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ONERA
THE FRENCH AEROSPACE LAB

PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DAAA-2025-21**
(à rappeler dans toute correspondance)

Lieu : Meudon

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DESCRIPTION DU STAGE

Thématique(s) : Aerodynamic Design

Type de stage : ☒ Fin d'études bac+5 ☒ Master 2 ☐ Bac+2 à bac+4 ☐ Autres

Intitulé : High-Lift design tools for uses in MDO process

Sujet : Today, the design process of high-lift configurations in industry mainly relies on experts' knowledge, and lacks of a systematic and automated exploration of the design space. However, taking into account low speed requirements in the aircraft wing design process is key, as the high-lift system has not only an important impact on low speed capabilities and on weight but it also introduces important constraints on airfoil design. It is therefore crucial to develop dedicated design capacities for flaps and slats in the MDO process to have a realistic estimation of the low-speed performance considering a high-lift system adapted to the wing architecture designed during the process. Up to now, the existing design tool suite for High-Lift systems available at ONERA was used only in a 2D optimization process [1] [2].

The internship objective is to adapt the existing design tool suite dedicated to high-lift systems to enable their use in the framework of a complete MDO workflow, by taking into account elements not considered at the moment (i.e. Krüger slat), and also dealing with kinematic constraints. In addition, an extension of these design tools to a 3D wing could be considered at the end of the internship. The capabilities of the method to properly design the different elements will be assessed, and gradient-based shape optimizations will be carried out by considering different levels of fidelity for CFD, firstly in 2D using coupled viscous-inviscid methods for the optimization (2D RANS for the verification of the solution), and then potentially in 3D using a lifting line method coupled with 2.5D computations at selected wing sections. A finite difference approach will be used for gradient estimation thanks to short runtime of the employed CFD tools for low-speed performance.

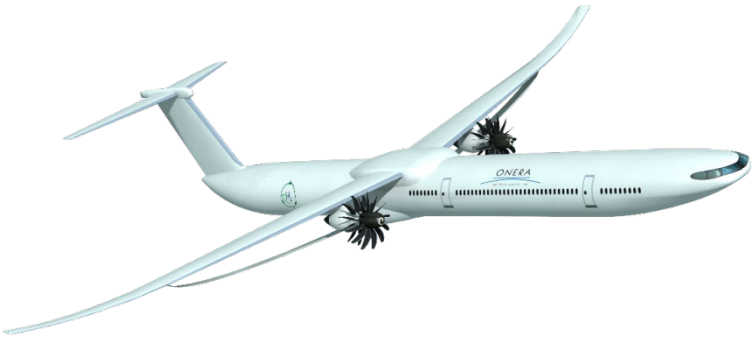

Figure 1: The challenge of High-Lift system design and optimization for innovative aircraft configurations

[1]: F. Moens, C. Wervaecke: "Multi-Point Sequential Optimization of Shapes and Settings of High-Lift Systems by means of Evolutionary Algorithm and Navier-Stokes Equations." Emerald Journal of Engineering Computations. Special Issue: Computational Methods in Engineering. Volume 30 - Issue 4 pp 601-622 (May 2013). https://doi.org/10.1108/02644401311329398

[2]: F. Moens, J. Dandois:"Optimization of Passive Flow Control Devices of a Slat-less High-Lift Configuration.", AIAA Journal of Aircraft , Vol 53, No 1 (January 2016) – pp 189-201.

Est-il possible d'envisager un travail en binôme ? **Non**

Méthodes à mettre en œuvre :

☐ Recherche théorique	☐ Travail de synthèse
☒ Recherche appliquée	☒ Travail de documentation
☐ Recherche expérimentale	☒ Participation à une réalisation

Possibilité de prolongation en thèse : **Oui**[CM1]

Durée du stage : Minimum : 5 Maximum : 6 (sur dérogation)

Période souhaitée : début en Février/Mars 2025

PROFIL DU STAGIAIRE

Connaissances et niveau requis :	Ecoles ou établissements souhaités :
- Aérodynamique - Langage de programmation (Python de préférence)	Master Recherche et/ou Ecole d'ingénieur