Internal and External Optimization of a Blended Wing Body Aircraft for Emergency Evacuation

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Introduction. One of the biggest challenges on the development of aircrafts using new configurations is the absence of statistical knowledge of previous works. This creates the need of better methods of optimization and foreknowledge of the final characteristics of the project. This problem becomes even more relevant when the emergency evacuation dynamics must be evaluated on a Blended Wing Body (BWB) aircraft, because on this kind of project longer aisles and different positioning of exits are required and no experience in this area exists. This work approaches the viability of simultaneous optimization of emergency evacuation routes respecting aerodynamics and structural constraints of a Blended Wing Body passenger aircraft using a connected system of optimization and analysis tools. The proposed system uses the Genetic Algorithm to find the best solution taking into account the results of Aircraft Emergency Evacuation Simulation using Ant Colony Optimization (AEES_ACO) [1]. Performance constraints are applied in order to make the optimization realistic and simplifications are done in order to evaluate the structural and mass parameters. **Objectives.** The main goal of this work is to demonstrate the possibility of finding the best positioning of aisles and exits of a new conceptual aircraft, even without statistical knowledge of previous aircrafts using a complete set of available tools. This optimization takes into account relevant characteristics of a conceptual design, like structural constraints, general aerodynamics performance aspects and the certification requisites, the emergency evacuation. **Methodology.** The system is composed of two main parts, the optimization algorithm and the evaluation sub-system. The optimization algorithm is responsible for generating the possibilities which will be evaluated next. This is done using the Genetic Algorithm, which was first described in [2] and has been improved for more than fifty years. The evaluation sub-system is composed of a series of tools each one related to the following areas: Emergency Evacuation, Aerodynamics, Structures, Performance. Each of these returns scores relative to the set of characteristics that are being evaluated which will be merged and used by the Genetic Algorithm to orientate the search of the best aircraft. **Conclusion.** The system showed to be capable of positioning the seats and the exits in order to minimize the time necessary to evacuate all the passengers of the airplane. Using the results obtained in this paper, it is possible to improve the evaluation system to calculate other relevant aspects of project, making possible an efficient preliminary sizing of a future aircraft with an innovative configuration including a more efficient emergency evacuation.