| Chantier E-AIR | INTERNSHIP 6 MONTHS -YEAR 2020-2021 |
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| Internship tutors:<br>Christophe Airiau (IMFT),<br>Jean-Christophe Jouhaud (CERFACS) | Location: IMFT / CERFACS / ISAE - Toulouse<br>Starting Date: February/March 2021, duration: 6 months |

# Distributed Propulsion with Propellers: Optimization and Numerical Simulation

**Background**

Given the current environmental challenges and the need to reduce polluting emissions, all-electric or hybrid propulsion is one of the options being considered by the aviation industry. These new propulsion modes will completely reshape the architecture of aircraft, particularly those designed for urban or short-haul journeys (vertical or short takeoffs and landings, regional flights). The RTRA STAE e-Airchitectures project proposes to conduct a reflection on the methodologies and concepts to be implemented for a better understanding of the scientific issues and technological barriers related to the design of these new aircraft. These approaches will be highly multidisciplinary and require a close collaboration between laboratories of different disciplines: IMFT, Cerfacs, ISAE-SUPAERO, ONERA, ENAC, INSA/ICA, LAPLACE, IRT and TBS.

**Description**

The internship proposed here will be supervised simultaneously by the IMFT and the Cerfacs labs. It has four objectives:

- To provide a state-of-the-art of the existing situation on the topic of distributed propulsion, from a fluid mechanics point of view (modeling and simulation), and possibly heat transfer effect on wing,
- To seek improvements through numerical simulation on a generic configuration of wing + propeller type with a parametrization,
- To propose a reduced modeling that can be implemented in partners' aircraft design codes,
- To investigate an optimal configuration.

**Timeline**

The internship will begin with a bibliographical work allowing to offer a synthesis on modeling and simulation in distributed propulsion, and its cooling effects on wing, which will be integrated in a white report. Then an emblematic configuration for investigation will be proposed.
High-fidelity simulations (RANS, URANS, LES) will then be carried out on a set of parameters representative of the different integration possibilities (with OpenFoam). The establishment of a law by regression or response surface can lead to an optimization.
Note: the subject may be amended according to discussions with the different partners of the e-AIRchitectures project.

**Skills**

Initiative, ability to work in a team, knowledge of CFD (OpenFoam) and aerodynamics, good knowledge of UNIX and programming (Python, C++ and F90).

**Profile**

Engineering student or Master 2 in fluid mechanics, aeronautics, applied mathematics

## APPLICATION FOR INTERNSHIP

To apply: CV and motivation letter to be send by email to:
Christophe Airiau – IMFT (christophe.airiau@imft.fr), Jean-Christophe Jouhaud – CERFACS (jjouhaud@cerfacs.fr)

For further information: please contact the above-mentioned contacts.