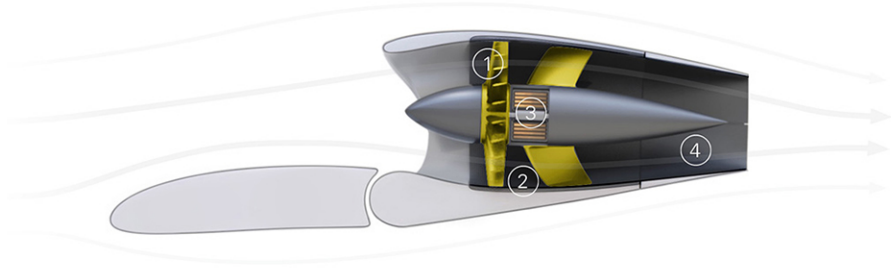
MSC thesis: Aerodynamc and aeroacustic analysis of a over the wing ducted-fan configuration for personal air mobility applications

The aeronautical sector has seen in recent years a strong increase in interest in the research and development of new solutions to meet emission and noise reduction targets such as those imposed by NASA and the Advisory Council for Aviation Research and innovation in Europe (ACARE). Moreover, the combination of the need to develop new methods of urban transport and the application of propulsion systems with reduced environmental impact has recently led to the development of a new aircraft category, the so-called e-VTOLs.

The aim of this thesis is to analyse the aerodynamics and aeroacustics characteristics of a new propulsion configuration that could be used in the development of new e-VTOLs aircrafts for urban (UAM) and regional (RAM) transport. The configuration under study uses a distributed ducted fan system positioned over the wing of the aircraft. The system act as a propulsion system to generate the necessary thrust but also as a control surface by being able to rotate 90 degrees thus increasing the aircraft's capabilities. In this way, the aircraft can switch from a vertical take-off and landing configuration to a forward flight configuration used in the cruise and climb/descent phases.

However, the complexity of the system brings with it new aerodynamic and aeroacoustic phenomena that define and influence its performance.



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Through an initial theoretical analysis necessary for understanding the new phenomena and subsequent numerical analyses (using numerical codes), we will focus on the influence this configuration has on the flow around the wing and how this is affected by certain geometrical characteristics of the ducted fan.

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