

Establishing a Holistic Assessment and Simulation Framework and Interfacing for Innovative Air Mobility

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Abstract

Innovative Air Mobility (IAM) has the potential to transform regional and urban transportation through the integration of electric vertical take-off and landing aircraft, advanced airspace operations, and multimodal transport networks. Assessing the performance of such systems requires simulation environments capable of representing complex interactions across multiple operational domains while accommodating models with varying levels of fidelity. This paper presents an agent-based simulation toolkit that serves as the foundation for a collaborative simulation framework, enabling the integration of higher-fidelity tools for demand modelling, passenger decision-making, trajectory generation, and vertiport and fleet management. The framework combines the computational efficiency of agent-based simulation with domain-specific models to support scalable, system-level analyses of IAM operations. By coupling these complementary tools through a standardized integration schema, the framework facilitates interoperability, modularity, and the reuse of independently developed models. This collaborative approach enables the exploration of passenger, and potentially cargo, mobility from a system-of-systems perspective, allowing the assessment of interactions between operational, infrastructural, and behavioural components that are difficult to capture in isolation. The proposed framework provides a flexible platform for scenario analysis, technology assessment, and operational studies, while contributing toward the establishment of a common architecture for integrating IAM simulation models across the research community.

Keywords: System-of-systems, agent-based simulation, collaborative simulation