

Methodologies for the initial design studies of an innovative community-friendly miniliner

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ABSTRACT:

The UNIFIER19 – Community Friendly Miniliner project is a research effort in response to the Clean Sky call H2020-CS2-CFP09-2018-02, focused on the conceptual design of a near-zero emission CS23 commuter aircraft conceived for the enhancement of the mobility of European citizens. This vehicle, capable to exploit the potential of the wide European small airport network, is seen as a key enabler of the Flightpath 2050 vision, including the ambitious policy of a 4-hour door-to-door travel duration for virtually all destinations in the EU.

This design activity involves several highly innovative aspects, stemming from the ambition to achieve an environmentally-friendly and, at the same time, cost-effective solution for short haul regional transportation. This brings into play dedicated market studies envisioning future services for hub-feeding (“microfeeder” role) and inter-city commuting (“miniliner” role) based on the UNIFIER19 commuter aircraft. As this market segment is not developed, a fundamental preparatory task involves the estimation of the potential passenger demand. This is considered crucial to the sensible determination of some of the most important top-level aircraft design requirements, namely payload, mission range, take-off and landing distances, cruising speed.

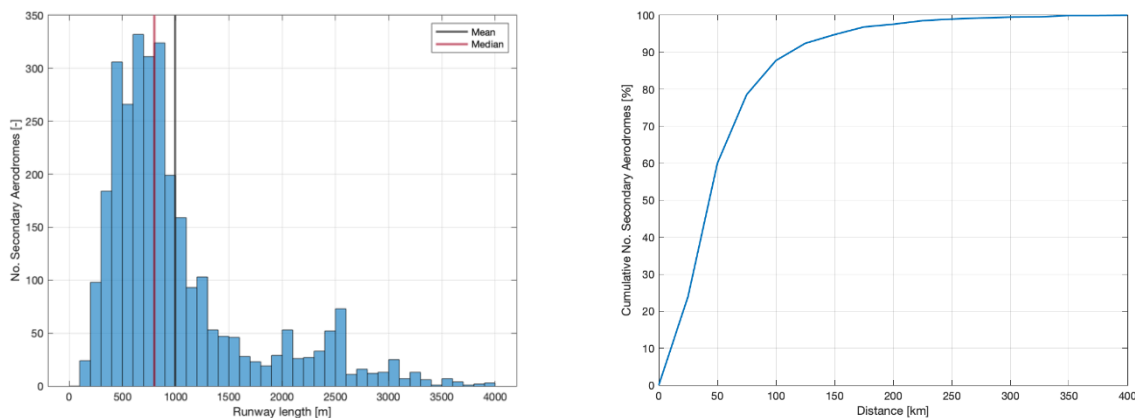


Figure 1. European secondary aerodrome statistics.

The demand estimation process starts from the analysis of the effectiveness of the existing ground transportation in European countries and the analysis of the potential aerodrome network supporting a vast number of candidate air routes. Example outcomes of such preparatory studies are depicted in Figure 1: in the left diagram, the distribution of field length for secondary airports and airstrips is

depicted; in the right diagram, the distribution of the minimal distance between such aerodromes is shown. These results point out the opportunity for a very-short haul service supported by relatively short runways.

The next step involves the determination of the potential demand based on the advantage – according to some predefined criteria, such as time saving – provided by an air transportation service as a substitute of ground-based transportation means. This leads to the definition of a catchment geographical area for each of the candidate air routes connecting secondary aerodromes between them or to hubs. This entails the estimation of the number of potential travelers and of the number of aerodromes involved.

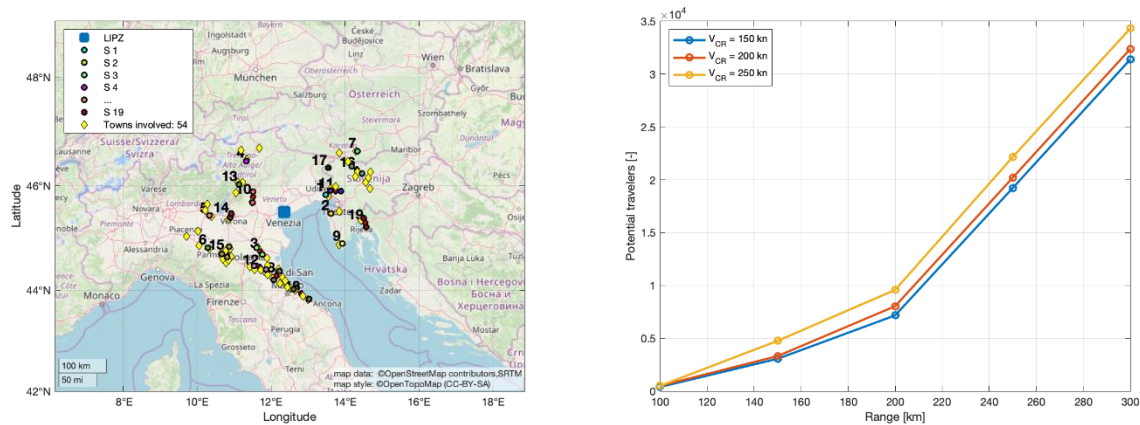


Figure 2. Potential demand for a microfeeder service for Venice International Airport.

Figure 2 provides an example of such studies for the case of a feeding service to the Venice International Airport, Italy, for the case of a commuter capable to take-off in 800 m. In the left diagram, the 54 towns served with a population over 20,000 are depicted (yellow diamonds) together with the 19 secondary aerodromes constituting the network (circles), corresponding to a maximum trip distance of 200 km and a cruising speed of 200 KTAS; in the right diagram, the potential demand is shown as a function of the maximum trip range and cruising speed. The paper provides examples of multiple scenarios for hub-feeding and inter-city commuting services in various European countries.

In addition, further elements of the preliminary studies devoted to the technology survey and the design framework are addressed. Specifically, requirements related to the usage of hydrogen and batteries in a zero-emission configuration for the aircraft powertrain are considered, taking into account their impact on the airframe design, the aerodrome infrastructure needs, and the operational scenario.