Schubklappe = pusher flap

Coandajet

AMELSENS INNOVATIONSMANAGEMENT

PLOTTERLAND INVENTION

FFG

Coandajet with pusher -flap

Estimation and development status

July- 2018

Schubklappe = pusher flap

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Who are we ?

News from South Nethersaxony

Schubklappe = pusher flap

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Who are we ? News from the Solling

FFG Flugwissenschaftliche Fachgruppe Göttingen e.V.

Bunsenstr. 10 37085 Göttingen

http://weperflieger-goettingen.de

Weper Airfield near Moringen at the Solling

Schubklappe = pusher flap

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Why new propulsion concepts for soaring?

- Take off – the daily problem

Schubklappe = pusher flap

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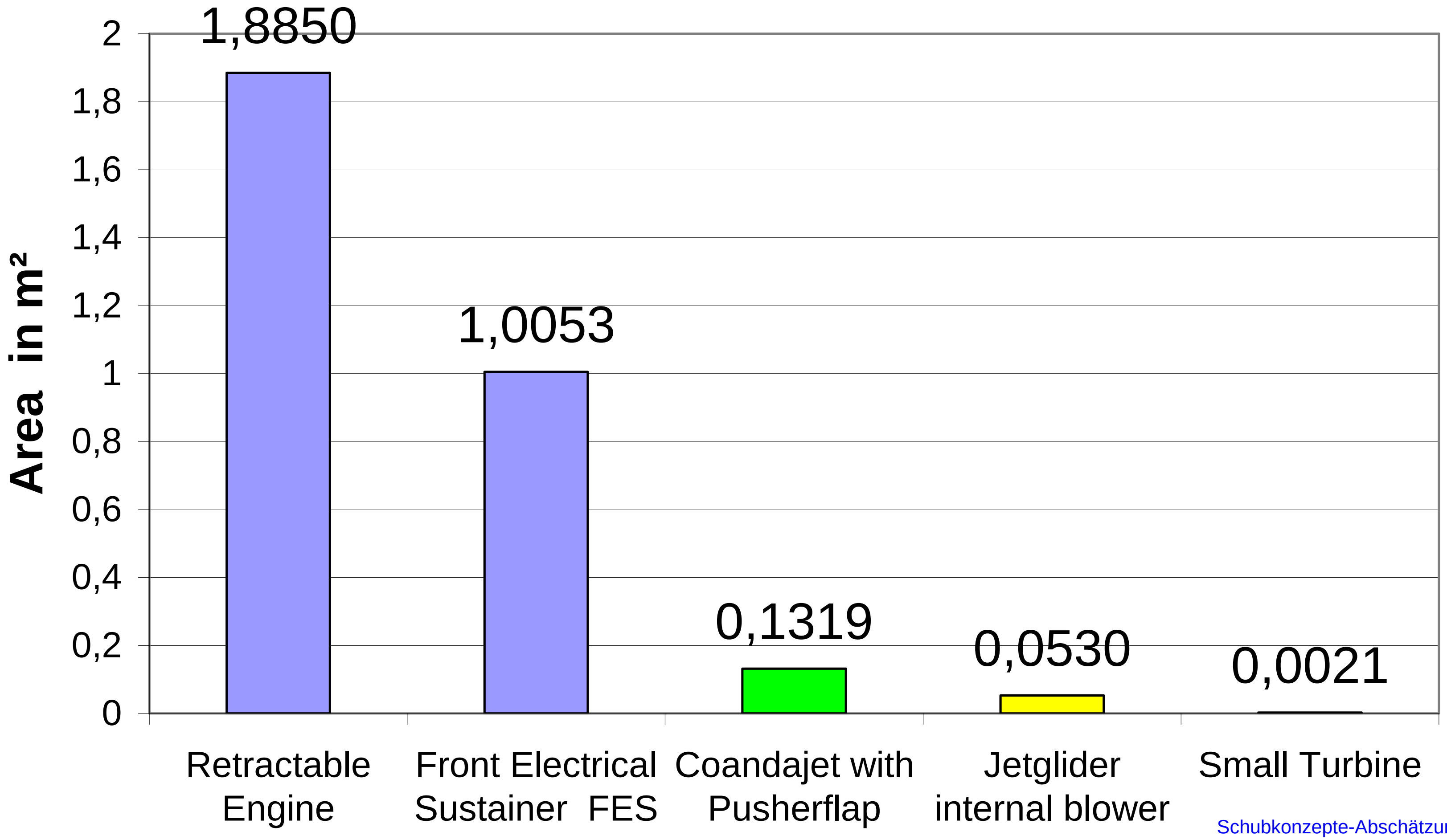
Distributed Propulsion – Verteilte Antriebe

- Aerodynamic optimization by BLC = Boundary Layer Control

Active surface of different propulsion concepts



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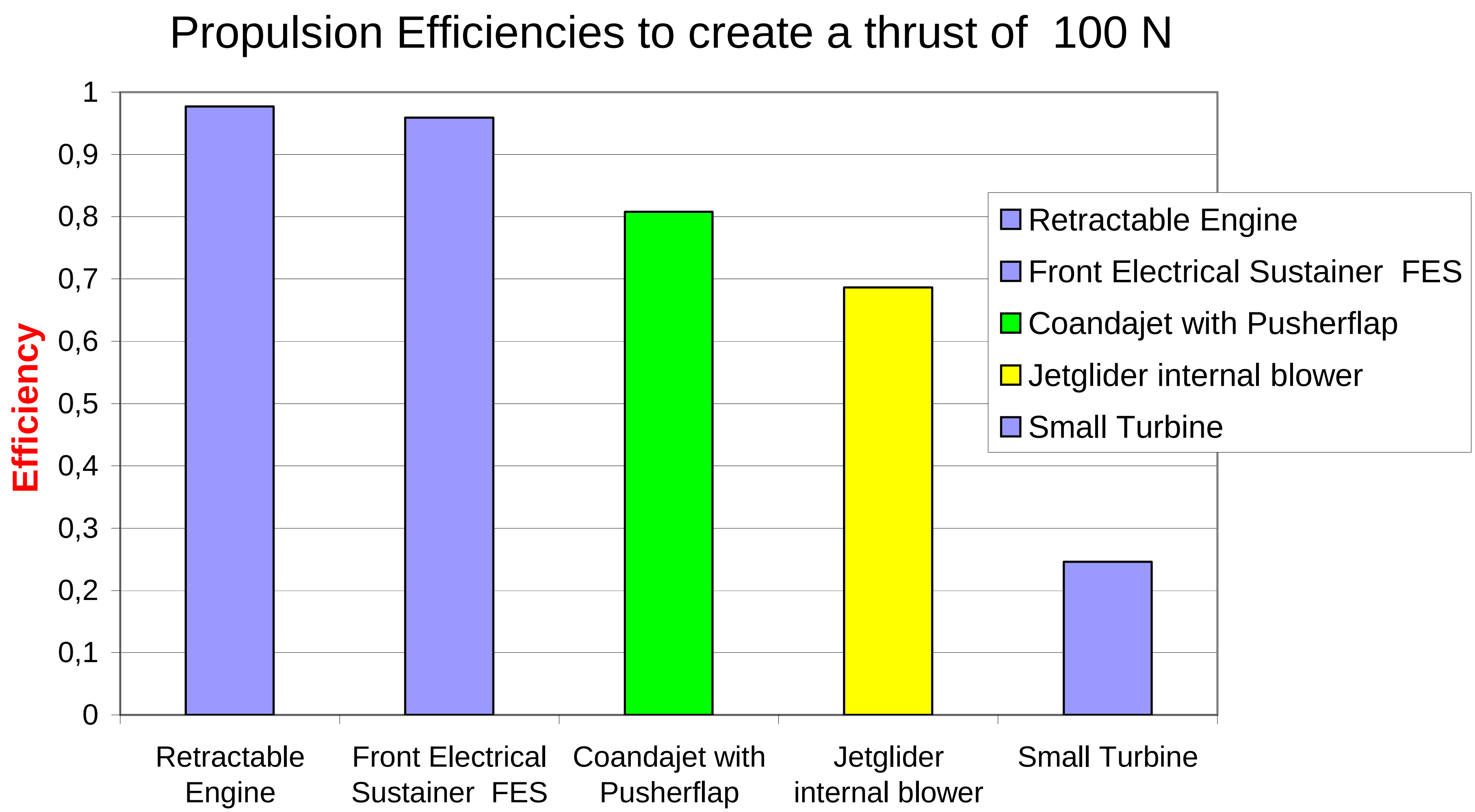
Propulsion efficiency of the propulsion efficiency



What is a pusher flap? / Was ist eine Schubklappe ?

Proposal: A device to extract a line of blowers out of the wings surface

Schubklappe = pusher flap

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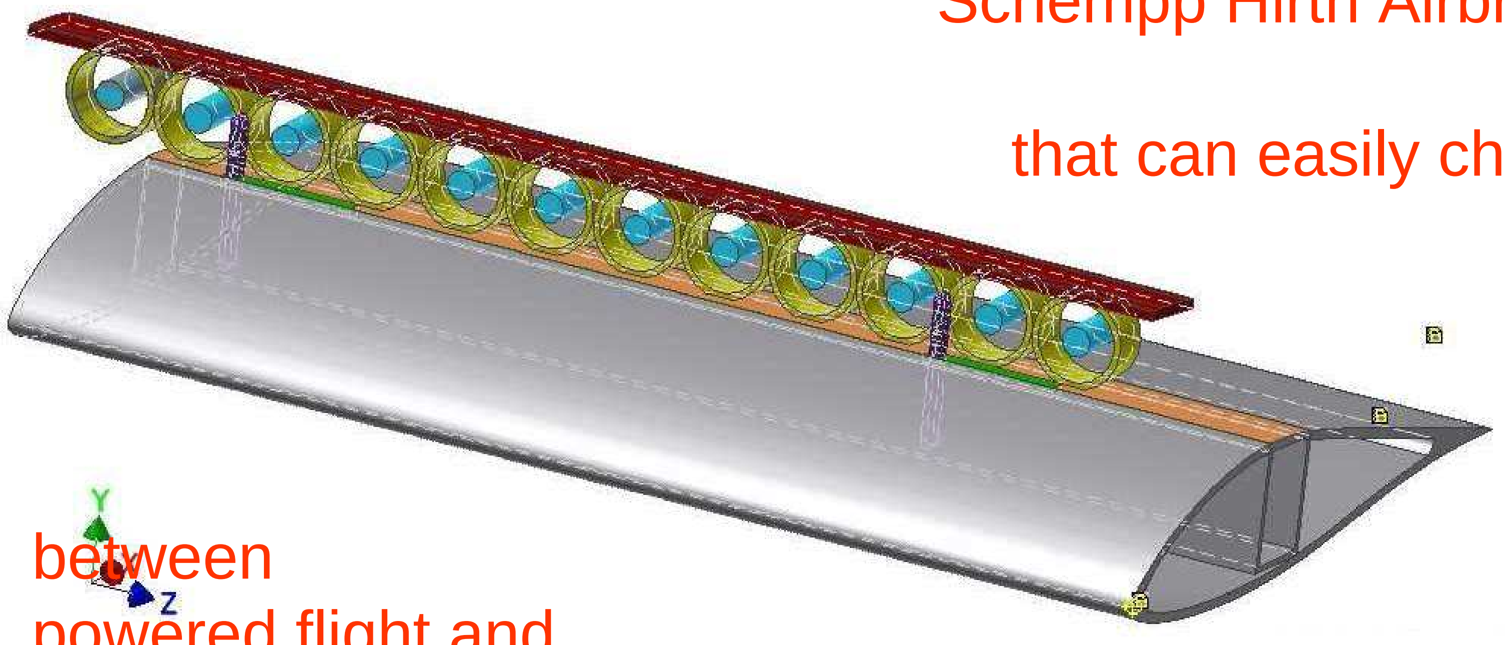
What is a Coandajet ? / Was ist ein Coandajet ?

Proposal:

a glider with extractable
lines of thrust-blowers
instead of the
Schempp Hirth Airbrakes

that can easily change



between
powered flight and
soaring flight

Bild-Schubklappe-CAD-Segsym

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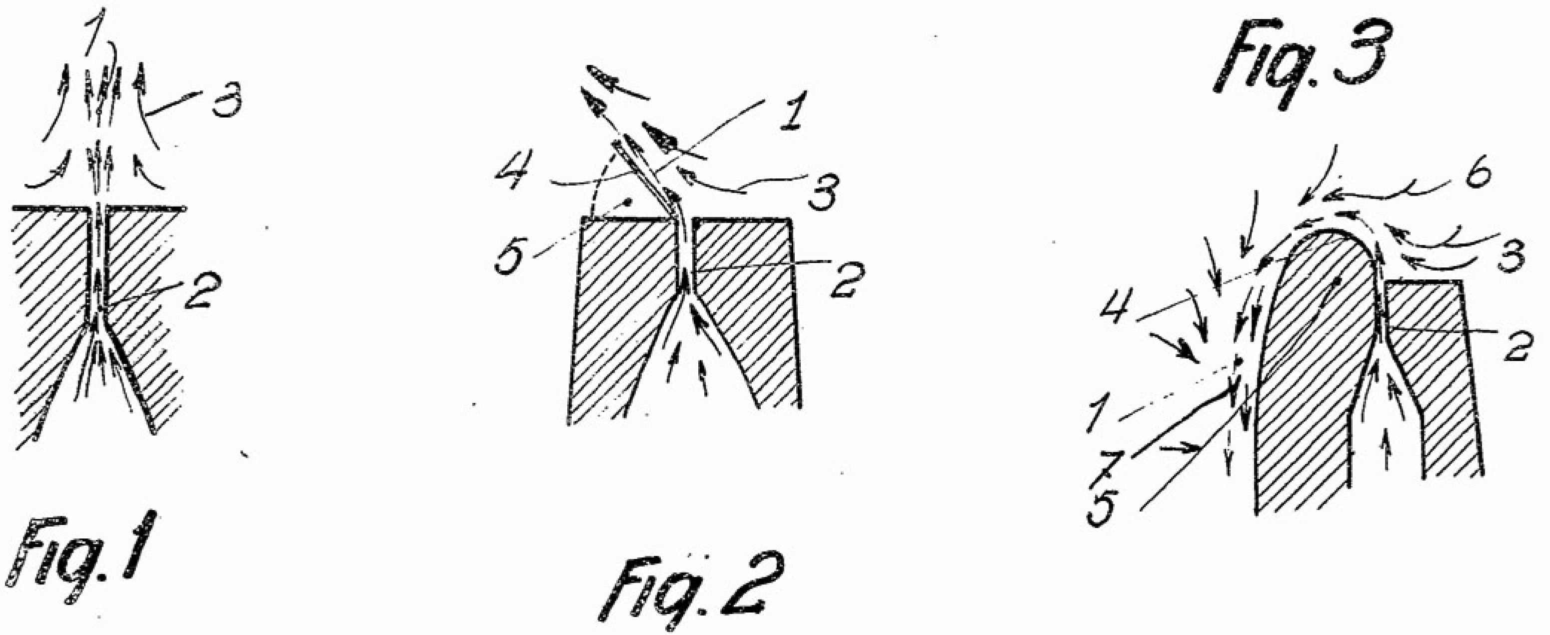
What is the Coandaeffect?

jet-jet- and jet-wall interaction

N° 792.754 M. Coanda Pl. unique



Advantages of many impellers

- operation only with partial load during sustaining flight
- extrem high thrusts possible
- small impellers fit into the Schempp-Hirth flap
- no extra retraction elements for the blowers necessary
- redundancy
- lift increase in the regíon of the pusher flap

Components off the shelf

- Impeller-provider – Hacker, Schübeler
- Batteries: Modellflug-Standard 8 kg/kWh Lipo
  technical batteries LiFePo 12kg/kWh
- Controller : MGM Controller from Zlin near Brno or
  YGE Controller from Wallenhorst
- Schempp-Hirth flap –a standard
- Soaring plane – in Europe availible

Schubklappe = pusher flap

Components traditional - SH-flaps

Example: Schübeler Impeller DS 86-AXI HDS ,

m ~ 1,2 kg axial very short, < 110 mm with Intake

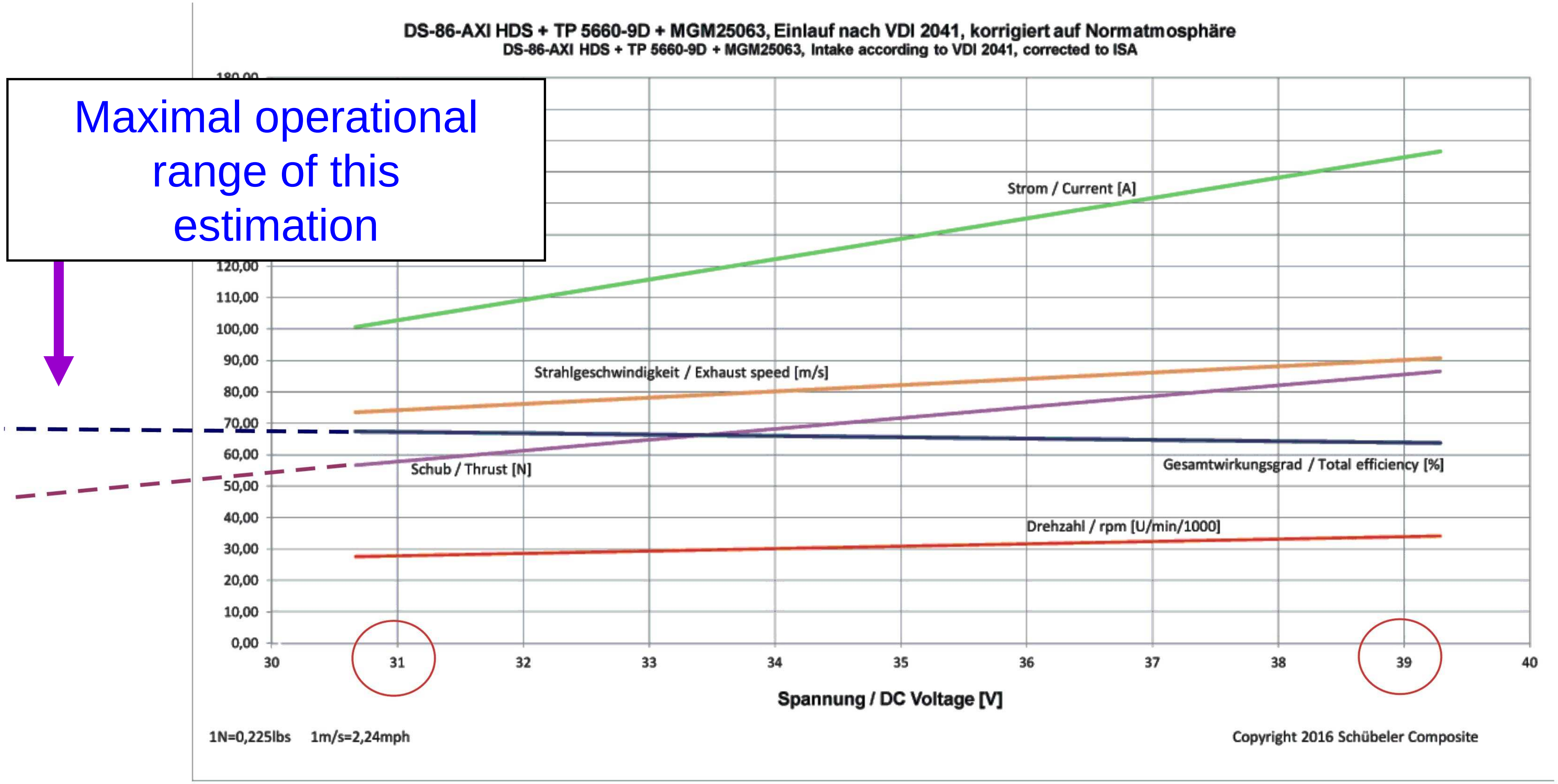
14 N/kW < thrust/power < 18 N/kW S_{max} = 78N

SCHUBELER TECHNOLOGIES GmbH

foto used with kindly permission of : Schübeler-Technologies
Link: http://www.schuebeler-jets.de/de/

Schubklappe = pusher flap

Beispiel: 16 Impeller für 700 N → 43,75 N pro Impeller



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Link: http://www.schuebeler-jets.de/de/

Schubklappe = pusher flap

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Estimation after manufacturers specifications

Schubklappen-Schub-V33-17-SST Seglervariante-2018-07		Schübeler DS-86-AXI HDS + TP5660-9D+MGM25083		
Voltage1	Spannung1	31		V
Thrust1	Schub1	58		N
Current1	Strom1	103		A
Power1	Leistung1	3193		W
Voltage2	Spannung2	39		V
Thrust2	Schub2	85		N
Current2	Strom2	155		A
Power2	Leistung2	6045		W
ThrustproPower1	SchubproLeistung1	18,16473536		N/kW
ThrustproPower2	SchubproLeistung2	14,06120761		N/kW
ThrustproPower-average	SchubproLeistunggemi	16,11297148		N/kW

Extrapolation

Estimation of thrust and power using refefrence values, Subskript 2, known values , Subskript X, extrapolated values

$$\frac{{n_X}^2}{{n_2}^2} = \frac{F_X}{F_2} \; und \; \frac{{n_X}^3}{{n_2}^3} = \frac{L_X}{L_2} \quad \Rightarrow \quad F_X = \frac{L_X^{2/3}}{L_2^{2/3}} \cdot F_2$$

$$\Leftrightarrow \quad F_X = L_X^{2/3} \cdot \frac{F_2}{L_2^{2/3}} \quad mit: \quad \frac{F_2}{L_2^{2/3}} = T_{REF} \quad : \text{Referenzterm}$$

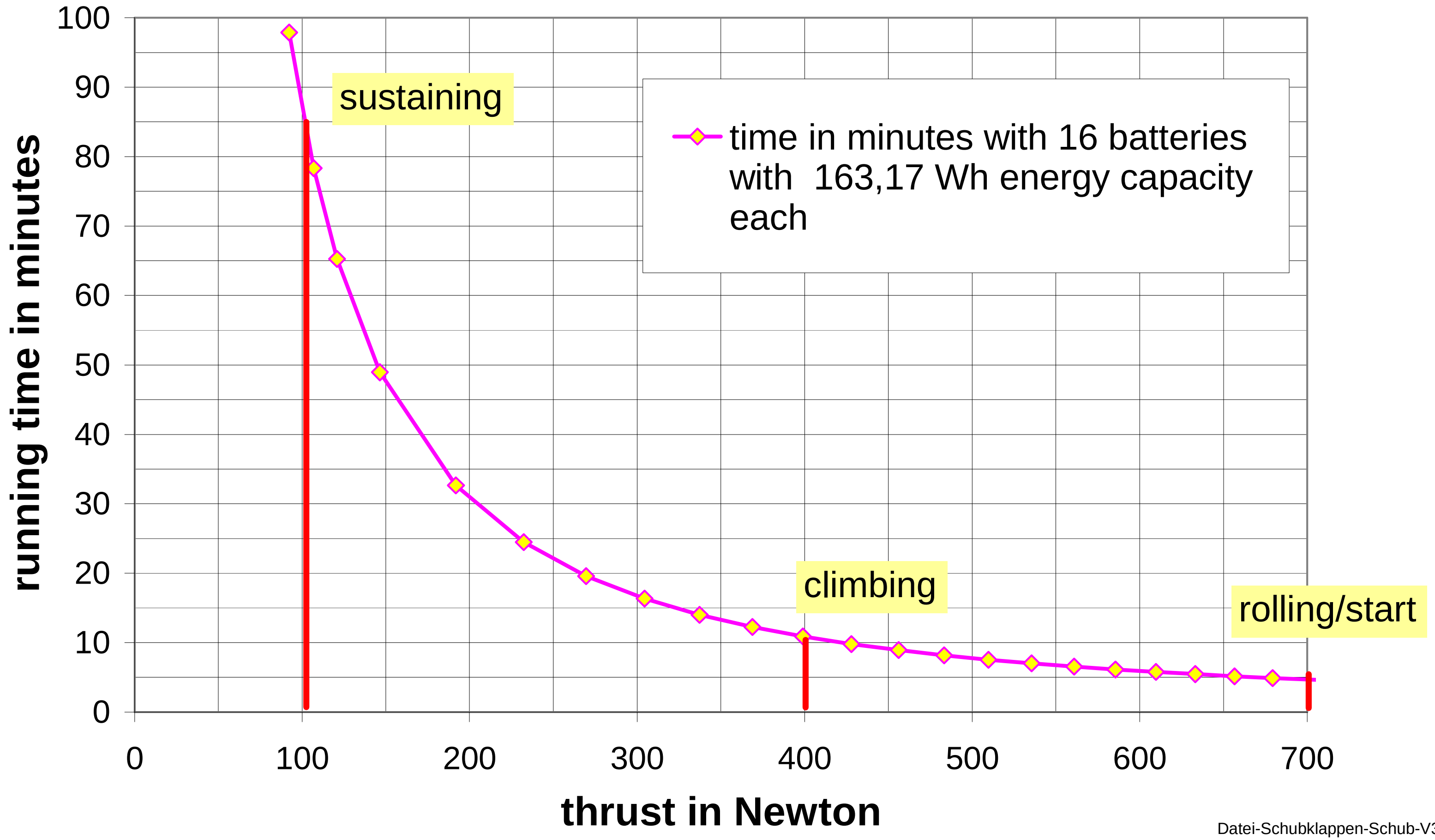
$$\Leftrightarrow \quad F_X = L_X^{2/3} \cdot T_{REF}$$

Schubklappe = pusher flap

Estimation energy consumption t = Energy / Power

Batterie 7S, 6.3 Ah, E(Batt.) =7* 3,7 * 6,3 VAh = 163 Wh

6,4 kg/kWh - total 2,6 kWh



Flight profil for a glider, rolling, climbing and sustaining flight

Weight impellers , 26 kg, 26kg/16 = 1,625 kg,
Weight batteries 17 kg Batteries, with 2.6 kWh
Flap mechanics 10 kg

flight profile	thrust in N	time in s	time in minutes	consumed energy kWh	consumed energy %	remaining energy %
rolling	700	60	1	0,59	22,47	77,53
climbing	400	300	5	1,33	51,07	26,46
sustaining flight	105	600	10	0,33	12,77	13,69

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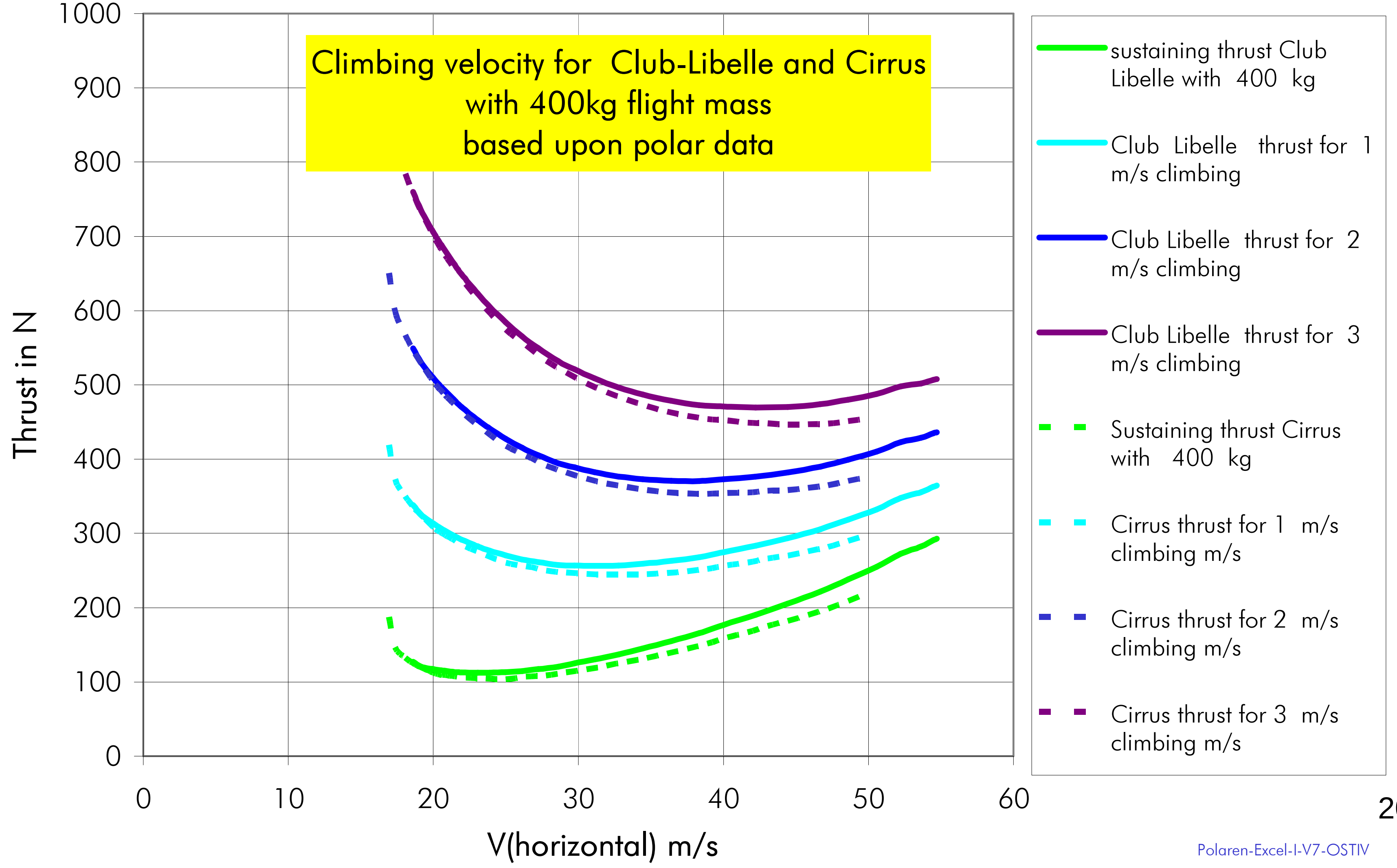
Thrust and climbing, what is the benefit of 5 min 400 N ?

600 m altitude



Polaren-Excel-I-V7-OSTIV

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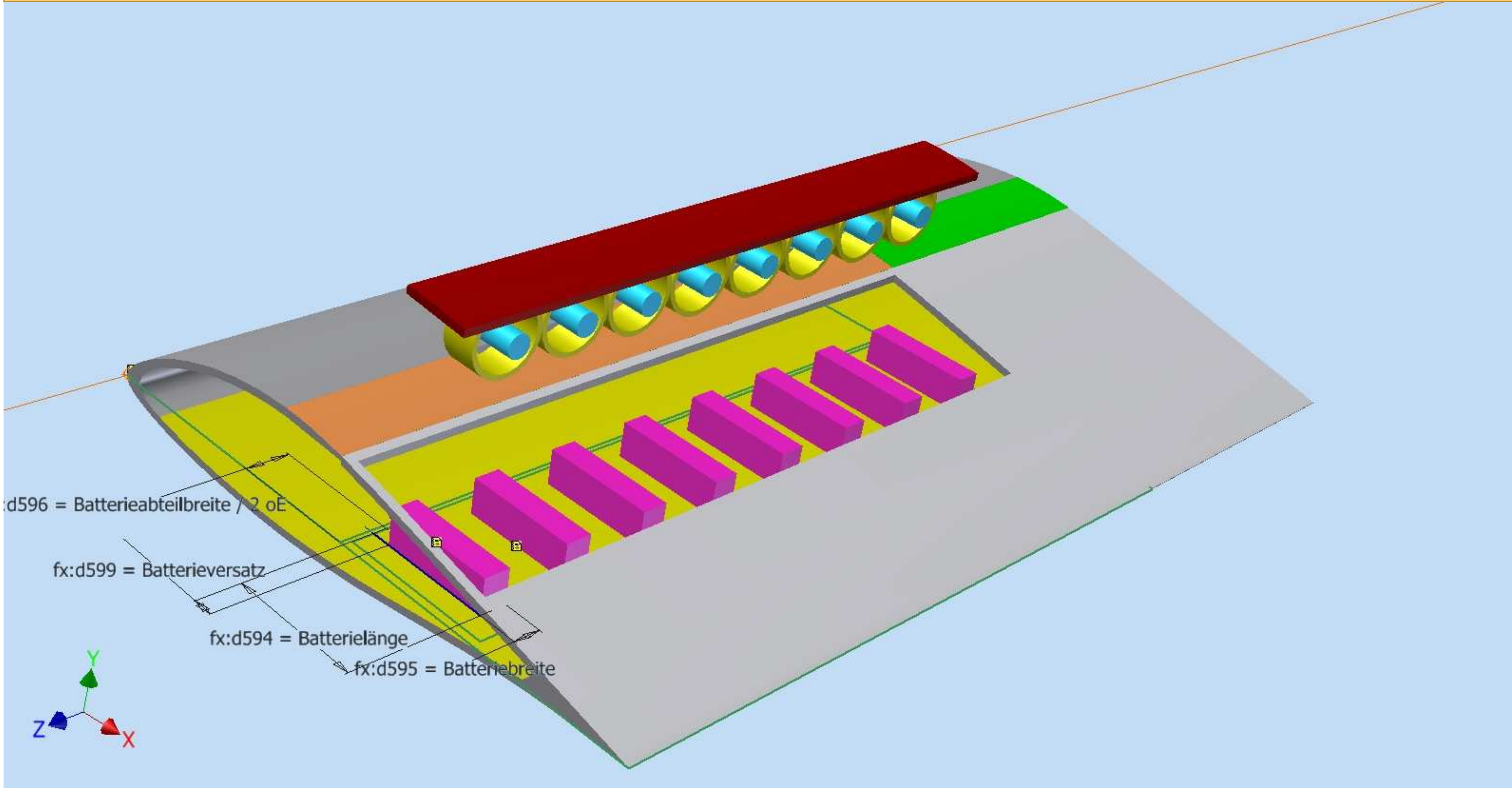
Advantages and problems – Rethinking selflauch

- Coandajet – increase of lift
- Power connection battery, controler and motor
- Extreme close distance between battery controller and motor!
- Accessibility of batteries, blower and controllers
- Fire protection many small batterie-units

- Profil thickness with carbon wings smaller compared to glasswings. Increase of thickness along the flaps??
- Flap mechanics – with shear or linear ?
- Intake of blowers –how to optimize?
- Landing impact–sensitivity
- Use of pusherflaps, Schleppstrahl-landing?
- Charging device – central oder each wing separately?
- Controlling of the blowers – one signal for all controllers, one signal for each wing or a complete controllsystem comparable to multicopters or the volocopter

Schubklappe = pusher flap

Battery assembly in the wing



Schubklappe = pusher flap

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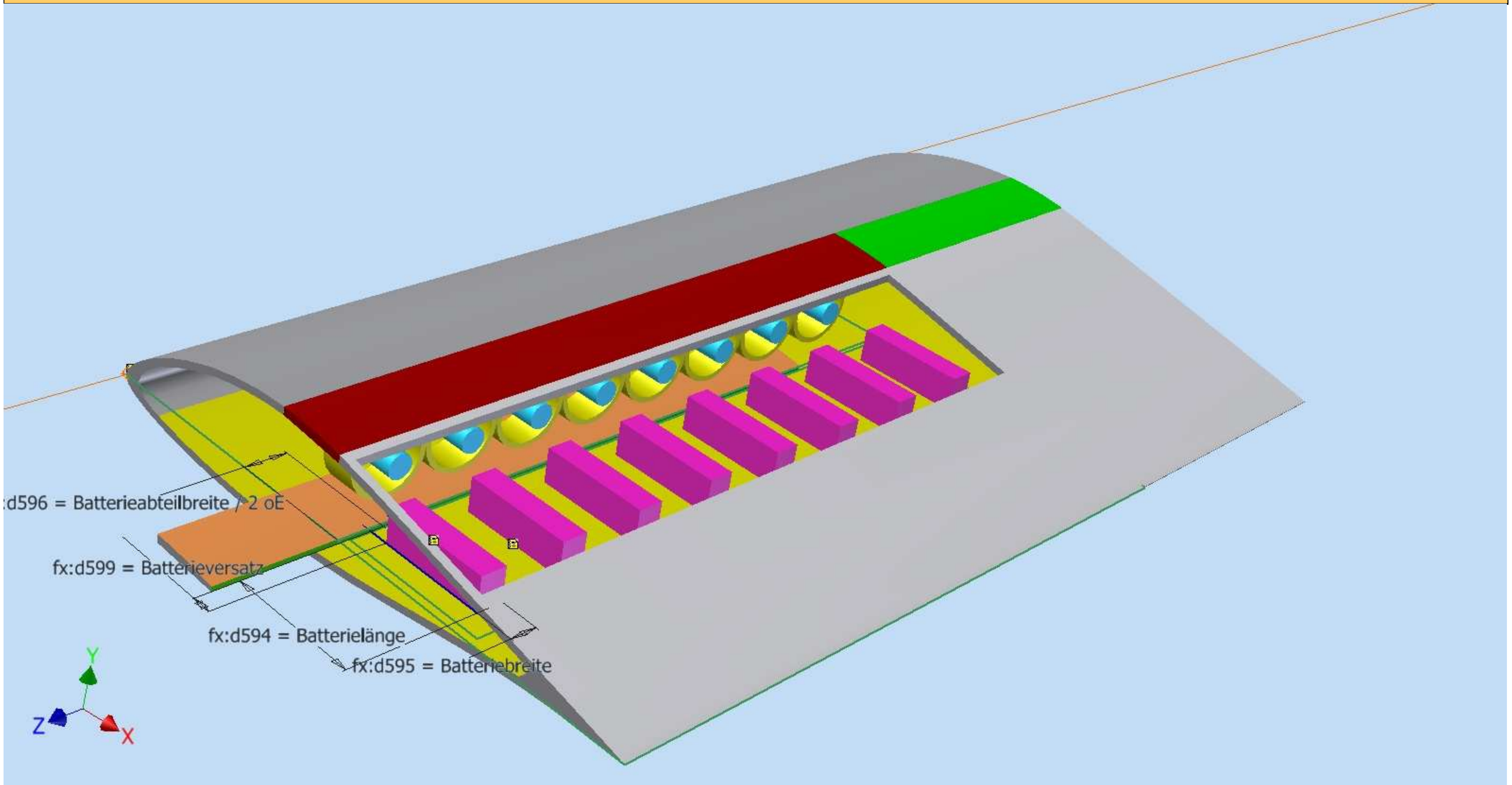
Battery assembly in the wing



Schubklappe = pusher flap

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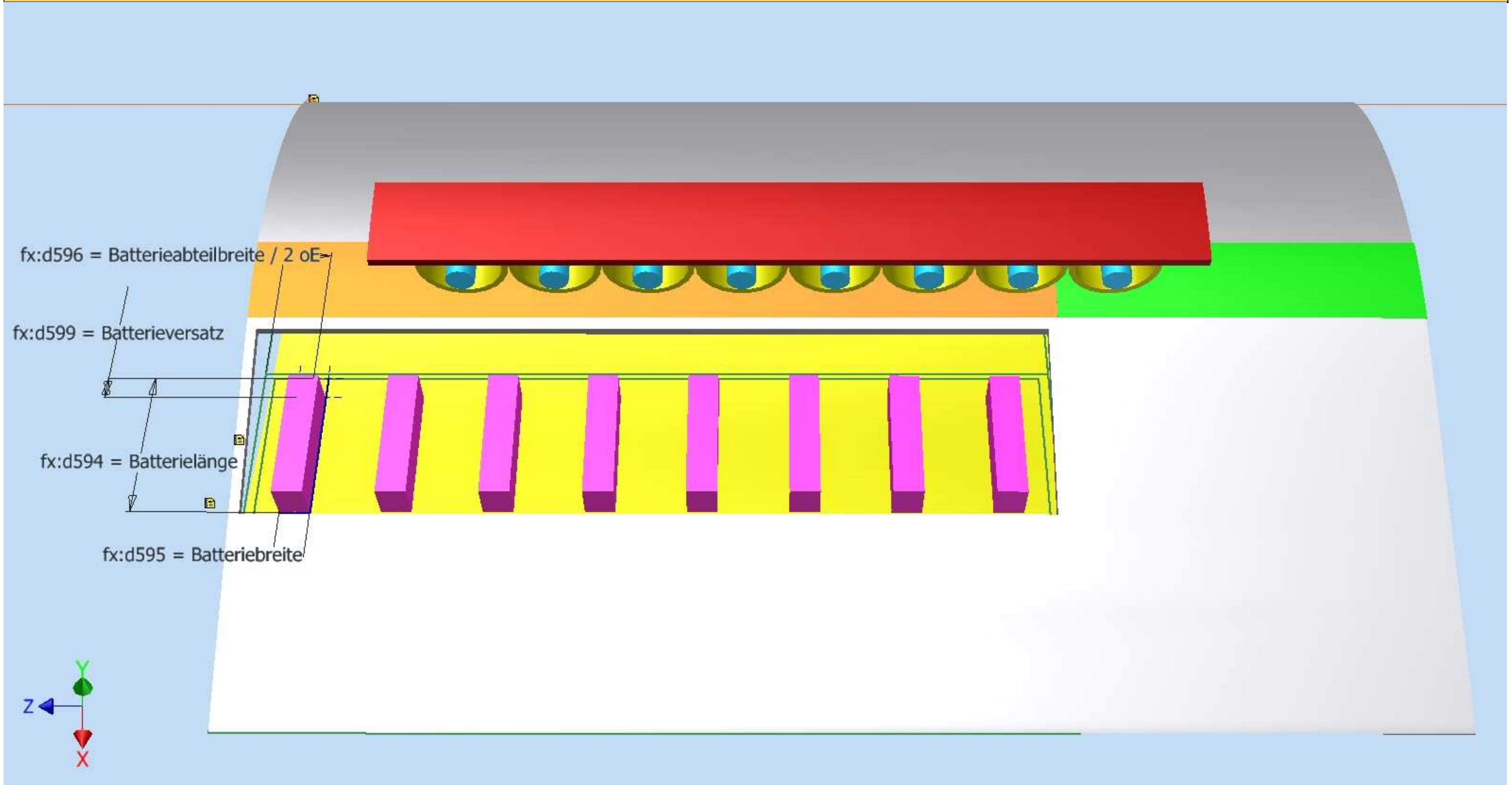
Battery assembly in the wing



Summary

- Good ratio of risk and possible profit
- Need of a new unstressing glider-propulsion
- Self launch easy realizable,
- no modifcation of landing gear necessary
- Application also for other e-mobility concepts
- Limited modifications of existing types
- Need of a clima-neutral sport aircraft
- fits into the E-trend
- Forward looking but based on existing structures

Joint development project:

- Research instituions
- Engineering offices and technology providers
- LTBs = Luftfahrttechnische Betriebe / Aeronautical companies
- Technology Management
- Akafliegs – academic flight clubs
- Glider manufacturer
- Battery manufcturer
- Private supporter

Brocken vom Acker her

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Other applications – Questions?

Coandajet.com – to go the green way

Schubklappe = pusher flap

Many thanks for your attention – Questions?

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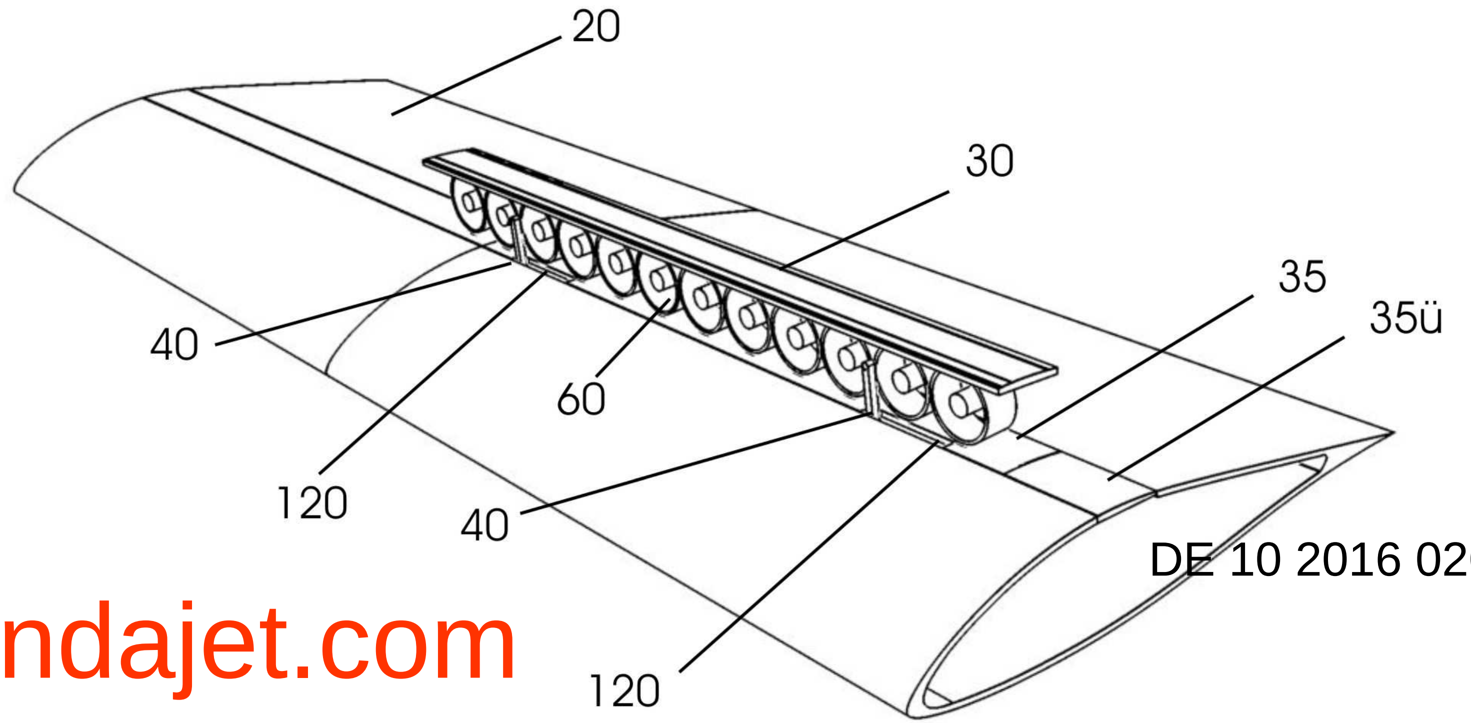
Patent application DE 10 2016 020216.0

Fig. 11



DE 10 2016 020216.0

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