Politecnico di Torino

AEROSPACE ENGINEERING

Leonardo S.p.A. - A numerical workflow for aeroacoustic aircraft noise prediction

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Context of the research activity	The civil aviation sector is increasingly tightening its regulations on sound pressure levels to mitigate noise pollution and its impact on surrounding communities. Supporting the industry's transition toward quieter and more sustainable operations demands the development of advanced predictive tools that can inform aircraft design across all stages—from preliminary concepts to final production. This research project specifically aims to advance the field of noise prediction for propeller-driven aircraft by developing a comprehensive computational workflow for assessing both airframe and propeller noise. The goal is to provide robust, physics-based insights that can guide the design of next-generation low-noise aircraft.
Objectives	The research project focuses on enhancing the capabilities of the open-source code FlowUnsteady to investigate noise generated by propeller-airframe interactions. The initial phase involves validating the aerodynamic flow field computed by FlowUnsteady against existing experimental datasets to ensure accuracy and reliability. Subsequently, an aeroacoustic solver will be developed to model the far-field propagation of aerodynamic noise sources. The solver's predictions will be benchmarked against both experimental measurements and high-fidelity simulation data. The resulting acoustic data will be used to assess the environmental impact of aircraft noise on communities near airports. This will be achieved by analyzing the noise footprint using the Effective Perceived Noise in Decibels (EPNdB) metric, which quantifies the disturbance caused by aircraft operations in residential and other noise-sensitive areas. Ultimately, the findings from this research will contribute to the development of improved methodologies for noise certification in civil aviation, supporting regulatory compliance and informing the design of quieter aircraft.
Skills and competencies for the development of the activity	The ideal candidate should possess a strong background in aeroacoustics, turbulent flow dynamics, and the aerodynamics of rotating wings. Proficiency with numerical solvers, particularly those based on the vortex particle method, is highly desirable. Additionally, the candidate should have solid programming experience and be proficient in languages such as Python,

the activity	Julia, or MATLAB.