



# Assessing the Integration of Electrified On-Board Systems in an MDAO framework for a small transport aircraft

M. Fioriti<sup>1</sup>

*Politecnico di Torino (PoliTo), Turin, Italy*

P. Della Vecchia<sup>2</sup>

*Università di Napoli "Federico II" (UNINA), Naples, Italy*

G. Donelli<sup>3</sup>

*German Aerospace Center (DLR), Institute of System Architectures in Aeronautics, Hamburg, Germany*

P. Hansmann<sup>4</sup>

*Rheinisch-Westfälische Technische Hochschule (RWTH), Aachen, Germany*

The integration of on-board systems design within the aircraft design process is often considered only in the late part of the initial design. This is acceptable for civil aircraft using standard technology systems. However, facing with MEA and AEA concepts and different possible architectures, the systems design and the assessment of their effects on the overall aircraft should be moved up in the usual design process. This paper deals with evaluation of the effect of different on-board systems architecture, with a different electrification level, on the overall aircraft design. These effects have been evaluated using three different MDA workflows developed within the AGILE4.0 European research project. The workflows are defined with an increasing number of disciplines to show how the effect of a proper selection of a systems architecture is differently caught by each one. In this way it is possible to define which disciplines should be included for the systems architecture assessment. The results show a save of 1% of MTOM for the AEA applied to a small turboprop aircraft when only the OBS mass is assessed. Increasing workflow complexity, adding performance and engine design the save increase to 1.2%. Finally, the save increases to 1.3% when the effect on engine SFC is also considered.

## I. Nomenclature

|     |   |                              |
|-----|---|------------------------------|
| ACM | = | Air Cycle Machine            |
| AEA | = | All Electric Aircraft        |
| ECS | = | Environmental Control System |
| EHA | = | Electro Hydrostatic Actuator |
| FCS | = | Flight Control System        |

---

<sup>1</sup> Assistant professor, Department of Mechanical and Aerospace Engineering

<sup>2</sup> Assistant professor, Department of Aerospace Engineering

<sup>3</sup> Researcher, Department of Aircraft Design & System Integration

<sup>4</sup> Researcher, Institute of Aerospace Systems