UNIFIER19: zero-emission regional transport solution for Next Generation Europe

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ABSTRACT:

UNIFIER19 has developed a new aircraft concept for passenger and cargo transportation, that would enable new mobility solutions on short and very-short haul routes. These transport service options would be built upon already existing, sparse, and underused small airport network, thus eliminating overwhelming investment burdens for new ground infrastructures. In addition, this aircraft would provide a zero-emission environmental footprint, thanks to its hybrid liquid hydrogen fuel-cell/battery propulsion system.

Two new mobility services were explored in the project: the microfeeder and the miniliner. The microfeeder service is intended as a hub-to-spoke air transportation service, used to feed major airports from smaller cities or open country territories, whether the miniliner service would provide an inter-city connection. An exhaustive market research was performed on Belgium, Italy and Latvia territory, representing high-, mid- and low-ground transportation density regions in Europe respectively.

The market study findings became a basepoint for top level aircraft requirements (TLAR), which were upgraded with 2025 technological assumptions. An interesting result from market study that indicated an average block range of 350 km (one hop) resulted in a specific multi-hop mission requirement which also eliminated the need of refuelling infrastructure on all small airports in the network.

A down-selection from all possible combinations of airframe configurations and propulsion architectures was performed, keeping only most promising configurations that were considered potentially beneficial by considering technological complexity and functional compatibility between aircraft building blocks.

Configurations were sized in one of two independent conceptual design loops and subsequently cross-checked by the other design loop. This approach not only provides cross-validation of the conceptual design loops but also ensures that results from each loop's component, albeit implementing different tools, predict similar values.

A winning design was selected based on noise emissions evaluation, production and operating cost analysis and qualitative structural, manufacturability and certifiability assessment.

The selected configuration was finalised by evaluating aerodynamics, structure and aeroelasticity, stability and control, and propulsion, at higher level of fidelity, in view of performance verification and possible optimization. Concurrently, noise footprints, life cycle, certification, and costs were assessed in detail, in order to meet both sustainability and marketability aspects.

Due to its liquid hydrogen powertrain system and distributed electric propulsion configuration, the aircraft will enable establishing a quiet and green enhanced mobility service with minimal ground infrastructure investment.

The present contribution details the specifications of the final design solution, its configuration, performance, stability and control, environmental impact, concept of operations, and estimated costs.