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AUGUST-SEPTEMBER 1976
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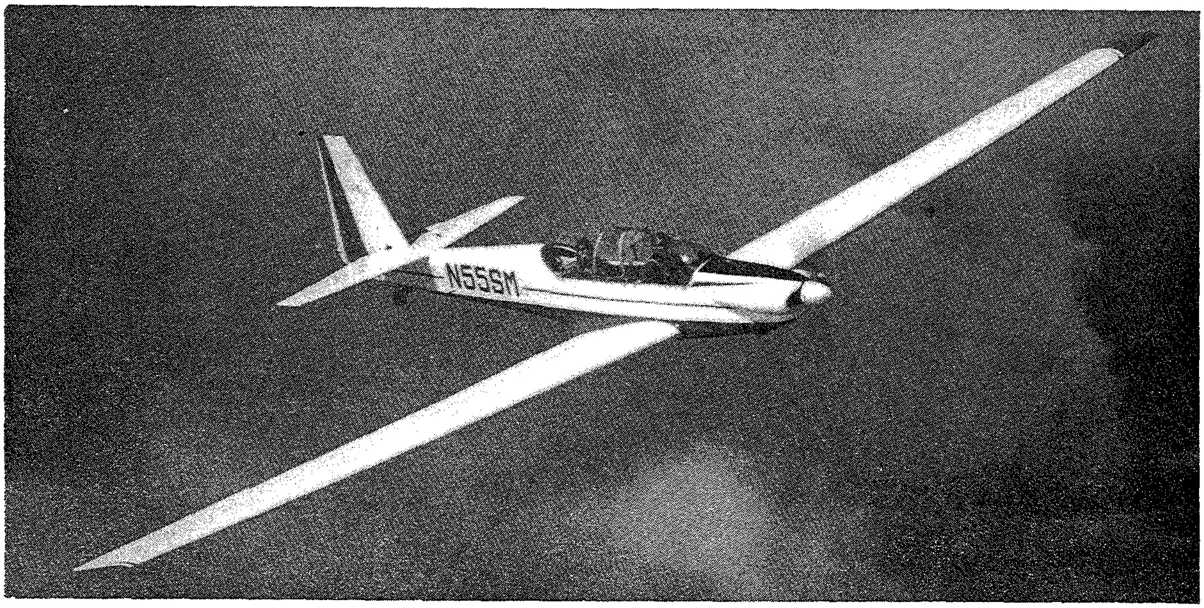

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MOTORGLIDING

Donald P. Monroe, Editor

Vol. 6, No. 4 Published by The Soaring Society of America, Inc. August-September 1976

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Circulation of the June-July 1976 issue was 1250. This issue was mailed in Jan. 1977.

AN ULTRALIGHT AUXILIARY-POWERED SAILPLANE

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

One of the papers presented at the May 1974 National Soaring Museum Spring Symposium was "2nd Generation Ultralight Sailplanes". It contained a summary of systematic design developments resulting in a new concept of ultralights. An ultralight auxiliary-powered sailplane was included since it is a natural extension of an ultralight sailplane.

They both are included in the following exerpt of this paper. Omitted are the detailed elaborations on the air loads (flight envelope), as well as some other details, including the Man-Powered Aircraft, and the Appendix.

The complete paper, "2nd Generation Ultralight Sailplanes", is available from the National Soaring Museum, RD 1, Harris Hill, Elmira, New York 14903; $1.50 per copy or three copies for $4, postpaid.

2ND GENERATION ULTRALIGHT SAILPLANES

FOREWORD

This paper was a part of a larger paper, "Auxiliary-Powered Sailplane: What Performance?" which was written during the autumn of 1972 and subsequently submitted for publication in *Soaring*. Although the paper was approved for an early publication it was persistently delayed for being too voluminous, too technical, etc. Because of these circumstances the paper was withdrawn.

Although the material of this paper is several years old by now and only minor changes were made to sever the ties with the original paper, it is hoped its contents would be of interest to many who are involved in designing, building and flying ultralight sailplanes.

INTRODUCTION

Recent upswing in popularity of ultralight gliders such as hang gliders, sailwings and other slow-flying devices caught our fancy anew. The never-ending trend toward better performing and faster sailplanes fueled our long-standing desire to explore the realm of sailplanes which have low wing loading.

Because of this feature such a sailplane could be called an Ultralight Sailplane (ULS)*. One end of the spectrum of this group is represented by the Man-Powered Airplane (MPA) with a typical wing loading of about 1 psf or less while the other end would be an ULS with a wing loading of up to 2 psf.

Basically, the ULS can be thought of as a 2nd generation of the present day hang gliders. Not only would they have a much better performance but they would also have the necessary controls for conducting a safe flight. The performance could be increased as much as eightfold: from a glide ratio of about 3 for a sailwing to as much as 24 for an ULS.

While the hang gliders are receiving substantial publicity there is hardly any indication that further development is under way which would increase the safety, performance and pleasure.

Our thoughts, roaming through the history of soaring, picked up pieces here and there, covered them with new feathers, and brought forth a new design family of ULS and ULAPS (Ultralight APS). They should find wide interest among the enthusiasts of slow flight because they are inexpensive to build, offer the best of fun in flying and are much safer than present hang gliders. As a natural addition the MPA was included in the group. Our proposed designs are outlined later on after a brief look into problems which would confront every ULS designer. Thus a better understanding of all governing factors will be possible.

DESIGN CONSIDERATIONS

To simplify the task of designing the three planes the concept was developed to use basically the same aerodynamic and structural design. Due to somewhat different load requirements (MPA vs ULAPS) the structural elements may vary accordingly, or in case of MPA certain design elements are added. The same design considerations outlined previously in this article guided us in formulation of these new designs.

Aerodynamic Design

In order to keep the total weight low (one man = pilot supports the plane's weight during takeoff, in case of ULS) the span was limited to 13 m for ULS and ULAPS. Using the same wing chord and aerodynamic design for all three planes the overall design is simplified.

To decrease substantially the induced drag, end plates are used, increasing the effective aspect ratio and thus improving the performance. The end plates also provide directional stability. Directional

*See *Motorgliding*, February 1974

control is provided by split flaps located on the outside surfaces only. They also serve as dive brakes when operated simultaneously (Figure 2).

As much as this configuration is desired to increase the performance, other considerations may favor the conventional vertical tail (fin-rudder) design instead of the end plates.

Lateral control is provided by the all movable wing tips rather than the conventional ailerons. This arrangement also simplifies the wing structure.

Structural Design

To design a structure, loads acting on it must be known. In case of airplanes these loads are prescribed by various governmental agencies (in the USA by FAA) for some time. However, they do not cover ULS and MPA. This area is so new and undefined that such regulations do not exist.

In view of this situation and the fact that the structure of an ULS and MPA must be strong but very light the designer is confronted with a problem of considerable magnitude.

The existing FAA regulations cover all kinds of airplanes, including gliders, sailplanes and auxiliary-powered sailplanes. Basic information about this important subject, written for pilots and amateur builders, is presented in one of our articles, Reference 1.

Due to the fact that there are no design requirements in existence which would cover the ULS and MPA the designer is confronted with the dilemma: How strong should the structure be?

If the selected limit load factors are too high the structure will be too heavy, thus defeating the original purpose. If they are too low the structure may break up in flight, resulting in dire consequences.

The very same problem was confronting airplane designers in the early years of aviation half a century ago, and to some extent, on occasion, even today. Our present requirements are the result of many years of observations, measurements and calculations.

[Detailed elaborations on proposed flight envelopes for ULS presented in the paper are omitted in this excerpt. Some thoughts are presented in the following three paragraphs.]

Considering the fact that a limiting load factor in a loop, when properly flown, does not exceed 2 g's, and that the same load condition exists in a 60° turn, then a maneuvering limit load factor of n = 2 should be sufficient. It is expected that an ULS will not be looped, the turns will not be much steeper than 30° and any pull-out of a dive would not be abrupt but similar to the lower portion of a loop.

We believe that by limiting the flying of the ULS to "normal" atmospheric conditions of slope and thermal soaring and avoiding extremes in which the high performance sailplanes are tossed around, a gust velocity of ±15 fps may well be the answer for the gust limiting load factor.

However, it must be emphasized that slow airplanes with low wing loading will be more affected by a gust than a fast airplane with a high wing loading. This condition is recognized when the gust limiting load factors are calculated.

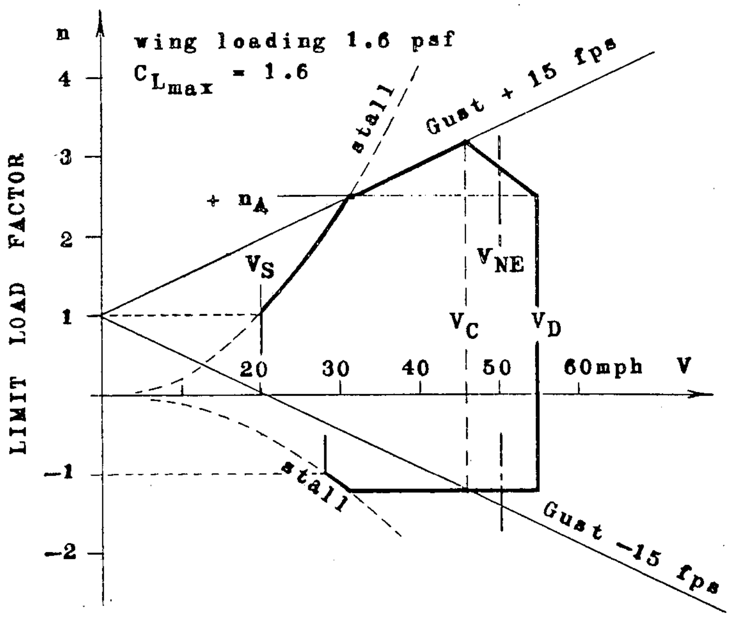

Figure 1 — ULS Resultant Flight Envelope

For an ULS having a wing loading of 1.6 psf and a high lift airfoil the flight envelope is presented in Figure 1. In this particular case, as shown in Figure 1, the positive portion of the resultant flight envelope is determined almost entirely by the gust envelope with exception of the pull-out of a dive at the limit load factor n_A = 2.5 [calculations contained in the paper].

Only detailed structural calculations which were not yet carried out would determine if the proposed flight envelopes are applicable to ULSs. Unsymmetrical flight conditions should also be investigated. The present generation of MPA need only meet the requirements of the maneuvering envelope since the flights are conducted in calm air. Thus there are no loads imposed on the structure due to gusts.

Load requirements established, the attention can be directed toward selection of materials used in construction of ULS and MPA. In order to achieve the very low wing loadings a new kind of structural design must be employed.

One step in this direction is to dispense with the usual cantilever wing design and use one strut for support of the wing panel instead. It should also have one main spar (I beam) built of wood with a thin plywood web. The remaining structure is based on a new design concept* which should result in a light but sufficiently strong structure. It also provides an aerodynamically excellent surface, a dire necessity for a MPA. The material used is plastic foam sheet, 1/4" thick (e.g. Styrofoam, 2 lb./cu. ft.), used for ribs as well as the skin. The main ribs, spaced every 24 inches are backed by a 0.010 wood veneer, whereas the other ribs in between have no backing. On top of the 1/4" foam sheet (skin) a gauze-like fiberglass cloth weighing only 0.9 oz./sq. yard, is resined-on (bonded). After it has cured the surface is finished.

While this gauze-like cloth has been used for a long time in (boat) fiberglass work, the usual 7.5 oz./sq. yard is more widely known. A recent article by Bingelis (Reference 2) not only supplies the information about its application for covering over a plywood surface of amateur-built planes but also gives the information about the weight of such application.

Using his figures for the gauze-like fiberglass cloth and resin the weight can be calculated to 0.07 lb./sq. ft.

Adding the weight of the 1/4" plastic foam, 0.05 lb./sq. ft., the total weight is 0.12 lb./sq. ft. which is quite acceptable.

This construction method is being used throughout ULS and MPA, providing not only the strength but also a very good surface. Although the work is messy the quality should be easier to control due to the fact that there is only one layer instead of the usual multilayer construction. Good work is still required since the fiberglass skin should contain no wrinkles which in an ordinary application would be sanded off. Such practice could not be tolerated because it could markedly reduce the strength of the skin.

*Developed by the author for our tribious aircraft design, IBAS (1963)

If further weight-saving is desired this construction method could be limited to the front half of the wing chord, past the main spar. Some very light weight fabric (doped) would be used for the rest of the surface.

It should be noted that this construction method could be used only on ULS, ULAPS and MPA due to their low speeds. Thus it is not applicable to other sailplanes and powerplanes.

The same approach is used in fuselage and tail surfaces. Good grade wood (reference 3) is used for other structural members and aluminum fittings are employed. The emphasis is on weight reduction without sacrificing the structural integrity.

Detailed calculations and some structural testing is required to confirm the suitability of the proposed surface. On the other hand it may well be that a light cloth, doped to the foam surface may provide sufficient strength. It would be also easier to build as compared to bonding the fiberglass gauze-like cloth. Otherwise a box spar to take care of torsional loads would be needed.

DESCRIPTION OF ULS AND ULAPS

Prelininary basic data and some performances of the proposed design family of planes are presented in the following table [MPA excluded]:

	ULS	ULAPS
Span (ft)	42.655	42.655
Wing area (sq ft)	149	149
Empty weight (lb)	88	95
Power package (lb)		25
Pilot (lb)	150	150
Gross weight (lb)	238	270
Wing loading (psf)	1.6	1.8
Best glide ratio (estimated)	24	21*
at (mph)	23	24
Stalling speed (mph)	20	21

*Fixed pitch propeller (non-feathering)

These airplanes could be built in two markedly different configurations as shown in Figure 2. However, as noted previously, other considerations may favor a conventional tail design, similar to our LAPS (Reference 4).

The advantage of tail first configuration (canard) is the fact that the horizontal tail contributes to the lift of the wing. In the usual configuration the horizontal tail's lift is subtracted, thus a higher angle of attack is need to compensate for this loss, resulting in an increased drag. This is especially noticeable for a forward location. The resultant loss in glide ratio may amount to over one point, depending on the design. The canard configuration also offers other advantages.

The configuration shown in Figure 2 is either ULAPS or MPA. The ULS does not have the central fin (pylon) with the propeller. The ULS and the ULAPS can be built and flown with an open cockpit (resulting in decreased performance). The boom is made of 0.016 inch aluminum sheet.

ULS

At the first soaring meet at Wasserkuppe in 1920 there was a hang glider which had a fuselage pod (drag reduction!). Since the shifting of the pilot's body weight and legs controlled the CG location and thus the flight itself, there was a large opening on the bottom of the pod through which the pilot's legs were protruding.

Ever since, cartoons appeared from time to time showing a "modernized version" of this hang glider whereby the pilot's legs are used only during takeoff and then retracted into the pod.

Our ULS design is based on the same idea. We added the doors which close automatically once the pilot's legs are retracted after the takeoff. However, any resemblance of our ULS to a hang glider ends here since the usual controls are provided which are necessary for a safe flight and, in addition, it exhibits a substantially better performance.

The landing is made on the skid, not the pilot's legs.

Our ULS was designed primarily for slope soaring and if any thermals could be caught over the valley, also for cross country soaring. It is a one-man operation from the takeoff to the landing.

ULAPS

The ULAPS is an ULS with a power package added, consisting of a small, up to 10-hp engine, fixed-pitch propeller, belt reduction drive and the usual accessories. A feathering propeller could be used which would bring the glide ratio to

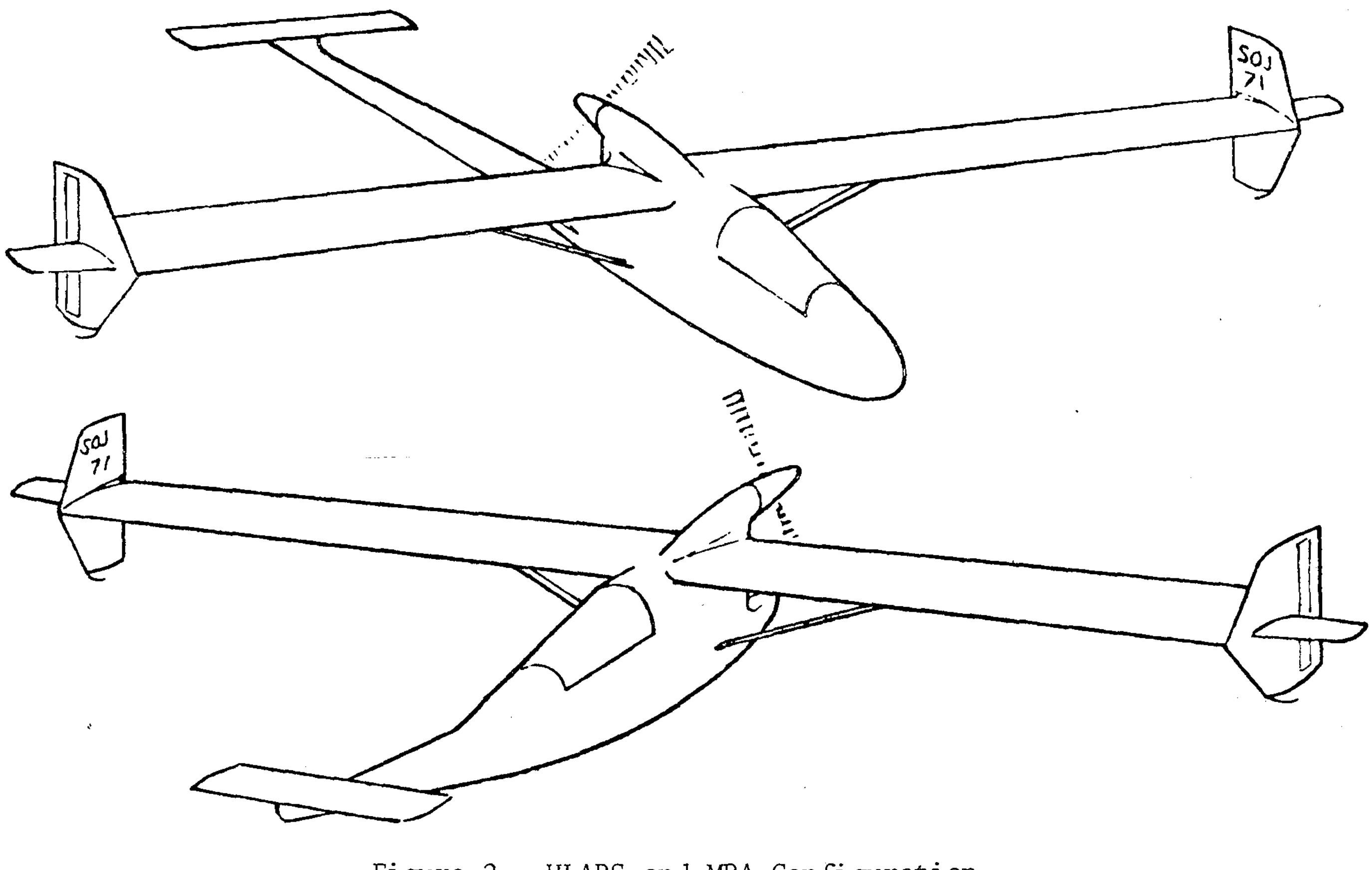

Figure 2 — ULAPS and MPA Configuration

the level of the ULS. It would have to be made by the builder since there are none available for such small power. Another possibility is a folding propeller.

This design would enable pilots to take off where slope soaring is not possible. After sufficient altitude is gained the engine is stopped, the propeller feathered (if there is one), a thermal is located and the soaring flight begins....

To facilitate the takeoff the ULAPS is equipped with one fixed main wheel (small-size bicycle wheel) and another smaller swivel wheel located either in front of the main wheel or aft, depending on the configuration chosen.

The landing is made on the main wheel.

CLOSING REMARKS

The proposed ULS, ULAPS and MPA have a bright future. Due to their simplicity, low cost of materials and ease of handling, any of them would make a nice spare time project over a period of a few months. They are especially suitable for the "estranged" younger generation (high school students) who cannot afford the high cost of the present day soaring. Soaring clubs would find a new impetus in these birds.

The nature of flying either an ULS or ULAPS is quite different from the present fast and expensive competition sailplanes. Like in the old days, it would be slow but high and cross country flights could be quite common.

One can even envision a MPA flying cross country some day, pedaling his or her way across a blue hole.

Would this ruffle again the feathers of our friends, the purists, on the other side of the fence?

On the other hand the potential of ULS and ULAPS might be much brighter than ever envisioned.

REFERENCES

* (1) *Sport Aviation*, May 1971, pp 43-47 (Printing errors correction May 1972, p. 60)
* (2) *Sport Aviation*, August 1972, pp 32, 33
* (3) *Sport Aviation*, June 1970, pp 28, 29 (Printing errors correction October 1970, p. 73)
(4) *Motorgliding*, March 1974, pp 5-8

*A publication of Experimental Aircraft Association (EAA)

LETTER

Editor:

Just finished reading my first *Motorgliding*. This was the June-July 1976 issue. After reading "The State of the Art" I wonder if these points have been covered in the past?

First, I believe a good story should be printed on forming a motorglider club. This is exactly what I would like to do. I know, though, there are some unique problems such as experimental planes, just what license must one have and how could a club get insurance for a commonly-owned motorglider.

I for one am not a loner but neither can I buy and keep a $30,000 plane. I just feel there would be many more motorglider clubs in the country if people could go to a source and find a unique method of starting them.

This could be of benefit both to general aviation and to glider clubs.

John W. Ecklin
Alexandria, Virginia

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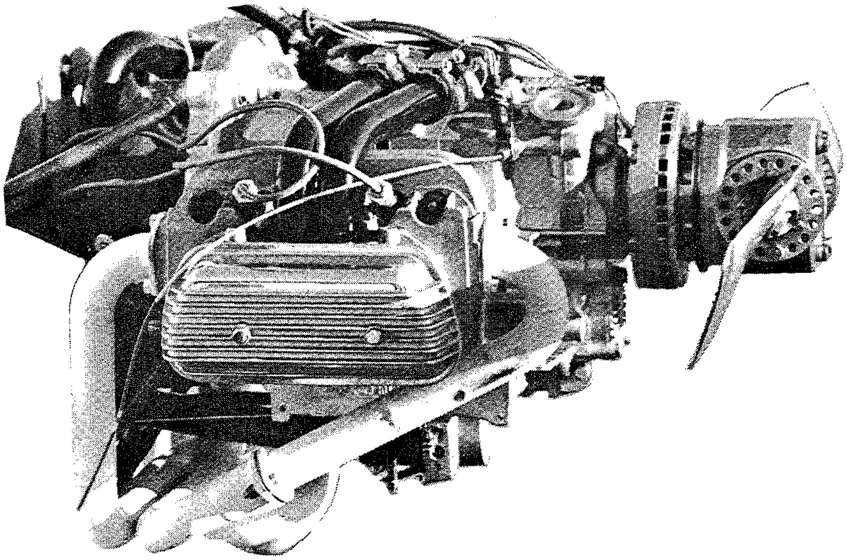

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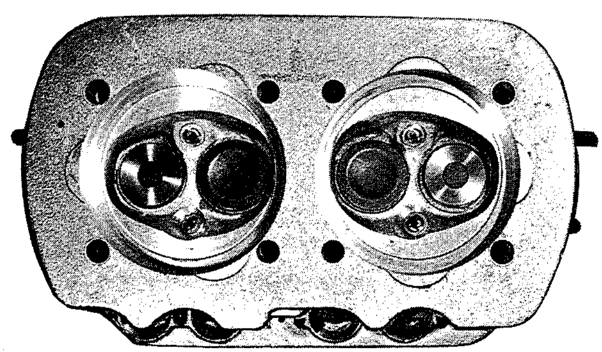

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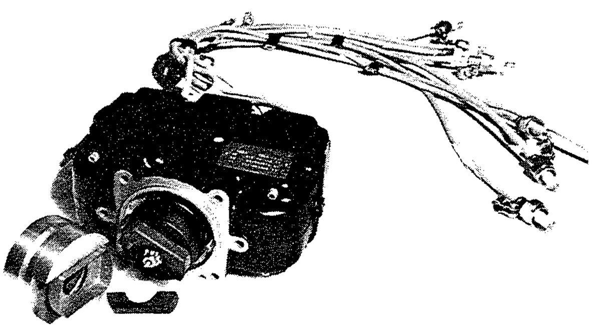

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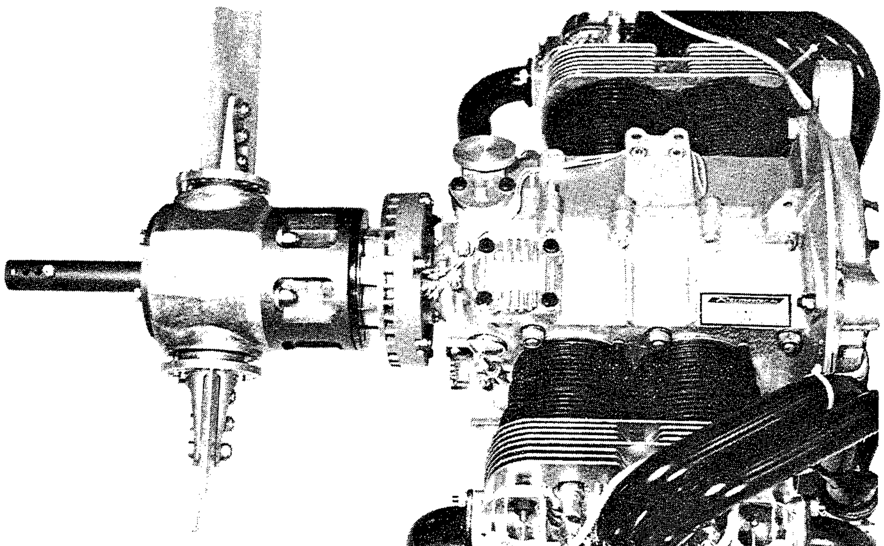

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by S. O. Jenko, Dipl. Ing. ETH
AMTECH SERVICES

1976 Burg Feuerstein Contest —
New Auxiliary-Powered Sailplanes

The 6th German Auxiliary-Powered Sailplanes Contest took place from May 29-June 6 of last year at Burg Feuerstein. While the weather was rather poor, new single-place auxiliary-powered sailplanes dominated the scene. This was in contrast to past years when new two-place auxiliary-powered sailplanes provided most of the excitement.

The contest description will be presented in a later issue.

As pointed previously in "Foreign Scene" (FS) on several occasions the development of high performance single-place auxiliary-powered sailplanes is handicapped because of lack of a suitable engine. When Hirth Motoren K.G. came out with a few new snowmobile engines which could be adapted for auxiliary-powered sailplanes, the company later on went bankrupt (FS, June 1974 *Motorgliding*). So, all hopes fell through — at least for awhile.

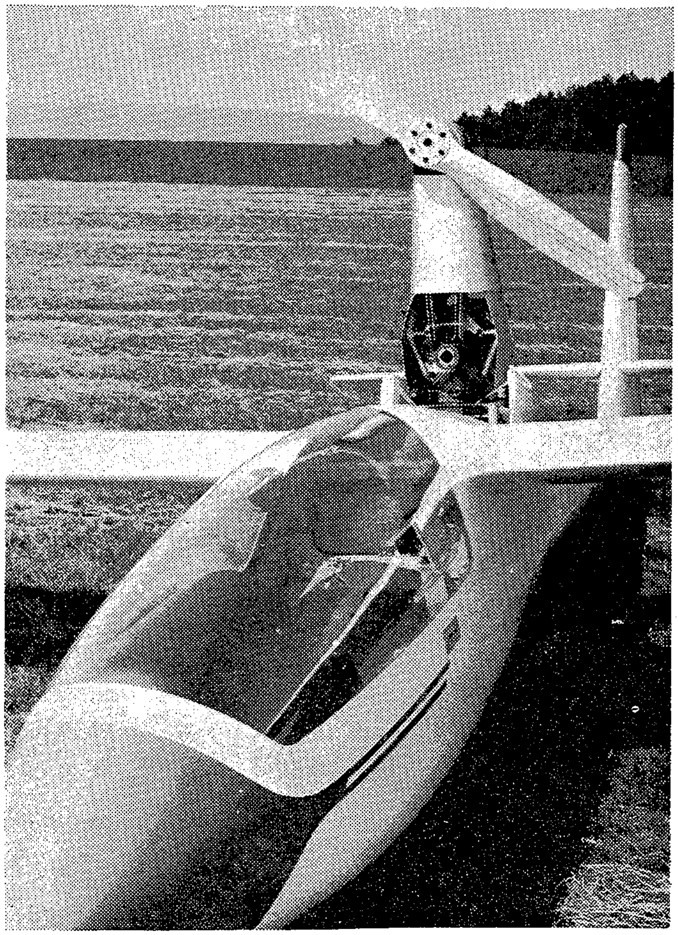
Back in FS, January 1974 *Motorgliding* we reported about a Wankel rotary engine and the results of some inquiries we made. Similar engines with some modifications are being used in two high-performance sailplane types which were flown at the Burg Feuerstein contest this year.

German aviation magazines carried accounts of these new adaptions. The following description is based on articles in July 1976 *Aerokurier*, and illustrations are from August 1976 *Luftsport*.

The new designs in the standard class were the conversions of AS-W 15B and Astir CS; in open class was the Scheibe SF-32 (FS, April-May 1976 *Motorgliding*). The description of Astir CSM will be presented in the next issue.

AS-W 15M with a Wankel Engine

The AS-W 15M has a Fichtel & Sachs KM 27 rotary engine. It performed very well during the contest; so did the electric starting, erection and retraction of the power package. The KM 27 Wankel engine (originally a motorcycle engine) was modified for this application by engineer Josef Vonderau who is examiner-aircraft instrumentation at Fichtel & Sachs. All the modification work was carried out as his spare-time project. The forced cooling



Schleicher AS-W 15M

air system was removed, the carburetor was replaced with a diaphragm type and a Bosch starter was installed. The single rotor engine (300 cc) develops 30 hp at 6000 rpm. At present a 300 hours between inspections is approved, although an AS-K 14 with a similar engine accumulated some 750 hours to date. After 600 hours no parts needed replacement. One thousand hours between overhauls appear to be possible.

A similar engine with two rotors was used in Rhein-Flugzeugbau's Fan Pod (FS, August-September 1975 *Motorgliding*), developing some 50 hp at 5500 rpm. Fichtel & Sachs is planning a four-rotor engine which should develop 100 hp.

The fuel tank has a capacity of 5.3 gallons, the fuel consumption is 1.6 to 1.9 gallons per hour.

The retractable power package weighs 121 pounds which includes the battery, propeller, all accessories and fuselage reinforcements. The engine with starter, carburetor and propeller comes to 70.4 pounds; engine with starter weighs 39.6 pounds (?).

The power package features a pylon-mounted propeller of 54" diameter, rotating at 2400 rpm, driven by a gear belt;

the engine is just outside the fuselage, exposed to propeller stream, when operating (fully erected position).

Ground roll is about 700 feet and the rate of climb 512 fpm. Rate of sink is 3.1 fps at 56 mph if the propeller is stopped. A rotating propeller with engine idling produces about the same glide ratio as the pure AS-W 15B.

The gross weight is the same as the AS-W 15B with water ballast, resuling in a wing loading of 7.6 psf. The best glide ratio is 37.4 at 58.4 mph.

Empty weight is 634 pounds, the gross weight is 898 pounds.

The cost of the AS-W 15B is about 29,500 DM. The power package and installation may cost 12,000 DM to 15,000 DM additional.

This AS-W 15M was flown during the contest by Walter Binder. (PS: The retractable power package design of AS-W 15M appears to be very similar, if not identical to ours, developed some seven years ago for the Jenko *APS I* and *APS II*, described in detail in December 1975-January 1976 issue of *Motorgliding*.)

Fichtel & Sachs KM27 Wankel engine

Kora 1 — 2nd Prototype

FS, March 1974 *Motorgliding* reported on the development of the two place *Kora* 1 auxiliary powered sailplane. Until a June 1976 article in the German *Luftsport* nothing more was heard about it. According to the article a second prototype of this fiberglass auxiliary powered sailplane flew for the first time on April 9 of this year.

The results of the redesign efforts are a weight reduction of some 242 pounds in empty weight. Other changes:

- Increase in effectiveness of rudders and ailerons
- Larger dive brakes
- Replacement of the retractable main gear with a fixed gear, featuring fairings; the nose wheel remains retractable. The steering on the ground is accomplished by differential braking (connected to the rudders).
- The blower of the forced-air engine cooling was removed; a Limbach SL 1700 EC I engine is currently being used.

The flight testing confirmed the validity of the redesign. *Kora* 1 is also known among the soaring pilots as "Mini-Noratlas".

RECORDS

Four world motorglider records have been approved. On April 19, 1976, Friedrich Kensche flew an SF-25E at 45.9 mph over a 100-km triangular course for a multiplace record. On April 28, Kurt Heimann flew an SF-27M on a 373-mile out-and-return flight, and on the same day, Guenther Jacobs flew an SF-25E with passenger for a 402-mile goal. On June 6, Werner Hoffmann using a Bergfalke IV M with passenger flew a 300-km triangular course at 67.62 km/hr at Burg Feuerstein.

WAVE CAMP

The annual Marion Wave Camp will be held Saturday, February 19 through Sunday March 6, 1977. Shiflet Field, Marion, North Carolina will be the site. Pilots generally work the wave off Mt. Mitchell, where a wave window has been arranged with the FAA. Bermuda High Soaring School will provide tow planes, oxygen, and briefing for pilots. For information contact Bermuda High Soaring School, Inc., P.O. Drawer 809, Chester, South Carolina 29706, (803) 385-6061.

THE *FALKE*

by Bill Budachs

Rrring! Swat that boz-eyed alarm. Funny, doesn't feel like morning already. Feels like I'd just fallen asleep.

Rrring! Drat, must have missed—swat it again. That's got the button down this time for sure.

Rrring! Wot in the world goes on here?

By the time I realized it was the phone, not the alarm, I was wide awake and recognized the caller. Would I be willing to go and test fly a motorglider for him and report on its condition and performance? Sure, who do I kill?

So that is how it all started. The situation was that the caller did not have the time to go to examine the aircraft and test fly it himself, and was entrusting the job to me.

Traveling in Quebec is a depressing experience. Not only is the language a problem—the writer respects the right of French Canadians to be addressed in French in their own province and for that reason avoids traveling there. On this occasion the trip was undertaken after considerable arrangements to avoid as far as possible the need to come into contact with the local residents, even to the extent of taking a reserve supply of fuel to avoid the need to get a fill-up. The other depressive feature is the quite overt gouge, or even greed. Whilst in the U.S., toll roads usually have system of tickets—you are given a ticket when you go on the read and pay according to mileage covered when you leave it, and depart with a cheerful "thank you" from the collector. In Quebec, on the other hand, (at least on the roads traveled on this trip) there are toll booths every few miles; you're always shelling out, always have a hand in your pocket, quite apart from the nuisance of the associated slowdowns one is always aware of being fleeced. Not only that, entrances to the road are always arranged immediately before a toll barrier, and exits immediately after one, so that one pays twice for one section. It may seem a small thing, but one that is not exactly calculated to leave pleasant memories of traveling in Quebec.

Enough of that. After overcoming all problems, the hangar doors were opened and there was the *Falke*. Not much to look at; derigged, with wings sitting on their own stands, fuselage stashed away at the back, behind some ski and float planes. The engine cowlings were open and the engine looked clean, simply a modified Volkswagen, driving a small wooden prop. The parts were examined separately, some help recruited by the local AME, and the rigging done. The wings went on quite straightforwardly, the controls were coupled up, everything checked and we were ready to go.

The ship had some history of damage, and this was examined in some detail. Apparently someone had "lost it" on a landing and veered into the fence, damaging a wing and the propeller. Now, in the course of orientation flights, it was found that the directional control during landing roll was quite tricky, especially if some power was on.

Some of the ship's general history may be in order. It was imported back in 1972 by one of the wealthy industrialists, to serve as a sort of rich man's toy. As a power aircraft, its performance was apparently somewhat disappointing to its owner—to be expected from a powered glider. Now, as a glider, its performance seems to be quite good, but all who have been gliding for many years will know that the art of staying up without an engine is something that simply must be learned, even if one is a millionaire. Of course, there are limits to the time one can take off from tending one's business, and without a gliding instructor it's hard to learn to stay up. What to do with a toy that does not satisfy? Obviously, sell it. And that is where this writer came in, as agent of the purchaser.

As regards the aircraft and its performance, let us take a look at the report prepared for the prospective purchaser. Here goes:

...Engine starting is straightforward. The battery master is switched on by its captive key, then the magneto switch is switched on. The fuel is turned on, the choke is closed, and the throttle pumped once and left partly open. The starter button is pressed, and usually the engine will fire after a few revolutions. The choke can be opened partly immediately with a cold engine and fully if the engine is somewhat warm. The crossover-muffler reduces exhaust noise to an acceptable level and conversation in flight is possible, albeit in raised voice.

Taxiing at low speed is easy and unremarkable. It may be difficult to keep the wings level, but the half-span outrigger wheels are quite up to their task on reasonably level ground. The absence of differential braking prevents sharp turns, with the realistic turning circle diameter being of the order of 100 feet at the cockpit—this requires a space of about 200 feet between fences to turn around. At higher speed, it is important to keep accurate control at all times—once a swing develops, it is difficult to control it.

Opening the throttle fully with the brake held gives approximately 2500 rpm. Since the engine does not have dual ignition, this is the only means of checking for proper functioning of all systems. The takeoff roll acceleration is unspectacular, but aileorn and elevator control is soon reached. Unstick takes place with slight rotation at an indicated 26 to 28 knots, which appears to give credence to the manufacturer's claim of 600-foot takeoff roll. Once airborne, the nose is lowered somewhat, and the climb airspeed of 45 knots is quickly reached. At full throttle the speed of 45 to 50 knots produces some 2700 rpm, which is throttled back to some 2500 for sustained climb, to relieve load on the engine. This produces a climb rate of some 300 to 400 ft/min.

The engine can be stopped in flight by closing the throttle, switching off the ignition and dousing the dieseling effect by closing the choke. The propeller will stop readily at speeds of 35 to 38 knots, and momentary touches of the starter button will position it horizontally for minimum drag. The propeller brake is not necessary to achieve this. In free flight the engine flicks over compression at about 75 knots and windmills steadily at about 85 knots. Inflight restarts are accomplished readily by following the same procedure as on ground: switch on, close choke partly, set throttle, and press starter. If battery is too low to turn over the engine, this may be done by diving at about 90 knots for a few seconds. In level flight, throttle settings of 2100 rpm will give a speed of about 45 knots, 2400 rpm for approximately 65 knots.

On the first soaring flight, which was undertaken for evaluation and assessment purposes, takeoff was made at 1300 hours. The aircraft was climbed under power to approximately 2200 feet ASL (field elevation 740), and a thermal was contacted. Due to lack of confidence in the climb performance the engine was left idling at this point, pending centering of the thermal. This was completed within two circles, the engine was stopped, and climb continued to cloudbase at 7200 feet ASL. At this point, lift was abandoned, engine restarted, and a series of level flight checks performed. The engine was stopped and a series of maneuvers performed, with a view to investigating handling. These were as follows:

Stalls. On holding the nose some 15° above the horizon, speed drops off rapidly. The usual prestall buffet is almost nonexistent, and the actual stall is a very gentle dropping of the nose, at about an indicated 30 knots. There is no tendency to drop a wing, and recovery is quick and easy, resulting in no more than two hundred feet loss.

Spins. If full pro-spin control is applied at the point of stall, autorotation starts immediately, and the wing drops rather more rapidly than the nose. This results in the aircraft reaching the 180° point in a pitch attitude somewhat past vertical. Airspeed increases, resulting in the wing unstalling and reduction of roll rate. A nose-up pitch movement develops and continues until the aircraft comes up through the level pitch attitude after about 360° heading change. Pro-spin control was removed at this point and the aircraft recovered immediately. There was no difference between spins in either direction, which shows the absence of rigging disbalance.

Level S-turns. Although the aircraft is not equipped with a slip indicator or yawstring, there was no difficulty in executing apparently well coordinated level S turns at normal rate. Roll rate is somewhat disappointing by glider standards, but pitch control is sensitive, resulting in easy airspeed control.

Lazy Eights. Due to the tendency for the propeller to flick over and windmill at higher speeds, full redline entry type lazy eights were not performed. The highest speeds reached were of the order of 90 knots. It was found easy to keep a smooth, continuous change of roll, pitch and airspeed in a coordinated maneuver.

Spiral Dive. The aircraft settles down in a stable spiral dive. No high-g effects were observed on any controls, and all control functions remained effective throughout the maneuver, enabling easy control of speed, g-loading and recovery. No g-meter is installed, but the writer's estimated g-loading was of the order of 3.

Clean Dive. It is at higher speeds that the penalty of carrying an engine with an unfeathered propeller and of a side-by-side fuselage becomes apparent. At some 90 knots, the flight attitude is very much nose down, with engine windmilling briskly, and a very high sink rate.

Spoiler Dive. Whilst the spoilers are normally effective at low speeds, their effectiveness seems to decline at higher speeds, perhaps by virtue of being a smaller part of the quite considerable total airplane drag. Although speeds over 90 knots were not attempted, it is the writer's impression that spoilers are not speed limiting.

The engine was only restarted on the ground for taxiing back to the apron. Total time for the flight was 1:20, with 25 minutes engine time.

The second flight takeoff was made at 1500 hours, and a good thermal was entered at 2400 feet ASL. Engine was stopped immediately. Several thermals were worked, timing climb rates, which revealed the variometer's calibration to be substantially accurate—on one occasion, climb from 5500 to 6500 was timed at 1 minute 50 seconds with the vario reading fluctuating about 600 feet per minute. Maximum full-circle climb rate observed was of the range of 900 fpm. Cloudbase was contacted once at 8000 feet ASL, and a normal descent was made. Whilst the specified engine-off performance states a minimum sink rate in excess of three fps, the flight performance seemed better than this would lead one to expect, mainly due to the low speed at which thermals can be worked. The second flight also terminated in an engine-off landing, which results in easier directional control during the landing roll. Time for the second flight was 1:50, with engine time of the order of 14 minutes.

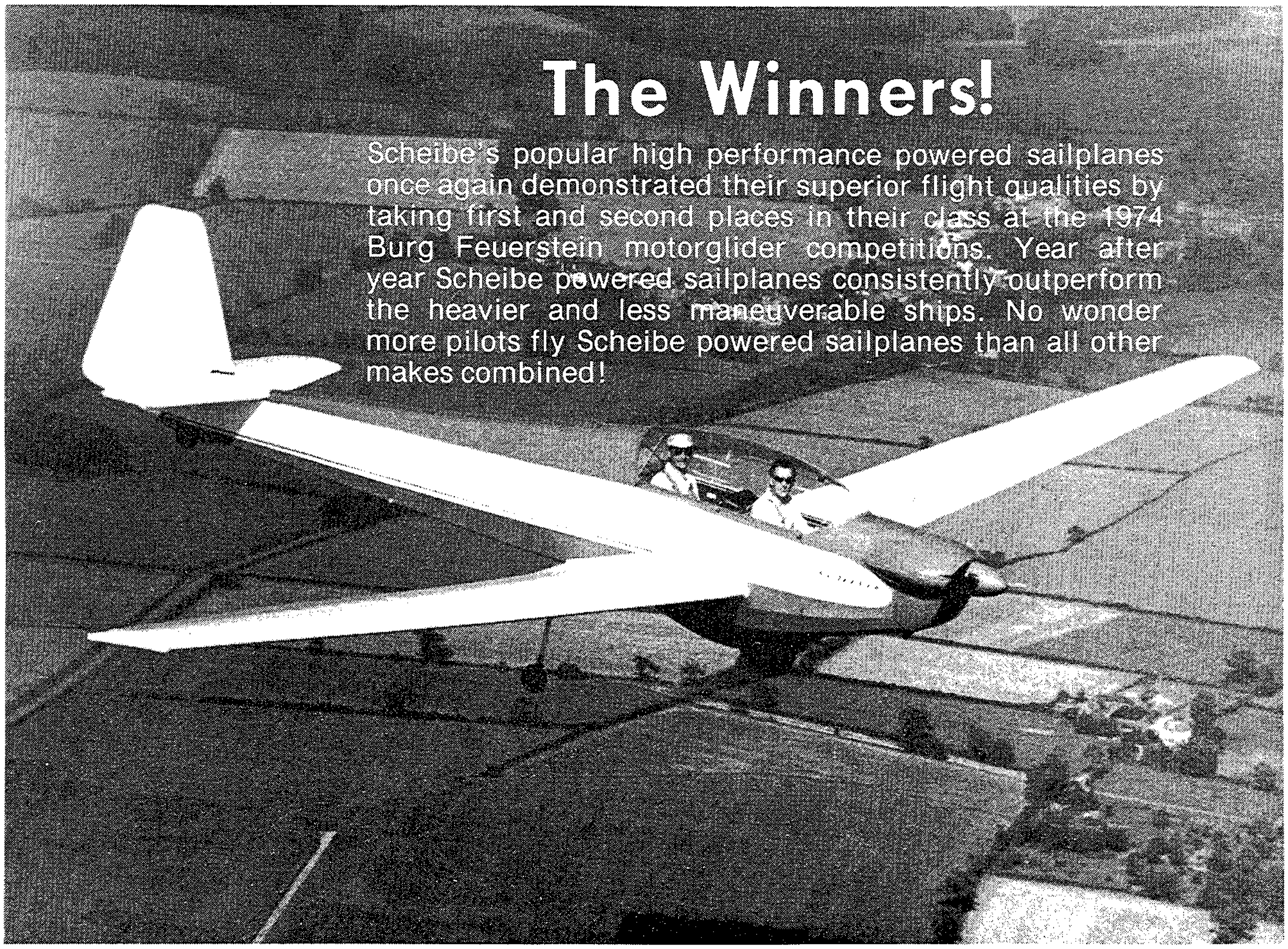
So much for the examination and evaluation. Now how to get the ship to the purchaser? Of course, there's the possibility of derigging and crating it, shipping it by rail or road, but surely, aircraft are made to fly? So the decision was made to ferry it. Ferry it? All 650 miles? Over the central Ontario bush country? Sure, I'll do anything that's not honest!

That was quite an adventure. Extra fuel capacity was installed in the passenger's seat, an extra ten gallons over the standard seven gallons in the main tank. That should be enough for the whole trip, consumption being some two gallons per hour. Now about navigation—all precooked, maps all marked up, visual checks written out, a route selected over as many local airports as possible in case something happens, a large-bowl naviating compass installed—that last one borrowed from an acquaintance. An ELT carried, just in case, emergency food supplies carried, just in case. No room for a parachute—that's hard lines, but the risk is minor. All documents sorted out, and takeoff planned for early in the morning, to take advantage of the morning calm—fast flying is easier in smooth air. All fuel capacity filled up, everything checked and ready to go. The original plan was to fly as far as possible, then to stay overnight and go the rest of the way the second day—the previous day's flight checking out all systems left the impression that it would be too tiring to fly all the way in one day.

Came the dawn. That boz-eyed alarm was not needed that time—the sun was just peeping over the horizon as this ferry pilot was having a package of 747 pilots for breakfast. A mile walk to the airport, unlock the barn and let the bird out, and off we go.

There is not much to say about the flight itself, except that it was a case of boring a happy hole in the sky. It was one of those sunny, hazy spring days, before the weather turns too hot to be comfortable, hazy enough to prevent convection and its associated turbulence, but good enough to give visibility of the order of ten to fifteen miles for most of the trip. A few cumulus (cumulii?) were spotted at about flight level at one time, but they soon died out and the rest of the day was just made to measure for cross-country flying. The flight itself was carried out mainly at 5000 feet, except for the portion over Algonquin Park

(cont'd back cover)



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:

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(First place, 1974 Burg Feuerstein)
Scheibe SF-28A Tandem Falke . . . . DM 49,800
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and its bush country, where 7000 feet was considered to give just that extra margin of safety. All systems worked well, navigation visual checks came in view on time and just about where they should be, fuel transfer needs were signalled by the engine running out of gas on the main tank—then it was time to switch on the transfer pump, and in three seconds exactly the engine resumed its happy song. That large-bowl navigating compass worked beautifully—you could fly it just about like a gyro, just look at it now and then and keep the lubber lines aligned with the needle system. On one occasion, after a 42-mile gap between visual checkpoints, the next one came in view about two or three degrees off the nose, and the track was maintained just to see how far off it would go. About half a mile error after 42 is pretty good going by compass only. After some 500 miles, when the last fuel was transferred, the question arose whether it would last. As it turned later, it would have done so, but this fella is not one for taking chances. A landing at a local strip and a trip into town produced five gallons of premium motor fuel—quite legitimate wear for a Volks. Then up, up and away again, for the last part. The flying was much less tiring than had been anticipated, and the whole trip was completed in one day, taking a flying time of some eight and a quarter hours. Landed at the destination, phoned the new owner.

"Where are you?"

"At the airport."

"For land's sake, did you put a couple of jets on it or something?"

And so the *Falke* changed hands. Subsequent flying and examinations revealed that the best climb airspeed is about 50 knots at full throttle (about 2700 rpm). The engine is rated at 45 hp at 3500 rpm, with yellow line at 3100. In practice, it was virtually impossible to exceed that yellow line—full throttle in level flight gave about 3000 to 3100 at some 80 knots. Obviously the prop installed is of cruise pitch. A finer pitch prop would give better climb performance, but would cut down the cruise potential under power. It was fun bashing the circuit with it at an international airport, in and out of the airliners.

Jet pilot: "What kind of plane is that?"

Tower: "I believe it's a glider."

Turbo prop pilot: "XYZ, what kind of engine do you have?"

This writer: "Modified Volkswagen."