Alex Baowend Soom M. A. Zongo

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RESEARCH INTERESTS

Multi-agent reinforcement learning and large language vision models for safety-critical autonomous systems, with applications to air traffic control and advanced air mobility. Current research focuses on robust aircraft conflict resolution under uncertainty, fine-tuning large language models for aircraft separation assurance, eVTOL aircraft energy estimation and energy efficient tactical deconfliction.

EDUCATION

Ph.D. in Mechanical and Aerospace Engineering — August 2024 – Present
George Washington University, School of Engineering and Applied Sciences — Washington, DC, USA
Advisor: Dr. Peng Wei — Research: *Multi-Agent Reinforcement Learning, Large Language Vision Models, Flight Control, Optimization* — *GPA: 3.91/4.0*

M.S. in Control Sciences and Engineering — September 2021 – May 2024
Tsinghua University, Department of Automation, — Beijing, China
Advisor: Prof. Qing Li — Research: *Reinforcement Learning, and Flight Dynamics and Control* — *GPA: 3.81/4.0*

Machine Learning Summer School — June 2022 – August 2022
University of Oxford — Oxford, United Kingdom

B.S. in Aircraft Design and Engineering — September 2018 – June 2021
Beijing University of Aeronautics and Astronautics, Department of Aeronautics, — Beijing, China
Advisor: Dr. Jidong Wang — Research: *Aircraft Design, Flight Dynamics and Control, Aerodynamics* — *GPA: 3.78/4.0*

Freshman Year in Aeronautics and Astronautics — September 2017 – June 2018
National Cheng Kung University — Tainan, Taiwan
GPA: 4.05/4.3

PUBLICATIONS

Published

· **Zongo, A.B.**, Li, Q. (2025). — Published, March 2025
Towards Intelligent Fault Tolerant Attitude Flight Control Of A Fixed-Wing Aircraft, In: Yan, L., Duan, H., Deng, Y. (eds) Advances in Guidance, Navigation and Control. ICGNC 2024. Lecture Notes in Electrical Engineering, vol 1353. Springer, Singapore. [PDF] [Code]

Under Review

· **Zongo, A.**, Wei, P. — Abstract accepted, January 2026
eVTOL Aircraft Energy Consumption Estimation with Conflict Resolution in High-Density Airspaces. Abstract accepted at the Integrated Communications Navigation, and Surveillance (ICNS) Conference 2026.

· **Zongo, A.**, Wei, P. — Abstract submitted, January 2026
Robust Multi-Agent Reinforcement Learning for Small UAS Separation Assurance under GNSS Degradation and Spoofing. Abstract submitted to the Digital Avionics Systems conference (DASC) 2026.

In Preparation

· Sharifi, I., **Zongo, A.**, Wei, P. — In preparation, December 2025 – February 2026
Fine-Tuning Large Language Models for Autonomous Tactical Deconfliction of Small Unmanned Aerial Systems. Target: Air Transportation Research and Development Symposium (ATRD) 2026.

TECHNICAL ESSAYS

Zongo, A. (2025). Published, December 2025
Aircraft Traffic Control: Managing Order in a Crowded Sky. Scholarly blog post, archived on Zenodo, and accessible Online.

RESEARCH EXPERIENCE

Graduate Research Assistant September 2024 – Present
Intelligent Aerospace Systems Lab (IASL), George Washington University

- Developing eVTOL aircraft energy consumption prediction with conflict resolution maneuvers for high-density airspaces. Integrated eVTOL aircraft models and energy consumption models into the BlueSky simulator. Designed and customized both learning-based and rule-based conflict resolution algorithms. (NASA University Leadership Initiatives)
- Designing robust multi-agent reinforcement learning framework for aircraft separation assurance under GNSS spoofing and degradation. Introduced an analytical closed-form solution using multi-agent value-gradient and dynamic programming to optimally synthesize the control policy under worst-case erroneous/spoofed state observations at each step.
- Developing a simulation-to-language data generation pipeline using BlueSky ATM for fine-tuning Large Language Models on autonomous tactical deconfliction of small UAS, achieving improved decision accuracy and reduced near mid-air collisions through parameter-efficient fine-tuning (LoRA, GRPO).
- Organized the Safe and Responsible AI Workshop (September 2024) with participants from FAA, DOT Highly Automated Systems Safety Center of Excellence (HASS COE), Johns Hopkins APL, MIT Lincoln Labs, TRAILS, NIST AI, and RAIUK.

Research Assistant September 2021 – May 2024
Navigation and Control Lab, Tsinghua University

- Developed intelligent fault-tolerant attitude flight control for fixed-wing aircraft using reinforcement learning, resulting in ICGNC 2024 publication.

Robotics Software Engineer Intern June 2022 – November 2022
Popular Robotics, Beijing, China

- Developed biped robot simulation in Gazebo using ROS/ROS2.
- Designed a curriculum module on gait motion fundamentals, simulation, and control.

TEACHING AND MENTORING

Graduate Teaching Assistant January 2025 – May 2025
George Washington University

- Course: Linear Systems Dynamics (MAE 3134), Spring 2025
- Conducted recitations, held office hours, graded assignments and examinations

Research Mentor Summer 2025 – Present
Intelligent Aerospace Systems Lab, George Washington University

- Mentored an undergraduate student on introductory air traffic management simulations and research (Summer 2025)
- Mentoring a M.S. student research on maritime traffic simulation and multi-agent RL (Fall 2025 – Present)

PROFESSIONAL SERVICE

Journal Reviews

- Journal of Aerospace Information Systems (JAIS) – 3 papers (2025)
- Journal of Guidance, Control, and Dynamics – 1 paper (2026)
- Journal of Engineering Applications of Artificial Intelligence (EAAI) – 1 paper (2026)

Conference Reviews

· International Conference on Guidance, Navigation, and Control (ICGNC) – 3 papers (2024)

TECHNICAL SKILLS

Programming	Python, Julia, MATLAB/Simulink, C/C++, ROS/ROS2, Ada
ML/AI Libraries	PyTorch, JAX, NumPy, Scikit-Learn, OpenCV
CAD/Simulation	BlueSky ATM, OpenVSP, SolidWorks, CATIA, ANSYS Fluent
Languages	French (native), English (C2), Chinese (B1)

AWARDS AND FELLOWSHIPS

Graduate Research Assistantship 2024 – Present
George Washington University, Fully funded Ph.D. program

Chinese Government Scholarship 2021 – 2024
Tsinghua University, Full funding for Master's program

Chinese Government Scholarship 2018 – 2021
Beijing University of Aeronautics and Astronautics
Outstanding Academic Achievement Award (2019, 2020)

Taiwan Ministry of Foreign Affairs Scholarship 2016 – 2018
National Cheng Kung University & Fu Jen Catholic University

OTHER SELECTED PROJECTS

George Washington University September 2024 – May 2025
· Visual odometry algorithm implementation on self-recorded datasets
· System identification and nonlinear control for SpaceX Grasshopper dynamics
· Graph algorithm analysis: Jack Edmonds' blossom algorithm implementation

Beijing University of Aeronautics and Astronautics September 2020 – May 2021
· Flight simulator modeling with MATLAB/Simulink using RCAM model [Code]
· Conceptual design of lightweight sport aircraft and preliminary helicopter design

LEADERSHIP AND SERVICE

Secretary General May 2022 – May 2024
Tsinghua University African Student Association (THUASA)
· Led cultural activities planning and community engagement initiatives
· Coordinated leadership development programs for international students

R&D Engineer September 2022 – May 2023
Tsinghua AI International Student Association (TAISA)
· Developed AI solutions for societal challenges as part of graduate-level club

SELECTED COURSEWORK

Machine Learning (A)	Deep Reinforcement Learning (A)	Computational Optimization (A)
Aerodynamics (A)	Electro-Mechanical Control Systems (A)	Advanced Engineering Mathematics (A)
Aircraft Design (A)	Robotics and Computer Vision (A)	Flight Dynamics, Simulation and Control (A)
Algorithm Design (A)	Automatic Control (A)	Large Language Vision Models (A)

EXTRA-CURRICULAR

- Church Musician at *North Cathedral of Beijing* September 2023 – July 2024
- Campus Service Volunteer at *Tsinghua University* September 2021 – May 2024

- Piano player and performer at the *Global Village* and *Starry Night* events at Tsinghua University, Beijing, China May 2023

REFERENCES

Dr. Peng Wei
Associate Professor, Department of Mechanical and Aerospace Engineering
The George Washington University, Washington, DC, USA
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Prof. Qing Li
Professor, Department of Automation
Tsinghua University, Beijing, China
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Dr. Ying Zhao
Associate Professor, Department of Computer Science and Technology
Tsinghua University, Beijing, China
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