

UNIFIER19: Conceptual design of a near-zero emission and cost-efficient regional air mobility solution

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This contribution is to be presented in the Clean Sky Thematic Topics Session.

ABSTRACT:

In the European Union, communities without adequate transport infrastructures are struggling to attract investments and create jobs due to the lack of connectivity to major urban areas, that can offer better and more diverse business opportunities. Providing enhanced mobility infrastructures to those communities is one of the major challenges in the implementation of Europe's Flightpath 2050 vision, that envisages that virtually all EU citizens shall reach any continental destination in less than four hours, door to door, by the year 2050.

It turns out that in Europe there is a sparse, underused small airport network, that could provide communities with a new mobility solution without overwhelming burdens for new ground infrastructures.

UNIFIER19 investigates a new aircraft concept for passenger and cargo transportation on short and very-short haul routes, to be used in two flavors: the microfeeder and the miniliner services. The microfeeder service is intended as a hub-to-spoke air transportation service, used to feed major airports from smaller cities and open country territories. The miniliner is intended as a point-to-point air transportation service, used for inter-city commuting and to connect open country territories.

The conceptual design loop starts by considering all possible combinations of aero-propulsion systems and hybrid-electric architectures, in the quest for the best possible candidate solution. A special focus is placed on the combination of liquid hydrogen fuel cells and batteries as energy source. Recently, hydrogen-based powertrains are enjoying a major boost for usage in transportation, since they represent a most environmentally friendly solution.

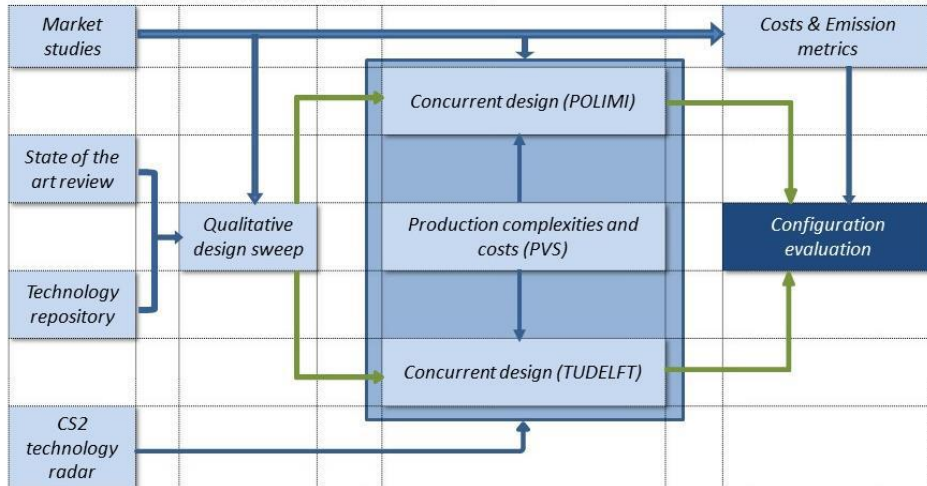


Figure 1. UNIFIER19 conceptual design workflow.

In the conceptual design loop (Figure 1), two metrics are introduced to rank candidate solutions: i) the emission index, aimed to capture the combination of CO₂ emissions, NO_x emissions and acoustic emissions; and ii) the success index, which aggregates estimations on development, certification and production costs, maintenance complexity, and operating costs to ensure future commercially successful operations. In this way, the loop will yield not only an environmentally friendly, but also cost-efficient air mobility solution to be further developed in the preliminary design process.

Both microfeeder and miniliner services are conceived as key components in the future development of a more connected European transportation network through enhanced, environmentally sustainable regional air travel. The new community-friendly short-haul airliner may drastically enhance connectivity in territories with inefficient ground transportation services to major airports or between towns, enabling Europe's Flightpath 2050 vision.