

ICAS Biennial Workshop, Cape Town, South Africa

The Future of More Electrical Aircraft

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SVP Head of EADS Innovation Works

September 2nd, 2013



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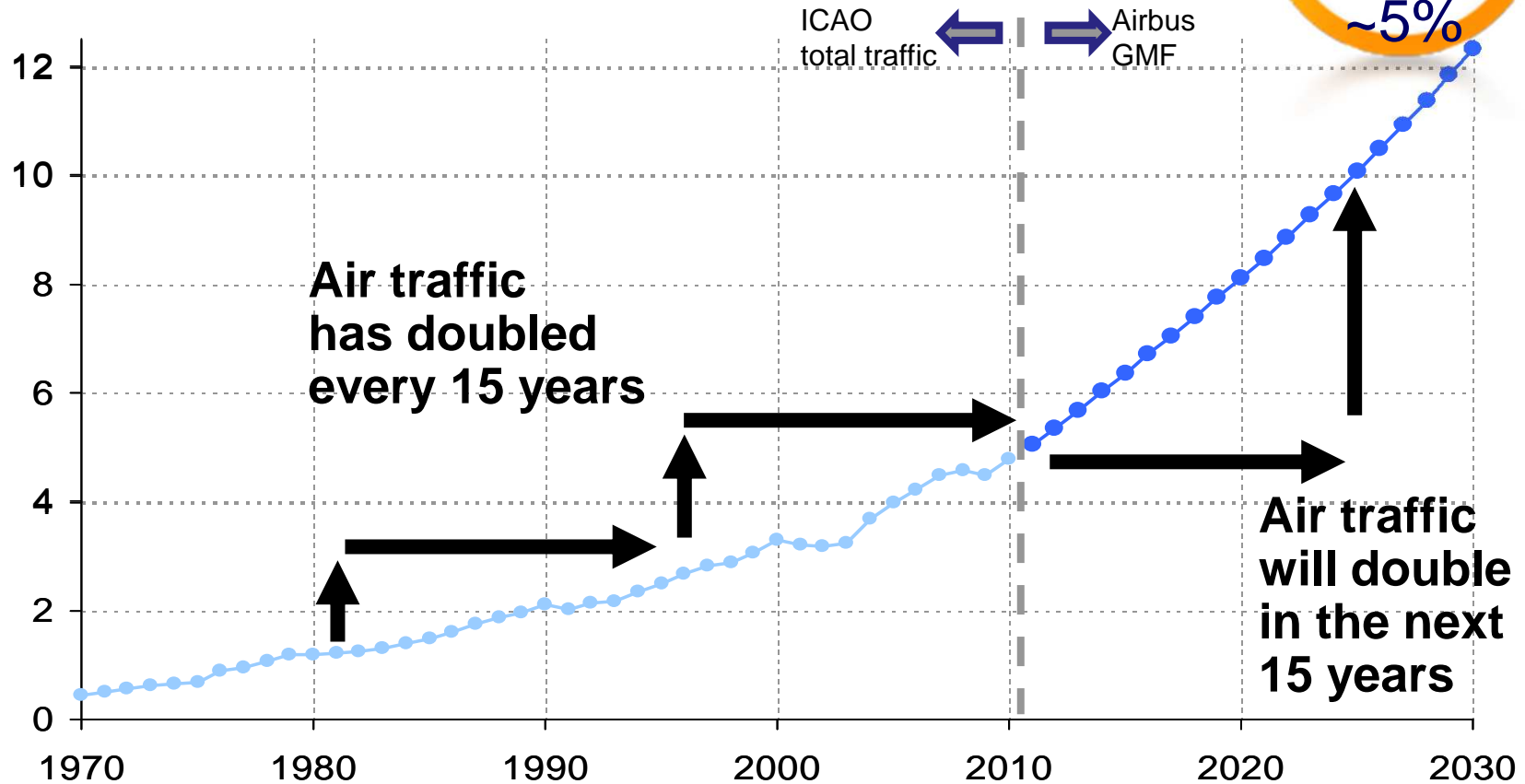
Air Transportation Merits

- Air Transportation is a catalyst to economic growth
 - Contributes to 8% of World GDP
 - Transports 40% of goods between regions
 - Represents more than 30 Millions jobs worldwide
- Air Transportation makes continents closer
 - It enhances understanding between the different nations and cultures



Air travel remains a growth market

World annual traffic (RPKs - trillions)



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Source: ICAO, Airbus

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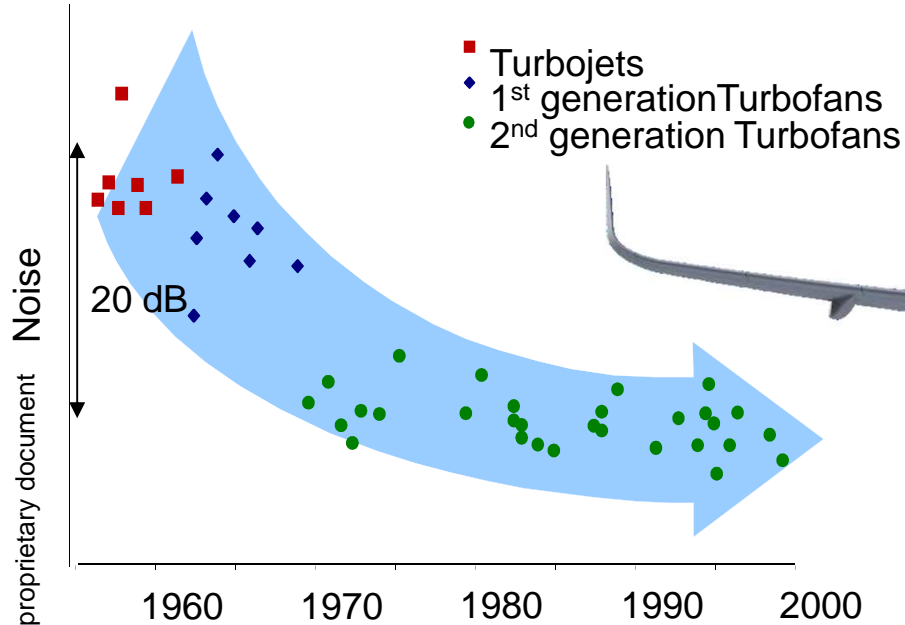
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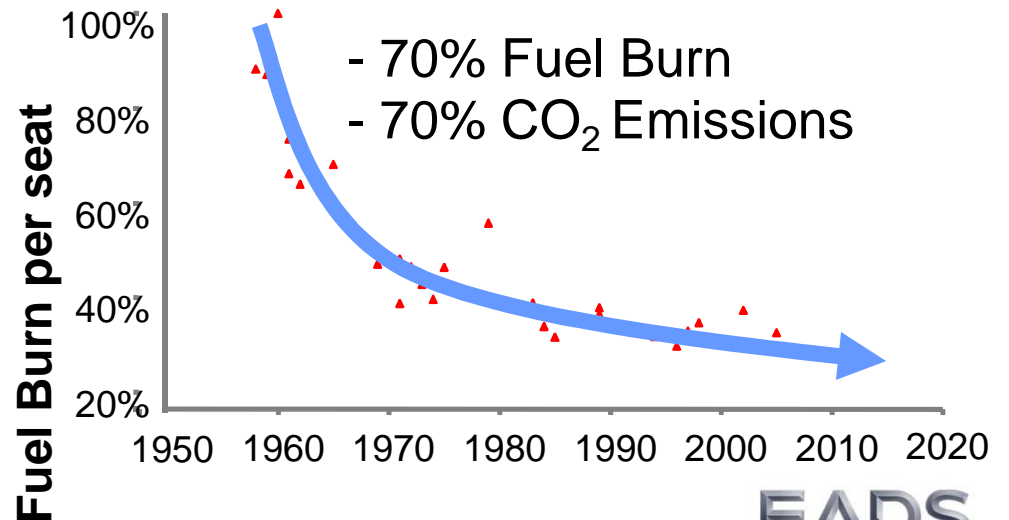
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Air transportation has improved a lot...

Over 20 dB aircraft noise reduction



...but we want to go further



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Air transportation ambitious targets...

Flight Path 2050 Goals



- ❑ **Meeting Societal and Market needs**

Mobility, travel time, robust schedules, capable ATM, coherent infrastructure

- ❑ **Environment and Energy Supply**

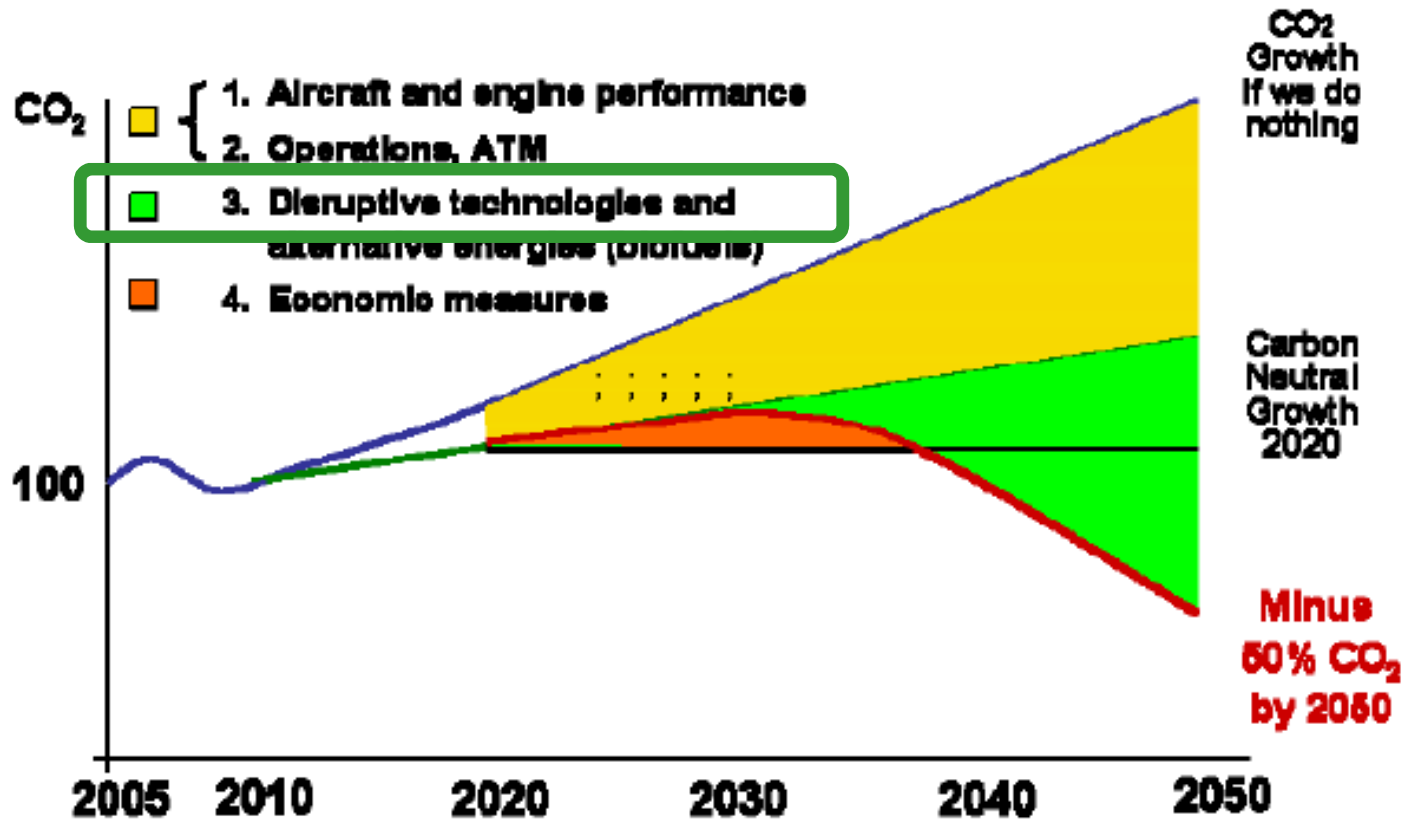
75% CO₂ reduction vs 2000
90% NO_x reduction vs 2000
65% Noise reduction vs 2000
Zero Emissions-taxiing
Recyclability

...

- ❑ **Safety and Security**

Safety Improvement, Mitigation of weather & other hazards, min. impact of security checks, seamless operating air transportation system (manned & unmanned), A/C inherent potential against threats, EU air transportation system with fully secured data network

Disruptive technologies are needed



Some imagine solutions...



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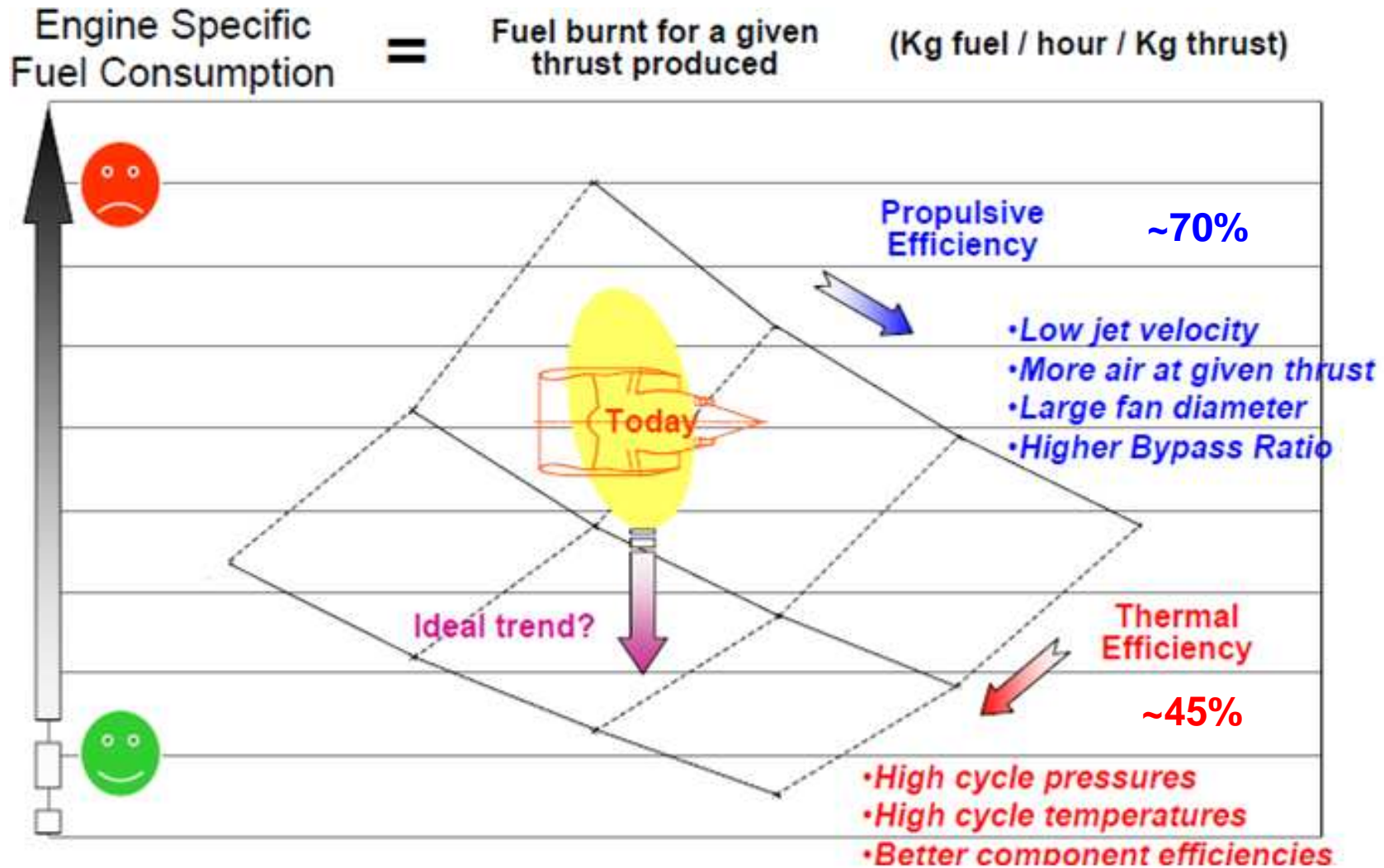
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Identifying current limitations...



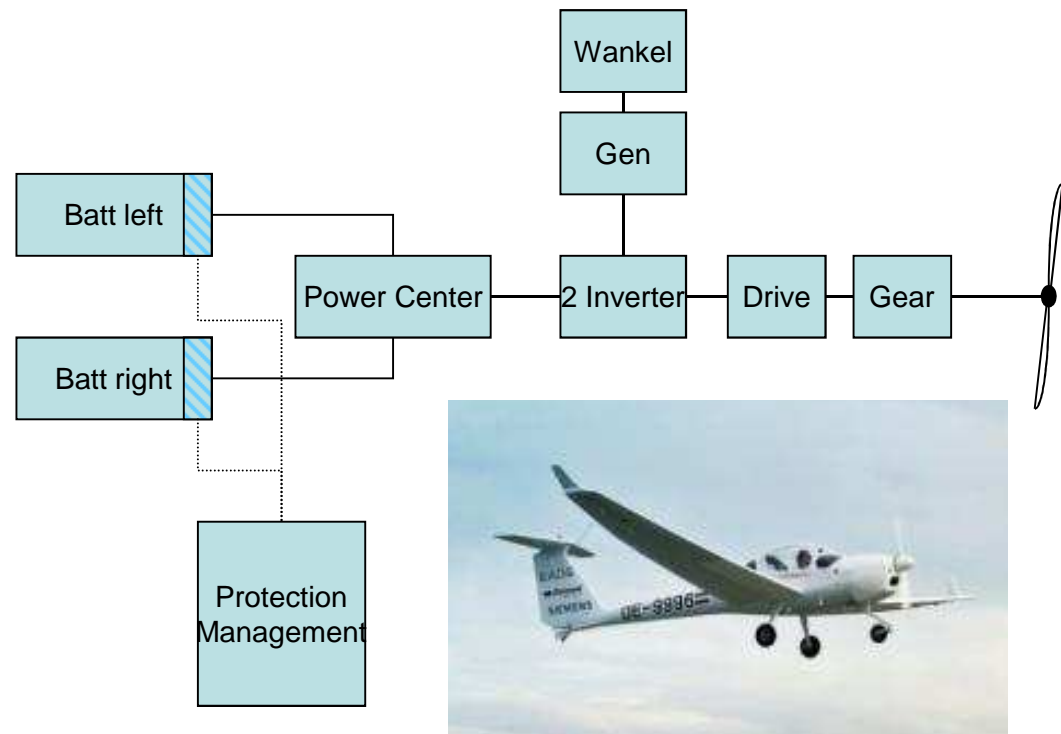
Can we expand / change the design space?

Towards Electrical Aircraft: Opportunities & Challenges

- Key Opportunities
 - Lower fuel burn, emissions, noise
 - Configuration
- Key Challenges
 - Energy storage & power density
 - Energy transmission
 - Power electronics
 - Certification

- Use of demonstrators
 - E.g. Diamond DA40 E-Star2
 - 80 kW Max Take-off, 13 kg
 - MOU signed at Le Bourget 2013 to investigate Certification aspects

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Small full electric aircraft are already feasible

- E-Fan Pilot Training aircraft
 - About 600 kg MTOW, 10m span
 - 2 x 60 kW electrical engines
 - Currently using Lithium Polymer cells for energy storage
 - Aircraft designed around electrical concept



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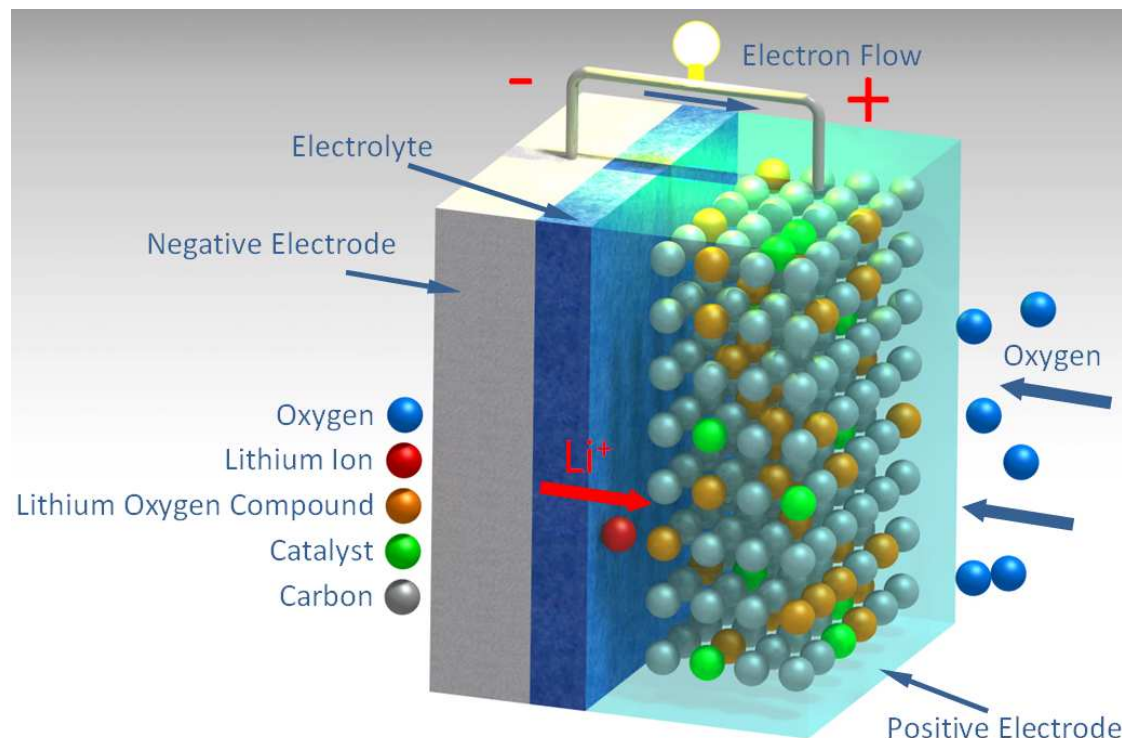
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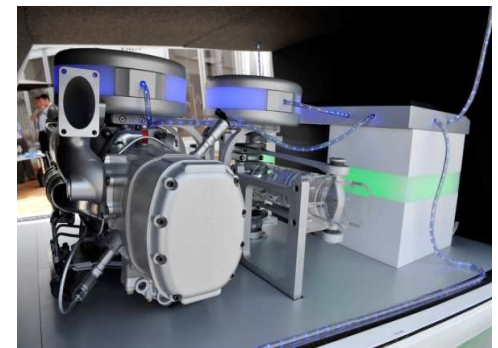
Energy Storage

- Current batteries offer power densities of up to a couple hundred Wh/kg
- Power densities meeting or exceeding 1000 Wh/kg could be offered within the next 2 decades e.g. with Lithium-Air batteries.



Electrical Motor Power

- By the end of next decade, electrical motors with power around 500 kW should be available
 - Big APU's, Hybrid helicopters



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A potential future for More Electrical Aircraft...



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Mission Profile

Approach & Landing

Power comes from energy storage unit
Turbine engine switched on

Take-off & Climb

Power comes from both
turbine engine and
energy storage unit

Initial descent

Power comes from energy storage unit
Turbine engine switched off
Fans windmill and fill energy storage unit

Cruise

Power comes from
energy storage unit

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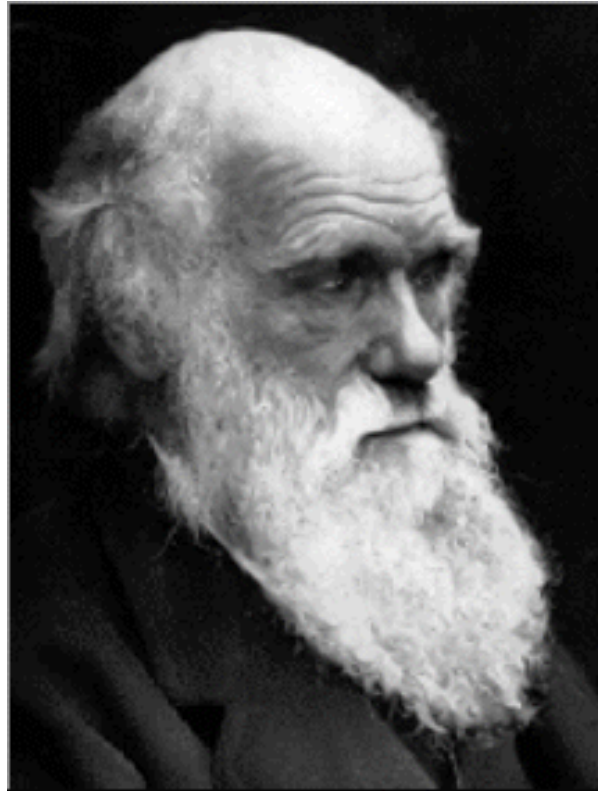
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Words of wisdom...



***“It is not the strongest of the species who survives,
not the most intelligent,
but the one most responsive to change”***

Charles Darwin

Thank you for your attention!



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