MOTORGLIDING

JUNE-JULY 1976
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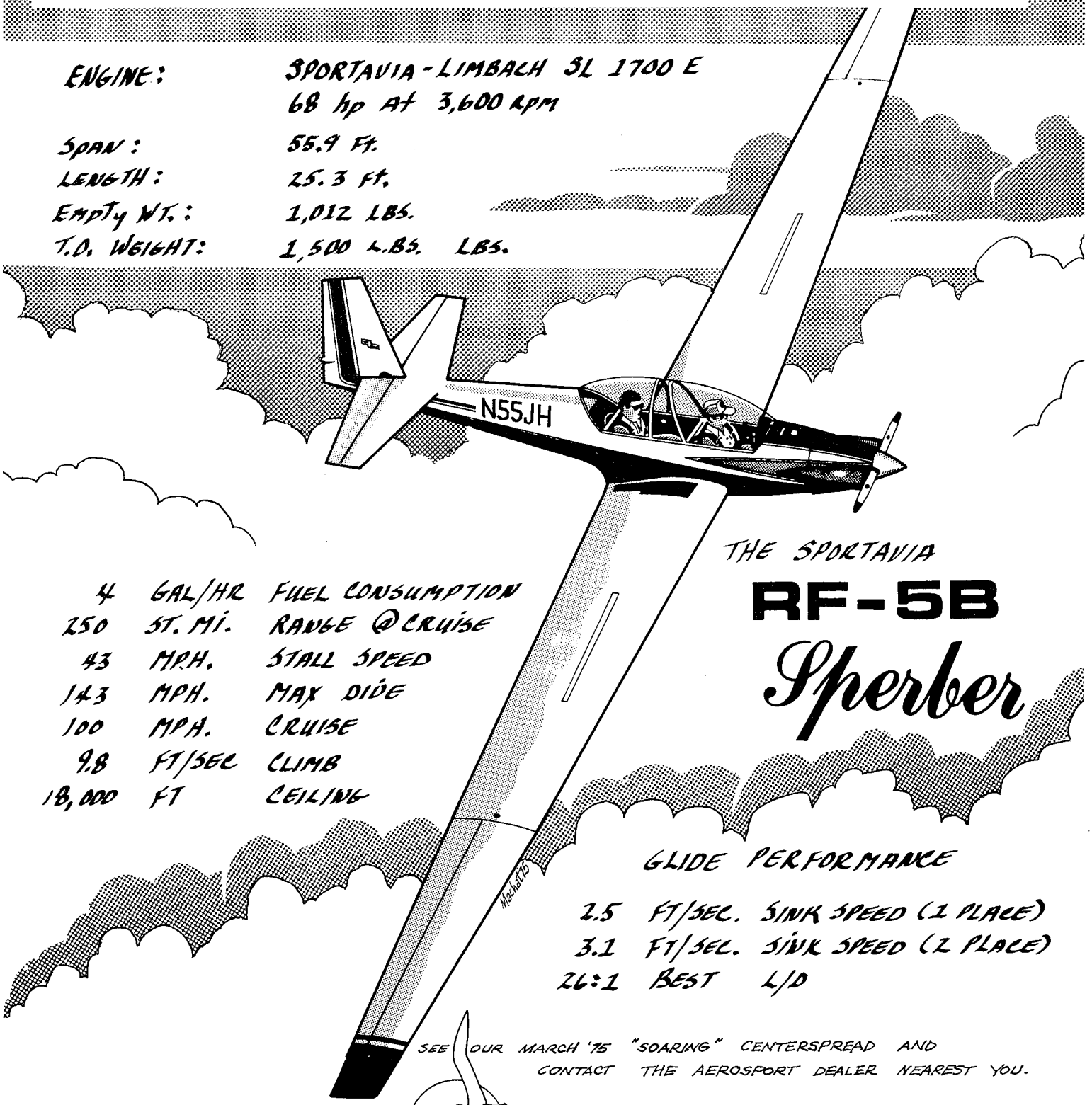
T.O. WEIGHT:	1,500 LBS. LBS.



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MOTORGLIDING

Donald P. Monroe, Editor

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MOTORGLIDERS: STATE OF THE ART

by Robert W. Tawse

Motorgliders—this name is rather an objectionable term to me. It implies a low performance, noisy vehicle, somewhat akin to the "stink pots" of the boating groups. Better sounding terms have been suggested, such as self-launching sailplanes and auxiliary powered sailplanes, however, the name motorglider has stuck.

Before discussing the present, I would like to put it in proper perspective by saying a few words about the past. Some 50 years ago, in 1924, there was the first powered sailplane design contest at the Wasserkuppe. As you recall, the W.W.I. treaty did not allow the Germans to put motors in aircraft; this was one of the early attempts to sneak by. There were two entries, one of which has been chronicled; that of a Willie Messerschmitt—who became quite famous 15 years later with another aircraft. His entry was a biplane, powered by a 500-cc motorcycle engine. It never did get in the air as the chain broke on takeoff and the propeller flew off. History doesn't mention the other entry.

In this country in 1945, Hawley Bowlus teamed with Ted Nelson to build the *Dragonfly*. A two-place, side-by-side, pod fuselage with a pusher motor. It has an L/D of 18. It was the first and only motorglider to be certified in this country. In 1953 Harry Perl and Ted Nelson built the beautiful *Hummingbird* which was a tandem two-place with a retracting motor; truly a *Cadillac* of its time and had a still respectable L/D of 25. In the mid 60 s Scheibe built the *Motorfalke* with a converted VW motor, an extremely rugged aircraft and used extensively on the continent for training. Over 400 have been built, more than any other motorglider. In 1967 Schleicher produced the single-place AS-K 14 with the wings and tail of the popular Ka-6 and a new fuselage with a retractable gear and a feathering prop. L/D was 29. In 1970 Scheibe came back with the SF-27M, an improvement of the *Zugvogel III* with a completely retracting motor and laminar flow wings—upping the L/D to 33. The following year Fournier put the Scheibe wings on an RF-4 and came up with the *Milan*. None of these aircraft are any longer in production; which brings us up to the present.

In the single-place field there is only one aircraft in production and that is the *Motor Nimbus II*. This is a conversion of the regular *Nimbus II* sailplane altered only by the addition of an electrically retracted 50-hp Hirth engine on a pylon. The wing was moved four inches aft to compensate for the 130-pound motor installation, but no changes were made in the spar attachments, flaps or ailerons. A larger *Janus* elevator was added and, as one might expect, fuel is stored in the wing. Klaus Holighaus says that the flight characteristics are indistinguishable from the regular *Nimbus* and there are no trim changes necessary with motor retraction. I had the pleasure of flying against it with an AS-K 14, but it was no contest, especially when flown by Klaus himself. This winter the prototype was to go to South Africa where I'm sure its owner and benefactor, Willibald Colle' will collect all of the international motorglider records.

A *Standard Cirrus* was converted by Helmut Reiter, a young West German who spent some time in this country working for Boeing and published several articles in *Motorgliding*. His conversion uses the same motor in a similar installation and, of course, similar weight which gives a spectacular climb but does deteriorate the soaring performance.

In the two-place field there are several aircraft in production. The Schleicher AS-K 16 with an 18-meter wing; side-by-side seating and a Limbach VW motor with a feathering prop. Hans-Werner Grosse and Rudy Kaiser flew it at the Burg Feuerstein meet in 1974 and I had a hard time staying ahead of them with my single-place ship. The Sportavia *Sperber* is by far the most common motorglider in this country today, there being about 25. It has a 17-meter wing, tandem seating, Limbach VW motor and a very neat folding wing which can be done in a minute or so and allows it to be hangared in an ordinary T hangar. It is a comfortable cross-country airplane and is usually well instrumented. It has an L/D of 27 and reasonable soaring performance even with two. Scheibe, not to be outdone, has cleaned up their *Motorfalke* with an 18-meter filled wing and increased its performance, but, I will say that it still has the beauty of a bulldog.

These then are the present production ships—what about the future? In the single-place field the most promising is the Scheibe 32. Egon Scheibe has the ability to stretch the Deutschmark quite far. The fuselage is a refined 27M steel tube with GFK covering and the 17-meter wing is from the Swiss Albert Neukom *Elfe* which is plywood with plastic honeycomb. The motor is an Austrian Rotax, electrically retracted, dual ignition and a large muffler to make it quite silent, which is a very large problem for aircraft on the continent today. The L/D is projected at 37. It looks interesting enough to me to consider trading my AS-K 14, particularly when the price is to be less than $15,000.

Another interesting project is Stan Hall's *Oryx* which is directed primarily towards the homebuilder, but will have an acceptable performance. Unfortunately, this got sidetracked by his foot geared sailplane—or his cross-country hang glider (which ever you prefer). Hopefully, he won't break a leg and will get back to it. Vern Oldershaw of Bakersfield, California has worked out an extremely neat retractable propeller connecting into a Japanese snowmobile motor which is fixed in the fuselage of his 17-meter 0-3. He has demonstrated this the last two years at Oshkosh and it looks useful. Another exhibitor at Oshkosh this year was the *American Eaglet* from Muskegon, Michigan, which is a fiberglass pod fuselage, pusher propeller and a very distinguishing inverted V tail. It also is directed toward the homebuilder and construction is quite simple and inexpensive. Performance should be in the range of a 1-26. Its problem has been trying to use an extended prop shaft. Many have looked longingly at the Schweizer 1-35 as a very suitable platform for a motor with its ability to carry weight and all metal.

In the two-place field there are several prospects. Scheibe has announced a motorized *Bergfalke IV* using a Colle-Hirth motor on the usual pylon which is electrically raised. Performance is comparable with the plain *Bergfalke III* and *IV*—it is reasonable. The Romanians have shown the M-2 which is all metal, side-by-side, 17-meter wing and a published L/D of 29. They also have an M-1 which looks identical to the *Sperber*, but is all metal and with a T-tail. L/D of 32.

Let's leave the future and get back to some of the technical problems of the present, the biggest of which is the motor. It should be readily available, reasonable in price, reliable and probably with dual ignition. In the two-place field the Volkswagen conversions have served admirably and probably will continue to do so. For the single-place, the 26-hp Hirth served for many, many years, being designed in 1935, however the company is now bankrupt and there has been no suggestion, to my knowledge, of it being reopened. There are several snowmobile motors which seem suitable; aircooled, lightweight and around 30-35 hp, however, product liability has been a problem and Rockwell has flatly refused to allow any of its motors to be used in aircraft. The U.S. Government has recently put out several grants for motor development for remote piloted vehicles (drones). These are to be in the range of 5 to 60 hp. Hopefully there will be some spin-off from this. Position of the motor with its streamlining has been solved in various ways: conventional mounting with a feathering propeller; a folding propeller; a retracting propeller; a retracting motor and even an extended shaft propeller. Another is an asymmetrical mounting in the trailing edge of the wing of a Ka-8. It worked quite well—providing you had a very strong wing runner, fast enough to make the rudder effective. Otherwise it went in circles. The obvious solution to this problem was to go twin-engined—which flew very well but was quite noisy. On the other hand, one design was a retracting prop which was two meters in length and geared so slow you could almost count the revolutions. It was silent.

The added weight of all the parts is generally figured at 120-130 pounds, which when added to a standard class wing, does raise the wing loading and deteriorate performance. This is much less true in the open class ships and apparently for acceptable performance 17 meters will be minimal as is 15 meters necessary in a non-powered sailplane. Retractable components seem necessary in spite of the added trim changes, weight and complexity. Motorgliders, like any other aircraft, are a study of compromises.

One last problem to touch on is that

of certification of motorgliders in this country. American production hinges on this entirely, without it, no American motorgliders. Schweizer has sponsored almost yearly meetings with the FAA. They politely listen and for the most part agree with what we say, but nothing gets done. Unfortunately, motorgliders are a small group and can exert little pressure. The Canadians (see box) have finally managed to get through a certification program which for the most part follows the F.A.I. definition of motorgliders. One could live with these restrictions, but it is conceivable that our FAA might be even more restrictive. One point they keep coming back to is the limitation of the fuel supply, which would hurt. Many feel we might lose more than we gain by certification. A suggestion has been to allow foreign certified aircraft to be used for flight training. It would be a toehold, but certainly not helpful to American manufacturers.

Next, I would like to pose the question of why have motorgliders in the first place? I want to spend a few minutes to attempt to justify the existence of motorgliders to all of you "purists" in the audience, and I do realize that I'm in a severe minority. First of all, let me make one point: all motorglider pilots have progressed on from the glider ranks. I know of no pilot that has come down from powered aircraft and has not gone through gliders first. We are rather used to being looked down on by the "purists", so please remember all of us were soaring pilots first. Now, why did we go to motorgliders? There are various reasons but one stands out, most of us are "loners" either by geography, by design or because of lack of a crew. You out there have remained purists simply because you were able to solve these problems; whereas we couldn't. In my own instance, I was trying to fly my 1-26 out of our local tower-controlled field because I didn't have the time to drive to the nearest glider field and then have to wait for a tow plane. Since I was the only enthusiast in town, it had to be a single-handed operation. First was to make sure there was a 172 available to screw on my own tow hook; then hope that a suitable pilot would be back from instructing or charter to fly it within a reasonable period of time. the 1-26 was on a dolly so after a check with the tower I then pulled it out behind my car, off the runway, unreeled the tow rope, called the F.B.O. on unicom and then waited for him to preflight, start up and taxi out. I would connect the rope to both aircraft, don my chute, climb in and signal. The tow pilot would get tower clearance, which usually came promptly simply because frequently we were holding up the active runway. Needless to say, by the time I got in the air I was exhausted—to say nothing of the fact that the towplane was on the Hobbs meter and frequently my tows cost over $20, and that was six years ago. Since I had no crew most of the flying was local and the constant mixing of jet traffic was not conducive to a relaxed afternoon, neither on my part nor the tower operators. On exceptional days I would try some cross country, which I really enjoyed, but outlandings meant a hitch-hike into town to pick up the trailer and back out to the glider. After two seasons of this, I was ready to give up, but an afternoon with Rudy Mozer and his AS-K 14 put new light on the subject. Now I can leave my office and be in the air in 15-20 minutes, all without help, and every flight is a cross country. If there is a little extra time at lunch and the clouds look good—an hour or so up there certainly makes it easier to face the afternoons' problems. Now, I ask: how many of you can do that? The majority of us are

CANADIAN REQUIREMENTS

Glide ratio at least 1:20
Approach glide less than 1:8
Stall speed less than 45 knots
Gross weight less than 1985 pounds
2 seats or less
Rate of climb at least 300 meters in 4 minutes (240 ft/min)
Power loading less than 1 hp/20 pounds (50 hp/1000 lb)

PILOTS REQUIREMENTS

Private pilot exam
15 hours in gliders, at least 5 in powered gliders
Restricted to 25 miles of airport until 45 hours time and in VFR equiped aircraft (ELT, etc)

quite limited as to time and when time is available you want to make use of it—good weather or bad. The motorglider does allow a pleasant afternoon even on marginal days, it is surprising what you can find on some days. You say that it takes all the sport out when you can fire up the motor and get out of a tight spot—which is true—but I would liken it to a golfer picking his ball up out of a sandtrap; it's cheating, plain and simple and all of us will spend an hour or so in negative sink over a parking lot, trying to get away.

Each year soaring loses many of its enthusiasts because they become disillusioned with the problems of soaring; availability of gliders, waits for tow planes, local soaring because of no crew or rental restrictions, mediocre weather and the like. My plea is that when you spot one about to give up, steer him towards the "putt-putts" —he may well stay in the group; remember, all of us were soaring pilots first. Another big reason for motorgliders is in instructing. I'm sure you are aware of its extensive use in England and the continent. The rugged Scheibe *Motorfalke* with its side-by-side seating and simple VW engine makes an admirable trainer. It is far more efficient in the instructing of airwork, landings, soaring flight and cross-country. One gets a full hour for an hour, even to the point of touch-and-goes. All that remains is the instruction in towing and the final put together. Unfortunately, in this country, the lack of ATC'd ships is a problem. The Chico California Club has found it feasible in confines of the club. The increased initial cost is very quickly offset by the freedom from tows.

One last point to discuss. Most of you here are competitive in spirit and certainly this is the acme of soaring flight. Where do the motorgliders stand? Unfortunately, almost at the end of the line. As I said before, most of us are "loners", and not competitive by nature. We have attempted to have contests but there are too few to make it practical. I have joined in local contests and have enjoyed fighting it out with other Ka-6s and especially enjoyed occasionally floating over a glob of glass on the ground on marginal days; however, this is really not competition. My AS-K 14 can't do better and my pocketbook can't go the *Nimbus II* route. Incidently, there is roughly a $7,000 premium for the motor in that airplane.

Each year the Germans sponsor an International Motorgliding Contest at Burg Feuerstein in Southern Germany. The year before last I had the pleasure of being the first American entry—truly a delightful experience. There are three classes: high performance singles, high performance two-place and the club two-place. To me the club class was the most interesting, frequently a husband-and-wife team, some of whom had to be newly-weds; others had hair a lot grayer than mine. The competition was keen, but they had a ball and I wasn't always sure who was flying the airplane. Motorglider contests do have some interesting rules. First of all—you are disqualified for off-field landings, you must land back at the airport. Scoring gives you points for a fast time, and all are speed tasks, and penalizes you severely for each minute you have to use the motor. Pilot briefing and opening and closing of the gates are usual, but there is no start board or grid. When the weather looks good, you fire up in the tie-down area, taxi out and take off. Someone with flags waves you off, keeping some separation, but there will be three or four ships on the runway, one after the other, so that 60-70 ships are off in 20-25 minutes. The start line is the same but the finish is different—it must be crossed *above* 200 meters; giving plenty of altitude for a non-hurried approach and landing. A definite safety factor you purists might well look into, the finishes aren't flashy, but no wings are lost in the pull-ups and there have been no near-misses. During the contest the use of the motor is recorded on a mandatory barograph. On landing one turns in both the turnpoint camera and the barograph for scoring.

What do we do in this country? We have rallies; once or twice a year—Mojave Desert, Sugarbush, Bald Eagle Ridge. We fly all day, rain or shine, and talk well into the night, just like any other soaring nut. Remember, we were soaring pilots first!!!

FOREIGN SCENE

by S. O. Jenko, Dipl. Ing. ETH
AMTECH SERVICES

Samburo—the Austrian APS

The German *Flieger* (November 1975) published a short article about a new Austrian auxiliary-powered sailplane *Samburo* (it certainly doesn't look or sound like a German word!). It was developed by the Alpla-Werke Alwin Lehner oHG of Hard (Vorarlberg), carrying a model designation AVO-60 or -68 (the number designates the horsepower).

Samburo is a low-wing APS with folding outer wing panels. The 41.4 inch wide fuselage features side-by-side seating. The large canopy slides backwards. There is a fixed main wheel (partly faired), a steerable tailwheel, and the wingtip boards house small wheels. The tail surfaces are of conventional design.

Power is provided by a Limbach engine of either 60 or 68 horsepower at 3550/3600 rpm. The 68-hp engine can be equipped with a variable-pitch propeller.

Technical Data:

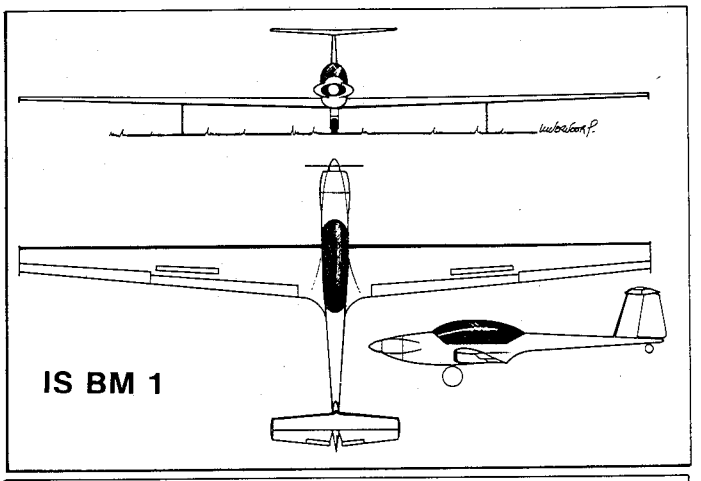
Wing span (folded span 32.8 ft)	54.6 ft
Wing area	223 sq ft
Empty weight	990 (1005) lb
Gross weight	1430 (1472) lb
Max. speed	106 (118) mph
Stalling speed	37 mph
Min. sink	2.8 (2.9) ft/sec
at	46.5 mph
Best glide ratio	22 to 24
at	49.7 mph

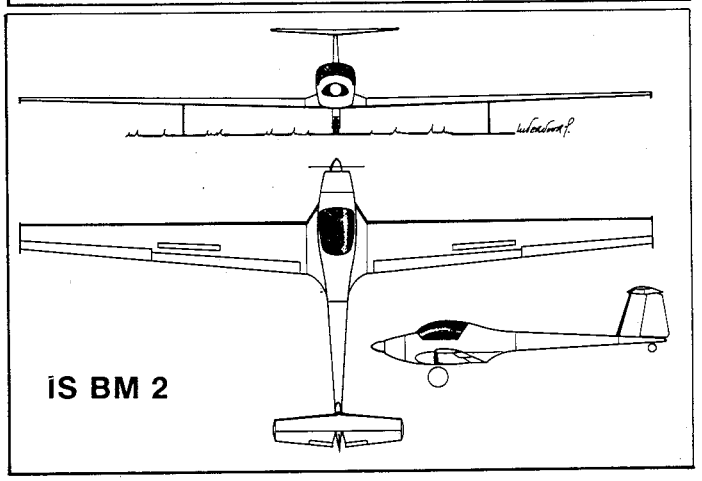
Note: the values in () are for -68 model.

Two New Romanian Auxiliary Powered Sailplanes

The August 1975 issue of the French *Aviasport* contained a brief description of two Romanian auxiliary-powered sailplanes, the IS BM 1 and IS BM 2. These new designs are based on a project shown at the exposition "Salon du Bourget 1973", which in turn evolved from a previous two-place sailplane design (see Foreign Scene, November 1973 *Motorgliding*).

The new design is available in two versions, featuring a choice of either side-by-side or tandem seating arrangement. The





wing panels, tail surfaces and the rear fuselage cone (beyond the cockpit) are common to both configurations.

The undercarriage consists of a retractable, sprung main wheel and there is a steerable tailwheel. Two outriggers are also provided.

The BM 1 model is equipped with a VW Limbach engine (SL 1700) developing 60 hp with a variable-pitch and feathering propeller. The BM 2 version may have the VW Stamo MS 1500/2 engine (48 hp). However, most likely both models will eventually feature the more powerful engine in order to provide excellent takeoff performance.

Technical Data:

	BM 1	BM 2
Wing span (ft)	55.8	55.8
Wing area (sq ft)	196	196
Empty weight (lb)	1010	968
Gross weight (lb)	1495	1430
Wing loading (psf)	7.6	7.3
Rate of climb (fpm)	512	434
Min. Sink (fps)	2.7	2.8
Best glide ratio	30	29

Noise Reduction of Limbach Engines

As pointed out in Foreign Scene previously (December 1975-January 1976 issue of *Motorgliding*) the noise reduction of engines is a top priority item in Europe. Aviation is by no means exempt and auxiliary-powered sailplanes are included. In order to fly the regulations must be met.

One way of meeting the noise requirements is by engine redesign, i.e., lowering the engine rotational speed (rpm) without reducing the power output. This is by no means a new approach. It is well known that the power output of an internal combustion engine is proportional to its rotational speed. Thus a reduction of engine speed will result in a decrease of power output—unless the engine is redesigned.

The German *Aerokurier* (November 1975) published a very interesting article about the efforts of the well known but small and progressive Limbach engine company. Highlights of this article are presented here for better understanding of the subject matter.

It is known that the propeller noise exceeds the engine noise. In order to lower the propeller noise the propeller's rotational speed must be reduced, also its design changed. The usual way to achieve this aim is to employ a reduction unit, resulting in a weight and cost increase.

A better way is to increase the cylinder's displacement whereby the power output remains the same but at a lower engine speed. In most cases only the cylinder bore is increased although the stroke may also be lengthened. The weight increase is very small as compared to the weight of a reduction unit (several pounds)—not to mention the increase of the frontal area. In addition, there are no suitable reduction units commercially available for four-sylinder opposed engines of 50 to 100 hp. They would have to be developed—when the funds become available.

Limbach engine company solved this problem with the SL 1700 ED engine which is currently installed in one of the RF-5B *Sperbers*. The advantages of this engine as compared to the original SL 1700 E are quite obvious (see table below):

However, the engine speed cannot be lowered below 2500 rpm because of encountering valve problems.

(One should keep in mind that VW engines are automobile engines which have been adopted and modified in various ways for homebuilt aircraft for the past several years.)

While much more devleopment work should be carried out in this area, the biggest problem is funding, which for a small organization is the limiting factor. Even so, the new Limbach engines with newly-designed Hoffmann propellers contributed much to substantial reduction of the total noise level. Hopefully further work in this area should lower the noise 10 dB(a) below the present allowable level—a FAA aim of the future.

With a lower engine speed a larger diameter propeller can be used, resulting in better propeller efficiency (also increased APS takeoff and climb performance) and, of course, less noise—a long time desire.

Various Limbach engines are used by most auxiliary-powered sailplane manufacturers in their two-place designs. Of special interest is the 2.3-liter engine SL 2300 EB I currently under development. It is rated 80 hp at 3000 rpm. If approved by the FAA it could also be used in older powered light aircraft such as Piper J-3 and others still flying in various parts of the world.

(Unfortunately the VW engines are not suitable for single-place auxiliary-powered sailplanes. So the search is going on....)

Engine	Bore	Stroke	Displacement	Power Takeoff	Power Cont.	Weight
	mm		cu. cm	hp/rpm		kg
SL 1700 E	88	69	1680	68/3600	60/3200	73
SL 1700 ED	90	74	1882	75/3600	65/3000	74

EXPLORING THE POSSIBILITIES OF A TAILLESS POWERED SAILPLANE

by M. A. Zimmerman

Having been co-owner of a 60 ft German Condor for about 10 years, and driving anywhere from 30 to 160 miles to fly—need any more be said? In fact, the primary glider that I designed, built, and learned to fly in (or is it *on*) in the late twenties almost became an auxiliary-powered glider.

About this same time (the twenties), some lift-off tests of a tailless machine took place at the Cleveland Airport where NASA now has a research facility. This aircraft was a French design by Abrial, and was a low-wing, sweepback design, with pusher engine, tricycle landing gear, and wingtip rudders. My past-two-year study on the tailless powered sailplane concept has reminded me of this unusual aircraft, and the memory of the inverted wingtip airfoils, the absence of empennage, and the very confusing impression that it was flying—but shouldn't.

This incident was forgotten until recently when a series of NACA papers were unearthed, including a picture of the Abrial along with much information by Lippisch, Fauvel, Lademan, De Lajarte, and a design by NACA, tested in the Langley spin tunnel.

After much consideration, a design based on the Fauvel-Marske style, with reflex airfoil, was selected to work with, and many hand-launched balsa models were made. These models, with 18- and 36-inch spans, using an 18:1 aspect ratio, were used to test for possible yaw difficulties. The first few models, with reflex thin airfoils, showed glide ratios of about 10:1. However, further experimentation, incorporating reflex only from wing root to the 30% semi-span point and using a standard thin undercamber section for the remainder of the span produced glide ratios of around 15:1 without loss of pitch stability. It was also found that with 5^{o} or 6^{o} dihedral, a no-yaw condition existed up to a high angle of attack with full up elevator. With *no* vertical fin or rudder, the no-yaw condition was fair with a 12^{o} dihedral.

At this point, a tentative, full-scale design was drafted to run a weight and balance under various load distribution conditions. With pilot and passenger loads located so close to the required c.g., an acceptable c.g. shift of only one inch was achieved between solo and maximum loading. This shift of c.g. is well within the allowable 2.25-inch shift limit. The drawing shown is the fifth revision with design work fairly complete, including vector analysis.

The major features of the aircraft are as follows:

1. A 230-series airfoil, as stated on the drawing, incorporating a method of reflexing the outer 23012 wing panels with the ailerons, for some flight conditions, but still allowing better L/D with ailerons neutral for minimum sink.
2. A wing placed such that the leading edge is at pilot eye level, enabling vision above and below to the rear. This position also eliminates wing-fuselage juncture airflow problems, and keeps the wing tips out of those tall weeds on sod fields.
3. Engine mounted in the nose of the aircraft to reduce cooling and engine control problems. Nose mounting the engine also helps the weight and balance picture.
4. A rotationally-positional, feathering, rear-mounted propeller will also reduce drag.
5. Engine power will be transferred to the propeller via a V-belt reduction drive unit between the engine and propeller shafts. This reduction unit is located just behind the main wing spar to keep the drive shafts short.
6. A tricycle undercarriage, with 10-inch diameter main wheels, for handling ease, gives little more drag than the usual faired center wheel and outrigger casters.
7. The outboard wing panels will fold to give a hangar package 7 x 15 x 24 feet. The center section can be detached for trailering.
8. Conventional construction consisting of steel tube and fabric pod, with fiberglass nose shell, and wood and fabric wings using many foam ribs in the "D" section.

Here, I guess, a description of the prime mover is in order. The engine is a four-cylinder, in-line, overhead rotary valve, four stroke cycle of 800 cc (49 cubic inch) displacement. Dynamometer tests of this engine indicate 50 - 54 horsepower at 6800 rpm. The weight, with flywheel, alternator, and starter, as shown in the pictures, comes just short of

110 pounds. Of course, carburetor, radiator, hoses, coolant, and oil bring the weight up to some 140 pounds.

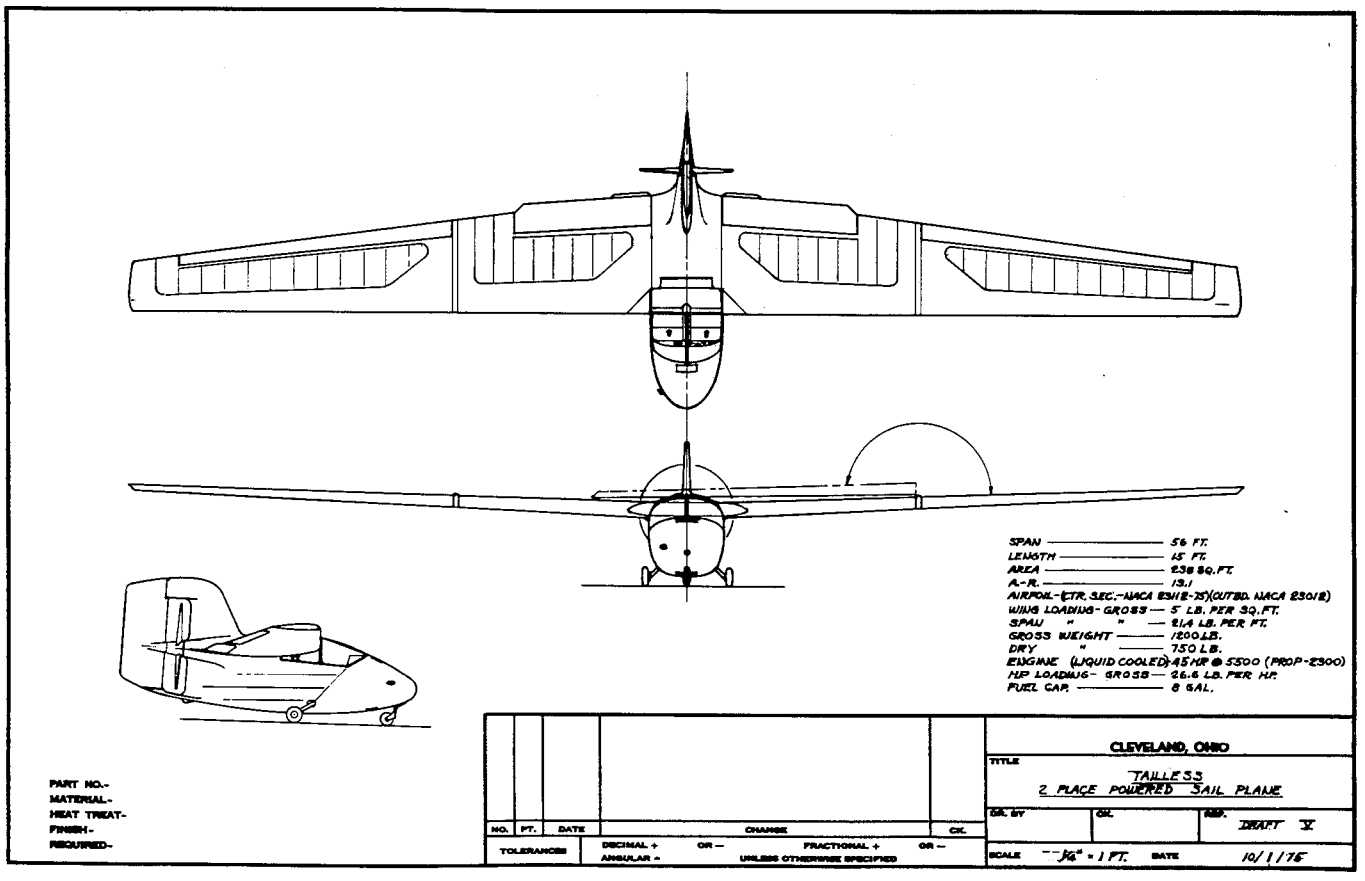
This rotary valve engine is the result of my 20 years of experimentation. The rotary valve allows a 12.5 : 1 compression ratio to be used with 87 octane, no-lead, automotive gasoline. The average fuel consumption from full load down to half load at 5500 rpm is 0.47 lb/hp/hr.

When mounted in the nose of the fuselage pod, cooling air is picked up through a door in the high pressure area below the nose. This air is routed through the engine compartment, through the horizontally-mounted radiator above the engine, and exhausted from the door just ahead of the canopy. Naturally, both doors are closed during power-off flight, which also keeps the coolant warm for relatively infrequent re-starts.

During the early part of 1974, a suggestion by Dee Harwell was made to the effect that possibly some knowledge could be gained by building a radio control, scale model of this aircraft using his help. Dee has been fussing with R.C. models since the beginning and really knows how to build and fly these skittery things. So, figuring that the cards would be somewhat stacked in our favor, I worked up a 1/5-scale machine with a scale airfoil.

The wing loading follows the Lippisch early model tests at approximately 1.5 lb/sq. ft. Checking the model's stall characteristics, and Reynolds Numbers, I now believe that the wing loading should be more in the neighborhood of 0.7 - 0.8 lb/sq ft. The blunt nose, 14% Fauvel airfoil probably would improve the stall characteristics for this scale size and weight.

We have found it mandatory to use washout at the tips because of the very low Reynolds Numbers involved at stall. If the stall of the model occurs at 25 mph, with a tip chord of 7 inches, the Reynolds Number would be roughly 100,000. At full scale, stall speed would be some 38 mph, and with a tip chord of 36 inches, the Reynolds Number is approximately 900,000. In the model, this condition also appears in the stall angle, which occurs at approximately 10^{o} - 11^{o} angle of attack. The NACA report for this airfoil indicates stall should occur at 15^{o} - 17^{o} angle of attack at high Reynolds Number. Due to the lack of elevator moment arm (full scale), the 15^{o} angle is not easily reached during slow flight with correct weight and balance.



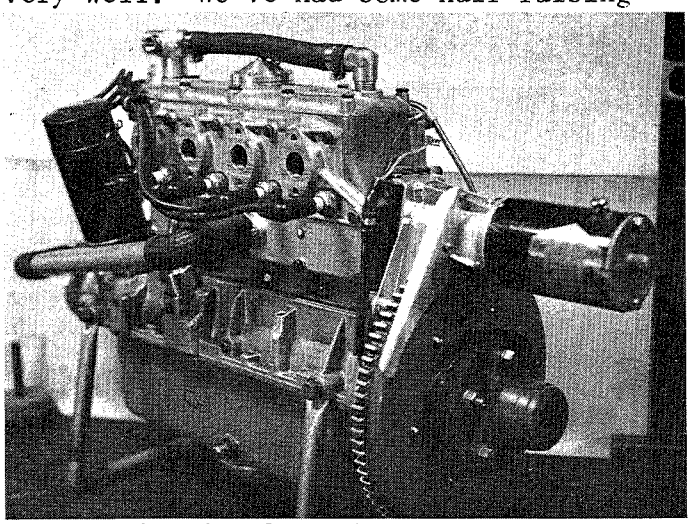
Learning to fly this bunch of balsa, as a tail dragger, was very interesting. Taxi tests showed it to be better balanced than most models on short, fast turns, with no wing digging. However, trial takeoffs were something else. Normally, the average model tail comes up, and after a short, easily controlled run, the aircraft lifts off. No so with out baby. The tailwheel lifted, and it immediately headed West or East from a North start and over-corrected barely moving the rudder due to prop blast. However, with all this sidewaggle going on, it started to lift, then settle, then lift, until the porpoising ended with a mighty leap into a stall. Well, after an unduly amount of mending, and a long conference, we decided to try a run and lift with full-up elevator, along with the reflexed ailerons, using the tailwheel to steer. No problems! All subsequent lift-offs were Ho Hum.

Next came the observation of flight characteristics. It was found the darn thing flew beautifully, making perfect aileron turns (full aileron deflection set 35° up and 10° down), but needing a bit of up elevator on rudder turns. It trimmed out stick-free in level flight at 40 - 60 mph with the elevator trim at 3° up. At speeds up to 80 mph, about 7° more trim was required because of the nose-down moment from the broad canopy slant (more later). Hunting yaw was experienced near stall when the c.g. was set at 20% mean aerodynamic chord (MAC), but this disappeared when the c.g. was moved to 17% MAC. Forcing yaw into a sideslip seemed to work very well. We've had some hair-raising stalls at altitude, with immediate left (?) wing drop, but could catch it with quick down, then up elevator on rollout. To determine the flight angle, without the conventional tail and fuselage, when the aircraft is higher than 200 feet in the air is not easy. With the engine at just above idle, and with proper trim, the aircraft will still gain altitude in slow flight.

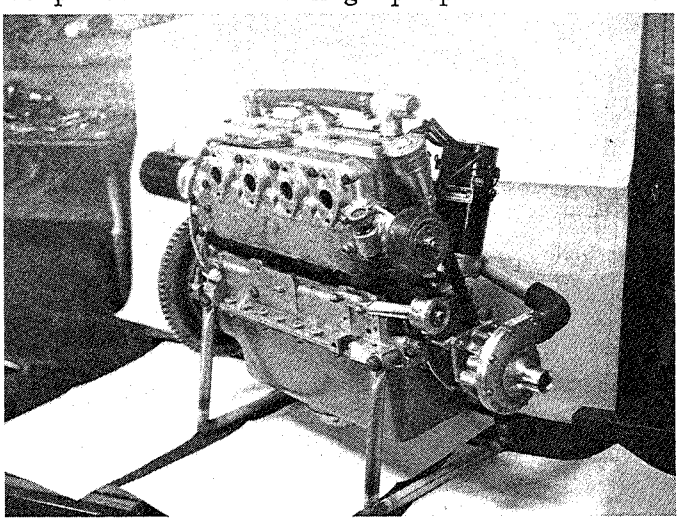
After it has been in the air for 8 to 10 minutes, the engine races a bit, coughs, and dies, indicating a dry fuel tank. However, being a sailplane allows another 5 minutes flight time from 600 feet, if stretched.

Landing this tail dragger version, again, was something else. On a perfectly gauged approach to the strip, the model would settle in until the instant of wheel contact, when it immediately and invariably acted in a rather undignified manner reminding one of an oversize duck setting down on an ice covered pond. After 18 landings, mostly as described, this type aircraft indicates a preference to having the main gear behind the c.g.

A change was made to a tricycle configuration, including a castering, but later steerable, nose wheel. However, on the next takeoff run, the aircraft would not rotate, and it did a nose-over in the strip-end weeds. On the following try, the power was cut near the end of the strip, causing an immediate lift-off, and reapplying power allowed a good climb-out. This behavior indicated a necessity to compensate for the high prop thrust line.



Engine intake side minus carburetion. Wico FWA-250 alternator is in flywheel and, using a tiny Wheatstone bridge rectifier, charges either 8 or 20 amperes.



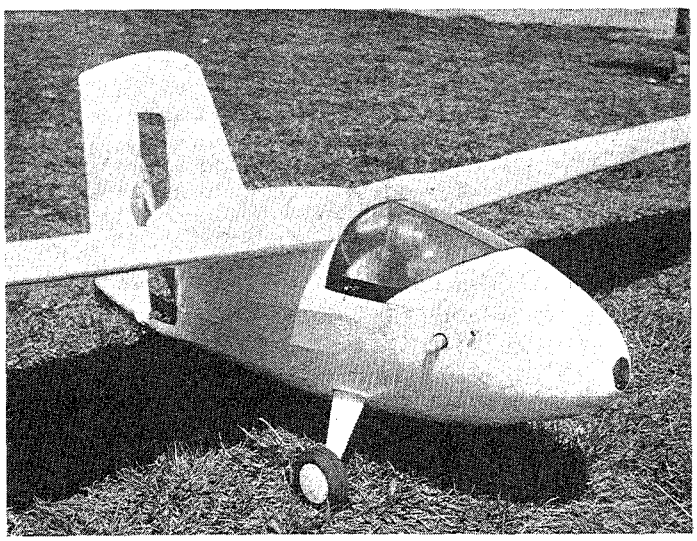
Engine exhaust side showing rotary valve gear shaft drive by timing belt. *(No camshaft)* Water pump designed for 28 gpm drives direct from crankshaft. Magneto will be replaced by distributor with modified Mallory set-up.

The cure was accomplished by increasing wing-to-ground incidence 2°, with adjustment of the nose gear, and moving the main gear forward 1/2 inch closer to the c.g. The lift run could be made shorter by canting the line of thrust down 4°, as is shown on the drawing. Also, at this low Reynolds Number, the elevators must be full up (30°) and the ailerons reflexed before the craft becomes bouyant. This action moves the Center of Pressure closer to the c.g.

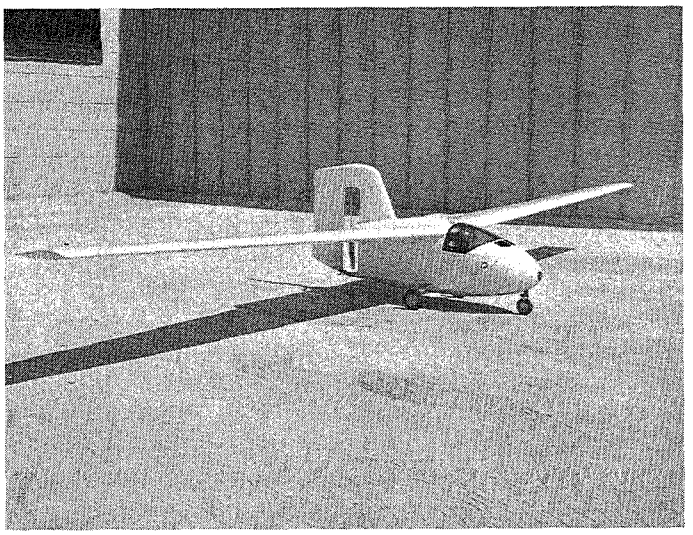
Returning to the high-speed flight, nose-down, pitch moment mentioned earlier, the canted prop thrust line, as originally installed in the model, compensated this condition, but was wrongly changed during alterations to the engine and drive shaft. However, the addition of a second engine cooling air intake just ahead of the canopy brought elevator up-trim back to normal. With the balance set nose heavy, at the 16% MAC point, the flight control response is sharply positive, with no stall tendency, and ballooning caused by gusts encountered upon landing is practically eliminated, however spoilers certainly would be a help.

Referring to the pictures, the span is 11 feet, with 11 square feet wing area. Total weight is 18.25 pounds. The engine in the nose is a 0.70, giving 1.25 hp at 11,000 rpm and drives the prop shaft through a pair of sewing machine V belts, at the same speed using an 11 x 7.75 prop. The c.g. is located between 16% and 18% MAC for best control. At this report, it has made 26 flights, totaling something over three hours under conditions varying from no wind to a very gusty 15 - 25 mph.

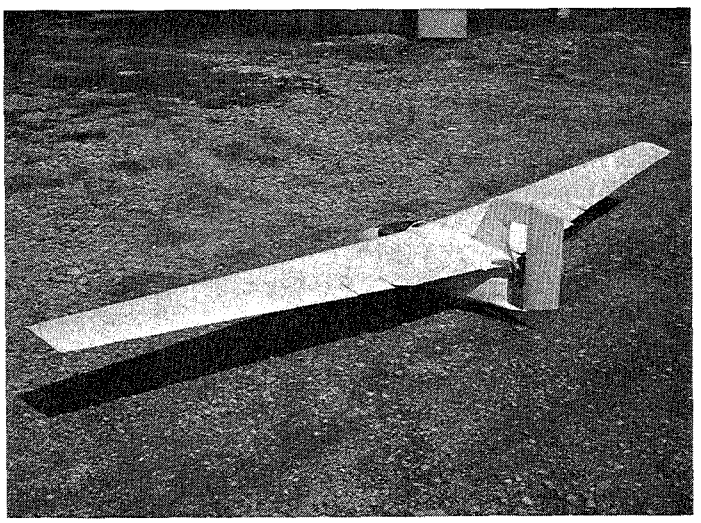
This account could include much more detail, and explanation, but I've overstepped my limit, already. With a bit more thought, plus some math and drawing, the "big one" ought to get underway.



Original gear set-up with small steerable wheel under rudder. Note V-belt driveshaft pulley in canopy which is also used for starting with electric hand starter. The small button ahead of the exhaust stack is the battery switch.



Our pet "Guppy" at present. Wheels are slightly over-scale for operating on dirt or sod. Black spot on nose is a one-pound lead slug adding to radio, battery, and throttle servo weights for balance.



View of wing planform, controls, and engine cooling air exhaust at leading edge behind canopy.

LETTER

Editor:

The *Super Falke* is coming to California!

This is just to let you know I ordered an SF-25E *Super Falke* in February from Graham Thomson. Scheibe just informed me it will be ready for shipment the first or second week of August 1976. I'll leave the performance details for a later date, but I would like to state it is a side-by-side, two-place motorglider with approximately 28-29 L/D with the engine off. The *Super Falke* is powered with a Limbach engine which develops 65 horsepower at 3550 rpm.

The *Super Falke* received dramatic publicity just recently in *Flight International* for June 26, 1976. In the 6th German Motorgliding competition held near Nuremberg May 29 - June 6, the 25E won first, second and third place in the two-seater class. Pilots were Weishaupt, Reuter and Gad.

This is all very impressive, but allow me to say that my personal interest is not all that wrapped up in competition. After a couple of thousand hours of power flying and several hundred hours of pure soaring (over the past nine years), I am primarily interested in soaring but without the burdens that soaring often presents. I want to get away from the "nest", but free of the ever-present logistics of tow planes, crew recruitment, retrieval equipment and much lost time driving freeways and country roads.

Let me make it "perfectly clear" that I intend to fly the 25E as a sailplane.

I plan to hangar the Scheibe motorglider at Santa Monica Airport which is just a little more than four miles from my Culver City home. On weekends or anytime I can sneak away from work, I will fly it to a favorite soaring site and do my thing. If I can wangle a week or two off, I'll "set sail" for distant places. As of now, that's 200 miles or so. Maybe later, I'll venture further.

The *Super Falke* is coming to California. As that politician said in his acceptance speech: You can bet on it!

Byron H. Alexander, Jr.
Culver City, California

MOTORGLIDER ALTITUDE FLIGHTS

Some motorglider owners are planning to fly at a wave camp this fall and have questioned the FAI Sporting Code requirement that a Start Line be used, even for altitude flights. That requirement seems to be unnecessarily burdensome and SSA has ruled that use of a Start Line is *not* required for altitude flights. We have requested our CIVV representative, Bob Buck, to clarify the matter at the November CIVV meeting.

MOTORGLIDER RECORD CLAIMED

V. Hoffman and R. Schwarzer are claiming a world motorglider record for speed over a 300-km triangular course of 67.62 km/hr (about 40 mph) for a flight they made at Burg Feuerstein on June 6, 1976 using a Bergfalke IV M. The record is subject to approval by the German Aero Club and the FAI.

POSTFLIGHT NOTES

Keep those cards and letters coming (and articles, and photos, and news ...)!

CLASSIFIED ADS

Contest winning performance at a reasonable price, plus docile handling characteristics and a worthwhile range under power (about 280 miles) mark the Tandem Falke as today's best value in self-launching sailplanes. The 60 hp Limbach engine with a Hoffman feathering propeller provides plenty of power to operate from regular airfields.

Engine-on Performance

Takeoff run	500/650 ft.
Rate of climb (sea level)	430 ft./min.
Maximum speed (sea level)	106 mph
Cruising speed	81-93 mph
Endurance (cruise)	3 hours
Fuel capacity	10 gallons

Gliding Performance

Maximum glide ratio	26/27 to 1 at 53 mph
Minimum sinking speed	2.95 ft./sec. at 43 mph

The Tandem Falke's outrigger wheels and steerable tailwheel allow completely independent operation. With its outrigger wheels removed the Tandem Falke may be conveniently hangared with other sailplanes.

A side-by-side version is available for pilots who prefer this arrangement. Similar performance, but slightly lower rate of climb and glide ratio. Order the SF-25CS "Falke."

Prices include flight test, German certificate of airworthiness, flight and engine instruments, electric starter, feathering propeller, cabin heater, upholstered cockpit, two-tone paint, packing in container, and shipping to the port of Hamburg:

Scheibe SF-25E Super Falke ..... DM 55,500
(First place, 1974 Burg Feuerstein)
Scheibe SF-28A Tandem Falke ..... DM 49,800
Scheibe SF-25CS Falke ..... DM 49,000

All prices FOB Hamburg

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