A1.06 Vertical Lift Technology and Urban Air Mobility

Lead Center: LaRC

Participating Center(s): AFRC, ARC, GRC

Technology Area: TA15 Aeronautics

Scope Title
Vertical Takeoff and Landing (VTOL) Urban Air Mobility (UAM) Ride Quality

Scope Description
Urban air mobility (UAM) is a concept for air transportation around metropolitan areas consisting of passenger-carrying operations. An emerging UAM market will require a high density of vertical takeoff and landing (VTOL) operations for on-demand, affordable, quiet and fast transportation in a scalable and conveniently-accessible “vertiport” network. UAM is envisioned to provide increased mobility within a given metropolitan area by traveling faster, and using shorter and more direct routing as compared to ground vehicles.

The expanding UAM vehicle industry has generated a significant level of enthusiasm among aviation designers and manufacturers, resulting in numerous vehicle configurations. The majority of the prototype UAM vehicles have more than 4 rotors or propellers, have electric propulsion, carry 2-6 passengers, fly more like a helicopter (vertical take-off and landing) than a fixed-wing aircraft and will fly relatively close to the ground and near buildings. There are many unknowns as to how the industry will mature but technical barriers may be secondary to the challenge of attracting passengers to fly in these new aircraft that are unconventional in appearance and operations.

A critical challenge for UAM market growth is to gain public acceptance that UAM VTOL aircraft are: 1) as safe, or safer than, commercial air travel and automotive transportation, and 2) as comfortable as conventional modes of transportation.

The solicitation will address likely obstacles to passenger acceptance of UAM vehicles. Passenger acceptance concerns include feeling safe, vehicle motion, noise and vibration, availability and access, passenger well-being, concern for the environment and others. Some of these concerns are highlighted in Ref. 1, and in a recent study funded by NASA (Ref. 2) below.

Phase I of the SBIR should review these passenger acceptance concerns and propose mitigation strategies.

Phase II of the SBIR should include development and demonstration of strategies for improving the passenger experience for VTOL UAM vehicles.

References
Expected TRL or TRL range at completion of the project: 2 to 4

Desired Deliverables of Phase II

Prototype, Analysis, Research

Desired Deliverables Description

Strategies that address the safety and comfort expectations of UAM vehicle passengers.

State of the Art and Critical Gaps

There are approximately 150 UAM vehicle concepts in varying stages of development. The immediate focus of the vehicle developers is overcoming obstacles on the path to certification. The public has experience flying in large transport aircraft and ground transportation (cars, trains, buses) and are calibrated to the comfort levels (motion, noise, vibration, air conditioning, heating, lighting, etc.) associated with these modes of transportation. Multirotor UAM vehicles will fly more like a helicopter and as a consequence, will likely have more or different motion, vibration and noise transmitted into the cabin. For UAM aircraft, research is needed that 1) addresses the safety and comfort expectations of the passengers and crew, and 2) provides vehicle design strategies for improving passenger comfort.

Relevance / Science Traceability

This subtopic is relevant to the Aeronautics Research Mission Directorate (ARMD) Revolutionary Vertical Lift Technology (RVLT) Project under the Advanced Air Vehicle Program. The goal of the RVLT Project is to develop and validate tools, technologies and concepts to overcome key barriers for vertical lift vehicles. The scope encompasses technologies that address noise, speed, mobility, payload, efficiency, environment and safety for both conventional and non-conventional vertical lift configurations. This subtopic directly aligns with the mission, goals and scope in addressing safety of non-conventional vertical lift configurations.