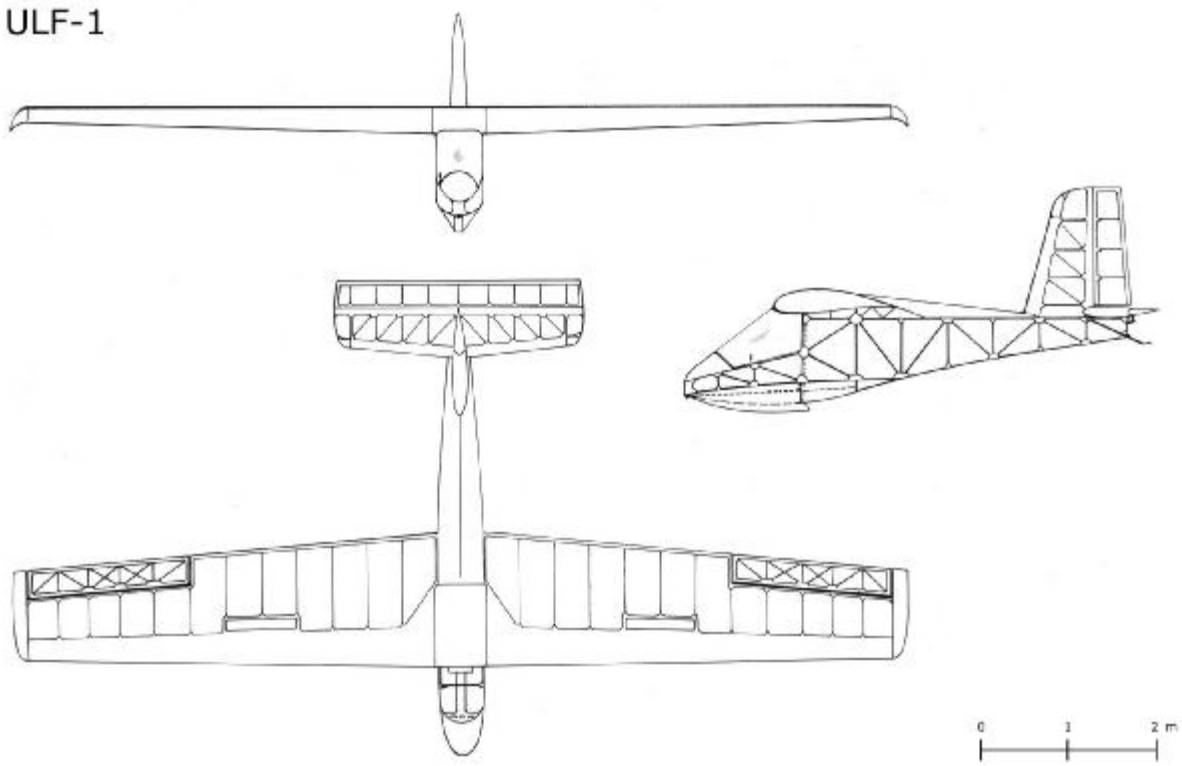
Single Seat Ultralight Sailplane

for Selfbuilders



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The ULF-1 single seat foot-launched sailplane was designed by Dieter Reich and constructed by Heiner Neumann of Germany. Designed for ridge soaring and marginal thermal currents (Microlift), it has full three-axis aerodynamic control. Its first flight was in November 1977; its first public appearance was in August 1978 at the 3rd International Hang Glider Meeting at the Wasserkuppe, the historic German soaring site.

Since that appearance different pilots on a number of ULFs have accumulated many hours of flight time. The prototype alone has more than 150 hours total flight time in 200 flights, most of them starting from foot-launch.

More than 40 ULFs are believed to have been completed and flown. Fifteen ULF-1s are in operation in Germany. The longest flight lasted six hours; the maximum distance achieved 140 km. Both of these flights started with a foot-launch.

In July 1980, the ULF-1 design received an airworthiness certificate issued by the German authorities, after all required calculations and tests had been provided by the designer. In 1983 the Australian authorities gave approval for the ULF-1 to be built and flown in Australia. ULF-1 is, as far as we know, one of the best-performing foot-launched aircraft to date.

Operation

The aircraft can be foot-launched from slopes of more than 15 degrees even at small wind speeds. The pilot supports the weight of the aircraft on shoulder straps and uses the side stick for lateral control. The self-launch is rather simple and does not require any special skill. As the pilot starts the take-off ground run, the elevator stick should be in slight nose-down position to lift the horizontal tail. The moment the pilot feels a pronounced seat pressure; the control stick is pulled back until the aircraft lifts off. After take-off the pilot retracts his legs and puts them on rudder pedals. A sliding slat-type construction behind the pilot's back can be released in flight to provide a seat.

Because of a low sink speed (0.8 m/s at max. take-off weight) and its good manoeuvrability, ULF-1 is sensitive to marginal thermal conditions. The best L/D of 16:1 is at around 55 km/h (about 34 mph). To reduce the aerodynamic drag of the fuselage, hinged doors have been fixed to the front superstructure of the fuselage. They are kept open during take-off ground run and closed manually after lift-off. For "record-breaking" flights a closed Plexiglas windscreen is recommended.

It is estimated that both measures, the "landing gear" doors and the windshield, improve the L/D by ten to fifteen per cent, resulting in an L/D of 18. Since the glide-performance is also at a relatively high speed, the average cross-country cruising speed, including time for circling is at least fifty percent higher compared with conventional hang gliders.

Landing the ULF-1 is done on a nose skid located beneath the pilot's seat. The airplane can also be launched by bungee rope (down hill), winch, car and air tow.

Handling Qualities

The three-axis aerodynamic control greatly reduces the pilot's workload compared to a conventional hang glider with its two-hand yoke bar, and frees one of the pilot's hands.

Dynamic pull-ups to about 20 degrees result in a smooth nose-down movement after the wing has stalled. In turns or in turbulent air, there is some wing drop in a stall. Recovery is properly and promptly achieved with opposite rudder. The loss of height is usually less than 10 meters (30 feet).

For sailplane pilots there will be no problems flying the ULF-l. However, experience with conventional hang gliders is not sufficient to handle the aircraft. At least some solo flights on sailplanes are recommended.

Construction

ULF-1 is specially suited for homebuilders. The basic construction materials are spruce, birch plywood and balsa wood. The airframe is covered with doped fabric. For hinges, fasteners and fittings, aluminium, steel sheet and fibreglass/resin are used. Steel tubes are employed only for the control stick, control parts in the cockpit area and rudder drive.

The ULF-1 prototype is equipped with a ballistic recovery system for both pilot and aircraft, located immediately behind the main bulkhead and activated by means of a mechanically released pull-out rocket.

For road transport, the two-piece wing can be detached. In addition, the horizontal tail can be removed. The aircraft can be taken off a trailer and assembled in about ten minutes.

Plans

A plan pack is available comprising of:

- A complete set of 31 blueprints (14 sqm) most of them are full scale, including full scale computer generated lines for wing and tail.
- A 37 page construction manual (with sketches) including a list of materials with their American, British and German designations.
- An inspector's test and check list.
- An 18 page flight-/operation manual.
- A cut-away drawing (A3).

All descriptions and manuals are in English language (metric units).

The cost of materials amounts to about EURO 2500. The aircraft can be built in less than 1000 hours. Kits or materials are not supplied.

Certification

In Germany all ULF-1 airplanes constructed under license are considered airworthy and permitted to be flown, provided the following requirements are met.

1. Construction supervision by an authorised inspector, according to the check-/test instructions as written in the ULF-1 construction manual, followed by a detailed final inspection.

2. Condition inspection by an authorised inspector every two years.

Data

Type description	ULF-1, foot-launched sailplane
Type responsibility	Dieter Reich
Take-off by	Foot launch (down hill), rubber cord (down hill), hang glider winch tow, car tow, air tow (trike)
Wing	Cantilever structure. Shoulder mounted, single wooden spar, plywood nose section, and wooden ribs, fabric covered. Wing section Wortmann FX 63-137, 18% thick at root, and 15% thick at tip. Spoiler on upper wing surface.
Fuselage	Wooden frame of triangular cross section, fabric covered
Tail	Cantilever structure, fabric covered
Landing Gear	Nose skid, centre wheel, tail-skid (fibre glass tube)
Accommodation	Sliding seat, open or closed cockpit
Rescue system	Fuselage integrated, consisting of parachute, release unit, pull-out rocket
Instruments	Air speed indicator, rate of climb indicator, altimeter
Dimensions	
Wing span	10.40 m (34.12 ft)
Wing chord at root	1.53 m (5.02 ft)
Wing chord at tip	1.07 m (3.51 ft)
Wing aspect ratio	8.10
Length overall	5.55 m (18.21 ft)
Tail plane span	2.90 m (9.51 ft)
Areas	
Wing gross	13.4 m² (144.18 sq.ft)
Vertical tail	1.5 m² (16.14 sq.ft)
Horizontal tail	2.4 m² (25.82 sq.ft)
Masses	
Mass empty	55 kg (121 lbs) (without rescue system)
Max. take-off mass	155 kg (342 lbs)
Ultimate Structural Load Factors	
Positive	6 g
Negative	4 g
Performance	
Best glide ratio	16 at 55 km/h (34 mph)
Min. sink speed	0,8 m/s (157 fpm)
Min. speed	33 km/h (21 mph)
Max. speed (VNE)	80 km/h (50 mph)

Photo: G. Marzinzik

Photo: H. Ross