SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Computational Aeroacoustics of Distributed Propulsion Devices

In parallel with the ever-increasing growth of civil air transport, the world has seen an unexpectedly fast development of a new paradigm: Urban Air Mobility (UAM) and the associated Vertical Take-Off and Landing (VTOL) PAVs and Air Taxis. In good part based on the successful deployment of drones for defence and professional applications, a number of companies have now successfully validated quite disruptive flying concepts. Noteworthy, such small vehicles show a higher probability of reaching the required maturity to be demonstrated in 2025 than disruptive concepts in civil aviation where much higher commercial risks are involved.

The above UAM and VTOL concepts will be investigated in several forthcoming H2020 European projects including ENODISE where Dr Karabasov and Prof. Toropov are involved as co-investigators and where several generic configurations are proposed to study the distributed rotor/surface noise as well as the boundary layer ingestion effects.

The suggested PhD project is devoted to flow and noise modelling of typical distributed propulsion configurations in OpenFOAM coupled with theoretical acoustic analogy approaches such as the Amiet theory and its later developments as well as acoustic integral methods such as the Ffowcs Williams – Hawings method.

2. Project Scope

Literature review on the state-of-the art modelling and simulation methods for UAM (Urban Air Mobility) and Vertical Take-Off and Landing (VTOL). Consideration of a few benchmark UAM or VTOL configurations.

For modelling of UAM/VTOL configurations, selection of a model of choice (e.g. URANS, hybrid LES, WMLES) and its implementation in OpenFOAM using the existing solvers there and capabilities such as Adaptive Mesh Interface (AMI) on rotating grids.

Development of suitable acoustic model for far-field noise predictions; high-fidelity and low-fidelity options.
Comparison with the experimental data from the literature and with those which will become available in the H2020 ENOIDISE project the supervising team are involved in.

3. Desired Skills from the Student

Excellent first (MSc preferably) degree in Aerospace/Mechanical Engineering or Computational Mathematics/Physics

Good skills in mathematics and physics

Good programming skills

Self-starter

4. Supervisory Team

Primary: **Dr Sergey Karabasov**

Secondary: **Prof. Vassili Toropov**