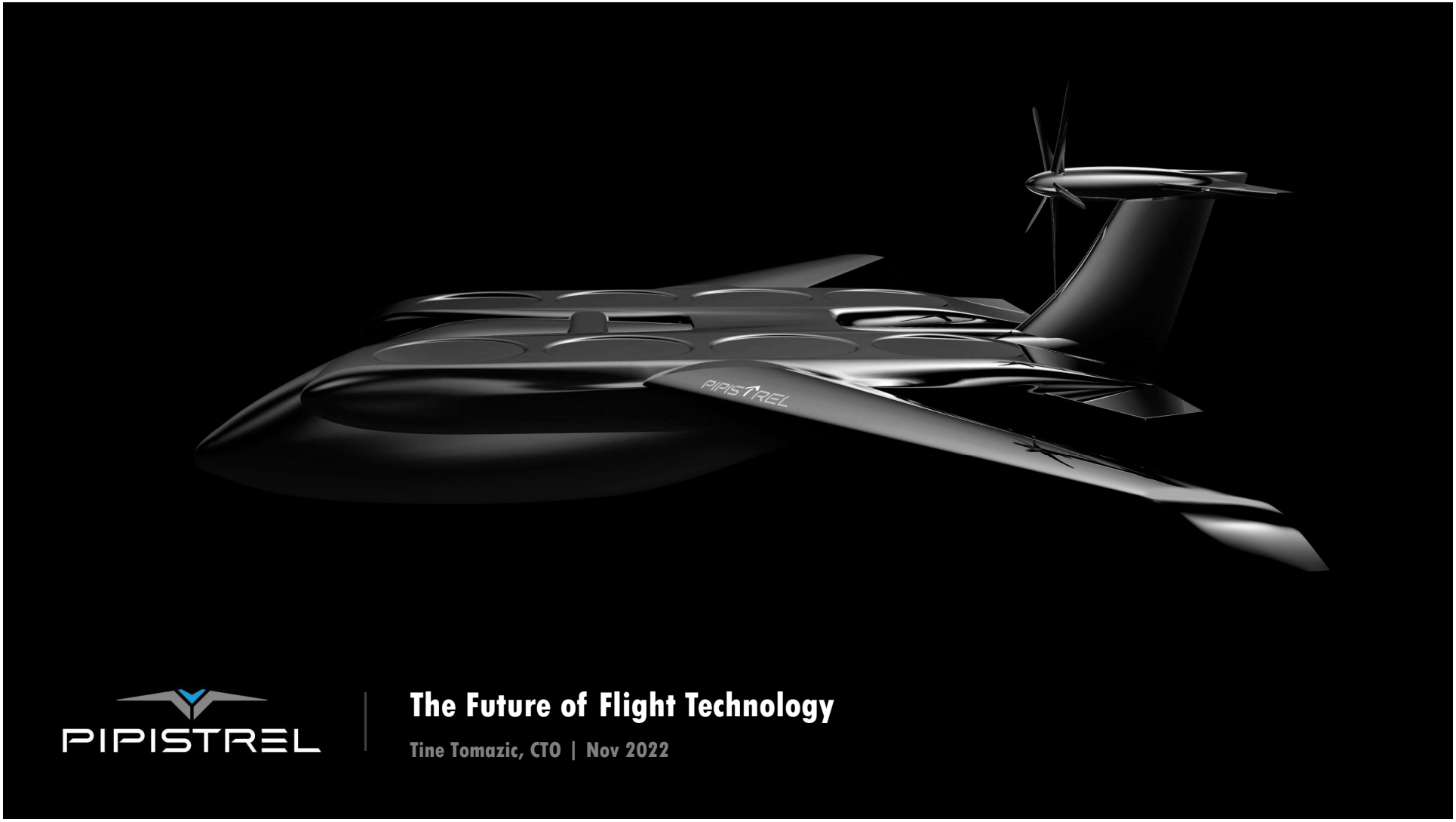
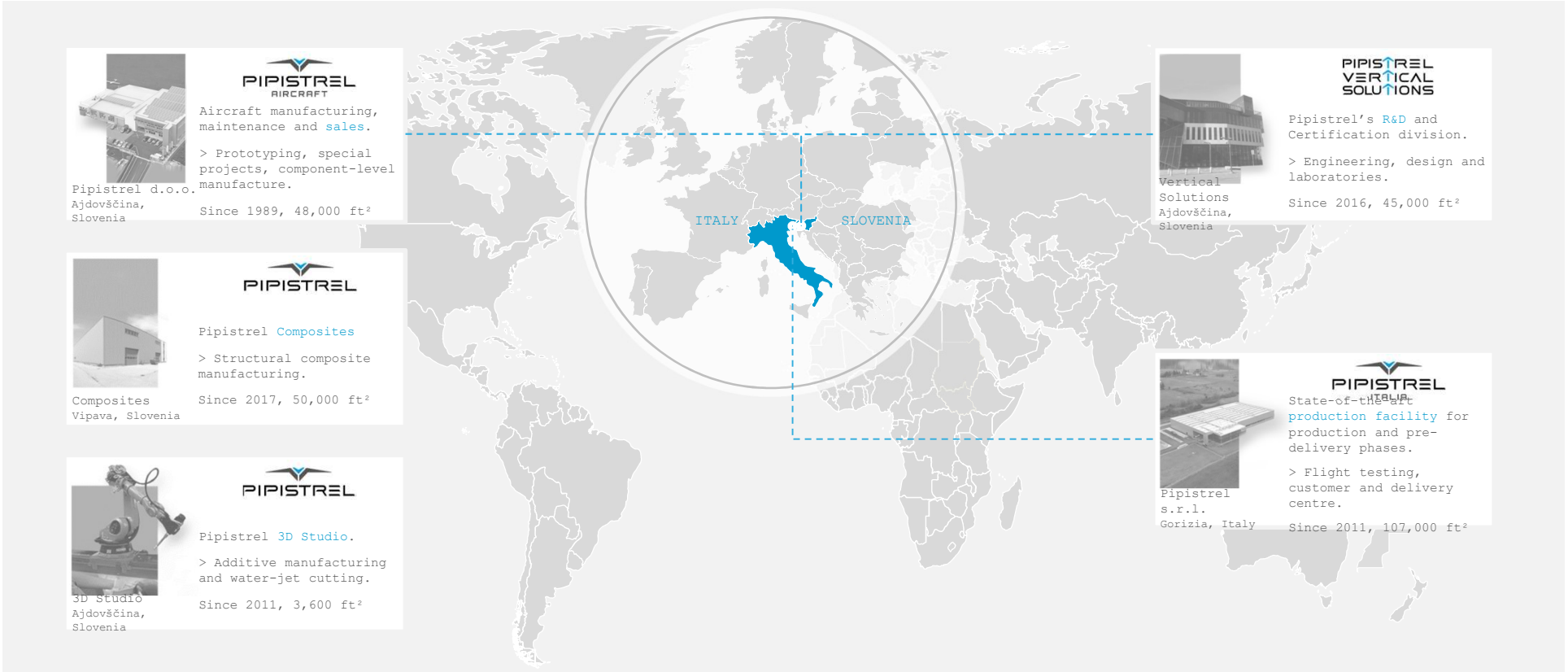


PIPISTREL

The Future of Flight Technology

Tine Tomazic, CTO | Nov 2022

The company has created a lean, scalable, end-to-end design and production capability, while ensuring ongoing innovation with world-leading partners



Pipistrel d.o.o.
Ajdovščina, Slovenia

PIPISTREL AIRCRAFT

Aircraft manufacturing, maintenance and sales.

> Prototyping, special projects, component-level manufacture.

Since 1989, 48,000 ft²

Composites
Vipava, Slovenia

PIPISTREL

Pipistrel Composites

> Structural composite manufacturing.

Since 2017, 50,000 ft²

3D Studio
Ajdovščina, Slovenia

PIPISTREL

Pipistrel 3D Studio.

> Additive manufacturing and water-jet cutting.

Since 2011, 3,600 ft²

Vertical Solutions
Ajdovščina, Slovenia

PIPISTREL VERTICAL SOLUTIONS

Pipistrel's R&D and Certification division.

> Engineering, design and laboratories.

Since 2016, 45,000 ft²

Pipistrel s.r.l.
Gorizia, Italy

PIPISTREL ITALIA

State-of-the-art production facility for production and pre-delivery phases.

> Flight testing, customer and delivery centre.

Since 2011, 107,000 ft²

It is moving to a vertically-integrated model to ensure a seamless, end-to-end experience for customers

DEVELOPMENT — DESIGN / CERTIFICATION
PRODUCTION — MANUFACTURING, LOGISTICS
DISTRIBUTION — SALES & MARKETING
AFTER SALES — TRAINING / MAINTENANCE

Pipistrel's capabilities cover the full idea-to-certification process in-house

1 CONCEPTUAL DESIGN
3D CAD models, project phases, estimated budget.

2 AERODYNAMIC ANALYSIS & DESIGN
Including computational fluid dynamics.

3 STRUCTURAL ANALYSIS & DESIGN
Predicting materials' behaviour by load condition.

4 SYSTEMS DESIGN
Design and integration of aircraft systems.

5 ELECTRIC / HYBRID POWERTRAINS
Design and airframe integration of powertrains.

6 AVIONICS AND ELECTRONICS
Custom electronics boards, software, or interfaces.

7 STRUCTURAL TESTING
Testing of full-scale airframes and aircraft components.

8 FLIGHT TESTING
Test plan, data collection and analysis.

9 PROTOTYPE CONSTRUCTION
Construction and tooling, including composites.

10 CERTIFICATION AND STC
Certification with EASA or supplementary type certs.

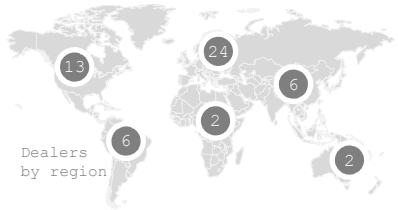
Production capacity will increase to 685,000 ft², or 450 aircraft per year

PRODUCTION LINE IN ITALY

A 40,000 m² SITE IS BEING CONSTRUCTED IN CHINA

The sales network now includes 53 dealers and contract manufacturers

1 DEALER NETWORK TARGETS CONSUMERS AND FLIGHT SCHOOL CUSTOMERS



2 DEDICATED SALES TEAM TARGETS OEM, CORPORATE AND GOVERNMENT CUSTOMERS

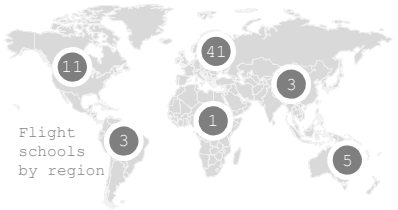
PIPISTREL | OEM | Corporate | Government

3 LOCALISED MANUFACTURING & DISTRIBUTION PARTNERS TO PENETRATE NEW REGIONS

PIPISTREL ASIA-PACIFIC

Pipistrel has partnered with 64 flight schools worldwide

WORLDWIDE NETWORK OF FLIGHT SCHOOLS PROVIDES TRAINING BUT ALSO MARKETING



DEALERS PROVIDE 1ST LINE MAINTENANCE, WHILE PIPISTREL HQ PROVIDES SPECIALIST SUPPORT

DEALERS	General maintenance
PIPISTREL ASIA-PACIFIC	Maintenance and parts
PIPISTREL	Specialist support and parts

EASA TC and TC-in-progress

EASA.A.573

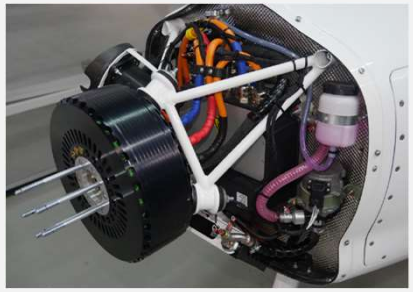
SW 121A

Velis Club

Velis Electro

EASA.E.234

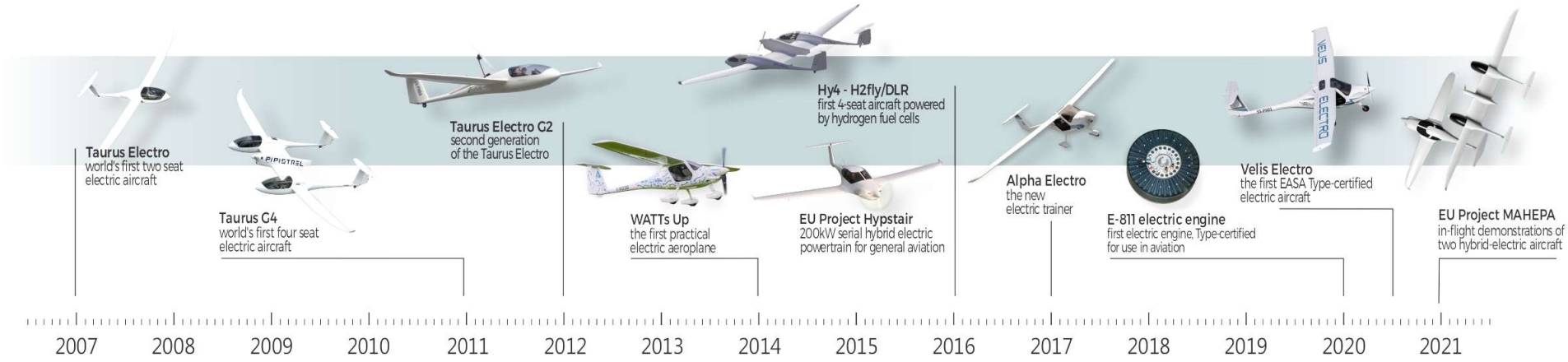
E-811/810 Electric Engine



EASA.A.660

Panthera 152

PIPISTREL



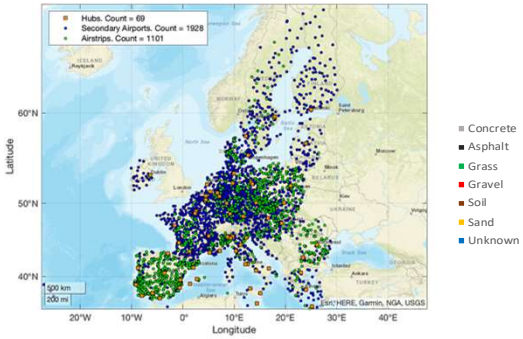
Flying electrically since 2007.

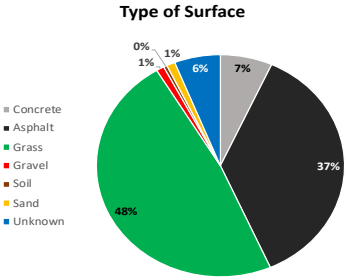
Research - MAHEPA

Photography: Jožef Kovačič – MAHEPA

MARKET STUDY

AVAILABLE AERODROME NETWORK



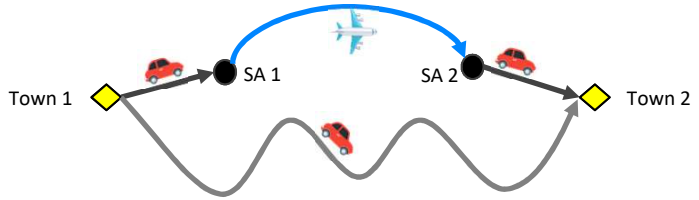


- >> **69** hubs
  3027 secondary aerodromes
- >> Runway length ≥ **800 m**; **50%** total airports
- >> **90%** secondary aerodromes has an airport within **100 km**

TRAVEL SCENARIOS

MICROFEEDER

MINILINER



CRITERIUM: time advantage of selected transport

PRVK-X

Increased complexity, optimised for DOC

PRVK-1

Optimised for low noise, short runways, steep arrival/departure

H2B-direct turbine compatible

PRVK-LR

Long range, high speed

H2B-direct turbine compatible

True innovators never consider failure, only the consequences of success

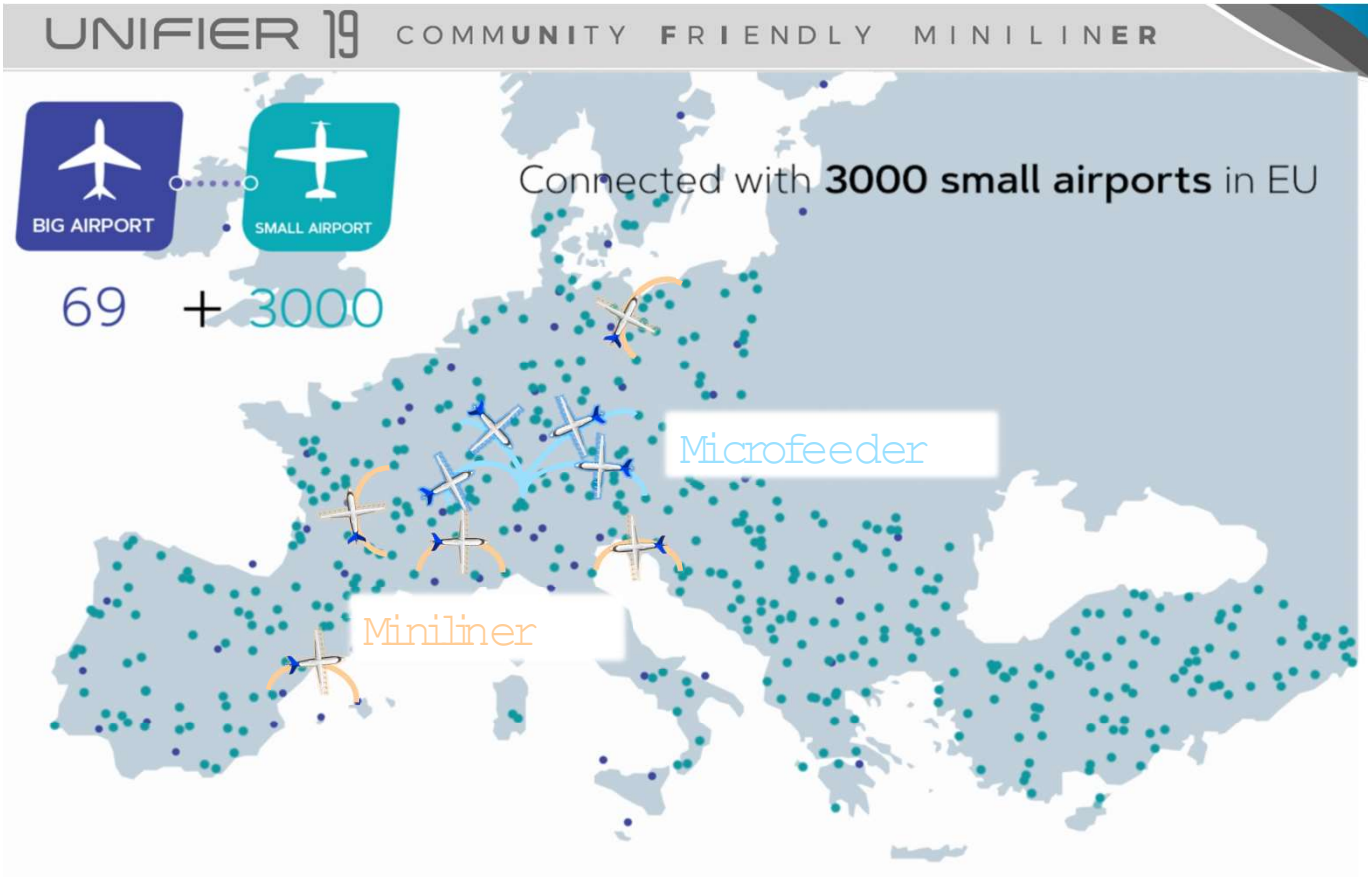
- UNIFIER19 kick-off meeting (October 2019):
- *„…the **only responsible, sensible and sustainable** way for European aviation for **regional** air-traffic to embrace, is going towards **complete zero emission flight**.“*

- European Comission, INEA and Clean Sky workshop (January 2020):
- *„**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.“*

*( ) Simulated


PIPISTREL

PIPISTREL



- Bring air-travel closer to people without compromising their well being
- Zero emission, quiet flight
- Minimal infrastructure investment


PIPISTREL

ENVIRONMENTAL OBJECTIVES

CO_2 AND NO_x EMISSION REDUCTION

>> 100% reduction

>> Fuel-cell hybrid system with liquid hydrogen tank

>> We do not consider water, or water vapors as a harmful emission due to lower operational altitudes

NOISE EMISSION REDUCTION

>> >10 dB reduction with respect to reference aircraft

REFERENCE AIRCRAFT

>> Twin turbo prop

>> Optimised for Unifier19 mission

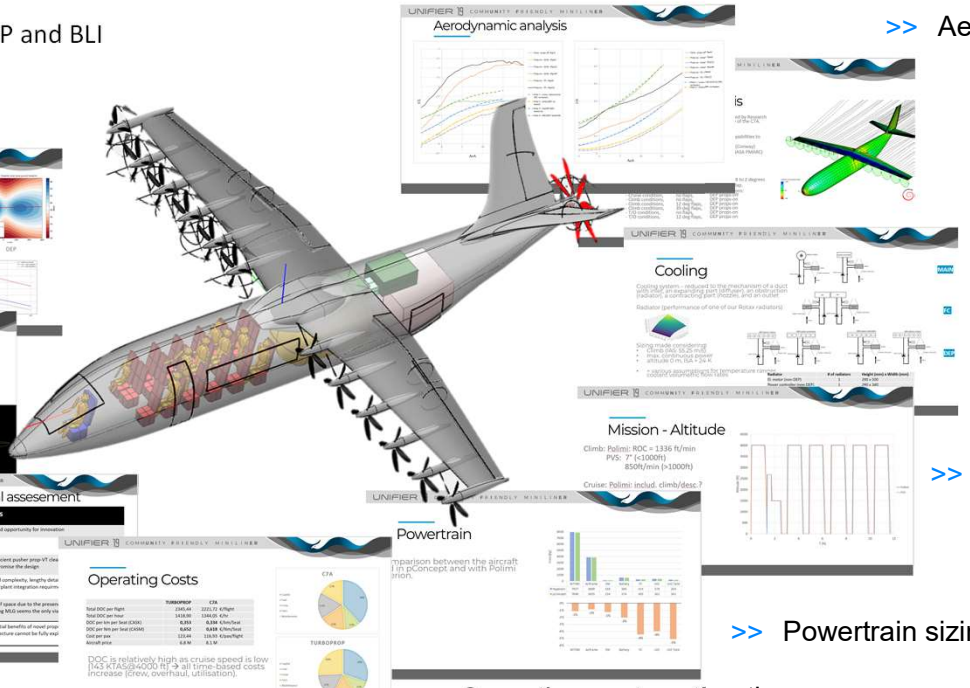
>> State-of-the-art propulsion, aerodynamics and structural characteristics

>> Within CS-23 regulation requirements

PIPISTREL VERTICAL SOLUTIONS

MULTIDISCIPLINARY OPTIMISATION

>> C7A: Traditional and DEP, WTP and BLI



>> Aerodynamic analysis

>> Noise assessment

>> Propeller design

>> Cooling drag prediction

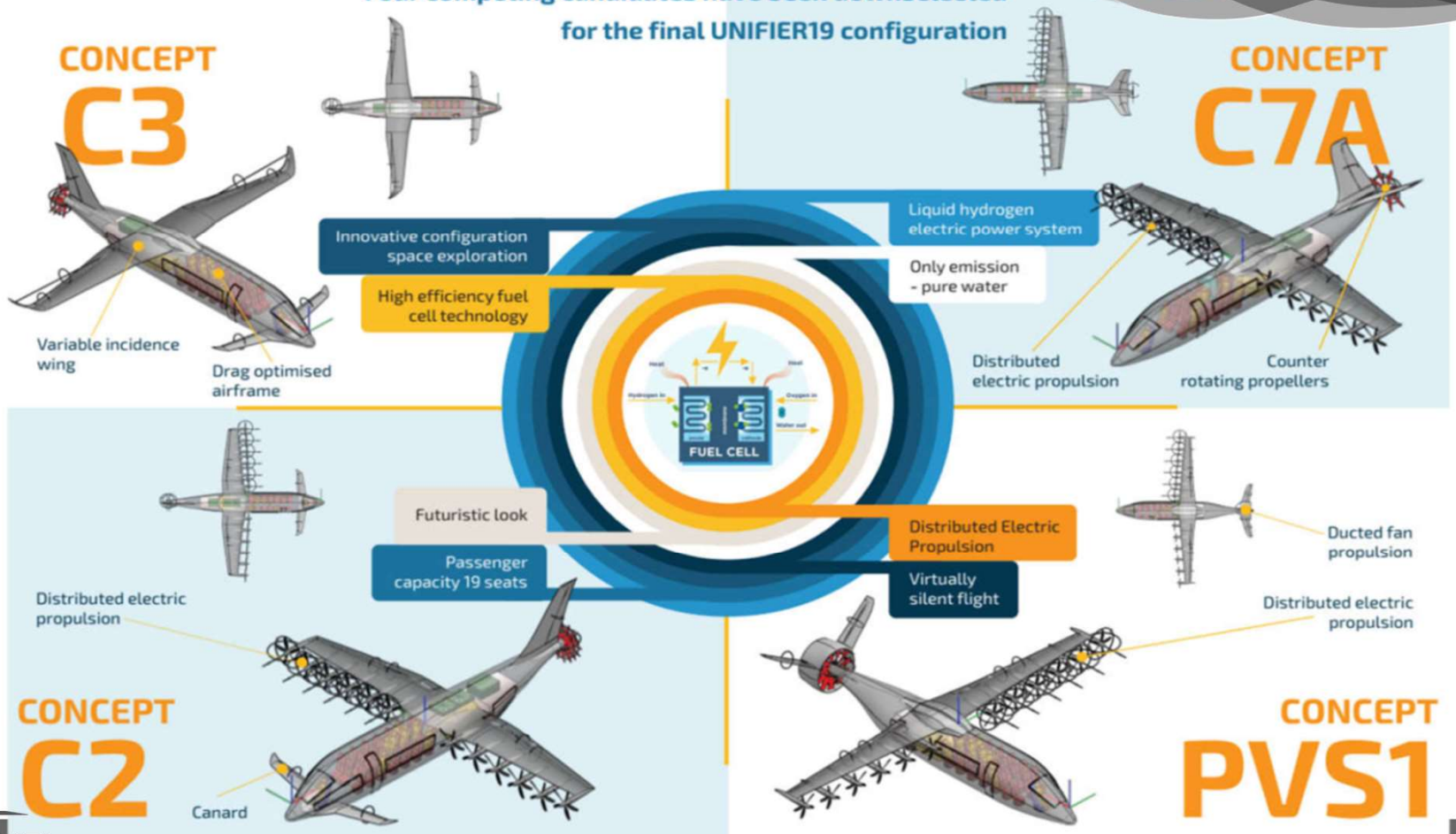
>> Mission analysis

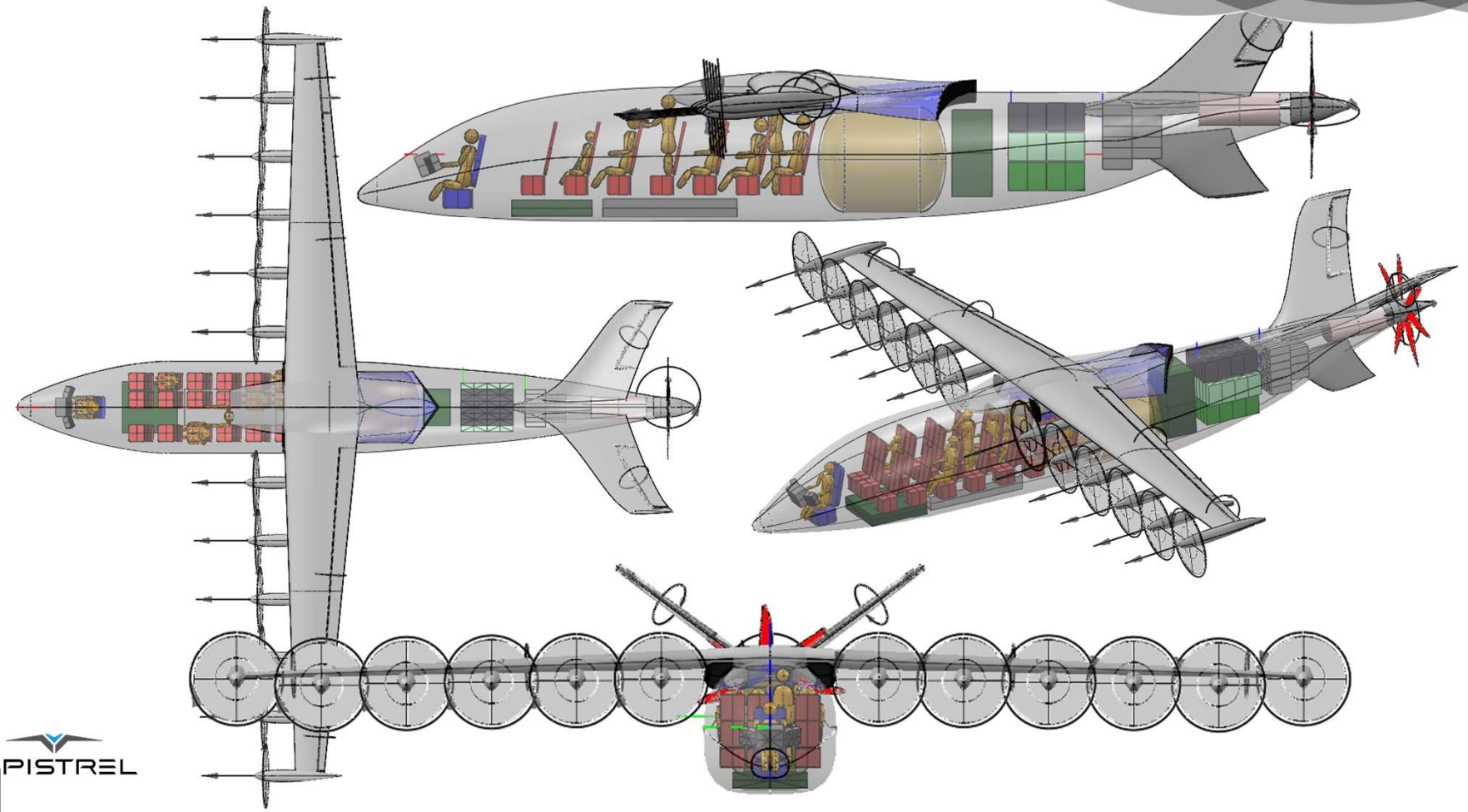
>> Qualitative structural assessment

>> Powertrain sizing

>> Operating costs estimation

Four competing candidates have been downselected for the final UNIFIER19 configuration





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Concepts overview

- ~2 MW of total installed power – Synergies with regional-sized airplanes
  - 1-1.5 MW from Fuel Cells
  - 1 MW from Battery
  - Single LH_2 tank, 250-320 kg capacity
  - Compatibility with H2B – propulsion agnostic airframes
- Operations from 800 m runways
- 250 KTAS, 24000 ft
- 1000 NM + 45 min reserves
- Fit within CS-23 bounds of today

PRVK-1

Main Characteristics

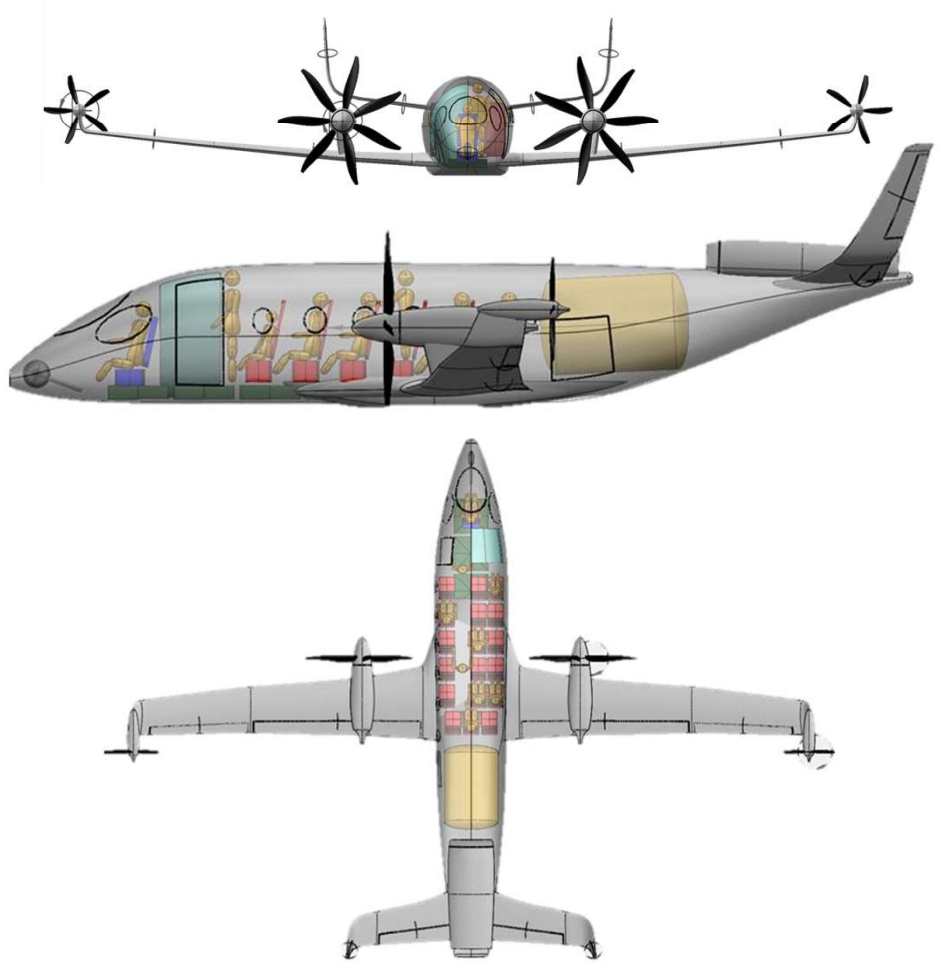
Crew	one pilot
Capacity	19 pax (w/o lavatory)
Length	14.75 m
Wingspan	21.60 m
Height	4.80 m
OEW	5300 kg (w/ battery)
MTOM	7500 kg

Propulsion system

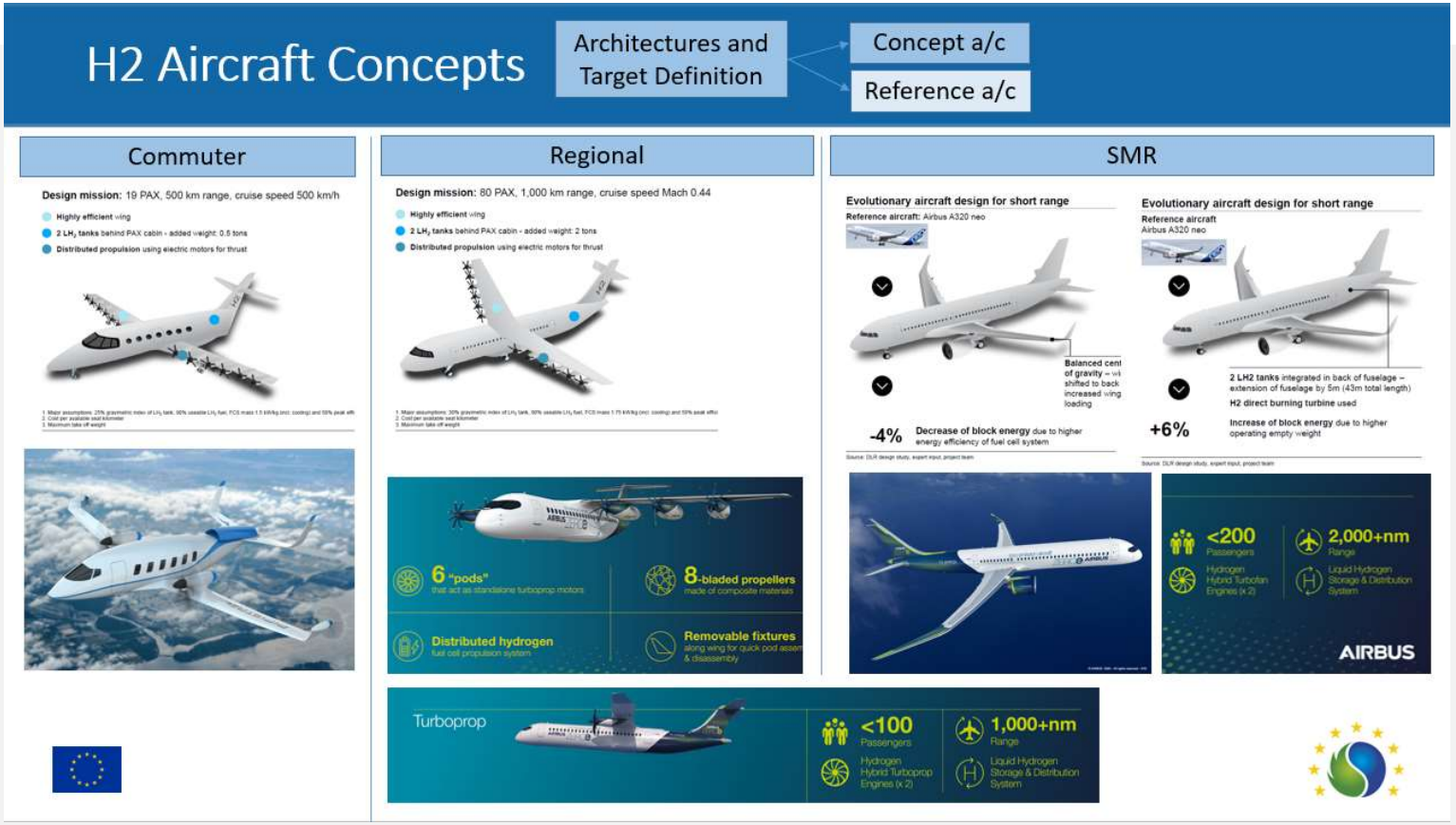
- 1+ MW fuel cell system, works with existing 1500 W/kg, sized for 2200-2500 W/kg on system level
- ~5 m^3 Liquid Hydrogen cryogenic tank, ~ 300 kg of LH2
- 1 MW battery, 1500 VDC bus, 480 kg, 2000+ W/kg,
- 2 low speed/low noise tractor propellers (0.35 M tip velocity) driven by twin-motors
- 2 wingtip pusher propellers (single motors)

Typical Mission Performance

Cruise speed	250 KTAS
Range	4x 350 km hops (each hop incl. 100 km diversion + 45 min)
Takeoff distance	< 800 m



Research – FLAGSHIP SPRINGBOARD – Clean Aviation 2022-2028

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PIPISTREL VERTICAL SOLUTIONS

sesar JOINT UNDERTAKING

- Drive the change towards new services with drones in all airspaces, anytime and anywhere
- Support development of new procedures, technologies and services
- Deliver environmentally friendly, digital and connected aerial cargo delivery solutions across Europe
- Being a catalyst of modernization of European air traffic management

Miniliner™ is for:

- Operators who believe in true zero-emission regional and sub-regional aerial mobility
- Cost effective multi-hop and/or long-range operations; 40% TOC reduction in cost from twin turboprops
- Powered by hydrogen fuel cells, using LH_2 300 kg-class storage and MW-class high-power density long-life battery
- Distributed electric propulsion w/ redundancy for CS-25 (airliner)-level safety and reliability
- 0.35 M tip-speed ultra low-noise propellers
- Fully digital aircraft set-up for single pilot operations from small airfields