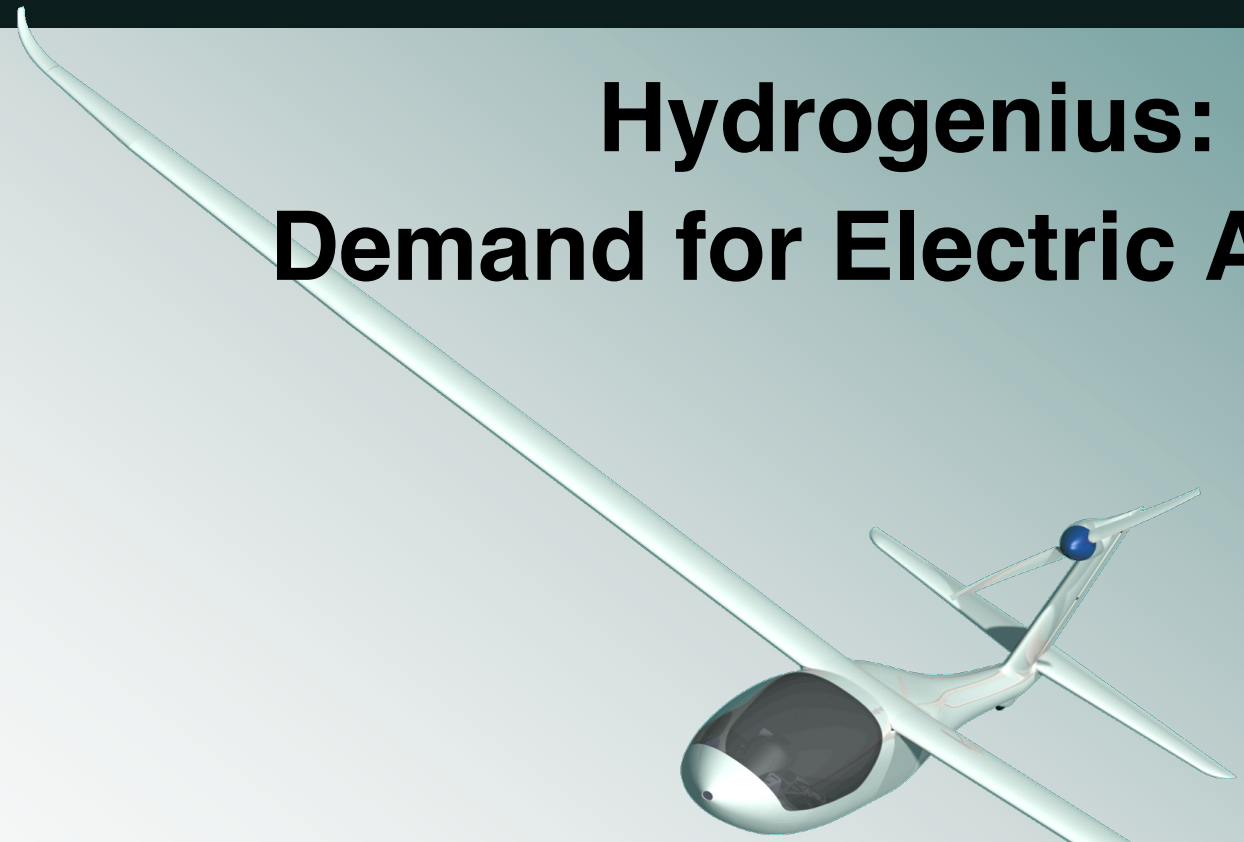
IFB

Hydrogenius:
Demand for Electric Aircraft



Project of the Faculty Aerospace Engineering and Geodesy (University Stuttgart/Germany) in Cooperation with Pipistrel (Slovenia)

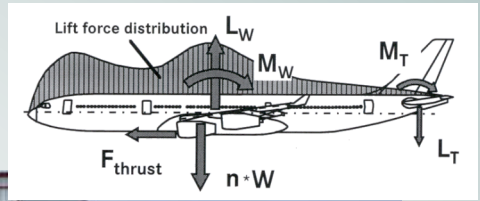
Prof. Rudolf Voit-Nitschmann, Steffen Geinitz, Len Schumann

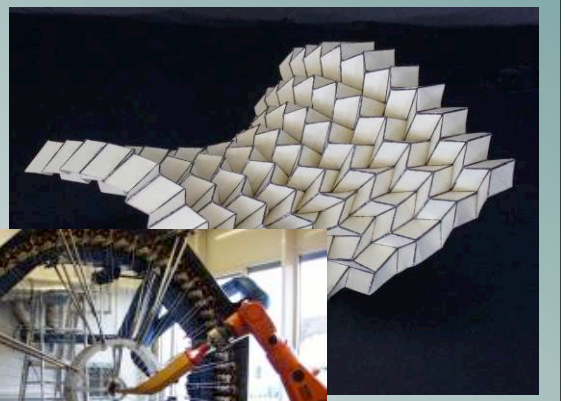
IFB icaré 2 and Institute of Aircraft Design

- icaré 2 had its maiden flight in 1996

icaré 2 is still one of the most powerful manned solar powered aircraft and still in use for research

IFB





IFB Hydrogenius: Team and History

- Prof. Dipl.-Ing. Rudolf Voit-Nitschmann:
  - Project Management and Public Relations
- Dipl.-Ing. Len Schumann:
  - Airframe and Aerodynamics
- Dipl.-Ing. Steffen Geinitz:
  - Propulsion System, Avionics and Integration
- 17 Students, 10 finished theses

- Berblinger Competition of Ulm/Germany
  - Environmental Sustainability
  - Operating Efficiency
  - Reliability
  - Construction Methods

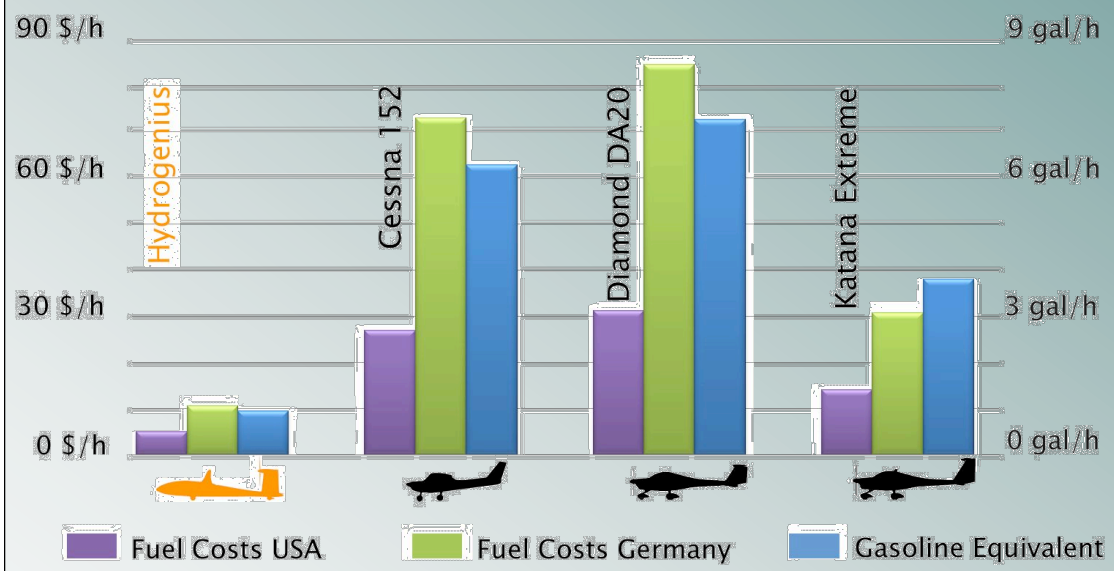
IFB Accident Statistics

- Backup battery
- Hybrid (Power Split)
- Easier Monitoring
- Reduced Loads
- …

- But…
- High Voltage
- Lifetime
- Standards, Regulations
- …

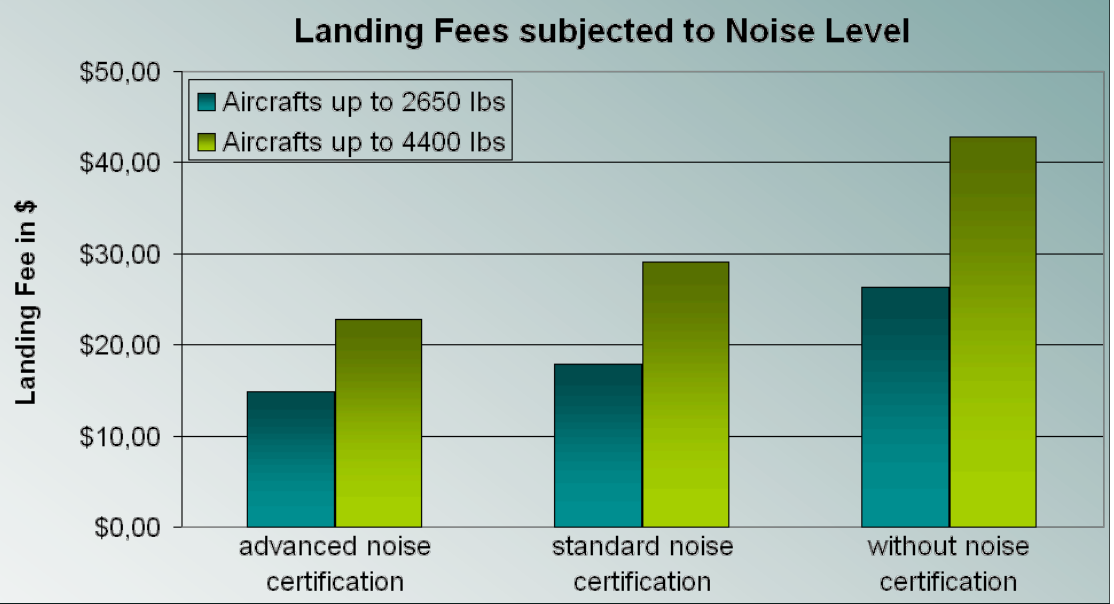
Sources: National Transportation Safety Board and German Federal Bureau of Aircraft Accidents Investigation

IFB Costs and Saving Potential

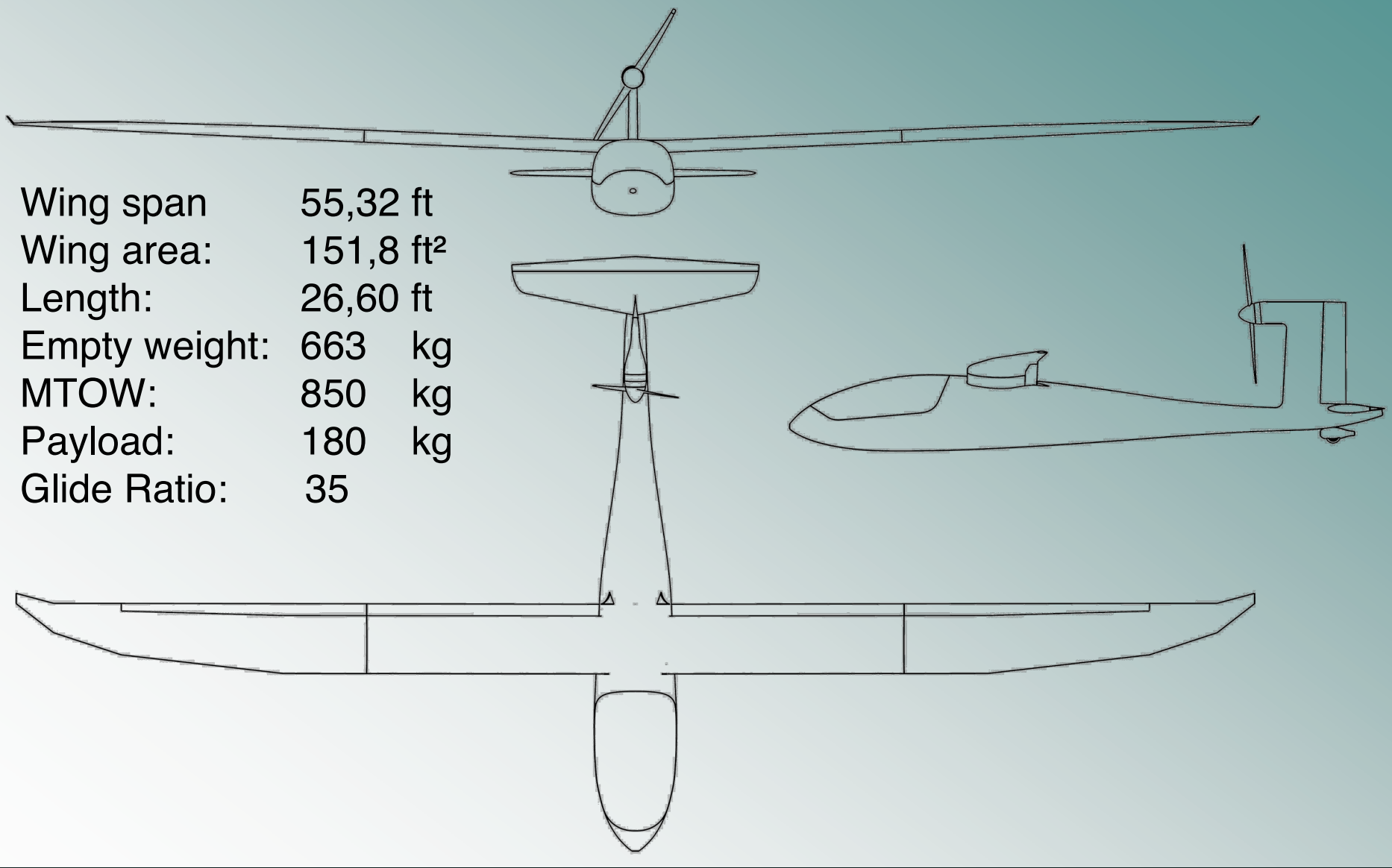


- Increasing fuel cost
- Fees related to…
- Noise
- CO_2-Emissions

- Increasing Efficiency
- Less Consumables
- Modular Change of Parts
- But...
- Expensive Technologies
- No Infrastructure

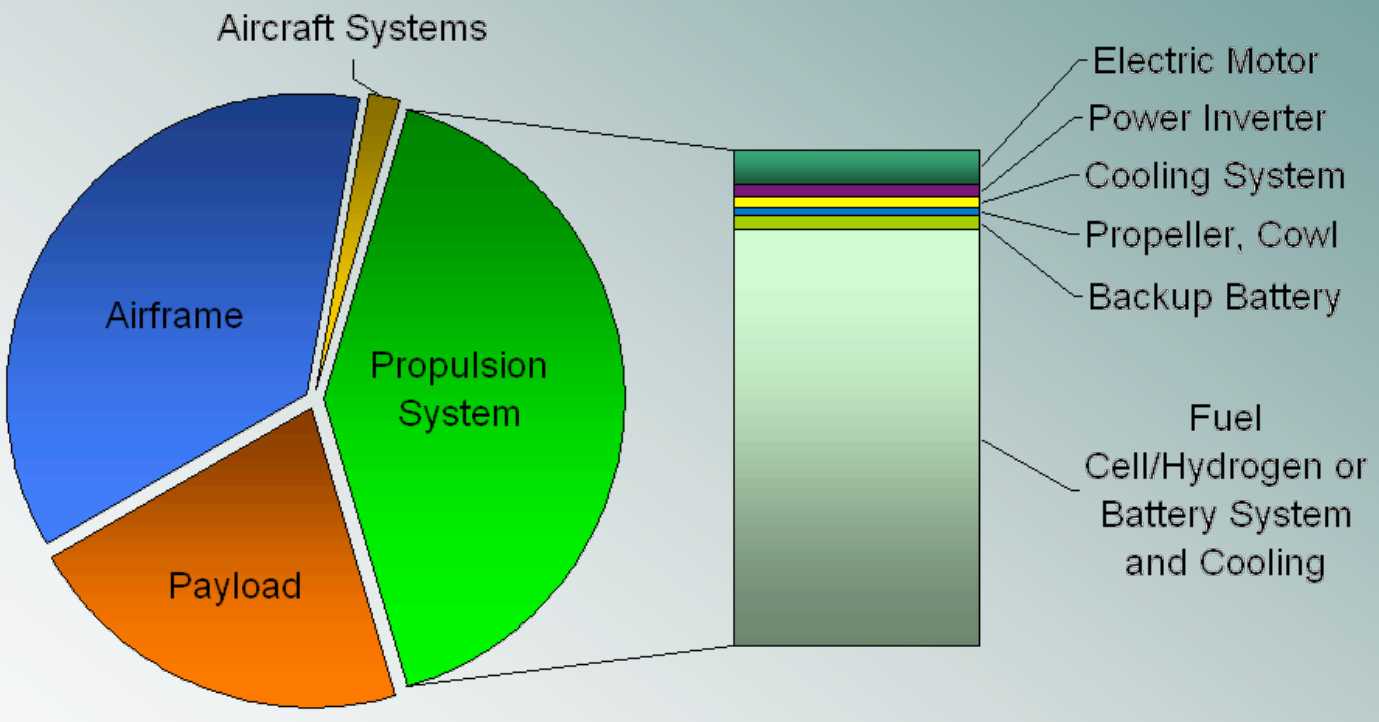


IFB Hydrogenius: Aircraft Data

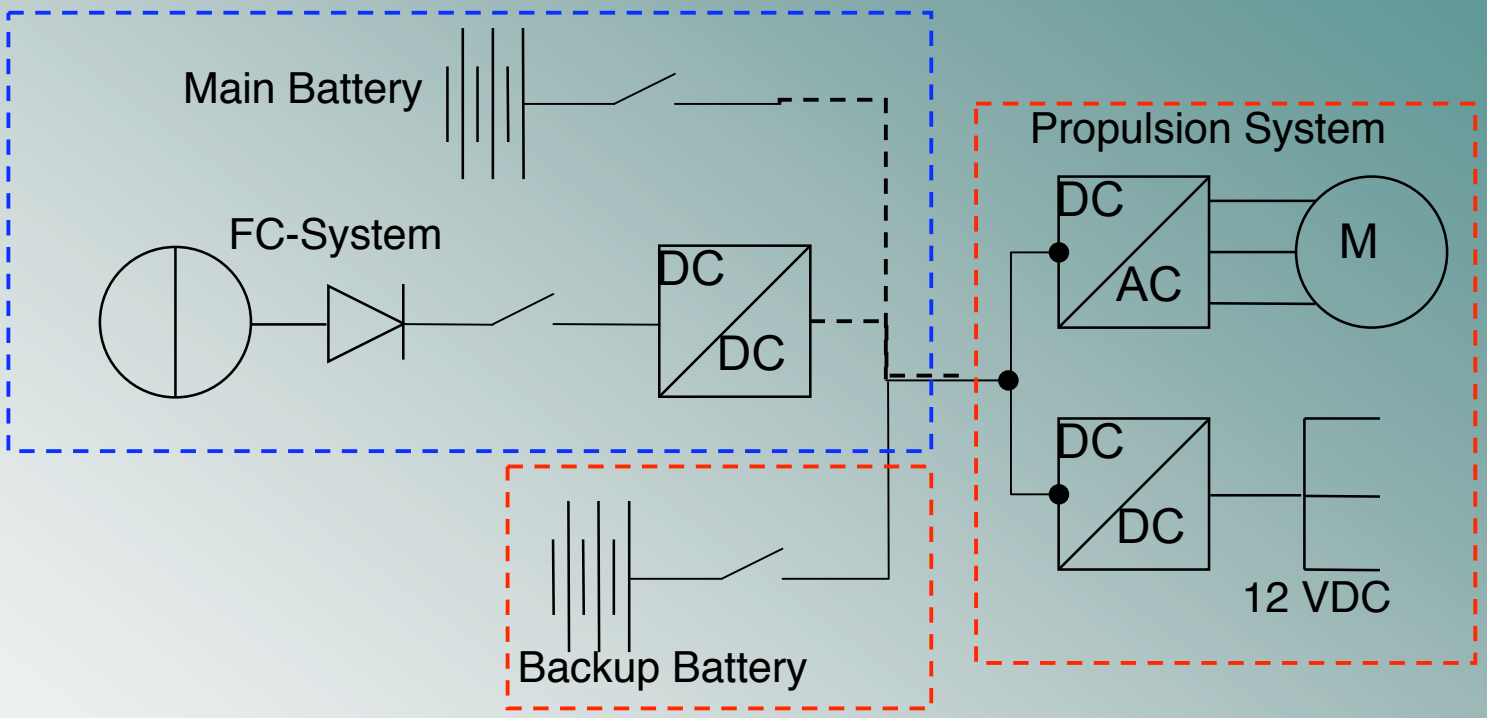


Wing span	55,32	ft
Wing area:	151,8	ft²
Length:	26,60	ft
Empty weight:	663	kg
MTOW:	850	kg
Payload:	180	kg
Glide Ratio:	35	

IFB Hydrogenius: Platform for Electric Flight



IFB Hydrogenius: Modular Propulsion System

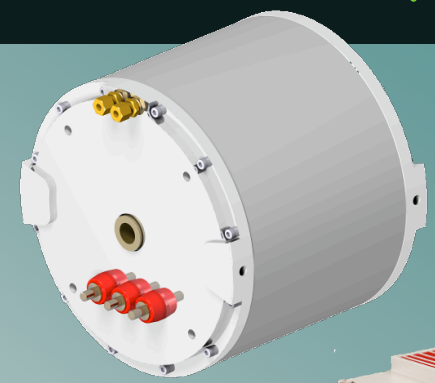


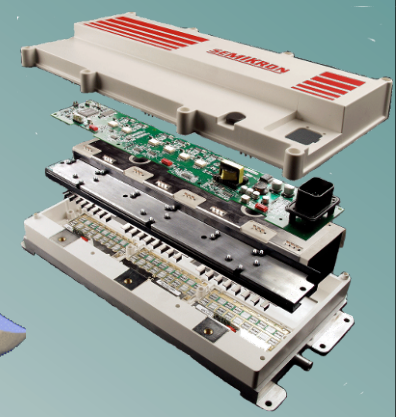
- Lean Fuel Cell System with Backup Battery
- ~70 kW electrical power output
- 700 bar hydrogen storage system
- 4.2 kg H_2 (~4.2 gal of gasoline)

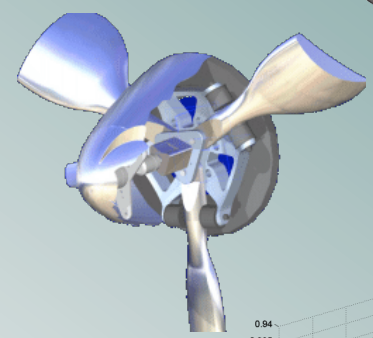
- Lean Battery System with Backup Battery
- Capacity ~16 kWh for flight test
- Capability for 60 – 70 kWh
- Bus Voltage 400 VDC

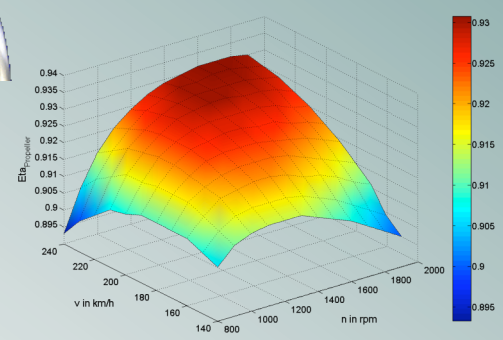
IFB Hydrogenius: Propulsion System

- Electric Motor by **Sineton**
  - Three-phase brushless permanent magnet synchronous motor
  - Weight: 25,5 kg, efficiency ~94 % at 20 kW
  - 72 kW at 2500 rpm (peak)
    58 kW at 2300 rpm (continuous)
- Power Electronics by **drivetek**
  - Weight: 8 kg
  - Communication via CAN-Bus
- Variable Pitch Propeller **Silence Aircraft**
  - Automatically controlled
  - No pitch controls in the cockpit
- Propeller Design by **Hydrogenius Team**
  - Efficiency ~93 % (cruise) and ~85 % (climb)



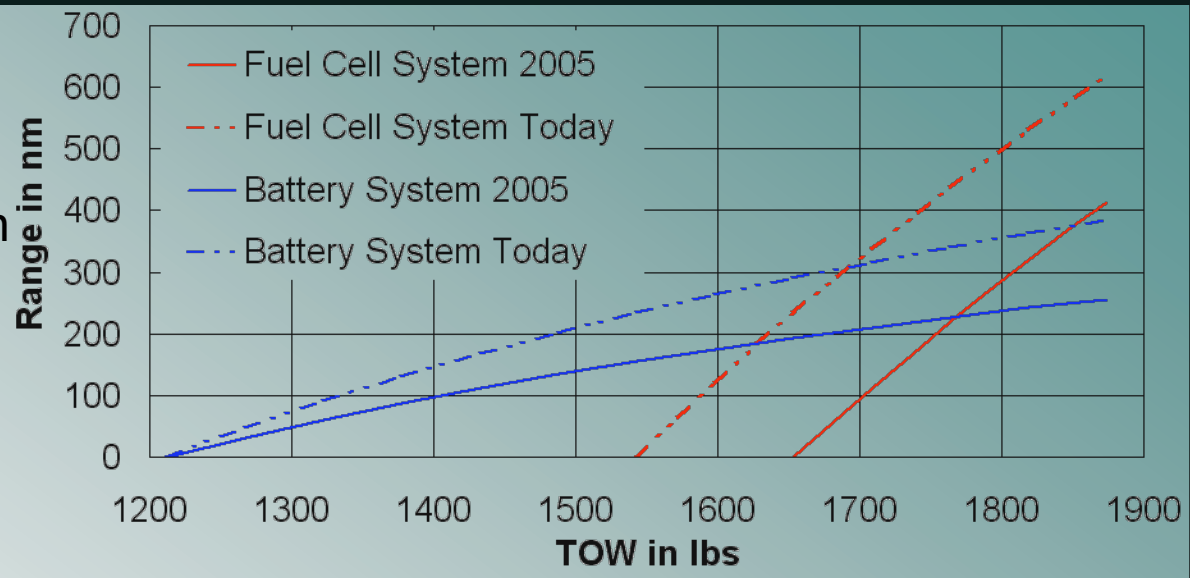


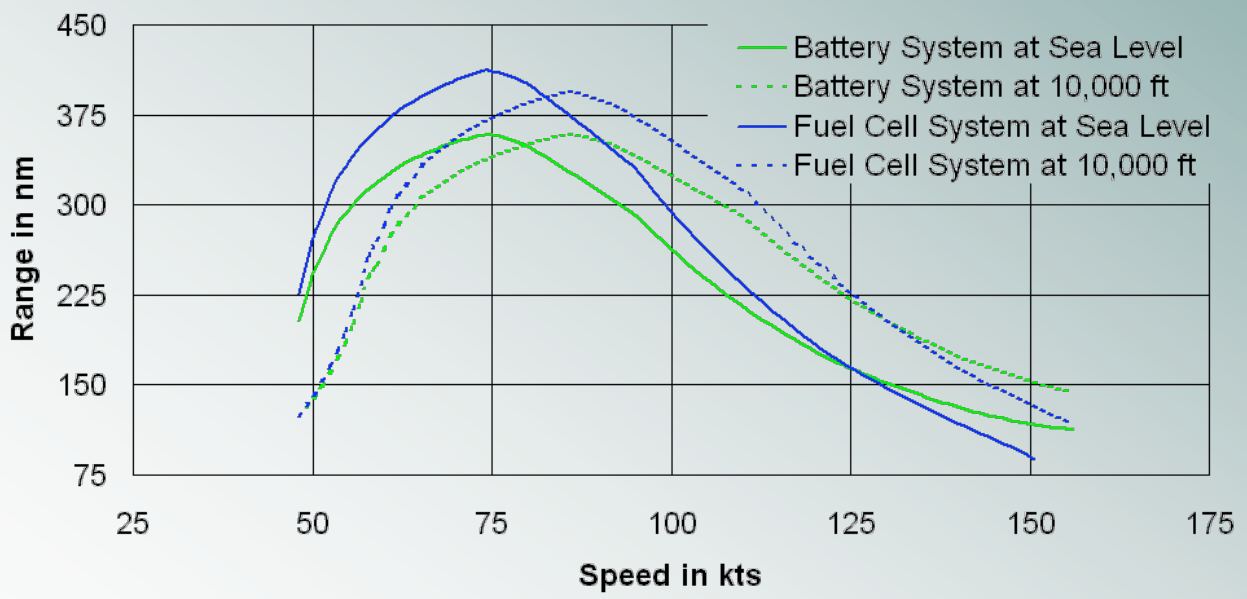




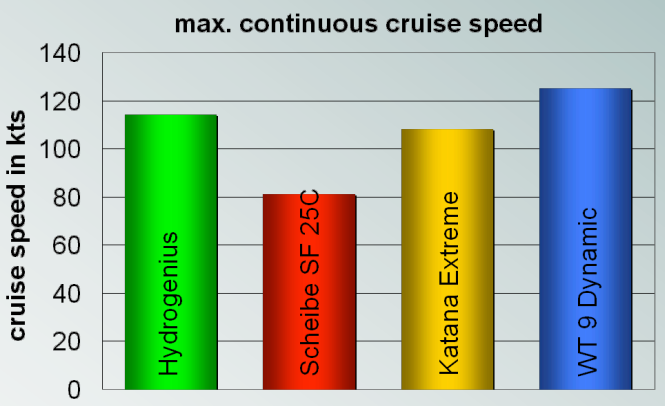
IFB Hydrogenius: Results

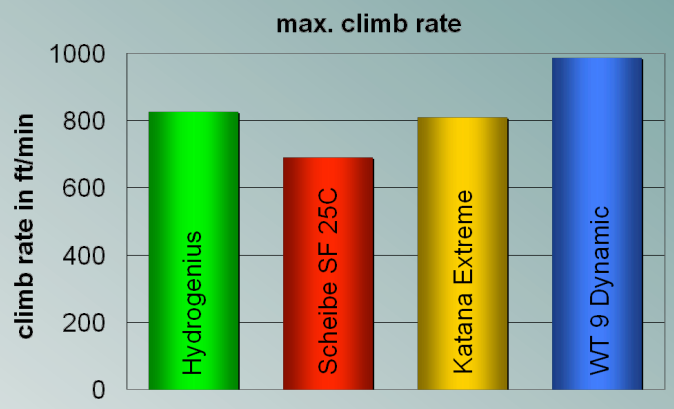
- Motor power: 60 kW
- Max. speed: 146 kts
- Best climb rate: 800 ft/min
- Take-off distance: <1475 ft
- Fuel capacity H2: 4.2 kg
- Service ceiling: >13000 ft

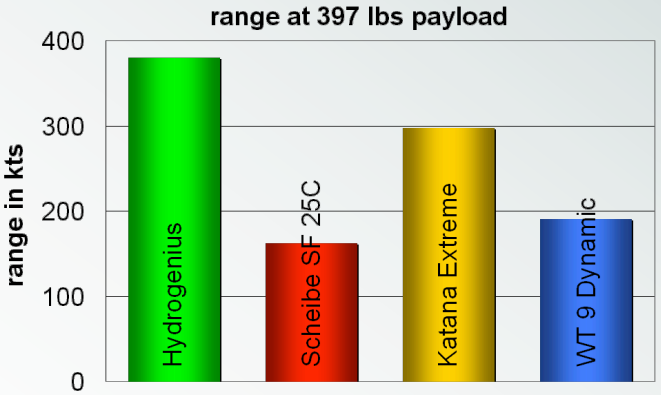


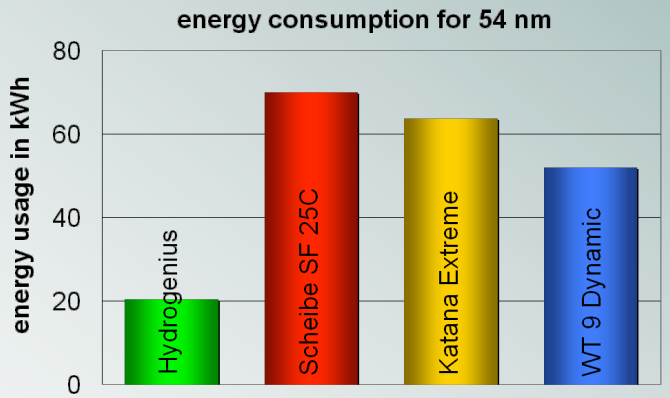


IFB Hydrogenius: Performance

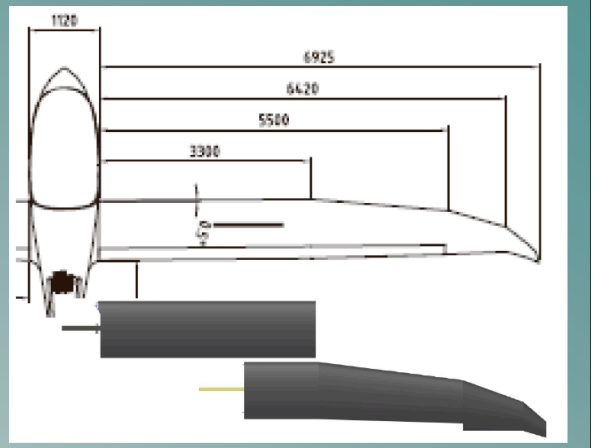


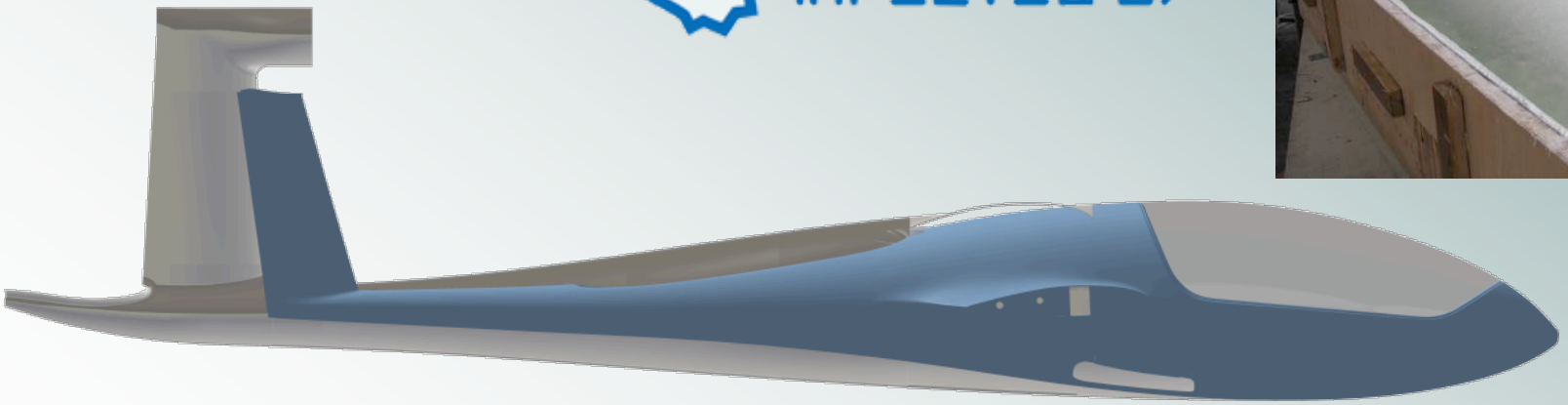






IFB Hydrogenius: Cooperation with Pipistrel





Hydrogenius: Sponsoring

fischer

Flughafen Stuttgart

PIPISTREL INFECTED BY

drivetek ag
development powerhouse

ECC
FABRICS FOR COMPOSITES

SolviCore
Fuel Cell Technologies

BAE SYSTEMS

SCHROTH Safety Products

AKG

Universität Stuttgart

dokeo
[Reputation, Image]

?

GSR
Ventiltechnik

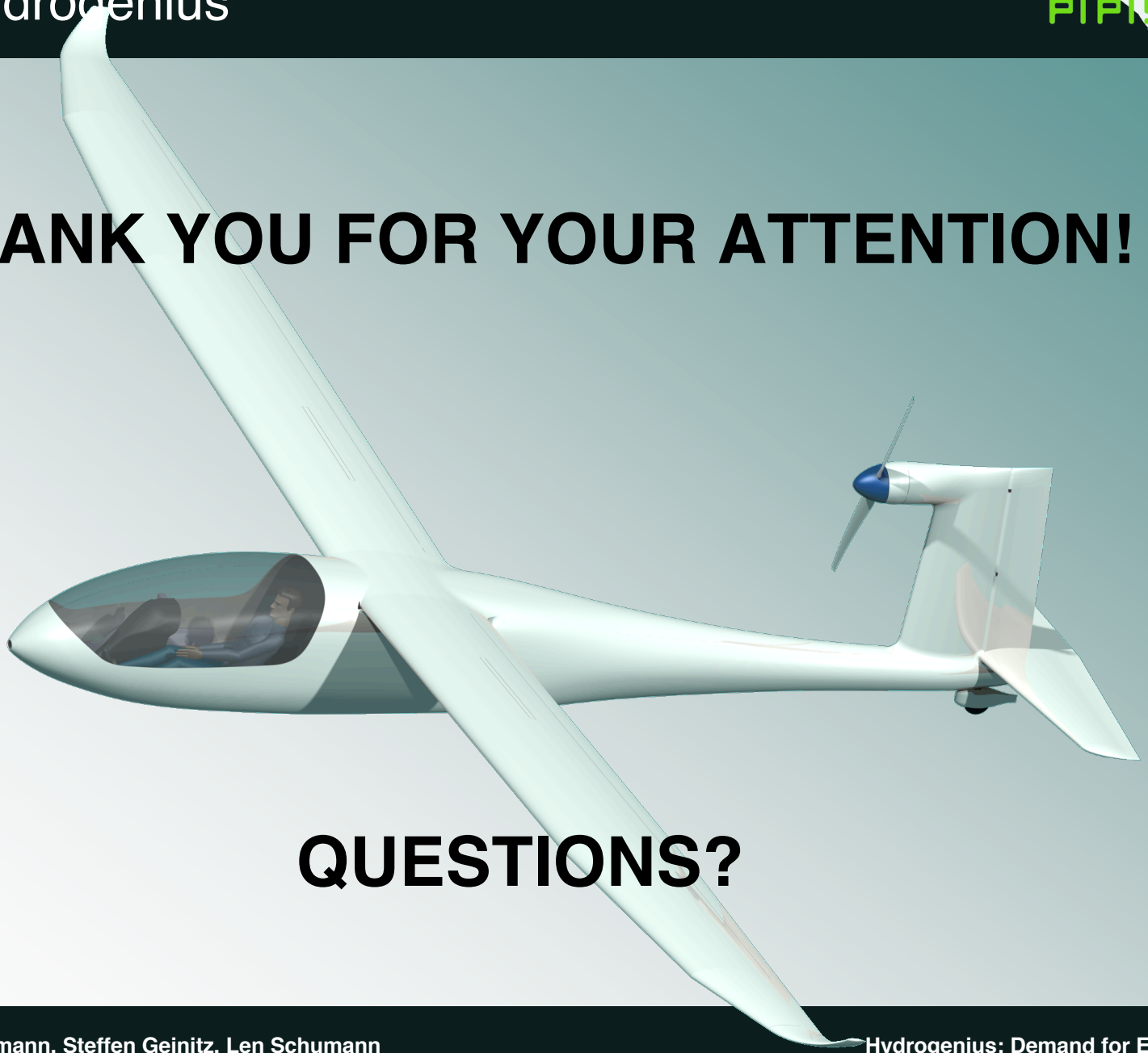
funkwerk
avionics

SINETON
RESEARCH AND DEVELOPMENT

Toho Tenax

Baden-Württemberg

metallbau Schmid



THANK YOU FOR YOUR ATTENTION!

QUESTIONS?