Community Noise Impact of Urban Air Mobility Vehicle Operations

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Abstract

Advanced air mobility (AAM) missions, carried out by electrically driven air vehicles, are characterized by ranges of less than about 300-500 nm (about 500-900 km) and include both rural and urban operations. The missions may include public transportation, cargo delivery, air taxi, and emergency response. While the urban air mobility (UAM) subset of AAM is projected to have high economic benefit, it is also the most difficult to develop because it must overcome many difficulties associated with the incorporation into the airspace system, safety, and community noise.

This presentation focuses on the utilization of UAM source noise data for assessment of community noise impact. Although a limited number of acoustic flight measurement campaigns have been made to characterize the source noise of prototype and preproduction UAM aircraft, prediction-based approaches are primarily considered herein. Following conceptual design, in which the vehicle is sized to perform a set of missions, a comprehensive analysis is be performed for a range of operating conditions spanning the flight envelope. The comprehensive analysis determines the corresponding trim state of the vehicle for each operating condition. For each trimmed state, the noise produced by each source, for example, steady and unsteady rotor noise, may be computed and so-called source noise (hemi)spheres generated. An example source noise hemisphere for a 6-passenger quadrotor reference vehicle in cruise is shown in Fig. 1.

These source data may subsequently be used in various community noise impact analyses. Several use cases are presented, including those supporting noise certification and those for auralizations that may, in turn, be used as part of a perception-influenced design process. Land use planning tools for generating noise exposure maps, including those using simulation and integrated modeling approaches, are also presented. Finally, use cases supporting development of reduced noise flight operations, including an acoustic flight simulator and acoustically aware flight control, are considered.

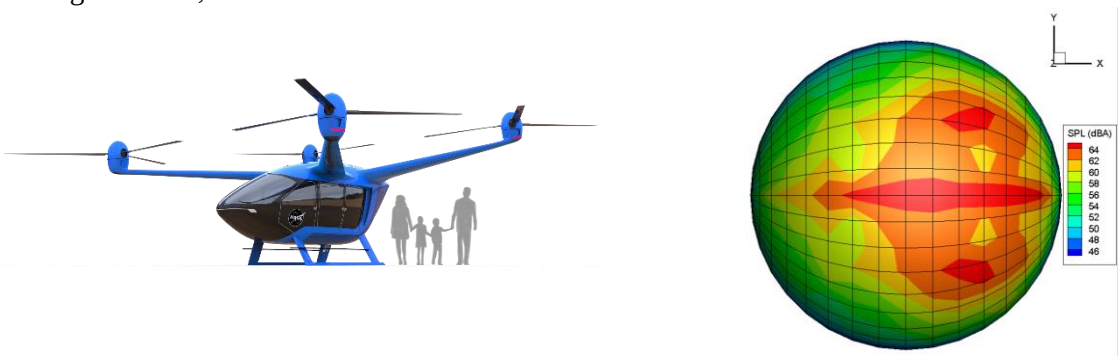

Fig. 1 NASA quadrotor reference vehicle (left) and A-weighted overall sound pressure level for loading and thickness noise component (right).

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