Dedicated to innovation in aerospace

Opportunities in Clean Aviation & Clean Hydrogen

Frank Wokke & Tim Buiting
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Aerospace Innovator
More sustainable, safer, more efficient and effective

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100+
Royal Netherlands Aerospace Centre
FOUNDED 1919

NOT-FOR-PROFIT APPLIED R&D INSTITUTE

HIGH END FACILITIES

MULTI-DISCIPLINARY

658

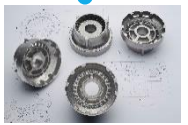
ACTIVE GLOBALLY

SCALED INSTRUMENTED (FLIGHT) TESTING

(ACOUSTIC) WINDTUNNELS

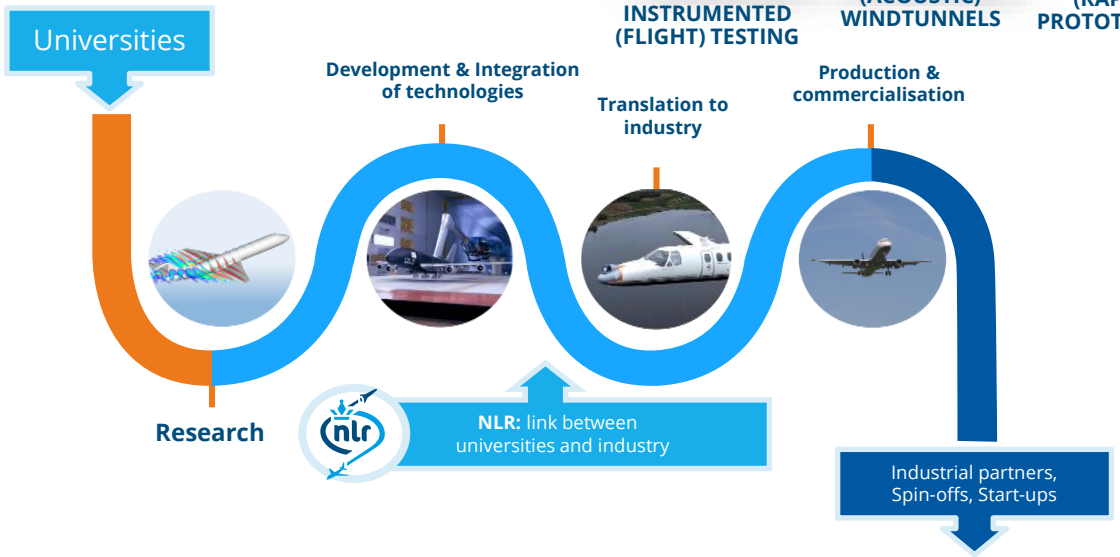
(RAPID) PROTOTYPING

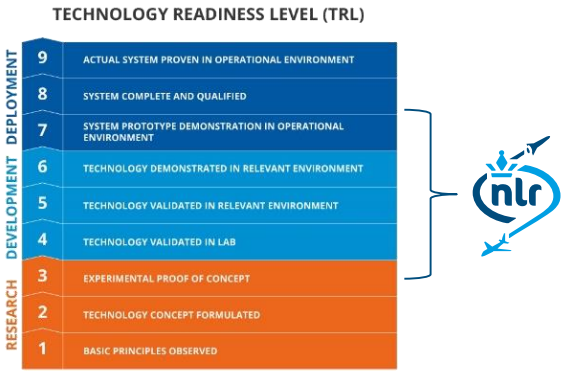
HYDROGEN PROPELLED TEST BED



3D Magnesium printing

X-LAB ND SHM





Three strategic themes

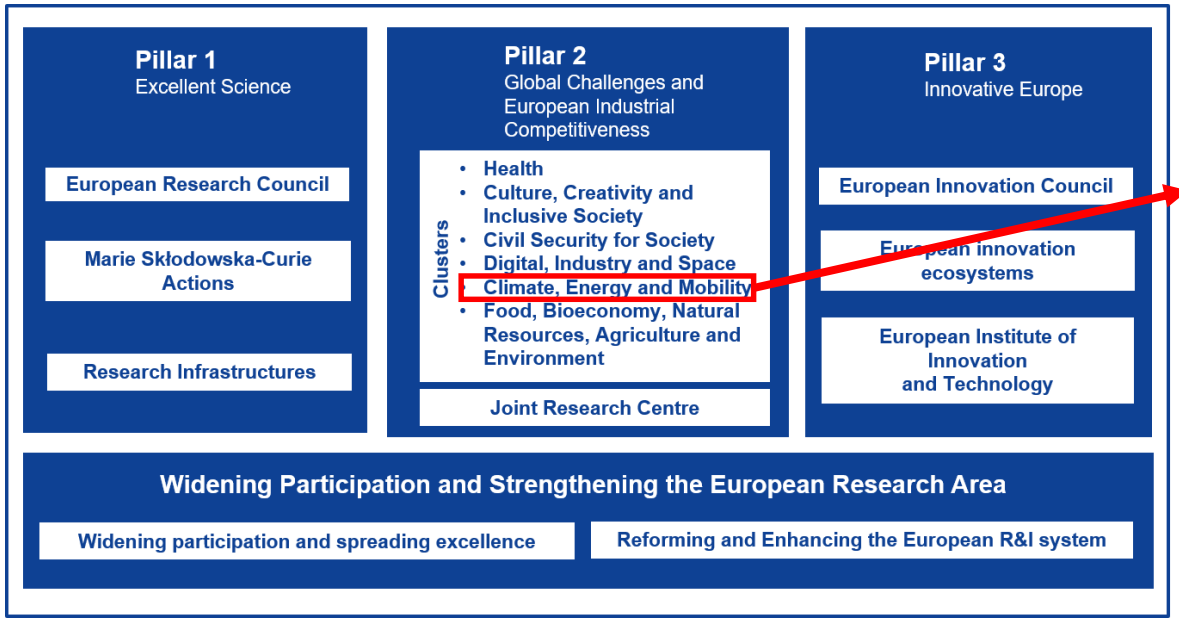
- Sustainable aviation
- Competitive aerospace
- A safe and secure society

Nine programs

1. Climate-neutral aviation
2. The impact on people and society
3. Safe and competitive operations
4. Aerospace vehicle development
5. Operational availability
6. Information-driven operations
7. Future air & space power
8. Unmanned and autonomous
9. Emerging technologies

Source: European Commission

Horizon Europe



Source: European Commission

Work programme

+

EU-partnerships
- Clean Hydrogen
- Clean Aviation
- SESAR3
- Etc.

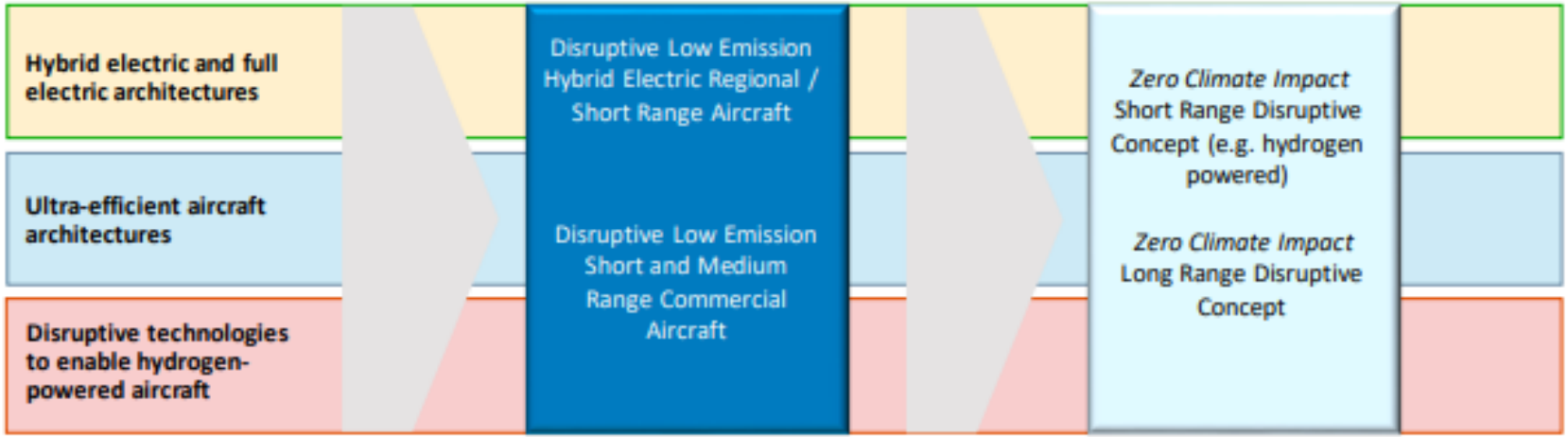
Clean Aviation

- Follow-up to Clean Sky 2
- Duration of 9 years
- Budget:
  - 2.4 G€ private contribution (mainly *in-kind*)
  - 1.7 G€ EU-funding (excl. UK)

- Programme is fully **open**
- Dutch members of the Joint Undertaking:
  - Royal NLR
  - GKN-Fokker
  - TU Delft

Source: Clean Aviation JU
Hyperlink: SRIA

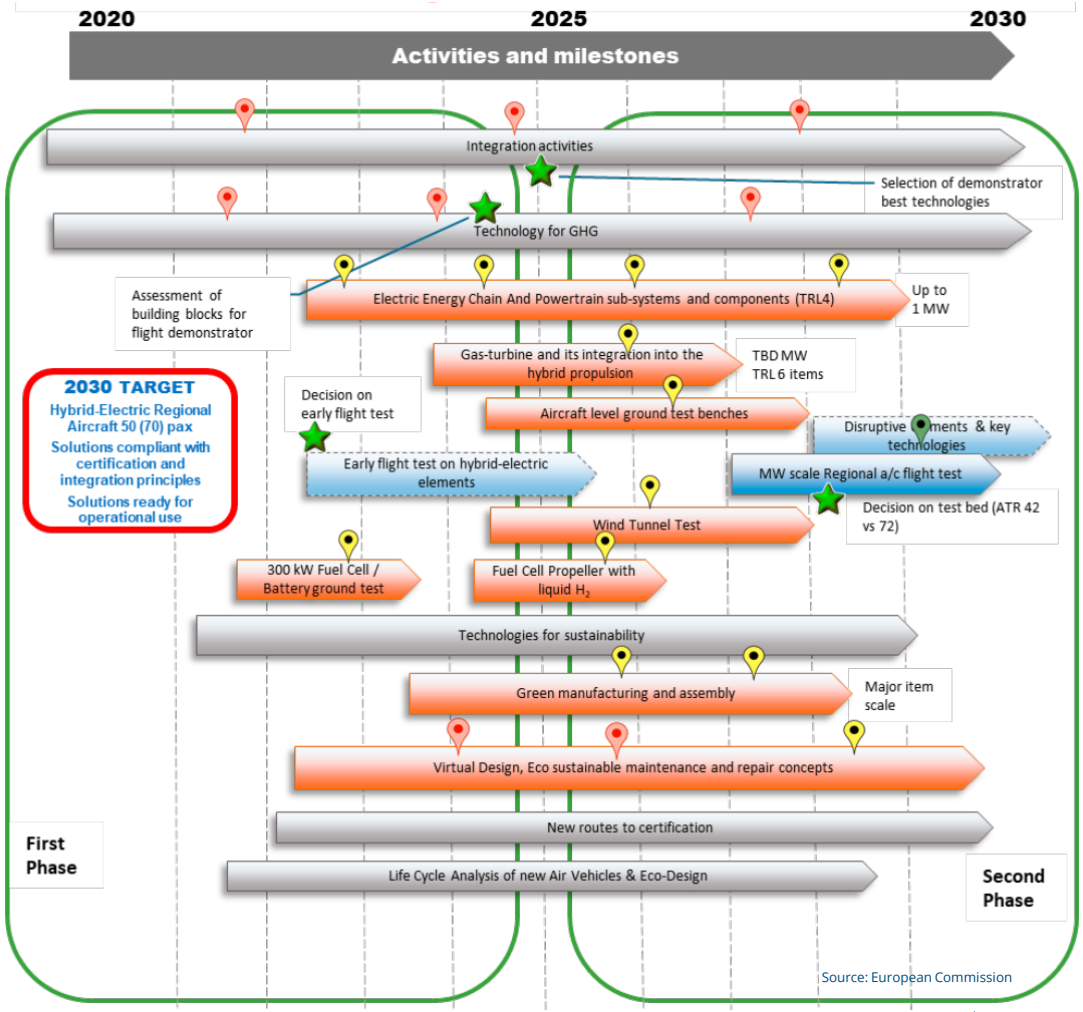
Clean Aviation: programme structure



Source: European Commission

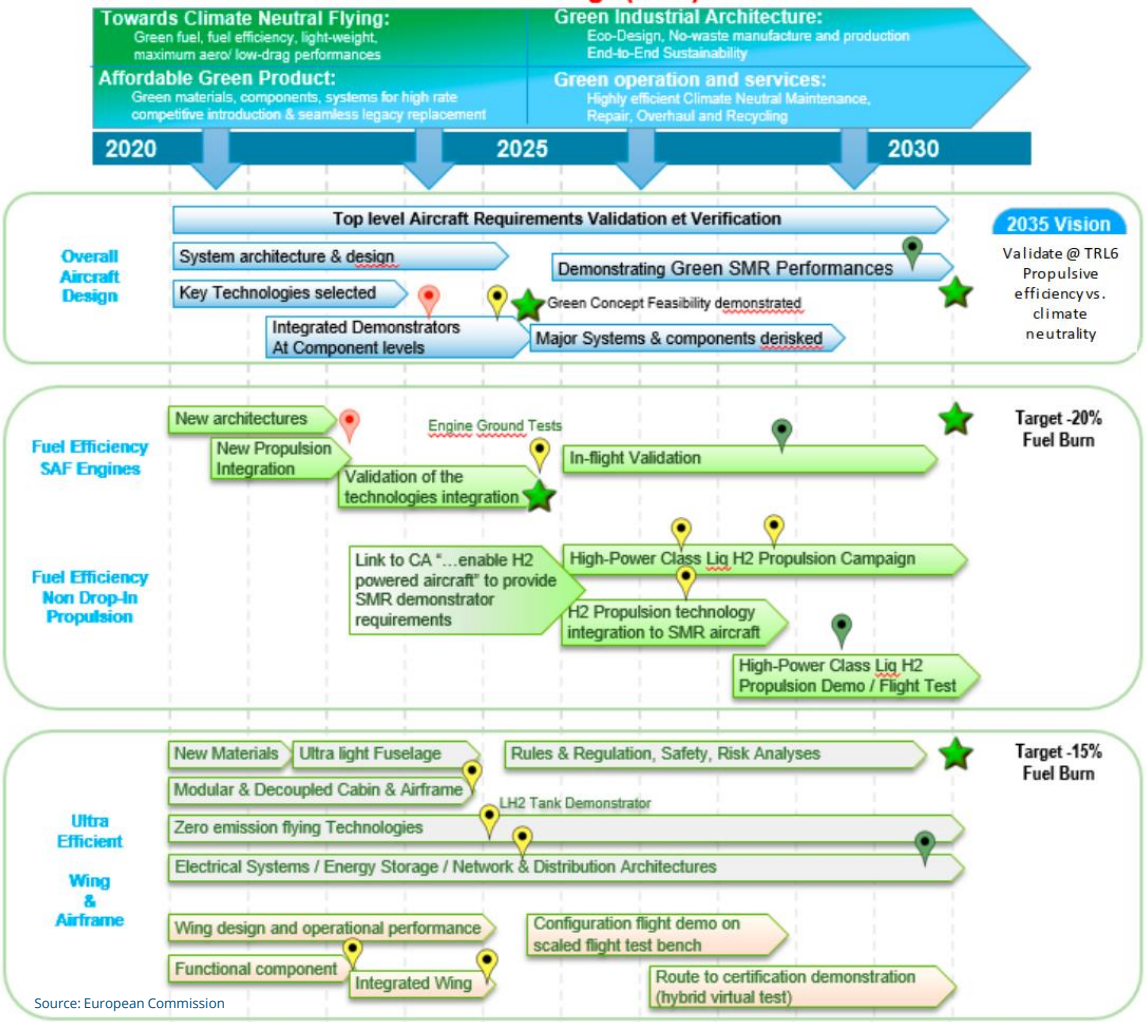
Clean Aviation Roadmaps

Hybrid Electrical Regional



Clean Aviation Roadmaps

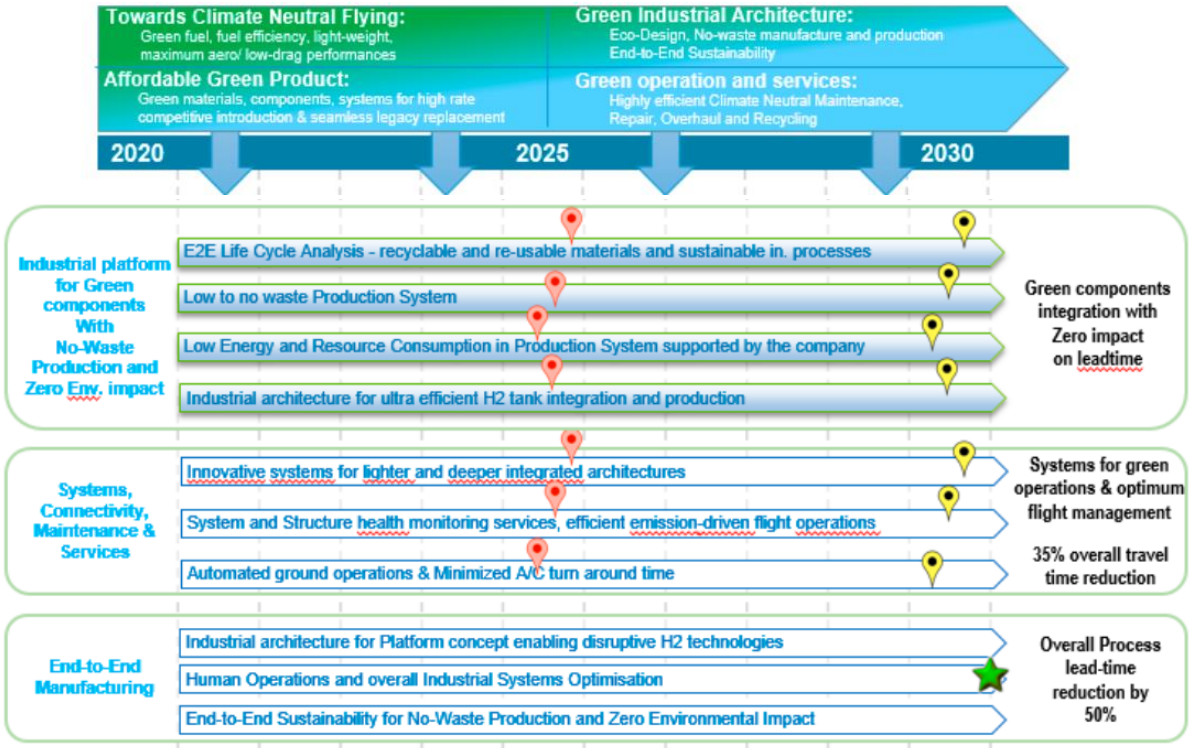
Short Medium Range 1/2



Source: European Commission

Clean Aviation Roadmaps

Short Medium Range 2/2



Source: European Commission

Clean Aviation Roadmaps

Hydrogen

Disruptive tech to enable hydrogen-powered aircraft

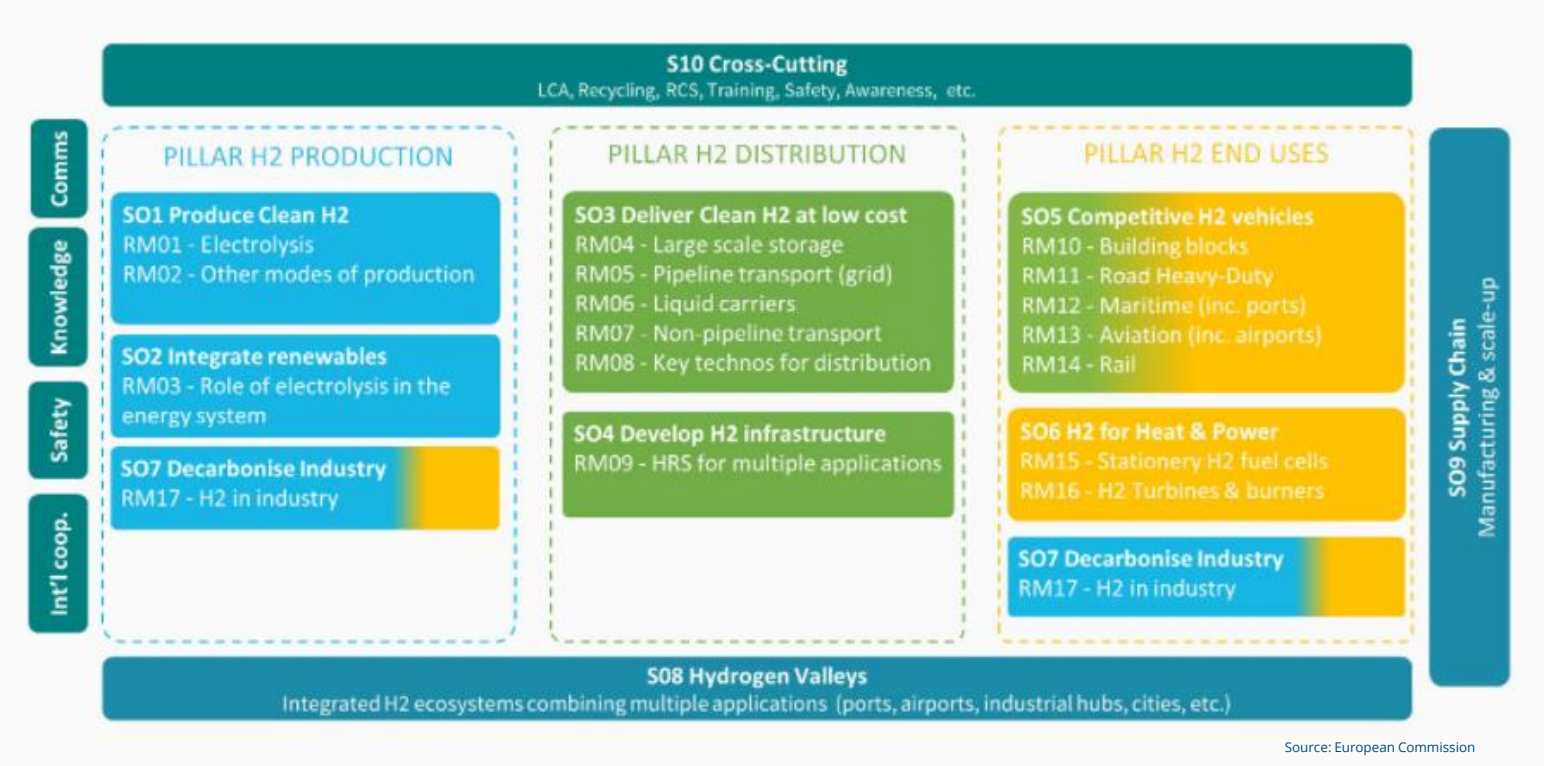
- Climate impact assessment
- Propulsion system
  - Storage and fuel distribution
  - Combustion
  - Fuel cells
- Safety and certification
- Demonstrators

Clean Hydrogen

- Follow up to Fuel Cell and Hydrogen (FCH)
- Covers nearly the complete ecosystem
- Budget:
  - 1 G€ EU-funding
  - >1 G€ private contributions
- Programme is fully **open**
- Dutch members a.o.
  - Royal NLR
  - Marin
  - TNO
  - Vopak
  - Etc.

Source: Hydrogen Europe
Hyperlink: SRIA

Clean Hydrogen: overview



Source: European Commission

Clean Hydrogen: Aviation

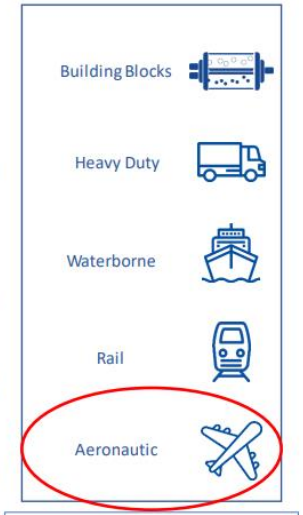
European Hydrogen Week

Pillar 3:
Hydrogen End-Uses: Transport Applications

3.1.E Aeronautic Applications

OBJECTIVES

1. Improving overall system and stack performance for scalable FC in terms of power density, durability and availability;
2. Reducing NOx emissions of turbines;
3. Addressing Airport infrastructure (of both liquid and compressed hydrogen) and refuelling tech / procedures;
4. Developing aviation dedicated technological bricks, focusing on on-board storage, distribution components and systems of liquid hydrogen.
5. Addressing safety and regulation, specific to hydrogen for aviation applications



End-use: Transport Applications

#EUHydrogenWeek
#CleanHydrogen

FCH

European Commission

RHIA Hydrogen Valley?

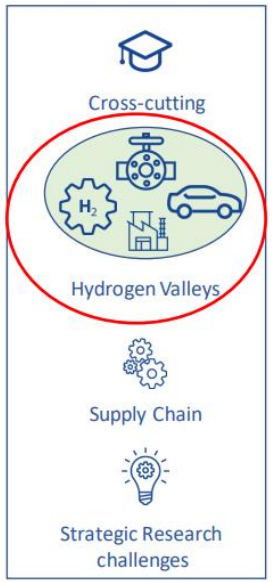
European Hydrogen Week

Horizontal Activities (2)

2. Hydrogen Valleys

MAIN OBJECTIVES

1. Innovation in integrating several technology elements together to improve overall synergies, facilitate sector coupling and improve energy and economic efficiency of the whole system;
2. Improved security and resilience of the energy systems;
3. Demonstration of new markets for hydrogen;
4. Complementarity of the development of hydrogen with RES, integration with other technologies, existing infrastructure, etc;
5. Assessment of the availability and affordability of clean energy provision for industry and city uses.



#EUHydrogenWeek
#CleanHydrogen

FCH

European Commission

How can we help?

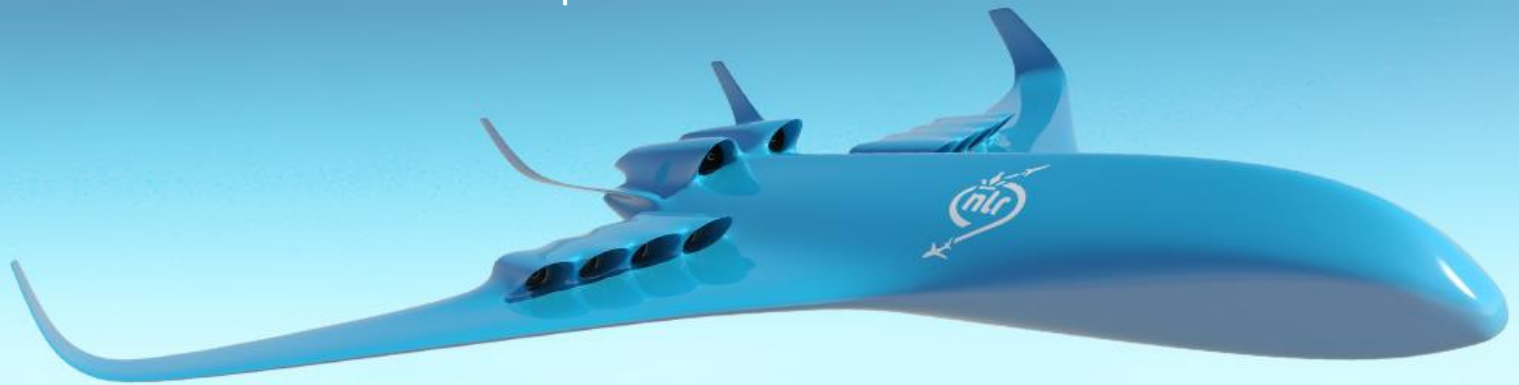
- NAG and NLR:
  - are available for questions,
  - will actively follow the work programmes and Calls for Proposal and approach Dutch parties in case of possible,
  - can help finding partners (e.g. via EACP, EREA, IMG's, EASN),
  - can be a partner in your consortium.

- NLR *MKB-ondersteuningsprogramma*
  - 50% subsidy on project cost.
  - "Engineer 4 a day" consultancy at no cost.

Dedicated to innovation in aerospace

Fully engaged

NLR - Netherlands Aerospace Centre



Anthony Fokkerweg 2
1059 CM Amsterdam
The Netherlands

p) +31 88 511 31 13
e) info@nlr.nl i) www.nlr.org

Voorsterweg 31
8316 PR Marknesse
The Netherlands

p) +31 88 511 44 44
e) info@nlr.nl i) www.nlr.org