HYBRID-ELECTRIC REGIONAL ARCHITECTURE

NEWSLETTER

Issue 1
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Dear Reader,

I am glad to share with you Issue#1 of the HERA project Newsletter.

Empowered by a consortium of 48 partners, spanning research powerhouses to industry giants, the Hybrid-Electric Regional Architecture (HERA) project, funded by EU, is on a mission to revolutionize regional aviation.
HERA's mission: To navigate the intricacies of regional aircraft concepts and architectures. We are not just dreaming; we are developing and integrating cutting-edge aircraft technologies to meet the ambitious 50% GreenHouseGas (GHG) emission reduction set in our playbook, the Strategic Research and Innovation Agenda (SRIA) for a Hybrid-Electric Regional Aircraft. Fasten your seatbelts; it's not just a project —it's a journey towards a greener aviation future!

Picture the HERA aircraft, tailored for 50-100 seats, taking center stage in regional and short-range air mobility, covering distances under 500 km for interurban regional connections. Poised to seamlessly integrate into upcoming sustainability frameworks, the HERA aircraft champions hybrid-electric propulsion, drawing from batteries or fuel cells, complemented by sustainable aviation fuels or hydrogen burning. The audacious goal: slashing emissions by an impressive 90%. Brace yourself for the future of environmentally conscious air travel!

By the mid-2030s, the HERA aircraft will take flight, adhering to new certification standards, seamlessly interacting with novel ground infrastructure, and embracing novel energy sources. It is a game-changer, ready to serve operators and passengers with actual revenue-generating flights.

Enjoy reading and become a member of the HERA online community on our website and social media so as not to miss any updates on the project designing the third era of aviation!

CLEAN AVIATION

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Learn more at **project-hera.eu**

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Why HERA ?

Aviation has taken the path of decarbonization while there is a considerable increase in the use of regional aircraft providing effective connections without discontinuity. To be the first to pursue the hybrid-electric regional aircraft, supported by Sustainable Aviation Fuels and, eventually, hydrogen burning at typical distances less than 500 km and capacity 50 - 100 seats.

HERA will identify and trade-off the concept of a Turboprop Regional Aircraft, its key architectures, develop required aircraft level technologies and integrate the required enablers in order to meet the quantitative targeted performance gains respect to a year 2020 regional turboprop conventional platform in terms of emissions and fuel burn reduction. HERA project aims to study and develop disruptive Regional Turboprop aircraft configurations that will carry 50 to 100 passengers over routes up to 1000 km long with an Entry in Service from 2035.

The regional aircraft will integrate technologies ready for entry into service by mid-2030, incorporating viable solutions to comply certification and interact with ground infrastructure. While the recent past research activities that studied hybrid regional turboprop architectures concentrated its efforts on the use of batteries feeding electric motors, HERA intends to create electric energy onboard, by means of hydrogen fuel cells, and bring electric current to electric motors with a high voltage distribution system.

Figure 1. Aircraft design steps to select the HERA configuaration

HERA's Vision for a Sustainable Future in Aviation

HERA is charting a path towards groundbreaking achievements in aviation, aiming for a robust technology development plan that spans propulsion, systems, aircraft, and industrialization. By integrating innovative solutions and disruptive technologies like batteries, fuel cells, and hydrogen, we are designing aircraft concepts that promise significant impacts and enhanced productivity for operators and passengers. Our disciplined approach includes the evaluation of feasibility against new metrics and targets, paving the way for a sustainable future with a 50% reduction in fuel burn. The journey culminates in a series of ground and flight demonstrators, setting the stage for aircraft ready for 2035 Entry Into Service (EIS).

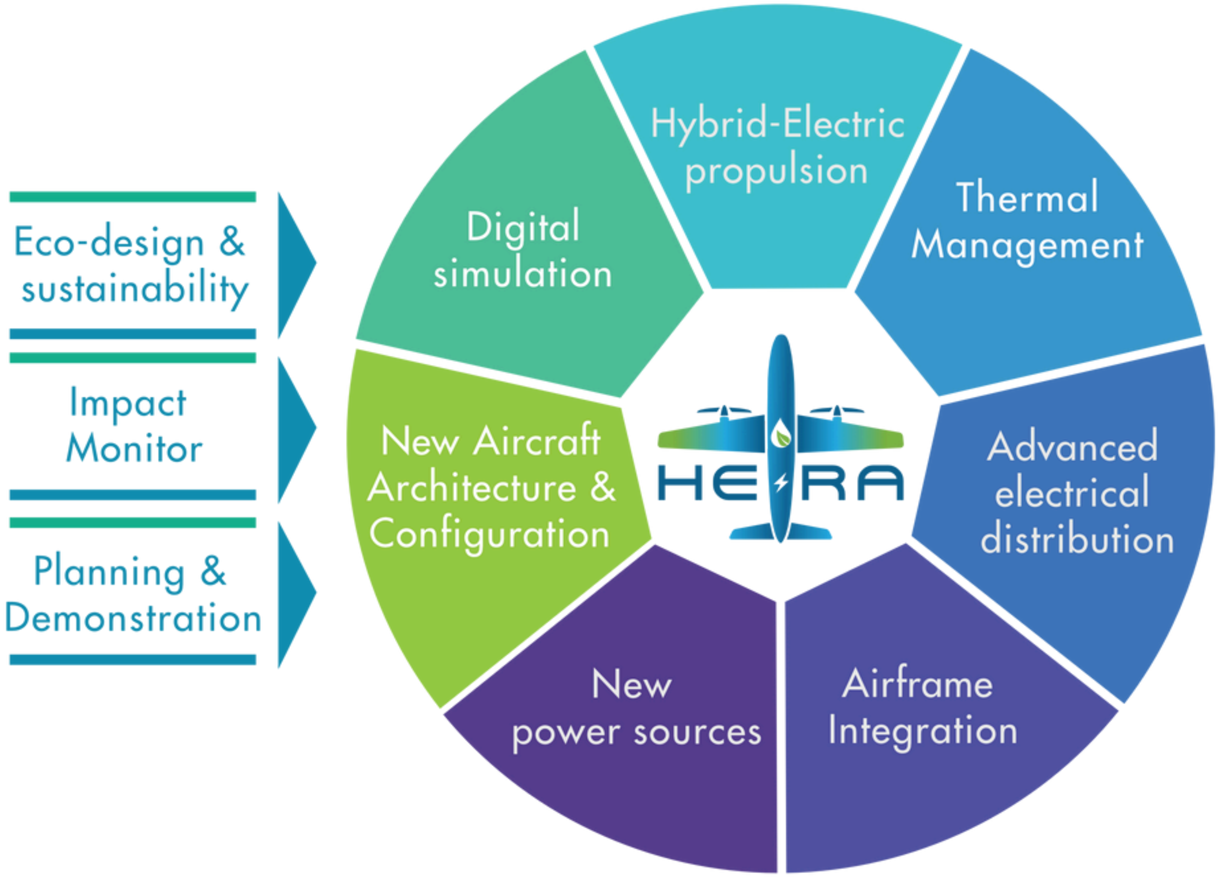


Figure 2. Synergy of Cutting-Edge Technologies and New Metrics in HERA

- The aircraft will include hybrid-electric propulsion supported by 100% drop-in fuels or hydrogen whether fuel cells or H2 burning for the thermal power source, to reach up to 90% lower emissions while being fully compliant with ICAO noise rules. Innovation of fuselage and empennage structures, as well as very performing and optimized wings, new integrated thermal management system will allow the objective to reducing fuel burn and emissions.

- Regional air transport may be a "first case" for other vehicle segments by introducing innovative and disruptive technologies into real operation. Starting by HERA, passengers and operators will be progressively familiar with new solutions to new business models for societal demands in terms of people and goods aerial transport: intermodal operations, small airports better connected with larger ones, simplified operations, quick turn-around times.

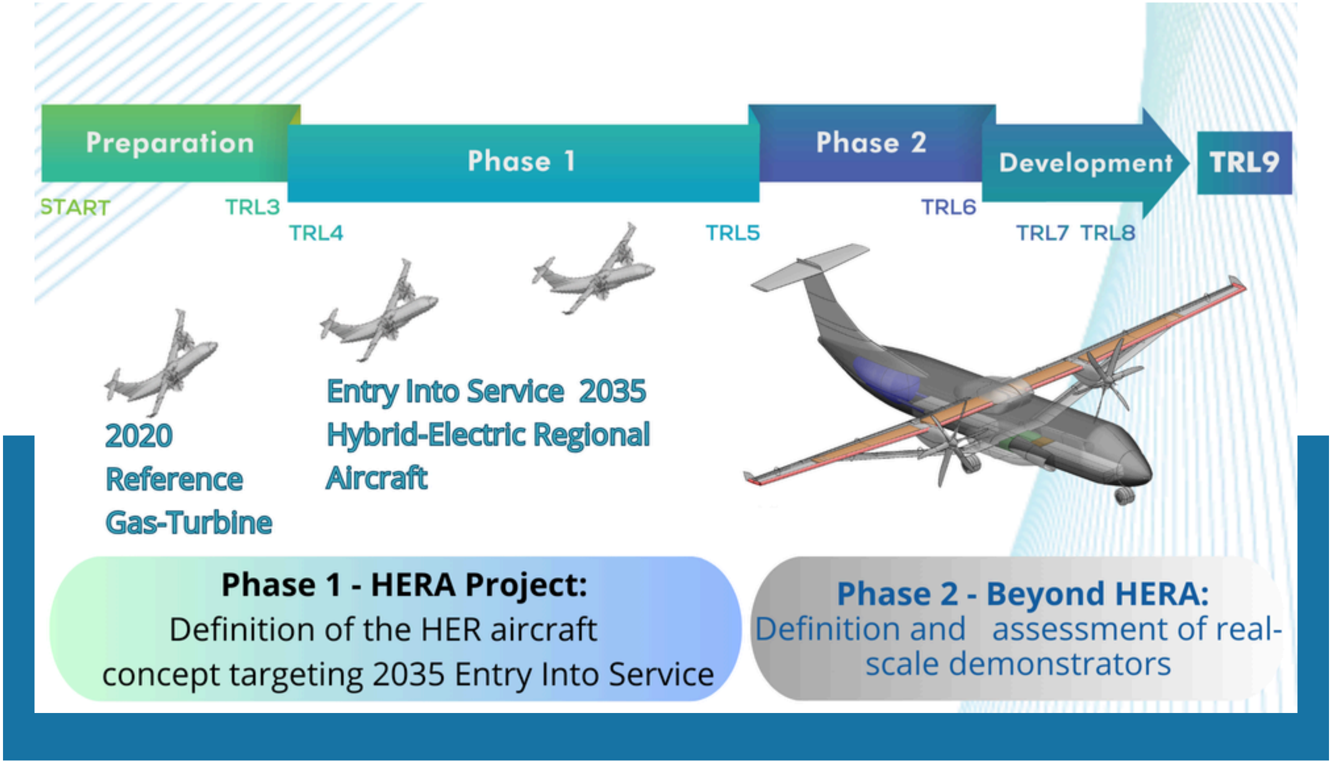


Figure 3. Roadmap towards a hybrid-elecric regional aircraft for 2035 Entry Into Service

- HERA is adopting advanced digitalization and industrialization approaches from Clean Aviation and beyond, aiming to cut costs, reduce time to market, and streamline complexity. This integrated methodology will support the sustainable design of regional aircraft, accelerating the introduction of regional aerial mobility and contributing to climate neutrality by 2035.

- In collaboration with leading Clean Aviation projects (HE-ART, AMBER, HYDEA, HERWINGT, HECATE, Thema4HERA, H2ELIOS, HERFUSE, NEWBORN, HyPoTraDe, flHYing Tank), HERA is integrating hybrid-electric and other advanced technologies to redefine aircraft architecture and performance.

HERA's two use cases

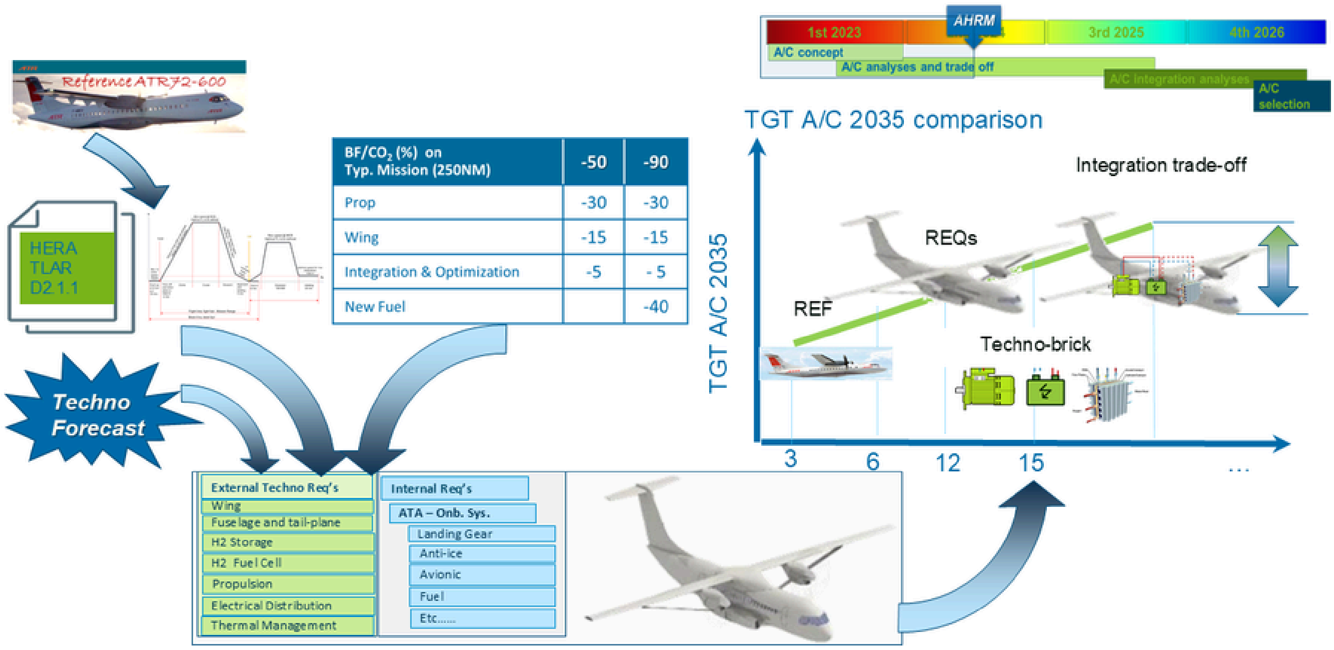
HERA will define the regional aircraft architecture and technology integration for aircraft concepts ranging from regional to short-range targeting for two Use Cases, A and B (UCA & UCB). The two configurations will have different propulsive structure but the same:

- Fuselage and tail planes
- System architecture
- Total installed propulsive power with different propulsive distribution

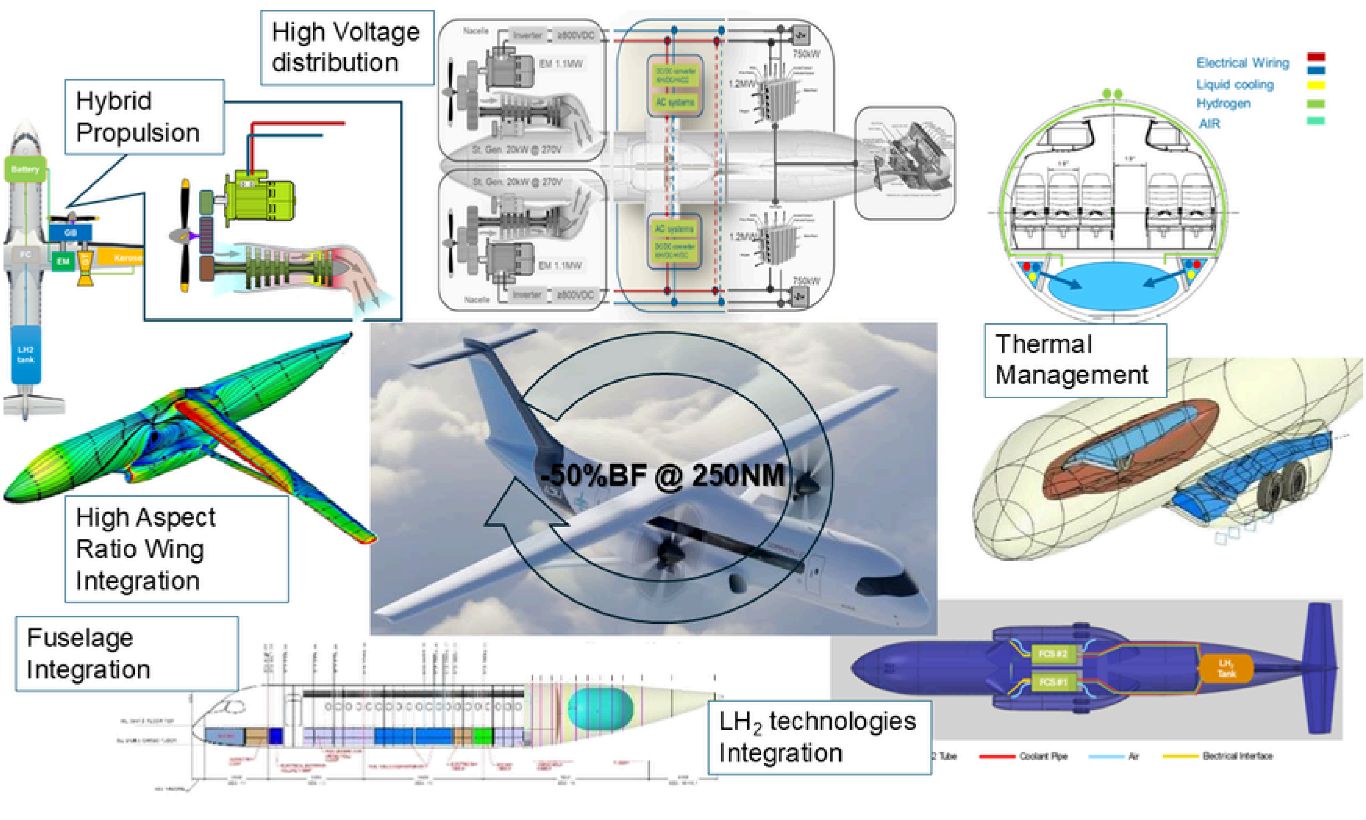
Figure 4. The two HERA's use cases

Use Case A and future of HERA

Deployment from the Top Level Aircraft Requirements (TLARs) to UCA systems (V-shape systems engineering:



Use Case A 2035 aircraft



Incremental development process using Computer-Aided Design

UCA team shares all the updates till the latest version of the Computer-Aided Design (CAD), configuration and data. Figure shows the evolution of the CAD update:

Figure 5. The two evolution of the CAD design

Future HERA concept studies

The battery-based concept aims to achieve technology readiness within the EIS timeframe, with an environmental objective of reducing emissions by at least 30% compared to the 2020 state-of-the-art. This includes a minimum of 20% reduction from innovative powerplant and hybridization, with additional reductions coming from improvements in the airframe and secondary systems, on-board energy optimization, and other enabling technologies for hybrid propulsion. In parallel, in the framework of the strategies demo studies, will be performed a design study for the integration of some hybrid technologies on the reference aircraft non necessarily achieving the -30% of block fuel reduction.

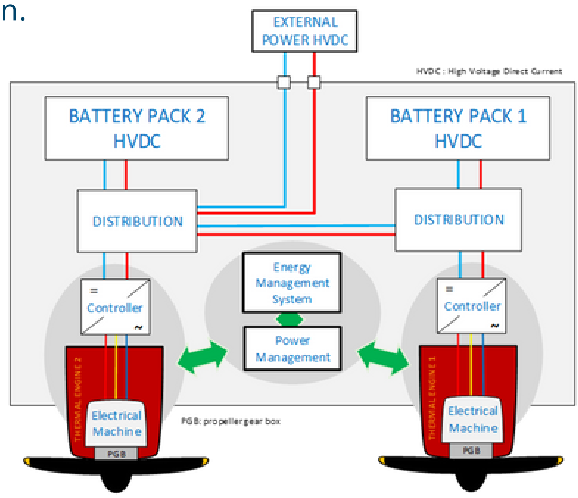


Figure 6. In parallel ATR DEMO studies for Flight Test Demonstration in Clean Aviation Phase II

Use Case B

UCB focuses on the development of disruptive aircraft configurations.
The main concept is based on distributed propulsion on the wing.
Distributed propulsion may offer the following advantages:

- aero propulsive benefits in cruise and take-off conditions, regarding wing efficiency and CLmax
- optimization of wing and empennage size
- reduction of noise footprint

Requirements to the engine manufacturers were adapted to UCB:

- Same electrical power as UCA (1,1MW) but equally distributed in 1 hybrid engine and two electric engines at 370KW each
- Common thrust and weight requirements for UCA

Preliminary solution proposed in requirements document:

- One hybrid engine and two electric engines
- Different sized propellers in collaboration with the projects HE-ART, AMBER and IAI involved in powerplant and propeller design.

Propulsive architecture

The HERA project is exploring innovative energy sources, with hybrid turboprops powered by a combination of gas turbines and fuel cells, and electrical engines exclusively powered by fuel cells. This forward-thinking approach aims to revolutionize aircraft propulsion, paving the way for a more sustainable aviation future.

Wing Configuration

The wing is being meticulously designed in collaboration with HERWINGT, featuring a cantilever structure with distributed propulsion that requires localized structural stiffening. The high-lift devices will transition from UCA to a specialized UCB design. To address the increased risk of vibrational motion caused by propeller imbalance, sudden engine stoppage, or windmilling, active flutter suppression will be implemented.

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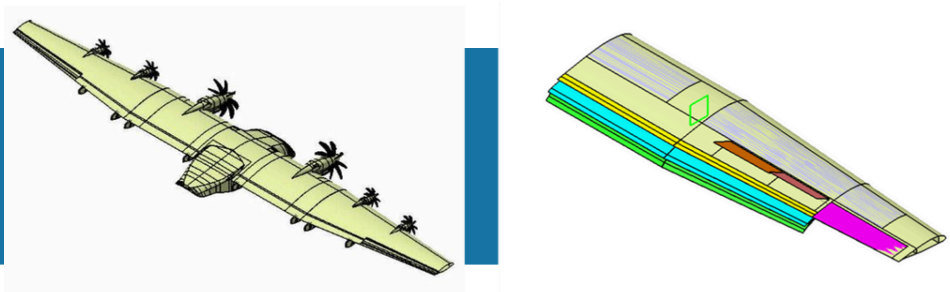


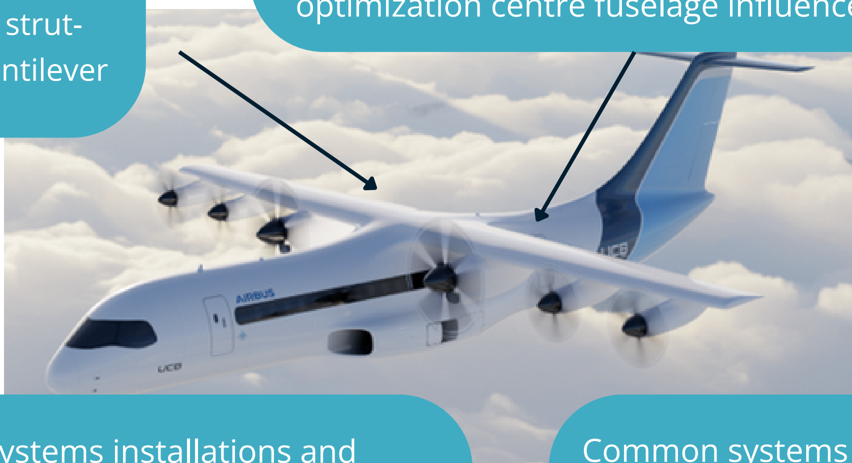
Figure 7. Wing configuration

Fuselage configuration

Below are the graphical depictions of the considerations to be taken into account for the UCB fuselage.

UCA-UCB difference in the wing-fuselage attachment: strut-braced vs cantilever

Difference in rear fuselage: kit H2 trade-off (inclusion of rear fuselage door/ramp for structural integration liquid hydrogen), aerodynamic optimization centre fuselage influence.



Interface of systems installations and structural solutions concepts developed in HERA will be similar in both use cases, geometry only adapted locally if needed

Common systems (LH2 tanks, thermal management...) developed in linked projects will be adapted to UCB

HERA at Scitech forum 2025

On January 9, at the Clean Aviation Special Session on Innovative Aircraft Concepts and Novel Configurations, Vittorio Ascione, Massimiliano Di Giulio, and Giuseppe Piscopo from Leonardo presented updates on the HERA Electrified Aircraft Technologies Integration and the HERA Innovative Aircraft Concept and Novel Configuration. Key highlights included the development concept design scheme, the new HERA working groups approach, and certification challenges. For more details, you can find the presentation slides in the following links leading to the HERA Zenodo profile.

- **HERA Electrified Aircraft Technologies Integration**
- **HERA Innovative Aircraft concept and Novel configuration**

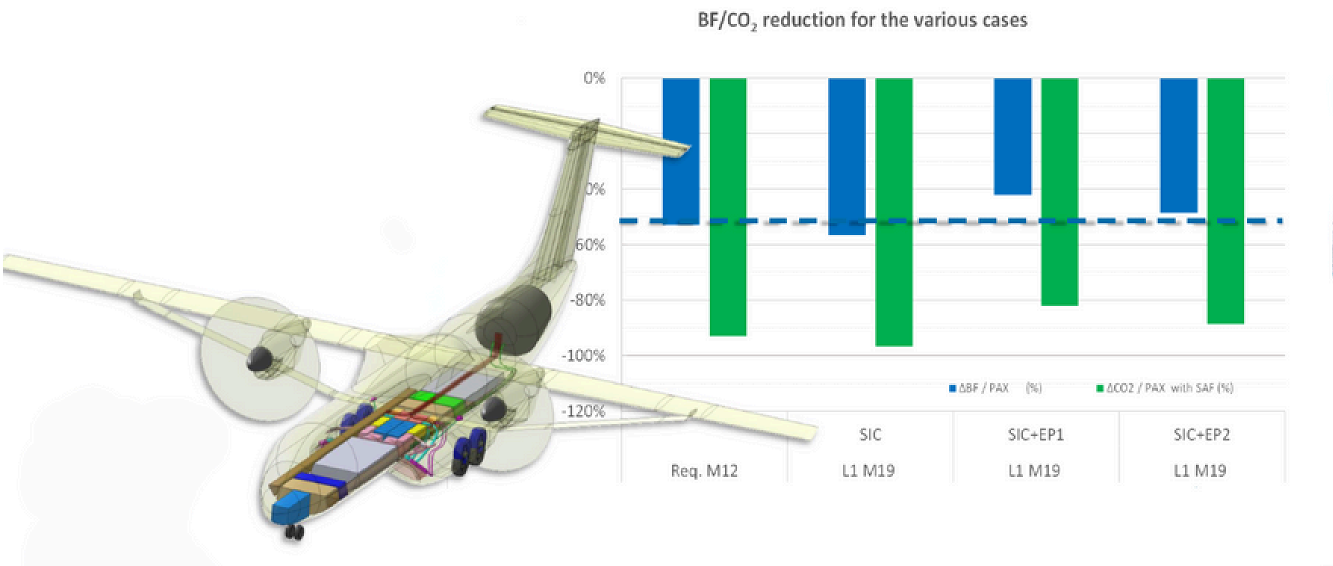


Figure 8. Use Case A first loop solution status

PRESENTATIONS

LEONARDO

HYBRID-ELECTRIC REGIONAL ARCHITECTURE

Designing the third era of aviation

Join us as we navigate the complexities of aviation technology and push the boundaries towards a cleaner, more efficient future.

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