

Eliminating Climate Impact from Aviation - a system level approach as applied in the framework of the DLR-internal project EXACT (Exploration of Electric Aircraft Concepts and Technologies)

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In aviation, the shift towards green energy has already begun, while recovering from the COVID-19 crises. In order to contribute to a smooth transition from fossil fuels to green energy sources, the German Aerospace Centre has bundled a wide range of competences into an integration framework for a systemic assessment approach. In order to identify sustainable solutions for a green air transportation system, the aviation sector has to take new pathways hand in hand with the energy sector. As extension of common multidisciplinary aircraft design and optimization procedures, the proposed framework includes life-cycle-analysis and life-cycle-cost benefit methods. With the ability to assess the economic and ecologic value along the entire energy and resource chain in a sustainable aviation scenario, aircraft concepts and enabling technologies for climate neutral flight & define respective technology roadmaps can be explored.

In the proposed paper a multi-domain, multi-fidelity integration and assessment framework is introduced and applied to evaluate future system architecture in aeronautics. In analogy to conceptual aircraft design, where the design process often starts with the top level aircraft requirements (TLARs), the architecture and integration process of future air transportation system (ATS) starts with top levels system requirements (TLRs). While TLRs specify the main features of an aircraft in terms of technical capabilities, the TLRs specify features on ATS-level like:

- Eliminated climate impact from aviation (zero average temperature response for given timeframe)
- Economic & Ecologic sustainable
- Economic viable for all stakeholder involved
- Operational feasible

The system architectural elements included in this paper are energy carrier, technologies, components, vehicles and its capabilities, production pathways, flight networks, demand, and much more.

