Title:
Towards Increasingly Autonomous Aircraft-enabled Mobility

Abstract:
The national vision for advanced aerial mobility (AAM) is essentially an airspace system where aircraft (primarily V/STOL aircraft) transport passengers and cargo in urban, suburban, and regional settings via a hybrid (point-to-point plus hub-and-spoke) network that is dynamically generated based on demand to achieve the desired economies of scale. The push for AAM has been motivated by our “need for speed” which in the latter half of the 19th century we satisfied by going underground but now in the early 21st century, when surface and underground transportation modes have both reached their limits, and the costs of additional infrastructure are prohibitive, we are seeking to satisfy by moving to the air. To my mind, this vision will require greater aircraft and air traffic management (ATM) system autonomy; a synergistic relationship between vertiport locations and flight trajectories to address noise, privacy, and safety concerns; and new certification standards for vehicles, systems, and operators.

In this presentation I will discuss how these challenges may be addressed via simulation and optimization, and present ongoing work on frameworks, algorithms, and policies for autonomous decision-making. Specifically, I will first propose an alternative definition for autonomy, i.e., a definition where autonomous decision-making and autonomous operations are explicitly defined and accounted for when addressing specific challenges. I will then show how autonomous or at least highly automated systems can perform two critical tasks that are currently primarily performed by humans, i.e., aircraft trajectory planning to maximize both mission success and survivability; and the decision whether to abort an approach and landing. Finally, I will propose a framework for the certification of vehicles that must both operate and make decisions autonomously.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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