# Abenezer Taye

PhD Candidate
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## EDUCATION

**George Washington University**, Washington, DC
Ph.D. in Aerospace Engineering, January 2021 - Present
**Advisor:** Prof. Peng Wei
**Dissertation title:** *Enhancing Safety and Energy-Efficiency in Advanced Air Mobility Through Trajectory Planning and Mission Feasibility Assessment Strategies*

**North Carolina Agricultural and Technical State University**, Greensboro, North Carolina
Ph.D. in Electrical and Computer Engineering (Transferred Before Completion), August 2019 - December 2020

**Addis Ababa Science and Technology University**, Addis Ababa, Ethiopia
B.S. in Electro-Mechanical Engineering, June 2017

## RESEARCH INTERESTS

By contributing to the intersection of **flight control**, **battery prognostics**, **multi-agent systems** and **machine learning**, I develop autonomous systems and decision support tools for aviation, air transportation, and aerial vehicles. My research expertise blends in both learning-based and model-based approaches for **flight mechanics** (both fixed-wing and rotorcraft) and **control**, **aviation electrification** and **battery prognostics**, and ensuring that new aircraft types such as small unmanned aerial systems (UAS) and electrical take-off and landing (eVTOL) vehicles operate **safely** and **energy-efficiently** in complex environments, e.g. high-density airspaces under winds.

## MAJOR PROJECTS

**Technical Lead**, *Safe, Scalable, and Energy-Efficient Trajectory Planner for AAM Operations* Jan. 2021 - Onward
The objective of this research project is to develop a multi-agent trajectory planner for AAM operations that is real-time, safe, and scalable. The planner incorporates a reachability analysis module to ensure safety and employs a scalable Markov Decision Process (MDP)-based framework for decision-making. Safety is further enhanced through action-shielding and reward-shaping mechanisms. In addition to ensuring safety, the planner generates energy-efficient trajectories by considering factors such as aircraft powertrain model, trajectory smoothness, and wind interactions.

**Thrust 1 Technical Lead**, *In-Time Learning-Based Safety Management for Scalable AAM Operations* Mar. 2021 - Onward
In this $2.5M **NASA System-Wide Safety (SWS)** project, the objective is to design, develop, and demonstrate an in-time learning-based aviation safety management system (ILASMS) for scalable, heterogeneous AAM operations. Specifically, I led the first thrust of the project and developed a framework for pre-departure mission feasibility assessment. This framework employs a battery prognostics-based uncertainty quantification scheme to evaluate the impact of adverse weather, such as winds, on AAM operations. We demonstrated the performance of the developed feasibility assessment framework in both UAS operations for package delivery and UAM operations for air taxi services.

**Technical Lead**, *Energy Demand Analysis for eVTOL Aircraft in Urban Air Mobility* Sept. 2023 - Onward
The objectives of this project is to develop a methodology to forecast charging demand for eVTOL (electric vertical takeoff and landing) aircraft in Urban Air Mobility (UAM) operations. The framework integrates an energy consumption model with factors like aircraft models, wind forecasts, and scheduled flight missions to estimate aggregated power demand at vertiports.

## INDUSTRY EXPERIENCE

**Software Engineering Intern**, Sensor Fusion and Tracking Toolbox, MathWorks May 2023 - Aug. 2023
Developed an automated tool to analyze the performance of multi-object tracking systems.

**Research Intern**, MathWorks Advanced Research and Technology Office, MathWorks May 2022 - Aug. 2022
Developed a Markov Decision Process (MDP) based real-time trajectory planning framework for high-density UAM/UAS air traffic.

## LANGUAGES/TOOLS/TECHNOLOGIES

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|---|---|
| **Programming Skills:** | Python (+5 years) |
| | MATLAB/Simulink (+5 years) |
| | C/C++ (3 years) |
| **Packages:** | TensorFlow, PyTorch, OpenCV, Keras, OpenAI Gym |
| **Operating Systems:** | Linux, Windows, ROS |
| **Standards:** | Familiar with DO-178C certification process |

## PUBLICATIONS

### Journal Publications

Published, in press, submitted

1. **A. Taye**, P. Wei, "Energy-Efficient Trajectory Planning and Mission Feasibility Assessment Framework for Drone Package Delivery Operations", Submitted to *AIAA Journal of Aerospace Information Systems*.
2. **A. Taye**, R. Valenti, A. Rajhans, A. Mavrommati, P.J. Mosterman and P. Wei, "Safe and Scalable Real-Time Trajectory Planning Framework for Urban Air Mobility", *AIAA Journal of Aerospace Information Systems*, vol. 21, no. 8, Aug. 2024.
3. P. Razzaghi, A. Tabrizian, W. Guo, S. Chen, **A. Taye**, E. Thompson, A. Bregeon, A. Baheri and P. Wei, "A Survey on Reinforcement Learning in Aviation Applications", *Engineering Applications of Artificial Intelligence,* vol. 136, part A, Oct. 2024.

### Conference Publications

Published, in press, accepted

1. **A. Taye**, S. Chen, P. Wei, "Energy-Aware Strategic Traffic Management for Urban Air Mobility", Accepted by AIAA SCITECH, Orlando, FL, Jan 2025.
2. A. Tabrizian, P. Gupta,**A. Taye**, J. Jones, E. Thompson, S. Chen, T. Bonin, D. Eberle and P. Wei, "Using Large Language Models to Automate Flight Planning under Wind Hazards", AIAA/IEEE Digital Avionics Systems Conference (DASC), San Diego, CA, Sept. 2024.
3. **A. Taye**, P. Wei, P. Pradeep, J. Jones, T. Bonin, and D. Eberle, "Energy Demand Analysis for eVTOL Charging Stations in Urban Air Mobility", AIAA AVIATION, Las Vegas, NV, July 2024.
4. **A. Taye**, P. Wei, "Flight Mission Feasibility Assessment of Urban Air Mobility Operations under Battery Energy Constraint", AIAA SCITECH, Orlando, FL, Jan. 2024.
5. **A. Taye**, E. Thompson, P. Wei, T. Bonin, and J. Jones, "Probabilistic Evaluation for Flight Mission Feasibility of a Small Octocopter in the Presence of Wind", AIAA AVIATION, San Diego, CA, Jun. 2023.
6. **A. Taye**, J. Bertram, C. Fan, and P. Wei, "Reachability based online safety verification for high-density urban air mobility trajectory planning", AIAA AVIATION, Chicago, IL, Jun. 2022.
7. E. Thompson,**A. Taye**, W. Guo, P. Wei, M. Quinones, I. Ahmed, G. Biswas, J. Quattrociocchi, S. Carr, U. Topcu, and J. Jones, "A survey of eVTOL aircraft and AAM operation hazards." AIAA AVIATION, Chicago, IL, Jun. 2022.

### Technical Reports

1. **A. Taye** and P. Wei, "AI Safety and Certification in Aviation Systems - Identifying the Gaps and Opportunities", Aerospace Industries Association (AIA), 2022.

## INVITED TALKS

1. **A. Taye** "Energy-Aware Strategic Traffic Management for Urban Air Mobility", Accepted by AIAA SCITECH, Orlando, FL, Jan 2025.
2. **A. Taye** "Energy-Efficient Trajectory Planning and Mission Feasibility Assessment Framework for Drone Package Delivery Operations", INFORMS Annual Meeting, Seattle, WA, Oct. 2024.
3. **A. Taye** "Energy Demand Analysis for eVTOL Charging Stations in Urban Air Mobility", AIAA AVIATION, Las Vegas, NV, July 2024.
4. **A. Taye** "Flight Mission Feasibility Assessment of Urban Air Mobility Operations under Battery Energy Constraint", AIAA SCITECH, Orlando, FL, Jan. 2024.
5. **A. Taye**, J. Bertram, C. Fan, and P. Wei, "Reachability based online safety verification for high-density urban air mobility trajectory planning", AIAA AVIATION, Chicago, IL, Jun. 2022.

## HONORS AND AWARDS

Honorable Mention Award, AIAA Young Professionals, Students, and Educators (YPSE) Conference 2022
Ambassador of Science and Technology of the graduation year 2017, Ministry of Science and Technology of Ethiopia 2017

## PROFESSIONAL AFFILIATIONS

American Institute of Aeronautics and Astronautics (AIAA), Student Member
Institute of Electrical and Electronic Engineers (IEEE), Student Member
Institute for Operations Research and the Management Sciences (INFORMS), Student Member

## PROFESSIONAL SERVICE

### Conference Session Organizer

*Session Co-Chair* Aug. 2024
"System-Wide Safety"
*AIAA Aviation 2024*, Las Vegas, NV

*Session Co-Chair* Aug. 2024
"Regional Air Mobility and General Aviation"
*AIAA Aviation 2024*, Las Vegas, NV

### Reviewer Activities

- *Journal referee*
  - Aerospace Science and Technology 2022 - 2024
  - The Aeronautical Journal 2023 - 2024
  - AIAA Journal of Aerospace Information Systems 2022 - 2024
  - IEEE Transactions on Intelligent Transportation Systems 2022 - 2024
- *Conference referee*
  - AIAA Aviation 2022 - 2024
  - AIAA SciTech 2022 - 2024

## TEACHING EXPERIENCE

Teaching Assistant for MAE4182 - Electro-Mechanical Control Systems course Fall 2024
Mentored 5 undergraduate researchers in trajectory planning and battery prognostics-related research 2022 - 2024