

Jet-Soarer (Strahlsegler)

The jet-soarer is a new idea to combine the advantage of a glider with the small drag of a jet propulsion system. To avoid the by principle high losses of small turbine engines the jet-soarer uses a normal 2 or 4 stroke ignition engine. The development refers to the one half century old results of **Hartmann, 1960**, and **Löhner, 1960**. These work describes the idea of motor gliders at the beginning of the glasfiber epoche for airplanes.

The inventor of the first moveable and retractable auxiliary propulsion unit was J.V. Carden, 1934. This work was improved by W. Hirth, 1936.

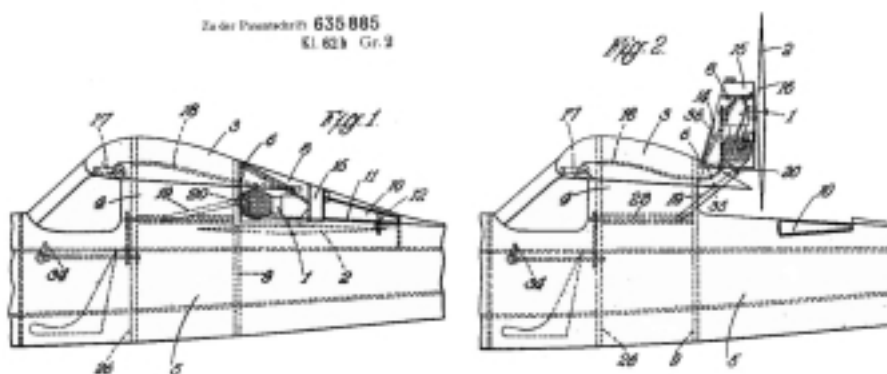


Abb. 1 Glider with retractable propeller, J.V. Carden 1934, DE-635885

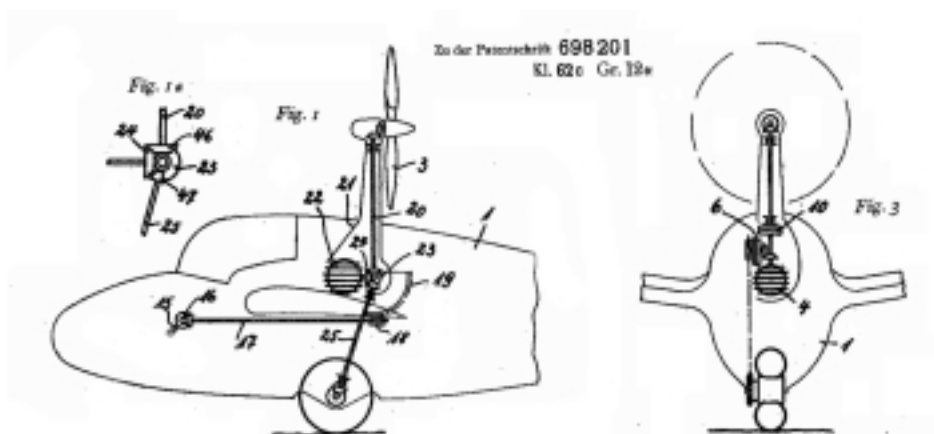


Abb. 2 Glider with auxiliary propulsion system, W. Hirth, 1937, DE-698201

At the moment the development of retractable engines (= Klapptriebwerk, german) has reached the end of the S-curve (sigmoid-curve), with other words; it has become a normal and mature technology. But it is contradictory to use a

propulsion system that reduces the gliding ratio of a high performance glider from 1:50 down to 1:25.

The idea of an internal propulsion is limited by the diameter of the blower wheels within the fuselage. Using several blower wheels on one axis working parallel (not in stages like in a turbo compressor) avoids and circumvents this problem of limited wheel diameter.

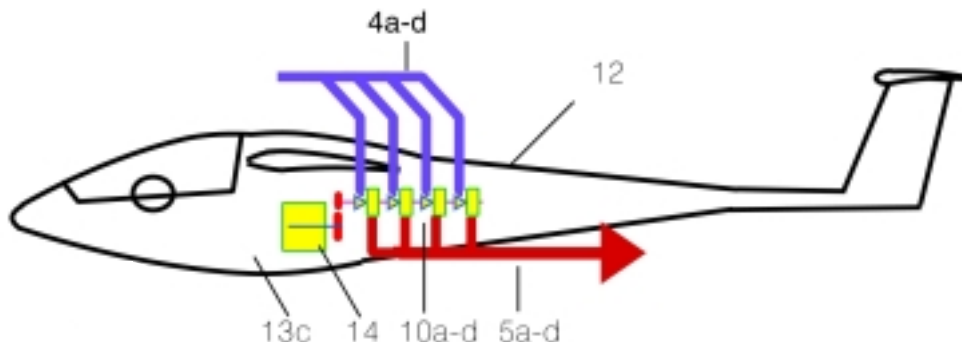


Abb. 3 Jet soarer basics, yellow 4 wheel blower, engine, blue suction, red propulsion jet

The theory of propulsion distinguishes between jet-propulsion with turbine-engine with high exit velocity and small mass flux and propeller propulsion with extrem low velocity difference between flight velocity and propulsion velocity and therefore very big mass fluxes. The jet-soarer uses the case in between. Ideally this system works around the minimum of kinetic energy flux to create a specific thrust. This minimum of kinetic energy flux is given by the following mass flux, Koppenwallner, 2003:

$$\text{Formula 1} \quad \frac{\partial E(\text{aus})}{\partial \dot{m}} = \frac{u_0^2}{2} - \frac{1}{2} \cdot \frac{F^2}{\dot{m}^2} \Rightarrow \dot{m} = \frac{F}{u_0}$$

This is given by the ratio of gliding thrust F (thrust to maintain flight level) and flight velocity u_0 . A typical value is 3-4 kg/s, using $F=90-120\text{N}$ and $u_0=30\text{m/s}$.

The main efforts of development have to be spend in the construction of blower wheels (at the present VW-beetle air cooling blower wheel) and the spiral housings. At the moment functional modell FM-9 (2007) is waiting for durability tests with an ignition engine. In the following FM-6 (2005) is shown.

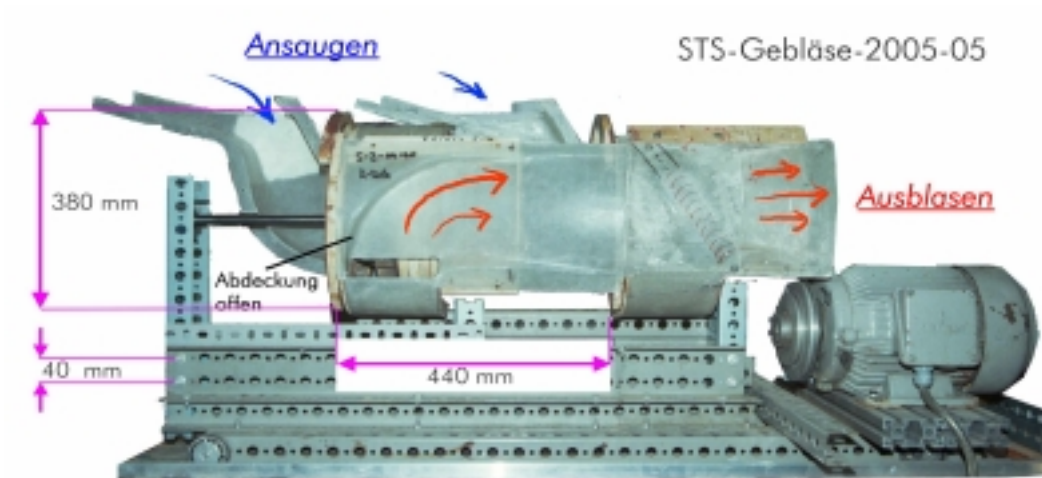


Abb. 4 Propulsion unit 2005, functional modell 6, FM-6

Next step will be the integration of this system into the fuselage of a standard sailplane



Abb. 5 Club-Libelle as jet-soarer – fotomontage.

Extra benefit of this propulsion idea is the possibility of boundary layer suction to reduce drag or to increase lift. This system is one of the first sailplane propulsion system that offers this advantage by the basic principle of its idea.

For further informations please contact: www.strahlsegler.ploland.de
or personally
Plotter/ *Georg E. Koppenwallner*

*Himmelsstieg 1
37085 Göttingen
0551 792230
plotter@ploland.de*

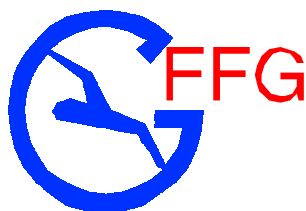
Literature *(can be downloaded from strahlsegler.ploland.de)*

- Hartmann, H., 1960, *Grundlagen des Motorseglers*, Jahrbuch 1960 der WGL, 433 – 441, DK 629.135.15
- Koppenwallner, G. E., 2003, Abschätzung eines Strahlseglers, Schriftliche Fassung des Vortrages auf dem Segelflugsymposium 2003 in Braunschweig.
www.segelflug.de/vereine/goettingen oder über email:
plotter@ploland.de
- Löhner, K., 1960, *Motorsegler*, Jahrbuch 1960 der WGL, 441-446, DK 629.135.15

Abb. : WGL = Wissenschaftliche Gesellschaft für Luftfahrt

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Plotter/ *Georg E. Koppenwallner*



*Mitglied der FFG
Flugwissenschaftlichen
Fachgruppe Göttingen e.V.
DLR Bunsenstr. 10
37085 Göttingen
Tel: 0551 709 2244*