SIZING AND PERFORMANCE IMPLICATIONS OF A REGIONAL AIRCRAFT FOR INNER-CITY-AIRPORT OPERATIONS

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Abstract: This technical work comprises an airport and aircraft symbiosis, designed to enable aircraft operation out of inner-city airports targeting the Advisory Council for Aviation Research and Innovation in Europe (ACARE) goals [1] of a four hour door to door travel. The study is the result of an interdisciplinary group design project at Bauhaus Luftfahrt e.V. following the SCRUM method [2]. Shorten airport access and terminal processing times are seen as key enabler. During the development, a holistic view on the concept [3, 4] is ensured to enable the implementation in urban regions with the aim to relieve congested hub airports from direct passengers and aircraft movements and permitting faster travel times. The realization and operation within modern cities needs to consider existing infrastructure. Space restrictions in city centers and the need for general acceptance from the public lead to demanding constraints for the overall aircraft design process. Combined with an economic market analysis, aircraft top level requirements were established that call for a low noise aircraft with Short Takeoff and Landing (STOL) capabilities.

The paper depicts the methodical approach and iterative procedure of the design process. A detailed concept for a 60 passenger single aisle aircraft is proposed for an Entry-Into-Service year 2040 with a design range of 1500 nautical miles for a load factor of 90 percent (Table 1). The benchmark against a similar year 2000 reference aircraft showed promising results. Although the design for STOL and low noise operation had to be traded partly with cruise efficiency, a noteworthy reduction in fuel burn per passenger and nautical mile could be achieved. An assessment of potential technologies is conducted to provide the required enhancements to enable the fulfillment of the abovementioned constraints. These include structural improvements, means of noise reduction, high lift enhancements and aerodynamic improvements. Methods published in [5] were used to estimate the airframe and propulsion noise impact in the vicinity of the airport as well as to quantify improvement potentials. Operational procedures were analyzed to reduce the noise propagation through flight path optimization. Furthermore a ground based assisted takeoff system was conceived to lower required takeoff field length prevent engine oversizing just for the takeoff case. Off design analysis was performed to confirm the aircraft is competitive on short range missions. Cabin design optimization for a fast turnaround has been conducted to ensure a wide utilization spectrum. Airport infrastructure has been tailored to the designed aircraft to maximize use of available space and ensure quick curb to gate time. The results prove the feasibility of an aircraft developed for inner city operation.

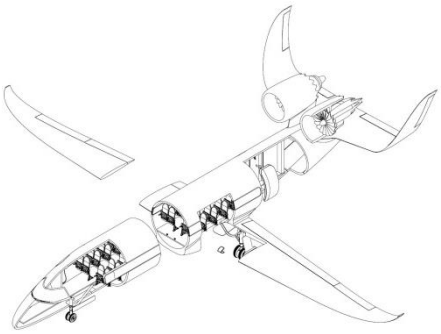

Figure 1 initial aircraft concept

Table 1 Concept specifications

Passengers/ Range	60@1000NM 54@1500NM
MTOW	20.8 t
Wingspan	28 m
Length	24 m
Cruise Speed	Mach 0.65

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[4] Urban, M. et al. (2016): Multi-modal Transport Hub Concept for Inner-city Airport Operation, abstract for a paper proposal submitted for the DLRK 2016.

[5] Bertsch, E.L.: "Noise Prediction within Conceptual Aircraft Design", PhD thesis, DLR, 2013

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