Gliders & Sailplanes

OF THE WORLD

Michael Hardy

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Introduction

To most aviation enthusiasts, especially if they live some distance away from the nearest gliding club or centre, gliders and sailplanes have probably always remained something of a closed book, largely because so very few of them are ever displayed at the major air shows like Farnborough and the Paris Salon. And those who made a brief acquaintance with gliders during their time in the Air Training Corps some years ago and have not since been in close contact with them, may well be surprised at how far they have developed from the simple, aerodynamically unsophisticated wood and fabric types of the 1940s, and how many different designs have been produced.

This book gives salient particulars of the history, development and technical features of nearly 300 different types of sailplane and powered glider not only from the major European sailplane-producing countries such as Germany, France, the United Kingdom and Poland, but from Argentina, Brazil, India, Japan, the People's Republic of China, South Africa, Australia and, of course, the USA. Most of these are in production or are flying in prototype form, but a few types no longer in service, such as the prewar German Condor, Rhönadler and Rhönbussard are included because in their time they were widely used and are of historical importance.

Hang gliders have not been included because they are now so numerous – sufficiently so, in fact, to justify a separate volume to themselves. One or two powered hang gliders, such as the Chotia Weedhopper, have been included, as well as one or two foot-launched sailplanes such as the unusual Swiss Avifiber Canard-2 FL, which have been influenced by hang glider design. A notable feature of the last few years has been the extent to which the once clear borderlines between powered gliders and light aircraft have become increasingly blurred, not only by the appearance of a number of powered versions of hang glider designs, but of several types of so-called 'minimum aeroplanes' for fun flying, which combine an engine of very low power with the most basic and simple airframe that can carry a pilot in reasonable comfort. These latter types are not included in this book because they are ultra-lights rather than powered sailplanes, and are not intended for soaring.

Paradoxically, perhaps, in a world of rising fuel prices the powered sailplane has enjoyed something of a boom in recent years, with over 700 of the Scheibe SF-25 Falke series built so far, and M Rene Fournier's RF3, RF4D and RF5 designs continuing to sell. Three categories may usefully be distinguished here: (1) the existing sailplane modified to take an engine, usually retracting dorsally into the fuselage, as in the Finnish PIK-20E and the Scheibe SF-27M; (2) the existing sailplane more drastically redesigned to take an engine in the nose, like the Rumanian IS-28M; and (3) a new design with sailplane characteristics, but not necessarily directly derived from an existing sailplane, examples being Rene Fournier's Avion-Planeur RF3, RF4D and RF5 built by Sportavia. Development of successful modifications of the Volkswagen car engine has done much to make the motor glider popular, and in the first category some very neat retractable engine installations result in only a minimal effect on soaring performance. Wankel rotary engines and ducted fans, as well as motorcycle engines and small turbojets have all been tried out in recent years, and rising fuel prices and the shortage of fossil fuels are likely to result in more examples of solar- and electrically-powered sailplanes in years to come. So far nobody has attempted an aircraft that runs on peat fuel but in these energy-conscious days one can never tell!

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Abbreviations

C of A	Certificate of Airworthiness
cc	Cubic centimetre
cg	Centre of gravity
db	Decibels (noise level)
ft	Feet
ft/min	Feet per minute
ft/sec	Feet per second
gal	Gallon
hp	Horsepower
Imp	Imperial
in	Inch
Kg	Kilogram
lb	Pound
lb/sq ft	Pounds per square foot
m	Metre
mm	Millimetres
mph	Miles per hour
rpm	Revolutions per minute
sq ft	Square feet
st	Static thrust

Part One Gliders and Sailplanes

AER-Pegaso M-100

Italy

Data: M-100S
Span: 49ft 2½in
Length: 21ft 6in
Height: 5ft 3in
Wing area: 141sq ft
Aspect ratio: 17.1
Empty weight: 441lb
Max take-off weight: 694lb
Max speed: 137 mph (in smooth air)
Min sinking speed: 2.13ft/sec at 41.6mph
Best glide ratio: 32:1 at 50mph

This Italian single-seater sailplane was designed by Alberto and Piero Morelli and in its M-100 form first flew in 1957, winning an Italian Aero Club competition for the best design of a single-seat sailplane. The M-100 had a 14m (45ft 11in) wing span and this version served Italian clubs for a time as their standard trainer. It was followed by the M-100S which featured a 15m (49ft 2½in) span wing to meet Standard class requirements, and which first flew in prototype form in January 1960. Production of the M-100S was undertaken in Italy by Aeromere, which built 41, by Avionautica Rio S. p. A., which started production in June 1963, and by the French licensees CARMAM (Coopérative d'Approvisionnement et de Réparation de Matérial Aéronautique de Moulins), who built the type as the M-100S Mésange (Tomtit), beginning deliveries in June 1963. Several improved features were introduced by CARMAM from aircraft No 23 onward, including light alloy air brakes instead of plastic ones, a new metal-framed one-piece canopy of Italian manufacture hinged sideways and a wooden seat for the pilot. Altogether about 180 of the M-100S were produced both in Italy and by CARMAM at Moulins-Avernes. The M-100S is fully aerobatic (except for inverted flight) and is of conventional all-wood construction; the single wing span is of beech and the wing is covered with plywood and fabric, with a leading edge torsion box. The slotted ailerons are fabric-covered and the air brakes are of an unusual design consisting of three pairs of light alloy rotating plates above and below each wing. Rudder and elevators are fabric covered, while the landing gear consists of a rubber-sprung nose-skid and a non-retractable mono-wheel with a disc brake; there is also a tailskid. Oxygen and radio equipment are stowed behind the pilot's seat.

Ahrens AR 124

USA

Data: AR 124
Span: 42ft 7¾in
Length: 20ft 0in
Height: 5ft 2in
Wing area: 135.0sq ft
Aspect ratio: 13.5
Empty weight: 350lb
Max weight: 640lb
Max speed: 150mph (in smooth air)
Max aero-tow speed: 103mph
Best glide ratio: 26:1 at 69mph

The AR 124 single-seater 13m (42ft 7¾in) span sailplane was designed and built by Ahrens Aircraft Corporation of Oxnard, California, which is the parent company of Ahrens Aircraft Inc, the main production and assembly plant, which is located at the former Ramey Air Force Base, Aguadilla, Puerto Rico. Three prototypes of the AR 124 have been built, the third, or AR 124V3, making its first flight in August 1975, and this is representative of the intended production version. Flight testing and certification trials have been proceeding to meet a target of first customer deliveries beginning late in 1979, although this has been affected by progress with the firm's other major project, the four-turboprop AR 404 30-passenger utility transport, and the AR 124 programme is currently dormant to give priority to the AR 404. The AR 124 is a cantilever mid-wing monoplane with a T-tail, an unusual feature being the all-aluminium construction employed both for the constant-chord wings and the fuselage, the latter being an elliptical-section flush-riveted monocoque; the wings have upper surface spoilers as well as ailerons. A constant-chord non-swept tailplane and one-piece elevator are mounted on the swept-back fin and rudder; constant-chord wings and tailplanes for ease of production are also a feature of the AR 404 utility transport. The AR 124 has a fixed and unsprung Gerdes monowheel with a hydraulic disc drake, and a tailwheel.

Air 100

France

Data: Air 100
Span: 59ft 0in
Length: 26ft 4in
Wing area: 194sq ft
Aspect ratio: 18.0
Empty weight: 535lb
Max weight: 745lb
Normal gliding speed: 39.7mph

This French high performance single-seater was designed and produced just after the war by Arsenal de l'Aéronautique, perhaps better known for the

VB 10 single-seater fighter-bomber powered by two Hispano-Suiza 12Z engines mounted in tandem in the fuselage, and for the jet-engined VG 70 and VG 90. The Air 100 was designed for the French National Gliding Centres and clubs, and was a cantilever high wing monoplane of mainly spruce and plywood construction. The 18m span wing featured slotted ailerons and spoiler-type flaps, and the landing gear consisted of a central monowheel with a landing skid fore and aft of it, plus a tail skid. An Air 100 flown by Eric Nessler set up a new French record for distance in a straight line of 311 miles (501km) at Wichita Falls, USA, on 14 July 1947. The final production version was the Air 102, and Arsenal de l'Aéronautique later became SFECMAS and was absorbed into SNCA du Nord towards the end of 1954.

Air SA 103 Emouchet

France

Data: SA 103
Span: 41ft 2½in
Length: 20ft 11in
Wing area: 178.6sq ft
Empty weight: 260lb
Max weight: 385lb
Normal gliding speed: 36mph

In the same category as the Grunau Baby, the SA 103 Emouchet (or Kestrel) single-seat elementary training glider and the very similar SA 104 was designed and built just after the war by Arsenal de l'Aeronautique and went into large-scale production at Châtillon-sous-Bagneux for the French National Gliding Centres and clubs; some were also built by Société Roche-Aviation. Of conventional wood and fabric construction, the Emouchet has a parasol wing with metal bracing struts and no air brakes or spoilers. The cockpit is an open one and landing gear consists of a landing skid under the forward fuselage and a tail bumper fairing. The fuselage itself is of hexagonal cross-section and the tailplane is set forward of the diminutive fin and large rudder.

Akaflieg Berlin B 12

FGR

Data: B 12
Span: 59ft 8½in
Length: 28ft 6½in
Height: 6ft 6in
Wing area: 178.5sq ft
Aspect ratio: 20.0
Empty weight: 976lb
Max weight: 1,366lb
Max speed: 155mph
Max aero-tow speed: 93mph
Min sinking speed: 1.97ft/sec at 45.5 mph
Best glide ratio: 42:1 at 65mph

Designed and built by the Akaflieg, or Akademische Fliegergruppe of Berlin University, the B 12 tandem high performance two-seater features the wings of a Schempp-Hirth Janus married to a new fuselage and tail unit which, like the wings, are also of glassfibre-reinforced plastic construction. Design work on the B 12 began in October 1973 and the prototype first flew on 25 July 1977; like the Janus the B 12 is a shoulder-wing monoplane wth Wortmann wing sections and a sweep forward of 2° 18' on the leading edge. The wings are of glassfibre foam sandwich construction, with glassfibre monocoque ailerons, flaps and Schempp-Hirth air brakes on the upper surfaces. Whereas the Janus has a T-tail, the B 12's tailplane is set low on a taller fin; the unsprung monowheel retracts rearwards and has a drum brake, whereas that of the Janus is fixed and the latter has a nosewheel unlike the B 12 and a rear fuselage bumper, a similar bumper also being a feature of the B 12.

Akaflieg Braunschweig SB-5C Danzig

FGR

Data: SB-5C
Span: 49ft 2½in
Length overall: 21ft 10in
Wing area: 140sq ft
Aspect ratio: 17.3
Empty weight: 485lb equipped
Max take-off weight: 716lb
Max speed: 124mph (in smooth air)
Min sinking speed: 2.07ft/sec at 41mph
Best glide ratio: 32.5:1 at 48mph

The Akaflieg, or Akademische Fliegergruppe, of Brunswick (Braunschweig) University has designed and built a series of high performance sailplanes, the SB-5 Danzig being a Standard Class (15m span) single-seater which first flew in prototype form on 3 June, 1959. Licence production was undertaken by Firma Eichelsdörfer at Bemberg, and over 100 SB-5s

of all variants were built. The SB-5C, which first flew in 1965, incorporated several design changes. The SB-5E, which entered production in 1974, had the wing span increased to 16m (52ft 6in) to comply with Club Class regulations. SB-5B or SB-5C Danzigs can be modified up to SB-5E standard. The type is of conventional all-wood construction, with a single-spar shoulder wing with plywood covering and a butterfly tail; Schempp-Hirth air brakes are situated at the 50% chord line. The landing gear is a non-retractable unsprung monowheel with a friction brake, and there is also a tailskid. The plywood monocoque fuselage has an outer coating of glass-fibre.

Akaflieg Braunschweig SB-7 Nimbus

FGR

Data: SB-7
Span: 49ft 2½in
Length overall: 22ft 11½in
Height over cockpit: 2ft 5in
Wing area: 127.6sq ft
Aspect ratio: 19
Empty weight: 562lb equipped
Max take-off weight: 794lb
Max speed: 158mph (in smooth air)
Min sinking speed: 2.20ft/sec at 56mph
Best glide ratio: 37.5:1 at 56mph

The SB-7 Nimbus is a development of the Akaflieg Braunschweig SB-6 Nixope, an ultra high aspect ratio high-performance single-seater with an 18m (59ft 0in) span wing, an aspect ratio of 25 and a best glide ratio of 42:1. The SB-6, which made extensive use of glassfibre in its structure, first flew on 2 February 1961 but was destroyed in August 1964. The SB-7 Nimbus, which first flew in October 1962, featured a 15m (49ft 2½in) span wing for Standard Class requirements with a lower aspect ratio, and a T-tail instead of the SB-6's lower-mounted tailplane. Like the SB-6, the SB-7's shoulder wing has a box spar with glassfibre flanges and is covered with diagonally-laid glassfibre skin stabilised with balsa; the ailerons are of wooden construction and there are two Schempp-Hirth air brakes on each side at the 75% chord line. The fuselage, again like the SB-6's, is a glassfibre monocoque stabilised with balsa. The tail unit is of similar construction to the wing, with the one-piece all-moving tailplane on top of the fin. Landing gear is a retractable monowheel with friction brake and there is also a tailskid. In Switzerland an SB-7 was modified by Paul Kummer and Oskar Wiesendanger of Zurich to have a completely new wing of increased span (54ft 2½in) and aspect ratio (20.85) and with an Eppler 417 aerofoil section; trailing edge air brakes replaced the Schempp-Hirth ones of the standard SB-7 and a tail-braking parachute was fitted. The first of two prototypes of this modified SB-7 made its maiden flight on 20 May 1967, and two more prototypes were built.

Akaflieg Braunschweig SB-7 Nimbus.

Akaflieg Braunschweig SB-9 Stratus

FGR

Data: SB-9
Span: 72ft 2¼in
Length: 24ft 7¼in
Height: 4ft 7in
Wing area: 166.6sq ft
Aspect ratio: 31.3
Empty weight: 692lb
Max weight: 917lb
Max speed: 107mph
Min sinking speed: 1.5ft/sec at 45mph
Best glide ratio: 48:1 at 53mph

The SB-9 Stratus high-performance single-seater was developed by Akaflieg Braunschweig from the 18m (59ft 0in) span SB-8, and first flew in prototype form on 23 January 1969, making its debut at the German National championships that year. The SB-9 featured a higher aspect ratio (31.3) wing of 22m (72ft 2¼in) span, this giving a best glide ratio of 48:1 compared to 42:1 for the SB-8, a lower minimum sinking speed and otherwise improved performance. But some problems were encountered with the wing geometry, especially aileron length,

load distribution over the wing and rudder action, and as a result the maximum speed had to be limited to only 107mph. Later, wing span was reduced to 21m (68ft 11in), this giving an improvement of 12mph in the maximum speed. The SB-9's wing is of PVC foam construction for lightness, and has a glassfibre roving spar; the HKS type flaps are of elastic glassfibre construction with no hinge or gap.

Akaflieg Braunschweig SB-9 Stratus.

The fuselage is of glassfibre construction with balsa wood support, and the landing gear is an unsprung retractable monowheel with a drum-type brake. A T-tail is featured, the tail unit being of glassfibre and balsa construction.

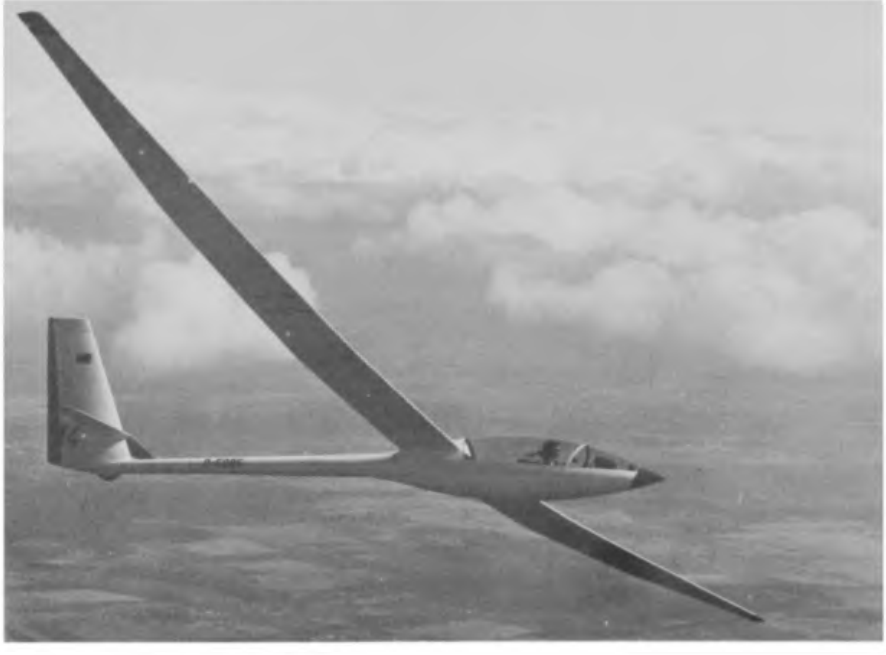
Akaflieg Braunschweig SB-10 Schirokko

FGR

Data: SB-10
Span: 95ft 1¾in
Length: 33ft 11¾in
Wing area: 247.1sq ft
Aspect ratio: 36.3
Empty weight: 1,272lb
Max weight: 1,978lb
Max speed: 124mph
Min sinking speed: 1.3ft/sec at 47mph
Best glide ratio: 53:1 at 56mph

The SB-10 Schirokko is an attempt to create a tandem two-seater sailplane of exceptional performance and aerodynamic refinement, and the

Akaflieg Braunschweig SB-10 Schirokko.



choice of a high aspect ratio (36.6) wing of 29m (95ft 1¾) span – as big a span as a DC-3 airliner – has enabled a best glide ratio of 53:1 and a minimum sinking speed of only 1.3ft/sec to be achieved. Design of the SB-10 began in 1969 and it first flew in prototype form on 22 July 1972; it can also be flown with a wing of 26m (85ft 3¾in) span instead of the 29m one. The wing structure is in five parts: the centre section is of plywood, balsa wood and carbon-fibre, while the outer wing panels and air brakes, as well as the wing tips, are the same as those of the SB-9 Nimbus, but of balsa wood and glassfibre construction with foam filling. Foam-filled carbon-fibre is used for the camber-changing flaps, which can be drooped in conjunction with ailerons; there are three of the latter each side on the 29m wing. The pod-and-boom type fuselage has a finely streamlined forward part, housing the pilots, tapering to a thin boom carrying the tail, and is a steel tube frame covered with a balsa/glassfibre sandwich shell and with light alloy at the rear. The tail unit is also of balsa/glassfibre sandwich construction and has a fixed incidence tailplane mounted low. The landing gear consists of an air-assisted retractable monowheel with a hydraulic brake, and a tailskid. The landing gear, air brakes and rudder controls were later modified, and several other changes made, and in this form the SB-10 set up a German distance record of 577 miles on 16 April 1974.

Akaflieg Braunschweig SB-11 Antares

FGR

Data: SB-11
Span: 49ft 2½in
Length: 24ft 3¼in
Height: 4ft 6¼in
Wing area: 113.7sq ft (flaps in)
142.1sq ft (flaps out)
Aspect ratio: 21.3 (flaps in)
17.0 (flaps out)
Empty weight: 573lb
Max weight: 1,036lb
Max speed: 155mph (flaps in; smooth air)
Max aero-tow speed: 112mph (flaps in)
Min sinking speed: 2.03ft/sec at 50mph (flaps in)
Best glide ratio: 41:1 at 64.5mph (flaps in)
36.1 at 53mph (flaps out)

The SB-11 Antares is a single-seat high performance research sailplane categorised in the FAI Unlimited Standard Class and intended to test a new variable-geometry flap system and to evaluate the use of carbon-fibre reinforced epoxy resin as a constructional material for all parts of a glider. Design work on the SB-11 started in the spring of 1974 and construction of the sole prototype began in April 1976; this made its first flight in May 1978. The SB-11 made its international debut at the 1978 World Championships at Chateauroux, France, when it was flown into first place in the 15m class by Helmut Reichmann, and in November that year it was named Antares. The constant-thickness Fowler flap system is designed to achieve a high average cross-country speed without the operational and technical difficulties of a telescopic wing, as tried on the Akaflieg Stuttgart FS-29, a high aspect ratio giving a very long span wing or a slotless Fowler flap-type wing. To retain conventional sailplane handling characteristics a constant thickness Fowler flap was devised that avoided friction between wing and flap and the need for a flexible lip at the lower surface of the wing. A special Wortmann wing section was evolved for the SB-11 and this was flight-tested mounted on the nose of a DFS Kranich 3 sailplane; the results were sufficiently encouraging to believe that the SB-11, with flaps extended, could outclimb any other Standard Class sailplane and, with flaps in, it would perform as well as a conventional Standard Class type. The cantilever shoulder wing is of 15m (49ft 2½in) span and has an aspect ratio of 21.3 with flaps in or 17 with flaps out; in the former condition the best glide ratio is 41:1. There is a single carbon-fibre spar with roving spar flanges; the outer shell is a carbon-fibre/plastics foam sandwich. Each wing trailing edge is made up entirely of a 25% chord slotless Fowler flap inboard and outboard a 'flaperon' of 22% chord when in and 17% when extended; both flaps and 'flaperons' are of carbon-fibre/plastic foam sandwich construction. They are supplemented by Schempp-Hirth air brakes on the upper surfaces of carbon-fibre/balsa wood sandwich construction, and wing tanks provide for up to 100kg (220lb) of jettisonable water ballast. The fuselage is a carbon-fibre monocoque and the cantilever T-tail, which as an all-moving tailplane with spring trim, is a carbon-fibre/plastic foam sandwich except for the rudder, which is a glassfibre/plastic foam sandwich. There is a retractable unsprung monowheel with an internal drum brake, and a rubber-spring tailskid.

Akaflieg Darmstadt D-36 Circe

FGR

Data: D-36
Span: 58ft 3½in
Length: 24ft 1½in
Height: 4ft 11in
Wing area: 137.8sq ft
Aspect ratio: 24
Empty weight: 622lb
Max weight: 904lb
Max speed: 124mph
Min sinking speed: 1.83ft/sec at 52mph
Best glide ratio: 44:1 at 58mph

The Akademische Fliegergruppe of Darmstadt Technical High School has been involved in designing, building and flying gliders since as far back as 1909, and among its more successful designs were the Edith of 1922, the Konsul, which was the first 18m (59ft 0½in) span glider, and the

Akaflieg Darmstadt D-36 Circe. John W. R. Taylor

metal high-performance D-30 Cirrus, which had an unusual pod-and-boom type fuselage and a minimum sinking speed of only 1.6ft/sec, being among the most efficient of the prewar German designs. After the war came the D-34a high-performance single-seater, which first flew in 1955, followed by the improved D-34b, which first flew in the autumn of 1956, the D-34c, first flown in the spring of 1958, and the D-34d, which made its first flight in March 1961. By this time members of the Akaflieg Darmstadt were investigating the possibilities of new materials such as reinforced glassfibre bonded resins and the D-36 Circe high-performance single-seater, on which design work started in the spring of 1963, made extensive use of these. The first of two D-36s made its first flight in March 1964 and went on to win the German National championships that year. The D-36 also took second place in the 1965 World Championships at South Cerney. The wing torsion box shell is of balsa reinforced with glassfibre and epoxy resin; camber-changing flaps and Schempp-Hirth air brakes are featured, although the second prototype differed from the first only in having these air brakes removed and replaced by a tail braking parachute. The monocoque fuselage is of balsa reinforced with glassfibre and epoxy resin, while the front section of the cockpit canopy is fixed and the rear part removable. The undercarriage consists of a large manually-retracted monowheel forward of the centre of gravity. The T-tail unit is of similar construction to the wings. The D-36 Circe was developed into the Schleicher AS-W 12 for advanced competition and long-distance flying.

Akaflieg Munchen Mü 13

FGR

Data: Mü 13
Span: 52ft 6in
Length: 19ft 9in
Wing area: 174sq ft
Aspect ratio: 15.85
Empty weight: 375lb
Max weight: 595lb
Max speed: 124mph
Min sinking speed: 2ft/sec at 34mph
Best glide ratio: 28:1 at 41mph

One of the principal prewar German high-performance designs, the single-seater Mü 13 was developed at the Munich Akaflieg from the two-seat Mü 10 Milan, which had been built there under the direction of Dipl-Ing Egon Scheibe, who later formed, at the end of 1951, the sailplane firm bearing his name. He built a development of the Mü 13 in Austria known as the Mü 13E Bergfalke (Mountain Falcon), which first flew in prototype form on 6 August 1951 and this two-seat general purpose glider went into production as the Scheibe Bergfalke. The original Mü 13 made its first flight in 1936 and the two prototypes were named the Merlin and the Atalante, differing from each other principally in the fuselage structure and control arrangements. The Atalante with a number of modifications was built by Kurt Schmidt at the Black Forest factory and about 150 Mü 13s were built in all. There were a number of variants, some later having air brakes instead of flaps while the rear fuselage cross section was later changed from a rectangular one to triangular. The Mü 130-3 of 1943 had an increased wing span, longer fuselage and a modified fin and rudder. In May 1939, Schmidt set a new German record for a goal flight of 482km (299 miles) in an Atalante. Unlike most sailplanes of its size the Mü 13 was of mixed construction, using steel and chrome-molybdenum-tin alloy as well as wood. The wooden cantilever wing had steel tube flaps and fabric-covered steel-framed ailerons while the fuselage was a fabric-covered steel framework of basically square cross-section and the tail unit of conventional wooden construction. Particular attention was paid to good visibility, there being large window panels inset into the sides of the cockpit while a clear panel inset into the wing centre section leading edge gave the pilot a better view above and behind him; the cockpit canopy was detachable, and several different shapes were used. A monowheel landing gear and tailskid were featured.

Akaflieg Munchen Mü 27

FGR

Data: Mü 27
Span: 72ft 2¼in
Length: 33ft 9½in
Height: 5ft 11in
Wing area: 189.5sq ft (flaps retracted)
Aspect ratio: 20.2
Empty weight: 1,058lb
Max weight: 1,543lb
Max speed: 174mph
Min sinking speed: 1.8ft/sec at 37mph
Best glide ratio: 47:1 at 63mph

Sailplanes, because their speed range and wing loadings are so much smaller than most fixed wing aircraft and because they land so slowly, have not needed the variety of high-lift devices that a modern jet airliner or combat aircraft might employ. But recently some attention has been paid by designers to varying the wing geometry or area in flight to cater for different soaring conditions, and one approach to this problem is embodied in the Mü 27, which features slotted Fowler-type flaps enabling the wing area to be varied in flight. At high speeds a good gliding angle can be obtained by retracting the flaps while at low speeds or in a weakening thermal the flaps can be extened to give more lift, increasing the wing area by 36%. The Mü 27 is a tandem two-seater of largely glassfibre construction, and first flew on 24 February 1979 piloted by Thomas Fischer. The wings are a glassfibre/Conticell sandwich with aluminium spars and metal webs, and air brakes on the upper surface are at the 50% chord line. The ailerons are linked to the flaps. The semi-monocoque fuselage is entirely of glassfibre with a large two-piece sideways-hingeing cockpit canopy, while the T-tail unit is of glassfibre/foam sandwich construction. The landing gear consists of a retractable monowheel and a fixed tailwheel.

Akaflieg Munchen Mü 27. John W. R. Taylor

Akaflieg Stuttgart FS-24 Phönix

FGR

Data: FS-24 Phönix
Span: 52ft 6in
Length: 22ft 5¼in
Wing area: 154.6sq ft
Aspect ratio: 17.83
Empty weight: 362lb
Max weight: 584lb
Max speed: 107mph
Min sinking speed: 1.7ft/sec at 43mph
Best glide ratio: 40:1 at 48mph

Notable as being the first sailplane to be built of glassfibre, design of the Phönix was started at the Stuttgart Akademische Fliegergruppe under R. Eppler and H. Nägele back in 1951. Originally balsa wood construction with a strengthened outer skin of paper-and-glue layers was decided upon with the

Akaflieg Stuttgart FS-24 Phönix.
John W. R. Taylor

idea of reducing weight, but the Phönix project had to be abandoned for a time. Work was continued when the Stuttgart Fliegergruppe was given a grant for further research, and by now the new glassfibre strengthened polyester resins were available as a constructional material. The Phönix was redesigned to a basically balsa wood/glassfibre sandwich form of construction, and made its first flight on 27 November 1957. At first a conventional tail unit with low-set tailplane was featured, but this was later replaced by a T-tail; the landing gear is retractable. Altogether eight Phönixes were built and all of them were still flying 21 years after the prototype first took to the air. The monocoque fuselage is built in two pieces with a sandwich skin with balsa wood filling and an outer skin of glassfibre. The wing attachment, controls and fittings are installed before the two pieces are glued together with the glassfibre skin overlapping; weight carrying points and the edge of the cockpit canopy are strengthened with plywood. The wings and tail unit are of similar balsa wood/glassfibre sandwich construction, the ailerons, flaps and rudder being cut out after the glueing process is completed.

Akaflieg Stuttgart FS-29

FGR

Data: FS-29
Span: 43ft 7½in to 62ft 4in
Length: 23ft 5¾in
Height: 4ft 2in
Wing area: 92.2 to 136.2sq ft
Aspect ratio: 20.67 to 28.54
Empty weight: 787lb
Max weight: 992lb
Max speed: 155 mph
Min sinking speed: 1.8ft/sec at 46mph
Best glide ratio: 44:1 at 62mph

For the sailplane pilot a variable geometry wing offers the exciting prospect of being able to vary the wing's area and geometry in flight to make the most of the soaring conditions encountered. A high aspect ratio could be selected for ascending in a thermal and a low aspect ratio (and hence a smaller area) for getting the maximum speed in cross-country flying. The Stuttgart Akaflieg's bold solution to this problem in the high-performance single-seater FS-29 is a telescopic wing in which the span can be varied in flight from 43ft 7½in to 62ft 4in by outer telescopic wing sections sliding over fixed inner sections. These outer wing sections are of glassfibre/foam/carbon-fibre sandwich construction and are extended and retracted manually by means of push-rods. A stub spar protrudes from each inner wing to provide a mounting for the guide rails on which the outer panels move. The inner wing is built up from a box spar of glassfibre/Conticell foam sandwich and is fitted with Schempp-Hirth air brakes on the upper surface which are only effective when the outer panels are extended. The plain ailerons are of similar construction to the outer wings. The fuselage is very similar to that of the Schempp-Hirth Nimbus 2, using the same landing gear and cockpit canopy, while the tail unit is the same as the Nimbus 2's. Design work on the FS-29 began in 1972 and the difficult problem of devising a wing which could be varied in span solely by manual power, and yet keep to the required aerodynamic and structural safety factors, meant that the first flight was not made until June 1975.

Akaflieg Stuttgart FS-29. John W. R. Taylor

Alsema Sagitta

Holland

Data: Sagitta 2
Span: 49ft 2½in
Length: 21ft 2¾in
Height: 3ft 11in
Wing area: 129.2sq ft
Aspect ratio: 18.7
Empty weight: 478lb
Max weight: 705lb
Max speed: 168mph
Min sinking speed: 2.1ft/sec at 48mph
Best glide ratio: 37:1 at 60mph

Holland's first 15m Standard class sailplane, the Sagitta (Arrow) was designed and built by Mr Piet Alsema, who formed a company called NV Vliegtuigbouw to put it into production at Teuge airfield, near Apeldoorn. The Sagitta first flew in prototype form on 4 July 1960. It was followed on 24 November 1961 by the first of the production aircraft, designated Sagitta 2; 20 of these were built in all, some of them being exported. The single-seat Sagitta is of conventional all-wood construction with a large, sliding blown canopy giving the pilot, seated over the wing leading edge, excellent all-round visibility. The mid-set wooden wings have a single spar and a plywood leading edge torsion box and the plain ailerons are also of wood; the wing is fabric-covered over 25% of its area. Air brakes of a special design operate on both the upper and lower wing surfaces. The fin and rudder is swept and the cantilever tailplane can be folded when the sailplane is towed in a trailer. A fixed monowheel with brake comprises the landing gear. A 17m (55ft 9in span) development of the Sagitta, known as the Super Sagitta, was reported in the spring of 1964, this being very similar apart from the increase in wing and tail surface areas, but the Super Sagitta remained a project only.

Alsema Sagitta. Eric Wagner

Ambrosini CVV6 Canguru

Italy

Data: Canguru
Span: 63ft 3in
Length: 26ft 2in
Wing area: 232.5sq ft
Aspect ratio: 17
Empty weight: 616lb
Weight loaded: 1,012lb
Sinking speed: 1.96ft/sec
Glide ratio: 30:1

An early postwar Italian high-performance sailplane several of which are still in service, the CVV 6 Canguru two-seater was developed by the CVV (Centro Volo a Vela del Politecnico di Milano) and built in small numbers by Ambrosini – or Societa Aeronautica Italiana, Ing A. Ambrosini & C, to give it its full name. It was also built under licence by Meteor SpA, Costruzioni Aeronautiche. The Canguru is of conventional all-wood and fabric construction, with a high cantilever wing which has a single main spar with a torsionally stiff D-type leading edge; the wing is in two halves and can easily be detached for transport. CVV-type air brakes limit the maximum diving speed to 137mph. The oval-section fuselage is a monocoque structure and the two pilots are seated in tandem, an unusual feature being the location of the second pilot actually beneath the wing rather than ahead of it or in line with the leading edge. The cantilever tail unit has a low-set tailplane.

Ambrosini CVV6 Canguro. Eric Wagner

Antonov A-11

USSR

Data: A-11
Span: 54ft 1½in
Length: 19ft 8½in
Wing area: 130.8sq ft
Aspect ratio: 22.4
Empty weight: 648lb
Max take-off weight: 882lb
Max speed: 217mph (in smooth air)
Max aero-tow speed: 124mph
Min sinking speed: 2.43ft/sec at 53.5mph
Best glide ratio: 32:1 at 60mph

Oleg K. Antonov first became known as a glider and sailplane designer in 1930, and his best known prewar design was the high-performance single-seater known as the Red Front 7, which was used by O. Klepikova to set up a women's distance record on 6 July 1939 with a flight of 465.25 miles from Moscow to Otradnoie, near Stalingrad; this record stood for no less than 38 years. Other Antonov designs were the A-1 single-seat elementary training glider, the A-2, a modernised version of the US-5 two-seat training glider, and the A-9 and A-10 single and two-seat high-performance sailplanes. The A-11, which first flew in prototype form on 12 May 1958, is a high-performance single-seater which followed the practice of US manufacturers such as Bryan and Schweizer in being of all-metal construction. The well-steamlined forward fuselage housing the pilot under a blown plastic canopy tapers to a slim boom carrying the cantilever butterfly tail, with an included angle of 90° between the tail surfaces. The A-11 is aerobatic and suitable for both spinning and cloud flying, and the mid-set wing has a single spar in the root and two spars in the outer wings. The leading edge is metal-covered, with fabric covering aft of the main spar. The fabric-covered slotted ailerons can be drooped through 8° to supplement the slotted flaps, and there are also lift spoilers on the wing upper surfaces. The monocoque fuselage has a retractable sprung monowheel and a rubber-mounted tailskid.

Antonov A-13

USSR

Data: A-13
Span: 39ft 8½in
Length: 19ft 8½in
Wing area: 112.4sq ft
Aspect ratio: 13.8
Empty weight: 560lb
Max take-off weight: 794lb
Max speed: 217mph (in smooth air)
Max aero-tow speed: 124mph
Min sinking speed: 3.74ft/sec at 60mph
Best glide ratio: 25:1 at 70mph

Developed in parallel with the Antonov A-11, and making its first flight exactly a week before the latter, the A-13 utilises the same fuselage, undercarriage and tail unit as the A-11 married to a shorter span (39ft 8½in) wing of lower aspect ratio for aerobatic training. This wing is very similar in construction to the A-11's, with a single spar in the root and two spars in the outer wings, and fabric covering aft of the main spar, but flaps are not fitted and the fabric-covered ailerons are not slotted. There are lift spoilers in the upper surfaces. The shorter span wing results in a higher wing loading of 7.07lb/sq ft and a much higher minimum sinking speed of 3.74ft/sec. Altogether about 350 examples of the A-11 and A-13 were built.

Antonov A-15

USSR

Data: A-15
Span: 55ft 9in
Length: 23ft 8in
Wing area: 132sq ft
Aspect ratio: 24
Empty weight: 661lb
Max take-off weight: 838lb

Antonov A-15. Eric Wagner

Max speed: 155mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.07ft/sec at 56mph
Best glide ratio: 40:1 at 62mph

The single-seater A-15 is a high-performance Open Class design of all-metal construction like the A-11 and A-13 but considerably more refined than these earlier types, and capable of aerobatics, spinning and cloud flying. The prototype first flew on 26 March 1960 and the A-15 soon set up a number of records, including the World goal flight distance record of 443 miles in June 1960. The mid-set wing has a single aluminium main spar of box section, and there is a 50 litre (13.2gal) water ballast tank built into the wing; wing covering is all-metal. The light alloy ailerons and Fowler flaps have plastic foam filling between the ribs, and there are lift spoilers on the wing upper surfaces. Small end-plate fairings called 'salmons' can be fitted on the wing tips. The fuselage is a light alloy semi-monocoque structure and the sideways-opening blown plastic canopy opens to starboard. The pilot's back-rest and rudder pedals are adjustable, and there is provision for oxygen and radio. Landing gear consists of a retractable sprung monowheel with brake. The cantilever butterfly tail has an included angle of 90° between the tail surfaces; the tailplanes are of light alloy and the elevators of mixed alloy and wood construction with fabric covering.

Applebay Zuni

USA

Data: Zuni
Span: 49ft 2½in
Length: 22ft 0in
Height: 4ft 3in
Wing area: 109.0sq ft
Aspect ratio: 22.2
Empty weight: 485lb
Max weight: 1,102lb
Max speed: 207mph (in smooth air)
Min sinking speed: 1.71ft/sec at 50mph

Designed and built by the New Mexico-based firm of Aero Tek under the direction of George Applebay, the Zuni, previously known as the Aero Tek Model V Zuni, is a single-seater 15m (49ft 2½in) span Contest Class sailplane of conventional modern layout, with a flush transparent canopy and a T-tail. It made its first fight on 18 November 1976, and is of glassfibre construction overall. The cantilever shoulder-mounted wing has a Wortmann wing section developed at the Akaflieg Stuttgart and has full-span camber-changing flaps and ailerons. There is provision for up to 180kg (397lb) of water ballast, and the undercarriage consists of a single monowheel with a tail bumper fairing under the fin; the forward fuselage tapers to a slimmer boom section carrying the tail unit, and the wings have rectangular inner sections and tapered outer panels. Production plans for the Zuni have not yet been announced.

AS Lenticular 15 S

Argentina

Data: Lenticular 15 S
Span: 49ft 2½in
Length: 21ft 4in
Height: 4ft 7in
Wing area: 129.2sq ft
Aspect ratio: 18.75
Empty weight: 573lb
Max weight: 904lb
Max speed: 152mph (in smooth air)
Max aero-tow speed: 99mph
Min sinking speed: 2.30ft/sec at 49mph
Best glide ratio: 32:1 at 53mph

This attractive Argentine single-seater Standard Class sailplane was designed by Ing Téodoro Altinger, the prototype flying for the first time on 5 August 1971; it took part successfully in the following year's national championships. Series production was commenced in 1974 by Aero Saladillo, which had been formed in 1973 to build aircraft of glassfibre-reinforced plastic construction at Saladillo in the province of Buenos Aires, and by February 1977, 12 of an initial order for 20 Lenticulars had been completed, but production has now been suspended. The type has an all-moving tailplane mounted on top of a distinctive swept-back fin and rudder, and the pilot is seated in line with the wing leading edge under a long transparent canopy giving excellent visibility. Construction is of glassfibre-reinforced plastic and glassfibre/balsa sandwich throughout and the wings, which have a Wortmann FX-63-168 section, have air brakes in the upper surfaces. The retractable monowheel has an internal brake and there is also a tailskid.

AS Lenticular 15 S. John W. R. Taylor

ATS-1 Ardhra

India

Data: ATS-1 Ardhra
Span: 54ft 1½in
Length: 28ft 6in
Height: 8ft 1in
Wing area: 235.0sq ft
Aspect ratio: 12.46
Empty weight: 604lb
Max weight: 1,000lb
Max speed: 133mph (in smooth air)
Max aero-tow speed: 77.5mph
Min sinking speed: 2.56ft/sec
Best glide ratio: 28:1 at 54mph

This tandem two-seater advanced training sailplane is the latest design of the Technical Centre of India's Civil Aviation Department at New Delhi; it was formerly designated TG-1. The prototype, VT-GEJ, first flew on 5 March 1979 and was certificated by the Indian DGCA in November that year. Plans for large-scale production were under way early in 1980 for the National Cadet Corps and civil clubs. The second prototype which was then under construction has 2° geometric twist (washout) from 50% span to the wing tips, and the dihedral increased to 3°. Of conventional wooden construction with fabric covering the ATS-1 resembles its predecessor, the single-seat HS-II Mrigasheer, although the cantilever shoulder wings have 3° of forward sweep and are plywood-covered multi-spar structures with fabric-covered trailing edges. The plywood plain ailerons are also fabric-covered; no flaps are fitted but there are wooden air brakes in the upper and lower wing surfaces. The tail unit is of similar construction to the wings, with a trim tab in the starboard elevator. The fuselage is a semi-monocoque wooden structure and there is a non-retractable rubber-sprung monowheel with an expanding shoe brake, plus a rubber-sprung skid under the nose and a tail skid. The two pilots sit in tandem under a long one-piece blown flush-fitting canopy.

Aviafiber Canard-2 FL

Switzerland

Data: Canard-2 FL
Span: 44ft 3½in
Length: 16ft 4¾in
Height: 5ft 11in
Wing area: 139.9sq ft
Aspect ratio: 20.0
Empty weight: 108lb
Max weight: 372lb
Max speed: 62mph
Stalling speed: 24mph
Min sinking speed: 1.64ft/sec at 31mph
Best glide ratio: 31:1 at 37.5mph

This unusual single-seater ultra-light sailplane of Swiss design reflects hang-gliding influence in that it is foot-launched by the pilot like a hang glider and, after launching, the pilot swivels up into a prone position on a sliding board and closes both the head and the leg doors which were open when he was running along in the upright position. This method of launching, which would be impractical with a conventional fuselage, partly explains the 'parasol monoplane' configuration in which the main wing at the rear is supported by Vee-form pylons which act both as lifting surfaces and 'vertical' fins and is also supplemented by a fixed-incidence canard foreplane. This layout results in an overall length of only 5m (16ft 4¾in) and enables an aspect ratio of 20 to be used with a modest wing span of 13.5m (44ft 3½in), which avoids the risk with a more conventional wing of digging in a wing tip while running up to the launch. The Canard-2 FL was designed by Dipl-Ing Hans U. Farner, who was also responsible for the Colibri 1 SL canard powered glider, and made its first flight on 7 September 1977; production was due to begin in the spring of 1978, achieving an output of as high as 20 per month by August that year, and a powered version of the Canard-2 FL was due for completion in the summer of 1978. The wing, which like the Vee-form pylons and canard foreplane, has a Wortmann FX-63-137 section, is a single-spar structure with a vacuum-formed shell of laminated resin and glassfibre and a core of styrofoam plate; conventional ailerons are featured. The vee-tail pylons have a similar structure and their trailing edges, which are movable to act as air brakes, have a core of solid hard foam unlike the styrofoam of the wings, while the ailerons have cores of hard foam cells. This type of structure is very light, as it has to be for a foot-launched aircraft, and results in an empty weight of only 108lb. The one-piece canopy/windscreen is open at the rear and for landing there is a retractable front skid and a non-retractable tailskid. A monowheel is optional for downhill rolling take-offs.

Aviamilano A-2 Standard

Italy

Data: A-2 Standard
Span: 49ft 2½in
Length: 23ft 1in
Wing area: 127.6sq ft
Aspect ratio: 19
Empty weight: 419lb
Max take-off weight: 683lb
Max speed: 161mph (in smooth air)
Min sinking speed: 2.03ft/sec at 41mph
Best glide ratio: 34:1 at 54mph

As its name implies, the Aviamilano A-2 is a high-performance Standard Class single-seater of 15m (49ft 2½in) span, and this Italian design went back into production in 1966 after first flying in prototype form a few years earlier. The mid-set wing has

rectangular inner panels and tapered outer panels which can be replaced individually if damaged; the central torsion box and spar structure is all-metal. There are trailing edge air brakes on the inner wings. The fuselage is of all-wood construction, with the forward part covered in glassfibre and the rear part with plywood. The pilot's seat is under a long flush transparent canopy, and the landing gear consists of a rubber-mounted skid and retractable monowheel. The cantilever T-type tail unit has all-moving horizontal surfaces with an anti-servo tab.

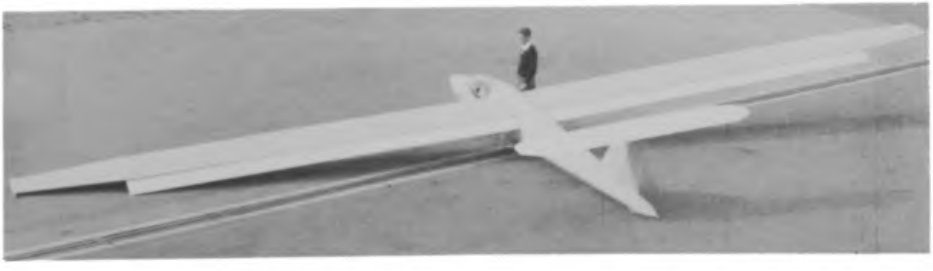
Beatty-Johl BJ-3

South Africa

Data: BJ-3
Span: 52ft 11¾in
Length: 24ft 7¼in
Wing area: 132.4sq ft
Aspect ratio: 20 (flaps in)
15.82 (flaps extended)
Max weight: 1,151lb
Max speed: 177mph (in smooth air)
Max aero-tow speed: 138mph
Min sinking speed: 2.2ft/sec at 46mph
Best glide ratio: 40:1 at 81mph

Designed by P. J. Beatty of Johannesburg and W. A. T. Johl especially for South African climatic conditions and the strong thermals experienced in that country, the single-seater BJ-3 was based on experience gained with the successful BJ-2. The prototype, which was built by Performance Sailplanes of Activia Park, Germiston, made its first flight in 1965 and a BJ-3 set up an international speed record over a 500km triangular course on 28 December 1967 of 84mph. The BJ-3 is of largely all-metal construction except for the fuselage, which is of glassfibre from the nose to the wing spar, the remainder being a semi-monocoque with duralumin skin and stringers. Landing gear consists of a retractable monowheel aft of the centre of gravity, with a brake, and – unusually for a sailplane – a retractable nosewheel; in its original form the BJ-3 was to have had a nose-skid. The one-piece plastic canopy hinges to open at the rear, jet fighter fashion, and the BJ-3 is fitted with a full instrument flight panel as well as VHF radio and oxygen. The wings have a basically duralumin load-carrying structure with a wide spar, and are covered with polystyrene foam with an outer protective skin of glassfibre which gives a smooth finish. An unusual feature is the very generous flap area, the Fowler flaps covering no less than 80% of the span and increasing the wing area by 30% when lowered to their full 30°; they have a steel tube spar and, like the main wing structure, are covered in polystyrene foam and glassfibre. Four sets of double DFS-type air brakes are fitted above and below each wing, and the ailerons are of foam and glassfibre. Another unusual feature for a sailplane is a tail braking parachute housed in the tail cone. The fin and rudder are of duralumin, whereas the fixed-incidence tailplane is of plywood-covered spruce construction. A developed version, the BJ-3A appeared in 1968 and this was followed by the BJ-4, two of which were built for the 1970 World Championships, in which the existing BJ-3 wings were married to a new fuselage and tail unit, the T-tail being replaced with a taller fin and rudder and an all-flying tailplane repositioned on the fuselage behind the rudder.

Beatty-Johl BJ-3. John W. R. Taylor



Bede BD-5S

USA

Data: BD-5S
Span: 27ft 10in
Length: 13ft 6¾in
Wing area: 60sq ft
Aspect ratio: 12.88
Empty weight: 225lb
Max weight: 425lb
Min sinking speed: 3.12ft/sec at 50mph
Best glide ratio: 23:1

Although there are a number of powered versions of existing sailplanes, the reverse process, in which a sailplane version is made of an existing light aircraft, is far less common. An example of such a process is the BD-5S, the sailplane version of the well-known Bede BD-5 Micro single-seat light aircraft, and this engineless version made its first flight in 1975. It differs principally in having a wing span increased by 10ft 5in, a revised cockpit layout and a redesigned

undercarriage in which the backwards-retracting nosewheel of the BD-5 and BD-5J is replaced by a similarly retracting nose skid and the outwards-retracting mainwheels are replaced by a pair of side-by-side twin mainwheels retracting into the fuselage. The main gear door opens forward and can also be used as an air brake. The rear-engined BD-5's low-set tailplane and rear fuselage shape, with its fairing housing the propeller shaft (in the BD-5) or jet exhaust (in the jet-powered BD-5J), is retained and the BD-5S, like the powered BD-5 variants, is designed to be suitable for amateur construction from plans and kits. Construction is all-metal and the low wings are attached to the fuselage simply by sliding the tubular spar on to the wing root section and securing it on each side by two bolts. The ailerons are conventional and the flaps extend almost the full trailing edge span and can be lowered through four positions to a maximum of 60°. The pilot is seated under a large detachable framed canopy.

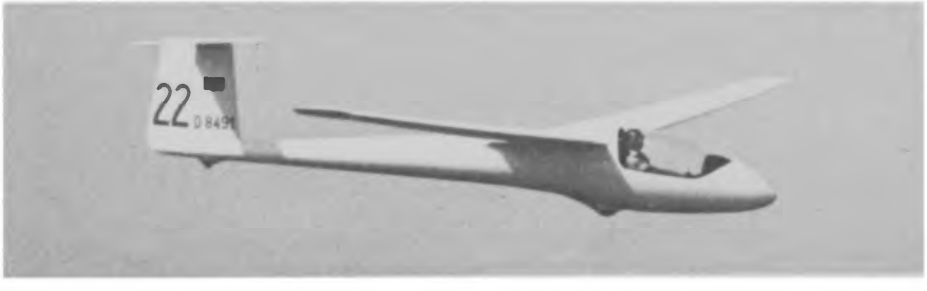
Bolkow Phoebus

FGR

Data: Phoebus C
Span: 55ft 9¼in
Length: 22ft 10¾in
Wing area: 151.4sq ft
Aspect ratio: 20.55
Empty weight: 518lb
Max weight: 827lb
Max speed: 124mph
Min sinking speed: 1.8ft/sec at 50mph
Best glide ratio: 42:1 at 56mph

Derived from the Akaflieg Stuttgart FS-24 Phönix, the first sailplane to be built of glassfibre, the Phoebus high-performance single-seater was designed jointly by R. Linder, R. Eppler and H. Nägele, the last two of whom had directed design work on the Phönix. The prototype was built by R. Linder and made its first flight on 4 April 1964; it came third in the Standard Class contest in the 1964 German National championships and 8th in the 1965 World Gliding Championships at South Cerney. Production of the Phoebus was undertaken by Bölkow GmbH at Ottobrun, and three versions appeared: the Phoebus A, the initial production Standard Class 15m (49ft 2½in) span variant which had a fixed monowheel and tail bumper for landing; the Phoebus B, which appeared in 1967, was the same as the A but with a retractable monowheel, and the Phoebus C was a 17m (55ft 9¼in) span version with a retractable monowheel and a tail braking parachute. The Phoebus was one of the most commercially successful of postwar German sailplanes, a total of 253 having been built when production ended in 1970, and the type did well in contests; at the 1968 World Gliding Championships at Leszno, Poland, Phoebus C pilots took second and sixth places in the Open class and a Phoebus also took third place in the Standard class. The Phoebus, like the Phönix before it, has a basically balsa wood/glassfibre sandwich structure but with a stronger skin. The shoulder wing has air brakes at the 70% chord line and the one-piece all-moving tailplane is mounted on top of the fin to avoid downdraft from the wing. The fuselage is a monocoque structure similar in outline to that of the Phönix, and the pilot is seated under a one-piece canopy, with a control mechanism which is a simplified development of the Phönix's. Compared to the latter, the Phoebus also has better high speed performance and improved gust response.

Bolkow Phoebus.



Breguet 901

France

Data: Type 901-S1
Span: 56ft 10in
Length: 24ft 10in
Wing area: 161.5sq ft
Aspect ratio: 20
Empty weight: 584lb
Max weight: 948lb
Max speed: 136mph
Min sinking speed: 2.0ft/sec at 45mph
Best glide ratio: 36:1 at 53mph

The Breguet 901 high-performance single-seater

was developed in 1953 from the Type 900, Breguet's first sailplane which, on its maiden flight on 13 May 1949, covered a distance of 292 miles at an average speed of 56mph which, had it been observed, would have set up a new French goal flight record. The Type 900 was of all-wood construction with fabric-covered wings of 46ft 11in span with slotted ailerons, slotted flaps and metal dive brakes, and a plywood-covered fuselage. The Type 901, designed by J. Cayla, incorporated several advanced features for its time and took first place in the single-seater class at the 1954 World Gliding Championships at Camphill, going on to repeat this success at the 1956 World Championships in France, by which time a production batch of 60 had been put in hand. The 901 differed from the 900 chiefly in having a longer span (56ft 10in) wing of higher aspect ratio and a more streamlined fuselage, with the large blown Plexiglas cockpit canopy flush with the fuselage top line, a practice since adopted by many other sailplane designers. Another unusual feature was the carriage of 165lb of water ballast in the wings, which could be discharged through openings just beneath the wings in each side of the fuselage. Construction was very similar to the Type 900 with slotted ailerons and multi-hinged slotted Fowler flaps on the laminar-flow wing, and metal dive brakes on the upper and lower surfaces. The leading edge torsion box is a sandwich of plywood and Klégécel, an expanded plastic pre-formed under heat to the required shape, giving very strong and light structure. The single spar is of spruce and plywood and wing covering is of plywood and fabric. The tail unit is of very similar construction, and the tailplane and elevators can be folded horizontally for transport. The fuselage is a plywood-covered monocoque with a single retractable monowheel with hydraulic brake for landing; a landing can be made with the wheel retracted without serious damage to the structure. The pilot is provided with radio, blind-flying equipment and oxygen. The Type 901-S1, which first flew in 1956, differed from the 901 in having modified flaps, a slightly longer fuselage and larger tailplane. The Breguet 904 Nymphale is a two-seater version of the 901, the first of two prototypes making its maiden flight on 26 May 1956. This featured a laminar-flow wing of 20m (65ft 7in) span and end-plate fairings called 'salmons' on the wing tips; the second seat increased the length to 29ft 6in.

Breguet 905 Fauvette

France

Span: 49ft 2½in
Length: 20ft 4¾in
Wing area: 121.1sq ft
Aspect ratio: 20.0
Empty weight: 342lb
Max weight: 606lb
Max speed: 124mph
Min sinking speed: 2.13ft/sec at 40mph
Best glide ratio: 30:1 at 48mph

One of the best of postwar French sailplane designs, the Breguet 905 Fauvette (or Warbler) is a Standard Class single-seater with a V-tail and made its first flight in 1958; like the Type 900 and 901 it was designed by J. Cayla. It was made available to customers either complete from the factory or in kit form for homebuilt assembly, and altogether 50 Fauvettes were built by Breguet. Construction makes extensive use of Klégécel, the expanded plastic giving a very strong and light structure which was used before in the Type 901. The fuselage is built in three main parts, consisting of the nose

Breguet 905 Fauvette.

section of moulded plastic foam including the pilot's seat and flying controls; the centre fuselage, which is a steel tube framework covered with a moulded polystyrene skin and carries the wing, the cockpit attachment points and the towing hook; and the rear fuselage, which is of plywood/foam sandwich construction. This sandwich is composed of 6mm plywood and 8mm of Klégécel, and the same sandwich construction is also used for the fixed tail surfaces, which can be folded to the vertical position for loading on a trailer; the movable surfaces are fabric covered. The cantilever single-spar shoulder wing is of similar plywood and Klégécel construction and has an NACA 63-series laminar flow section; the single spar is of wood and the air brakes are made up of a metal and Klégécel sandwich. The Fauvette soon made its mark in contest flying, and among the records set up in it was the United Kingdom distance record broken by Rear Admiral H. C. N. Goodhart on 12 June 1959 with a flight of 388 miles.

Breguet 906 Choucas

France

Span: 59ft 0in
Length: 25ft 11in
Wing area: 183.5sq ft
Aspect ratio: 19.1
Empty weight: 640lb
Max take-off weight: 1,146lb
Max speed: 124mph (in smooth air)
Min sinking speed: 2.13ft/sec at 43.5mph
Best glide ratio: 30:1 at 43.5mph

The Breguet 906 Choucas (Jackdaw) is a slightly larger two-seater trainer development of the Fauvette with a wing span of 18m (59ft 0in) instead of the latter's 15m, and the prototype flew for the first time on 26 October 1959. It was not until April 1964 that the French government announced that they had decided to put it into production with an initial order for three, and as Breguet had ceased making sailplanes in 1963 Choucas production was entrusted to CAARP – Cooperative des Ateliers Aéronautiques de la Region Parisienne – at Beynes aerodrome in the Seine-et-Oise department. CAARP replaced all the plastic parts with wooden components on the production aircraft, but the prototype was very similar in construction to the Fauvette, with the same three-section fuselage structure, the moulded plastic foam nose section housing the pilot's seat, the steel tube centre portion covered with polystyrene skin containing the rear seat with its transparent canopy, and the rear fuselage being of plywood/Klégécel sandwich construction. The tail surfaces were the same construction as the Fauvette's, and the cantilever shoulder wing had a single wooden spar with a plywood/Klégécel leading edge torsion box and a fabric-covered trailing edge. Slotted ailerons covered 45% of the span and the air brakes were metal and Klégécel sandwich like the Fauvette's. The non-retractable monowheel has a brake and there is a shock-absorbing tailskid. There is provision for a baggage compartment for the pilots, and other optional 'extras' include a turn-and-bank indicator, artificial horizon, VHF radio and oxygen systems.

Briegleb BG 12

USA

Data: BG 12BD
Span: 49ft 1½in
Length: 21ft 11in
Height: 4ft 0in
Wing area: 141sq ft
Aspect ratio: 17.9
Empty weight: 500lb
Max weight: 750lb
Max speed: 140mph (in smooth air)
Min sinking speed: 2.26ft/sec at 47mph
Best glide ratio: 33:1 at 52mph

One of the USA's pioneer sailplane designers, William G. Briegleb built and flew his first glider as long ago as 1928, and later formed the Sailplane Corporation of America to market gliders of his own

Briegleb BG 12A. John W. R. Taylor

design. Just before World War 2 he produced the BG 6 and BG 7 strut-braced high wing designs with fabric-covered steel fuselages, the BG 6 being type-certificated in 1941; a few of these were used by the USAAF for training as well as by private owners and clubs. Recently Mr Briegleb's firm re-introduced construction of the BG 6 and BG 7 as a plans-only service to homebuilders, and by the beginning of 1978 59 sets of BG 6 plans and 29 sets of the BG 7 had been sold. The BG 12 is a single-seat high performance sailplane the sole prototype of which first flew in March 1956, and the basic design was intended especially for homebuilt construction in kit or plan form, kits and/or plans for a total of 257 BG 12s and 58 of the later BG 12-16 having been sold by early 1978; about 100 of these have been completed so far. All wing ribs and fuselage bulkheads are cut from plywood and construction is similar to that of a model aeroplane, with spruce longerons being covered with 1/8in plywood. First production version was the BG 12A, first flown in July 1958, which had a three-piece cantilever wooden wing of 15% thickness/chord ratio and NACA 44-series section, the control system utilising aluminium tubes and castings. This was succeeded by the BG 12B, which first flew in July 1963 and had a two-piece wing with a thicker 18% section at the root, and a welded system of control linkages. The BG 12C was a Standard Class version with a span of exactly 15m instead of the 15.24m (50ft 0in) of the A and B, and this version also featured air brakes, the flaps being used as air brakes on the A and B models at speeds up to 130mph. Current production verison is the BG 12BD, which first flew in July 1973 and reverts to the 15% wing root section of the A. On all versions, both ailerons and flaps are of wood and covered by 1/16in plywood, while the tail unit is also of wood; the tailplane incidence can be adjusted on the ground and there are no tabs. The undercarriage consists of a fixed unsprung monowheel with a Briegleb circumferential brake, a shock-mounted nose skid and a spring tail skid. The pilot sits under a large one-piece moulded Plexiglas canopy and has an adjustable seat and rudder pedals.

Briegleb BG 12-16

USA

Data: BG 12-16
Span: 50ft 0in
Length: 24ft 0in
Height: 4ft 2in
Wing area: 142.1sq ft
Aspect ratio: 17.9
Empty weight: 525lb
Max weight: 850lb
Max speed: 140mph (in smooth air)
Min sinking speed: 2.23ft/sec at 48mph
Best glide ratio: 34:1 at 56mph

The BG 12-16 was developed from the single-seat BG 12BR, a special contest version of the BG 12 which was flown into seventh place in the 1964 US National Championships by Ross Briegleb. This later damaged its fuselage in a landing accident and was given a new fuselage originally built for the BG 16, a projected new design, thus becoming the BG 12-16 prototype; it made its first flight in this form in June 1969. The new low profile fuselage is slimmer than the BG 12's, with a glassfibre forward section containing the pilot in a semi-reclining seat under a two-piece canopy, the aft section of which is detachable; this tapers into a slim rear fuselage of circular section instead of the rectangular section of the BG 12's. A distinctive forward-swept fin and rudder is featured, and the all-flying tailplane, built in two halves, is of metal construction with glassfibre covering, and has two anti-balance servo tabs. The wing and its construction is similar to the BG 12's but with longer span flaps; the flaps, ailerons and rudder are built of ply-covered wood using spruce and Douglas fir. The undercarriage consists of a fixed unsprung monowheel, a shock-absorbing nose skid and a sprung tailwheel or tail skid. By the beginning of 1978 kits and/or plans for homebuilt construction of 58 BG 12-16s had been sold, although Mr William Briegleb has now retired from sailplane design and ceased all advertising.

Bryan HP-15

USA

Data: HP-15
Span: 49ft 2½in
Length: 23ft 2½in
Wing area: 75sq ft
Aspect ratio: 33.0
Empty weight: 331lb
Max weight: 600lb
Max speed: 150mph (in smooth air)
Min sinking speed: 1.6ft/sec at 45mph
Best glide ratio: 45:1 at 54.5mph

One of America's foremost sailplane designers and pilots is Richard E. Schreder whose HP-8, built and flown by himself, won the US National Championships in 1958 and 1960; this was followed by the single-seat high performance HP-10, produced in kit form by Helisoar Aircraft Inc of Danbury, Connecticut, by the HP-11 and HP-11A competition single-seaters, the HP-11 being placed third in the 1963 World Championships, and the Standard Class HP-12 derived from the HP-11. The HP-11, HP-11A and HP-12 were built by Airmate at Toledo, Ohio – a company formed by Mr Schreder – and his next design, the HP-14 high performance single-seater, was produced in kit form by Bryan Aircraft Inc of Bryan, Ohio, which firm had also produced plans of the HP-11A for homebuilders; the HP-14 was also licence-built in modified form by Slingsby Sailplanes Ltd as the HP-14C. The 1970 World Championships were held at Marfa in Texas and Schreder designed the HP-15 for this contest to take full advantage of the high-lift Texan thermals; it was

Bryan HP-14 licensed built by Slingsby.
Howard Levy

also intended to meet the new Standard Class rules which had come into force in 1969 allowing a retractable undercarriage and fixed-hinge flaps on 15m span sailplanes. A very high aspect ratio of 33 and (for a sailplane) the high wing loading of 7.99lb/sq ft were chosen to ensure high speed performance, and the HP-15 was of all-metal construction. The two-spar wings had only three ribs in each, plastic foam covered by rolled-to-contour metal skins and with plastic leading edges filling the intervening spaces; the ailerons droop in conjunction with the metal flaps. The fuselage is an aluminium monocoque and incorporates an aluminium butterfly tail with an included angle of 90°; this V-tail was a characteristic of previous Schreder designs. The retractable monowheel has hydraulic shock-absorber struts and the tailwheel is steerable. Flight trials of the HP-15 – it first flew in the summer of 1969 – showed it to have difficult handling characteristics and it did not, in the end, fly in the 1970 World Championships nor did it go into production.

Bryan HP-18

USA

Data: HP-18A
Span: 49ft 2½in
Length: 23ft 6in
Height: 4ft 0in
Wing area: 114.7sq ft
Aspect ratio: 21.1
Empty weight: 420lb
Max weight: 920lb
Max speed: 150mph (in smooth air)
Max aero-tow speed: 120mph
Min sinking speed: 1.70ft/sec at 45mph
Best glide ratio: 40:1

Schreder's latest design to appear is the Standard Class HP-18, which made its first flight in 1975; it is designed for sale in kit form for homebuilt construction and assembly, and about 170 had been built or were under construction by early 1979. It is of all-metal construction with machined aluminium spars for the cantilever shoulder wing and precut hard foam wing ribs spaced at 10cm intervals; the HP-18A differs in having carbon-fibre spars but has similar wing rib construction. Camber-changing flaps and ailerons occupy the entire trailing edge, and up to 200lb of water ballast can be carried. The design also incorporates certain improvements over the Standard Class RS-15 to which it is generally similar, such as new wing tips, a removable tailwheel, better gap seals and improved streamlining. The HP-18 has a slightly longer fuselage than the RS-15, , with a circular instead of oval section, and this is supplied as a pre-formed Kevlar pod, aluminium rear fuselage and the V-tail; the pilot sits under a two-piece flush canopy. A retractable Tost monowheel with a mechanically-expanding brake is supplemented by a steerable tailwheel. One HP-18, C-GOIY, has been modified by its Canadian builders Don Band and Peter Masak to have winglets of glassfibre and balsa and Wortmann FX-60-126 section at the wing tips.

Bryan RS-15

USA

Data: RS-15
Span: 49ft 2½in
Length: 22ft 0in
Height: 3ft 10in
Wing area: 113sq ft
Aspect ratio: 21.4
Empty weight: 440lb
Max weight: 940lb

Max speed: 150mph (in smooth air)
Max aero-tow speed: 120mph
Min sinking speed: 2.10ft/sec at 50mph
Best glide ratio: 38:1

To meet the Standard Class specifications of OSTIV – the Organisation Scientifique et Technique Internationale du Vol à Voile – Mr Schreder designed the 15m span RS-15 single-seater, which first flew in 1973 and is especially intended for simple and rapid assembly by homebuilders; it is licensed in the amateur-built Experimental category. No jigs are required, and most major components are prefabricated, thus reducing assembly time for a builder with no more than average mechanical aptitude to approximately 500 man-hours. The cantilever shoulder wings are all-metal except for polyurethane foam plastic ribs spaced at 4in intervals. The main-wing spar caps are machined from aluminium plate and up to 200lb of water ballast is carried inside the wing box spars. Plain ailerons are featured, and these can be linked to the optional trailing edge flaps/air brakes, which are of aluminium sheet bonded to foam ribs. The monocoque fuselage is built in two main parts: a prefabricated glassfibre forward pod, complete with bulkheads, floorboards and a moulded pilot's seat, and a 6in diameter tail boom of aluminium tube with an all-metal V-tail which can be folded upwards for towing or storage. The retractable monowheel has a hydraulic shock-absorber and brake, and there is a fixed steerable tailwheel, also with a shock-absorber.

Caproni Vizzola Calif A-21S

Italy

Data: A-21S
Span: 66ft 10¼in
Length: 25ft 4½in
Height: 5ft 3½in
Wing area: 174.3sq ft
Aspect ratio: 25.65
Empty weight: 961lb
Max weight: 1,419lb
Max speed: 156mph
Max aero-tow speed: 87mph
Min sinking speed: 1.97ft/sec at 53mph
Best glide ratio: 43:1 at 65mph

The Caproni company, formed in 1910, is Italy's oldest aircraft manufacturer and was best known for its bombers, such as the pioneer Ca 30 heavy bomber of 1913, and a line of 'Type Coloniale' bomber transports such as the Ca 133 used in the Italian African colonies. In recent years it has concentrated largely on subcontract work, but in 1969 began producing a series of Calif sailplanes designed by Carlo Ferrarin and Livio Sonzio; these were the A-10, of which one was built, the A-12 (two built), the A-14 (one built) and A-15 (one built) and the A-20; an improved two-seater version of the latter, designated A-20S, is now being developed. The original A-21, the prototype of which made its first flight on 23 November 1970, was a high performance two-seat version of the A-14, from which it differed in having a slightly longer fuselage widened to accommodate two in luxurious side-by-side seating. This version is now out of production and has been succeeded by the A-21S, which currently holds as many as four world records for two-seaters; among these is the current Class D2 speed record for women over a 300km closed circuit, set up on 18 August 1974 by Adele Orsi and Franca Bellingeri in an A-21S at a speed of 60.73mph. Over 100 A-21S Califs have so far been built, production of a third batch of 54 being ordered by January 1980, of which 29 had been delivered. The cantilever mid wings have a wide constant chord centre section and tapered trapezoid outer panels, and are all-metal; the three-piece all-metal main spar is supplemented by two auxiliary spars in the centre section and one in each outer panel, the downturned wing tips being of glassfibre. The trailing edge flaps/spoilers can act as air brakes when deflected to 89° downwards, and as camber-changing surfaces between ±8°; the plain ailerons are differentially-operated. The forward fuselage is a glassfibre/foam plastics semi-monocoque structure with a load-carrying light alloy frame, and the rear fuselage is a thin boom of all-metal stressed skin construction. The distinctive high aspect ratio fin and rudder is all-metal, and has the all-moving metal tailplane and elevator, which both have glassfibre tips, mounted on top; the tailplane trim is spring-adjusted. The mechanically-retractable twin main wheels have rubber-in-compression shock absorbers and a brake, and there is a fixed steerable tailwheel, as well as a small wheel in each downturned wing tip. The two pilots have dual controls under a rearward-sliding two-piece canopy, and sit in luxury seating equivalent to the best light plane standards.

Caproni Vizzola Calif A-21S.

CARMAM JP 15-36A Aiglon

France

Data: JP15-36A
Span: 49ft 2½in
Length: 20ft 3¼in
Height: 4ft 7in
Wing area: 114.7sq ft
Aspect ratio: 20.4
Empty weight: 505lb
Max weight: 860lb
Max speed: 136mph (in smooth air)
Max aero-tow speed: 103mph
Min sinking speed: 2.03ft/sec at 45mph
Best glide ratio: 36.9:1 at 50mph

Societe Anonyme CARMAM was previously known as the Coopérative d'Approvisionnement et de Réparation de Matérial Aéronautiques de Moulins, and built the Aer-Pegaso M-100S and its two-seater version the M-200 under licence, as well as manufacturing certain sailplane components for the West German firm of Glasflügel. The Aiglon (Eaglet) was a private venture design by CARMAM's technical directors Robert Jacquet and Jean Pottier, and is a restricted Standard Class sailplane; design work began in September 1971, and the prototype made its first flight on 14 June 1974. Series production began in 1976, the first production JP15-36A making its first flight on 16 October that year; a version with a retractable monowheel and provision for up to 121lb of water ballast is designated JP 15-36AR, while the Pottier PA 15-34 Kit-Club is a variant intended for homebuilt construction and designed by Jean Pottier. By January 1980 a total of 39 JP 15-36A and JP 15-36AR Aiglons had been sold. The single-seater Aiglon is intended for intensive club use and so special attention has been paid to good flying qualities and safe landing characteristics for not-so-experienced pilots. Construction is of glassfibre, the cantilever mid wing having a single glassfibre spar and a glassfibre/Rohacell/epoxy sandwich skin and steel-tipped wing tip 'salmon' fairings. The ailerons are of plastic and can be operated either differentially or in unison, and there are Schempp-Hirth air brakes on the upper and lower surfaces; for ease of wing rigging the aileron and air brake controls are designed to connect automatically. The semi-monocoque glassfibre fuselage is moulded in two halves and joined at the centreline, a single bulkhead forming the cockpit backrest and a shock-absorbing structure for the monowheel. A large one-piece canopy gives excellent visibility, while both seat and rudder pedals are adjustable in flight: on the JP 15-36A the monowheel s fixed and has a cable brake, and there is also a tail bumper. The swept back fin is integral with the fuselage, and the wooden rudder is fabric-covered, the all-moving tailplane is of plastics construction.

The Pottier PA 15-34 Kit-Club homebuilt version is essentially the same as the JP 15-36A but with some structural simplification and redesign to make it more suitable for amateur builders; the glassfibre wings are factory-made. Plywood-covered spruce construction of the fuselage and tail unit replaces the Aiglon's more sophisticated glassfibre structure, although the Kit-Club's nose-cone is of glassfibre. The tail boom, rudder and rear part of the tailplane are fabric-covered, and there is a fixed unsprung monowheel, with a cable-operated drum brake on production aircraft. The change to wood construction results in only a slight weight penalty, the maximum weight going up to 926lb, and performance is very similar to the JP 15-36A's. The prototype Kit-Club made its first flight on 6 November 1976, and 12 had been built by December 1979. The Kit-Club is also available in factory-built form from CARMAM.

CARMAN JP 15-36 Aiglon.
Flow Technology (2000) Ltd

CARMAM 15-38

France

Data: 15-38
Span: 49ft 2½in
Length: 21ft 11¾in
Height: 4ft 9in
Wing area: 118.4sq ft
Aspect ratio: 20.6
Empty weight: 507lb
Max weight: 970lb
Max speed: 136mph (in smooth air)
Max area-tow speed: 136mph
Min sinking speed: 1.97ft/sec at 46.5mph
Best glide ratio: 38:1 at 62mph

This new Standard Class single seater utilises the same wings as the JP 15-36A Aiglon with provision for 220lb of water ballast; these are married to a new fuselage of similar construction to the JP 15-36A, which has a mechanically retractable unsprung monowheel. Instead of the Aiglon's low-set tailplane the 15-38 has a T-tail, with elevator and spring trim. Construction of the 15-38 began in February 1977 and the prototype made its first flight on 17 June 1979.

CARMAN JP 15-38. Flow Technology (2000) Ltd

CARMAM M-200 Foehn

France

Data: M-200
Span: 59ft 6½in
Length: 24ft 11¼in
Height: 6ft 5¼in
Wing area: 188.4sq ft
Aspect ratio: 19.0
Empty weight: 761lb
Max weight: 1,257lb
Max speed: 140mph (in smooth air)
Min sinking speed: 2.3ft/sec
Best glide ratio: 32:1 at 61mph

Designed by Alberto and Piero Morelli, the M-200 is a two-seater high performance version of their Standard Class M-100S which was built under licence both in Italy and by CARMAM at Moulins-Avernes as the M-100S Mésange (Tomtit). The prototype M-200 was built under contract for the Aero Club of Italy by the CVT (Centro di Volo a Vela del Politecnico di Torino) at Turin, and made its first flight in May 1964. Production was undertaken under an exclusive licence by CARMAM, who built it as the M-200 Foehn, completing one more prototype and five pre-production aircraft before starting the

CARMAN M-200 Foehn.
Flow Technology (2000) Ltd

definitive production batch. Main difference between the M-200 and the M-100S is the former's widened fuselage to accommodate two staggered side-by-side seats, the one-piece canopy opening sideways to port; this seating arrangement obviates the need for ballast when the aircraft is flown solo, and gives good visibility to both pilots. The M-200 is designed to be easy to fly for first solos and, like the M-100S, is fully aerobatic; it is also suitable for flying in cloud. Wing span of the M-200 has been increased from the 15m of the M-100S to 18.15m (59ft 6½in) and it is slightly longer; the wing structure is very similar to that of the M-100S, with a leading edge torsion box and air brakes consisting of four instead of three pairs of light alloy rotating plates above and below each wing. The fuselage is of plywood construction with frames and stringers and the landing gear consists of a non-retractable monowheel with a drum brake and a rubber-sprung nose-skid; there is also a tailskid.

Castel C25S

France

Span: 53ft 10in
Length: 23ft 10½in
Empty weight: 470lb
Min sinking speed: 2.65ft/sec at 42mph

Since 1936 the French firm of Etablissements Fouga et Cie operated an Aircraft Department which built aircraft to the designs of its Director, Pierre Mauboussin, and the Technical Director, Robert Castello, as Castel-Mauboussin or just Castel and later as Fouga designs. These included a number of sailplanes culminating in the postwar CM 10 military glider which could carry up to 35 fully armed troops or two jeeps, and the V-tailed CM 8R-13 and CM 8R-15 Sylphe each powered by a dorsally-mounted Turboméca Piméné jet for flight testing and research; the two latter types led directly to the Fouga CM 170R Magister jet trainer. The C 25S two-seater primary training glider, also sometimes known as the Aire, was an early post-war design of which just over 200 were built. Of conventional wood and fabric construction, it has a cantilever high wing with the two pilots sitting side-by-side under the leading edge beneath a transparent canopy which swings up and back over the wing for entry and exist; dual controls are provided. The tailplane is mounted forward of the rudder on a raised step, and landing gear consists of a nose-mounted skid and a tailskid. About a dozen examples of the C 25S were still on the French civil register in 1979.

Castel C25S. Eric Wagner

Castel C311P

France

Span: 45ft 11in
Wing area: 158sq ft
Aspect ratio: 13.3
Empty weight: 345lb
Max weight: 537lb
Speed at best gliding angle: 40.3mph
Min sinking speed: 2.1ft/sec

This single-seater first flew in 1950 and was intended for training in performance and distance flying, and for pilots who aimed to qualify for the French 'D' licence. It is a semi-cantilever high wing monoplane with a small bracing strut each side for the single-spar wooden wing, which is covered partly with plywood and partly with fabric. The air brakes

consist of two staggered rows of three semi-circular metal plates on each side of the wing just outboard of the bracing strut; these rotate on their axes to protrude above and below the wing surface or to be withdrawn into the wing section. No flaps are fitted, and the oval-section fuselage is of all-wood construction with the pilot sitting under a small canopy. The landing gear consists of a fixed monowheel with a sprung nose-skid and a tailskid, and the tail unit is also of wooden construction. There were still about seven examples of the C 311P on the French register in 1979.

Castel C311P. Eric Wagner

Caudron C-800

France

Span: 52ft 5in
Length: 27ft 4in
Wing area: 237.3sq ft
Empty weight: 507lb
Max weight: 892lb
Normal gliding speed: 45mph

In the same class as the Slingsby T21 Sedbergh, this side-by-side two-seater basic training sailplane first flew just after the war and has always been known as the Caudron C-800 although its production was undertaken by SNCA du Nord at Méaulte (Somme) after SNCAN had absorbed the Société Anonyme des Avions Caudron-Renault at the end of 1945 and taken over its designs. The Caudron company had been known in the 1930s for a series of touring and racing monoplanes, and the Goeland twin-engined light transport, and in 1946 the French Government ordered no less than 300 C-800s for use at clubs and elementary flying training schools. Repeat orders were also placed, and the type was at first known as the Epervier (or Sparrowhawk), although this name did not catch on and was later applied to the Morane-Saulnier MS 1500 light COIN aircraft of 1957. The C-800 is of conventional all-wood construction with mixed plywood and fabric covering; the high wing is braced and there is dihedral on the tailplane. The landing gear consists of a fixed monowheel with a sprung wooden skid under the forward fuselage and a tailskid. The two pilots have dual controls and there is an extra transparent panel below the cockpit canopy on each side that hinges downwards. About two dozen C-800s were still on the French civil register in 1979.

Caudron C-800. Eric Wagner

Concept 70

USA

Span: 49ft 2½in
Length: 24ft 0in
Height: 6ft 0in
Wing area: 124sq ft
Aspect ratio: 20.0
Empty weight: 500lb
Max weight: 875lb
Max speed: 121mph (in smooth air)
Min sinking speed: 2.03ft/sec at 50.5mph
Best glide ratio: 40:1 at 60mph

Rather surprisingly, in view of the large-scale use of glassfibre in such leisure products as sailing boats and dinghies, the USA was a latecomer in its application to sailplane structures, American manufacturers generally preferring to use metal construction. The first US all-glassfibre sailplane, known as the Concept 70, did not make its first flight until 1970, some 13 years after the Akaflieg Stuttgart FS-24 Phönix had pioneered this material for sailplane structures and the same year in which Bolkow ended production of the balsa wood/glassfibre Phoebus, derived from the Phönix, after over 250 had been built. The single-seater Standard Class Concept 70 was the responsibility of Arthur Zimmerman and Wolfgang Schaer and production by the Berkshire Manufacturing Corporation got under way in 1973, some 16 Concept 70s having been built by the spring of 1974. The cantilever shoulder wings have a constant chord centre section and tapered outer panels, and are of glassfibre/PVC foam sandwich construction, with aluminium flaps lowering to 90°; up to 200lb of water ballast can be carried. The glassfibre monocoque fuselage has a steel tube reinforcing frame connecting the monowheel and wing fittings and continuing into the cockpit for greater strength and rigidity. The pilot sits in a semi-reclining seat, recessed for an American-type parachute, under a one-piece flush Plexiglas canopy which is hinged and jettisonable. The manually-retractable Tost monowheel has a drum brake.

Concept 70. Howard Levy

CVT M-300

Italy

Data: M-300
Span: 49ft 2½in
Length: 20ft 11½in
Wing area: 98.6sq ft
Aspect ratio: 24.7
Empty weight: 419lb
Max weight: 661lb
Max speed: 155mph
Min sinking speed: 2ft/sec at 49mph
Best glide ratio: 38:1 at 55mph

Designed by Alberto Morelli, the M-300 is a high performance single-seater intended not only for club use but for competition and record flying, and to this end particular attention has been paid to structural design and techniques both to reduce the time taken for contruction and to ensure the necessary accuracy and quality of surface finish. Only two prototypes of the M-300 were in the end built and flown at the CVT (Centro di Volo a Vela del Politecnico di Torino) at Turin, the first making its maiden flight in April 1968. The shoulder wings are of composite construction, the tapered wing spar being a machined aluminium-zinc alloy I-section beam with lightening holes in the web, and the ribs are milled out of a wooden sandwich, the wing skin being of thick pre-formed plywood panels. The fuselage is a semi-monocoque wooden structure with four main frames and nine stringers, and with a glassfibre nose cone; wing/fuselage attachment is by means of Redux-bonded dural fittings. The rudder is double-slotted and the all-moving tailplane on top of the fin is a narrow chord one-piece aluminium alloy structure. A retractable monowheel is provided.

Dagling Primary

UK

Data: Slingsby T3 Primary
Span: 33ft 0in
Span: 33ft 11½in (with rounded tips)
Length: 17ft 10½in
Wing area: 163sq ft
Aspect ratio: 6.6
Tare weight: 180lb
All-up weight: 380lb
Stalling speed: 25mph

Primary training gliders evolved as very simple, even crude, airframes sufficiently basic and strong to withstand the rough handling of inexperienced beginner pilots while having just enough flying ability (and vices) to give the trainee pilot the feel of the controls and enable him to grasp the basic skill of controlling an aircraft in flight. The best known British prewar example in this category was the Dagling, a primary glider the prototype of which was built in 1930 by R. F. Dagnall, founder of the R.F.D. Co Ltd, for the London Gliding Club using plans acquired through America; this was a version of the German Zogling primary, and the combination of 'Dagnall' and 'Zogling' resulted in the name Dagling, which was often later applied to all primary gliders regardless of their true identity. The Dagling had a low aspect ratio constant chord wing from which a rudimentary wooden A-frame fuselage framework was suspended housing the pilot, the tail unit being carried on four steel tubular members – these had been wooden members in the Zogling, but were changed to metal to give a stronger support for the tail. Simple wood and fabric construction was employed, with wire-braced wings and only a main skid on the bottom fuselage member for the landing gear. Some Daglings had a nacelle fitted to give the pilot some protection from the elements, while others had rounded instead of squared-off wing tips, and at least one had a nacelle with two seats in it. Although pretty basic, the Dagling was successful enough to go into production and the R.F.D. Co built at least 27 but in January 1932 announced the cessation of its glider making activities to concentrate on its Air Ministry contracts, and the name of R.F.D. was henceforth to become far better known for liferafts, dinghies, parachutes, air and sea rescue equipment and related products. Dagling production was taken up by several other British firms, the foremost of which was Slingsby, which started building the type at Scarborough in 1933 as the T3 Primary, and eventually built 67; Slingsby's 1933 price for a complete Dagling was a mere £45, and this had risen to £57 15s (£57.75) by 1939, or £66 with a nacelle. For amateur constructors, the British Gliding Association offered a complete set of Dagling plans in 1933 for only £2. Dagling production was also undertaken by Hawkridge Aircraft Ltd, who built five after the war, by Dart Aircraft Ltd, by the Dunstable Sailplane Co, who built one, and Abbott Baynes Sailplanes Ltd; the type's simplicity also enabled it to be built by students at technical schools and colleges such as the College of Aeronautical Engineering, who built one at Redhill. Several other nations produced single-seater primary types in the 1930s basically similar in appearance and performance to the Dagling, such as the Italian Allievo Pavullo, also available with or without a nacelle, the US-designed Denver Primary and the German Schülgleiter SG 38 (the 108-14) and the Grunau Ei.

Dagling Primary. Air-Britain

DFS Kranich

FGR

Data: Kranich 2
Span: 59ft 0¾in
Length: 25ft 3¼in
Wing area: 244.4sq ft
Aspect ratio: 14.3
Empty weight: 562lb
Max weight: 959lb
Max speed: 133mph
Min sinking speed: 2.3ft/sec
Best glide ratio: 23.6:1

Although the first two-seater glider had been produced by Anthony Fokker as far back as 1922, it was not until the mid-1930s that the high performance two-seater sailplane with a performance that compared favourably with its single-seater counterparts began to emerge, and the DFS Kranich (or Crane), which first flew in the autumn of 1935, was the real forerunner of this new breed of two-seater which could be used for competition flying and long distance soaring as well as dual-control training. Prior to the new fashion set by the Kranich most two-seaters were built similarly to, and had similar handling and performance characteristics to single-seater secondary training gliders such as the Grunau Baby and Slingsby Kirby Cadet, which represented a half-way stage between primary trainers like the Dagling and SG 38 and true sailplanes. Designed by Ing Hans Jacobs and built by Ing Lück, the Kranich prototype was developed from an earlier Jacobs design, the Rhönsperber high performance single-seater which was probably the most successful of the prewar German sailplanes, breaking many records in its day. After successful flight trials, the Kranich was put into production by Karl Schweyer A.G. at Mannheim, since the DFS did not manufacture aircraft of its own design except for prototypes, and altogether 400 Kranichs were built in Germany. The type was also built under licence in Sweden, Poland, Yugoslavia, Czechoslovakia and Spain. As late as 1952 Kranichs captured the first three places in the two-seater class in the World Gliding Championships held at Madrid and the type had previously set up more world records and many national ones. The two pilots sit in tandem under a long and narrow framed canopy with individual detachable sections, dual control being provided, and an unusual feature is a small transparent panel in each wing root to provide downward visibility for the instructor in the rear seat located behind the wing spar. Construction is of wood and fabric, the fuselage being of plywood. The mid-set gull wings were fitted with spoilers in the initial production version – use of these had been pioneered in the Rhönsperber – but the strengthened Kranich 2 was fitted with air brakes. Take-offs were made on a double wheel unit that was jettisoned when airborne, and there was a long ash skid under the forward fuselage for landing. A Kranich 3 was recently used to flight test a special wing section for the Akaflieg Braunschweig SB-11, this wing section, of 1.5m span and 0.75m chord, being mounted on a steel tube framework on the tip of the nose in front of the cockpit, and having two large endplate surfaces on each side of it.

After the war 40 Kranich 3s were built by Focke-Wulf GmbH, the prototype of this series, registered D-3002, first flying on 28 May 1952. The Kranich 3 was different in several important respects from the prewar versions; it had a new wing in the low-mid instead of mid position, with dihedral from the roots and straight taper instead of the gull wing with compound taper of prewar aircraft; aspect ratio was now 15.6 A longer forward fuselage was featured with the canopy top now flush with the fuselage top line; length was now 30ft 6¼in. In the early 1970s a powered version of this veteran design was produced by Eduard Schappert in Germany, who modified one of the Kranich 3s built postwar by Focke-Wulf GmbH to have a 35hp Fichtel & Sachs SA-2-440 engine mounted on a retractable pylon aft of the rear seat, and driving a two-blade tractor propeller. A fuel tank of glassfibre in the fuselage held 1.87 Imp gallons, and this variant was designated Kranich 3M. It had a maximum speed of 87mph with the engine on, a cruising speed of 62mph, a take-off run of 985ft and a maximum range of 74 miles.

DFS Kranich 3. Eric Wagner

DFS Meise

Data: Meise
Span: 49ft 2½in
Length: 23ft 10¼in
Wing area: 161.5sq ft
Aspect ratio: 15.0
Empty weight: 353lb
Max weight: 562lb
Max speed: 136mph
Min sinking speed: 2.2ft/sec at 37mph
Best glide ratio: 25.5:1 at 42.5mph

Designed by Ing Hans Jacobs of the Glider Development Department of DFS – the Deutsches Forschungsinstitut für Segelflug (or the German Research Institute for Gliding), the DFS Meise occupies an important niche in the history of gliding as the winner of the first Standard Class sailplane design contest that resulted from the International Olympic Committee's decision, in the spring of 1938, to recognise gliding as an Olympic sport. To overcome the difficulty of judging sailplanes of many different types and sizes a Standard class specification was drawn up to the requirements of which competing gliders had to conform, and the FAI (Fédération Aeronautique Internationale) duly announced a design competition for what was to be the Olympic sailplane. This specified a span of 15m (49ft 2½in), an empty weight of 160kg (353lb), a payload of 95kg (209lb) and a maximum speed of 200km/hour (124mph); only one material was to be used for construction throughout, air brakes were to be fitted but flaps or a retractable undercarriage were not allowed. The competition was held in Italy in February 1939 and was duly won by the Meise which had first flown earlier that year and which, like the other competing aircraft, was evaluated by well-known pilots from several other European countries. Because the DFS enjoyed Government financial backing and conducted extensive research on a scale far beyond amateur sailplane manufacturers in other countries – it was already test flying the still highly secret DFS 230 troop-carrying glider when the Meise first flew – it was not perhaps surprising that the Meise soon aroused interest in many countries in the few months before war broke out, and the German Aero Club supplied design details to a number of prospective customers. Nevertheless the Meise was in many respects a classic design with excellent flying qualities; its high cantilever wing was of wood and fabric construction and had DFS air brakes, while the fabric-covered wooden fuselage had a landing skid under the forward part, and the pilot sat under a detachable framed cockpit canopy in line with the wing leading edge. The Meise, also sometimes known by the designation 108-70, set a pattern that lasted well into the postwar years, for it was built in France after the war and the Nord 2000, in Spain, in Czechoslovakia as the Zlin 25 Sohaj and by Elliotts of Newbury in an improved version known as the EoN Olympia.

DFS Meise. Eric Wagner

DFS Weihe

FGR

Data: Weihe 50
Span: 59ft 0½in
Length: 26ft 8½in
Wing area: 197.4sq ft
Aspect ratio: 17.7
Empty weight: 507lb
Max weight: 539lb
Max speed: 140mph
Min sinking speed: 1.9ft/sec at 37.5mph
Best glide ratio: 29:1 at 43.5mph

The Weihe single-seater high performance competition sailplane was designed for the DFS by Ing Hans Jacobs, who was responsible for so many of the leading prewar German types, such as the Meise, Kranich, Rhönadler and Rhönsperber. The Weihe was developed from an earlier gull wing design known as the Reiher and first flew in 1938, being placed fourth in the Rhön competition of that year. It soon aroused the interest of prospective customers and more than 550 were eventually built in Spain, France, Sweden and Yugoslavia as well as Germany, and including a few built after the war as the Weihe 50 by the Focke-Wulf company when it was reconstituted at Bremen Airport as Focke-Wulf GmbH. The Weihe remained in the front rank of competition sailplanes for a very long time; it took first place in the 1948 World Gliding Championships flown by Per-Axel Persson of Sweden, and at these championships no less than 13 out of 29 competitors were flying Weihes. The type also took the first two places in the 1950 World Championships and third place in the 1954 World contest, being able to hold its own with the many more advanced postwar designs then in use. Persson, who had won the 1948 World contest, had set a world height record of 26,411ft in his Weihe the year before, and in 1959 a Weihe set another height record of 31,709ft. The 18m span wings have a thin Göttingen 549 aerofoil section, and small spoilers are fitted just inboard of the ailerons. For rigging the high cantilever wings are fitted into the fuselage with their tips on the ground, the tips then being raised and the wings locked into position with a bolt. The Weihe is of conventional wooden construction; the fuselage is rather long with a narrow cross section that makes for a somewhat cramped cockpit. The canopy was originally of the multi-framed type with a sliding window, but the later Weihe 50 had a more streamlined one-piece canopy. Take-offs are made on a jettisonable dolly wheel landing gear and there is a landing skid under the forward fuselage. Nine Weihe 50s were built postwar by Focke-Wulf GmbH, the prototype of this series first flying on 14 March 1952.

DFS Weihe. Eric Wagner

DSK BJ-1 Duster

USA

Data: BJ-1b
Span: 42ft 7¾in
Length: 20ft 0in
Wing area: 104.65sq ft
Aspect ratio: 17.4
Empty weight: 390lb
Max weight: 620lb
Max speed: 128mph
Min sinking speed: 5.9ft/sec at 77mph
Best glide ratio: 29:1 at 54mph

Intended for pleasure flying rather than contests or competitions, the BJ-1 Duster single-seater is specifically designed for homebuilt construction from plans and/or component kits. No component of the simple wooden structure exceeds 18ft in length so that it can be built at home and in the garage; the average construction time is approximately 600-700 hours. Designed by Ben Jansson, an aerodynamicist who captained the Swedish teams in the 1968 and 1970 World Gliding Championships, and H.

DSK BJ-1 Duster. Howard Levy

Einar Thor, the Duster is marketed by the DSK Aircraft Corporation of Van Nuys, California. Design work began in early 1964 and the prototype BJ-1 first few in August 1966; over 200 Duster kits have now been supplied to customers in the USA and other countries. The cantilever shoulder wing is built in three pieces – a 7ft span centre-section integral with the fuselage and two outer panels – and there is a single spruce main spar with plywood ribs and covering. The trailing edge flaps also act as air brakes. The straight-sided fir plywood fuselage has an elongated hexagonal cross-section in the cockpit area changing to a triangular cross-section aft of the wings. There is a ventral plywood keel reinforced by two bulkheads shaped to the seat contour and supporting a floor-mounted seat. There is a non-retractable semi-recessed monowheel beneath the keel, as well as a tailwheel; the fuselage nose cone and fairings are of glassfibre. The tailplane is mounted on top of the fuselage and the tail unit is of similar construction to the wings, all tail surfaces being plywood-covered. The BJ-1b differs from the BJ-1 in having a slightly increased wing span, a reduced weight and a Plexiglas canopy reduced in height to allow the pilot to sit in a semi-reclining position; it can be flown with this one-piece flush-fitting canopy or with an open cockpit and just a windscreen. An auxiliary power package for the Duster was under development in 1977 using a 26hp engine mounted dorsally, and the plans provided give details of all the changes necessary to support an engine mounting, which can then be added when the builder so desires without further alteration of the airframe. Previously, a version of the BJ-1b powered by a 35hp Rockwell JLO-600LM 'flat twin' engine mounted behind the cockpit on struts and driving a two-blade fixed-pitch wooden pusher propeller was flown in 1973. This powered version was produced by the Duster's co-designers, Hank Thor and Ben Jansson, and the engine is not retractable into the fuselage.

EEUFMG CB-2 Minuano

Brazil

Data: CB-2/B
Span: 49ft 2½in
Length: 22ft 11¾in
Height: 4ft 8¼in
Wing area: 109.8sq ft
Aspect ratio: 22.0
Empty weight: 507lb
Max weight: 882lb
Max speed: 161mph (in smooth air)
Max aero-tow speed: 99mph
Min sinking speed: 1.97ft/sec at 51.5mph
Best glide ratio: 39:1 at 59mph

In spite of the difficulties facing gliding in Brazil, in particular the inhospitable and inaccessible nature of so much of the hinterland, and the lack of good roads to make retrievals easier, examples of current

EEUFMG CB-2 Minuano.

Brazilian sailplane design bear favourable comparison with some of the best European types. Named after a strong, cold wind common to southern Brazil, the Minuano high perfromance single-seater was designed by Professor Claudio Pinto de Barros, head of the CEA (Centro de Estudos Aeronáuticos, or Air Research Centre) of the Engineering School at Minas Gerais Federal University – the Escola de Engenharia da Universidade Federal de Minas Gerais, or EEUFMG. The Professor had completed his first sailplane design, the CB-1 Gaivota, when he was a student; design work on the Minuano began in 1969, construction started in 1971 and the prototype first flew on 20 December 1975. Four more Minuanos were ordered, the second being due for completion by the end of 1978, and this incorporates several modifications, being designated CB-2/B. The cantilever high wing has a single aluminium alloy main par, and the wing skin is of plywood/glassfibre honeycomb sandwich. The flaps and ailerons, which are interconnected, are similar except for having wooden spars and the flaps can be used as air brakes by deflecting up to 90°. Up to 176lb of water ballast can be carried. The all-wood fuselage is a semi-monocoque, and there is a retractable unsprung monowheel with an internal shoe brake, and a sprung tailskid. The tail surfaces are plywood covered, and stiffened with foam plastics, and the all-moving tailplane has a trim tab in each half.

Eiri PIK-20

Finland

Data: PIK-20D
Span: 49ft 2½in
Length: 21ft 2in
Height: 4ft 6¾in
Wing area: 107.6sq ft
Aspect ratio: 22.5
Empty weight: 485lb
Max weight: 992lb
Max speed: 181mph (in smooth air)
Max aero-tow speed: 118mph
Min sinking speed: 2.17ft/sec at 53.5mph
Best glide ratio: 42:1 at 73mph

Finland has produced some notable glider designs, the best known of these being the PIK series of sailplanes which get their name from the Polyteknikkojen Ilmailukerho, which was founded at Helsinki University of Technology in 1931. Latest of these is the single-seat high performance Unrestricted Class PIK-20, design work on which, by a team headed by Pekka Tammi, started on 1 May 1971, the first of two prototypes making its first flight on 10 October 1973. Finnish certification of the PIK-20 was granted on 20 June 1974, followed by FAA certification exactly a year later. The PIK-20 was soon followed by the PIK-20B, the main production version, which had an increased gross weight, greater water ballast capacity of 309lb, interconnected flaps and ailerons for improved performance, and a pneumatically-sealed sideways opening cockpit canopy. From aircraft No 20100 carbon-fibre spars became available as an option, reducing the empty weight to 496lb. Current production version is the PIK-20D, first flown on 19 April 1976 and which has now superseded the B; this has carbon-fibre spars as standard, a more pointed nose and the tailplane moved forward slightly to give greater rudder area and is fitted with Schempp-Hirth air brakes and improved flaps, or 'flaperons', which act as both flaps and ailerons for enhanced performance. The cockpit is enlarged and its layout improved, and carbon-fibre is also used to reinforce the fuselage. The PIK-20E powered version is described separately. PIK-20 production is undertaken by Eiriavion O/Y, and by January 1979 a total of 149 PIK-20Bs and 150 PIK-20Ds had been delivered. The type soon made its mark in competitions, winning the first three places in the Standard class at the 1976 World Gliding Championships in Finland, and also winning several national championships. The cantilever shoulder wings are of glassfibre/epoxy/PVC foam sandwich construction, with spars of carbon-fibre reinforced epoxy, and the flaps, which have different settings for speed flying or soaring, lowered to 90° in the earlier PIK-20B to act as air brakes; the D has Schempp-Hirth air brakes. The fuselage is a glassfibre/epoxy monocoque reinforced with ribs and carbon-fibre; there is a retractable Tost monowheel with a drum brake as well as a tailwheel. The T-tail is of similar construction to the wings, and the fixed-incidence tailplane has a one-piece elevator.

Eiri PIK-20. John W. R. Taylor

Latest verison is the PIK-20F, which is available as a 15m Class variant (with 308lb of water ballast) or a Club Class variant, the latter having a fixed monowheel. The PIK-20F has carbon-fibre spars, a modified wing profile, a lower drag fuselage, a forward-opening carbon-reinforced cockpit canopy, a carbon-reinforced cockpit area, and a new wing/fuselage epoxy finish. By the spring of 1981 a total of 409 PIK-20s of all versions (including the motorised PIK-20E) had been built, of which 85% were for export.

EoN 463

UK

Data: EoN 463
Span: 49ft 2½in
Length: 21ft 0in
Height: 5ft 8in
Wing area: 132sq ft
Aspect ratio: 18.0
Empty weight: 400lb
Max weight: 630lb
Max speed: 136mph (in smooth air)
Min sinking speed: 2.2ft/sec at 42.5mph
Best glide ratio: 32:1 at 48mph

Intended as a Standard Class 15m span single-seater to replace the popular Olympia, the EoN 463, also known as the EoN 460/463, was the production version of the EoN 460 and incorporated the design experience and certain features of the laminar flow Olympia variants, especially the Olympia 403 and 419. The EoN 460, or Elliotts AP/10 Type 460 as it was also known, first flew in prototype form on 26 April 1960 and only the five prototype 460s were built; the first had an aspect ratio of 20 and an all-up weight of 600lb, the second and third had an aspect ratio of 18 and an all-up weight of 630lb, the fourth was the same as the first but with a modified one-piece canopy and the fifth prototype was the same as the fourth but had modified outer wing sections. The tail unit was very similar to the Olympia 419's and, as on the latter, the tailplane could be folded upwards for transport. The shoulder wings were set slightly lower than the Olympia's and the centre and forward fuselage were similar to the Olympia 419's, while the same NACA 64-series laminar flow wing section as on the 419 was used. The production EoN 463 first flew in April 1963 and a total of 48 were built; this was practically the same as the fifth prototype 460, with an aspect ratio of 18 and an all-up weight of 630lb. The fabric and stringer top fuselage fairing of the 460 was now replaced by a glassfibre one on the 463, which also had a glassfibre instead of plywood nose section and a new cockpit canopy. Both the 460 and 463 have wooden wings with light alloy spars, plywood-skinned and with overall fabric covering; the wings are similar to the Olympia 419's except for the reduced span, the Frise ailerons being fabric-covered and the DFS-type air brakes of plywood. The fuselage, like the 460's, is a wooden Warren girder-type structure with plywood covering and a glass-fibre rear fairing. The tail unit is a conventional fabric-covered wooden structure and the tailplane, unlike the all-moving surface of the Olympia 403 and 419, reverts to conventional elevators with a trim tab in the starboard one. There is a fixed unsprung mono-wheel with an internal expanding brake, and a tailwheel. The pilot's canopy has direct vision panels and a demister, and oxygen and radio can be fitted if desired.

The 463 was followed by the EoN 465, developed for the 1965 World Championships, only two of these being built, the first one, the Series 1, making its maiden flight on 8 March 1965. The 465 had the fuselage height reduced and the pilot seated in a reclining position to reduce cross sectional area and hence drag; the main landing gear skid was deleted and the monowheel centre raised. An all-moving tailplace was reintroduced which did not fold up for storage. The EoN 465 Series 1 had an all-up weight of 680lb and the second one, known as the Series 2, had a thinner wing section than the Series 1 and a strengthened main spar; its all-up weight was 700lb and wing area was increased to 140sq ft. Following the death of Elliott's managing director, Mr H. C. G. Buckingham, in the summer of 1965 the firm's board of directors, after reviewing the situation, decided to end glider production due to its increasing unprofitability.

EoN 465. Eric Wagner

EoN Olympia

UK

Data: Olympia 2
Span: 49ft 2½in
Length: 21ft 8in
Wing area: 161.5sq ft
Aspect ratio: 15.0
Empty weight: 430lb
Max weight: 670lb
Max speed: 129mph
Min sinking speed: 2.2ft/sec at 39mph
Best glide ratio: 25:1 at 45mph

Just after the war, when sporting gliding was getting started again, it was evident that there would be a need for new sailplanes to supplement the surviving prewar ones, and to fill the gap until such time as postwar designs could go into production it was a logical step to build some of the best German prewar designs, some captured examples of which had been brought to this country, in British factories. Elliotts of Newbury Ltd had been formed in 1895 and specialised in joinery and furniture production; during the war it manufactured components and sub-assemblies for wooden and other types, including the Tiger Moth, Mosquito and Horsa and Hamilcar troop-carrying gliders. A combination of a desire to make use of this experience and refusal by the Board of Trade to allow Elliotts to return to its prewar furniture-making activities led to a decision to enter glider manufacturing, starting with the production of an improved version of the well-known DFS Meise known as the Olympia. This was originally to have been built in Britain by Chilton Aircraft Co Ltd, makers of the prewar DW1 ultra-light, but after building a prototype Chilton disposed of the manufacturing and sales rights and associated drawings to Elliotts. The prototype Olympia first flew in January 1947 and an initial production batch of 100 was started; the type soon proved to be popular with private owners and clubs, also beng exported to a number of countries. The Olympia was built in three versions differing only in the landing gear; the Mk 1 had a central steel-sheathed ash skid under the forward fuselage very similar to the Meise's, while the Olympia 2 had a built-in fixed central mono-wheel and the Mk 3 had a jettisonable dolly wheel landing gear. A one-piece quickly detachable bubble canopy for the pilot with a sliding ventilation and clear-vision panel on the port side replaced the Meise's framed canopy, and there was an aerobatic harness and provision for a back-type parachute. Otherwise the Olympia is very similar to the Meise; the high cantilever wings are of wooden construction with plywood and fabric covering, with D-spars in the leading edge and DFS air brakes, while the wooden ailerons are fabric-covered. The all-wooden monocoque fuselage has a luggage compartment under the wing root with an access door on the port side. The tail unit is of wooden construction with plywood and fabric covering, and there is a trim tab in the starboard elevator. Price of the Olympia 2 in 1960 was £850.

EoN Olympia 419

UK

Data: Olympia 419
Span: 62ft 0in
Length: 25ft 0in
Aspect ratio: 19.9
Max weight: 850lb
Min sinking speed: 1.84ft/sec at 46mph
Best glide ratio: 38:1 at 52mph

The first three marks of Olympia, which formed the bulk of the production of this type, differed little from the DFS Meise, but in the 1950s Elliotts began development of a new family of high performance Olympia variants incorporating laminar flow wings, and leading to the Olympia 419, which was sufficiently different from the first three marks of this design as to be almost a new type. First of these new variants was the Olympia 4, later known as the 401,

EoN Olympia 419. J. M. G. Gradidge,

which was a Mk 2, G-ALNF, fitted with a laminar flow wing of NACA 64-series section, identical in span (15m) and plan form to the previous wing; Frise ailerons were featured but these were found to have only marginal power at low speeds and, after the 401's debut in the 1954 World Gliding Championships, these were enlarged and the wing itself modified. G-ALNF was then fitted with a 17m span wing of the same aerofoil sections at root and tip, thus becoming the Olympia 402; aileron chord and span were increased. It was flown by Bill Ivans of the USA into fifth place in the 1956 World Championships, but was lost in an accident on the last day of the competition. It was succeeded by the Olympia 403 prototype, G-APEW, which retained the 17m span wing with a slightly thickened root but introduced some important design changes; this made its debut at the 1957 British national championships. The tail surfaces were entirely redesigned with increased area, the tailplane now being an all-moving surface which could be hinged upwards for transport. It had an anti-balance and trimming tab which at first covered the full span but was later reduced to half span. The fuselage was extended 10in forward by inserting an extra bay between the main bulkhead and the cockpit, and both the cockpit canopy and fuselage 'neck' were widened, that part of the fuselage under the wing being redesigned. The next variant was the Olympia 419, which had the wing span increased to 18.9m (62ft), longer span Frise ailerons, a slightly longer nose than the 403 and greater rudder area, these changes giving better low speed performance and tailplane balance than the 403. The 419 was constructed mainly of spruce, and all surfaces were covered by birch ply except for the rudder, tailplane and wings inboard of the ailerons. Balsa wood was used extensively as a filling for the wing ribs and as a non-structural material for wing tips and fairings. The undercarriage consisted of a jettisonable twin-wheel main unit and a tailskid, and the main landing skid under the forward fuselage was of stainless steel. Both the Olympia 419 prototype and the Olympia 415, which was a 15m span version of it, first flew in 1958; the latter did not go into production but the 419 was marketed at a price of £2,150 and in the end eight were built. These put up some good performances in both World and British National championships flown by such pilots as Nicholas Goodhart and Peter Scott.

EoN Primary

UK

Span: 34ft 0in
Length: 20ft 6in
Height: 8ft 0in
Wing area: 180sq ft
Aspect ratio: 6.0
Empty weight: 250lb
Max weight: 490lb
Max speed: 73mph
Max aero-tow speed: 54mph
Stalling speed: 27mph

The EoN Primary, or Elliotts AP/7 Primary EoN as it is known in full, is a more modern but essentially very similar version of the well-tried Dagling/Slingsby T3 Primary and SG 38 formula of the 1930s for a simple single-seater basic training glider. The prototype made its first flight in February 1948, and the first production model flew in April that year; the type was used not only by clubs but by the Air Training Corps and Combined Cadet Force under the service name of Eton TX Mk 1 to replace the Daglings previously used for Cadet instruction. It could also be supplied with a static training stand which acted as a simple flight simulator in which the glider was balanced on a pivot and wind forces assisted the trainee pilot to get the feel of the controls. Production of the EoN Primary ended in 1958 after 80 had been built, but a number of these were still at Elliotts' works at Newbury ready for final assembly in the spring of 1965, not long before Elliotts ceased all glider production. The constant chord wooden wing is wire-braced and has a high lift section of 12% thickness/chord ratio; it has a plywood leading edge and fabric covering, with fabric-covered wooden ailerons. Plywood leading edge spoilers are featured for use during ground-slides only. The fuselage is a flat wooden open girder-type structure supported by a horizontal beam with the landing skid underneath, with sprung compression legs; the pilot has a single open seat with minimum controls. Unlike the Dagling and Slingsby Primary, the EoN design did not have the option of a nacelle to provide some protection for the pilot. The tail unit is of fabric-covered wooden construction and strut- and wire-braced, effective fin area being provided by filling in part of the open rear fuselage in front of the rudder.

EoN Primary. Air-Britain

ENSAE Farfelu

France

Span: 52ft 6in
Length: 25ft 3in
Wing area: 181.4sq ft
Aspect ratio: 15.19
Empty weight: 617lb
Max weight: 1,102lb
Min sinking speed: 2.50ft/sec
Best glide ratio: 32:1

The Farfelu is a two-seat training glider designed and currently being built at Toulouse by students of ENSAE – the Ecole Nationale Supérieure de l'Aéronautique et de l'Espace. Instructor and pupil sit side-by-side under a one-piece canopy and the monocoque fuselage, of integrally stiffened epoxy/Nomex/epoxy sandwich construction, is built in two halves, the cockpit section tapering into a slimmer rear half carrying the tail; a metal box structure provides additional strength and reinforcement at the wing attachment points. The cantilever shoulder wings have single box spars and a laminated epoxy/Nomex/epoxy sandwich skin; there are Schempp-Hirth air brakes above and below each wing. The unswept cruciform tail unit is of similar construction to the wings, and there is a fixed monowheel in a small fairing and a tail bumper. At the time of writing the Farfelu prototype had not yet flown.

Explorer PG-1 Aqua Glider

USA

Span: 16ft 0in
Length: 13ft 8in
Height: 5ft 0in
Wing area: 94.0sq ft
Aspect ratio: 5.0
Empty weight: 180lb
Max weight: 400lb
Max speed: 65mph (in smooth air)
Stalling speed: 35mph
Best glide ratio: 6.5:1 at 45mph

One of the very few waterborne gliders, the Aqua Glider single-seater is also unusual in being a biplane; it is intended for tethered gliding by unlicensed pilots, and is towed behind any speedboat that can attain a speed of 30kt (35mph). The pilot can also cast off from the speedboat when airborne and make a free flight before landing back on the water, but to do this he must have a licence. The Aqua Glider was designed by Col William L. Skliar, USAF (Ret'd), who began design work on it in September 1958, the prototype making its first flight in July 1959. After making about 1,000 flights and being flown by about 60 pilots, the prototype was donated to the Experimental Aircraft Association Museum in Milwaukee. Approximately 1,000 sets of plans have now been sold to amateur constructors in more than 20 countries all over the world, and about 200 Aqua Gliders are currently under construction; so far about 12 are known to have flown, in the Bahamas, Brazil and Japan as well as in the USA. The forward staggered single bay biplane wings are conventional single-spar wooden structures with fabric covering, and there are spoiler-type light alloy ailerons on the lower wing only, immediately behind the main spar. Balance floats – basically just plate-type fairings – are carried at the extremities of the lower wing tips. The pilot sits in an open cockpit in the unstepped watertight wooden hull and, instead of a conventional planing bottom, take-offs are made on a pair of standard jumper skis, 6ft in length, attached to small wire-braced struts below the hull. The latter is of spruce with a mahogany plywood bow, bottom skins and sides, the plywood being glassfibre-covered below the waterline. There is a towing hook on the nose. The wire-braced tail unit is of spruce with plywood and fabric covering, and is carried on a boom of welded steel tube or wire-braced wooden construction. The rudder is conventional and the tailplane an all-moving one-piece surface.

Explorer PG-1 Aqua Glider. J. W. R. Taylor

Fauvel AV 361

France

Data: AV 361
Span: 41ft 10½in
Length: 10ft 8in
Length: 8ft 1in (folded)
Wing area: 157.2sq ft
Aspect ratio: 11.4
Empty weight: 269lb
Max weight: 569lb
Max speed: 137mph (in smooth air)
Min sinking speed: 2.5ft/sec
Best glide ratio: 30:1 at 53mph (laminar flow section)

The tailless sailplane, because it embodied the designer's dream of the flying wing as a purely aerodynamic surface providing lift but devoid (or almost so) of drag-producing excrescences such as a fuselage, had for long been an interesting avenue of development. In Germany before the war both Dr Alexander Lippisch and the Horten brothers had built and flown several tailless gliders in their search for the ultimate in performance that culminated in the rocket-powered Me 163, and the Westland-Hill Pterodactyls and Northrop flying wing designs likewise had military applications. In France Charles Fauvel has been developing tailless sailplanes for many years, his original AV 36 Monobloc single-seater having first flown in 1951, and over 100 were sold to customers in 14 countries, many in kit form for amateur construction, before the Monobloc was succeeded by the improved AV 36 Mk II, officially designated AV 361, whcih first flew in 1960. This sales record showed that the problems of stability and control so often associated with tailless aircraft could be avoided by sound design, as could unpleasant handling characteristics. Well over 100 AV 36s and AV 361s are now flying in 17 countries and construction by amateurs continues, especially in the USA and Spain; plans are now available in French and English, and 50 AV 36s were also built by Wassmer-Aviation SA. A recent bonus is that customers can now choose a laminar flow Wortmann FX-66-H-159 wing section instead of the non-laminar F_2 section of 17% thickness/chord ratio used hitherto; this increases the best glide ratio to 30:1 at 53mph. The AV 361 is suitable for competition flying or training, and can be flown safely in cloud; its span has been increased to 41ft 10½in from the AV 36's 39ft 2½in, and it has redesigned fins and rudders, as well as larger ailerons than the AV 36. The cantilever shoulder wing is of fabric-covered wooden construction and has no sweep-back because, in a tailless sailplane, the problem of cg range can be neglected since there is no changing load to cater for, and the wing can be designed to obtain the lowest value of induced drag. The elevators are in the trailing edge of the wing centre section, since there is no tailplane, the fins and rudders being carried on two short stub-like fairings projecting from the wing; the rudders can be folded forward to reduce overall length for transportation on a trailer. There are Schempp-Hirth retractable air brakes above and below each outer wing, and there is a large trim tab in the port elevator. The fuselage is a short nacelle of wooden construction, with the pilot seated under a sideways-opening blown Plexiglas canopy; there is provision for oxygen and radio. The nose can be hinged upwards to reduce length when the aircraft is transported sideways on a trailer. The landing gear consists of a flexible rubber-sprung skid, although a monowheel and rear skid can be fitted as an alternative, and there are curved wire 'bumpers' under the wing tips. In February 1971 Mons Fauvel decided to cease commerical production of his sailplanes, but plans for the AV 361 and other designs are still available for construction by gliding clubs or homebuilders.

Fauvel AV 361. Author

FFA Diamant

Switzerland

Data: Diamant 18
Span: 59ft 0½in
Length: 25ft 4in
Height: 4ft 5in
Wing area: 186sq ft
Aspect Ratio: 22.7
Empty weight: 617lb
Max weight: 970lb
Max speed: 149mph
Min sinking speed: 1.71ft/sec at 45mph
Best glide ratio: 45:1 at 62mph

This Swiss high performance single-seater is notable in being a true all-glassfibre sailplane in which the whole structure is made of that material, differing from most other glassfibre designs which use such materials as plywood or balsa quite extensively; only the flying control systems and fittings of the Diamant are of other materials. The ideal of an all-glassfibre sailplane was achieved in several stages, the first being development of the fuselage and tail unit at the Swiss Federal Institute of Technology in Zurich under the direction of Professor Rauscher. A prototype fuselage was built in 1962 and was flown with the plywood and fabric wings of a Schleicher Ka 6CR, the resulting aircraft being designated Ka-Bi-Vo. The Diamant's development was now gradually taken over by Flug- und Fahrzeugwerke AG – FFA, and the next stage was the HBV-Diamant 15 which used the 15m span wings of the Glasflügel H 301 Libelle. This first flew on 5 September 1964 and 13 of this variant were subsequently built; the Libelle's wings being glassfibre balsa sandwich shells without ribs, featuring ailerons that gave partial downward movement when the flaps were lowered, and there were glassfibre dive brakes forward of the flaps. The HBV-Diamant 15 was followed by the generally similar Diamant 16.5, with wings of increased span (16.5m) designed and built by FFA; a total of 41 of this variant were built. Latest version is the Diamant 18, which first flew in February 1968, very similar to the 16.5 but with the span increased to 18m (59ft 0½in); like the Diamant 16.5, water ballast an be carried in the wing roots. The monocoque fuselage is an epoxy-glassfibre sandwich with foam inserts, and the tail unit is of the same construction, the all-moving one-piece tailplane being mounted on top of the fin. As well as a small tailwheel (a tailskid is optional) there is a manually-retractable mono-wheel with a brake, and another feature is a glassfibre ring spring shock absorber; the tow release retracts with the landing gear. The pilot sits in a semi-reclining position under a long forward-sliding one-piece canopy, and there is provision for radio and oxygen.

A powered version of the Diamant 18 known as the EFF Prometheus 1 made its first flight on 21 June 1971, powered by a 176lb st Microturbo Eclair II turbojet mounted behind the cockpit. The Prometheus was developed by EFF – Entwicklungsgemeinschaft fur Flugzeugbau der Akademischen Fluggruppe, and it was later converted back to a standard Diamant 18.

FFA Diamant.

Fibera KK-1 Utu

Finland

Data: KK-1e
Span: 49ft 2½in
Length: 21ft 4in
Height: 4ft 0in
Wing area: 121.6sq ft
Aspect ratio: 20.0
Empty weight: 441lb
Max weight: 684lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 124mph
Min sinking speed: 2ft/sec at 46mph
Best glide ratio: 35:1 at 50mph

The Finnish Utu is a Standard Class single-seater that was designed and built over a three year period by a team of engineers of OY Fibera AB, a company specialising in glassfibre manufacture; the design team was headed by Dipl-Ing Ahto Anttila, and the

Fibera KK-1 Utu. Via Eric Wagner

Utu was intended to investigate the structural applications to sailplanes of plastic laminates stabilised with polyurethane foam. The prototype, designated KK-1a, first flew on 14 August 1964, and was followed by four more prototypes, designated KK-1b,c,d and e, each with structural modifications resulting from variations in the constructional techniques used. Tests with these proved the superiority of plastics over conventional wooden construction, and the Utu in due course went into small-scale production, a total of 22 having been built when production ended early in 1970. The high cantilever wings have single I-spars and no ribs, each wing consisting of a polyester/glassfibre laminate sandwich shell with foam plastic core. The upper-surface hinged ailerons are of glassfibre reinforced plastic shell construction with foam plastic stiffening; there are no spoilers but flaps are fitted. The fuselage is a double shell monocoque with a polyester/glassfibre laminate outer shell and a sandwich-type inner shell of similar construction to the wing. The fin is moulded integrally with the fuselage and has the tailplane mounted on top of it; the tail surfaces are glassfibre-reinforced plastic shells stiffened with foam plastic. There is a non-retractable monowheel with a drum brake, and a tail skid. The one-piece canopy is blended into the forward fuselage shape, and oxygen and radio is installed aft of the pilot's seat.

Flight Dynamics Seasprite

USA

Span: 34ft 0in
Length: 20ft 0in
Height: 8ft 0in
Wing area: 166.0sq ft
Aspect ratio: 6.96
Empty weight: 165lb
Max weight: 500lb
Max aero-tow speed: 35mph
Best glide ratio: 6:1 at 50mph

This unusual single- or two-seat homebuilt glider is distinguished by an aerofoil-shaped fuselage reminiscent of the Burnelli lifting fuselage designs, and bat-like sailwing type wings, the tail unit being carried on a slender aluminium boom. It is, in fact, an unpowered Stage 1 version of an aircraft which, in fully developed powered form, will be known as the Flightsail VII, the Seasprite being of more simplified construction, and it is being marketed in the form of plans to amateur constructors. One Seasprite has been fitted with twin tail booms preparatory to adding a small pusher engine between them, this being an interim stage in the development of the Flightsail VII. The fuselage is basically a framework of aluminium tubing, the sides and top of which are covered with polyethylene foil, except for the upper

Flight Dynamics Seasprite. Howard Levy

part of the nose section, which has a transparent covering of polyester film and Plexiglas. Alternatively, the structure can be covered with aluminium foil for only a minimal weight increase, and this has a much longer life. The underside of the fuselage has catamaran-type twin floats, built of plastics with a plywood covering, enabling the Seasprite to be operated off water if so desired. The pilot sits in an open cockpit in the centre section, to the right of the aluminium boom carrying the tail unit, and his weight is balanced by a counterweight at the port wing tip if a second pilot or passenger is not carried. The wings are of triangular planform with aluminium tube leading edges and wire trailing edges, the whole being covered in polyethylene. They can be folded rearwards when not in use but are otherwise braced to the fuselage sides. The wing tips pivot about their leading edges to provide roll control. The tail is built as a single fin/tailplane unit pivoting only in the vertical plane for control in pitch.

GEP TCV-03 Trucavaysse

France

Data: TCV-03
Span: 49ft 2½in
Length: 21ft 11¾in
Height: 5ft 11in
Wing area: 121.1sq ft
Aspect ratio: 20.0
Empty weight: 423lb
Max weight: 665lb
Max speed: 130mph (in smooth air)
Min sinking speed: 2.62ft/sec at 37.5mph
Best glide ratio: 28:1 at 50mph

The TCV-03 is a Standard Class single-seater designed by Dr Pierre Vaysse, head of the sailplane amateur construction department of the Fédération Francaise de Vol a Voile – FFVV, and it was built by the Groupe d'Etudes Georges Payre – GEP. The Trucavaysse started as a redesigned version of the well known Breguet 905 Fauvette to make it suitable for amateur construction, but with a new, more slender fuselage and a conventional tail instead of the Fauvette's V-tail, it evolved into a new type bearing little resemblance to the Breguet design; other changes include recovered wings with an improved control system and reinforced trailing edges, and the removal of the landing skid. Design work began in October 1968 and prototype construction started in the following February, the prototype, which was actually built by the Aero Club de Norois, making its first flight on 14 July 1973. The type is sold in kit form for amateur or club construction, and several have been built by amateur constructors. The single spar cantilever shoulder wings have plywood/Klégécel sandwich leading edges and slotted wooden ailerons; there are DFS metal airbrakes on both upper and lower surfaces but no flaps. The wooden fuselage is plywood-covered, and the wooden tail unit has a low set one-piece all-moving tailplane with anti-tabs. There is a fixed monowheel and a tailskid utilising rubber shock absorbers. Under development in 1977, the TCV-04 is basically a modified TCV-03 fuselage and tail unit, with a longer one-piece cockpit canopy and small dorsal fin, married to the wings of a Siren C-30 Edelweiss mounted in the shoulder position, thus following Dr Vaysse's design philosophy of utilising components of existing designs. No further details of the TCV-04 had been released at the time of writing.

GEP TCV-03 Trucavaysse. John W. R. Taylor

GEPAS Compact

France

Span: 42ft 0in
Length: 19ft 8¼in
Wing area: 102.3sq ft
Aspect ratio: 17.2
Max weight: 586lb
Best glide ratio: 31:1

Designed and built by B. de Lagarde of GEPAS – Groupe d'Etudes Pour l'Aviation Sportive – the Compact is a homebuilt single-seater of conventional modern appearance and glassfibre construction, and the prototype was due to make its first flight in May 1978. Few details have been released so far, but this cantilever mid wing monoplane is built of glassfibre and epoxy resin, with a non-retractable monowheel and flaps that also act as air brakes. The tailplane is low-set and the pilot sits under a one-piece flush fitting cockpit canopy.

Ginn-Lesniak Kestrel

UK

Span: 59ft 0½in
Length: 24ft 8¾in
Wing area: 243sq ft
Aspect ratio: 14.3
Empty weight: 680lb
Max weight: 1,100lb
Max speed: 98mph
Min sinking speed: 2.2ft/sec at 50mph
Best glide ratio: 28:1

This unusual two-seater semi aerobatic sailplane with its distinctive forward wing sweep was designed in 1956 by Mr Lesniak, who began construction of a prototype with Mr Vic Ginn at the Dunstable Gliding Club's workshops. However, after a time the project was abandoned and after several years the uncompleted Kestrel prototype was saved from destruction by Mr Ron Dodd, a chartered engineer who had worked at the RAE Farnborough, and Mr Jeff Butt. They reactivated the project, with Mr Dodd recalculating, modifying and improving the design, and they completed the Kestrel prototype, which eventually made its first flight in July 1969 at Enstone. It is of conventional wood and fabric construction, the two-part wings incorporating large Schempp-Hirth air brakes and Frise ailerons, and there are metal-bonded reinforcements at the wing roots. The all-wood fuselage has plywood/balsa sandwich reinforcement from the tip of the nose to just aft of the cockpit. Landing gear consists of a fixed monowheel and a tailskid, with a skid block mounted under the nose to protect it. The pilots sit in tandem in a roomy cockpit under a two-piece canopy, the sideways-hinged forward section being a complete Skylark 4 canopy which also secures the transparent detachable rear half.

Glaser-Dirks DG-100

FGR

Data: DG-100
Span: 49ft 2½in
Length: 22ft 11¾in
Height: 4ft 7in
Wing area: 118.4sq ft
Aspect ratio: 20.5
Empty weight: 507lb
Max weight: 921lb
Max speed: 161mph (smooth air)
Max aero-tow speed: 102.5mph
Min sinking speed: 1.94ft/sec at 46mph
Best glide ratio: 39.2:1 at 65mph

The DG-100 Standard Class single-seater is a modified and lighter weight developement of the Akaflieg Darmstadt D-38 glass-reinforced plastic sailplane, which first flew in February 1973. It displayed better performance and handling qualities than expected and so its designer, Dipl-Ing Wilhelm Dirks, sought the necessary backing to develop a production version. With Gerhard Glaser he founded the Glaser-Dirks Flugzeugbau GmbH and the DG-100, design of which had begun in August 1973, first flew in prototype form on 10 May 1974, a mere nine months later. A total of 102 DG-100s had been delivered by the beginning of 1978, plus a further 15 examples of the DG-100G, first flown on 11 June 1976. This is generally similar to the DG-100 except that its tailplane and elevators are similar to those of the later DG-200. Production of the DG-100 series was transferred to the Yugoslav firm Elan, who have been building the DG-100 under licence since the autumn of 1978. The DG-100 itself is basically very similar to the D-38 but with a lighter plastic foam supporting the glassfibre skin instead of the balsa wood used in the D-38, and the latter's rounded nose has been replaced by a more pointed nose of better aerodynamic shape. The DG-100 Club version for club flying is available with either an all-moving tailplane or conventional tailplane like the DG-100G's and a fixed monowheel. The cantilever shoulder wings each have a glassfibre roving main spar and are of glassfibre/Conticell/foam sandwich construction, as are the ailerons and the tailplane. Instead of flaps, there are Schempp-Hirth duralumin air brakes oin the upper wing surfaces; these are considered to be cheaper to make and lighter than flaps, as well as being simpler to operate for landing. Up to 220lb of water ballast can be carried in two wing tanks, and this can be jettisoned in flight. The semi-monocoque fuselage is an all glassfibre structure, as are the fin and rudder. The prototype DG-100 had an all moving tailplane with a large anti-servo tab, and production aircraft have a similar tailplane with a full-span trimmable anti-Flettner tab. The manually-retractable monowheel has a drum brake, and there is a tailwheel. The pilot sits in a semi-reclining position under a two-piece cockpit canopy, the rear section of which is hinged to open upwards and backwards, the adjustable headrest being attached to the canopy hinge. Current production versions are the DG-101, DG-101G and DG-101G Club, which now have the forward-opening one-piece canopy of the DG-202.

Glaser-Dirks DG-100.

Glaser-Dirks DG-200

FGR

Data: DG-200
Span: 49ft 2½in
Length: 22ft 11¾in
Height: 4ft 7in
Wing area: 107.6sq ft
Aspect ratio: 22.5
Empty weight: 529lb
Max weight: 992lb
Max speed: 168mph (smooth air)
Max aero-tow speed: 118mph
Min sinking speed: 1.8ft/sec at 45mph
Best glide ratio: 42.5:1 at 68.5mph

To meet the demand for a sailplane with flaps for the Unrestricted Class 15m International competitions the DG-200 was developed, the prototype making its first flight on 22 April 1977. This has the same 15m span wing with glassfibre flaps added, the Schempp-Hirth air brakes being retained; wing area was slightly reduced, and the water ballast capacity was increased to 287lb. The fuselage and tail unit are the same as the DG-100's. The tailplane is a glassfibre/foam sandwich, with an all-glassfibre elevator, and the ailerons are also of glassfibre; construction is otherwise the same as the DG-100. A total of 20 DG-200s had been delivered by early 1978. The DG-200/17 is a 17m span version of the DG-200 created by adding special insertable wing tips to the DG-200. The DG-200 Acroracer is an aerobatic version of the DG-200 with detachable wing tips that reduce the span to 13.1m (42ft 11¾in); these can be replaced to bring the span up to 15m. The prototype Acroracer first flew on 28 November 1978, but was the only one of this variant built.

The DG-200C is similar to the DG-200 but has carbon-fibre spar booms, wing skin and flaps. The DG-200/17C is the same as the DG-200/17 but has the DG-200C's carbon-fibre wing structure. Altogether 89 DG-200s had been built by April 1980.

The 15m span DG-202, which first flew in prototype form on 30 April 1980, is very similar to the DG-200 but has an improved cockpit and controls, a large one-piece forward-opening canopy, automatic tailplane connection and an improved water ballast system. The DG-202/17 has detachable wing tips to bring the span up to 17m and the DG-202/17C has carbon-fibre in the wing structure and a carbon-fibre spar.

Glasflügel BS 1

FGR

Data: BS 1B
Span: 59ft 0½in
Length: 24ft 7¼in
Height: 5ft 0½in
Wing area: 151.7sq ft
Aspect ratio: 23.0
Empty weight: 739lb
Max weight: 1,014lb
Max speed: 155mph
Min sinking speed: 1.8ft/sec at 53mph
Best glide ratio: 44:1 at 59mph

Regarded as having one of the highest performances of any sailplane when it was first rolled out at the end of 1962, the BS 1 was unusual in having a prone position for the pilot to keep the fuselage cross section as small as possible, as well as a braking parachute housed in the T-tail. It was designed by Björn Stender, who had worked on the SB-6 when a student at Akaflieg Braunschweig and who in 1962 had been asked to design and build a high performance sailplane by the South African pilot Helli Lasch. He set to work with only three other helpers and in spite of the BS 1's advanced nature they succeeded in finishing it by the end of 1962; it was of glassfibre construction – still a comparative novelty at that time – and also had camber changing flaps. After completing its flight tests the BS 1 broke the 300km (186 mile) international triangular speed record during the spring of 1963 and also had a number of competition successes. But following the tragic death of Björn Stender on a test flight in October 1963 the type was taken over by the Glasflügel company, who produced the modified BS 1B, which first flew on 24 May 1966. This featured a redesigned fuselage to provide a roomier cockpit, and a modified wing of increased span and a new Eppler 348 aerofoil section to give improved soaring capabilities in weak thermals. Glasflügel built a total of 18 BS1Bs, one of these being supplied to the naturalist and sailplane pilot Sir Peter Scott.

Glasflügel H 301 Libelle

FGR

Span: 49ft 2½in
Length: 20ft 4in
Height: 2ft 7½in (wheel up)
Wing area: 102.25sq ft
Aspect ratio: 23.6
Empty weight: 397lb
Max weight: 661lb
Max speed: 155mph (smooth air)
Max aero-tow speed: 84mph
Min sinking speed: 1.8ft/sec at 46.5mph
Best glide ratio: 39:1 at 59mph

The H 301 Libelle (or Dragonfly) high performance single-seater is an all-glassfibre design developed jointly by Ing Eugen Hänle and Dipl-Ing W. Hütter from the V-tailed Hütter H-30 GFK; the latter had also participated in the design of the pre-war Schempp-Hirth Minimoa and a number of other successful gliders such as the H-17 and the H-28. The Libelle (the H in its designation stood for Hütter) made its first flight on 6 March 1964 and, although of Standard Class span, its camber-changing flaps and manually retractable monowheel put it into the

Glasflügel H 301 Libelle.

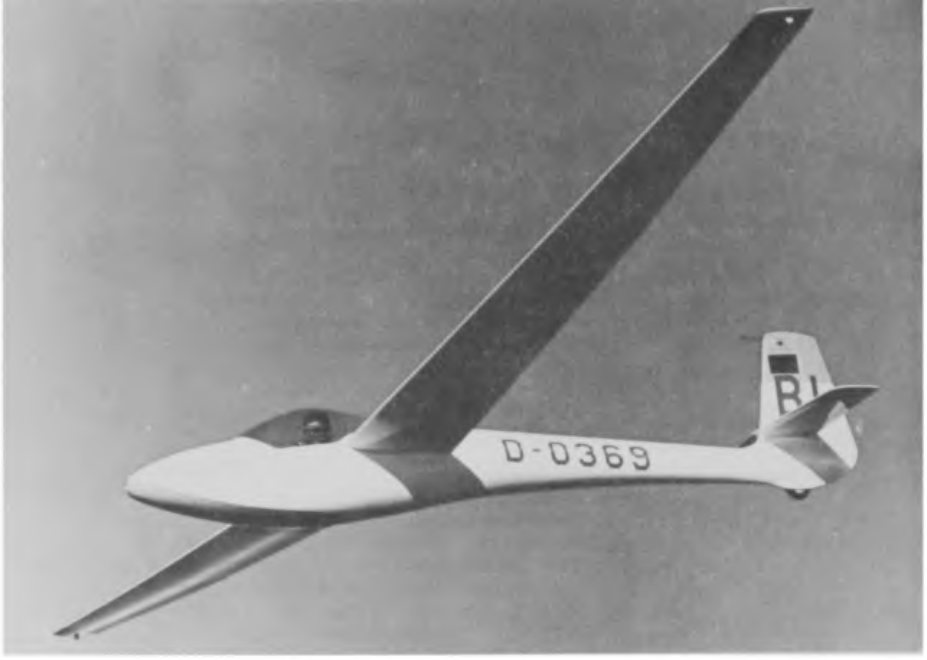
Open Class; it could, however, be flown with flaps up and wheel locked down to conform with the then Standard Class rules. It was one of the first production glassfibre sailplanes and as such proved immediately popular, winning a number of National championships and breaking world speed and distance records; a total of 100 Libelles had been built when production finally ceased in 1969. Construction is similar to the Hütter H-30 GFK, the two-piece cantilever mid wings being glass-reinforced plastic/balsa sandwich structure with a single spar web and no ribs; the glassfibre spars are joined at the fuselage by a tongue/fork type of junction which was later to be adapted in a number of other sailplane designs. The mass-balanced ailerons are linked differentially with the flaps, and there are Hütter air brakes, each 8ft 2½in long, forward of the flaps. The wing leading edge has a compartment for water ballast, of which 110lb can be carried. The fuselage is an all-glassfibre monocoque with balsa and synthetic foam and an integral fin; and the rest of the tail unit is of the same type of construction as the wings. The pilot sits in a semi-reclining position under a rearward-sliding one-piece canopy to reduce fuselage cross-section and hence drag, and a slightly higher canopy could be fitted if the customer so desired; there is provision for radio and oxygen, and the seat backrest and rudder pedals are adjustable in flight. The monowheel is mounted on a glassfibre shock absorber and has a brake; it is supplemented by a sprung tailskid or tailwheel.

Glasflügel H 201 Standard Libelle FGR

Data: H 201B
Span: 49ft 2½in
Length: 20ft 4in
Height: 4ft 4in
Wing area: 105.5sq ft
Aspect ratio: 23.0
Empty weight: 408lb
Max weight: 772lb
Max speed: 155mph (smooth air)
Min sinking speed: 1.96ft/sec at 46.5mph
Best glide ratio: 38:1 at 53mph

As its name implies, the Standard Libelle is a version of the popular Open Class H 301 Libelle with modifications to meet the Standard Class requirements; these consisted of removing the flaps and tail braking parachute, fitting a fixed instead of retractable monowheel and raising the height of the canopy. A new Wortmann wing section is featured and terminal velocity dive brakes are fitted. The canopy is unusual in having a catch that enables the front to be raised by 25mm in flight to provide a blast of ventilating air if required, instead of the more conventional small sliding panel used for this purpose. When the Standard Class rules were modified in 1970, a retractable monowheel was substituted for the fixed one. The Standard Libelle is of similar glassfibre construction to the H 301 Libelle, and likewise has provision for 110lb of water ballast in the wing leading edge. The prototype made its first flight in October 1967 and the Standard Libelle proved to be very popular, a total of 601 being built altogether. The type soon made its mark in contest flying; one flown by Per-Axel Persson of Sweden, winner of the 1948 World Championships, came second in the Standard Class at the 1968 World Championships at Leszno in Poland.

The H 101 Salto is a version of the Standard Libelle developed by Frau Ursula Hänle, widow of Ing Eugen Hänle, the former Director of Glasflügel; the Salto (this word is German for loop) is produced by Start + Flug GmbH formed by Frau Hänle, and differs from the Standard Libelle largely in having a V-tail with an included angle of 99°. The Salte also owes something to the V-tailed Hütter H-30 GFK. Four flush-fitting air brakes repositioned on the wing trailing edges replace the more conventionally-sited air brakes of the Standard Libelle; the Salto's air brakes are hinged at their mid-points so that half the surface projects above the wing and half below. The Salto prototype first flew in March 1970 and 60 had been delivered by the spring of 1977; German type



Glasflügel H 201 Standard Libelle.

certification was granted on 28 April 1972 and the Salto has also been certificated by the FAA as well as Germany in the Normal and Aerobatic catergories. The wing span is 13.6m (44ft 7½in) but a 15m (49ft 2½in) span wing can be fitted optionally for Normal category operation; the former wing has an area of 92.35sq ft and an aspect ratio of 21.8. The landing gear consists of a fixed monowheel with a fairing, and a tailskid, and the one-piece canopy is hinged to open sideways.

Glasflügel 205 Club Libelle

FGR

Span: 49ft 2½in
Length: 21ft 0in
Height: 4ft 7in
Wing area: 105.5sq ft
Aspect ratio: 23.0
Empty weight: 441lb
Max weight: 727lb
Max speed: 124mph
Min sinking speed: 1.84ft/sec at 42mph
Best glide ratio: 35:1 at 56mph

The Libelle and Standard Libelle had proved to be so popular that the need was recognised for a development of these designs suitable for club training, especially for conversion training to the modern high performance glassfibre types in both Standard and Open Classes, and also for advanced cross-country soaring in preparation for Diamond C flights. Good handling characteristics and ease of landing away from base for the less experienced pilot were also necessary, and these were the qualities the designers sought in the Club Libelle. This was based on the Standard Libelle, differing from it principally in having new shoulder-mounted

Glassflügel 205 Club Libelle.

wings with a double taper, and a T-tail. The prototype Club Libelle made its first flight in September 1973 and a total of 171 had been built when production ended in August 1976. The two-piece wings are of glassfibre reinforced plastic (GRP) foam section with spar flanges of parallel glassfibre and spar webs of GRP-balsa, and the trailing edge flaps also act as air brakes. The fuselage is an all-glassfibre monocoque with no balsa or other type of sandwich, and there is a fixed monowheel with a brake. The cockpit is roomier than the Standard Libelle's, although the one-piece canopy is shorter, and, unlike the Libelle and Standard Libelle, the Club model does not carry water ballast.

Glasflügel Kestrel 17

FGR

Data: Glasflügel Kestrel 17
Span: 55ft 9¼in
Length: 22ft 0½in
Height: 5ft 0in
Wing area: 124.8sq ft
Aspect ratio: 25.0
Empty weight: 574lb
Max weight: 882lb
Max speed: 155mph
Min sinking speed: 1.80ft/sec at 46mph
Best glide ratio: 43:1 at 60.5mph

The 17m span Kestrel high performance Open Class single-seater was designed to meet the demand for a successor to the Libelle variants with a longer wing span and roomier cockpit; it was known originally as the 17m Libelle and has a new fuselage and wing profile and a T-tail. The prototype Kestrel first flew at Karlsruhe-Forchheim on 9 August 1968 and production deliveries began the following year, reaching a total of 129 by January 1978. The Kestrel 17 has several records to its credit, including the 100km closed circuit speed record of 102.74mph set by K. B. Briegleb of the USA on 18 July 1974 (since broken by an AS-W 17), and the ladies' 300km closed circuit speed record of 71.1mph set up by Susan Martin of Australia on 11 February 1972. The cantilever two-piece shoulder wings are of glassfibre and balsa and/or foam sandwich construction, with unidirectional glassfibre spar caps and glassfibre and balsa shear webs. High lift camber-changing flaps are featured which operate in conjunction with the ailerons between −8° and +12°, and can be lowered to 35° for a landing; both ailerons and flaps are partially mass-balanced. Up to 99lb of water ballast can be carried. There are flush fitting air brakes on the wing upper surfaces, and also a tail braking parachute which can be streamed for short-field landings. The monocoque fuselage is entirely of glassfibre (not sandwich) construction, and to cure a small airflow separation problem at the wing root fuselage junction at low speeds large wing root fillets were added to production aircraft; these were actually developed by Vickers-Slingsby, who built the Kestrel 17 under licence. The Italian firm of Glasfaser Italiana SrL has also built 25 Kestrel 17s, as well as 130 complete fuselage assemblies for the Kestrel. The Kestrel 17 tail unit is similar in construction to the wings, the fixed T-tail being secured by three attachments. Both the elevator and rudder are mass balanced. The monowheel is retractable, with an internally expanding brake, and there is an interchangable tailwheel or tailskid.

After Slingsby Aircraft Company Ltd had gone into liquidation in July 1969 the firm was reorganised as part of the Vickers Group, at first as Slingsby Sailplanes, later trading as Vickers-Slingsby and now as Slingsby Engineering Ltd. It was decided in September 1969 to produce a modern glassfibre design, and a licence to build the Kestrel was negotiated with Glasflügel. Construction of the first Slingsby-built T 59 Kestrel 17 began in March 1970, and it first flew on 15 August that year at Rufforth, Yorkshire; a total of 101 Kestrels had been built by Vickers-Slingsby by the end of 1974, plus two 22m span T 59H Kestrel 22s. Most of these have been 17m span versions, the first 19m span Kestrel, the T 59B, being flown by Mr G Burton in the 1970 World Championships in Texas. The next 19m version was the T 59C, which had a carbon-fibre main spar and first flew on 7 May 1971. This was followed by the T 59D of the same span, which first flew in July 1971, the extra span being in the form of 0.5m at each wing root and 0.5m at each wing tip. The T 59D also featured a larger fabric-covered rudder and an anti-balance tab in the elevator.

Glasflügel Kestrel 17.

Glasflügel 206 Hornet

FGR

Span:49ft 2½in
Length: 21ft 0in
Height: 4ft 7in
Wing area: 105.5sq ft
Aspect ratio: 23.0
Empty weight: 500lb
Max weight: 926lb
Max speed: 155mph
Max aero-tow speed: 93mph
Min sinking speed: 1.97ft/sec at 47mph
Best glide ratio: 38:1 at 47mph

The Hornet is a derivative of the popular Club Libelle, differing from it chiefly in having an enlarged, longer two-piece flush-fitting cockpit canopy hinged at the front and rear, a retractable instead of fixed monowheel, and provision for up to 165lb of water ballast. The prototype made its first flight on 21 December 1974 and a total of 90 Hornets had been delivered by the summer of 1979. This Standard Class mid-wing design has, like the Club Libelle, a T-tail and the entire structure is of glassfibre monocoque, glassfibre/foam sandwich and glassfibre/balsa sandwich. The mid wing has a different incidence to improve high speed performance. Rotating air brake-type flaps and partially mass-balanced ailerons are on the wing trailing edges, and the elevator has a spring trim. The unsprung monowheel has an internally-expanding brake, and there is a fixed tailwheel. The Hornet C introduced in 1979 has a carbon-fibre torsion box to each wing, with carbon-fibre spar caps and a wing skin of carbon-fibre/plastic foam sandwich; the lighter weight of these wings allows the water ballast capacity to be increased to 375lb. The wing root fairings are modified and the C has the same one-piece cockpit canopy as the Glasflügel Mosquito. The prototype Hornet C first flew on 6 April 1979.

Glasflügel Hornet.

Glasflügel 303 Mosquito

FGR

Data: Mosquito
Span: 49ft 2¼in
Length: 21ft 0in
Height: 4ft 7in
Wing area: 105.5sq ft
Aspect ratio: 22.8
Empty weight: 529lb
Max weight: 992lb
Max speed: 155 mph (smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 2.26ft/sec at 58.5mph
Best glide ratio: 42:1 at 71mph

This Unrestricted 15m Class single-seater is, like the Hornet, a development of the Club Libelle and differs from the earlier Hornet chiefly in having carbon-fibre mass-balanced ailerons, and a new flap/spoiler/air brake system. Design of the Mosquito was started in the summer of 1975 and the prototype first flew in March 1976; a total of 90 Mosquitos had been delivered by January 1978. It was the first type to go into production after the reorganisation of the Glasflügel company under the name Holighaus & Hillenbrand GmbH & Co K.G following the death of its Director, Ing Eugen Hänle, on 21 September 1975. Dipl-Ing Klaus Holighaus, the Director of Schempp-Hirth and Herr Hillenbrand of Glasflügel formed the present company, which now has the world's largest sailplane production capacity, continuing to market them under the Glasflügel name. The Mosquito's

Glasflügel 303 Mosquito.

construction is generally similar to the Hornet, except for the ailerons, and up to 253lb of water ballast can be carried. The new flap/air brake system was developed jointly by Klaus Holighaus and Eugen Hänle; conventional camber-changing trailing edge flaps act in conjunction with spoilers immediately ahead of them in the wing upper surface to act as a trailing edge air brake. The normal flap lever lowers the flaps and droops the ailerons in conjunction with them, while there is a second lever for the spoilers or brake flaps. As this is pulled, the spoilers start to open and further backward movement movement of this lever moves the flaps further downwards as well as opening the spoilers further. The latter can be opened or closed at any time like the more conventional Schempp-Hirth type air brakes fitted to other sailplanes. The tailplane at the top of the fin is fixed incidence, and the elevator has spring trim. The retractable unsprung monowheel has an internally expanding brake, and there is a fixed semi-recessed tailwheel. The one-piece canopy is raised by the pilot to hinge forward onto the nose tip for exit. Mr Humphrey Dimock, who runs the Royal Naval Gliding Club at Lee-on-Solent in Hampshire, has fitted a Mosquito with a 36-cell solar panel in the cockpit to charge a German Dry-Fit 14 volt battery at a rate of 0.46A when in sunlight; spare capacity generated by the panel can power blind-flying instruments if necessary and there is a cut-out to prevent overcharging. The panel weighs only a few ounces and is mounted directly in front of the pilot edge-on to his line of sight so as not to restrict visibility. Following the success of this panel Mr Dimock planned to fit 10 solar cells in a 5ft x 3½in strip along the top of the fuselage under a perspex fairing.

Glasflügel began building the prototype of a new version, the Mosquito B, in September 1977. This differs from the standard Mosquito in having glassfibre reinforced plastic ailerons, no fuselage/wing root fairings, a reduced wing span and a tailplane of reduced span. Empty weight is reduced to 518lb but maximum weight and performance are the same as the standard Mosquito. First flight was on 24 March 1978 and about 90 Mosquito Bs had been delivered by January 1980.

Glasflügel 304

FGR

Span: 304 49ft 2½in
402 55ft 9¼in
Length: 21ft 2in
Height: 4ft 5½in
Wing area: 304 106.35sq ft
402 114sq ft
Aspect ratio: 304 22.78
402 27.3
Empty weight: 518lb
Max take-off weight: 992lb
Max speed: 156mph (smooth air)
Min sinking speed: 2.26ft/sec at 58mph
Best glide ratio: 43:1 at 72mph

Intended to succeed the Mosquito B, the 15m span Glasflügel 304 single-seater is a new design very similar to the Mosquito, work on which began in the autumn of 1979 by a team under Martin Hansen. The prototype, D-9304, first flew on 10 May 1980. It employs a new 16.4% thickness/chord ratio wing profile developed by Akaflieg Braunschweig and extensively tested and refined on a Mosquito. Construction is of glassfibre, with no carbon-fibre employed, although the 304/17 (now known as the Glasflügel 402), which has detachable wing tips to give a span of 17m, has largely carbon-fibre wing tips. The fuselage is similar to the Mosquito's but with a more pointed nose; the monowheel is retractable. An unusual feature is that the instrument panel can be tipped up, together with the front-hinged upwards opening canopy, with which it is integral, to allow the pilot more unobstructed entry. Up to 253lb of water ballast can be carried. Production of the 304 started in the spring of 1981, and it will soon be followed by a carbon-fibre version, while there are plans for a motor glider variant.

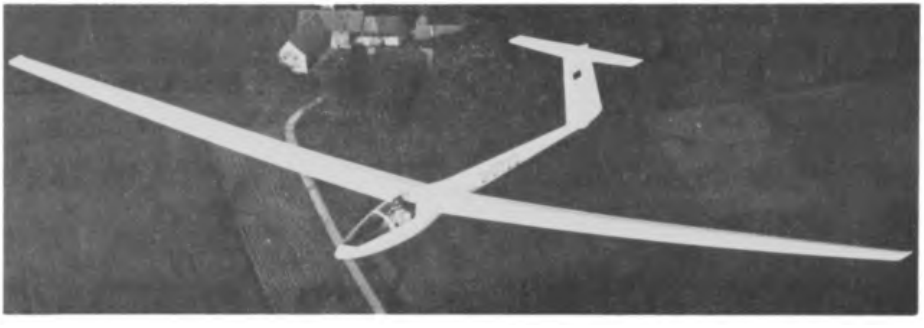
Glasflügel 604

FGR

Span: 72ft 2in
Length: 24ft 11¼in
Height: 5ft 5¾in
Wing area: 174.7sq ft
Aspect ratio: 29.8
Empty weight: 992lb
Max weight: 1,433lb
Max speed: 155mph (smooth air)
Min sinking speed: 1.64ft/sec at 45mph
Best glide ratio: 49:1 at 61mph

The 604 high performance single-seater is a 22m span version of the Kestrel 17, and in fact originated as a design study for a similar two-seater sailplane. The prototype made its first flight in April 1970, only four months after construction began, and took part in the 1970 World Gliding Championships at Marfa, Texas, taking sixth place; it later took second place in the 1974 World Championships at Waikerie, Australia. Only 10 604s were built but the type gained a number of competition successes and has set several world and national records, including one for speed over a 300km triangle, set by W. Neubert of West Germany in Kenya in March 1972 with a speed of 95.3mph, and the ladies' 100km triangular speed record of 79.1mph set by Adele Orsi of Italy in August 1975. The 604's wing consists of a centre section incorporating the fuselage top, and two outer panels joined to the centre section by the Hütter-Hänle method. The fuselage is 5ft 5in longer than the Kestrel 17's to give improved directional control with the longer span wing; the cockpit canopy, which is slightly shorter than the Kestrel's, is hinged to open upward and aft. There is a manuallly retractable monowheel with a brake, and a fixed tailwheel. Structurally the 604 is very similar to the Kestrel 17, and can carry up to 220lb of water ballast. Vickers-Slingsby has developed a similar 22m span version the Kestrel 17 known as the T 59H Kestrel 22 via the 19m span T 59D Kestrel 19.

Glasflügel 604.



Grob G-102 Astir CS

FGR

Data: Astir CS 77
Span: 49ft 2½in
Length: 21ft 11¼in
Height: 4ft 7in
Wing area: 133.5sq ft
Aspect ratio: 18.2
Empty weight: 595lb
Max weight: 992lb
Max speed: 155mph
Max aero-tow speed: 105mph
Min sinking speed: 1.97ft/sec at 47mph
Best glide ratio: 38:1 at 65mph

This high performance Standard Class single-seater is designed and produced by the German firm of Burkhart Grob Flugzeugbau GmbH, who also built the Schempp-Hirth Standard Cirrus under licence during 1972-75. The Astir CS (Club Standard) is intended for clubs and private owners looking for a modern all-glassfibre design that is easy to fly and has a roomy cockpit. Construction of the prototype Astir CS began in March 1974, and it first flew on 19 December that year; it went into production in July 1975 and soon proved to be popular, a total of 534 having been delivered before being succeeded by the Astir CS 77. The Astir was offered in two versions, the Standard Astir and Club Astir, the latter having a non-retractable monowheel and no provision for water ballast. The current standard version, the Astir CS 77, has a new slimmer and larger fuselage and modified tailplane actuation and made its first flight on 26 March 1977; nearly 400 of the CS 77 and Club Astir had been built by the end of 1978. The cantilever mid wings have glassfibre roving main spars and a glassfibre/epoxy resin sandwich skin except for the ailerons, which are of glassfibre sandwich. There are Schempp-Hirth aluminium air brakes in the wing upper surfaces, but no flaps, and up to 220lb of water ballast can be carried in tanks in the wings, being jettisoned via a dump valve in the fuselage. Rigging is carried out without any separate removable parts as the wings

and the tailplane are attached by a system of 'snap-lock' connectors. The glassfibre semi-monocoque fuselage has a towing/launching hook, and the large one-piece cockpit canopy opens sideways to starboard. Construction of the T-tail unit is the same as that of the wings. The Astir CS 77 has a retractable monowheel with an internally-expanding drum brake, which folds up behind closed doors, and there is also a rubber-sprung tail wheel. The Astir CSM was a powered version under development in mid-1976 with a 25hp Fichtel & Sachs Wankel KM24 rotating piston engine on a retractable pylon aft of the pilot, driving a two-blade Hoffman tractor propeller. A 6.6 gal fuel tank is fitted.

The Club Astir II and the Standard Astir II featured the new fuselage of the Speed Astir II. with a one-piece canopy, as well as the elasticated flaps of the Speed version and a new wing tip profile. Current production variants are the Club Astir III, IIIB and Standard Astir III, which have a roomier cockpit and reduced empty weight. The IIIB has its monowheel further aft and a small wheel added under the cockpit to improve ground handling.

Grob G-103 Twin Astir

FGR

Span: 57ft 5in
Length: 26ft 8¾in
Height: 5ft 3in
Wing area: 192.7sq ft
Aspect ratio: 17.1
Empty weight: 860lb
Max weight: 1,367lb
Max speed: 155mph (smooth air)
Max aero-tow speed: 105mph
Min sinking speed: 2.40ft/sec at 56mph
Best glide ratio: 38:1 at 68.5mph

This is the tandem two-seater version of the Astir CS, differing from it principally in having a fuselage lengthened by 9¾in to accommodate the second seat, and also reduced in depth by 1½in; wing span has been increased to 17.5m (57ft 5in) and the wings are now swept forward 3° 18'. Dual controls are provided under the two individual canopies, and the Twin Astir is offered to customers both with and without the basic instruments in the front cockpit and with or without water ballast, of which up to 198lb can be carried. Design of the Twin Astir began in September 1974 and construction of the prototype was commenced in March 1976; this made its first flight on 31 December 1976. By the end of 1978 over 225 Twin Astirs had been delivered; production has now ended. The type is also known as the Twin Astir Trainer when used for this task. The Twin Astir has the same mid wing position and T-tail as its single-seat counterpart, and is of the same glassfibre construction. Unlike many two-seaters which have fixed landing gear, the Twin Astir at first had a retractable monowheel but because the rear seat, positioned on the centre of gravity, takes up the space that would normally be used for retraction the wheel is rotated sideways through 90° to fit in horizontally under the rear seat; the monowheel is now fixed.

Grob G-103 Twin II

FGR

Span: 57ft 5in
Length: 26ft 10in
Height: 8ft 1in
Wing area: 191.6sq ft
Aspect ratio: 17.2
Empty weight: 794lb
Max take-off weight: 1,278lb
Max speed: 155mph (smooth air)
Max aero-tow speed: 105mph
Min sinking speed: 2.10ft/sec at 50mph
Best glide ratio: 37:1 at 65mph

Formerly the G118, the Twin II is a new tandem two-seater for training and club use to succeed the Twin Astir, from which it differs in having a narrower and more streamlined fuselage, improved cockpit layout and larger canopies, lower-set wings, a fixed monowheel plus a small wheel (likewise semi-recessed) under the forward cockpit and a tailwheel, downturned wing tips and reduced empty weight. The same type of elasticated flaps as featured on the Speed Astir are fitted, and the T-tail is similar to the Twin Astir's. Unlike the latter, no water ballast is carried. The Twin II first flew late in 1979.

Grob G-104 Speed Astir II

FGR

Data: Speed Astir II
Span: 49ft 2½in
Length: 21ft 11¼in
Height: 4ft 2in
Wing area: 123.5sq ft
Aspect ratio: 19.6
Empty weight: 584lb
Max weight: 1,135lb
Max speed: 168mph (smooth air)
Min sinking speed: 1.97ft/sec at 47mph
Best glide ratio: 41.5:1 at 74.5mph

This single-seater Unrestricted 15m Class version of the Astir is generally similar to the Astir CS 77 except for wings of reduced area and different section, which have carbon-fibre spars and are fitted with so called 'elastic flaps' in which the gaps between the flap and the wing trailing edge are elastically sealed; these flaps can be deflected upwards to act as air brakes as well as downwards, and the ailerons can be drooped with the flaps. The Speed Astir has the same cantilever mid-wing and T-tail as the Astir, but with a shorter fin and rudder and constructionally it

Grob G-104 Speed Astir II.

is the same as its predecessor. The water ballast capacity has been increased to 330lb. After 25 of the original Speed Astirs had been built, production switched to the Speed Astir II which first flew on 11 November 1978. This had a new and slimmer laminar flow fuselage, with carbon-fibre reinforcements in high stress areas, and a two-piece canopy, the rear section of which hinges to open aft. In October 1979 the cockpit was lengthened by nearly 8in to accommodate taller pilots, and the Speed Astir IIB has carbon-fibre spars. From the same date the Speed Astir II 17.5, a version with a longer span of 17.5m, was due to become available. Altogether 98 Speed Astir IIs had been built by December 1979 and the type is currently out of production.

Grunau Baby

FGR

Data: Baby 2B
Span: 44ft 6¼in
Length: 19ft 11¾in
Wing area: 152.9sq ft
Aspect ratio: 13.0
Empty weight: 375lb
Max weight: 551lb
Max speed: 93mph
Min sinking speed: 2.8ft/sec at 34mph
Best glide ratio: 17:1 at 37.5mph

One of the classic training sailplane designs, the Grunau Baby occupies much the same sort of place in gliding history as types like the Tiger Moth and Avro 504 do in the annals of powered flight instruction. It was the type in which many prewar and wartime pilots learnt their basic skills, and in

Grunau Baby 2. J. M. G. Gradidge

which many prewar holders of the Silver C gained their certificates. By 1930 interest in gliding was already widespread in Germany, and pilots had begun to explore the techniques of soaring and the use of thermals to make long cross-country flights. There was a need for a glider which would be suitable both for training and high performance cross-country flying, and to meet this need Wolf Hirth and Edmund Schneider designed and built the Grunau Baby, which made its first flight in 1932; it took its name from the town of Grunau just south of Berlin where it was built. This single-seater was of simple wood and fabric construction with a high strut-braced wing, a plywood fuselage of hexagonal cross-section and an open cockpit ahead of the wing leading edge. In its initial form the Baby's span was 42ft 2½in but two years later the Baby 2 was produced with the wing span increased to 44ft 6¼in. This was followed by the Baby 2A and 2B in which the retangular cross-section fuselage was strengthened with double layers of diagonal plywood; there was now a windscreen to protect the pilot. About 80 Mk 1s and around 700 Mk 2A and 2B variants were built by Grunau Riesengebirge, and the Baby was built under licence in a number of other European countries, production eventually totalling several thousand. Among the licensees were Slingsby, who built 15 at their Kirkbymoorside works from 1935 as the T 5 Baby 2, and some others were also built by amateur constructors from BGA-supplied plans. The Slingsby-built ones had no air brakes whereas Elliott's version, known as the Type 8 Baby Eon, had spoilers in the wing upper surfaces. The Baby Eon was an improved version of the Baby 2B, and had an enclosed cockpit canopy; instead of the German-built Baby's single main landing skid, the Elliott version had a rubber-mounted ash main skid with a single main wheel of fixed centre, plus a tail skid. It was also available with an open cockpit as well as an enclosed 'bubble' canopy; an elevator trimmer and a belly hook for higher winch launching were offered as optional extras. Production of the Baby Eon began in 1948 and 47 were built altogether, plus several more from Elliott factory-supplied kits. An improved variant of the Baby Eon, incorporating a new tailplane and mass-balanced elevators, first flew in 1956 while another improved postwar variant was the Grunau Baby 3, which had several modifications over the earlier Mk 2, including an enclosed cockpit. When Edmund Schneider, the Baby's co-creator and manufacturer, moved to Australia after the war and formed his own company there at the invitation of the Gliding Federation of Australia, he produced the final improved version, the Grunau Baby 4. In Finland in 1949 Mr Pentti Alanne and Mr Vilho Swahn fitted a Grunau Baby with a French Poinsard engine in the nose, and a landing gear similar to a Piper Cub's.

Haig Minibat

USA

Span: 25ft 0in
Length: 9ft 0in
Height: 4ft 0in
Wing area: 62.5sq ft
Aspect ratio: 10.0
Empty weight: 80lb
Max weight: 300lb
Max speed: 126mph
Min sinking speed: 3.0ft/sec at 35mph

Resembling the French Fauvel AV 221 in basic configuration, the N44MB Minibat tailless single-seater was designed and built by 44-year-old aircraft designer Larry Haig of Muskegon, Michigan, over a three-month period at a cost of $3,500, and made its first flight on 11 March 1979. It is constructed of Kevlar, carbon-fibres and foam sandwich with glassfibre covering and is designed for amateur construction; it was planned to offer kits for the homebuilder to be available towards the end of 1979, and assembly is said to require only 5-10 days using pre-moulded parts. A powered version is planned using a 3hp chain saw sustainer engine mounted behind the cockpit and driving a pusher propeller mounted in a slot between the fin and rudder.

Haig Minibat. Howard Levy

Hegetschweiler Moswey

Switzerland

Data: Moswey III
Span: 45ft 11in
Length: 19ft 8in
Height: 4ft 7in
Wing area: 141sq ft
Aspect ratio: 15.0
Empty weight: 353lb
Max weight: 551lb
Max speed: 130mph
Min sinking speed: 2.1ft/sec at 37.5mph
Best glide ratio: 27.5:1 at 43.5mph

Before the war and during the 1940s the best-known sailplanes to emerge from Switzerland were the Moswey range of training and competition single-seaters designed by Georg Müller and produced by the Hegetschweiler firm. The Moswey 1 trainer of 1930 was a braced high wing glider of 43ft 6in span, and this was followed in 1935 by the Moswey II, which had cantilever shoulder-mounted gull wings of 45ft 3in span. This was of conventional plywood and fabric construction, and in 1937 the Moswey II was among the types participating in the first International Competition to be held at the Wasserkuppe in Germany. The Moswey IIA had the wing span increased to 49ft 10in and the Moswey III, which first flew in October 1943, had the span reduced again to 45ft 11in for aerobatic training. In 1948 a Mk III piloted by Alwin Kuhn took third place in the World Championships at Samedan in Switzerland, and that same year one flown by Siegbert Maurer made the first sailplane crossing of the Alps from north to south. After the war a Moswey III set the first world record for speed over a 100km triangle, and this variant captured most of the Swiss national records of early postwar years. In 1950 the Mk III was succeeded by the Moswey IV, which had a span increased to 47ft 3in, a roomier cockpit and an enlarged one-piece Plexiglas canopy which gives excellent visibility. There are air brakes in the wing upper and lower surfaces, and landing gear consists of a nose skid and a monowheel plus a tail bumper fairing. Ten of the 14 Moswey IIIs built were still on the Swiss register at the beginning of 1964, plus one Moswey II, three Mk IIAs and a Mk IVA.

Hegetschweiler Moswey II.

Horikawa H-22B-3

Japan

Data: H-22B-3
Span: 40ft 1in
Length: 23ft 0in
Wing area: 180.8sq ft
Aspect ratio: 8.87
Empty weight: 375lb
Max weight: 661lb
Max speed: 75mph (in smooth air)
Min sinking speed: 3.80ft/sec at 34mph
Best glide ratio: 14.2:1 at 41.5mph

One of the earliest postwar Japanese gliders, the H-22B-3 two-seater primary trainer was designed by Mr Ikuo Horikawa and first flew in August 1953; it was put into small scale production by the Hagiwara Glider Co Ltd (Hagiwara Kakkuki Seisakusho) and at least 30 were built. It is basically a larger version of the Dagling/Eon Primary formula, seating two in tandem in a fabric-covered steel tube nacelle with an open girder-type boom carrying the fabric-covered wooden tail unit; there is no fixed fin. The landing gear consists of a rubber-mounted skid and a non-retractable monowheel under the nacelle. The high wing is braced with V-struts on each side and has a constant chord of 4ft 7in; it is an all-wood two spar structure with fabric covering and has spoilers in the upper surface and fabric-covered wooden ailerons.

HS-2 Mrigasheer

India

Data: Mrigasheer second prototype
Span: 49ft 2½in
Length: 24ft 10¾in
Height: 8ft 2½in
Wing area: 121.0sq ft
Aspect ratio: 19.85
Empty weight: 522lb
Max weight: 738lb
Max speed: 132mph (in smooth air)
Max aero-tow speed: 71.5mph
Min sinking speed: 1.90ft/sec
Best glide ratio: 32:1

India has her own active gliding movement which is Government-sponsored and from time to time holds its own National Championships, but because India's shortage of foreign exchange has precluded the large-scale import of foreign gliders a number of indigenous types have been designed and produced at the Technical Centre of the Civil Aviation Department under the leadership of the Director-General, S. Ramamritham, making use of predominantly local materials in their construction. The first of these gliders, an open-cockpit primary type, made its first flight in November 1950 and since then the Technical Centre has built eight types of sailplane for Indian civil gliding clubs or centres, of which five were original designs. To succeed the earlier KS-II Kartik high performance single-seater the Technical Centre started design of another Standard Class sailplane known as the HS-1, which first flew in November 1970; this had a higher aspect ratio wing than the Kartik's with Wortmann wing sections instead of the earlier design's NACA 64-series aerofoils. This was further developed into the HS-2 Mrigasheer under a design team lead by Mr K. B. Ganesan the centre's Director of Research and Development, and the prototype of this made its first flight in April 1973. The following month it was flown into second place in the first Indian national gliding championships held at Kanpur. A second prototype, based on the aerodynamic design of the first, made its first flight in May 1977; this has trailing edge slotted flaps instead of the first prototype's upper surface air brakes, and a glassfibre reinforced plastic tailplane and elevators of different aerofoil section. The Mrigasheer is of plywood-covered wooden construction and the high wings are two-spar structures with a plywood leading edge torsion box and plywood covering aft of the main spar, the wooden flaps and ailerons being hinged on the rear spar. The semi-monocoque fuselage is plywood-covered, as is the fin, but the rudder is fabric covered. There is a retractable unsprung monowheel with a drum-type brake, as well as a rubber-sprung nose skid with a replaceable steel shoe and a similarly sprung tail skid. The pilot sits under a long forward-opening jettisonable one-piece canopy.

HS-2 Mrigasheer. John W. R. Taylor

ICA-Brasov IS-3D

Romania

Data: IS-3D
Span: 50ft 3½in
Length: 23ft 9½in
Height: 5ft 3in
Wing area: 164.6sq ft
Aspect ratio: 15.30
Empty weight: 485lb
Max weight: 754lb
Max speed: 150mph
Max aero-tow speed: 75mph
Min sinking speed: 2.23ft/sec at 40mph
Best glide ratio: 28:1 at 46mph

The ICA-Brasov or Intreprinderea de Constructii Aeronautice Brasov (Aircraft Construction Factory Brasov) is responsible for all sailplane development and production in Romania, and their principal designer is Professor Iosif Silimon, who has created a long series of sailplanes that are widely used in the national clubs; these are prefixed by the letters 'IS' which form the Professor's initials. Among the earliest of these was the IS-3D training or Standard Class single-seater, the prototype of which, the IS-3 Traian Vuia, was built in 1956 and which continued in production at Brasov until the early 1970s, being widely used in the Romanian clubs. This elegant design has a distinctive pointed top to the fin and rudder and is fitted with a drogue parachute for deployment in short-field landings. It is of conventional wooden construction with plywood and fabric covering, the single-spar high cantilever wings being plywood-covered from the leading edge to the spar and fabric covered aft of the spar to the trailing edge; there are air brakes in the wing upper and lower surfaces and wing tip 'salmon' fairings are fitted. The all-wood fuselage is of oval cross-section and the fin and tailplane are plywood-covered, the elevators and rudder being fabric covered; there is a Flettner-type trim tab in the starboard elevator. The landing gear consists of a fixed monowheel forward of the cg with a pneumatic tyre and mechanical brake, and a short nose skid and tailskid. The pilot sits under a large sideways-hinging cockpit canopy.

ICA-Brasov IS-8

Romania

Data: IS-8
Span: 43ft 9½in
Length: 24ft 1½in
Wing area: 166.3sq ft
Aspect ratio: 11.5
Empty weight: 463lb
Max weight: 882lb
Max speed: 112mph (in smooth air)
Max aero-tow speed: 74.5mph
Min sinking speed: 3.22ft/sec at 43.5mph
Best glide ratio: 23:1 at 53mph

This two-seater design was intended to fill the roles of training, solo flying and aerobactic flying and first flew in prototype form on 14 September 1960, duly going into service with the Romanian gliding clubs.

The IS-8 is of very similar plywood- and fabric-covered wooden construction to the IS-3, and is characterised by cantilever shoulder wings with a distinctive 7° forward sweep at the 25% chord line,and with a rectangular centre section and tapered outer panels. The wings are all-wood single-spar structures with a leading edge torsion box, 70% fabric covered, and the slotted wooden ailerons are plywood- and fabric-covered. The fuselage is a metal and plywood monocoque and has an air brake on each side of it, instead of in the more usual wing-mounted position. The wooden tail unit is also ply and fabric-covered and there is an unsprung non-retractable monowheel without a brake, and a rubber-mounted skid. The pilot and pupil sit in tandem under a moulded plastic canopy.

ICA-Brasov IS-28B2

Romania

Data: IS-28B2
Span: 55ft 9¼in
Length: 27ft 5¼in
Height: 5ft 10¾in
Wing area: 196.3sq ft
Aspect ratio: 15.8
Empty weight: 826lb
Max weight: 1,300lb
Max speed: 140mph (in smooth air)
Min sinking speed: 2.26ft/sec at 45mph
Best glide ratio: 34:1 at 62mph

Developed from the IS-28 two-seater high performance training sailplane of 1970, which first flew in August of that year, the IS-28B2 has a number of important differences from the earlier design which include 17m span all-metal mid wings of Wortmann section instead of the IS-28's 15m span shoulder wings of NACA section, a longer and more slender fuselage and reduced wing and tailplane dihedral. Design work on the IS-28B began in the autumn of 1971 and the prototype made its first flight on 26 April 1973. The first production version was the IS-28B1 which did not have wing flaps, but this has now been succeeded by the IS-28B2 which has trailing edge split flaps and Schempp-Hirth air brakes instead of the DFS-type ones of the B1. About 100 IS-28B2s have been sold so far, and a high proportion of this total have gone to customers in Australia and the USA. Both versions are of all-metal construction, as was the earlier IS-28, and the forward-swept wings have L-section main spar booms and dural spar webs, a dural auxiliary spar and dural ribs. The Schempp-Hirth air brakes above and below the wings are metal, whereas the ailerons and flaps are fabric covered except for their leading edges. The wings are attached to the fuselage by two adjustable tapered bolts at the leading edge and two fixed tapered bolts at the trailing edge. The forward and centre fuselage is an all-metal semi-monocoque structure, while the rear fuselage is a duralumin monocoque. The two pilots are seated in tandem under a one-piece Plexiglas canopy which opens sideways to starboard and can be jettisoned in flight. A nose towing hook with Tost cable release is standard, but a towing hook mounted on the cg is an optional choice for the customer. The folding cantilever all-metal T-tail is similar to the IS-28's but has a single-spar fin; the elevator trailing edges and rudder are fabric covered and there is a trim tab in each elevator. The landing gear consists of a semi-retractable monowheel with a disc brake and oleo-pneumatic shock absorber, and there is a sprung tailskid.

A new Open Class development of the IS-28B2 known as the IS-30 was undergoing flight tests in the spring of 1978; this has 18m (59ft 0¾in) span wings without provision for water ballast, and the redesigned tail unit of the IS-32.

ICA-Brasov IS-29

Romania

Data: IS-29D2
Span: 49ft 2½in
Length: 24ft 2½in
Height: 5ft 6¼in
Wing area: 111.9sq ft
Aspect ratio: 21.6
Empty weight: 518lb
Max weight: 794lb
Max speed: 155mph (in smooth air)
Min sinking speed: 1.41ft/sec at 50mph
Best glide ratio: 48:1 at 58mph

The IS-29, designed by a team under Dipl Ing Iosif Silimon, is an attempt to create a multi-role high performance single-seater suited to a variety of requirements and soaring conditions, and is offered in Standard Class (IS-29B and IS-29D) versions with 15m span wings, in Open Class form as the IS-29E with increased span wings and the IS-29G for club use with 16.5m span wings. All versions have an identical fuselage and tail unit, differing mainly in the wing fitted, and are basically similar to the IS-28B2 with the same all-metal construction and a similar T-tail. The IS-29B Standard Class version with 15m span all-wooden wings was the first to fly, in April 1970, and was certificated in September that year; the prototype has a three-piece wing with constant chord centre section and tapered outer panels, and 'salmon' fairings on the wing tips. The IS-29B was succeeded by the Standard Class IS-29D which had all-metal wings of the same span and first flew in November 1970. About 30 had been built by 1974 and from 1976 the current production version has been the IS-29D2, which features an improved cockpit and controls, Hütter air brakes, a separate tailplane and elevator instead of the earlier all-moving tailplane, and an improved rigging system. More than 60 of this variant have been sold in Australia and the USA and the IS-29D4, which appeared in 1977, had provision for water ballast. The Open Class IS-29E first flew in August 1971 with wings increased in span to 17.60m (57ft 9in), and fitted with flaps and Schempp-Hirth air brakes as well as integral water ballast tanks. The current production version of the E is the IS-29E3, also known as the IS-31, with 20m (65ft 7½in) span wings, and a 19m span (62ft 4in) version, the IS-29E2, was under development in 1977, while the IS-29E4 is a 24m span version. The club version is the IS-29G, also known as the IS-29D3, which has all-metal 16.5m span (54ft 1½in) wings; this first flew in 1972, and the E2 and E3 variants have slightly different Wortmann wing sections to those of the IS-29D2. All versions except the IS-29B have all-metal shoulder wings with a main spar, false rear spar and riveted dural skin. The full-span flaps and ailerons are coupled to operate in unison but the flaps can be disconnected for separate operation during landing. The D2's Hütter air brakes are in the upper surface of the wings only, those of the other models being in the upper and lower surfaces. The all-metal semi-monocoque fuselage is the same for all versions except for local variations at the wing attachment points, and there is a detachable glassfibre nosecap. The retractable monowheel has a brake and there is a fixed tailwheel. The cockpit canopy hinges side-ways to starboard and can be jettisoned in flight.

The IS-29D3 Club version has a fixed undercarriage and unpainted (all-chrome) finish. The IS-29D4 15m Class version has a maximum flap setting of 80° and air brakes, and will later be offered with 26.4 Imp gallons of water ballast.

The IS-29E2 19m span version has interconnected flaps and ailerons, and will be offered with 22 Imp gallons of water ballast. The IS-29E4 has a wing of 24m span made in four sections, with interconnected flaps and ailerons, and carries water ballast.

The IS-29DM and IS-29EM each have a 39hp Rectimo 4AR-1200 engine driving a Hoffman HO-V42 propeller; the fuel capacity is 6 Imp gallons. A retractable tubular-sprung Tost monowheel is fitted to these versions, plus a Tost tailwheel. Production IS-29DMs and IS-29EMs were due to become available from mid-1980.

The IS-33 racing version has interconnected flaps and ailerons on its 15m span wings, and is to be offered with 33 Imp gallons of water ballast.

The IS-31(E3) is a version of the IS-29 with 20m span wings and interconnected flaps and ailerons; it will be offered with 33 Imp gallons of water ballast. The prototype has flown but had not been certificated by mid-1979.

ICA-Brasov IS-29D. John W. R. Taylor

ICA-Brasov IS-32

Romania

Span: 65ft 7½in
Length: 27ft 5¼in
Height: 6ft 0¾in
Wing area: 158.0sq ft
Aspect ratio: 27.2
Empty weight: 771lb
Max weight: 1,300lb
Max speed: 144mph
Min sinking speed: 1.74ft/sec at 53mph
Best glide ratio: 46:1 at 61mph

First shown publicly at the Paris Air Show in June 1977, and making its first flight that same month, the IS-32 Open Class tandem two-seater is developed from the IS-28B2, having the same fuselage as the latter married to an entirely new wing of 20m (65ft 7½in) span with an improved aerofoil section, and a redesigned tail unit. The interconnected flaps and ailerons are also known as 'flaperons', the flaps working in conjunction with the ailerons in negative position for high speed cruising, and in the positive position for soaring in thermals, being disconnected for landing. Like the IS-28B2, Schempp-Hirth metal air brakes are fitted above and below each wing and there are water ballast tanks. A new landing gear is fitted, the main monowheel now being fully retractable instead of semi-retractable as on the IS-28B2. The one-piece tailplane has a new thinner section aerofoil. The IS-32 is of the same all-metal construction as the IS-28B2, and deliveries were due to commence late in 1978.

ICA-Brasov IS-32. John W. R. Taylor

Ikarus Kosava

Yugoslavia

Span: 62ft 9in
Length: 27ft 4in
Wing area: 227.4sq ft
Aspect ratio: 17.3
Empty weight: 741lb
Max weight: 1,268lb
Max speed: 136mph
Min sinking speed: 2.17ft/sec at 46.5mph
Best glide ratio: 33.5:1 at 54mph

The Kosava (or North Wind) was a high performance two-seater intended to replace the DFS Kranich then in use in Yugoslav clubs; its design was commissioned by the Yugoslav Flying Sports Organisation from Milos Ilic and Adrýan Kisóvec, and the prototype made its first flight in March 1953. A few weeks later Bozo Komac flew it to victory in the Yugoslav National Championships, and the type went on to win many prizes in contest flying in the two-seater class, taking first place in this category in the 1954 World Championships at Camphill, Bedfordshire, and second place in the 1956 World Championships at St Yan in France. Of conventional wood and fabric construction, the Kosava had a shoulder-mounted gull wing with a slight forward sweep at the leading edge and a more marked trailing edge sweep; the forward sweep served to maintain the cg at a suitable place when the Kosava was being flown solo. The ailerons were divided into inner and outer halves, and underwing spoilers were fitted, as well as trailing edge flaps which operated in conjunction with the ailerons, being used separately during landing. The second prototype Kosava was fitted with Schempp-Hirth air brakes. The two pilots are seated in tandem under a two-piece canopy and the landing gear consists of a single skid under the forward fuselage.

The Kosava-2 was a redesigned version intended for training from basic to advanced levels, including blind flying training, aerobatics and high altitude soaring. It features a new more streamlined fuselage with the pilots in tandem under a flush-fitting cockpit canopy divided by a centre frame; the two canopy sections are jettisonable, and there is provision for an oxygen system for the pilots. A retractable monowheel and tail bumper replaces the skid of the

earlier Kosava, and the fin and rudder are swept back and the mid-set tailplane's span increased, whereas the earlier Kosava's tail unit, fuselage and cockpit resembled those of the DFS Kranich it was designed to replace. The Kosava-2's wing is very similar in plan to the earlier Kosava's, but has dihedral from the roots and is of 18m span (59ft 0¾in), with one-piece ailerons, air brakes in the upper surfaces and no flaps.

Ikarus Kosava. Eric Wagner

Ikarus Meteor

Yugoslavia

Data: Meteor 60
Span: 65ft 7½in
Length: 26ft 5in
Wing area: 172.2sq ft
Aspect ratio: 25.0
Empty weight: 829lb
Max weight: 1,113lb
Max speed: 155mph (in smooth air)
Min sinking speed: 1.77ft/sec
Best glide ratio: 42:1 at 56mph

Yugoslavia has produced relatively few sailplane designs, but several of those that have appeared from this country have made their mark both in contest flying and on future sailplane design trends. Among these is the all-metal Meteor, designed in 1954 by Boris Cijan, Stanko Obad and Miho Mazovec, which team had earlier created the Orao II which had been flown into third place in the 1950 World Championships at Oerebro in Sweden. The Meteor high performance single-seater with its laminar flow wing, camber-changing flaps and very slim fuselage to give minimum cross sectional area set a pattern for the high performance types of today when it first flew from Belgrade on 4 May 1956. It soon made its mark in competition flying, taking fourth or fifth place in the Open Class in the World Championships of 1956, 1958 and 1960 and for a time it held the world speed records for the 100 and 300km triangular closed circuits. The ailerons are divided into inboard and outboard sections, of which the inner sections can be drooped in con-junction with the flaps for landing, and modified DFS-type air brakes are fitted in the wing upper surfaces. The semi-monocoque all-metal fuselage is built in two sections for ease of repair, the rear section being straight tapered with stringers and a stressed skin. The landing gear consists of a bow-shaped front skid that extends some way out from under the forward fuselage, and a retractable monowheel with brake. The pilot is seated under a detachable one-piece canopy.

Ikaris Meteor. Eric Wagner

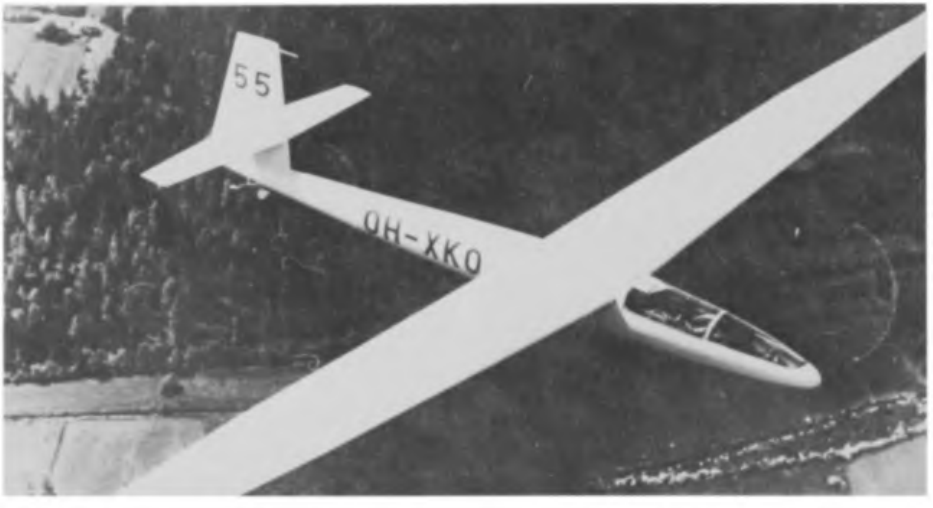
IKV-3 Kotka

Finland

Span: 59ft 8½in
Length: 25ft 5in
Height: 6ft 6½in
Wing area: 183sq ft
Aspect ratio: 19.0
Empty weight: 749lb
Max weight: 992lb
Max speed: 155mph (in smooth air)
Min sinking speed: 1.74ft/sec at 43.5mph
Best glide ratio: 38:1 at 62mph

This Finnish high performance single-seater was designed by Mr Tuomo Tervo and Mr Jorma Jalkanen, whose earlier designs included the PIK-16C Vasama and Havukka sailplanes. Design work on the Kotka (or Eagle) began in December 1964 and the prototype was built by members of the Aeroclub Vasama or IKV, in association with K.K. Lehtovaara O/Y, construction starting in mid-1965; the Kotka made its first flight in May 1966; the type was later going to be put into series production by Ilmailukerho Vasama, but only the prototype was built. On 26 May 1968 a Kotka flown by Seppo Hämäläinen set up a Scandinavian goal-and-return record distance of 374 miles. The Kotka is of conventional wooden construction with some use made of plastic foam and glassfibre; the cantilever shoulder wing is a box-type single-spar wooden structure from almost the leading edge to the 55% chord line and entirely plywood-skinned, with a small number of wooden or plastic foam ribs at the trailing edge, and a glassfibre leading edge. Both the plain ailerons and the flaps are of plywood covered plastic foam construction. There are two pairs of light alloy air brakes in each wing, on the upper and lower surfaces. The wooden fuselage is glassfibre-covered from the nose to the wing trailing edge, and plywood-skinned aft of the wing. Some plastic foam is employed in the wooden tail unit, the variable incidence tailplane and fin being plywood covered and the rudder and elevators fabric covered. There is a mechanically retractable monowheel with drum-type brakes and also a detachable tailwheel for ease of ground handling. The pilot is seated in a semi-reclining and adjustable seat under a long, flush-fitting cockpit canopy which, together with the tall angular fin, gives the Kotka a distinctive appearance. The instrumentation is of a high standard, with radio, an oxygen system, a central electric control panel and a landing gear warning system being provided.

IKV-3 Kotka. Pentti Lehto



IPD Urupema

Brazil

Span: 49ft 2½in
Length: 24ft 8½in
Height: 4ft 11½in
Wing area: 129.2sq ft
Aspect ratio: 18.75
Empty weight: 507lb
Max weight: 683lb
Max speed: 159mph (in smooth air)
Min sinking speed: 2.1ft/sec at 48mph
Best glide ratio: 36:1 at 58.5mph

This very sleek Brazilian high performance Standard Class single-seater was designed by a group of engineers and students at the Centro Tecnico de Aeronautica (CTA) of the Instituto de Pesquisas e Desenvolvimento (IPD) under the leadership of Mr

IPD Urupema.

Guido Pessotti; the IPD had also worked on powered aircraft and had produced the little 8m (26ft 3in) span Periquito II single-seater sailplane which had first flown in 1957 and of which three production examples were built. Also known as the PAR-6505 from the letters PAR signifying the IPD's Departamento de Aeronaves, design work on the Urupema started in 1964 and construction of the prototype began the following year; it first flew on 20 January 1968 and took part in that year's World Gliding Championships at Leszno in Poland and in the 1970 World Championships at Marfa, Texas, where it was placed 22nd out of 40 competitors in the Standard class. After flight tests were completed, production of a batch of 20 Urupemas began in January 1971 at the works of Embraer, the major Brazilian aircraft manufacturer, under the designation EMB-400. The cantilever shoulder wings have a forward sweep of 1° 22' at the quarter-chord line and are of wood/paper honeycomb/wood sandwich construction, as are the ailerons; DFS air brakes are fitted. The wooden semi-monocoque fuselage has a nose section of plywood/plastic foam/plywood sandwich construction. The tail unit is also of wood and honeycomb paper sandwich construction like the wings, and the tailplane is a one-piece all-moving surface with automatic anti-balance tabs. There was a non-retractable BF Goodrich monowheel with brake mounted ahead of the cg on the prototype, but production aircraft have a retractable monowheel. The pilot sits in a semi-reclining seat under a long one-piece flush-fitting cockpit canopy, and optional 'extras' include a battery-operated electrical artifical horizon and a Bertea transceiver.

IPE 02 Nhapecam

Brazil

Data: 02
Span: 54ft 5½in
Length: 25ft 11in
Height: 4ft 11in
Wing area: 170.1sq ft
Aspect ratio: 16.6
Empty weight: 551lb
Max weight: 1,058lb
Max speed: 124mph (in smooth air)
Min sinking speed: 2.13ft/sec
Best glide ratio: 30:1 at 50mph

The 02 tandem two-seater, known as the Nhapecam, is the second training sailplane from the Brazilian firm of IPE – Industria Paranaense de Estruturas at Curitiba, and has been under development for some months; it made its first flight on 24 May 1979. The 02 is a cantilever shoulder wing monoplane with a modified Scheibe SF-30 Club-Spatz wing section; it is rather larger than the Quero Quero II, with a span of 16.60m (54ft 5½in), a longer, more pointed nose and a lengthened one-piece cockpit canopy under which the two pilots sit. There are spoilers in the wing upper and lower surfaces, and the landing gear consists of a non-retractable monowheel and a tailwheel. A powered version of the 02, the IPE 03, is under development; this has a repositioned low wing and a retractable landing gear, and the 60hp powerplant will probably be one of the Limbach SL 1700 range of four-stroke engines that are fitted to several other types of powered glider. An order for at least 30 IPE 02s for the Brazilian Clubs was confirmed in 1980.

IPE Quero Quero

Brazil

Data: Quero Quero II
Span: 49ft 2½in
Length: 21ft 2¾in
Height: 4ft 4¾in
Wing area: 125.9sq ft
Aspect ratio: 18.0
Empty weight: 374lb
Max weight: 595lb
Max speed: 93mph (in smooth air)
Min sinking speed: 2.10ft/sec at 38.5mph
Best glide ratio: 28:1 at 45mph

This Brazilian single-seater training glider, known in full as the IPE KW 1 b 2 Quero Quero II, is a development of the original KW 1 designed by Ing Kuno Wiedmaier and made its first flight on 1

October 1972. Certification from the Brazilian CTA in the semi-aerobatic category, with an extension for cloud flying, was awarded in December 1976 and the Quero Quero II was put into production by IPE – Industria Paranaense de Estruturas at Curitiba in the state of Parana. By 31 March 1979 IPE had completed 28 Quero Queros, consisting of one static test and three flying prototypes, a pre-series of four production aircraft, one of which was lost in a non-fatal accident, and all of a second-series batch of 20 Mk IIs, which are now in service with various Brazilian clubs. The Quero Quero is a cantilever high wing monoplane with the same Wortmann wing section as the Scheibe SF-30 Club-Spatz, which it somewhat resembles, and is of wood and Brazilian pine plywood construction. There are spoilers in the wing upper and lower surfaces, and the wing tips are turned down to provide an endplate effect. Landing gear consists of a non-retractable monowheel and a tailwheel, and the pilot sits under a one-piece detachable cockpit canopy.

IPE KW Ib 2 Quero Quero. John W. R. Taylor

ISF Mistral-C

FGR

Data: Mistral-C
Span: 49ft 2½in
Length: 22ft 1in
Height: 4ft 9in
Wing area: 116.8sq ft
Aspect ratio: 20.7
Empty weight: 529lb
Max weight: 771lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 105mph
Min sinking speed: 2.17ft/sec at 43.5mph
Best glide ratio: 35:1 at 55.5mph

Developed from the original Mistral, which first flew in 1975, the ISF Model 2 Mistral-C single-seat Club Class sailplane is a product of the German firm Ingenieur/Büro Dipl-Ing Strauber – Frommhold GmbH & Co KG. Design work on the Mistral-C, which was intended to conform with the new FAI Club regulations, started in October 1974 and the prototype made its first flight in October 1976; 20 examples of this glassfibre T-tailed sailplane had been completed by the beginning of 1979. The type took 3rd place out of 33 contestants in the first Club-class international competition held in Sweden in 1979. The Mistral-C is a cantilever shoulder wing monoplane with 1° forward sweep at the quarter-chord line; the wings and tail unit are of glassfibre reinforced plastic/foam/Conticell CC60 sandwich construction, the ailerons being of glassfibre reinforced plastic (GRP). There are Schempp-Hirth aluminium air brakes in the wing upper surfaces. The fuselage is a GRP monocoque structure, and the landing gear consists of a non-retractable mono-wheel with a brake, and a tailskid. The tailplane is a fixed incidence one with spring trim, and the pilot sits under a large flush-fitting one-piece canopy that opens sideways. There is a towing hook on the centre of gravity, and a nose-mounted hook is optional. In 1980 Mistral Flugzeugbau was formed to continue production of the Mistral-C at Hassfurt/Main; it had previously been built at Bensheim. There are plans for a 17m span and a Standard Class version of the Mistral-C, as well as a motorised variant with retractable dorsal engine.

ISF Model 2 Mistral-C. John W. R. Taylor

Jastreb

Bulgaria

Span: 49ft 2½in
Length: 26ft 3in
Wing area: 209.9sq ft
Aspect ratio: 11.55
Empty weight: 529lb
Max weight: 850lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 75mph
Min sinking speed: 2.95ft/sec at 37mph
Best glide ratio: 20.5:1mph

The Jastreb (or Hawk) two-seater fully aerobatic trainer was, with the Kometa-Standard single-seater, one of the two indigenous Bulgarian designs that went into production in that country after the war. In much the same class as the Slingsby T31 Tandem Tutor, the Jastreb was designed by Eng L. Panov and D. Panchovsky, the prototype making its first fight on 6 February 1948; the type was put into small-scale production for the Bulgarian clubs. Of conventional wood and fabric construction, the Jastreb is a braced high wing monoplane with the centre section swept forward 5° at the quarter-chord line to improve the view from the rear seat, the absence of sweep on the outer panels enabling the spar to be uncranked. The wing is a single-spar wooden structure with leading edge plywood torsion box and is 30% fabric-covered; the wooden ailerons are plywood and fabric covered and there are spoilers in the wing upper and lower surfaces. The plywood-covered wooden fuselage has a metal nose-cap and the two pilots are seated in tandem under a sideways-opening Perspex canopy. The cantilever wooden tail unit is covered with plywood and fabric, and the landing gear consists of a fixed unsprung monowheel with no brake and a rubber-mounted skid under the forward fuselage.

KAI-14

USSR

Span: 49ft 2½in
Length: 19ft 1in
Wing area: 107.7sq ft
Aspect ratio: 22.5
Max weight: 573lb
Max permissible diving speed: 155mph
Max aero-tow speed: 87mph
Min sinking speed: 1.90ft/sec at 56mph

The Kazan Aviation Institute at Kazan on the River Volga, nearly 500 miles east of Moscow, has designed and produced some of Russia's most notable sailplanes, especially the very advanced KAI-19 high performance all-metal single-seater which, in two-seater form, broke the world's 300km closed circuit speed record on 1 August 1964, and the KAI-17 training glider. Like these two types the KAI-14 high performance Standard Class single-seater was designed by a team headed by M. P. Simonov; of all-metal construction it made its first flight in about 1962, and two KAI-14s were entered in the 1965 World Championships held at South Cerney in England. Two versions of the type have been produced, the first being for competition flying with the pilot seated in a reclining position under a long flush-fitting one-piece transparent canopy; this version has a polished metal finish to reduce drag. The second version, intended for series production, is similar except that the pilot sits upright in a conventional seat under a raised cockpit canopy, and is unpolished. Both versions are otherwise the same, with cantilever shoulder wings with a forward sweep of 2° at the leading edges and compound taper on the trailing edges; the inset ailerons are each in two sections and small trailing edge air brakes are featured. The wings are metal-covered as is the semi-monocoque fuselage, in which the forward section tapers to a slimmer rear half carrying the all-metal cantilever 'butterfly'-type V-tail. The landing gear consists of a non-retractable monowheel faired into the bottom of the fuselage, with a brake that is linked to the air brakes, and a tail bumper.

KAI-14. Eric Wagner

Kenneth Holmes KH-1

UK

Data: KH-1
Span: 60ft 8½in
Length: 23ft 9in
Height: 5ft 0in
Wing area: 120sq ft
Aspect ratio: 31.0
Empty weight: 490lb
Max weight: 710lb
Max speed: 97mph
Best glide ratio: 37:1 at 55.5mph

Designed and built entirely by Mr Kenneth Holmes, a meteorologist, this British high performance single-seater is characterised by a very high aspect ratio (31.0) wing and a slim fuselage of minimum cross-sectional area; construction is largely of wood. Design work on the KH-1 began in1968, construction commenced in the following year and the prototype flew for the first time on 24 November 1971. The cantilever shoulder wings are of largely wooden construction with single aluminium spars bonded by epoxy resin and also pop riveted to plywood webs. The spars and closely spaced ribs are covered by a pre-moulded plywood/balsa sandwich to the 50% chord line, by a 2mm thick plywood skin for a further 20% of the chord and with fabric for the remainder of the wing. Small-span trailing edge flaps also act as air brakes, but spoilers are not fitted. The fuselage is built of plywood frames and spruce longerons covered with a birch ply skin, and the landing gear consists of a retactable monowheel and a tail bumper. The tailplane is an all-moving surface with anti-balance tabs controlled by a spring trimmer in the cockpit, and the tall fin and rudder is unswept. A tail braking parachute is fitted for control during the approach and in short field landings. A second example of the KH-1 named the JSH Scorpion was built by Mr John Halford and first flew in July 1977.

Kometa-Standard

Bulgaria

Span: 49ft 0½in
Length: 22ft 9½in
Wing area: 136.7sq ft
Aspect ratio: 17.6
Empty weight: 573lb
Max weight: 750lb
Max speed: 130mph (in smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 2.69ft/sec at 48.5mph
Best glide ratio: 28:1 at 51mph

The second postwar Bulgarian sailplane designed by Eng L. Panov and D. Panchovsky, the Kometa-Standard (or Comet Standard) fully aerobatic Standard Class single-seater flew for the first time in prototype form on 5 August 1960; the type later went into small-scale production for the Bulgarian gliding clubs. The Kometa-Standard is a cantilever mid-wing monoplane of conventional wooden construction with a butterfly-type V-tail with an included angle between the tailplanes of 110°. The wings are single-spar wooden structures with a leading edge plywood torsion box and wing tip 'salmon'-type fairings; the slotted ailerons are fabric-covered and there are spoilers on the wing upper and lower surfaces. The plywood monocoque fuselage has a metal nose-cap and the landing gear consists of a non-retractable wheel with brake and a rubber-mounted skid under the forward fuselage. The tail unit is of wooden construction with plywood and fabric covering, and the pilot is seated under a hinged Perspex canopy.

KS-II Kartik

India

Data: KS-II
Span: 49ft 2½in
Length: 24ft 2in
Height: 7ft 5in
Wing area: 145.7sq ft
Aspect ratio: 16.6
Empty weight: 463lb
Max weight: 705lb
Max speed: 124mph
Max aero-tow speed: 71mph
Min sinking speed: 1.97ft/sec at 40mph
Best glide ratio: 31:1 at 47mph

One of the indigenous types designed and produced at the Technical Centre of India's Civil Aviation Department, the Kartik high performance single-seater was designed by S. Ramamritham, who later became Director-General of the Centre, and first flew in prototype form, designated KS-I, on 18 March 1963. It performed successful stalling and spinning trials that same day and was followed by a second prototype. An unusual feature of the KS-1 was its 'double rectangular' wing planform in which the constant chord outer panels were joined to the larger, constant chord centre section with just a large fillet where the change of chord took place; this absence of taper minimised the number of different ribs required for a tapered wing, easing production and ensuring close control of the accuracy of the aerofoil section. A third prototype, designated KS-II, first flew on 4 May 1965 and this had a conventional tapered wing to allow flight evaluation of the relative performances of the two wings; fabric-covered slotted wooden ailerons replaced the KS-I's ply-wood-covered wooden ones. Other changes in the KS-II included a slight increase in fuselage length and a reduction in cockpit height, and second, third, fourth and fifth prototypes of the KS-II were test flown during February 1967, March and May 1968 and May 1969, plus a sixth prototype in 1970. The third and subsequent aircraft incorporated several improvements, including a reduction in fuselage

KS-II Kartik. John W. R. Taylor

height, improved forward vision and seating, and larger air brakes, while the ninth KS-II Kartik, flown in 1976, has the air brakes replaced by trailing edge slotted flaps. The KS-II was type certificated in 1965 and during the first Indian National Gliding Rally, held in 1967, the Kartik scored many successes, including setting a national speed record over a 200km triangular course.

The Kartik is of conventional wooden construction, the high cantilever wings having one main spar, one rear spar and a diagonal spar at the root; the torsion box back to the rear spar is plywood-covered and the trailing edge fabric-covered. There are retractable wooden air brakes above and below the wing. The semi-monocoque fuselage is plywood-covered and has a glassfibre nose cap, while the wooden tail unit has a plywood-covered fin and the other tail surfaces are fabric-covered with ply covering on the leading edges; there is a trim tab in the starboard elevator. Landing gear consists of a non-retractable Palmer/Dunlop unsprung monowheel, with a drum brake, and a rubber-sprung nose skid with a replacement steel-shoe; there is also a tail skid which is sprung by ordinary tennis balls. The pilot sits under a rearward-opening hinged Perspex canopy, and oxygen equipment is optional.

LAK-9 Lietuva

USSR

Span: 65ft 8¼in
Length: 23ft 10¼in
Height: 5ft 0¼in
Wing area: 161.35sq ft
Aspect ratio: 26.8
Empty weight: 842lb
Max weight: 1,477lb
Max speed: 130mph (in rough air)
Max aero-tow speed: 87mph
Min sinking speed: 1.67ft/sec at 46mph
Best glide ratio: 48:1 at 64mph

The LAK-9 Lietuva (or Lithuania) single-seater Open Class sailplane was developed by LAK – Litovskaya Aviatsionnaya Konstruktsiya (or Lithuanian Aircraft Construction) from an earlier plastics sailplane, the BK-7, also named Lietuva, designed by Balis Karvyalis which made its first flight in December 1972. At this time the LAK factory was known as the Experimentalnii Zavod Sportivnoi Aviatsii (or Experimental Sports Aviation Factory), and a small experimental production batch of Lietuvas, designated BK-7A, was built and two of these participated in an international contest between Communist countries at Kishinev in April 1976. As a result of this competition a number of modifications were introduced in a developed version, the LAK-9, designed by Kestutis Gechas and which was then under construction; the prototype of this took part in the World Championships in Finland in June 1976 flown by O. Pasetsnik, but this particular aircraft withdrew from the last two days of the competition because of aileron damage. The LAK-9 was the first Russian sailplane to compete in the World Championships since 1968 and at the time it was reported that the three LAK-9s then built had not, at that time, completed their flight testing. The type is now in production and the fourth series batch, begun in the winter of 1976-77, is reported to be designated LAK-9M (M for Modernised). The LAK-9 is a cantilever shoulder-wing monoplane of glassfibre/epoxy construction, with single-spar wings and provision of up to 397lb of water ballast, and trailing edge flaps. The landing gear consists of a retractable monowheel and a tailwheel.

Laister LP-15 Nugget

USA

Span: 49ft 2½in
Length: 20ft 0in
Height: 4ft 2in
Wing area: 109sq ft
Aspect ratio: 22.1
Empty weight: 463lb
Max weight: 900lb
Max speed: 145mph
Best glide ratio: 36:1 at 55mph

One of the pioneer US sailplane designers, John W. (or Jack) Laister built his first design, a gull-winged

Laister LP-15 Nugget. John W. R. Taylor

aerobatic sailplane in 1938 and later formed, with John R. Kauffman, the Laister-Kauffman Aircraft Corp. This produced, among other types, the TG-4A training glider version of the LK-10 for the USAAF and was one of the 16 firms taking part in the Waco CG-4A Hadrian programme, building 310 out of the nearly 14,000 CG-4As completed. Laister-Kauffman also produced one of the biggest troop-carrying gliders of the war, the 42-seat XCG-10A, which had a span of 105ft and could carry a 155mm howitzer or a 2½ton truck. The firm was later succeeded by Laister Sailplanes Inc and in 1970 Jack Laister and his son Bill, an aerodynamicist, started design work on the LP-15 Nugget Standard Class single-seater of metal construction. They decided to wait for the recommendations of the CIVV conference on Standard Class requirements before starting construction of the prototype in February1971, and this first flew in June that year, its maiden flight also being a contest flight; the Nugget was certificated in mid-1975. It is a cantilever shoulder-wing monoplane with a T-tail and long-span flaps which are raised slightly for high speed flight, are lowered 8° for soaring in thermals and can be extended to 85° for use as air brakes. Up to 185lb of water ballast can be carried. The wings and top-hinged plain ailerons are of Chem-Weld bonded aluminium alloy construction, while the semi-monocoque fuselage has the forward portion of moulded glassfibre and the rear part of bonded aluminium alloy construction which incorporates the swept fin. Landing gear consists of a retractable monowheel and the pilot sits in a semi-reclining seat under a two-piece canopy with a removable section and a sliding ventilation panel.

Laister LP-49

USA

Span: 49ft 2½in
Length: 20ft 7¼in
Wing area: 143sq ft
Aspect ratio: 17.0
Empty weight: 460lb
Max weight: 900lb
Max speed: 135mph
Min sinking speed: 2.07ft/sec at 50mph
Best glide ratio: 36.5:1 at 58mph

The LP-49, popularly known as the 'Forty Niner', is a Standard Class single-seater that was first rolled out in prototype form, designated LP-46, on 4 July 1966. It is of metal and glassfibre construction, but designed to be sold in kit form for the amateur constructor, and more than 50 LP-49 kits had been sold by early 1976, about 35 of which had been completed and flown. The high cantilever wings are of laminar flow section, the extruded aluminium main spar booms being curved in a chordwise direction to follow the aerofoil section; the roll-contoured aluminium sheet wing skin is butt jointed and flush riveted with blind pop rivets. The semi-monocoque fuselage is made up of two pre-moulded glassfibre halves joined over aluminium bulkheads and fittings. The tail unit is of aluminium with a swept back fin and rudder, and the landing gear consists of a retractable monowheel with a brake and a glassfibre nose skid with a steel shoe; a fixed shrouded tailwheel replaces the retractable tailwheel of early production aircraft.

LCF II

FGR

Span: 42ft 7¾in
Length: 20ft 10in
Height: 2ft 11½in
Wing area: 107.6sq ft
Aspect ratio: 16.9
Empty weight: 419lb
Max weight: 661lb
Max speed: 174mph
Max aero-tow speed: 105mph
Min sinking speed: 2.30ft/sec at 42.5mph
Best glide ratio: 30:1 at 53mph

This single-seat Club Class sailplane is intended for use as a trainer, for competition flying and for aerobatics; it was designed in 1971 as a successor to the earlier LO 100 and the prototype was built in approximately 4,000 hours by five engineer members of the Luftsportclub der Zeppelinstadt

Friedrichshafen. It first flew on 22 March 1975 and won first prize at that year's meeting of the CUV or Oskar-Ursinus-Vereinigung, Germany's equivalent of the Experimental Aircraft Association. There were plans for production of the LCF II by Scheibe if sufficient orders for it had been received, but these have now been dropped. The type resembles in appearance the Scheibe SF-30 Club-Spatz; as well as being factory-built it is also suitable for amateur construction. The cantilever shoulder wings are single-spar wooden structures, with Conticell foam ribs and plywood covering; there are Schempp-Hirth air brakes on the wing upper surfaces. The oval-section fuselage is a welded steel tube structure with glassfibre covering of the nose section and fabric covering of the rear half. The plywood tail unit is filled with Conticell foam, and the landing gear consists of a semi-recessed non-retractable monowheel and a tailwheel. The pilot sits under a one-piece flush fitting cockpit canopy.

LCF II. John W. R. Taylor

LET L-13 Blanik

Czechoslovakia

Span: 53ft 2in
Length: 27ft 6½in
Height: 6ft 10in
Wing area: 206.1sq ft
Aspect ratio: 13.7
Empty weight: 677lb
Max weight: 1,102lb
Max speed: 157mph (in smooth air)
Max aero-tow speed: 87mph (IAS)
Min sinking speed: 2.79ft/sec at 50mph (IAS)
Best glide ratio: 28:1 at 55mph (IAS)

Arguably the most commercially successful sailplane ever to be built, the LET L-13 Blanik all-metal tandem two-seater trainer has been exported to more than 40 countries, more than 2,000 of about 2,500 sold by the summer of 1977 having been exported abroad, including more than 1,000 to the Soviet Union, about 200 to the USA, about 150 to the United Kingdom and more than 100 each to Australia and Canada. Production continues at the LET Národní Podnik (Let National Corporation) and is now getting close to the 3,000 mark; like all Czechoslovak aircraft, export sales of the L-13 Blanik are handled by the Omnipol Foreign Trade Corporation. The Blanik has set up no fewer than 13 international records recognised by the FAI, as well as many other national gliding records, and in 1969 a particularly notable flight across the Andes in a Blanik by the Chilean pilot Alejo Williamson, taking 5hr 51min, won him an FAI Gold Medal. The Blanik is intended for training in all categories from elementary to blind flying and is

LET L-13 Blanik. John W. R. Taylor

also suitable for high performance flight. It is fully aerobatic when flown solo, and can do basic aerobatic manoeuvres when carrying two pilots; this degree of versatility, combined with good flying qualities, sound construction, durability and ease of maintenance have helped it to become a best-seller. Design work on the Blanik, whose designer was Karel Dlouhy, started in January 1955 and construction of two prototypes began in August of that year; the first flight was made in March 1956 and 2,094 Blaniks had been built by the end of 1975. The cantilever shoulder wings are characterised by a moderate aspect ratio (13.7) and 5° forward sweep at the quarter-chord line; wing tip 'salmon' fairings are fitted. The wings are all-metal two-spar structures, the main spar forming a torsion box with the leading edge, and each wing is secured by three fuselage attachments. The metal ailerons and slotted area-increasing flaps are fabric-covered, and there are light alloy DFS-type air brakes above and below the wings. The all-metal fuselage is a semi-monocoque of oval cross-section built in two halves riveted together in the vertical plane, with riveted skin, and the cantilever all-metal tail unit has fabric-covered elevators and rudder, with a controllable trim tab in each elevator. The horizontal tail surfaces fold upwards parallel to the rudder for transport. The landing gear consists of a retractable monowheel, with an oleo-pneumatic shock absorber and mechanical brake. The two pilots sit in tandem in a partly-upholstered cockpit with heat-insulated walls, under a sideways-opening canopy hinged to starboard which is jettisonable in flight. Optional 'extras' include, amongst other things, electric gyros, navigation lights, radio, a battery and rear compartment blinds for instrument flying instruction, while more unusual 'extras' are a water ballast system to increase the wing loading for solo flight and skis for operation on snow.

LIBIS-17

Yugoslavia

Span: 55ft 9in
Length: 25ft 1in
Height: 8ft 11½in
Wing area: 237.9sq ft
Aspect ratio: 13.0
Empty weight: 739lb
Max weight: 1,135lb
Max speed: 138mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.82ft/sec at 47mph
Best glide ratio: 27:1 at 58mph

Formerly known as the KB-17, this Yugoslav two-seater high performance trainer was designed and built by the Letalski Institut Branko Ivanus, Slovenija – LIBIS at Ljubljana, and it is cleared for looping, spinning and cloud flying as well as normal flight; it is also suitable for flying solo up to the Silver and Gold C standards. The prototype LIBIS-17 first flew on October 1961, and the first production aircraft flew in June 1963; by 1972 there were 23 examples of the type on the Yugoslav civil register. Of largely wooden construction, with a fabric covered welded steel tube fuselage, the LIBIS-17 has a cantilever single-spar high-set wooden wing, with a plywood-covered leading edge torsion box supported by Styrofoam, the remainder of the wing being fabric covered. The fabric covered wooden Frise ailerons are also filled with Styrofoam, and there are Hütter-type wooden plate spoilers in the wing upper surfaces immediately aft of the spar. The angular tail unit is also a wooden structure filled with Styrofoam, and is made up of an all-moving one-piece fin and tailplane, each with a servo tab. The landing gear consists of a non-retractable unsprung Borovo main wheel and nose sheel in tandem, with a LIBIS mechanical brake. The two pilots are seated in tandem under a forward-hinged one-piece blown canopy; a ventilation system is provided and blind flying instrumentation, radio and oxygen equipment can be fitted if required.

Lie-Fang

China

Span: 49ft 2½in
Length: 26ft 3in
Height: 4ft 5½in
Wing area: 200sq ft
Aspect ratio: 12.4
Empty weight: 534lb
Max weight: 926lb
Max speed: 102.5mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.62ft/sec at 38.5mph
Best glide ratio: 22:1 at 53mph

When during the 1950s the Chinese People's Republic decided to revive the country's sporting gliding movement it was to Poland that they turned for help, and with the aid of instructors, technicians and designers from the Polish SZD organisation a central Gliding School was organized at An-Yan and large gliding establishments were set up at Tchan-Tia-Kou. It was here that a Chinese glider design office was formed towards the end of 1956 under the direction of Dipl Ing Niespal of the Polish SZD, and a Glider Manufacturing Centre was organized for the licence production of Polish types such as the ABC, Salamandra, the SZD-8 Jasolka, the SZD-12 Mucha 100 and the SZD-9 Bocian, examples of which had already been purchased from Poland; production of these types began during 1955-56. And it was at Tchan-Tia-Kou that the first Chinese glider of original design, the Lie-Fang (or Liberation) two-seater intermediate trainer, was created, the prototype making its first flight on 10 May 1958. It was intended that pupils should graduate from the Lie-Fang to the single-seat SZD Mucha, which it resembles in appearance, for their first solo flights and the Lie-Fang went into small-scale production

for the Chinese gliding centres. It is a cantilever mid-wing monoplane of conventional wood and fabric construction; the single-spar wings have a plywood leading edge torsion box and fabric covering aft of the spar, the forward sweep being 2° at the quarter-chord line. The wooden slotted ailerons are also fabric covered and there are spoilers on both top and bottom wing surfaces. The fuselage is a plywood monocoque with a light alloy nose-cap, and the cantilever tail unit is of wood with fabric covering. The landing gear consists of a non-retractable monowheel with brake, and a rubber-mounted skid under the forward fuselage. The two pilots are seated in tandem under a large sideways-opening Perspex canopy.

Mahrer HB-1340 Delphin

Switzerland

Span: 49ft 2½in
Wing area: 107.6sq ft (flaps in)
121.6sq ft (flaps out)
Aspect ratio: 22.5 (flaps in)
19.9 (flaps out)
Empty weight: 617lb

This single-seater sailplane is an experimental variable-geometry version of the Swiss Neukom S-4A Elfe 15, and was first flown by Herr Fritz Mahrer on 6 May 1977. It is basically a modified Neukom S-4A with new 15m span wings; these have Eppler wing sections similar to those on the Neukom AN-66C Super-Elfe, and are fitted with area-increasing Fowler-type flaps actuated electrically. When extended these flaps increase the wing area from 107.6sq ft to 121.6sq ft, and the aspect ratio of 22.5 with flaps in becomes 19.9 when they are extended. The Delphin also has a T tail unit similar to that of the Schempp-Hirth Cirrus replacing the Neukom S-4A's low-set tailplane, thus avoiding tailplane buffeting when the flaps are extended. Construction of the Delphin is mainly of plastics materials.

Manuel Condor

UK

Span: 50ft 2½in
Length: 21ft 0in
Wing area: 250.0sq ft
Aspect ratio: 10.0
Empty weight: 492lb
Max weight: 899lb
Max speed: 86.5mph
Best glide ratio: 14:1

One of the pioneer British sailplane designers before the war, Mr W. L. Manuel designed the Wren series of gliders which culminated in the Willow Wren of 1932, and more recently he created the Hawk single-seater. He became concerned at the number of fatal accidents in hang gliding in recent years, and in the Condor has designed a simple two-seater sailplane intended especially for hill soaring and aimed at meeting the needs of those who would like to fly but who could not afford the price of a modern high performance sailplane, and who do not have the skills or the time to construct one of the homebuilt designs now on offer. Resembling the primary trainers of the early 1930s in appearance, the Condor has a short boat-shaped fuselage nacelle of metal tube construction with comfortable side-by-side seating for two in an open cockpit; at the rear of the nacelle is a pylon on which the high constant chord wings are mounted, these being braced by V-struts on each side to a keel running under the cockpit. The tail unit is carried on an open girder-type rear fuselage of aluminium tubing, the tail surfaces being of generous area with fabric covered ribs and wide-chord elevators. The landing gear consists of a bow-shaped ash skid under the fuselage nacelle, with rubber rollers as shock absorbers. The prototype Condor made its first flight in August 1976 and in addition to local soaring has made a number of longer distance flights.

Manuel Hawk

UK

Span: 42ft 0in
Length: 20ft 6in
Wing area: 149sq ft
Aspect ratio: 11.88
Empty weight: 406lb
Max weight: 639lb
Max speed: 90mph
Min sinking speed: 2.53ft/sec at 38mph
Best glide ratio: 25:1 at 41.7mph

Mr W. L. Manuel, who designed the Willow Wren and other gliders during the 1930s, continued working during retirement by designing and building the Hawk single-seater which is intended for soaring in weak thermals. The prototype was built at Fairoaks in Surrey during 1968-70 and made its first flight at the College of Aeronautics airfield at Cranfield on 25 November 1972. Initial flight tests revealed the need for some modifications, including revised aileron controls, removing the air brakes from the wing under surfaces and increasing the rudder area; further flight testing followed these changes. The Hawk is characterised by a wing of rather low aspect ratio (11.88) and a fuselage that, although well steamlined, is not as slim as some contemporary types. The cantilever shoulder wing is a three-piece wooden structure with a centre section and two outer panels; the single spar is of spruce with a plywood leading edge torsion box and fabric covering aft of the spar, and there are air brakes in the wing upper surfaces. The semi-monocoque fuselage is of spruce covered by plywood, with a

non-retractable monowheel for landing. The T-tail is likewise of wooden construction, with a trim tab in the starboard elevator and a small dorsal fin. Instead of the conventional one-piece cockpit canopy, a three-piece one is fitted in which the front and rear sections are fixed one-piece single-curvature transparencies and the hinged middle section is a framed double curve segment.

Marske Monarch C

USA

Data: Monarch C
Span: 42ft 0in
Length: 11ft 6in
Wing area: 185.0sq ft
Aspect ratio: 9.5
Empty weight: 220lb
Max weight: 450lb
Max speed: 70mph (smooth air)
Min sinking speed: 2.70ft/sec at 30mph
Best glide ratio: 19:1 at 40mph

Like Charles Fauvel in France, Mr Jim Marske of Michigan City, Indiana, is an advocate of the tailless configuration for sailplanes and designed and built his first Monarch single-seater ultra light glider in this form during 1973-74; this made its first flight on 4 July 1974. The Marske Aircraft Corporation was formed to make plans and kits available to amateur constructors, and 71 Monarchs were under construction by early 1979, of which at least four had been completed. The Monarch prototype was later test flown successfully with a 12hp McCulloch engine fitted behind the pilot's seat driving a 2ft 1in diameter push propeller, but it is felt that any homebuilt powered version to be marketed would need an engine of about 20hp. The current production version is the Monarch C, which has now replaced the earlier Monarch B, and the type is of wood, glassfibre and foam plastics construction. It is a braced high wing monoplane with a single steel strut on each side, and a forward sweep of 3° at the quarter-chord line. There is a glassfibre front spar and a moulded glassfibre D leading edge, and wood and foam plastics ribs between the front spar and the wooden rear spar and trailing edge, the wing aft of the front spar being fabric covered. Both the ailerons in the conventional outboard positions and the elevators inboard of them have single Sitka spruce spars with foam plastics ribs, and there is a fixed tab in each elevator; all the control surfaces are Dacron-covered and there is an aluminium spoiler above each wing. The fuselage is a simple minimal pod-and-boom type structure of laminated glassfibre, moulded in two halves and joined at the centreline; the forward section carries the pilot seated in the open without a transparent canopy, with a nose fairing over the instrument panel, and the rear boom section also forms the integral fin leading edge. There is a cg towing hook on each side of the nose fairing. The fin and rudder extend below as well as above the wing level, the fin having a glassfibre leading edge and the rudder a wooden trailing edge; both have foam ribs and fabric covering. Landing gear consists of a single wheel below the pilot's open seat, and a reinforced underfuselage landing skid. The pilot has a conventional floor-mounted control column.

Marske Monarch C. Howard Levy

Miller Tern

USA

Data: Tern II
Span: 55ft 6in
Length: 21ft 3½in
Height: 5ft 0in
Wing area: 140sq ft
Aspect ratio: 22.0
Empty weight: 550lb
Max weight: 800lb
Max speed: 120mph (smooth air)
Max aero-tow speed: 88mph
Min sinking speed: 1.95ft/sec at 48mph
Best glide ratio: 38:1 at 60mph

The Tern high perfomance single-seater was designed by Mr W. Terry Miller of Furlong, Pennsylvania, for amateur construction and the prototype, which was built in a total of 1,180 working hours, made its first flight in September 1965. An improved version, known as the Tern II, made its first flight in August 1968; this featured a wing span

Miller Tern 2. John W. R. Taylor

increased by 4ft 6in to 55ft 6in, increasing the aspect ratio from 20 to 22, and giving an improved best glide ratio and minimum sinking speed. During 1968 brake parachutes were fitted to the prototype Tern, and two types of these were later made available for installation in both versions of the Tern in the base of the rudder, namely a 6ft diameter cross parachute or a 5ft diameter guide surface parachute. By May 1970 nearly 100 Terns and 12 Tern IIs were under construction not only in the USA, but by amateurs in Africa, Australia, South America and Canada. Of conventional all-wood construction, the Tern has unswept cantilever shoulder wings which are two-piece two-spar spruce structures, entirely plywood covered. There are no flaps and the plain ailerons are also all wood; there are wooden spoilers in the wing lower surface used for approach and glide slope control. The semi-monocoque wooden fuselage has a plastic-reinforced glassfibre nose and plywood skinning aft of the cockpit. The cantilever all-wood tail unit has modified NACA laminar flow sections and special hinge-line contours to reduce drag and increase control effectiveness at large angles of deflection; there are no elevator or rudder tabs. Landing gear consists of a non-retractable mono-wheel forward of the cg housed in a streamlined pod, and skids under the nose and tail; there is a brake lever for applying pressure directly to the tyre. The pilot sits in a semi-reclining seat under a three-piece canopy, the centre portion of which hinges sideways for entrance and exit, and radio can be fitted.

MME R-25 Standard

Hungary

Span: 49ft 2½in
Length: 23ft 11½in
Wing area: 120.6sq ft
Aspect ratio: 20.09
Empty weight: 408lb
Max weight: 683lb
Max speed: 137mph (in smooth air)
Max aero-tow speed: 84mph
Min sinking speed: 2.23ft/sec at 47mph
Best glide ratio: 31.2:1 at 51mph

Hungary's leading postwar sailplane designer is Ernö Rubik, a number of whose designs in the R-series went into production at Esztergom during the 1940s and 1950s, including the R-15 Koma (or Godfather) and the R-16 Lepke (Butterfly) training gliders, the R-17 Móka (Joy) aerobatic sailplane and the R-22 Futár (Courier). The metal and fabric R-25 Standard had its origins in the all-metal single-seater R-23 Gebics experimental sailplane which first flew in 1957 and was designed at the Alagi Központi Kisérleti Üzem Dunakeszi, where Ernö Rubik was head of the design office. This organisation's development of the Gebics and the services of Rubik as chief designer were taken over that year by MME – Müzseripari Müvek Esztergom, and a Standard Class derivative of the Gebics with a laminar flow wing, the R-24 Bibic, was completed in 1958. This was further developed by Rubik into the R-25 Standard single-seater, the prototype of which first flew on 29 September 1960; as its name implies, this is a Standard Class sailplane and is fully aerobatic, as well as being suitable for cloud flying. This attractive design has a pod-and-boom all-metal monocoque fuselage and a 'butterfly'-type V-tail, with an included angle of 90° between the tail surfaces. The cantilever high wings are all-metal single-spar structures with a leading edge torsion box and fabric covering aft of the spars. Slotted Frise ailerons are fitted and an unusual feature is the use of fan-type air brakes on each side of the fuselage instead of the more usual wing type. The all-moving tail surfaces are of fabric covered metal construction, with a geared tab in each trailing edge. Landing gear consists of a non-retractable monowheel with torsion rubber spring and a brake, and the pilot sits under a removable one-piece blown plastic canopy.

MME R-26 Góbé

Hungary

Span: 45ft 11in
Length: 29ft 5in
Wing area: 193.75sq ft
Aspect ratio: 10.88
Empty weight: 454lb
Max weight: 882lb

Max speed: 106mph (in smooth air)
Max aero-tow speed: 68.5mph
Min sinking speed: 3.15ft/sec at 46.5mph
Best glide ratio: 23.7:1 at 50.3mph

Like the R-25 Standard, the R-26 Góbé metal and fabric two-seater sailplane was developed from the R-23 Gebics and R-24 Bibic; unlike the Standard it has a conventional fabric-covered cantilever metal tail unit with the tailplane mounted part of the way up the fin, and lower aspect ratio (10.88) constant chord wings. The first of two R-26 Góbé prototypes made its maiden flight on 6 May 1961 and an initial production batch of 50 was put in hand. The cantilever high wings are single-spar all-metal structures with a leading edge torsion box and fabric-covered from the 35% chord line aft; the slotted metal ailerons are also fabric-covered and DFS air brakes are fitted. The metal monocoque fuselage is partly fabric-covered and the landing gear consists of a non-retractable monowheel with a torsion rubber spring and a brake. The two pilots are seated in tandem under a sideways-opening blown plastic canopy.

MME R-27 Kópé

Hungary

Span: 39ft 4½in
Length: 23ft 0in
Wing area: 165.8sq ft
Aspect ratio: 9.35
Empty weight: 344lb
Max weight: 595lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 62mph
Min sinking speed: 3.28ft/sec at 43.5mph
Best glide ratio: 20:1 at 46.5mph

This single-seater training sailplane first flew in prototype form on 7 October 1961 and is closely related to the R-26 Góbé, having basically the same fuselage, and 80% of the components of the two types are interchangeable. The wings are the same as the R-26's but of reduced area and lower aspect ratio (9.35), and the fuselage is very much the same metal monocoque structure, partly fabric-covered. The tail unit reverts to the cantilever 'butterfly'-type of the R-25 Standard, again of fabric-covered metal construction with a trim tab in each elevator. Landing gear consists of a non-retractable monowheel with torsion rubber spring and a brake, and the pilot is seated under a removable blown plastic canopy.

Neukom Standard Elfe S-3

Switzerland

Data: Standard Elfe S-3
Span: 49ft 2½in
Length: 23ft 11½in
Height: 4ft 11in
Wing area: 128.1sq ft
Aspect ratio: 19.0
Empty weight: 459lb
Max weight: 705lb
Max speed: 150mph (in smooth air)
Min sinking speed: 2.07ft/sec at 47mph
Best glide ratio: 37.5:1 at 59mph

Just after World War 2 Albert Neukom of Switzerland began the creation of a line of sailplanes bearing the name Elfe; the first of these, the Elfe 1, had a wing span of only 9m (29ft 6¼in), later increased to 11m (36ft 1in), and it was followed by the Elfe 2, designed by Dr W. Pfenninger, with a span of 50ft 6¼in and camber-changing flaps. Later came the Elfe PM3 of 1951 and this was succeeded by the Elfe M with laminar flow wings. The prototype Standard Elfe S-1 first flew on 1 May 1964 and had a V-tail; as its name implies, it was a Standard Class high performance single-seater, and was followed by the Standard Elfe S-2, which differed in having a conventional tail unit with the tailplane at the base of the fin. The production version was the Standard Elfe S-3, first flown in May 1966, with the tailplane mounted part-way up the fin and a total of 18 Standard Elfes were flying by April 1970, the year in which the developed S-4A Elfe 15 first flew. Flown by the Swiss plot Markus Ritzi, a Standard Elfe took 2nd place in its class at the 1965 World Gliding Championships held at South Cerney, and at the 1968 World Championships at Leszno in Poland a Standard Elfe S-3 flown by Andrew Smith of the USA came 1st out of 57 entries, with other Elfes placed 4th and 6th. The Elfe S-3 has a high cantilever wing built in three parts, and of plywood-balsa sandwich construction; it is fitted with trailing edge air brakes. The fuselage and tail unit are of glassfibre and plywood sandwich construction, while the landing gear consists of a retractable rubber-sprung monowheel with brake. The pilot sits upright under a removable transparent canopy.

Neukom S-4A Elfe 15 and 17

Switzerland

Data: Elfe 17
Span: 55ft 9¼in
Length: 23ft 3½in
Height: 4ft 11in
Wing area: 142.1sq ft
Aspect ratio: 21.8
Empty weight: 562lb
Max weight: 837lb
Max speed: 130mph
Max aero-tow speed: 87mph
Min sinking speed: 1.84ft/sec at 46.5mph
Best glide ratio: 39:1 at 56mph

Neukom S-4A Elfe. John W. R. Taylor

A developed version of the Standard Elfe S-3, the S-4A Elfe 15 differs from it principally in having a new two-piece wing of the same 15m span, strengthened and fitted with Schempp-Hirth air brakes; the single spar is of aluminium alloy and the wing skin of plywood/foam sandwich. A roomier forward fuselage of improved aerodynamic shape is featured, with the slight step forward of the canopy on the Standard Elfe S-3 completely eliminated. The fuselage and tail unit are of glassfibre and plywood/foam sandwich construction, and the landing gear consists of a retractable rubber-sprung monowheel with brake. The prototype Elfe 15 made its first flight in 1970 and 10 had been built by early 1973; production continues, although at a rather slow rate. Both the Elfe 15 and Elfe 17 are available in kit form for amateur construction, the latter being a 17m span Open Class version of the S-4A Elfe 15, with the same fuselage but with a wider span two-piece wing, with provision for a tank in each leading edge to house a total of 132lb of water ballast. The Elfe 17 also has a braking parachute fitted, and a total of 10 of this version had been built by the spring of 1973, with production continuing at a relatively slow rate.

The Elfe M17 is a single-seat motor glider version of the Open Class Elfe 17 and first flew in prototype form in mid-March 1978. It is powered by a 45hp Parodi HP 45 four-cylinder four-stroke engine driving a Hoffmann two-bladed propeller; this is pylon-mounted aft of the cockpit and retracts into the fuselage when not in use. Electric starting is provided and the fuel tank capacity is 10 Imp gallons (45 litres). Apart from the engine and its related modifications the Elfe M 17 is the same as the unpowered Elfe 17.

Neukom AN-66 Super-Elfe

Switzerland

Data: AN-66C Super-Elfe
Span: 75ft 5½in
Length: 26ft 6¾in
Height: 6ft 0¾in
Wing area: 172.2sq ft (flaps in)
Aspect ratio: 33.1 (flaps in)
Empty weight: 926lb
Max weight: 1,433lb
Max speed: 168mph (in smooth air)
Min sinking speed: 1.64ft/sec at 46.5mph (flaps out)
Best glide ratio: 48:1 at 56mph (flaps in)

The Neukom AN-66 high performance single-seater first flew in prototype form in 1966, and was followed by two others, designated AN-66-2, which featured a modified fuselage. These versions have cantilever shoulder-mounted wings of 18m (59ft 0½in) span and of Eppler 441 aerofoil section, which are of sandwich construction with a metal spar and have plain flaps. The forward fuselage is a glassfibre sandwich structure, while the rear portion is a wooden plywood and balsa sandwich semi-monocoque, and a 'butterfly'-type V-tail is fitted. The landing gear is a rectractable monowheel and the

Neukom AN-66C Super Elfe. John W. R. Taylor

pilot sits under a long flush-fitting transparent canopy. The AN-66C Super Elfe is a development of the AN-66-2 with the same fuselage but with an entirely new variable-geometry wing with a special aerofoil flap that can be extended to increase the wing area by about 20%; a conventional tail unit with a low-set tailplane, similar to that of the Standard Elfe S-3, replaces the AN-66-2's V-tail. Flight tests of the prototype AN-66C began at Butzweilerhof in Germany on 11 September 1973. The new wing has a longer span of 23m (75ft 5½in) and the aerofoil flaps are chain-operated by a crank in the cockpit and can either be fully extended or fully retracted, no intermediate position being possible; when fully extended or retracted the wing profile is changed so as to result in a continuous Eppler aerofoil section. A tank to contain 132lb of water ballast is situated in the leading edge of each wing centre section, the latter being 21ft 4in in length and the two outer panels 27ft 0¾in each. The single-spar wings have riveted duralumin double-T spars, and plywood/balsa/plywood sandwich outer skins formed by vacuum pressing; Schempp-Hirth air brakes are fitted. Landing gear consists, as it did on the AN-66-2, of a retractable monowheel and tailskid. The wing area is increased from 172.2sq ft with the flaps in, to 206.7sq ft with flaps extended, when the aspect ratio is 27.6 compared to 33.1 with the flaps in. The AN-660 prototype, produced in 1974, has a four-piece wing of 21m (68ft 11in) span.

Oberlerchner Mg 19

Austria

Data: Mg 19a
Span: 57ft 9in
Length: 26ft 4½in
Height: 5ft 6in
Wing area: 226.1sq ft
Aspect ratio: 14.23
Empty weight: 657lb
Max weight: 1,058lb
Max speed: 112mph
Min sinking speed: 2.1ft/sec at 38.5mph
Best glide ratio: 27.8:1 at 42mph

The firm of Josef Oberlerchner Holzindustrie had become the foremost Austrian sailplane manufacturer, producing over 4,000 gliders and powered aircraft between 1941 and 1967, of which the Mg 19 tandem two-seater trainer and the Mg 23 high performance single-seater were the most important postwar types. Before the war Austria, like its more powerful neighbour Germany, had produced some notable sailplanes, in particular the Mg series designed by Ing Erwin Musger which culminated in the Mg 19 and Mg 23. The first of these was the gull-winged Mg 2 of 1930, a cantilever shoulder wing monoplane of 18m (59ft 0½) span, followed in 1931 by the Mg 4, Austria's first high performance glider which made some notable long distance fights, and which was developed into the Mg 10. The two-seater Mg 9 was designed in 1935, and in this Musger himself set up an Austrian duration record of 8.09 hours in 1936. This was followed by a world duration record of 40 hours 51 minutes set up on 10 September 1938, also in an Mg 9; six months before Austria had been annexed by Nazi Germany under the Anschluss, and the last type to be produced before war broke out was the Mg 12 training glider. The Mg 19, which made its first flight in November 1951, is a development of the prewar Mg 9, of conventional wood and fabric construction and distinguished by a laminar flow gull wing in the low/mid-set position, of Göttingen 549/676 section. There are air brakes in the wing upper surfaces and the two pilots sit in tandem under a sideways-hinging cockpit canopy. The Mg 19 proved to be popular as a training sailplane and examples of the type competed in the 1954 and 1956 World Gliding Championships.

Oberlerchner Mg 19. Eric Wagner

Oberlerchner Mg 23

Austria

Data: Mg 23 SL
Span: 53ft 9½in
Length: 23ft 4in
Height: 4ft 10¾in
Wing area: 153sq ft
Aspect ratio: 18.54
Empty weight: 529lb
Max weight: 794lb
Max speed: 137mph (in smooth air)
Max aero-tow speed: 80mph
Min sinking speed: 2.10ft/sec at 48.5mph
Best glide ratio: 33:1 at 53mph

The Mg 23 high performance single-seater was the last of the Mg series designed by Erwin Musger and first few in prototype form on 25 June 1955. That was the year in which Austria had signed its State Treaty with the Allied occupying powers, and Soviet and Western troops withdrew from the country. With normal peacetime conditions returning for the first time since 1938, Austrian gliding amongst other activities began a resurgence and the Mg 23, as the Mg 19 had done before it, won the Austrian State Championships and set a number of new national records; it also equipped the country's national gliding team which began to re-establish Austria's prewar position in competition flying. The Mg 23 was followed by the production Mg 23SL, which flew for the first time on 1 April 1962, and had a number of refinements including a longer, flush fitting cockpit canopy, larger fin and rudder and a lowered monowheel. It is cleared for cloud flying and spinning, but is not aerobatic; it was awarded type approval by the US FAA, as well as by the Austrian authorities, and examples have been exported to the USA and Canada. The Mg 23SL was the last sailplane to be built by the firm of Josef Oberlerchner, about 100 having been completed when production ceased in 1967. Of conventional wood and fabric construction, the Mg 23 has cantilever single-spar shoulder wings with no flaps and wooden fabric-covered inset-hinge ailerons. Wooden Schempp-Hirth air brakes are fitted, and there are layers of plywood stiffening forward of the spar which, combined with a close rib spacing, make easier the production of a smooth polished wing surface. The semi-monocoque plywood fuselage is of oval section and the wooden tail unit has fabric-covered rudder and elevators, and a Flettner-type tab in the starboard elevator. The landing gear consists of a non-retractable monowheel behind the cg, with a brake but with no shock absorber, plus a nose skid partly shock-absorbed by rubber, and a bow-shaped tailskid. The pilot sits under a jettisonable Plexiglas canopy which slides forward to open; the seat back and rudder pedals are adjustable and the cockpit is ventilated.

Oberlerchner Mg 23. Eric Wagner

Oshkinis BRO-11 Zile

USSR

Data: BRO-11
Span: 23ft 10½in
Length: 16ft 11½in
Wing area: 113.0sq ft
Aspect ratio: 5.05
Empty weight: 128lb
Max weight: 260lb
Stalling speed: 19mph
Min sinking speed: 3.28ft/sec

The BRO-11 Zile (or Acorn) single-seat basic training glider is a rather smaller Russian version of the EoN

Primary/Dagling/SG 38 formula, and first flew in 1954; it has since been built in large numbers for use by the DOSAAF as an elementary training glider. It was designed by B. Oshkinis and among the factories building it was the Experimentalnii Zavod Sportivnoi Aviatsii (or Experimental Sports Aviation Factory) where B. Oshkinis was one of the designers and which started production of the type in 1969; this later became the LAK organisation, which created the LAK-9 Lietuva and continues to produce the BRO-11. A modified version known as the BRO-11-M was later produced, and a biplane seaplane version, the BRO-16, made its first flight in August 1973. Another, shorter-span version, which may be experimental, is the BRO-17U Utochka. The BRO-11 is a strut-braced high wing monoplane of fabric and ply-covered wooden construction, with the pilot sitting on an elongated beam which forms the fuselage and which has a semi-recessed monowheel for landing; there is a towing hook under the nose and a bumper at the end of the boom to act as a tailskid. The tail unit is carried on a framework of metal tubing and wire bracing, and the flaps are similar in appearance to the Miles high-lift auxiliary flaps fitted to the Aerovan and Gemini.

Partenavia Sea-Sky

Italy

Span: 24ft 7in
Length: 20ft 0in
Height: 7ft 3in
Wing area: 121.1sq ft
Empty weight: 187lb
Max weight: 375lb
Min sinking speed: 4.90ft/sec at 33.5mph
Best glide ratio: 9:1

One of the very few water-based gliders, the Sea-Sky was designed and produced in the early 1960s by Partenavia of Naples, best known today for the P68B Victor light transport and its derivatives. The Sea-Sky was a small single-seater with the pilot seated in a single-step speedboat-like wooden semi-monocoque hull, with a small water rudder under the step, and the cantilever tail unit, of fabric-covered metal construction, carried on a steel tube tail boom. The tailplane is a one-piece all-moving surface, with a tab on the port trailing edge. The braced parasol wing is of constant chord and is carried on an inverted vee steel tube structure at the rear of the hull, with steel tube bracing struts at the sides; the wing is a two-spar wooden structure, fabric-covered, with plain fabric-covered wooden ailerons and small fixed floats at the squared-off wing tips. The pilot sits in an open cockpit and has an overhanging control column and conventional rudder bars; the Sea-Sky is designed to be towed behind a motor boat. It is, however, capable of free flight and the wings and tailplane can be easily removed for transport and storage.

PIK-3C Kajava

Finland

Data: PIK-3C
Span: 49ft 2½in
Length: 21ft 7¾in
Height: 3ft 3in
Wing area: 141sq ft
Aspect ratio: 17.1
Empty weight: 364lb
Max weight: 617lb
Max speed: 155mph
Min sinking speed: 2ft/sec at 40.5mph
Best glide ratio: 30:1 at 46.5mph

The PIK series of sailplanes designed and produced in Finland gets its name from the Polyteknikkojen Ilmailukerho, the flying club of the Student Union formed at Helsinki University of Technology in 1931; this series started in 1945 and the PIK-3 single-seater, intended for use by and for construction by gliding clubs, was the first to go into series production. It was followed by the PIK-5A, B and C intermediate training sailplanes and the PIK-7 primary glider which, together with the PIK-3, became standard types in the Finnish clubs, and the first two-seater in the series, the PIK-12 trainer. The PIK-3 was designed by Lars Norrmen and Ilkka Lounama, the first prototype making its maiden flight in the summer of 1950, and was of conventional wooden construction. It was followed by 20 PIK-3A and PIK-3B variants, the 3B, developed by Aush Koskinen, featuring air brakes instead of the 3A's wing flaps, and both these versions had a 13m (42ft 7¾in) span wing. The PIK-3C Kajava is a high performance version of the 3B incorporating modifications, in particular a wing span increased to 15m (49ft 2½in), to comply with Standard Class rules. The wing structure was completely redesigned and a new cockpit canopy fitted, the fuselage remaining otherwise unchanged from the 3B's. The prototype PIK-3C first flew on 20 May 1958 and the 3C was modified for series production by Tuomo Tervo at the Suomen Ilmailuliito (the Finnish Aeronautical Association); 20 had been built by the beginning of 1970. Resembling the EoN Olympia, but with a more angular fin and rudder, the PIK-3C has high-set single-spar wooden wings and an oval-section wooden fuselage with diagonal ply covering, the fin and tailplane also being ply covered.

PIK-16C Vasama

Finland

Data: PIK-16C
Span: 49ft 2½in
Length: 19ft 7in
Height: 4ft 9in

Wing area: 125.9 sq ft
Aspect ratio: 19.2
Empty weight: 419lb
Max weight: 661lb
Max speed: 155mph (in smooth air)
Min sinking speed: 1.94ft/sec at 45.5mph
Best glide ratio: 34:1 at 53mph

The PIK-16C Vasama (or Arrow) single-seat Standard Class sailplane was designed by Tuomo Tervo, Jorma Jalkanen and Kurt Hedström, who made use of design experience with the earlier PIK-3C Kajava. The prototype first flew on 1 June 1961 and had a 'butterfly' V-tail; the PIK-16A and PIK-16B were followed by the major production version the PIK-16C, which has a conventional tail unit instead of the earlier V-tail, and several other improvements, such as a sandwich-type construction for the wing leading edge. In 1963 the PIK-16C was awarded the OSTIV prize for the best Standard Class sailplane, and at that year's World Gliding Championships held at Junin, Argentina, a PIK-16C was flown into third place in the Standard Class by Juhani Horma of Finland; the type also set up several Finnish records. The PIK-16C was put into production by K. K.

PIK-16C Vasama. Eric Wagner

Lehtovaara O/Y of Hämeenlinna and a total of 56 of all variants were built. The Vasama is of all-wood construction, the cantilever shoulder wings being built of pine and birch wood and having an exceptionally low (for a sailplane) thickness/chord ratio of 14% at the root to give a good optimum glide angle. The shaped box spar of birch plywood forms 40% of the chord and takes the bending and torsion loads. Aft of the spar the top surfaces are plywood-covered and the under surfaces fabric-covered, and there are spoilers in the top and bottom wing surfaces. The plain ailerons are of ply-covered wooden construction, and all the Vasama's surface areas are highly polished to help give it a higher performance. The monocoque fuselage is of plywood construction with a glassfibre nose-cap, and the pilot sits in a semi-reclining seat under a removable blown Perspex canopy that extends some way back past the wing leading edge. Landing gear consists of a non-retractable monowheel with a brake, and a skid under the nose section. The tail unit is also of wood, with a trim tab in the port elevator.

Pilatus B4-PC11

Switzerland

Data: B4-PC11AF
Span: 49ft 2½in
Length: 21ft 6¾in
Height: 5ft 1¾in
Wing area: 151.1sq ft
Aspect ratio: 16.0
Empty weight: 507lb
Max weight: 771lb
Max speed: 149mph (in smooth air)
Max aero-tow speed: 112mph
Min sinking speed: 2.1ft/sec at 45mph
Best glide ratio: 35:1 at 53mph

More than 330 examples of this popular Standard Class Swiss single-seater had been delivered to customers in no less than 30 countries by March 1978, and the production rate was as high as 7-8 aircraft per month. The popularity of the Pilatus B4-PC11 AF, as the current version is designated, owes much to its suitability both for the pilot who has just soloed, because of its docile handling characteristics, and to the more experienced pilot because it is

Pilatus B4-PC11.

cleared for aerobatics and has a good performance, besides being suitable for multi-purpose training. Certification for full aerobatic manoeuvres was granted in January 1975. Of all-metal construction, the type was designed by Ingo Herbot as a private venture and first flew in prototype form, as the B-4, in 1966; the design was taken over and developed by Pilatus as the B4-PC11, which first flew in 1972. Swiss certification was granted on 12 June that year, and the first delivery was made shortly afterwards. On 19 June 1978 Pilatus announced the sale of all manufacturing and sales rights in the B4 to the Japanese firm of Nippi – Nihon Kikoki Kabushiki Kaisha (or Japan Aircraft Manufacturing Co Ltd) so as to be able to concentrate on production and development of the PC-6 Turbo-Porter and PC-7 Turbo-Trainer. The first Nippi-built B4-PC11 AF was rolled out on 1 June 1979 and initial production is to be at three per month after Japanese certification. The first Nippi-built B4-PC11 AF made its maiden flight on 25 November 1979. Pilatus is to continue the product support of Swiss-built examples. The B4 is a cantilever shoulder-wing monoplane with a T-tail; the wings are of light alloy with a U-shaped light alloy main spar and hard PVC foam ribs between the metal ribs; the large skin panels are attached to the main spar by a single row of countersunk rivets, and the ailerons are of similar construction. There are light alloy spoilers in the wing upper surfaces at the 60% chord line. The semi-monocoque fuselage is also of light alloy, with a flush-riveted skin, and the rear fuselage consists of two half-shells riveted together. The light alloy T-tail has PVC ribs and a fixed-incidence tailplane, and the elevator has a bias spring for trimming. The landing gear consists of a non-retractable unsprung Tost monowheel with drum brakes, although a retractable one can be fitted if the customer desires, and there is a fixed tailwheel; small doors enclose the monowheel when retracted. The pilot sits in a semi-reclining position under a sideways-hinging canopy that is jettisonable in flight, and a battery radio and oxygen system are optional.

Reghin RG-5 Pescarus

Romania

Span: 49ft 6½in
Length: 24ft 3in
Wing area: 165.75sq ft
Empty weight: 463lb
Max weight: 661lb
Min sinking speed: 2.49ft/sec at 37mph
Best glide ratio: 27:1 at 47mph

The Romanian organisation of Cil Reghin began developing gliders to the design of Ing Vladimir Novitchi in 1953, starting with the RG-4 Pionier primary trainer, which first flew in May 1954 and 50 of which were built subsequently. This was followed by the RG-5 Pescarus single-seater which made its first flight on 8 September 1957; it went into production the following year, a total of 26 being delivered to Romanian gliding clubs. It is a cantilever mid-wing monoplane of all-wood construction with a rather large two-piece cockpit canopy; the single-spar wing has a plywood leading edge torsion box and is covered with ply and fabric. DFS air brakes are fitted and there are no flaps. The wooden fuselage has plywood stressed skin covering, the landing gear consisting of a monowheel, a front skid under the forward fuselage and a tail bumper. The cantilever wooden tail unit is also ply- and fabric-covered.

Reghin RG-9 Albatros

Romania

Span: 54ft 0in
Length: 26ft 2in
Wing area: 215sq ft
Aspect ratio: 13.5
Empty weight: 639lb
Max weight: 1,036lb
Min sinking speed: 2.79ft/sec at 38.5mph
Best glide ratio: 25:1 at 49mph

The second of Ing Vladimir Novitchi's sailplanes to go into service with Romanian clubs was the RG-9 Albatros tandem two-seater trainer, which first flew in prototype form on 1 June 1958, and of which 25 were built. It is of conventional wooden construction, characterised by a cantilever mid wing and a long cockpit canopy with two separate sideways-opening sections for pilot exit and entry. The wooden wings each have a plywood leading edge torsion box and fabric covering aft of the spar; air brakes are fitted and the wooden ailerons are fabric-covered. The fuselage is a plywood monocoque, and the landing gear consists of twin wheels under the centre fuselage plus a skid under the nose. The cantilever tail unit is of wooden construction.

RG-1 Rohini-1

India

Span: 54ft 4in
Length: 26ft 9½in
Height: 7ft 7¾in
Wing area: 223.3sq ft
Aspect ratio: 13.2
Empty weight: 604lb
Max weight: 1,089lb
Max speed: 108mph (in smooth air)
Max aero-tow speed: 70mph
Min sinking speed: 2.35ft/sec at 38mph
Best glide ratio: 22:1 at 48mph

Resembling the Slingsby T21B Sedbergh, the RG-1 Rohini-1 side-by-side two-seater trainer was the first

RG-1 Rohini. John W. R. Taylor

type designed at the Technical Centre of India's Civil Aviation Department to go into production in more than small quantities. Starting with an open-cockpit primary type glider first flown in November 1950, the Technical Centre built two Model PT-G open-cockpit primary single-seaters based on the ESG design, six Model IT-G intermediate trainers based on the Grunau Baby, two Model AS-1 high performance sailplanes based on the Olympia and five Ashvini tandem two-seater trainers resembling the DFS Kranich; 11 more Ashvinis were built by Aeronautical Services Ltd of Calcutta. Next of the Centre's types to appear was the RG-1 Rohini-1, designed by S. Ramamritham, who eventually became the Centre's Director-General, and it first flew on 10 May 1961; four prototypes were built at the centre between 1961 and January 1964. Since the Centre does not undertake quantity production of its gliders, but supplies complete sets of drawings of its designs to any firms interested in manufacturing them, the Rohini went into production elsewhere, 17 examples being built by Veegal Engines and Engineering Co of Calcutta and a further 86 by Hindustan Aeronatuics Ltd at its Kanpur Division. To minimise production costs the tail surfaces, air brakes and many wing ribs of the Rohini were made identical to those of the earlier Ashvini. Of all-wood construction, the Rohini has a braced high wing which is a two-spar structure, plywood-covered to the rear spar and with a fabric-covered trailing edge; the fabric-covered wooden ailerons have ply-covered leading edges, and there are air brakes above and below the wing on each side. The fuselage is built as a one-piece structure with integral fin, the forward portion to the wing rear spar attachment and the rear portion aft of the tailplane front attachment bulkhead being plywood-covered wooden semi-monocoques, whereas the remaining centre and rear portions have a fabric-covered wooden girder structure. The cantilever wooden tail has a plywood-covered fin and fabric-covered rudder, tailplane and elevators except for the leading edges and that part of the tailplane between the two root ribs, which are ply-covered. There is a trim tab in the starboard elevator. The landing gear consists of a non-retractable unsprung Dunlop monowheel and tyre, with no brake, and a rubber-sprung nose skid under the forward fuselage with a replaceable steel shoe; there is a spring steel tail skid. The two pilots sit side-by-side in an open cockpit with small windshields.

Rolladen-Schneider LS1

FGR

Data: LS1-f
Span: 49ft 2½in
Length: 21ft 11¾in
Height: 3ft 11½in
Wing area: 105sq ft
Aspect ratio: 23.0
Empty weight: 507lb
Max weight: 860lb
Max speed: 155mph (in smooth air)
Min sinking speed: 2.1ft/sec at 43.5mph
Best glide ratio: 38:1 at 56mph

The LS1 high performance Standard Class single-seater is one of the most advanced German sailplanes, and was designed by Dipl-Ing Wolf Lemke and produced by Walter Schneider, at first under the name Segelflugzeugbau Schneider OHG, but now as Rolladen-Schneider Flugzeugbau GmbH. Two prototypes of the LS1 competed in the German National Championships of 1968, taking first and second places out of 44 competitors, and the prototypes were fitted with a novel form of air brake consisting of a portion of the trailing edge hinging upwards inboard of the ailerons, and hinged close to its mid-chord line so that the air brake's leading edge moved down while its trailing edge moved upwards. These brakes were found to be effective only at certain speeds, however, and so production LS1s featured conventional Schempp-Hirth air brakes. Characterised by a cantilever mid wing and a T-tail, the LS1 is of glassfibre and PVC foam construction, with the pilot seated in a semi-reclining position under a

Rolladen-Schneider LS1.

large one-piece flush-fitting canopy. The LS1-c featured an all-moving tailplane instead of the tailplane and elevators of earlier versions, and the LS1-d introduced provision for water ballast, over 200 of these two versions being built. The LS1-f has a redesigned rudder and reverts to a fixed tailplane and elevator; there is provision for up to 198lb of water ballast and the monowheel is now retractable instead of fixed as on earlier versions, and has rubber shock absorbers. Some improvements have been made to the cockpit interior and the tow release mounted on the landing gear strut has been modified; this can also be fitted in the nose, as required. The LS1-f first flew in 1972 and made its competition debut in that year's World Championships at Vrsac, Yugoslavia; an LS1 flown by Helmut Reichmann of Germany had taken first place in the Standard Class at the 1970 World Championships at Marfa, Texas. The LS1-f went on to take 8th, 10th and 14th places at the 1976 World Championships at Räyskälä in Finland. By January 1977 a total of 240 LS1-fs had been built, and a club version of the LS1-f, designated LS1-c Club, has been announced.

Rolladen-Schneider LS3

FGR

Data: LS3
Span: 49ft 2½in
Length: 22ft 3¾in
Height: 3ft 11¼in
Wing area: 109.8sq ft
Aspect ratio: 22.0
Empty weight: 617lb
Max weight: 1,040lb
Max speed: 168mph (in smooth air)
Max aero-tow speed: 118mph
Min sinking speed: 1.97ft/sec at 43.5mph
Best glide ratio: 40:1 at 68.5mph

Developed from the LS1-f via the LS2, which never went into production even though in prototype form, flown by Helmut Reichmann, it won the Standard Class section of the 1974 World Championships in Australia, the LS3's design and construction began in 1975. The prototype first flew on 4 February 1976 at Egelsbach in Germany, and more than 200 LS3s had been ordered by mid-January 1978; by the beginning of 1980 a total of 358 of all versions had been built. The LS3-a, which first flew in prototype form in the spring of 1978, differs from the LS3 chiefly in having horizontal and vertical tail surfaces of greater area and different aerofoil sections, and the empty weight reduced to 551lb; the maximum weight and performance remain the same. A 17m span version,

Rolladen-Schneider LS3.

designated LS3-a-17, is being developed with detachable wing tips which can be removed to restore the span to 15m, the LS3 itself conforming to the Standard Class 15m span. Like the LS1-f, the LS3 is a cantilever mid-wing monoplane with a T-tail; the wings are of glassfibre/foam sandwich construction as are the one-piece 'flaperons', or combined ailerons and flaps, which form the entire trailing edge; from 1979 the 'flaperons' have been replaced by conventional flaps and ailerons. There are air brakes in the upper wing surfaces and there is provision for up to 309lb of water ballast. The semi-monocoque fuselage, very similar to the LS1-f's, has a hinged one-piece flush-fitting canopy under which the pilot sits in a semi-reclining position. There is a retractable rubber-sprung monowheel with a drum-brake, and a tailskid. The fin and rudder, and the tailplane and elevators mounted on top of them, are all of glassfibre/foam construction. There is a mechanism to prevent the air brakes from opening at an incorrect flap setting, and the one-piece 'flaperons' enabled shorter, steeper landing approaches to be made than with conventional ailerons drooping in conjunction with the flaps.

Rolladen-Schneider LS4

FGR

Span: 49ft 2½in
Length: 22ft 1in
Empty weight: 517lb
Max gross weight: 1,004lb
Best glide ratio: 40.5:1 at 62mph
Min sinking speed: 1.9ft/sec at 51.5mph

Design work on this Standard Class sailplane began in the winter of 1978 and the prototype, registered D-6680, first flew on 28 March 1980. Production began in the autumn of that year and by the spring of 1981 50 LS4s had been built out of 160 on order. The type took the first seven places in the Standard Class at the 1981 World Gliding Championships at Paderborn, West Germany. The LS4 has a modified LS3-a fuselage married to a new thin-section wing mounted in the mid position, and with a double taper planform. It has air brakes in the upper surfaces, but flaps are not fitted. The cantilever T-tail has separate elevators rather than an all-moving tailplane,and the retractable monowheel has rubber suspension and a cable-operated brake. There is a rubber bumper-type tailskid with a semi-recessed tailwheel offered as an alternative. The pilot sits under a canopy that hinges upward and forward to open, and up to 140 litres of water ballast can be carried. The same glassfibre/foam sandwich construction as the LS3's is employed.

Scheibe Bergfalke IV

FGR

Data: Bergfalke IV
Span: 56ft 5¼in
Length: 26ft 3in
Height: 4ft 11in
Wing area: 183sq ft
Aspect ratio: 17.4
Empty weight: 661lb
Max weight: 1,102lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.23ft/sec at 47mph
Best glide ratio: 34:1 at 59mph

This tandem two-seater training and competition sailplane had its origins in the prototype Mü-13E Bergfalke I general purpose two-seater designed and built by Dipl-Ing Egon Scheibe in Austria, and which made its first flight on 5 August 1951. At the end of that year the Scheibe Flugzeugbau GmbH was founded and the Bergfalke (or Mountain Falcon) was the first type to go into production at the new company's works at Munich-Riem airport. From the

Scheibe Bergfalke. Eric Wagner

Mü-13E the Bergfalke II was developed with 4° forward sweep on the wings, and more than 250 of these two versions were built; the Mk II was succeeded by the Bergfalke II/55 two-seater which also had a fabric-covered steel tube fuselage and single-spar wooden wings of 54ft 6in span and 15.6 aspect ratio, these being of 14.5% Mü section. The II/55 was succeeded by the Bergfalke III with a more streamlined cockpit canopy, a redesigned and taller fin and rudder and 2° forward sweep on the wings of the same section, which have Schempp-Hirth air brakes; the monowheel is non-retractable as before, but a tailwheel replaces the II/55's tailskid. A few Bergfalke IIIs were built under licence by the Spanish firm Stark Ibérica SA. The Mk III was succeeded in its turn by the Bergfalke IV which has a new wing of Wortmann section and 2ft greater span, with an aspect ratio of 17.4; this gives improved performance, including a best glide ratio of 34:1 instead of 28:1 and a lower minimum sinking speed. Construction of the prototype Bergfalke IV began early in 1969 and the first flight was made a few months later, and a total of 70 of this version had been built by the beginning of 1978. The cantilever mid-wings are of all-wood construction with a fabric-covered plywood skin; they have single laminated beechwood box spars joined at the fuselage centre-line with a single vertical pin. The ailerons and Schempp-Hirth air brakes are also of wood. Like previous versions, the welded steel tube fuselage is fabric-covered, the nose section on the Mk IV being a moulded glassfibre shell. The tail unit is of wooden construction, the tailplane being mounted on the fuselage forward of the fin; there is a Flettner trim tab in the starboard elevator. The landing gear consists of a non-retractable monowheel and a tailwheel. The two pilots are seated under a blown Plexiglas canopy.

A Bergfalke IV has been modified by the Flying Training School of the Detmold Aero Club into a motor glider, with one Lloyd LS-400 piston engine in the fuselage driving a pair of small two-bladed pusher propellers which rotate within cutouts in each wing near the trailing edge; there is a 12v battery for engine starting. In this form the Bergfalke IV is known as the LVD BF IV-BIMO, the letters LVD signifying Schülerfluggemeinschaft der Luftsport-verein Detmold EV. Scheibe themselves were test flying another powered version of the Bergfalke IV early in 1976 with a 52hp Hirth 0-28 'flat twin' engine mounted on a retractable pylon aft of the cockpit and driving a two-blade fixed-pitch tractor airscrew; the engine can be raised and lowered into the fuselage electrically in less than 20 seconds, retracting behind closed doors. This version was known as the Bergfalke IVM.

Scheibe L-Spatz-III

FGR

Data: L-Spatz-III
Span: 49ft 2½in
Length: 20ft 6in
Height: 3ft 11in
Wing area: 125.9sq ft
Aspect ratio: 19.0
Empty weight: 353lb
Max weight: 585lb
Max speed: 112mph
Max aero-tow speed: 78mph
Min sinking speed: 2.20ft/sec at 38.5mph
Best glide ratio: 28:1

Second of the postwar Scheibe designs to go into production was the Spatz (or Sparrow) single-seater suitable for training or competition flying; this first flew on 12 March 1952 and in its initial form was a mid-wing monoplane. It was developed into the high wing Spatz-55 and L-Spatz-55, the latter differing from the Spatz-55 mainly in having a wing span increased to 15m (49ft 2½in) to give a 10% improvement in performance; the Spatz had the usual Scheibe construction of fabric-covered steel tube fuselage and a wooden single-spar wing, which on the L-Spatz-55 had an area of 125.9sq ft and an aspect ratio of 19.0. Next variant was the L-Spatz-III, which differed from the 55 version in having aerodynamic twist on the outer wings to improve the stalling characteristics, larger air brakes and tail surfaces, a shallower fuselage to improve the aerodynamics and appearance, a roomier cockpit and a Flettner trim tab in the elevators. The wing leading edge torsion box is plywood-covered, the remainder of the wing being fabric-covered. The

Scheibe L-Spatz-55. Eric Wagner

fuselage is rectangular in section forward and of triangular section at the rear, the rear fuselage having fabric covering over wooden formers. The nose is covered with a moulded glassfibre shell on the L-Spatz-III, and the cantilever tail unit is of wood. The landing gear normally consists of a monowheel and nose skid, but a longer skid can be fitted under the fuselage and a detachable ground handling trolley can replace the monowheel. The pilot sits under a one-piece blown Plexiglas canopy, and has adjustable rudder pedals.

The L-Spatz-55 was also built under licence in small numbers at Monfalcone by the Italian firm of Meteor SpA Costruzioni Aeronautiche, as the MS 30L Passero (or Sparrow), and in France by Société Avialsa as the Fauconnet A-60 (or Falconet). The latter was a refined version of the L-Spatz-55 which first flew in prototype form in June 1960 and received its French C of A in 1961; it was produced at the rate of two or three a month both in standard form and in a special version with 'super finished' wings, and was also made available in kit form for amateur constructors, requiring only about 400 hours of work to assemble. The special 'super finished' version had a better best glide ratio (29.5:1) and minimum sinking speed (2.03ft/sec) than the standard one. A few L-Spatz-IIIs were also built under licence by the Spanish firm Stark Ibérica SA.

Scheibe SF-27 Zugvogel-V

FGR

Data: Zugvogel-V
Span: 49ft 2½in
Length: 23ft 3½in
Wing area: 129.9sq ft
Aspect ratio: 18.6
Empty weight: 474lb
Max weight: 728lb
Min sinking speed: 2.10ft/sec at 46mph
Best glide ratio: 34:1 at 55mph

Scheibe's first postwar essay into the high performance field was the Zugvogel (or Migratory Bird) single-seat sailplane which had laminar flow wings of NACA 63-series section and with a forward sweep of 2.5°. This made its competition debut when it was flown by veteran test pilot Hanna Reitsch into the winning place in the 1955 German National gliding championships. It had the traditional Scheibe fabric-covered steel tube fuselage and wooden single-spar wing and tail surfaces, the wing span being 16m (52ft 6in) with an aspect ratio of 18.3 and area of 150.16sq ft. Next version as the Zugvogel-II, which had an unswept wing of simpler construction, a simplified control system and various other changes over the initial version. This was developed into the Zugvogel-III, which first flew in prototype form in April 1957 and which differed from the Mk II only in having the wing span increased to 17m (55ft 9in) and a larger fin and rudder, the aspect ratio now being 20.0 and wing area 155.9sq ft. Further versions were the Zugvogel-IIIA and IIIB, the latter version, the prototype of which was completed in June 1962, having a redesigned nose and cockpit canopy, the stepped canopy of earlier versions being replaced by a longer flush-fitting one-piece plastic canopy blending into a shorter, more pointed nose. The high cantilever wings have Schempp-Hirth aluminium air brakes, and depending on the degree of surface polishing the best glide ratio can be improved from 36:1 at 62mph to 39:1.

The SF-27 Zugvogel V, the prototype of which first flew on 12 May 1964, is a single-seat Standard class development of the Mk IIIB with cantilever shoulder instead of high wings of 15m (49ft 2½in) span and Wortmann aerofoil sections; the tailplane is now an all-moving surface and more glassfibre is used in the fuselage structure. The wings have a single laminated beechwood box spar and plywood ribs, with a leading edge torsion box; the outer halves of the wings are plywood-covered, and the inboard halves are ply-covered to just behind the spar, the rest of the wings being part plywood- and part fabric-covered. The wooden ailerons are ply-covered and the Schempp-Hirth air brakes are of glassfibre and metal. The welded steel tube fuselage has the nose section back to the wing trailing edge covered with moulded glassfibre shell, and the rear section fabric-covered over wooden stringers. There is a moulded glassfibre fairing over the wing/fuselage junction. The cantilever tail unit is of wood, with a ply- and

Scheibe SF-27 Zugvogel V. Eric Wagner

fabric-covered tailplane, the fin is plywood-covered and the rudder fabric-covered; there is an anti-balance tab in the tailplane. Landing gear consists of a non-retractable and unsprung monowheel ahead of the cg, with a brake, and a tailwheel. The pilot sits in an inclined seat under the moulded Plexiglas canopy, and there is a baggage compartment behind the seat.

The Zugvogel V is built under licence in France by Lorraine Aviation as the Loravia LA-11 Topaze, this company having taken over production of the type from SLCA, which had built nine SF-27s under the designation SLCA-10 (now LA-10). The LA-11 has the monowheel lowered by 80mm and first flew on 15 October 1973; 18 LA-11s were built by SLCA and Loravia had built 30 by early 1976.

Scheibe SF-30 Club-Spatz

FGR

Span: 49ft 2½in
Length: 20ft 0in
Wing area: 100.1sq ft
Aspect ratio: 24.0
Empty weight: 408lb
Max weight: 650lb
Max speed: 131mph
Min sinking speed: 1.9ft/sec at 47mph
Best glide ratio: 37:1 at 57mph

Although bearing the same name as the earlier L-Spatz-III, the SF-30 Club-Spatz single-seater Club Class sailplane was developed from the SF-27A Zugvogel, which it resembles, and was designed to the German Club Class requirements intended to meet the need for simple and easy to fly gliders for inexperienced pilots, which would also be strong and easy to rig. Design work started in 1973 and the prototype Club-Spatz first flew on 20 May 1974; eight had been built by the spring of 1977 but production has now ended. The fuselage is of traditional Scheibe welded steel tube construction with fabric covering, except that the forward fuselage is glassfibre-covered. The pilot sits under a one-piece sideways-hinging flush-fitting blown Plexiglas canopy, and his seat and rudder pedals are adjustable. Landing gear consists of a fixed unsprung monowheel with brake, and a sprung tail skid. Wings and tail surfaces are of composite glassfibre construction, with the outer surfaces made wholly of glassfibre supported by plastic foam; there are spoilers in the wing upper surfaces. Instead of the SF-27 Zugvogel's all-flying tailplane, the Club-Spatz has a conventional tailplane and damped elevators, the latter having an adjustable spring for trimming.

Scheibe SF-30 Club-Spatz. John W. R. Taylor

Scheibe SF-H34

FGR

Span: 51ft 10in
Length: 24ft 7.25in
Height: 4ft 9in
Wing area: 159.3sq ft
Aspect ratio: 16.9

Empty weight: 675lb
Max weight: 1,102lb
Max speed: 155mph (in smooth air)
Min sinking speed: 2.30ft/sec at 47mph
Best glide ratio: 35:1 at 59mph

Intended to succeed the veteran Bergfalke, the SF-H34 tandem two-seater training and sporting sailplane can be used for ab initio and advanced training and cross-country flying, and is Scheibe's first unpowered design of all-glassfibre construction. Design work, headed by Dipl-Ing Hoffman, began in 1978 and the SF-H34 prototype first flew on 28 October 1978; production began early in 1979. The cantilever two-piece mid-set wing has a glassfibre roving main spar and is of glassfibre honeycomb sandwich construction, as is the tail unit with its low-set tailplane; there are Schempp-Hirth air brakes in the wing upper surfaces, and production aircraft have no leading edge sweepback. The fuselage is a glassfibre honeycomb sandwich shell, and there are towing hooks fitted under the nose and at the centre of gravity. Landing gear consists of a fixed semi-exposed monowheel directly below the cg and a nosewheel, plus a tailskid. The pilots sit in semi-reclining seats with dual controls under a large one-piece frameless flush canopy that opens sideways; the seat backrests and rudder pedals are adjustable in flight.

Scheibe Sperber

FGR

Span: 46ft 7in
Length: 24ft 3in
Height: 4ft 7in
Wing area: 187.3sq ft
Aspect ratio: 11.6
Empty weight: 485lb
Max weight: 882lb
Max speed: 106mph
Min sinking speed: 3.05ft/sec
Best glide ratio: 19:1

The third postwar design of Scheibe-Flugzeugbau GmbH, following the Mü-13E Bergfalke and the Spatz, was the Specht (or Woodpecker) tandem two-seater training glider, which was completed in prototype form in March 1953. This featured the usual Scheibe construction of fabric-covered steel tube fuselage and two-spar braced wooden wings, which had a span of 44ft 3½in and an aspect ratio of 11. The Specht was developed into the Sperber (or Sparrowhawk), also a two-seat trainer but with enclosed side-by-side instead of tandem seating, and this first flew on 7 March 1956, later going into small-scale production. It also had a fabric-covered steel tube fuselage and braced fabric-covered wooden wings of 14% Mü section. The landing gear consists of a fixed monowheel and a spring steel tailskid.

Schempp-Hirth Cirrus

FGR

Span: 58ft 2½in
Length: 23ft 7¼in
Height: 5ft 0in
Wing area: 135.6sq ft
Aspect ratio: 25.0
Empty weight: 573lb
Max weight: 882lb
Max speed: 137mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 1.64ft/sec at 45mph
Best glide ratio: 44:1 at 53mph

This high performance single-seater is Schempp-Hirth KG's first sailplane of glassfibre construction, and was designed and test flown by Dipl-Ing Klaus Holighaus, who became a 50% shareholder in Schempp-Hirth in 1970 and five years later became co-owner of the reorganised Glasflügel firm. To achieve good low speed and climb characteristics the new thick Wortmann FX 66 series wing section was used, without any flaps, the stalling characteristics being better and weight saved by comparison with a thinner wing of similar span and aspect ratio with flaps, the slight disadvantage this thick section has compared with the thinner wings being over-

Schempp-Hirth Cirrus. Eric Wagner

come by provision for water ballast, up to 216lb of which can be carried. The prototype Cirrus made its first flight in January 1967 with an all-moving V-tail unit, but the second prototype and production aircraft had a conventional tail with the tailplane mounted part-way up the fin. A Cirrus flown by Harro Wödl of Austria was first in the Open Class in the 1968 World Championships at Leszno in Poland. A total of 120 Cirrus sailplanes were built by Schempp-Hirth before production ended late in 1971, but manufacture of the type has been continued since early in 1972 at Vrsac in Yugoslavia by VTC – Vazduhoplovno Technicki Centar – Vrsac; VTC had built about 60 by early 1975 under licence and production continues. The cantilever mid wings have an all-glassfibre box spar and the wing shell is of glassfibre/foam sandwich construction; the hinged ailerons are of glassfibre/balsa sandwich, and the Schempp-Hirth air brakes on both upper and lower wing surfaces are of aluminium alloy, a tail braking parachute also being fitted. The fuselage is a glassfibre shell, 1.5mm thck, stiffened with foam rings, and secured with resin. The cantilever tail unit is a glassfibre/foam sandwich structure. Landing gear consists of a manually-retractable monowheel with an annular rubber-sprung shock absorber and a drum brake. The pilot sits on a semi-reclining adjustable seat under a one-piece Plexiglas canopy.

Schempp-Hirth Janus

FGR

Data: Janus
Span: 59ft 8½in
Length: 28ft 3¼in
Height: 4ft 9in
Wing area: 178.5sq ft
Aspect ratio: 19.97
Empty weight: 838lb
Max weight: 1,366lb
Max speed: 136mph (in smooth air)
Max aero-tow speed: 105mph
Min sinking speed: 2.30ft/sec at 56mph
Best glide ratio: 39.5:1 at 68.5mph

Although there are many single-seat sailplanes of glassfibre construction few two-seaters so far have been built of this material, the Janus high performance trainer being among the first of them. Design work on this type was begun by Dipl-Ing Klaus Holighaus in 1969, was continued from early 1972 onwards and the prototype first flew in May 1974. Production began with the second aircraft, incorporating several improvements, in January 1975 and 100 examples of all versions of the Janus had been delivered by early 1980 plus three motorised Janus CMs. The Janus B became available to customers in March 1978, this having a fixed-incidence tailplane instead of the all-moving type previously fitted. The Janus has set several speed and distance records for two-seaters, including a 100km triangular closed circuit speed of 88.8mph in Switzerland flown by Klaus Holighaus and U. Plarre on 15 August 1974, a women's goal and return flight record of 339 miles in Italy in April 1976, flown by Adele Orsi and M. Monti, and further speed records over 100km, 300km and 500km triangular closed circuits in South Africa in November 1977. The Janus has a glassfibre monocoque fuselage with bonded-in foam bulkheads, and this is similar to the Nimbus 2's but the cockpit section is lengthened to accommodate the two pilots in tandem with dual controls under a hinged one-piece canopy. Landing gear consists of a non-retractable monowheel with a drum brake, and a nosewheel; there is also a bumper under the rear fuselage. The two-piece cantilever mid wings have 2° forward sweep on the leading edge, and are of glassfibre/foam sandwich construction, with glassfibre monocoque ailerons, flaps and Schempp-Hirth air brakes in the wing upper surfaces; the camber-changing flaps are operated between +12° and −7°. The tailplane is also of glassfibre/foam sandwich construction. The Janus C has carbon-fibre wings of 20m span and a carbon-fibre tailplane.

A French development of the Janus is the SCAP-Lanaverre SL-2 all-plastics sailplane created by SCAP – Société de Commercialisation Aéronautique du Plessis, SàRL and Lanaverre Industries, the latter building the Standard Cirrus under licence from Schempp-Hirth. First flown on 15 October 1977, the SL-2 differs from the Janus chiefly in having provision for 30.8 Imp gallons (140 litres) of water ballast in the wings and a fixed tailplane with elevators instead of a one-piece all-moving tailplane; a more comfortable cockpit for the two pilots is provided, with provision for back-type parachutes.

The Janus M prototype, D-KIBO, first flew in 1978 and is a motorised version with a 55hp Hirth 0-28 engine mounted on a pylon aft of the cockpit end retracting into the fuselage.

Schempp-Hirth Minimoa

FGR

Span: 55ft 9¼in
Length: 22ft 11½in
Wing area: 204.5sq ft
Aspect ratio: 15.2
Empty weight: 476lb
Max weight: 772lb
Max speed: 136mph
Min sinking speed: 2.1ft/sec at 39.5mph
Best glide ratio: 26:1 at 53mph

One of Germany's leading high performance single-seaters before the war, this gull-winged glider was designed by two of Germany's leading sailplane pilots, Martin Schempp and Wolf Hirth, who in 1935 founded the firm bearing their name in Göppingen. They designed and developed the Minimoa from the 20m span Moazagotl, and the name Minimoa is a contraction of miniature Moazagotl, although the design was also known as the Göppingen 3. In its original form it had cantilever shoulder-mounted

Schempp-Hirth Minimoa. J. M. G. Gradidge

gull wings, and it was built by Wolf Hirth and Dipl-Ing Wolfgang Hütter; the latter later helped to create the Glasflügel H 301 Libelle. By 1938 the Minimoa 3B was introduced with the gull wings now in the mid position with a modified aerofoil section, and reduced weight. From July 1935 to 1939 a total of 110 Minimoas were built, of which 13 were sold abroad to Britain, France, the USA, Argentina, South Africa and Japan; a few survived the war and are still flying. The Minimoa soon made its mark in contest flying, taking third place at the 1937 International Competition at the Wasserkuppe in Germany flown by Wolfgang Spate, and also setting many national records; it also set a world altitude record of 21,939ft. Of conventional wood and fabric construction, the Minimoa is characterised by swept back wing outer panel leading edges and large ailerons with trailing edges projecting beyond those of the wing itself; air brakes of the same basic Schempp-Hirth type later to be featured on many other sailplanes are fitted. The tailplane is mounted ahead of the fin and is raised above the fuselage top line. The pilot sits under a one-piece hinged cockpit canopy that opens to starboard, and by prewar standards the cockpit was roomy. Landing gear consists of a non-retractable monowheel and a skid under the nose, plus a small tailskid.

Schempp-Hirth Mini-Nimbus

FGR

Data: Mini-Nimbus C with carbon-fibre wings
Span: 49ft 2½in
Length: 21ft 0½in
Height: 4ft 4in
Wing area: 106.1sq ft
Aspect ratio: 23.0
Empty weight: 474lb
Max weight: 1,102lb
Max speed: 155mph
Min sinking speed: 1.74ft/sec at 48.5mph
Best glide ratio: 42:1 at 65mph

The Nimbus 2's exceptional performance had made it a leading contender in Open Class competition flying, in which it had twice won the World championships, and so there were obvious possibilities in a Standard Class version of this type with a shorter 15m span wing with camber-changing trailing edge flaps/air brakes and designed to meet the new FAI regulations for Standard Class 15-metre sailplanes.

Schempp-Hirth Mini-Nimbus.

This was the HS-7 Mini-Nimbus, designed by Dipl-Ing Klaus Holighaus, which first flew in prototype form on 18 September 1976, and a total of 200 had been ordered by February 1977; altogether 155 Mini-Nimbuses of all versions had been delivered by the beginning of 1980. As with the Nimbus 2, the T-tailplane was an all-moving surface on initial production aircraft, but from March 1978 a fixed-incidence tailplane was offered as an option for customers, the type being known as the Mini-Nimbus B with this tailplane. The Mini-Nimbus C is offered with either carbon-fibre wings and tailplane or those of glassfibre construction and the same new features as on the Nimbus 2C. Of the same glass-fibre/foam sandwich construction as the Nimbus 2, the cantilever mid wings have flaps that incorporate the wing root fairings and glassfibre air brakes in the wing upper surface immediately ahead of them. The flaps can be selected to five positions between −7° and +10°, and when they are lowered the trim lever operates the all-moving tailplane at the same time so as to give an automatic flap/trim system. Up to 265lb of water ballast can be carried, or 419lb in the carbon-fibre-winged Mini-Nimbus C. The glassfibre fuselage shell is stiffened with bonded foam rings and has a central tubular steel framework like that of the Nimbus 2; the fin is integral with the fuselage and the tailplane is of glassfibre/foam sandwich. Landing gear consists of a manually-retractable rubber-sprung monowheel with a drum brake. The pilot sits under a large one-piece flush-fitting canopy in a semi-reclining position.

Schempp-Hirth Nimbus 2

FGR

Data: Nimbus 2C with carbon-fibre wings
Span: 66ft 7¼in
Length: 24ft 0½in
Height: 4ft 9in
Wing area: 155.0sq ft
Aspect ratio: 28.62
Empty weight: 694lb
Max weight: 1,433lb
Max speed: 168mph (in smooth air)
Max aero-tow speed: 99mph
Min sinking speed: 1.5ft/sec at 50mph
Best glide ratio: 49:1 at 65mph

The HS-3 Nimbus high performance single-seater was designed and built in his spare time by Dipl-Ing Klaus Holighaus, with the aid of Schempp-Hirth, of which he became a 50% shareholder in 1970. It had the same fuselage as the Open Class Cirrus married to a new high-set three-piece wing of 22m (72ft 2½in) span and the high aspect ratio of 30.6; the tail unit was similar to that of the Cirrus. The prototype first flew in January 1969 and the next year a Nimbus flown by George Moffat of the USA won the Open Class in the World Gliding Championships at Marfa, Texas. The HS-3 Nimbus was of glassfibre/foam sandwich construction, the fuselage having a steel tube frame for the attachment of wings and landing gear, and the manually-retracted monowheel had a drum brake. No air brakes were fitted, and the pilot sat under a long two-piece canopy. The Nimbus had an exceptionally high performance, with a best glide ratio of 51:1 at 56mph and a minimum sinking speed of only 1.44ft/sec, and this performance would ensure its sales prospects. The Nimbus 2 is the production version, differing from the HS-3 in having the same fuselage as the Standard Cirrus married to a wing of shorter span (20.3m) and built in four sections to limit weight and dimensions for ease of rigging, storage and trailer transport. The glassfibre/foam sandwich wing structure was stiffened to eliminate the bending experienced with the earlier Nimbus wing, and glassfibre Schempp-Hirth air brakes are fitted in the upper surfaces; there is also a tail braking parachute. The ailerons and interconnected flaps are glassfibre shells, the flap settings ranging from −8° for high speed flight to +6° for soaring in thermals and 20° for landing; the flaps of the earlier Nimbus drooped to 90° for landing. Up to 353lb of water ballast can be carried. The glassfibre fuselage shell is stiffened with bonded-in foam bulkheads and there is a central tubular steel framework for attaching the wings and landing gear. The Nimbus 2 also differs from the earlier version in having a glassfibre/foam sandwich T-tail very similar to that of the Standard Cirrus; the first 132 Nimbus 2s have an all-moving tailplane, but 133rd and later aircraft known as the Nimbus 2B have a fixed incidence T-tailplane and elevator. The retractable rubber-sprung monowheel has a drum brake. The pilot sits in a semi-reclining seat under a long flush-fitting hinged canopy. The Nimbus 2C has a higher gross weight, is fitted with new brake type flaps instead of upper surface air brakes, and is available to customers with wings and tailplane built of carbon-fibre as an alternative to glassfibre construction; with the former up to 550lb of water ballast can be carried.

Design work on the Nimbus 2 began in January 1970 and the prototype, construction of which began in April that year, first flew in April 1971. By 1 January 1979 a total of 185 Nimbus 2s, 2Bs and 2Cs had been delivered, and the type has an outstanding competition record. It has twice won the Open Class in World Championships, in 1972 at Vrsac, Yugoslavia, flown by Goran Ax of Sweden and in 1974 at Waikerie, Australia, flown by George Moffat of the USA; in the 1976 World Championships in Finland, Nimbus 2s took no less than 14 of the first 25 places. On 15 February 1977 a Nimbus 2 flown by R. J. Rowe of Australia set a speed record of 83.264mph over a 750km course, and a similar record over 500km was set up by Edward Pearson of Rhodesia in another Nimbus 2 on 27 November 1976. The world distance record to a goal, for single-seaters, was set up by a group of three Nimbus 2s which covered 779.36 miles in New Zealand on 14 January 1978. The Nimbus 2CS that won the 1980 German National championships was modified to have extra wing panels to increase the span to 23.5m (77ft 0in). This preceded the Nimbus 3 which has a four-piece carbon-fibre wing of 22.9m span, and which was first flown in prototype form on 21 February 1981 by its

designer Klaus Holighaus. The Nimbus 3 makes extensive use of carbon-fibre in its structure, only the forward fuselage being of glassfibre. The three-part ailerons droop in conjunction with the flaps, and over 80 gallons of water ballast can be carried. The Nimbus 3 is probably the first sailplane to achieve a glide angle of better than 1 in 50, a figure of 55:1 being claimed, and Mk 3s took the first three Open Class places in the 1981 World Gliding Championships at Paderborn, West Germany.

Schempp-Hirth SHK

FGR

Span: 55ft 9¼in
Length: 20ft 8in
Wing area: 158.2sq ft
Aspect ratio: 20.2
Empty weight: 573lb
Max weight: 815lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 1.97ft/sec at 43.5mph
Best glide ratio: 38:1 at 56mph

The SHK high performance Open Class single-seater first flew in 1965, and was developed by Schempp-Hirth from the Austria SH, the 1964 version of the Standard Austria, which type Schempp-Hirth had built under licence from March 1962 to 1965. The SHK's 17m span (55ft 9¼in) wings are based on those of the Standard Austria, like them with an Eppler 266 laminar flow aerofoil section, and have been redesigned by the Akaflieg Darmstadt. They gave the SHK a performance that was among the best of the last generation of wooden sailplanes, enabling it to win several World and National championships. The SHK prototype, flown by Rolf Kuntz of Germany, took third place in the Open Class of the 1965 World Championships at South Cerney, and once in production the SHK sold steadily, between 40 and 50 a year being built; type certification was granted by the UK and USA as well as Germany. Like the Standard Austria, the SHK has a V-tail, but this is 50% larger than that of the earlier design and its fuselage is longer, with a roomier cockpit; the pilot's seat and rudder pedals are adjustable. The 1968 model SHK had a fully faired-in Plexiglas cockpit canopy. The two-piece shoulder wings have main spars of birch laminate covered with plywood and fabric; Schempp-Hirth air brakes are fitted and later production aircraft had a tail braking parachute. The tail unit itself consists of two all-moving tailplanes mass-balanced and fitted with trim tabs. The fuselage is mainly of wooden construction, the centre portion being a plywood monocoque structure with internal wooden stiffening, containing the retractable monowheel and the main wing attachments. The nose, cockpit section and tail cone are of glassfibre construction.

Schempp-Hirth SHK. Eric Wagner

Schempp-Hirth Standard Cirrus

FGR

Data: Standard Cirrus 75
Span: 49ft 2½in
Length: 20ft 9¾in
Height: 4ft 4¾in
Wing area: 107.6sq ft
Aspect ratio: 22.5
Empty weight: 474lb
Max weight: 860lb
Max speed: 137mph
Max aero-tow speed: 93mph
Min sinking speed: 1.87ft/sec at 44mph
Best glide ratio: 38.5:1 at 56mph

Designed by Dipl-Ing Klaus Holighaus, this high performance single-seater is, as its name implies, a Standard Class version of the Cirrus but with some important differences, in particular a T-tail, a new fuselage with a long flush-fitting one-piece Plexiglas canopy hinged at the starboard side, and a 15m span wing of different Wortmann aerofoil section, with

the same root thickness/chord ratio of 19.6% as on the Cirrus and also without flaps. The prototype Standard Cirrus first flew in March 1969 and production began in the summer of that year. The type proved to have very docile and pleasant handling qualities and soon made its mark in competition flying, winning the Standard Class at the International Soaring Competition at Hahnweide in 1969 and going on to win many national gliding contests. By April 1977, when production by Schempp-Hirth ended, a total of 700 Standard Cirruses had been built, including 200 built under licence by Grob Flugzeugbau, makers of the Astir series of sailplanes, between 1972 and July 1975. Manufacture of the type is being continued under licence from Schempp-Hirth by the French firm Lanaverre Industrie, formed at Bordeaux in 1977 by Morin SA and the boatbuilding concern Yachting France; 30 had been completed by 1 January 1979 as the Lanaverre Standard Cirrus, also known as the SCAP Cirrus 78L. VTC of Yugoslavia had also built 14 Standard Cirrus 75-VTCs by early 1979. The Standard Cirrus 75 was an improved variant produced by Schempp-Hirth in 1975 which had enlarged fairings at the wing roots, increased area air brakes, a modified nose similar to that of the Nimbus 2, jettison valves for the wing water ballast tanks repositioned to behind the monowheel, and a new type of easy-to-rig tailplane fitting. The cantilever mid wings and the ailerons are glassfibre/foam sandwich structures, and there are Schempp-Hirth glassfibre air brakes in the wing upper surfaces; unlike the Cirrus, there are no lower surface air brakes. The fuselage is a glassfibre shell, 1.5mm thick, stiffened with bonded-in foam rings, and the T-tail unit is of glassfibre/foam sandwich, the tailplane being an all-moving surface. The standard landing gear is a manually-retractable monowheel, but a non-retractable faired monowheel is optional for the customer; in both cases there is a drum brake. The pilot sits in a semi-reclining seat and has adjustable rudder pedals.

Schempp-Hirth Ventus

FGR

Span: 49ft 2½in
Length: Ventus A 20ft 9½in
Ventus B 21ft 4¾in
Wing area: 102.4sq ft
Aspect ratio: 23.7
Empty weight: Ventus A 474lb
Ventus B 486lb
Max weight: Ventus A and B 949lb
Max speed: 155mph
Min sinking speed: 2.17ft/sec at 9.2lb/sq ft wing loading
Best glide ratio: 44:1 at 74.6mph

The Ventus high performance single-seater (its name is the Latin for 'wind') is the first of a new generation of racing and competition 15m Class sailplanes featuring carbon-fibre in their structures; the mid-set wings are specially designed to take full advantage of this material's lightness and extra stiffness. A new wing section, thinner and more laminar than previous Wortmann profiles, has been developed for the Ventus by Professor F. X. Wortmann, physicist Dieter Althaus and Dipl-Ing Klaus Holighaus, this being specially designed for carbon-fibre construction and giving better performance throughout the entire speed range. A special characteristic of this new section is that at low-drag speeds, stall warning buffeting occurs when the angle of attack must increase over 10° before the stall itself actually occurs, this giving a previously unknown safety margin in narrow thermals, in ridge or mountain flying and in landing. The wing and its skin are made entirely of carbon-fibre, which gives increased torsional stiffness and reduces by over two-thirds the negative tip twist experienced with thin glassfibre wings, and the resulting lift penalties; the wing skin is made of specially developed extra-fine-weave carbon cloth, and has high stiffness to maintain the wing profile. The same new air brake/flap system as on the Nimbus 2C is featured, the air brakes being behind the 70% chord line outside the wing's laminar flow area, and this system gives an unusually short and slow landing. The two-piece ailerons feature Grob elastic flap-type joints on the lower wing surfaces to make the aileron/wing joint gapless and reduce drag, while enabling the upper surface gap to be kept very small. Tail surfaces are similar to those of the Nimbus, with a fixed-incidence tailplane and elevator.

There are two fuselage sizes, the normal version (the Ventus B) being big enough for pilots from 5ft 9in to 6ft 5in tall, this fuselage being 24⅜in wide, 32¾in high and 21ft 4¾in long. The smaller fuselage (the Ventus A) is designed so that pilots up to 5ft 9in tall will not feel 'lost' in a cockpit designed to accommodate six-footers, and is 21¼in wide × 29½in high × 20ft 9½in long; its smaller size results in a slight performance bonus. In both versions the pilot sits under a one-piece sideways-hinging cockpit canopy which is easily jettisonable; the canopy frame is of carbon-fibre and there is provision for a variety of instrumentation. Both fuselage sizes have a steel mid-fuselage frame on which is mounted the retractable monowheel, the flap and aileron drives and the wing lift-pin sockets; this frame takes the stresses from the landing gear directly through to the wings, and there is also a tail bumper fairing under the fin. The rudder sizes are slightly different for each fuselage size, and there is provision for over 330lb of water ballast in integral fuselage tanks. The prototype Ventus first flew on 3 May 1980, and a one-off sailplane known as the Lentus, which consists of a Ventus A fuselage fitted with Nimbus C wings, is used for performance comparison trials with the Ventus.

Schleicher AS-K 13

FGR

Span: 52ft 6in
Length: 26ft 9½in
Height: 5ft 3in
Wing area: 188.4sq ft
Aspect ratio: 14.6
Empty weight: 640lb
Max weight: 1,060lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.62ft/sec at 43.5mph
Best glide ratio: 28:1 at 56mph

This tandem two-seater training and high performance glider was developed from the earlier Ka 7, likewise designed by Rudolf Kaiser, and has similar swept forward single-spar wooden wings in the mid-set instead of high position, this lowering of the wings allowing a larger one-piece blown Mecaplex canopy, hinged to starboard, to be fitted giving better all-round visibility; other improvements over the Ka 7 include more comfortable seating and a sprung landing wheel for softer touchdowns, while the AS-K 13 has a better performance than the Ka 7. It first flew in prototype form in July 1966 and by January 1978 a total of approximately 700 AS-K 13s had been built, with production continuing. The type is also sold in kit form for amateur constructors. The wings have a forward sweep of 6° at the quarter-chord line and 5° of dihedral; the D-type leading edge torsion box is of plywood and the whole wing is fabric-covered. There are metal Schempp-Hirth air brakes above and below the wing, and the wooden ailerons are fabric-covered. The fuselage is a welded steel tube structure with spruce stringers and fabric-covered overall, except for the nose, which is of glassfibre; the turtle decking aft of the cockpit canopy is a plywood shell. The cantilever wooden tail unit is plywood-covered, except for the rear part of the rudder and elevators, which are fabric-covered, and there is a Flettner trim tab in the starboard elevator. Landing gear consists of a non-retractable sprung monowheel with a drum brake, mounted aft of the cg, with a skid under the forward fuselage and a steel tailskid. The pilots have glassfibre seat panels for greater comfort, and adjustable rudder pedals; there is provision for radio and oxygen, and an aero-tow release is fitted in the nose.

Schleicher AS-K 13. Eric Wagner

Schleicher AS-K 18

FGR

Span: 52ft 5¾in
Length: 22ft 11½in
Height: 5ft 6in
Wing area: 139.8sq ft
Aspect ratio: 19.7
Empty weight: 474lb
Max weight: 739lb
Max speed: 124mph
Min sinking speed: 2ft/sec at 40.5mph
Best glide ratio: 34:1 at 46.5mph

This single-seater Club Class sailplane is intended as a type on which pilots can progress from the first solo stage to their early competition flights, and is based on the earlier and popular Ka 6E and Ka 8, embodying the docile handling characteristics, simple and rugged construction, soaring ability in weak thermals and good cross-country performance of these types. Of similar basically all-wood construction to the Ka 6E and Ka 8, the AS-K 18 first flew in prototype form in October 1974. The single-spar wooden wing has the same aerofoil section as the Ka 6E and a very similar plan form; there are Schempp-Hirth air brakes above and below the wing, the rear part of which is fabric-covered and the ailerons are plywood-covered. The cantilever

Schleicher AS-K 18.

wooden tail unit has a ply-covered fin and tailplane and fabric-covered rudder and elevators; there is a Flettner trim tab in the elevator. The fuselage, like that of the Ka 8B, is a welded steel tube framework with spruce longerons, and covered overall with fabric; the nose portion is of glassfibre. The pilot sits in a semi-reclining position under a hinged one-piece blown Plexiglas canopy that gives excellent all-round visibility. There is a fixed monowheel just ahead of the cg with an internal brake, together with a sprung tailskid, and there is no nose skid.

Schleicher AS-K 21

FGR

Span: 55ft 9¼in
Length: 28ft 10in
Height: 5ft 3in
Wing area: 193.2sq ft
Aspect ratio: 16.1
Empty weight: 772lb
Max weight: 1,256lb
Max speed: 136mph
Max aero-tow speed: 96mph
Min sinking speed: 2.13ft/sec at 42mph
Best glide ratio: 34:1 at 59mph

This tandem two-seater Open Class and training sailplane is the latest design of Rudolf Kaiser and is intended to succeed the well-known AS-K 13 as a trainer for the new high performance competition sailplanes. It is of the same basic layout, differing from the AS-K 13 in having a wing span increased to 17m (55ft 9¼in), a T-tail, a more streamlined fuselage, and a non-retractable semi-recessed nose wheel, as well as a sprung fixed monowheel with drum brake and a steel-shod rubber tailskid. Originally an improved version of the AS-K 13 with glassfibre wings and T-tail was studied but the requirement for a new two-seater was met instead of the AS-K 21. Construction is mainly of glassfibre reinforced plastics/foam sandwich, instead of the AS-K 13's mainly wooden structure with welded steel tube fuselage. Production of the AS-K 21 began in 1979 and the prototype first flew in December 1978. The cantilever single-spar mid-set wings have Wortmann aerofoil sections and 4° dihedral, and there are Schempp-Hirth air brakes in the upper and lower surfaces. The wing tips are turned down to reduce tip stalling. The tailplane is fixed, with a separate elevator with spring trim. Unlike the AS-K 13, there are two separate cockpit canopy sections, the front one opening forwards and the rear one rearwards, and the pilots sit in a semi-reclining position, with dual controls.

Schleicher AS-W 12

FGR

Span: 60ft 0½in
Length: 24ft 1½in
Height: 5ft 3¾in
Wing area: 140sq ft
Aspect ratio: 25.8
Empty weight: 650lb
Max weight: 948lb
Max speed: 124mph
Min sinking speed: 1.6ft/sec at 45mph
Best glide ratio: 47:1 at 59mph

This Open Class single-seater has one of the best performances of any production sailplane today, and was designed by Gerhard Waibel – hence the 'W' in its designation – as a production development of the Akaflieg Darmstadt D-36 Circe, in the design of which Waibel had also participated, and which had won the 1964 German National championships. The prototype AS-W 12 was built by Edgar Krämer, who made the first flight in it on 31 December 1965, and the type has since achieved a number of important competition victories and record-breaking flights. In 1969 W. Scott of the USA set a new world goal flight record of 600 miles in an AS-W 12, and in 1970 Hans-Werner Grosse of West Germany became one of the few pilots to make a flight of 1,000km (621 miles), also in an AS-W 12; on 25 April 1972 he set a world record for distance in a straight line by flying 907.7 miles. Grosse was also runner up in the Open Class of the 1970 World Championships at Marfa, Texas, in which five of the first nine places in this class were taken by AS-W 12s. Of glassfibre reinforced plastic/balsa sandwich construction, the AS-W 12 has cantilever shoulder wings of high aspect ratio (25.8)

and with full-span camber-changing flaps interconnected with the ailerons. There are no air brakes, and an unjettisonable tail braking parachute is the only means of reducing the approach speed when landing, a fact that demands some care in piloting. The monocoque fuselage is similar in outline to that of the D-36 Circe, and the pilot sits in a semi-reclining position under a long flush-fitting two-piece cockpit canopy. Landing gear consists of a large retractable unsprung monowheel with brake, plus a tailskid, and a small fixed-incidence tailplane and elevators are mounted on top of the fin.

Schleicher AS-W 15

FGR

Span: 49ft 2½in
Length: 21ft 3in
Height: 4ft 9in
Wing area: 118.4sq ft
Aspect ratio: 20.45
Empty weight: 507lb
Max weight: 899lb
Max speed: 136.7mph
Max aero-tow speed: 90mph
Min sinking speed: 1.9ft/sec at 45.5mph
Best glide ratio: 38:1 at 55.9mph

This high performance Standard Class single-seater was designed by Dipl-Ing Gerhard Waibel, who had been responsible for the AS-W 12, and is of glassfibre/foam sandwich construction. It first flew in prototype form in April 1968, and initially had a fixed monowheel and fairing which could be converted into a retractable one for Open Class competitions, but after this requirement was relaxed the retractable wheel became standard. The AS-W 15B introduced a number of improvements, including a larger monowheel, a strengthened fuselage keel, a larger rudder, a lengthened cockpit and – as an optional 'extra' – two 40 litre water ballast tanks; the all-up weight was increased. A total of 447 AS-W 15s of all versions had been built by January 1977, and production has now ended. The type made its competition debut at the 1968 World Championships at Leszno in Poland, when an AS-W 15 flown by Hans-Werner Grosse of Germany came 10th in the Standard Class. The AS-W 15 resembles the AS-W 12 externally except for an all-moving tailplane set low on the fin, and the cantilever shoulder wings have a glassfibre roving spar and a glassfibre/balsa sandwich torsion box; the Schempp-Hirth air brakes are spring-sealed in separate boxes to preserve the streamlining, and the ailerons are of glassfibre/foam sandwich construction. The fuselage is a glassfibre/honeycomb sandwich structure, and ease of rigging is ensured by using tongue-fork connections for the wings, secured by two bolts. The tailplane is similar in construction to the wing, while the fin is similar structurally to the fuselage and the rudder has the same structure as the ailerons. The monowheel is retracted manually by means of push-pull rods, and has an internal drum brake. The pilot sits in a semi-reclining seat under a large flush-fitting one-piece canopy, and his rudder pedals are adjustable in flight.

In 1976 an AS-W 15B was fitted with a 30hp Wankel KM 27 300cc rotating piston engine by Ing Joseph Vonderau of Fichtel & Sachs System-Technik. In this form it was known as the AS-W 15M, and a 4.4 Imp gallon fuel tank was installed.

Schleicher AS-W 15. J. M. G. Gradidge

Schleicher AS-W 17

FGR

Span: 65ft 7½in
Length: 24ft 9¼in
Height: 6ft 1¼in
Wing area: 159.8sq ft
Aspect ratio: 27.0
Empty weight: 893lb
Max weight: 1,257lb
Max speed: 149mph (in smooth air)
Min sinking speed: 1.6ft/sec at 46.5mph
Best glide ratio: 48.5:1 at 65mph

Also known as the Super Orchidee, this Open Class single-seater of exceptionally high performance was designed by Dipl-Ing Gerhard Waibel as a development of the AS-W 12. It first flew in prototype form on 17 July 1971 and 52 AS-W 17s had been built by January 1977; production has now ceased. Of similar appearance to the AS-W 12 except for a shorter cockpit canopy and a taller fin and rudder with low-set tailplane, the AS-W 17 is of similar glassfibre sandwich construction, and has cantilever shoulder wings of 20m span built in four pieces to limit dimensions for rigging, transport in a trailer and storage. The modified Wortmann wing section is thicker than the AS-W 12's to enable up to 220lb of water ballast to be carried in wing tanks, and there are large Schempp-Hirth aluminium air brakes in both the upper and lower surfaces. The camber-changing flaps are interconnected with the ailerons. The fuselage structure is a two-skin glassfibre sandwich of a special plastic hexcell monocoque, and tailplane and elevators are set low on the slightly swept fin. The landing gear consists of a retractable sprung monowheel, and the pilot sits in a semi-reclining seat under a flush-fitting one-piece canopy, the nose tapering to a point. The AS-W 17 soon made its mark in competition flying, coming second in the Open Class in the 1972 World Championships at Vrsac, Yugoslavia, flown by Mathias Wiitanen of Finland, third in the 1974 World Championships at Waikerie, Australia, flown by Hans-Werner Grosse of Germany, and winning the 1976 World Championships, held in Finland, for Britain flown by George Lee; this was the first British victory since 1952, when the late Philip Wills had come first in a Slingsby Sky. The AS-W 17 has made some notable long distance flights, inlcuding a world record goal flight of 765.4 miles by Hans-Werner Grosse on 16 April 1974; he also set a triangular distance record of 660.5 miles (1,063km) in Australia in an AS-W 17 on 18 January 1977, this flight also breaking the speed record for a 1,000km triangular closed circuit at 61.2mph.

Schleicher AS-W 19

FGR

Span: 49ft 2½in
Length: 22ft 3¾in
Height: 4ft 8in
Wing area: 118.4sq ft
Aspect ratio: 20.4
Empty weight: 551lb
Max weight: 899lb
Max speed: 152mph
Max aero-tow speed: 109mph
Min sinking speed: 2.30ft/sec at 53mph
Best glide ratio: 38.5:1 at 67mph

This Standard Class single-seater is basically an improved version of the AS-W 15B and very similar to it externally except for a T-tail similar to that of the AS-W 12; it is intended for more advanced pilots than the AS-W 15, and was designed to take advantage of the new Standard Class and 15m Unrestricted Class rules of 1975, which now permit camber-changing flaps (not fitted on the AS-W 19) and water ballast. The AS-W 19 first flew in prototype form on 23 November 1975, and production began in the spring of 1976. An AS-W 19 flown by the Dutch pilot Baer Salen won the Standard Class section of the 1978 World Championships at Chateauroux in France. The cantilever laminar flow mid-wings are of glassfibre/foam sandwich construction, with a glassfibre roving main spar and Schempp-Hirth metal air brakes above and below each wing. Up to 220lb of water ballast can be carried. The tail unit is also of glassfibre/foam sandwich and the tailplane is an all-moving surface; the AS-W 19B has a tailplane and elevator, and air brakes on the upper wing only. The fuselage is a glassfibre/honeycomb sandwich structure with a reinforced keel, and the nose tapers to a point like that of the AS-W 17. There is a retractable monowheel with an internal drum brake and a tail-skid. The pilot sits in a semi-reclining seat under a large flush-fitting one-piece canopy which hinges at its front end to open upwards. The AS-W 19 Club is a club class version with a fixed unsprung monowheel, no water ballast carried and larger air brakes.

Schleicher AS-W 19.

Schleicher AS-W 20

FGR

Span: 49ft 2½in
Length: 22ft 4½in
Height: 4ft 9in
Wing area: 113.0sq ft
Aspect ratio: 21.43
Empty weight: 551lb
Max weight: 1,000lb
Max speed: 168mph (in smooth air)
Max aero-tow speed: 112mph
Min sinking speed: 1.97ft/sec at 45.5mph
Best glide ratio: 43:1 at 62mph

The AS-W 20, like the AS-W 19, was designed by Dipl-Ing Gerhard Waibel and is a 15m Unrestricted Class version of the AS-W 19 fitted with camber-changing flaps to take advantage of the new March 1975 CIVV regulations for this class of sailplane. It has an additional high drag range of flap movement incorporating a special mechanism to eliminate pitch and airspeed changes when the flap position is changed between 30° and 55°. The AS-W 20 also has a new device, developed by Wil Schuemann, that automatically co-ordinates and optimises the flap position to the prevailing airspeed so as to give optimum glide performance and to reduce the pilot's workload. This device also eliminates the need for underwing air brakes, although the AS-W 20 has larger spoilers in the wing upper surfaces than the AS-W 19. The prototype AS-W 20 first flew on 29 January 1977 and a version designated AS-W 20F is being built under licence in France by Centrair; this received its French certification on 31 March 1978. A version with a 16.5m (54ft 1½in) span wing, designated AS-W 20L (the L denoting Lang, or long) has detachable outer wing panels to increase the span to 54ft 5¼in for Open Class competition; 48 of this variant had been built by the beginning of 1980. Apart from its flaps, the AS-W 20 is very similar to the AS-W 19, with longer ailerons of narrower chord, which rise to −8° when the flaps are lowered to 55° for landing, and with the same glassfibre sandwich construction and T-tail; up to 265lb of water ballast can be carried, and the cockpit canopy hinges to open upward like the AS-W 19's. Two AS-W 20s at the 1981 World Gliding Championships were fitted with winglets for improved performance.

Schleicher AS-W 20. Sailplane & Gliding

Schleicher AS-W 22

FGR

Span: 22m 72ft 2¼in
24m 78ft 9in
Length: 26ft 10¾in
Height: 5ft 9in
Wing area: 22m 244.1sq ft
24m 251.0sq ft
Aspect ratio: 22m 21.3
24m 24.7
Empty weight: 22m 882lb
Max take-off weight: 1,543lb
Best glide ratio: 55:1 (estimated)

The AS-W 22 is one of the new generation of Open Class single-seater sailplanes with a wing span of 22m (72ft 2¼in) or more and a best glide angle of better than 1 in 50. It is also available with detachable wing tip extensions to give a span of 24m, and a 21m span verison will be offered with a higher maximum take-off weight for competition or record flights in rough weather. The AS-W 22's structure makes extensive use of glassfibre, carbon-based and aramid fibres, and the wing is made in four sections. The combined flaps/air brakes on the trailing edge are similar to the AS-W 20's, and up to 44 Imp gallons of water ballast can be carried. To cater for the rather high take-off weight twin retractable mainwheels are featured with oleo-pneumatic shock absorption and disc brakes; the tailwheel is retractable.

Schleicher Condor

FGR

Data: Condor 3
Span: 56ft 6¼in
Length: 24ft 11¼in
Wing area: 174.4sq ft
Aspect ratio: 15.0
Empty weight: 507lb
Max weight: 717lb
Max speed: 112mph
Min sinking speed: 2ft/sec
Best glide ratio: 28:1

One of the pioneers of sporting gliding in prewar Germany was Alexander Schleicher, who won the contest for training-sailplanes at the 1927 meeting at the famous Wasserkuppe gliding centre and in the same year built a small factory at Poppenhausen for glider manufacture; the firm bearing his name is now one of the oldest sailplane manufacturers in the world. Of the types built by Schleicher before the war the Condor and Rhönadler were the first of a new series of German high performance single-seaters of high aerodynamic efficiency that were to set a standard for sailplane designers until well into the 1950s. The Condor was designed by Heini Dittmar with the advice and help of Alexander Lippisch (later to be famous for his part in the Me 163 rocket fighter) and Dipl-Ing Fritz Kramer; the Condor owed something to an earlier sailplane, the 19m (62ft 3½in) span Fafnir. Dittmar built the prototype Condor in a workshop at Wasserkuppe in his spare time and it made its debut in the 1932 Rhön gliding contest, which it won; its very clean lines aroused considerable interest, and it went into series production. In its original form, the Condor 1, the high-set gull wings were braced with V-struts and had strengthened leading edges, and the Condor 2, developed in 1935, had a new wing section of reduced thickness/chord ratio on the outer parts of the wings, living an improved glide angle and lower rate of sink at higher speeds. This version set a new world distance record of 303 miles in 1935 and was a well-known type at prewar gliding contests. In February 1934 a Condor was taken to South America and, flown by Heini Dittmar, set a new world altitude record of 14,272ft for sailplanes, breaking the previous record by nearly 6,000ft. The Condor 3, which appeared in 1938 and was built by Schleicher, had a longer, slimmer fuselage and strengthened cantilever wings which now incorporated DFS air brakes. After the war Heini Dittmar formed his own company, Möwe-Flugzeugbau Heini Dittmar, and there developed a tandem two-seater version, the Condor 4, which first flew in 1953 and was very similar to the Mk 3 apart from the second seat. In October 1963 the Argentine state aircraft factory DINFIA began construction of the prototype IA 54 two-seat research sailplane intended to test a new 19m (62ft 3½in) span wing; the fuselage was based on that of a Condor 4 and the all-wood wing, of 18% thickness/chord ratio, had down-turned wing tips, Frise ailerons, unslotted flaps and – inboard of the flaps – metal trailing edge air brakes. The Condor itself was of conventional wood and fabric construction, with very long span ailerons and a landing skid under the fuselage; no monowheel was fitted.

Schleicher Ka 6CR

FGR

Data: Ka 6CR
Span: 49ft 2½in
Length: 21ft 10in
Height: 5ft 1½in
Wing area: 133.5sq ft
Aspect ratio: 18.1
Empty weight: 419lb
Max weight: 661lb
Max speed: 124mph
Max aero-tow speed: 87mph
Min sinking speed: 2.26ft/sec at 42mph
Best glide ratio: 29:1 at 50mph

Designed by Rudolf Kaiser and developed by Rudolf Hesse, the Ka 6 series of single-seat Standard Class

Schleicher Ka 6CR. Jack MacNulty

sailplanes may, perhaps more than any other German type, lay claim to being the true postwar successor of the famous DFS Meise or Olympia. The Ka 6 first flew in prototype form in November 1955, with a wing span of 14m (45ft 11in), and the type's high performance and attractive price led to steady sales and widespread use in contest flying; more than 1,400 Ka 6s had been built when production ceased in 1968, and the type has been widely exported. In 1956, when the Standard Class regulations were revised, the wing span was increased to 15m (49ft 2½in), this version being the Ka 6B with a landing skid under the fuselage, and the Ka 6BR with a non-retractable monowheel in place of the skid. The Ka 6C has modified wing roots and an underfuselage landing skid, while the Ka 6CR is the same but with a monowheel in place of the skid. At the 1958 World Championships at Leszno in Poland, a Ka 6 flown by Heinz Huth of Germany came 3rd in the Standard Class, and Rudolf Kaiser was awarded the prize for the best sailplane design in this class for the Ka 6. A Ka 6CR flown by Heinz Huth took 1st place in this class in both the 1960 World Championships in Germany and the 1963 World contest at Junin in Argentina; 16 of the 35 Standard Class entries in 1960 were Ka 6s, which took 2nd, 4th 5th and 6th places, and in 1963 22 out of 38 Standard Class entries were also Ka 6s. In the 1965 world contest, the best position gained by a Ka 6CR was 6th place, taken by W. Scott of the USA. Of conventional wooden construction with ply and fabric covering, the Ka 6 has cantilever high-set single-spar wings of pine and plywood, covered with fabric; they have a forward sweep of 1° 12′ and 3° of dihedral. Schempp-Hirth air brakes are fitted and the wooden ailerons are plywood-covered. The wooden semi-monocoque fuselage is also ply-covered, and the cantilever tail unit is of similar construction to the wings, and a trim tab in the elevator is an optional fitting. The Ka 6CR has a non-retractable unsprung monowheel with a band-brake, and both the Ka 6C and CR have a tailskid. The pilot sits under a one-piece blown Plexiglas canopy just ahead of the wing leading edge.

An Australian-built version of the Ka 6CR was produced by Edmund Schneider Pty Ltd, the makers of the prewar Grunau Baby, who had transferred their operations to Australia after the war. Known as the ES Ka 6, this licence-built Australian version first flew in December 1961, and had many changes to suit Australian conditions. The keefer main spar was retained, but the rest of the structure was changed to spruce. The monowheel was enlarged to allow interchangeability with that of the ES 52 Kookaburra, and a new sideways-hinging metal-framed Perspex canopy was introduced. Lifting handles were also provided at the nose and tail. Schneider built seven ES Ka 6s, and was planning to start a further batch of four late in 1964, but production was ended apparently before the latter were built. Schneider also built a few Ka 7 two-seaters under licence.

Schleicher Ka 6E

FGR

Data: Ka 6E
Span: 49ft 2½in
Length: 21ft 10in
Height: 5ft 3in
Wing area: 133.5sq ft
Aspect ratio: 18.1
Empty weight: 430lb
Max weight: 661lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.17ft/sec
Best glide ratio: 34:1 at 50mph

The Ka 6E Standard Class single-seater differs from the Ka 6CR in having a revised wing with modified leading edge profile and mounted just a little bit lower on the fuselage, a slightly different fuselage profile of 10% less cross-sectional area, a slightly longer cockpit canopy lowered by three inches and a redesigned tail unit, with a taller fin and rudder and a low-set all-moving tailplane; the latter is the same (except for the lack of trim tabs) as on the Ka 10,

Schleicher Ka 6E. Eric Wagner

which did not go into production and was a modified Ka 6CR with the tailplane moved to about one-third of the way up the fin. Like the CR, the Ka 6E has Schempp-Hirth air brakes, and tailplane stability and trimming are controlled by a single lever which adjusts the spring tension on the control column; glassfibre wing tips are featured. The Ka 6E first flew in the spring of 1965, the same year that the Ka 10 took part in the World Championships at South Cerney, and the E version likewise took part in many national championships and other contests. It is of the same wooden construction with ply and fabric covering as the Ka 6CR, and the landing gear is the same except that the monowheel is now retractable.

Schleicher Ka 7

FGR

Span: 52ft 6in
Length: 26ft 7in
Wing area: 188.4sq ft
Aspect ratio: 14.6
Empty weight: 617lb
Max weight: 1,058lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 81mph
Min sinking speed: 2.66ft/sec at 43.5mph
Best glide ratio: 26:1 at 50mph

This tandem two-seater training and club sailplane was designed by Rudolf Kaiser to succeed the wooden two-seater Ka 2 and Ka 2B which had proved to be popular trainers in Germany and had been Kaiser's first design for the Alexander Schleicher firm which he had joined in 1952. The Ka 7 first flew in prototype form in 1959 and was intended to provide not only basic training but continuation training without a break for pilots graduating to the more advanced high performance sailplanes. In this it was successful and a total of 370 had been built by the spring of 1964; Ka 7s twice set new German distance records and the type also set a new German goal flight record for two-seaters over a decade after it first appeared. Of conventional wood and fabric construction, with a steel tube fuselage which had fabric covering over wooden formers, the Ka 7 is characterised by high cantilever wings with a forward sweep of 6° 36′ at the quarter-chord line and 4° dihedral. The single-spar wings are of pine and plywood with fabric covering and a plywood-covered leading edge torsion box; there are Schempp-Hirth air brakes above and below the wings and the wooden ailerons are fabric-covered. The cantilever tail unit is of similar construction to the wings, and there is a trim tab in the starboard elevator. Landing gear consists of a non-retractable and unsprung Dunlop monowheel and a nose skid forward of it carried on rubber blocks for shock absorbtion; there is also a tailskid. The two pilots sit under a Plexiglas canopy the front portion of which hinges to starboard and the rear portion hinges rearwards.

Schleicher Ka 7. Eric Wagner

Schleicher Ka 8

FGR

Data: Ka 8B
Span: 49ft 2½in
Length: 23ft 0in
Height: 5ft 1¾in
Wing area: 152.3sq ft
Aspect ratio: 15.9
Empty weight: 419lb
Max weight: 683lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 81mph
Min sinking speed: 2.1ft/sec at 37.5mph
Best glide ratio: 27:1 at 45:5mph

This training and club sailplane is basically a single-

Schleicher Ka 8B. Eric Wagner

seater version of the tandem two-seater Ka 7; designed by Rudolf Kaiser, it also owes something to the Ka 6 series but has a simpler structure, very similar to that of the Ka 7, which makes it suitable for amateur construction. The prototype Ka 8 made its first flight in November 1957 and over 1,100 have now been built in three main versions; in its original form the Ka 8 had a very small cockpit canopy, the second version had windows in the sides of the cockpit for improved visibility, and the third version, the Ka 8B, has a larger one-piece blown Plexiglas canopy under which the pilot sits. The cantilever high wings are single-spar structures of pine and plywood, with a plywood leading edge torsion box and fabric covering aft of the spar; their forward sweep is 1° 18′ and dihedral is 3°. There are Schempp-Hirth air brakes in the upper and lower surfaces and the wooden ailerons are plywood-covered. The cantilever tail unit is of similar construction to the wings, with ply-covered fixed surfaces and fabric-covered rudder and elevators, and a trim tab in the elevator is an optional fitting. The fuselage is a welded steel tube structure, with fabric overing over spruce longerons and a glass-fibre nose cone. There is a non-retractable and unsprung monowheel, with no brake, and a nose skid mounted on rubber blocks in front of it, plus a steel spur at the tail. A motor glider conversion of the Ka 8B is being offered by LVD (the Flying Training School of the Detmold Aero Club) similar to their conversion of a Scheibe Bergfalke IV known as the BF IV-BIMO, in which a Lloyd LS-400 piston engine mounted in the fuselage drives a pair of small two-blade pusher propellers rotating within cutouts in each wing near the trailing edge.

Schleicher Rhönadler

FGR

Span: 57ft 1in
Length: 23ft 7½in
Wing area: 193.8sq ft
Aspect ratio: 16.8
Empty weight: 375lb
Max weight: 551lb
Max speed: 80.5mph
Min sinking speed: 2.5ft/sec
Best glide ratio: 20:1

The Rhönadler (or Rhön Eagle) high performance single-seater was designed to enable pilots to make long cross-country flights by soaring in thermals, and first flew in 1932; at this time the techniques of long distance soaring flight were beginning to be explored in earnest by sailplane pilots, and distance covered rather than time spent airborne was what pilots were aiming to achieve. The Rhönadler was designed by Hans Jacobs, who was also responsible for the DFS Meise and Kranich, the DFS Weihe, the Rhönbussard and Rhönsperber, and the Rhönadler was the type that began his unrivalled record as a leading sailplane designer. It made its competition debut in the 1932 Rhön contest, and its fine flying qualities thereafter made it one of the leading types in prewar European competition flying; production was undertaken by Schleicher at Poppenhausen. The cantilever two-piece high-set wings have straight taper to the tips, and are single-spar wooden structures with fabric covering; the ailerons, like the Condor's, are long in span. The wooden fuselage's cross-section was wide enough to allow a fairly roomy cockpit, and the landing gear consisted of a single wooden skid under the forward fuselage. The wooden cantilever tail has a large rudder and an all-moving tailplane set low on the fin.

Schleicher Rhönbussard

FGR

Span: 46ft 11in
Length: 19ft 0¼in
Wing area: 151.8sq ft
Aspect ratio: 14.5
Empty weight: 331lb
Max weight: 540lb
Max speed: 81mph
Min sinking speed: 2.5ft/sec

Best glide ratio: 20:1

Schleicher Rhönbussard. Eric Wagner

Of very similar size to the Grunau Baby, the Rhönbussard single-seater was designed by Hans Jacobs although, unlike the Baby, it was not regarded as a trainer when it first flew in 1933 but as a high performance type capable of cross-country flights of 200 or 300km (124 to 186 miles). It could, however, be regarded as an intermediate type for pilots graduating to larger sailplanes such as the Condor, Rhönadler or Minimoa. Of conventional wood and fabric construction the Rhönbussard has cantilever two-piece high-set wings with a single spar and a leading edge torsion box and, as on the Rhönadler, the wings are secured to the fuselage by two conical bolts, so enabling rigging to be done quickly and easily. No air brakes or spoilers are fitted, and the long-span ailerons are operated by push-rods. The pilot sits in an open cockpit under the wing leading edge, with a widescreen for protection, and the short oval section fuselage has a main skid for landing plus a tailskid, take-offs being made on a jettisonable double wheel. The tailplane is mounted on top of the fuselage forward of the rudder. The Rhönbussard was a popular type in Germany before the war, and at least two examples have recently been restored and flown by British owners.

Schneider ES 52 Kookaburra

Australia

Data: ES 52 Mk III
Span: 38ft 5in
Length: 25ft 11in
Height: 4ft 6½in
Wing area: 161.5sq ft
Aspect ratio: 9.13
Empty weight: 484lb
Max weight: 865lb
Max speed: 136mph (in smooth air)
Max aero-tow speed: 70mph
Min sinking speed: 3.36ft/sec at 45mph
Best glide ratio: 20:1 at 50mph

After the war Edmund Schneider, one of the pioneer prewar German sailplane designers and co-creator and manufacturer of the Grunau Baby trainer, was invited by the Gliding Federation of Australia to set up a sailplane factory in that country, and so he transferred his operations there, Edmund Schneider Pty Ltd being duly formed as a private venture at Parafield airport near Adelaide, South Australia. Its

Schneider ES 52 Kookaburra. John W. R. Taylor

first design here was the Kangaroo two-seater, which first flew in 1953, and this was followed by an improved version of the Baby, the Grunau Baby 4, the Nymph and Kingfisher, and the ES 52 Kookaburra two-seater side-by-side trainer, which was used by most of the Australian gliding clubs and is semi-aerobatic. Of conventional wooden construction, the ES 52 Kookaburra first flew in prototype form on 20 June 1954, and four Mk Is, eleven Mk IIs and eight Mk IIIs were built. The ES 52B Kookabura IV, which first flew in 1959, featured an increased wing span of 48ft 9in, a nose wheel in place of the rubber-sprung wooden nose skid ahead of the monowheel, a brake for the monowheel and an enlarged cockpit. By early 1966 a total of 23 Mk IVs had been built, and production ceased when Schneider decided to build the Schleicher Ka 7 two-seater under licence. The Mk III's cantilever high-set one-piece wing is a single-spar wooden structure with a D-section plywood leading edge and fabric covering; there are wooden scissor-type air brakes above and below each wing, and the sealed-gap ailerons are fabric-covered. The fuselage is a plywood-covered semi-monocoque made up of wooden frames and stringers, and there is a non-retractable unsprung monowheel, without a brake on the Mks I-III, these versions having the nose skid and the Mk IV a nose wheel; all Marks have a tail-skid. The tail unit is a fabric-covered wooden structure, with a trim tab in the port elevator. The one-piece Perspex canopy hinges rearwards to open, and the two pilots sit in slightly staggered side-by-side seats; there is also a window on each side under the leading edge wing root to improve visibility. Extra instrumentation can be fitted if the customer so desires.

Schneider ES 59 Arrow

Australia

Data: ES 59 Series 2
Span: 43ft 5in
Length: 22ft 2½in
Height: 4ft 7in
Wing area: 118.3sq ft
Aspect ratio: 16.0
Empty weight: 375lb
Max weight: 616lb
Max speed: 148mph
Max aero-tow speed: 80mph
Min sinking speed: 2.7ft/sec at 46mph
Best glide ratio: 28:1 at 51mph

This single-seat general purpose club sailplane was designed to replace the Grunau Baby 4 and the ES 57 Kingfisher built by Schneider, and was commissioned by the Gliding Federation of Australia. The prototype Arrow flew for the first time on 14 April 1962, and completed its airworthiness trials on 7 May that year. Small-scale production was put in hand, and 10 Arrows had been built by 1966, the latest production version being the ES 59 Series 2, which had a shorter swept fin and rudder than the initial production aircraft. The cantilever high-set plywood-covered wooden wing has 'bumpers' at the tips and a forward sweep of 3° at the spar; there are wooden scissor-type air brakes at the 45% chord line and flaps are not fitted, the wooden ailerons being ply-covered. The fuselage is plywood-covered semi-monocoque and the tail unit a ply-covered cantilever wooden structure. There is a non-retractable monowheel with a band brake, and a foam rubber-sprung nose skid forward of it which has a steel shoe; there is also a spring steel tailskid. The pilot sits under a sideways-opening Perspex canopy, and is provided with cushions and a sunshade; extra instrumentation can be installed if required.

Schneider ES 60B Super Arrow

Australia

Data: ES 60B Super Arrow
Span: 49ft 2½in
Length: 23ft 2½in
Height: 5ft 0in
Wing area: 138sq ft
Aspect ratio: 17.5
Empty weight: 488lb
Max weight: 765lb
Max speed: 140mph (in smooth air)
Max aero-tow speed: 103mph
Min sinking speed: 2.3ft/sec at 47mph
Best glide ratio: 30.7:1 at 53mph

The ES 60B Super Arrow was developed from another Standard Class single-seater, the ES 60 Series 2 Boomerang, and the ES 59 Arrow; the Boomerang was designed in 1964 for competition flying, and the first of two prototypes made its first flight on 28 November 1964, followed by the second on 24 December that year. These were followed by six ES 60 Series 1s built in 1966, and 28 ES 60 Series 2s completed in 1967 and 1968, plus a few more built since then, this differing from the Series 1 in having the height of the plywood-covered fin reduced by 3in, and a lengthened sideways-opening Perspex cockpit canopy; later production Series 2s had the nose lengthened by 2½in, a larger monowheel and an adjustable seat back for the pilot. The Boomerang soon made its mark in contest flying, and for a time held all the Australian national speed records over 100km, 200km and 300km triangular closed circuits, at speeds of 54mph, 55mph and 59mph respectively. The Boomerang was succeeded by the ES 60B Super Arrow, also designed for competition flying, which first flew in prototype form on 22 September 1969 and which was awarded a C of A on 31 October that year. It was the same as the ES 60 Series 2 Boomerang but had the conventional tail unit of the ES 59 Arrow with an unswept, fixed tailplane mounted at the base of, and forward of the fin instead of the Boomerang's swept-back 'all flying' tailplane, the halves of which were mounted separately on the fin about one-third of the way up, being secured by automatic spring-loaded bayonet

Schneider ES 60B Super Arrow. John W. R. Taylor

couplings. In both cases the tailplanes were cantilever wooden structures with plywood and fabric covering, that of the Boomerang having a trim tab that also acted as an anti-balance tab, the fin being ply-covered and the wooden rudder fabric-covered.

Apart from their tailplanes, the two types are of the same wooden construction, with a cantilever high-set one-piece wing with a laminated beech spar at the 50% chord line, a moulded plastic leading edge and birch ply covering back to 60% chord; wing tip 'bumpers' are fitted. There are no flaps, but metal scissor-type air brakes with epoxy-bonded wooden flanges are fitted at 55% chord; the wooden ailerons are plywood-covered. The ply-covered semi-monocoque fuselage has glassfibre fairings, and the non-retractable monowheel has an expanding shoe brake; unlike the ES 59 Arrow, there is no nose skid, but there is a spring steel tailskid. The pilot sits under a sideways-opening jettisonable Perspex canopy, and has adjustable rudder pedals and seat back; the customer specifies what instruments are fitted, and oxygen and radio can also be carried.

Schweizer SGS 1-23

USA

Data: SGS 1-23H and 1-23H-15
Span: 52ft 8in (1-23H)
49ft 2½in (1-23H-15)
Length: 20ft 10in
Wing area: 164.9sq ft (1-23H)
159.4sq ft (1-23H-15)
Aspect ratio: 16.9 (1-23H), 15.12 (1-23H-15)
Empty weight: 480lb (1-23H), 474lb (1-23H-15)
Max weight: 750lb (both versions)
Max speed: 140mph (both versions)
Min sinking speed: 2.05ft/sec at 37mph (1-23H)
2.15ft/sec at 38mph (1-23H-15)
Best glide ratio: 30.8:1 at 50mph (1-23H)
29.2:1 at 50mph (1-23H-15)

The Schweizer Aircraft Corporation of Elmira, New York, is the leading American designer and manufacturer of sailplanes, and has long specialised in all-metal types. The SGS 1-23 all-metal high performance single-seater was first flown at the 1948 US National Soaring Contest at Elmira, NY, and was based on the 1-21, which had won the previous year's US Nationals at Wichita Falls, Texas, flown by Dick Comey, General Manager of the Soaring Society of America. On 30 December 1950, a 1-23 flown by William Ivans set a new World height record of 42,100ft above sea level at Bishop, California, gaining 30,100ft from his aero-tow release height, and on 25 February 1961 a 1-23E flown by Paul Bikle set the current world height record of 46,266ft. The 1-23 has mid-set single-spar cantilever wings and is of truly all-metal construction with flush riveting, there being no fabric covering at all; 75ST alloy was used in the spar ends

Schweizer 1-23.

and fuselage centre-section, and the remainder of the structure was of 24ST Alclad. In its initial form the 1-23 had a wing span of 43ft 10in, and an aspect ratio of 12.88, and there were two sets of spoilers in the wing upper surfaces. The outside spoilers were double ones and could be locked in four positions, fully open as dive brakes or intermediately for the landing approach; the inner spoilers were single for glide control on the approach, and were coupled to the monowheel brake. There was a rubber-mounted skid forward of the non-retractable unsprung monowheel, and a small tail wheel. The SGS 1-23D like the 1-23B and 1-23C featured a wing increased in span to 50ft 0in, with an aspect ratio of 15.58, for improved performance, and production of this version started in July 1953; the wing tips were now square-cut instead of pointed as on the 1-23, and the fin and rudder were slightly larger. The D was later succeeded by the 1-23E in 1954, which had a wing span of 52ft 9½in and a thicker wing skin, and the 1-23F featured butt joints in the structure instead of lap joints. A larger fin and rudder with squared-off top distinguished the 1-23G, and one of these was developed into the experimental 1-29, which was basically a 1-23G fitted with a new constant-chord laminar flow wing, the first Schweizer design to be so fitted; this was used to flight test new design features as well as for competition flying. Final production versions, also with the larger vertical tail surfaces, were the 1-23H and 1-23H-15, the H having a span of 52ft 8in and limiting speed DFS-type air brakes which replaced the double spoilers of earlier versions, as well as detachable wing tips enabling it to be converted to a Standard Class 15m span, in which form it was known as the 1-23H-15. The pilot sits over the leading edge under a blown one-piece sidways-opening Perspex canopy, and there is room behind him for a radio, barograph and oxygen equipment. The 1-23H and H-15 hae a squared-off top to the fin and rudder.

Schweizer SGS 1-26

USA

Data: SGS 1-26E
Span: 40ft 0in
Length: 21ft 6½in
Height: 7ft 2½in
Wing area: 160.0sq ft
Aspect ratio: 10.0
Empty weight: 430lb
Max weight: 700lb
Max speed: 114mph
Max aero-tow speed: 114mph
Min sinking speed: 2.60ft/sec
Best glide ratio: 23:1 at 53mph

This small medium performance single-seater, with a wing span of only 40ft 0in, was developed for one-design class activities, and is produced in kit form for the amateur constructor as well as complete at the Schweizer factory. It first flew in prototype form in January 1954 and following FAA Type Certification production began in November that year of 1-26s both complete and in kit form. To help the amateur constructor, all the complicated alignments, welding and assemblies requiring specialised tooling are undertaken by the manufacturer; included in the kit is a basic welded fuselage assembly, and parts such as a pre-formed aluminium nose cap and the moulded Plexiglas canopy. The 1-26 was reckoned to require from 300 to 600 man-hours for assembly, depending on the home-builder's skill and experience and, unlike the earlier SGS 1-23, it had fabric covering of the control surfaces, fuselage and tail unit. The prototype 1-26 had fabric-covered wings, whereas the 1-26B, which first flew in June 1956, had an all-metal skinned wing. The 1-26C is the kit version of the 1-26B, with a welded chrome-molybdenum steel tube fuselage with Ceconite fabric covering, and the 1-26D, which first flew in June 1968, featured a redesigned cockpit canopy, a metal nose section lowered to give improved visibility, and a new fin and rudder with squared-off top and straight trailing edge, replacing the curved top and rudder trailing edge of earlier versions. The SGS 1-26E first flew in March 1971 and is the current production version, with an all-metal semi-monocoque fuselage, and more than 700 1-26s of all variants had been produced by January 1980, of which about 200 were in kit form. An SGS 1-26E is to be a prototype for an electrically-powered light

Schweizer 1-26E.

aircraft currently being studied by NASA's Dryden Flight Research Center and the Jet Propulsion Laboratory.

The 1-26E has cantilever all-metal mid-set wings of aluminium alloy, with metal skinning and fabric-covered ailerons, and balanced air brakes immediately aft of the spar. The cantilever tail unit is of aluminium alloy, with fabric covering on all versions. Landing gear consists of a non-retractable unsprung monowheel with a brake, with a nose skid mounted on solid rubber blocks just ahead of it; there is also a small solid rubber tailwheel, although the early versions had a tailskid, and there is a small wheel mounted under each wing tip. The pilot sits under a one-piece moulded Plexiglas canopy, and there is provision for radio to be carried.

Schweizer SGS 1-34

USA

Data: SGS 1-34B
Span: 49ft 2½in
Length: 25ft 9in
Height: 7ft 6in
Wing area: 151.0sq ft
Aspect ratio: 16.04
Empty weight: 550lb
Max weight: 800lb
Max speed: 135mph (in smooth air)
Max aero-tow speed: 115mph
Min sinking speed: 2.1ft/sec at 46mph
Best glide ratio: 34:1 at 52mph

This high performance Standard Class single-seater is intended to replace the popular SGS 1-23 series for club and syndicate use as well as for the private owner, and design work on it started in 1967; construction of the prototype began the following year, and it first flew in April 1969, the 1-34 receiving FAA Type Certification in September of that year. By January 1978 a total of 93 production 1-34s had been completed, the current production version being the SGS 1-34B, the 51st and subsequent aircraft being the 1-34A variant with a smoother wing upper surface through the use of bonded corrugations on the underside of the top skin. Of traditional Schweizer all-metal construction, the 1-34 has cantilever shoulder wings of aluminium alloy, with differential ailerons and double-flap type air brakes above and below each wing; no flaps are fitted. The fuselage is an aluminium alloy semi-monocoque structure, and the cantilever aluminium alloy tail unit has a swept back fin and rudder, and a fixed incidence tailplane with no trim tabs. Landing gear consists of a non-retractable monowheel (a retractable one can be fitted if desired) with a Cleveland brake; an unusual feature for a metal sailplane is the forward skid ahead of the monowheel, and there is also a tailwheel. The pilot sits under a large one-piece canopy and has an adjustable back rest.

Schweizer 1-34.

Schweizer SGS 1-35

USA

Data: SGS 1-35C
Span: 49ft 2½in
Length: 19ft 2in
Height: 4ft 5in
Wing area: 103.8sq ft
Aspect ratio: 23.29
Empty weight: 425lb
Max weight: 685lb
Max speed: 139mph
Max aero-tow speed: 139mph
Best glide ratio: 36:1

The 1-35 is a high performance 15m Class single-seater which first flew in prototype form in April 1973, and completed its FAA certification programme in the spring of 1974. It is currently offered in two versions in addition to the standard 1-35, the SGS 1-35A Unrestricted 15m Class variant,

Schweizer 1-35.

and the SGS 1-35C, or Club-35, a simplified and cheaper version for club or syndicate ownership. The 1-35A has a retractable monowheel forward of the cg, with a hydraulic brake, a large tailwheel and no nose skid. Interconnected flaps and ailerons are standard, and the flaps can be lowered to 80° for use as air brakes; there is provision for up to 323lb of water ballast. The 1-35A is claimed to have the widest range of wing loadings in the FAI 15m Class, from 5.78 to 8.96lb per sq ft, enabling it to compete effectively in both weak and strong soaring conditions. Later production 1-35As have a more painted nose and improved wing root fairings. The 1-35C has a non-retractable unsprung Cleveland monowheel aft of the cg, with a hydraulic brake, and a nose skid plus a tailskid. There is no provision for water ballast, and the maximum wing loading is 6.59lb/sq ft. Low profile rivets are used on the 1-35C's rear fuselage, and its best glide ratio is 36:1 compared to 41:1 for the 1-34A. Altogether 96 1-35s of all versions had been built by January 1980. The type has cantilever shoulder wings with aluminium stressed skin and stringers, the ailerons and flaps being of aluminium torque cell construction; air brakes or spoilers are not fitted. The monocoque fuselage is entirely of aluminium, and incorporates an integral fin; the T-tail is likewise of aluminium with a fixed-incidence tailplane and fabric-covered elevator. The pilot sits in a semi-reclining position under a one-piece detachable canopy.

Schweizer SGS 1-36

USA

Span: 46ft 2in
Length: 20ft 6in
Height: 4ft 7¾in
Wing area: 140.7sq ft
Aspect ratio: 15.15
Empty weight: 450lb
Max take-off weight: 710lb
Max speed: 123mph
Max aero-tow speed: 123mph
Min sinking speed: 2.25ft/sec at 46mph
Best glide ratio: 31:1 at 57mph

The SGS 1-36 Sprite single-seater is intended to be an all-round sailplane, which can be flown and soared by an inexperienced pilot shortly after his first solo, but is also easily capable of Diamond distance flights, and able to offer modern performance, handling and appearance whether as a personal, club or school aircraft. It will serve as a replacement for the veteran SGS 1-26 series, and a one-design competition class is planned. The prototype SGS 1-36 Sprite first flew on 2 August 1979, and the design is a cantilever mid-wing monoplane of traditional Schweizer all-metal construction. There are air brakes in both upper and lower wing surfaces, and also a cantilever T-tail with elevator. Landing gear consists of a fixed monowheel and tailwheel.

Schweizer SGS 2-32

USA

Span: 57ft 1in
Length: 26ft 9in
Wing area: 180sq ft
Aspect ratio: 18.05
Empty weight: 850lb
Max weight: 1,430lb
Max speed: 140mph (in smooth air)
Max aero-tow speed: 110mph
Min sinking speed: 2.38ft/sec at 50mph
Best glide ratio: 34:1 at 59mph

One of the very few sailplanes designed to carry passengers as distinct from a second pilot under training, the high performance SGS 2-32 accommodates a pilot and one very large or two average-sized passengers under a long jet fighter-type blown Perspex cockpit canopy that opens sideways; dual controls are provided, and the rear control column can be removed for the passenger's comfort. The cockpit is of a size more usually associated with powered aircraft than gliders, and among the

Schweizer 2-32.

optional 'extras' are radio, special instrumentation, electrical and oxygen systems, canopy locks, map cases, cushions and small wheels mounted at the wing tips. The prototype SGS 2-32 first flew on 3 July 1962 and FAA Type Approval was granted in June 1964, whereupon production started at once, a total of 89 having been built by January 1978. The 2-32 has set up a number of world and national records, including a new world height record for women, in Class D2, of 35,462ft set by Babs (Mary L.) Nott and Hannah F. Duncan of the United States on 5 March 1975. Of traditional Schweizer all-metal construction, the 2-32 has cantilever single-spar mid-set wings with metal covering and fabric-covered ailerons; there are air brakes in the upper and lower surfaces. The fuselage is an all-metal monocoque, and there is a non-retractable unsprung monowheel, with a hydraulic brake, and a tailskid. The cantilever tail unit has an all-moving tailplane with an adjustable trim tab in it, the fin being metal-skinned and the control surfaces fabric-covered. A special SGS 2-32 with a new wing of 67ft span with integral water ballast tanks was built in 1970 for Joe Lincoln.

The SGS 2-32 was chosen by the Lockheed Missiles & Space Co as the basic airframe of their YO-3A quiet observation and reconnaissance aircraft developed for service in Vietnam through the earlier QT-2 and Q-Star, likewise based on the 2-32. The first of two QT-2s first flew in August 1967 and both were evaluated in Vietnam during the Tet offensive of 1968. The Q-Star, developed by Lockheed as a private venture, first flew in June 1968 and was powered by a 185hp dorsally-mounted Curtiss Wright RC 2-60 rotary combustion Wankel engine driving a special low speed propeller through a long prop shaft passing over the top of the cockpit. The YO-3A had a much-modified 210hp Continental 'flat six' engine in a conventional tractor installation driving a three-blade propeller. The wings were now in the low-set position, with the wheels retracting into the roots, and the pilot and observer sat under a greatly enlarged canopy, the pilot in the rear. There was a radome under the nose and fairings under the fuselage housed battlefield surveillance sensors. The SGS 2-32 also formed the basis of another quiet observation aircraft, the LTV Electrosystems L450F, which first flew in prototype form in February 1970 and was powered by a Pratt & Whitney PT6A-29 turboprop derated to 680shp.

Schweizer SGS 2-33

USA

Data: SGS 2-33A
Span: 51ft 0in
Length: 25ft 9in
Height: 9ft 3½in
Wing area: 219.48sq ft
Aspect ratio: 11.85

Empty weight: 600lb
Max weight: 1,040lb
Max speed: 98mph (in smooth air)

Schweizer 2-33.

Max aero-tow speed: 98mph
Min sinking speed: 3.00ft/sec (with two pilots)
Best glide ratio: 22.25:1

The SGS 2-33 two-seater is a slightly larger version of the SGS 2-22, of improved performance, developed to meet the need for a medium-priced sailplane for general soaring and training; it first flew in prototype form in the autumn of 1966 and received FAA Type Approval in February 1967. Production began in January that year and a total of 570 had been built by January 1980; the type is also available in kit form for amateur constructors, and the current production version is the SGS 2-33A. Of the same all-metal construction as the 2-22, the 2-33 has strut-braced aluminium alloy high-set wings of slightly greater span than its predecessor, with metal skinning and all-metal ailerons; there are spoilers in both upper and lower wing surfaces. The fuselage is of welded chrome-molybdenum steel tubing and is covered with Ceconite fabric except for the nose, which is covered with glassfibre. Landing gear is a non-retractable Cleveland monowheel mounted just aft of the nose skid, which is mounted on rubber blocks for shock absorption; there is also a small wheel mounted under each wing tip. The tail unit is a steel tube structure covered with Ceconite fabric, the tailplane being braced. The two pilots sit in tandem, with dual controls, under a one-piece cockpit canopy hinged to port, and there is a door to starboard for the rear pilot's exit; he also has windows at the side and a transparent panel above him.

Schweizer SGU 2-22

USA

Data: SGU 2-22E
Span: 43ft 0in
Length: 25ft 8½in
Height: 9ft 0in
Wing area: 210sq ft
Aspect ratio: 8.81
Empty weight: 450lb
Max weight: 900lb
Max speed: 89mph (in smooth air)
Min sinking speed: 2.8ft/sec (solo)
Best glide ratio: 18:1

In the same category as the Slingsby T31 Tandem Tutor, this two-seater utility and training sailplane first flew in 1947 and entered service the following year, going on to become the most popular type in its class in the States; altogether 258 were built, including kits sold for amateur construction. The SGU 2-22A which appeared in 1957 featured several changes in the cockpit section, and was succeeded by the SGU 2-22B, C and D variants, the final production version, the SGU 2-22E, featuring a longer nose. Of all-metal construction with metal and fabric covering, the 2-22 has strut-braced constant chord aluminium alloy high-set wings, with a metal D-tube leading edge ahead of the main spar and fabric covering aft of it; there are no flaps or spoilers. The fuselage is a welded chrome-molybdenum steel tube structure with fabric covering, and there is a non-retractable and unsprung Goodyear mono-wheel with brake immediately aft of a nose skid mounted on rubber blocks; there is also a rubber-mounted tailskid. The fin and rudder are of aluminium with fabric covering, while the strut-braced tailplane and elevators are steel tube frameworks with fabric covering. The two pilots are seated in tandem with dual controls under a transparent, sideways-opening canopy, and in its initial form the 2-22 had tandem open cockpits with provision for an enclosed canopy.

Schweizer 2-22E.

Schweyer Rhönsperber

FGR

Span: 50ft 2½in
Length: 19ft 10¼in
Wing area: 162.6sq ft
Aspect ratio: 15.3
Empty weight: 357lb
Max weight: 562lb
Max speed: 124mph
Min sinking speed: 2.4ft/sec
Best glide ratio: 20:1

The Rhönsperber (or Rhön Sparrowhawk) was the second high perfromance single-seater designed by Hans Jacobs, and made use of the growing experience being gained in soaring in thermals at the Rhön competitions of 1932, when the Rhönadler had first appeared, and 1934. Developed from the Rhönbussard, and owing something to the earlier Rhönadler, the Rhönsperber differed from these types by having the cantilever gull wing lowered to the mid-set position, and slightly increased in span over the Rhönbussard's. For the first time in a sailplane, spoilers were fitted into the wing upper surfaces, and these were later developed by Hans Jacobs into the DFS air brakes which were to be fitted to many other sailplane designs. Lowering the wing made possible a larger cockpit with better visibility above and behind, in which the instrument panel could be placed further from the pilot so as to enable him to see the whole panel at a glance; the pilot also had the benefit of an adjustable seat and rudder pedals for greater comfort on long soaring flights. Of conventional wood and fabric construction, the Rhönsperber was put into production by the firm of Schweyer at Ludwigshafen, where about 100 were built; the prototype had first flown in 1935 and for the next two or three years the type was regarded as the leading German high performance sailplane. It had many competition successes and made some notable long distance and record flights, including the first sailplane crossing of the Alps into Italy, made by Heini Dittmar in 1936, and a new world altitude record of 18,898ft set up in 1937 by Paul Steinig. Landing gear consists of a long wooden skid under the forward fuselage and a tail bumper fairing.

Schweyer Rhönsperber. Chichester Observer

Sidou Joao Grande

Brazil

Span: 59ft 0¾in
Length: 29ft 6¼in
Height: 8ft 3¼in
Wing area: 139.5sq ft
Aspect ratio: 25.0
Empty weight: 595lb
Max weight: 992lb
Max speed: 112mph (in rough air)
Min sinking speed: 1.87ft/sec at 50.5mph
Best glide ratio: 43.9:1 at 59mph

Designed by Eng Antonio Menezes Sidou of Porto Alegre in the state of Rio Grande do Sul, this Brazilian tandem two-seater is intended for primary and advanced training and Open Class contest flying, and Eng Sidou hoped to begin construction of the João Grande (or Stork) at Paso Funde in Rio Grande do Sul early in 1978. It is a cantilever mid-wing monoplane similar to the IPD Urupema in appearance but with a T-tail and cambered wing tips, of all-wooden construction with plywood covering

and abrasion-resistant plastics finish; it is designed for aerobatics and cloud flying. There are Schempp-Hirth air brakes on the upper and lower surfaces of the wing, which has long span ailerons and a dihedral of 3° 36'. The ailerons, elevators and rudder are both statically and dynamically balanced, a narrow-chord tailplane being mounted on top of the swept back fin. There is a retractable rubber-sprung monowheel with rubber shock absorbers and a brake, and a tail bumper. The two pilots sit in tandem under a long flush-fitting one-piece jettisonable Plexiglas cockpit canopy.

Siebert Sie 3

FGR

Span: 49ft 2½in
Length: 22ft 0in
Height: 3ft 11in
Wing area: 127.44sq ft
Empty weight: 467lb
Max weight: 750lb
Max speed: 124mph (in smooth air)
Min sinking speed: 2.23ft/sec at 48.5mph
Best glide ratio: 34.3:1 at 56mph

This wooden Standard Class single-seater was designed by Paul Siebert and first flew in prototype form in 1971; by January 1975 a total of 27 had been built by the Paul Siebert Sportund Segelflugzeugbau and sold to Belgium, Holland, Denmark and Portugal as well as to customers in Germany. Permission was being sought from the Luftfahrtbundesamt, the Federal German civil aviation authority, to offer the Sie 3 in a form suitable for amateur construction. Of conventional wooden construction, the Sie 3 is a cantilever high wing monoplane with a constant chord centre section and tapered outer panels; Schempp-Hirth aluminium air brakes are featured. The fin and rudder are swept back and the low-set tailplane is an all-moving surface. Landing gear consists of a monowheel with brake and a tailskid, and the pilot sits under a one-piece flush-fitting cockpit canopy.

Siebert Sie 3.

Siren C 30S Edelweiss

France

Data: C30S Edelweiss
Span: 49ft 2½in
Length: 24ft 7¼in
Wing area: 133.9sq ft
Aspect ratio: 18.0
Empty weight: 518lb
Max weight: 838lb
Max speed: 140mph (in smooth air)
Max aero-tow speed: 112mph
Min sinking speed: 2.1ft/sec at 50mph
Best glide ratio: 36:1 at 59mph

This very elegant high performance Standard Class single-seater was designed by Dr J. Cayla, who had created the Breguet 901 and 905 Fauvette, and like the latter it features a V-tail and makes use of moulded plywood/Klégécel sandwich in its structure. The first of two Edelweiss prototypes made its maiden flight on 25 September 1962, and both prototypes took part in the 1963 World Championships at Junin in Argentina, finishing 2nd, flown by Jacki Lacheny of France, and 17th in the Standard Class contest. The prototype differed from production aircraft in having a slight forward wing sweep, longer span ailerons and air brakes and a longer fuselage nose. The first of an initial production batch of 15 was completed in January 1965, and one of these, piloted by François Henry, won the Standard Class section of the 1965 World Championships held at South Cerney, while another Edelweiss was placed 7th; two others of the type also finished 8th and 10th in the Open Class. The Edelweiss is no longer in production, but 50 had been delivered by 1 March 1968. The cantilever single-spar shoulder wings are foam-filled all-wood structures with only eight ribs, of sandwich

Siren C.30S Edelweiss. Eric Wagner

construction, and are covered by a plywood/Klégécel sandwich skin 8mm thick; the down-turned wing tips are of reinforced plastics and the unslotted ailerons are all-metal. The air brakes in the upper and lower wing surfaces are interconnected with the hydraulic monowheel brake, and up to 110lb of ballast in the form of eight lead bars can be mounted in the wing roots so that the wing-loading can be varied; unlike the more conventional water ballast, this kind cannot be jettisoned. The fuselage is a moulded plywood/Klégécel sandwich structure made in two portions, with integral longerons and nose and tail cones made of laminated plastics. The V-tail consists of two identical all-moving surfaces, with an included angle of 90°, each with a trim tab; the leading edges are of wooden sandwich construction and the remainder is fabric-covered. There is a non-retractable monowheel with a hydraulic brake, and a castoring leaf-spring tailskid. The pilot sits in a semi-reclining seat under a long flush-fitting canopy hinged to starboard, and optional 'extras' that may be installed include a barograph, VHF radio, an oxygen system, artifical horizon, a Jaeger altimeter and a flight calculator.

The Edelweiss IV was an Open Class version with a wing span increased to 17.5m (57ft 4¾in) and the length increased to 25ft 7in. The first of two prototypes of the Mk IV flew on 9 May 1968 but it did not go into production, and differed in some respects in structure from the earlier Edelweiss. The wings were built in two panels, with sandwich skins and pinch-webbed spars with spruce booms, and the fuselage was of completely moulded sandwich construction with built-in spruce longerons, and laminated plastic nose and tail cones. The monowheel was now retractable, and the wheel brake was also connected to operate with the air brakes.

Siren D 77 Iris

France

Span: 44ft 3½in
Length: 20ft 10¾in
Height: 3ft 11¼in
Wing area: 122.7sq ft
Aspect ratio: 16.0
Empty weight: 485lb
Max weight: 727lb
Max speed: 145mph (in smooth air)
Max aero-tow speed: 105mph
Min sinking speed: 2.3ft/sec at 50mph
Best glide ratio: 33:1

Design of the D 77 Iris single-seat training sailplane was started in 1973 by Siren SA, who were well known as manufacturers of aircraft components and equipment. The prototype first flew on 26 February 1977 and made its public debut at that year's Paris Salon Aéronautique; after the manufacturer's tests were completed, tests by the CEV (Centre d'Essais en Vol) followed early in 1978, after which certification got under way. Production of the Iris and of the E 75 Silène is now the responsibility of Société Issorie-Aviation, which was formed late in 1977 by the President of Siren SA following the bankruptcy of Wassmer-Aviation; approximately 50 D 77s had been ordered by February 1979 when production was due to begin. Of glassfibre/plastic foam sandwich construction, the Iris is also available in kit form for homebuilders, and has cantilever mid-set wings of Bertin E55-166 aerofoil section and glassfibre/polyester/PMC sandwich construction, with glassfibre ailerons and metal Schempp-Hirth air brakes in the upper surfaces. The fuselage is a glassfibre/polyester monocoque built in two halves and reinforced at the wing attachment points. As originally designed, the Iris had a cantilever T-tail but this was changed to one with a low-set fixed-incidence tailplane and a spring tab in each elevator; the tail is of similar construction to the wings. There is a non-retractable unsprung monowheel with a Siren hydraulic brake, and a tailskid. The pilot sits in an adjustable semi-reclining seat under a one-piece flush-fitting cockpit canopy which opens sideways to starboard.

Siren E 75 Silène

France

Data: E 75 Silène
Span: 59ft 0½in
Length: 26ft 1in
Height: 4ft 11in
Wing area: 193.8sq ft
Aspect ratio: 18.0
Empty weight: 805lb
Max weight: 1,246lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 105mph
Min sinking speed: 2.20ft/sec at 56mph
Best glide ratio: 38:1 at 59mph

Designed by Siren SA, this side-by-side two-seater training sailplane of 18m span was originally known as the CERVA CE 75 Silène, the letters CERVA standing for Consortium Européen de Réalisation et de Ventes d'Avions, which was owned jointly by Siren SA and Wassmer-Aviation SA. Design of the Silène, which was the first French two-seater of glassfibre construction, began on 1 January 1972 and construction of the prototype by CERVA began on 1 February 1973; this first flew at Argenton on 2 July 1974. The Silène was intended to be suitable for all stages of training from ab initio to cross-country flights, and Siren SA was responsible for marketing it; by early 1978 40 Silènes had been ordered and six of them flown. But following the bankruptcy of Wassmer-Aviation, which built the wings and was the co-partner in CERVA, the President of Siren formed Société Issorie-Aviation late in 1977, taking its title from Wassmer's Aérodrome d'Issoire works, to continue production of the Silène, now known as the Siren E 75, and the D 77 Iris. The first six Silènes had a retractable rubber-sprung monowheel but a non-retractable monowheel can if the customer desires also be fitted as optional, and a Siren hydraulic brake is optional; there is also a tailskid. French certification of the type was granted on 3 February 1978 and planned output for 1978 was two per month, with Siren SA building the fuselages. Construction is entirely of glassfibre/polyester/PMC sandwich, and the cantilever mid-set wings, of Bertin E55-166 aerofoil section, have 2° forward sweep at the quarter-chord line. The two-section ailerons have spring tabs and there are Schempp-Hirth air brakes above and below the wings. The fuselage is a semi-monocoque, and the two pilots' semi-reclining seats are slightly staggered, the starboard seat being a little to the rear, so as to keep fuselage width to a minimum; oxygen systems can be installed if desired. The rear section of the two-piece canopy is hinged to open to starboard, and is jettisonable. There is a low-set fixed-incidence tailplane with a spring tab in each elevator.

The E 78 Silène is a new variant featuring improved and roomier accommodation for the pilots, an enlarged cockpit canopy, lowered seats and a slight increase in available cockpit width; the E 78B is the same as the E 78 but with a fixed monowheel. This was followed by the 1 79 variant which has flaps and provision for water ballast, and was under development in 1979. The modified wings incorporate carbon-fibre componets, and the flaps, air brakes and monowheel are hydraulically actuated.

Sisu 1A

USA

Span: 50ft 0in
Length: 21ft 2½in
Wing area: 108.0 sq ft
Aspect ratio: 23.1
Empty weight: 546lb
Max weight: 755lb
Max speed: 161mph (in smooth air)
Min sinking speed: 2.07ft/sec at 55mph
Best glide ratio: 41.4:1 at 62mph

Designed and built over a period of six years by Convair engineer Leonard Niemi in his garage workshop, this American high performance single-seater was noteworthy in being the first sailplane ever to exceed 1,000km in a soaring flight when, flown by Alvin H. Parker, it set up an international straight line distance record of 1,041.52km (647.17 miles) in a flight from Odessa, Texas, to Kimball, Nebraska, on 31 July 1964. Alvin Parker also set up two other world records in the Sisu 1A, including a goal flight record of 487.24 miles on 27 August 1963, and the type has won the US National Soaring Championships three times, in 1962, 1965 and 1967, flown by different pilots. The Sisu 1A N1100Z, the second 1A to be built, which set the straight line distance record, is now in the Smithsonian Institute and A. J. Smith, winner of the 1967 US Champion-

Sisu 1A. Eric Wagner

ships, flew his Sisu for a time with wing tip extensions to increase the span from the standard 50ft 0in. The prototype, known as the Sisu 1, flew for the first time on 20 December 1958, and was a cantilever shoulder-wing type of all-metal construction with a laminar flow wing of NACA 65-series section to provide very low drag over a broad speed range, with forward sweep to delay tip stall. The 'butterfly'-type V-tail has an included angle of 90°. The two-spar wing has an aluminium alloy skin and plate stringers, with glassfibre/foam stiffening in the leading edge and camber-changing flaps. To achieve the smoothness and accuracy necessary for laminar flow, wing contours were filled and sanded, and all control surface hinge lines and joints in the canopy and removable fairings were sealed. The Sisu 1A was the production version, 10 of which were built by Arlington Aircraft at Arlington, Texas, and later at Greenville, South Carolina, between 1960 and 1965. This version featured vented air brakes and large-span slotted flaps. Landing gear consists of a retractable monowheel and a miniature fixed tailwheel; the pilot sits under a flush-fitting two-piece canopy.

Slingsby HP-14C

UK

Data: HP-14C
Span: 59ft 0½in
Length: 23ft 10½in
Height: 3ft 11in
Wing area: 146.2sq ft
Aspect ratio: 23.9
Empty weight: 639lb
Max weight: 840lb
Max speed: 135mph (in smooth air)
Min sinking speed: 1.64ft/sec at 52mph
Best glide ratio: 44:1 at 60mph

During the 1960s the traditional wood and fabric construction for sailplanes was increasingly challenged in Europe by glassfibre and to a lesser extent by metal construction, and so Slingsby, to remain competitive, acquired a licence to build the American Bryan HP-14 all-metal high performance single-seater, designed by R. E. Schreder, while their own first all-metal design, the T53, was on the drawing board. All-metal construction rather than glassfibre was chosen because it involved considerably fewer man-hours for assembly than wood, and metal was easier and less critical to repair than glassfibre. The Bryan HP-14, of aluminium construction, made its first flight in prototype form on 24 June 1966 with a 'butterfly'-type V-tail of 90° included angle, and this aircraft, flown by its designer, won the 1966 US National Soaring Championships. The HP-14T version with a conventional T-tail first flew on 19 May 1968, and over 100 of both versions were built by Bryan Aircraft Inc and amateur constructors supplied by them with kits for the HP-14, which had all skins, ribs and bulkheads formed and welded parts welded ready for assembly. The first of two Slingsby-built HP-14s was completed and flown in May 1967, but the type was redesigned by Slingsby's to suit British conditions and airworthiness requirements, the revised version being known as the HP-14C. The V-tail was replaced by a conventional fin and rudder with a fairly low-set all-moving tailplane, the wing span was increased to 18m (59ft 0½in) and the cantilever shoulder wings moved back 6in to give a wider cg range and a roomier cockpit, the structure was redesigned to meet ARB requirements and a tail braking parachute was fitted. The original rack-and-pinion flap operating mechanism was replaced by a pneumatic system with two jacks to lower the flaps to 90°, when they serve as air brakes; on the US-built HP-14s the flaps could be hydraulically operated if the customer desired. The HP-14C prototype first flew on 11 April 1968 and the three HP-14Cs were built by Slingsby, two for the British team at the 1968 World Championships in Poland, and one for the Spanish team, but these were all that could be built before the firm's main factory area was destroyed by fire on 18 November 1968. Five more under construction were not completed due to loss of jigs in the fire, and were later stored, but six HP-14C kits were supplied to Australia and one to Finland, one more being built from a kit by W. J. Provins of Scarborough. Another HP-14 built by Southdown Aero Services Ltd of Lasham had a V-tail of 50% greater span than the American version, and was later sold to the USA as N8838, where it was converted into an HP-14T with a T-tail.

The Bryan HP-14 has an aluminium wing structure, with plain aluminium ailerons, and no spoilers are fitted. The fuselage is an aluminium monocoque, with a steel tube frame around the cockpit, and there is a manually retractable monowheel and a fixed steerable tailwheel; the monowheel has a hydraulic shock-absorber and brake. The pilot sits in a semi-reclining position under a long Plexiglas canopy consisting of two fixed pieces and a hinged section; a 90-channel transceiver and an oxygen system can be fitted.

Slingsby Kirby Cadet

UK

Data: Cadet TX Mk 1
Span: 38ft 6in
Length: 20ft 10½in
Wing area: 170sq ft
Aspect ratio: 8.67
Empty weight: 295lb
Max weight: 513lb
Min sinking speed: 3.5ft/sec at 32mph
Best glide ratio: 16:1

Well known as the glider on which hundreds of Air Training Corps cadets received their training, this single-seat intermediate trainer was originally designed in 1935 as a soarable version of the

Slingsby T3 or Nacelled Primary glider, and was at first known as the T7 Kirby Kadet. It first flew in prototype form at Sutton Bank on 11 January 1936, and was of conventional wood and fabric construction, with a high-set, braced, two-spar constant-chord wing that was, in fact, interchangeable with that of the later T8 Tutor; no flaps or air brakes were fitted, and the ailerons were fabric-covered. The plywood-skinned wing was mounted on a built-up centre portion of the fuselage, in front of which the pilot sat in an open cockpit, and there was no monowheel, the landing gear consisting of a nose skid and a tailskid. Only 22 Kadets had been built when the war put a stop to production, the price of a new one being £93 in 1939, which had risen to £325 by 1948, but the type was put back into production with an Air Ministry order for 200 for use by the ATC, the first aircraft from this order, later to be known as Cadet TX Mk 1s, being built in 1943; the ATC variant differed slightly from the prewar civil Kadet in having reduced rudder height and a monowheel in the fuselage as well as the nose skid. The ATC's predecessor, the Air Defence Cadet Corps, had given its cadets some instruction at British gliding clubs before the war, but this stopped when war broke out, and it was not until 1942 that the first ATC gliding school was opened at Kirbymoorside, Yorkshire, where the Slingsby works were located, and an instructors' course was started. By December 1945 the ATC had 84 gliding schools with over 600 Service and civilian instructors, and about 4,500 cadets had received some gliding instruction, as well as instruction in winch-launching, and an equal number had reached the top proficiency stage of their training. Altogether 226 Cadets were built during the war by Slingsby and three other sub-contractors, of which Martin Hearn Ltd of Hooton Park, Cheshire, was the most important; this firm also built 27 of the postwar production for gliding clubs, which brought the total built since 1936 to 431. The Cadet's Göttingen 426 wing section gave it gentle stalling characteristics and good lift at low speeds and this, allied to a simple design making for ease of repair as well as manufacture, made it an excellent trainer. By the early 1950s most Cadet TX Mk 1s had been converted to Tutor standard (the T8 Cadet TX Mk 2) by fitting the Tutor's longer span wings, and spare Cadet TX Mk 1 wings were used to produce the Slingsby T38 Grasshopper TX Mk 1, which was a version of the SG 38 primary glider with a simplified open-framework fuselage, modified tail unit and the surplus Cadet wings; production began in 1952 and 115 Grasshoppers were built.

Slingsby Kirby Tutor

UK

Data: T31 Tandem Tutor
Span: 43ft 3¾in
Length: 23ft 3¾in
Wing area: 170sq ft
Aspect ratio: 11.1
Empty weight: 388lb
Max weight: 830lb
Max speed: 81mph
Min sinking speed: 3.44ft/sec at 42mph
Best glide ratio: 18.5:1 at 45.5mph

The T8 Tutor single-seater introduced in 1937 was an improved version of the Kirby Kadet with a new two-spar wing of increased span (43ft 3¾in) and tapered outer wing panels married to the same wooden fuselage and wooden tail unit with braced tailplane as the Kadet's. At the same time a differential mechanism was introduced into the aileron control circuit. This wing was, in fact, capable of being fitted to the Cadet TX Mk 1, most of which, by the early 1950s, had been converted to Tutor standard as the T8 Cadet TX Mk 2 by the fitting of this wing. The Tutor prototype first flew in July 1937 and seven examples had been built by the outbreak of war; it re-entered production after the Cadet to meet the demands for an ATC trainer, and 62 more were built in the war as the Cadet TX Mk 2. Total Tutor production was 106, and the price had risen from £99 10s (£99.50) in 1939 to £360 ex-works in 1948. A new two-seater version for teaching the initial stages of flying, and suitable for the arduous circuits and bumps of training, was the T31 Tandem Tutor, which

Slingsby T8 Kirby Tutor. Author

first flew in prototype form in September 1950. This was selected as a standard ATC trainer, being known as the Cadet TX Mk 3 by the RAF, and altogether 131 were built for the ATC and 69 for gliding clubs and other civil customers; 14 more were built from Slingsby-supplied kits and a number of Tandem Tutors were also built from Government surplus spares. The Tandem Tutor can be flown either dual or solo, and differs from the single-seat Tutor chiefly in having the forward fuselage lengthened to accommodate the second cockpit. An extra V-strut over the rear cockpit windscreen supports the wing leading edge, and wing spoilers are usually fitted in the upper surfaces, although some Tandem Tutors do not have them, and flaps are not fitted. The forward fuselage is plywood-skinned and the rear fuselage is fabric-covered; the pilots have full dual controls. Landing gear is basically the same as the Cadet's with a monowheel, a skid under the forward fuselage and a tailskid.

A powered version of the Tutor was undertaken, somewhat against his wishes, by Mr Fred Slingsby, and this, the T29 Motor Tutor, featured a new fuselage with a fixed, divided-axle type undercarriage and tailwheel married to the standard Tutor wings and tail unit. It first flew, as the T29A with a 25hp Scott Flying Squirrel engine, in December 1947 but this first prototype was underpowered, and the second prototype, the T29B which first flew in June 1948, had a 40hp Aeronca JAP two-cylinder, horizontally-opposed air-cooled engine; a single 9.5 Imp gallon fuel tank was installed. It was intended that the Motor Tutor should be sold in kit form for assembly by Ultra-Light Aircraft Association groups but when, after protracted deliberations, the ARB at last granted the Motor Tutor a C of A it was not for training and, since this role had been the main reason for developing the type in the first place, further work on the Motor Tutor ceased and an initial order for six was cancelled.

Slingsby T 13 Petrel

UK

Span: 56ft 9in
Length: 23ft 9½in
Wing area: 180sq ft
Aspect ratio: 17.9
Empty weight: 440lb
Max weight: 637lb
Max speed: 105mph
Min sinking speed: 2.1ft/sec at 50mph
Best glide ratio: 27:1 at 42mph

This high performance single-seater was one of the first prewar British attempts to produce a sailplane to rival such well-known German types as the Condor, Rhonädler and Minimoa in terms of performance and aerodynamic refinement. It was, in fact, based on the Rhonädler, with a gull wing of very similar plan form and long span ailerons, with a low wing loading suitable for the rather weak British thermals; no air brakes or flaps were fitted. The Petrel first flew in prototype form in December 1938 and production aircraft, known as the Petrel 1, were offered to customers for a mere £266 in 1939, but only six were built before the war put a stop to further production. Two of these G-ALNP and G-ALPP, survived the war, the latter later being sold to Eire as IGA101. Of conventional spruce and birch plywood construction, the Petrel had an all-moving tailplane very similar in outline to the Rhonädler's in its initial form, but later production aircraft had a larger, broader chord tailplane and elevators with a step in the rear fuselage underneath the tailplane. The cockpit canopy was of a type later to become commonplace on many sailplanes, flush-fitting and completely faired into the fuselage line without a step, while the landing gear consisted of a long wooden skid under the fuselage, without a monowheel, and a tail bumper. A proposed postwar development was the T22 Petrel 2, which had a revised cockpit with a step, wing spoilers, a monowheel and a tailplane with elevators, but this version was not built. A Petrel was fitted with a small engine on top of the fuselage in 1947 by Wing-Commander K. H. Wallis, later well known for his WA-116 and WA-117 autogyros, but this version of the Petrel was never flown.

Slingsby T 21 Sedbergh

UK

Data: T21B
Span: 54ft 0in
Length: 26ft 8in
Wing area: 260.5sq ft
Aspect ratio: 11.2
Empty weight: 589lb
Max weight: 1,047lb
Max speed: 105mph
Min sinking speed: 2.79ft/sec at 38.5mph
Best glide ratio: 21:1 at 43mph

Well known to several generations of ATC and gliding club members as the type on which they received their ab initio training, this big side-by-side two-seater was designed to meet the ATC's requirements for a simple dual control sailplane of medium performance and low price. The prototype, designated T21P, first flew in 1944 and had a wing span of 50ft 0in, and the first production version was the T21A for clubs and other civil customers, with the span increased to 54ft 0in, which first flew in April 1947. The T21B (originally designated T28) was the version of the T21A ordered for the ATC and known as the Sedbergh TX Mk 1 in Service use, being named after the famous Yorkshire public school; this first flew in December 1947. Altogether 121 civil T21As were built and 73 T21B Sedberghs for the ATC, plus 19 more T21Bs built under sub-contract by Martin Hearn Ltd, who had also built Cadets for Slingsby. Three more T21s were built outside – by the Midland Gliding Club, by Leighton Park School and by Mr J. Hulme, making a total, including

Slingsby T21B Sedbergh. Eric Wagner

prototypes, of 218 T21s; the 1948 price was £780. The Slingsby T33 was a projected version of the T21 of 1950 with cantilever instead of braced wings and an enclosed canopy, and this led a few years later to the rather similar T46 with the span increased to 56ft 6in, a braced wing with air brakes but no flaps, an enclosed cockpit and a revised tail unit similar to the T45 Swallow's. The prototype T46 first flew in October 1957 but the type did not go into production. One example of the T21C, a slightly modified T21A with enclosed cockpit was however, built for use by Slingsby.

Of conventional wood and fabric construction, the T21 has a single-spar pylon-mounted braced wing with a leading edge torsion box and a light secondary spar to carry the ailerons; there is fabric covering aft of the main spar, and spoilers are fitted in the wing upper surfaces. The forward portion of the fuselage back to the two main wing attachment frames is a wooden stressed skin structure, and the centre and rear portions are of fabric-covered girder construction. The tailplane is braced and the rudder and elevators fabric-covered. Landing gear consists of a large non-retractable monowheel with a nose skid in front of it, and a sprung tailskid. The two pilots sit side-by-side in an open cockpit with dual controls, and with two small windscreens ahead of them; the spoiler lever, cable quick-release and trimming controls are positioned on a console between the two pilots.

Slingsby T 30 Prefect

UK

Span: 45ft 0in
Length: 21ft 3½in
Height: 4ft 2in
Wing area: 154sq ft
Aspect ratio: 13.2
Empty weight: 390lb
Max weight: 587lb
Max speed: 100mph
Min sinking speed: 2.75ft/sec
Best glide ratio: 21:1

This single-seat intermediate trainer is basically an updated and improved version of the Grunau Baby, of which Slingsby had built a small number under licence before the war as the T5 Baby. The Prefect, which first flew in prototype form in June 1948, is semi-aerobatic and suitable for cloud flying and cross-country flights. Of conventional wood and fabric construction, it has a braced wing with air brakes but no flaps, and a nose skid under the forward fuselage just ahead of the non-retractable monowheel; there is also a tailskid, and the tailplane is braced. The pilot sits in an open cockpit and has a small windscreen. Altogether 30 Prefects were built for clubs and other civil users, and 16 for the ATC as the T30A Prefect TX Mk 1 (WE979 to WE993 and WG783). Prefect WG783 was initially delivered with camera mounting fittings and flaps fixed in the down position for the second stage of carrier wake trails, which involved flying a glider from the deck of an aircraft carrier to investigate characteristics of the wake over the flight deck.

Slingsby T30A Prefect. Eric Wagner

Slingsby T 34 Sky

UK

Span: 59ft 0½in
Length: 25ft 1¼in
Wing area: 187sq ft
Aspect ratio: 18.7
Empty weight: 556lb
Max weight: 800lb
Max speed: 113mph
Min sinking speed: 2.17ft/sec at 39mph
Best glide ratio: 27.5:1 at 43mph

Although only 16 examples were built, the Sky high performance single-seater has a secure place in gliding history as being the first British-designed type to win the World Championships, which it did in 1952 flown by Philip Wills when this event was held at Cuatro Vientos, near Madrid; eight T34 Skys took part, also being flown by the Dutch and Argentine teams, and all but one of them were placed in the first 14, including the 3rd place taken by Robert Forbes. Philip Wills flew his Sky into second place in the 1954 World Championships at Camphill, Bedfordshire, and in the 1956 event this place was taken by Luis Vicente Juez of Spain in another Sky. The Sky first flew in prototype form in September 1950 and was designed for the 1951 British National Championships, in which it came first and second, at the request of the newly-formed Royal Air Force Gliding and Soaring Association, who wanted a contest sailplane with a better performance than that of the well-known DFS Weihe. The Sky was basically an 18m span version of the 15m Slingsby Gull 4 with a longer fuselage and was at first known as the Gull 5 or the 'Slingsby 18 metre', but the name Sky was suggested by John Furlong as it was made up of the initial letters of Slingsby, Kirbymoorside where the firm's works were, and Yorkshire. The Gull 4 was intended to be Slingsby's postwar 15m design, but did not go into production as the rival EoN Olympia was cheaper. The Sky, which resembled it, was of conventional wood and fabric construction; the production aircraft were designated T34A Sky 1 to distinguish them from the improved T34B Sky 2 intended for the 1954 World Championships but not, in the end, built. This version had NACA 64-/63-series wing sections instead of the Mk 1's Göttingen 547 and NACA 2R 12 aerofoils, and revised square-cut wing wips and tail units.

The high single-spar cantilever wings have a leading edge torsion box and a light secondary spar to carry the two-piece ailerons; the wing is fabric-covered aft of the main spar and DFS-type air brakes are fitted in the upper surfaces, but there are no flaps. The fuselage is a ply-covered stressed skin wooden structure, and the landing gear is a single fixed monowheel behind an ash skid under the forward fuselage; there is a tail bumper and a jettisonable two-wheel dolly can be used in place of the monowheel. The tailplane is cantilever and the rudder and elevators are fabric-covered. The pilot sits under a one-piece moulded Perspex canopy and has adjustable rudder pedals; oxygen, radio and barographs can be installed for contest flying. After its victory in the 1952 World Championships the Sky went on to achieve a great many competition successes in the 1950s.

Slingsby T34 Sky. Eric Wagner

Slingsby T 38 Grasshopper

UK

Span: 39ft 0in
Length: 21ft 1½in
Wing area: 174sq ft
Aspect ratio: 8.73
Empty weight: 293lb
Max weight: 550lb
Max speed: 80mph

This single-seater primary glider was produced for ATC and Combined Cadet Force use in initial ground training and low level hops. The open framework fuselage with a seat for the pilot was a simplified version of that of the Schülgleiter SG 38, one of the leading German prewar primary trainers, and this was fitted with the wings and modified tail unit of the Cadet TX Mk 1, the wing being wire-braced and without flaps or air brakes. Most Cadet TX Mk 1s were converted to Tutor standard as the T8 Cadet TX Mk 2 by fitting them with the Tutor's longer span wings, and the spare wings of the TX Mk 1s were used to produce the Grasshopper TX Mk 1. Production began in 1952 and altogether 115 Grasshoppers were built.

Slingsby T38 Grasshopper. Eric Wagner

Slingsby T 42 Eagle

UK

Data: Eagle 3
Span: 58ft 2in
Length: 27ft 11in
Height: 6ft 0in
Wing area: 240sq ft
Aspect ratio: 14.8
Empty weight: 896lb
Max weight: 1,240lb
Max speed: 147mph
Min sinking speed: 2ft/sec at 49mph
Best glide ratio: 31:1 at 49.5mph

The Eagle high performance tandem two-seater was originally desinged to meet possible ATC requirements and was developed from the Slingsby T36 two-seater project, itself a development of the Sky; the Eagle also owed something to the Skylark series. The T42 Eagle 1 prototype first flew on 12 June 1954 and had a cantilever three-piece wing with a slightly swept forward centre section of 20ft span, air brakes in the centre section and no flaps. The second prototype, the T42A Eagle 2, first flew in May 1956 and had a centre section span of 13ft 10in, with a cut-out in the leading edge to accommodate the rear cockpit; the air brakes were repositioned to the outer wings. The Eagle 2 won the two-seater class in the 1956 World Championships at St Yan, France, flown by Commander H. C. N. Goodhart and Captain Frank Foster; its success was the more gratifying because it was not designed as a contest sailplane but rather as a type for advanced training and cross-country soaring, to enable pilots to bridge the gap between the 'C' and 'Silver C' certificates. The third prototype, the T42B Eagle 3, had the cockpit moved forward to avoid the Mk 2's leading edge cut-out; this version went into production and a total of 17 was built, the price being £1,650. In 1966-67 an Eagle 3, BGA 821, was converted into the T55 Eagle 4, also known as the Regal, this variant having the centre section span increased to 21ft 3in and the total span to 65ft 7½in, or 7ft 5½in more than that of the Eagle 3.

Of conventional wood and fabric construction, the Eagle has a high wing of NACA laminar flow section with a main spar and a light secondary spar to carry the plywood-covered ailerons; the wing is plywood-covered to the rear spar, the trailing edge being fabric-covered. The wooden fuselage is of braced girder-type construction, with a glassfibre- and ply-

Slingsby T42 Eagle. J. M. G. Gradidge

covered nose and fabric-covered rear fuselage. The fin and tailplane are ply-covered and the rudder and elevators fabric-covered. Landing gear consists of a fixed monowheel, a nose skid under the forward fuselage and a tailskid. There is a one-piece Perspex canopy and the two pilots have provision for back-type parachutes; the rearmost pilot sits under the wing.

Slingsby T 43 Skylark 3

UK

Data: Skylark 3B
Span: 59ft 8¼in
Length: 25ft 0in
Height: 5ft 9in
Wing area: 173.3sq ft
Aspect ratio: 20.5
Empty weight: 547lb
Max weight: 830lb
Max speed: 134mph
Min sinking speed: 1.84ft/sec at 40mph
Best glide ratio: 36:1 at 46mph

Probably the most successful of all the Slingsby designs were the Skylark series of high performance single-seaters, which won the World Championships in 1960 and set many national and international records; altogether 192 Skylark Mks 1-4 were built. The T37 Skylark 1, first of the series, was built for a lark, according to Mr F. N. Slingsby – hence its name – and was an experimental single-seater with a three-piece laminar flow wing of 45ft span, intended to test various lateral stability devices to determine the best type of lateral control surface for use with a laminar flow aerofoil; the wing was of NACA 63-/64-series section and had very effective air brakes but no flaps. The fuselage was based on that of the T30 Prefect, with a one-piece canopy, the length being 20ft 11½in, and there was a main skid only plus a tailskid, no monowheel being fitted. The first of two prototypes made its maiden flight in March 1953, and only the two Mk 1s were built partly as this version had, for that time, a very high stalling speed. But it had proved sufficiently promising to be developed into the T37B (later T41) Skylark 2, the prototype of which first flew in November 1953. This had the wing span increased to 48ft and a new semi-monocoque elliptical cross section fuselage with spruce frames and plywood skin which increased the length to 24ft 6in; a fixed monowheel was introduced to supplement the nose skid, although this could be replaced by jettisonable dolly wheels. The Mk 2 was of all-wood construction with plywood covering, like the Mk 1, and it also had a three-piece laminar flow wing. Its good performance made it popular both with clubs and private owners, and a total of 61 Mk 2s were built, plus two more from Slingby-supplied kits; about half this total were exported, production of the Mk 2 ending in 1962.

The Mk 2 was followed by the T43 Skylark 3 single-seater, an enlarged and developed verison suitable for Open Class competition; this had the wing span increased by nearly 12ft to 59ft 8¼ft (18.19m) and the aspect ratio to 20.5, while the tail surfaces were enlarged, just as the Mk 2's tail unit had been larger than the Mk 1's. The prototype Mk 3 first flew in July 1955 and there were several sub-types; altogether 65 Mk 3s of all variants were built, and a Skylark 3B flown by the Argentine pilot Rudolfo Hossinger won the Open Class in the 1960 World Championships in Germany, a historic instance of a British type beating the Germans on their own ground. The Skylark 3A, of which seven were built, was the original Mk 3 variant with a length of 24ft 9in, and the Mk 3B had the cockpit moved forwards by 3in to compensate for the rearward movement of the cg caused by the larger tail; the elevator mass balances were also repositioned and the 3B's length was 25ft. Altogether 24 Mk 3Bs were built, and both 3As and 3Bs later had the all-up weight increased to 830lb by a

retrospective modification. The Mks 3C and 3D, two examples of each of which were built, were the same as the 3A and 3B respectively but had the wing spars strengthened to meet BCAR and ARB requirements. The Skylark 3E was a 'one-off' experimental version (serial BGA 480) with outer wings of a different NACA 64-series section and reduced chord ailerons, but was otherwise the same as the Mk 3B; it was later converted back to this standard. The Mk 3F was the same as the 3B but had geared tabs added to the ailerons, a modified tailplane and elevator plan form of greater span, and an all-up weight of 830lb; 25 of this variant were built plus five more constructed from kits supplied by Slingsby. Last variant was the Skylark 3G, which was the same as the 3F but with increased span ailerons of reduced chord with the geared tabs removed; four Mk 3Gs were built.

All the Mk 3 variants had the same all-wood construction with plywood covering as the Mk 2, and a similar high-set laminar flow three-piece cantilever wing of spruce and plywood with air brakes in the upper and lower surfaces. The wing has a main spar and a light rear spar to carry the ply-covered ailerons, and is plywood-covered to the rear spar with a fabric-covered trailing edge. The wooden cantilever tail unit has a plywood-covered fin and tailplane and fabric-covered rudder and elevators. The landing gear is very similar to the Mk 2's, with a tail bumper as an alternative to the tailskid, and the monowheel can be replaced by jettisonable dolly wheels. The pilot sits under a one-piece blown canopy which hinges sideways to open, and he is provided with an adjustable seat and rudder pedals.

Slingsby T 45 Swallow

UK

Span: 42ft 9¾in
Length: 23ft 2in
Height: 5ft 2½in
Wing area: 145.9sq ft
Aspect ratio: 12.6
Empty weight: 423lb
Max weight: 700lb
Max speed: 141mph
Min sinking speed: 2.49ft/sec at 41.5mph
Best glide ratio: 26:1 at 49mph

Described as 'a poor man's Skylark', the Swallow single-seater was intended to meet the need for a small moderately-priced high performance sailplane for clubs and the private owner. The prototype first flew on 11 October 1957 with a span of 39ft 4in (12m) but this was increased to 42ft 9¾in to improve performance. The type, then unnamed, got its name when the prototype, flown by John Reussner, crashed and ended up hanging from some telephone wires – 'just like all the other swallows', said Mr F. N. Slingsby, who witnessed the accident and promptly dubbed the type Swallow. Reussner later acquired the prototype and rebuilt it as a standard Swallow; it became BGA 865 in October 1958. It was later modified to his own ideas as the Reussner Swift, with the span increased to 15m (49ft 2½in) by extending the wing roots, lengthening it by a 1ft insert in the rear fuselage, and fitting a revised canopy similar to that of the Swallow 2. As the Swift it became BGA 966 and crashed on 24 November 1963 at Netheravon, Wiltshire. The Swallow 1 prototype was followed by the Swallow 2 production version which differed in having a revised canopy of slightly different shape; the type was sold to nine different countries and a total of 106 were built up to 1968, plus 10 more constructed from kits supplied by Slingsby. The Swallow 3 project of January 1968 was a variant designed for that year's Swallow Competition organised by the cigarette firm of W. D. & H. O. Wills, with which the leading British sailplane pilot Philip Wills was associated; the Mk 3, which was not built, had a revised nose shape incorporating a flush-fitting one-piece canopy with no step, and the wing span was increased to 24ft and the area to 180sq ft.

Of conventional wooden construction, the Swallow has cantilver high-set wings of spruce and plywood, with single spars, plywood covering and a leading edge torsion box; the wooden fabric-covered ailerons are unbalanced and there are dive brakes in the wing upper and lower surfaces. The forward fuselage is a plywood semi-monocoque while the rear portion is a braced structure of spruce and plywood with fabric-covered sides. The wooden tail unit has ply covering for the fin and tailplane and fabric covering for the rudder and elevators. Landing gear consists of a rubber-sprung skid under the nose, a fixed unsprung monowheel and a tailskid.

Slingsby T45 Swallow. Eric Wagner

Slingsby T 49 Capstan

UK

Data: T49B
Span: 55ft 0in
Length: 26ft 6in
Height: 5ft 2½in
Wing area: 220sq ft
Aspect ratio: 13.75
Empty weight: 761lb
Max weight: 1,250lb
Max speed: 135mph
Min sinking speed: 2.17ft/sec at 43.5mph
Best glide ratio: 30:1 at 47mph

Intended as a successor to the T42 Eagle the Capstan side-by-side two-seater is designed to be suitable for all stages of dual instruction, and also for club or private owner use; a wide cg range enables it to be flown solo when required. Design work began in 1960 and the prototype, the T49A first flew on 4 November 1961; this differed slightly from the T49B production version, having a smaller fin and rudder. Production started in the spring of 1963, and altogether 31 T49B Capstans were built, plus two more constructed in New Zealand by Mr Fred Dunn from kits supplied by Slingsby; price of the T49B was £1,750 in October 1963. Of conventional wooden construction, the Capstan has glassfibre covering for the nose section and other double curvature panels and fairings, with ply and fabric covering elsewhere. The cantilever high-set single-spar wings have a plywood leading edge torsion box and fabric coveirng aft of the spar; there are dive brakes in the upper and lower wing surfaces and the ailerons are plywood-covered. The wings are attached to each side of the fuselage with three pins, making for ease of rigging. The forward fuselage is made up of spruce frames attached to a central keel box and is covered in glassfibre, while the rear fuselage is a braced wooden girder structure, with a bottom skin of plywood and the top and sides fabric-covered. The fixed surfaces of the cantilever tail unit are ply-covered and the control surfaces fabric-covered; there is a trim tab in the starboard elevator. There is a nose skid under the forward fuselage mounted on a full-length rubber shock absorber, and a fixed Dunlop monowheel with a band brake, plus a leaf-spring tailskid. The two pilots sit under a rearward-hinged one-piece Perspex canopy, and all controls are duplicated except for the tow release and elevator trimmer.

The T49C Powered Capstan was a standard Capstan fitted with a 45hp Nelson H-63CP four-cylinder two-stroke engine mounted on a pylon behind the cockpit and driving a pusher propeller. Small wing tip wheels and a tail wheel instead of a skid were fitted. The prototype, G-AWDV, first flew on 15 February 1968 at Wombleton, Yorkshire, but was burnt out in the fire that destroyed Slingsby's factory in November that year. It had been intended to make complete 'power eggs' available to convert existing Capstans but this idea was not proceeded with. The T49C had a maximum level speed of 85mph, a sea level rate of climb, when flown solo, of 510ft/min, and a take-off run of 420ft with two pilots.

Slingsby T49B Capstan. Eric Wagner

Slingsby T 50 Skylark 4

UK

Span: 59ft 7in
Length: 25ft 1in
Height: 5ft 3in
Wing area: 173sq ft
Aspect ratio: 20.5
Empty weight: 570lb
Max weight: 830lb
Mex speed: 135mph
Max aero-tow speed: 80mph
Min sinking speed: 1.74ft/sec at 43mph
Best glide ratio: 36:1 at 47mph

Although developed from the later versions of the Skylark 3, the Skylark 4, with its new and shallower fuselage with the pilot sitting in a semi-reclining position, and its new outer wings and ailerons giving a wing span of exactly 18m (59ft 0½in), was almost a new design. It was developed through the Slingsby T47, a verison of the Skylark 3 projected in December 1958 with a span of 20m (65ft 7in) created by increasing the span of the constant chord centre section; the wing area was now 193.45sq ft and the aspect ratio 22.2. The Skylark 4 has the wings faired directly into the top fo the fuselage without the built-up pylon-type structure behind the cockpit of the Mks 3 and 2, the height of the wing being 9in lower than the Mk 3's. The wing is very similar to that of the 3G but has modified wing roots, and the main spar has been strengthened to avoid the Mk 3's tendency for the wing tips to be deflected downwards at high

Slingsby T50 Skylark 4. Eric Wagner

speed. The prototype Skylark 4 first flew in February 1961 and altogether 63 Mk 4s were built, plus three more constructed in New Zealand by Mr Fred Dunn from kits supplied by Slingsby. The Mk 4 was successful in competitions, and scored two notable successes in 1963 when examples of this version won both the US and Canadian National Championships. Structurally the Mk 4 was very similar to the Mk 3, with a light rear spar carrying the ply-covered ailerons, the wing being plywood-covered to the rear spar and with a fabric-covered trailing edge; the air brakes in both upper and lower surfaces are on the 50% chord line. The wooden fuselage is a semi-monocoque of elliptical cross section with a glassfibre-covered nose and plywood covering for the remainder. The pilot sits under a moulded Perspex canopy that is larger than the Mk 3's, and likewise hinges sideways to open. Landing gear consists of a non-retractable Dunlop monowheel with rim brake, a rubber-sprung nose skid and a tail bumper. The fin and tailplane are plywood-covered and the rudder and elevators fabric-covered, with a trim tab in the starboard elevator.

Slingsby T 51 Dart

UK

Data: T51 Dart 17R
Span: 55ft 9¼in
Length: 25ft 5in
Wing area: 149.3sq ft
Aspect ratio: 20.4
Empty weight: 525lb
Max weight: 816lb
Max speed: 136mph (in smooth air)
Min sinking speed: 1.97ft/sec at 46mph
Best glide ratio: 36:1 at 51.5mph

This high performance Standard Class single-seater was the last Slingsby type of conventional all-wood construction and the last to be designed under Mr F. N. Slingsby's direction. The prototype Dart 15 first flew on 26 November 1963 and the Dart 15 – known as the 15R when fitted with a retractable monowheel – was the initial Standard Class version with 15m span shoulder wings, which were cantilever single-spar spruce structures with a birch plywood leading edge torsion box and a fabric-covered rear portion; there were air brakes at the 50% chord line and the plain ailerons were plywood-covered. The wing spars were initially entirely of wood, but were later changed to box spars of mixed wood and light alloy construction with Redux bonding when this type of spar was introduced into the Dart 17 in 1965. Wing root fillets like those on the Dart 17 were also fitted at this time and later production Dart 15s had an all-metal tailplane. Altogether 50 Dart 15s were built, plus five more constructed from kits supplied by Slingsby, four of these being built by Mr Fred Dunn in New Zealand; the price of a Dart 15 in July 1964 was £1,425. This verison scored a number of competition successes: one flown by G. Burton gained 5th place in the Open Class at the 1965 World Championships at South Cerney, Gloucestershire, and the Dart 17 prototype, flown by H. C. N. Goodhart, took 7th place in this event. The Dart 15 was awarded the OSTIV Design Prize at these 1965 Championships. In League One of the 1967 British

Slingsby T51 Dart 17. Eric Wagner

Championships, Darts came 1st and 2nd and took eight more of the first 20 places.

But the Dart 15 in its wooden-sparred form was really too heavy and did not really have the performance for soaring in average British conditions, and this led to the Dart 17 – or 17R with retractable monowheel – with the span increased to 17m, this now being the Open Class version; the prototype 17 first flew in November 1964 and the price of a 17R was £1,950 in August 1966. Altogether 44 Dart 17s and 17Rs were built, plus four more built from kits in New Zealand by Fred Dunn. There was also one Dart 15/17, G-ATOE, which had detachable wing tips for changing the span from 15 to 17m, and two examples of the Dart 15W were built, this being a special version for the British team in the 1968 World Championships in Poland. The 15W had a new Wortmann wing section instead of the previous NACA 64-series aerofoils, a revised canopy shape and cockpit interior; the 15W first flew at Lasham on 29 March 1968 and after the Championships both 15Ws were convertred to Dart 17Ws with the 17m span wing, first flying in this form on 3 May 1969, and both were later fitted with retractable monowheels, in which form they were designated Dart 17WR.

Most Dart 15s and 17s had the retractable wheel, which became available as an optional fitting at the end of 1965, and this allowed a change of wing incidence, thus avoiding the Dart's tail-high attitude when flying at high speeds. All-metal tailplanes were also fitted to the later production Dart 17s. With the original wooden spar wing, flexure was caused when the Dart 17's air brakes were extended, and so to reduce this a new box spar with light alloy booms Redux-bonded to wooden webs was introduced, the first Dart 17 with this spar being rolled out in April 1965. At the same time the aileron span was increased by 11¾in, and new wing root trailing edge fillets were added to reduce drag. On the Dart 15 the new spar resulted in a saving of 45lb in tare weight over the wooden-sparred version.

The Dart's fuselage is a semi-monocoque spruce structure of elliptical cross section, the cockpit section being covered with glassfibre and the remainder with birch plywood. The pilot sits in a semi-reclining seat under a sideways hinging moulded Perspex canopy with clear vision panels, and the cockpit is very similar in size and general arrangement to the Skylark 4's. The fuselage is shallower than the latter's because the flying controls run along the sides of the cockpit instead of under the pilot's seat. The fin and rudder are of spruce with glassfibre leading edges, the rudder being fabric-covered, and the light alloy stressed skin tailplane, previously wooden, is an all-moving surface with anti-balance tabs. As well as the monowheel, which has an expanding brake, there is a short forward skid under the nose and a tail bumper fairing.

Slingsby T 53

UK

Data: T53C
Span: 55ft 6in
Length: 25ft 3¼in
Height: 4ft 7¼in
Wing area: 194sq ft
Aspect ratio: 15.9
Empty weight: 780lb
Max weight: 1,279lb
Max speed: 135mph
Min sinking speed: 2.5ft/sec at 50mph
Best glide ratio: 29:1 at 53mph

Made distinctive by its swept forward wing and the extensive area of its transparent canopy glazing, which extends back to the wing trailing edge, the T53 tandem two-seater trainer was designed by J. L. Sellars and was Slingsby's first all-metal type since it was by now apparent that the days of wood and fabric construction were numbered. The type is intended for initial or advanced training and the prototype, the T53A, made its first flight at Wombleton, Yorkshire, on 9 March 1967. It had tapered wings with camber-changing flaps with a range of 5° up to 15° down, ailerons of large chord and an all-moving tailplane. The first production version, the T53B, made its first flight on 28 March 1968, and had the cockpit moved forward, the structure redesigned and simplified, the flaps deleted and the all-moving tailplane replaced by a conventional tailplane and elevators; the aileron chord was also reduced and these changes resulted in lighter stick forces and a considerable saving in weight. The first T53B, XV951, was in RAF markings for air cadet training, and there were a number of modifications made to meet ATC requirements. These included fitting a nose skid in place of the standard nose wheel, to shorten the landing run; fitting a ground rapid-retrieve factility to improve utilisation in circuit training; fitting a performance-retarding device for basic pilot training and making the main wheel spring-loaded. It was also envisaged

Slingsby T53. Author

that the ATC variant could be operated with open cockpits if the crew's comfort demanded. But in the end it was the T53C that was built in small numbers for the ATC, the variant incorporating the special ATC modifications being known as the T53C(M). The C, which first flew in May 1970, had a revised and extended fin and rudder with extra area above the tailplane, no dorsal fin, a structurally redesigned wing, reduced aileron control loads resulting from the use of aileron servo tabs, a revised spring trim system and improvements in the cockpit layout, seating, ventilation and canopies; some extra equipment was carried and the all-up weight was increased. The T53D project of October 1968 was a semi-aerobatic powered trainer version with a pusher engine installed on the port wing only, and a fuel tank in the wing leading edge, and the T53E was another project for a powered trainer version of the T53C. Only 16 T53Bs and one more T53C (actually the last T53 converted) were built before the November 1968 fire at Slingsby's works put a stop to production, but the design was later acquired by Yorkshire Sailplanes, who had built three more as the YS.53 Sovereign by 1974. This differed from the T53B chiefly in having longer tail surfaces and a nosewheel instead of nose skid.

Of light alloy stressed skin construction throughout, the T53C has two-spar cantilever shoulder wings with 3° forward sweep at the quarter-chord line as compared to the 5° 15′ forward sweep of the T53B; the ailerons are mass-balanced and there are Schempp-Hirth air brakes in the upper and lower surfaces. The fuselage is a semi-monocoque and the cantilever tail unit has an internal spring-loaded trimmer. Landing gear consists of a non-retractable main wheel and nose wheel (or skid on the ATC variant), plus a tailskid; main wheel shock absorption on the T53C is by Armstrong damper units and there is an expanding caliper brake. The pilots sit under a sideways-hinging moulded flush Perspex canopy, and radio and an oxygen system can be fitted if desired.

SSVV Uribel C

Italy

Data: Uribel C
Span: 49ft 2½in
Length: 19ft 6in
Wing area: 148.5sq ft
Aspect ratio: 16.2
Empty weight: 463lb
Max weight: 683lb
Min sinking speed: 2.17ft/sec at 43mph
Best glide ratio: 31:1 at 48mph

The SSVV, or Sezione Sperimentale Volo Vela, was formed by the Aeroclub Volovelistio Milanese to maintain and repair the club's gliders and also to build new designs. It concentrated at first on reconditioning Zogling and Allievo Cantu primary training gliders, and its first new product was the CVV 7 Pinocchio single-seat sailplane. This was followed by the Spillo EC 37-53 high performance single-seater, a small series of the Urendo EC 38-56 two-seater and the prototype EC 40 Eventuale two-seat trainer, all designed by Eng Edgardo Ciani, and the small Gheppio R1 single-seater designed by Eng Gianfranco Rotondi. Eng Ciani next designed the Uribel single-seater Standard class sailplane, and after five examples of the Uribel and Uribel B had been built a small series of the improved Uribel C was started, this version having a completely redesigned wing and a fuselage of reduced cross section, but otherwise being similar to the B. Like its contemporary, the Standard Austria, the Uribel C is a cantilever shoulder wing monoplane of all-wooden construction with a 'butterfly' V-tail. The C's plywood-covered wings are of Eppler 257 aerofoil section and of 17% thickness/chord ratio; air brakes are fitted and there are no flaps. The fuselage is a wooden monocoque structure, with the cockpit canopy faired completely into the top profile of the nose section. There is a fixed monowheel and a small tailskid.

SSVV Uribel C. Eric Wagner

Standard Austria

Austria

Span: 49ft 2½in
Length: 20ft 4in
Wing area: 145.3sq ft
Aspect ratio: 16.7
Empty weight: 452lb
Max weight: 712lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.3ft/sec at 43.5mph
Best glide ratio: 34:1 at 65mph

This high performance Standard Class single-seater was the result of a commission by the Austrian Aero Club (Österreichischer Aero-Club) to Ing Rüdinger Kunz to design them a sailplane in this category; the prototype first flew in July 1959, and the design duly won the OSTIV Trophy in 1960 for the best Standard Class type. Only a few Standard Austrias were built in the Club's workshops for its own use, the bulk of production being undertaken by the German firm Schempp-Hirth which began building Standard Austrias under a licence arrangement in March 1962. The 1964 model of the type, the Standard Austria SH, had an Eppler 266 laminar flow wing section instead of the previous NACA 65-series aerofoil, giving an improved performance at lower speeds; the SH also had a retractable monowheel as an optional feature, and this version was developed into the Schempp-Hirth SHK. In designing the Standard Austria Rüdinger Kunz sought to combine a high lift/drag ratio and a relatively low wing loading, and the type's great strength and excellent flying characteristics made it suitable for cloud flying and spinning, although it is not aerobatic. The cantilever shoulder wings are of wooden construction and are unusual in having no spars; they are fabric-covered from the 65% chord line to the trailing edge and there are air brakes in the upper surfaces. The circular section monocoque fuselage has a glassfibre nose section, pilot's seat and rear fuselage, the centre portion being of wood. The 'butterfly' V-tail surfaces are all-moving wood and fabric structures with an included angle of 90°, and each surface has a geared tab. There is a fixed monowheel forward of the cg, with a disc brake, and a small tailwheel. The pilot sits in an adjustable seat under a blown plastic canopy, and there is provision for radio, an oxygen system and full blind-flying instrumentation.

Standard Austria SH. Eric Wagner

Start + Flug H 121 Globetrotter

FGR

Span: 55ft 9¼in
Length: 25ft 1½in
Height: 3ft 5¾in
Wing area: 170.1sq ft
Aspect ratio: 18.3
Empty weight: 639lb
Max weight: 1,102lb
Max speed: 155mph
Min sinking speed: 2.13ft/sec at 50mph
Best glide ratio: 36:1 at 62mph

Originally known as the Schulmeister, this side-by-side two-seater training sailplane first flew in prototype form on 28 July 1977, and production began in March 1978. The Globetrotter is a cantilever mid-wing monoplane of 17m span with a T-tail, and mainly of glassfibre reinforced plastic construction. The wings have an Eppler E 603 aerofoil section and are swept forward 2° 30'; air brakes are fitted in the upper surfaces, and there is provision for water ballast. Landing gear consists of a non-retractable monowheel and tailwheel, and the two pilots sit under a one-piece canopy that slides forward to open over the tip of the nose.

Start + Flug Hippie

FGR

Span: 32ft 9¾in
Length: 18ft 8½in
Height: 4ft 7in
Wing area: 96.9sq ft
Aspect ratio: 11.1
Empty weight: 110lb
Max weight: 298lb
Max speed: 37mph
Best glide ratio: 12:1

This simple ultra-light single-seat glider weighs only 106lb without the pilot and is designed to achieve take-off by a variety of methods: by foot-launch, auto-tow, winch launching or any other suitable form of assisted launch. For a foot-launch the product of the hill's angle in degrees and the wind speed in metres per second should be a figure of 80 or above. After foot-launching, the pilot draws up his legs into the hoop-like glassfibre seat fairing at the front of the aircraft, which also serves as the landing skid. The Hippie flew for the first time on 15 August 1974 and examples are now flying in five countries outside Germany. It has strut-braced dihedral wings of constant chord with small endplate-type fairings and Wortmann aerofoil sections. The basic structure is of glassfibre with carbon-fibre reinforcement; the wings are plastic-covered and the tail surfaces fabric-covered, the tail being carried on an open girder-type framework, and the braced tailplane being mounted on the large fin. The landing gear is formed by the glassfibre seat fairing which has a small keel surface underneath it, and there is a metal hoop at the base of the rudder to form a tailskid. The pilot sits behind a windscreen extending from the leading edge to the front of the seat fairing. The airframe can be dismantled and packed into a carrying case measuring 5m (16ft 4¾in) by 1.10m (3ft 7¼in) by 0.60m (1ft 11¾in). A new version of the Hippie is now available, with wings of honeycomb construction, a longer tail structure of aluminium tubing, an enlarged rudder, quick-connect fittings and an enlarged seating area for the pilot.

Start + Flug Hippie. John W. R. Taylor

Sunderland MOBA 2C

Aûstraliä

Data: MOBA 2C
Span: 49ft 2½in
Length: 22ft 3in
Height: 4ft 4in
Wing area: 97.7sq ft
Aspect ratio: 24.74
Empty weight: 499lb
Max weight: 730lb
Max speed: 121mph (in smooth air)
Max aero-tow speed: 101mph
Min sinking speed: 2.0ft/sec at 52mph
Best glide ratio: 37:1 at 57.5mph

Designed and built by Mr Gary Sunderland of Heatherton, Victoria, an engineer with the Australian Department of Civil Aviation, the MOBA 2C is a Standard Class single-seater developed from the MOBA 2A, one of two 13m span sailplanes that competed with each other in 1972 in a design competition organised by the Australian Gliding Federation. MOBA is an acronym for My Own

Sunderland MOBA-2C.

Bloody Aircraft, and the MOBA 2B was a 15m span version of the 2A; the 2C is an improved version of both the earlier models with a 15m span and the fin and rudder height increased to 4ft. The prototype 2C made its first flight on 12 December 1979 and is a cantilever high wing monoplane of mixed construction with a T-tail; series production is not intended. The single-spar wings are built in three pieces and have plywood ribs with PVC foam infilling, and a skin of pop-riveted aluminium alloy sheet covered with glassfibre. The plain aluminium alloy flaps on the trailing edge also serve as air brakes, and the wooden ailerons are plywood-covered. The nose and centre fuselage are box structures of sheet aluminium alloy with a non-structural glassfibre skin, while the tail boom is of flush-riveted aluminium alloy sheet. The fin and rudder are also of flush-riveted aluminium, while the tailplane and elevator are of wood and plywood. Landing gear consists of a retractable monowheel and a fixed tailskid, while the pilot sits under a forward-sliding canopy.

Swales SD3-15

UK

Data: SD3-15T
Span: 49ft 2½in
Length: 20ft 0in
Height: 4ft 3in
Wing area: 102.0sq ft
Aspect ratio: 23.7
Empty weight: 490lb
Max weight: 728lb
Max speed: 125mph (in smooth air)
Max aero-tow speed: 90mph
Min sinking speed: 2.4ft/sec at 48.5mph
Best glide ratio: 36:1 at 55mph

This single-seater 15m span sailplane is designed especially for use by clubs and small syndicates, with the emphasis on low running costs and capital outlay together with safe flying qualities. Available in two forms, as the SD3-15T with a T-tail and the SD3-15V with a V-tail, the Swales was developed from the Birmingham Guild BG 135 Gipsy, the 13.5m span version of the BG 100/12 designed by J. C. Gibson, K. Emslie and the late L. P. Moore of Sailplane Design Ltd. Manufacturing rights of the BG 135 were acquired by Yorkshire Sailplanes Ltd, who built a batch of seven as the YS 55 Consort. The BG 135 was itself developed from the earlier and very similar Birmingham Guild Gipsy 12/15 project which, like the BG 100/12, was intended to be a low cost lightweight Standard/Sports Class sailplane in which either a medium-performance 12m wing or a high performance 15m one could be fitted to a common fuselage and tail unit. This was to be achieved by special attention to structural efficiency resulting from efficient wing skin stabilisation, with rigid foam cores, and low cost was achieved by eliminating taper as well as twin-skin sandwich or ribbed forms of construction. The prototype BG 100/12, with a 12m (39ft 4in) span wing, first flew on 7 April 1970 and, like the later SD3-15V, was a cantilever shoulder-wing monoplane of all-metal construction with a V-tail and a large hinged moulded cockpit canopy; a 13.5m span wing was later fitted. Construction of the prototype SD3-15 began in September 1974 and it first flew in March 1975, being designated SD3-13V. The first prototype SD3-15V first flew in July 1975 and the first SD3-15T made its maiden flight in December 1976, the suffix letter denoting the tail configuration; six SD3-15s had been built by mid-1979; production is now only to order and is restricted to the T-tailed SD3-15T. Structurally, the SD3-15 is very similar to the BG 135 and BG 100/12 from which it was developed; the constant chord wings have metal and polystyrene ribs and glassfibre reinforced plastic (GRP) wing tips, and the trailing edge flaps also act as air bakes. The plain metal ailerons have foam ribs. The metal-skinned semi-monocoque fuselage has a GRP nose cone and is built up on four longerons. The landing gear consists of a non-retractable monowheel with an internally-expanding brake, and a tailskid. Both versions have a metal tail unit with 50% foam ribs; the SD3-15T has a full-span elevator with spring trim while the SD3-15V has all-moving tail surfaces with anti-balance tabs. The cockpit canopy opens sideways to starboard.

SZD-8 Jaskolka

Poland

Data: Jaskolka-Z
Span: 52ft 6in
Length: 22ft 11½in
Height: 4ft 7½in
Wing area: 146.4sq ft
Aspect ratio: 18.8
Empty weight: 595lb
Max weight: 816lb
Max speed: 155mph (in smooth air)
Min sinking speed: 2.5ft/sec at 46mph
Best glide ratio: 28.5:1 at 51.5mph

Since the war Poland has established herself as probably the leading Eastern European rival to the Federal German Republic in the design and manufacture of high quality sailplanes. Between 1947 and 1977 the Polish aircraft industry produced 3,638 gliders of 91 different types, and SZD sailplanes were exported all over the world, setting up many world and national records over the years. The SZD organisation responsible for Polish sailplane design and devleopment was officially formed in April 1946 as the Instytut Szybownictwa (or Gliding Institute) at Bielsko-Biala and was renamed in 1948 the Szybowcowy Zaklad Doswiadczalny – SZD (or Experimental Glider Establishment). In July 1969 the name was changed again and since July 1975 the former SZD has been known as Przedsiebiorstwo Doswiadczalno-Produkcyjne Szybownictwa, or Experimental and

SZD-8 Jaskolka. Eric Wagner

Production Concern for Gliders, although the well known letters SZD continue to be used for its products. The sale of these to foreign customers, like those of other Polish aircraft, is handled by the PEZETEL trading organsiation.

The SZD-8 Jaskolka (or Swallow) high performance single-seater first appeared in 1951, two prototypes being rolled out in September and December that year; in prototype form it had a fuselage length of 22ft 1½in but in the production version, which started coming off the line in 1954, the length was increased to 24ft 4¼in. The Jaskolka soon began to make its mark in contest flying, and between May 1954 and May 1960 the type held no fewer than 15 world records for speed and distance. The SZD-8L was a special version for the 1956 World Championships at St Yan, France, in which one, flown by Gorzelak, took 3rd place; this version had a wing of laminar flow section, a 'butterfly'-type V-tail and wing tip end plates which had the effect of increasing the wing span as well as acting as 'bumpers'. The SZD-8L also carried 100 litres (22 Imp gal) of water ballast to permit maximum performance in varying weather conditions, and was one of the first sailplanes to employ this form of ballast, which is now a feature of many high performance types. Of conventional wooden construction, the Jaskolka has two-piece cantilever mid-set wings with single spars and fabric covering; the Fowler flaps can be lowered to 12° or 25° and air brakes are fitted in the upper surfaces. The wings are quickly detachable and the ailerons are aerodynamically-balanced. The fuselage is plywood-covered and the pilot sits over the wing leading edge, rather than in front of it, thus giving him an excellent view; the cockpit is enclosed by a moulded two-piece Plexiglas canopy the rear section of which slides back for exit and entry. A novel feature of the rear fuselage is a built-in recessed handle each side for ease of handling the Jaskolka on the ground. A semi-retractable monowheel with a mechanical brake is fitted, plus a short nose skid and a tail bumper. Altogether 80 Jaskolkas had been built when production ended in 1961.

SZD-9bis Bocian 1E

Poland

Data: Bocian 1E
Span: 58ft 4¾in
Length: 26ft 10¾in
Height: 4ft 0¼in (excluding wheel)
Wing area: 215.3sq ft
Aspect ratio: 15.85
Empty weight: 754lb
Max weight: 1,191lb
Max speed: 124mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.69ft/sec at 44mph
Best glide ratio: 26:1 at 50mph

The Bocian (or Stork) tandem two-seater sporting and training sailplane has proved to be one of the most successful postwar types in this category, and between 1955 and 1968 set a number of height and distance records in the hands of Polish pilots. The prototype SZD-9 flew for the first time on 11 March 1952 and the Bocian was to have one of the longest production runs of any sailplane, a total of 620 having been built when production ended at the end of 1977. The type was exported to 33 countries, including the Chinese People's Republic, where licence production of Bocians and several other Polish sailplanes commenced at the Glider Manufacturing Centre at Tchan-Tia-Kou during 1955-56. The Bocian is cleared for cloud flying, spinning and basic aerobatics and was, in fact, one of the few two-seaters to be stressed for aerobatics, including inverted flight; controls and instrumentation have, from the start, been intended to be suitable for sporting flying as well as training. Of conventional all-wood construction, the Bocian is distinguished by its mid-set wing swept forward, in the Mk 1E version, by 1° 30' at the quarter-chord line

SZD-9bis Bocian 1E.

and with 4° dihedral. The first production Bocian flew in March 1953 and the type went through several versions; the Bocian 1C first flew in February 1954, the Mk 1D in 1958 and the final version, the Mk 1E, on 6 December 1966. The early versions featured several differences in the tail, and especially the rudder. Within a few years of first going into production, the type had set several world speed records over 200 and 300km closed circuits, and in 1962 Franciszek Kepka set a world record for a goal flight distance by flying 401 miles (636.6km) in a Bocian. On 5 November 1966 a Bocian 1D flown by the Polish pilots S. Josefczak and J. Tarczon set an international gain of height record for multi-seaters of 38,320ft, while the corresponding ladies' record was set in another Bocian on 17 October 1967 by Adela Dankowska and M. Mateliska, who achieved a height gain of 27,657ft. An experimental verison of the Bocian was being modified during 1964 for flights at up to 15,000m (49,200ft); this was to be flown as a single-seater with the pilot wearing a special WUK type pressure suit with advanced oxygen equipment. Eight 4-litre (0.87 Imp gal) oxygen bottles, sufficient for up to four hours' flight, were carried in the fuselage, and the cockpit was heat-sealed and provided with R/T radio. At a later stage it was intended to provide heating, double glazing for the canopy and de-frosting of the canopy glass, amongst other improvements, for this special Bocian, and a high altitude pressurized variant with a crew of two was also studied for a time.

The Bocian 1D's wings are of slightly larger span than the Mk 1E's (59ft 5½in instead of 58ft 4¾in) and have 3° 30' of forward sweep; the Mk 1D is also 9¾in shorter in overall length than the 1E, and its rudder contours are slightly different to the 1E's. In both versions the wings are two-spar structures with a plywood D-section leading edge and fabric covering; the slotted ailerons are each in two parts, which are separately controlled. No flaps are fitted but there are SZD air brakes inboard of the ailerons. The oval section fuselage is plywood-covered on both versions and the two tandem seats, under a long two-piece blown Plexiglas canopy, are so positioned that the rear seat is over the cg and there is no need to carry ballast when the aircraft is flown as a single-seater. There is a non-retractable monowheel with a brake and a shock absorber fitted, and a short nose skid, plus a tailskid. The cantilever wooden tail unit has a trim tab in the port elevator.

SZD-21-2B Kobuz 3

Poland

Data: Kobuz 3
Span: 45ft 11½in
Length: 23ft 7½in
Height: 6ft 3in
Wing area: 145.3sq ft
Aspect ratio: 14.52

One of the very few sailplanes designed especially for aerobatics, this high performance single-seater first flew in prototype form as the SZD-21-2 Kobuz 2 on 3 June 1961, and was designed by Trzeciak. It was developed into the Kobuz 3, the prototype of which was built at the No 4 ZSLS (Sport Aviation Equipment Plant) at Wroclaw, and flew for the first time on 10 December 1964, piloted by S. Skrzydlewski; an initial production batch of three Kobuz 3s followed in 1965. The Kobuz 3 differed from the Mk 2 in having the cockpit moved forward and the pilot in a semi-reclining instead of a fully-reclining seat, a slightly longer and more pointed nose, a wing of 0.5m greater span with plywood stressed-skin covering, and a taller fin and rudder with the low-set tailplane moved back to underneath the rudder. The Kobuz 3 is stressed to airframe limits of +7G to −5G, and has a cantilever mid-set laminar flow wing built as a sparless torsion box structure with plywood and foam sandwich skinning; the two-section ailerons are fabric-covered and flaps as well as air brakes are featured. The monocoque fuselage is built in two portions and is covered with a glassfibre and plywood skin; the cockpit has provision for an oxygen installation and R/T radio. A manually-retractable monowheel is fitted, plus a tail bumper. The cantilever tail unit is structurally similar to the wing, and has a fabric-covered rudder and elevators.

SZD-22 Mucha Standard

Poland

Span: 49ft 2in
Length: 23ft 0in
Height: 5ft 3in
Wing area: 138.2sq ft
Aspect ratio: 17.6
Empty weight: 529lb
Max weight: 772lb
Max speed: 155mph (in smooth air)
Min sinking speed: 2.4ft/sec at 44mph
Best glide ratio: 27.8:1 at 47mph

This high performance Standard Class single-seater had its origins in the well known IS-2 Mucha (or Fly) intermediate single-seater of 1948, which was produced in several versions and used in some numbers by the Polish gliding clubs; the Mucha-ter set up several national records for altitude and distance, and the type achieved several Diamond C flights. The IS-2 Mucha had a single-spar high wing with an aspect ratio of 15, and was fitted with dive brakes and spoilers; the fuselage was of elliptical cross-section. The Mucha-ter was developed into the SZD-12 Mucha 100 of 1953, this single-seater being used for training. It was of all-wood construction, the cantilever high wings having a single main spar and an oblique auxiliary spar, with a plywood-covered leading edge torsion box; air brakes were fitted and the ailerons were aerodynamically and mass balanced. The oval-section fuselage was plywood-covered and the pilot sat under a one-piece Plexiglas canopy. Landing gear consisted of a monowheel and short front and rear skids sprung with rudder pads.

The SZD-22 Mucha Standard was a further development of the Mucha 100 designed by R. Grzywacz espeically for the 1958 World Championships held at Leszno in Poland and, flown by Adam Witek, came 1st in the Standard Class section of this event. The next year it entered quantity production as a replacement for the Mucha 100 and the SZD-8 Jaskolka and over 150 were built in several versions. The SZD-22B had a plywood-covered wing and the SZD-22C a fabric-covered one, the type having the same all-wood construction with a single main spar and an oblique auxiliary spar as the Mucha 100; air brakes were fitted in the upper and lower surfaces, and the fabric-covered Frise ailerons were aerodynamically and mass balanced. The Mucha Standard was one of the first production sailplanes to have provision for water ballast, which was carried in the inboard leading edge. The fin and rudder differ from the Mucha 100's in having a squared-off top and a straight trailing edge. The plywood-covered oval-section fuselage had a very similar landing gear to the Mucha 100's, with a monowheel and front and rear rubber-sprung skids; the SZD-22D had a modified skid and monowheel and the last variant, the SZD-22E, introduced a new wing. The pilot sits under a streamlined clamshell Plexiglas canopy and is provided with a collapsible chart table as well as the conventional insturments; an oxygen installation can also be fitted. A special experimental high altitude version of the Mucha Standard was also developed, with the cockpit modified for flights at heights above 39,000ft.

SZD-22 Mucha Standard. Eric Wagner

SZD-24 Foka

Poland

Data: Foka 5
Span: 49ft 2in
Length: 23ft 6½in
Height: 5ft 3½in
Wing area: 130.9sq ft
Aspect ratio: 18.5
Empty weight: 565lb
Max weight: 850lb
Max speed: 155mph (in smooth air)
Min sinking speed: 2.03ft/sec at 48mph
Best glide ratio: 36.3:1 at 53mph

Appropriately named Foka (or Seal) on account of its beautifully streamlined fuselage, this high per-

SZD-32A Foka 5.

formance Standard Class single-seater was designed by Dipl-Ing Wladislaw Okarmus and first flew in prototype form on 2 May 1960. Flown by Adam Witek, the Foka gained 3rd place in the Standard class in that year's World Championships in Germany, where the type's design features aroused considerable interest. Three pre-production aircraft designated SZD-24B Foka 2 were completed early in 1961, and the first major production variant was the SZD-24C Foka-Standard, which first flew in September 1961; deliveries to the Polish gliding clubs and to export customers began soon after. This version was succeeded in production by the SZD-24-4A (or SZD-24D) Foka 4, which first flew in prototype form in February 1962 and later took part in the 1963 World Championships in Argentina. The Mk 4 had the same fuselage as the Foka-Standard but the wing structure was redesigned to make it much simpler and less costly to produce while retaining the same aerodynamic shape. The first production Foka 4A made its first flight on 7 Feburary 1964 and four Mk 4As were flown by the Polish team in the 1965 World Championships at South Cerney, Gloucestershire; in one of these Jan Wroblewski won the Open Class and his team-mate E. Makula came 4th, while the Fokas flown by F. Kepka and J. Popiel took 3rd and 4th places in the Standard Class. Of all-wood construction, the Foka 4A has two-piece cantilever shoulder wings which are sparless torsion box structures with thick plywood sandwich stressed skin covering which replaces the Foka-Standard's plywood and foam skinning; the latter's wing had a central torsion box structure built up of a main spar and two auxiliary spars. There are special SZD plain ailerons of NACA 4415 section. No flaps are fitted but there are SZD metal air brakes at the 60% chord line. The wooden monocoque fuselage is unusual in that the forward part has a modified laminar section, with the maximum depth aft of the pilot's cockpit at 40% wing root chord; the forward section is covered with a plywood/glassfibre sandwich skin. The pilot sits in a fully-reclining seat under a large flush-fitting canopy which slides forward to open; blind flying instrumentation is standard and there is provision for radio and oxygen. The landing gear consists of a long skid under the nose and a non-retractable monowheel located well aft of the cg, plus a tail bumper. The swept fin is integral with the fuselage and, like the tailplane, is an all-wooden sandwich structure; the laminar flow tailplane and elevator slot into the rear fuselage cone below and behind the rudder in a manner very similar to the Zefir 2. The elevator and rudder are fabric-covered and there is a trim tab in the former.

Final production version was the SZD-32A Foka 5 (formerly SZD-24E), which first flew in prototype form on 28 November 1966 and received its Polish C of A on 7 October 1967; this differed from the Mk 4 chiefly in having a roomier cockpit and the one-piece wooden tailplane and elevator repositioned at the top of the fin. The Foka 5 won first prize at the 1968 OSTIV Congress for the best Standard Class sailplane and a Mk 5 flown by Eward Makula finished 8th in the Standard Class in that year's World Championships at Leszno, Poland. Altogether 330 Fokas of all variants had been built when production of the type ended in 1971, and 200 of these were exported to 17 countries. The Foka 5 had several other changes from the Mk 4: the wing section was slightly different and the plywood-covered wing was now a multi-longeron semi-monocoque structure, with spars in the inboard section of each panel only; ailerons and air brakes were the same. The fuselage is now a semi-monocoque of oval section, with the monowheel relocated to be under the cg when the aircraft is empty; its brake is linked with the air brakes and the nose skid is retained. The cockpit canopy is slightly shorter but the pilot has the same blind flying instrumentation and provision for radio and oxygen as on the Mk 4.

SZD-25 Lis

Poland

Span: 49ft 2in
Length: 23ft 0in
Height: 5ft 0in
Wing area: 137.24sq ft
Aspect ratio: 17.65
Empty weight: 452lb
Max weight: 695lb
Max speed: 143mph (in smooth air)
Min sinking speed: 2.5ft/sec at 43mph
Best glide ratio: 27:1 at 47mph

This high performance single-seater combines the

wings of the SZD-22 Mucha Standard with a metal fuselage developed from that of the SZD-16 Gil prototype. Designed for large scale production, with low manufacturing and maintenance costs, the Lis (or Fox) made its first flight as a prototype on 5 March 1960, and production aircraft began to enter service with the Polish gliding clubs early in 1962; not a great many were built, but several were exported. Slotted ailerons are fitted, instead of the SZD-22's Frise-type ones, and these are aero-dynamically and mass balanced, and air brakes are also fitted. The all-metal fuselage is built in two portions: the welded steel tube forward part with fabric covering and the tail boom of riveted sheet duralumin, the cantilever all-wood tail unit being fabric-covered. Landing gear consists of a semi-retractable sprung monowheel with brake and a rubber-mounted nose skid. The pilot sits under a sideways-hinging canopy.

SZD-25 Lis.

SZD-30 Pirat

Poland

Data: SZD-30C
Span: 49ft 2½in
Length: 22ft 8½in
Height: 5ft 5¾in
Wing area: 148.5sq ft
Aspect ratio: 16.3
Empty weight: 562lb
Max weight: 816lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 2.30ft/sec at 47mph
Best glide ratio: 34:1 at 52mph

This Standard Class single-seater, designed by Ing Jerzy Smielkiewicz, is intended to be suitable for a wide range of tasks from training to competition flying, and is cleared for cloud flying, spinning and basic aerobatics. The prototye Pirat first flew on 19 May 1966 and production started the following year; a total of 776 of all versions had been built by the beginning of 1980, including 430 completed at the WSK-Swidnik works where production was under-taken until October 1977. Production has now ended. The type had been exported to 24 countries, including Argentina, Egypt, North Korea, New Zealand, the USA, the Soviet Union and Venezuela amongst others. The Pirat is a T-tailed cantilever high wing monoplane of wooden construction, the initial production version having mass-balanced ailerons larger than those of the current improved SZD-30C, which has epoxy/glassfibre partially mass-balanced ailerons; the first SZD-30C made its maiden flight on 10 January 1978, and was preceded by the SZD-30B Pirat 75, which was a prototype only. On the C variant the forward fuselage is reinforced with a thick layer of glassfibre, which replaces the removable front skid with shock abosrber of the initial production SZD-30; the latter's non-retractable monowheel had a band brake instead of the C's disc brake, the C also having a tailwheel which can be replaced by a tailskid and a roomier cockpit with an enlarged canopy. The wing has a rectangular centre section which is a plywood-covered multi-spar structure, and ply-covered tapered outer panels of single-spar torsion box construction; there are double-plate air brakes in the centre section in both upper and lower surfaces. The fuselage is a plywood monocoque, all versions having a glassfibre nose and cockpit floor, and the cantilever wooden tail unit has a tab in the elevator trailing edge. The pilot sits under a jettisonable sideways-hinged blown Perspex canopy, and has an adjustable seat back rest and rudder pedals, as well as two baggage compartments; there is provision for radio and oxygen.

SZD-30 Pirat.

SZD-31 Zefir 4

Poland

Data: Zefir 4
Span: 62ft 4in
Length: 26ft 3in
Height: 7ft 0in
Wing area: 169sq ft
Aspect ratio: 23.0
Empty weight: 772lb
Max weight: 970lb
Max speed: 149mph (in smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 1.97ft/sec at 58mph
Best glide ratio: 42:1 at 58.5mph

The Zefir series of high performance single-seaters represented what was arguably the high point of wood and fabric sailplane design before this traditional form of construction was superseded increasingly by glassfibre types in the 1960s. The Zefirs resulted from work done by a team under Dipl-Ing B.Szuba and the SZD-19X Zefir 1 prototype, designed by B. Szuba, made its first flight on 4 January 1959 as an Open Class single-seater and this was followed by the SZD-19-2 Zefir 2, which first flew in March 1960. The first two examples of this version, flown by the Polish pilots Makula and Popiel, took 2nd and 3rd places in the Open Class in that year's World Championships in Germany. The Zefir aroused great interest here because of its advanced design features, in particular the reclining pilot's position that made possible such a well-streamlined fuselage of low cross sectional area, the tail braking parachture, the towing hook unit combined in the retractable monowheel, and the swept back fin and rudder with the one-piece tailplane and elevator slotting into the tail cone below the rudder. The Zefir 2 went into limited production during 1963-64 and three improved Zefir 2As took part in the 1963 World Championships in Argentina; this time their pilots Makula and Popiel came 1st and 2nd in the Open Class and the Argentine pilot Rudolfo Hossinger, who had won the 1960 World contest in a Skylark 3, was placed 5th in a Zefir 2A. The cantilever shoulder wings were of 17m (55ft 9½in) span and 20.7 aspect ratio, with an NACA 65-series laminar flow section; each wing has a central plywood torsion box with a plywood/plastic core sandwich skin, a D-section leading edge and a plywood-covered trailing edge. The wooden ailerons are fabric-covered and the VZLU mechanically-operated slotted flaps are in six sections covering 35% of the chord; there are no dive brakes. The wooden fuselage has the monocoque nose section covered with glassfibre, the centre section and tail cone being ply-covered semi-monocoque structures, the drag parachute being housed in the tail cone. The tail surfaces have laminar flow sections, the fin and tailplane being covered with a sandwich skin and the rudder and elevators fabric-covered, with a trim tab in the elevator. The long flush-fitting cockpit canopy slides forwards about 3in and then is opened by hinging upwards from the tip of the nose cone; radio, oxygen and blind flying instruments for the pilot are standard, and a termal detector can be fitted as an optional 'extra'.

The SZD-29 Zefir 3 was a much improved version of the Mk 2 intended for advanced competition flying, with a wing of 19m (62ft 4in) span, full-span Fowler flaps, a longer fuselage and an unswept fin and rudder; the Mk 3 first flew in prototype form in April 1965 and had an improved best glide ratio of about 42:1. Its production development was the Zefir 4, the first Mk 4 prototype making its maiden flight on 7 December 1967. It was devleoped for the 1968 World Championships, in which one flown by Jan Wroblewski came 14th in the Open Class. The wing has an NACA 66-series section and no dihedral, unlike the Mk 2's; it is a multi-longeron sparless stressed skin wooden structure with full-span flaps like the Mk 3's, the outer sections of which are wooden and also act as ailerons while the inboard sections are of plywood/balsa sandwich; unlike the Mk 2, double metal air brakes are featured. The fuselage is an oval section monocoque, the forward part being made of glassfibre laminate and the rear portion of wood. The tailplane is an all-moving mass-balanced surface with trim tab, and the unswept rudder is also mass-balanced. The monowheel is manually retractable with rubber shock absorbers and a hand-operated wheel brake and, like the Mk 2, a tail-braking parachute is fitted; unlike the Mk 2, the cockpit canopy is now sideways-hinging.

SZD-36A Cobra 15

Poland

Data: Cobra 15
Span: 49ft 2½in
Length: 22ft 11¼in
Height: 5ft 2¾in
Wing area: 125sq ft
Aspect ratio: 19.4
Empty weight: 567lb
Max weight: 849lb
Max speed: 155mph (in smooth air)
Min sinking speed: 1.97ft/sec at 45.5mph
Best glide ratio: 38:1 at 60mph

This high performance Standard Class single-seater was designed by Dipl-Ing Wladislaw Okarmus for the Polish gliding team at the 1970 World Championships at Marfa, Texas; design work began in October 1968 and the prototype Cobra 15 made its maiden flight on 30 December 1969. At the 1970 World contest, Jan Wroblewski and Franciszek Kepka of the Polish team flew their Cobra 15s into 2nd and 3rd places respectively in the Standard Class, and a Cobra 17 – this being the 17m span version – came 5th in the Open Class. Altogether 238 Cobras of all versions had been built when production ended in 1977, and the type has been exported to more than 20 countries. Of all-wood construction with plywood and glassfibre covering, the Cobra 15 has cantilever single-spar shoulder

wings with heavy moulded plywood stressed skin covered by glassfibre; the plain ailerons are mass-balanced and are of plywood/polystyrene/foam sandwich construction, and there are SZD double-plate metal glassfibre air brakes in the upper and lower wing surfaces. The SZD-39 Cobra 17 is the same as the Cobra 15 except for the increased span (55ft 9¼in) wing of 23.56 aspect ratio, which has provision for water ballast. The fuselage is an oval section semi-monocoque covered with plywood over the rear part and glassfibre on the forward portion, and there is an aero-tow hook in the lower fuselage forward of the monowheel. The SZD-36A differs from the SZD-36 in having this hook repositioned about 1m further forward of the cg with provision for locating it at the cg if required. The monowheel retracts mechanically to lie horizontally in the bottom of the fuselage, and has a brake; there is also a tailskid. The Cobra is distinguished by a sharply swept back fin and rudder with an all-moving mass-balanced tailplane mounted on top of it, with a trim tab on its trailing edge. The pilot sits under a vacuum-formed jettisonable flush-fitting canopy which slides forward to open; there is a small luggage compartment behind the pilot's seat and also a full range of instrumentation, plus provision for an oxygen system with a 4-litre cylinder in the baggage compartment and a radio.

SZD-36A Cobra 15.

SZD-40X Halny

Poland

Span: 65ft 7½in
Length: 28ft 8½in
Height: 5ft 11in
Wing area: 173.4sq ft
Aspect ratio: 24.66
Empty weight: 904lb
Max weight: 1,314lb
Max speed: 150mph
Min sinking speed: 1.8ft/sec at 46.5mph
Best glide ratio: 43:1 at 62mph

This high performance two-seater research sailplane strongly resembles the SZD-41A Jantar Standard, and was designed by Dipl-Ing Wladyslaw Okarmus to test a new NN-11M wing section based on that of the SZD-31 Zefir 4, which gave excellent performance at high speeds but was not so good for soaring in weak thermals. The Halny made its first flight on 23 December 1972 piloted by Dipl-Ing Z. Bylock. The new cantilever 20m span shoulder-mounted wing has 4° forward sweep at the quarter chord line and is a sparless glassfibre/wooden box structure with stainless steel fittings; the hingeless flaps and plain ailerons are operated by pushrods, and there are SZD-type double plate metal air brakes above and below the wing surface at 60% chord. The forward part of the fuselage is an all-plastic monocoque, the centre portion has a steel tube frame on which the wings and monowheel are mounted, and the rear fuselage is a monocoque metal tube. The cantilever T-tail is made of glassfibre and has spring trimming , while the landing gear consists of a backwards-retracting monowheel with a shoe brake and a fixed tailwheel. The forward seat is occupied by a flight observer, the controls and instrument panel being fitted in the rear cockpit only; the crew of two sit under a long flush-fitting one-piece canopy in tandem.

SZD-40X Halny.

SZD-41A Jantar Standard

Poland

Data: SZD-41A
Span: 49ft 2½in
Length: 23ft 4in
Height: 5ft 3in
Wing area: 114.7sq ft
Aspect ratio: 21.1
Empty weight: 551lb
Max weight: 970lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 2.03ft/sec at 48.5mph
Best glide ratio: 40:1 at 65mph

Types like the SZD-31 Zefir 4 and the SZD-24 Foka series had demonstrated that sailplanes of up to date wooden construction could achieve as high a degree of streamlining as any glassfibre designs, and could make their mark in the World Championships and other contests. Perhaps because of this Poland was comparatively late in attempting an all-glassfibre design, the first SZD type in this category being the prototype Open Class SZD-38 Jantar-1 single-seater (or Amber) of 19m span, designed by Dipl-Ing Adam Kurbiel, which first appeared in public at the 1972 World Championships at Vrsac, Yugoslavia, where it came 3rd in the Open Class and won the OSTIV cup for the best 19m design; in the following year it set up seven new Polish national records. It was then developed by Dipl-Ing W. Okarmus into the SZD-41A Jantar Standard, which had the same fuselage and tail unit as the Jantar-1 but new cantilever mid-set wings of 15m span designed to OSTIV Standard Class requirements. The SZD-41A made its first flight on 3 October 1973 in the hands of A. Zientek, and the Polish team flying the type in the 1974 World Championships at Waikerie, Australia, took 3rd and 7th places in the Standard Class, while SZD-41s were placed 4th, 6th and 18th in the 1976 World Championships at Räyskälä, Finland. Altogether 160 Jantar Standards had been built by the beginning of 1980 and the type has been exported to 18 countries, including both East and West Germany, the USA and the Soviet Union. The wings are single-spar ribless structures with foam-filled glassfibre/epoxy resin sandwich skin; no flaps are fitted and there are DFS glassfibre air brakes above and below each wing. There is also provision for 80kg (176lb) of water ballast in the leading edges. The fuselage is an all-glassfibre/epoxy resin shell, the centre portion having a steel tube frame on which the wings and the monowheel are mounted. The cantilever T-tail is also of glassfibre/epoxy resin, the fin being integral with the fuselage; the elevator has a spring trim. There is a retractable monowheel with a disc brake and a fixed tailwheel. The pilot sits on a semi-reclining seat under a flush-fitting two-piece canopy of which the front half is fixed and the rear section is removable for exit and entry.

The SZD-48 Jantar Standard 2 single-seater is a development of the SZD-41A also designed by Dipl-Ing W. Okarmus, and first flew in prototype form on 10 December 1977; 96 had been built by the beginning of 1980. The cantilever shoulder wings have single glassfibre roving main spars and no ribs; they are covered with glassfibre/foam/glassfibre moulded skins and have plain ailerons, with duralumin air brakes in the upper and lower surfaces. There is provision for 150 litres (33 Imp gal) of water ballast. The glassfibre fuselage has a steel tube central frame, and the rear portion is stiffened by half-frames and ribs. The cantilever T-tail is of similar construction to the wings and has a spring trim in the elevator. There is a retractable monowheel with disc brake and a semi-recessed tailwheel. With simple modifications to the trim and speed measuring systems the SZD-48 becomes the SZD-48-2.

The SZD-49 Jantar K is an FAI 15m class version of the Jantar Standard with wing flaps; the prototype first flew on 10 October 1978.

SZD-41A Jantar Standard.

SZD-42-1 Jantar 2

Poland

Data: Jantar 2
Span: 67ft 3in
Length: 23ft 4in
Height: 5ft 9¼in
Wing area: 153.4sq ft
Aspect ratio: 29.5
Empty weight: 727lb
Max weight: 1,307lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 87mph
Min sinking speed: 1.80ft/sec at 56mph
Best glide ratio: 48:1 at 63.5mph

Originally designated SZD-42A, this high performance Open Class single-seater was developed by Dipl-Ing Adam Kurbiel from the all-plastics SZD-38A Jantar-1 of which a small number had been built; the Jantar 2 made its first flight on 2 February 1976. The first two prototypes were flown by the Polish team in the 1976 World Championships in Finland, where they came 2nd and 3rd in the Open Class flown respectively by J. Ziobro and H. Muszczynski. These two Jantars had wings built in two sections whereas the production aircraft have the wings built in four pieces for ease of rigging and trailer transport; one of the latter aircraft, flown by R. Johnson of the USA, came 7th in the Open Class in the 1976 World Championships. Altogether 23 Jantar 2s had been built by the beginning of 1979, and these differ from the Jantar Standard chiefly in having wings of 20.5m (67ft 3in) span and a low-set tailplane with elevators and no tabs. Up to 287lb of water ballast can be carried, and when it is the g limits of the airframe are +4.0/−1.5, or +5.3/−2.65 g without the water ballast. The Jantar 2 is of all-glassfibre construction very similar to the Jantar Standard; unlike the latter it has hingeless trailing edge flaps hung from the upper surfaces, as well as light alloy DFS-type air brakes in both the upper and lower wing surfaces. The cantilever tail unit is of glassfibre/epoxy resin and there is a retractable monowheel and a tailskid instead of a tailwheel.

Latest version is the SZD-42-2 Jantar 2B, which is very similar to the Mk 2 but with the wings raised from the mid to the shoulder position and the incidence reduced slightly. Up to 375lb of water ballast can now be carried, and the Jantar 2B features improvements to cockpit comfort, the monowheel retraction system and the elevator spring trim; there is provision for a towing hook on the cg. The Jantar 2B made its first flight on 13 March 1978 and 32 had been built by the beginning of 1980.

SZD-42A Jantar 2.

SZD-50-2 Puchacz

Poland

Span: 54ft 8¼in
Length: 29ft 10in
Height: 6ft 10½in
Wing area: 195.5sq ft
Aspect ratio: 15.3
Empty weight: 729lb
Max weight: 1,212lb
Max speed: 136mph (in smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 2.30ft/sec at 48.5mph
Best glide ratio: 30:1 at 60mph

Designed by Dipl-Ing Adam Meus, this high performance tandem two-seater is intended to succeed the popular SZD-9 Bocian for training and performance flying, and resembles the SZD-42 Jantar 2 and 2B but with a shorter span and the addition of the second seat. The Puchacz (or Eagle Owl) has been modified and developed from a prototype known as the SZD-50-1 Dromader which first flew on 21 December 1976; the Puchacz first flew a year later. The first production aircraft flew on 13 April 1979 and nine had been built by the

SZD-50-3 Puchacz.

beginning of 1980. It is mainly of glassfibre sandwich construction, and has cantilever mid-set wings with slight forward sweep, plain ailerons and air bakes in the upper and lower surfaces. The glassfibre fuselage is supported in the central portion by two wooden frames, to which the wings and undercarriage are attached, and the landing gear consists of a non-retractable semi-recessed nose wheel, a sprung monowheel mounted behind the cg with a disc brake, and a tailskid which can be replaced by a tail wheel. There are two towing hooks, one in the nose for aero tows and the other mounted on the cg for winch launching. The tail unit is of glassfibre sandwich, the rudder being fabric-covered. The two pilots sit under a flush-fitting one-piece cockpit canopy that opens sideways, and have dual controls; the instrumentation for the front seat is easily visible from the rear seat.

Tainan Mita III

Japan

Span: 52ft 5in
Length: 26ft 1½in
Height: 4ft 2½in
Wing area: 170.82sq ft
Aspect ratio: 16.13
Empty weight: 661lb
Max weight: 992lb
Max speed: 118mph (in smooth air)
Max aero-tow speed: 81mph
Min sinking speed: 2.36ft/sec at 47mph
Best glide ratio: 30:1 at 51mph

Japan has never attempted, in her light aircraft nd sailplane designs, the sort of highly successful onslaught on world markets represented by her Honda motorcycles and transistor radios, and her sailplanes of indigenous design often represent, as does the Mita III tandem two-seater training and sporting glider, an essentially conventional, not to say cautious, design philosophy. The Mita was built by LADCO – the Light Aircraft Development Co of Tokyo, whose designer was Mr Asahi Miyahara, and its production has been continued under licence by the Tainan Industry Co Ltd (Tainan Kogyo KK) after the latter took over the manufacture of sailplanes from LADCO; by 1 January 1979 a total of 37 Mita IIIs had been built. Of conventional wood and fabric construction, the Mita has cantilever shoulder wings of constant chord centre section with tapered outer panels, of all-wood single box spar construction with plywood covering. The ailerons are fabric-covered an there are Schempp-Hirth air brakes in the wing upper surfaces. The fuselage is a steel tube framework with wooden stringers and fabric covering; the nose and forward section are of glassfibre, and there is an aero-tow release in the nose as well as a winch release at the cg. The wooden tail unit has a fabric-covered rudder and elevators, and the landing gear consists of a rubber-sprung non-retractable monowheel with brake, plus a tailskid. The pilots sit under a flush-fitting two-piece blown canopy that hinges sideways to starboard for entry and exit.

Tainan TN-1

Japan

Span: 50ft 10½in
Length: 25ft 0¾in
Height: 7ft 2¾in
Wing area: 172.0sq ft
Aspect ratio: 15.03
Empty weight: 595lb
Max weight: 837lb
Max speed: 81mph (in smooth air)
Max aero-tow speed: 81mph
Min sinking speed: 2.59ft/sec
Best glide ratio: 26:1 at 49mph

Also known by the manufucturers' designation F5, the TN-1 single-seater was designed by Yukio Tanaka and construction of the prototype began in August 1974; this made its first flight in December 1976. The Japan Civil Airworthiness Board was conducting certification trials in the spring of 1978 and it was hoped to begin production in the summer of that year. Of conventional wood and fabric construction very similar to the Mita III, the TN-1 had cantilever single-spar high wings of spruce and plywood, with fabric covering and a forward sweep

Tainan TN-1. John W. R. Taylor

of 2° 4′ at the quarter-chord line; the wooden ailerons are ply-covered and there are Schempp-Hirth air brakes. The steel tube fuselage framework has fabric covering over wooden stringers, and the nose is of glassfibre. The wooden tail unit has fabric-covered elevators and rudder, and there is a trim tab in the starboard elevator. There is a non-retractable unsprung monowheel mounted at the cg with a band brake, plus a tailskid.

Torva 15

UK

Data: Torva 15 Standard
Span: 49ft 2½in
Length: 23ft 3¾in
Height: 5ft 0in
Wing area: 121.5sq ft
Aspect ratio: 20.0
Empty weight: 525lb
Max weight: 900lb
Max speed: 134mph (in smooth air)
Min sinking speed: 2.03ft/sec at 50mph
Best glide ratio: 37:1 at 51mph

This Standard Class single-seater was designed by John Sellars, who was also responsible for the Slingsby T53, for Torva Sailplanes Ltd of Scarborough, Yorkshire, which company he had formed in September 1969 with Chris Riddell, and it was intended to be a moderately priced type with good performance suitable both for clubs and the private owner and competition pilot, for whom two production versions were to have been marketed. These were the Torva 15 Standard for club use and the Torva 15 Sport for the private owner and contest flying, the latter being fitted with flaps and having a retractable monowheel, while the Standard had provision for up to 130lb of water ballast. The Torva 15 was noteworthy as being the first British-designed sailplane to be constructed largely of glass-reinforced plastics (GRP), although the wings have plywood ribs and the fuselage has plywood and foam sandwich frames to support its GRP shell and side longerons. Design work began on 6 October 1969 and construction of the Torva 15 Sport prototype (also known as the Torva TA 1) commenced on 16 March 1970; this first flew on 8 May 1971 in the hands of Chris Riddell. A modified Wortmann aerofoil section was chosen for the cantilever shoulder wings to give a very high lift coefficent for achieving a good rate of climb in weak British thermals, and also to give a low stalling speed for short-field landings. The wings have a GRP spar with ply webs and GRP/balsa shell; both the ailerons and flaps are of GRP with a foam core, the ailerons having variable differential and drooping with the flaps, but being isolated from the latter at the flap full-down position. Light alloy Schempp-Hirth air brakes are also fitted. The fuselage and canopy shape were computer-calculated to achieve a good aerodynamic shape and roomy cockpit; the pilot sits under a Suntex lift-off transparent one-piece canopy and has a GQ five-point seat harness. The tail surfaces have GRP/balsa shells and plywood webs, the tailplane being an all-moving surface with a geared anti-balance tab. The retractable rubber-sprung monowheel is located forward of the cg and is manually retracted, with an internal expanding brake; there is also a GRP sprung tailskid with a small wheel. Only three more Torva 15s were built after the prototype, as the company was unfortunately forced to close down; these were also known as TA 2 Sprites.

VFW-Fokker FK-3

FGR

Span: 57ft 1in
Length: 23ft 7½in
Height over tailplane: 5ft 11in
Wing area: 148.54sq ft
Aspect ratio: 22.0
Empty weight: 529lb
Max weight: 882lb with water ballast
Max speed: 168mph
Max aero-tow speed: 87mph
Min sinking speed: 1.64ft/sec at 40mph
Best glide ratio: 42:1 at 55mph

This high performance Open Class single-seater, distiguished by a pod-and-boom fuselage and a very

VFW-Fokker FK-3.

tall fin and rudder, was designed by Dipl-Ing Otto Funk and the prototype was built by apprentices at VFW-Fokker's Speyer plant in Germany in the course of their regular training. It first flew on 24 April 1968 and production started in January 1969, soon building up to a rate of three or four per month. Designed especially for weak thermal conditions, the FK-3 is characterised by ease of handling; in its first competition, flown by Dr Rolf Spänig, the prototype won the Open Class in the 1968 Italian Championships, and two FK-3s later gained first and second places in the Austrian Championships. The cantilever shoulder wings have a thickness/chord ratio of 15.3% and are of an unusual metal and foamed honeycomb construction, bending loads being carried by a single metal spar which tapers from a T-section to a U profile, and drag and torsion loads being carried by a light alloy nose spar which transmits these loads to the fuselage fittings. The wing ribs are of light alloy and plastic foam sandwich construction, spaced at intervals of approximately 4ft 7in, and supporting a 0.5mm thick light alloy skin. Between the ribs a foamed honeycomb known as Conticell 60 gives additional support to protect the skin from minor damage, and the overall wing finish is very smooth. The camber-changing flaps are divided into inner and outer sections and Schempp-Hirth air brakes are fitted. Up to 110lb of water ballast can be carried if desired in two rubber tanks in the wings with the dump valve positioned in the fuselage aft of the retractable monowheel. The fuselage nose section is of steel tube construction covered with a glassfibre-reinforced shell, and the tail boom, of small cross section, is built of riveted light metal sheet without frames or stringers, the lower part incorporating a rubbing strip to minimise damage in a rough landing. The tail unit is similar in construction to the wings, the rudder being fabric-covered. The monowheel is manually-retracted and has a drum brake; there is also a tailwheel. The pilot sits in a semi-reclining position on an adjustable seat and has adjustable rudder pedals; the long one-piece Plexiglas canopy is removable, except for a small front portion.

Vickers-Slingsby T 59H Kestrel 22

UK

Data: T59H
Span: 72ft 2¼in
Length: 24ft 9¼in
Height: 6ft 4¼in
Wing area: 166.2sq ft
Aspect ratio: 31.35
Empty weight: 860lb
Max weight: 1,453lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 1.57ft/sec at 53mph
Best glide ratio: 51.5:1 at 64.5mph

After putting the Glasflügel Kestrel 17 into production, Vickers-Slingsby (now Slingsby Engineering Ltd) began to pursue its own line of development of this Open Class single-seater, which resulted in the 19m span T59B, T59C and T59D. The D model was still further developed into the T59H of 22m (72ft 2¼in) span, the extra span consisting of two 1.5m stub wings inserted into the exisiting wing at the roots. The fuselage is similar to the Kestrel 17 up to just aft of the canopy, beyond which an additional section 29½in long is inserted which considerably reduced the 'waisting' of the earlier version. The fin and rudder area are increased by about 25%, although the tailplane is the same size as the Kestrel 17's; the rudder is lightened to prevent flutter by fabric-covered cut-out sections. Two prototype T59Hs were built, the first of these flying in 1974, but the new variant was found to suffer from a wing flutter at 140kts (161mph); Vickers-Slingsby had to recover the prototype T59H from the original customer who had bought it, while the flutter

problem was investigated by the College of Aeronautics, where it was still being studied early in 1978. Like the T59C, the H has a carbon-fibre main spar and, apart from the longer fuselage and long-span four-piece wing, joined at the flap/aileron junction, it is structurally similar to the Kestrel 17 with the same cantilever T-tail, up to 220lb of water ballast can be carried. There are Schempp-Hirth air brakes in the upper and lower wing surfaces, and there is a retractable unsprung monowheel with a disc brake, plus a fixed tailwheel. The two T59H prototypes are known as the Kestrel 22 Series 1 and Series 2.

Vickers-Slingsby Vega

UK

Span: 49ft 2½in
Length: 22ft 0½in
Height: 4ft 11in
Wing area: 108.2sq ft
Aspect ratio: 22.4
Empty weight: 515lb
Max weight: 970lb
Max speed: 155mph (in smooth air)
Max aero-tow speed: 92mph
Min sinking speed: 2.21ft/sec at 51mph
Best glide ratio: 42:1 at 69mph

This 15m Contest Class single-seater is the first sailplane, of entirely Slingsby design to appear since the liquidation of the former Slingsby Aircraft Co in July 1969 and its reorganisation as part of the Vickers group; it is now known as Slingsby Engineering Ltd (Aircraft Division). The Vega was designed to take advantage of the change in Standard Class rules permitting camber-changing flaps to be installed in this class after 1976. The cantilever mid-set wings are designed for optimum performance and have combined flaps/air brakes inboard and the ailerons outboard; the latter can be operated independently or in conjunction with the flaps. The wings have a unique single-lever operation for the flap and air brake system instead of using two separate levers as in other types; in the Vega the lever moves fore and aft in the usual way for air brake movement but is rotated by wrist action to select the flap positions which range from −12° to +12°. The air brakes are hinged to the flaps with continuous flexible straps. The Vega prototype first flew on 3 June 1977 and, after some initial problems resulting from stiffness of the single-lever flap/air brake control, resumed test flights in November that year; the first production delivery was in April 1978, by which time 48 had already been ordered. By the beginning of 1980 34 Vegas had been delivered. The wings are of foam plastics sandwich construction with a single carbon-fibre main spar, which keeps the weight of each wing down to only about 130lb; the Wortmann wing section and carbon-fibre spar allow a constant 15% thickness/chord ratio from root to tip, giving performance benefits at the higher speeds. The wing tips are turned downwards to reduce tip stalling and are protected by inset metal rubbing strakes, and a convenient feature is that all controls are automatically coupled on rigging, leaving only the centre pin to be inserted. The wings also hold up to 195lb of water ballast in shaped plastic bags, thus avoiding any leakage which may occur when the wing itself is used as a tank. The fuselage is a conventional semi-monocoque plastics structure, and is gently 'waisted' to reduce the possibility of airflow separation over the wing/fuselage junction; the tow hook is carried on the frame that carries the monowheel, and retracts with it. The latter has a brake, and an unusual feature for a sailplane is that the Vega's tailwheel retracts as well. The pilot sits upright under a long one-piece canopy which opens forwards and upwards, and is jettisonable. The cantilever T-tail has a tailplane of symmetrical Wortmann section with a carbon-fibre spar and a separate elevator with a spring trimmer.

The T65C Sport Vega first flew on 18 December 1979, and this version differs from the Vega in having a glassfibre main spar, rotating trailing edge air brakes instead of flaps, and a fixed monowheel and tailwheel. There is no provision for water ballast.

Vickers-Slingsby Vega. Sailplane & Gliding

Volpar-Spencer Drag-N-Fly

USA

Span: 17ft 0in
Length: 15ft 11in
Height: 5ft 9in
Wing area: 113.0sq ft
Aspect ratio: 2.56
Empty weight: 225lb
Max weight: 425lb
Max speed: 75mph (in smooth air)
Required take-off speed: 40mph

This single-seat waterborne biplane glider is in the same class as the Explorer PG-1 Aqua Glider and, like the latter, is deisgned to be towed in tethered flight behind a conventional motor boat. It was designed at the instigation of Volpar Inc, better known for their various turboprop and other modified versions of types such as the Beech 18 and Grumman Goose. In February 1977 Volpar engaged Mr Percival H. Spencer, a pioneer pilot and amphibian designer whose Air Car amphibian had influenced the configuration of the Republic Seabee, to design a small but fully manoeuvrable water-based glider. This was to use modern plastics and foam materials for high strength and low cost, and to have simple controls that could be operated safely by an amateur or non-pilot. Mr Spencer himself made the first flight of the prototype Drag-N-Fly, on 20 April 1977 (nearly 63 years after his first solo flight!) and continued air and water trials have proved very satisfactory. Flight testing during 1978 resulted in the addition of a 1ft extension on each wing tip, to reduce the power requirements of the towing boat. When in flight the tether can be disconnected by the pilot in an emergency, and will disconnect automatically if the glider tends to overrun the tow boat. The fuselage is hinged so that the Drag-N-Fly can be transported on a light road trailer without exceeding a width of 8ft 0in.

The structure makes extensive use of stryrofoam and other lightweight materials; the strut-braced biplane wings are of constant chord and covered in glasscloth laminate, bonded with epoxy resin; there are spoilers on the outer panels of the upper wing. The wings themselves are built up of aerofoil-shaped styrofoam blocks, with plywood spar caps bonded to styrofoam shear webs with epoxy resin. There are wooden blocks between the capstrips at each end to provide bolt attachments for joining the panels together. The fuselage and the twin floats which attach directly to the bottom of the lower wing are built up from plywood internal frames and bulkheads and are covered in polyester resin-bonded moulded glassfibre cloth laminate. The cantilever tail unit has a styrofoam core and glassfibre laminate covering; the vertical surfaces have wooden frame edges and the one-piece horizontal tail has plywood spar caps. The latter is hinged at the aft fuselage bulkhead and is statically balanced by means of a bob-weight; trim adjustment is by means of a bungee spring. There is a single open cockpit forward of the wings, an a water rudder is provided for control during towing, as well as the more conventional rudder.

VSO 10

Czechoslovakia

Span: 49ft 2½in
Length: 22ft 11¾in
Height: 3ft 11¼in
Wing area: 129.2sq ft
Aspect ratio: 18.75
Empty weight: 516¾lb
Max weight: 837lb
Max speed: 161mph (in smooth air)
Max aero-tow speed: 99mph
Min sinking speed: 2.07ft/sec at 45mph
Best glide ratio: 36.2:1 at 58.5mph

This Czech high performance single-seater was created by the Vyvojova Skupina Orlican – VSO group, whose chief designer is Dipl-Ing Jan Janovec and which was formed by members of the former VSB (the Aircraft Faculty of Brno Military Academy) and some of the design staff of the Orlican National Works, which had built the VT-16 Orlik; VSB had produced the VSB-66-S Orlice V-tailed single-seat Standard Class design which first flew on 17 September 1970. The VSO 10 is the VSO group's first design and is of mixed construction, employing wood, glassfibre and metal. Design work began in March 1972 and construction of three prototypes, one a static test airframe, began in 1975; the first flight took place on 26 October 1976 and series production began in December 1978. The VSO-10G took first and second places at the first International

VSO 10. John W. R. Taylor

Club Class competition held in Sweden in the summer of 1979. To comply with Club Class rules the retractable monowheel was locked down and covered with a glassfibre fairing, this variant being known as the VSO-10C. The cantilever single-spar shoulder wings have slight forward sweep and are all-wood structures with a sandwich skin; the slotted ailerons are also of wood and there are metal DFS air brakes in the upper surfaces. The front and centre fuselage sections are glassfibre monocoque structures, the centre portion being reinforced by a steel tube frame on which the wings are mounted. The rear fuselage is a monocoque made of aluminium alloy sheet. The metal T-tail has a fixed-incidence tailplane and fabric-covered rudder and elevators. There is a retractable rubber-sprung monowheel with a drum brake, and a semi-recessed unsprung tailwheel. The pilot sits under a detachable canopy.

VTC Delphin 3

Yugoslavia

Data: Delfin 3
Span: 49ft 2½in
Length: 22ft 5½in
Height: 5ft 3in
Wing area: 138sq ft
Aspect ratio: 17.55
Empty weight: 492lb
Max weight: 717lb
Max speed: 155mph (in smooth air)
Min sinking speed: 2.13ft/sec at 46.5mph
Best glide ratio: 31:1 at 54mph

This Yugoslav single-seater high performance Standard Class sailplane was designed by T. Dragovic and Z. Gabrijel, two young engineers at the Faculté des Siences Mathématiques in Belgrade, and the prototype, known as the Delfin 1, made its first flight in December 1963. It made its public debut at the 1965 World Championships at South Cerney in Gloucestershire, and went into production as the Delfin 2 at the Vrsac works of VTC – Vazduhoplovno Tehnicki Centar (Aeronautical Technical Centre); The Mk 2, which first flew on 26 April 1965, differed from the prototype in having the plywood fuselage covering extended to cover the nose, a smaller sideways opening canopy, a rubber-sprung nose skid added and wooden instead of metal ailerons, and 27 of this version were built, four of which were later converted to Delfin 3s. The Delfin 2 achieved its first real competition success when it came 1st and 2nd in the Polish National Championships of 1966, no mean feat in view of the strength of opposition from the indigenous SZD designs. The Delfin 3 first flew on 29 July 1968 and has a conventional tailplane instead of an all moving one, reduced fin sweepback and increased rudder area. It is of plywood-covered wooden construction; the cantilever shoulder wings have plywood-covered leading edges and fabric-covered rear portions, and wing tip 'salmon' fairings are fitted. There are metal Schempp-Hirth air brakes above and below the wing surfaces at 60% of the chord. The fuselage is a monocoque structure with a small cross-section made possible by putting the pilot in a semi-reclining position under a one-piece curved flush-fitting cockpit canopy that opens sideways to starboard for entry and exit. The swept back fin is integral with the fuselage, and the fixed tailplane has a trim tab in the starboard elevator. Landing gear consists of a non-retractable unsprung monowheel with a mechanical brake and a rubber-sprung nose skid, plus a tail bumper.

VTC Delfin 1. Eric Wagner

VTC Trener

Yugoslavia

Span: 49ft 2½in
Length: 22ft 7¾in
Wing area: 139.6sq ft
Aspect ratio: 17.35
Max speed: 136.5mph (in smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 2.36ft/sec at 48.5mph
Best glide ratio: 31:1 at 53mph

The Trener is a modified version of the LIBIS-18 single-seater Standard Class sailplane which first flew on 20 October 1964 and was designed by the Letalski Institut Branko Ivanus, Slovenija – LIBIS. Of wooden construction with cantilever shoulder-mounted wings with tapered outer panels, the LIBIS-18 did not go into production. The VTC Trener differs from it chiefly in having the all-moving tailplane mounted slightly higher on the sweptback fin and rudder, and an improved cockpit layout, the pilot sitting under a flush-fitting one-piece cockpit canopy. The Trener is also of all-wood construction, using beech and Swedish plywood, and has Wortmann wing sections giving a thickness/chord ratio of 18% at the root. The fuselage is a wooden monocoque with a non-retractable monowheel with a brake, and a tailskid. An initial batch of 50 Treners is believed to have been ordered by the Yugoslav Aero Club, these being built by VTC at Vrsac.

LIBIS-18.

VT-16 Orlik

Czechoslovakia

Span: 52ft 6in
Length: 24ft 3in
Height: 4ft 7in
Wing area: 137.8sq ft
Aspect ratio: 20.0
Empty weight: 485lb
Max weight: 705lb
Max speed: 124mph (in smooth air)
Min sinking speed: 1.87ft/sec at 40mph
Best glide ratio: 32.6:1 at 47mph

Rather surprisingly, in view of the great commerical success of the L-13 Blanik, Czechoslovakia has produced very few other sailplane designs in the last two decades. One of these was the VT-16 Orlik high performance single-seater designed by Ing Jiri Matejcek, the prototype of which made its first flight in August 1959 with Standard Class wings of 15m span. Subsequent variants appeared with 16m and 18m span wings, and the type went into small-scale series production at the Orlican National Works at Chocen as the VT-16 Orlik with 16m (52ft 6in) span wings. Orliks equipped the Czech gliding clubs and set up several national records in 1962. Of wooden construction, the Orlik has single-spar cantilever high-set wings covered with plywood and with a Umakol high-smoothness surface. The wing's interior is filled with polystyrene foam and only a few widely-spaced ribs are featured; there are air brakes above and below the wing. The fuselage is a plywood semi-monocoque structure and the pilot sits under a detachable one-piece canopy, with oxygen and radio equipment as optional. The landing gear consists of a non-retractable monowheel and a tailskid. The wooden fin and rudder are both fabric-covered and the all-moving tailplane has a leading edge structurally similar to the wing, with fabric covering aft of the spar, and an anti-servo tab fitted.

Wassmer WA 20 Javelot

France

Span: 52ft 9in
Length: 23ft 2in
Wing area: 166.9sq ft
Aspect ratio: 16.7
Empty weight: 430lb
Max weight: 728lb

Max speed: 124mph (in smooth air)
Min sinking speed: 2.2ft/sec at 47mph
Best glide ratio: 29:1 at 50mph

The WA 20 Javelot (or Javelin), designed by Maurice Collard, made its first flight in August 1956, and was intended to meet the growing need of the French gliding clubs for a single-seater of good performance and uncomplicated construction to replace the now obsolescent German designs such as the Weihe and the Nord 2000 (the French-built DFS Meise) and early postwar French types such as the Arsenal Air 100 that were then in service. Wassmer-Aviation SA had been founded in 1905 and for some years concentrated on repair and overhauls, and the licence production of other firms' designs. In 1955 it began building the Jodel D120 Paris-Nice, later completing over 300 Jodels and launching its own range of light aircraft, of which the WA 51 Pacific was noteworthy in being of largely glassfibre construction. The Javelot marked Wassmer's entry into sailplanes and was of conventional mixed construction, the cantilever shoulder wings being of wood with a single box spar and D-type leading edge torsion boxes; there are air brakes above and below each wing, and small end-plate 'bumper'-type fairings at the wing tips. The wings are in two pieces and joined with two cylindrical pins, being rigged to the fuselage with four securing pins. The fuselage is a steel tube framework covered by fabric and is distinguished by a rather blunt nose and a flush-fitting cockpit canopy that is curved longitudinally but has flat sides and a flat curved top. There is a non-retractable monowheel with a brake aft of the rubber-sprung nose skid, and a tailskid. The tail unit is a cantilever wooden structure with a trim tab in the one-piece elevator.

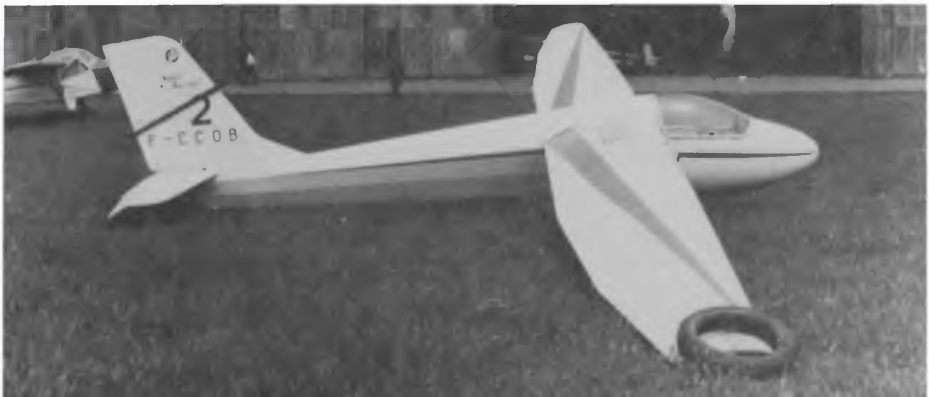
Wassmer WA 22 Super Javelot

France

Data: Super Javelot 64
Span: 49ft 2½in
Length: 23ft 2in
Height: 6ft 3in
Wing area: 155.0sq ft
Aspect ratio: 15.7
Empty weight: 452lb
Max weight: 750lb
Max speed: 124mph
Min sinking speed: 2.29ft/sec at 50mph
Best glide ratio: 30:1

The Super Javelot is a single-seat Standard Class version of the WA 20 Javelot with three-piece instead of two-piece wings of 15m span and 5° 30' dihedral on the outer panels, there being no dihedral on the centre section; the modified fuselage has the forward portion covered with three resin-bonded glass-cloth panels and the rear part fabric-covered, the nose now being longer and more streamlined and the blown plastic canopy redesigned. In addition, the fin and rudder are now swept back. The prototype Super Javelot first flew on 26 June 1961 and the type succeeded the WA 21 Javelot in production; in 1964 two Supers a month were being turned out. A number of refinements were introduced on the 1964 model, which was known as the Super Javelot 64; these included a modified leading edge for improved performance at low speeds, modified wing roots to improve airflow at the wing/fuselage junction, increased dihedral of 5° 30' on the outer wing panels and the use of birch plywood to cover the entire wings to give better laminar flow. The cantilever wooden shoulder wings have single spars and the wooden ailerons are each in two parts operated differentially; there are perforated wooden air brakes above and below each wing, and small end-plate 'bumper'-type fairings at the wing tips. The welded steel tube fuselage framework is now in two portions, the forward section having four longerons and the rear part only three, both sections being differently covered to those of the Javelot. The cantilever tail unit is of wood, with a trim tab in the one-piece elevator. Landing gear consists of a rubber-sprung nose skid with a non-retractable monowheel mounted aft of it; this has a brake linked to the wing air brake control, and there is also a rubber-sprung tailskid. The pilot sits in a canvas seat and there is provision for radio and oxygen. The Wassmer WA 23, of which the prototype first flew on 6 August 1962, was an experimental 'one-off' sailplane used to test a new 18m (59ft 0in) span wing with an aerofoil section developed by M Maurice Collard; this had an aspect ratio of 22 and was married to the fuselage of a WA 22 Super Javelot.

Wassmer WA-22 Super-Javelot. Eric Wagner



Wassmer WA 28 Espadon

France

Data: WA 28 Espadon
Span: 49ft 2½in
Length: 25ft 1¼in
Height: 5ft 5½in
Wing area: 135.6sq ft
Aspect ratio: 17.82
Empty weight: 540lb
Max weight: 833lb
Max speed: 151mph (in smooth air)
Best glide ratio: 38:1 at 56mph

The WA 28 Espadon (or Swordfish) high performance single-seater is the all-glassfibre version of the earlier WA 26 Squale (or Shark), differing from it in having cantilever shoulder wings of the same span, area, aspect ratio and plan form but of glassfibre/plastic foam sandwich construction instead of the WA 26 Squale's conventional wooden construction with trailing edge air brakes inboard of the ailerons; the Espadon has perforated Schempp-Hirth air brakes above and below the wings. The WA 26 Squale first flew in prototype form on 21 July 1967; series production started in 1968 and by January 1970 a total of 85 Squales had been ordered. A version without the spring-loaded anti-tab in the all-moving one-piece tailplane was designated WA 26CM. Design work on the Espadon began in 1972 and the prototype WA 28 made its first flight in May 1974, followed by the first production Espadon in November that year; 20 were on order by the spring of 1975. Both types have an oval section fuselage made of reinforced polyester plastics, with the pilot in an adjustable semi-reclining seat, with adjustable headrest and rudder pedals, under a long flush-fitting one-piece Plexiglas cockpit canopy that opens sideways to port. Comprehensive instrumentation is provided. Both types have a retractable monowheel mounted forward of the cg with a hydraulic brake; a fixed tailwheel is optional in place of the bumper fairing. The tail unit is a conventional wooden structure with fabric covering, with an all-moving one-piece tailplane with (on the Espadon) spring-loaded trimming.

Wassmer WA 30 Bijave

France

Span: 55ft 3½in
Length: 31ft 2in
Height: 9ft 0in
Wing area: 206.7sq ft
Aspect ratio: 15.0
Empty weight: 650lb
Max weight: 1,213lb
Max speed: 149mph (in smooth air)
Max aero-tow speed: 93mph
Min sinking speed: 2.30ft/sec at 47mph
Best glide ratio: 30:1 at 47mph

This tandem two-seat advanced training glider was the standard aircraft in this category for the French gliding clubs during the 1960s, and was developed from the WA 21 Javelot. Designed by M Maurice Collard, the first prototype Bijave made its maiden flight on 17 December 1958 and the second prototype, incorporating some improvements, first flew on 18 March 1960. The type soon went into production and over 300 were eventually built. The Bijave is of conventional mixed construction very similar structurally to the Javelot; the cantilever wooden shoulder wings are in three pieces, with 4° 30′ dihedral on the outer wings and none on the centre section. They have single box spars and D-type leading edge torsion boxes, with birch plywood covering forward of the spar and fabric covering aft of it; the plain spruce ailerons are also fabric-covered. There are no flaps, but perforated

Wassmer WA 30 Bijave. John W. R. Taylor

Schempp-Hirth wooden air brakes retract into slots above and below each wing; wing tip 'salmon' fairings are also fitted. The fuselage is a welded steel tube framework covered with fabric, and with a glassfirbe nose cone. The two pilots sit in tandem under individual blown Plexiglas canopies, the rear seat being raised a bit to give its occupant a good view forward; a full range of instrumentation, a compass, oxygen and radio can be carried. There is a retractable monowheel with rubber ring shock absorption and a SATMO motor-cycle brake mounted aft of a rubber-sprung wooden nose skid, and there is also a steel tailskid. The cantilever wooden tail unit has a fabric-covered rudder, and the all-moving one-piece tailplane has large anti-balance tabs.

Zauner OZ-5

USA

Span: 49ft 2½in
Length: 22ft 0in
Height: 4ft 0in
Max pilot weight: 234lb
Max weight: 669.5mph
Max speed: Approx 180mph (in smooth air)
Max aero-tow speed: 120mph

This single-seater sailplane was designed and built to Standard Class specifications by Otto Zauner of Vineland, New Jersey, who had previously built from kits and/or plans a Schweizer SGS 1-26, a Briegleb BG 12, a Bryan HP-14 and a Thorpe T-18 ultra-light. The OZ-5's fuselage and tail unit are of Mr Zauner's own design but the wings of a Bryan HP-15 are fitted in the shoulder position. The forward fuselage and cockpit tapers to a slim boom carrying the tail, the former being of glassfibre construction to about one-third back along the tail boom; the rest of the boom and the cantilever T-tail are all-metal, the fin and rudder being swept back. There is a retractable monowheel and the pilot sits under a one-piece flush-fitting cockpit canopy. The wings are the same structurally as the HP-15 and of high aspect ratio; they are two-spar all-metal structures with metal skinning and plastic leading edges, and only three ribs in each wing, the spaces between the ribs being filled with plastic foam. Metal fixed hinge flaps are fitted, the ailerons drooping in conjunction with them. Flight testing of the OZ-5 began in 1975.

Zauner OZ-5. Howard Levy

Part two Motor Gliders

Akaflieg Darmsstadt D-39

FGR

Span: 49ft 2½in
Length: 23ft 5½in
Height: 3ft 4¼in over fuselage
Wing area: 118.4sq ft
Aspect ratio: 20.5
Empty weight: 639lb
Max weight: 882lb
Max speed: 155mph (power off)
Max aero-tow speed: 103mph
Min sinking speed: 2.30ft/sec at 52mph
Best glide ratio: 36:1 at 65mph
Max rate of climb: 885ft/min at sea level
Range with max fuel: 310 miles

This single-seat motor glider utilises the basic airframe of the D-38 high performance sailplane designed by the Akademische Fliegergruppe of Darmstadt University, which went into production in slightly modified form as the Glaser-Dirks DG-100.

The D-39 differs from the D-38 chiefly in having a low-mounted wing with 4° dihedral from the roots, and two 47hp modified Fichtel & Sachs KM-914V engines in the nose coupled to drive a two-blade wood and glassfibre propeller which, when stopped for soaring flight, is folded back against the sides of the nose to eliminate drag. The prototype D-39 made its first flight on 28 June 1979, powered temporarily by a 68hp Limbach SL 1700 'flat four' engine. Of similar glassfibre/balsa sandwich construction to the D-38, the D-39 has glassfibre/Klégécel foam sandwich ailerons and Schempp-Hirth air brakes in the upper wing surfaces; no flaps are fitted. The T-tail has an all-moving one-piece swept tailplane, with half-span Flettner tab, and there is a manually-retractable sprung monowheel with a drum brake, plus a small tailwheel. The pilot sits on a semi-reclining seat under a flush-fitting canopy, the rear section of which is detachable for entry and exit.

Akaflieg Karlsruhr AK 2

FGR

Span: 65ft 7½in
Length: 24ft 11¼in
Height: 5ft 5¾in
Wing area: 156.1sq ft
Aspect ratio: 27.6
Max weight: 1,278lb
Best glide ratio: 47:1 at 62mph

Designed by the Akademische Fliegergruppe of Karlsruhe University, this single-seater motor glider is based upon the earlier and similar AK 1, which differed from the AK 2 in having a four-cylinder horizontally-opposed engine driving a two-blade pusher propeller and retractable into the fuselage behind the cockpit when not in use. The AK 1 also had a slightly shorter nose and a low-set tailplane instead of the T-tail of the AK 2. The AK 2 is powered by a 55hp Hirth O-28 two-cylinder two-stroke engine buried in the fuselage behind the cockpit and driving a two-blade tractor propeller mounted on an extension shaft; this pivots downward to retract into the fuselage over the engine when not in use. The prototype AK 2 was under construction during 1979, but due to some difficulties with the engine and propeller transmission had not yet made its first flight at the time of writing. Of glassfibre reinforced plastics construction, the AK 2 has cantilever mid-set wings with air brakes in the upper surfaces as well as trailing edge flaps. There is a retractable monowheel mounted forward of the engine, and the tailwheel is semi-recessed. The pilot sits in a semi-reclining position under a flush-fitting canopy.

Akaflieg Karlsruhe AK2.

Alanne Motorlerche

Finland

Span: 42ft 7¾in
Length: 22ft 6in
Height: 5ft 2¼in
Wing area: 175.9sq ft
Aspect ratio: 10.3
Empty weight: 635lb
Max take-off weight: 882lb
Max speed: 93mph (in smooth air)
Min sinking speed: 3.28ft/sec at 40.5mph
Best glide ratio: 17:1 at 48.5mph

The Scheibe Rhonlerche II (or Rhön Lark) was a single-seat primary training glider that was produced in some numbers for the German clubs. It had the traditional Scheibe wood and fabric construction with fabric-covered welded steel tube fuselage, with a span of 42ft 7¾in. Recently two powered conversions of the Rhonlerche have been made, one by Mr Penti Alanne of Finland and known as the Alanne Motorlerche, and the other by Herr Knechtel of Rodheim, West Germany, and known as the Knechtel Rhonlerche IIM. The latter, registered D-KABQ, has a 43hp Volkswagen 1500 car engine mounted above the wings and driving two small two-blade propellers mounted on outriggers extending over the wings. This gives it a maximum level speed of 99mph, a service ceiling of 14,765ft and a range of 155 miles, although it is heavier than the Motorlerche, with a maximum take-off weight of 1,179lb. Mr Alanne's conversion has a 50hp modified Volkswagen 1,500cc engine mounted in the nose and driving a two-bladed propeller; the forward part of the fuselage has been removed and attachments for the engine welded on. To give adequate airscrew ground clearance mainwheel and tailwheel unit similar to those of a Piper Cub are fitted. The prototype Motorlerche first flew in powered form on 10 August 1973, and by the spring of 1980 six more similar conversions were flying and five more under construction. Complete conversion to a Motorlerche can be done in about 200 hours.

Alpavia Avion-Planeur RF3

France

Span: 36ft 9in
Length: 19ft 8in
Wing area: 118.0sq ft
Aspect ratio: 11.0
Empty weight: 529lb
Max weight: 772lb
Max level speed: 118mph
Max cruising speed: 112mph
Min sinking speed: 3.94t/sec
Take-off run to 50ft: 875ft
Range with max fuel: 310 miles

This single-seater low wing motor glider was the first of a series of such types designed by M René Fournier to go into production, and to be built by several different companies in France and Germany. The RF3 was developed from the prototype Avion-Planeur, known as the Fournier RF01, which first flew on 6 July 1960. It proved to be so successful that the French Government helped to finance the building of two RF2 pre-production prototypes, the first of which flew in June 1962, and later ordered six of the production version, the RF3, for national flying clubs; the first RF3 made its maiden flight in March 1963 and received its C of A on 7 June that year. René Fournier entered into partnership with Comte Antoine d'Assche of Alpavia SA, which had been building Jodel D 117s, and this firm took on the production of the RF3, building a total of 95 in all; deliveries started in November 1963. Although the engine can be stopped and restarted in flight and the RF3 is capable of prolonged soaring flights – many such flights of up to five hours have been made – the type should not be regarded as just a powered sailplane, as it has a high performance and is capable of all simple aerobatic manoeuvres such as stall turns, loops, half-rolls, slow rolls and spins. This performance was soon being proved in service, one

Alpavia Avion-Planeur RF-3. Author

notable flight in the winter of 1963-64 being made by an RF3 pilot over St Auban in the Basses-Alpes region, who climbed to 19,700ft after stopping his engine at 6,500ft. Another RF3 was successfully operated in the French Alps with a mono-ski landing gear replacing the retractable monowheel. The engine is a 39hp modified version of the Volkswagen 1,200cc 'flat four' car engine, converted by the Rectimo Co of Chambery. The only modifications are the fitting of a special Zenith carburettor, a propeller shaft and a Bendix magneto of the type used on the 65hp Continental engine. For restarting in flight, an optional mechanical system pushes the four exhaust valves in simultaneously, enabling the propeller to start the engine during a dive at 90mph; a two-blade wooden prop made by Evra or Hélice Légère is fitted, and there is a single 6.5 Imp gallon fuel tank in the fuselage.

Of all-wood construction, the RF3 has a single-spar one-piece wing with 4° dihedral and plywood and fabric covering, attached to the fuselage by four bolts. The ailerons are fabric-covered and there are no flaps, but instead a three-section air brake in the upper surface of each wing inboard of the ailerons. The wooden fuselage is plywood-covered, the pilot sitting under a moulded one-piece canopy; radio and oxygen equipment are among the optional 'extras'. The monowheel has rubber chord shock absorption and retracts forward manually into a glassfibre cowling; it has a manually-operated brake and is supplemented by a hoop-shaped balancer skid of 6mm steel wire under each wing. There is also a steerable tailwheel. The cantilever wooden tail unit has a trim tab in the rudder.

Alpla AVo 68V Samburo

Austria

Data: AVo 68V
Span: 54ft 8¾in
Length: 26ft 0½in
Height: 5ft 9¾in
Wing area: 222.8sq ft
Aspect ratio: 13.6
Empty weight: 1,036lb
Max weight: 1,510lb
Max speed: 106mph
Max cruising speed: 90mph
Min sinking speed: 2.79ft/sec at 46mph
Best glide ratio: 24:1 at 50mph
Take-off run: 492-500ft

This Austrian side-by-side two-seater motor glider was designed by Werner Vogel with the assistance of Professor Dr Ernst Zeibig, and is intended for training as well as cross-country an pleasure flying. It first appeared as the AVo 60 Samburo with a 60hp Limbach SL 1700EA 'flat four' engine driving a two-blade fixed-pitch propeller and with a slightly smaller fuel tank. The current production AVo 68V first flew in 1977 and has a 68hp Limbach SL 1700E4 engine driving a two-blade variable-pitch propeller, and has higher weights than the AVo 60. A total of 16 Samburos had been built by the Alpla-Werke Alwin Lechner OHG by the end of 1977, but production ended in January 1979. The cantilever low wings are of conventional wood and fabric construction with spoilers in the upper surfaces, and can be folded back to an overall width of 32ft 9½in (10m) for hangar storage. The fuselage is a fabric-covered steel tube framework and the rear section of the two-piece cockpit canopy slides backwards for the pilots' access; the latter have dual controls. The cantilever tail unit has a low-set tailplane with a trim tab in the starboard elevator. The undercarriage consists of a non-retractable monowheel recessed into a fairing under the fuselage, and small outrigger wheels on nylon legs under the wings at about 40% of each half-span; there is also a steerable tailwheel, and the main wheel brake can also be used as a parking brake.

AmEAGLE American Eaglet

USA

Span: 36ft 0in
Length: 16ft 0in
Height: 3ft 0in
Wing area: 72.0sq ft
Aspect ratio: 18.0
Empty weight: 160lb
Max weight: 360lb
Max speed: 115mph (in smooth air, power off)
Min sinking speed: 2.50ft/sec at 40mph
Best glide ratio: 27:1 at 52mph
Max rate of climb at sea level: 450ft/min
Take-off run: 1,000ft

Design of this single-seater homebuilt self-launching powered sailplane was begun in September 1974 by Mr Larry Haig, of Muskegon, Michigan, who formed the AmEAGLE Corporation to market it. Construction of the prototype, registered N101EA, started in June 1975 and this made its first flight on 19 November that year; a second prototype was later flown. A total of 400 kits had been ordered by early 1980, of which 20 had been completed. The type is a high wing monoplane with a pod-and-boom type fuselage with the engine mounted aft of the cockpit and driving a pusher propeller; the cantilever inverted-Vee tailplane and elevators are carried on a tail boom that is a thin-walled aluminium tube with a moulded glassfibre tailcone. Construction is largely of glassfibre and urethane foam cores, with some components of aluminium. The wings are stressed-skin structures with spruce load-bearing spars and a single aluminium tube bracing strut on each side; the spars are surrounded by a urethane foam core, the leading edges and wing tips being of moulded glassfibre, and the urethane core portions are covered with epoxy-bonded pre-cure glassfibre skin. There are no ailerons or flaps, but the functions of these two (ie roll and glide path control) are

AmEAGLE American Eaglet. Howard Levy

combined in two spoiler-like surfaces called 'spoilerons' at 30% chord on each upper surface towards the wing tip. The forward portion of the fuselage consists of two pre-formed glassfibre half-shells pop-riveted to tubular aluminium longerons, the main load-bearing member in the fuselage being the bulkhead which carries the pilot's seat on one side and the engine mounting on the other. This also carries the tail boom at the top rear, the monowheel at the bottom and the wing spar carry-through at the top, and this bulkhead is an aluminium-skinned urethane foam composite structure. There is a combined pitot tube/lifting handle in the fuselage nose. The inverted-Vee tailplane is very similar to the wings structurally, with an epoxy/glassfibre skin over urethane foam cores, and this V-tail greatly improves control in pitch and yaw, as the prop wash 'blows' directly over the tail surfaces; the V-tail also makes spins impossible. The manually-retractable monowheel has an external friction-pad brake, and is supplemented by a tailwheel under the tip of each tailplane.

The American Eaglet can be completed and flown as a pure sailplane, without the engine; the powerplant fitted is a McCulloch 101B single-cylinder two-stroke engine developing 12.2hp at 8,000rpm, and drives a two-blade fixed-pitch pusher propeller with nylon plastic blades that fold backwards through 90° when the engine is stopped. The engine is intended only for take-off and self-recovery, and is not designed for continuous cross-country operation; it can be restarted in flight. A fuel tank of 2 litres (0.5 US gallons) capacity is provided. The McCulloch 101B engine is now available in only limited quantities, and the West Bend 820 engine will be fitted when availability of the 101B becomes a problem.

Blessing Rebell

FGR

Data: With Hirth M28 engine
Span: 49ft 2½in
Length: 24ft 7¼in
Wing area: 182.0sq ft
Aspect ratio: 13.2
Empty weight: 926lb
Max weight: 1,366lb
Max speed: 124mph
Economical cruising speed: 93mph
Best glide ratio: 24:1

Designed and built by Herr Gerhard Blessing of Hamburg, this single-seat homebuilt motor glider has provision for carrying a second occupant, and the wings can, at the choice of the builder, be made in two, three or four parts. To assist the amateur constructor further, no component of the aircraft is more than 3.5m (11ft 5¾in) long, and the fuel tank

Blessing Rebell.

and several other components are standard car items obtainable from the motor industry. The prototype Rebell, registered D-KEBO, first flew on 3 June 1973 powered by a 54hp Hirth M28 two-cylinder engine driving a Hoffman two-blade pusher propeller that could be feathered for soaring flight. In 1975 a modified Volkswagen engine was fitted which had a slightly larger air intake. The Rebell is a mid-wing monoplane of basically steel tube construction with wood covering; the wings can be folded for storage and the vertical tail surfaces are swept back, with a dorsal fin. Landing gear consists of a non-retractable semi-recessed monowheel supplemented by a balancer wheel under each wing about half way along the semi-span, plus a tailwheel. The fuselage has been redesigned to take a 62hp Limbach SL 1700 engine in the nose, and the Rebell was expected to fly again in this form early in 1980.

Brditschka HB-3

Austria

Data: HB-3B
Span: 39ft 4½in
Length: 22ft 11¾
Height: 9ft 8in
Wing area: 153.1sq ft
Aspect ratio: 10.11
Empty weight: 573lb
Max weight: 837lb
Max speed: 108mph (in smooth air, power off)
Max cruising speed: 99mph
Min sinking speed: 3.77ft/sec at 45.5mph
Best glide ratio: 20:1 at 50mph
Take-off run to 50ft: 755ft
Range with max fuel: 341 miles

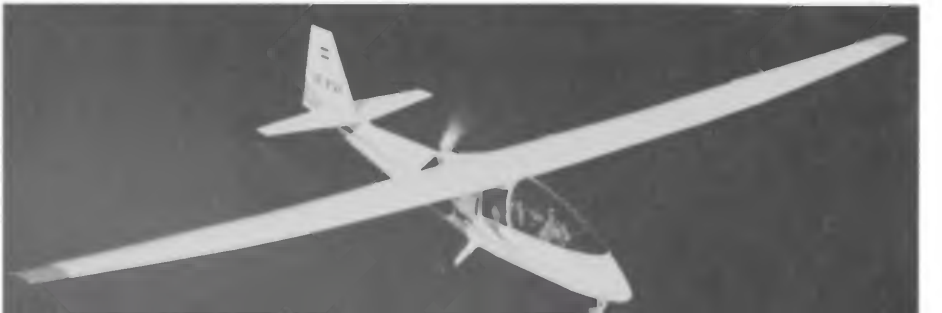
Designed by Heinz W. Brditschka and built by his firm at Linz in Austria, the HB-3B is a single-seater cantilever high wing monoplane distinguished by a pusher propeller rotating in a triangular cut-out in the glassfibre-covered tubular steel framework carrying the tail. This consists of two steel tubes, the upper one running through the centre of the propeller and the lower one from the bottom of the fuselage just under the propeller disc; the forward fuselage containing the engine and cockpit is likewise a steel tube framework covered with glassfibre. The HB-3 uses the basic wing design of the Krähe sailplane designed in Germany by Ing Fritz Raab; the wing is a conventional all-wood structure of red pine, spruce and birch ply, with spoilers in the upper surfaces; no flaps or trim tabs are fitted. Design of the HB-3 started in 1968 and the first of three prototypes made its maiden flight on 23 June 1971, followed by the second on 5 June 1972 and the third on 28 July 1972. Nine production HB-3s had been completed by early 1976, but production ended that year. Brditschka also converted an HB-3 airframe in 1973 to have electric power, in which form it was known as the Militky MB-E1; Fred Militky, who designed the installation of the 13hp Bosch electric motor that replaced the piston engine, was an engineer with the Graupner model-building company, and used his experience with electrically-powered radio-controlled models to produce this first electric motor glider. This made what is claimed to be the first ever manned electric-powered flight on 21 October 1973. The HB-3's standard powerplant was a 41hp Rotax 642 two-stroke 'flat twin' mounted aft of the cockpit and driving a Hoffman two-bladed fixed-pitch propeller via a belt; the fuel used is a 75/25% petrol and oil mixture, and there is a single fuel tank in the fuselage and an aluminium tank in the wing centre-section, which together provide a total capacity of 8.15 Imp gallons. The tail unit is of all-wood construction, with wire bracing from the fin to the centre section trailing edges; the fixed-incidence tailplane has a trim tab in the starboard elevator. The fixed nosewheel undercarriage has glassfibre legs which provide all the necessary shock absorption without the need for separate shock absorbers. The main wheels have Tost mechanical brakes. The pilot sits under a large cockpit canopy that hinges to open sideways to starboard; there is a small baggage space behind his seat and a ram air intake in the nose is provided for cabin ventilation.

Brditschka HB-21

Austria

Data: HB-21L
Span: 53ft 3½in
Length: 25ft 11in
Height: 8ft 6¼in
Wing area: 204.3sq ft
Aspect ratio: 13.89
Empty weight: 1,102lb
Max weight: 1,565lb
Max speed: 124mph (in smooth air, power off)
Max cruising speed: 99mph
Min sinking speed: 3.94ft/sec at 52mph

Brditschka HB-21.



Best glide ratio: 24-26:1 at 65mph
Max rate of climb: 650ft/min at sea level
Take-off run: 330ft
Range with max fuel: 497 miles

The HB-21, which first flew in 1973, is basically an enlarged version of the HB-3 with an increased wing span and a lengthened forward fuselage seating two people in tandem under a long three-piece cockpit canopy hinged to open sideways. The HB-3's basic configuration of high wings and a pusher propeller rotating in a cut-out portion of the fuselage is retained. Construction is very similar to the HB-3, the fabric-covered three-piece wooden wings being of birch ply with laminated beech spars; they now have Wortmann aerofoil sections and there are spoilers in the upper surfaces. The fuselage is a steel tube framework covered with glassfibre, and the wooden tail unit has a fixed-incidence tailplane and fabric-covered control surfaces. The fixed nosewheel undercarriage has Tost mechanical brakes on the main wheels. Four prototypes were built which included both the HB-21R with a 41hp Rotax 642 two-stroke engine like the HB-3, and the HB-21L with a 65hp Volkswagen(VW)-Westermayer 1600G 'flat four' motor, the latter being the principal version; both powerplants drove a Hoffman HO 14-175 B 117 LD two-blade fixed-pitch propeller, and both versions have an 11.9 Imp gallon aluminium fuel tank in the wing. Certification of the HB-21 was granted in February 1978, and a year later 15 had been built.

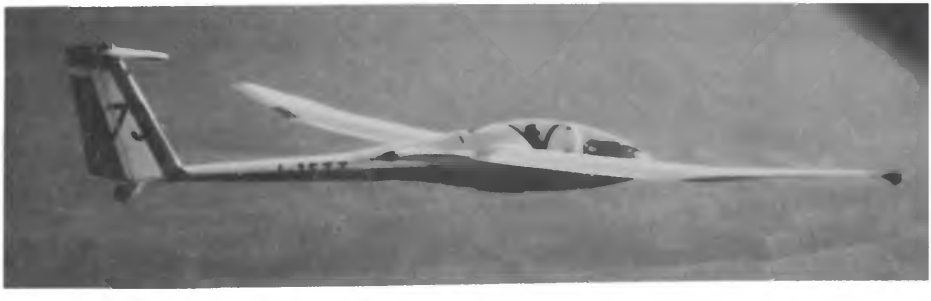
Caproni Vizzola Calif A-21SJ

Italy

Data: A-21SJ
Span: 66ft 10¼in
Length: 25ft 4½in
Height: 5ft 3½in
Wing area: 174.3sq ft
Aspect ratio: 25.65
Empty weight: 1,164lb
Max weight: 1,781lb
Max level speed: 143mph (power on)
Max rate of climb: 787ft/min (sea level, power on)
Take-off run: 985ft (power on)

The first powered version of the Caproni Vizzola Calif A-21 two-seater was fitted with a 202lb st Microturbo TRS 18 single-shaft turbojet of French design installed at the rear of the cockpit, and this version, known as the A-21J, first flew at the end of January 1972. In 1976 the sole prototype of the A-21J was acquired by the Lockheed-Georgia Co for use in a joint research programme with Mississippi State University. The J was succeeded by the A-S1SJ, which first flew in May 1977 and is based on the current production A-21S sailplane; this is powered by a 198lb st Microturbo TRS 18-046 turbojet aft of the cockpit, with a dorsal intake that can be closed in flight when soaring. Up to 242.5lb of fuel is carried in fuselage and wing tanks, and there is a starter/generator and batteries for in-flight and ground starting; this same engine also powers the Bede BD-5J jet lightplane. Apart from the engine the A-21SJ is very similar to the A-21S, but has larger mainwheels and tailwheel. Two A-21SJs had been completed by May 1979 and five more were being built. One A-21SJ was being tested with a more powerful Microturbo TRS 18 jet of 242.5lb st.

Caproni Vizzola Calif A-21SJ.



Chotia Weedhopper

USA

Cruising speed: 30mph
Stalling speed: About 20mph
Take-off run: 200ft from a hard surface

Designed by John Chotia and marketed in kit form by his company, Ultra Systems of PO Box 2253, Ogden, Utah, the Weedhopper is a powered hang glider envisaged as a low cost fun aeroplane that does away with the conventional hang glider's need for a hill and wind, and the bruises, hard landings and other exertions that usually accompany this form of flying. The Weedhopper is Chotia's 23rd design, following 18 hang gliders of both rigid and flex-wing types, and five powered gliders of which several are foot-launched. It was designed from the start to take engine and landing gear loads, and has conventional rudder and elevator controls (but no ailerons) and proper seating for the pilot, who sits

suspended under the wing just about on the cg position; this means that the design is not nearly so sensitive to pilot weight changes as other ultra-lights. The triangle undercarriage is mounted on the small platform-like structure on which the pilot sits, and has a steerable nosewheel. A rigid as distinct from flexible wing was chosen so as to retain control and stability in all attitudes, and the wings are of the 'roll up' kind, which can be dismantled easily for transport. The Weedhopper's structure is basically of aluminium tubing partially covered with dacron sailcloth, which simply bolts together for assembly, and is strong enough to lift a man weighing 200lb at an airfield elevation of 5,000ft. The engine is a 292cc Yamaha which produces 19hp at 5,000 rpm and is mounted just ahead of the wing leading edge on a tubular framework. An optional double-surfaced wing is available together with streamlined struts for pilots of over 190lb weight who wish to fly at airfield elevations of 4,000ft or more, especailly on warm days. The Weedhopper can be stalled safely and does about 30 miles to a gallon of fuel. It is one of a growing number of powered hang gliders and what are termed 'minimum aeroplanes' – ultra-lights of low power and a very simple and basic type of airframe which, unlike motor gliders, are not intended for soaring flight with the engine stopped.

Corcoran 65-1

USA

Data: First Prototype
Span: 26ft 0in
Length: 18ft 6in
Height: 5ft 0in
Wing area: 100sq ft
Aspect ratio: 13.0
Empty weight: 364lb
Max weight: 550lb
Max speed: 100mph (power on)
Cruising speed: 67mph
Take-off run: 500ft
Range: 140 miles

One of the very few biplane motor gliders, the 65-1 was designed and built by R. S Corcoran, an experienced sailplane pilot who was also the president of a company bearing his name which manufactured centrifugal pumps and other products. The 65-1 single-seater first flew in prototype form in October 1965, the powerplants being two 8hp West Bend 820 single-cylinder go-kart engines mounted on small booms extending from aft of the cockpit, and driving two-blade fixed-pitch pusher propellers. Construction is all-metal, the single-spar wings having aluminium skinning and unbalanced piano-hinged ailerons; the upper wing has flaps along 60% of its span which can be lowered to four positions, the maximum deflection being 35°. There is a single interplane strut and bracing strut on each side. The slab-sided fuselage is built up from aluminium extrusions and is also covered with aluminium; the landing gear consists of a monowheel mounted in an under-fuselage fairing, a steerable tailwheel and two small outrigger balancing wheels under the lower wings below the interplane struts – these are actually Sears ball-bearing lawnmower wheels. The pilot sits under a single-framed cockpit canopy that hinges to port for entry and exit. The prototype 65-1 had a wing area of 100sq ft and was followed by a second prototype with a wing area increased to 180sq ft and two engines mounted inboard in the fuselage and driving belt-driven propellers mounted on outriggers.

Corcoran 65-1. Howard Levy

Eiri PIK-20E

Finland

Data: PIK-20E
Span: 49ft 2½in
Length: 21ft 5in
Height: 4ft 8¾in
Wing area: 107.6sq ft
Aspect ratio: 22.5
Empty weight: 617lb
Max weight: 1,036lb
Max speed: 177mph (power off)
Max cruising speed: 84mph (power on)
Min sinking speed: 2.3ft/sec at 55mph (power off)
Best glide ratio: 41:1 at 73mph (power off)
Take-off run: 1,640ft to a height of 50ft (power on)

The PIK-20E is the powered version of the Eiri PIK-20D Unrestricted Class single-seater, and was developed by Jukka Tervamaki, the chief designer of Finland's Eiriavion O/Y, to meet the OSTIV airworthiness regulations for powered sailplanes. The powerplant is a 43hp Rotex 503 two-cylinder two-stroke engine driving a Hoffmann two-blade wooden propeller, and both engine and propeller can be retracted manually into the fuselage aft of the cockpit when not in use; retraction is affected mechanically by means of a hand wheel. The prototype PIK-20E was powered by a 30hp Kohler 440cc engine and first flew on 2 October 1976, making a four hour flight of which two hours were spent soaring with the engine retracted. The production prototype made its first (aero-tow) flight on 16 March 1978, and its first powered flight two days later, and series production began shortly after. There is an electric starter for the engine, and the fuel tank behind the pilot's seat holds 7.3 Imp gallons. Apart from the engine, the PIK-20E is very similar, structurally and otherwise, to the PIK-20D, with a longer nose, 25% more tailplane area, small fixed wheels at the wing tips and a rubber-sprung tailwheel now mounted on a steel sprung skid moved behind the fin spar to the base of the rudder so as to make it steerable; the water ballast capacity (an optional feature) is smaller than the D's.

Production rights for the PIK-20E were sold in 1981 to the French firm Siren SA, whose E 75 Silène and D 77 Iris sailplanes are manufactured by Société Issoire-Aviation at Issoire-le-Broc, where the PIK-20E will presumably be built. Altogether 102 PIK-20Es had been built in Finland when production ceased there in the spring of 1981.

Eiri PIK-20E.

Farner HF Colibri 1 SL

Switzerland

Span: 57ft 5in
Length: 23ft 7½in
Height: 4ft 9in
Wing area: 103.9sq ft
Aspect ratio: 31.7
Empty weight: 562lb
Max weight: 798lb
Min sinking speed: 1.80ft/sec at 48mph
Best glide ratio: 41-43:1 at 63mph
Take-off run: 394ft

Designed, built and test-flown by Dipl-Ing Hans U. Farner, who was also responsible for the Aviafiber Canard-2 FL ultra-light foot-launched sailplane, the Colibri single-seat motor glider is one of the most bizarre-looking aircraft in this class ever to be built.

Its most distinguishing feature is a canard foreplane of constant chord and constant section mounted on a telescopic 'elephant's trunk' extension of the long tapering nose to vary the moment arm; this extension can be pivoted about the fuselage's longitudinal axis, permitting the overall length to be varied in flight. Adjustment of the telescopic nose permits the foreplane incidence to be varied, yaw control being achieved by pivoting the canard surface about the fuselage longitudinal axis, and pitch control by varying the canard's moment arm by means of the 'elephant's trunk' extension. The very short, narrow main part of the fuselage has the pilot sitting just in front of the wing, the rear fuselage ending in a split-wedge section which acts as the vertical fin when closed and as an air brake when opened. The retractable tricycle landing gear is of narrow track limited by the fuselage width, and rather short wheelbase. The main gull wing is of very high aspect ratio (31.7) mounted on top of the fuselage at the rear, and unbraced. It has dihedral on the constant chord and constant section (Wortmann FX-61-184) inner panels, and anhedral on the all-moving outer panels which have leading edge taper and a Wortmann FX-60-1261 aerofoil section, the same as that of the canard foreplane. No flaps or ailerons are fitted, roll control being achieved by operating the all-moving wing tips (or 'tiperons') with dynamically irreversible drive. Engines are two 13.6hp McCulloch MC-101A single-cylinder two-stroke engines of 123cc mounted aft of the cabin and driving, through a reduction gear, a two-blade pusher propeller aft of the wing trailing edge. The propeller blades can be folded to the rear when not in use, for soaring flight. Fuel capacity is 4.6 Imp gallons. A two-seater version of this unusual Swiss motor glider is also under development.

Fauvel AV 45

France

Data: AV 45 second prototype
Span: 45ft 1in
Length: 11ft 9in
Height: 6ft 0in
Wing area: 171.7sq ft
Aspect ratio: 11.84
Empty weight: 476lb
Max weight: 772lb
Economical cruising speed: 80mph
Min sinking speed: 2.62ft/sec at 43.5mph
Best glide ratio: 27:1 at 53mph
Rate of climb at sea level: 550ft/min
Take-off run: 492ft

This single-seat tailless self-launching motor glider was developed from the AV 36 and AV 361 sailplanes, and first flew in prototype form on 4 May 1960, powered by a 35hp Nelson four-cylinder two-cycle engine in a pusher installation driving a two-blade propeller. Later a 45hp Nelson engine was fitted, and in the summer of 1967 the prototype was re-engined with a 150lb st Microturbo Eclair 012-01 turbojet based on the turbo-starter used for the Olympus engines of the Concorde SST prototypes; this was mounted in the same position as the Nelson engine, with the long jet pipe exhausting over the wing trailing edge. In this form the prototype was redesignated AV 45-01R and the Eclair gave it an outstanding performance despite the heavier powerplant and the necessary fire protection; maximum level speed was now over 140mph at 2,625ft and the maximum rate of climb 990ft/min, the time to 10,000ft being 15min. The Eclair's battery permitted repeated restarts in flight as well as ground starting, and this turbojet was also seen as a possible powerplant for two other Fauvel tailless powered glider projects, the tandem two-seater AV 46 and the single-seater AV 48, which were originally designed to have the 40hp Fauvel Pygmée 'flat four' four-stroke, as was the production AV 45. The prototype has now been fitted with a 30hp Rockwell-JLO engine by another amateur builder. Meanwhile, a second slightly modified prototype had flown which had been built by Société Aéronautique Normande and had a 22hp Hirth Solo 'flat four' two-stroke engine. This prototype was representative of production AV 45s, which are intended for amateur construction, and it incorporated several changes, including the introduction

Fauvel AV45. John W. R. Taylor

of additional windows under the cockpit canopy, moving the pilot's seat 2.4in further forward, lengthening the fuselage by 3.5in, and fitting larger vertical tail surfaces carrying at the bottom small steerable skids which replace the underwing curved wire 'bumpers' of the first prototype. Hoerner wing tips were also successfully tried on the AV 45, and the original two-blade fixed-pitch airscrew was later replaced by an automatically feathering prop.

The standard engine recommended for production aircraft is now the 40-55hp modified Hirth O-280R 'flat four', there being integral wooden fuel tanks in the wing leading edges. A French homebuilt AV 45 is flying with a Nelson engine, and a Japanese homebuilt one with Hirth Solo engine is flying in South Africa; in early 1978 11 more AV 45s were being built by amateur constructors, four in France, three in the USA, and one each in Finland, Germany, Martinique and Spain, the German one having a Solo engine. Like the AV 361, the AV 45 can now be fitted with a wing of Wortmann laminar flow section, which gives an improved best glide ratio of 30:1. The AV 451 is an improved version of the AV 45, also with a laminar flow wing of Wortmann FX-66-H-159 section and the span increased to 15m (49ft 2½in). The nose is more tapered, the wheel fairings more streamlined, and the vertical tail surfaces are of Wortmann symmetrical section. The Gross (Fauvel) AV 451, actually the first AV 451, was designed and built by Mons Francois Gross with his son's help and is a modification of AV 45 F-CCRM with the 15m wing span and new Wortmann wing section of the AV 451, a longer fuselage modified in the cockpit area to take the canopy from a Grob Astir, and with a 38hp Rotax 642 two-cylinder two-stroke engine aft of the cockpit, driving a two-blade Hoffmann pusher propeller. It was due to make its first flight in mid-1978 and is expected to have a best glide ratio of 32:1 at 54mph with the propeller folded and stowed.

The cantilever shoulder wings are of F_2 17% thickness/chord ratio section or Wortmann profile, with no dihedral on the centre section and 5° 13' on the outer wings. The wings are single-spar wooden structures, with a plywood leading edge torsion box and fabric covering aft of the spar; there are conventional ailerons and the elevators are in the trailing edge of the centre wing, with a large trim tab in the port one. Schempp-Hirth air brakes are fitted in the upper and lower surfaces of each outer wing, just outboard of the fins. The fuselage consists of a short wooden nacelle with glassfibre covering, the pilot sitting under a sideways-hinged blown plastic canopy. The wooden twin fins and rudders are inset at the junctions of the centre section and the outer wings, there being no tailplane; the fins are plywood-covered and the rudders fabric-covered. The undercarriage consists of two wheels in tandem, a steerable front wheel and a rear wheel with mechanical brake, supplemented by small steerable skids at the bottom of the vertical tail surfaces.

Fauvel AV 221 and AV 222

France

Data: AV 222
Span: 53ft 9¾in
Length: 17ft 1½in
Wing area: 247.6sq ft
Aspect ratio: 12
Empty weight: 716lb
Max weight: 1,212lb
Min sinking speed: 2.85ft/sec at 46mph
Best glide ratio: 26:1 at 53mph
Take-off run: 361ft
Rate of climb at sea level: 591ft/min

Developed from the AV 22 tailless sailplane, the AV 221 is a side-by-side two-seater self-launching motor glider which first flew in prototype form on 8 April 1965, and was followed a few years later by a lighter and simplified version designated AV 222. Both these versions have the traditional Fauvel tailless layout, but the twin fins and rudders of the AV 361 and AV 45 series are replaced by a single fin and rudder, and the pusher engine installation of the AV 45 by a conventional tractor one. In February 1971 M Fauvel decided to end the commerical production of his sailplanes, but plans of the AV 222 are still available for amateur constructors, who are building examples of this version in France, Germany, Italy, the UK and the USA. First shown in

Fauvel AV 221.

model form at the 1964 Cannes air show, the AV 221 has a short fuselage, mid-set cantilever wooden wings with slight forward sweep and built in three sections, a large fin and rudder with no tailplane and – in its original form – a non-retractable monowheel from a Piper Cub in a large under-fuselage fairing supplemented by outrigger wheels under the wings and a small steerable tailwheel. The prototype AV 221 was powered by a 39hp Rectimo 4 AR 1200 conversion of the Volkswagen car engine, driving a fixed-pitch fully feathering wooden propeller, and with this modest power it had completed six crossings of the Alps by mid-June 1966. Production AV 221s would have been powered by the 61hp Rectimo 4 AR 1600 version of the Volkswagen engine or – in AV 221B form – by the 40hp or 50hp Fauvel Pygmée four-stroke 'flat four' engine; both these version would have had the wing span increased by 3ft to 53ft 9½in, with Hoerner wing tips, and the AV 221B was 16½in longer than the prototype at 17ft 1½in. M Fauvel developed the Pygmée in collaboration with E. de Coucy because he had been unable to find an entirely suitable engine for powering his tailless types, and this motor was also to power the AV 46. Bench testing of the Pygmée began early in 1967 and it was hoped that a large industrial concern would eventually produce the engine, but this did not in the end happen. The AV 222 can be powered by the 39hp Rectimo 4 AR 1200 or the 60hp Limbach conversion of the Volkswagen engine or the 40 or 50hp Rotax powerplants of Austrian design; the Rectimo and Limbach engines drive a two-blade fixed-pitch wooden propeller of 3ft 5¼in diameter. The AV 221 prototype was later fitted with a conventional landing gear with twin main wheels, as was the AV 222, to improve handling over rough ground; this new undercarriage consisted of cantilever self-sprung laminated glassfibre legs and Duruble wheels with hydraulic brakes and streamlined wheel fairings. This replaces the former fixed monowheel in its large fairing and the two outrigger wheels under the wings, but for amateur construction the monowheel landing gear is recommended as being lighter, cheaper and easier to install. With the new undercarriage a larger dorsal fin was fitted to compensate for the smaller side area of the spats compared to the monowheel fairing.

Flaglor/Hall Cherokee II

USA

Span: 40ft 0in
Length: 21ft 6in
Wing area: 125sq ft
Aspect ratio: 12.8
Empty weight: 375lb
Max weight: 580lb
Max level speed: 72mph (power on)
Cruising speed: 60mph (power on)
Min sinking speed: 4ft/sec (unpowered)
Best glide ratio: 16.5:1 at 45mph (unpowered)
Take-off run: 900ft
Endurance: 1 hour (power on)

This powered version of a Hall Cherokee II single-seater sailplane was produced by Mr Ken Flaglor of Northbrook, Illinois, who fitted the Cherokee II he had built from plans some years before with two 10hp West Bend Model 82001-1 and Model 82002-1 Power Bee go-kart engines. These were mounted on pylons each side of the fuselage under the wings, and drove opposite-rotating Troyer wooden pusher propellers of 2ft 0in diameter; the fuel capacity was 2 US gallons. The first flight of Mr Flaglor's powered Cherokee II, registered N12042, was made in June 1964. The basic Cherokee II is a shoulder wing single-seater of conventional wood and fabric construction, plans of which were marketed by its designer, Mr Stanley A. Hall.

Fournier RF-9

France

Span: 55ft 9½in
Length: 25ft 3in
Height: 6ft 0in
Wing area: 193.75sq ft
Aspect ratio: 16.0
Empty weight: 1,168lb
Max weight: 1,653lb
Max speed: 119mph
Max cruising speed: 99mph
Min sinking speed: 2.56ft/sec at 50mph
Best glide ratio: 28:1 at 62mph
Take-off run: 328ft
Range: 324 miles

Designed by M René Fournier, the RF-9 is basically a side-by-side two-seater development of his earlier Avion-Planeur RF4D and RF5 which were manufactured in Germany under licence by Sportavia Pützer. After the latter was formed in 1966 M Fournier remained active as an independent designer, later forming the Fournier Design Office and Avions Fournier SA, which produced the RF-6B two-seat light aerobatic trainer and sporting type. The latter company went bankrupt in 1977 not long after the first prototype RF-9 had made its maiden flight on 20 January that year, and while the first production aircraft was being built. The second prototype, which is representative of production aircraft, has a lighter undercarriage, new air brakes and trailing edge flaps. Avions Fournier SA was succeeded in the spring of 1978 by Fournier Aviation, formed by the marine equipment specialist René Caillet of Paris, and M Fournier now acts as consultant to this firm. The RF-9 motor glider is intended for training and is of conventional all-wood construction; the cantilever low wings have dihedral from the roots and on the prototype differ from the RF4D's and RF5's in having electrically-actuated trailing edge flaps as well as air brakes in the upper surfaces. The outer part of each wing can be folded

Fournier RF-9.

inward for easier hangarage, and has connect/disconnect aileron controls. The semi-monocoque fuselage is broadly similar to the RF4D's with a polyester skin, but it is cut down behind the one-piece cockpit canopy, which opens upwards and rearwards and gives exceptional visibility. Full dual control is provided. The tail unit is similar to the RF4D's, with a small dorsal fin. Instead of the monowheel and outriggers of the RF4D and RF5, the RF-9 has a conventional inwards-retracting undercarriage and a steerable tailwheel, also retractable. The engine is a 68hp Limbach SL 1700E 'flat four' driving a Hoffmann two-blade fixed-pitch propeller; a variable-pitch prop from the same manufacturer can be fitted if required, as can VHF radio and oxygen equipment. The fuel capacity is 6.6 Imp gallons.

Fournier RF-10

France

Span: 57ft 0in
Length: 26ft 0in
Empty weight: 1,168lb
Min sinking speed: 2.6ft/sec at 50mph

The RF-10 two-seat motor glider is a development of the RF-9 but primarily of glassfibre instead of wooden construction, as the latter is now considered too expensive in labour costs. It has a wing built in four sections and incorporating some carbon-fibre componets, as well as folding capability for easier hangar storage. Engine is an 80hp Limbach L2000 or – for customers in the United States – an 80hp Revmaster with turbocharger and dual ignition. Fuel capacity is increased over the RF-9's to 8.8 Imp gallons, and the mainwheels are larger. The prototype RF-10 first flew in the spring of 1981 and production was due to start by September. One RF-10 has been ordered for a projected London-Australia record flight in 1982.

Glaser-Dirks DG 400

FGR

Span: DG 400/15 – 49ft 2½in
DG 400/17 – 55ft 9in
Length: 23ft 0in
Empty weight: DG 400/15 – 595lb
DG 400/17 – 610lb
Max take-off weight: DG 400/15 – 1,058lb
DG 400/17 – 992lb

The DG400 is a single-seater motor glider version of the DG202, with a dorsally-mounted 43hp Rotax engine driving a tractor airscrew and electrically retractable backwards into the fuselage. Fuel capacity is 4.5 Imp gallons, with optional extra fuel tanks in each wing. Detachable wing tips can be fitted to the DG400/15 to increase the span to 17m for Open Class competition, in which form it becomes the DG400/17. The DG400 prototype first flew in May 1981 in the hands of Walter Binder, and first production deliveries are planned for December 1981.

Grob G-109

FGR

Span: 54ft 0in
Length: 25ft 7in
Height: 5ft 10¾in
Empty weight: 990lb
Gross weight: 1,590lb
Max speed: 136mph (in smooth air)
Max cruising speed: 124mph (power on)
Min sinking speed: 2.73ft/sec
Best glide ratio: 30:1 at 75mph

The G-109 side-by-side two-seater motor glider is of glassfibre reinforced plastic construction throughout with a swept fin and T-tail. The prototype, D-KBGF, made its first flight on 14 March 1980 and the

engine is an 80hp Limbach L2000 E1 driving a two-blade wooden Hoffman propeller, with the pitch variable in three positions for take-off, cruise and glide. Fuel capacity is 17.5 Imp gallons. The glassfibre monocoque fuselage has frames and longerons, while the low wing has a glassfibre roving main spar and a glassfibre/epoxy resin sandwich skin; there are aluminium air brakes in the upper wing surfaces. The fixed undercarriage has Scheibe hydraulic brakes on the spatted main wheels, and the tailwheel is steerable. The pilots sit under a one-piece forward-opening canopy and, after some flight testing, this was fitted with a central frame, while changes made to the undercarriage included moving the main wheels further back so as to unload the tailwheel, the main wheel struts being of steel. Wing span was increased from the original 15m (49ft 2½in) to 54ft, the empty weight was increased and the motor cowling and wing roots were aerodynamically refined.

Haufe Hawk

USA

Span: 40ft 6in
Length: 22ft 6in
Empty weight: 462lb
Max speed: 40mph
Min sinking speed: 3.0ft/sec
Rate of climb: 500ft/min

Designed and built by Walter Haufe, of Neenah, Wisconsin, this single-seater high wing motor glider is powered by a 40hp Nelson H-59 four-cylinder horizontally-opposed engine mounted in the nose. This is unusual in that the engine, when stopped for soaring flight, swings back through 80° inside its cowling so that the two-blade fixed-pitch propeller, also designed and built by Mr Haufe, is stopped in the vertical position and lies flat along the top of the cowling to minimise drag. The cooling air intakes for the cylinders are open when the engine is running but are closed when the engine is stopped. The cantilever wooden wing is of semi-elliptical planform with upturned tips, the fuselage is a fabric-covered steel tube structure and the tail unit is wooden with fabric covering. Landing gear consists of a fixed monowheel and a tailskid, plus an unusual skid with small balancer wheel just behind the engine cowling to prevent the prop from touching the ground. The pilot sits under a removable cockpit canopy set into the wing leading edge. The Hawk prototype, N1051Z, made its first flight in 1962.

Hoffmann H-36 Dimona

FGR

Span: 52ft 6in
Length: 22ft 5¾in
Height: 5ft 3in
Wing area: 163.6sq ft
Aspect ratio: 16.8
Empty weight: 882lb
Max take-off weight: 1,433lb
Max speed: 130mph (power on)
Economical cruising speed: 112mph
Min sinking speed: 2.95ft/sec at 50mph
Best glide ratio: 27:1 at 65mph (power off)
Max rate of climb at sea level: 689ft/min
Max range: 621 miles

The Dimona side-by-side two-seat motor glider was designed by Wolff Hoffmann, who was also responsible for the Scheibe SF-H34, and who left Scheibe to form his own company, Hoffmann Flugzeugbau, to put the Dimona into production at Friesach in Austria, where production was due to start in the summer of 1981. Design work began in 1979, and the prototype made its first flight on 9 October 1980; some 50 Dimonas had been ordered by the spring of 1981. Of glassfibre construction, the Dimona is a low wing monoplane with a T-tail and a fixed tailwheel undercarriage with spats on the main wheels. The wings can be folded alongside the fuselage and are fitted with air brakes. The cockpit canopy hinges upward for entry, and there are two rear windows. The 80hp Limbach SL2000 EB1 'flat four' engine drives a Hoffmann three-position two-blade propeller, and a special engine suspension is featured to ensure low noise and vibration levels.

Hudson Tri-Motor

USA

Data: Tri-Motor
Span: 36ft 5in
Length: 21ft 0in
Height: 5ft 6in
Empty weight: 449lb
Max weight: 670lb
Max level speed: 55mph at sea level (power on)
Cruising speed: 45mph (power on)
Rate of climb: 150ft/min at sea level
Take-off run: 750ft (power on)
Endurance: 8min

Devised and made by Mr Sandy Hudson Jr, a law enforcement operator of Black Mountain, North Carolina, the Tri-Motor is a powered conversion of a Schweizer SGU 1-19 single-seat sailplane fitted with three West Bend go-kart engines producing a total of 17.3hp and each driving a 2ft 1in diameter two-blade wooden pusher propeller. Two West Bend Model 70013 engines are mounted on pylons on each side of the fuselage aft of the cockpit and between the wing bracing struts, and a West Bend Model 70012 is carried on a pylon on top of the rear fuselage in front of the fin. The total fuel capacity is approximately 2

Hudson Tri-Motor. Howard Levy

US gallons, a small separate tank for the rear engine being mounted on the fin leading edge. This powered conversion of SGU 1-19 N91817 was started in May 1962 and completed in September 1963 at a cost of $1,000; Mr Hudson won an award for the lowest powered aircraft with the Tri-Motor at the 1963 Fly-In of the Experimental Aircraft Assocation.

The standard SGU 1-19 is a utility and training single-seater of early postwar design with an all-wood constant chord fabric-covered wooden wing with two spruce spars, spruce and mahogany plywood ribs and a ply leading edge. The fuselage is a fabric-covered welded chrome-molybdenum steel tube structure, and the landing gear is an unsprung monowheel with a single skid mounted on rubber blocks ahead of it, and a rubber-mounted tailskid. The tailplane and elevators are fabric-covered welded steel tube surfaces, the tailplane being braced, and the fin and rudder are either of fabric-covered wooden construction when the SGU 1-19 is supplied in kit form for amateur builders, or of fabric-covered steel and aluminium alloy when factory-built. The pilot could sit in an open cockpit, or a transparent canopy could be provided as an optional 'extra'.

ICA-Brasov IS-28M

Romania

Data: IS-28M2
Span: 55ft 9¼in
Length: 24ft 7¼in
Height: 7ft 0¾in
Wing area: 196.3sq ft
Aspect ratio: 15.8
Empty weight: 1,168lb
Max weight: 1,642lb
Max level speed: 124mph
Economical cruising speed: 102.5mph
Min sinking speed: 2.85ft/sec at 50mph
Best glide ratio: 29:1 at 62mph
Take-off run: 525ft
Range with max fuel: 280 miles

Two motor glider versions of the IS-28B2 were developed, the IS-28M1 tandem two-seater with a monowheel undercarriage, and the IS-28M2 seating two side-by-side and with a conventional retractable undercarriage; both of these differed from the B2 chiefly in having the wings moved to the low-set position, and the forward fuselage, cockpit canopies and main landing gear redesigned. The rear fuselage, tail unit and main wing structure were virtually unchanged from those of the IS-28B2; in both versions the wings can be folded from a point just inboard of the ailerons. The IS-28M2 was the first to take to the air, the prototype, registered YR-1013, making its first flight on 26 June 1976 and making its public debut at that year's Farnborough air show; the first 10 M2s were allocated to the UK, where they are distributed by Morisonics Ltd, and this version has also been exported to Canada and the USA. The M2 has two main wheels retracting backwards into the wing roots to lie semi-exposed in the centre-section, and incorporating shock-absorbers and brakes; there is also a steerable tailwheel. Wing span is 17m (55ft 9¼in) instead of the 18m (59ft 0¾in) of the IS-28M1, which has a slightly greater length and less height. The latter's undercarriage consists of a retractable monowheel with balloon tyre and outrigger wheels mounted under each wing tip, plus a steerable tailwheel. Deliveries of the M1 were due to begin in 1979, and both versions are powered by a 68hp Limbach SL 1700E1 'flat four' engine, driving a Hoffman HO-V-62R two-blade variable-pitch and fully-feathering propeller; there is a single fuel tank aft of the cockpit holding 7.9 Imp gallons.

Both versions, like the IS-28B2, are of mainly metal construction, the single-spar wings having 2° dihedral and 2° 30' forward sweep at the quarter-

ICA-Brasov IS-28M2. Author

chord line. The wing, ribs and skin are of aluminium, the metal ailerons are fabric-covered and the trailing edge split flaps, which can be set to a negative position, are now an optional feature, instead of standard as on the B2; there are all-metal two-section Hütter air brakes in the upper surfaces. Wing folding is also optional, the outer panels folding inwards. The fuselage is built in three parts; a metal front portion, built up on two longerons and cross-frames and with glassfibre fairings and engine cowling panels; a centre portion which is an aluminium alloy monocoque; and a rear portion made up of aluminium alloy frames and skin. Like the B2, the cantilever T-tail is of aluminium alloy with slight dihedral on the tailplane; the rudder and the elevator trailing edges are fabric-covered, and there is a trim tab in each elevator. Both versions have full dual controls and a rearward-sliding main portion of the canopy.

The IS-29DM and IS-29EM currently under development are motorised versions of the IS-29D2 and IS-29E3 respectively.

Kortenbach & Rauh Kora 1

FGR

Data: Second prototype
Span: 59ft 0¾in
Length: 24ft 3¼in
Height: 6ft 0¾in
Wing area: 209.25sq ft
Aspect ratio: 16.65
Empty weight: 1,124lb
Max weight: 1,653lb
Max speed at sea level: 118mph
Min sinking speed: 2.79ft/sec at 53mph
Best glide ratio: 30:1 at 59mph

Unusual among motor gliders in having a twin-boom pusher configuration and (on the second prototype) a conventional fixed, spatted main undercarriage, the Kora 1 is a side-by-side two-seater intended primarily for training; it was designed by Messrs Schultes, Seidel and Putz, and the firm of Kortenbach & Rauh is perhaps best known for its range of furniture and other products for the garden and household. The prototype Kora 1 made its maiden flight on 13 September 1973 and had a forwards-retracting nosewheel and the main wheels retracting backwards into the tail booms. The second prototype, which first flew on 9 April 1976, had a fixed main undercarriage to save weight and complexity, and was still undergoing flight testing at the beginning of 1978, at which time it had not yet been decided whether to start production, although orders had already been received for about a dozen Koras. The power plant is a 65hp Limbach SL 1700EC1 air-cooled 'flat four' driving a Hoffman two-blade variable-pitch feathering propeller. The Kora is of all-wood construction, with cantilever high wings which have Schempp-Hirth air brakes in the upper surfaces. The pod-type fuselage nacelle has roomy side-by-side seating in a cockpit 47in wide, the canopy opening sideways to starboard. The twin tail booms end in twin fins and rudders which have the tailplane mounted on top of them. The fixed main undercarriage units on the second prototype consist of two spatted main wheels set on thin steel-sprung legs cantilevered from the fuselage underside.

Kortenbach & Rauh Kora I.

Lanzalone Aulanz

Argentina

Span: 40ft 8¼in
Length: 17ft 8½in
Height: 6ft 1¾in
Wing area: 125.9sq ft
Aspect ratio: 13.1
Max weight: 617lb

This Argentine single-seater motor glider was designed and is being built by Senor Augusto Lanzalone of Rosario in Santa Fe province, who has also formed the Asociacion Argentina de Constructores de Aviones Experimentales – Avex for aircraft like the Aulanz. Not only has Senor Lanzalone designed and built the engine for it – a 30hp Lanzalone two-cylinder two-stroke inverted in-line motor of 700cc – he has evolved his own special alloy for the construction of the airframe. This is known as Alcusing, and consists of aluminium with portions of copper, nickel, magnesium, silicon and chrome; the two-blade variable pitch propeller is also made of this material. The Aulanz is a conventional low-wing monoplane of semi-monocoque Alcusing structure, with the engine in the nose and a retractable rubber-sprung monowheel under the wing leading edge, plus a tailskid. The total fuel capacity is 20 litres (4.4 Imp gallons). By the spring of 1973 the prototype's fuselage and tail unit were completed, and construction of the remainder had been proceeding slowly, not surprisingly considering the amount of work that must have been involved with the engine and the Alcusing alloy.

LET L-13J Blanik

Czechoslovakia

Data: L-13J
Span: 53ft 2in
Length: 27ft 6½in
Height: 6ft 10in
Wing area: 206.1sq ft
Aspect ratio: 13.7
Empty weight: 794lb
Max weight: 1,228lb (two pilots)
Max speed: 92mph
Cruising speed: 80mph
Best glide ratio: 21:1
Normal range: 112 miles

The L-13J was a powered version of the well-known L-13 Blanik tandem two-seater trainer, fitted with a newly-developed 42hp Avia Jawa (Motorlet) M-150 two-cycle three-cylinder inverted air-cooled engine, driving a V-210 two-bladed wooden tractor propeller. This auxiliary engine, which was housed in a non-retractable glassfibre cowling aft of the cockpit, could be stopped and restarted in flight to prolong periods of soaring flight. The L-13J prototype, OK-9821, first flew on 26 March 1968 but only a small number were built and this variant did not go into large-scale production. The first powered version of the Blanik had been the XL-13M, a 1964 conversion with a 26hp Walter engine on a non-retractable mounting aft of the cockpit, and this was later followed by a number of other powered conversions of the Czech glider. The XL-13T was similar to the L-13J, with a 35hp Motorlet M-151 also on a non-retractable dorsal mounting; the prototype, registered OK-62, first flew in 1970. The following year a twin-engined conversion was produced by the German firm of Sigmund Flugtechnik, who also helped in the design of the Yugoslav VTC SSV-17 motor glider. Designated L-13-2M, this version of the Blanik, registered D-KACS, was fitted with two 44hp Lloyd LS-400 radials mounted in overwing nacelles in a conventional leading edge installation and driving two-blade fixed-pitch propellers; there is a small outrigger wheel under each wing to ensure ground clearance for the airscrews.

A second foreign conversion was produced in 1975 by the Russian LAK factory (Litovskaya Aviatsionnaya Konstruktsiya), which produced the LAK-9 Lietuva sailplane. LAK fitted a 68hp Limbach SL 1700E1 'flat four' engine into the nose of a standard L-13 Blanik, the resulting aircraft being designated LAK-6 and serving as a flying test bed for a new motor glider of plastics construction, of which a prototype was being built in 1977. LAK is now the sole repair and overhaul centre in the USSR for the Blanik, more than 300 of which had been overhauled by mid-1977. Another version with the engine in the nose was the L-13SW with a 65hp Walter Mikron IIIA in-line powerplant; the prototype of this, registered

LET L-13-2M Blanik. John W. R. Taylor

OK-068, first flew on 10 May 1978. In 1976 a conversion of the L-13 with a 50hp Wankel rotating piston engine appeared; this motor was carried dorsally on a non-retractable mounting. A similar mounting is being used by Mr Pentti Alanne of Finland in his conversion of an L-13 to have a Volkswagen engine; this was expected to make its first flight in 1981.

In Germany Blanik D-KOEB has been modified to flight test an RFB SG 85 fan pod engine, which is mounted dorsally and gives 209½lb st at full throttle at sea level. This powerplant, made by Rhein-Flugzeughau GmbH, is a fixed-geometry pod marketed as a complete unit for fitting to powered gliders or ultra light aircraft. It consists of dual rotating-combustion Wankel-type engines mounted in tandem, and driving a three-blade fan in a circular fan duct.

Nelson Hummingbird

USA

Span: 54ft 0in
Length: 22ft 0in
Wing area: 185.0sq ft
Aspect ratio: 15.76
Empty weight: 810lb
Max weight: 1,150lb
Cruising speed: 80mph
Min sinking speed: 3.0ft/sec
Best glide ratio: 25:1

The Hummingbird is a tandem two-seater glider built by the Nelson Aircraft Corporation of Irwin, Pennsylvania, which firm also makes the 45hp Nelson H-63CP four-cylinder horizontally-opposed two-stroke engine that powers it. This is mounted aft of the cockpit and drives a two-blade fixed-pitch pusher propeller; it retracts forward into the fuselage behind the one-piece tear drop cockpit canopy when not in use. The Hummingbird is of all-metal construction with cantilever mid-set wings which have spoilers and air brakes. The landing gear is of the steerable bicycle type.

Nelson Hummingbird PG 185-B. Howard Levy

Nippi NP-100A Albatross

Japan

Data: Prototype
Span: 59ft 0¾in
Length: 26ft 3in
Height: 6ft 7½in
Wing area: 193.75sq ft
Aspect ratio: 18.0
Empty weight: 926lb
Max weight: 1,322lb
Max level speed at sea level: 99mph
Max cruising speed: 74mph
Min sinking speed: 2.62ft/sec at 51.5mph
Best glide ratio: 30:1 at 56mph
Take-off run: 1,200ft
Range with max fuel: 124 miles

This Japanese side-by-side two-seater motor glider, designed and built by the Nihon Hikoki Kabushiki Kaisha (Japan Aircraft Manufacturing Co Ltd), is unusual in being powered by a motorcycle engine 'buried' in the centre of the fuselage aft of the main landing gear and driving a ducted fan. Nippi began the design of the Albatross late in 1973 and the prototype NP-100 made its first flight on 25 December 1975; several modifications were made

Nippi NP-100A Albatross. John W. R. Taylor

as a result of the first flight test programme, and a second such programme was to take place during January-March 1978 so as to finalise details of the production version. The prototype's powerplant is a modified 60hp Kawasaki H2 three-cylinder two-stroke air-cooled in-line motorcycle engine of 748cc driving a four-bladed wooden ducted fan of 23.5in diameter, the fan duct being under the tail boom. There are triple 'Venetian blind'-type air intake doors on each side of the fuselage, which are interconnected with the engine starting circuit so as to prevent the engine running when the doors are closed. There is a single fuel tank in the fuselage of 8.8 Imp gallons capacity, and it is expected that production aircraft will have the 68hp Nippi 'flat four' engine. Planned production is now awaiting the final choice of a type-certificated powerplant. Of all-metal construction, the Albatross has cantilever shoulder wings with a single spar and two-section metal-skinned flaps on each side that move upwards or downwards; the inner ones can be lowered to 80° for use as air brakes, and there are no spoilers. The fuselage is a semi-monocoque structure, with the forward-retracting twin-wheel main landing gear operated mechanically with spring assistance, and positioned just ahead of the 'Venetian blind' air intake doors. There is also a steerable fixed tailwheel linked to the rudder movement. The two pilots are provided with dual controls and sit under a rearward-hinged flush-fitting framed cockpit canopy. The unswept tail unit has conventional elevators and rudder.

Oldershaw 0-3

USA

Span: 55ft 0in
Length: 23ft 0in
Height: 4ft 8in
Wing area: 125.0sq ft
Aspect ratio: 24.1
Empty weight: 780lb
Max weight: 1,000lb
Max speed: 125mph (in smooth air, power off)
Max cruising speed: 95mph (power on)
Min sinking speed: 2.30ft/sec at 55mph
Best glide ratio: 37:1 at 68mph
Take-off run: 900ft
Range with max fuel: 50 miles

The original 0-3 single-seat sailplane was designed and built by Mr Vernon W. Oldershaw of Bakersfield, California, in 15 months for a cost of $4,000, and it made its first flight in June 1967. He then began to develop a retractable powerplant installation which was added to a second 0-3 completed in 1975, the engine being used primarily for take-off and climb to soaring height. It is a 31hp Yamaha Snowmobile SW 433 two-stroke 'flat twin' driving a two-blade fixed-pitch wooden pusher propeller, the pylon-mounted propeller retracting forwards into the fuselage behind closed doors to lie over the engine, which is behind the cockpit. There is a single aluminium fuel tank in the fuselage of 2.5 US gallons capacity. The 0-3 is of all-wood construction with cantilever shoulder wings and a V-tail; the wings have a spruce spar and plywood ribs and skins, with wooden ailerons and air brakes on the trailing edges. The ellipitcal-section fuselage is built up from plywood bulkheads, the front portion from the nose to the wing trailing edge having a glassfibre outer shell and the remainder being plywood-covered. The tail surfaces, which are slightly swept back, are of similar construction to the wings. There is a retractable rubber-sprung monowheel and a tail-skid. The pilot sits under a one-piece flush-fitting cockpit canopy.

Oldershaw 0-3. Howard Levy

Onishi OS-G3

Japan

Span: 46ft 3in
Length: 21ft 3½in
Height: 5ft 2½in
Wing area: 185sq ft
Aspect ratio: 11.6
Empty weight: 143lb
Max gross weight: 297lb
Cruising speed: 24mph
Stalling speed: 21mph

Designed and built by Mr Onishi, a Japanese sailplane pilot, the OS-G3 single-seater is unique in being powered by six model aircraft engines, mounted three on each side of the nose on a strut-braced boom in line with the front of the cockpit canopy; these engines are intended to overcome the need for winch-launching or aero tows. Each 10cc OS.60 two-stroke glowplug engine drives a 12in diameter two-bladed propeller and develops 1.7hp at 14,000rpm, or 1.275hp at a rather less noisy 8,000rpm, the six together producing a total of 10.2hp for take-off, or 7.65hp for cruising flight. This is just enough for an unaided take-off, the take-off run being about 500ft when the OS-G3 made its first flight early in 1977, and this miniscule power output leaves a mere 3mph margin between the cruising speed of 24mph and the stalling speed! This and a payload of only 154lb, to say nothing of the noise these high-revving engines must produce, make this form of sailplane power an interesting but hardly a practical proposition. The OS-G3 itself is a cantilever shoulder-wing design with a swept back fin and rudder and the tailplane mounted on top; the engine slipstream is in line with the wing leading edge. There are no flaps or air brakes, and the landing gear consists of a fixed monowheel, a fixed nosewheel and a tailskid. The pilot sits under a one-piece canopy, and has six throttle levers and six cut-out switches for the engines.

Projekt Dolphin

Denmark

Span: 61ft 5in
Length: 27ft 10¾in
Height: 4ft 3¼in
Wing area: 223.9sq ft
Aspect ratio: 16.8
Empty weight: 1,058lb
Max weight: 1,653lb
Max speed: 163mph
Max aero-tow speed: 77.5mph
Min sinking speed: 2.30ft/sec at 50mph
Best glide ratio: 32:1 at 62mph

This Danish tandem two-seater motor glider was designed and built by the Projekt 8 I/S company of Roskilde, formed by Helge Petersen and 10 other glider pilots; construction of the prototype was taking place at three separate sites near Copenhagen, and it was expected that the first flight would have been made late in 1978. The Dolphin is a cantilever mid-wing monoplane of mixed construction with a T-tail, powered by a 54hp Volkswagen VW 1600 engine driving a two-blade pusher propeller, mounted on a pylon and retracting rearwards behind closed doors into the top of the fuselage aft of the wings in a manner similar to the PIK-20E and Scheibe SF-27M. The wings, which have 4° dihedral, have an aluminium centre section and wood and glassfibre outer panels, flaps and ailerons; there are aluminium air brakes in the upper surfaces just ahead of the flaps. The forward fuselage is a welded steel tube framework covered with a light glassfibre shell, and the rear fuselage is a wooden structure reinforced by glassfibre. The tail unit is likewise of wood, with a fixed incidence tailplane, a central trim tab in the elevator and an inset tab at the base of the rudder. There is a semi-retractable rubber-sprung mainwheel plus a nosewheel and a steerable tailwheel, as well as retractable wing tip balancer wheels. The one-piece cockpit canopy opens sideways.

Rhein-Flugzeugbau Sirius

FGR

Data: Sirius II
Span: 66ft 10¼in
Length: 26ft 4½in
Height: 5ft 11in
Wing area: 173sq ft
Aspect ratio: 25.8
Empty weight: 1,124lb
Max weight: 1,521lb
Max speed: 168mph (power on)
Min sinking speed: 1.97ft/sec
Best glide ratio: 38:1
Take-off run: 656ft
Range: 168 miles

The Sirius 1 single-seat high performance motor glider was developed primarily to investigate the efficiency of the ducted fan as a powerplant for sailplanes, and its use of a new integrated power system enabled a sailplane's aerodynamic qualities to be retained virtually uncompromised by the drag of a conventional tractor or pusher engine installation, at the same time making powered take-offs from small airfields possible. The Sirius 1 was developed from the basically all-metal VFW-Fokker FK-3, but was of combined metal and glassfibre construction, and in its initial form was powered by a 48hp Nelson 'flat four' air-cooled two-stroke driving an eight-bladed ducted metal fan coupled directly to the engine. The powerplant is a fixed low drag installation fitted at the cg, the fan exhausting down

the length of the tail boom; fuel capacity is 7 Imp gallons and an electrical starter enabled the engine to be restarted in flight easily. The Sirius 1 was later fitted with two Yamaha motorcycle engines, and finally with two 20hp Finkel & Sachs Wankel rotary engines. It had cantilever mid-set wings with flaps variable in movement from −10° to +15°, and conventional air brakes just ahead of the flaps. There was a retactable monowheel with brake shoes, and a tailwheel, and the Sirius 1 could be landed with the wheel retracted. The tail unit resembled that of the VFW-Fokker FK-3, and the pilot sat on a glassfibre seat under a large sideways-hinged Perspex canopy; he could be provided with radio, oxygen equipment and a barograph.

The Sirius II is a side-by-side two-seater development of the Sirius 1 which utilised the wings, tail unit and landing gear of the Caproni Vizzola Calif A-21S; this version made its first flight in January 1972 and the wing span was now 66ft 10¼in and aspect ratio 25.8 compared to the Sirius 1's 57ft 6½in and 22.0, while length was increased by 2ft 3in. Powerplant consists of two 30hp Wankel rotary engines coupled to drive a ducted fan in an installation similar to that of the Sirius 1, one engine being mounted in front of the fan and the other behind it. The fan shroud has an annular slat-type intake around the wing leading edge to keep the airflow attached to the duct and prevent its breakaway; suck-in doors shut to fair off this intake when the powerplant is not operating, so as to enable the soaring performance to be maintained unaffected by drag. Fuel capacity is 6.6 Imp gallons.

Ryson ST-100 Cloudster

USA

Span: 57ft 8in
Length: 25ft 6½in
Height: 5ft 10in
Wing area: 213.0sq ft
Aspect ratio: 15.61
Empty weight: 1,212lb
Max weight: 1,650lb
Max speed at sea level: 150mph
Max cruising speed: 135mph
Min sinking speed: 2.93ft/sec
Best glide ratio: 28:1
Take-off run to 50ft: 950ft
Range with max fuel: 900 miles

The ST-100 Cloudster tandem two-seater motor glider is believed to be the first American type in this category to be designed for production, and was created by the Ryson Aviation Corporation, founded by T. Claude Ryan, who until 1969 was chariman and chief executive of the Ryan Aeronautical Co (now Teledyne Ryan Aeronautical); his son Jerome D Ryan is Executive Vice-President of Ryson and Mr Ladislao Pazmany is Chief Engineer. The ST-100 is a cantilever low-wing monoplane of all-metal construction, with a T-tail, a fixed spatted undercarrage and a conventional engine installation in the nose. It differs from European types such as the Scheibe SF-25 Falke and Sportavia RF4D and RF5 in being rather larger and more powerful, with a proven certificated aircraft engine (the Continental 0-200) instead of a modified Volkswagen engine, and in being of all-metal construction rather than wood and fabric to suit the needs of the American market. Design work started on 18 March 1974 and construction of the prototype, registered N2RY, began on 11 July that year; it made its first flight on 21 December 1976 in the hands of test pilot Ray Cote. The ST-100 is designed to be aerobatic and to meet the current FAR Part 23 gust load requirements and, in addition to being flown as a conventional powered aircraft, can also be used as an aero-tow aircraft for unpowered sailplanes. It has towed a Schweizer SGS 1-26 single-seater to 13,000ft with an initial climb rate of 450ft/min and, with two people aboard, it has also towed a Schweizer SGS 2-33 with two occupants at an initial rate of climb of about 400ft/min. In the summer of 1977 Ray Cote made a notable economy-record flight in the ST-100 from El Mirage, California, to the EAA display at Oshkosh, Wisconsin, covering the 1,676 miles on 28 of the 32 available US gallons of fuel in 18 hours of soaring flight and 13 hours of powered flight. This was followed by a 4,300 mile flight around the perimeter of the United States. Production of the ST-100 by a licensee is planned when FAA type certification is awarded.

The wings are all-metal safe-life structures, with some fail-safe features, and have a single main spar located at the 40% chord line, the point of maximum thickness, and an auxiliary spar at 80% chord; dihedral is 4°. Both ailerons and trailing edge flaps are of aluminium with a foam core, the flaps being electrically-operated and can be lowered to 72° when used as air brakes; the ailerons, like the flaps, can be raised 12° and they can be drooped 8° in conjunction with the flaps. No spoilers or trim tabs

Ryson ST-100 Cloudster.

are fitted, and the wings can be folded back alongside the fuselage, leading edges down, for hangarage or transportation. The fuselage is a semi-monocoque structure with extruded aluminium longerons, and sheet metal frames, bulkheads and skinning. The pilots sit in tandem under a one-piece Plexiglas canopy that opens sideways to starboard; there is baggage space aft of the rear seat, and the rear occupant has flight controls but not an instrument panel, as he can see the instruments over the front pilot's shoulders. The cantilever T-tail has a sweptback fin and rudder, a fixed-incidence tailplane and a one-piece balanced elevator. The rudder and elevator are aluminium-covered, with sheet metal and foam ribs, and the elevator tips can be removed when the aircraft is being transported; the elevator has an anti-servo and trim tab. A conventional fixed tailwheel landing gear is featured, with streamlined glassfibre fairings on the main gear legs, main wheels and tailwheel, which is steerable. The main wheels have Cleveland hydraulic disc brakes and Ryson oleo-pneumatic shock absorbers. Powerplant is a 100hp Continental 0-200-A 'flat four' engine driving a two-blade three-position Hoffman HO-V-62 feathering propeller with composite blades. There are two integral fuel tanks in the wing centre section leading edges with a total capacity of 32 US gallons (26.6 Imp gallons.)

Scheibe SF-24B Motorspatz

FGR

Data: SF-24B
Span: 46ft 1in
Length: 20ft 0in
Height: 4ft 5in
Wing area: 127sq ft
Aspect ratio: 16.7
Empty weight: 485lb
Max weight: 760lb
Max speed at sea level: 93.5mph
Min sinking speed: 3.28ft/sec
Rate of climb: 394ft/min at sea level
Take-off run: 426ft

The SF-24 Motorspatz was developed in 1957 as a powered version of the L-Spatz-55 and L-Spatz-III single-seater trainer or competition sailplanes; the Spatz (or Sparrow) had first flown on 12 March 1952. The initial production version of the Motorspatz was the SF-24A with a 21hp Zink-Brandl ZB300-S two cylinder horizontally-opposed air-cooled two-stroke mounted in the nose in a conventional tractor installation; the SF-24B was powered by a 25hp Hirth-built Solo 560A 'flat four' air-cooled two-stroke driving a two-blade fixed-pitch wooden propeller, and this version had a better performance than the SF-24A. Both versions had a fuel tank of 3.3 Imp gallons capacity in the fuselage behind the wing spar. About 70 examples of both versions were built altogether. The Motorspatz is very similar structurally to its unpowered predecessor, with a fabric-covered welded steel tube fuselage and wooden single-spar cantilever high-set wings with plywood and fabric covering; the inset-hinged ailerons are also fabric-covered and there are spoilers in the upper surfaces. The wooden tail unit is also covered with plywood and fabric, and the landing gear conists of a fixed monowheel partly faired into the bottom of the fuselage, plus a rubber-sprung tailskid; there are no outrigger balancer wheels under the wings to maintain the aircraft upright on the ground. The pilot sits under a one-piece blown canopy.

Scheibe SF-25C and C-S Falke '76 (Falcon)

FGR

Data: SF-25C and C-S Falke '76
Span: 50ft 0¼in
Length: 24ft 9¼in
Height: 6ft 0¾in
Wing area: 195.9sq ft
Aspect ratio: 13.8
Empty weight: 826lb
Max weight: 1,345lb
Max speed: 112mph (power on)
Max cruising speed: 99mph
Min sinking speed: 3.28ft/sec at 43.5mph
Best glide ratio: 23:1
Take-off run: 590ft
Range with max fuel: 466 miles

Following the successful development of the SF-24 Motorspatz powered glider from the L-Spatz-55 and L-Spatz-III single-seater sailplanes, it was a logical step to produce a two-seater motor glider based on the popular Bergfalke III. This emerged as the SF-25 Motorfalke which, in its original form, had a cantilever high-set wooden wing with Schempp-Hirth air brakes similar to that of the Bergfalke III but, unlike the sailplane, was a side-by-side rather than a tandem two-seater. Powerplant was a 28hp Hirth-built Solo 'flat four' air-cooled two-stroke engine in an installation very similar to the SF-24B Motorspatz, and with a fuel tank of 5.5 Imp gallons capacity. The fuselage aft of the cockpit was very similar to the Bergfalke III's, being the traditional Scheibe fabric-covered welded steel tube structure, and the wooden tail unit and fixed monowheel landing gear were also similar to the Bergfalke's. The two pilots have dual controls as standard and the Motorfalke went into production, a total of 25 having been built by early 1966. Later versions of the SF-25, now known simply as the Falke (or Falcon), had low-set two-piece cantilever wooden wings developed from the Motorfalke's with air brakes in the upper surfaces and slight forward sweep; the SF-25B's span was now 50ft 2½in and aspect ratio 13.4, compared with the Motorfalke's 54ft 5½in span and aspect ratio of 16. A more powerful engine was fitted, the forward fuselage underside fairing for the fixed monowheel with brake was revised in shape and outrigger stabilising wheels were fitted under

each wing, so that the SF-25B was almost a different aeroplane to the Motorfalke, although just as suitable for basic and advanced training. Its powerplant was a 45hp Stamo MS 1500-1 modified Volkswagen 'flat four' engine which also incorporated some Porsche parts; this was started on the ground or in the air by a pull-cable starter in the cabin, with an electrical starter available as an optional extra and the fuel capacity was 8.5 Imp gallons. Another optional extra for the SF-25B is a tow-hitch for winch-launching. The tail unit is of wooden construction and there is a steerable tailwheel; dual controls are standard.

The SF-25C is an improved version of the SF-25B, differing from it primarily in having a 65hp Limbach SL 1700EA modified Volkswagen 'flat four' engine driving a two-blade propeller; an electric starter is fitted and the single fuselage fuel tank has a capacity of 9.9 Imp gallons, or 12.1 Imp gallons optionally. The SF-25C received its type certification in September 1972 and by January 1980 a total of 295 of this version had been built by Scheibe, plus another 50 built under licence by Sportavia in Germany, who also built 80 SF-25Bs. About 200 SF-25Bs had been built by Scheibe, about 10 more by Aeronautica Umbra Sppp in Italy, plus 35 by Vickers-Slingsby, who are producing a modified verison of the B as the

Scheibe SF-25B Motorfalke. J. M. G. Gradidge

T61E Venture T Mk 2 for the Air Training Corps. The SF-25C-S is a further improved variant with a Hoffman feathering propeller, adjustable engine cowl flap and slightly modified fuselage, and 20 of this version had been built by January 1980. Further optional features include an additional exhaust outlet and a slower-turning propeller, these reducing the noise level to less than 60 dB. Optional wing folding is also available, reducing the span to 31ft 2in for easier hangar storage. The Falke '76 was an improved model and featured a number of design improvements, including a domed cockpit canopy, an enlarged fin and smaller rudder with greater sweepback, a coating of laminated glassfibre for the forward section of the fuselage, some engine and exhaust modifications and an alternative twin-wheel main landing gear with wheel spats, which is offered as an option to customers. The non-retractable monowheel is normally unsprung, but a rubber-sprung monowheel is also offered as optional. Current production version is the C-Falke '80, which becomes the SF-25K K-Falke '80 with fully-folding wings. Latest version of the SF-25C has an 80hp Limbach L2000 'flat four' engine.

Scheibe SF-25E Super-Falke

FGR

Span: 59ft 0¾in
Length: 24ft 11¾in
Height: 6ft 0¾in
Wing area: 187.3sq ft
Aspect ratio: 17.8
Empty weight: 904lb
Max weight: 1,389lb
Max speed: 112mph
Max cruising speed: 99mph
Min sinking speed: 2.79ft/sec at 47mph
Best glide ratio: 29:1 at 53mph
Take-off run: 490-655ft
Endurance: 4 hours

The Super-Falke is basically an SF-25C-S with a wing increased in span to 18m (59ft 0¾in); the fuselage aft of the wing has a wider section than that of the C-S to improve airflow at the wing root, and the fairing for the non-retractable monowheel, which is now rubber-sprung as standard, is now larger. Production aircraft also have a tailwheel, Schempp-Hirth air brakes in the wing upper surfaces and a cabin heater fitted as standard. The same 65hp Limbach SL 1700EA engine as in the SF-25C is fitted,

Scheibe SF25E Super-Falke. J. M. G. Gradidge

driving a two-blade feathering propeller; there is a 12 volt battery and alernator for electrical engine starting, and the engine cowl flap is adjustable. Wing folding of the outer panels is optional, as on the SF-25C-S, and the same outrigger stabilising wheels are fitted under each wing. The Super-Falke made its first flight in June 1974, and the type took first place in the advanced two-seater class at the First International Motor Glider Competiton; a total of 52 Super-Falkes had been delivered by January 1980. The type is structurally the same as the SF-25C-S, and has the same side-by-side seating with dual controls; like the SF-25C, optional folding wings are available for easier hangar stowage.

Scheibe SF-27M and SF-32

FGR

Data: SF-32
Span: 55ft 9¼in
Length: 22ft 11½in
Height: 4ft 1¼in
Wing area: 143.2sq ft
Aspect ratio: 21.73
Empty weight: 750lb
Max weight: 992lb
Max speed: 136mph
Min sinking speed: 2.1ft/sec at 50mph
Best glide ratio: 37:1 at 56mph
Take-off run: 656ft
Range: 186 miles

The SF-27M, designed in 1967, is a single-seater powered verison of the SF-27 Zugvogel V, and was an early example of the completely retractable powerplant installation, the 26hp Hirth Solo vertically-opposed four-cylinder engine being mounted just aft of the wings and retracting backwards into the centre fuselage behind closed doors. This retractability gives the SF-27M about the same soaring performance as the Zugvogel V, and makes it capable of self-powered take-off as well as normal launching by winch or aero-tow; the engine installation weighs only about 88lb, so its effect on soaring performance is minimised. The SF-27M is structurally similar to the Zugvogel V except that the fuselage centre section has been modified to take the engine, increasing the overall length, and the wings and control surfaces have been strengthened internally; the main wheel tyre size has also been increased. The engine is raised into position and retracted manually by a crank-driven draw chain-pushrod system, swinging up into its operating position; raising and lowering it is very simple, requiring only 3½ turns on the crank and being completed in five seconds. The doors over the engine and propeller bay open and close automatically while this is being done, the two-blade propeller of about 4ft 5in diameter being stopped in the vertical position for retraction. Engine starting is by a hand-operated cable, and a specially-designed ignition system facilitates easy starting. A fuel tank of 4.4 Imp gallons capacity is mounted in the fuselage behind the pilot. The first Distance Diamond award for a powered sailplane flight was granted by the German Aero Club to Willibald Collé, who flew his SF-27M a distance of 334 miles from Elz to Le Rabot airfield, France, on 28 July 1968. Collé took off under his own power just before 11am, climbed to about 3,000ft and switched off and retracted the engine; he covered the distance to Le Rabot in about eight hours at between about 2,500 and 6,000ft, and the special barograph installed confirmed that the flight had been made without assistance from the engine. The SF-27M also won the single-seater class at the German Motor Glider competitions held in 1970 and 1971, and about 30 SF-27Ms were built.

It was succeeded by the SF-32, also a single-seater, which first flew in prototype form in May 1976 and is basically very similar, being powered by a 40hp Rotax 642 'flat twin' two-stroke driving a fixed-pitch two-blade wooden propeller, and mounted on a pylon and retracted into the fuselage in the same way as the SF-27M's but electrically instead of manually. The cantilever shoulder wings, which are built in two parts, are of 17m (55ft 9¼in) span instead of the SF-27M's 15m span, and are basically the same as the Swiss Neukom Elfe 17's, with an aluminium alloy main spar and a glassfibre and plywood/foam sandwich skin. There are Schempp-Hirth air brakes in the upper surfaces but – unlike the Elfe 17 – no provision for water ballast. The fuselage is very similar to the SF-27M's and Zugvogel V's, being a welded steel tube structure with the nose section covered with a moulded glassfibre shell back to the wing trailing edge, the rear section being fabric-covered. The tail unit is very similar to the SF-27M's, with a geared anti-balance tab in the all-moving tailplane. Only the prototype SF-32 was built.

Scheibe SF-27M. J. M. G. Gradidge

Scheibe SF-28A Tandem-Falke

FGR

Span: 53ft 5¾in
Length: 27ft 3in
Height: 5ft 1in
Wing area: 197.0sq ft
Aspect ratio: 14.5
Empty weight: 881lb
Max weight: 1,345lb
Max speed: 118mph (in smooth air, power off)
Max cruising speed: 87mph
Min sinking speed: 2.95ft/sec at 43.5mph
Best glide ratio: 27:1 at 53mph
Take-off run: 575ft
Range with max fuel: 261 miles

The Tandem-Falke, as its name implies, is a development of the SF-25C Falke wth the two seats in tandem positioned over the wings under a lengthened one-piece perspex canopy, instead of the side-by-side layout of the earlier Falke series. The Tandem-Falke can be flown solo from the front seat, with space for up to 198lb of baggage on the rear seat. Design work on the SF-28 began in 1970 and the prototype, registered D-KAFJ, made its first flight in May 1971, powered by a 45hp Stamo MS 1500 modified Volkeswagen engine. The production SF-28A has a 65hp Limbach SI 1900EA1 engine, the same as fitted to the SF-25C Falke but fitted to drive a Hoffman two-blade variable-pitch feathering propeller; a fixed-pitch prop is available as an option and the fuel capacity totals 8.8 Imp gallons. Altogether 112 Tandem-Falkes had been built by January 1980 and the Tandem-Falke has competed in the German Motor Glider Competition; one flown by Peter Ross set up two United Kingdom records for motor gliders in 1976. The type has the same basic wooden construction with fabric-covered welded steel tube fuselage as the SF-25 Falke series; both wing span and length are slightly greater than the SF-25C's, the fin and rudder are now unswept. The single-spar wooden wings have spoilers in the upper surfaces and no flaps; there is an outrigger stabilising wheel on a nylon leg under each wing, as well as a faired non-retractable monowheel with internal brake and a steerable tailwheel. There is a trim tab in the elevator.

Scheibe SF-28A Tandem-Falke. J. M. G. Gradidge

Scheibe SF-33

FGR

Span: 49ft 2½in
Length: 22ft 1¾in
Height: 4ft 9in
Wing area: 134.5sq ft
Aspect ratio: 18.0
Empty weight: 661lb
Max weight: 904lb
Max speed: 106mph (in smooth air, power off)
Max cruising speed: 93mph (power on)
Min sinking speed: 2.79ft/sec at 50mph
Best glide ratio: 29:1 at 47mph
Take-off run: 490-655ft
Range with max fuel: 186 miles

This single-seater motor glider was developed from the earlier SF-29 and is intended especially for training and powered cross-country flying, and for use by clubs as well as private owners. It made its first flight in 1977, and although it did not go into production it was aimed at filling the gap between the two-seater SF-25 Falke variants and the higher performance single-seat powered gliders such as the PIK-20E and Nimbus 2M; it was also designed for ease of handling by the less experienced pilot. Like the earlier SF-25 Falke variants which it resembles, the SF-33 is a cantilever low-wing monoplane of basically wooden construction; the fuselage is a steel tube framework covered with plywood and fabric, and the engine cowling panels are of glassfibre reinforced plastic. The two-piece wings have plywood leading edges and wooden ailerons, and there are spoilers in the wing upper surfaces. The wooden tail unit has a trim tab in the starboard elevator. The landing gear consists of a fixed monowheel, a steerable tailwheel linked to the rudder for taxying, and two detachable outrigger wheels under the wings. The pilot sits under a large blown canopy that opens sideways to starboard and gives excellent all-round visibility. Powerplant is a 900cc BMW two-cylinder motorcycle engine derated to 35hp and driving a Hoffman two-blade variable-pitch propeller; total fuel capacity is 4.8 Imp gallons. The SF-33 is self-launching, and its gliding performance is claimed to be comparable to that of the popular Schleicher Ka 8.

Scheibe SF-36

FGR

Span: 53ft 6in
Length: 23ft 10in
Wing area: 166sq ft
Aspect ratio: 17.2
Empty weight: 950lb
Max gross weight: 1,390lb
Min sinking speed: 3.0ft/sec at 50mph

The SF-36 two-seater motor glider was developed from the SF-H34 and uses the latter's wings and tail unit married to a new fuselage, seating two side-by-side instead of the SF-H34's tandem seating. The wings are low-mounted with Schempp-Hirth air brakes, and are detachable for hangarage; folding wings may later be offered for the SF-36. Engine is an 80hp Limbach SL2000 driving a fixed-pitch or a three-position variable-pitch airscrew. Construction is of glassfibre-reinforced plastic, and a two-mainwheel undercarriage similar to that of the C-Falke '80 is featured, although a single monowheel with small outrigger wheels under the wings is also offered to customers. The latter was featured on the prototype, which first flew in the summer of 1980, and a retractable single-wheel undercarriage is planned for a later version; in all cases the tailwheel is steerable. The forward-sliding canopy allows entry to be made over the wings. First SF-36 deliveries were due to start in the spring of 1981.

Schempp-Hirth Nimbus 2M

FGR

Span: 66ft 7¼in
Length: 24ft 0½in
Height: 4ft 9in
Wing area: 155.0sq ft
Aspect ratio: 28.62
Empty weight: 970lb
Max weight: 1,279lb
Max speed: 155mph
Min sinking speed: 1.8ft/sec at 53mph
Best glide ratio: 47:1 at 62mph

The Nimbus 2's outstanding performance not surprisingly led to thoughts of a powered version which, by virtue of its engine, could be self-launched. The Nimbus 2M, or Motor Nimbus, was developed under the direction of Dipl-Ing Klaus Holighaus and is fitted with a 50hp Hirth two-cylinder two-stroke engine that was originally produced for snowmobile racing in Canada. This drives a two-bladed fixed-pitch wooden propeller and is completely retractable, being lowered when stopped behind closed doors in the centre fuselage, the propeller being stopped so as to lie on the fuselage centreline. The powerplant is raised and lowered electrically, using the motor and rack-and-pinion gearing from a Bosch car sun roof installation, and since the engine weight is less than that of the water ballast carried by the unpowered Nimbus 2, its effect on performance when retracted is very slight. Up to 88lb of fuel can be carried in wing tanks and the take-off run with engine on is 1,310ft; rate of climb is 395ft/min and the range is 310 miles. The prototype Nimbus 2M first flew in June 1974, and made its debut at the First International Motor Glider Competition at Burg Feuerstein, West Germany, that same month. Apart from the engine installation, the Nimbus 2M is the same as the unpowered Nimbus 2.

Schleicher AS-K 14

FGR

Span: 46ft 11in
Length: 21ft 8in
Height: 5ft 3in
Wing area: 136.49sq ft
Aspect ratio: 16.2
Empty weight: 540lb
Max weight: 793lb
Max speed: 124mph (in smooth air)
Min sinking speed: 2.46ft/sec at 45mph
Best glide ratio: 28:1 at 52mph
Take-off run: 393ft

This single-seater motor glider was originally known as the Ka 12 and was designed by Ing Rudolf Kaiser

Schleicher AS-K 14. J. M. G. Gradidge

but, to avoid confusion with the AS-W 12 high performance sailplane which was also built by Schleicher, it was redesignated AS-K 14. The prototype made its first flight on 25 April 1967, and the type took second, third and fourth palces in the first German Motor Glider Competition, which was held in 1970; in the sixth of these competitions, in 1976, the AS-K 14 was still good enough to take second and third places. Of conventional wooden construction, it has what is basically a Ka 6E's semi-monocoque fuselage with plywood covering married to low-set cantilever wood and fabric wings with 5° dihedral, similar to the Ka 6E's and with the same aerofoil section; the single-spar wings have spoilers in the upper surfaces and plywood-covered ailerons. The pilot sits under a large one-piece blown Plexiglas canopy that hinges sideways to starboard, and the landing gear consists of a manually-retracted monowheel on a leg tall enough to give adequate ground clearance for the propeller, plus a tailskid. Powerplant is a 26hp Hirth F10 K19 'flat four' two-stroke engine in a conventional tractor installation driving a two-blade Hoffman feathering propeller; starting is manually. The tail unit is of wood/plywood/fabric construction, with a low-set all-moving tailplane.

Schleicher AS-K 16

FGR

Span: 52ft 6in
Length: 24ft 0¼in
Height: 6ft 10¾in
Wing area: 204.5sq ft
Aspect ratio: 13.5
Empty weight: 1,036lb
Max weight: 1,543lb
Max speed: 124mph
Min sinking speed: 3.28ft/sec at 46mph
Best glide ratio: 25:1 at 58.5mph
Take-off run: 755ft
Range: 310 miles

The AS-K 16 is a two-seater motor glider directly comparable with the Scheibe SF-25 Falke series, with the same basic powerplant and side-by-side seating; with dual controls provided it is suitable for basic and advanced training. It first flew in prototype form on 2 February 1971 and first appeared in public at the second German Motor Glider Competition at Burg Feuerstein in June that year, but it did not compete. An AS-K 16 flown by Hans Werner Grosse and Ing R. Kaiser took third place in the First International Motor Glider Competition in 1974. By January 1976 38 AS-K 16s had been built, but it is now out of production. The type is of mixed construction similar to the SF-25 Falke, with a welded steel tube fuselage covered in fabric, plywood and glassfibre. The cantilever single-spar low-set wooden wings are fabric-covered with glassfibre tips and spoilers in the upper surfaces. The tail unit is of wooden construction with fabric covering, with combined trim and anti-balance tabs in the port elevator. Unlike the SF-25 Falke's monowheel and under-wing balancing wheels, the AS-K 16 has main wheels retracting inwards into the bottom of the fuselage, and a fixed tailwheel; the main wheels have rubber shock absorbers and Tost drum brakes. The pilots sit under a one-piece blown canopy that hinges sideways to open. Powerplant is a 72hp Limbach SL 1700EB1 modified Volkswagen 'flat four' engine driving a Hoffman HO-V 62 two-blade variable-pitch propeller.

Schleicher AS-K 16.

Slingsby/Osbourn Twin Cadet

UK

Data: Twin Cadet Mk 1
Span: 38ft 6in
Length: 20ft 10½in
Tare weight: 455lb
All-up weight: 657lb
Max speed: 60mph (power on)
Cruising speed: 40mph (power on)
Range: 100 miles

This powered converison of a T8 Tutor was made by E. W. Osbourn at Cranfield, Bedfordshire, in 1969 and was known as the Twin Cadet Mk 1. It was fitted with two 197cc Villiers 9E single-cylinder two-stroke engines mounted on the wing bracing struts and driving two small propellers just behind the pilot's head. The prototype, G-AXMB (ex-VM590 and BGA 805) first flew with power on 20 September

Slingsby/Osborne Twin Cadet. J. M. G. Gradidge

1969, and received its Authorisation to Fly on 2 July 1970. It was later re-engined with a single 500cc Triumph T100 motorcycle engine mounted in the nose and first flew in this form as the Cadet Mk 2 at Cranfield on 22 January 1972, receiving its Authorisation to Fly on 6 June that year.

Another motorised version of the basic Cadet/Tutor airframe was the Slingsby/Martin Motor Cadet Mk 3, which was a T31 Tandem Tutor acquired from the Dorset Gliding Club in 1970 and converted by P. J. Martin and D. R. Wilkinson at Twinwood Farm aerodrome, Bedfordshire, to have a 1,600cc Volkswagen engine in the nose. It was now a single-seater ultra-light, the front seat being replaced by a 6½ gallon fuel tank, and a Luton Minor's undercarriage was fitted to give airscrew clearance. Registered G-AYAN and named 'Thermal Hopper', the sole Cadet Mk 3 received its Authorisation to Fly on 15 January 1971.

Sportavia Avion-Planeur RF4D

FGR

Span: 36ft 11¼in
Length: 19ft 10¼in
Height: 5ft 1¾in
Wing area: 121.7sq ft
Aspect ratio: 11.2
Empty weight: 584lb
Max weight: 859lb
Max level speed: 122mph
Max cruising speed: 112mph
Min sinking speed: 4.27ft/sec
Best glide ratio: 20:1
Take-off run to 50ft: 875ft
Range with max fuel: 422 miles

Although very similar in appearance to the Alpavia Avion-Planeur RF3, the RF4 has been completely redesigned and restressed to make it fully aerobatic, with a safety factor of 13 at full loading. Three prototype RF4s were built in France by Alpavia SA but in 1966 the latter's director, Comte Antoine d'Assche, formed Sportavia-Pützer GmbH und Co K.G. with Alfons Pützer to take over manufacture of the Avion-Planeur series form Alpavia, and production of the RF4 started at Dahlemer Binz in Germany. By the spring of 1971 a total of 160 RF4Ds had been built and exported to a number of countries, this being the production version with a main spar of laminated pine, giving increased structural strength for aerobatics. All plywood covering is of Finnish birch, the Frise-type fabric-covered ailerons are aerodynamically compensated, the underside of the fuselage is now rounded instead of flat as on the RF3, and the wing/fuselage junction has been improved. Other differences from the RF3 include revised exhaust silencing and capacity of the single fuel tank in the fuselage increased to 8.4 Imp gallons, with a 5.5 Imp gallons auxiliary tank optional. A notable flight was made by M. J. Slovak in RF4D N1700, who crossed the Atlantic in May 1969 in 175hr 42min 7.11sec to win the *Evening News* £1,000 prize for the best performance in that year's *Daily Mail* air race by a light aircraft of under 5,000lb weight. Structurally the

Sportavia/Avion Planeur RF-4.

RF4D is very similar to the RF3, except for the necessary strengthening to make it fully aerobatic; the entire tail unit can now be detached for transportation, and the three-section spoilers in each wing upper surface are metal-skinned. The landing gear is very similar, with the addition of a parking brake, and a ski landing gear is offered as an optional installation. The pilot's canopy opens sideways to starboard, and there is a baggage space aft of his seat; VHF radio and an oxygen system are optional. The engine is a 40hp Rectimo 4 AR 1200 converted 1,200cc Volkswagen 'flat four' car engine driving a Hoffman two-blade fixed-pitch wooden propeller of 4ft 4in diameter; as on the RF3, this can be stopped and restarted in flight.

A later development of the RF4D was the Avion-Planeur RF7 which was very similar to it except for a wing span reduced to 30ft 10in, an increased tailplane span and a more powerful engine very similar to the RF5's. Construction of the prototype RF7 began in July 1969 and it first flew on 5 March 1970. Powerplant is a 68hp Sportavia-Limbach SL 1700D dual ignition 'flat four' engine driving a Hoffman two-blade fixed pitch metal propeller of 4ft 9¾in diameter, and the RF7 has the same fuel tankage as the RF4D. Wing area is now 108sq ft and aspect ratio is 8.8; the maximum cruising speed at sea level is now 137mph.

Sportavia Avion-Planeur RF5

FGR

Span: 45ft 1in
Length: 25ft 7¼in
Height: 6ft 5in
Wing area: 162.8sq ft
Aspect ratio: 12.25
Empty weight: 926lb
Max weight: 1,433lb
Max level speed: 124mph at sea level
Max cruising speed: 112mph
Min sinking speed: 4.59ft/sec
Best glide ratio: 22:1
Take-off run: 655ft
Range with max fuel: 472 miles

The RF5 is basically a tandem two-seater version of the RF4D and RF3, differing from them mainly in having wings of increased span, with folding outer sections to facilitate hangar storage, and a more powerful engine. Dual controls are fitted, the pupil sitting in the forward seat when under instruction, this seat being occupied by the pilot when the aircraft is flown solo. Construction of the prototype RF5, registered D-KOLT, was started in the summer of 1967, and it first flew in January 1968. Production started late that year, and a total of 145 RF5s had been delivered by the end of 1978; production ended in the spring of 1979. The RF5 received its German domestic type certification in the powered sailplane category in March 1969. The wings are very similar structurally to the RF4D's with slightly less dihedral (3° 15') at the main spar centre-line; the outer wing panels fold inwards, and the same type of metal-skinned spoilers are fitted in the upper surfaces. The wooden oval-section fuselage is made up of bulkheads and stringers, and is ply- and fabric-covered. The cantilever wooden tail unit is similarly covered, and has a fixed-incidence tailplane with a Flettner trim tab in the port elevator; the entire tail can be removed for transportation. Landing gear is similar to the RF4D's, the single Tost mainwheel having twin oleo-pneumatic shock absorbers and a manually-operated brake and retracting forward with spring assistance; there is a steerable tailwheel with oleo-pneumatic shock absorber, and small outrigger wheels under each wing, just inboard of the fold line. The powerplant is a 68hp Sportavia-Limbach SL 1700E Comet 'flat four' engine with a maximum continuous rating of 63hp and driving a Hoffman two-blade fixed-pitch metal propeller of 4ft 9¾in diameter. Two metal fuel tanks in the wing root leading edges give a total capacity of 13.8 Imp gallons. The pilot and pupil or passenger sit under a one-piece sideways-hinged Plexiglas canopy, with a small baggage space aft of the rear seat; rudder pedals are adjustable and the canopy can be jettisoned in emergency. Optional equipment includes VHF radio, radio compass, VOR, ADF, oxygen, navigation and landing lights and a rotating beacon.

The RF5D is an improved 1974 model of the RF5 incorporating the full range of improvements introduced on the RF5B Sperber in 1973, and with a more powerful (74hp) Sportavia-Limbach SL 1700ED engine.

Sportavia RF5B Sperber

FGR

Span: 55ft 10in
Length: 25ft 3¼in
Height: 6ft 5in
Wing area: 204.5sq ft
Aspect ratio: 15.25
Empty weight: 1,014lb
Max weight: 1,499lb
Max level speed: 118mph
Max cruising speed: 112mph
Min sinking speed: 2.92ft/sec at 46.5mph
Best glide ratio: 26:1 at 61mph
Take-off run: 615ft
Range with max fuel: 261 miles

The RF5B Sperber (or Sparrowhawk) is an improved version of the RF5 differing from it chiefly in having the wing span increased by 10ft 9in and the rear fuselage cut down to give improved rearward visibility from the new bulged sideways-opening cockpit canopy, and to reduce the side area. Construction of the prototype began in early 1971 and it first flew in May of that year. The RF5B

Sportavia/Avion Planeur RF5B Sperber.

received German certification in the motor glider category in March 1972, and by the spring of 1977 a total of 80 RF5Bs had been delivered; from 1979 it is only available to a firm order. In 1973 several modifications were introduced on production aircraft including an improved cabin heating system; an engine muffler to decrease exterior and cabin noise levels; an adjustable ventilation system; optional disc brakes and a wider range of instrument and equipment optional 'extras', which now include an artificial horizon, electric compass and a flight data computer. The same 68hp Sportavia-Limbach SL 1700E Comet engine as on the RF5 is fitted, although the SL 1700E1 of the same horsepower can be fitted optionally, this variant being equipped to drive the Hoffman HO-V62R two-blade three-position variable-pitch propeller that is available as an alternative to the fixed-pitch prop. All fuel is now contained in a single fuselage fuel tank of 8.6 Imp gallons capacity. The RF55, which first flew in 1972, was a modified version of the RF5B fitted with a slightly-modified 60hp Franklin 2A-120-A engine to meet overseas certification requirements; an electric fuel pump was featured, as well as a larger fuel tank; this version did not go into production.

Sportavia SFS 31 Milan

FGR

Span: 49ft 2½in
Length: 19ft 10¼in
Height: 5ft 1¾in
Wing area: 129.0sq ft
Aspect ratio: 18.6
Empty weight: 661lb
Max weight: 948lb
Max cruising speed: 112mph at sea level
Min sinking speed: 2.8ft/sec
Best glide ratio: 29:1
Take-off run: 690ft
Range with max fuel: 415 miles

This single-seat motor glider was produced by combining the Avion-Planeur RF4D's fuselage and tail unit with the wings of the Scheibe SF-27M, which is a powered version of the SF-27 Zugvogel V single-seater Standard Class sailplane. The Milan's designation is formed by adding together the manufacturers' initial letters and the numbers in the designations of these two aircraft, and the SFS 31 was produced jointly by Sportavia and Scheibe. The Milan prototype, D-KORO, made its first flight on 31 August 1969. The cantilever wings are low-set instead of in the shoulder position of the SF-27M and Zugvogel V, with 4° dihedral from the roots, and are

Sportavia/Avion Planeur SFS-31 Milan. Author

wooden structures with a pine box spar and plywood ribs covered with birch plywood and fabric; Schempp-Hirth glassfibre/metal air brakes are fitted in the upper surfaces. The SF-27M's wings were made stronger than those of the unpowered SF-27 Zugvogel V, and it is powered by a 26hp Hirth Solo vertically-opposed four-cylinder engine retracted manually backwards into the fuselage, being completely enclosed behind closed doors. The Milan's powerplant is a 39hp Rectimo (converted Volkswagen) 4 AR 1200 'flat four' engine in a conventional tractor installation, driving a Hoffman two-blade fixed-pitch or fully-feathering wooden propeller, of 4ft 4in of 4ft 5½in diameter respectively. The single fuel tank in the fuselage has a capacity of 7.7 Imp gallons. The landing gear is similar to the RF4D's, but with spring-assisted retraction of the main wheel.

SZD-45A Ogar

Poland

Span: 57ft 6¼in
Length: 26ft 1in
Height: 5ft 7¾in
Wing area: 205.6sq ft
Aspect ratio: 16.2
Empty weight: 1,042lb
Max weight: 1,543lb
Max level speed: 112mph at sea level
Min sinking speed: 3.61ft/sec at 50mph
Best glide ratio: 22.6:1 at 59mph
Take-off run: 656ft
Range with max fuel: 341 miles

The Ogar (or Greyhound) two-seater motor glider designed by Dipl-Ing Tadeusz Labuc is SZD's first aircraft in this category to go into production and is intended for training from ab initio to advanced stages, and for cross-country flying. It first flew in prototype form on 29 May 1973 with a 45hp Stamo engine mounted behind the cabin and driving a two-bladed pusher propeller; the T-tail unit is carried on a tubular duralumin boom that passes under the airscrew disc. Because the German Stamo engine was no longer in production a 68hp Sportavia-Limbach four-cylinder horizontally-opposed engine was later fitted to the prototype which was also later fitted with wing tip winglets, first flying with these on 10 September 1979. This modificatiion was devised by Mr W. Blazewicz of Warsaw Technical University. The production SZD-45A is powered by a 68hp Limbach SL 1700EC powerplant driving a two-blade Hoffman pusher propeller. In 1978 a version of the Ogar was proposed powered by a 60hp PZL-Franklin 2A-120C (later 2A-120CP) 'flat twin' engine, which is to become the standard engine for production aircraft. The Franklin-engined SZD-45-2 Ogar-F first flew on 13 March 1979. A total of 65 Ogars had been built by the beginning of 1980, and the type had been exported to both East and West Germany, Sweden, the UK and the USA. Production has now ended. Of mixed glassfibre and wooden construction, the Ogar's single-spar cantilever shoulder-mounted wooden wings have a moulded plywood stressed skin covered with glassfibre, and slotless ailerons of glassfibre sandwich construction; there are air brakes above and below each wing. The main nacelle of the pod and boom fuselage is a glassfibre/epoxy resin shell built on two wooden frames which carry the wings, engine mounting and fuel tank (up to 48.5lb of fuel can be carried) and also the tail boom. The two pilots sit side-by-side with dual controls as standard under a two-piece flush-fitting canopy, the rear portion of which opens upwards for exit and entry. The fin is integral with the tail boom and there is a fully-castoring tailwheel under the rudder plus a semi-retractable monowheel with shock absorbers and a disc brake; for flying school use outrigger legs and wheels are mounted under the wing tips.

Valentin Taifun

FGR

Data: Taifun 15E
Span: Taifun 15E, 15S – 49ft 2½in
Taifun 17E, 17S – 55ft 9¼in
Length: 25ft 6½in
Height: 7ft 1in
Wing area: Taifun 15E, 15S – 176.0sq ft
Taifun 17E, 17S – 189.4sq ft
Aspect ratio: Taifun 15E, 15S – 13.8
Taifun 17E, 17S – 16.4
Empty weight: 1,058lb
Max take-off weight: 1,598lb
Max speed: 165mph (in smooth air)
Max cruising speed: 132mph
Min sinking speed: 3.25ft/sec at 54mph
Best glide ratio: 28:1 at 75mph
Max rate of climb: 531ft/min at sea level
Range with max fuel: 652 miles

The Taifun two-seater motor glider was designed by Thomas Fischer and Dipl-Ing Jörg B. Stieber for Valentin GmbH Gerateund Maschinenbau, makers of high-quality aircraft switches. The prototype, a Taifun 17E registered D-KONO, made its first flight late in February 1981, when more than 25 had been ordered; construction of the prototype had begun in July 1979. Four versions of the Taifun will be produced: the Taifun 15S is the basic model with 15m span wings and a fixed tailwheel undercarriage, the Taifun 17S has the same undercarriage as the 15S and 17m span wings, the Taifun 15E has 15m span wings and a retractable nosewheel undercarriage, and the Taifun 17E has the same undercarriage as the 15E but has 17m span wings. The Taifun is a cantilever low wing monoplane with a T-tail; the one-spar wings and ailerons are of glassfibre/foam sandwich construction, with all-glassfibre flaps. The wings can be folded flat along the fuselage for easier hangar stowage, and Schempp-Hirth air brakes are fitted in their upper surfaces. The stressed skin fuselage is also a

glassfibre/foam sandwich structure as are the fixed-incidence tailplane and elevator. All versions have disc brakes on the main wheels, and the nosewheel of the 15E and 17E is steerable; the undercarriage of both these variants is fully enclosed when retracted.

Vickers-Slingsby T 61E Venture

Data: Venture T Mk 2
Span: 50ft 0¼in
Length: 24ft 9¼in
Height: 6ft 0¾in
Wing area: 195.9sq ft
Aspect ratio: 13.8
Empty weight: 827lb
Max weight: 1,350lb
Max level speed: 92mph
Min sinking speed: 3.28ft/sec
Best glide ratio: 22:1
Take-off run: 650ft
Range: 248 miles

Slingsby Sailplanes – now Slingsby Engineering Ltd (Aircraft Division) – began production under licence of the Scheibe SF-25B Falke two-seat motor glider as the T61, construction of the first Slingsby-built example beginning in April 1970; a total of 35 were built. The T61 and T61A have the 45hp Stamo MS1500-1 engine with manual starter as fitted to the SF-25B, whereas the T61C has the Stamo MS1500-2 with electric starter. With the firm's long record of supplying gliders for the needs of the Air Training Corps, it was not surprising that the possibilities of a motor glider such as the T61 for ATC training should be considered, especially its time-saving potential in being able to dispense with winch launches and retrieving vehicles, and its ability to continue flying in weather when unpowered sailplanes were grounded. A prototype Slingsby-built T61 serialled XW983 was evaluated as the Venture T Mk 1, and this led to an order for 15 of a special version, the Venture T Mk 2, by the Ministry of Defence (Air) for Air Training Corps use. The first production T Mk 2, serialled XZ550, made its first flight on 2 July 1977 and deliveries began that autumn. A total of 19 T61F Venture T Mk 2s had been completed by the beginning of 1980. The T Mk 2 differs from previous Slingsby- and Scheibe-built SF-25Bs in having a special glassfibre spar encased in plywood and many other glassfibre components are employed. Use of this material in the spars and elsewhere both reduces the empty weight and increases the maximum permissible take-off weight, and hence payload. New glassfibre seats are also featured of improved comfort and designed to reduce the hazard of loose articles slipping under the seat into the control area. The powerplant is a 45hp Rollason Ardem 'flat four' of 1,600cc driving a two-blade fixed-pitch propeller; this is a version of the Volkswagen car engine modified by Rollason Aircraft and Engines Ltd of Shoreham, Sussex, and has single ignition and an electric starter.

The T61G Falke is a civil development of the Venture T Mk 2, with a 60hp Limbach SL 1700EA 'flat four' engine driving a Hoffman two-blade fixed-pitch propeller (a variable-pitch one can be fitted if desired).

The pilots are seated side-by-side under the rear-sliding canopy, with dual controls as standard. Engine is an 80hp Limbach L2000 EB 'flat four' driving a Hoffman HO-V62 three-position two-bladed propeller.

UK

VTC SSV-17

Span: 55ft 9¼in
Length: 23ft 11½in
Height: 9ft 3¾in
Wing area: 199.1sq ft
Aspect ratio: 15.65
Empty weight: 943lb
Max weight: 1,472lb
Max level speed: 155mph (power on)
Cruising speed: 99.5mph (power on)
Best glide ratio: 29:1 (unpowered)
Min sinking speed: 2.79ft/sec (unpowered)
Take-off run: 820ft
Range: 497 miles

This two-seater powered sailplane was developed jointly by VTC of Yugoslavia and Sigmund Flugtechnik of West Germany, under the design leadership of Dipl-Ing Alfred Vogt and Dipl-Ing Ivan Sostaric. The prototype, registered YU-M6009, made its maiden flight on 24 June 1972 in the hands of VTC test pilot A.Stanojevic; it was certificated in May 1973 and an initial order for 10 was placed by the end of that year. The SSV-17 is a low-wing monoplane of glassfibre sandwich construction with a conventional retractable undercarriage, seating two side-by-side; it resembles the Rumanian IS-28M2, but has a swept-back fin and rudder and a low-set tailplane; the fin spar is of steel tube. The wing has a light alloy main spar and Schempp-Hirth air brakes above and below, but there are no flaps. The fuselage is a semi-monocoque structure and the fuselage/wing centre section, 6ft 6¾in wide, forms the cabin floor and also serves as the wing spar carry-through structure. The main wheels have coil spring shock-absorption and retract upwards into 'knuckle' fairings, remaining semi-exposed when retracted to minimise damage in a wheels-up landing. The tailwheel is fixed and steerable. The powerplant is a Franklin 2A-120-A two-cylinder horizontally-opposed engine of 60hp driving a two-blade Hoffman propeller; but following the Franklin Engine Co's cessation of engine manufacture the rights to produce and market this company's range of air-cooled piston engines was acquired by Pezetel of Poland in 1975, to power such types as the Polish-built PZL-110 Rallye. Alternative engines of similar size and power to the 2A-120-A could be fitted. It is believed that only the initial batch of 10 SSV-17s was built.

Yugoslavia

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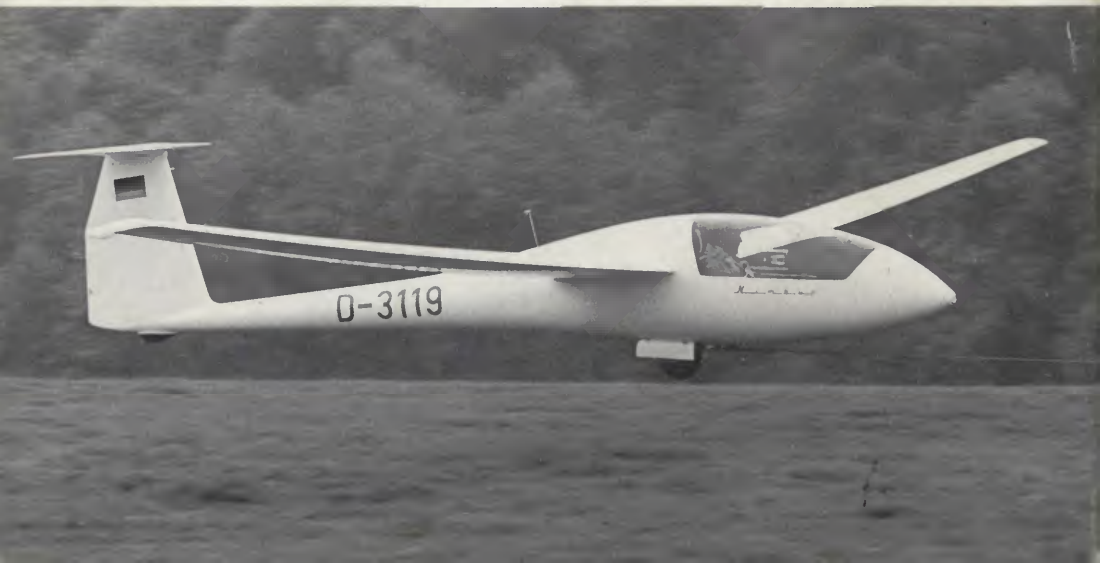
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