

# Abenezer Taye

Post-Doctoral Research Scholar  
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## EDUCATION

**George Washington University**, Washington, DC  
Ph.D. in Aerospace Engineering, January 2021 - August 2025

**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**, **robotics**, **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 **trajectory planning**, **control**, **aircraft mechanics**, 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.

### Testing Platforms for Novel AAM Concepts

- eVTOL simulators
- sUAS hardware flight testing
- Battery digital twins
- UAM/UAS transportation networks

## MAJOR PROJECTS

**Technical Lead, Safe, Scalable, and Energy-Efficient Trajectory Planner for AAM Operations** Jan. 2021 - Onward

- Developed a real-time, multi-agent trajectory planner for AAM operations to ensure both safety and scalability in dense urban airspace environments.
- Integrated a data-driven reachability analysis module and a scalable Markov decision process (MDP) framework to guide decentralized decision-making.
- Enhanced safety through action-shielding and reward-shaping strategies, while optimizing for energy efficiency using aircraft powertrain modeling, trajectory smoothness, and wind-aware planning.

**Technical Thrust Lead, In-Time Learning-Based Safety Management for Scalable AAM Operations** Mar. 2021 - Onward

- Led the first thrust of a **\$2.5M NASA-funded System-Wide Safety** project to develop a scalable, data-driven safety management system for heterogeneous Advanced Air Mobility (AAM) operations.
- Designed a mission feasibility assessment framework that integrates battery prognostics with uncertainty quantification to evaluate the impact of adverse weather (e.g., wind) on flight safety.
- Demonstrated the framework's effectiveness in real-world-inspired scenarios, including drone package delivery and urban air taxi services.

**Technical Lead, Learning-based Li-ion Battery Modeling for Online Decision Making**

Sept. 2022 - Onward

- Developed a real-time predictive model for Li-ion batteries powering drones using **Neural ODEs** and **Physics-Informed Neural Networks** to address the computational limitations of traditional electrochemical models.
- Achieved a **33 × speedup** in battery state prediction and mission feasibility assessment compared to model-based approaches, without compromising prediction accuracy.
- Enabled mission feasibility assessment and mid-flight replanning through efficient online battery state prediction, supporting safe and adaptive aircraft operations.

**Technical Lead, Energy Demand Analysis for eVTOL Aircraft in Urban Air Mobility**

Sept. 2023 - Onward

- Developed a predictive framework to forecast charging demand for electric vertical takeoff and landing (eVTOL) aircraft in urban air mobility (UAM) operations.
- Integrated energy consumption models with aircraft specifications, wind forecasts, and scheduled flight missions to estimate aggregated power demand at vertiports.
- Enabled proactive energy planning and infrastructure optimization for UAM networks through data-driven demand forecasting.

## INDUSTRY EXPERIENCE

**Research Intern, Sensor Fusion and Tracking Toolbox, MathWorks**

May 2023 - Aug. 2023

- Built a MATLAB application to analyze and diagnose multi-agent tracking systems, identify root causes of performance issues, and suggest algorithmic improvements.
- Enabled support for advanced tracking algorithms (JPDA, PHD, MHT) to facilitate in-depth performance evaluation and comparative analysis.
- **Accelerated the tracker development cycle by 60%** and demonstrated effectiveness using real-world radar data in aircraft landing approach scenarios.

**Research Intern, MathWorks Advanced Research and Technology Office, MathWorks**

May 2022 - Aug. 2022

- Developed a decentralized, data-driven trajectory planning framework for urban air mobility using real-time reachability analysis and Markov decision processes (MDP) to ensure aircraft separation and safety.
- Designed an online learning algorithm to approximate aircraft reachable sets via a discrepancy function trained on simulated trajectories, enabling adaptive and efficient collision avoidance.
- **Demonstrated a 78% reduction in near-midair collisions** in large-scale simulations (up to 32 aircraft over a 15 km area).

## LANGUAGES/TOOLS/TECHNOLOGIES

**Programming Skills:** Python (+5 years)  
MATLAB/Simulink (+5 years)  
C/C++ (+5 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”, Accepted by *AIAA Journal of Aerospace Information Systems*.
2. **A. Taye**, R. Valenti, A. Rajhans, A. Mavrommatti, 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**, A. Coursey, M. Quinones-Grueiro, C. Hu, G. Biswas, P. Wei, "Safe to Fly? Real-Time Flight Mission Feasibility Assessment for Drone Package Delivery Operations", The 36th International Conference on Principles of Diagnosis and Resilient Systems (DX'25), Nashville, TN, Sept. 2025.
2. C. Vu, M. Ghazanfari, K Dong **A. Taye**, A. Tabrizian, and P. Wei "Transformer or CNN? Benchmarking Real-Time Detection Transformer and YOLOv8 for Small UAS Autonomous Landing", AIAA AVIATION, Las Vegas, NV, July 2025.
3. J. Xu, C. Vu, **A. Taye**, A. Tabrizian, P. Wei, "Small UAS Landing Site Detection with ArUco Markers and Deep Learning based Computer Vision", AIAA AVIATION, Las Vegas, NV, July 2025.
4. D. Ding, C. Vu, **A. Taye**, A. Tabrizian, P. Wei, Z. Zhao, "Synthetic Data Generation for Computer Vision based Autonomous Landing for Small UAS Package Delivery", AIAA AVIATION, Las Vegas, NV, July 2025.
5. **A. Taye**, S. Chen, P. Wei, "Energy-Aware Strategic Traffic Management for Urban Air Mobility", AIAA SCITECH, Orlando, FL, Jan 2025.
6. 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.
7. **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.
8. **A. Taye**, P. Wei, "Flight Mission Feasibility Assessment of Urban Air Mobility Operations under Battery Energy Constraint", AIAA SCITECH, Orlando, FL, Jan. 2024.
9. **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.
10. **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.
11. 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** "Safe to Fly? Real-Time Flight Mission Feasibility Assessment for Drone Package Delivery Operation", The 36th International Conference on Principles of Diagnosis and Resilient Systems (DX'25), Nashville, TN, Sept. 2025.
2. **A. Taye** "Energy-Aware Strategic Traffic Management for Urban Air Mobility", AIAA SCITECH, Orlando, FL, Jan 2025.
3. **A. Taye** "Energy-Efficient Trajectory Planning and Mission Feasibility Assessment Framework for Drone Package Delivery Operations", INFORMS Annual Meeting, Seattle, WA, Oct. 2024.
4. **A. Taye** "Energy Demand Analysis for eVTOL Charging Stations in Urban Air Mobility", AIAA AVIATION, Las Vegas, NV, July 2024.
5. **A. Taye** "Flight Mission Feasibility Assessment of Urban Air Mobility Operations under Battery Energy Constraint", AIAA SCITECH, Orlando, FL, Jan. 2024.
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.

## 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 and Workshop Organizer

<i>Workshop Co-Host</i> “NASA System-Wide Safety Program Workshop ” <i>George Washington University</i> , Washington DC, DC	Apr. 2025
<i>Session Co-Chair</i> “System-Wide Safety” <i>AIAA Aviation 2024</i> , Las Vegas, NV	Aug. 2024
<i>Session Co-Chair</i> “Regional Air Mobility and General Aviation” <i>AIAA Aviation 2024</i> , Las Vegas, NV	Aug. 2024

### Reviewer Activities

• <i>Journal referee</i>	
– Aerospace Science and Technology	2022 - 2025
– The Aeronautical Journal	2023 - 2025
– AIAA Journal of Aerospace Information Systems	2022 - 2025
– IEEE Transactions on Intelligent Transportation Systems	2022 - 2025
• <i>Conference referee</i>	
– AIAA Aviation	2022 - 2025
– AIAA SciTech	2022 - 2025

## 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