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I.FAST Workshop

Airbus ASCEND program exploring the use of HTS technologies for aircraft electric propulsion

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Presented by

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"At Airbus, our ambition is to lead the decarbonisation of our sector and build the world's first **zero-emission airliner by 2035.** We're committed to this ambition as demonstrated by our new **ZEROe aircraft** concept designs."

ASCEND = Advanced Superconducting and Cryogenic Experimental powertraiN Demonstrator

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PURPOSE

Boost Airbus by accelerating future technologies

VISION

Fly the future of aerospace, Incubate talent, Inspire Airbus transformation

AMBITION 2025

Be THE reference for Technology Value Assessment

Be recognized as an inspiring place to work

Act as entrepreneurs

VALUES Keep it Simple, Be Audacious, Exploring Together

Mindset

DNA Speed Of Execution, Caring for Each Other, Open to the World

Unique value proposition

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Pathways to decarbonise the AVIATION sector

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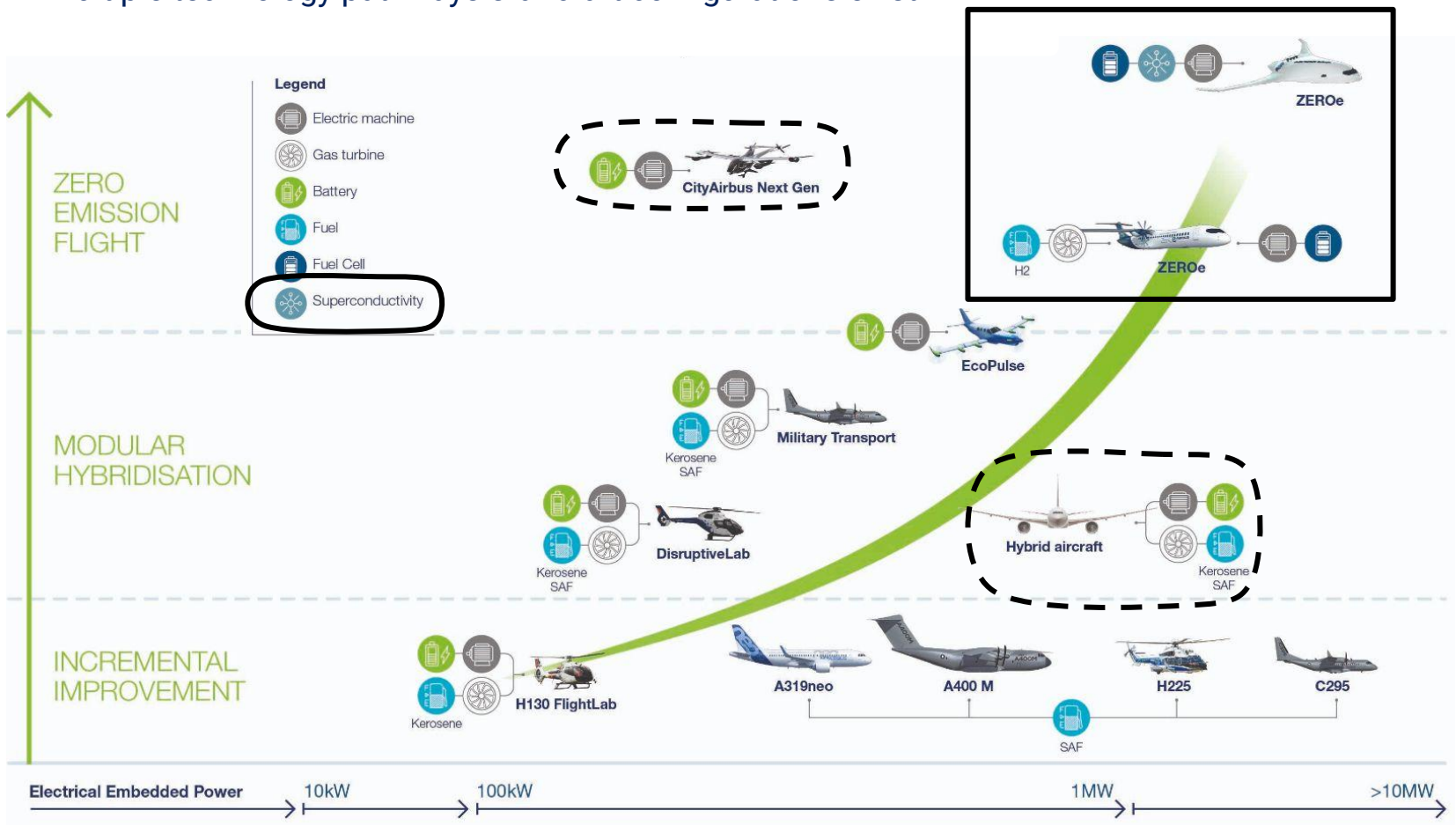
Multiple technology pathways & aircraft configurations exist:



Powertrain: As we scale up to larger aircraft with higher power levels, increased electrical losses & conductor masses of conventional technologies would quickly become unmanageable

Bringing cleaner technologies to aerospace

1. **Airbus Group plans to develop technologies for Electric and Hybrid aircraft propulsion.**

2. **2 main PERFORMANCE challenges:**
   - Energy storage/Power generation
   - How to convert efficiently electrical power into mechanical power (powertrain)?

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ZEROe Aircraft Platform & Technologies

Fuel Cell
(Providing electrical power,
Megawatt scale)

Liquid Hydrogen Storage
(cryo-temperature~20K)

Electrical distribution, Power Electronics & Electric Motors
(convert electricity to mechanical power)

From Conventional to Cryogenic Propulsion System

A breakthrough for electric propulsion **to reduce weight & volume**
→ **Losses divided by 10 for conductors, 3 to 5 for semiconductors**
→ **No DC losses / Carry >100 times more current than copper**

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Our path to ZEROe

With Hydrogen storage on-board of future aircraft, that's open up/accelerate multiple options for HTS

Collaborating with all stakeholders to drive down costs & grow the ecosystem **targeting** all aspects: aircraft design, safety, maintenance, industrialisation, operations, market, infrastructure, etc.

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ASCEND Demonstrator for Cryogenic Propulsion (1/2)

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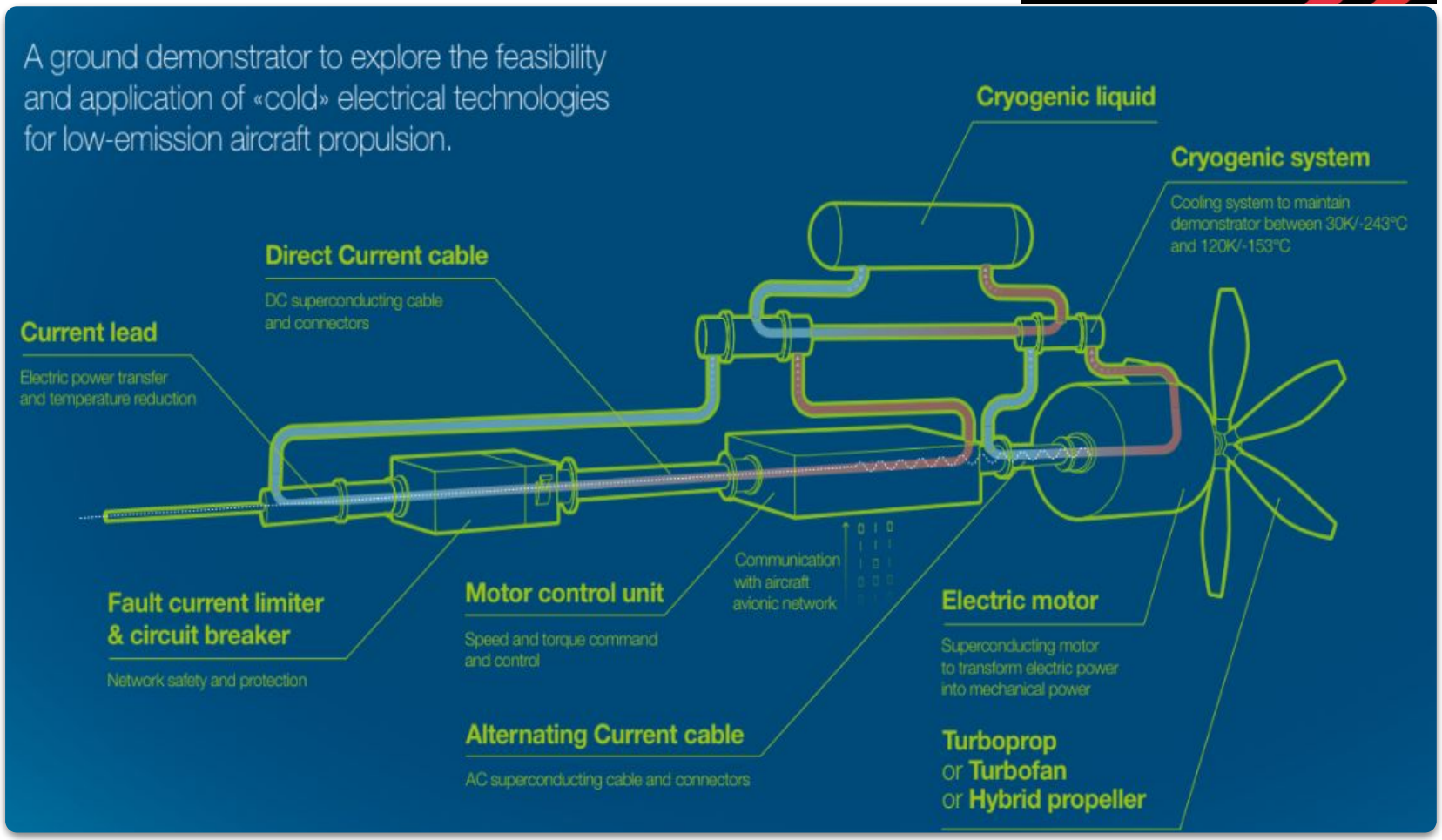

ASCEND project

Launched in 2021

500kW powertrain with key technos bricks

- Superconducting cables
- Cryogenic power electronics
- Superconducting motors

Testing in EAS facility end of 2023.

(*) ASCEND Advanced Superconducting and Cryogenic Experimental powertraiN Demonstrator

ASCEND Demonstrator for Cryogenic Propulsion (2/2)

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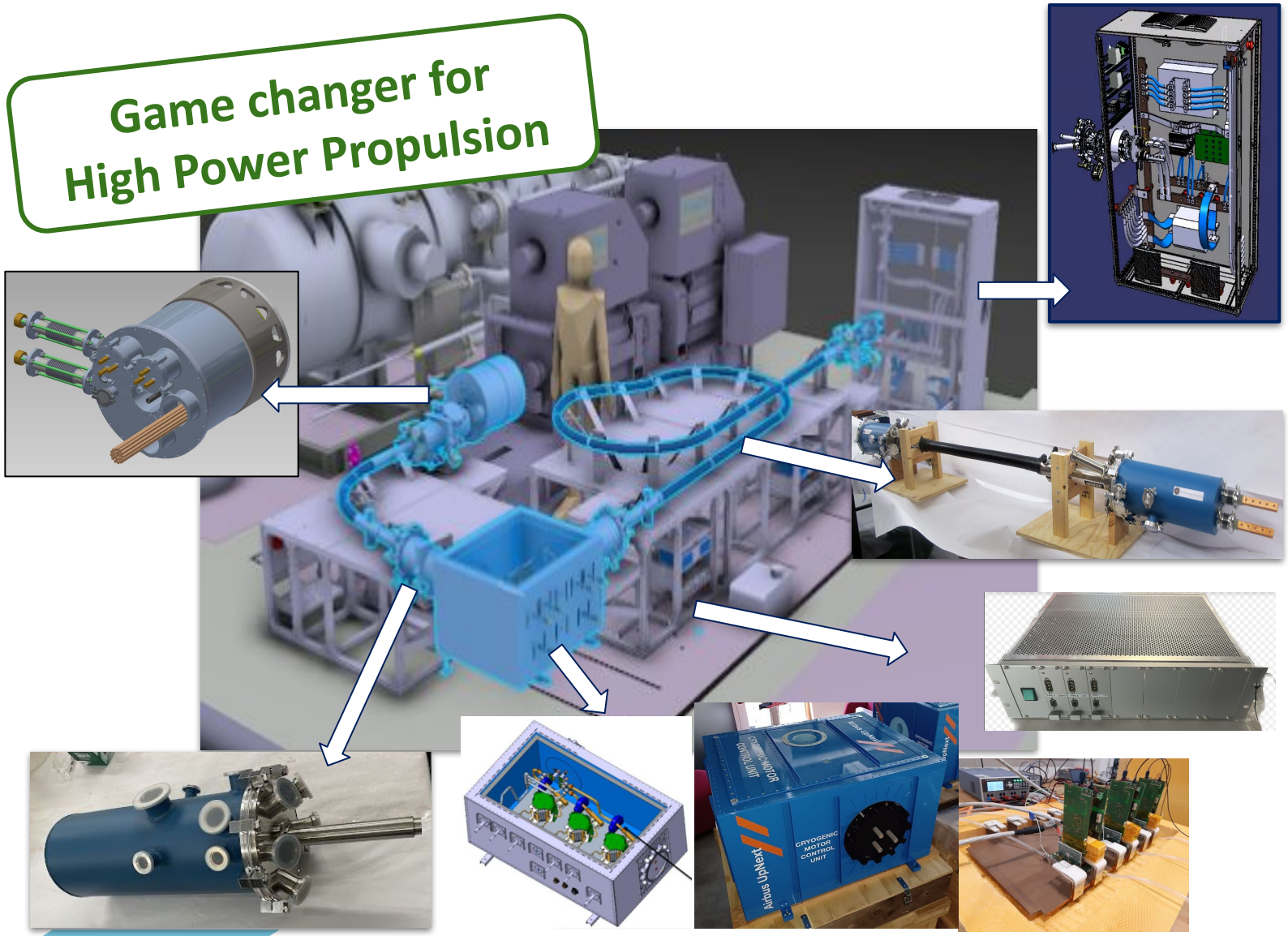
Game changer for High Power Propulsion



Preliminary results

1. **No showstopper for ground demonstrator**
2. **Promising performances with available technos**
   - Efficiency +4-5%
   - Weight
   - New degrees of freedom (current density, torque)
   - Higher maturity than expected
3. **Challenges**
   - Weight of cryogenics
   - Reliability
   - Operation

(*) ASCEND Advanced Superconducting and Cryogenic Experimental powertraiN Demonstrator

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Cryo-Propulsion System - Roadmap

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2020 | 2024 | 2026 | 2028 | 2033 | 2035 | 2038 | 2045

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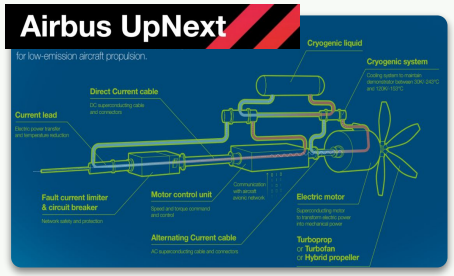
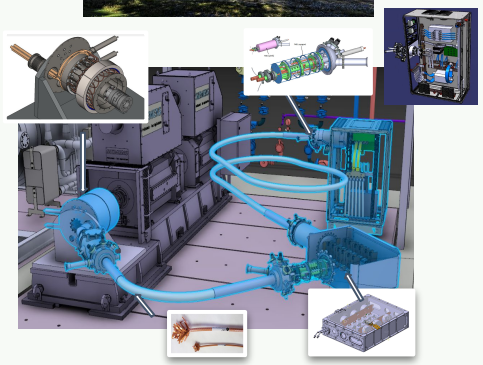
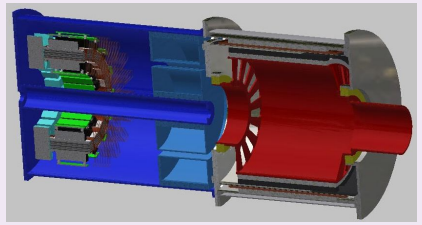




Feasibility Demonstration + Value at aircraft level

ASCEND v2



Technology Maturation (reliability) + Integration Ecosystem reinforcement

ZEROe Product v1

TRL6/7 (Launch ready)

- Cryo-MCU+S-motor
- Super-Cable + FCL
- DC/DC + protection
- LH2/GHe cooling system
- Standalone Super-cables

Product v2

1 MW-Class power per channel

TRL6/7

- Cryo-MCU+S-motor
- Super-Cable + FCL
- DC/DC + protection
- LH2/GHe cooling system

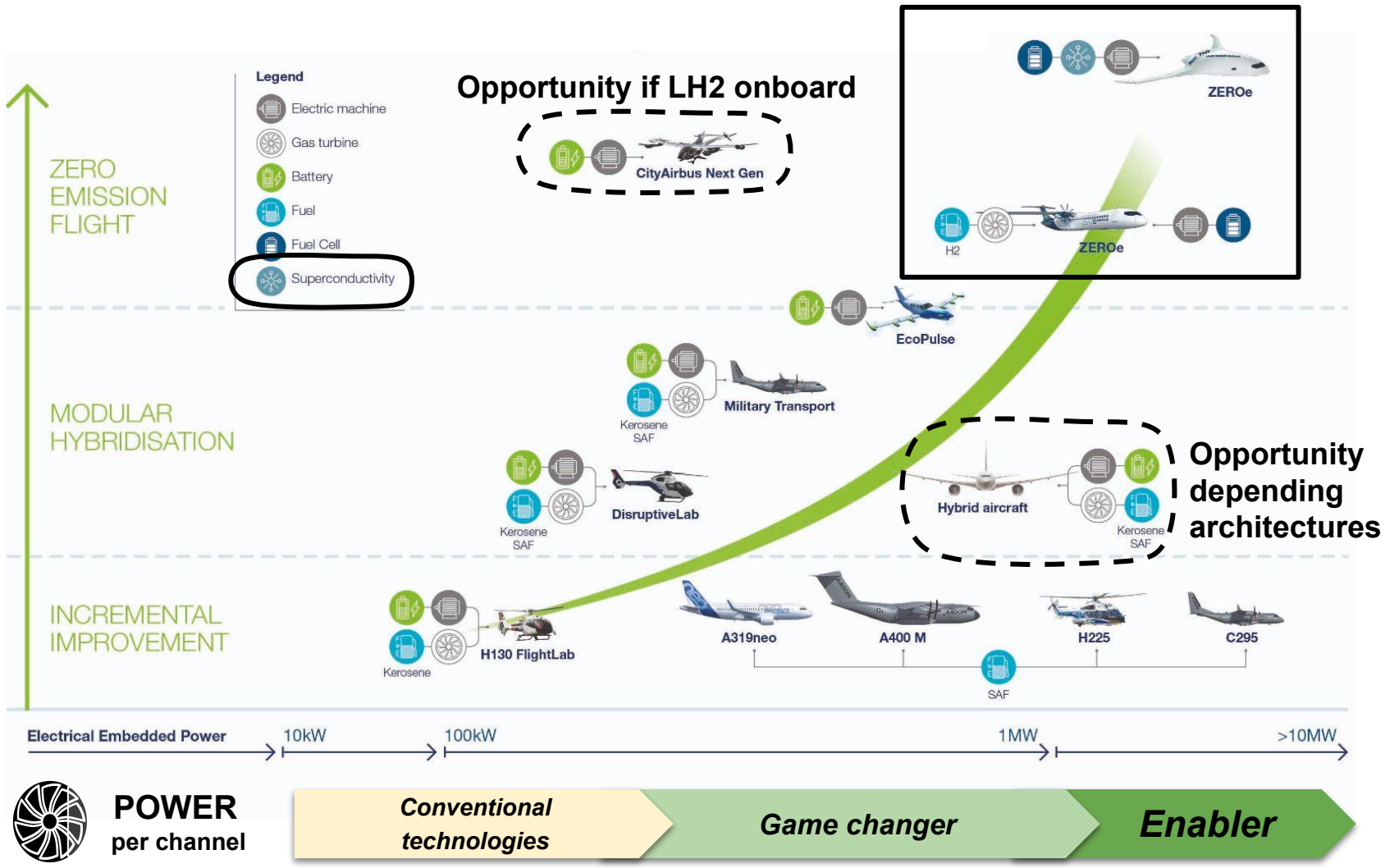
Product v3

5 MW-Class power per channel

TRL6/7

- Cryo-MCU+S-motor
- Super-Cable + FCL
- DC/DC + protection
- LH2/GHe cooling system

Conclusion



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HTS : New paradigm for electric propulsion

1. As we scale up to larger aircraft with higher power levels, HTS derived technologies become a more viable and could become a Game Changer / Big enabler of Electric and hybrid aircraft propulsion.

2. We are at the beginning…

   We must prepare now for the 2030s and beyond.

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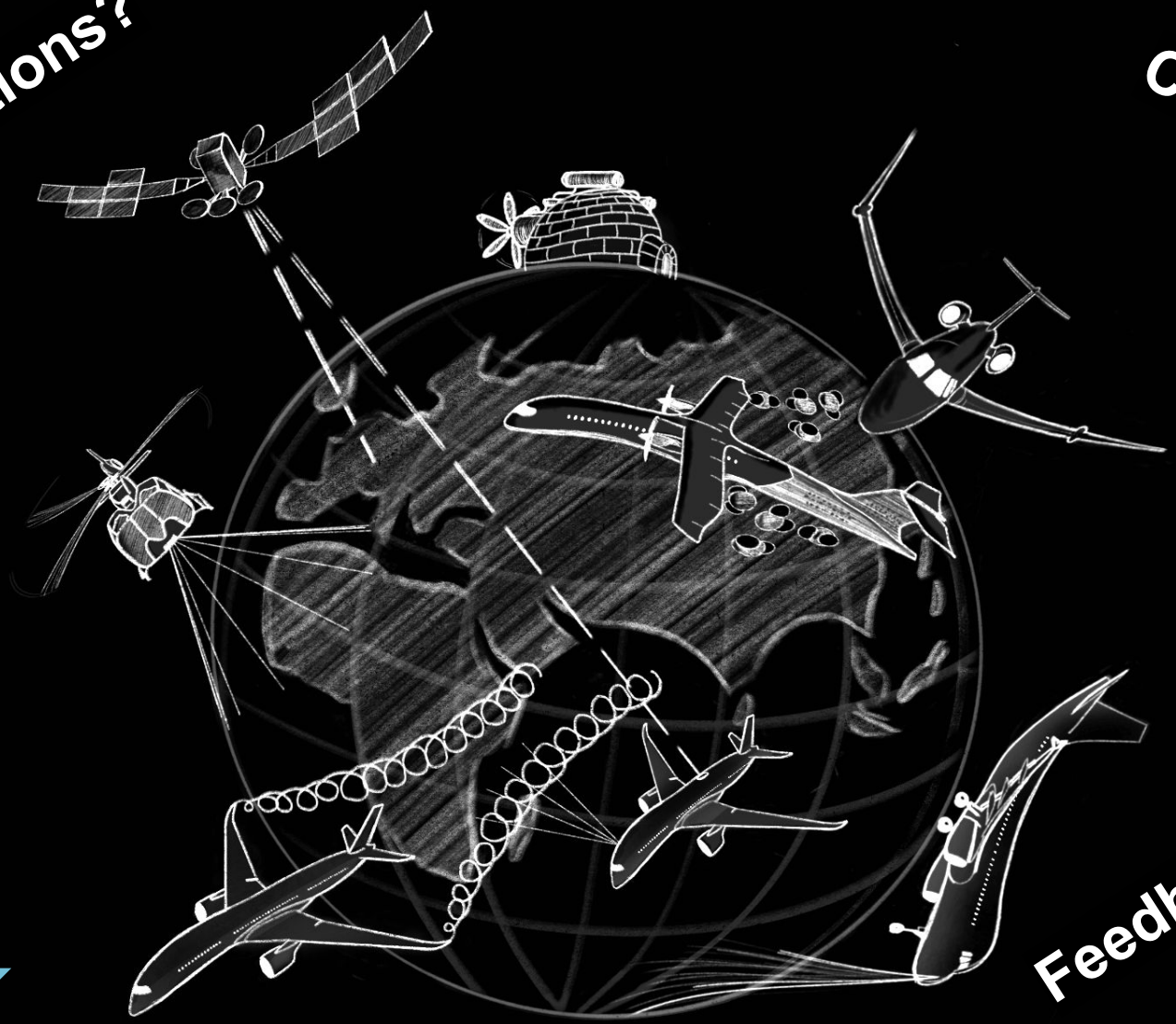
Questions?

Comments?



Feedback!

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