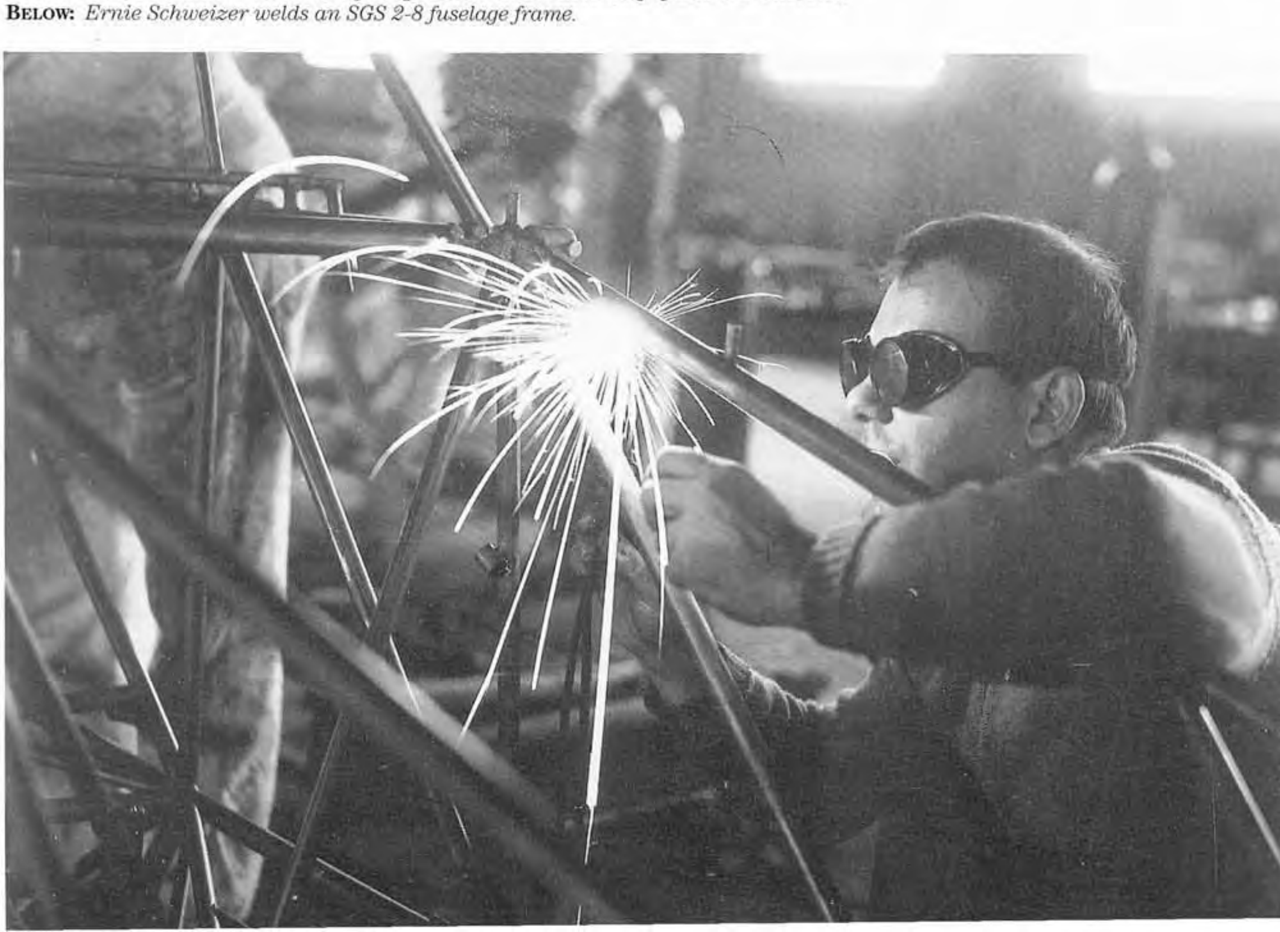
A second 2-8 was also present at this competition. The S.S.A. had purchased the Ross R-2 Ibis, a high-performance, single-seat sailplane which Barringer used for demonstration and promotional purposes.[4] The new S.S.A. manager, Hank Wightman, believed that a two-seat sailplane would be more useful for the promotional work. The S.S.A. directors decided to sell the Ibis, and in February 1939 they placed an order for a SGS 2-8, to be delivered at the 1939 Nationals.

With the repair of the Airhoppers' 2-8 and construction of one for the S.S.A., the Schweizers needed help, so Paul Nissen, a soaring enthusiast from Philadelphia, and Don Medrick, a graduate of the Elmira Aviation Ground School, became our first full-time employees. The S.S.A. 2-8 was completed in time and delivered to Elmira at a price of $1,200.

In those days a bill of sale had to be notarised, and when we were transferring the 2-8 to the S.S.A. it was proposed that Bob McDowell should notarise it. McDowell, an Elmira attorney, was a great supporter of soaring and anxious for the town to be recognised as the 'soaring capital' of America. He had assisted in launching Jack O'Meara in 1930 for the first soaring flight in the district. He suggested we should move our plant to Elmira. We were interested, since the barn at home was inadequate and lacked heating, but we did not have the capital to make such a change. McDowell convinced the local business



ABOVE: *Paul Schweizer instructs a young worker in the assembly of SGS 2-8 ailerons.*
BELOW: *Ernie Schweizer welds an SGS 2-8 fuselage frame.*



The SGS 2-8 in production in the Knitting Mills buildings.

development organisation, Elmira Industries, to provide space in the Elmira Heights Knitting Mills building in return for stock in a new company, to be called the Schweizer Aircraft Corporation. He also assisted in selling stock to local businessmen.

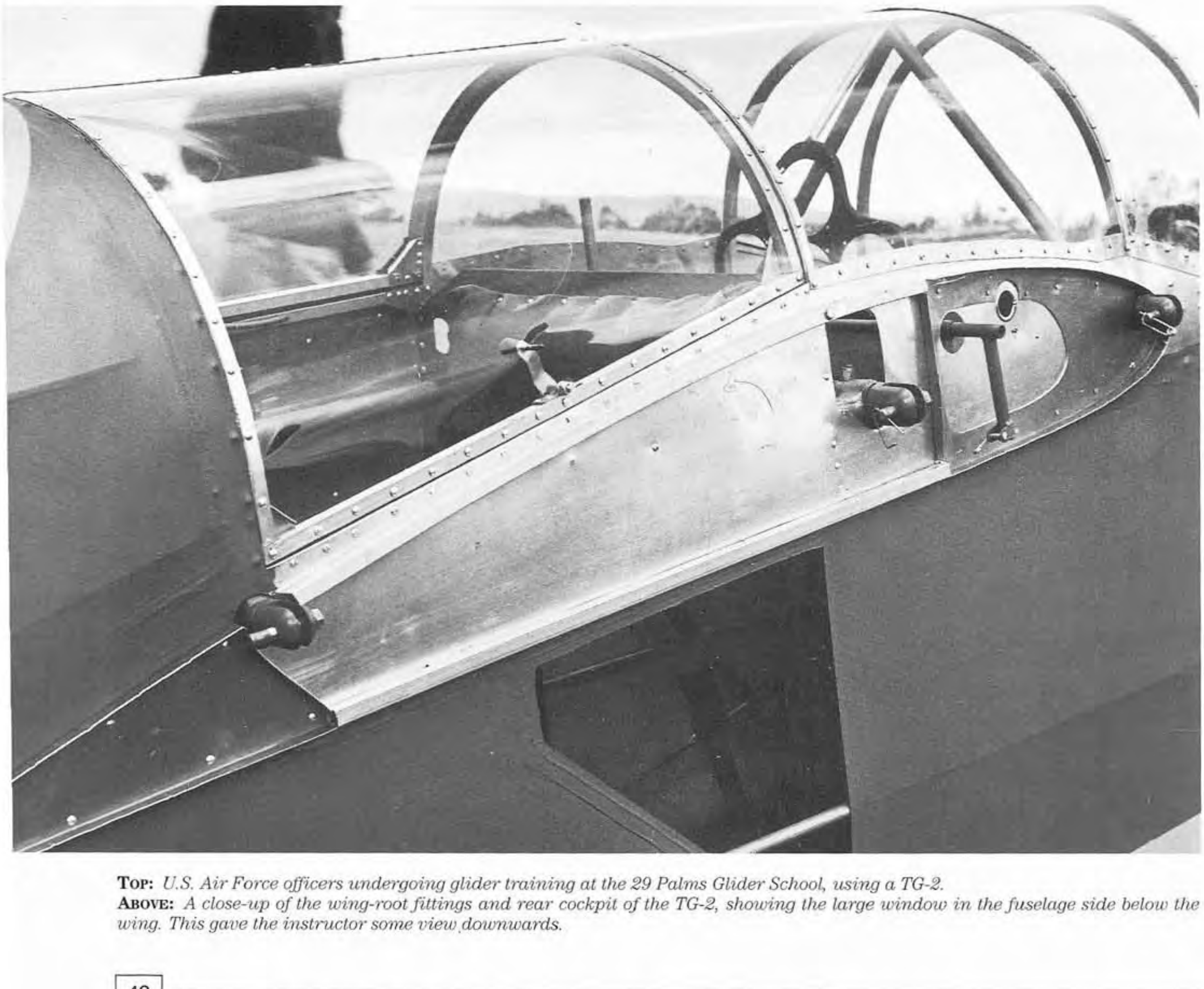
All the details were worked out. Ernie and I sold the assets of our little company, Schweizer Metal Aircraft, for a 53% stake in the new corporation, and we moved to the new location early in December 1939. Paul Nissen decided to come with us and Atlee Hauck, our old friend from the Mercury Glider Club, joined us too. Our brother Bill was still attending Syracuse University.

For the move we relied on Atlee's Ford Roadster, as we did not yet have our own car. We had to leave our home-made drop hammer in the barn, because it was mounted on a big block of concrete. For some time afterwards, until we could equip the new plant properly, we had to travel back to Peekskill regularly to use this machine. Ernie was elected president and secretary of the new Corporation, and I became vice-president and treasurer. Bob McDowell and two other experienced local businessmen became directors. The new Schweizer works was on the 12,000 ft² upper floor of a two-storey warehouse, and large components such as wings and fuselages had to be lowered to the ground by means of rope slings, a slow and somewhat risky procedure.

An order for a 2-8 was received from a group of engineers at Bell Aircraft Corporation in Buffalo, among them Stan Smith and Howard Burr.

By early 1940 we were tooling up for series production and working towards the F.A.A. approved type certificate. We applied for Class 2 (non-cloud flying) rather than Class 1 certification, in order to simplify the procedure. This resulted in lower placard airspeeds but higher safety factors so long as pilots stayed within the indicated limits, or some extra margins if the placards were not observed. The type certificate was received in May 1940, and the first fully certificated 2-8, the third one built, went to the Bell group. The fourth should have gone in June to Joe Steinhauser, who was starting a pilot-training operation in Chicago, but he had trouble at the last minute finding the money. This put us in a tight spot for a time.

The aircraft Joe had ordered was used and demonstrated during the 1940 National Meet when



Top: *U.S. Air Force officers undergoing glider training at the 29 Palms Glider School, using a TG-2.*
Above: *A close-up of the wing-root fittings and rear cockpit of the TG-2, showing the large window in the fuselage side below the wing. This gave the instructor some view downwards.*

Robert Stanley and Ernie Schweizer set a new National two-seat distance record with a 219-mile flight to Washington, D.C. Given a little more height in the final stages, Bob reckoned he could have landed on the White House lawns but needed one more thermal, which did not appear. They landed a few miles short. We wondered what kind of national fame or notoriety would have resulted if that thermal had been found! Later that summer Lewin Barringer organised a soaring expedition to Sun Valley, Idaho, using this aircraft (still not paid for), which we loaned to him. He set a two-seat gain of altitude world record with a climb of 14,960 ft. The ascent above his point of release from tow took him to more than 21,000 ft above sea level.[5]

The record flights helped to fill our orderbooks, and Steinhauser at last scraped up the cash he needed. SGS 2-8 number 5 went to Ed Knight, and number 6 to Dick Johnson, a very young Californian pilot already showing brilliant talent. The youngest pilot in the contest, he had come third in the 1940 Nationals flying a Bowlus Baby Albatross, the boom-tail type we had heard of when building our own 1-6. He later became many times National Champion and a world-record-breaker.

Joe Steinhauser was now making a success of his training school, and ordered another 2-8 from us in January 1941. Three kits were required by the National Youth Association aviation school, a State-financed operation in Michigan run by Ted Bellak,

The first TG-2 delivered to the military, with Col. Fred Dent in the cockpit. (Hans Groenhoff).

Jeff Byard's splendidly restored TG-2 displays its authentic paint scheme at the 1995 International Vintage Sailplane Meet at Harris Hill.

who had been very active in the early 1930s. A couple more were built and sold, making twelve altogether, so far. We had more work than four people could handle, and took on more employees towards the end of 1940.

We recognised that the 2-8 had some defects. For launching by winch and for landing, the instructor, in the rear seat, had a very poor field of vision. He could see clearly only behind and upwards, but hardly at all ahead and down. When being towed by an aeroplane at moderately high airspeeds, and in fast flight generally, the broad ailerons gave heavy stick forces which soon became tiring for the pilot. The vertical fin areas and rudder were not sufficiently effective and, for crossing regions of sinking air at high gliding speeds, the washout of the wings, introduced to prevent wing dropping and possible spinning, produced reversed lifting forces at the tips and created too much drag, spoiling the glide.

Meanwhile, Barringer was compiling a book, *Flight Without Power*, to which Ernie and I contributed chapters on aerodynamics and glider design, construction, and maintenance. It was the only book of its kind available in the U.S.A. and was reprinted three times during the next few years. We looked forward to receiving our share of royalties, for things were still tight financially. However, when Lewin was lost over the Atlantic, Ernie and I and the other authors turned over the royalties to his widow.

A big change was on the way. In the spring of 1941 the U.S. military became interested in gliders. The Germans used troop-carrying gliders most effectively during the invasion of Belgium in May 1940. Radar did not exist at that time except in Britain, and it was not sure even then that wooden gliders could be detected by this new system. There were elaborate sound amplifiers with huge horns to try to detect the sound of approaching aero-engines, but otherwise aerial defence relied on patrolling fighters actually seeing and intercepting enemy aircraft.

At dawn on 10 May 1940 a fleet of forty German DFS 230 gliders, each carrying eight or nine fully armed soldiers, were released from tow by Junkers Ju 52/3M aircraft while still over Germany, and glided silently into the neutral country. Nine actually landed inside the huge and vital strategic fortress at Eben Emael, and others at several key bridges over the River Meuse and the Albert Canal nearby, capturing them all with very few casualties. Compared with paratroop landings, which tend to scatter troops and supplies over wide areas, the glider forces arrived in organised and compact fighting groups and were immediately in action, while the Belgian high command had barely learned they were at war. Many of the 780 defending garrison, woken by what was taken to be a practice alert, realised they were under genuine attack only when hollow-charge explosives penetrated their massive concrete gun cupolas and emplacements. The gliders landed at 04.25 and the big guns were virtually out of action by 05.30, with most of the defenders trapped uselessly underground. The glider force captured and held the fortress until the first wave of German infantry relieved them the next morning. By 26 May the

German Army was on the English Channel coast.[6]

The British implemented an urgent glider programme, the first priority being defence against these silent invaders. They made secret tests with sailplanes to find out if radar could detect them and found that it was just possible, since even a wooden glider has some metal parts to reflect the radio waves. Thoughts then began to turn to offence. The U.S. Army Air Corps (U.S.A.A.C.) began to take a serious interest, and in February 1941 Maj.-Gen. Arnold directed that a study should investigate the possibilities. This was followed in March by definite official proposals, and specifications for gliders capable of carrying between twelve and fifteen troops equipped with automatic weapons and supplies.

The Army had no experience of motorless flight and no glider pilots. Indeed, from 1931 Army personnel were specifically forbidden to fly other than government-owned aircraft, and there were no gliders among these. The U.S. Navy had done a little more, Capt. Ralph Barnaby having experimented with launching a glider from the airship *Los Angeles* in 1930. The Navy had bought a very few Franklin Utilities in the 1930s for training experiments, but next to nothing had been done since.

Much work was now needed to develop suitable methods, and there was urgent need for a pilot-training programme. In the whole of the U.S.A. there were estimated to be only about 166 qualified glider pilots. Colonel Fred Dent was given the task of starting the programme, and he visited Elmira in April 1941. A small glider school run by the Elmira Area Soaring Corporation was about to be formed, basing itself on Harris Hill, and Dent arranged for a small group of U.S.A.A.C. trainees to come for training.[7] Three military versions of the SGS 2-8 were ordered from us, for delivery at the earliest possible time.

There were still many doubters, but in May of that year the Germans used very large glider forces, as well as paratroops, to invade and conquer the large fortified island of Crete in the Mediterranean. We did not understand until much later that their casualties had been almost catastrophic; we knew only that they had achieved their objective. In May the Navy also ordered two sailplanes. The military glider programme was surely going to expand greatly, although it took some time to get fully into its stride.

After struggling for orders we suddenly had our hands full, and could see that more work was on the way. We expanded our work-force to fifteen. Previously we had turned out about one aircraft every six weeks, but now we foresaw that we would need to produce one per week by the end of the

The Navy version of the SGS 2-8, designated the LNS-1, takes off for test flight at Chemung County Airport 1941.

year. Ernie and I became entirely occupied with engineering, design, sales and administration. We needed someone to organise production. It was now that Bill, our young brother, joined the company. When he graduated from Syracuse University in June he planned to begin pilot training with the U.S. Army Air Force (U.S.A.A.F.), but was rejected for medical reasons, and when he heard from us, came to Elmira. Soon we took over more space in the Knitting Mills building and constructed large sloping wooden ramps to the upper floor to make movement of complete wings and fuselages easier and safer.

Fred Dent started his courses with six trainees on Harris Hill, on 1 June. Schweizer delivered the first glider to the military in that month, with no modifications. Manuals and maintenance schedules had to be prepared, standard instruments and military harnesses had to be fitted and the paint scheme had to conform to official requirements. In military finish, the 2-8 was painted in training yellow with a large dark blue flash on the fuselage sides, and stencils and numbers in appropriate places. National markings, a red disc inside a white star on a blue circle, were painted above and below the wings and the words 'US Army' in large block capitals underneath, with the red and white stripes of the national flag and vertical blue band on the rudder. The wing leading edge was left in natural aluminium. It looked very smart. The 2-8 became the Army TG-2, i.e., Training Glider number 2. We felt that we should have received the designation TG-1, but the Frankfort Company had been allocated this number for their version of Stan Corcoran's Cinema – even though their first delivery was made several months later. The Naval examples of our two-seater were designated LNS-1.

Although the U.S.A. was not at war it began to seem that we soon might be, one way or another. Sport soaring continued. During the 1941 National Contest Dick Johnson finished in fourth place in his SGS 2-8, and Stan Smith set a two-seater goal record of 73 miles. Major Dent flew the first TG-2 in the Nationals to gain experience in soaring. The Air Force pilot-training scheme soon outgrew the facilities on Harris Hill. It was essential to continue training during the winter, when the Hill operation was usually out of action because of bad weather, so the school was moved to Mobile, Alabama, and others were opened in other states. Schweizer remained hard at work producing the aircraft needed.

Fifty-seven SGS 2-8s had been built before we were required in 1942 to change to a new design. The type played an important part in getting the military pilot-training programme underway. Perhaps from the Army's viewpoint the 2-8 was too good. It had been designed as a light sporting sailplane with a degree of refinement and a good glide ratio. The troop-carrying glider was much cruder, intended only to be towed into action and then to get its cargo down to the landing zone as quickly as possible. The kind of trainer needed by the Army was really something more like these aerial barges, but the TG-2 was available when it was most needed and did the job it was required to do.

Post-war, in 1946, Dick Johnson used his 2-8 to set a national two-seater distance record of 309.68 miles, which stood unbroken for twenty years. Twenty-three were still recorded in use in 1964.

Today the 2-8, usually still referred to as the TG-2, is regarded as a vintage sailplane, and a few are still in use. Some have been fully restored to their lively military paint schemes and are treasured by their owners. I had the pleasure of flying in a fifty-plus-year-old TG-2 that Jeffery Byard restored and had entered in the International Vintage Sailplane Meet at Harris Hill in July 1995. During the same week Martin Simons, the editor and illustrator of this book, had his first flight in a TG-2.

4 The Ross R-2 Ibis, developed from the R-S 1 Zanonia, was followed by the R-3 and, in postwar times, the world record-breaking Ross-Johnson RJ-5.

5 The world record climb at this time was 10,840 ft, but in May 1940 German troops invaded France, which surrendered on 22 June. Paris, where the Fédération Aéronautique Internationale (F.A.I.) had its offices, was occupied by the Germans, and Barringer's flight was never registered there. A decision was subsequently made that records broken in belligerent countries during the Second World War would not be recognised. The chief effect of this was to negate certain duration records flown in France and Germany. Several distance flights in the U.S.S.R., not belligerent in 1940, were allowed. On this basis, Barringer's flight should have been accepted

6 A full description of the preparation and operation of the German glider force at Eben Emael is given in the book *The Fall of Eben Emael*, by James E. Mrazek, Luce, 1970.

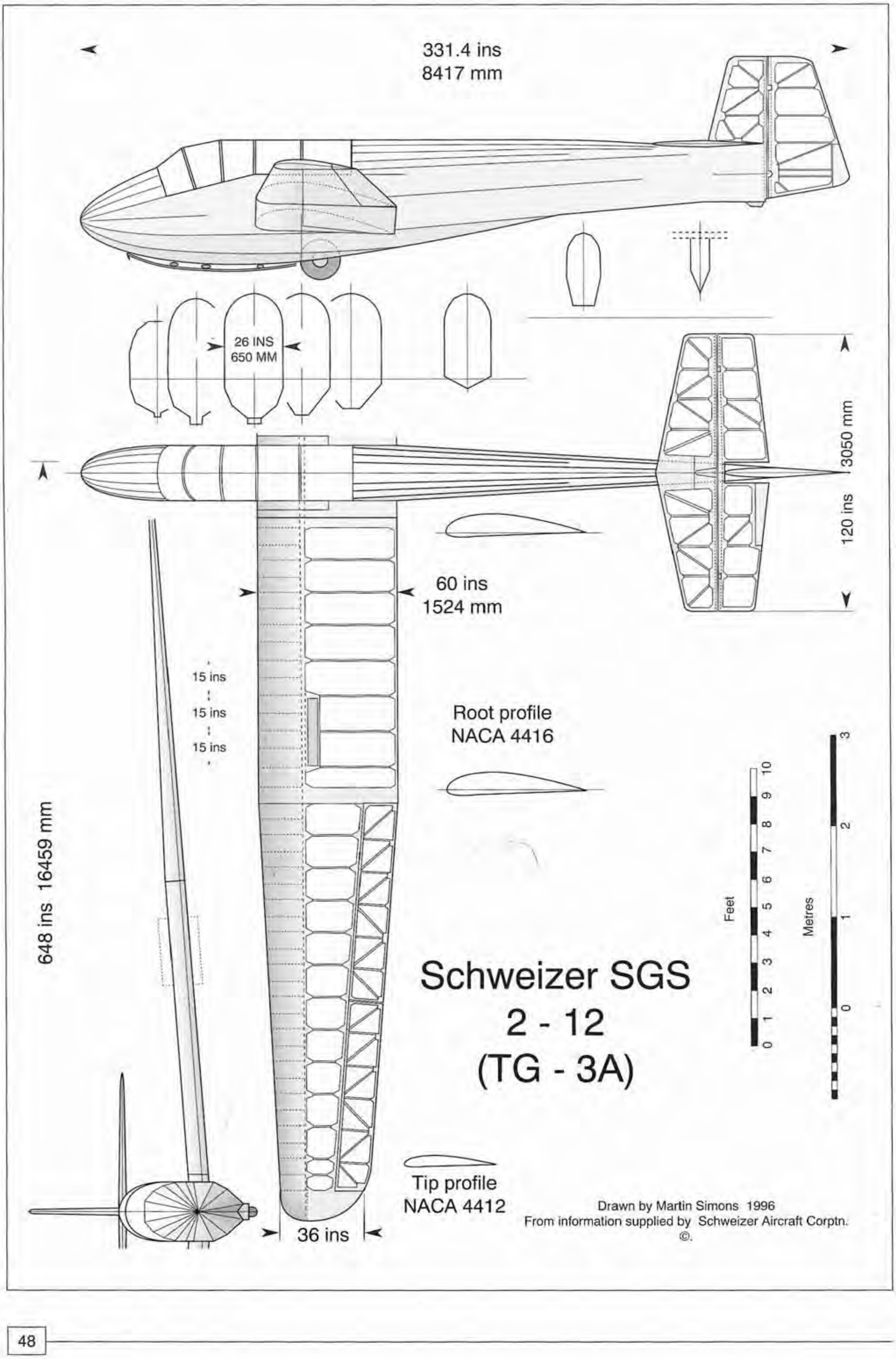
7 A few weeks later the U.S. Army Air Corps, wholly subordinate to the Army High Command, became the U.S. Army Air Force with a degree of independence.

Schweizer SGS 2-8

Total number built: 57

Specification		
Span	52 ft	15.85 m
Length	25.25 ft	7.70 m
Wing area	214 ft^2	19.88 m^2
Aspect ratio	12.6	
Aerofoil section	NACA 4412	
Empty weight	450 lb	204 kg
Pilots	410 lb	186 kg
Flying weight	860 lb	390 kg
Wing loading	4.0 lb/ft^2	19.5 kg/m^2
Estimated best L/D	23: 1 at 42 mph	
Minimum rate of sink	2.75 ft/sec at 40 mph	0.84 m/sec at 64.3 km/h
Speed at 2 m/sec sink rate	68 mph	109 km/h

Two early SGS 2-8 sailplanes during demonstration for the U.S. Navy in April 1941. (Hans Groenhoff)


331.4 ins
8417 mm
26 INS
650 MM
3050 mm
120 ins
60 ins
1524 mm
15 ins
15 ins
15 ins
Root profile
NACA 4416
648 ins 16459 mm
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
Schweizer SGS
2 - 12
(TG - 3A)
Tip profile
NACA 4412
36 ins
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©.

SGS 2-12 (TG-3)

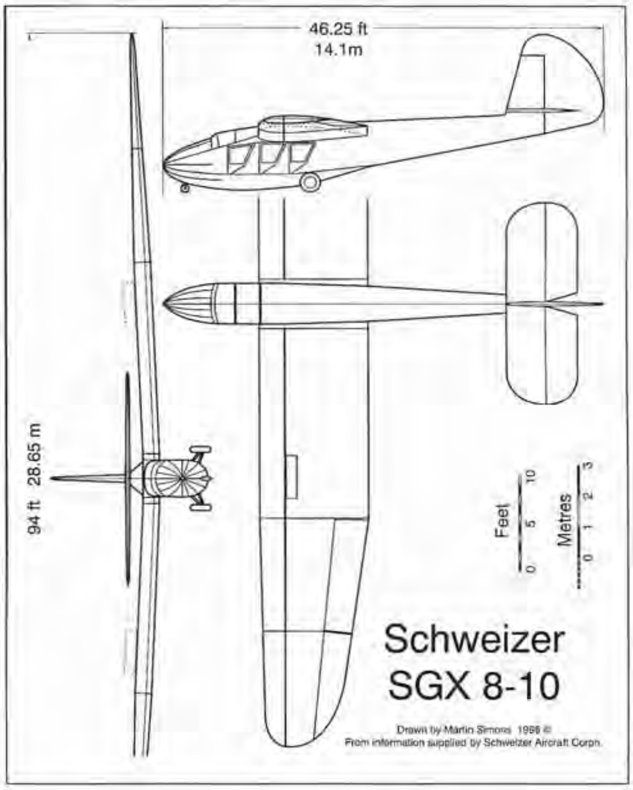
Aircraft aluminium alloy was becoming hard to obtain owing to the very rapid expansion of military aircraft production throughout the U.S.A., so we began to think about a new sailplane which would, despite our convictions, have to be built mainly in wood. No records of it survive. Before things had progressed beyond the sketch and notebook stages the U.S.A.A.C. started to talk to us about troop-carrying gliders. What might have been our ninth design was abandoned while we studied the new proposals.

One of the military specifications we were shown asked for an eight-seat glider, and another for a fifteen-seater. It was supposed that if no open countryside was available, the gliders might touch down in rough country or even among trees, at night or in the very early hours of dawn, to achieve complete surprise. This necessitated a very low landing speed of 38 mph to give the troops and their equipment at least some chance of survival in the likely crashes. To keep the aircraft simple, the use of landing flaps to reduce the approach speed was ruled out, which meant that the wing area had to be very large to keep the wing loading down. Our TG-2, carrying only two persons, landed at about 35 mph as it was, with a wing loading of 4 lb/ft². Now we were looking at something required to carry more than four times the load, fully-armed soldiers rather than civilians in ordinary dress, yet still able to touch down very slowly.

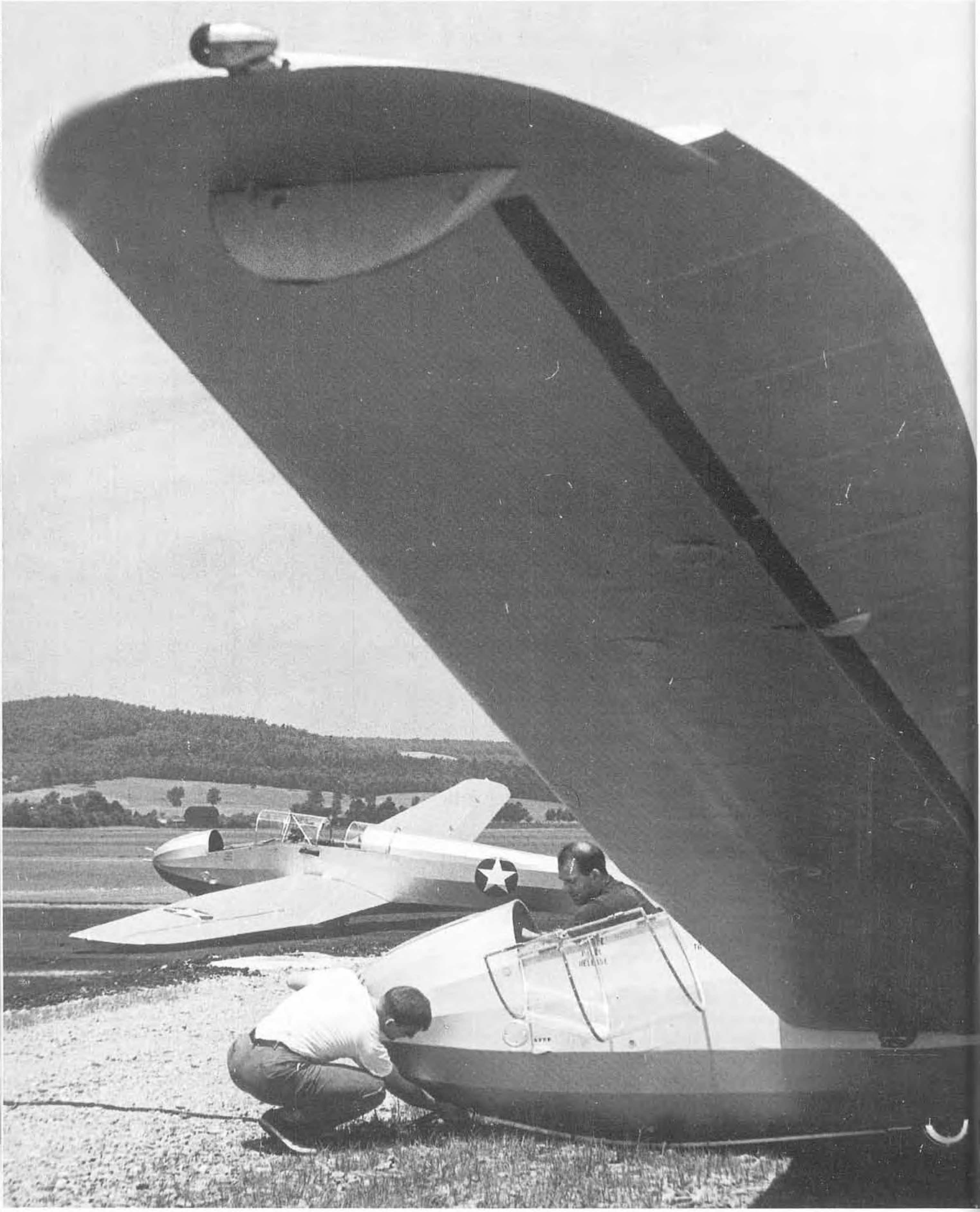
We developed a preliminary design for the eight-man glider which we designated SGX 8-10. This had a 94 ft span and a wing area approaching 1,000 ft². It was to have had a thick, high wing, a tricycle undercarriage, and doors along the fuselage sides for use by the troops.

When we started on the fifteen-seater, to which we assigned the designation 15-11, it began to look like a monster, with a wing span bigger than a four-engine bomber! We believed that neither of these gliders would be practical. Such extremely large, light craft would be very difficult to handle on the ground, and most susceptible to winds and wind gusts. They would also be incompatible with the aircraft that might be used for towing. Aeroplanes of the necessary power would probably not be capable of flying at the low airspeeds required. The more we studied the proposals the more sceptical we became.

We had plenty on our hands with TG-2 production, and there was also the possibility of undertaking some subcontract work. We therefore reluctantly decided not to bid on the troop carriers. It was the right decision. Some other companies did construct gliders to these original requirements but, as we had expected, they proved unsuccessful and the factories concerned ran into serious financial problems as a result. In any case, the U.S.A.A.C. soon saw the need to rethink the whole matter. The idea of secret and silent approaches into rough terrain was replaced by mass landings in carefully chosen locations. Higher wing loadings and flaps could be tolerated; vehicles and guns would have to be carried and deployed quickly. It was not long before the Waco CG-4A was chosen as the mainstay of the US military glider programme. Nearly 14,000 were built, but none by Schweizer.



While all this was occupying us, in November 1941 the U.S.A.A.F. asked us to design a new two-seat glider which would use as much wood as possible, to avoid further pressure on supplies of alloy. The technical experts at Wright Field also wanted better visibility for the instructor than was possible in the TG-2, and correction of some of the other faults, of which we were well aware. They wanted no more of that type. This decision was rather disappointing for us, because it came just when our TG-2 production was getting into its full stride, and we thought we



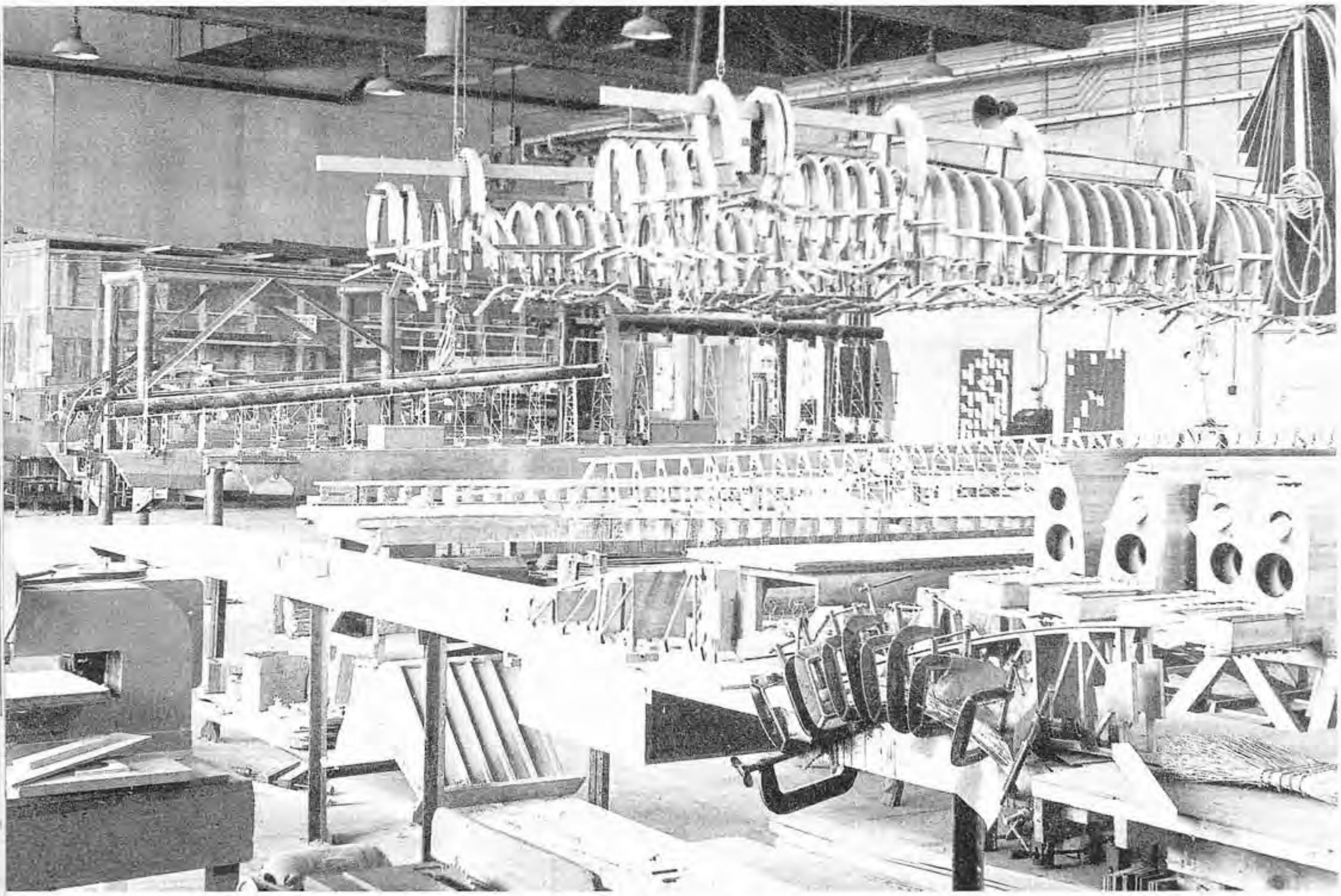
Above: *The SGS 2-12, the one and only commercial version of the TG-3A takes off from Harris Hill. (Hans Groenhoff).*
Opposite Page: *Two TG-3s lined up for production test flights. Bill Schweizer hooks up Ernie Schweizer in nearest TG-3A. (Hans Groenhoff).*

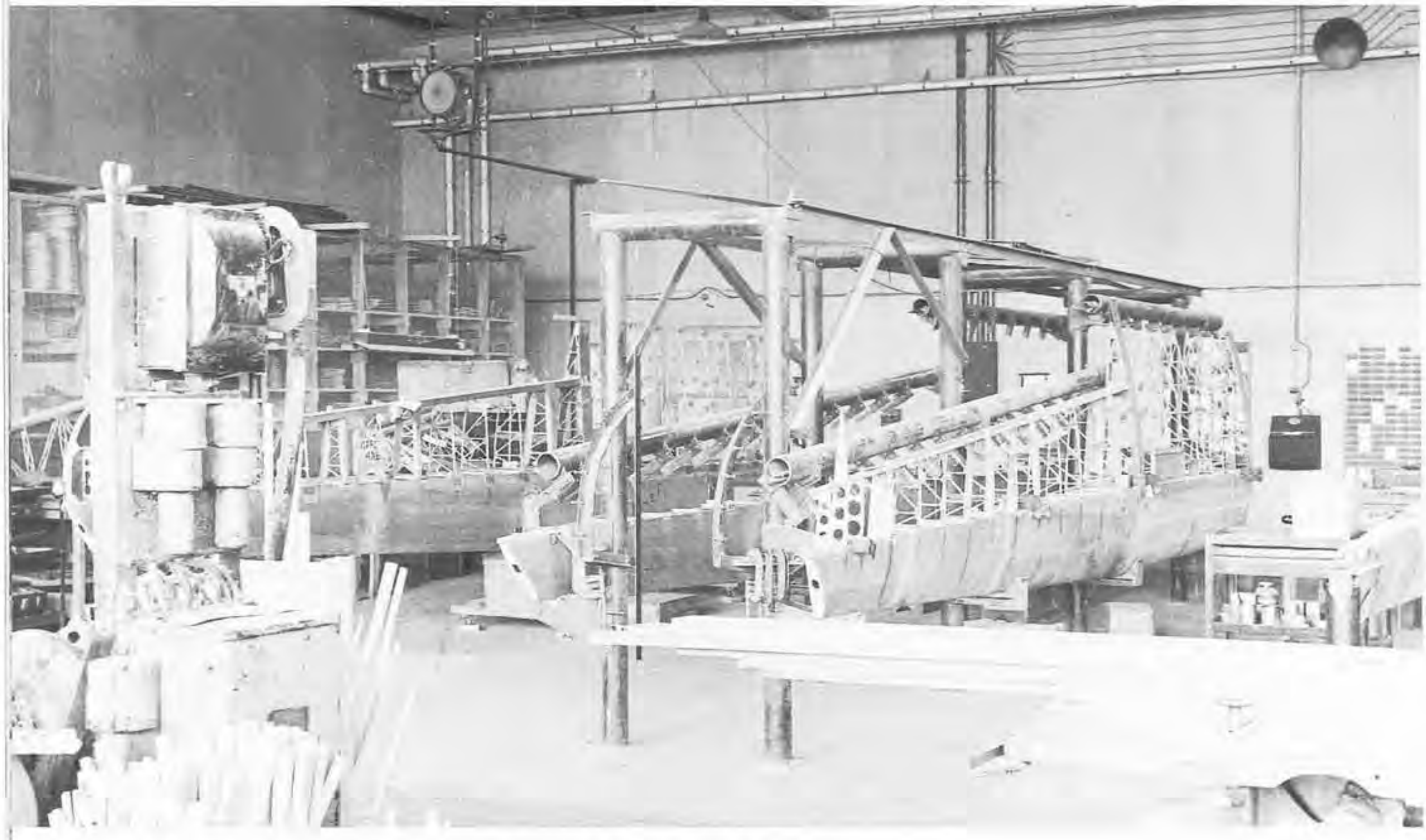
had a clear road ahead for a time. There was nothing else for it, and work began on the SGS 2-12, which the U.S.A.A.F. was to designate TG-3.

We chose a low-wing layout which gave the instructor a much better view and easier access to the rear cockpit. Other shortcomings of the TG-2 were also overcome. Both the handling and the high-speed glide performance were improved. To allow trimming for different airspeeds and for long periods under tow, a trim tab was required for the elevator. The military also expected these sailplanes to be used for dual towing. Two gliders would be attached to the tug aircraft by separate ropes in V fashion, one rope longer than the other. The gliders had to keep apart laterally, the pilot applying a constant amount of rudder to keep position out on the appropriate side. This required us to provide a rudder trim tab to take the load off the rudder pedals.

The wing was all wood with a single main spar and a pre-formed plywood D-tube leading edge. We used the new urea resin adhesive instead of the traditional casein glue, which had many deficiencies. The usual light structure aft of the wing was fabric covered. The tail surfaces and ailerons were of wood with fabric covering, and the fuselage was of 4130 welded steel tube. At that time wooden aircraft had to be designed with a safety factor of 2, rather than the 1.5 allowed for other materials, owing to the variation in the properties of wood, and this tended to confirm our belief that metal was a better material. Soaring performance was not considered a major factor, so we accepted that the structural weight would be higher than that of the TG-2. To prove the design we had first to build a prototype, which was taken to Wright Field for structural testing. At that time there were a number of wooden troop gliders, designed to those original, impractical specifications, under test, and there were many failures due to inexperience in the use of wood for such large structures. The TG-3 passed its tests easily, and we received a letter commending us for getting the glider through without a failure.

We foresaw problems in getting suitable spar material. The authorities insisted that all aircraft companies building trainer aircraft had to redesign in wood to conserve metal alloys, and as a result they created a shortage of aircraft-specification spruce! At the inboard end, the TG-3 spar was a hefty beam approximately 3 in. wide and 9 in. deep, glued up in laminations to make a solid section. This tapered to a lighter laminated box section towards the tip. We heard that there was a lumber yard in Brooklyn that handled spruce, so on the weekend of 6–7 December 1941 Bill and I took the company





Top: *The wing "D" Tube assembly tooling with assembly jig in rear.*
Above: *The TG-3A wing assembly jigs in the humidity controlled assembly area.*

A rear view of a TG-3A ready for test flight at Chemung County Airport in 1943.

station wagon to visit the site. We did not have much luck in securing supplies of spruce, but on the way back we called at our old home in Peekskill to see the family and to stamp out some parts for the TG-2 wings on the old drop hammer, still there on its concrete foundation.

On the way back to Elmira we called at Wurtsboro Airport, where a 'Keep 'em Flying Glider Meet' was underway. Meetings of this kind were organised widely at the time because it was feared that the increased emphasis on military aviation might restrict private flying and gliding. A nationwide movement was established to promote civilian and sporting aviation and keep it in the public eye. As we drove down to the operations area, Ginny Mayer, who was doing the timing in the mobile field office, came running out, yelling that she had just heard on the radio that the Japanese had bombed Pearl Harbor. This shocking news gave us much to think about as we drove on to Elmira. On Monday all work

Top: *Schweizer TG-3A number 114 takes off from Harris Hill. This was the aircraft built for our own use, and it now hangs in the passenger lounge at Elmira/Corning Airport.*
Above: *The final-assembly line for the military TG-3A.*

in the plant stopped for a while so that we could hear President Roosevelt on the radio, announcing the formal declaration of war. We knew we would be contributing to the huge military industrial effort which must now ensue.

We received a contract to build seventy-five TG-3s, each with trailer, to cost $3,900. Delivery was to start in the fall of 1942. The flight-test prototype was flown in May. After the first three had been produced the nose was slightly lengthened to produce the TG-3A, which became the production model. The military indicated that a production rate of one glider per day would soon be required, and we made plans accordingly. We took on many new employees, but it was obvious that we would need more space than the old mill building could provide. The arrangement during wartime was that the government would build new factories when required to expand military production, and lease them to the corporations needing them. Several miles out of town to the northwest, the new Chemung County Airport was under construction to serve Elmira and Corning. The area, between the villages of Horseheads and Big Flats, was very little populated and low lying, close to the so-called Singsing Creek tributary to the Chemung River. Flooding was a recognised hazard, and was allowed for in laying out our new building. As it would not be ready for some months, we continued for the time being in the old mill.

To ease the spruce shortage the U.S.A.A.C. allowed the substitution of yellow poplar or Douglas fir, providing it was to military specification. The answer to our lumber supply problem came when one of the Bernhardt brothers of the Bernhardt Furniture Company of Lenoir, North Carolina, anxious for some war work, visited us in search of possible sub-contracts. The company had a good source of local yellow poplar, and proposed to supply us with complete spars, glued-up as subcomponents in the furniture factory. It was a very attractive proposition from our point of view, and we agreed. While at our plant, Bernhardt noticed that the desks in our office were merely tables that we had built ourselves from 'two-by-fours' and fir plywood, and had painted green. He said he wanted to give each of us Schweizers a Bernhardt desk. The new furniture arrived in a very short time, and certainly added a more businesslike appearance to our offices.

Thereafter, Bernhardt supplied the spars for the TG-3As and met our production schedules, although not without difficulties for themselves. To find poplar and fir that met the aircraft-quality specification they had to sort through large quantities of timber in the log, rejecting much of it. This inflated their costs and caused them to lose money on the contract, but they were happy to have contributed to the war effort and did not request any price adjustment.

The order for TG-3s was increased in November 1942, bringing the total to 113. We had delivered 22 by the end of that year. We were also directed by the U.S.A.A.C. to licence the Air Gliders Company of Barberton, Ohio, to build fifty TG-3As to our designs, and to supply them with all the necessary drawings. Air Gliders had been formed by Frank Gross, a soaring pioneer who had built a number of famous gliders in the late 1920s and early 1930s. It seemed that the military was going to need unlimited numbers of training gliders, so we were not too much concerned about there being a competing manufacturer building the TG-3A. However, we were on fixed-price contracts and had actually lost money on the TG-2. We felt that we should be compensated, particularly since Air Gliders was on a cost-plus contract and could not lose. The U.S.A.A.C. agreed that we should be paid a royalty on each glider produced in the Ohio plant. Air Gliders went ahead with its programme, but made rather slow progress, as it had no previous experience of aircraft production work. We were contracted to deliver the remaining ninety-or-so gliders during the next seven months. When we moved into the new plant, at the end of February 1943, our production rate improved considerably, and we knew that we would need new orders soon.

There were now four manufacturers producing training sailplanes for the military.[8] But a new development had been taking place. Several of the established light-aeroplane manufacturers, Piper, Aeronca and Taylorcraft, were also building large numbers of gliders. These were simply their standard small aeroplanes without engines, the engine being replaced by a forward cockpit with one or more seats and dual controls. Although these were not elegant aircraft, they were considered

A typical production TG-3A outside the new Schweizer plant. It was painted all silver except for the national insignia.

A production TG-3A, showing the stencilled markings required by the U.S.A.A.F. Note the step to help the front pilot to get into the cockpit. The large venturi was used to drive gyro instruments. Radio was sometimes carried, as revealed by the aerial.

adequate for teaching pilots to fly the large cargo gliders, and their aerodynamic crudity was considered an advantage. They would descend fast, did not gain too much speed in a dive, and behaved much more like a Waco CG-4. They were also cheap. Each of these three companies turned out 250 trainers, the TG-5, TG-6 and TG-8 for the U.S.A.A.F., and an additional three of each for the Navy, 759 all told. The Army suddenly did not need sailplanes.

After we had completed 113 TG-3As in July 1943 there were no more orders for them. At the same time the U.S.A.A.F. cancelled their order with Air Gliders after they had completed only one TG-3A, so we received just one royalty payment. When we reviewed our position we found that we had lost on the TG-3A contract, and tried unsuccessfully to recover the deficit of $26,000 from the U.S.A.A.F. We never recouped the losses on the TG-2 either, partly due to the inflation of the early forties! We were compelled to reduce our work-force from the peak of 221 it had reached in March 1943 to 85 in August.

We built one extra TG-3A for company use, No. 114, which gave us and our company pilots something to fly. Including the one built by Air Gliders, 115 were completed.

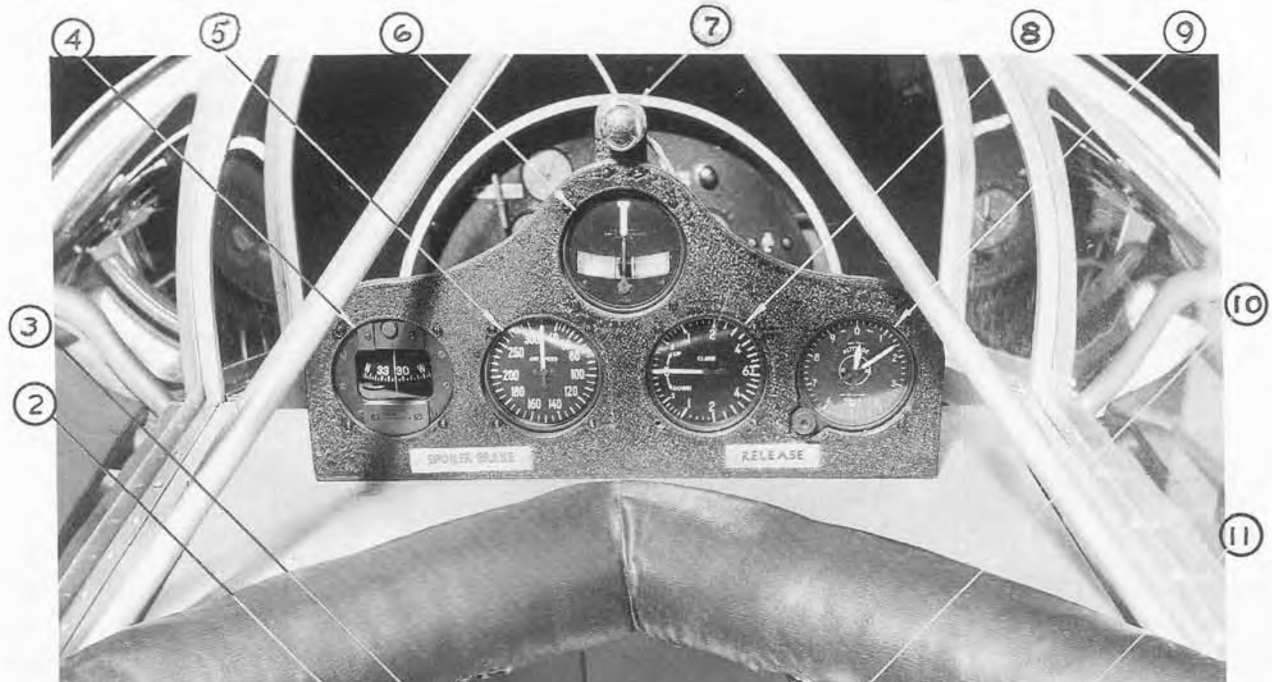
We were now told that we had to look for sub-contract work from the other aircraft companies, and the government was prepared to help us equip for this. We soon received contracts from Curtiss, Fairchild, Republic and others.[9] Having learned a hard lesson, we henceforth resolved to negotiate as high a price as possible while still getting the business. We re-equipped the plant with modern metalworking machinery, which we had not needed while building the predominantly wooden TG-3. At last we could abandon the old drop hammer in the barn at Peekskill! Apart from helping with the war effort and saving our financial situation, we gained valuable experience and would be in a good position to compete as an aircraft manufacturing company in the postwar world. We were able gradually to expand our workforce again, and ended the year with a modest profit after all. Glider and sailplane production ceased, although our dreams and plans for new designs did not.

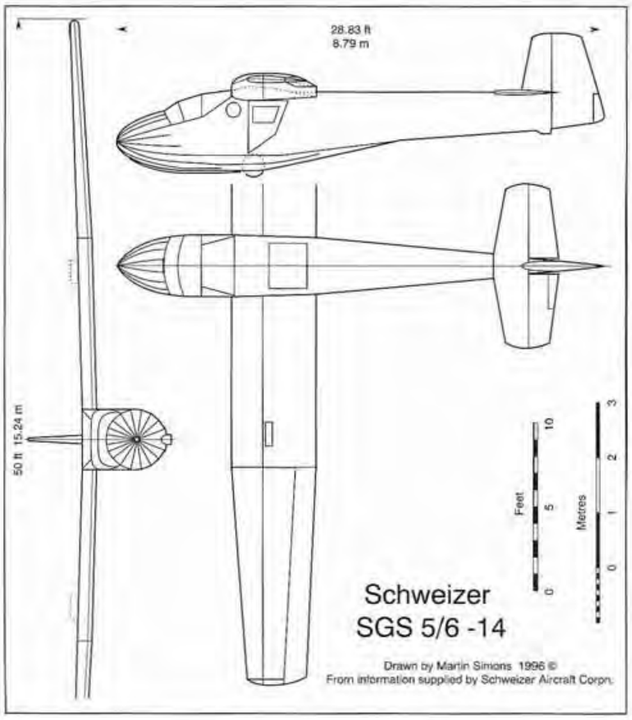
When we knew there would be no more orders for the TG-3, we did some design studies to find other uses for TG-3A components and ensure additional work for us. One idea was to make a small six-seater troop glider that could be used for landing special forces of soldiers behind the lines for sabotage or other purposes. It would be smaller and more manoeuvrable than a CG-4A, would be able to land in smaller fields and, since it would use components that were already tooled up and in production, the cost would be low. The 5/6-14 was a high-wing glider

Opposite Page Top: *The standard instrumentation for the front cockpit. The handles on either side of the cockpit were for the elevator and rudder trim tabs.*

Opposite Page Bottom: *Instrumentation for the TG-3A rear cockpit. Key: 1, rudder trim; 2, control column; 3, spoiler control handle; 4, compass; 5, airspeed indicator; 6, bank-and-turn indicator; 7, instrument light; 8, rate-of-climb indicator; 9, altimeter; 10, tow release knob; 11, rudder pedal; 12, elevator trim.*


SPOILER BRAKE
RELEASE
PULL TO TALK
U.S. ARMY
AIR
CORPS
AIRPLANE


1
2
3
4
5
6
7
8
9
10
11
12
SPOILER BRAKE
RELEASE



which used a slightly shortened TG-3A wing, had smaller tail surfaces, and had a new welded-steel-tube fuselage to accommodate a pilot and four or five passengers, with some additional payload.[10] The fuselage was to be fabric covered, with doors under the wing on each side for entrance and exit to the passenger compartment. We made a proposal to the U.S.A.A.F. at Wright Field to see if there was any potential interest. There was none, so the 5/6-14 never left the drawing board.

The next idea was for a single-seat small cargo glider. This arose from discussions we had with the All American Aviation Company (A.A.A.), whose chairman was Richard Du Pont, a former champion soaring pilot who had been one of the most important supporters and officers of the S.S.A. in prewar years.[11] With the inventor, Dr L.S. Adams, Du Pont's group had developed a pick-up system allowing aeroplanes to snatch packages off the ground. The U.S. Postal Service had been using the system since 1939 to collect mail from scattered rural communities in West Virginia and Pennsylvania.

The mail bag was set up ready, with a towline suspended between two light poles. The aeroplane flew low overhead with a hook suspended from a sort of fishing rod, designed to catch and lock on to the line. A drum like a large fishing reel in the aircraft paid out line at the start so that there would not be too big a jerk as the line was snatched, and then a clutch on the drum gradually applied load until the 'catch' was wound in and the mail bags arrived in the aeroplane's cargo compartment.

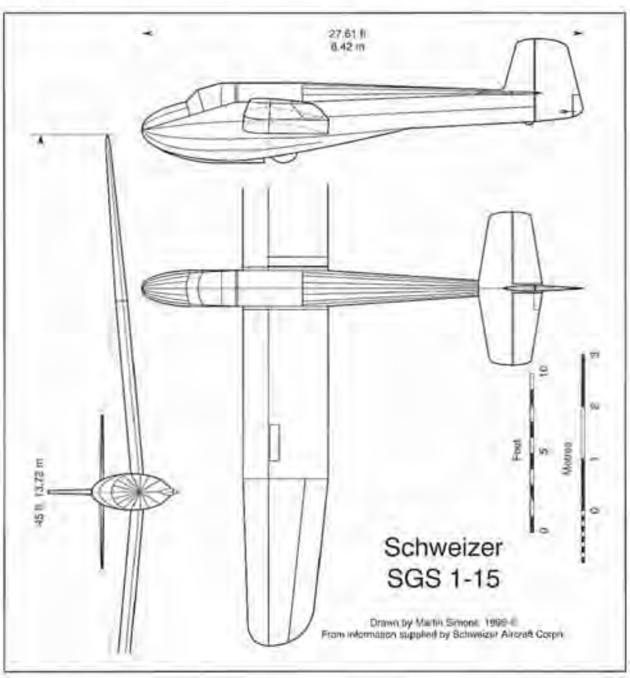
The first pick up of a 'glider' was made in

ABOVE: *A TG-3A with colour scheme used on first three TG3-As*

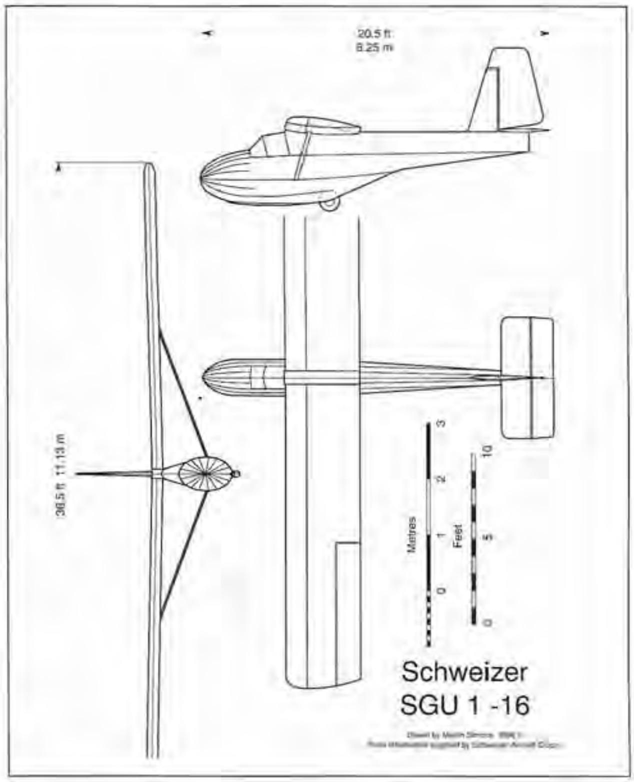
Wilmington with Du Pont in the cockpit of a Piper Cub which had its propeller removed and a tow hook mounted at the end of its prop shaft. This test proved that a similar technique could be used to pick up gliders from places where aeroplanes could not land. A few weeks later a pick up of a Midwest sailplane by a Stinson plane was demonstrated to the military at Wright Field by Du Pont and Lewin Barringer. This method was again demonstrated to the military in June of 1943 by Chet Decker, a former soaring champion who was now a U.S.A.A.F. pilot, using a TG-3. Later, two A.A.A. pilots flew to the Schweizer plant in a Stinson L-1 tug aircraft and a number of pickups were made by A.A.A. of a production TG-3A, to familiarise us with this type of take-off.

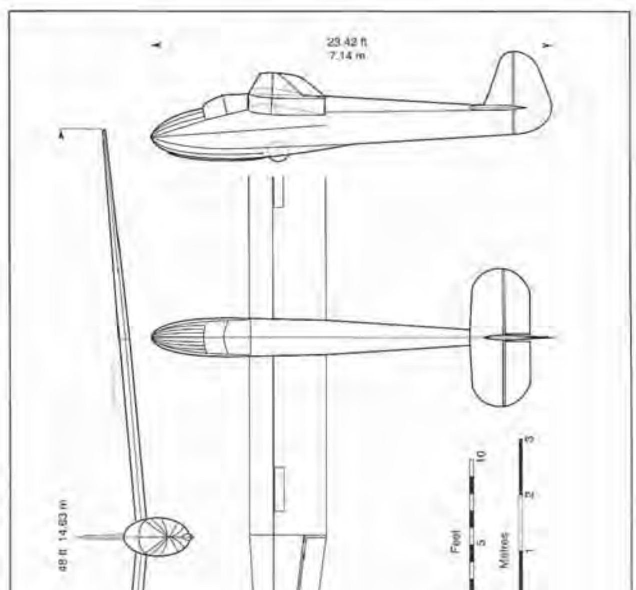
The system was sometimes used to retrieve agents and resistance commanders from enemy-occupied countries, especially southern France, where the 'maquis' guerrillas controlled areas in the mountains. Gliders could also be used in this way to pick up wounded troops from inaccessible front-line dressing stations and get them to hospital. A CG-4A or a British Airspeed Horsa glider would be towed to the site, land with some cargo of arms or personnel, then reload and be snatched out and towed home.

To meet this special need we proposed a new design, the 1-15, which we would make using TG-3A components. It had shortened wings and a large cargo compartment behind the cockpit, near the centre of gravity, so that variations in the load would not affect the trim of the glider. The 1-15 would have been easy to produce, as we were already tooled up and the cost would have been about the same as that of a TG-3A. However, nothing came of it and the 1-15 was never built.



There was not much spare time available to spend designing possible postwar sailplanes. The 1-16 we





projected was based on the 1-7 but was to be slightly larger. We remembered that the 1-7, with its wing area of only 130 ft², had flown well with a light pilot but tended to have a high rate of sink and come down rather rapidly when a heavy pilot was in the cockpit. The 1-16 was never built.

We continued to dream up new designs. The 1-17 was to be a high-performance, single-seat sailplane

Paul Schweizer takes a Schweizer employee for a flight in the TG-3A.

with a span of 48 ft and a welded-steel fuselage frame, fabric covered. We got as far as welding up a prototype fuselage, but other work interfered with further development.

Our interest then turned to improving the SGS 2-8. This would have been the 2-18, but we realised that the military were going to dispose of all of their gliders cheaply at the end of the war. A two-seat sailplane that offered only a marginal advance on the TG-2 and TG-3A would not attract customers, so no further action was taken on the 2-18.

Although none of the various models we considered from the 1-14 to the 2-18 went ahead, nothing was entirely wasted. Each project taught us something and clarified ideas which were reintroduced later in new designs.

Towards the end of the war, A.A.A. carried out some experiments using a TG-3A to carry fresh lobsters from a pick-up at a New England beach, towing the glider to a New York airport where the lobsters were delivered to a restaurant truck. The A.A.A.'s standard TG-3A had been modified to make the front cockpit the cargo compartment, and Taylor Boyer, the pilot, flew it from the rear seat. Our projected T-15 would have been ideal for such use, but the economics did not justify going ahead with the scheme. The idea worked well, but the trade never developed and there was no demand for our little cargo carrier.

All U.S.A.A.F. contracts were terminated as soon as peace came in August 1945. Waco CG-4A gliders, which had cost $20,000 each, were dumped in their thousands on the market for about $75 each. People bought them not for the aircraft, but for the high-quality lumber used in their export packing boxes. There was enough lumber there to build a small house!

Sport flying began again, and we were anxious to rekindle interest in soaring. Like many others, we anticipated that there would be a very rapid growth in all kinds of aeronautical activity, and wanted to ensure that we played our part in it. We felt that we ought to do anything we could to promote the sport. In retrospect, it is easy to see that we were over-optimistic.

More than 1,000 two-seat sailplanes, our own products the TG-2 and TG-3, the LK 10, the Pratt Read and the TG-1 Cinema, were offered on the surplus market for $350 to $600 each. Clubs and private-owner groups bought most of the TG-3As that survived the military gliding schools. Some of them had not been used since leaving the factories. They now served as trainers and even cross-country sailplanes. Betsy Woodward used a TG-3A to set a women's altitude gain record of 10,797 ft in 1950, and TG-3As also found their way to other countries: some to Canada, Iceland and Norway and one to Australia, where it was used to establish several altitude records.

The TG-3 was not entirely popular with small groups because it was a very heavy sailplane which required a large field and a strong tow car or winch for ground launching and a powerful tug aircraft for aero-tows. It also required a crew of four or five fairly strong people to rig and de-rig it. It had never, of course, been intended as a club sport sailplane.

As with many of the war surplus sailplanes, by removing some of the built-in military equipment, such as toolboxes, radios and heavy batteries, and by working carefully over the whole aircraft, sealing gaps and smoothing surfaces, improvements in performance were possible. In a few cases, somewhat against our recommendations, the entire upper part of the canopy and aft top fuselage fairing were removed, the canopy being replaced by small transparent plastic bubbles. This gave some reduction in drag and raised the best glide ratio slightly. The Laister Kauffman TG-4A, or LK 10A, was even more often modified in this way to make a so-called 'flat top'. Although for some time such modified wartime trainers helped the soaring movement to grow again, from our point of view as a manufacturer they created serious competition. Who

An All American Airlines Stinson tug picks up the A.A.A. lobster-carrying TG-3A from the Massachusetts beach. The long 'fishing rod' on the tug picked up the line suspended between the two poles, paying out line at first to avoid too great a jerk, and the glider took off smoothly and safely.

At the other end of the lobster flight, Taylor Boyer, the glider pilot, delivers the catch at Teterboro Airport near New York City. Unfortunately the venture did not prove economically successful.

would want to buy a new Schweizer sailplane when an almost unused one could be picked up on the surplus market at a fraction of the price?

About forty TG-3As were still flying as late as 1974, and a few survived in 1996 as 'vintage' sailplanes. The last one built, No. 114, hangs proudly on display in the terminal of Elmira/Corning Airport.

[8] Sixty-two of Corcoran's TG-1As were built, Laister Kauffman delivered 156 of LK 10As, known as the TG-4, Pratt Read produced 75 of the Naval LNE-1, all two-seaters.

[9] Details of the important and varied work undertaken at this time are given in Bill Schweizer's book *Soaring with the Schweizers*.

[10] We decided not to allocate the number 13, not because we were superstitious but thought that some of our potential military customers might be so.

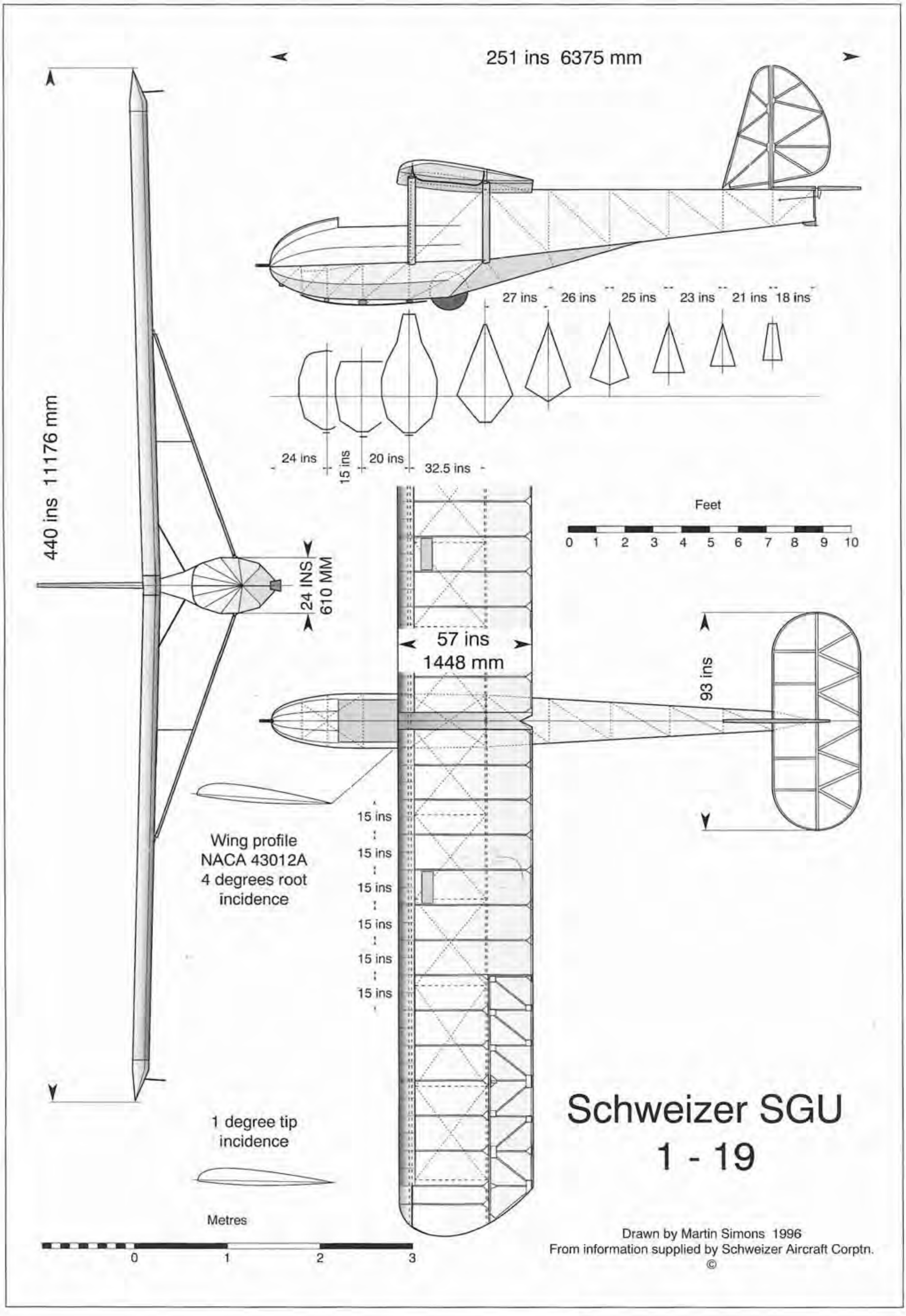
[11] Richard Du Pont was killed in 1944 when testing a large 40-seat troop-carrying glider.

Schweizer SGS 2-12

Total number built: 115 (one by Air Gliders of Ohio)

Specification		
Span	54 ft	16.46 m
Length	27.6 ft	8.42 m
Wing area	237 ft^2	22.02 m^2
Aspect ratio	12.3	
Aerofoil section	NACA 4416	
Empty weight	860 lb	390 kg
Pilots	340 lb	154 kg (military, 400 lb, 181 kg)
Flying weight	1,200 lb	544 kg (1,260 lb, 571 kg)
Wing loading	5.05 lb/ft^2	24.6 kg/m^2
Estimated best L/D	24:1 at 52 mph	83.9 km/h
Minimum rate of sink	3 ft/sec at 52 mph	0.91 m/sec at 83.8 km/h
Speed at 2 m/sec sink rate	72 mph	116 km/h

Top: *Paul Schweizer in front cockpit and Emil Lehecka in rear cockpit of No 114 commercial version of the TG-3A at Harris Hill.*
Above: *Examples of the TG-3 were to be found in many places around the world. This one was imported to Australia and modified to 'flat-top' configuration to reduce drag. It is here shown at the Port Augusta Gliding Club in South Australia (Australian Gliding)*


251 ins 6375 mm
27 ins
26 ins
25 ins
23 ins
21 ins
18 ins
24 ins
15 ins
20 ins
32.5 ins
440 ins 11176 mm
24 INS
610 MM
Feet
0 1 2 3 4 5 6 7 8 9 10
57 ins
1448 mm
93 ins
15 ins
15 ins
15 ins
15 ins
15 ins
15 ins
Wing profile
NACA 43012A
4 degrees root
incidence
1 degree tip
incidence
Metres
0 1 2 3
Schweizer SGU
1 - 19
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©

SGU 1-19

During the early part of the war, some of those who had been involved in prewar soaring, but who had not been directly engaged in the military programme, felt they could contribute by helping to train teenagers too young for Army or Navy flying schools. The youngsters would benefit from some introductory experience with gliders, somewhat on the lines of the Air Training Corps (A.T.C.) programme in Britain. A conference sponsored by Cdr Ralph Barnaby, former president of the S.S.A., the S.S.A. directors and the Philadelphia Glider Council was held at the Franklin Institute in Philadelphia on 27 March 1943. Thirty people attended, including the Schweizers.

During the 1930s most glider training had been by the single-seat method originally invented and vastly expanded in Germany. Almost every Luftwaffe pilot had been a member of a gliding club, and had learned to solo on primary gliders. Britain's A.T.C. was using hundreds of Slingsby Cadet single-seat gliders. Most of those at the conference felt that a plan like the A.T.C. was the only one that could be carried out under existing war conditions. To get such a programme going, a single-seat glider suitable for solo training, capable of being built from a kit by the students and requiring no scarce resources, would be needed. Launching would be by winch or car tow from large fields.

We took on the project of designing a glider for this programme, but because we were so busy with our military orders, progress was slow. We thought it should be produced in kit form, capable of being put together by amateur groups in the shortest number of working hours. We looked back again to the 1-7 and the 1-16 we had sketched out, and what emerged was the 1-19. The prototype was flown in the summer of 1944, having been put together as quickly as possible in spare time. Getting it into production was the big problem, and would take considerably more time and require extensive and accurate tooling. By this time the military had plenty of pilots, and the need for the teenage training scheme had passed. The 1-19 programme was put on hold until the end of the war, when we felt there would be a need for a good, strong, single-seat glider for solo training which would not be in direct competition with the ex-military two-seat sailplanes.

The 1-19 had a span of 36.66 ft and a wing area of 170 ft^2. The aerofoil section was the NACA 43012A. Its wings were of wooden two-spar design with truss-type ribs and diagonal bracing, with fabric covering except for a narrow strip of aluminium along the leading edge to give a smooth entry. This metal skin took none of the stresses. The wings were each supported by two streamline steel struts that would be tooled accurately so that no adjustment was needed on assembly to assure correct wing rigging. The fuselage and tailplane were simple welded-steel-tube frames, but aluminium was used for the fin and rudder, the whole being fabric covered. A large wheel was fitted with a wooden, rubber-sprung forward skid. Wherever possible, parts were made interchangeable to permit easy assembly and replacement.

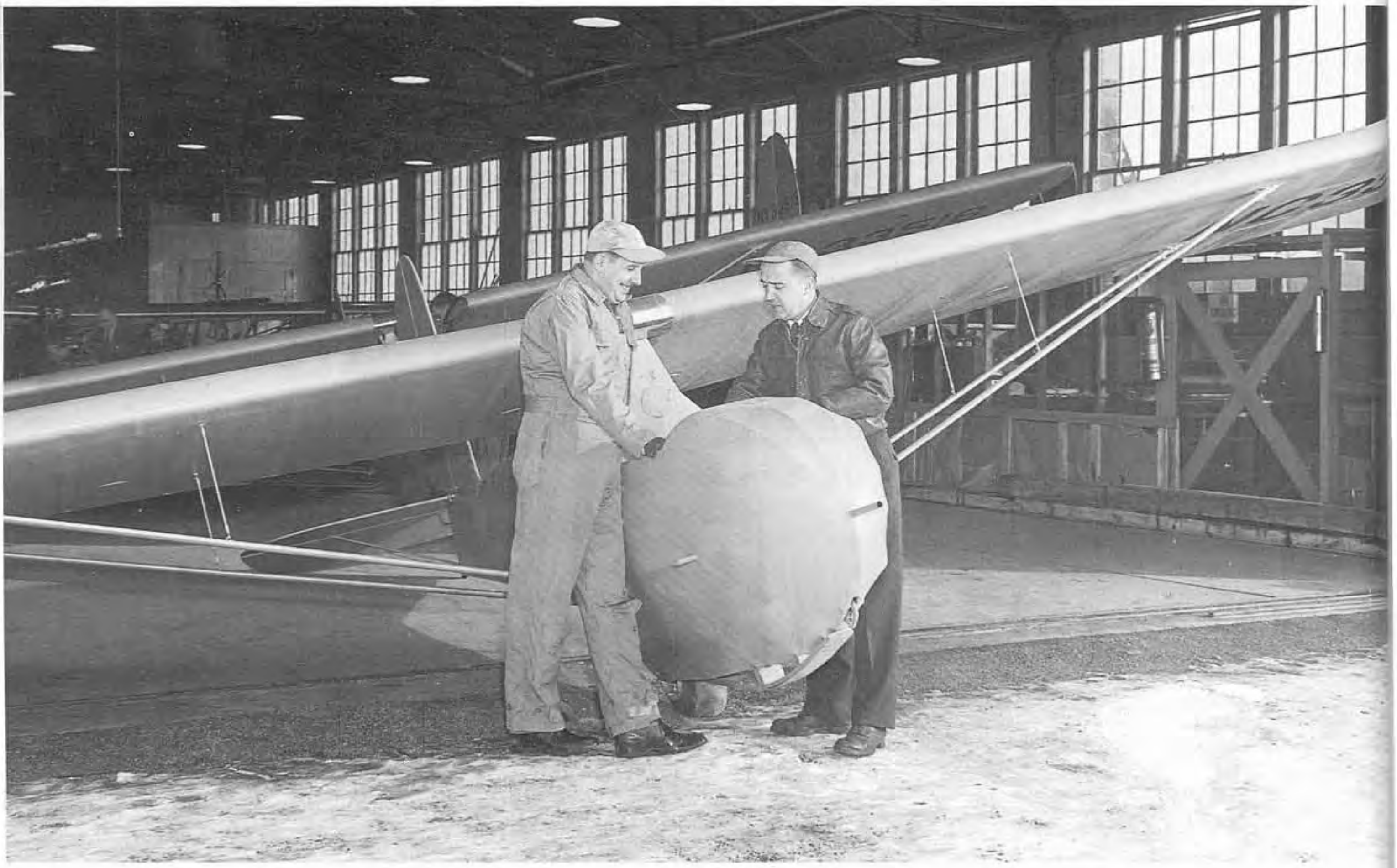
We recognised the limitations of single-seat training, but wanted to get the 1-19 into production. Although there were still restrictions on some materials, we received approval from the War Production Board for a pilot production run of ten gliders; C.A.A. type approval was completed in 1945.

After the original ten gliders had been completed, in January 1946, a run of parts was made for a hundred and a release issued to build forty sailplanes and kits. In production, each wing panel could be assembled from parts in eight man-hours, plus covering. Painted bright yellow, our 1-19s were advertised and displayed to interested parties at every opportunity.

Finding customers for the glider became a much greater problem than we had anticipated, as the soaring movement was slow to grow again. We took on several energetic former military pilots as sales staff, including Bob Taylor, Chuck Light and Larry Creighton. Frank Hurtt, a former member of the old Hudson Valley Glider Club, had become an instructor in the Mobile (Alabama) Military Glider School, and later instructed at a military power flying school. He had worked in graphic arts before the war, and therefore fitted in well as company test pilot and illustrator for our brochures, sales literature and advertisements. He and I set a new national two-seat glider duration record by flying the Harris Hill Ridge for almost 10 hours in the Schweizer works TG-3A.

Twenty more 1-19s were built during February and ten in March, but we were compelled to stop production in April after fifty had been completed and only about thirty, plus a few kits, sold. We had twenty in stock.

At the same time, gliding clubs and groups using the cheap two-seat sailplanes began to spring up all



ABOVE: *Bob Taylor and Larry Creighton of the Schweizer sales department examine a new 1-19 at the end of the factory production line.*
BELOW: *The prototype 1-19 under auto-tow at Chemung County Airport. (E.A. Lehecka)*

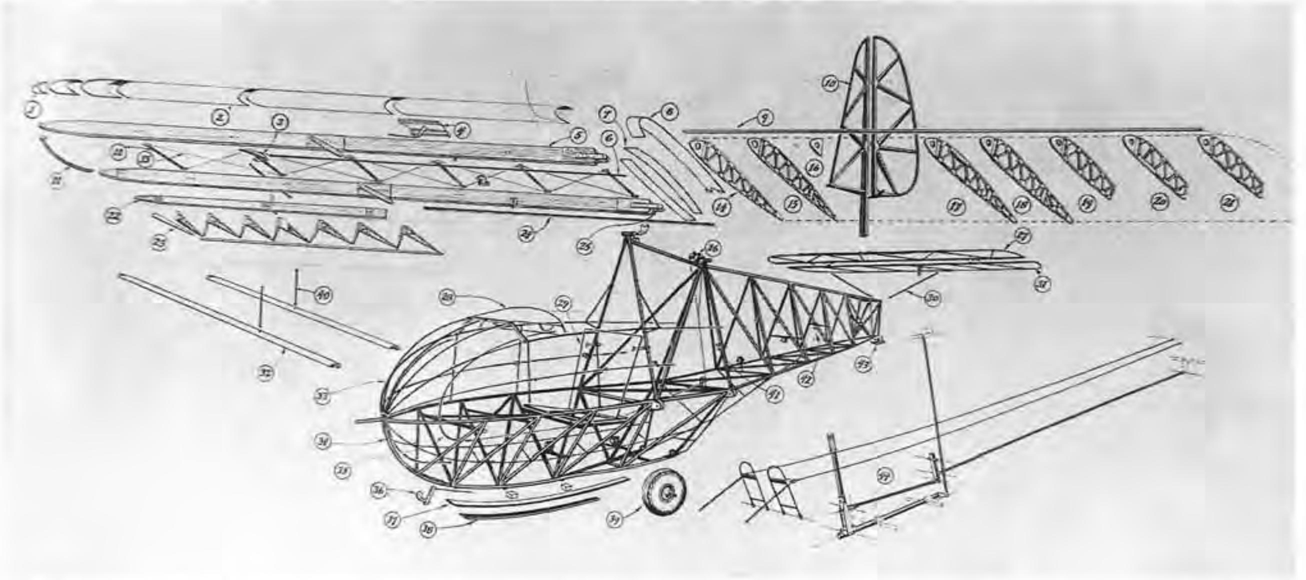
Top: *The SGU 1-19 on winch tow at Chemung County (Elmira/Corning) Airport.*
Above: *An SGU 1-19 with an auxiliary powerplant as its engine. This was Schweizer's first attempt at producing a motor glider.*

over the country, which suggested that in the longer term the soaring movement would expand and there would be a growing need for our products. We had overestimated the postwar glider market, much as the U.S. light aeroplane manufacturers had overestimated the light aeroplane market. The other glider manufacturers, Laister, Pratt Read and Frankfort, withdrew from the field altogether, so direct competition came only from California, where Gus Briegleb continued his glider-manufacturing operation, mainly producing kits.

The longer-term prospects looked good, if only our sailplane business could survive the slow period, but it became essential for us to undertake more subcontract work. This bridged the gap for Schweizer, but it also became and continued to be a major part of our work. Thenceforth, we were forced to regard sailplane production as a subordinate part of our main business. We would not have been able to continue at all otherwise.

Although the 1-19 was successfully used in solo training, it was becoming obvious that two-seat training with aero-towed launching had many advantages. Some pilots used the 1-19 for soaring, and a few cross-country distance flights were made with it. In good conditions it could do surprisingly well. Jim Hard of Richland, Washington, fitted his 1-19 with an enclosed canopy and achieved a remark-

ABOVE: *A production 1-19 painted yellow all over, with registration letters and numbers in black.*
BELOW: *An SGU 1-19 in a different scheme: green and cream. The insignia on the rudder is the Vintage Sailplane Association*



TOP: *An SGU 1-19 with an enclosed canopy flies above desert country near Elsinore, California. The pilot was John Bock. (June Sargent)*
ABOVE: *The exploded view of the Schweizer 1-19 kit as provided to homebuilders, showing the completed furnished parts.*

able 190-mile distance flight to a pre-declared goal in 1962, earning a diamond for his international Gold C badge.[12] As an experiment Ernie obtained a 12 hp Andover motor and mounted it with a pusher propeller on a pylon above the centre section of a 1-19, with the idea, often mooted, of making a self-launching sailplane. The motor, which supplied the auxiliary power on B-29 bombers, was not powerful enough, and the 1-19 could just get off the ground but could only cruise round about 10 ft high over the airfield, to the annoyance of the airport management. The 'ground effect' reduced drag sufficiently to allow the glider to get airborne, but to climb any higher proved impossible. If launched by auto-tow the 1-19 would slowly descend until, at 10 ft, it could just sustain itself. On one occasion, when a powerful thermal came along, Frank Hurtt was able to climb to 2,000 ft. No other suitable low-powered engines were available, so after these trials the motor was removed and the 1-19 returned to its glider status.

[12] The requirements for the Gold C are a flight of 300 km (186.4 miles), a gain of height of 3,000 m (9,843 ft), and a duration flight of 5 hours. All three tasks may be done in one flight, or they may be done on separate occasions. The 5 hours duration is normally completed first as part of the Silver C tests. For a 300 km flight to a nominated goal, a diamond is added to the badge.

Schweizer SGS 1-19

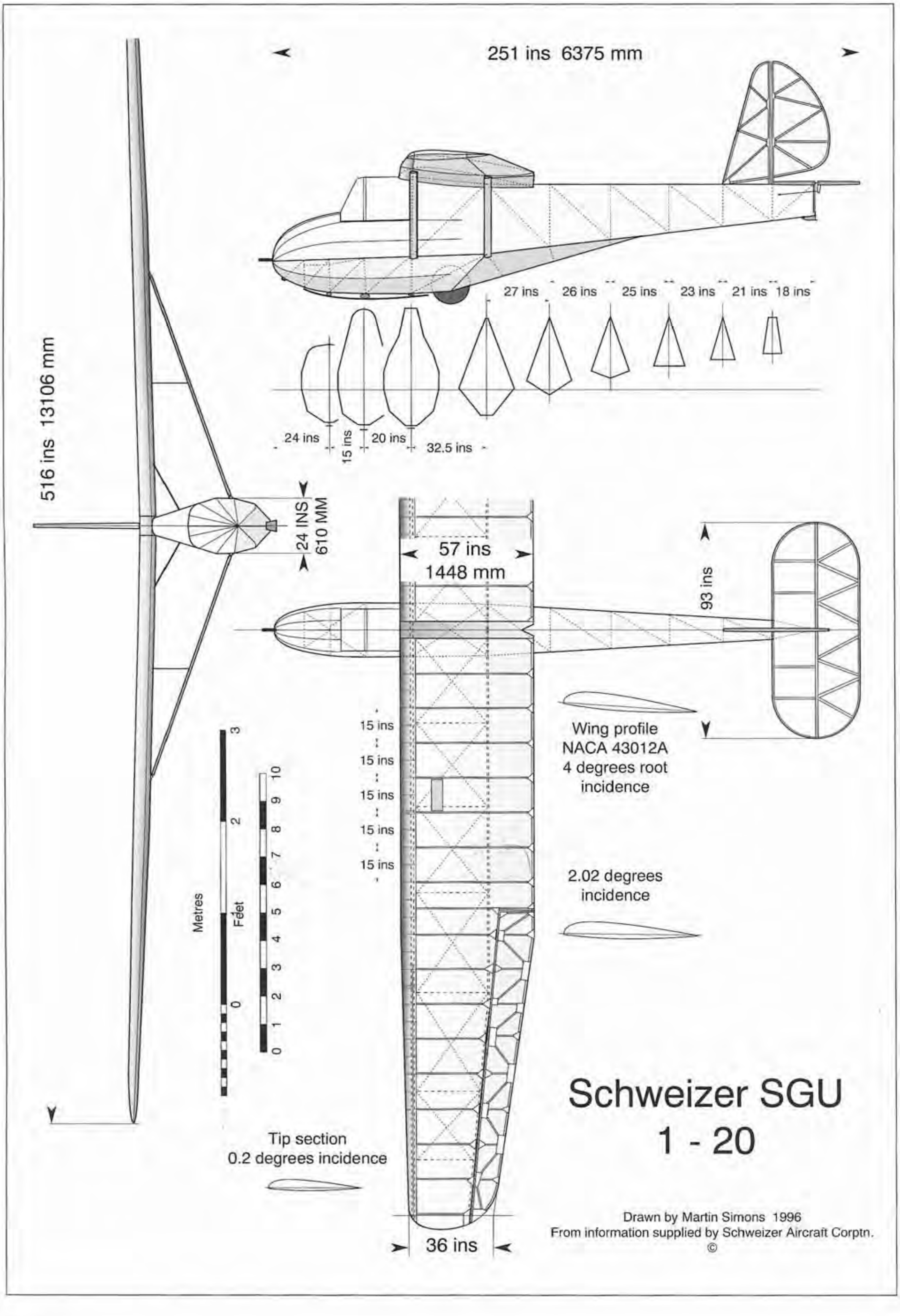
Total number built: 57

Specification

Span	36.66 ft	11.18 m
Length	20.9 ft	6.38 m
Wing area	170 ft^2	15.8 m^2
Aspect ratio	7.9	
Aerofoil section	NACA 43012A	
Empty weight	320 lb	145 kg
Pilots	230 lb	105 kg
Flying weight	550 lb	250 kg
Wing loading	3.24 lb/ft^2	15.8 kg/m^2
Estimated best L/D	16:1 at 42 mph	68 km/h
Minimum rate of sink	3.5 ft/sec at 33 mph	1.1 m/sec at 53 km/h

ABOVE: *A 1-19 takes off via aerotow from Chemung County Airport. (S.A.C photo).*
BELOW: *A restored vintage 1-19 Serial Number 32 without any registration numbers.*
OPPOSITE PAGE: *Beulah Wheeler in the prototype 1-19. (Hans Groenhoff).*


SCHWEIZER UTILITY
MODEL SGU 1-19


251 ins 6375 mm
27 ins
26 ins
25 ins
23 ins
21 ins
18 ins
24 ins
15 ins
20 ins
32.5 ins
516 ins 13106 mm
24 INS
610 MM
57 ins
1448 mm
93 ins
15 ins
15 ins
15 ins
15 ins
15 ins
Wing profile
NACA 43012A
4 degrees root
incidence
2.02 degrees
incidence
Metres
Feet
Tip section
0.2 degrees incidence
36 ins
Schweizer SGU
1 - 20
Drawn by Martin Simons 1996
From information supplied by Schweizer Aircraft Corptn.
©

SGU 1-20

The 1-20 was an extended-span version of the 1-19, to achieve a better soaring performance at minimal cost. It first flew in 1946. The fuselage and tail surfaces were exactly the same as those of the 1-19, except for the fitting of a cockpit canopy to reduce parasitic drag. The span was stretched to 43 ft, the wing being tapered from outboard of the strut attachment point. The aircraft's performance was considerably better than that of the 1-19. We produced only one in the factory, and made drawings available to enable owners of the 1-19 to make the conversion to 1-20 standard. A few did so, one in Canada and two or three in the U.S.A., but demand was not sufficient to justify production.

The 1946 Nationals were organised at Harris Hill, Elmira, as before. Forty-eight sailplanes competed, and thirty-eight of these were war surplus aircraft. Things were to change. The National Contest in 1947 was moved away from the hills for the first time. Texas was superb thermal soaring country, and the airfield at Wichita Falls gave us plenty of room. Launching was by aero-tow, and the main emphasis in the competition was on distance flying. Howard Burr and I took the prototype 1-20 to the event and had many good flights. On one occasion I was able to cover a distance of 138 miles, which was a record for a utility glider at that time. Most of the contestants were flying the war surplus two-seaters, sometimes modified to improve their performance.

One pilot who has pleasant memories of flying the 1-20 is Jim Gray, who bought N2708A in 1957. A 1-19 fuselage with 1-20 wings built by Ben Hyson, Art Heavener and Otto Zauner, it was painted light blue and had the name *Hy Heaven* stencilled near the

The SGU 1-20 prototype on an early flight.

ABOVE: *The fabric patch from the nose of Jim Gray's Blue Auk now hangs on the living-room wall of his home in Payson, Arizona. (Jim Gray)*
BELOW: *The 1-20 on aero-tow just after take-off from the airport outside the Schweizer plant.*

The 1-20 in its final colours, awaiting launch.

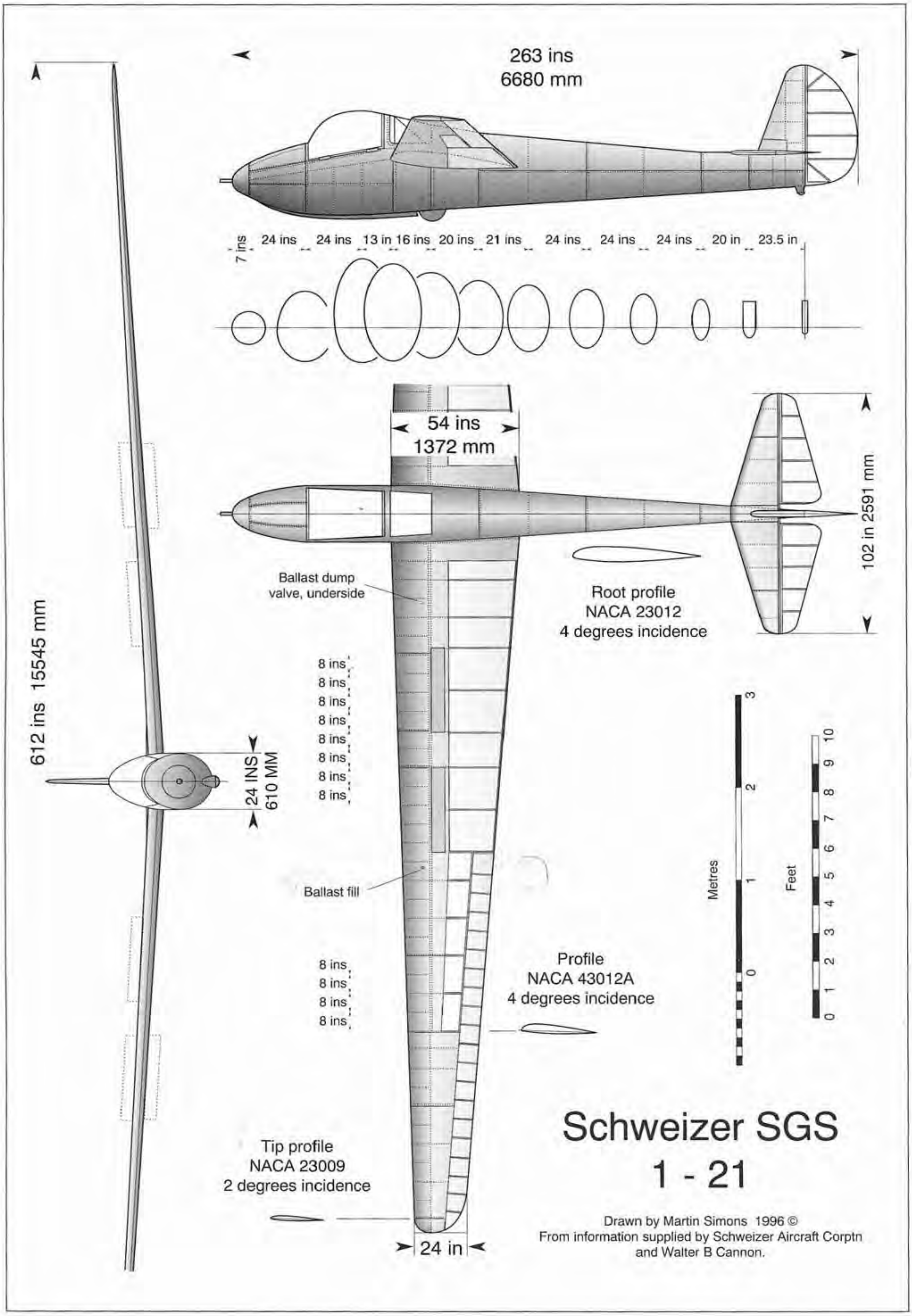
cockpit. Jim found the cockpit very tight for a tall man, but was able to outclimb all the other sailplanes in thermals. Jim made his five-hour Silver C duration fight over Harris Hill in May 1958, and attempted several times to do his 50 km Silver distance, but always fell short. He changed the glider's name to *Blue Auk* and had a suitable emblem painted on the nose by artist Dale Gustin. Jim flew a total of 45 hours in the *Auk*, an average flight time of about 46 min. The *Auk* was later sold to Dave Welles, who achieved a 300 km Gold distance in this 1–20. The nose was lengthened to accommodate him, which required the fabric with the painted emblem on it to be removed. A quarter of a century later Dave Welles presented to Jim Gray the original piece of fabric carrying the *Blue Auk* emblem, and it is carefully preserved at Jim's home in Arizona. Two of the type are still flying in the U.S.A.

Schweizer SGU 1-20

Total number built: 2 (plus some 1-19s converted to 1-20 standard)

Specification

Span	43 ft	13.1 m
Length	20.9 ft	6.38 m
Wing area	182 ft^2	16.90 m^2
Aspect ratio	10.15	
Aerofoil section	NACA 43012A	
Empty weight	385 lb	175 kg
Pilots	220 lb	100 kg
Flying weight	605 lb	275 kg
Wing loading	3.32 lb/ft^2	16.9 kg/m^2
Estimated best L/D	16:1 at 43 mph	69 km/h
Minimum rate of sink	3.1 ft/sec at 35 mph	0.94 m/sec at 56 km/h


263 ins
6680 mm
7 ins
24 ins
24 ins
13 in
16 ins
20 ins
21 ins
24 ins
24 ins
24 ins
20 in
23.5 in
54 ins
1372 mm
102 in 2591 mm
Ballast dump valve, underside
Root profile
NACA 23012
4 degrees incidence
612 ins 15545 mm
24 INS
610 MM
8 ins
8 ins
8 ins
8 ins
8 ins
8 ins
8 ins
8 ins
Ballast fill
Metres
Feet
Profile
NACA 43012A
4 degrees incidence
8 ins
8 ins
8 ins
8 ins
Tip profile
NACA 23009
2 degrees incidence
24 in
Schweizer SGS
1 - 21
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corptn
and Walter B Cannon.

SGS 1-21

Struggling to keep the glider side of our business alive, we believed there would be some demand for a high-performance single-seat sailplane. Pilots who learnt to fly in the numerous ex-military two-seaters now available, or even in one of our more recent products, would wish to progress to cross-country flying and competitive soaring. We also hoped that some of those who had been trained to fly gliders during the war, and the numerous Air Force and Navy pilots now released, might want to take up soaring as a sport, but there was hardly anything available for them. The prewar RS-1 Zanonia was the only surviving American design of this quality, and only one example had ever been built. Flown by John Robinson, it won the 1946 Nationals. A very few imported sailplanes had survived, such as the German Minimoa and the Polish Orlik, but they were all-wood, ageing and, by modern standards, rather slow.

In the September/October 1946 issue of *Soaring* magazine, and in formal propsals sent to the top soaring pilots in the country, we offered the 1-21. We set the price tentatively at $2,700, with a $750 downpayment. It was hoped that sufficient orders would be received to justify going ahead, with deliveries set for the 1947 season. The glider was to have a glide ratio of over 27 to 1, but the most unusual feature was the inclusion of water-ballast tanks in the wings. Carrying ballast was an idea the German experts had proposed as early as 1934, and a few of their sailplanes had provision for tanks in the fuselage, but these had very rarely been used in practice.

Frank Hurtt, Schweizer's test pilot, in the prototype 1-21 ready for the first test flight.

The aim of carrying extra weight in a cross-country sailplane is to improve the average cruising speed in good weather. It is true that, when trying to gain height in a weak upcurrent, a light sailplane will do better. It will have a low rate of sink through the air and will also be able to turn on a small radius, so by banking steeply it can work right into the stronger core of a thermal. But having climbed, the sailplane on a cross-country flight has to glide off on track in search of more thermals. For this some extra weight is an advantage. The heavy sailplane can cruise fast at a shallow angle of descent, and so can search through more air and also penetrate any regions of down-current quickly. When some air is going up on a good soaring day, some also must come down! The light sailplane can fly only slowly, so it remains in bad air longer and loses much more height. The ballasted sailplane will have reached the next thermal (if there is one) and will be climbing while the lightweight is still floating gently along and sinking fast, far behind. Of course, if no thermal is found, a suitable field has to be chosen for a premature landing, but in this case still the heavier sailplane is likely to have flown a greater distance.

Carrying a quantity of water ballast gives the pilot an option. If the thermals are expected to be strong, the tank can be filled up before take-off. The rates of climb are a little less, but this is more than compensated for by the faster cruising. The average speed over a distance is better, allowing many more miles to be flown in the limited hours of a soaring day. Later in the flight, towards evening, when the thermals begin to weaken, or if a region of poor weather is encountered, the water can be dumped through a valve and the flight may be able to creep cautiously along a little further. The 1-21 would have this option and, as far as we knew at the time, it would be the first sailplane to be offered from a factory with built-in ballast tanks. It was shown that with a wing loading of 5 lb/ft^2, which in those days was thought to be very high, the cruising speed would be 82.5 mph, very much faster than the other available sailplanes.[13]

ABOVE: *The prototype SGS 1-21 flying in Texas during the 1947 National Soaring Contest.*
BELOW: *The all-metal fuselage of the SGS 1-21 under construction.*

Above: *Richard Comey in the cockpit of the prototype SGS 1-21, in which he won the 1947 National Soaring Contest, chatting with Paul Schweizer before launch. (Howard Levy)*
Right: *The SGS 1-21 displays its clean and well-proportioned planform as it passes overhead.*

The 1-21 was all-metal except for the fabric covering of the movable control surfaces and the aft portion of the wings. The wing was straight tapered, of 51 ft span and had the NACA 23012 aerofoil at the root, the 43012A at the aileron root and 23009 at the tip. We chose profiles from the NACA five-digit series because they had proved very satisfactory on our earlier designs. Only 12% thick at the root, this was, for its time, a very thin wing, giving low drag at high cruising speeds, but the five-digit profiles, with their point of greatest camber well forward, also gave good lift at high angles of attack, and hence slow stalling and landing speeds. To prevent dangerous tip stalling, a washout or negative twist of 4 degrees was built in, as well as the changes of profile. The ballast tanks in the wings were integral with the D tube of the wing, close to the fore-and-aft balance point and not likely to alter the trim when the water was dropped. Spoilers of generous size were provided, opening both above and below the wing.

The main spar was built up using L-section angle extrusions for the flanges and sheet webs. Near the wing roots, reinforcing strips of alloy were riveted to the flanges inside the angle. Towards the tips the angle extrusions were progressively trimmed away to save weight where their full strength was not needed. We lacked the costly milling machines that would be used in a large aircraft factory for spar production, so this type of spar, involving a good deal of hand work, was the simplest and cheapest for us. The metal skinning of the forward third of the

Ginny Meyer Bennis (later Schweizer) gets into the SGS 1-21 at Grand Prairie Airport during the 1950 Nationals.

wing, to form a D-section torsion tube, was 0.032 in. alloy sheet out to three-quarters of the span, thinning to 0.020 in. thickness for the last quarter. The ailerons were hinged along their top surfaces with flush piano-type hinges. The main wing ribs, and the small sub-ribs ahead of the spar to stiffen the skin, were pressed on Masonite forms. With a tapered wing of this type, every rib differs from every other, so a separate form has to be made for each one, requiring more hand work. To attach the fabric to the metal, a strip of plywood was riveted to the underside of the aluminium skinning where it projected slightly beyond the spar extrusions. The fabric was then doped directly to the wood.

Only metal construction allowed such a wing to be sufficiently strong and stiff. With a semi-span of 25.5 ft the depth of the spar at the inner end was only 6.5 in., and the cantilever ratio was more than 45 to 1. Contemporary wooden sailplanes of about the same span, like the very popular German-designed Olympia which was then in production in Britain, Sweden and France, were 16% thick at the root with cantilever ratios around 33. The wings of the 1-21 together weighed 252 lb complete, 54% of the complete sailplane's total structural weight.

The fuselage was all-aluminium, being a sheet-metal-skinned semi-monocoque construction of well-streamlined oval cross-section with frames at 24 in. spacing. There were four light longerons of extruded angle, and the skins were of 0.032 in. sheet at the front and 0.020 in. thick for the after part behind the wing. The size of our press was such that we could not form the fuselage frames in one piece. Each had to be built up from four separate segments pressed individually, over the usual hand-made forms. By making the frames symmetrical we needed only one form for each, the four segments being identical. The extreme nosecap was a spun dome. The skin panels immediately aft of this were of double curvature, but the rest were curved only in one dimension. The cockpit, which had a blown Plexiglas canopy, was roomy enough for large persons and sufficient space and weight were allowed to provide for extra instruments, batteries and oxygen equipment. A simple landing wheel was fitted with a shallow, rubber-mounted forward skid. Allowance was made for a retractable landing wheel in future developments.

To attach the wing to the fuselage a large yoke, comprising two sheets of half-inch-thick 75 ST alloy spaced apart to allow the wing fittings to slide

LEFT: *The 1-21 with spoilers open on the approach to land.*
BELOW: *Johnny Robinson, many times National Soaring Champion, flies the 1-21 over Elmira. Robinson was the first pilot to achieve the distinction of adding three diamonds to his gold soaring badge.*

between them, was built up and riveted to the main cross-frame above the wheel. The yoke was set at the correct angle of incidence, 4 degrees. Four bolts attached the spars to the yoke, one on each side for the lower spar flanges and two above for the upper flanges. A single bolt on each side attached the inner end of the wing D nose directly to the fuselage frame just aft of the cockpit.

The tail unit was as simple as we could make it: a metal-skinned aluminium frame for the fixed tailplane and fin, and light steel tubing for the elevator and rudder, fabric covered.

After considerable promotional effort we received only two orders, one from Dick Comey, a Second World War military pilot, and the other from Dave Stacey, who had flown a Baby Albatross before the war. The price of the 1-21 was considered high when compared with the average cost of surplus sailplanes that were still available, and too few were prepared to pay so much for a sailplane at that time.

We decided to go ahead nevertheless, and built two 1-21s on the basis that once the sailplane was flying and showing what it could do, more orders would follow. We completed the one for Comey in time for him to enter the 1947 Nationals at Wichita Falls, Texas. The soaring conditions there were very good, and almost every day a 'free distance' task was set. Pilots were required to make the longest possible distance flight, to a remote landing, each day. The pilot and crew had a hard time because after each flight they had to retrieve the sailplane by road and get it back to the airfield in time to take off again in the next day's contest. The more successful the flight, the further the crew had to drive. Dick Comey, even with his limited contest experience, scored on every day and won the Nationals with the 1-21. The performance was exceptionally good. Comey set a national distance record of 300.25 miles on one day, but before the end of the meeting this was broken, first by Eric Nessler, a French visiting pilot, and then by John Robinson, who flew his Zanonia to a landing 332 miles away.[14]

We completed the second 1-21 for Dave Stacey later in the year, but to our chagrin no further orders were forthcoming. In spite of the glider's proven performance, the soaring movement at that time was so small that there were not enough pilots willing to pay $3,000 for a sailplane. In fact, with labour and material costs in 1947, $3,750 would have been a more realistic price from our viewpoint.

It was all very disappointing. The 1-21 was ahead of its time, and had it been more marketable it would probably have dominated the soaring scene in North America for many years. As it was, since we had not tooled up for production or gone ahead with all the work required for F.A.A. type approval, we decided not to go any further with the 1-21. Any new single-seat high-performance sailplanes that we might design would have to be much simpler and cheaper.

Dick Comey let Ginny Mayer Bennis fly his 1-21 in the 1950 Nationals, and she set a women's record of 146 miles. It was then sold to Stanley W. Smith, who flew it in the 1952 World Championships in Spain. In 1957 he won the U.S. Nationals in it, ten years after its debut. It is now owned by Alan McNicol and his son, who fly it in New England. David Stacey eventually gave his 1-21 to the S.S.A., who were in need of funds. It was auctioned off and purchased by Bob Moore of Washington State, who flew it for years and turned in many good performances at regional and national meets. It was then sold to Dr Walter Cannon, who restored it to its original condition. It won the 'Best Schweizer' award at the 1995 International Vintage Sailplane Meet, at Harris Hill.

13 In recent times, it is normal for competition sailplanes to carry large amounts of water, often weighing as much as two or three additional pilots. Wing loadings may reach 10 lb/ft^2 (48 kg/m^2) and cruising speeds between thermals may be 100 mph or higher.

14 Robinson was thus the first American to achieve the distance diamond award for a flight over 500 km. Comey's flight was 17 km short of this. In 1950 Robinson became the first pilot in the world to achieve all three diamonds. Nessler was a famous French pilot, who had flown a solo duration record of 38 hours in 1942, only to have it disallowed. See footnote 5.

Schweizer SGS 1-21

Total number built: 2

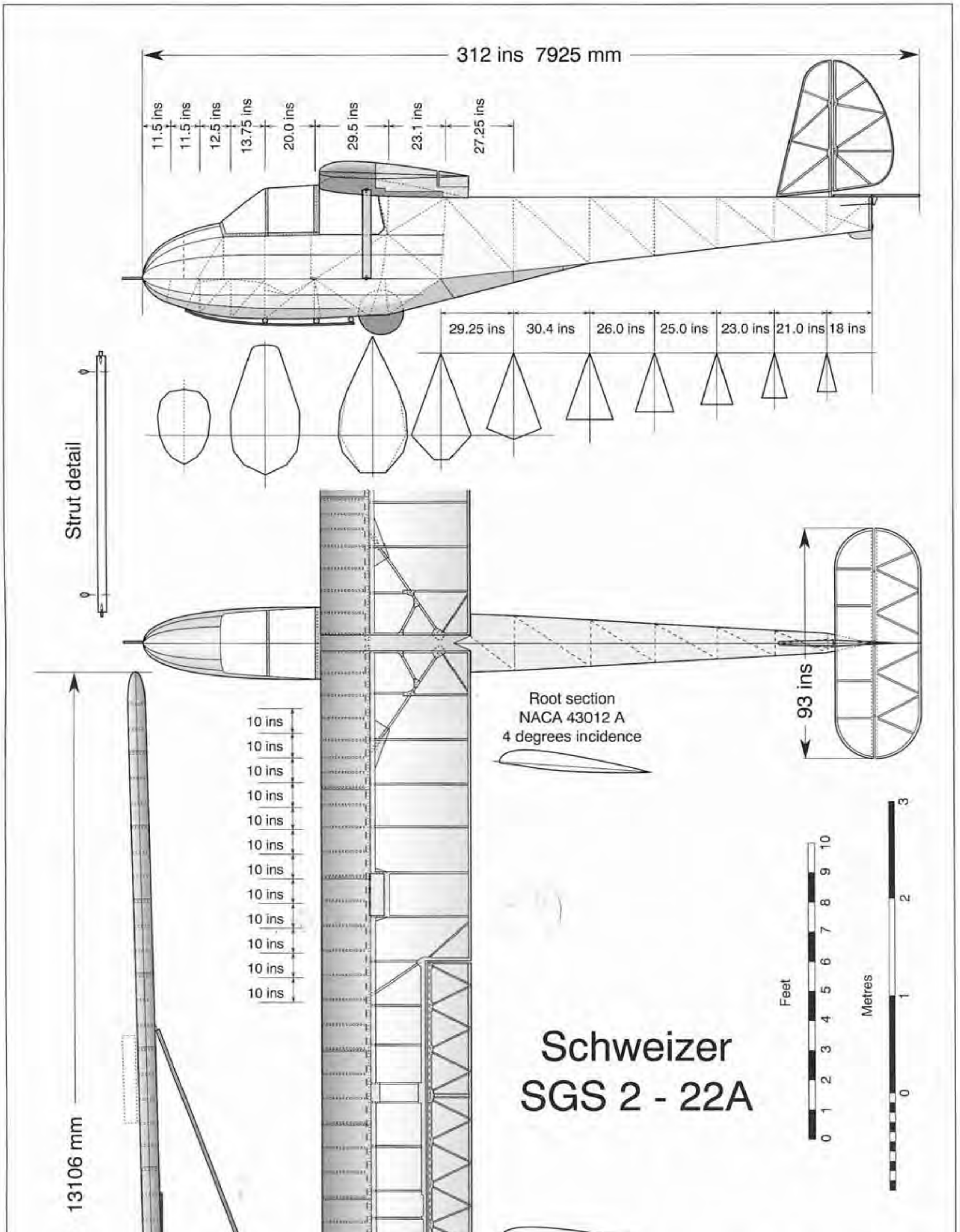
Specification		
Span	51 ft	15.54 m
Length	21.9 ft	6.68 m
Wing area	165 ft^2	15.3 m^2
Aspect ratio	15.75	
Aerofoil sections	NACA 23012A (root), 43012A at 72% span, tip 23009	
Empty weight	470 lb	214 kg
Pilot	260 lb	118 kg
Flying weight	732 lb	332 kg (unballasted)
Ballast	260 lb	118 kg
Maximum flying weight	992 lb	450 kg
Wing loading	4.4 lb/ft^2	21.7 kg/m^2 (unballasted)
Maximum wing loading	6.0 lb/ft^2	29.4 kg/m^2 (ballasted)
Estimated best L/D	27:1 at 45 mph	72 km/h
Minimum rate of sink	2.2 ft/sec at 38 mph	0.66 m/sec at 61 km/h

Opposite Top: *The second 1-21, restored perfectly by Walter Cannon, participated in the 1995 International Vintage Soaring Meet at Harris Hill. It was painted all silver with dark blue trim and registration.*

Opposite Right: *The cockpit and canopy of Cannon's restored SGS 1-21. Note the steel tubular crash pylon behind the pilot's seat, and the total-energy probe mounted on the nose.*


NX
91861


EXPERIMENTAL


312 ins 7925 mm
11.5 ins
11.5 ins
12.5 ins
13.75 ins
20.0 ins
29.5 ins
23.1 ins
27.25 ins
29.25 ins
30.4 ins
26.0 ins
25.0 ins
23.0 ins
21.0 ins
18 ins
Strut detail
93 ins
Root section
NACA 43012 A
4 degrees incidence
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
Schweizer
SGS 2 - 22A
43 ft 13106 mm
60 ins
1524 mm
Tip section
NACA 43012 A
1 degree incidence
Drawn by Martin Simons 1996
From information supplied by
Schweizer Aircraft Corptn.
©

SGS 2-22

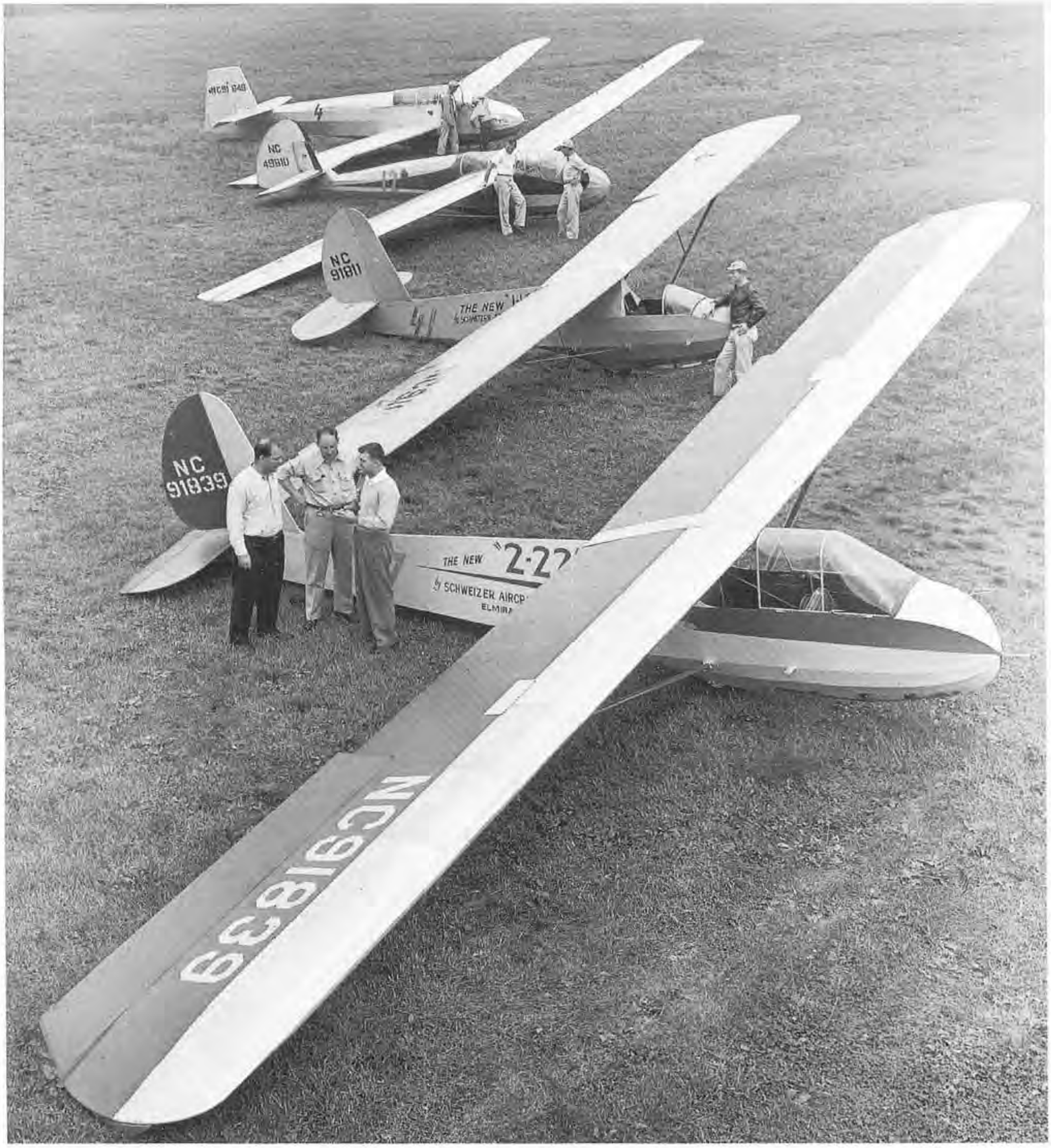
The solo training method we had envisaged for the proposed wartime youth training scheme would not be acceptable in future. Two-seat training was obviously safer, more efficient and, in the long run, cheaper because fewer aircraft would be damaged. Although surplus military training gliders would become available at low prices, the TG-2 and TG-3A, and the others, were not ideal for sport glider training. Their relatively high wing loadings and flying speeds, although acceptable for teaching pilots to fly the heavier military cargo and troop-carrying gliders, were not desirable for beginners in soaring. They were not suitable for auto or winch launching unless a very large field or airport was available. Furthermore, when the seats were arranged in tandem, as they were in four of the five available types, the instructors did not have an adequate view from the rear seats. The Pratt Read sailplane had seats side-by-side, but this had disadvantages, too. The TG-2 was all-metal, but the others all had wooden wings and other wooden components, making it impractical to store them outside, as many clubs and private owners had to do. An all-metal trainer could be tied down outside for the soaring season, saving on hangarage.

The earliest sales of our 1-19 single-seat trainer were mostly to small organisations at established airfields, fixed-base operators (F.B.O.s) as they were called. An F.B.O. would launch the gliders by aerotow, fitting in with the regular powered flying organisation of the airfield better than a winch or car towing could. Our salesmen reported that there was a need for a simple two-seat training sailplane that could readily be towed by light aeroplanes. Some F.B.O.s indicated that they might buy both a two-seater and a 1-19 to go with it for early solo flying, but they were not interested in the 1-19 by itself.

We hoped that a market would develop in time for a new, light and cheap trainer. More people would be attracted to soaring if they could start in something easy to fly, giving them the confidence that would maintain their enthusiasm. It was also thought that a new trainer should be offered as a kit for assembly by clubs and individuals, further reducing their costs.

Late in 1945 Ernie started to design what would become the SGS 2-22. Work on this glider ran alongside that for the 1-21, but the need for the trainer was more urgent, so the 1-21 was held back and the 2-22 prototype flew on 8 February 1946, more than a year earlier than the 1-21.

Ernie Schweizer talks to test pilot Frank Hurtt before the first flight of the SGS 2-22.



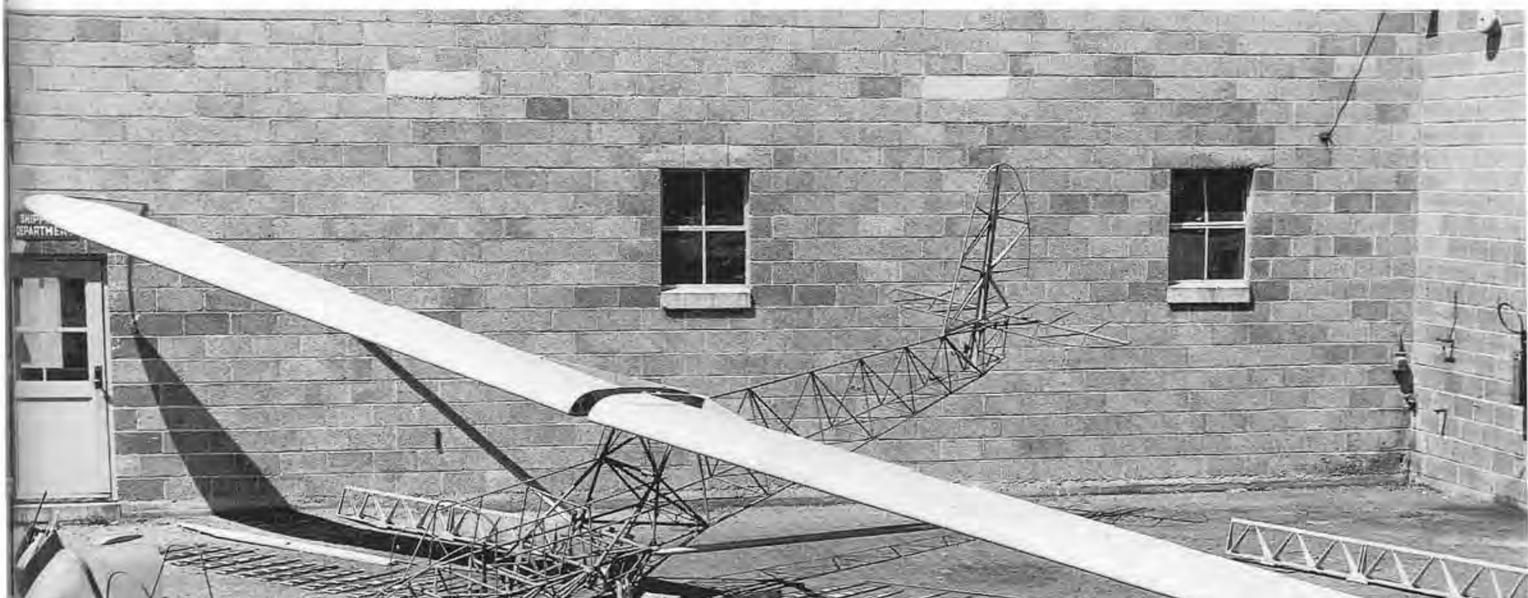
The Schweizer family of sailplanes lined up at Harris Hill in 1946. In order from the rear they are TG-3A number 114, a TG-2, a 1-19 and the new SGS 2-22.

The 2-22 was basically a scaled-up 1-7 with both the student and instructor sitting ahead of the wing spar, the rear cockpit being just under the leading edge of the wing near the centre of gravity, so there would be little change in the flight characteristics when the pupil was sent solo. The front cockpit had a large windshield and a hinged, transparent enclosure, but the instructor had no side windows. He could lean his head to either side, into the airflow, to see directly in front. The wing leading edge restricted the view directly upwards. The instructor had to climb into the rear cockpit first, then the pupil took the front seat and closed the canopy. There was no room for parachutes. The rectangular wing, spanning 43 ft, used the 43012A aerofoil section, a slightly modified version of the 43012. As in the 1-7, the wing was all-metal, having a simple spar built up from L-section alloy extrusions, pressed sheet ribs and alloy skinning over the D-tube leading edge. Fabric covered the rear portion of the wing, and there was a single streamlined steel-tube strut. The experience gained in doing subcontract work for metal military aircraft, and our new metalworking equipment, made such a structure an obvious choice. The fuselage was of welded chrome-moly steel tubing, which had worked well in our previous gliders.

To keep production costs down we used parts from the 1-19 wherever possible, since they were already tooled. The rear-fuselage assembly aft of the wing, including the tail surfaces, was identical to that of the 1-19, as were many control systems and small fittings.

Under test, the prototype nicely met the requirements that we had set for it. The weight was 450 lb, which allowed 380 lb for the two crew, giving a flying weight of 830 lb. The 2-22 was easy to fly and, with its relatively low wing loading and low rate of sink, could turn tightly. It was good at climbing in light thermals, and very stable. We could not get it to spin, even with temporary tail ballast to get the centre of gravity far back. This very safe feature actually created a slight difficulty. For the F.A.A. flight tests we had to demonstrate that, if it did somehow get into a spin, the glider could recover! We changed the rudder stops to permit greater rudder movement to force the 2-22 to spin, and it recovered very promptly as soon as the controls were centred. After the tests we put the rudder stops back to their normal position. We felt that these characteristics were preferable for this type of training sailplane, because some relatively inexperienced instructors might be in the rear cockpit. For teaching spins, other sailplane types, such as the military surplus ones, could be used. The F.A.A. type certification, which took three months, was duly received, and production started in May

Above: *The welded fuselage frame of the SGS 2-22.*
Below: *The SGS 2-22 in kit form, as sold by the Schweizer Aircraft Corporation. The most important and difficult work was already done. The buyer was required to complete the assembly and cover with fabric.*



One of the early SGS 2-22 sailplanes with the open rear cockpit at the International Vintage Soaring Meet at Harris Hill in 1995.

1946, with orders for three in hand. We hoped to sell one per week, but soon had to think again.

We had a trainer that could be paired with the 1-19, but we had to face the fact that cheap war-surplus sailplanes were flooding the small market and, with all their disadvantages, price was a critical factor. A new 2-22 would cost $1,500, whereas a war-surplus sailplane in nearly new condition might be only $500. To get some publicity for our new aircraft, Frank Hurtt and Richard Powell took the prototype to Harris Hill and set a new two-seat duration record of 10 hours 9 minutes, hill soaring in ridge lift. Even so, sales were slow. We established a chain of dealers around the country, but they could make little headway.

At about this time Ernie and I were elected directors of the revived S.S.A., which decided to campaign for glider training to be included as an option in the G.I. Training Bill. This was successful. Ex-servicemen and women who wanted to fly gliders could now do so at little cost. The first G.I. glider school to be approved for this kind of work was established at Sanford in Florida by Steve and Ginny Meyer Bennis. It seemed a good move then for the Schweizer Aircraft Corporation to establish a glider school on the airport, just outside the plant, using our own 1-19 and, as soon as one became available, a 2-22. Our three sales staff pilots would be the instructors. They, unfortunately, had time on their hands, but were available at any time to give demonstration flights to potential customers, as well as bringing up a new generation of soaring pilots who, in their turn, would become instructors and might then order sailplanes from Schweizer. This school took its first batch of student pilots on 17 May 1946, and has continued very successfully ever since.

Our business now went through a very difficult time, with only one substantial subcontract, making rudders and ailerons for the Fairchild C-119 Packet. The C-119 work and the gliders together occupied a total staff of only 71, a far cry from the peak of 221 we had touched briefly in 1943. Bill, our younger brother, decided that the corporation could not afford to pay all three of us, so he left and found a post with the Commonwealth Aircraft Corporation. He expected to gain wider experience in the larger-scale aircraft industry but hoped, one day, to return to the family business. It was five years before he was able to do so.

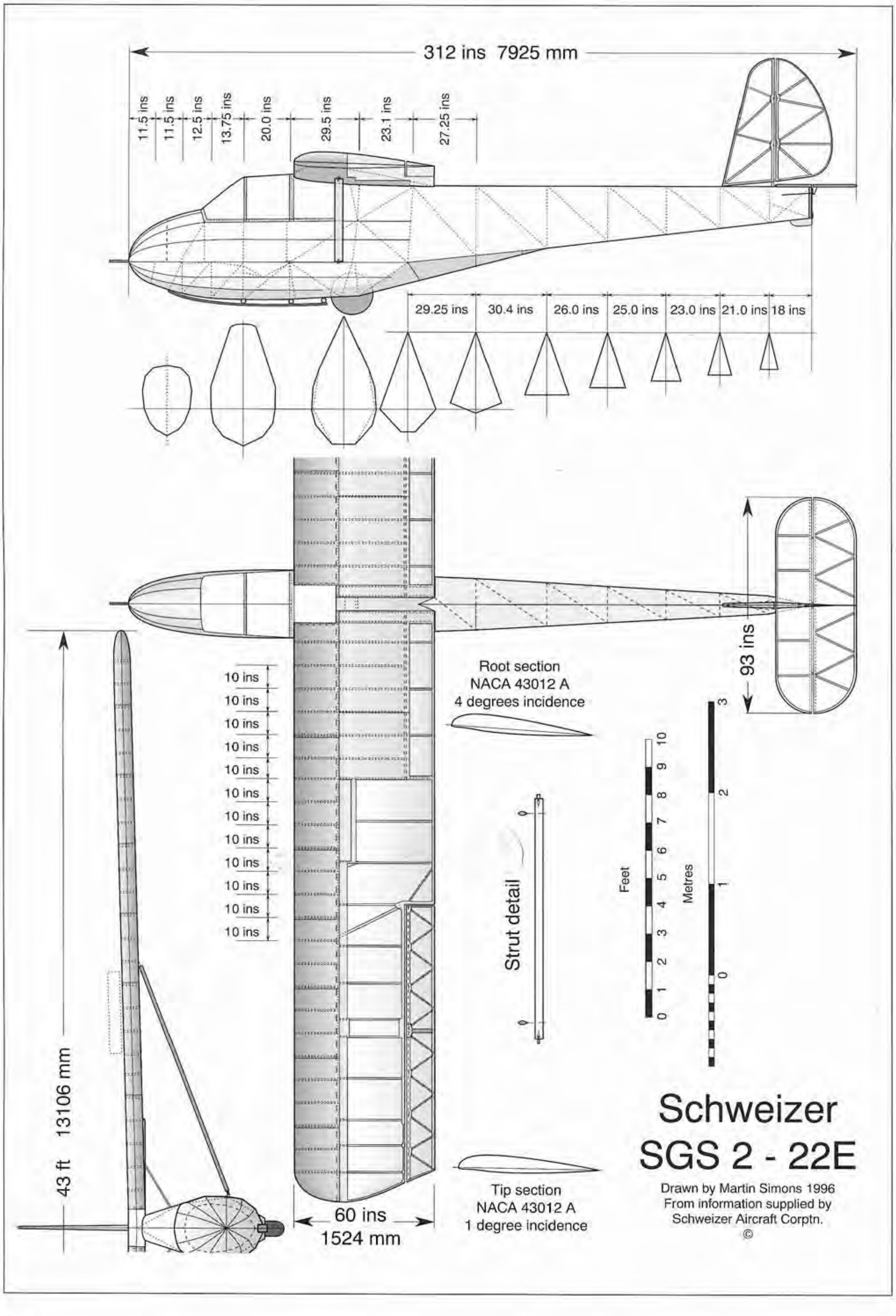
As the soaring movement began to grow, rather slowly, sales of the 2-22 limped along. The Korean War, which broke out in 1950, brought an expansion in our military subcontract work, so for a time we could not have built many sailplanes even if there had been a demand for them. We had sold a total of only 51 of the standard model 2-22 by 1957.

In 1957 the Air Force Academy was interested in acquiring three 2-22s for their new glider training programme. They wanted a number of modifications, so we developed the 2-22A, which had a longer nose to allow room for the crew to be equipped with parachutes, and for more equipment in the front cockpit. An increase in the permitted all-up weight to 900 lb was approved. The rear cockpit was fully enclosed, with a rear door on the starboard side for access to the rear seat. The three 2-22As were used to start the Air Force Academy glider programme, which grew considerably from this small beginning. The 2-22B model was the civil version of the 2-22A, a few of which were built following delivery of the three Air Force 2-22As, and were retrospectively modified to the C-model standard. The 2-22C had narrower-chord ailerons, which reduced the aileron control forces without reducing their effectiveness. Seventy-five Cs were built, plus twenty-two of the 2-22 CK kit version. The soaring movement in the U.S.A. was now growing rather better, and most of the old wartime sailplanes had been retired. Sales of the 2-22 were also boosted by an order for thirty to be delivered to the United States Air Force (U.S.A.F.). These went to Indonesia during 1961 and '62, as part of an aid package to help that country with a youth pilot-training programme. (Along with this order went a similar number of single-seat 1-26s.)

In 1963 further modifications were made to the 2-22. A new moulded canopy and larger cockpit was designed, and a transparent panel in the wing roots above the cockpit gave the instructor improved upward vision and more headroom. The size of the spoilers was increased. We also introduced a new type of wingtip skid, since the high wing caused the tips to take a beating when they went down after landing. This tip skid was made in the form of a heat-treated spring with a small rubber wheel at the ground end. This worked well, particularly for commercial operations, and was used later in some of our other sailplanes. This new model became known as the 2-22E, and eighty-seven were built, plus twelve of the kit version, the 2-22 EK.

In addition to the Indonesian batch, some were exported to Canada, Australia, Argentina and Sweden. In 1966 a single 2-22 was sent to England for evaluation by Slingsby Sailplanes, the long-established company which had been building gliders and sailplanes in wood since the early 1930s. It was thinking of changing to metal, and envisaged large

TOP: *Schweizer test pilot Bernie Carris flies a production 2-22E at Chemung County airport.*
ABOVE: *The SGS 2-22E, showing the door for entry to the rear cockpit. In this case wingtip skids were fitted, but when touching the ground they were very noisy. Later, sprung tip wheels became standard on many Schweizer sailplanes.*



Schweizer SGS 2 - 22E

Drawn by Martin Simons 1996
From information supplied by
Schweizer Aircraft Corptn.
©

Bernie Carris with Skeet Fox, assembly foreman of the sailplane department, preparing for a flight in the SGS 2-22E.

orders from the A.T.C., the paramilitary youth training organisation originated during the Second World War. The idea of building our 2-22 under licence was attractive, but although it toured the gliding clubs in Britain, it was not particularly well liked by them or by the A.T.C. When Slingsby did make the change, its first all-metal product was the T-53 two-seat trainer, which did not have much success.

A total of 258 of all versions of the 2-22 was produced. The type played an important part in the growth of soaring during the 20 years they were in production, from 1946 to 1967. Our dealer in Texas, Al Parker, earned his Gold C and a diamond in a 2-22 with a flight of more than 200 miles to a declared goal.

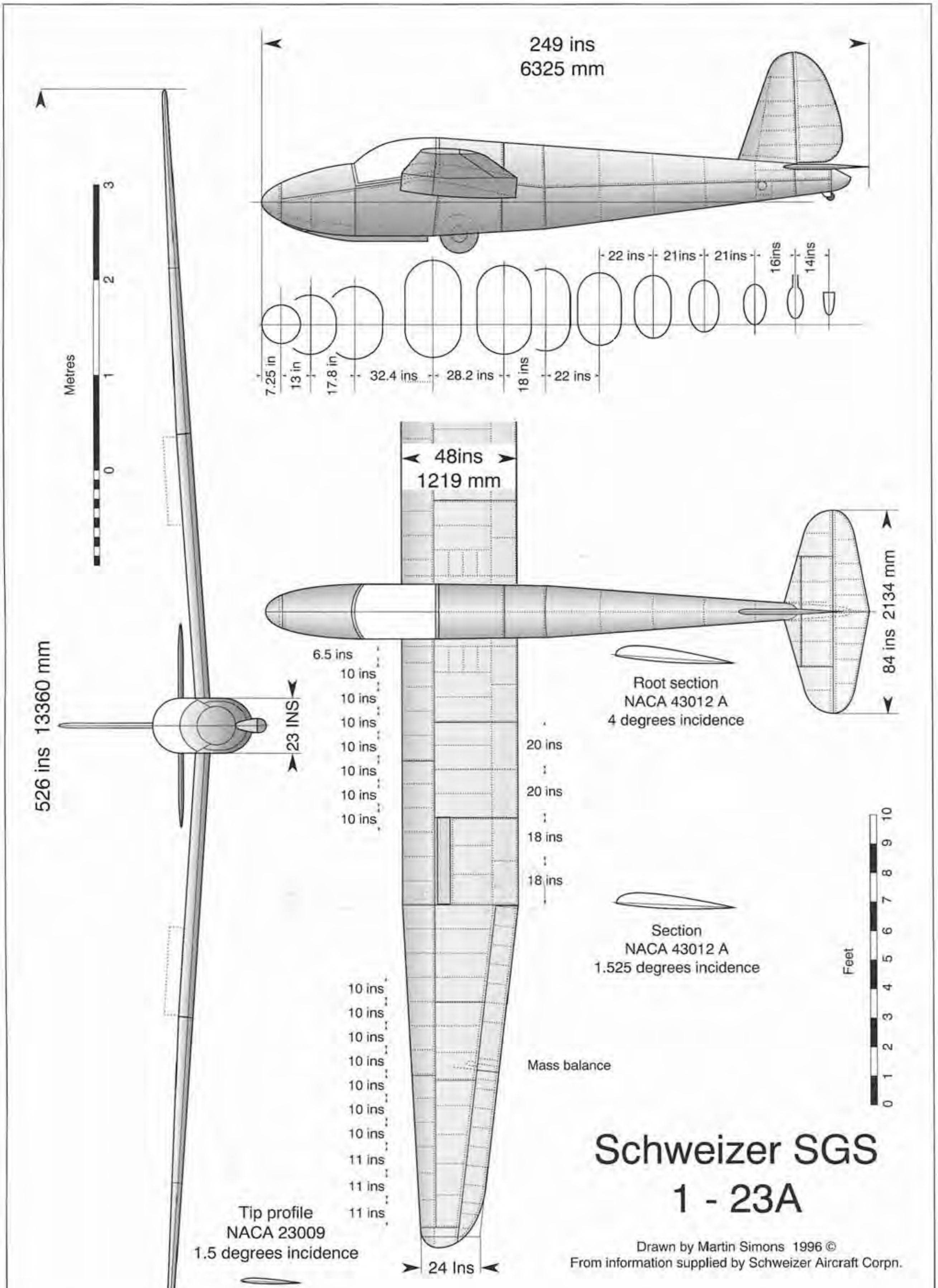
As with all sailplanes produced in some quantity, the 2-22 was sometimes involved in accidents, but these were never caused by any fault in the design. Because we had taken care to give the pilots as much protection as possible, very few were seriously injured. One spectacular incident occurred in May 1962, when a 2-22 was being used for film making among the mountains of British Columbia, Canada. While being flown, for the sake of the film, too close to the rocky slope near the small town of Hope, the glider ran into heavy turbulence and was thrown into the rock wall. The pilot and cameraman were hardly injured, but after getting out of the wreck they found themselves 3,200 ft above the valley, perched on the edge of a 500 ft cliff. They had to scramble down a 45-degree slope to reach a logging road 1,500 ft below. Later, the wreckage of the sailplane was lifted off the mountain by helicopter and was rebuilt to fly again. Another incident, which occurred in 1962, reflected little credit on the pilot. He was smoking while flying, and dropped the cigarette as the sailplane was rolling along the ground after landing. The doped fabric beneath the seat caught fire immediately and, as the two pilots leapt unharmed from the cockpits, all of the fabric covering of the fuselage, wings and tail went up in flames, leaving a metal skeleton. It was fortunate that the cigarette was not dropped while the sailplane was a few hundred feet up.

More than 200 examples of the 2-22 remained active in 1983, and a good number were still flying in 1996, fifty years after the prototype first emerged. One of the original production run, N91833, looking as good as new, flew at the 1995 International Vintage Soaring Meet at Harris Hill.

Schweizer SGS 2-22

Total number built: 258 (2-22, 51; 22A, 3; 22C, 75; 22CK, 29; 22E, 88; 22EK, 12)

Specification		
Span	43 ft	13.1 m
Length	26 ft	7.92 m
Wing area	210 ft^2	19.51 m^2
Aspect ratio	8.81	
Aerofoil section	NACA 43012A	
Empty weight (prototype)	450 lb	204.1 kg
Pilots	380 lb	172.3 kg
Flying weight	830 lb	376.4 kg
Wing loading	3.95 lb/ft^2	19.3 kg/m^2
Empty weight (E model)	470 lb	213.2 kg
Pilots	430 lb	195.0 kg
Flying weight	900 lb	408.2 kg
Wing loading	4.28 lb/ft^2	20.9 kg/m^2
Estimated best L/D	17:1 at 47 mph	75.6 km/h
Minimum rate of sink	3.5 ft/sec at 37 mph	1.07 m/sec at 58 km/h


249 ins
6325 mm
22 ins
21ins
21ins
16ins
14ins
7.25 in
13 in
17.8 in
32.4 ins
28.2 ins
18 ins
22 ins
Metres
0
1
2
3
48ins
1219 mm
84 ins 2134 mm
526 ins 13360 mm
23 INS
6.5 ins
10 ins
20 ins
18 ins
Root section
NACA 43012 A
4 degrees incidence
Section
NACA 43012 A
1.525 degrees incidence
Feet
Mass balance
11 ins
Tip profile
NACA 23009
1.5 degrees incidence
24 Ins
Schweizer SGS
1 - 23A
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.

SGS 1-23

The 1-21 created a lot of interest in the possibility of Schweizer making a lower-priced single-seat sailplane. By using a simpler basic design and reducing the number of parts, we thought we could find a market. Design work on what would become the 1-23 was started in the fall of 1947, and the construction of the prototype began in May 1948 when Bill Frutchy, a local soaring pilot, agreed to purchase the first one.

The 1-23 was much simpler than the 1-21. It spanned 43 ft 10 in., compared with 51 ft for the 1-21, and the centre section of the wing was rectangular in plan, with tapered outer panels and rounded tips. The aerofoil section was the well-proved NACA 43012A, with 23009 at the tip. The greater camber at the wing root, compared with the 1-21, would improve the low-speed flight performance at a small cost in the fast glide between thermals. The single main spar was built up from simple extrusions with a sheet web. All the exposed surfaces, including the movable surfaces, were metal skinned; there was no fabric at all. The fuselage was of monocoque construction, with a generously large cockpit and a blown canopy.

The structural weight of the 1-23 was 385 lb which, with a 170 lb pilot and 52 lb of extra equipment, such as a parachute and oxygen breathing gear, gave a wing loading of about 4lb/ft^2. It could be loaded to more than this with safety. Its small size and light weight made for easy handling on the ground, and it could be transported on an open trailer. The tailplane, which spanned only 7ft, could be left on for trailering without infringing road traffic regulations. Because of its all-metal skin, the 1-23 could be tied down outside most of the time.

The prototype was completed in nine weeks and first flown in July 1948. The 1-23 proved to have pleasing control characteristics, and its stalling speed was only about 32 mph. It would make the most of small and weak thermals, being able to turn

A 'standard' SGS 1-23 in natural-metal finish just before take-off. An SGS 2-22 is in the background

E.J. Reeves, SSA President in 1948, test flies the prototype 1-23 at Chemung County Airport.

tightly without much increase in the rate of sink.

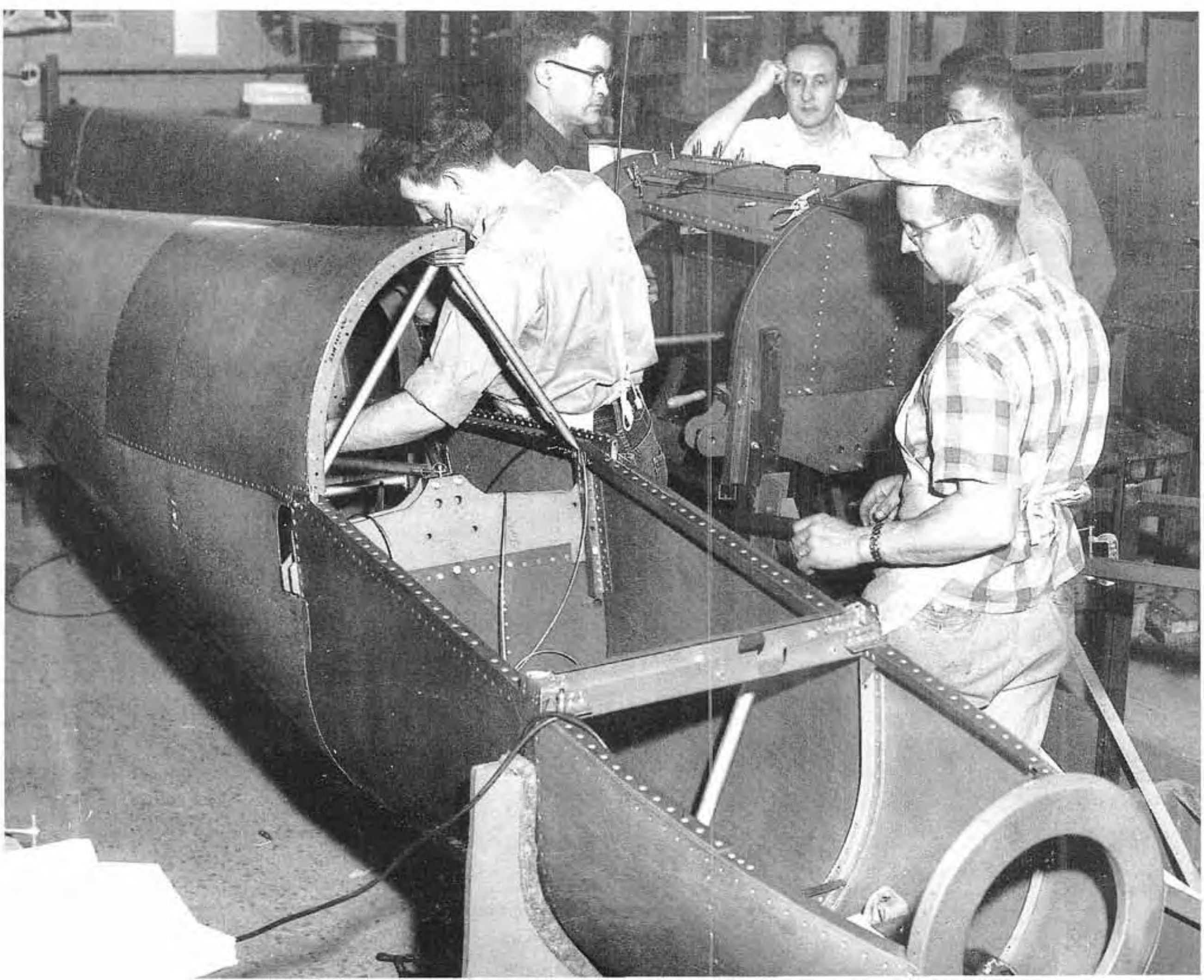
We did not quite finish the 1-23 in time for the start of the 1948 Nationals, so Bill Frutchy flew only the last few days of the contest. Many of the other pilots were given a chance to fly it, and they were all enthusiastic. E.J. Reeves, the S.S.A. president, was the first to make a definite commitment. Several others, encouraged by him, followed, but we were not swamped with orders.

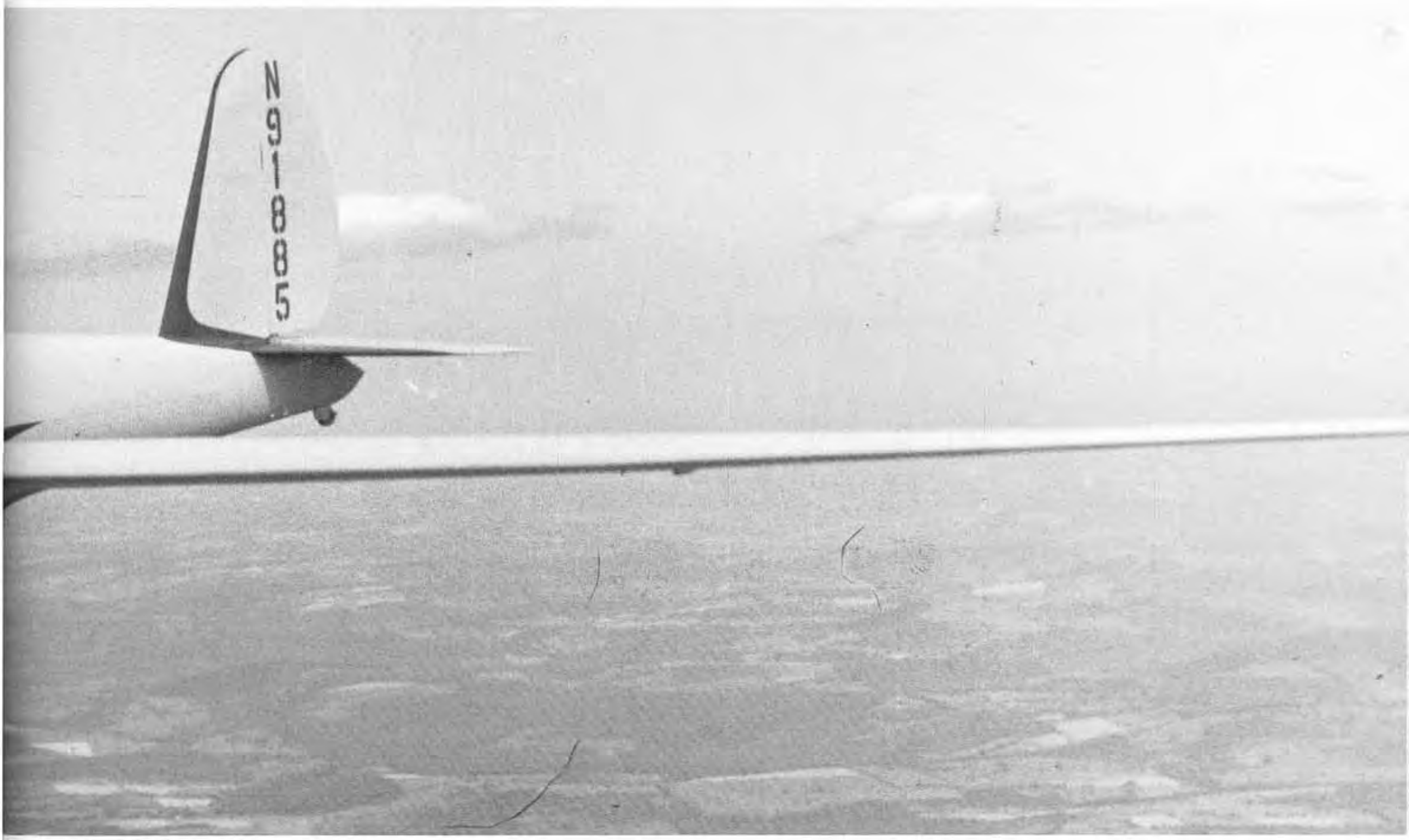
We hesitated. The company estimated that a minimum of ten orders for the sailplane were needed before we could justify tooling-up for production. By January 1949 we had only five, and by March, nine. After some heart searching we decided that this was good enough, and production began, accompanied by the usual bureaucratic procedures necessary to gain F.A.A. approval. The price was $2,200 for the basic sailplane, but most buyers wanted some additional equipment, which usually added another $300 to the cost. Flush riveting was one popular option. Three 1-23s were flown in the 1949 Nationals at Elmira, but the contest was won by Paul MacCready, flying the old Polish Orlik wooden sailplane of 1938 vintage. It had been exhibited in the Polish pavilion at the 1939 World Fair in New York! Our 1-21, flown by Dick Comey, came second, and another old wooden sailplane, the Minimoa, was third. But all three 1-23s did well and we were confident that if they had been flown by the more experienced pilots they would have won. Perhaps more importantly, there was no other modern American production sailplane of equal performance.

On 29 December 1949, during a holiday meeting at Bishop in California, Bill Ivans in his 1-23 set an absolute altitude record with a wave flight to 30,200 ft. He was towed to 12,100 ft, so his gain of height after release was 18,100 ft. The wave, formed on the lee side of the Sierra Nevada range, had been known for some years and had been used by soaring pilots before, but the huge heights attainable were only now being realised. This flight took Ivans, equipped with a pressure breathing mask and oxygen, into temperatures over 30 degrees Centigrade below freezing. Heavy frost up to a sixteenth of an inch thick formed on the inside of the cockpit canopy, and he had to scrape it away to see out. The idea of improvising a kind of double glazing overcame this problem on later altitude flights. Pieces of transparent plastic were taped on the inside of the canopy, with an air gap to provide some insulation, and these areas remained clear. The record did not stand for long. Two days later John Robinson in the RS-1 Zanonia reached 32,600 ft, and on New Year's Day 1950 he exceeded this with 33,800 ft, a gain of 23,500 ft. In a three-day period, ten outstanding

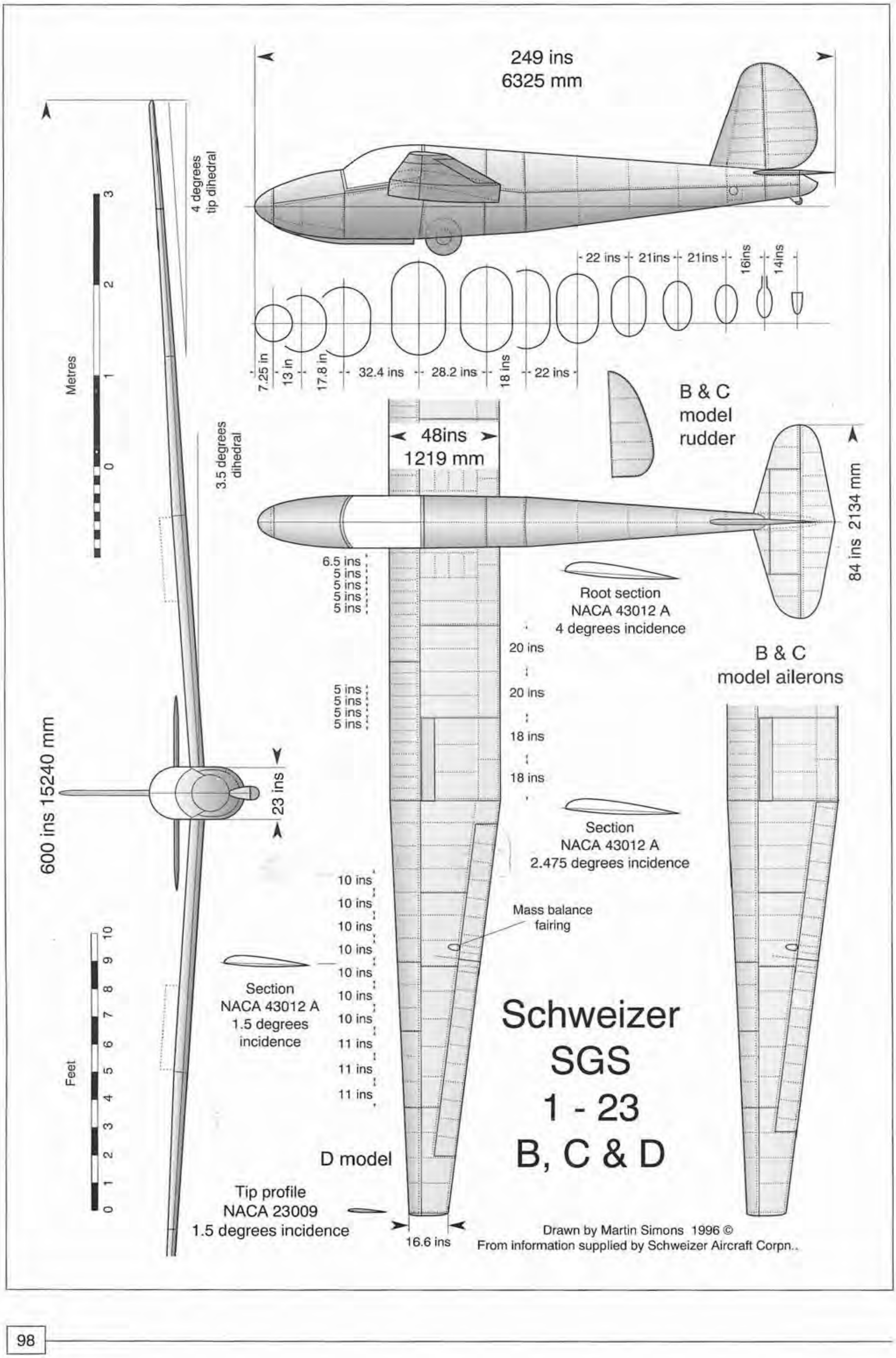
ABOVE: *Paul Schweizer flies the SGS 1-23 for an air-to-air photographic sortie.*
BELOW: *The 1-23 banks away from the camera aircraft, revealing its underside and showing the wheel-and-skid main undercarriage and the latch-type tow release hook.*

ABOVE: *Paul A. Schweizer on board an SGS 1-23D over Horseheads.*





Below: *An Air-view of the Schweizer Aircraft plant and the Schweizer Soaring School adjacent to the Chemung County Airport.*
Opposite Page: *Schweizer Aircraft workers building 1-23 all metal fuselages at SAC plant.*


249 ins
6325 mm
4 degrees tip dihedral
Metres
0
1
2
3
22 ins
21ins
21ins
16ins
14ins
7.25 in
13 in
17.8 in
32.4 ins
28.2 ins
18 ins
22 ins
B & C model rudder
48ins
1219 mm
3.5 degrees dihedral
84 ins 2134 mm
6.5 ins
5 ins
5 ins
5 ins
5 ins
Root section
NACA 43012 A
4 degrees incidence
20 ins
20 ins
18 ins
18 ins
B & C model ailerons
5 ins
5 ins
5 ins
5 ins
600 ins 15240 mm
23 ins
Section
NACA 43012 A
2.475 degrees incidence
Mass balance fairing
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
11 ins
11 ins
11 ins
Section
NACA 43012 A
1.5 degrees incidence
Feet
0
1
2
3
4
5
6
7
8
9
10
Schweizer
SGS
1 - 23
B, C & D
D model
Tip profile
NACA 23009
1.5 degrees incidence
16.6 ins
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn..

Ernie Schweizer assists with assembly of the 1-23C during the 1952 World Championships in Madrid, Spain.

climbs were made by six different pilots.

At the 1950 Nationals, held in August at Grand Prairie, Texas, nine 1-23s were entered. The winner was Dick Johnson in his RJ-5, which had so-called laminar-flow low-drag wing profiles. His wings had to be sanded and filled repeatedly to maintain their shape. The next three pilots, Coverdale, Ivans and Reeves, were all flying 1-23s, and five 1-23s finished in the top ten places. Bill Coverdale set a national out-and-return record of 242 miles which was a fraction short of the world record set by a Swedish pilot in July. (Bill made up for this in 1952, with a world record out-and-return flight of 260 miles.)

The power of the Sierra wave was demonstrated again in February, when a pilot flying a Lockheed P-38 Lightning twin-engined fighter engaged in cloud-seeding experiments, unable to land because of a dust storm, closed down both engines and soared the eight-ton aircraft from 10,000 to 30,000 ft, descending and climbing again several times until the dust cleared from the airfield, whereupon he restarted the engines and landed normally.

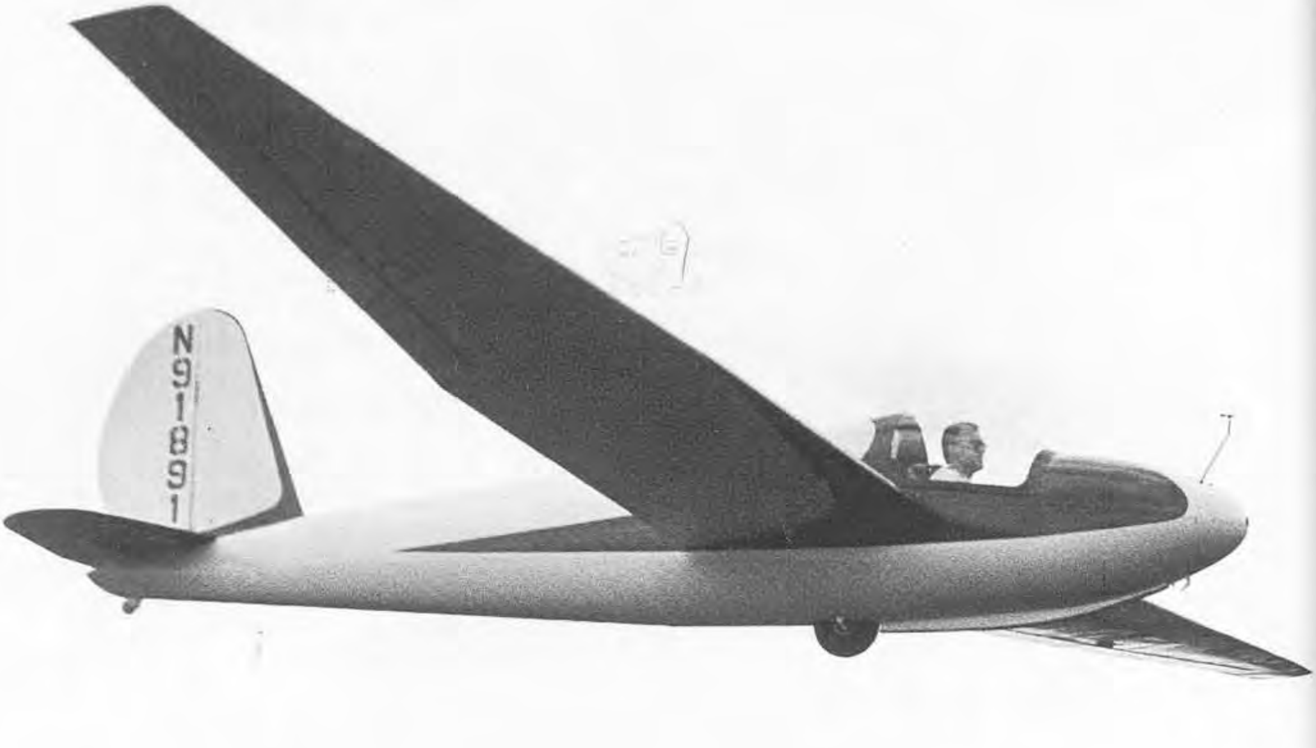
At the end of the year another sailplane meeting was held at Bishop. On 30 December Bill Ivans soared his well-equipped 1-23 to a double world record for height gain, 30,101 ft (9,175 m), and absolute altitude, 42,070 ft (12,823 m). This record was not broken until 1961.

Twenty-one 1-23s were built and sold, which suggested we had judged the market conditions correctly, although we hoped for more orders. We did not anticipate that we should still be building versions of the 1-23 more than ten years later.

The 1-23B and C

It was announced in 1951 that the next International Soaring Championships would be held in Spain. It was hoped that the U.S.A., for the first time, could send a full team, and we wanted to improve the 1-23 so that the American pilots could fly them against the best European types. Increasing the span of a sailplane is always the most obvious (though not always the easiest) way to improve its performance.

We built the 1-23B with a 50 ft-span wing. The fuselage, tail surfaces and centre panels were the same as those of the ordinary 1-23, but the outer main wing panels were extended by projecting the lines 3 ft further on each side, adding the necessary extra rib bays and skinning. The narrow wingtips



TOP: *The 1-23D flown by Richard Schreder in the 1956 National Contest at Grand Prairie Airport, Texas.*
ABOVE: *An SGS 1-23D in flight, showing the extended, squared wingtips and a total-energy probe mounted on the nose.*

were left almost square, because published research papers indicated that nothing was gained by rounding them, as had been the custom. Flush rivets were used for the leading edges of the wings, to maintain a smooth skin and reduce drag. The ailerons were lengthened but not extended all the way to the tip. The aspect ratio became 15.58.

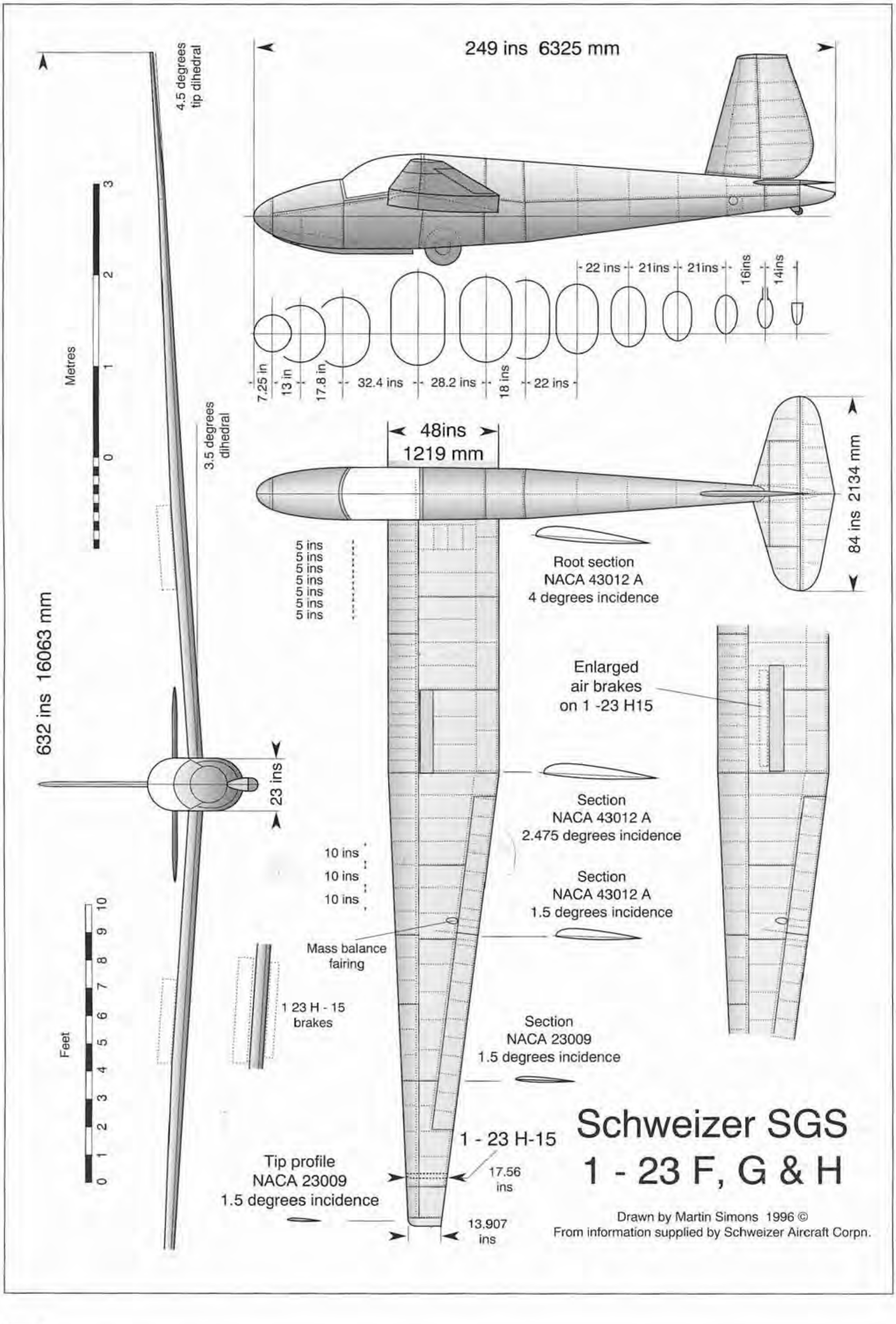
A check of the stressing showed that it was not necessary to strengthen the main spar on this experimental model. There was some 'oil canning' of the wing skins in flight. (This term is used to describe the slight distortions, accompanied by metallic noises like those produced when an oil can is squeezed, which appear when a thin metal sheet is under stress.) Otherwise the 1-23B flew very well and obviously had an improved performance. After testing it was decided to build another sailplane with stronger and stiffer spars and thicker skins, so that we would achieve a smoother and quieter wing. This aircraft was designated 1-23C. It was necessarily heavier, so had a slightly greater sinking speed but a better glide than the 1-23B.

Paul MacCready flew the 1-23B in the 1952 World Championships at Madrid. I myself flew the 1-23C, and Stan Smith the 1-21, slightly modified. Most of the sailplanes entered in this contest were typical European designs with old-style aerofoil sections. The main exception was Dick Johnson's RJ-5, which had a laminar-flow profile. The three Schweizer sailplanes all had thin 12% aerofoils which gave a fast cruising performance. As often happens in such competitions, we all had some days with low scores, but some were much better. The last day of the competitions was a speed task to a goal 77 miles east of Madrid. The U.S. team did very well, with Johnson coming first by a good margin (107 km/h) and Paul MacCready second (89 km/h), while Smith and I were placed seventh and eighth at slightly under 80 km/h out of the thirty-six participants. These championships were won by Philip Wills, the English champion, flying a 59 ft (18 m) span wooden Slingsby Sky. MacCready was placed sixth, an excellent result which would have been better but for one poor score on the second day. I was placed eighteenth after five days.

SGS 1-23D

After much test-flying of the B and C models, of which we built only one each, we decided to go into production with the 1-23D. This was a compromise between the B and C, with the full 50 ft span but with somewhat lighter spar and skins than the C. The ailerons were the same length as on the C, but were shifted bodily outwards, nearer the tip, by 10.25 in. It turned out very well. We received F.A.A. approval in the spring of 1953. Paul MacCready won the 1953 Nationals in a 1-23D, and Stan Smith came second in the old 1-21 prototype. I came next and Steve Bennis was fourth, both flying 1-23Ds. Schweizer sailplanes took all four of the top places and eight of the top ten.

A fully instrumented 1-23D, with the side panel removed to reveal the crash pylon.



Schweizer SGS 1 - 23 F, G & H

Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.

A guest at this contest was the prominent British pilot Nick Goodhart, a Royal Navy officer working for the time being in Washington, D.C. He flew an LK-10 and came fifth. I offered him a chance to fly the 1-23D, and he accepted gladly. He admired the handling and the comfortable cockpit with its adjustable back and arm rests, and the excellent field of vision through the large moulded canopy. He described the control response in the air as 'a joy to feel', beautifully harmonised. After a few thermals he made a rapid climb in cloud to 10,700 ft using the only gyro instrument fitted, a turn-and-slip indicator. The 1-23 was stable and viceless. His only criticism was that the spoilers had to be held open against the air loads which, at high speeds, were too much. They would not act as airbrakes in the manner required for cloud flying in Britain. We sold twelve of the D version.

SGS 1-23E

For the next World Championship, to be held in England in 1954, we built a special 1-23E for Paul MacCready. The span was increased to 52 ft 8 in. (16 m), and to improve performance further we used a faired skid instead of a wheel. This was appropriate, since for the contest they would use winch launches from the grass field at Camphill, Derbyshire. The airfield was on a 1,200 ft-high plateau in a region of fairly high rainfall. A skid was an asset for landing in small English fields, giving immediate braking on touchdown. More attention was given to detail design, with butted joints instead of lapped skins and a greater amount of flush riveting. We were able to give the 1-23E a much smoother painted finish. I myself was chosen for the team, to fly the 1-23D.

The weather was bad for most of this meeting. There were only four days on which competitive flying was possible, and these were very difficult, with weak thermals and large areas of overcast sky. Paul MacCready did not score at all on the third day, but won the fourth, which helped his final standing. He flew from Camphill to the east coast, landing as close as he dared to the lighthouse on Flamborough Head, a rocky promontory which gave him an extra mile or so distance. The Swedish pilot Per Axel Persson climbed inside a cloud, and when he

Paul Bikle in his 1-23E with original launching dolly at Harris Hill.

emerged was actually over the North Sea. He turned back to land on the beach. The contest was won by the young Frenchman Gerard Pierre in a large complex Breguet 901 sailplane with a 'laminar-flow' wing profile and large extensible wing flaps. Wills was second in his Sky, and the German Wietüchter came third in a Weihe, originally designed in 1938 and well suited to the weak weather conditions. Paul

Paul Bikle with the 1-23E in which he set a number of world altitude records. His gain-of-height record, made in the Sierra Wave, still stood in 1997.

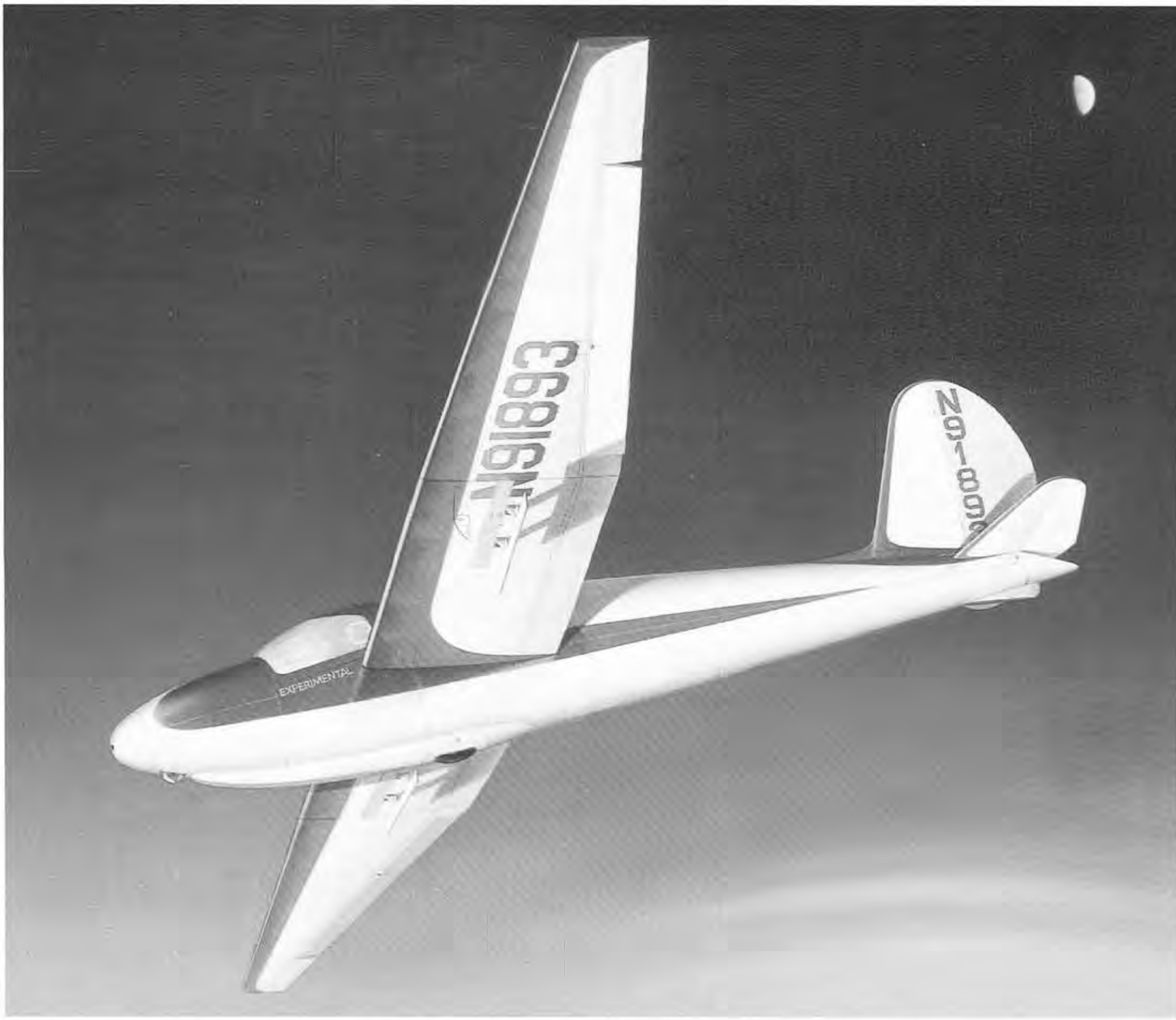
Top: *Paul MacCready in the 1-23E, with no landing wheel, takes a winch launch at the World Championships at Camphill, England, in 1954. Bad weather almost washed out the contest. (C.E. Brown, RAF Museum).*
Above: *Instead of a wheel the SGS 1-23E had a take-off dolly that was dropped by the pilot just after leaving the ground.*

MacCready finished fourth of the thirty-three competitors in the single-seater championships. I was able to score only on two days, yet came fifteenth. There were eighteen pilots who had a worse time than I did, which was some consolation! The 1-23, we felt, had done very well, given the unfamiliar and very difficult conditions.

The 1-23E was later sold to Bill Ivans, who finished fourth with it in the 1955 Nationals, which were back at Elmira again and lasted nine days, with scoring on every day. For this meeting Bill loaned his original 1-23, in which he had set the altitude record, to Nick Goodhart, who earned the most points but could not be named champion because he was not a U.S. citizen. The best American was Kempes Trager, flying a very thoroughly reconstructed and much improved LK-10, and third place went to Bob Smith with another, much modified, LK. The old war-surplus sailplanes were still haunting us! But five of the top ten places went to 1-23s, I myself taking fifth

ABOVE: *Paul MacCready in the SGS 1-23E with, left to right, the English pilot Nick Goodhart, Dr MacCready senior and crewman, at Camphill. Paul Schweizer's 1-23 is behind. Beyond are the competitors' road trailers for retrieving the sailplanes after landings away. (Sheffield Telegraph)*

BELOW: *This SGS 1-23H has tip wheels and a panel window behind the cockpit, fitted at the request of a customer.*



A painting of Paul Bikle's record-breaking 1-23E by Mike Machat.

place in a D model. Ivans later sold the solitary 1-23E to Paul Bikle. In 1961 Bikle exceeded Ivans's records with an absolute altitude of 46,267 ft (14,101 m) and a world record gain of altitude of 42,303 ft (12,894 m) which still stands today. Schweizer Sailplanes were now reaching the stratosphere.[15]

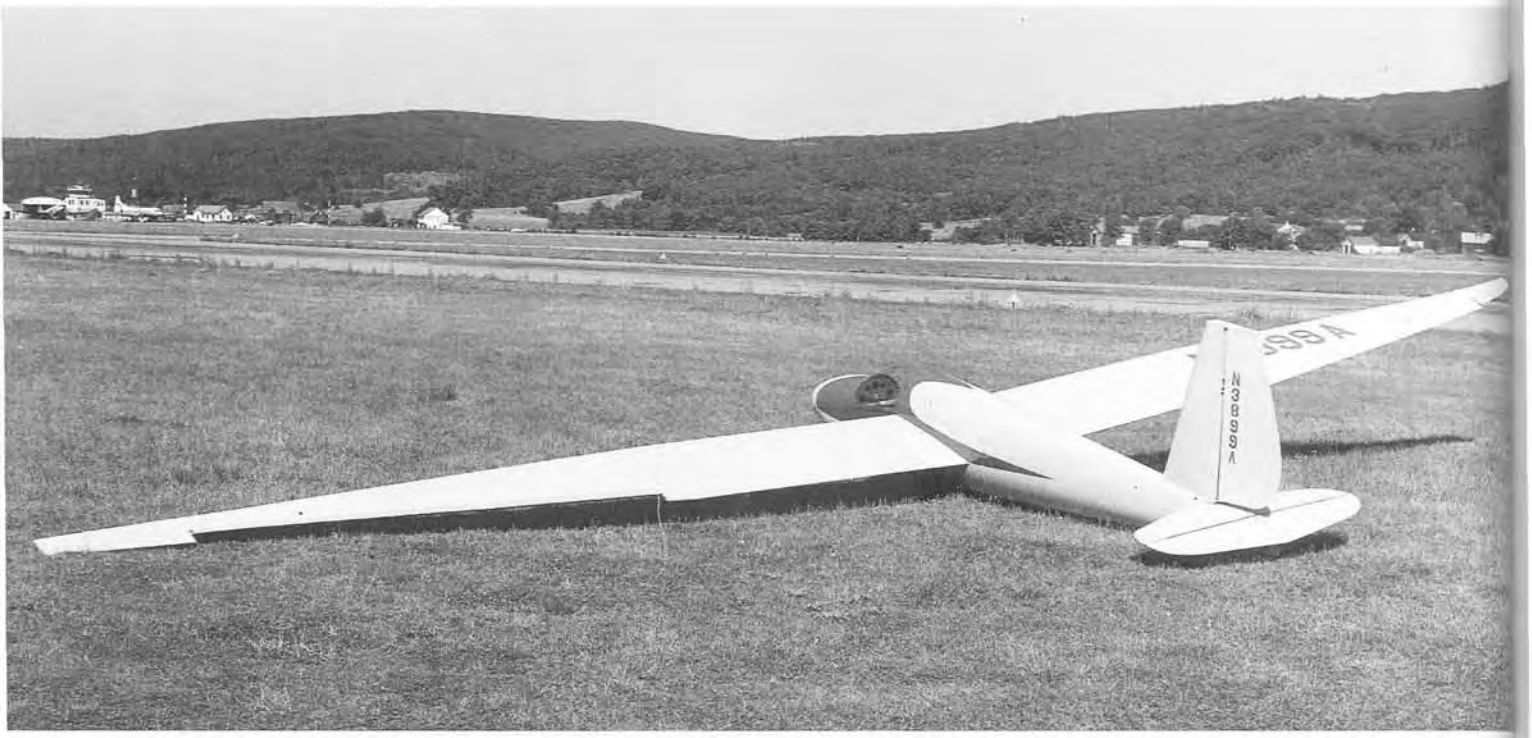
SGS 1-23F

In an attempt to improve the 1-23 still further we built another experimental version, the 1-23F. This was much the same as the 23E, with the longer span, but we used heavier skins and butt jointing everywhere to eliminate all laps. By attention to many other details, minimising leaks and other sources of drag and giving the whole aircraft a superior, filled and smoothed finish, the performance was enhanced. I flew the 23F and finished fourth in the 1956 Nationals, held again at Grand Prairie in Texas. There were forty-six competing sailplanes at the meeting, and seven Schweizer sailplanes finished in the top ten, although the champion, Lyle Maxey, was flying a special, advanced homebuilt sailplane and Graham Thompson, who came second, flew the famous laminar-flow RJ-5 which Dick Johnson had used for the world record distance flight of 545 miles in 1951.

In 1956 Paul MacCready won the World Championships, which were held at St Yan in France. However, he flew a hired Breguet 901. It had to be accepted that there was no American sailplane that could compete with this top European type.

SGS 1-23G

As a result of the success of the 1-23F we decided to go into production with a development of it, the 1-23G. It had the same wing but a larger vertical tail



Above: *The 1-23G at Chemung County Airport, showing its extended wing.*
Below: *Robert Fisher in the 1-23H 'Miss Columbia Basin' that he flew across the U.S. in 29 hops during 1996. (SAC Photo).*

The Schweizer brothers and Bob Fisher look at the map of his trans-American flight, which was painted on the nose of the 1-23H.

surface for improved handling. The longer span tended to reduce the yawing stability, so the increased fin area was desirable. Eight were built.

SGS 1-23H

The 1-23H was developed from the 1-23G and had the same tail surfaces and the same span, but we now introduced aerodynamically balanced dive brakes. These opened both above the wing, like ordinary spoilers, and below. The lower paddle was hinged along its back edge so that, as it opened, the air load on it tended to force it open further while the somewhat larger upper paddle resisted. Consequently there was only a small load on the lever in the cockpit, even when the brakes were deployed at a high airspeed. There were a few other minor modifications, and as a special option the wingtips could be made detachable, reducing the span from 50 ft to the International Standard Class figure of 15 m (49.2 ft). Ten of these were built.

SGS 1-23H-15

The International Standard Class specification was introduced by the International Gliding Commission (C.I.V.V.) in an attempt to encourage designers and manufacturers to produce a simple, relatively inexpensive sailplane of limited size but good performance, built from readily available materials and without any complications such as retractable wheels, flaps and water ballast tanks. The span was limited to 15 m (49.2 ft). No complex special devices were allowed. One of the chief requirements was air brakes which would limit the airspeed, when open, to less than the permitted maximum for the aircraft, so that there would be no danger of going over the 'red line' on the airspeed indicator and causing the sailplane to break up. This was considered very important for cloud flying in Europe, when a pilot, lacking all external references and relying on instruments, might easily lose orientation and fall out of control in a spiral dive. Speed, and hence torsional and bending loads on the wing and tail, increase rapidly in such situations, and opening the brakes would prevent a disaster.

The Standard Class was to become a World Championship class in its own right, to be run simultaneously with the 'Open' championships, the first occasion being the 1958 World Championships at Leszno in Poland. Many people outside the U.S.A. believed that the Standard Class would quickly become highly prestigious because, with sailplanes designed to a common formula, their performance would be approximately the same. Pilot skill, rather than bank balance, would therefore determine the outcome. This proved true to some extent, although

TOP: *An SGS 1-23H over Horseheads, New York, with Bernie Carris in the cockpit. (S.A. Aldott).*
ABOVE: *A Sandor Alec Aldott photograph of a 1-23H over Odessa, Texas. (S.A. Aldott).*
OPPOSITE PAGE: *An SGS 1-23H in a steep turn.*


N3908A
69

The Sailplanes of the Schweizer Soaring School outside the Schweizer Aircraft Plant adjacent to the Chemung County Airport. A 1-23G is in the foreground and (3) 1-26s and (3) 2-33s in the background along with a Super Cub towplane. (S.A.C.)

in America there was a good deal of scepticism about the new class at first.

An international biennial design competition to choose the best Standard Class design was first conducted in 1958 at Leszno. I was on the jury that picked the Ka 6 sailplane designed by Rudolf Kaiser.

In the U.S.A. little support had been given to the Standard Class, but the S.S.A. thought it important for American pilots to compete internationally. We had no sailplane to enter in the design competition at Leszno, and our pilot, Fritz Compton, had to hire a Polish aircraft, a Mucha Standard, for the event. Another of this type, flown by Adam Witek, actually won the championship. Compton was placed sixteenth in a field of twenty-four. But in the long run, commercially, the Ka 6 was the real winner. More than 1,200 were produced in different versions by the Alexander Schleicher firm over the next ten years. More of this type of sailplane were sold than any other since the ancient Grunau Baby of the 1930s.

A Standard Class competition was thereafter introduced to the U.S. Nationals, and pilots began to take more notice. As a result of the growing interest we made a 15-m variation of the 1-23H which had the span fixed at 15 m and dive brakes to limit the speed in a vertical dive to within the maximum placard speed, bringing it into the class limitations. Testing the brakes to prove their full effectiveness was an interesting and exciting experience. It involved being towed to a good height, usually over 10,000 ft, then entering a very steep dive, watching the airspeed rise rapidly and then opening the brakes and holding the sailplane in the vertical dive at the terminal speed for 1,000 m (3,281 ft) loss of altitude. One had to be confident in the structural strength of the sailplane, particularly the dive brakes, since almost the whole weight of the sailplane was supported by the four small plates of the brakes.

We found that it required considerable practice to carry out these tests, for it was difficult to hold the sailplane exactly in the vertical dive so that the speed stabilised. As the earth is rapidly approaching at the terminal speed of about 145 mph it gives an eerie feeling, as everything moves out radially from your field of vision. You realise that this is about the same speed that a body would reach in a free fall. With some minor changes to the brakes the 1-23H-15 met the specification.

This was the first Standard Class sailplane produced in the U.S.A., and twenty were sold. In the 1960 World Championship at Cologne, Germany, Paul Bikle in a 1-23H-15 came twelfth in a field of thirty-five. The 1-23 basic design was by now twelve years old. Most of the other Standard Class sailplanes were of later design and had better performance, taking advantage of recent advances in sailplane aerodynamics and laminar wing profiles.

The design contest was won this time by the Standard Austria, a wooden sailplane with a V tail and a very unusual form of construction which gave it a highly accurate wing profile, almost free from humps and waves. It was, of course, an Austrian design by Rüdi Kuntz, but was subsequently built in quantity and further developed by the Schempp-Hirth factory in Germany.

The H-15 was the last of the 1-23 line. A total of seventy-four 1-23s of all types were produced and many are still flying, including the altitude-record-setting 1-23E, which in 1996 was owned by the Niagara Soaring Club of North Tonawanda, New York.

[15] Bikle's gain-of-height record remained unbroken in 1997, although the absolute altitude figure was exceeded by Robert Harris with 49,012 ft (14,938 m) in a Grob 102.

Schweizer SGS 1-23

Total number built: 21

Specification

Span	43,83 ft	13. 36m
Length	20.75 ft	6.32 m
Wing area	149 ft^2	13.8 m^2
Aspect ratio	12.89	
Aerofoil section	NACA 43012A root, 23009 tip	
Empty weight	385 lb	175 kg
Pilot & equipment	275 lb	125 kg
Flying weight (maximum)	660 lb	300 kg
Wing loading (maximum)	4.43 lb/ft^2	21.7 kg/m^2
Best L/D	27:1 at 45 mph	72 km/h
Minimum rate of sink	2.3 ft/sec at 40 mph	0.7 m/sec at 58 km/h

Schweizer SGS 1-23D

Total number built: 12

Specification

Span	50 ft	15.24 m
Length	20.75 ft	6.32 m
Wing area	160.6 ft^2	14.9 m^2
Aspect ratio	15.6	
Aerofoil section	NACA 43012A root, 23009 tip	
Empty weight	465 lb	210.9 kg
Pilot & equipment	285 lb	129 kg
Flying weight (maximum)	750 lb	340 kg
Wing loading (maximum)	4.67 lb/ft^2	22.8 kg/m^2
Best L/D	30:1 at 48 mph	77 km/h
Minimum rate of sink	2.3 ft/sec at 43 mph	0.7 m/sec at 55 km/h

Schweizer SGS 1-23E, F, G, H

Total number built: E, 1; F, 1; G, 8; H, 19 (total, 29)

Specification

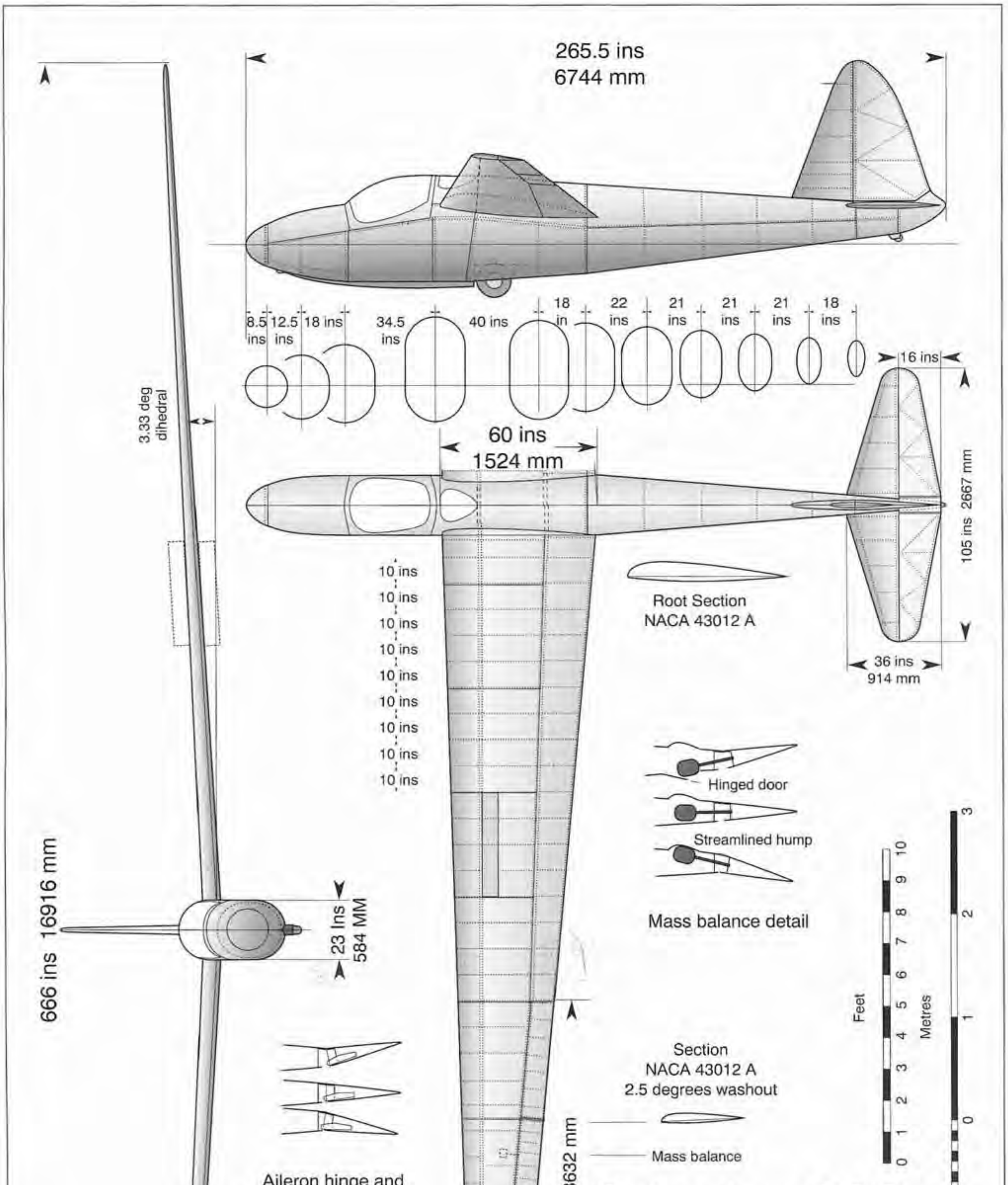
Span	52.66 ft	16.05 m
Length	20.75 ft	6.32 m
Wing area	164 ft^2	15.2 m^2
Aspect ratio	16.9	
Aerofoil section	NACA 43012A root, 23009 tip	
Empty weight	479 lb	217 kg
Pilot & equipment	271 lb	123 kg
Flying weight (maximum)	750 lb	340 kg
Wing loading (maximum)	4.56 lb/ft^2	22.3 kg/m^2
Best L/D	31:1 at 36 mph	58 km/h
Minimum rate of sink	1.95 ft/sec at 40 mph	0.6 m/sec at 64 km/h

Schweizer SGS 1-23H-15 (Standard Class)

Total number built: 10

Specification

Span	49.2	15.0 m
Length	20.75 ft	6.32 m
Wing area	159.4 ft^2	14.8 m^2
Aspect ratio	15.12	
Aerofoil section	NACA 43012A root, 23009 tip	
Empty weight	470 lb	213 kg
Pilot & equipment	280 lb	127 kg
Flying weight (maximum)	750 lb	340 kg
Wing Loading (maximum)	4.70 lb/ft^2	22.9 kg/m^2
Best L/D	29:1 at 40 mph	64.4 km/h
Minimum rate of sink	2.2 ft/sec at 37 mph	0.67 m/sec at 59.5 km/h



Schweizer SGS 1 - 24 Brigadoon

Drawn by Martin Simons 1996 ©
From information supplied by
Schweizer Aircraft Corpn and Howard Burr.

Schweizer-Burr SGS 1-24 'Brigadoon'

Howard E. Burr had been interested in soaring as long as we Schweizers, and like us had attended the early soaring contests at Elmira and Harris Hill. He had crewed for Ralph Barnaby in the 1932 national contest,[16] and also for the German pilot Martin Schempp in the 1933 and '34 nationals, and was a member of the soaring group at Bell Aircraft that purchased our SGS 2-8 No. 3. Howie was a leading lofts man at Bell, and was involved in the lofting and tooling of the first U.S. jet fighter, the Bell XP-59A Airacomet, as well as the rocket-powered Bell X-1 which in 1947 became the first aircraft to exceed the speed of sound.

When the war ended, Howie came to work at Schweizer and was chief of lofting for many years. He made an arrangement with us to build his own sailplane at the plant, outside working hours, and with Ernie developed a new design derived from the SGS 1-23. This was the 1-24, which Howie named the *Brigadoon.*

The original idea was simply to marry the fuselage and tail unit of a 1-23 to a new straight-tapered wing of 55.5 ft span. The fuselage was taken from the 1-23 production line, and while Howie was working on tooling for the wing it was suspended in the roof of the plant. Seeing it there, he thought it would be a good idea to make some space behind the cockpit to allow him to take one of his small sons for a ride. Accordingly, having persuaded the Schweizers that the changes were allowable, he cut the fuselage and inserted a 10 in.-long extra bay between the back of the seat and the main bulkhead, making room for a small child. This made the 1-24 unofficially a 1.5-seat sailplane. Feeling that while he was doing all this work he might as well make other improvements, he raised the wing to the shoulder position to give more ground clearance for landing in scrub vegetation, should the need arise. To ensure adequate control of the longer wing, the tail surfaces were enlarged and Howie took the opportunity to clean up the tail-cone,

Howard Burr with the 1-24 he designed with help from Ernie Schweizer and built during his spare time.

making this a glassfibre moulding.

The wing was all-metal, except that it originally had fabric covering behind the rear spar inboard of the ailerons. The rudder and elevator were also fabric covered at first. The airbrakes, hinged at the front, opened above and below the wing. The ailerons needed mass balancing, and a suitable lead weight was fitted on an arm attached to the aileron spar. When the ailerons were fully deflected this weight protruded beyond the wing skin, and on the upper surface a moulded glassfibre fairing 2 in. high was provided to accommodate the mass balance. On the underside there was a small, spring-loaded hinged plate which remained closed unless the aileron was fully deflected to push the door open briefly. The wingtips were glassfibre mouldings.

The 1-24 flew well and, because of its greater span and wing area and higher aspect ratio, its performance was a step ahead of that of the long-winged 1-23. After some flights had been made, Howie felt the need of a trimmer to take loads off the stick at different airspeeds. He fabricated a long, square-section aluminium tube and fixed this inside the fuselage between the rear mainframe and the base of the front fin spar. Inside this, controlled by a loop of cable over pulleys before and aft, and a crank in the cockpit, was a substantial lead weight of 13.5 lb which was mounted on eight wheels to allow it to roll back and forth to any position required by the pilot. This system worked well, and allowed the 1-24 to be trimmed to fly 'hands-off' at any speed between 50 and 80 mph.

Howie entered the 1953 Nationals, which were held at Harris Hill. The 1-24 had only recently been completed and test-flown, and on the first contest day Howie had still some work to do on it before he could take off. He arrived at the plateau site a little late, to find that all the other competitors had departed on task. Launching by aero-tow at noon, he was only 100 ft up, having left the airstrip and headed out over the valley, when the tow rope broke. Normally this would have required him to glide down to land at the emergency field in the valley, de-rig and return by road, and then rig again for a very late 're-light'. This would probably have spoilt his chances of covering a long distance on this day. Fortunately he found himself already in a thermal, began circling and climbed away from 100 ft to cloud base at 4,000 ft, and then set off to try to reach his goal on the other side of the Hudson River in Massachusetts. He found the going quite good, reaching and crossing the Hudson at about 17:30. His goal at Pittsfield was to the north, and the thermals were dying, but he followed a ridge which yielded

Howie Burr in the cockpit of the 1-24 before his flight from Harris Hill to Pittsfield, Massachusetts.

TOP: *The SGS 1-24 Brigadoon, now based at Tehachapi in California, showing the rear windows intended for the small passenger.* **ABOVE:** *The 1-24 originally had fabric-covered areas on the wing, behind the rear spar. Soon after the move to California these panels were covered with metal for better resistance to the sun.*

sufficient lift to keep him airborne, yet low enough to wave to picnickers sitting on the slope. He came to the end of the hills and there, within reach, was his destination airfield. He landed at 18:00, just before the rather disgruntled staff closed the airport and departed for home. It was the second longest flight of the contest that day and, as it exceeded 300 km distance, gave him a diamond for his Gold C badge. It was an impressive contest debut for the new sailplane.

Howie let me fly the 1-24 in the 1957 Nationals, and I won the first day's task and the Stroukoff Award for that flight, but had to withdraw from the contest owing to my father's death.

After flying the 1-24 for years, Howie reluctantly sold it, but was able to buy it back later. He took it with him in 1959 when he retired from Schweizer and went to live in California, close to the soaring centre at Tehachapi. The effects of strong sunlight soon persuaded him to replace the fabric with 0.012 alloy metal skins. He still keeps his *Brigadoon* to fly from Tehachapi, and achieved his diamond altitude requirement with a flight to 30,000 ft.

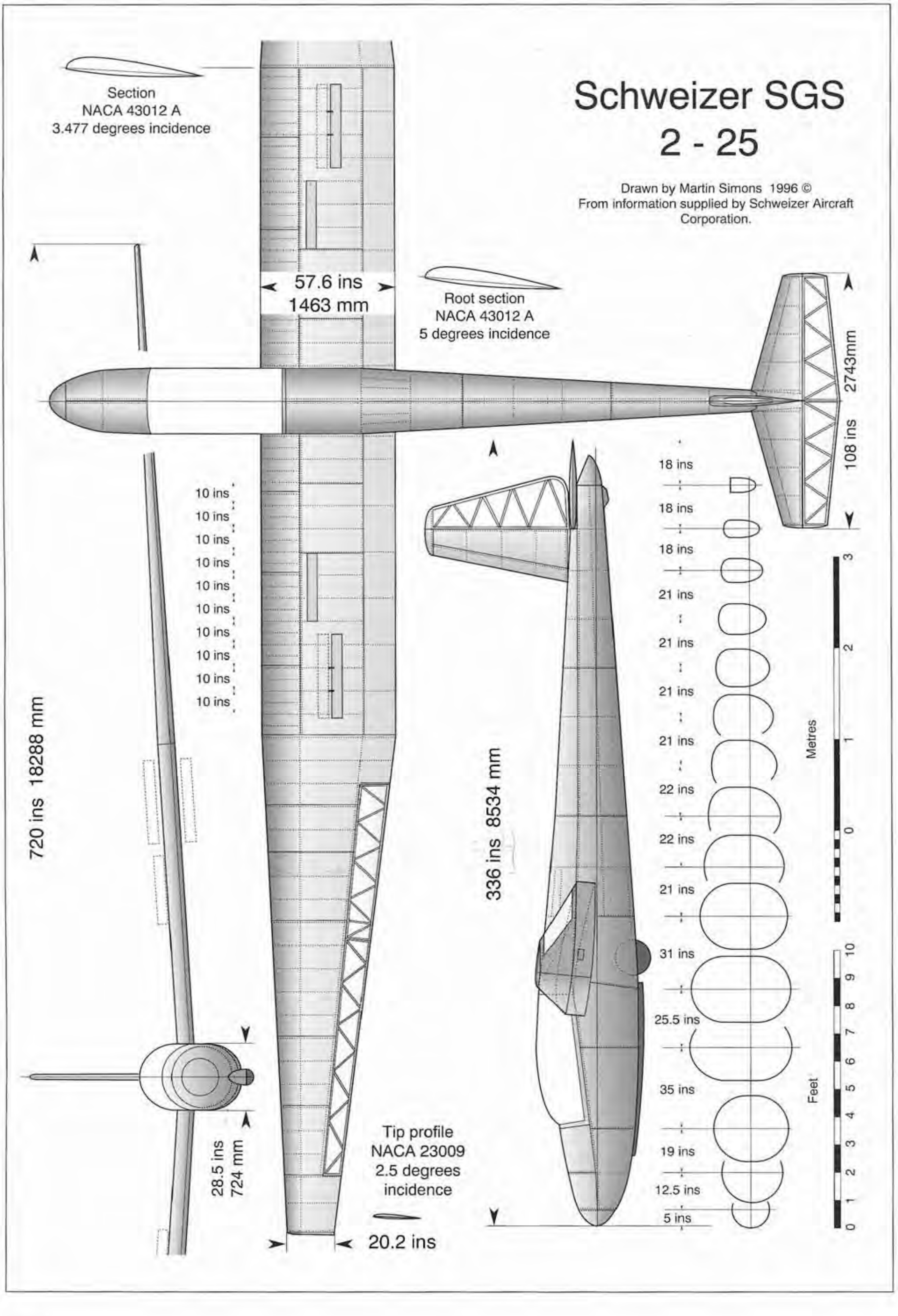
[16] Barnaby, a naval officer, was the first American citizen to achieve the C soaring certificate, which he did at Cape Cod in 1929. He played a central role in the development of soaring in the U.S.A.

Schweizer-Burr SGS 1-24

Total number built: 1

Specification

Span	55.5 ft	16.9 m
Length	22.15 ft	6.744 m
Wing area	180 ft^2	16.7 m^2
Aspect ratio	17.11	
Aerofoil section	NACA 43012A root, 23009 tip	
Empty weight	585 lb	265 kg
Pilot & equipment	200 lb	90.7 kg
Flying weight (maximum)	785 lb	356 kg
Wing loading (max)	4.7 lb/ft^2	22.9 kg/m^2
Best L/D	30:1 at 50 mph	80.45 km/h
Minimum rate of sink	2 ft/sec at 46 mph	0.61 m/sec at 74 km/h


Section
NACA 43012 A
3.477 degrees incidence
Schweizer SGS
2 - 25
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corporation.
57.6 ins
1463 mm
Root section
NACA 43012 A
5 degrees incidence
2743mm
108 ins
18 ins
18 ins
18 ins
21 ins
21 ins
21 ins
21 ins
22 ins
22 ins
21 ins
31 ins
25.5 ins
35 ins
19 ins
12.5 ins
5 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
10 ins
720 ins 18288 mm
336 ins 8534 mm
Metres
0
1
2
3
Feet
0
1
2
3
4
5
6
7
8
9
10
28.5 ins
724 mm
Tip profile
NACA 23009
2.5 degrees
incidence
20.2 ins

SGS 2-25

For the 1954 World Championships, which were held in England, each nation was allowed a single two-seat entry and two single-seat entries. The S.S.A. planned to enter a full team, with the solo pilots flying 1-23s (see previous), but no U.S. high-performance two-seat sailplane was available. The Schweizers therefore decided to put together a proposal for one.

The pilots chosen for the two-seater team were Stanley Smith and Robert Kidder. They liked our proposed sailplane, and we decided to go ahead with the SGS 2-25. It was basically a 120% scaled-up 1-23D with a span of 60 ft. The forward fuselage was extended to allow for a two-seat cockpit, and a one-piece blown canopy gave excellent visibility. The fuselage had to be widened to 28 in. to make room for the rear pilot's feet on either side of the front seat. Even so, things were rather tight if the crew wore fur-lined flying boots, as later became necessary for high-altitude work. The rest of the aircraft was generally the same as the 1-23D, but larger. Wherever possible, subcomponents from the 1-23 were used. The prototype was completed in the spring of 1954. Its performance was better than that of the 1-23D, due to the advantages of the favourable scale effect, its larger size and wing chord, raising the Reynolds numbers. After the initial flight tests proved satisfactory we were all pleased with it. Smith and Kidder made some practice flights, and it was then shipped to England. There were only nine two-seat sailplanes in the competition.

The Derbyshire site, called Camphill, belonged to one of the oldest gliding clubs in Britain. Hill soaring along the slopes was a normal expectation, as well as thermals when the weather permitted. The surrounding area was divided into numerous small, sloping fields bounded by solid dry-stone walls, four or five feet high, rather than fences or hedges. All

Clarence See makes the first flight in the SGS 2-25, still in its primer paint coat.

Now fully painted in blue and white, the 2-25 approaches for a landing at the home airport, shortly before being shipped to England for the 1954 World Championships.

launches were by winch from the rather undulating, and in places quite rough, airfield, which had been created by removing, stone by stone, all the walls from about twelve little fields.

The competition was almost ruined by rain. In the two weeks, only four contest days could be flown, the bare minimum allowed for a valid championship. Someone, sitting in a tent as the rain poured down, christened the place 'Damphill' which, for this fortnight, was very accurate. It was the last time such a site was used for an international championship.

Smith and Kidder did very well in the contest, and were placed second in the two-seat class after three days. Then came a day when the two-seat sailplanes were launched but only four managed to make any distance at all. Smith and Kidder scraped away for 24 miles, which was actually the best distance of the day, but on landing the field was small and the 2-25's spoilers and wheel brake were not powerful enough to stop them rolling into a fence. Fortunately it was not a stone wall, but it was made from heavy timbers. The canopy was unbroken, but became jammed under a fence rail so they could not open it. They did not want to break it, and so were trapped. An elderly English gentleman cautiously approached the glider and, seeing movement in the cockpit, called to see if they were all right. They yelled back that they were OK, so he said 'Tally-ho' and turned on his heel to walk away. Stan and Bob yelled until he returned and moved the beam so that the canopy could be opened. But the wings had hit the heavy fence posts, which were embedded deeply in their leading edges.

There was too much damage to be repaired in a short time, and in any case there were no facilities at Camphill for repairs to metal sailplanes. It would have had to be taken to a well-equipped metal aircraft repair shop somewhere else. Stan and Bob were two unhappy pilots, for their chance to win the contest was gone. They did not even score any points for their 24 miles, because in an important competition a certain minimum number of sailplanes has to make a reasonable distance before the day counts at all.

To make things worse, on the return trip by road to Camphill, the fin and rudder of the sailplane were damaged when they hit a low canopy over the fuel pumps at a petrol station. The 2-25 was withdrawn from the competition. On the following day the other two-seat sailplanes did, just, manage to score some points, and the championship went to the Yugoslavians in their very graceful Kosava, a wooden sailplane. The Italian Canguro was second, the 2-25 slipping to third place.

The 2-25 was returned to Elmira and repaired, and we added another set of spoilers to improve its short-field landing characteristics. We were then approached by Dr Kuettner of the Jet Stream Project about the possibility of our lending the 2-25 to their research team based at Bishop, California. Since we had not built it for production, we agreed to let them use the 2-25. This project was a large combined effort by the U.S.A.F., the University of California's Department of Meteorology, and the Southern California Soaring Association. Joachim Kuettner was from the Geophysics Research Directorate associated with the Massachusetts Institute of Technology. A specially instrumented Boeing B-47 and a Boeing B-29 were flown by the U.S.A.F. and

On a gloomy day at Camphill in 1954, Stan Smith (left) and Bob Kidder work on the 2-25 near the trailer park.

The SGS 2-25 at St Yan Airport, France, for the 1956 World Soaring Championships.

a Pratt Read sailplane (an ex-U.S. Navy trainer) and our 2-25 were specially fitted with breathing apparatus and other instruments under the supervision of Kuettner and the University of California staff.

On one flight Kuettner reached an altitude of 43,000 ft with the 2-25, and there were several other flights over 40,000 ft. He had hoped to try for a distance record by going cross-country from a high wave, but the weather did not co-operate.

One difficulty that had to be overcome during the stratospheric flights, reaching extremities of cold, was differential contraction of the various metals used in the structure and controls. On the 2-25 the elevator was cable operated, and because the stranded steel contracted less than the aluminium of the fuselage, the cables became very slack, causing the pilot some difficulties in maintaining a safe airspeed. The dive brakes became hard to operate because the steel torque tubes operating them ran in aluminium bearings which contracted and clamped the pushrods. During rapid descents from these very high altitudes the metal skins warmed up and expanded more rapidly than the underlying structure, and developed extensive wrinkles. The wing immediately over the main spar, which remained cold, was often still covered with frost after landing.

The results of this research project were of great importance to meteorology, increasing the understanding of lee waves and their interaction with high-level jet streams. Somewhere in the many serious academic papers and reports which resulted was buried the story of Larry Edgar, who, flying the Pratt Read on 25 April 1955, entered an aerial rotor cloud which formed part of the wave system. The turbulence was so severe that the sailplane was totally destroyed by it in a few seconds. Edgar was thrown out, finding himself, half-blinded by negative 'g' forces, in mid-air with remnants of the sailplane's nose section still hanging round his feet. He managed to find and pull his parachute ripcord, descended, and was dragged across the ground by the 'chute, but made a full recovery. The 2-25 being flown by Dr Kuettner had just previously encountered similar violent turbulence, but it did not break up.

Larry Edgar's flight was the last made during this period of intensive research, which explored the huge atmospheric waves repeatedly during the month of 29 March to 25 April. The turbulence in rotor clouds and, without clouds, clear-air turbulence, was henceforth widely recognised and data were circulated to airlines.

The World Championships of 1956 were to be held in St Yan, France. Having had the 2-25 returned, unharmed, from Kuettner's group, we again loaned it to the U.S. Soaring Team, and it went off to Europe

Ernie Schweizer discusses instrumentation with Dr Joachim Kuettner, alongside the fuselage of the SGS 2-25 before it leaves for Bishop, California, to take part in the Sierra Wave research project.

The instrument panel of the 'Sierra Wave' SGS 2-25. One instrument and the radio are missing.

to be flown by Kemp Trager and Gene Miller. There were thirteen entrants in the class this time. While Paul MacCready was busy winning the single-seat class in the Breguet 901, the Americans with the 2-25 were doing very well, scoring top points on two of the seven contest days, but slipping down a little in the end to fourth place. The two-seater championship was won by the British with the Slingsby Eagle. This was the last World Championship in which the two-seat class was included as a separate class. (This did not mean that two-seaters could no longer compete, but in future they would be included in the open championship with the single-seat aircraft.)

After this contest we were approached by George Arents, who was interested in attempting some two-seat records. Since we had no further plans for the 2-25, we sold it to him, and he made many attempts to set records, but without success. When he decided to buy one of our new 2-32s for further record flying, he gave the 2-25 to the Air Force Academy glider programme. This was before the Academy had hangars for their sailplanes. The 2-25 was tied down on the airfield, and a rotor in connection with a lee wave tore it loose and damaged it severely. The sailplane was sent to the National Soaring Museum at Harris Hill for storage, and the Air Force intends to sell it some day to a buyer who will restore it. The 2-25 was one of the most travelled sailplanes at that time, but we considered it too costly for production, so only the one was built.

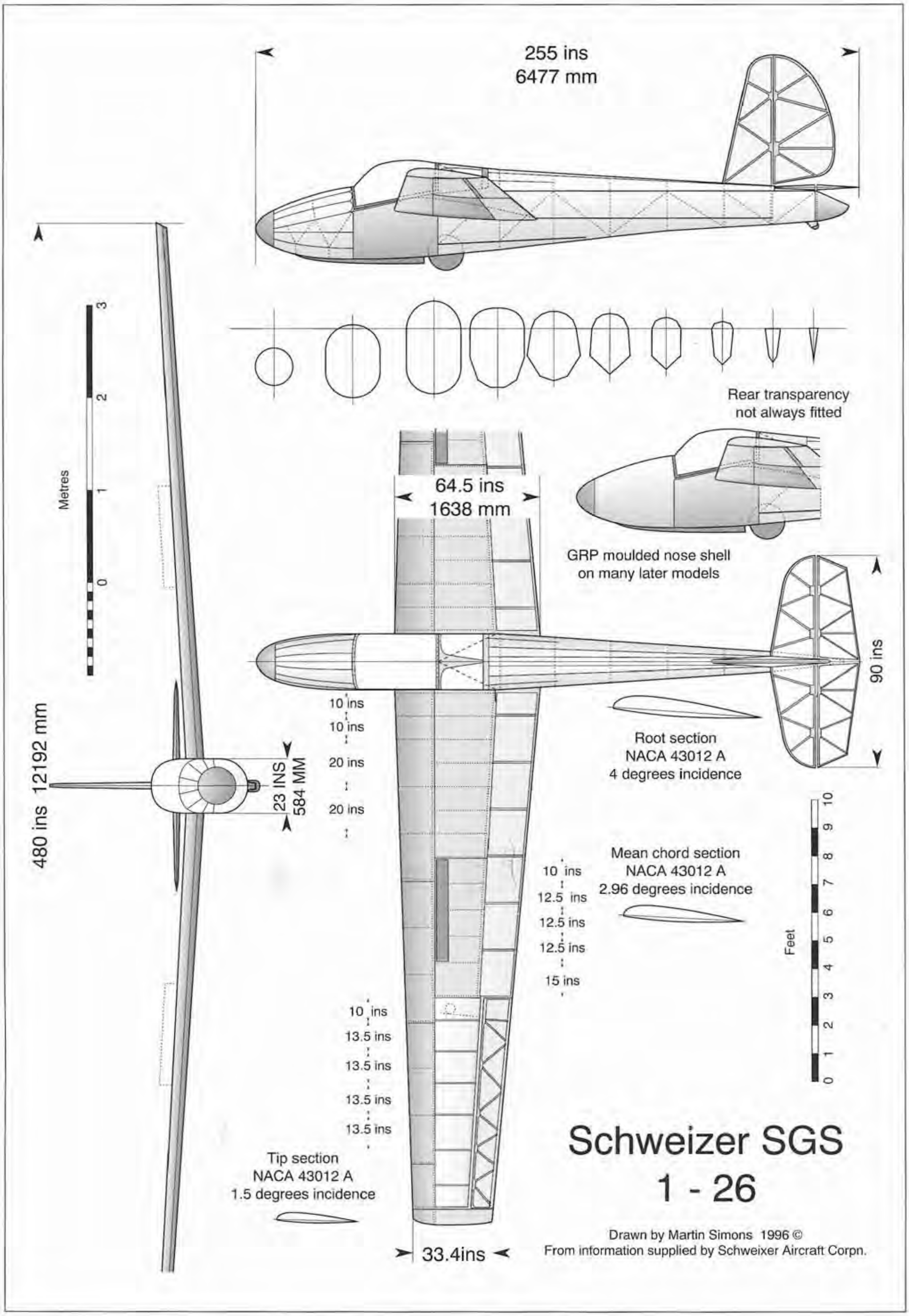
Schweizer SGS 2-25

Total number built: 1

Specification

Span	60 ft	18.28 m
Length	28.0 ft	8.53 m
Wing area	231 ft^2	21.45 m^2
Aspect ratio	15.58	
Aerofoil section	NACA 43012A root, 23009 tip	
Empty weight	1,050 lb	476 kg
Pilots	400 lb	181 kg
Flying weight (maximum)	1,450 lb	657.6 kg
Wing loading (maximum)	6.27 lb/ft^2	27.7 kg/m^2
Best L/D	32:1 at 65 mph	104.6 km/h
Mininum rate of sink	2.2 ft/sec at 46 mph	0.7 m/sec at 74 km/h

Philip Wills the famous English Soaring pilot stops off at Elmira on his way back from flying in the 1960 Nationals, with the Schweizer brothers in front of the SGS 2-25. Left to Right: Bill, Ernie, Philip Wills and Paul A.


255 ins
6477 mm
Rear transparency
not always fitted
64.5 ins
1638 mm
GRP moulded nose shell
on many later models
90 ins
Metres
480 ins 12192 mm
23 INS
584 MM
10 ins
10 ins
20 ins
20 ins
Root section
NACA 43012 A
4 degrees incidence
Mean chord section
NACA 43012 A
2.96 degrees incidence
10 ins
12.5 ins
12.5 ins
12.5 ins
15 ins
Feet
10 ins
13.5 ins
13.5 ins
13.5 ins
13.5 ins
Tip section
NACA 43012 A
1.5 degrees incidence
Schweizer SGS
1 - 26
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.
33.4ins

SGS 1-26

The idea of a Schweizer one-design sailplane probably started when, as boys, we were interested in boats in the late 1920s. We used to go to the annual Boat Show in the Grand Central Palace in New York City, and became interested in the many sleek one-design sailing boats that appeared there. For all entrants in a yacht race to use the same type of vessel seemed to us the fairest way to compete.

We were very much interested in continuing the idea of a one-design sailplane for the fairest of competition and the possibility of soaring in the Olympic Games. This had actually been agreed by the International Olympic Committee, following a campaign in the 1936–39 period. The German Meise sailplane was chosen as the 'Olympic' sailplane, and the first one-design competition should have been held as part of the 1940 Olympics, but the outbreak of war caused these games to be cancelled. Soaring was not included when the Olympics resumed after the war, so the development of one-design sailplane contests was delayed.

Toward the end of the Second World War, when we started to think again about what we should build for the postwar sport soaring market, the idea of a one-design sailplane resurfaced. To get more information on how it applied in sailing, I contacted the editors of *Yachting* magazine and the Skaneateles Boat Company, which was producing a one-design sailing boat in Upper New York State. I then prepared a paper entitled 'One-Design Class' to present at the 1944 S.S.A. Technical Conference. The paper was printed in the November-December 1944 issue of *Soaring* magazine, retitled 'Adapting the One-Design Class to Gliding and Soaring'. Nothing more happened at that time, but the idea lingered on.

When we saw that, even though the 1-23 series

Paul Schweizer checks out Bob Smith for a first flight in the prototype SGS 1-26. Don Ryan adjusts the special calibration airspeed indicator, which is mounted on the wing, while a crewman hooks up the tow rope.

ABOVE: *An SGS 1-26 for the Air Force Academy programme.*
BELOW: *Fifteen SGS 1-26 sailplanes assembled at Harris Hill for one of the earlier 'one-design' competitions.*

was quite successful, price was still a limiting factor, we thought about producing something cheaper than the 1-23 which we could sell in greater numbers. It would be difficult to reduce the cost much, so we thought of a simple kit, in which all the parts and material would be supplied and critical assembly operations such as welding and machining were already completed. We decided that completion had to take less than one year's spare time for an individual with limited tools and space. By means of a questionnaire and a supporting article in *Soaring*, we learned that the majority were looking for an easy-to-fly single-seat sailplane with Gold C badge flight potential, available as a $1,000 kit or at $1,500 for a completed sailplane.

We outlined a small, 40 ft-span sailplane which would weigh about 350 lb. It had a sporty look, and Frank Hurtt drew an artist's conception which aroused a lot of interest. However, we could not get down to the suggested price. The best we could do was a kit for $1,465 and the completed sailplane for $2,150. Sufficient interest was shown at these prices, so we decided to go ahead with a prototype in the fall of 1953. The 1-26 was completed early in 1954, and I made the first flight on 16 January. Many others flew it, and all agreed that it handled well and met the goals we had set.

The fuselage was of welded-steel-frame construction with a 'belly band' of aluminium around the cockpit area. There was a spun aluminium nose cap, and the bay between the nose cap and the belly band was faired by aluminium tubes and covered with fabric. A blown canopy was fitted. The aft section of the fuselage was faired with wooden stringers and covered with fabric. The leading edge of the wing, which had a built-up main spar, was a metal D-tube stressed skin. The rest of the aluminium wing structure was covered with fabric. The ailerons and tail surfaces were aluminium frames, fabric covered. The empty weight was 357 lb, and the maximum flying weight 575 lb.

We did a lot of flying with the prototype. Clarence See took it to the 1954 Nationals and finished in eighth place, competing against many higher-performance sailplanes. Enquiries came, and we began to think we had done the right thing, so we decided to go ahead with F.A.A. type approval and tool up for production. This was accomplished by the end of the year, and deliveries started in the beginning of 1955. Of the first fifty orders, forty-

An SGS 1-26 with the original fabric-covered nose section takes off on winch launch.

The Golden Flyer was a 1-26 built from a kit in England by a Pan American Airways captain, before being shipped to the U.S.A. in a P.A.A. cargo aircraft. It is here seen at the Lasham Gliding Centre in England, where it was first flown.

The SGS 1-26 sailplanes exported to Indonesia as part of a government aid deal. A 2-22 is also in the line-up.

A 1-26B with the optional tip wheels used for training flights. (M. Simons)

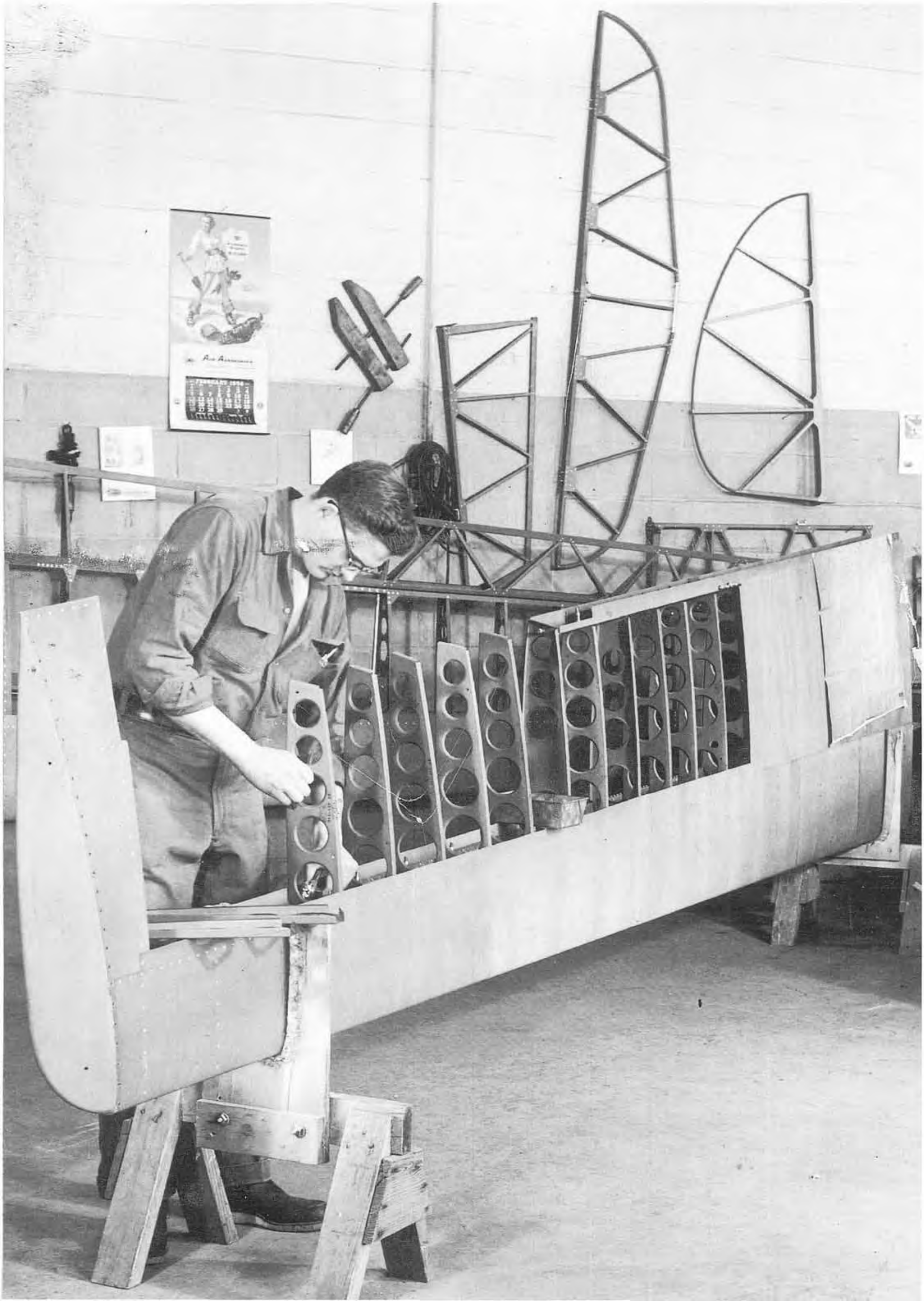
seven were for the kit version, which we designated SGS 1-26A.

In the 1955 Nationals Bernie Carris finished in ninth place, again with competition from much more sophisticated and expensive sailplanes. Bill Ivans came to Elmira to fly the prototype, and made the first wave flight in the Harris Hill area. By now we all knew about the gigantic waves associated with great mountain ranges, but it was only recently understood that smaller waves could be generated by quite low hills and ridges, given the right atmospheric conditions. Soaring pilots now had three types of upcurrent to use: ordinary hill lift, when the breeze rises over windward slopes; thermals, which are convection currents of warm air rising from warm spots on the Earth heated by the Sun; and the lee waves which form like ripples in a stream on the downwind side of ridges.

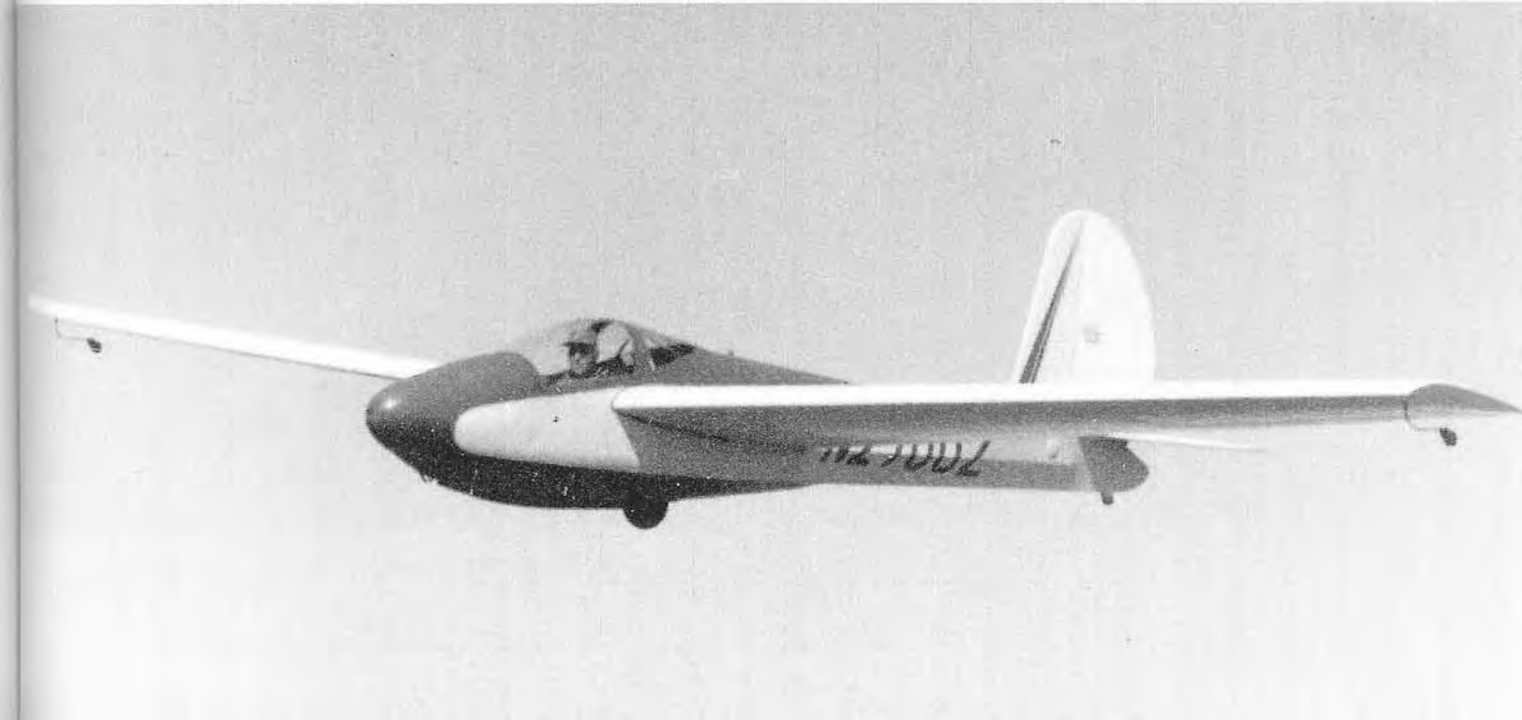
Although 117 kits were sold, only 22 of the completed sailplanes, designated the Standard 1-26, were built in the factory. We finished these as simply as possible, leaving the metal-skinned areas in natural aluminium and doping the fabric silver. Owners and kit builders often devised their own lively paint schemes. Over the Labor Day weekend in 1955 we held the first 1-26 Regatta at Harris Hill, with seven 1-26s entered. Five of these had been built from kits, and in one case the sailplane had been completed within six months of delivery. Thereafter, regattas were organised on each Labor Day weekend.

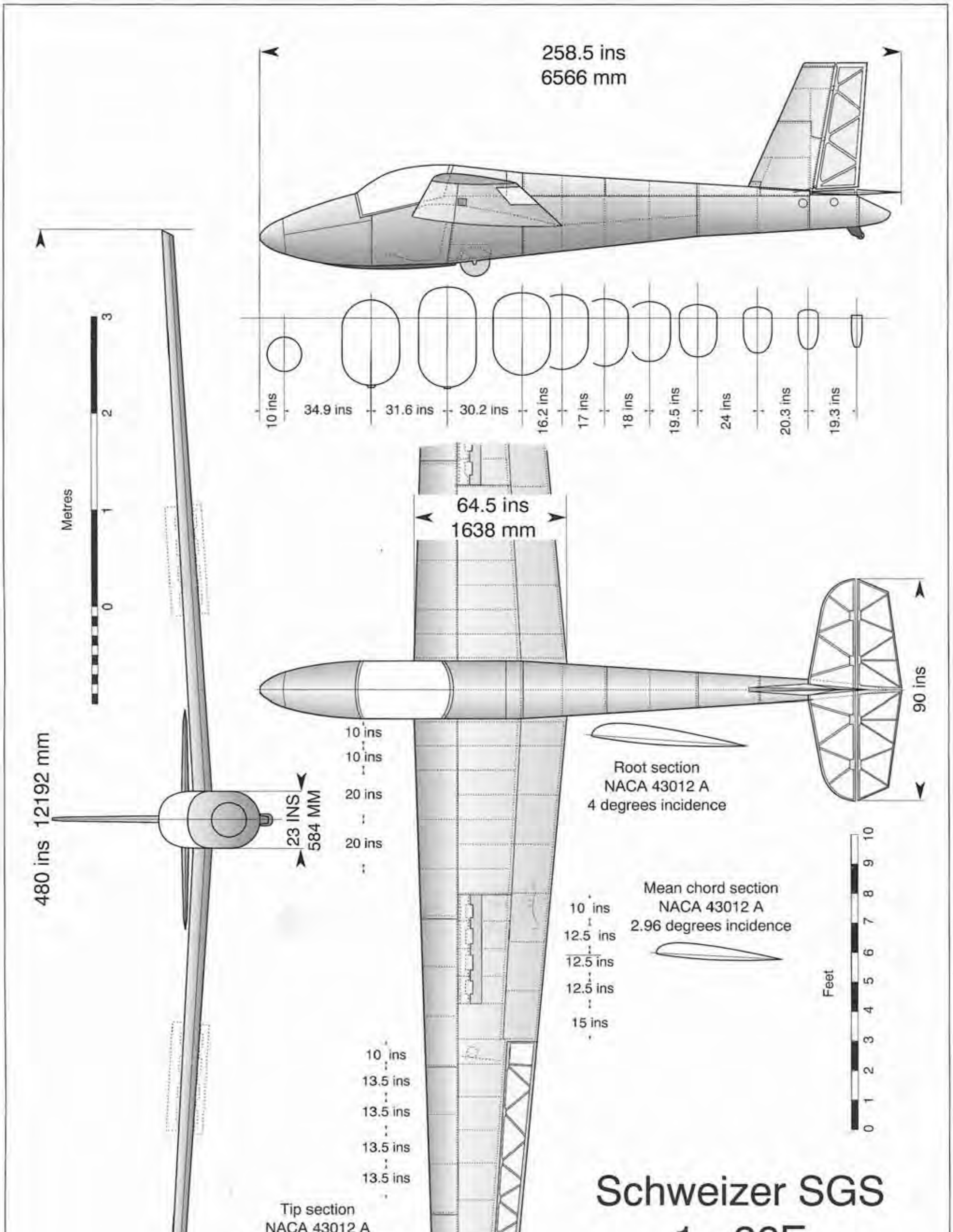
As orders continued to arrive, interest in the kits gradually diminished and we found ourselves producing a greater number of complete sailplanes. It became more important than ever to reduce production time, but having launched the 'one-design' concept, we would have undermined the principle if we had made very substantial changes to the 1-26. When we introduced the 1-26B in 1956, the changes were relatively small and had little effect on its performance. The wing was completely metal skinned except for the ailerons. This reduced production time and made the aircraft more durable, but increased the weight by about 25 lb. There were some improvements in pilot comfort and visibility from the cockpit. In total, 184 B models were built.

The 1-26C, the kit version, was offered in several varieties. The standard kit included all materials, the fuselage frame completely welded up and primed, the wings with spars and all stressed parts assembled, the rear ribs ready to be riveted on, the main root fittings machined and in place, ready for rigging to the fuselage. There was a glassfibre nose, a wheel cover, a stick boot, and a battery rack.



ABOVE: *The prototype SGS 1-26 over Horseheads, NY, during a test flight.*
BELOW: *A 1-26E model with optional tip wheels*
OPPOSITE PAGE: *A SGS 1-26 kit builder assembling the rear wing ribs to the spar of his 1-26. The other wing, completed, stands against the wall and the tail components await covering.*





258.5 ins
6566 mm
10 ins
34.9 ins
31.6 ins
30.2 ins
16.2 ins
17 ins
18 ins
19.5 ins
24 ins
20.3 ins
19.3 ins
Metres
0
1
2
3
64.5 ins
1638 mm
90 ins
480 ins 12192 mm
23 INS
584 MM
10 ins
10 ins
20 ins
20 ins
Root section
NACA 43012 A
4 degrees incidence
Mean chord section
NACA 43012 A
2.96 degrees incidence
10 ins
12.5 ins
12.5 ins
12.5 ins
15 ins
Feet
0
1
2
3
4
5
6
7
8
9
10
10 ins
13.5 ins
13.5 ins
13.5 ins
13.5 ins
Tip section
NACA 43012 A
1.5 degrees incidence
33.4ins
Schweizer SGS
1 - 26E
Drawn by Martin Simons 1996 ©
From information supplied by Paul Schweizer.

Adjustable rudder pedals and oxygen bottle racks were also provided. Only coloured paints, harness and instruments were omitted. Fabric and silver dope for covering were included. A so-called 'dry' kit, without fabric, plywood and dopes, could be bought for $200 less. A completed aircraft, requiring only the fabric covering and paint, was also available.

In October 1963 the magazine *Soaring* devoted most of one issue to the 1-26. By this time more than 200 had been sold, and *Soaring* was receiving more stories about them than could be printed in the limited space available. A distance of 443 miles had been achieved by Wallace A. Scott, whose flight was described in full. In the same issue Rose Marie Licher gave an account of her national women's distance record of 273 miles. Another pilot had reached 36,000 ft in a 1-26. As the editorial said, no one should underestimate the performance possibilities of this small, inexpensive sailplane. The ninth Labor Day Regatta had nineteen entrants, and plans for a full one-design championship were being made. In September the 1-26 Association was formed to organise contests and other related activities. Tony Doherty, Schweizer's sailplane sales manager, who had experience with one-design sailboats, took the lead in promoting the association and helping it to grow. It still flourishes.

In 1965 the first 1-26 Championships were held at Harris Hill in the week just before the usual Labor Day Regatta. It had taken ten years from the production of the first 1-26 for the one-design idea to come to its full realisation. Since then, the 1-26 Championships have become a regular feature of the annual contest calendar. The meeting has been held at different venues around the U.S.A. to give pilots in all States the chance to enter without always having to travel great distances.

We had delivered eighty-seven of the C model, but the kit market now dried up altogether. The total of all 1-26 kits produced had reached 204. All were successfully completed and licensed, but for one apparently still languishing in a crate in New Mexico. We remembered the old Baby Albatross which Hawley Bowlus had produced in kit form before the war. He had manufactured more than 100 kits, but we never saw anything like that number actually flying. There must have been many Baby Albatrosses lying partly completed in garages and sheds all over the country. In 1968 we were quoting the kits at $3,450. The price reflected the rate of currency inflation over the previous decade.

In 1968 we received an order from the Indonesian Air Force for thirty completed 1-26s, to accompany the 2-22 trainers that were sent there as part of a government aid package. We made some further

A 'patriotic' SGS 1-26 with red, white and blue decoration and tip wheels.

An SGS 1-26B with glassfibre nose skin, swept fin and special paint finish for an exhibition.

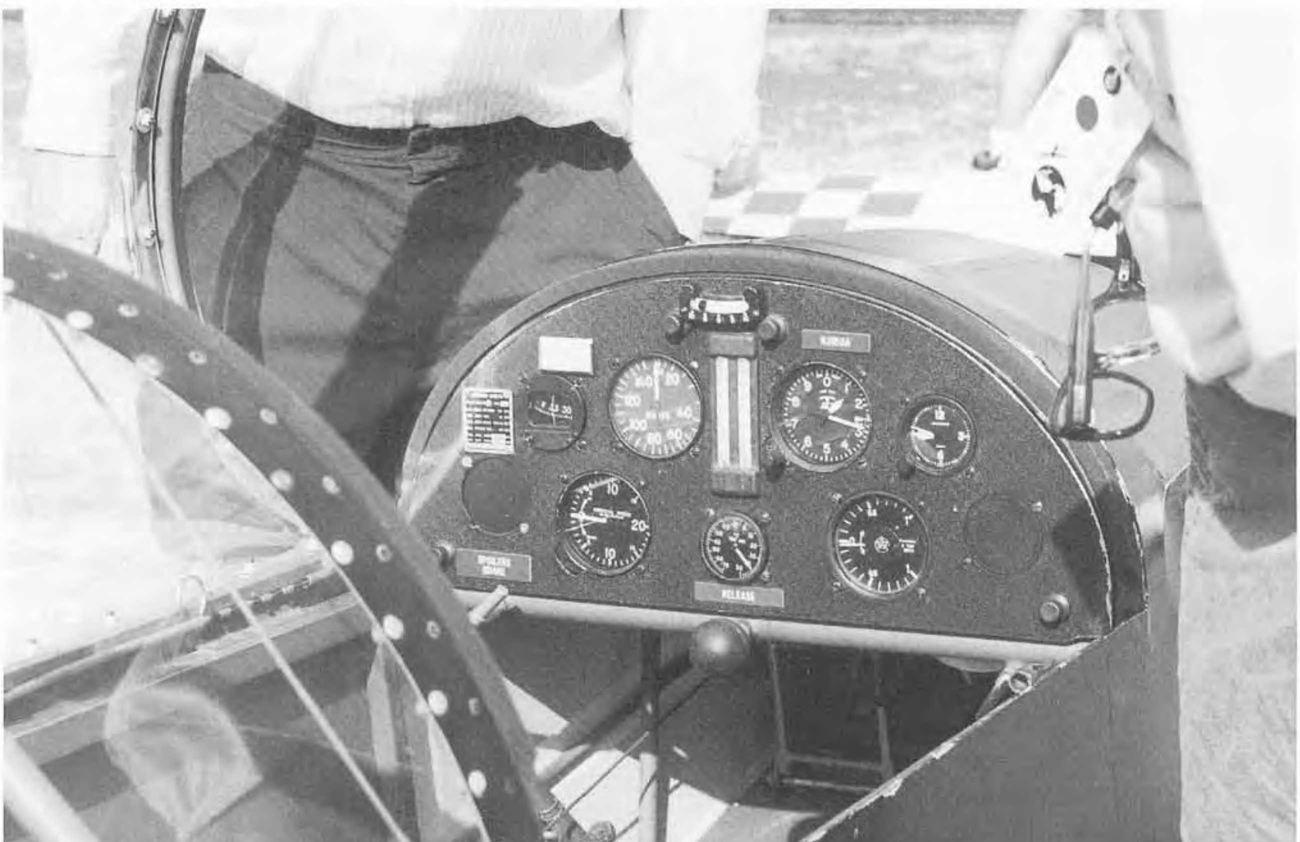
modifications for the sake of easier production, and some other small improvements were introduced to produce the 1-26D, again without greatly affecting the performance. The forward portion of the fuselage was changed to sheet-metal construction, the nose profile was refined slightly to improve vision and to allow a little more leg room in the cockpit, and the canopy lines were improved. Dive brakes, rather than spoilers, were added to the wings and a swept tail was designed, purely for styling. Empty weight crept up over 400 lb, and the gross weight to 640 lb. Seventy-nine of this D model were built, thirty for Indonesia. A kit version was not offered.

The price of a 1-26D in our January 1969 quotations was $4,995, with glassfibre wheel cover, seat belt and shoulder harness, and fresh air vent all fitted, and the glider fully finished in white with a choice of red, blue, orange or green trim and registration numbers, with air speed indicator and certificate of airworthiness, ready to fly. Our special sprung wingtip wheels could be added for an extra $30, and a well-designed and fitted contour cushion for $47. These were F.B.O. Elmira prices. Crating for shipment cost another $219.50.

With the advent of the 1-23E, late in 1970, we finally replaced the fabric-covered rear fuselage with an all-aluminium alloy monocoque. This gave the 1-26 almost a new lease of life, and 200 were produced. The only fabric-covered parts now were the movable control surfaces, and for these we were using a modern, ultra-violet-resistant heat-shrinking fabric. The weights increased again, the final version of the 1-26 flying 125 lb heavier than the prototype, at 700 lb.

The increased weight of the later models, and the

Above: *Jim Short flies SGS 1-26E, factory number 700, above the clouds.*
Below: *The cockpit of a 1-26 at the 1995 International Vintage Soaring Meet. (M. Simons)*



Above: *An SGS 1-26E over the Rocky Mountains.*
Below: *For those who prefer to fly with an open cockpit, a 'sports' canopy is available for the 1-26.*

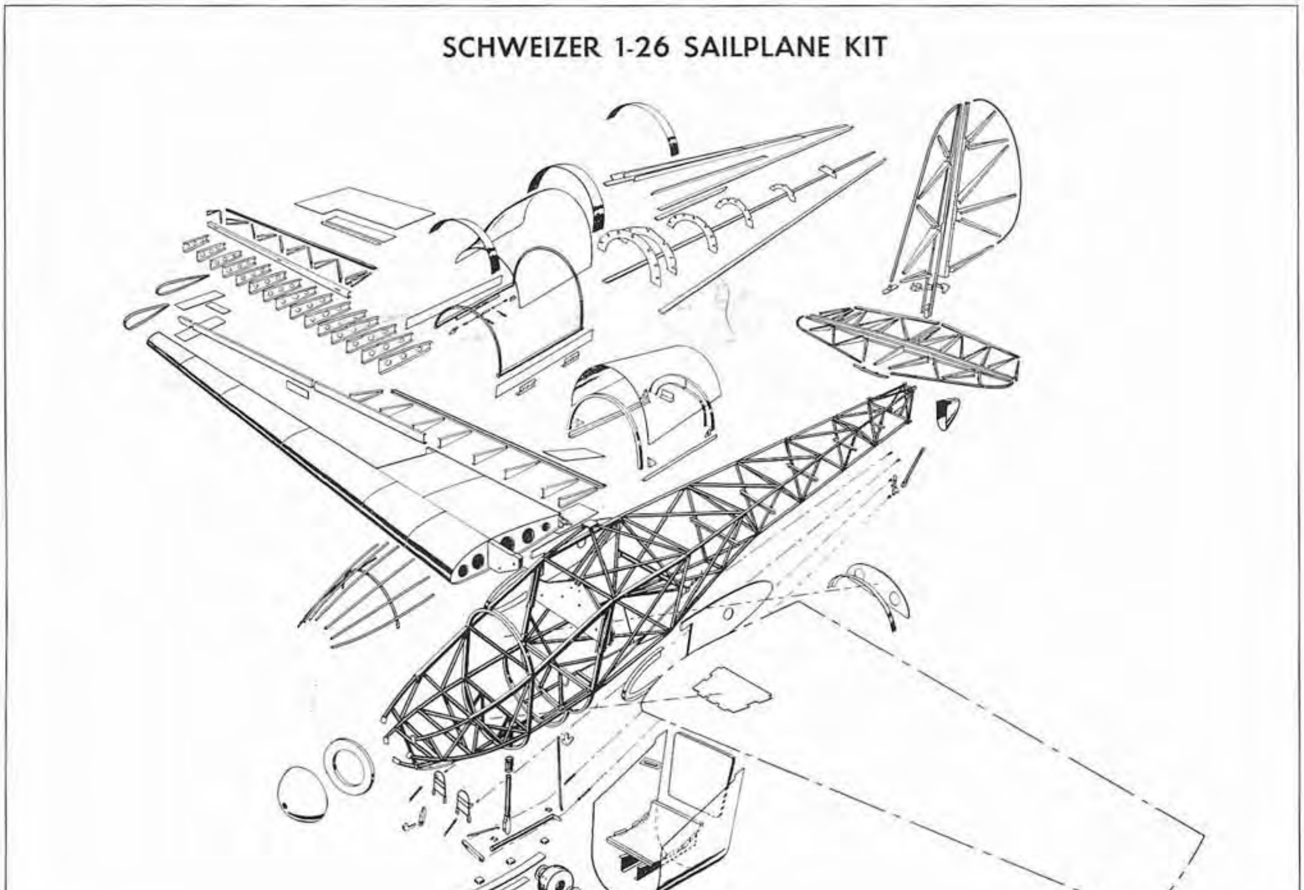
The SGS 1-26 prototype hanging above the Arnot Shopping Mall in Big Flats, New York, in 1995.

detailed changes, bother some design 'purists', but these variations have little effect in actual competition. The lighter sailplanes have a lower sink rate, so can climb a little faster in weak thermals on difficult days, when the heavier aircraft gain height more slowly. But the extra weight allows a higher cruising speed after leaving a thermal, so in better conditions the heavier sailplanes can usually catch up and overtake. In a ten-day competition, with mixed weather, the differences average out very well. At the 1-26 Championships the pilots have a lot of fun, and are not humiliated by seeing a very costly super sailplane with wings spanning perhaps 26 m (85 ft) racing away into the far distance. Many of the American pilots who later became champions did their earliest competition flying in the 1-26.

The performances turned in are far in excess of our original aims. The goal of the 1-26 being a Gold C sailplane has been exceeded many times, with thirty complete diamond badges having been achieved in 1-26s and more than eighty-seven diamond distances of 500 km flown.[17] As the aircraft get older, interest in the 1-26 continues. The 1-26 is a good financial investment for a beginner, as there is little chance of depreciation when the sailplane is sold. So, in spite of the design being over forty years old, it is still a very popular type, especially for early solo pilots who want to gain experience in competition.

As an experimental project, to see if there was any future in a long-span version of the 1-26, we extended the span to 15 m and extended the ailerons part of the way out towards the tip. We did some

Above: *Al Donor, Schweizer photographer in a 1-26 with Sports Canopy, with friend at the Schweizer Soaring School.*
Below: *An exploded view of the SGS 1-26 Kit, showing how the kit is received by the purchaser.*



test-flying with this, and concluded that it was not the way to get a higher-performance sailplane, so the project was discontinued. It was felt that we had to go to a new sailplane with a new aerofoil section to get the increase in performance we sought.

Of the 689 1-26s sold, it is estimated that about 500 are still flying. The difference in the total number built and the last one having the factory number 700, is explained by the fact that a block of 11 numbers for Model C kits was assigned, but they were never produced.

Both the prototype and the last 1-26 are in the National Soaring Museum's collection. Number 1 is on permanent exhibition in the Arnot Mall in Big Flats, New York, only a few hundred yards from the plant where it was built, and No. 700 was loaned to the Science Museum of Chicago and is now at the National Soaring Museum.

The successful experience that the 1-26 Association had with the 1-26 one-design competitions has had its impact on the international soaring community. Nothing had been done by the International Gliding Commission about resurrecting the Olympic sailplane since the Second World War, until the idea was again proposed at an Organisation Scientifique et Technique Internationale du Vol à Voile (O.S.T.I.V.) congress in 1987, based upon the success of the 1-26. After considerable discussion and argument, it was agreed to launch a design competition to produce a 'World Class' small sailplane which could be used for international championships. The winning design, the PW-5, came from Poland, and entered production during 1995. The first World Class International Championships was scheduled for 1997 in Turkey, the first of what is expected to become a long series.

[17] To qualify for a complete diamond badge, which is a Gold C badge with three diamonds mounted on it, the pilot has to fly a 300 km (186-mile) distance flight to a predeclared goal, a 500 km (311-mile) distance flight, and make a height climb after release from tow, of 5,000 m (16,405 ft). The last requires oxygen breathing apparatus and might be done in a lee wave or by cloud flying.

Stu Schweizer aboard the Sports canopied 1-26, at the Schweizer Soaring School.

ABOVE: *Tony Doherty, SAC Sales Manager (left) with Jim Doyle, New England Dealer turns over 1-26 papers to an American Airlines Captain (S.A.C)*
BELOW: *A line up of 1-26s for a Regatta at Harris Hill (S.A.C)*

Schweizer 1-26

Total built of all models, 689

Schweizer SGS 1-26 & 26A

Total number built: 139 (22 1-26, 117 1-26A kits)

Specification

Span	40 ft	12.19 m
Length	21.25 ft	6.48 m
Wing area	160 ft^2	14.86 m^2
Aspect ratio	10	
Aerofoil section	NACA 43012A	
Empty weight	355 lb	161 kg
Pilots	220 lb	100 kg
Flying weight (maximum)	575 lb	261 kg
Wing loading (maximum)	3.59 lb/ft^2	17.5 kg/m^2
Best L/D	23:1 at 49 mph	78.8 km/h
Minimum rate of sink	2.7 ft/sec at 40 mph	0.82 m/sec at 64 km/h

Schweizer SGS 1-26B & C

Total number built: 271 (184 1-26B, 87 1-26C kits)

Specification

Span	40 ft	12.19 m
Length	21.25 ft	6.48 m
Wing area	160 ft^2	14.86 m^2
Aspect ratio	10	
Aerofoil section	NACA 43012A	
Empty weight	380 lb	172 kg
Pilots	220 lb	100 kg
Flying weight (maximum)	600 lb	272 kg
Wing loading (maximum)	3.75 lb/ft^2	18.3 kg/m^2
Best L/D	23:1 at 50 mph	78.8 km/h
Minimum rate of sink	2.7 ft/sec at 40 mph	0.82 m/sec at 64 km/h

Schweizer SGS 1-26D

Number built: 79

Specification

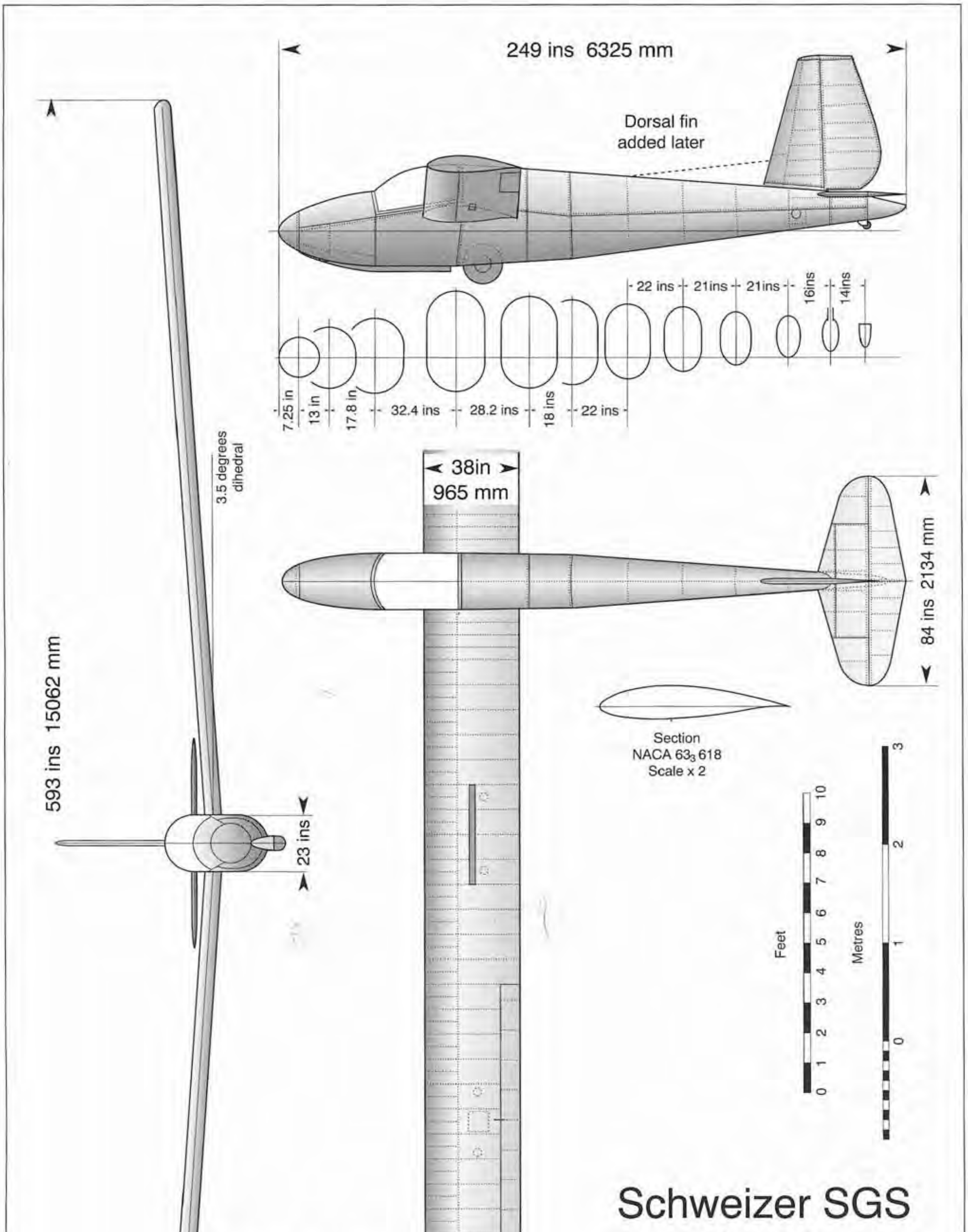
Span	40 ft	12.19 m
Length	21.25 ft	6.48 m
Wing area	160 ft^2	14.86 m^2
Aspect ratio	10	
Aerofoil section	NACA 43012A	
Empty weight	400 lb	181 kg
Pilots	240 lb	109 kg
Flying weight (maximum)	649 lb	290 kg
Wing Loading (maximum)	4 lb/ft^2	19.5 kg/m^2
Best L/D	23:1 at 52 mph	83 km/h
Minimum rate of sink	2.8 ft/sec at 40 mph	0.85 m/sec at 64 km/h

Schweizer SGS 1-26E

Total number built: 200

Specification

Span	40 ft	12.19 m
Length	21.25 ft	6.48 m
Wing area	160 ft^2	14.86 m^2
Aspect ratio	10	
Aerofoil section	NACA 43012A	
Empty weight	445 lb	202 kg
Pilots	255 lb	116 kg
Flying weight (maximum)	700 lb	317 kg
Wing loading (maximum)	4.38 lb/ft^2	21.4 kg/m^2
Best L/D	23:1 at 53 mph	85 km/h
Minimum rate of sink	2.9 ft/sec at 40 mph	0.88 m/sec at 64 km/h


249 ins 6325 mm
Dorsal fin
added later
22 ins
21ins
21ins
16ins
14ins
7.25 in
13 in
17.8 in
32.4 ins
28.2 ins
18 ins
22 ins
3.5 degrees
dihedral
38in
965 mm
84 ins 2134 mm
593 ins 15062 mm
23 ins
Section
NACA 63_3 618
Scale x 2
Feet
0
1
2
3
4
5
6
7
8
9
10
Metres
0
1
2
3
Original tips square with
plywood end plates,
span 15 metres
Schweizer SGS
1 - 29
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.

SGS 1-29

We were doing some preliminary planning for a new, high-performance two-seat sailplane, and we had to choose an aerofoil section. We decided to use a laminar-flow profile, but wanted to be sure that we chose the best one.

When a wing moves through the air, there is a very thin layer of air close to the skin, called the boundary layer, which tends to stick and resist the motion rather in the way that syrup sticks to a spoon. Syrup is very viscous or sticky, while air is very slightly viscous. The boundary layer on a wing is extremely thin and, of course, invisible, but the flow in this region is very important for all kinds of aviation, especially for sailplanes, where drag reduction is vitally important for good performance at all flying speeds.

As a rule, for the first few inches the flow in the boundary layer on a wing, or anywhere else close to the skin of an aircraft, is laminar. That is, the flow is very smooth. The air particles closest to the wing almost stick to it and are carried along. The next tiny layer slides smoothly over this, but a fraction faster, the next layer out slides over the inner one faster again, and so on, each layer behaving as if it were a thin sheet, or lamina, each sliding by with only a little dragging between them, until at the outermost edge of the boundary layer the last lamina is moving with the general airflow. Near the leading edge of a wing the entire boundary layer, with all this sliding, is only a few hundredths of an inch deep. There is very little resistance to the motion. A laminar boundary layer creates only small drag on the wing.

However, with most ordinary wings there are small irregularities, things like rivet heads, slight wobbles where the skin passes over ribs and spars, and, in flight, sometimes actual distortions caused by stress and strain, which spoil the perfect shape. Such bumps and hollows tend to disturb the boundary layer, breaking up the laminae as they slide by. The flow is spoiled, the boundary layer becomes turbulent and thicker, and the resistance to the passage of the wing is much greater. The change from laminar to turbulent boundary layer is called transition. Even a strip of adhesive tape on a wing, or the crushed body of an insect, can sometimes force a laminar boundary layer into transition and so increase the drag. Raindrops and icing have the same effect.

The SGS 1-29 prototype ready for its first flight at Chemung County Airport.

The SGS 1-29 circles, showing the tip plates on the wings which also acted as tip skids. The plates were later removed and the wingtips reshaped. A dorsal fin extension was also added.

A rough idea of what transition in the boundary layer is like can be obtained very easily by looking at the behaviour of a jet of water striking a flat surface. This can be observed even in an ordinary kitchen sink. From the place where the jet strikes the surface, the flow spreads out in all directions as a thin sheet. This is a kind of laminar flow, fast and smooth. But some way out there is transition. A little cliff of water appears, and the sheet becomes much thicker and slows down. The flow beyond this is turbulent. Of course this is not an accurate representation of boundary layer transition in air, but it gives a good visual impression of something that normally we cannot see directly. Transition is quite sudden, not a gradual process.

It would be very good for sailplane designers and pilots if the flow over the entire skin of the sailplane could be laminar. The drag would be very small, and gliding performances would increase greatly. This cannot normally be achieved, but a start can be made by keeping the wings smooth. This was shown in 1949, when an ordinary Schweizer TG-3 sailplane had its wings carefully filled and smoothed, reducing the best drag figure by 25%. We improved the performance of our 1-23 sailplanes by making all rivet heads flush with the skin, butting skin joints instead of lapping them, and by filling, smoothing and painting the wings. Using thicker skins, to prevent 'oil-canning' in flight, made a further small improvement, but the wing profiles we used most often, from the N.A.C.A. five-digit series, such as the 43012A, were never designed for laminar flow. Even with a perfectly smooth and wave-free skin, transition in the boundary layer on the upper side of these profiles was certain to occur at about the quarter-chord point, measured from the leading edge.

It had been discovered even before the Second World War that, by careful calculation of the shape of a wing profile, the extent of laminar flow could be increased considerably. The most obvious feature of the laminar wing profiles was that the point of maximum thickness and camber was moved aft, to 35 or 40% of the chord. The boundary layer would remain laminar to this point, but only if the wing was smooth and accurately built. Special care had to be taken with the leading edges, where quite a small error could 'turbulate' the flow over the whole wing. Windtunnel tests at the N.A.C.A. laboratories had shown that the drag of these new sections, if they were accurate and very smooth, could be about a half that of a turbulent profile. The first important application of laminar wings was in the North American P-51 Mustang fighter. In active service it was not easy to keep the wings clean and smooth, so the full benefits could not be realised, but the P-51 owed some of its great success to its low-drag wing profiles. All of the details were not published until 1945.

It was not certain at first that the new profiles would be useful for sailplanes, which fly so much more slowly than military aircraft or airliners. Necessary research in this direction was carried out by Dr August Raspet of the Aerophysics Department of Mississippi State College. Ray Parker, with advice from Gus Raspet, worked very hard on the *Tiny Mite*, a small sailplane which was improved almost beyond recognition. Then came the RJ-5 which Harland Ross (who had, prewar, designed the RS-1 Zanonia and the R-2 Ibis) had designed and built. It had a laminar wing profile, the NACA 63_2615, but at first the performance was not as good as expected because the skin was not smooth enough. Dick Johnson, by now recognised as one of the world's leading soaring pilots, spent hundreds of hours in 1950 rebuilding the RJ-5's wing almost completely, filling it and smoothing, cleaning up and sealing all the gaps. As a result its best glide ratio was improved from a rather ordinary 30:1 to more than 40:1. With the RJ-5 Johnson shattered the world distance record in 1951, making a flight of 545 miles (877 km) from Odessa in Texas.

European designers were quicker than we were to take advantage of these discoveries, making a number of experimental prototypes. By 1954 several sailplanes with laminar profiles were in factory production, including the French Breguet 901, which won the World Championship that year, and the British Slingsby Skylark. The Ka 6 from Germany followed in 1955 and won the O.S.T.I.V. design prize in 1958, thereafter becoming a very popular type.

By 1957 it was clear that any new design from Schweizer would have to have a modern wing profile if it was to have any chance of competing in the market with European imports. We decided to try out the 63_3618 section by building a test wing which could be mounted on a 1-23G fuselage and tail. It was never intended that we would go into production with the 1-29, but the experience gained would be applied directly to future designs. A 15 m-span wing was drawn up, with a constant chord planform. This enabled us to make exact rib tooling without much cost, as each rib was exactly the same in outline. The rectangular wing would require more rudder and aileron in thermal soaring owing to the greater inertia and damping in roll, but the pilot would soon get used to it. There would be a slight penalty in drag compared with a tapered wing, but we accepted that for this experimental aircraft.

We took a great deal of trouble to ensure that the wing was exactly to contour. We wanted to establish that an ordinary flush-riveted metal skin, if built with proper care, would be just as good as a wooden one in preserving accuracy. We knew we should have to compete with new structural methods emerging from other designers, such as sandwich skins of wood and plastic foam and honeycomb metal skins, and (although only a hint of it had been heard as yet) the glass-reinforced-plastic (G.R.P.) sailplane was likely to appear before long. It was important for us to show that we could achieve good performance

The original SGS 1-29 with Bernie Carris pilot, with original tip plates flies over the Harris Hill ridges. (Howard Levy).

with orthodox methods of metal construction. We aimed at deviations from the exact contour of the profile of no more than 0.003 to 0.005 in.

The wing spar was built for higher 'g' forces so that we would not get 'oil-canning' in normal flight. The sailplane was completed in August 1958, and evaluated in comparison flight tests with an 1-23G. Even with bare metal skin on the wing, it was found to have a substantially better glide ratio and high-speed performance. We then filled and painted the wing, and were confident that we had achieved the expected proportion of laminar flow.

I flew the 1-29 in the 1959 National Contest to compare it with other 15 m sailplanes. It was a contest in which thermals were generally rather weak, and in these light airs Dick Johnson won, flying an old, wooden, pre-Second World War Weihe. I finished seventh in the Open Class. On a 'free distance' task day the 1-29 proved its worth when I achieved 267 miles (429 km), landing at Greene, Rhode Island. It was the best flight of the day. A Ka 6 flown by Kit Drew won the Standard Class.

I had good opportunities to compare the 1-29 with the Ka 6 in the 1961 Nationals, held at Wichita, Kansas. A Ka 6 pilot and I flew along together for many miles. He could outclimb me in each thermal, but I would get to the next thermal above him. This continued until our chosen routes diverged, and I landed in Nebraska. The 1-29 was flown in contests by a number of other pilots, including Bill Ivans, Tom Smith and Les Schweizer, Ernie's son.

We had proved the aerofoil section and our methods of construction. At a late stage we felt that directional control would be improved by adding a dorsal fin, and this was done, but the sailplane had by then served its purpose and did not do a great deal of flying afterwards. The 1-29 was eventually donated to the National Soaring Museum.

Schweizer SGS 1-29

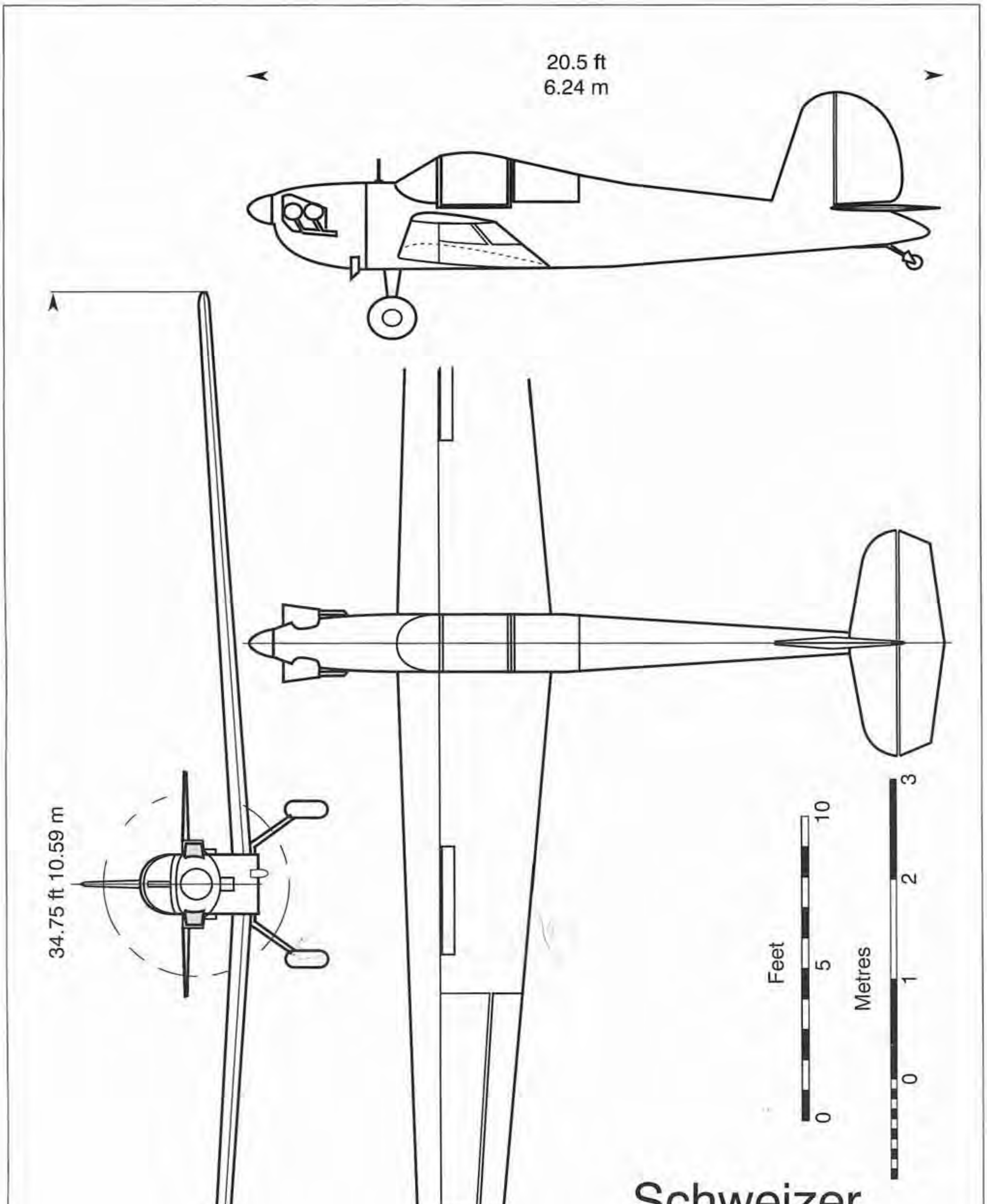
Total number built: 1

Specification

Span	49.2 ft	15.0 m
Length	20.75 ft	6.32 m
Wing area	153.8 ft^2	14.29 m^2
Aspect ratio	15.75	
Aerofoil section	NACA 63_3618	
Empty weight	495 lb	224 kg
Pilots	255 lb	115.6 kg
Flying weight (maximum)	750 lb	340 kg
Wing loading (maximum)	4.87 lb/ft^2	23.7 kg/m^2
Best L/D	34:1 at 52 mph	83.7 km/h
Mininum rate of sink	2.05 ft/sec at 43 mph	0.62 m/sec at 69.2 km/h

RIGHT: *Another view of the original SGS 1-29 being prepared by flight crew for its first test flight. This angle shows the wing not yet filled or painted.*


IENT


20.5 ft
6.24 m
34.75 ft 10.59 m
Feet
0
5
10
Metres
0
1
2
3
Schweizer
SGA 1-30
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.

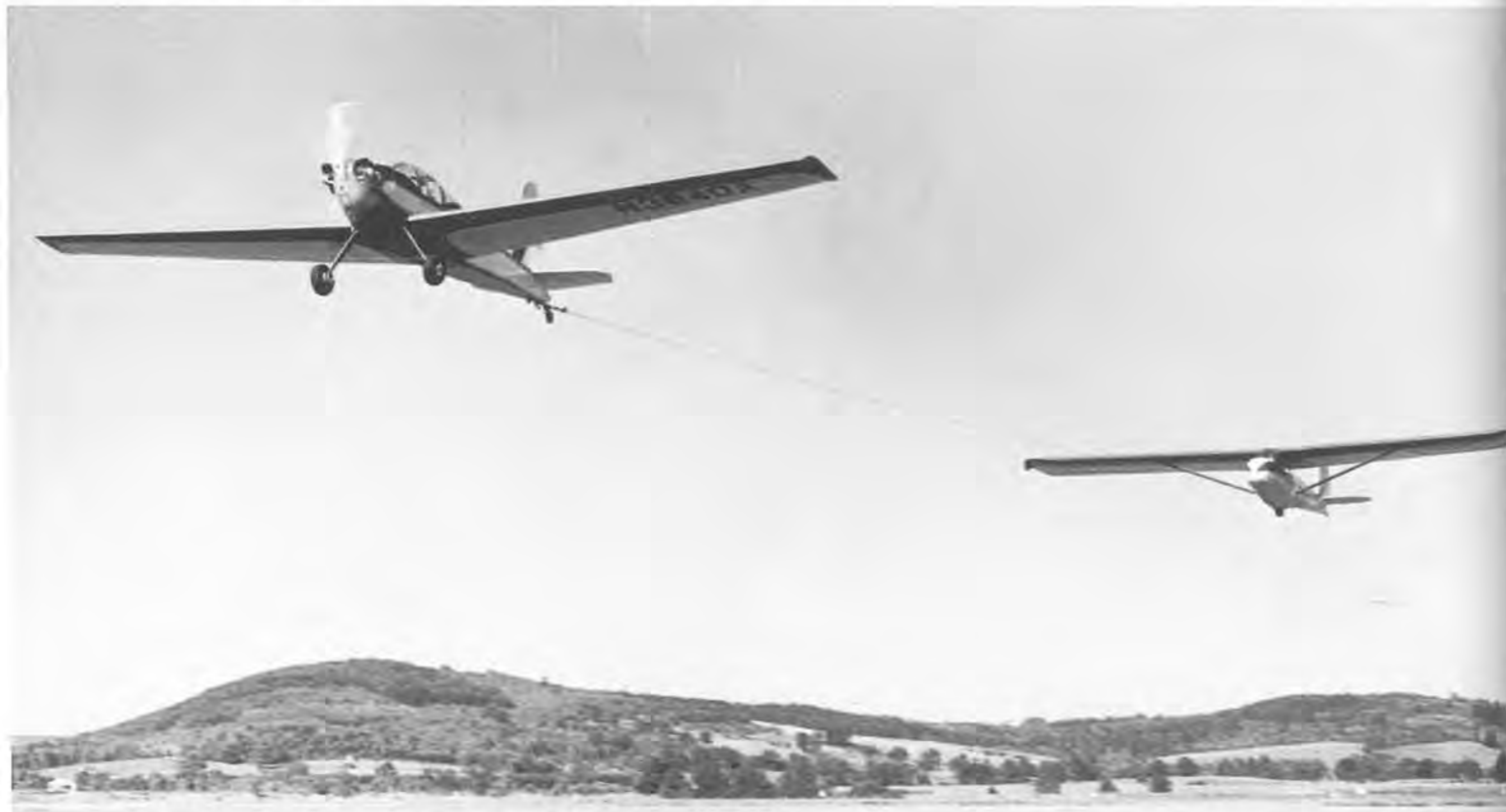
SA 1-30 & SA 2-31

We had always wanted to produce a powered aeroplane of our own design. In 1955 Ernie had outlined a two-seat light aeroplane, but it was never built. This would have been the SGA 2-27. The 7-28 was another aeroplane project, much larger and intended as a commercial transport, but this, too, never left the drawing board. In 1958 we decided to investigate the possibility of using some 1-26 assemblies and parts to produce a single-seat aeroplane, with an eye to future development, planning a simple aircraft using as many glider subassemblies and parts as possible to keep the cost down. We made a welded-steel-tube fuselage with some sheet-metal structure around the cockpit, and used a set of conventional 1-26 tail surfaces and a spring-type 'Cessna' landing gear. We fitted a 65 hp Continental engine in the nose, and a pair of 1-26B wings were mounted in a low-wing position. It was built with temporary tools and, as we say 'it was a quick and dirty job'.

The 1-30 first flew in July 1958, and proved a joy to fly. Any pilot who saw it wanted to fly it. The high-lift sailplane wing and spoilers, and its light weight, enabled it to operate from very short fields. We

The SA 1-30 aeroplane used 1-26 wings and tail unit, and had a sprung landing gear.

Above: *The 1-30 single place airplane ready for take off at Chemung County Airport.*
Below: *The SA 1-30 made a satisfactory tug for relatively light sailplanes.*



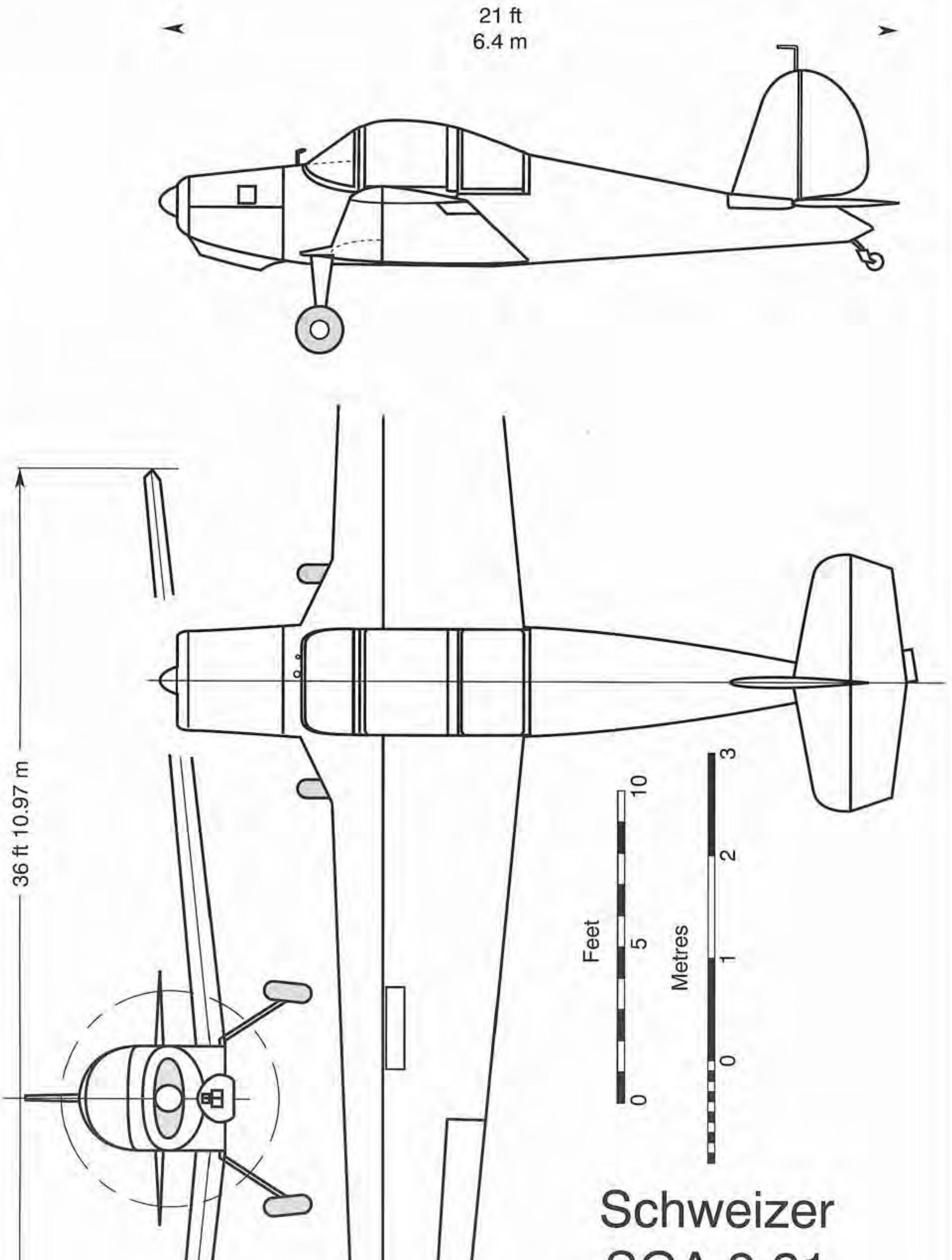
Clyde Cook flying the SA 1-30. This small aeroplane was delightful to fly, and we later regretted not marketing it in kit form.

asked many people to fly it to get their reactions, and all were delighted. The aircraft was sometimes used by us and our staff for short business trips. Tony Doherty used it quite often to visit dealers. The 1-30 was so much fun to fly that we were often challenged as to the necessity of the trip!

We went through a soul-searching process to see if we should put the 1-30 into production as a kit, like the 1-26, for sport flying. Many suggested that we should make it into a two-seater, so that a passenger could be carried, while others felt that the fact that it was a single-seater was actually an asset, for there was nothing to compete with it at that time. Our surveys indicated that the market for a two-seater was larger, but perhaps we overlooked the point that there would be much more competition in this area. We decided at last to go ahead with a two-seat version, and did not put the 1-30 into production.

We did a lot of development flying with the 1-30, shortened the span to 36 ft and installed a 90 hp engine to increase the cruising speed to a little over 100 mph. We tried it out for towing sailplanes with both types of engines. The 65 hp version was slightly underpowered for this, but 90 hp made it into a good tug.

Years later we agreed that we 'missed the boat' by not putting the 1-30 into production as a kit at that time, for the Experimental Aircraft Association kit-building programme was just beginning to grow at a good rate.



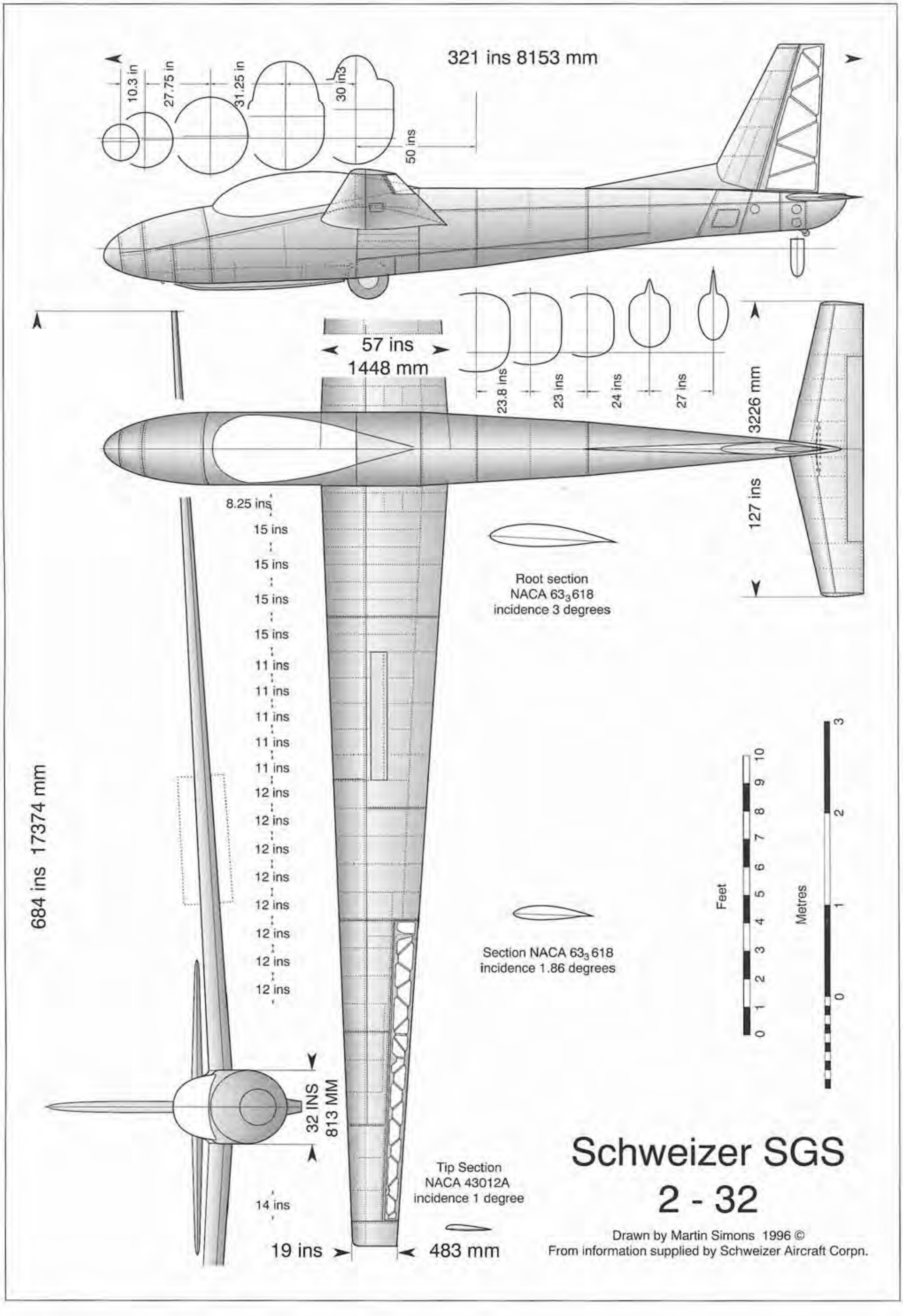
Schweizer
SGA 2-31

Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.

SA 2-31

The fuselage of the 2-31 was similar to that of the 1-30 in construction, but it was mated to strengthened 1-26B wings. The tail surfaces were modified from those of the 1-26. Completed and test-flown in July 1960, the 2-31 flew well, but the wider fuselage was responsible for some flow separation which struck the tailplane, causing an irritating 'burble'. This was corrected by adding cuffs at the root of the wing. We thought that it was a good aeroplane which would have more sales potential than the 1-30, but the cost of tooling and development to meet the competition would have been high, and with the heavy requirements for taking care of the other projects in the plant we decided not to go ahead with it after all.

ABOVE: *Bill Schweizer and his son, Paul H., fly the 2-31 from the home airport.*
BELOW: *Like the 1-30, the 2-31 used the wings and tail of a 1-26 sailplane, with necessary strengthening.*



Schweizer SGS 2 - 32

Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.

SGS 2-32

By 1961 the soaring movement was growing at a good rate, and Schweizer's sailplanes sales were increasing substantially as a result of our expanding dealer organisation. Although sailplane sales amounted only to 8% of the company's total income, we wanted to keep them going. Apart from our long-standing love of soaring, we were the only commercial producers of motorless aircraft in the U.S.A., and felt that our continued existence in this business was important. In 1961 we delivered fifty-one gliders, mostly 1-26s and 2-22s, but only three 1-23s.

The 2-22 had been doing excellent work as a basic trainer and was still selling well, but many customers were now asking for a new two-seater. In performance it needed to be an advance on the 2-22, but the sales department argued that everything should be as simple as possible to keep the cost down. What was envisaged was a two-seat version of the 1-26, effectively a '2-26', a very simple sailplane for building from a kit but capable of good cross-country flights as well as training complete beginners. There would be no complicated and expensive extras. It was hoped it would fit into the

Bernie Carris test-flies the prototype SGS 2-32 with the original rectangular tailplane.

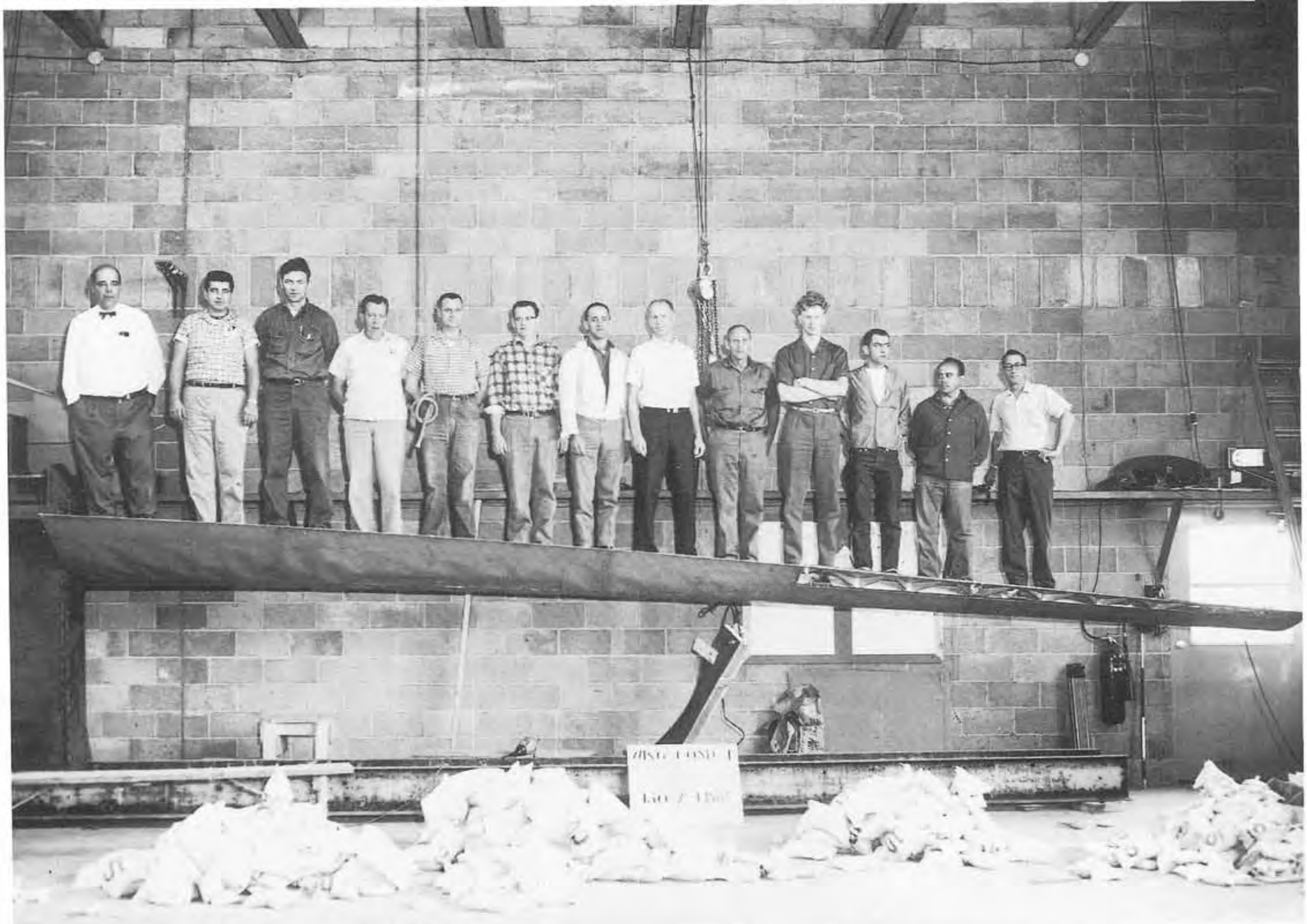
The 2-32 prototype on the airport in natural-metal finish.

soaring world as the 1-26 had, and encourage further growth of the movement. As we had done before, we sent out a questionnaire. The results made us think again.

A demand was revealed for a high-performance two-seat sailplane to introduce inexperienced pilots to advanced flying, and for competitions. Many pilots were looking for a personal two-seater in which they could take family members and friends on extended soaring flights, as well as competing in soaring contests. Those seeking this type of sailplane felt that there should be lots of room and weight allowance for oxygen apparatus, batteries, radio and other equipment and instruments. The cockpit had to be large enough to take pilots dressed for high-altitude wave flying, and sufficiently comfortable for flights lasting several hours. All this, and the necessary strengthening to carry the extra payload, implied a larger, heavier and more sophisticated high-performance sailplane than we had first imagined. It would cost considerably more than the proposed '2-26' type, and was therefore a major project requiring a big investment in engineering and development, much more so than any of our previous sailplane projects.

A preliminary mockup of the cockpit was presented at the annual Schweizer dealers' meeting in the autumn of 1961 at the company plant. The dealers were very enthusiastic, and urged us to go ahead. Engineering of the 2-32 proceeded, and work began on a prototype. We expected to have it flying by the summer of 1962.

A tandem seating arrangement was chosen. Some designers prefer side-by-side seating, but it was felt that fuselage drag could be minimised by the tandem layout. We were interested in getting as much performance as possible out of a moderate-sized aircraft, and while the fuselage's frontal area could be reduced by reclining the side-by-side seats, the tandem arrangement offered a greater saving in drag along with other advantages, such as the ability to fly solo from the front without having to add trimming ballast. The rear seat would be close to the centre of gravity.



Above: *After successful static proof loading, the work crew submit the 2-32 wing to a practical test. Ernie Schweizer, the designer, is at the root end.*
Below: *Proof loading of the tapered tailplane of the 2-32. Ken Smith, the engineer, on the right, and Bill Solometo apply the loads.*

The cockpit of the SGS 2-32. The boxes on either side of the front seat were for the rear pilot's feet. The rear seat was wide enough for two persons of moderate size. Note the oxygen breathing apparatus.

We remembered the difficulty with the 2-25, when pilots in heavy clothing and boots for high altitudes could barely get into the cockpits. The fuselage was widened to 32 in to allow space for the rear pilot's feet to fit under the front pilot's armrests, and the rear seat was then so wide that two small-to-average-sized people could sit side-by-side. This opened the possibility of the 2-32 being used as a 'three-seat' sailplane, a unique feature that proved to be of great interest to the dealers and commercial operators for selling introductory sailplane rides. It is often the case that people arriving at a glider port or school in search of their first flight do so in pairs. While passengers tend to hesitate to fly with an unknown pilot, they are very willing to go up if they have a friend in the back seat. It is rather cramped but 'cozy'. This makes it easy for the pilot, who does not have to be concerned about his passengers being at ease because they take care of this themselves. For a little extra cost two people could be taken for a ride in a 2-32 at the same time. This would encourage more people to try soaring and produce greater profits for a commercial operator or club.

Great care was taken to design a safe and strong fuselage. The basic structure was an all-metal monocoque of oval cross-section, skinned with 2024-T3 Alclad. The canopy, in one piece and hinged on the left side for access, was of teardrop shape, giving an excellent view in all important directions. The nose section was designed so that in the event of an accident it would collapse progressively and absorb most of any shock. Both head-on and lateral crash loads were allowed for, and the structure under the seat was deep enough to allow some protection from spinal injury in a very bad landing. This required the fuselage to be deeper than on most other high-performance sailplanes, but was justified by the greater safety. A full military-type cockpit harness was provided for both seats. Only one instrument panel was fitted, in the front, because the rear pilot could see the panel without difficulty, but extra instruments could be added in the rear cockpit if required. Provision for radio and oxygen was made in a central console under the main panel.

A number of wing designs were investigated, with various spans, areas and aerofoil sections. The best compromise appeared to be the 57 ft-span wing with an aspect ratio of 18.05 and area of 180 ft^2. The taper ratio was 3 to 1. The aerofoil section was the NACA 633618, which we tested thoroughly on the 1-29, as far as the inboard end of the ailerons. From there to the tip the profile changed progressively to our old favourite, the 43012A, which we knew would give safe stalling characteristics and good aileron control. A washout of 2.5 degrees was used. The dive brakes were sufficiently large to restrict the terminal velocity to the design limits, following those developed for the 1-23H-15.

High-strength alloys 7075 T6 and 2014 T6 were used for the main spar. In nearly all cases the joints were riveted, using rivets which could be driven without prior heat treatment. This was to enable repairs to be made without requiring a full aircraft workshop. All of the aluminium in the structure was chemically treated and painted with zinc chromate to protect against corrosion, and the external skins were enamelled.

The tailplane was of the all moving type, with an anti-servo trim tab. In plan, this surface was rectangular on the prototype, but on the production model it was increased in area and tapered. The vertical tail was swept back only for stylistic reasons.

The control systems were by cable with ball-bearing pulleys, except for the aileron controls in the wing, which comprised pushrods running in nylon bushings. Only the ailerons and rudder were covered with Ceconite fabric. It was not expected that the 2-32 would ever be launched by winch, so only an aero-tow releasable hook was provided. The undercarriage consisted of a simple wheel and skid, plus a small tailwheel.

The prototype was first flown in July 1962, and preliminary tests showed promise of meeting design expectations. A large number of experienced pilots tried the 2-32, and sufficient soaring flights were made to evaluate its all-round performance. Late in 1963 we held our annual dealers' meeting and the proposed 2-32 production plans were announced. As a result of the enthusiastic response we decided to certificate the 2-32 and put it into production. Before the end of the year we had received thirteen orders, at our estimated unit price of $8,000. We hoped to sell about 200 over the next ten years.

Extensive flight tests were carried out with the prototype 2-32 over the ensuing five months. The rudder area was slightly increased, and the tailplane, as mentioned above, was increased in area to improve pitching stability and tapered to improve its appearance. Rudder and aileron gearing were

David Welles takes two Elmira College girls for a flight in the SGS 2-32.


SCHWEIZER
AIRCRAFT
the 1000th.
Schweizer Sailplane

improved, and the dive brakes were modified several times to achieve a better balance of opening and closing forces. The design maximum speed was 166 mph, and the sailplane was flown up to 180 mph. This indicated the need for mass-balancing of the rudder, ailerons and tailplane to prevent flutter. It was also necessary to run flutter tests of the wing with dive brakes open up to terminal velocity. The brakes were proved to limit terminal velocity to 158 mph at the full gross weight of 1,340 lb. These tests involved prolonged vertical or nearly vertical dives from tow release heights of 12,000 ft, made at such a fast rate of descent that the sailplane was often on the ground again three or four minutes after release, beating the tug aircraft down.

The structure was completely checked by stress analysis, and all major components were static-tested as well. After ultimate loads were applied there was no appreciable set, and only a few rivets showed any yield.

With the aircraft carrying three persons, the allowed gross weight was increased from 1,350 lb to 1,430 lb, but in the non-cloud-flying category and with slightly reduced placard speed.

The 2-32 required about 400 drawings, 15,000 hours of engineering, many hours of development and testing, and about 16,000 hours of tooling. The estimated production hours were set at 1,100. Because of the higher-than-expected costs to the company, we were forced to slow down the development to spread the financial burden over several years, and the price had to rise. The numerous tests required of the prototype to satisfy F.A.A. requirements were completed early in 1964, by which time production had begun. Full type approval came in June, almost three years after the start of the project.

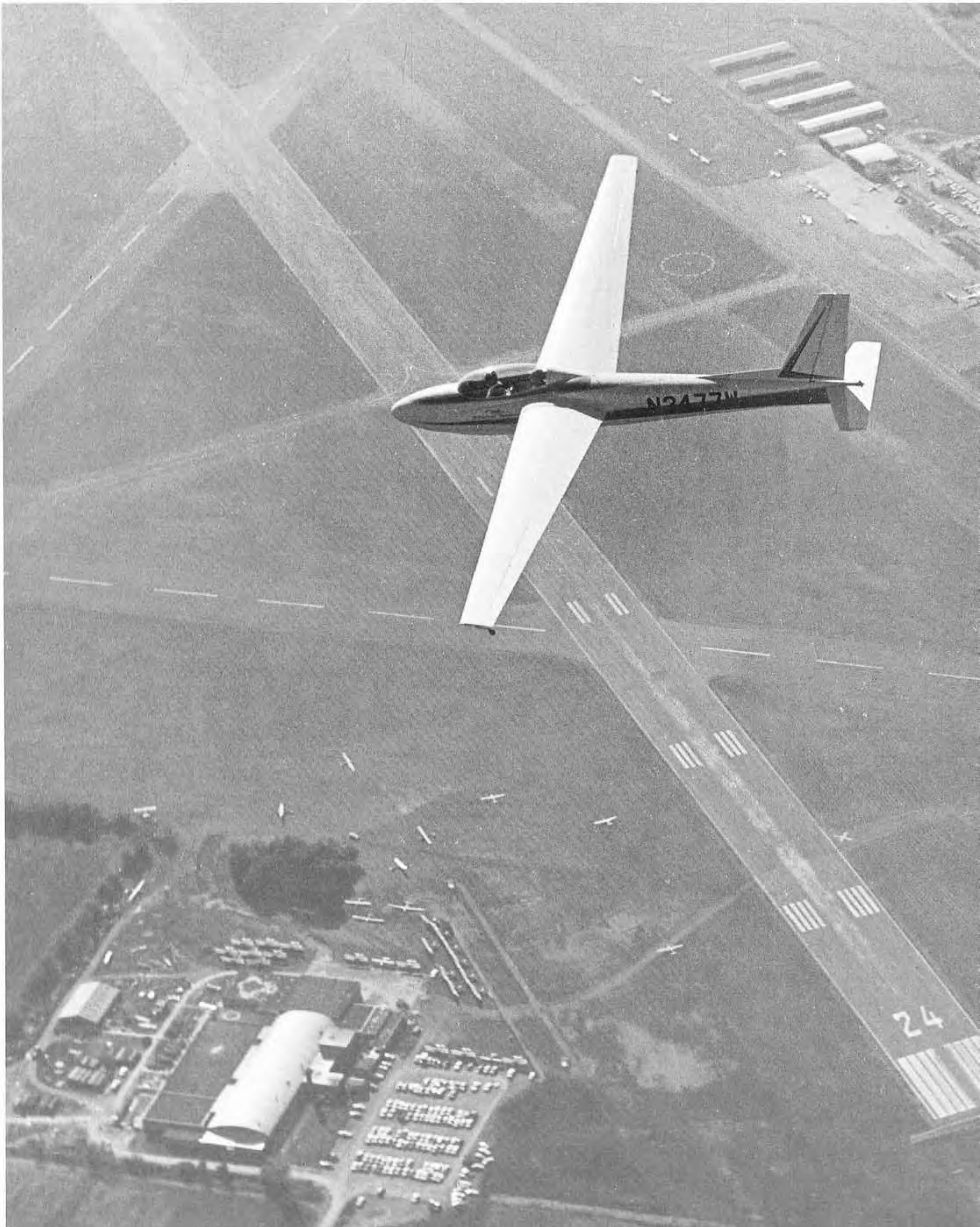
To popularise the sailplane and increase its sales we had a film made called *Zero Zero Romeo*, the 'N' numbers of the prototype. The 2-32 soon proved very popular. It performed very well and sales began to grow. Commercial operators used their 2-32s to give dual rides, which, as expected, proved popular and profitable. Of the ninety sailplanes sold by Schweizer in 1964, eight were 2-32s. The rest comprised forty-seven 1-26s, thirty-three 2-22s and only two 1-23s.

Because of its technical interest, Ernie wrote a report on the design process for presentation at the 1965 O.S.T.I.V. congress, held at South Cerney in Gloucestershire, England, at the time of the World Soaring Championships there. He included in that account many more details than are given here.

In January 1968 Schweizer produced its 1,000th sailplane, a 2-32. The sailplane share of the total business had reached 19%, and in that year 130

Celebrating the 1,000th Schweizer sailplane, Bill, Paul and Ernie Schweizer demonstrate that three people can get into the 2-32.

Above: *Bernie Carris flying a passenger in the SGS 2-32, the 1,000th Schweizer sailplane.*
Below: *Not everyone found the rear cockpit entirely comfortable!*



A 2-32 over the Schweizer plant and Soaring School on Chemung County Airport. The airport terminal buildings are on the right.

The SGS 2-32 Explorer sailplane for research into clear-air turbulence, showing the very complete instrumentation including 'Omni' navigational equipment.

motorless aircraft were delivered, including ten 2-32s. We were now quoting the 2-32 at $11,995 F.O.B. Elmira. The price of the 2-32 was raised yet again in 1970, to $15,000, and only three were sold that year. Production continued at a low rate, but this was not entirely because of the cost. Two-seaters were no longer recognised as a separate class in the major competitions, but had to compete on equal footing with the best single-seat sailplanes. Bernie Carris and I flew 2-32s in a number of national meetings, but it was not competitive against the imported German high-performance single-seat plastic sailplanes.

Anne Burns, the British champion, flying a 2-32 in California, set a world women's altitude record of 31,231 ft (9,519 m) in 1967, and Joe Lincoln set a number of two-seater records with his 2-32. They included national records; a distance record of 500.4 miles and a world out-and-return record of 404.5 miles in 1970. Helen 'Babs' Nutt and her passenger, Hannah Duncan, set a world altitude record in 1975 of 35,463 ft (10,809 m) that still stands today. I myself set a national record for speed around a 500 km triangle that was within a few miles per hour of the world record. The 2-32 became the Cadillac of sailplanes. George Arents, a wealthy pilot, ordered his 2-32 with a genuine suede interior, and many other 2-32s had fancy finishes. We sold 87 altogether, never reaching our target of 200. When new German high-performance two-seater sailplanes such as the

Schempp-Hirth Janus became available, 2-32 orders virtually ceased, and production was ended in 1976.

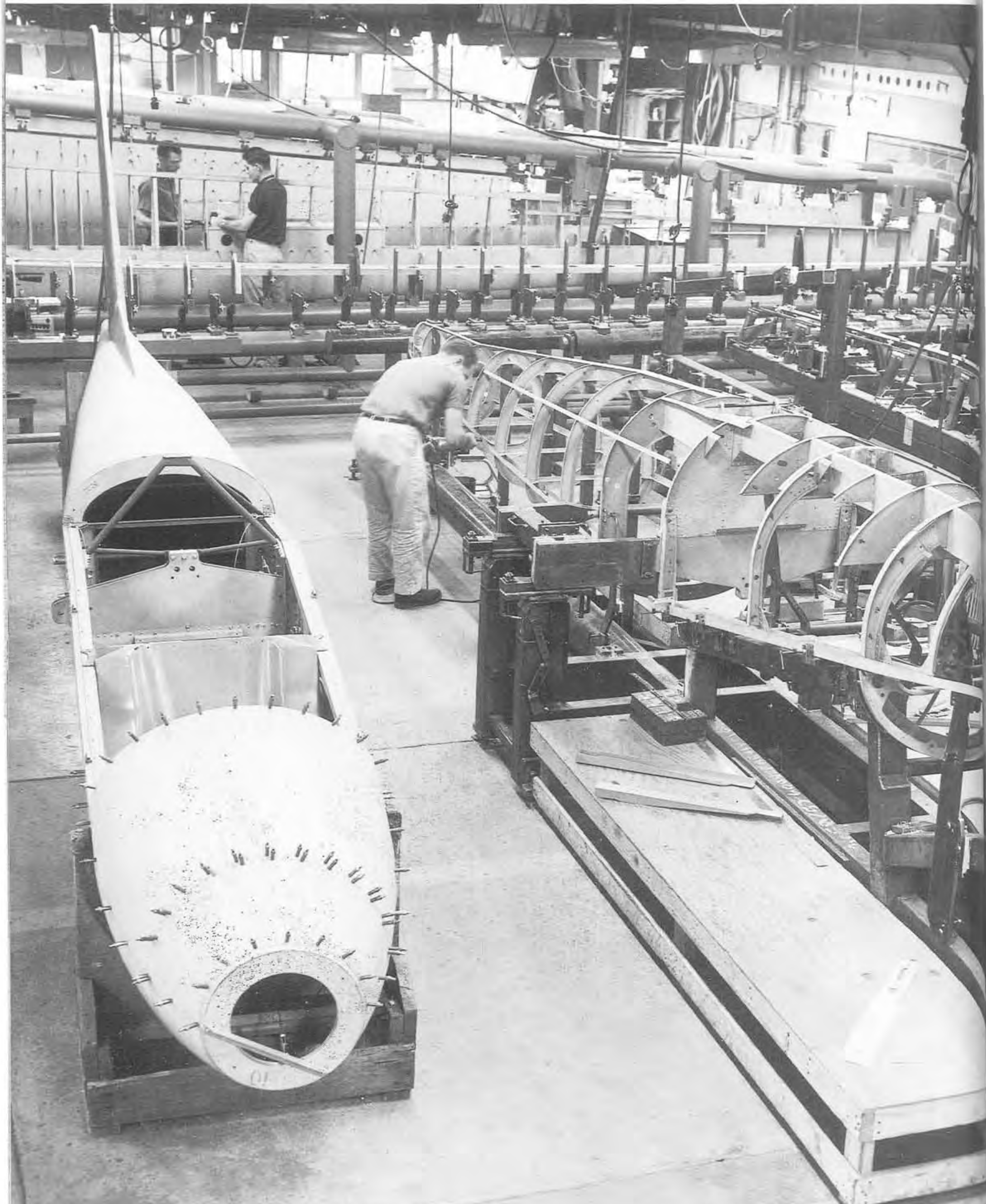
Because of the design's aerodynamic efficiency and strength, a number of 2-32 airframes were used for special projects. The first of these was a 2-32 with a complete 'wet wing' – virtually a wing which was one huge fuel tank. This was built for Jim Bede, so that he could add an engine and attempt a non-stop solo flight round the world. He never accomplished this, but the aircraft did make some very long flights, including one of 10,070 miles. The fuel consumption showed that the round-the-world flight was technically feasible, but the physical requirements for the pilot were the main problem. He needed an astronaut's training, plus ample backup systems and equipment.

A special version of the 2-32 was made for Joe Lincoln, who was hoping to set some two-seater records. He wanted a 2-32 with extended-span wings to improve its performance. Les came up with a 67 ft-span version with tanks for 300 lb of water ballast and a lower-profile canopy, achieved by reclining the front seat. It also had a retractable landing wheel and a flush tow release. This had an appreciably better performance, but unfortunately Joe Lincoln died of a brain tumour before he had much chance to fly his special 2-32.

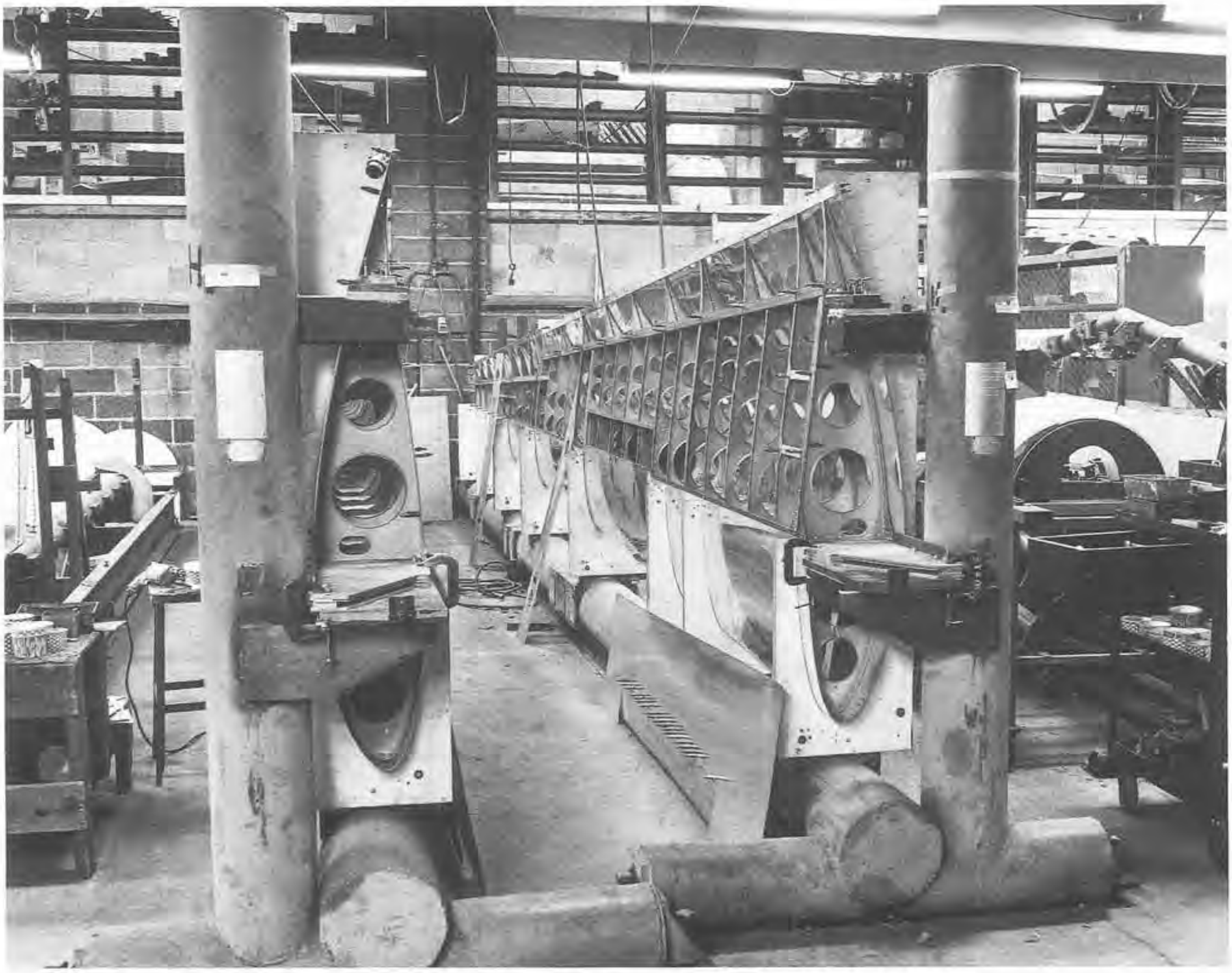
In 1968 the Lockheed company used the 2-32 airframe as the basis for a military quiet aeroplane, first the experimental and very unusual-looking Q-Star, and later the much more conventionally proportioned YO-3A, which was successfully used in Vietnam for night surveillance of the Viet Cong. We built 16 of these, but a promised follow-on order for another 50 to 100 was cancelled in 1970.

Another use for the 2-32 airframe was as a high-altitude, unpiloted drone. This was developed by Ernie in co-operation with LTV Electronics. It was

The Blue Bird SGS 2-32 over Corning, New York. Note the unusual aerial on the dorsal fin.



Above: *The 2-32 left wing assembly fixture.*
Below: *The SGS 2-32 wing assembly jigs at the Schweizer plant.*
Opposite Page: *The 2-32 wing and fuselage assembly area at the Schweizer plant.*



ABOVE: *A view of the sturdy 2-32 assembly fixtures. (S.A.C.).*
OPPOSITE PAGE: *A 2-32 in a steep turn with Bernie Carris on board with passenger.*

powered by a 660 hp turboprop motor, and had wing tanks of very large fuel capacity. The drone, full of electronic surveillance equipment, was to be capable of flying a 24-hour mission at 40,000 ft. The piloted version of the LTV L450 established many records for turboprop-powered aircraft, and a prototype of the pilotless drone was delivered in late 1969. It made a flight to 52,000 ft.

Kim Scribner, with support from the Wings Club, ordered a specially equipped 2-32 for clear air turbulence (C.A.T.) investigation. It was the most completely equipped 2-32 that we ever produced, and is still used for upper air research by the National Center for Atmospheric Research in the Boulder, Colorado, area.

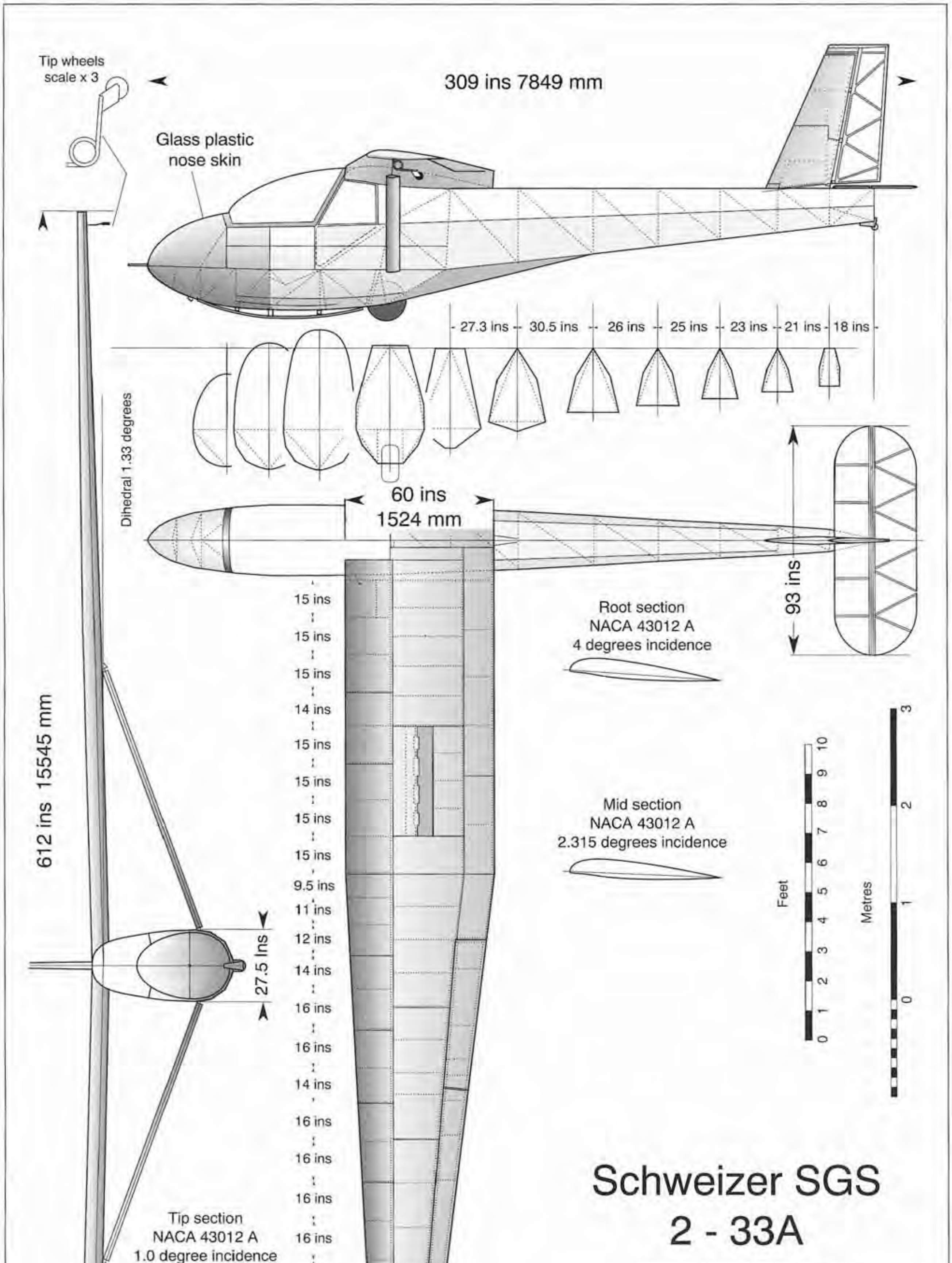
Most of the 2-32s built are still in use for dual rides, and are very profitable for their operators. A used 2-32 in good condition now sells for $50,000. To put the type into production again would probably require us to charge at least twice as much. The 2-32 project was not a profitable one, because of the high development costs. These were offset against profits made on the sale of other types, and by the fact that 2-32 components were used on many special aeroplane projects, such as the SGM 2-37 and the SA 2-37A. Modified versions of the tailcone and vertical tail surfaces were later used on the SA 2-38. So the 2-32 turned out to be a good investment for Schweizer.

Schweizer SGS 2-32

Total number built: 87 (sailplanes)

Specification		
Span	57 ft	17.4 m
Length	26.7 ft	8.15 m
Wing area	180 ft^2	16.7 m^2
Aspect ratio	18.05	
Aerofoil section	NACA $63_3$618, NACA 43012A tips	
Empty weight	831 lb	377 kg
Pilots	509 lb	231 kg
Flying weight (U)	1,340 lb	610 kg
Flying weight (maximum)	1,430 lb	650 kg
Wing loading (U)	7.44 lb/ft^2	36.3 kg/m^2
Wing loading (maximum)	7.94 lb/ft^2	38.7 kg/m^2
Best L/D	34:1 at 65 mph	104 km/h
Minimum rate of sink (U)	2.4 ft/sec at 52 mph	0.73 m/sec at 84 km/h


N7770S


Tip wheels
scale x 3
309 ins 7849 mm
Glass plastic
nose skin
27.3 ins
30.5 ins
26 ins
25 ins
23 ins
21 ins
18 ins
Dihedral 1.33 degrees
60 ins
1524 mm
93 ins
612 ins 15545 mm
15 ins
15 ins
15 ins
14 ins
15 ins
15 ins
15 ins
15 ins
9.5 ins
11 ins
12 ins
14 ins
16 ins
16 ins
14 ins
16 ins
16 ins
16 ins
16 ins
14 ins
27.5 Ins
30 ins
Root section
NACA 43012 A
4 degrees incidence
Mid section
NACA 43012 A
2.315 degrees incidence
Tip section
NACA 43012 A
1.0 degree incidence
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
Schweizer SGS
2 - 33A
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corporation.

SGS 2-33

There was exceptional growth of gliding and soaring in the U.S.A. in the 1950s and early 1960s, and a need developed for a new training sailplane. We had delivered nearly 250 2-22s. They had been doing a good job for the dealers and soaring clubs and continued to do so, but with many new and more sophisticated sailplanes coming from Europe, dealers were looking for a more attractive trainer with improved performance, to entice more beginners, especially power pilots, into soaring. Most dealers had a number of 2-22s in their fleet, and usually one 2-32. To replace their 2-22s with 2-32s would have been too costly, and the advanced 2-32 was not ideal for early training. Something lower in price than the 2-32 but more elegant than the 2-22, and with better performance, was required.

At the time that we were considering the design of the 2-32, the sales department had proposed a two-seat trainer to the '2-26' concept, and this was still in mind. It was felt that there was a growing market which would justify the cost of putting the new two-seat design into production.

The 2-33 evolved from the 2-22. The wings were modified by adding a tapered section from the strut point outboard, with the span increased to 51 ft. A single strut on each side supported the wing, which had aerodynamically balanced dive brakes for easy control during the approach and landing. The wings were all-metal, including the ailerons. Modification of the 2-22 fuselage provided more room and comfort in the cockpit, with a smooth, moulded glassfibre nose section. The welded tubular

Bernie Carris and passenger above the clouds for a photographic sortie in an SGS 2-33.

Above: *A 'dealer meeting' in the Schweizer plant. An SGS 1-26 is in the foreground, the port wing of a 2-32 is visible and, in the rear, a 2-33 is being studied by a group of dealers.*
Below: *This underside view of a 2-33 shows its wingtip wheels.*

Top: *An SGS 2-33 in flight over the Schweizer Soaring School.*
Above: *A 2-33 over Chemung County.*

TOP: *The right-hand side of the SGS 2-33 Pegasus at Sugarbush Airport, Vermont, with a special paint job and winged horse emblem. Pegasus is white with orange trim and a very fine black dividing line. (M. Simons)*
ABOVE: *A rear view of Pegasus, showing the orange sunburst colour scheme. (M. Simons)*

chrome-moly steel-tube fuselage was covered with Ceconite fabric, and more attention was given to providing a more streamlined appearance. A stylish swept fin was added.

The prototype 2-33 was flown under an experimental licence in the fall of 1965. All the paperwork was done, the approved type certification was granted and the 2-33 entered production early in 1967. Since many 2-22 parts and subassemblies were used in the 2-33, it was cheap and easy to produce. It was just what the dealers, commercial operators and clubs asked for, and we delivered fifty-five 2-33s in the first year, with orders coming in for more.

In 1968, after 85 deliveries, we converted to the 2-33A model by adding a balanced rudder to reduce the control forces and incorporating some other minor improvements. The SGS 2-33 rapidly became the standard trainer in the U.S.A., and 475 of the A model were built in the factory. In 1973 we made available a kit version, the 2-33AK, and a total of ten of these were sold. A grand total of 579 was achieved.

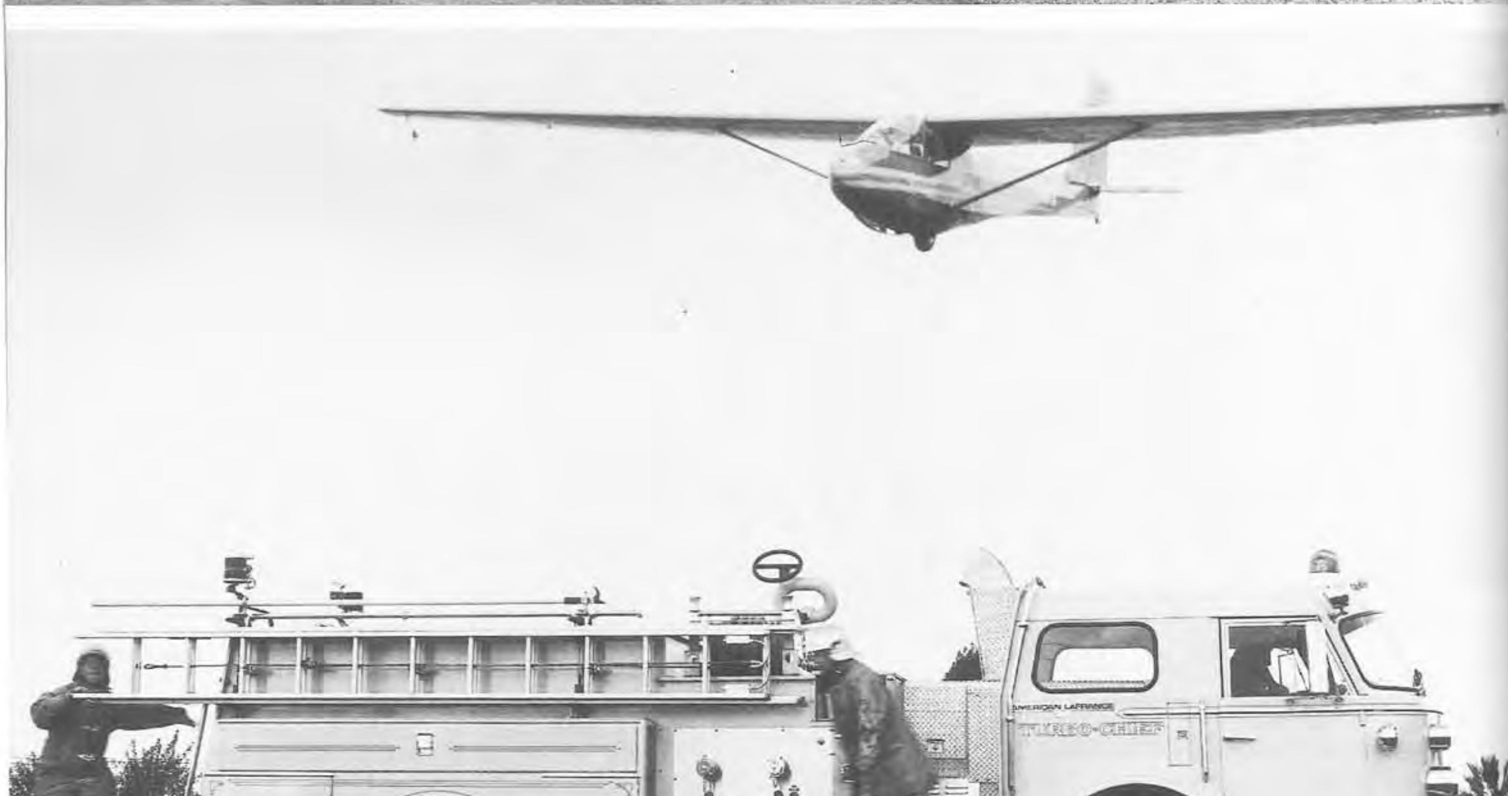
Since then, the 2-33A has been performing the main training task in the U.S.A. The type is ideal for

Top: *Dauntless, the sister-ship of Pegasus, at Sugarbush. The photograph shows the eagle motif. (M. Simons)*
Above: *The SGS 2-33 Dauntless tied down at Sugarbush.*

preparing students for solo flying in the 1-26, since the performance is very similar. The 2-33 is excellent for local soaring, and when flown solo can outclimb almost any other sailplane owing to its light span loading and tight turning ability. It is capable of 'Silver C' performances and is versatile, strong, easily maintained and most popular with all operators. It was the first sailplane adopted by many new commercial operators, and enabled them to grow and expand their fleet.

The Air Cadet League of Canada has fifty-five 2-33As for their nationwide youth-training programme. The Canadian Cadets logged their millionth flight in 1995, most of them having been made in 2-33s. The U.S.A.F. Academy glider programme also uses 2-33s. In the U.S.A. more pilots have flown the 2-33, and it has probably given more people their first sailplane flight, than any other sailplane type.

In 1976 we painted production 2-33s in patriotic colours with red, white and blue striped tails and the old Second World War star insignia on each wing to help celebrate the bicentennial. We featured one of



TOP: *Canadian Air Cadets take care of their school 2-33 fleet.*
ABOVE: *A 2-33 approaches over another Elmira manufactured product, an American LaFrance fire engine.*

A 2-33 at Las Vegas Airport, which shows the door to the rear cockpit. (The tow rope being attached without a pilot in the sailplane infringes a safety rule.) (Las Vegas News Bureau)

these in our national advertising, and found the approach very successful. Many commercial operations offered special bicentennial glider rides.

When growth of the soaring movement started to taper off in the 1980s, 2-33 orders decreased, and production soon ceased altogether. Because of their safe flying characteristics and general ruggedness, 2-33s have an excellent safety record, and most of those which suffer damage are repaired or rebuilt. Consequently, the majority of those produced are still flying.

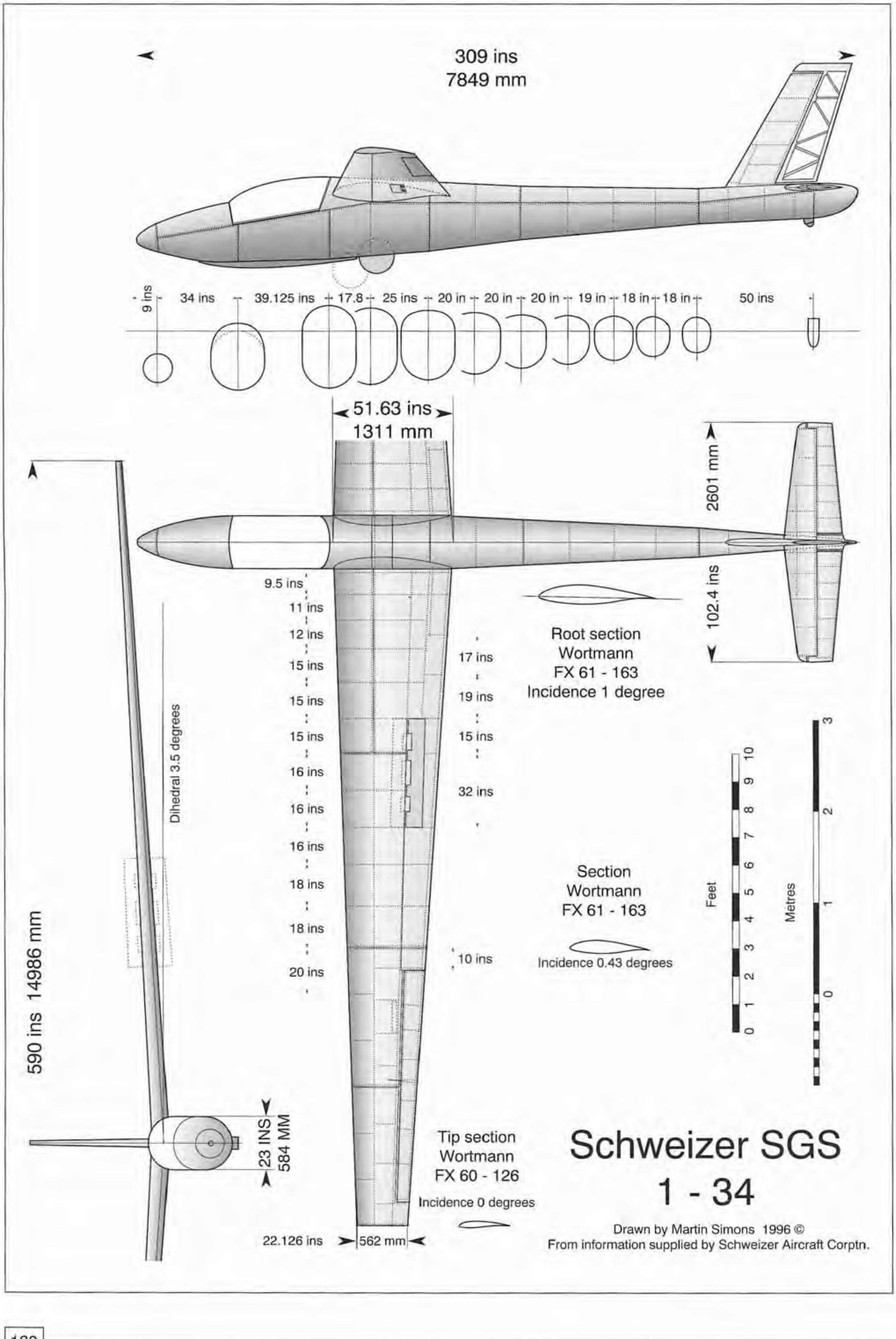
With almost 600 2-33s sold, the Schweizer department's '2-26' concept was justified, although they would say that we did not go far enough. Yet this was by far the most successful two-seat sailplane the company produced, and it played an important part in the rapid growth of soaring which occurred in the 1960–80 period, and continues today.

Schweizer SGS 2-33

Total number built: 579 (10 from kits)

Specification

Span	51 ft	15.5 m
Length	25.75 ft	7.85 m
Wing area	219.5 ft²	20.39 m²
Aspect ratio	11.85	
Aerofoil section	NACA 43012A	
Empty weight	600 lb	272 kg
Pilots	440 lb	200 kg
Flying weight	1,040 lb	472 kg
Wing loading	4.74 lb/ft²	23.1 kg/m²
Best L/D	22.25	
Minimum rate of sink	3.0 ft/sec	0.9m/sec (Flown solo, 2.6 ft/sec., 0.79 m/sec)


309 ins
7849 mm
9 ins
34 ins
39.125 ins
17.8
25 ins
20 in
20 in
20 in
19 in
18 in
18 in
50 ins
51.63 ins
1311 mm
2601 mm
102.4 ins
9.5 ins
11 ins
12 ins
15 ins
15 ins
15 ins
16 ins
16 ins
16 ins
18 ins
18 ins
20 ins
17 ins
19 ins
15 ins
32 ins
10 ins
Root section
Wortmann
FX 61 - 163
Incidence 1 degree
Dihedral 3.5 degrees
Section
Wortmann
FX 61 - 163
Incidence 0.43 degrees
Feet
Metres
590 ins 14986 mm
23 INS
584 MM
Tip section
Wortmann
FX 60 - 126
Incidence 0 degrees
22.126 ins
562 mm
Schweizer SGS
1 - 34
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corptn.

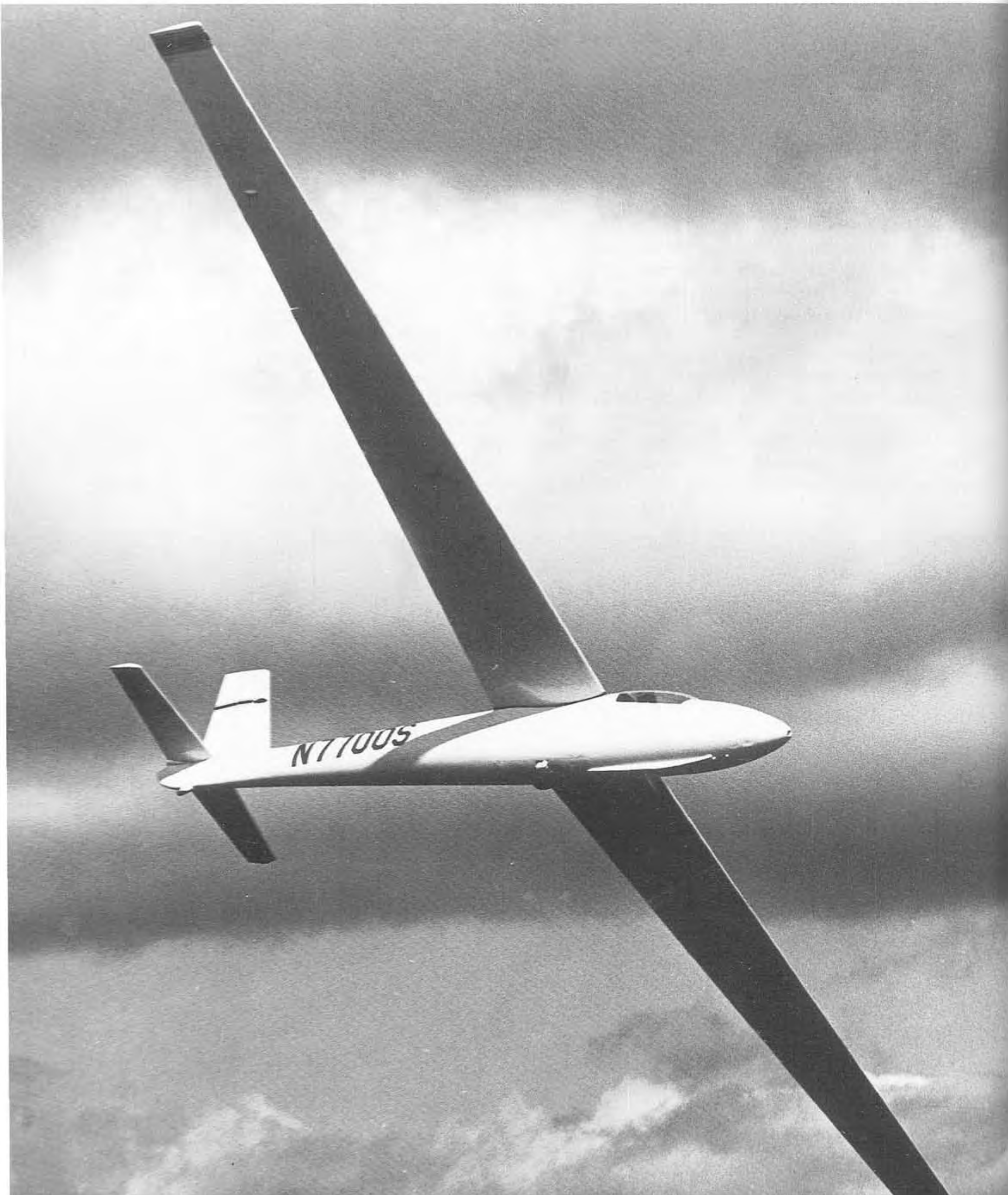
SGS 1-34

Schweizer built its first Standard Class sailplane, the 1-23H-15, in 1959. The basic design of the 1-23 then was already twelve years old, but twenty-one H-15s were built. The type did fairly well in the 1960 World Championships at Cologne in Germany. Flown by Paul Bikle, it finished twelfth out of thirty-five entered in the Standard Class Championships. The later-model sailplanes in this class obviously had better performance.

There had been so much controversy about the Standard Class in the U.S.A. during the 1960s that it did not seem wise for us to go ahead with a new design at that time. The S.S.A. did not support the class, and the specifications were too simple to assure that these sailplanes would meet the original concept of a low-cost, easy-to-fly club sailplane. Probably the first winner of the O.S.T.I.V. design competition, the Ka 6 designed in Germany by Rudolf Kaiser, was the best example of a sailplane which truly did embody all the requirements in spirit as well as meeting the formal specifications. Many of the new Standard Class sailplanes which began to appear in Europe were increasingly sophisticated and expensive, specialised competition aircraft for experienced pilots, yet they still fitted into the letter of the regulations.

In England during the 1965 World Championship I was on the jury that evaluated the fourteen Standard Class sailplanes entered in the O.S.T.I.V. design contest. The jury carefully inspected and flew each aircraft, and agreed that they should try to pick the sailplanes that most closely met the original club

Bernie Carris flying the 1-34 over Harris Hill. Elmira town is in the background.


N7700S

ABOVE: *Erwin Jones flies the SGS 1-34 with a retractable wheel and special paint scheme. Note the wingtip wheels. The colours are cream with very dark green trim and numerals.*
OPPOSITE PAGE: *An SGS 1-34 makes a good thermalling turn beneath impressive cumulus clouds.*

sailplane concept. Such entries as the French Edelweiss, Polish Foka and German Phoebus were rejected because it was felt they did not meet the spirit of the Standard Class. The final winner was the Slingsby Dart.

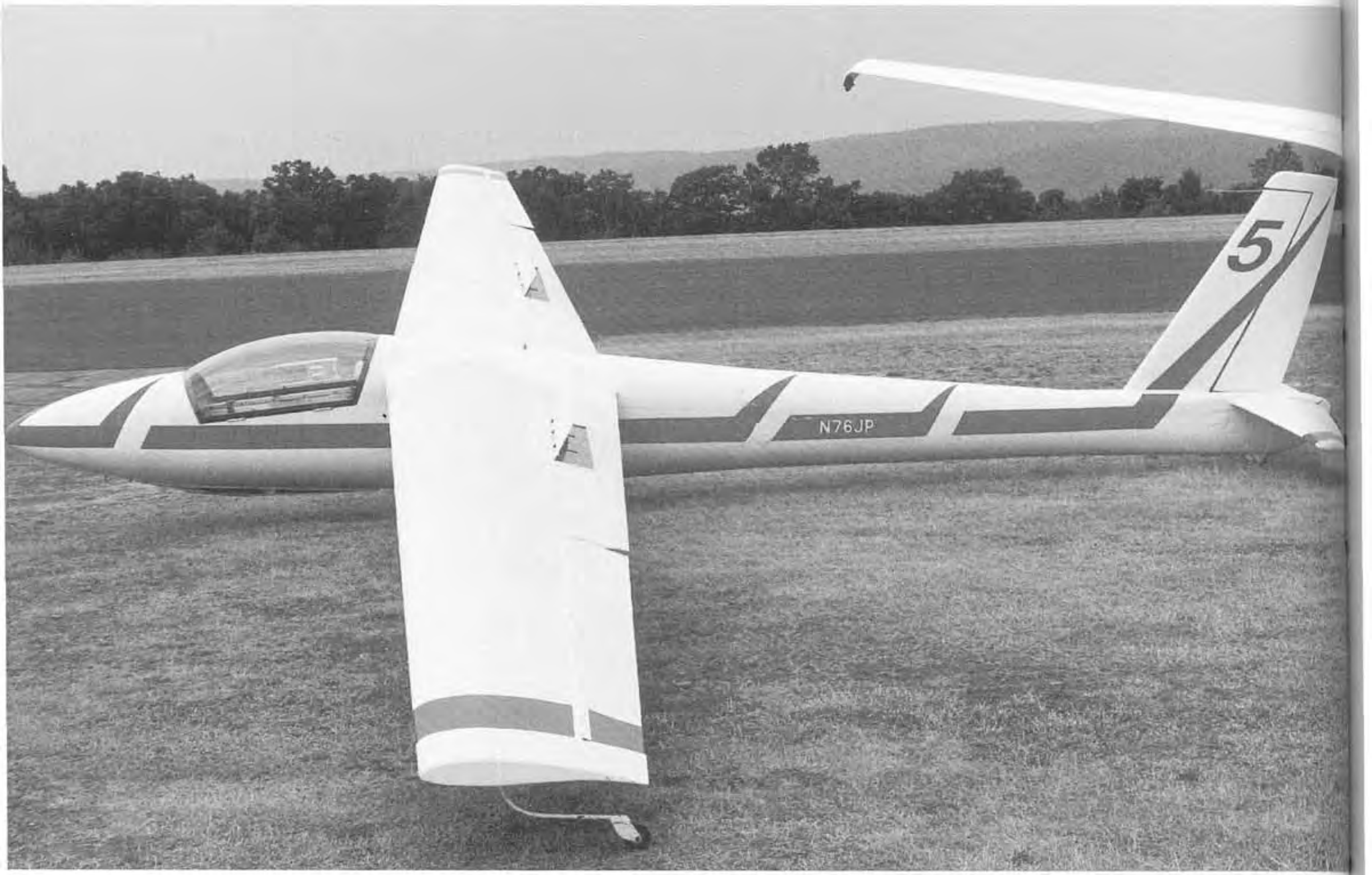
With the growing international emphasis on the class, we at Schweizer felt the the U.S.A. should have a Standard Class sailplane. Moreover, the company needed a higher-performance sailplane to replace its 1-23 line. We liked the general configuration of the Dart, and started work on what would become the SGS 1-34, deciding to design a wing for the 1-34 that could be tested on a 1-26 fuselage with normal tail surfaces. Two sets of wings were built, the No. 1 wings being mounted on a 1-26B fuselage and the No. 2 wings on a 1-26D fuselage. These sailplanes were designated X-391. Bernie Carris flew No. 1 and I flew No. 2 in the 1968 National Soaring Contest. We both liked the way they flew, and it was decided to go ahead and use these wing designs for the 1-34. After the contest and further evaluation the wing from the No. 1 X-391 was used on the 1-34 prototype, and the other wing for static testing.

The prototype 1-34 was first flown in April 1969. The F.A.A. type certificate was received and the first delivery made in September 1969.

The 1-34 was of all-metal construction, the only fabric being on the rudder. The cantilever wing used Wortmann aerofoils: FX61-163 from the root to station 175.0 in. from the centreline, changing progressively from there to FX60-126 at the tip. The metal monocoque fuselage had a generous-sized cockpit, and because the wheel was aft of the loaded centre of gravity there was a forward-mounted, rubber-sprung skid. The tail surfaces were all-metal with fabric-covered control surfaces.

The 1-34 had speed-limiting dive brakes as specified in the original Standard Class rules. From the experience we had gained in getting the 1-23H-15 to meet these requirements, we had no problem other than a lot of flight testing and modification to bring the 1-34's brakes to the requirements, limiting the 90-degree terminal dive speed while retaining reasonable closing and opening forces.

On a trip to Europe in 1969, while we were still getting the 1-34 into production, I visited the


5
N76JP


5

Opposite Top: *The Harris Hill Soaring Corporation SGS 1-34, with dive brakes open. Colours are white with vermilion trim. (M. Simons)*
Opposite Bottom: *A close-up of the airbrakes on the Harris Hill 1-34. (M. Simons)*
Above: *The nose section of the Harris Hill 1-34, showing the nose skid. (M. Simons)*
Right: *The tail of the Harris Hill 1-34, showing the elevator mass-balances and details of the rear fuselage. (M. Simons)*

Schleicher plant and Gerhard Waibel let me fly their G.R.P. ASW-15 Standard Class prototype. This apparently had better performance than the 1-34. At the Schempp-Hirth plant with Klaus Holighaus I looked over the Standard Cirrus, also G.R.P., which was still under construction. It was generally similar to the ASW-15. I noticed that the dive brakes on the Standard Cirrus were obviously not large enough to limit the speed in a 90-degree dive, as called for in the Standard Class specifications, with which we had complied in the 1-23H-15 and the 1-34. Klaus said that their airworthiness authority, the L.F.S., only required the limiting speed to be proved in a 45-degree dive, not 90 degrees. I had not particularly noticed the brakes on the ASW-15, but found them to be adequate.

Klaus now told me that all the Standard Class sailplanes in Europe had been built to the less demanding L.F.S. requirement, and that the Commission International de Vol à Voile (C.I.V.V.) of the Fédération Aéronautique Internationale, responsible for controlling the World Championships, tacitly accepted the German standard. We and Jack Laister (who designed and


5
8
N76JP


N70238

built the LP 49) had gone to a lot of extra cost and trouble to meet the original specification, but the German manufacturers did not bother with it. Those in the U.S.A. who had purchased European-built Standard Class sailplanes felt cheated, since they did not have terminal-speed-limiting airbrakes.

The 1-34 was a club sailplane which met the original Standard Class requirements. It handled well in the air, and its performance was about what we expected: not really good enough for international competition, but popular in the U.S.A. We started production in September 1969 and delivered eighty-four in the ten years that followed. From 1971 we also offered the 1-34R with a retractable wheel, and sold nine of these, bringing total 1-34 output to ninety-three units.

Three examples of a specially modified version of the 1-34 were made for Martin Marietta, for entry into the military high-altitude Compass Dwell drone programme. Designated Model 845, they flew well, but no follow-on production resulted because the requirement was cancelled by the military.

The 1-34 remains a favourite with many soaring pilots, and most of those built are flying regularly, used by many clubs and commercial operators as the next step beyond the 1-26.

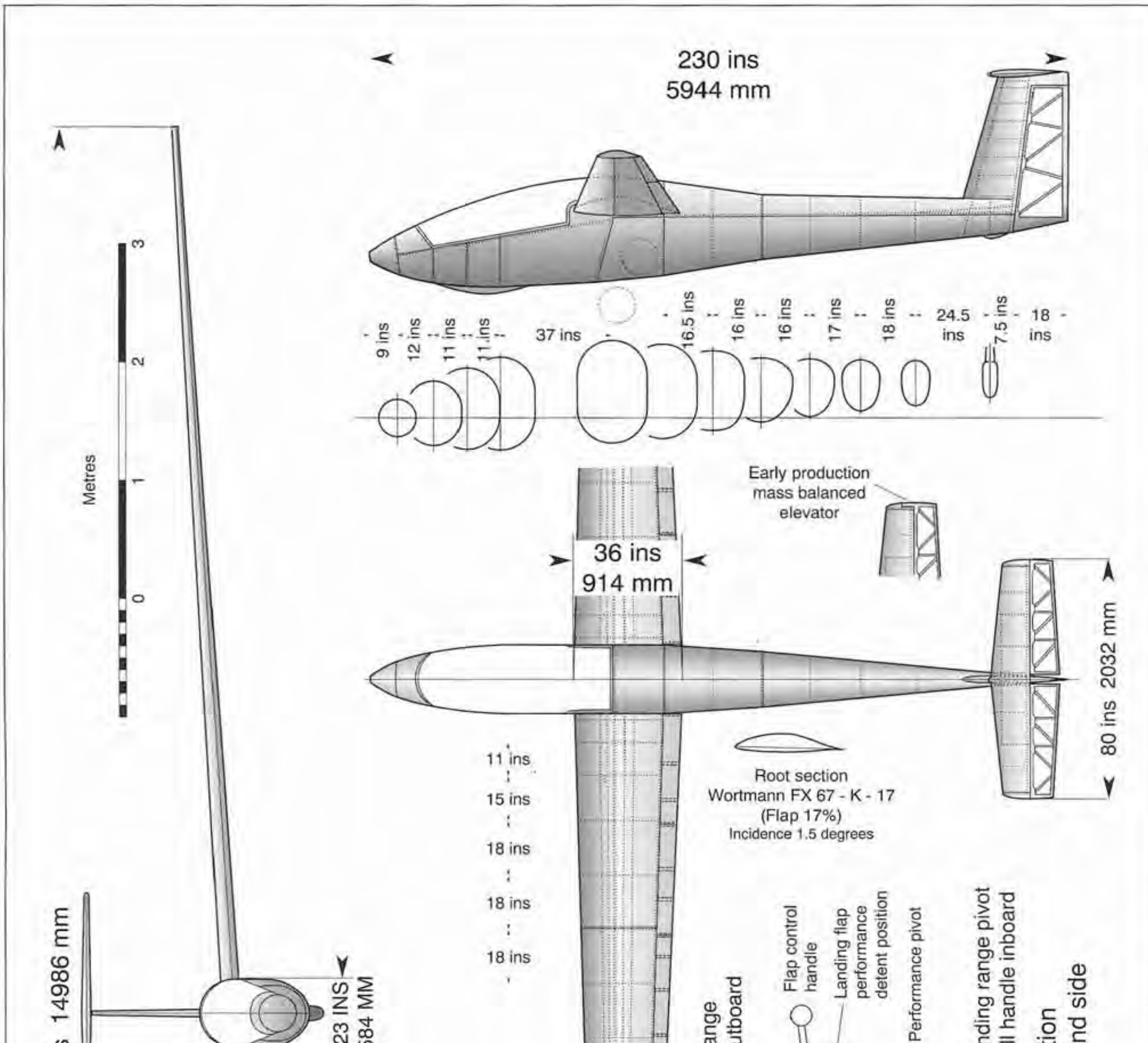
Schweizer SGS 1-34

Total number built: 93

Specification

Span	49.17 ft	14.99 m
Length	25.75 ft	7.85 m
Wing area	151 ft^2	14.04 m^2
Aspect ratio	16	
Aerofoil section	root, Wortmann FX 61-163, tip FX 60-126	
Empty weight	570 lb	259 kg
Pilot+equipment	270 lb	122 kg
Flying weight	840 lb	381 kg
Wing loading	5.56 lb/ft^2	27.1 kg/m^2
Best L/D	1:33 (R version, 1:34)	
Minimum rate of sink	2.2 ft/sec	0.67 m/sec
	(R version, 2.11 ft/sec, 0.64 m/sec)	

Left Top: *A side view of the Harris Hill SGS 1-34, showing the position of the wheel. (M. Simons)*
Left Bottom: *A deep yellow SGS 1-34 with orange trim at Sugarbush, Vermont. A pale blue Piper Cub tug is in the background. (M. Simons)*


230 ins
5944 mm
9 ins
12 ins
11 ins
11 ins
37 ins
16.5 ins
16 ins
16 ins
17 ins
18 ins
24.5 ins
7.5 ins
18 ins
Early production mass balanced elevator
36 ins
914 mm
80 ins 2032 mm
Root section
Wortmann FX 67 - K - 17
(Flap 17%)
Incidence 1.5 degrees
11 ins
15 ins
18 ins
18 ins
18 ins
Water ballast fill
18 ins
18 ins
18 ins
18 ins
20 ins
Tip section
Wortmann FX 67 - K - 15
Incidence 1.0 degrees
14.67 ins
590 ins 14986 mm
23 INS
584 MM
Metres
Feet
Performance range
Push handle outboard
Flap control handle
Landing flap performance detent position
Performance pivot
Landing range pivot
Pull handle inboard
Performance range detents
30 deg stop
Flap drive pushrod
80 deg Detent & stop
Landing flap range
Pull handle inboard
Flap control operation
View outboard - left hand side
Schweizer SGS
1 - 35
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft6 Corpn.

SGS 1-35

The SGS 1-35 was the first Schweizer sailplane to use flaps instead of spoilers or airbrakes. It became popular in the U.S.A. but we were caught and, we felt, unfairly penalised, by decisions of the C.I.V.V. over which we had no control.

The Standard Class rules had never been very satisfactory. The original intention was to encourage the development of safe, robust and inexpensive 15-m sailplanes with adequate performance, but what was emerging was a generation of refined, specialised contest aircraft using expensive materials and, in the interest of higher competition scores, fuselages of minimal cross-section, with the pilot lying almost supine to minimise drag. Some of the landing wheels were recessed so far into the fuselage belly that damage on landing in rough fields was very likely.

The C.I.V.V. conferred in 1969 and changed the regulations. Simple trailing-edge flaps were now to be permitted as airbrakes, as well as retracting undercarriages and water ballast. It seemed that the original idea of the class had been forgotten, but it was argued that a retracting wheel, even though somewhat more costly, was safer because it raised the fuselage well off the ground and also enabled a high angle of attack and lower landing speed on touchdown – provided the pilot always remembered to lower the wheel!

The water ballast would require tankage and some plumbing valves and filling vents, but there would be an improvement in cross-country performance and the additional cost was considered worthwhile.

The flaps raised even more controversial issues. When lowered to about 90 degrees they present a

Les Schweizer flew the SGS 1-35 in natural aluminium finish. The two-piece cockpit canopy was peculiar to the prototype.

The 1976 Smirnoff Derby was won by Wally Scott, here shown flying his 1-35. (G. Reynolds)

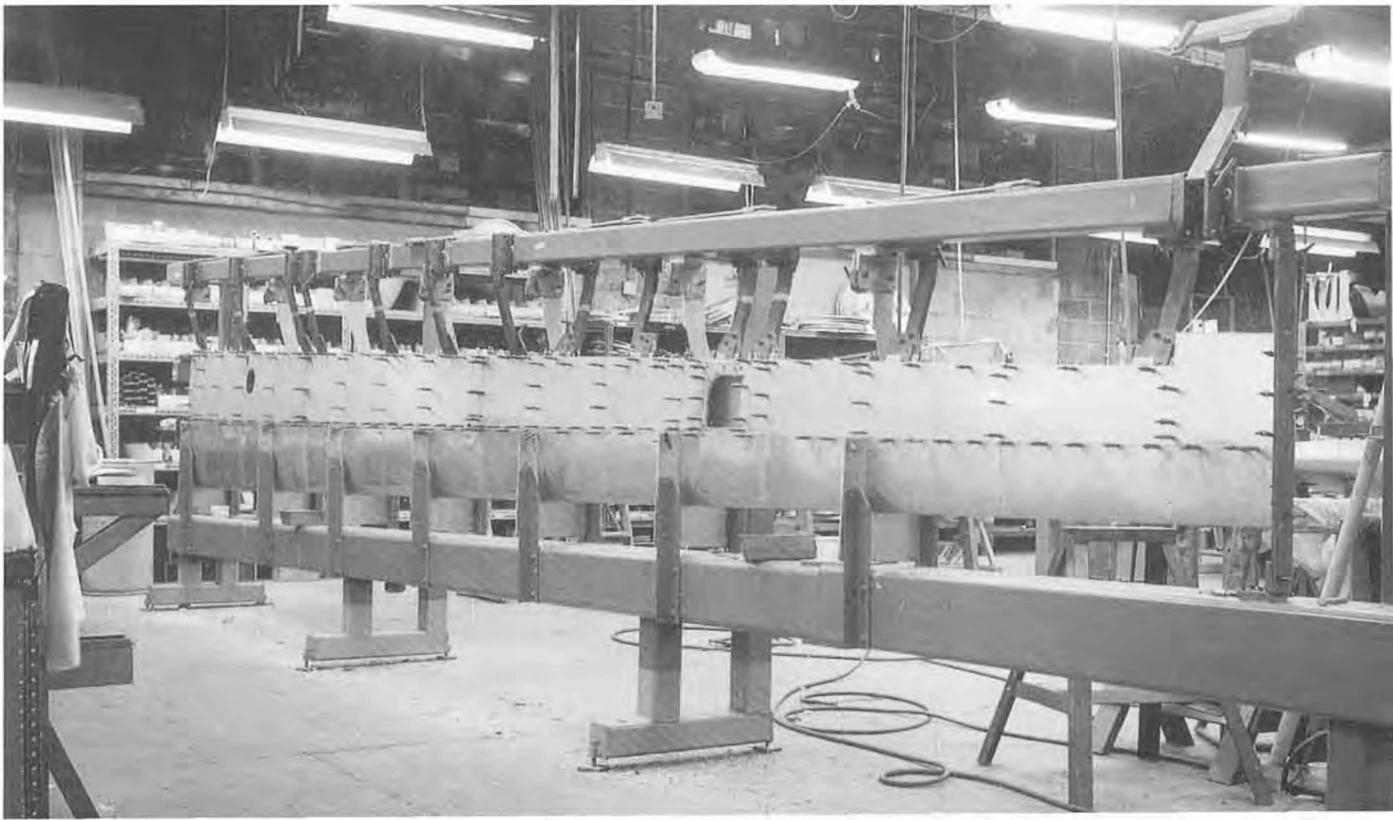
very large drag area with high lift, allowing a low landing speed and short ground run. Flaps of this kind are simpler and cheaper to build than the rather complicated 'parallel-ruler' type of airbrakes fitted to most European sailplanes. American designers and pilots favoured them because, although they required a different technique in the final stages of a landing approach, they had proved easy and safe to use on several American sailplane designs. European pilots distrusted brake flaps. In their view they suffered from two main disadvantages. If a pilot misjudged an approach to a landing and was undershooting, closing the orthodox brakes immediately allowed the glide to be extended without difficulty. If landing flaps were fully down and, in such a situation, the pilot suddenly raised them to stretch the glide, the result could be a loss of lift and a rapid descent, making the undershoot worse.

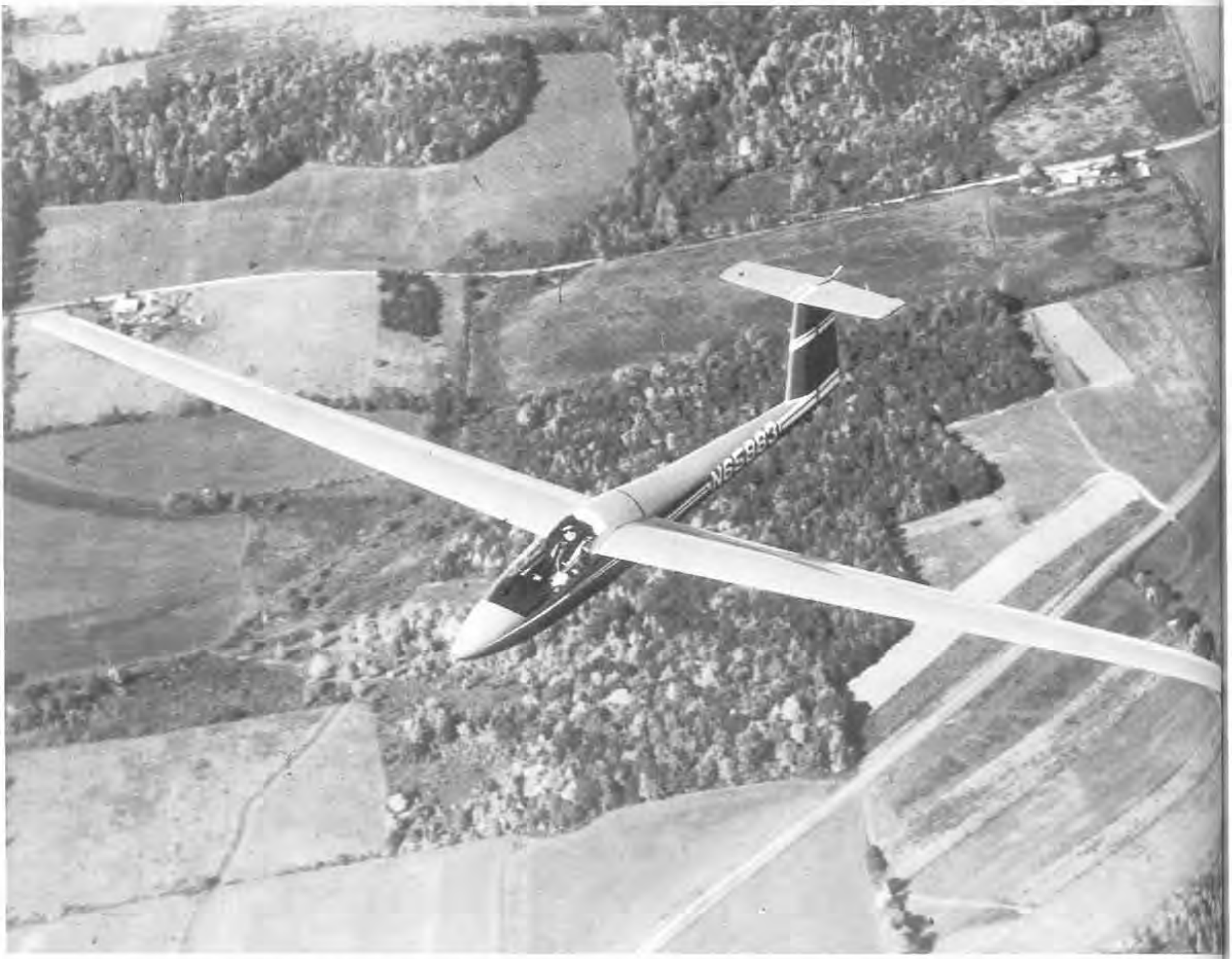
Another difficulty could arise in cloud flying if the flaps, control system and supporting structures were not properly designed. If the pilot was losing control, the usual type of airbrakes could be extended immediately to prevent the airspeed rising dangerously and endangering the sailplane's structure. Flaps required a greater force to get them down against the fast airflow, and in a bad situation the pilot might not be strong enough to lower them fully. The British firm, Slingsby, tried to adapt the American HP-14, which had flaps, by building a pneumatic drive to assist the pilot in these circumstances. The result was not satisfactory because the rear wing spar, to which the flaps were hinged, was not strong enough to take the strain when the flaps were forced down.

There are advantages in cross-country flying if flaps can be used to vary the wing camber; drooping them a little for slow flight in thermals, raising them slightly for the fast glide between thermals. To get the most effect, the camber should be changed across the whole wing span, but this requires the flaps and ailerons to be coupled in a way that allows the ailerons to continue to perform their primary control function in roll, while also moving up or down together with the flaps. The new rules disallowed this flap-aileron coupling.

Interest in the Standard Class among leading contest pilots in the U.S.A. increased after the World Soaring Championships were successfully held at

Above: *Bernie Carris tests an SGS 1-35 with a patriotic red, white and blue colour scheme.*
Below: *Assembling a wing of the SGS 1-35 on the jig in the factory.*





Bernie Carris flies a production model of the SGS 1-35, with the one-piece canopy, over the home airport.

Marfa, Texas, in 1970. Several American manufacturers decided to enter this design field. They included the Laister Sailplane Corporation with its LP 50 'Nugget', Schreder's Airmate Company with its HP 15 and later the HP 18, and the first American glass plastic sailplane, the Berkshire Manufacturing Corporation's Concept 70.

Schweizer was also interested in the new specification. Ernie and Les, his son, and Stuart, our nephew, started working on the design of the 1-35 in early 1972. Les had graduated as an aeronautical engineer from the Guggenheim School of Aeronautics at New York University, where his father and I had studied more than thirty years before, and he joined the company's engineering department soon after graduation. His first project was the Martin derivative of the 1-34, the high-altitude drone. Stuart, Bill's son, was now a graduate engineer from Dartmouth and a Master from Princeton's Forrestal Laboratories. He had been working for Boeing on the supersonic transport project, but when this was cancelled he was not enthusiastic about his new position at the Boeing rocket engine plant in Huntsville, Alabama, so he joined Schweizer. His first project with us was getting the Teal Amphibian into production.

The assembled Schweizers felt that they could design an all-metal structure for a new sailplane, to be the 1-35, that would be lighter than glassfibre. Glass plastic is a highly elastic material, so sailplane structures have to be made rather heavy to ensure that they are stiff enough to avoid flutter and other aeroelastic problems. Carbonfibre was not yet available to stiffen the wings, and we believed that metal was a better proposition.

Design work continued during 1972. The 1-35 was given an aspect ratio of 23.29, higher than that of any other Standard Class sailplane except Schreder's extreme HP 15, which had proved unsatisfactory. The 1-35 was designed with wing tanks to carry 320 lb of water ballast. With a light basic structural weight but large ballast capacity, it would have a wide range of wing loading and hence be able to cope with a great variety of different weather conditions in contests. The flap brakes would give it the ability to make short landings in fields. The design of the flap system and the strength of the supporting structure was adequate to meet the forces during a 45-degree dive, as required by the C.I.V.V. rules.

For operating the flaps a unique but simple control system, involving a compound handle, was devised. This enabled the pilot to vary flap settings by small amounts while in cross-country flight, but also allowed them to be used purely as brakes for landings. A short pivoted lever with a comfortable handgrip was mounted on a quadrant which was itself attached to a longer control lever on the port side of the cockpit, with a second pivot under the pilot's seat. To change camber in normal flight a slight leftward movement of the handle disengaged the short lever from notches on the quadrant, enabling the flaps to be shifted easily from one position to another over a range from −8 degrees (raised) to +18 degrees (drooped). For landing, the whole assembly, including the quadrant, could be disengaged from its restraining detents by a small but positive rightward hand movement, and then the entire lever system, pivoting on the underseat bearing, could be pulled back to use the flaps for the approach. Over a range of angles determined by a system of detents, from about 30 degrees to full deflection at 80 degrees, flaps may be used exactly like airbrakes. Moving the handle between these limits has no appreciable effect on lift but does change the drag, so the pilot may adjust the approach glide without danger of losing lift.

The aileron and flap skins were not riveted to their underlying frames and spar structures, but were bonded. This increased their strength and stiffness to meet the large loads arising in a high-speed dive. Some weight and assembly time were also saved. The 1-35 used the latest Wortmann aerofoils designed for flaps, the FX67-K-170 at the root of the wing, changing to the FX67-K-150 at the tip. It had a T tail and a retractable wheel with a small forward rubber-mounted skid.

Bill Holbrook over the San Gabriel Mountains near Los Angeles in the 1-35 which he flew in the 1975 Smirnoff Derby. This was an annual race in stages across the U.S.A. from Los Angeles to Washington, D.C. Note the flaps depressed almost to the landing position, the wingtip wheels and nose skid. Later models had the landing wheel further forward, making the skid unnecessary.

Construction of the prototype started in the fall of 1972, and it was completed and test-flown in April 1973. After about 50 hours of flying, including comparisons with other sailplanes, it was decided to put the 1-35 into production. About a year later we received the type certificate and deliveries began. We had a very good backlog of orders at the start, but it took a while for production to get fully into stride, and we lost orders because some pilots were not prepared to wait for delivery. New foreign Standard Class sailplanes were coming on to the market, promising higher performances. As a result, sales of the 1-35 slowed down.

At this point the C.I.V.V. again changed the rules for Standard Class. Helmut Reichmann won the 1974 World Championships flying the prototype of a new German sailplane, the Lemke-Schneider LS-2. In this, to get the maximum possible benefit of camber-changing in flight, the flaps were made very long, reducing the ailerons to marginally small dimensions. Reichmann himself was unhappy with the aircraft. At low airspeeds, when taking off, the ailerons were not sufficiently powerful to prevent a wing dragging on the ground, with the likelihood of a ground loop. On approaching to land with the flaps fully down, aileron control was seriously lacking, a very dangerous situation. It was realised that the 1969 rules were likely to produce a series of unsatisfactory and even unsafe sailplanes.

The C.I.V.V. tried to solve the problem by creating a new class, the 15-m unrestricted or 'racing' class, in which any performance-enhancing device whatever was allowed, provided the wingspan did not exceed 15-m. But now once again flaps were disallowed in the Standard Class (although ballast and retracting wheels were still permitted). Sailplanes like the 1-35, built with flaps to the 1969 rules, were now excluded from the competitions for which they had been designed! In the new 15-m 'racing' class they would have to compete with new, more elaborate and costly specialised aircraft. The 1-35 and all other flapped Standard Class (1969 rule) sailplanes were at a serious disadvantage.

For a while, in the U.S.A. only, a rule was introduced to allow flapped sailplanes to compete in the Standard Class if they had a timing device which restricted the use of their flaps to landing only. This did not work well. Then it was allowed that sailplanes with flaps could fly in Standard Class with the flaps locked in the neutral position, but this made them quite unsafe unless there were airbrakes as well as flaps. The 1-35 and other similar types had to be ruled out of the Standard Class entirely. All of the U.S. manufacturers had invested a great deal of money in developing their present designs, and they

Right: *All of the Schweizers alongside the SGS 1-35 which was the 2,000th sailplane produced by their company. From left to right, Leslie, Stuart, Paul H., Ernie, Paul A., and William.*


The 2000th. Schweizer Sailplane
N2000D

Paul H. Schweizer in a late-production SGS 1-35, with his cousin Sally Lese. The canopy is now hinged at the front, supported in the open position by a gas strut.

were not in a financial position to undertake completely new 15-m designs.

In spite of the above developments, the 1-35 did well. In the 1975 Standard Class Nationals, Les Horvath in a 1-35 finished in the top ten and made the best flight on one of the contest days with a speed of 76 mph on a 200-mile triangular task flight. The following year he came fifth in the first 15-m -Class Nationals, and Wally Scott took fifth place in 1977.

To improve the 1-35's performance it was decided to produce a 1-35A. This led to a number of changes. A sharper fuselage nosecap was designed, the wheel position was moved forward, eliminating the need for a front skid, and a small, faired tailwheel was added. At the inboard end of the flaps a fillet was added, the fuselage cross-section at this location being modified slightly to prevent air leakage round the end of the flaps in their various positions. Some of the wing skins were increased in thickness, and the shape of the wingtips was improved. Additional ballast tanks were added. Further improvements were made as production continued. The original 1-35 had a completely detachable cockpit canopy, but later versions had a canopy hinged at the front, with a gas strut to give support when it was in the open position. The angle of incidence of the wing to the fuselage was reduced to improve cruise performance, and aileron coupling with the flaps was incorporated in some cases. A few of the earlier models were retrospectively modified to 1-35A standard.

In the 1976 Smirnoff Soaring Derby, in which flights were made across America in stages, Wally

Scott finished first in a 1-35A. This sailplane was later bought by the Smirnoff Company and given to the Smithsonian National Air & Space Museum in Washington, D.C., where it was exhibited for three years as part of the sport flying exhibit. In his 1-35A, which had the lower wing incidence, Tom Beltz finished seventh in the 1977 15-m Nationals.

To help sales further, we decided to produce a 'C' or 'Club' version. In this model the retractable undercarriage was replaced by a fixed wheel with larger-diameter tyre and an improved hydraulic wheel brake. The ballast tanks in the wing were eliminated. We worked to reduce the cost of this version as much as possible, and to help further we simplified the finish of the sailplane. The C model was a success, and forty-one were sold.

In all, 101 1-35s of all versions were built, making available a good, rugged, high-performance sailplane with the ability to make really short landings. Most of the 1-35 fleet are still in service. The all-metal design is very popular with those seeking high performance as well as the extra crash protection that the 1-35 gives, and who do not want to 'baby' their sailplanes. The 1-35 can safely be tied down outside, and does not need to be dismantled and put in an enclosed trailer after each use.

The 1-35 was not as successful as it might have been had the C.I.V.V. not changed the Standard Class regulations. Schweizer and the other U.S. manufacturers who had designed to the 1969 specification felt cheated when the rules, inadequate from the first in their view, were modified and then so soon changed again.[18]

[18] See also the remarks about speed-limiting airbrakes in the accounts of developing the 1-23H-15 and 1-34, above.

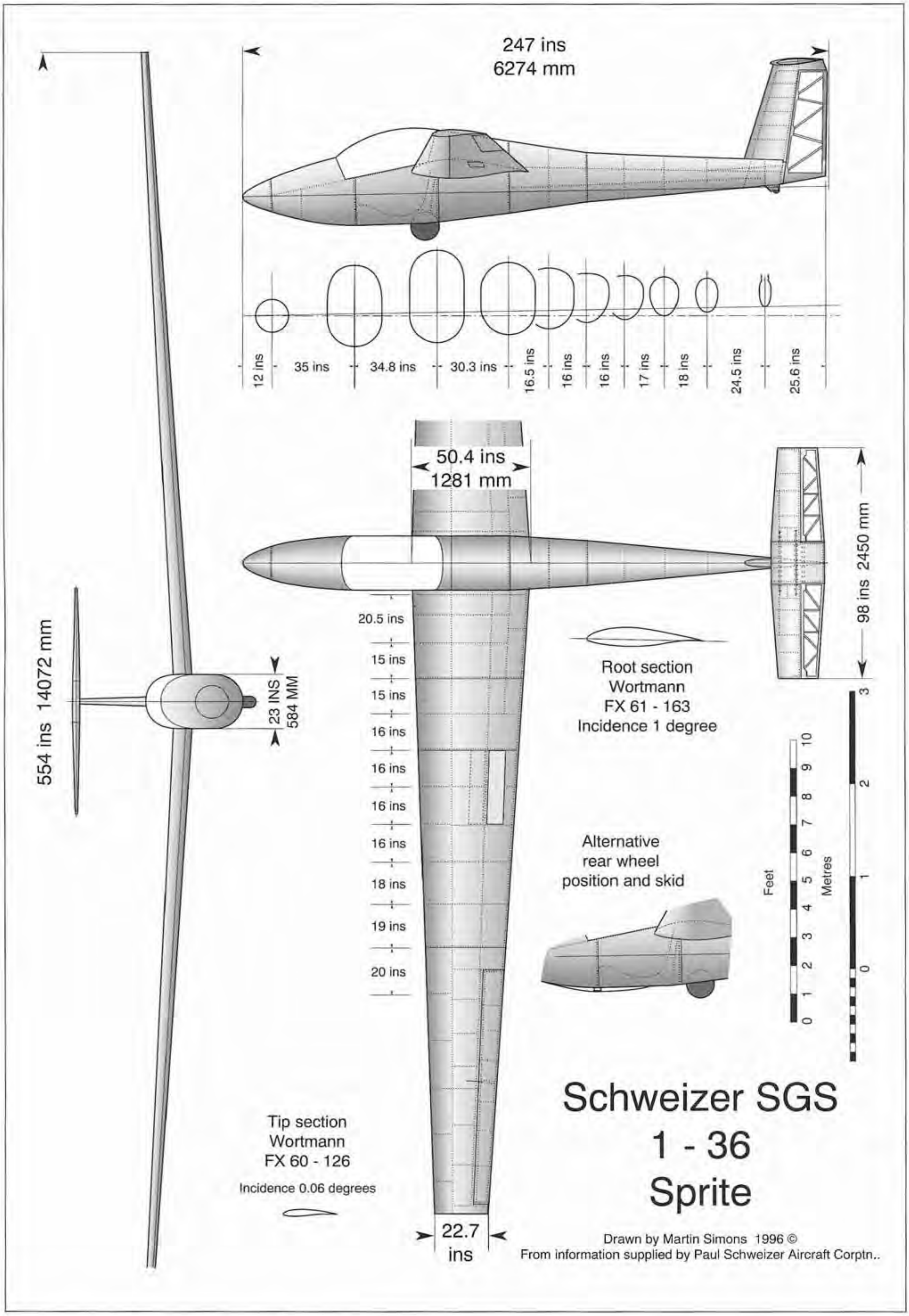
Schweizer SGS 1-35

Total number built: 101

Specification

Span	49.17 ft	14.99 m
Length	19 ft	5.8 m
Wing area	103.8 ft^2	9.65 m^2
Aspect ratio	23.29	
Aerofoil section	root, Wortmann FX 67-K-170, tip FX 67-K-150	
Empty weight	495 lb	225 kg
Pilot	190 lb	86.2 kg
Ballast	320 lb	145 kg
Maximum flying weight	1,500 lb	680 kg
Wing loading	6.38 lb/ft^2 (unballasted)	31.1 kg/m^2
	8.96 lb/ft^2 (ballasted)	43.7 kg/m^2
Best L/D	38:1 at 55 mph	
Minimum rate of sink	2.1 ft/sec at 45 mph	6.4 m/sec at 72 km/h

The Schweizer 1-35 alongside fellow Schweizer product the Ag-Cat agricultural airplane on the Chemung County Airport. (S.A.C.).


247 ins
6274 mm
12 ins
35 ins
34.8 ins
30.3 ins
16.5 ins
16 ins
16 ins
17 ins
18 ins
24.5 ins
25.6 ins
50.4 ins
1281 mm
20.5 ins
15 ins
15 ins
16 ins
16 ins
16 ins
16 ins
18 ins
19 ins
20 ins
22.7 ins
98 ins 2450 mm
554 ins 14072 mm
23 INS
584 MM
Root section
Wortmann
FX 61 - 163
Incidence 1 degree
Alternative
rear wheel
position and skid
Feet
Metres
Tip section
Wortmann
FX 60 - 126
Incidence 0.06 degrees
Schweizer SGS
1 - 36
Sprite
Drawn by Martin Simons 1996 ©
From information supplied by Paul Schweizer Aircraft Corptn..

SGS 1-36 'Sprite'

When it became known that we were phasing-out 1-26 production with aircraft No. 700 in 1979, many wondered what would replace this most popular aircraft. It was generally agreed that we needed a new recreation sailplane to fill the void between the training and national competition aircraft now available. We felt that it would have to be inexpensive and easy to fly and maintain, a club-type sailplane with a glide ratio of at least 30:1 with 'Diamond C' capability. It was suggested that it could form the basis for another one-design class similar to the 1-26 and, might lead to the formation of an organisation like the 1-26 Association. The need for this type of sailplane was confirmed by a survey of our dealers.

At about this time brother Ernie retired and his son Les took over from him as chief engineer. Stu, Bill's older son, would take over his father's responsibilities when he retired. Paul Hardy Schweizer, Stu's brother, joined the company, the intention being for him to take over my responsibilities after my own retirement, which was not far away. Paul H. was also an aeronautical engineer from Dartmouth, and had been working at Boeing Engineering on the Compass Cope project, a high-altitude drone that was something like a large sailplane. Tony Doherty, who had been deeply involved in the sailplane sales programme and in developing the Schweizer Sailplane Dealer programme, was also now retiring. He was replaced

Paul A. Schweizer, in 1997, demonstrates the hinged canopy of a Schweizer Soaring School SGS 1-36. (M. Simons)


NO SMOKING
ALT
TOTAL ENERGY
RADIO CALL
SAILPLANE NO 9
N3623B
FLIGHT LIMITS
DIVE
BRAKE
OPEN
CLOSED

Above: *A Schweizer Soaring School SGS 1-36, finished in orange with red trim, tied down on Chemung County Airport.*
Opposite Page Top: *The airbrakes of the SGS 1-36 in the open position.*
Opposite Page Bottom: *The very basic instrument panel of the Soaring School 1-36 contains all that is necessary for a novice pilot: left to right, altimeter, airspeed indicator, two mechanical and one electrical audio variometers, and a radio on the central pillar below the release knob. (M. Simons)*

by Jim Short, who had been assisting Tony in the sales department and before that had gained experience in sales work with a large transport company. He had been a soaring pilot since his youth, and was deeply involved in the sport.

There were other changes in the way Schweizer operated. One minor decision was to give any new sailplane we developed a name, rather than to use only the rather impersonal and not always easily remembered designation. The 1-36 was to be called the Sprite.

With the rising manufacturing costs in the U.S.A., the most difficult part in developing the Sprite would be to keep the price down. It was believed that we could achieve the required performance with a 14 m (46.2 ft) wing. On the first prototype we used the tailcone and tail surfaces of the 1-26E. The forward fuselage was designed with a lower profile and reclined seating to minimise fatigue on long flights. The high 'g' design of the front cockpit provided the typical Schweizer superior energy absorption in the event of a crash.

The prototype was flown in August 1979, and was ready for the Schweizer dealer meeting, where all the dealers were given an opportunity to fly the Sprite. They were impressed, and it was judged acceptable to all, provided only that we gave it a T tail instead of the conventional tail surfaces. It was pointed out that this would raise the cost, but the dealers felt that the T tail was necessary to sell the glider in competition with the imported sailplanes, most of which had such tails. We agreed to make the change, and pushed on with the F.A.A. type certification work and tooling. Production began in October 1979, and the first delivery was made to Al Freedy of Hinckley Soaring.

It was no problem to fill the immediate orders, but after that new orders were slow in coming. Financing was a problem for the dealer and the purchaser, since prime interest rates were up to 20%, which was almost prohibitive. At that time the U.S. dollar was very high compared with the Mark, so the German sailplanes could come in to the U.S.A. at very low prices in dollars. At the same time, the U.S.

Above: *An SGS 1-36 at the Schweizer Soaring School at the start of the 1997 season. An orange and white 2-33 is seen behind.*
Below: *Detail of the 1-36C version, with a forward-mounted landing wheel and no nose skid.*

The SGS 1-36 with Bernie Carris on board flies over Harris Hill and the original National Soaring Museum.

general-aviation industry was involved in a drastic decline, partly because of the massively increased cost of product liability insurance. This affected Schweizer in spite of the company's good safety record, since the increased premiums were spread industry-wide. We were forced to increase our prices just at the time when our overseas competitors were selling cheaper. Sales of the Sprite diminished, and we had to phase out 1-36 production after only forty-three had been delivered.

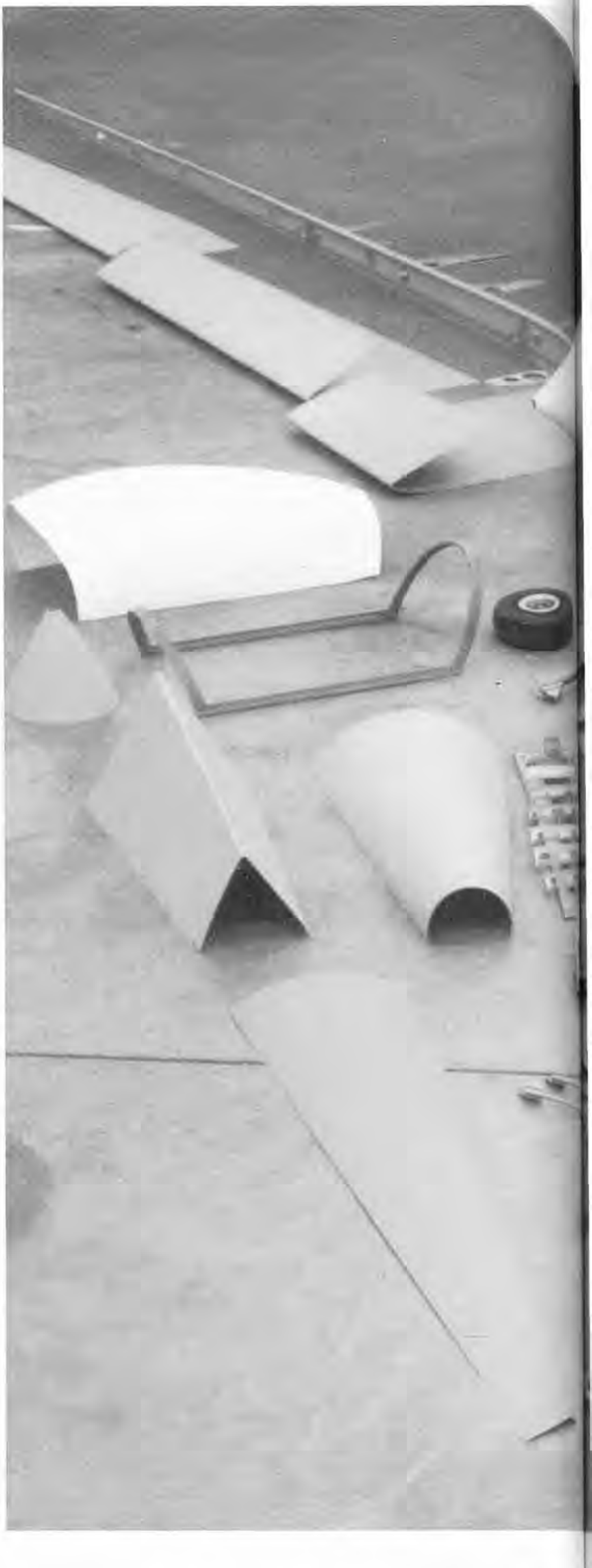
It is interesting to note that the 1-36 generally meets the new World Class Specification, which has been established in another attempt to encourage the development of a low-cost, easily flown club sailplane. Schweizer did not enter the World Class design competition because the Sprite was already out of production. The cost of redesigning it to meet the new specifications, plus the product liability premiums and some retooling, would have made it too expensive. Its performance, with a better than 30:1 glide ratio, is very similar to that of the PW-5 which was chosen as the winner of the World Class design contest, and its size is about the same. A 1-36 World Class sailplane could have been available much sooner, and could have been produced at a much higher rate than the present PW-5 from Poland.

The forty-three Sprites out in the field are still filling the need for a recreational sailplane, and we regret only that not enough were built to start another one-design class. The same conditions which caused us to discontinue 1-36 production also caused us to phase out the small remaining production of our other sailplanes. After 45 years of continuous production we were out of the sailplane business.

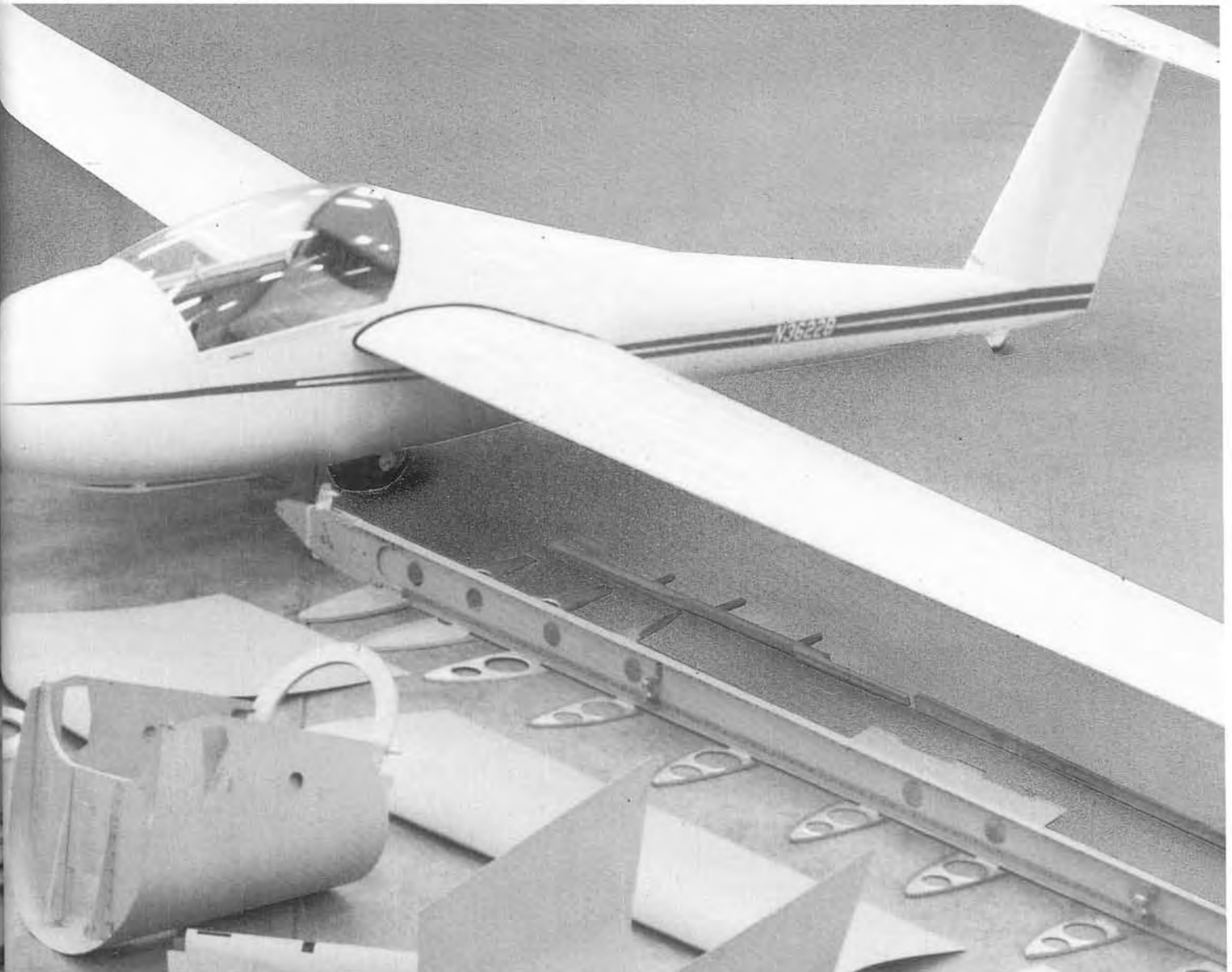
Schweizer SGS 1-36

Total number built: 43

Specification		
Span	46.17 ft	12.85 m
Length	20.58 ft	6.27 m
Wing area	140.7 ft^2	13.09 m^2
Aspect ratio	15.5	
Aerofoil section	root, Wortmann FX 61-126, tip FX 60-126	
Empty weight	475 lb	215.4 kg
Pilot+equipment	235 lb	107 kg
Maximum flying weight	710 lb	322 kg
Wing loading	5.05 lb/ft^2	24.6 kg/m^2
Best LD	1:31 at 53 mph	85 km/h
Minimum rate of sink	2.25 ft/sec at 42 mph	0.68 m/sec at 67.5 km/h

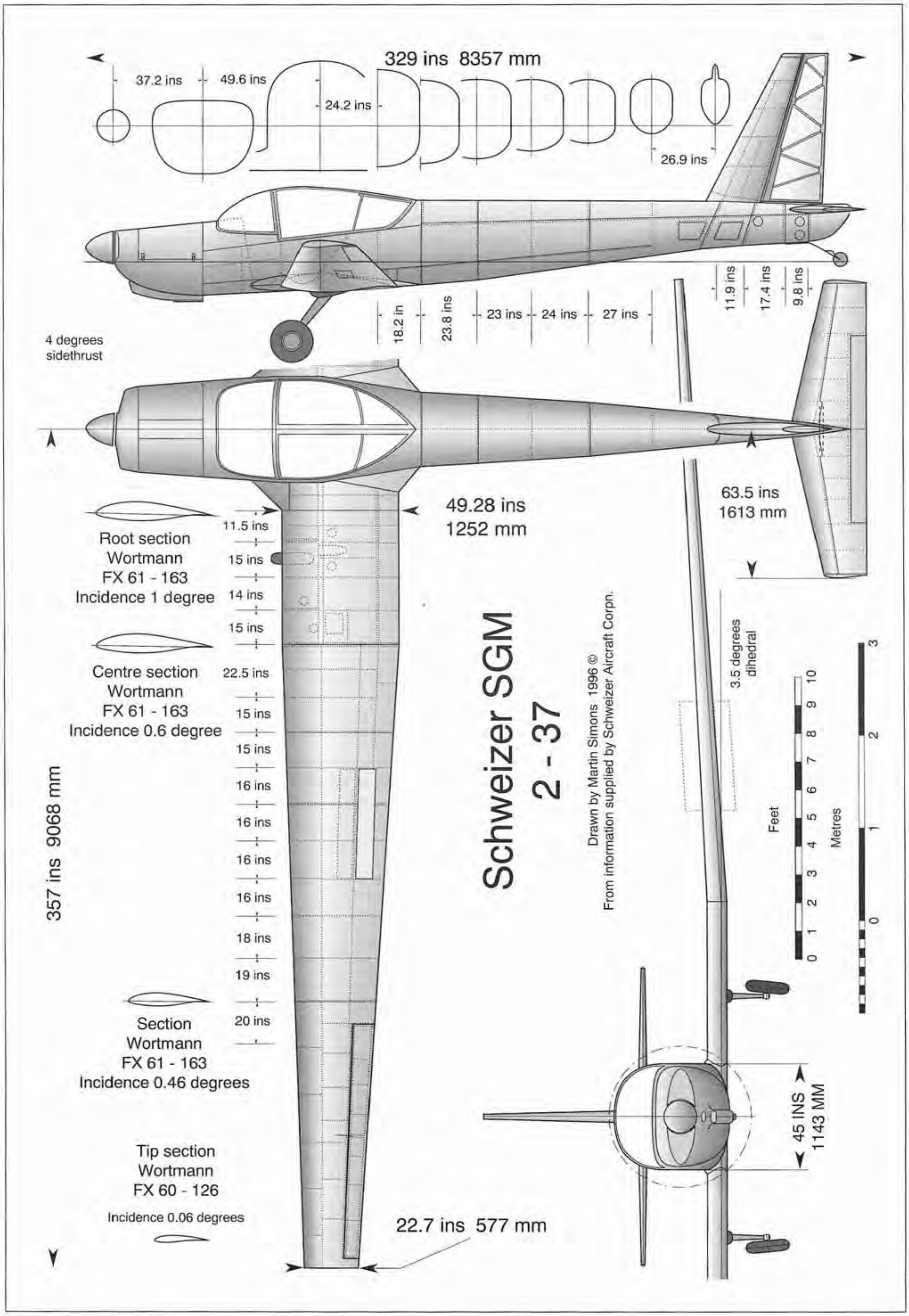


RIGHT: *Plans to sell kits of the SGS 1-36 for homebuilders did not come to fruition, but this photograph shows what the kit would have contained. Wing spars and ribs were ready for assembly, metal skin sheets were preformed, and also included were fuselage frames and skins, tail unit frames and skins, the cockpit canopy and frame, instrument panel and fittings, wheels, controls, and the wingtip wheels.*




N36238

Opposite Page Top: *N36238 on Chemung County Airport. Colours are cream with very dark green trim. (M. Simons)*
Opposite Page Bottom: *A 1-36 posed for a photograph. Its colours are yellow with orange trim.*
Above: *An SGS 1-36 flies over Big Flats countryside.*
Below: *The headquarters of the Schweizer Soaring School on Chemung County Airport just outside the Schweizer plant. (M. Simons)*


329 ins 8357 mm
37.2 ins
49.6 ins
24.2 ins
26.9 ins
11.9 ins
17.4 ins
9.8 ins
18.2 in
23.8 ins
23 ins
24 ins
27 ins
4 degrees
sidethrust
63.5 ins
1613 mm
49.28 ins
1252 mm
11.5 ins
Root section
Wortmann
FX 61 - 163
Incidence 1 degree
15 ins
14 ins
15 ins
Centre section
Wortmann
FX 61 - 163
Incidence 0.6 degree
22.5 ins
15 ins
15 ins
16 ins
16 ins
16 ins
16 ins
18 ins
19 ins
20 ins
Section
Wortmann
FX 61 - 163
Incidence 0.46 degrees
Tip section
Wortmann
FX 60 - 126
Incidence 0.06 degrees
357 ins 9068 mm
Schweizer SGM
2 - 37
Drawn by Martin Simons 1996 ©
From information supplied by Schweizer Aircraft Corpn.
3.5 degrees
dihedral
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
45 INS
1143 MM
22.7 ins 577 mm

SGM 2-37 Motor Glider

In the late 1970s and early 1980s motor gliders were becoming more popular in Europe and were being imported into the U.S.A. in increasing numbers. They generally had an engine and propeller that folded into the fuselage, as had been done by Wolf Hirth in Germany with his Hi 20 MoSe (Motor Segelflugzeuge) in 1941 and by Ted Nelson with his Hummingbird, developed in the 1950s. These were true sailplanes that could launch themselves, the power unit being shut down and completely retracted once the sailplane was high enough to begin soaring. The motor could be used to fly the sailplane home after a cross-country flight, or even for emergency 'saves' if thermals ran out far from home and a field landing was likely.

A new group of motor gliders appeared with the engine and propeller mounted as in an aeroplane, incapable of retraction. The Grob 109, Dimona and Lark motor gliders are well-known examples. They are readily able to soar under good conditions with the engine stopped and the propeller feathered, but they cannot achieve the excellent gliding performance of the true motor sailplane. They are really light aeroplanes, for many pilots never turn off the engine.

At Schweizer we had not felt that the market was

The prototype SGM 2-37 motor glider, built for the U.S.A.F. Academy. The rear fuselage and tail unit were from the SGS 2-32 sailplane, but note the absence of the dorsal fin extension.

Air Force Academy SGM 2-37 motor gliders at the school.

big enough to go into motor gliders, although, as described earlier, just after the Second World War we had fitted a small engine to a 1-19 as an experiment. The glider was of too low performance and the engine of such low horsepower and high rpm that the combination did not make a successful powered glider. We had developed the 1-30 and 2-31 aeroplanes with no intention of their being used for soaring.

In the late 1970s the U.S.A.F. Academy Glider Programme, which we had helped to start and which was using 2-22, 2-33 and 1-26 sailplanes, was steadily growing. The activities, gliding, parachuting and aeroplane operations, were overloading their airport. At the same time the Academy officials were very pleased with the effectiveness of their glider programme in motivating the cadets towards flying, and they decided to expose the complete corps of the second-year cadets to gliding. To accomplish this from their present flying facilities they felt they needed to add a number of motor gliders to their operational fleet. Touch-and-go landings could be made in a motor glider, eliminating two movements of the tug aircraft, while a greater amount of air work could be given per aircraft movement. The motor glider could also fly to alternative landing fields to make practice landings and take-offs.

The Academy evaluated most of the foreign two-seat motor gliders at their airport, but none of them met their requirement because they were under-powered for the location, which was over 5,000 ft above sea level. The Academy therefore asked Schweizer to tender a proposal for eight motor gliders that would meet their special needs.

We made a study, and came up with what soon became the SGM 2-37. The proposed motor glider would have a 112 hp Lycoming aircraft engine mounted in the nose, as in a conventional aeroplane. It would be all-metal with side-by-side seating and a 59.5 ft-span wing with an aspect ratio of 18.09. The undercarriage was to be a rubber-supported, spring type of gear, not retractable. The empty weight was to be 1,260 lb and the gross weight 1,760 lb. With the motor off and propeller feathered it was expected to have about a 30:1 glide ratio.

The efficient wing and the relatively low wing loading would make flaps unnecessary. The Academy wanted dive brakes which would give a 7:1 approach ratio, and wanted the port side of the cockpit to simulate a normal sailplane cockpit; the starboard side was to be for the pilot-in-command.

To keep the tooling and development costs low, we planned to use some of our existing sailplane components. From aft of the wing, the tailcone and tail surfaces would come from the 2-32, and the outer wing panels were from the 1-36. From the firewall forward we used a Piper Tomahawk assembly. The balance would be new except for some of the small, standard parts.

In 1982 the Academy was very much interested, and awarded us a contract for eight, with deliveries to start in April 1983. The first was flown and accepted on schedule. The 2-37s were all delivered by flying them from Elmira to Colorado Springs, the Schweizers and some of our other company pilots taking turns to make these delivery flights. Since the standard equipment included only communication radio and no navigational radio, it was necessary to fly by dead reckoning and by following the highways and railroads, like the old-time barnstorming pilots. All of us and our passengers had a lot of fun on these delivery trips.

The 2-37 worked out well at the Academy, which introduces over 1,000 cadets per year to flying through their gliding programme. Some of the 2-37s are approaching 10,000 hours' flying time, and have proved to be the answer to the Academy's needs.

We built an extra 2-37 for company use and later sold this, too, to the Academy. We then decided to develop a quiet surveillance aeroplane from the 2-37, and this was designated SA 2-37A. The wings were given additional span by the addition of winglets, and the fuselage was modified to accept the special equipment needed for surveillance missions. In the current production version the SA 2-37A uses a 250 hp turbocharged engine with dual mufflers with tuned pipe resonators, and a three-bladed propeller. The winglets increased the span by 6 ft and the gross weight became 4,300 lb. Using low power settings, the 2-37A became a quiet aeroplane, and by the addition of an infra-red imaging system its crew were able to see at night. It became a successful aeroplane, and we were able to interest the U.S. Coast Guard in purchasing it for the interdiction of drug-smugglers' boats around the coast of Florida.

In October 1988 Schweizer received an order for

The 2-37 in its Air Force Academy paint scheme: deep yellow with black fuselage decking.

four more 2-37As from another government source. These orders helped to justify the investment made in the motor glider project.

The 2-37As used by the Coast Guard were flown at low altitudes at night, sometimes going out a great distance from the coast. The pilots liked the 2-37A, but they wished that under those conditions they had a spare engine. As a result the Coast Guard asked Schweizer to develop a twin-engine version of the 2-37, and this became the RU-38A. The prototype first flew early in 1995, and is currently under further development. Although it is a twin-engine aeroplane, not designed for soaring, it incorporates many parts originating from its high-efficiency-sailplane heritage. It is expected that further modifications of the basic design will be made to meet other special requirements. Because the 2-37 was designed specifically for the U.S.A.F. training requirement, it does not fit into the motor glider and self-launching sport soaring activities which are growing in the U.S.A.

Schweizer SGM 2-37

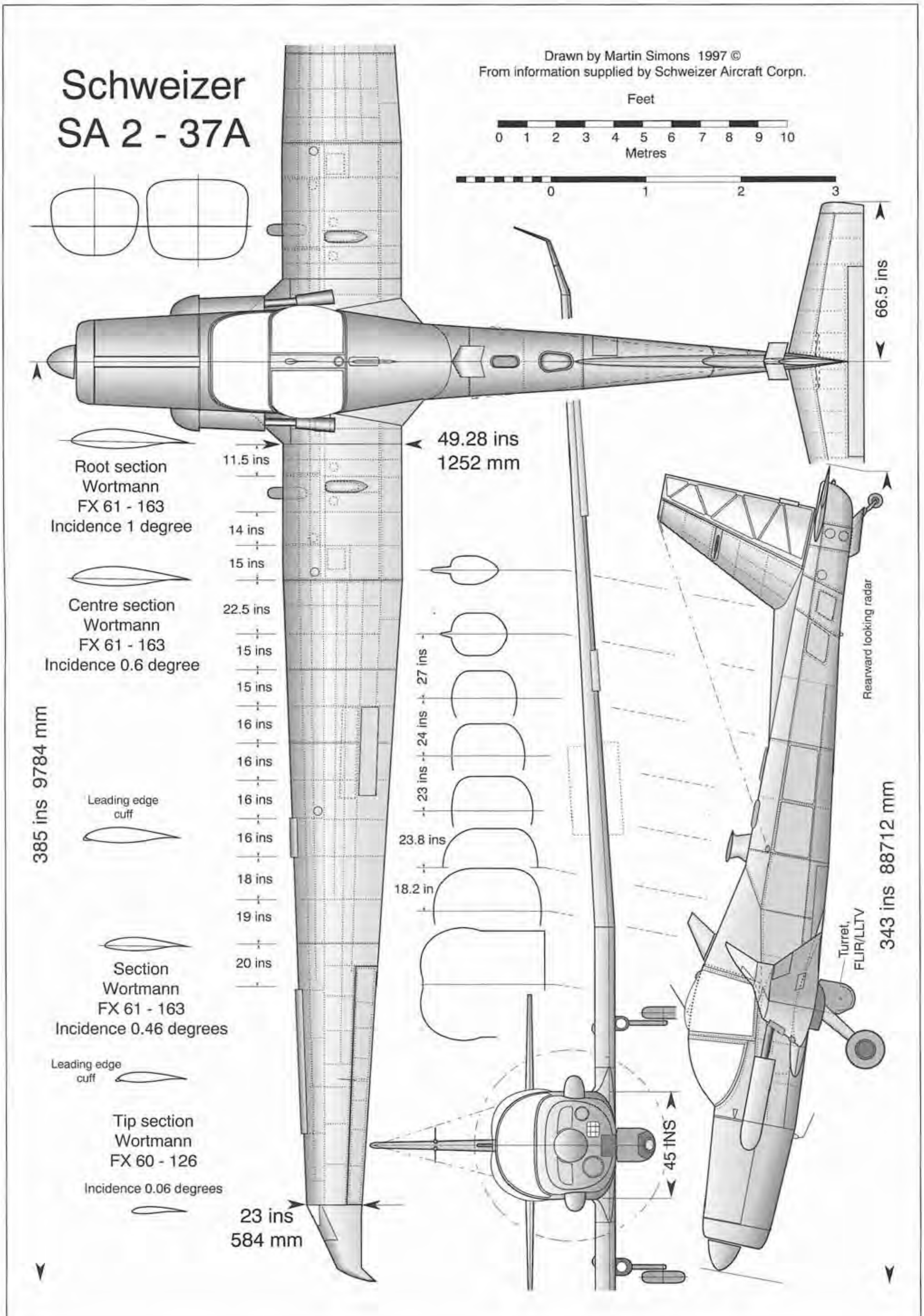
Total number built: 12 (plus variants)

Specification

Span	59.5 ft	18.13 m
Length	27.4 ft	8.35 m
Wing area	195.7 ft^2	18.2 m^2
Aspect ratio	18.09	
Aerofoil section	root, Wortmann FX 61-163, tip FX 60-126	
Empty weight	1,260 lb	571.4 kg
Flying weight	1,850 lb	839 kg
Wing loading	6.44 lb/ft^2	31.4 kg/m^2
Best L/D (prop feathered)	1:29	
Minimum rate of sink (prop feathered)	3.17 ft/sec	0.965 m/sec)
Engine	112 hp Lycoming O-235-L2C (options: 150 hp Lycoming O-320-E26 or 180 hp Lycoming O-360-A series)	
Propeller	Sensenich (73CK-0-50) (options: McCauley fixed-pitch climbing propeller or Hoffmann HO-V-72 constant-speed feathering propeller)	
Fuel tank, standard	14.2 gal, optional 31.0 gal	
Take-off distance	500 ft (150 m) (grass surface)	
Take-off to clear	50 ft (15.2 m): 1,018 ft, (305.4 m) (grass surface)	
Landing distance over	50 ft (15.2 m) obstacle: 1,266 ft, (380 m) (grass surface)	
Endurance	50% power, no reserve, 3.5 hr	
Cruising speed	75% power, 114 mph	183.5 km/h

Although the SA 2-37A is not a sailplane, it still uses the basic, efficient sailplane type of wing and the rear fuselage, with modifications, from the SGS 2-32. Note the addition of anti-stall cuffs to the leading edges of the outer wing. The latest version (shown in the drawing on page 214) has winglets but no wheel spats, and carries a great deal of advanced surveillance and detection apparatus.


N9237A


Schweizer
SA 2 - 37A
Drawn by Martin Simons 1997 ©
From information supplied by Schweizer Aircraft Corpn.
Feet
0 1 2 3 4 5 6 7 8 9 10
Metres
0 1 2 3
66.5 ins
49.28 ins
1252 mm
11.5 ins
Root section
Wortmann
FX 61 - 163
Incidence 1 degree
14 ins
15 ins
Centre section
Wortmann
FX 61 - 163
Incidence 0.6 degree
22.5 ins
15 ins
15 ins
16 ins
16 ins
16 ins
16 ins
18 ins
19 ins
20 ins
27 ins
24 ins
23 ins
23.8 ins
18.2 in
385 ins 9784 mm
Leading edge
cuff
Section
Wortmann
FX 61 - 163
Incidence 0.46 degrees
Leading edge
cuff
Tip section
Wortmann
FX 60 - 126
Incidence 0.06 degrees
23 ins
584 mm
45 INS
Rearward looking radar
Turret,
FLIR/LLTV
343 ins 88712 mm

A Look Back and a Look Ahead

Looking back over the sixty-five years that we have been involved in gliding and soaring produces some mixed feelings. We designed, built and sold more than 2,100 F.A.A. type-certificated gliders during this period. They played an important part in the growth of soaring in the U.S.A., which gives us a lot of satisfaction. Our soaring activity and other aircraft work also provided an interesting and enjoyable occupation which enabled us to build up our business, make many friends and establish interesting contacts with aviation and soaring people around the world.

Unhappily, in 1983 we had to discontinue production of sailplanes. The high product liability insurance costs and the relatively low volume of glider production made it difficult to operate profitably, and competition from Europe became more severe in the early 1980s owing to the high value of the dollar and resulting low price of imported sailplanes.

An important factor which enabled us to compete in producing gliders in relatively small quantities was our growing subcontract business, making major assemblies for other aircraft companies such as Bell Helicopter, Grumman, Fairchild, Sikorsky and Boeing, and making the Ag Cat agriculture aeroplane for Grumman. This extra business helped to spread overhead costs and exposed us to new design and manufacturing techniques and quality control methods, enabling the company to grow and keep up to date.

Having started in the 1930s with little capital during the depths of the Depression, we learned how to do things with a minimum of tools and equipment. We designed things so that they were simple to produce and could be built with the equipment we had on hand. We also did a thorough planning job on each project so that it could be efficiently produced, making only the tooling that would pay off in the quantities that we expected to sell.

We also used co-ordinated lofting for metal parts, and made master tools to assure interchangeability of components and assemblies. This made production much more efficient, and at the same time enabled sailplane owners and operators to reduce the costs of repair and maintenance and keep their machines in the air. Spare parts which fitted were always available. This was one of the Schweizer sailplane's main advantages.

Safety was also a selling point. On our first visit to a National Soaring Contest, at Elmira in 1931, there were three serious sailplane accidents which impressed on us the importance of giving the pilot and passenger as much protection as possible in the event of a crash. All of our production sailplanes were type-certificated by the F.A.A. and built under an F.A.A. Production Certificate, a big factor in making safe sailplanes available. Ernie always took the lead in matters of safety, and added the extra margin in his designs which, over the years, has resulted in many grateful pilots who had the misfortune of having an accident in a Schweizer sailplane but emerged unscathed. Ernie wrote:

> Safety is an important factor in a recreational activity like soaring. Safe flight characteristics, proper training methods and the design for best possible crash protection will improve the safety level. The 2-22 and 2-33 series have had an outstanding safety record, in spite of some less-than-adequate training methods in the field, which was particularly true in the 1930s when no two-place trainers were available. Among sailplane enthusiasts it is hard to sell safety features, as they are more concerned about performance and style. It reminds me of the car buyer who will buy 'hot' vehicles like convertibles and jeeps which practically guarantee fatalities in the case of a roll over.

A number of years ago, when the S.S.A. was considering the safety problem, they asked Ernie for his comments on pilot protection in sailplanes. Ernie submitted the following report:

Comments on Pilot Protection

All crashes cannot be survivable, but the design should protect the pilot against survivable accelerations:

(1) 40 'g' head-on. This requires that the forward area of the pilot cockpit has sufficient energy absorption characteristics to prevent peak impact forces in initial contact. If a suitable restraint system is provided to prevent fatal injuries some injuries to the lower extremities may still be expected. This can be improved if the design provides more crushing distance with a longer forward section. If this feature can be sold, it will make Condition (2) more critical.

(2) 20 to 25 'g' at 30 degrees to the side or vertical. This will help prevent folding of the cockpit area at the pilot's location.

(3) Protection should be provided for high vertical accelerations due to dropping in stalls or high-speed flat-angle strikes. This requires deeper fuselages so that this protection can be provided. This is also difficult for the designer to sell.

(4) Local injury protection. This requires cockpit design that eliminates lethal or piercing objects. Protection from missile-like objects from inadequately secured equipment. There are also many unanticipated conditions which are only revealed by accidents. Some of these are on record and are sometimes incorporated in the design.

The creation of the Schweizer dealer organisation in the 1950s was a big factor in popularising soaring and building up sales. Each dealer was required to have a flight operation so that he could check out pilots and gain their interest in soaring, as well as demonstrate our sailplanes to potential customers. This organisation, which at its high point totalled more than thirty active dealers, played an important part in the growth of soaring in the U.S.A. Tony Doherty, our sales manager, and Jim Short who succeeded him, were responsible for the growth and operation of this organisation, which during the 1960s and '70s accounted for most of the soaring flight activity in the U.S.A. Another part of our sales programme was the Schweizer School. Bernie Carris, Irwin Jones and Dave Welles were key people in the school, which was started in 1946 and is still in operation, having introduced and trained thousands of soaring pilots, including many of the present competition pilots.

Some may wonder why Schweizer did not get into glassfibre and composite construction for its sailplanes. During the main period of sailplane production, in the 1960s and '70s, the difficulty was satisfying the F.A.A. manufacturing and engineering representatives as to the reliability of glassfibre structures. Because of their inexperience, weight disadvantages would result from their over-conservative requirements relating to this mode of manufacture. This was the case with the Windecker aeroplane. While the prototype was better than the Bonanza, after many years' work and many millions of dollars, the type certificate was received from the F.A.A. but the aeroplane was no longer competitive with the Bonanza because its weight had increased substantially and many other compromises had had to be made to meet the F.A.A. requirements. This situation has changed over the years, and we at Schweizer are now deeply involved with composite materials. The company now makes many non-structural and subassemblies from glassfibre. Our present work in this field includes making rotor blades for our helicopters, but this method of construction is still an expensive way to build sport aircraft.

If we were to start making sailplanes again, we would make a careful study of the current situation to see which way to go, but at present we still believe that sheet metal construction is best for popular recreational and training sailplanes. We do not feel that we should produce more glamorous, advanced competitive sailplanes because they are becoming so sophisticated and expensive that the market is very limited. Rather, we believe that the one-design recreational/competition sailplanes will become much more popular in the future with the introduction of the World Class Sailplane.

One thing that surprises some observers is how three brothers could work together successfully for such long periods. If there was a disagreement, we followed an unwritten rule that, whatever the majority decided, the third party would accept it. This worked well. We are happy that the three second-generation Schweizers, who have been operating the plant for more than twelve years, seem to follow the same policy. So far as we know, Schweizer is the only pre-Second World War family-owned aircraft company still in continuous operation by the same family. We want to thank all the many employees who helped us make this possible through the years.

In the late 1970s and early '80s, as glider sales dropped and the Ag Cat business shrank, owing to negative environmental factors associated with spraying and dusting insecticides, the three young Schweizers, Stu, Paul H. and Les, saw the need for a new major project. The opportunity to buy the Hughes Model 300 Helicopter project arose. This required much more sophisticated aircraft engineering and manufacturing techniques and a lot of new equipment, but the decision was made, and in 1983 the company was deep into the helicopter business. An important consideration in the undertaking was the fact that there were over 2,700 Model 300s in the field, including 800 military versions. This assured a large spares business, which would be a big help while we were putting the type into production. The helicopter business, the growing development and production work on surveillance aircraft for the Coast Guard and other users, together with continuing aircraft subcontract work, provided sufficient business to replace the Ag Cat and gliders.

The three second-generation Schweizers all became soaring pilots on their fourteenth birthdays at the Schweizer Soaring School, and then became aeronautical engineers. Although they are soaring enthusiasts, they are realists about re-entering glider production. They feel that the higher costs associated with helicopter and subcontract work makes it difficult to undertake low-cost glider manufacture at the same factory. Furthermore, before any consideration can be given to going back into the glider design business, there would have to be a great reduction in product liability insurance costs and a substantial increase in the sailplane market.[19] The three founding brothers are satisfied with what they have accomplished, and wish Stu, Paul H., Les and the Schweizer Company every success in the future.

[19] As mentioned in the introduction to this book, further information on the company's operations and the other work that made it possible for us to manufacture sailplanes is covered in Bill Schweizer's book *Soaring with the Schweizers* [ISBN 0-9630731-0-9]. Information on how our sailplanes fit into the American soaring movement is covered in my own book, *Wings Like Eagles* [ISBN 0-87474-828-3]. These books are available from the Soaring Society of America, Box E, Hobbs, New Mexico 88241. For a history of sailplanes over the 1908–45 period we recommend Martin Simons's book *The World's Vintage Sailplanes 1908–45* [ISBN 0-85880-046-2], which describes many sailplanes before we got into the business. This is available only by mail order from Kookaburra Technical Publications, Box 648, Dandenong, Victoria 3175, Australia. His more recent book, *Slingsby Sailplanes* [ISBN 1-85310-732-8] may be ordered directly from Airlife Publishing Ltd, 101 Longden Road, Shrewsbury SY3 9EB, Shropshire, England.

A view from Harris Hill with a group of 1-26s in the foreground and a 1-26 taking off on tow with a Super-Cub Tow-plane.

Appendix 1
The Schweizer Numbering System

The first Schweizer glider was known as the HG-1, because it was the first glider of the Mercury Glider Club (Hg being the chemical symbol for mercury). As we built more gliders we developed a numbering system which seemed ambitious at that time but remains in use today. The HG-1 became the SGP 1-1. Our most popular sailplane, the SGS 1-26E, may be used as an example to show how the system works:

S The first letter, S, is for Schweizer.
G The second letter, G, indicates a glider, or it could be A for aeroplane.
S The third letter describes the purpose of the aircraft, such as S for sailplane, P for primary trainer, U for utility or M for motor glider.
1 The first number is the number of seats in the aircraft.
-26 The dash number is the consecutive design number.
E Any letter after the dash number is a modification indicator, in this case the E modification of the 1-26

Design numbers 4, 5, 9, 13, 14, 15, 16, 17, 18, 27 and 28 were unbuilt projects. At No. 29 the company decided not to assign any number until the aircraft was actually built and flown, so the sequence from SGS 1-29 onwards is continuous.

The numbers include two sport aeroplanes, the SA 1-30 and the SA 2-31, which were built and flown but never put into production. The SGM 2-37 was a motor glider and the 'A' modification of it, the SA 2-37A was the quiet-surveillance aeroplane used by the U.S. Coast Guard and other agencies. A further modification was the SA 2-38, a special twin-engine aeroplane developed for the Coast Guard from the SA 2-37A.

The following table lists the gliders and sailplanes that Schweizer has produced, and the numbers built of each.

Appendix 2
The Schweizer Sailplane Family

Model	Production years built	Number
SGP 1-1	1930 & 1989	2
SGU 1-2	1932	1
SGU 1-3	1933	1
SGU 1-6	1937	1
SGU 1-7	1937–38	2
SGS 2-8	1938–42	57
SGS 2-12	1942–43	114
SGU 1-19	1944–46	50
SGU 1-20	1949	1
SGS 1-21	1947–48	2
SGS 2-22 Std	1946	51
SGS 2-22A		3
SGS 2-22 C		75
SGS 2-22 CK		29
SGS 2-22 E	1967	88
SGS 2-22EK		12
SGS1-23 Std	1949	21
SGS 1-23 B	1952	1
SGS 1-23C	1952	1
SGS 1-23D	1954	12
SGS1-23E	1954	1
SGS 1-23F		1
SGS 1-23G		8
SGS 1-23H		10
SGS 1-23H-15	1969	19
SGS 1-24	1950	1
SGS 2-25	1954	1
SGS 1-26	1954	22
SGS 1-26AK		117
SGS 1-26B		184
SGS 1-26CK		87
SGS 1-26D		79
SGS 1-26E	1980	200
SGS 1-29	1960	1
SGS 2-32	1967–76	87
SGS 2-33	1967	85
SGS 2-33A	1984	484
SGS 2-33AK		10
SGS 1-34	1969	84
SGS 1-34R	1979	9
SGS 1-35	1973	58
SGS 1-35A		2
SGS 1-35C	1982	41
SGS 1-36	1980–82	43
SGM 2-37	1981–87	12
Total		**2,170**

(2-22 all models, 258; 1-23 all models 74; 1-26 all models 689; 2-33 all models 579; 1-34 all models 93; 1-35 all models 101)

Appendix 3
A note about the drawings

The three-view drawings of sailplanes illustrating this book are to a uniform scale of 1:50, except for the few showing unbuilt projects and the two light aeroplanes. In almost all cases they have been prepared using the original factory workshop construction plans. The correct locations of internal frames and ribs are shown by stylised rivet lines. External metal sheet skin splices are indicated by fine solid lines. Wing and fuselage cross-sections are also correctly shown.

Exceptions are the SGU 1-2, 1-3 and 1-6, for which no detailed plans survive. For these, three-view drawings produced by the Schweizers to illustrate earlier historical articles have been used as a basis, supplemented by additional information remembered by the designers and some further details extracted from photographs.

In the case of the 2-25 and the 1-29, few plans survive, but some details of these aircraft, currently in storage at Harris Hill in the National Soaring Museum, were measured by Paul A. and Ginny Schweizer, assisted by James Swinnich, Director of the Museum, to allow completion of the drawings for the book.

All of the drawings were prepared on an Apple Macintosh® Power PC Performa 5200 DC using Adobe™ Illustrator 5.01 software. The text has been prepared using Microsoft® Word 5.01.

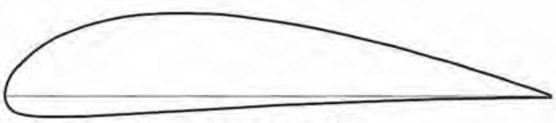
Appendix 4
Aerofoils

For those interested in aerofoils, this is the list of those used on Schweizer sailplanes.

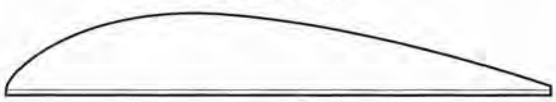
Type	Aerofoil
1-1	Clark 'Y'
1-2	U.S.A. 35A
1-3	Durand 24
1-6	NACA 2412
1-7	NACA 2415
2-8	NACA 2412, tip 2409
2-12	NACA 2415
1-19	NACA 43012A
1-20	NACA 43012A
1-21	NACA 23012A at root, 43012A by ailerons, 23009 at tip
2-22	NACA 43012A
1-23	NACA 43012A
1-24	NACA 43012A
2-25	NACA 43012A
1-26	NACA 43012A
1-29	NACA 63_3618
2-32	NACA 63_3618, tip 43012A
2-33	NACA 43012A
1-34	Wortmann FX 61-163 (root to station 175.0), FX60-126 (tip, station 295.0)
1-35	Wortmann FX67-K-170 root, FX67-K-150 tip
1-36	Wortmann FX61-163 (to 10 in. inboard of aileron), FX60-126 (tip)
2-37	Wortmann FX61-163 (to 10 in. inboard of aileron), FX60-126 (tip)

Wing profiles used

Clark Y



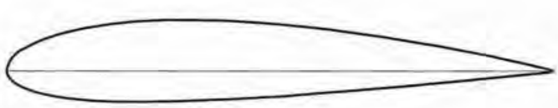
USA 35A



Durand 24

NACA 2409

NACA 2412



NACA 2415

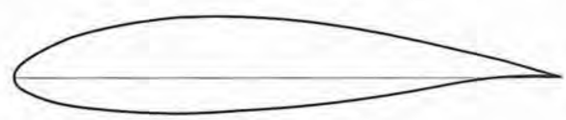
NACA 4412

NACA 4416

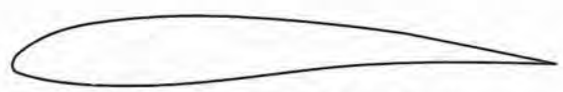
NACA 23012A

NACA 23009

NACA 43012A

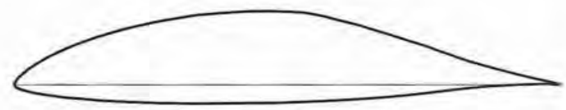


NACA 63_3618



Wortmann FX 60 - 126

Wortmann FX 67 - K - 150

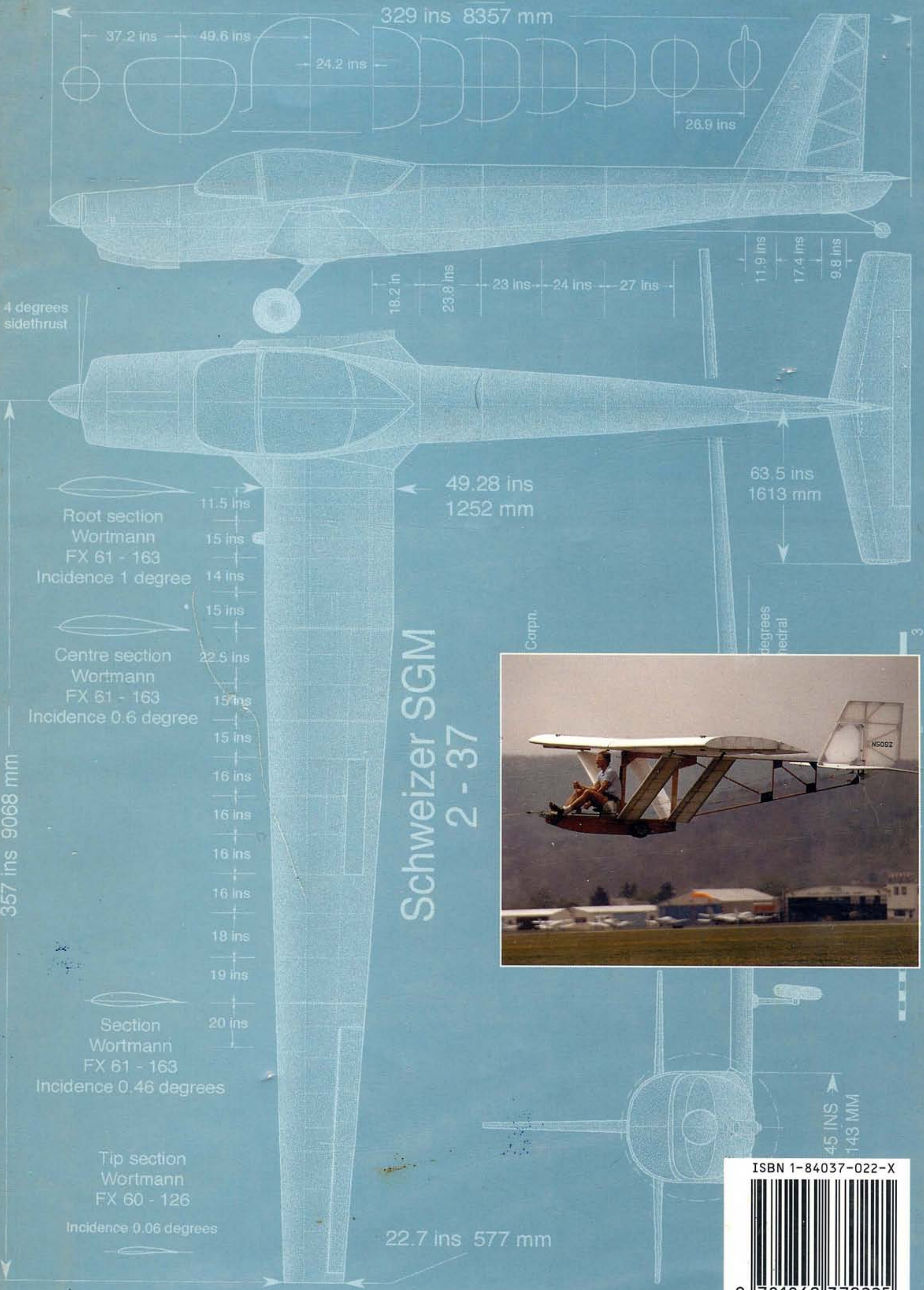


Wortmann FX 67 - K - 170

Index

Index

Aircraft (other than Schweizer's)



ISBN 1-84037-022-X