PIPISTREL VERTICAL SOLUTIONS

POLITECNICO MILANO 1863

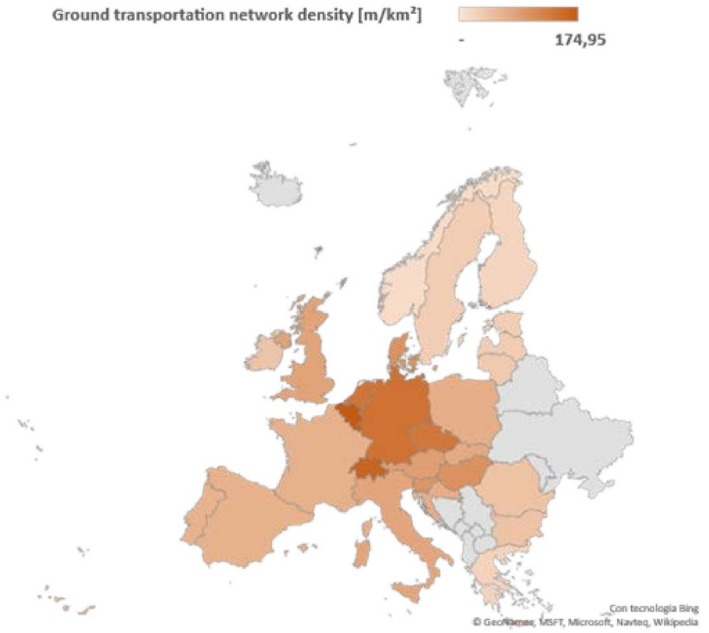
TU Delft
Delft University of Technology

UNIFIER 19
COMMUNITY FRIENDLY MINILINER

Clean Sky 2

David Eržen
Pipistrel Vertical Solutions d.o.o.

GROUND TRANSPORTATION EFFICIENCY

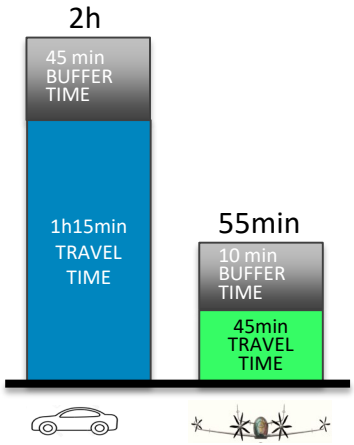


Ground transportation density

$$= \frac{\text{total length of motorways and railways}}{\text{country area}}$$

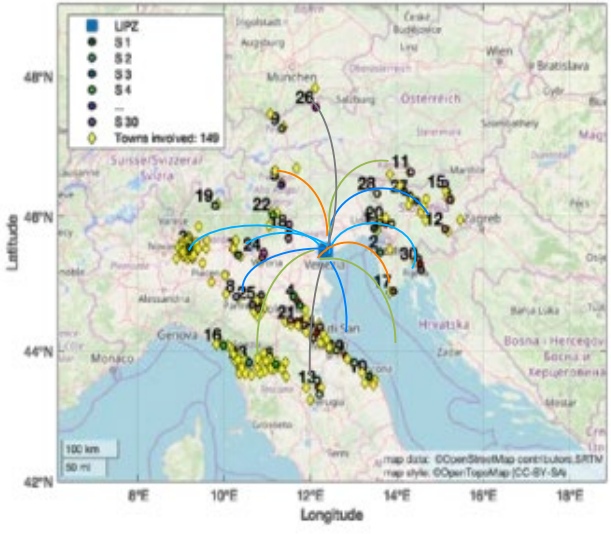
Typical regions:

- High density (Belgium)
- Mid density (Italy)
- Low density (Latvia)



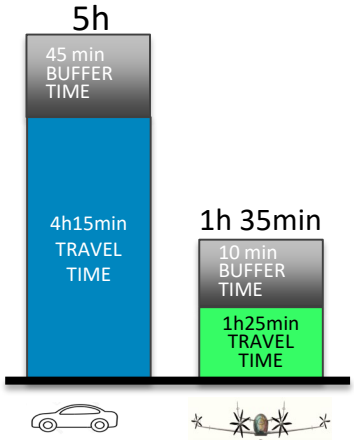
MICROFEEDER

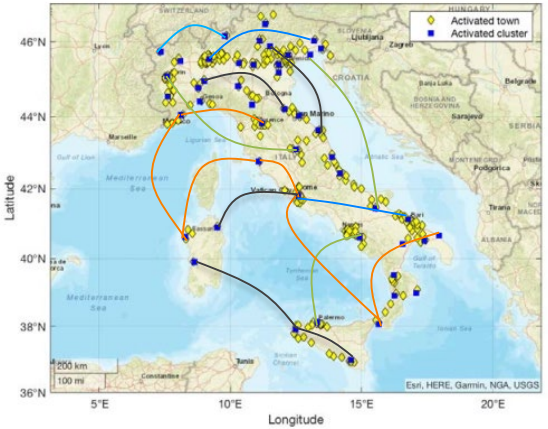
Feeds travellers from small community airports and unpaved airfields to bigger airports served by regularly scheduled commercial air transport.



MINILINER

Mini airliner: connects small airports among them via scheduled or on-demand services.





OBJECTIVES

- [ ] Available market
- [ ] Affordable solution
- [ ] Community and environmentally friendly

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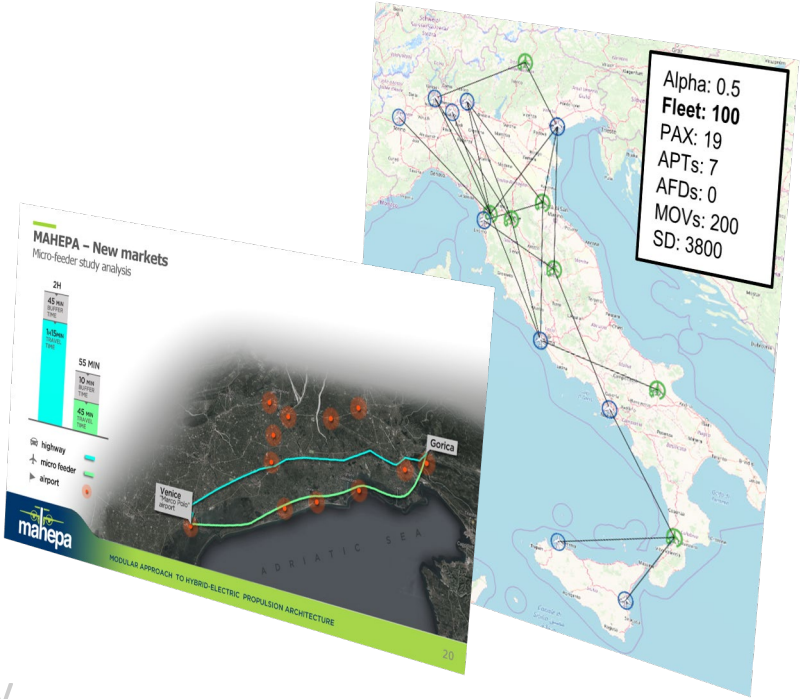
Available market

MARKET STUDY

- The **microfeeder** (hub-and-spoke) study has roots in MAHEPA project.
- Exploiting small airports and airfields (spokes) as **passenger collection/distribution points** to feed major airports (hubs).
- In UNIFIER19,
  - expand its analysis range from Italian teritory to specific **characteristic regions in Europe**.
  - introduction of **miniliner** (point-to-point) option that addresses commuter challenges
  - Introduction of **cargo** (convertible) option



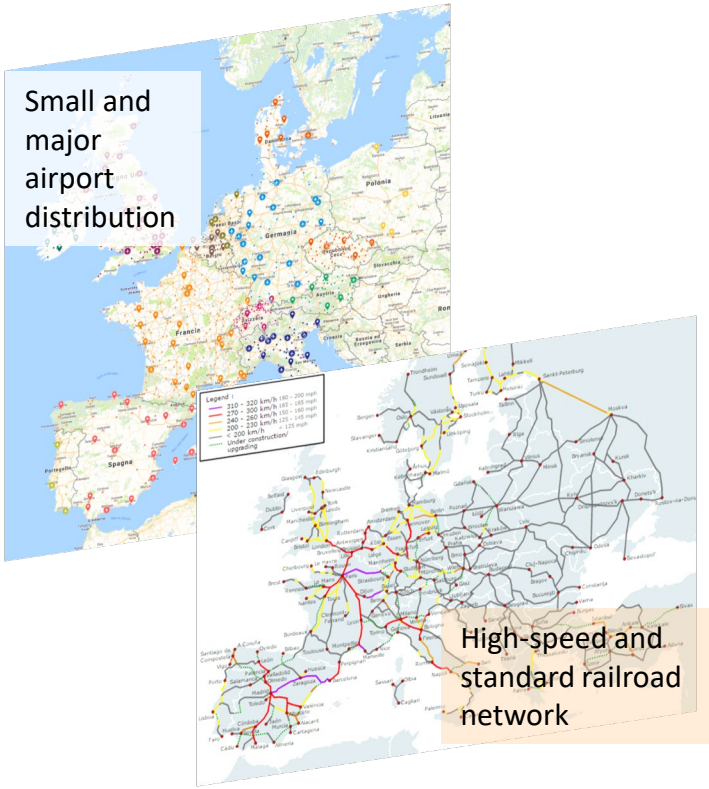
Affordable solution

Community and environmentally friendly

Available market

A new methodology combines:

- **Transportation model** estimating **demand** by considering:
  - Ground connection density
  - Hub traffic
  - GDP distribution
  - Demography
- **Operation Research (OR) algorithm** for optimal airport network capturing highest demand
  - Initial (MAHEPA) approach based on **deterministic solution** – impossible to consider the whole europe
  - New approaches (**heuristic, matheuristic**) being developed and tested,using deterministic solution as benchmark



Affordable solution

Community and environmentally friendly

- [ ] Available market
- [x] Affordable solution

MARKETABILITY

Goal is to minimize **operating**, **manufacturing** and **maintenance** costs by developing:

Operating and maintenance cost model: upgrade existing (AEA, TU Berlin and Gudmundsson DOC method) suitable (modular) cost models for 19-seat category with unconventional propulsion systems

Manufacturing cost model: material and work cost of individual building blocks is estimated by experience, available data and external expert advice. Model is validated with data from existing conventional aircraft on the market.

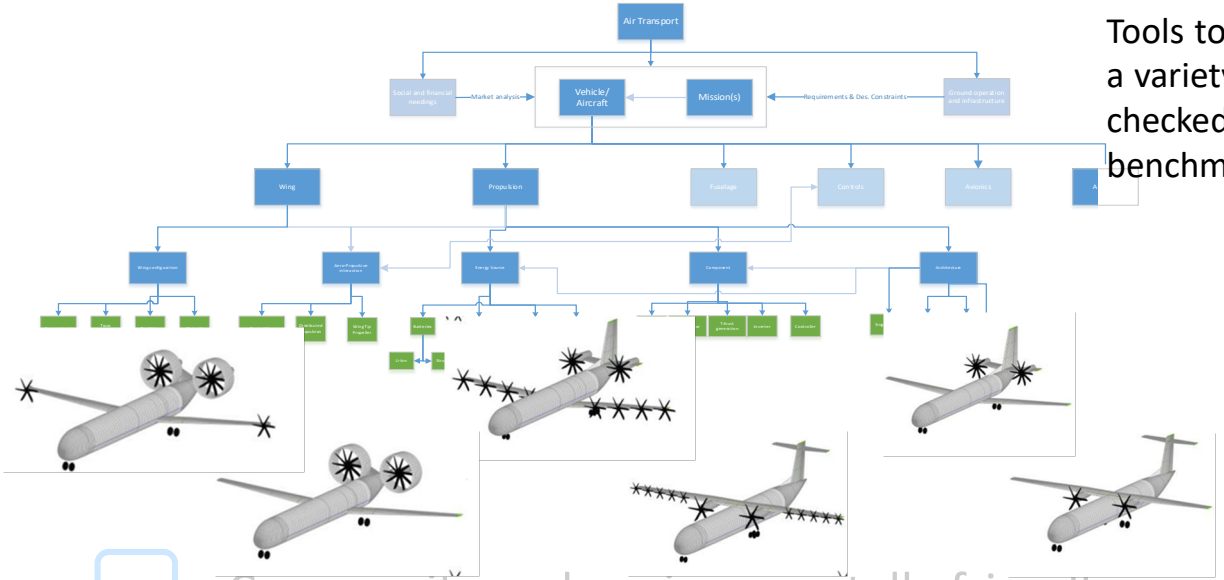
Challenges: acquiring cost data for new technologies due to business confidentiality, low TRL for actual operation and non-conforming technology with aviation regulations.

- [ ] Community and environmentally friendly

Available market

Affordable solution

SYSTEM DESIGN OPTION TREE



Tools to determine the operating performance of a variety of hybrid architectures have been cross-checked and validated through MAHEPA benchmarks:

Hoogreef M., et al: *"Synthesis of Aero-Propulsive Interaction Studies Applied to Conceptual Hybrid-Electric Aircraft Design",* AIAA Scitech Forum, 2020

Community and environmentally friendly

- [ ] Available market
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NOISE MITIGATION AND REDUCTION

- NEW method: an A-weighted combination of all noise sources on hybrid aircraft (propeller, airframe, electric motor, …)

  in combination with…

- ECAC Doc 29: noise exposure contours

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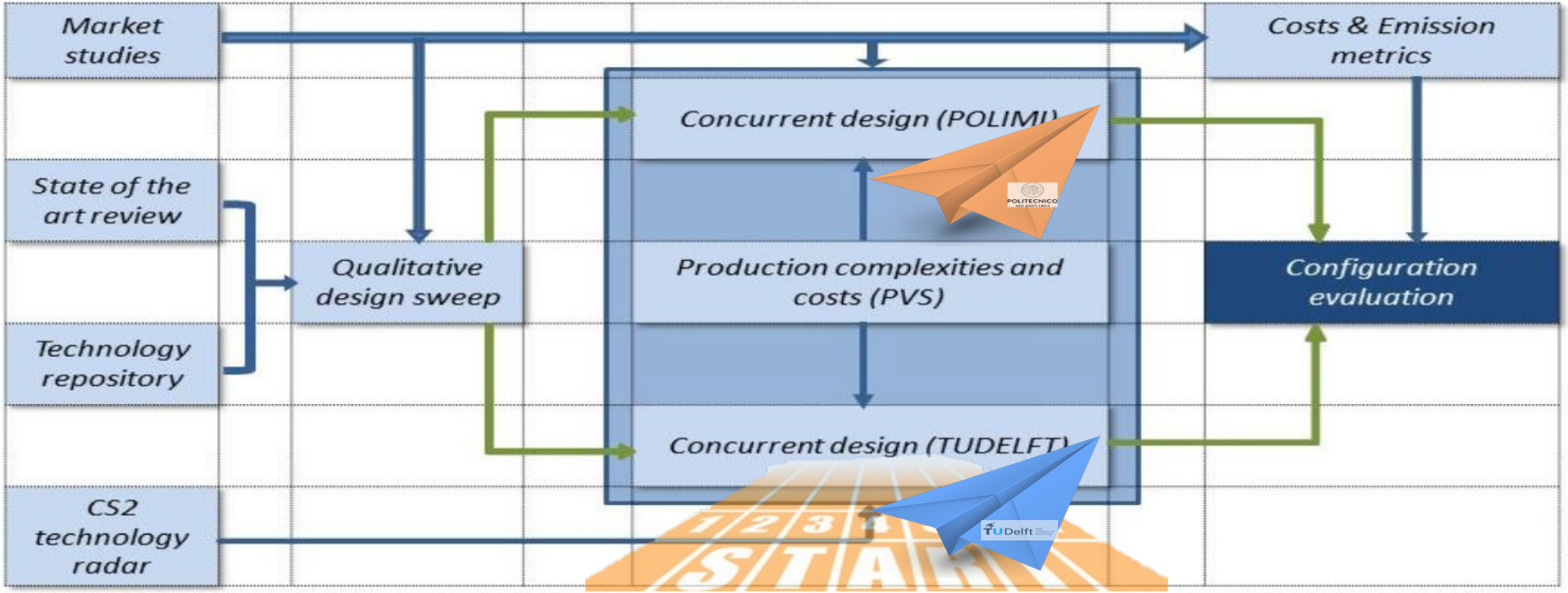
CO_2 AND NO_X EMISSION

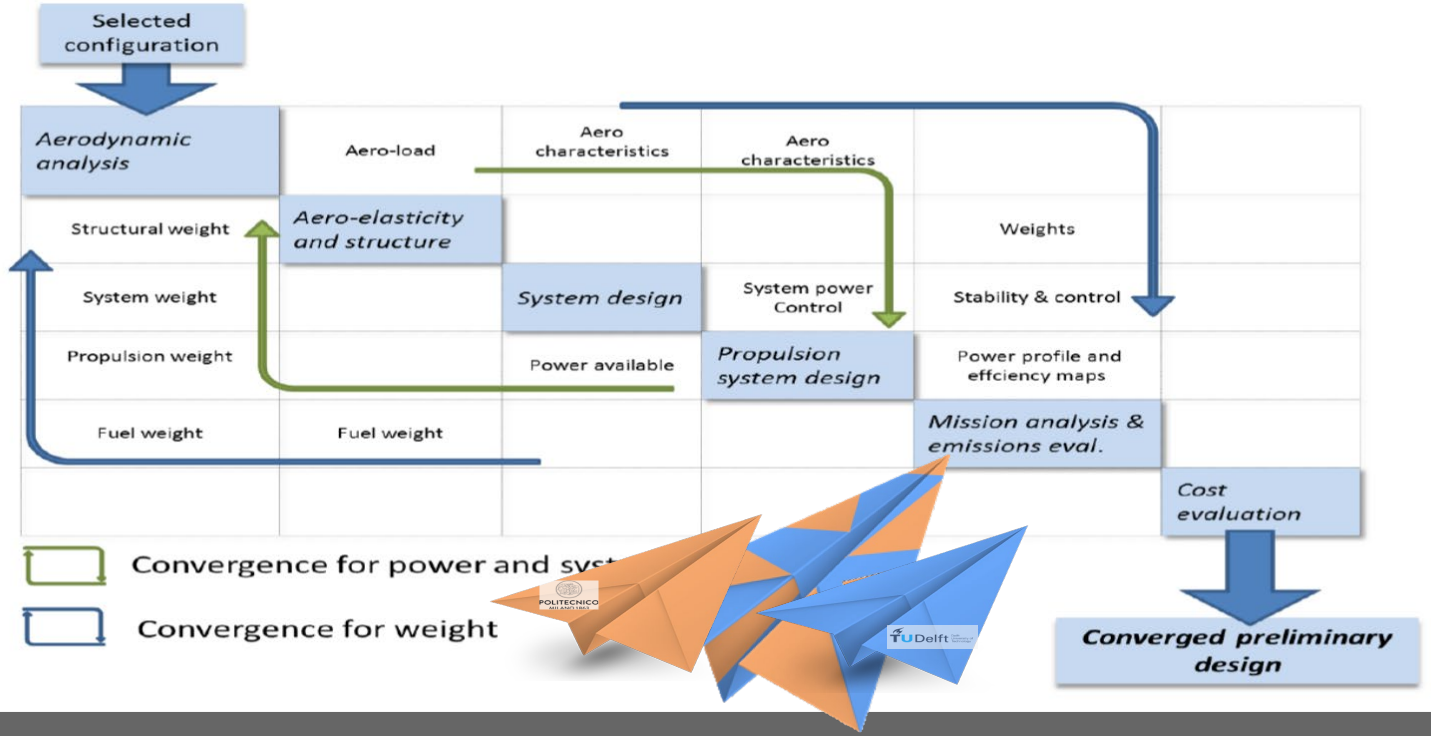
NONE

The project‘s focus wil be entirely on hydrogen fuel cells and battery based propulsion.

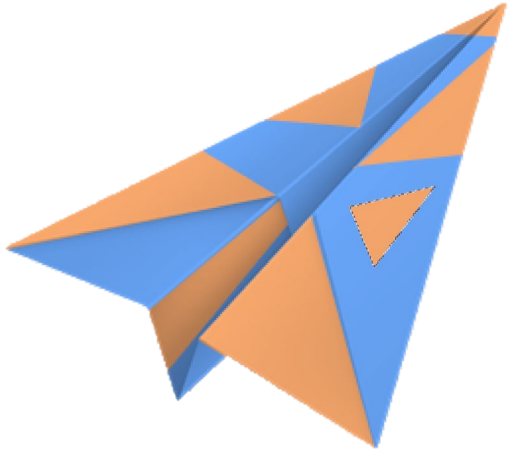
CURRENT WORK



FUTURE WORK


Selected configuration
Aerodynamic analysis
Aero-load
Aero characteristics
Aero characteristics
Structural weight
Aero-elasticity and structure
Weights
System weight
System design
System power Control
Stability & control
Propulsion weight
Power available
Propulsion system design
Power profile and effciency maps
Fuel weight
Fuel weight
Mission analysis & emissions eval.
Cost evaluation
Convergence for power and syst
Convergence for weight
Converged preliminary design

FUTURE WORK



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THANK YOU FOR YOUR ATTENTION

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"A kilometer of highway will take you one kilometer.
A kilometer of runway will take you anywhere."

TWO-IN-ONE SOLUTION

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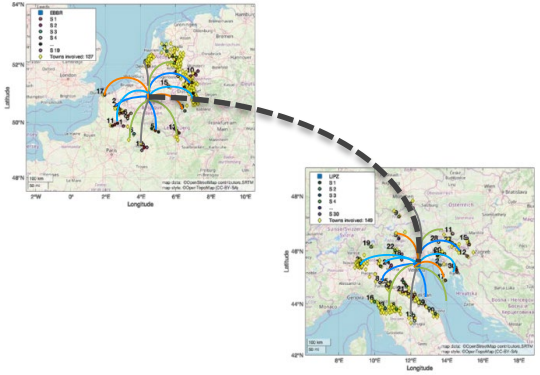
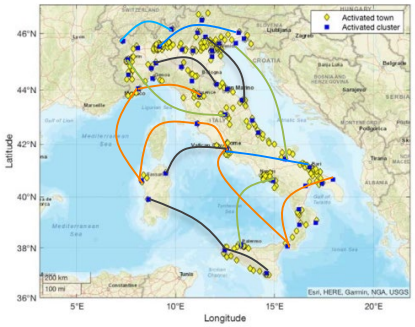


MINILINER

Mini airliner: connects small airports among them via scheduled or on-demand services.



diffused service connecting smaller airports among them and with hubs → scheduled and on-demand shuttle flights → capture the mobility demand for short- and very short-haul travel scenarios

„Non-negotiable“ measures

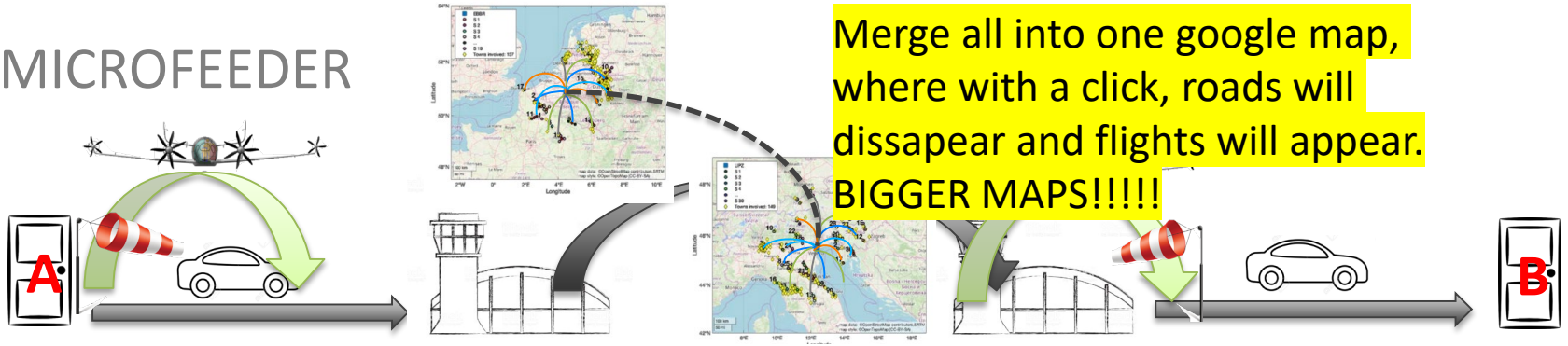
- Strict noise control
- Near Zero Emission
- Simple embarking and disembarking

- Available market
- Affordable solution
- Community and environmentally friendly

CO_2 AND NO_X EMISSION

The project‘s focus will be, from now on, on hydrogen and battery based propulsion for the well-being of European citizens and leadership of European Aerospace Industry.

MICROFEEDER



Merge all into one google map, where with a click, roads will dissapear and flights will appear. BIGGER MAPS!!!!!

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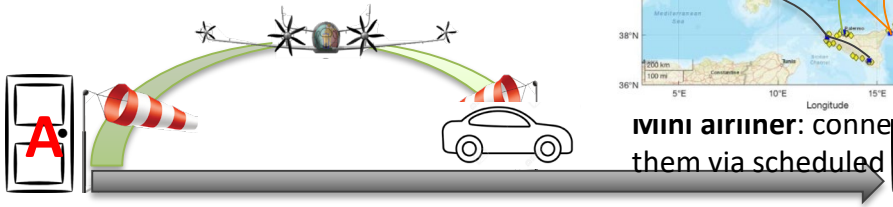
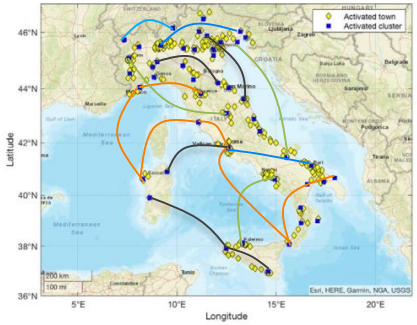
MINILINER





Mini airliner: connects small airports among them via scheduled or on-demand services.

ADVISORY BOARD

Aniello Cozzolino (Piaggio Aerospace)
19 seater class aircrat production and ceritfication

Paweł Guła (Warsaw Institute of Aviation)
production technologies, materials and innovative technologies

Bert Hoojier (Innovate)
airport infrastructure, procedures and handling

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CONSORTIUM