

Affordable and Environmental Friendly Small Commuter Aircraft Improving European Mobility

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Abstract : Mobility is one of the most important societal needs for amusement, business activities and health. Thus, transport needs are continuously increasing, with the consequent traffic congestion and pollution increase. Aeronautic effort aims at smarter infrastructures use and in introducing greener concepts. A possible solution to address the abovementioned topics is the development of Small Air Transport (SAT) system, able to guarantee operability from today underused airfields in an affordable and green way, helping meanwhile travel time reduction, too. In the framework of Horizon2020, EU (European Union) has funded the Clean Sky 2 SAT TA (Transverse Activity) initiative to address market innovations able to reduce SAT operational cost and environmental impact, ensuring good levels of operational safety. Nowadays, most of the key technologies to improve passenger comfort and to reduce community noise, DOC (Direct Operating Costs) and pilot workload for SAT have reached an intermediate level of maturity TRL (Technology Readiness Level) 3/4. Thus, the key technologies must be developed, validated and integrated on dedicated ground and flying aircraft demonstrators to reach higher TRL levels (5/6). Particularly, SAT TA focuses on the integration at aircraft level of the following technologies [1]: 1) Low-cost composite wing box and engine nacelle using OoA (Out of Autoclave) technology, LRI (Liquid Resin Infusion) and advance automation process. 2) Innovative high lift devices, allowing aircraft operations from short airfields ($\leq 800\text{ m}$). 3) Affordable small aircraft manufacturing of metallic fuselage using FSW (Friction Stir Welding) and LMD (Laser Metal Deposition). 4) Affordable fly-by-wire architecture for small aircraft (CS23 certification rules). 5) More electric systems replacing pneumatic and hydraulic systems (high voltage EPGDS -Electrical Power Generation and Distribution System-, hybrid de-ice system, landing gear and brakes). 6) Advanced avionics for small aircraft, reducing pilot workload. 7) Advanced cabin comfort with new interiors materials and more comfortable seats. 8) New generation of turboprop engine with reduced fuel consumption, emissions, noise and maintenance costs for 19 seats aircraft. (9) Alternative diesel engine for 9 seats commuter aircraft. To address abovementioned market innovations, two different platforms have been designed: Reference and Green aircraft. Reference aircraft is a virtual aircraft designed considering 2014 technologies with an existing engine assuring requested take-off power; Green aircraft is designed integrating the technologies addressed in Clean Sky 2. Preliminary integration of the proposed technologies shows an encouraging reduction of emissions and operational costs of small: about 20% CO₂ reduction, about 24% NO_x reduction, about 10 db (A) noise reduction at measurement point and about 25% DOC reduction. Detailed description of the performed studies, analyses and validations for each technology as well as the expected benefit at aircraft level are reported in the present paper.

Keywords : affordable, European, green, mobility, technologies development, travel time reduction

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