Advanced Air Mobility as a Demand Response Asset

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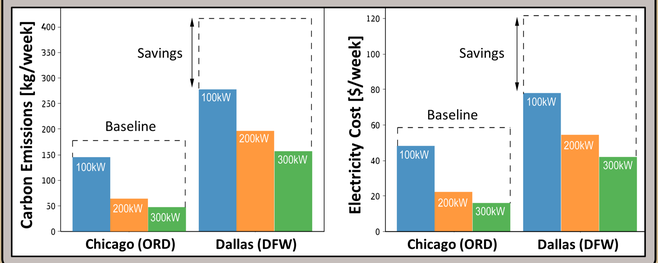
Problem and Motivation

Urban air mobility (UAM) and other eVTOL services will require significant investment in power systems to avoid blackouts or overcurrent fires[1]. Such services must be engineered with energy infrastructure in mind. For UAM to achieve widespread viability while meeting sustainability goals, there is an urgent need for cost-effective and easy-to-integrate solutions that reduce operating expense and safely ease the transition to clean energy.

Data-Centric Simulation

Our algorithms are testing using a custom agent-based modeling (ABM) framework built with mesa-python. The simulation considers historic electric grid prices and satellite measurements of solar radiation, along with synthetic UAM demand datasets from literature[2] and vehicle performance data from manufacturers.

We show >50% savings in electricity cost with case studies with on-site solar power. This results in over $100,000/year of savings using the dispatch software.



Cost Comparison

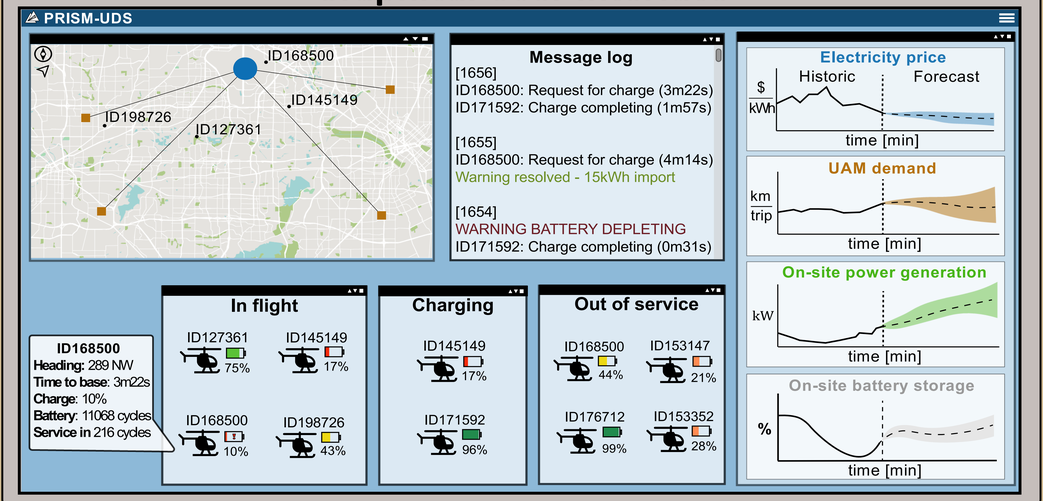
Our product could return initial controller development cost in less than 1 to 5 years (based on location and onsite power).

Our expected "microgrid" controller costs[3]	Investment in UAM since 2010[4]
$4.5K - $500K	>$6.3B

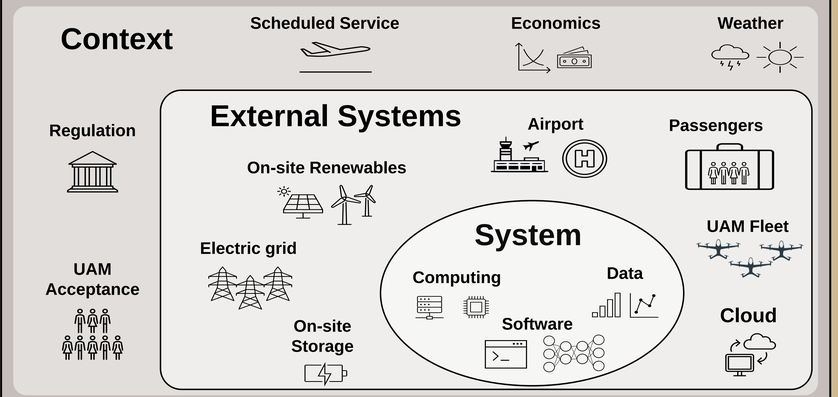
We provide a decision-support platform to design and operate power infrastructure of urban air mobility fleets for clean vertiports of the future.

Our framework aims to reduce UAM operational expense by using data that is already collected at airports (e.g. weather, passenger throughput, etc.). It does this by optimizing when vehicles charge and are dispatched based on changes in on-site renewable energy and electric grid pricing. In current vehicles, propulsion accounts for a majority of costs. Our product scales well with trends in aviation and energy as municipalities are trending to adopting renewables and time-of-use pricing markets.

Graphical User Interface



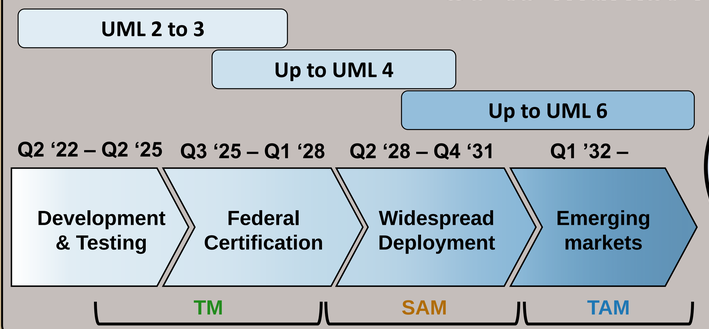
External Systems Diagram

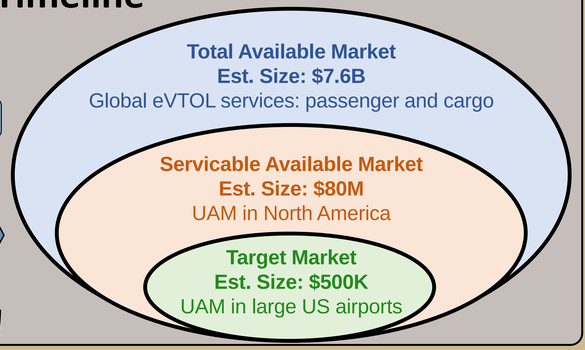


Functional decomposition

Gather current states	Predict future states	Dispatch system commands	Monitor system health
Vehicle states	Vehicle states	Charge vehicles	Operating zones
Trip demand	Trip demand	Assign trips	Security check
Grid price	Grid price	Buy electricity	Weather forecast
Onsite battery	Onsite battery	Charge battery	Check battery
	Onsite power		Human to verify

Go-to-Market Timeline





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[1] Black & Veath, "eVTOL electrical infrastructure study for UAM aircraft," NIA & NASA, 2018.
[2] A. Maheshwari, et al. , "Identifying and analyzing operations limits for passenger-carrying urban air mobility missions," AIAA Aviation 2020.
[3] J. I. Giraldez Miner, et al., "Phase i microgrid cost study: Data collection and analysis of microgrid costs in the united states," Tech. Rep., 2018.
[4] https://tnmt.com/infographics/advanced-air-mobility-investment-dashboard/

Acknowledgements

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