An Investigation of the Micro-Feeder Aircraft Concept

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This paper describes the conceptual design of a new aircraft model devised to provide a "micro-feeder" service, starting in 2025-2030. This is intended as a way to exploit the existing European network of small local airports as feeders to larger hubs, in an effort to contribute towards the ACARE policy towards a 4-hour door-to-door total journey time reduction. The resulting design solution is an 8-passenger, twin-propeller commuter airplane relying on a pure-electric power-train. This particular configuration was selected after a preliminary study that involved other competing solutions, both pure-electric and hybrid-electric, on the basis of the expected operating costs and environmental impact.

A thorough market study allowed the determination of a typical mission range of 250 km, which covers nearly 90% of the short-haul European routes. The proposed configuration is designed to operate on any airfield, starting from small, 400 m-long, grassy airstrips, enabling its role as a link between minor and major airports. The typical flight lasts less than 1 hour and involves cruising at 8,000 ft, 200 knots. Figure 1 shows the design point on the sizing matrix plot, which is drawn according to applicable performance constraints, including OEI (one-engine inoperative) conditions.

The preliminary sizing of the aircraft constitutes the basis on which preliminary design was carried out, considering aerodynamics, power-plant, propellers, structures, on-board systems, and flight mechanics. In particular, existing electric motors and battery models were selected and the latter arranged in 24 packs distributed on the wings and fuselage. A 7-blade optimized propeller was designed in order to meet thrust specifications as well as severe low-noise requirements, fully complying with applicable regulations. Also, structural design was carried out by analyzing the full set of maneuvers and load conditions required by the CS-23 certification rules. Figure 2 shows the resulting complete structural model.

The proposed design has the potential to impact substantially on the quality of the journey experience for commuters and travelers at large. Travel time reductions in the range of 80% are expected when compared to ground-based transportation (car and trains). A customer cost reduction in the range of 40% is estimated when compared to the use of a car, including parking fees. Example simulations of the integration of the micro-feeder service within the European commercial aviation have been carried out, showing the performance in terms of block travel time.

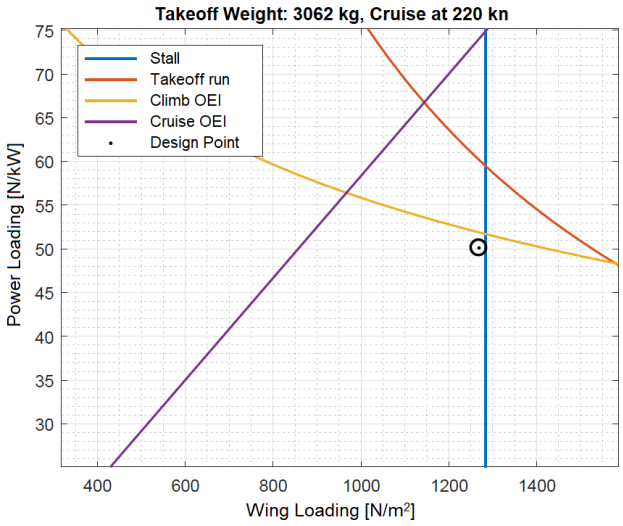

Figure 1. Sizing matrix plot showing the design point of the proposed micro-feeder concept.

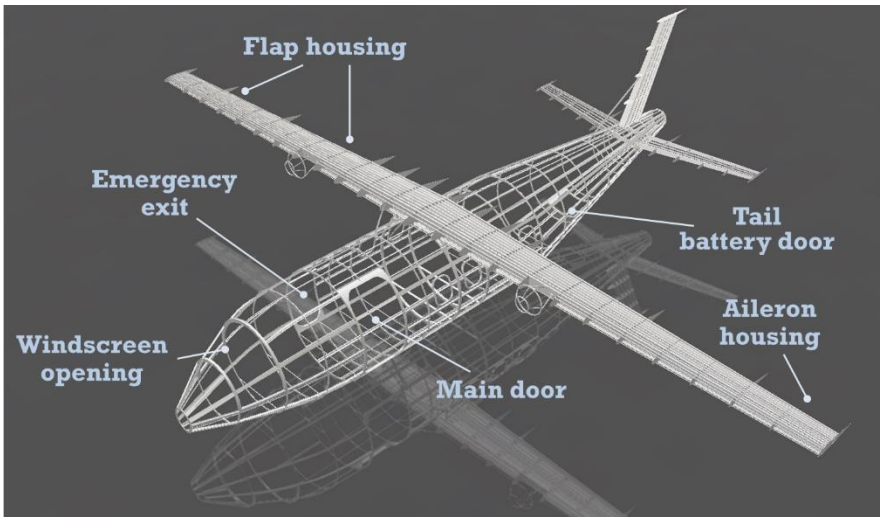

Figure 2. Structural configuration of the proposed micro-feeder concept.