How to efficiently design aircraft with minimum climate impact?

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Publication date
2020

Document Version
Final published version

Citation (APA)
Linke, F., Radhakrishnan, K., Grewe, V., Vos, R., Niklaß, M., Lührs, B., Yin, F., Dedoussi, I. C., Proesmans, P., & Deck, K. T. (2020). *How to efficiently design aircraft with minimum climate impact?*. 81-81. Abstract from 3rd ECATS conference.

HOW TO EFFICIENTLY DESIGN AIRCRAFT WITH MINIMUM CLIMATE IMPACT?

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Abstract. Given the comparably high impact of aircraft emissions, especially their non-CO_2 effects, on climate in the order of 5%, aviation stakeholders are required to act to reduce the warming effects of air traffic. Besides new operational procedures, like e.g. climate-optimized routing, this demands the development of completely new global-warming optimized aircraft by aircraft manufacturers. The European Clean Sky 2 project "Global-Warming Optimized Aircraft Design" (GLOWOPT) aims at providing aircraft designers an innovative tool to perform aircraft design studies for minimum climate impact, which we call Climate Functions for Aircraft Design (CFAD). The CFAD will substantially change the way aircraft are designed, while maintaining compatibility to existing Multidisciplinary Design Optimization (MDO) methods. The functions need to integrate a lot of information on the typical aircraft usage, including the routes the aircraft will be operated on. This is because, besides the amount of emissions, the impact of aviation non-CO_2 effects, such as NO_x, H_2O as well as contrails, on climate is highly dependent on location (i.e. latitude, longitude) and altitude. So, the representative operating profile of the aircraft needs to be considered in a characteristic route and fleet model. This work will present the interdisciplinary GLOWOPT approach, which comprises expertise on aircraft design, operations, atmospheric physics and climate. Conceptual thoughts on how the complexity of the operating profile in combination with the geographically variable climate impact of aircraft emissions will be reduced such that it can be used in an aircraft design process are given.

Keywords: Aircraft design, Climate impact, CFAD, Climate function, Non-CO_2 effects

ACKNOWLEDGEMENTS

This work has received funding from the Clean Sky 2 Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement No. 865300