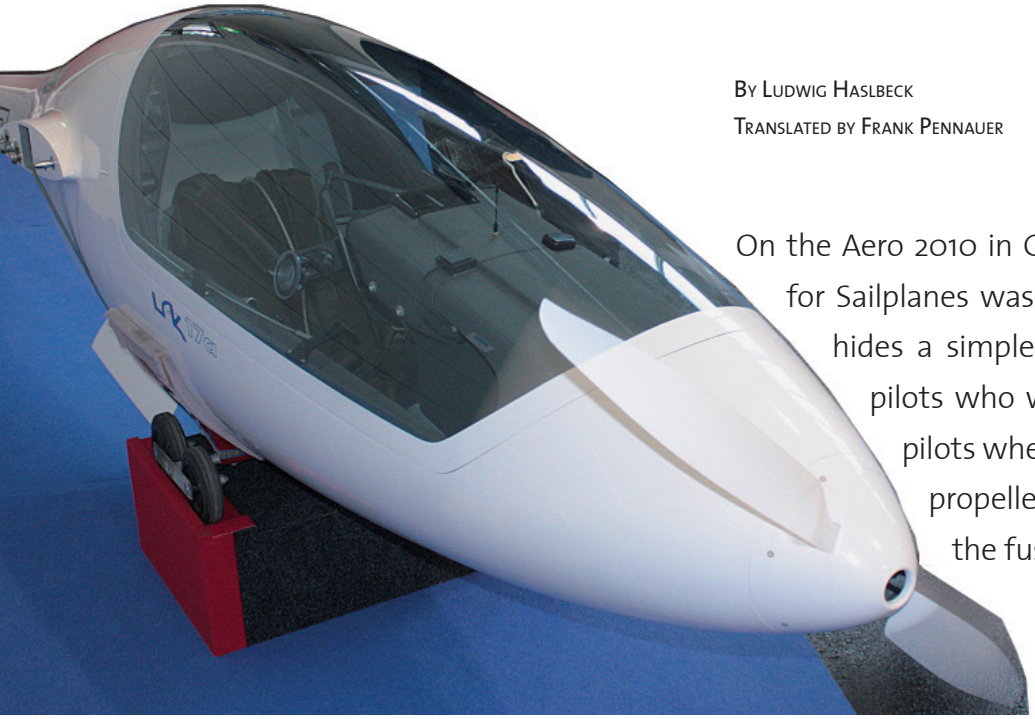
FES a new Sustainer Engine Concept



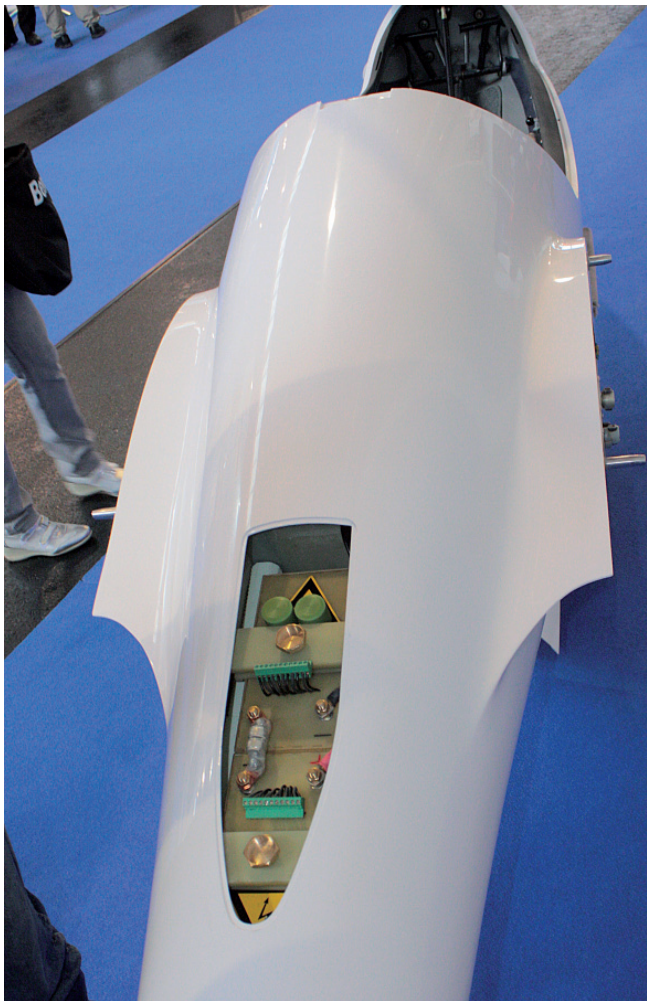
By Ludwig Haslbeck
Translated by Frank Pennauer

On the Aero 2010 in Germany a new propulsion concept for Sailplanes was introduced. Behind the name FES hides a simple idea which is known to all glider pilots who were at one time also model plane pilots where an electric motor drives a folding propeller which is mounted on the nose of the fuselage.

This propeller folds itself smoothly against the fuselage during soaring flight, without creating any appreciable additional drag and it opens whenever engine power is applied. It is not surprising that the developers of this concept, Luka Znidarsic and his son Matija are not only glider pilots but also avid model plane builders.
Their company Lzdesign is located in Slovenia, a country which in the past several years has firmly established itself to be known for the development of modern concepts in aeroplane construction.
The FES Concept was developed in a surprisingly short period of time and already during the world championship in Szeged/ Hungary in 2010 was a LAK17B with an FES sustainer engine demonstrated in flight.

The FES System is amazingly simple
The relatively light electric motor is mounted in an aerodynamically favourable location. The propeller when in it is in its folded position against the fuselage hardly creates any additional drag. The centre of gravity shift caused by the less than 7 kg propulsion system in the nose is compensated by the batteries which are mounted in the fuselage behind the wings.
As there was no suitable electric motor available on the market the designers developed their own brushless electric motor. Their motor produces 15kW continuous power output at 100V but can produce 25kW over short time periods.
The motor with a diameter of 18 cm and a depth of 8 cm is sufficiently compact to fit into the nose of the fuselage of most Sailplanes. The motor weight is only 5 kg. It drives a light weight carbon propeller with a diameter of 1 m.
The propeller was also designed and built by the developers of the system. The hole in the point of the carbon spinner provides cockpit ventilation and cooling for the electric motor.

The Energy Source
The battery box is located in a reinforced fuselage behind the wings. Used are 2 battery blocks, each consisting of 24 in line connected LIPO cells, in total providing 3.6 kWh.. The weight of both battery blocks is 27 kg and is positioned in such a way as to counterbalance the weight of the motor in the fuselage nose. The batteries are also used to supply power to the electric instruments. The advantage of the LIPO batteries is that they hardly lose any power, even 4 -5 months after recharging.
Recharging requires about 4 hours. For safety reasons it is absolutely important that the correct charger for this type of battery is being used.
This motor is strictly meant as a sustainer to bring the plane back to its home port or suitable landing field.
With electric motors the duration of energy provided by the batteries is always the critical point. The designers give following performance figures: At maximum power an achievable climb rate of 1.6 m/s.
After the climb, an additional hour of duration is expected to be available for level cruising flight at reduced power. This value certainly will depend on the time/energy used on the climb.



The Fuselage has to fit
It is the intention of the designers to install this propulsion system in new and used sailplanes. But it is required that the fuselage nose is as round as possible, Most of the Schleicher and Schempp-Hirth planes meet this criteria. But DG planes because of their far to the front extended canopies do not meet this criteria. Of course, the increase by
35 kg within the maximum payload must also be possible. But as most modern gliders are already designed to allow for the additional weight of power plants this should not present a problem. At this time some LAK planes can be ordered with the FES system. "Sportine aviacija ir KO" has taken over the production of LAK planes from the insolvent "Sportin Aviacije" intending to continue the production and further develop the present LAK models.

The Price
has not been established at this time. It will depend on if the installation is into a new plane or a used plane. It is expected that the price will be close to the presently available sustainer engine systems.

Conclusion
FES is a new and interesting propulsion concept for high performance gliders. It actually is surprising that it took such a long time before this relatively simple system used for many years on model gliders was only now developed for full size gliders by two enterprising engineers.
Many disadvantages of the presently available propulsion systems do not exist on FES. The combination of the electric motor which always reliably starts, with a motor position which eliminates the extending and retraction of the propeller mount with all its possible operational problems, is an absolute plus for flying safety. It is hoped that all expectation put into this system will be proven during the operational flight test program which is part of the certification process.

Originally published in German by "Segelfliegen" Nov/Dec 2010

The designers comments on the advantages of this propulsion system:

- Minimal Drag
- Low noise level - No headsets will be required
- Starting and Stopping the motor is simple and without problems
- Less mechanical parts in comparison to existing systems
- Almost no maintenance
- No centre of gravity changes while motor is in operation
- Minimal aerodynamic deterioration while motor is in operation

The motor can be started at minimum altitude. The major accident source with existing systems is the excessive sink with extended motor/propeller and also the time required to extend the propeller both do not exist with the FES system. In addition the electric motor ensures an immediate start, quiet and vibration free operation and no emission.