**Stage 2016-2017**

**Micro-drones furtifs**

**Supervisors:** Jean-Marc Moschetta (professor), Marc Jacob (professor), Ronan Serré (postdoctoral researcher).

**Location:** ISAE Supaero, Toulouse.

**Duration:** 6 months

**Founding:** DGA/MRIS

Context:

The demand in Micro-Air Vehicles (MAV) is increasing as well as their potential missions. Whether for discretion in military operations or noise pollution in civilian use, noise reduction in MAV is a goal to achieve. Aeroacoustic research has mainly been focusing on full scale rotorcrafts, now yielding significant improvements and original shape designs. At MAV scales however, investigations on the lift generation mechanisms are relatively recent while aerodynamically generated noise in this context has rarely been addressed. The relatively low Reynolds number range of operating conditions in MAV flight increases the difficulties to predict lift and drag coefficients because of a predominant effect of flow viscosity. This study is about the complete process of designing silent blades for MAV, from numerical prediction, to shape optimization and experimental measurements.

Numerical tools that are already available at ISAE Supaero allow estimation of aerodynamic loading on rotor and the resulting noise radiation and optimization algorithms are at use although only focusing on chord and twist distributions. A significant noise reduction has already been reached. Experimental procedure has been set up but needs improvements.

Objectives:

This internship opportunity can address multiple objectives, whether numerically or experimentally. In order to keep a fast and reliable numerical tool for the optimization process, simple and accurate aeroacoustic models are needed, that are able to address various sources of noise and to yield relevant geometric optimizations (for instance, to account for unsteady effects, multi-rotor interactions, serrated trailing-edge and improve the broadband noise predictions). On the experimental side, an anechoic chamber will soon be available and a new measurement protocole is needed. Innovative geometries that could not be predicted by the numerical tool should also be experimentally investigated.

Context:

The schedule of the internship (its start and its length) can be adapted to the student requirements. It can begin in early 2017 and lasts for 5 to 6 months. It can be moved into a doctoral thesis.

Applications:

The applicant should be in Master studies with major in fluid mechanics, aerodynamics and acoustics while feeling at ease in UNIX environments and Matlab programming software. Skills about signal processing and CAD would be suitable. Knowledge about Python and/or Labview would be an advantage.