



Dedicated to innovation in aerospace

Electrification of aircraft – a sketchy picture?

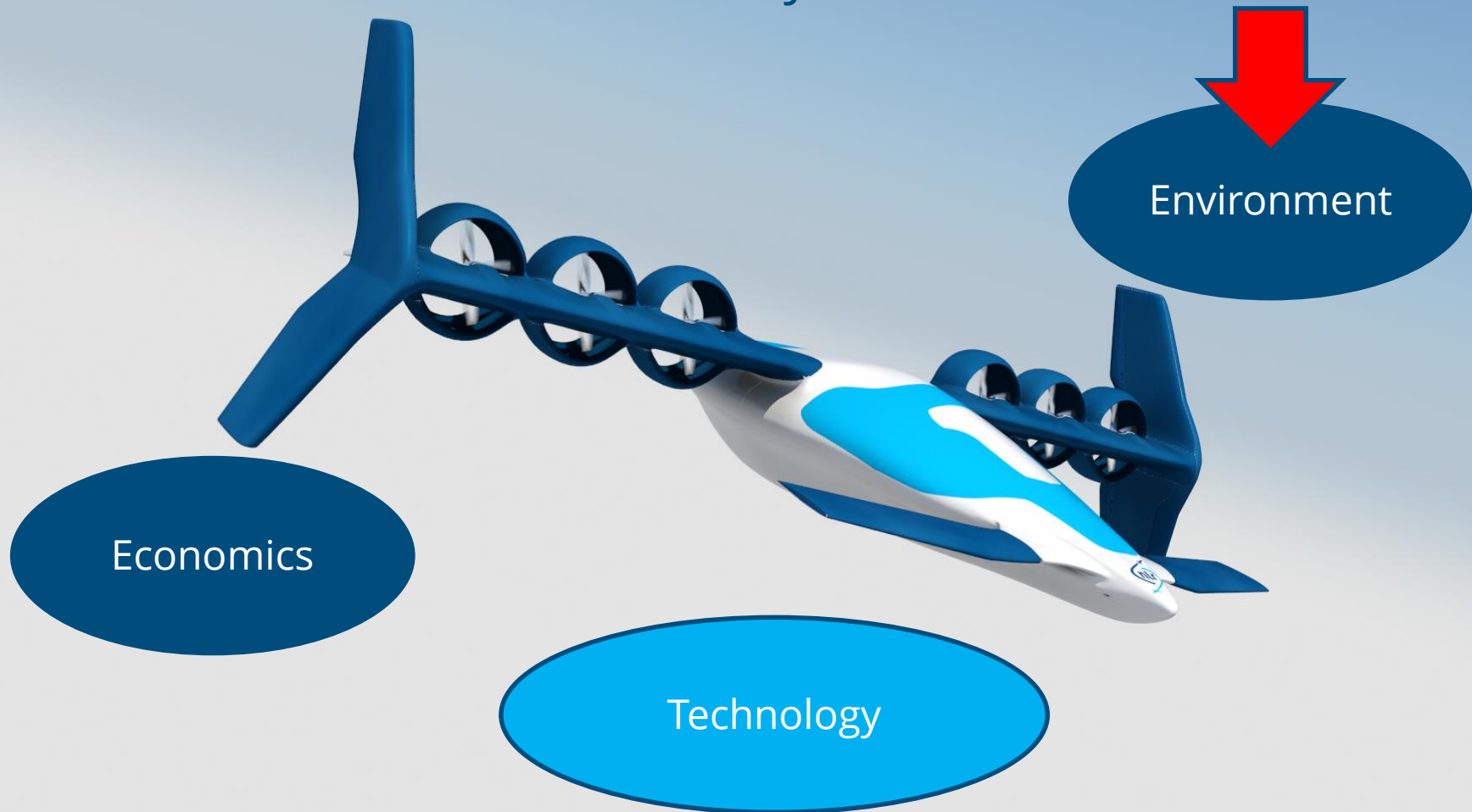
Frank Wokke | 6 April 2022



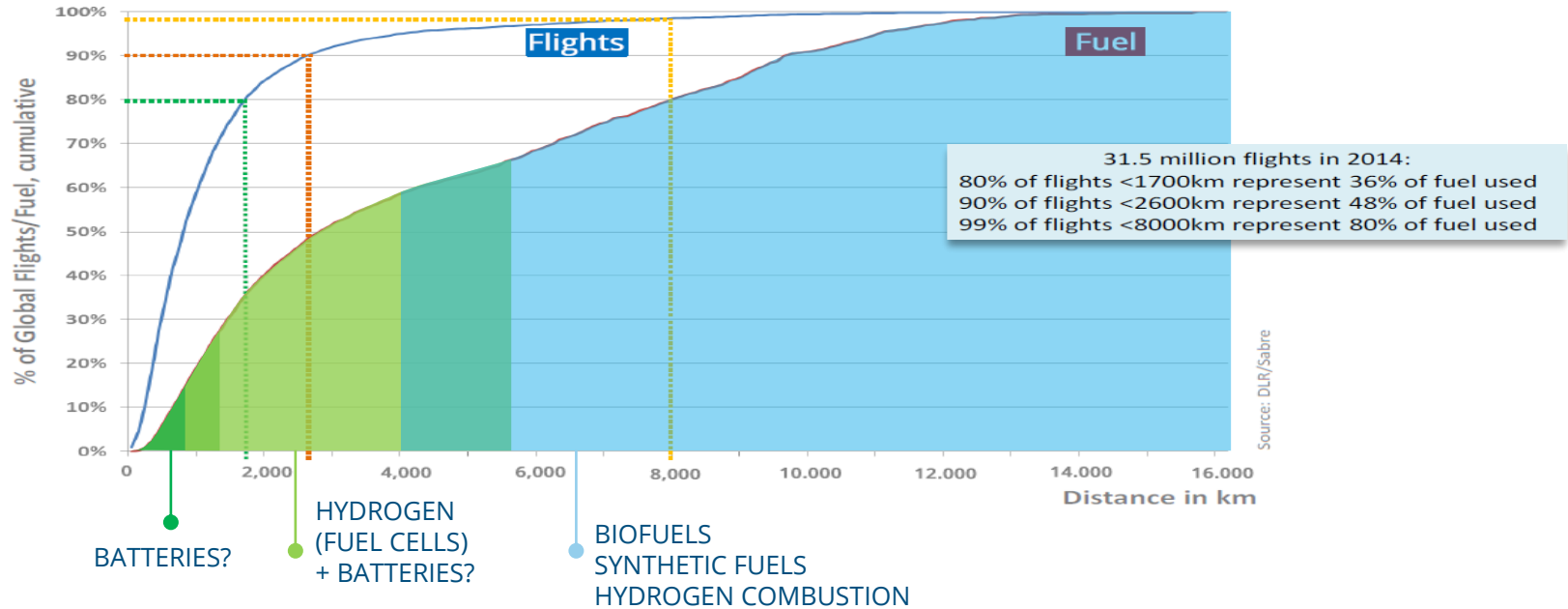
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Electrification of aircraft: why?

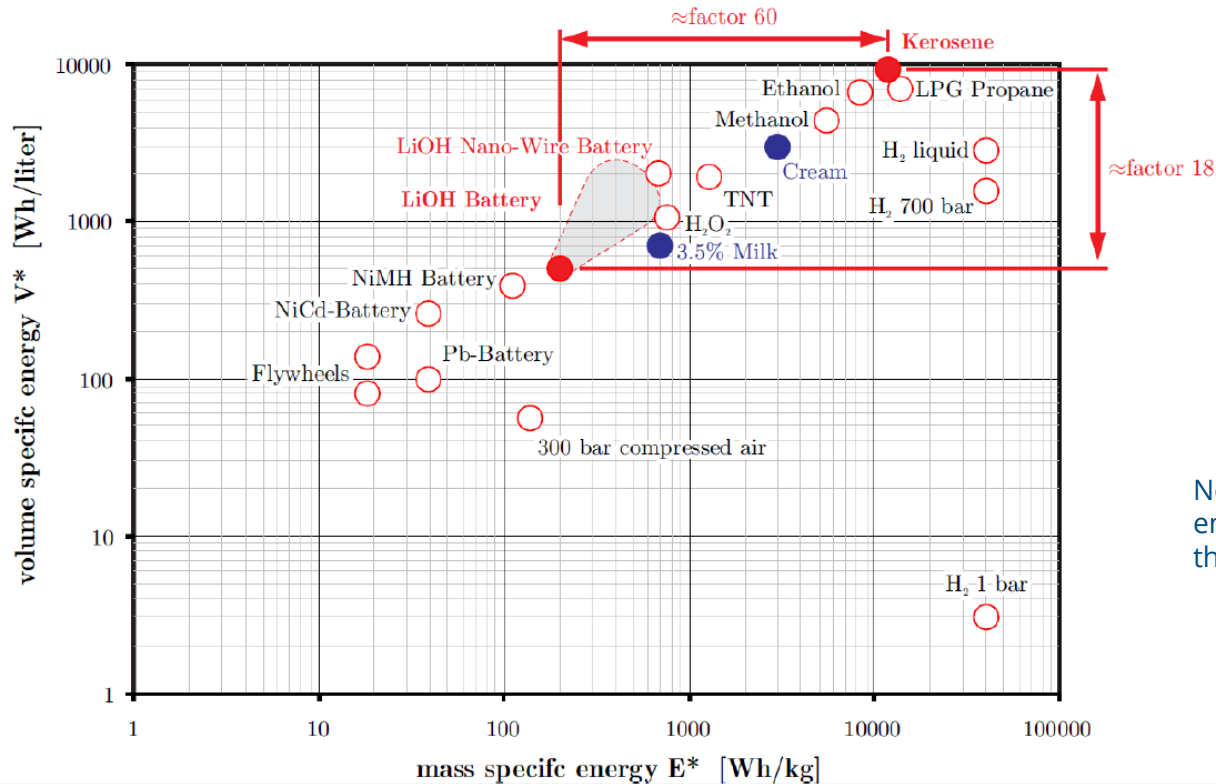


Long haul flight is the biggest environmental challenge



Source: DLR/Sabre

Energy carriers pose a challenge

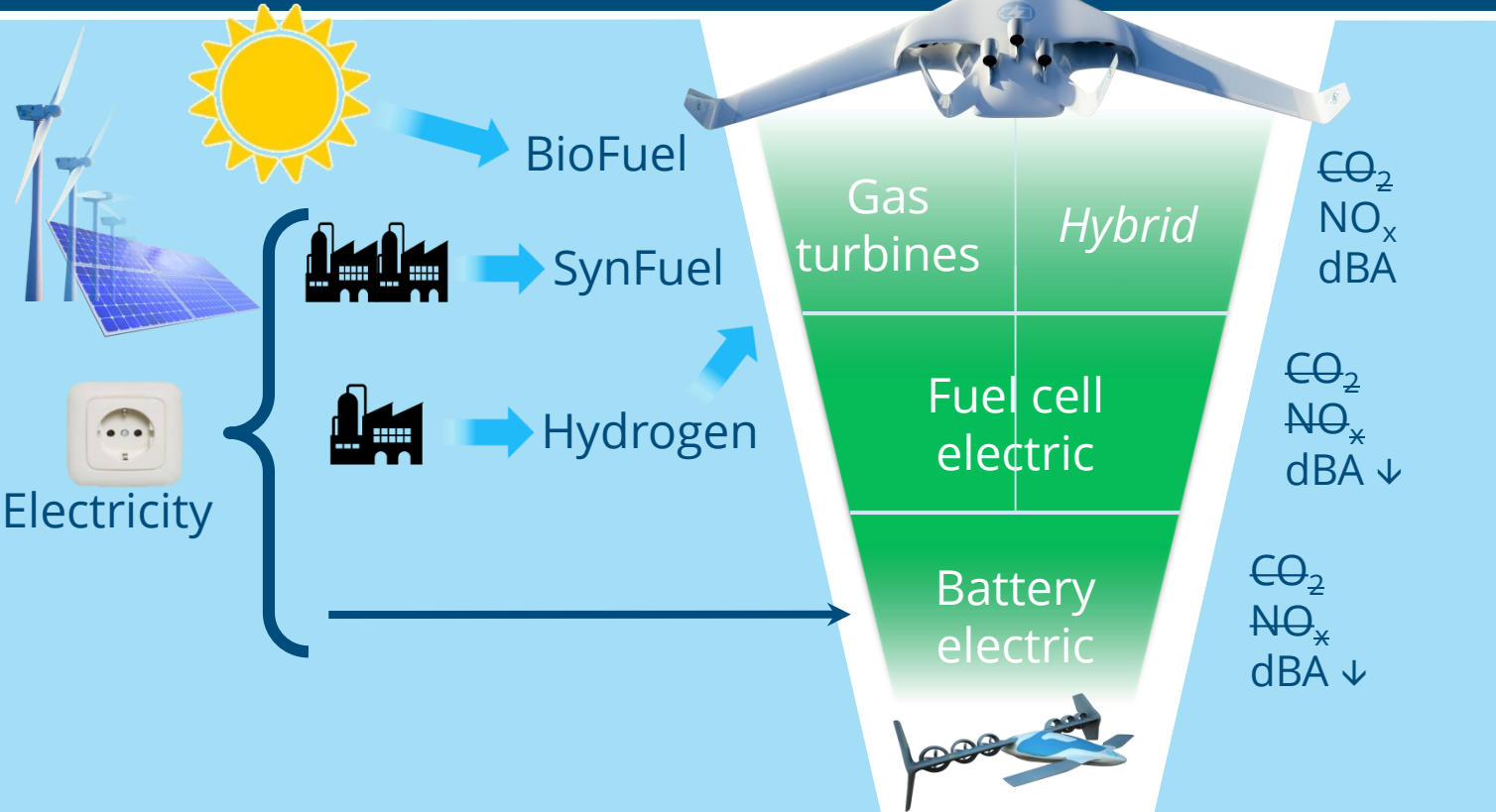


Note: combustion engines less efficient than electrical motors



Propulsion type over aircraft size range

Scenario: 100% sustainable



η	$\$/\text{km}$
~10%	\$\$\$ \$\$\$ \$\$\$
~30%	\$\$\$
~85%	\$

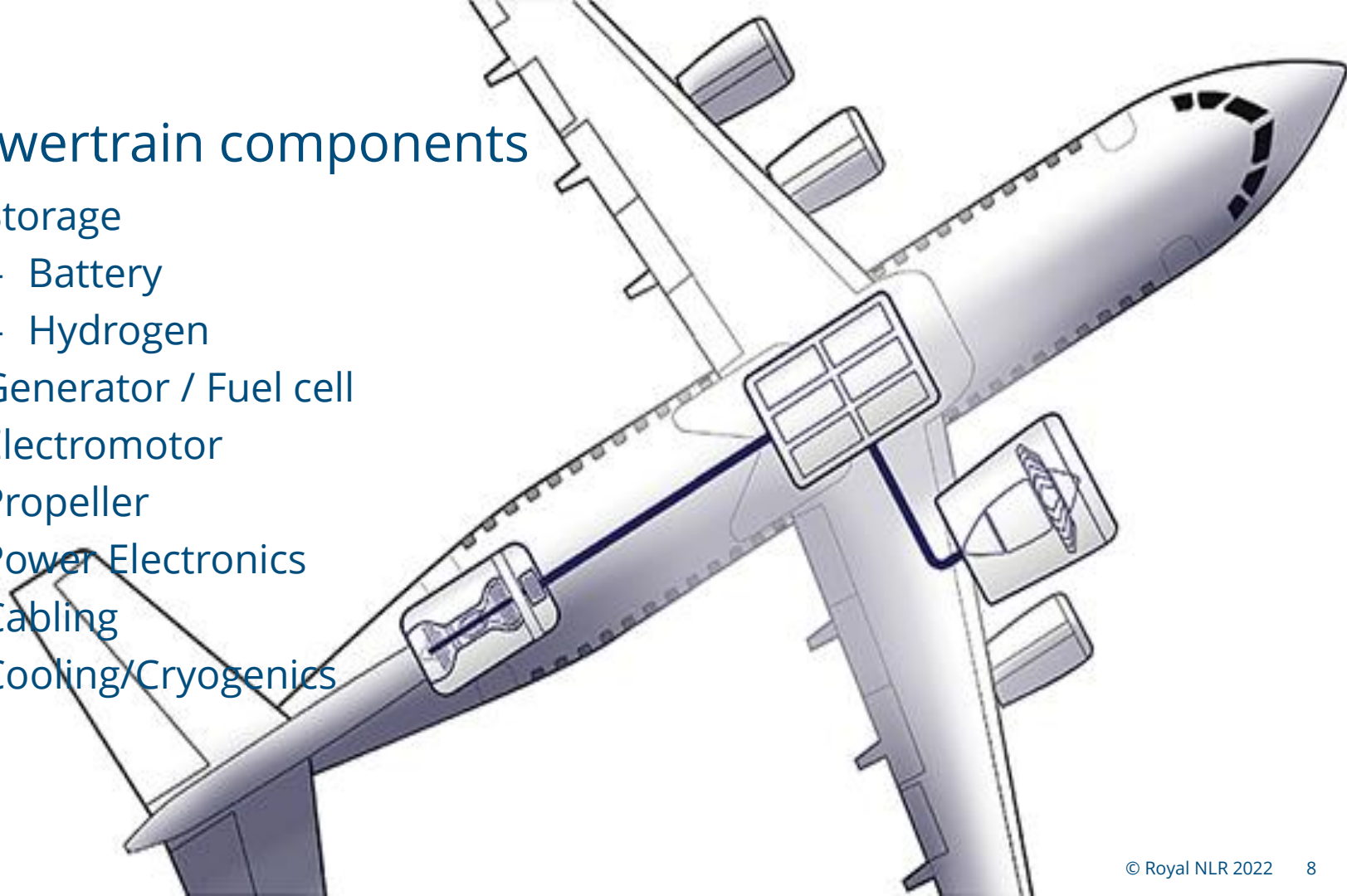


Revolution!

- Emissions will lower, but at the cost of higher total energy use.
- Electrical propulsion increases design freedom.
- New views on range and payload diversity, more aircraft types.
- New very-short-haul market for battery-electric.
- Traditional operations will change; Lower and Slower, Hopping.
- Holy Grail has not been found yet; we need open minds and broad views; find parallels in other sectors, converge.
- Co-operate where there are potential cross-overs.
- Focus on niches.

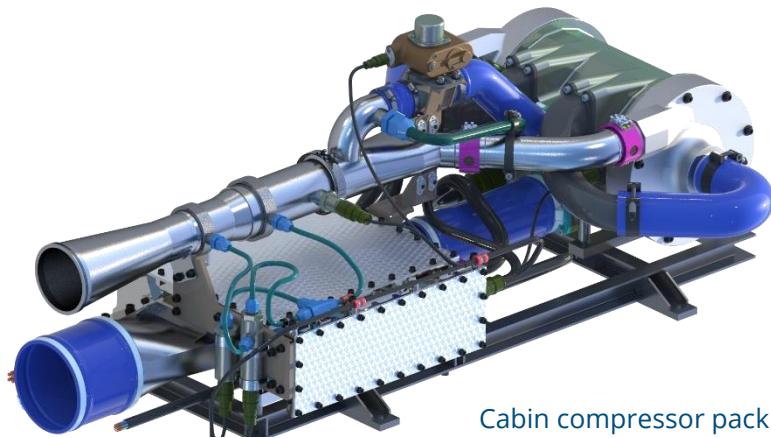
Powertrain components

- Storage
 - Battery
 - Hydrogen
- Generator / Fuel cell
- Electromotor
- Propeller
- Power Electronics
- Cabling
- Cooling/Cryogenics

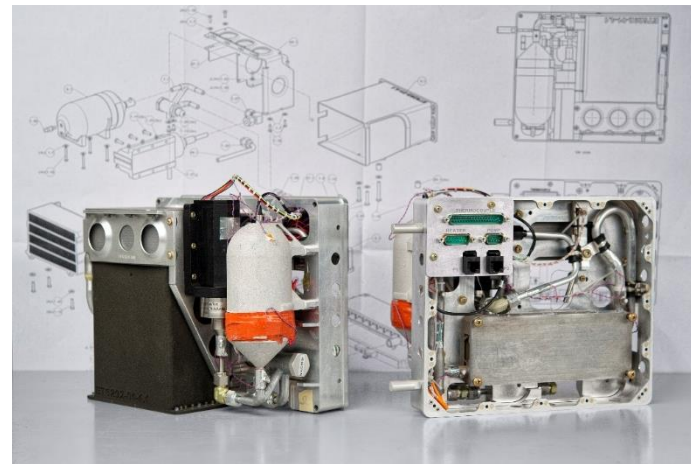


... but not just the powertrain

- move to More Electric Aircraft



Cabin compressor pack.
Image © Aeronamic/NLR
EU CS2 funded ELECTRA project



Two-phase avionics cooling system
Image © NLR
EU CS2 funded, TOPMOST project

These projects have received funding from the Clean Sky 2 Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreements No 831999 and 738094.

... and not just manned flight



Scaled Flight Demonstrator

Source: NLR / Orange Aerospace
This project has received funding from the Clean Sky 2 Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreements No 717183 and 945583

... and not just manned flight



NLR Hydrogen fuel cell demonstrator

... but still: SAFETY

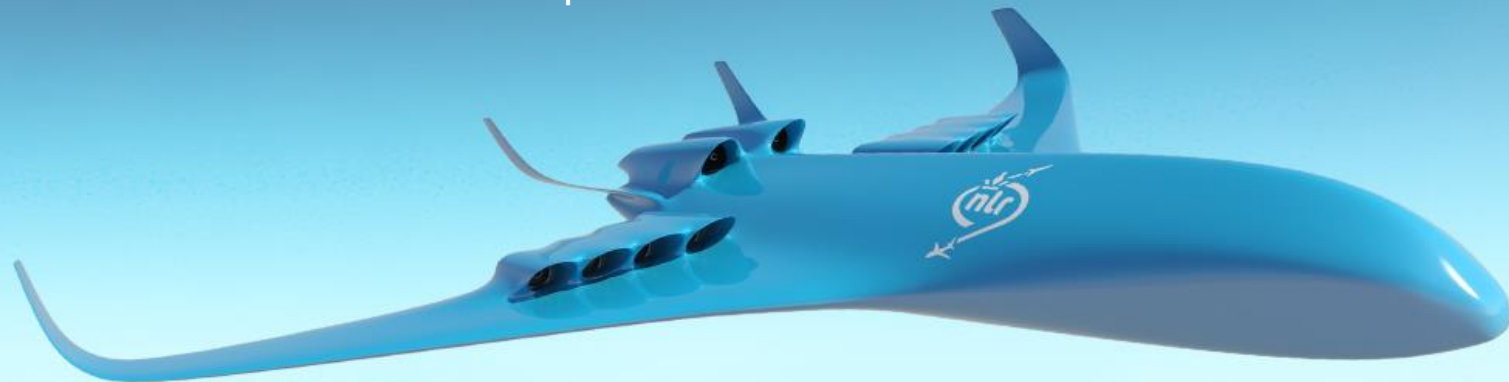




Dedicated to innovation in aerospace

Fully engaged

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