Psychoacoustic evaluation of drone noise

PARTENAIRES

Maison des Sciences Humaines et Sociales de Toulouse

(MSHS-T, UAR3414, CNRS et COMUE de Toulouse)

Key words: acoustic, perception, signal processing, drone

Department: Aerodynamics, Energetics, and Propulsion Department

This internship proposes to evaluate the sound perception associated with multi-copter drones to allow the development of effective noise reduction strategies and awareness actions.

JOB DESCRIPTION:

The use of drones is rapidly expanding in various sectors of activity (industry, defense, cinema...) and the deployment of multi-copter drones for postal parcel delivery has started in France in recent years in areas with difficult access. In 2025, the Occitanie region began a test phase for medical transport by drones between hospitals and laboratories, which can constitute a new source of noise pollution for city dwellers.

In this context, this study aims to provide elements of understanding on the human perception of noise emitted by drones. The acoustic signature of multi-copter drones is composed of the tonal and broadband noise emitted by each propeller which interacts with both the noise emitted by the other propellers and the drone's fuselage. A test campaign carried out at the l'Institut Supérieur de l'Aéronautique et de l'Espace (ISAE-SUPAERO) on an isolated propeller and in interaction with a fuselage element highlighted the impact of different design parameters (rotational speed, geometry of the propeller, position and geometry of the fuselage) on the emitted noise [1,2]. At the border between engineering and human and social sciences, this project proposes to use this database to

define and carry out listening tests on a representative number of participants to evaluate quantitatively and qualitatively the perception of these sounds and the discomfort caused. This constitutes the tasks that will be entrusted to the intern in collaboration with the Maison des Sciences Humaines et Sociales de Toulouse (MSHS-T). The psychoacoustic tests will be carried out within the Cognition Comportements Usages (CCU) platform thanks to the technical resources of the PETRA platform dedicated to sound perception. This work will be based on a previous study conducted by MSHS-T on the perception of noise emitted by aircraft [3,4] and on the first psychoacoustic modeling of drone propeller noise [5].

This evaluation can serve as a basis for subsequently studying more complex configurations, developing effective noise reduction strategies and conducting awareness campaigns. These elements constitute indispensable keys for the different actors (local authorities, state bodies, companies...) associated with the use of drones in public space to work on their acceptability and limit and/or predict their societal and environmental impact.

REQUIRED PROFILE: end-of-study internship from M2 or engineering school in acoustics, psychology and/or signal processing

DURATION: 6 MOIS

LOCATION: ISAE-SUPAERO, TOULOUSE

RESPONSIBLE OF THE SUBJECT:

NAME : Hélène Parisot-Dupuis
E-MAIL : helene.parisot-dupuis@isae-supaero.fr

APPLICATION PROCESS: Application [CV, cover letter, reference contacts, latest transcripts] to send to: helene.parisot-dupuis@isae-supaero.fr

REFERENCES:

[1] R. Gojon, T. Jardin, H. Parisot-Dupuis, “Experimental investigation of low Reynolds number rotor noise”, Journal of the Acoustical Society of America, 149(6), 2021.
[2] R. Gojon, H. Parisot-Dupuis, B. Mellot, T. Jardin, “Aeroacoustic radiation of low Reynolds number rotors in interaction with beams”, Journal of the Acoustical Society of America, 154(2), 2023.
[3] J. Tardieu, C. Magnen, M. Le Roux, P. Gaillard, “Perceptual relevance of acoustical parameters in aircraft noise”, In: 26th International Congress on Sound & Vibration (ICSV26), Montreal, 2019.
[4] C. Magnen, J. Tardieu, M. Le Roux, P. Gaillard, “Mental representations evoked by aircraft noise components”, In: 26th International Congress on Sound & Vibration (ICSV26), Montreal, 2019.
[5] A. J. Torija, Z. Li, P. Chaitanya, “Psychoacoustic modelling of rotor noise”, Journal of the Acoustical society of America, 151(3), 2022.