THEODORE LENGKONG

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EDUCATION

University of Virginia, School of Engineering | Charlottesville, VA
Bachelor of Engineering in Aerospace Engineering
Expected Graduation: May 2026 | **GPA: 3.842** | Dean's List

RESEARCH EXPERIENCE

Aerodynamics Subteam Lead | Dragonfly Inspired MAV - Senior Capstone | August 2024 - Present
Advisor: Dr. Haibo Dong

- Leading 4-person aerodynamics subteam within 15-person capstone project to develop bio-inspired micro aerial vehicle with independently actuated four-wing system capable of autonomous takeoff, hover, turning, forward flight, and landing
- Directing CFD analyses using Rivanna Supercomputer to optimize wing rigidity through resonance analysis and quantify angle of attack influences on lift capability across flight modes
- Building kinematic models of biological dragonfly wing motion patterns in Autodesk Maya to inform mechanical design constraints and control system requirements
- Collaborating with structures and avionics subteams to balance aerodynamic performance with structural weight limits and motor torque capabilities
- Synthesizing computational findings from previous damselfly research with practical hardware constraints to guide design tradeoffs for prototype development

Undergraduate Researcher | Lagor Research Group | July 2024 - Present
Advisor: Dr. Frank Lagor

- **Current Research:** Developing machine learning algorithms for UVA MantaBot to predict drag forces and identify optimal positioning in wake flows using pressure sensor data alone (targeting *Bioinspiration & Biomimetics*)
- **Bio-inspired Sensing:** Creating artificial lateral line system using pressure sensor arrays for underwater state estimation and wake detection, with sensor placement informed by expected Karman vortex street patterns
- **Hardware Development:** Designed and fabricated sensor integration hardware using SolidWorks and 3D printing; implemented embedded data acquisition systems using Raspberry Pi with custom Python scripts for real-time pressure measurements
- **Machine Learning Development:** Developing end-to-end ML pipeline: preprocessing noisy pressure signals, extracting hydrodynamic features, training neural network architectures for vortex classification, and tuning hyperparameters to generalize from training to experimental validation
- **Electronics Integration:** Built custom circuit boards for pressure sensor arrays, including signal conditioning circuits and analog-to-digital conversion for multi-channel simultaneous sampling
- **System Integration:** Integrated sensor arrays with robotic control systems to enable autonomous wake-riding behaviors based on real-time flow field measurements
- **Experimental Work:** Conducting wind tunnel and towing tank experiments for sensor calibration and algorithm validation

Undergraduate Researcher | Flow Simulation Research Group | May 2023 - Present
Advisor: Dr. Haibo Dong

- Harrison Grant recipient for damselfly aerodynamics and fish schooling research (2024-2025)
- **Current Research:** Investigating optimal gliding configurations for damselflies to maximize aerodynamic efficiency using computational fluid dynamics (CFD) simulations and aerodynamic force analysis (targeting International Journal of Micro Air Vehicles)
- **Machine Learning Project:** Developing ML models to classify fish positions within schools using pressure sensor data and predict optimal schooling configurations for thrust/drag optimization (targeting Bioinspiration & Biomimetics)
- **Previous Fellowship:** Dean's Undergraduate Engineering Research Fellowship recipient for damselfly backward flight aerodynamics research
- **Published Research:** First-author investigation of backward flight aerodynamics in damselflies, focusing on wing kinematics and leading-edge vortex dynamics

- **Conference Contributions:** Co-authored presentations at ASME FEDSM 2024 (robotic swarms) and APS Division of Fluid Dynamics 2024 (damselfly maneuvers)
- Utilized UVA Rivanna Supercomputer for large-scale CFD simulations with in-house flow solver and tree-topological mesh refinement
- **Publications:** Spectra Journal (peer-reviewed), ASME conference proceedings, APS conference abstracts

Undergraduate Researcher | Maeng Research Group | September 2022 - September 2024

Advisor: Dr. Jennifer Maeng | Project: Advancing Rural Computer Science (ARCS)

- Federally Funded Research: Contributing researcher on US Department of Education Grant (#U411C190032) studying computer science education in K-5 schools across Virginia
- Conducted data analysis and management for large-scale randomized controlled trial examining teacher professional development effectiveness
- Performed quantitative and qualitative analyses on large datasets from teachers and students across multiple school districts
- Supported statistical analyses including systematic coding of survey responses using validated rubrics
- Developed expertise in educational research methodology, large-scale data management, statistical analysis, and mixed-methods program evaluation
- **Formal Acknowledgment:** Named as contributing researcher in multiple annual federal grant reports and publications

PUBLICATIONS & PRESENTATIONS

- **LengKong, T.**, Huang, Z., Dong, H. "Using Machine Learning to Identify Schooling Neighbors from Pressure Signatures of Digital Fishes." *ONR MURI Review*, September 2025.Oral presentation attended by collaborators from Lehigh, Harvard, and Princeton University on using machine learning to classify fish positions within schools using pressure sensor data and predict optimal schooling configurations for thrust/drag optimization.
- **LengKong, T.**, et al. "Aerodynamic Analysis of Backward Flight in Damselflies: Wing Kinematics and Leading-Edge Vortex Dynamics." *Spectra Journal*, 2024. First-author peer-reviewed publication investigating aerodynamic mechanisms enabling damselfly backward flight maneuvers using computational fluid dynamics simulations on UVA Rivanna Supercomputer.
- Menzer, A., **LengKong, T.**, Ni, D., Nagpal, R., and Dong, H. "Hydrodynamic Interactions in Fish-Like Robotic Swarms with Flexible Propulsors." *Proceedings of the ASME 2024 Fluids Engineering Division Summer Meeting*, Anaheim, CA, July 2024. DOI: 10.1115/FEDSM2024-131405. Co-authored conference proceedings examining hydrodynamic interactions between fish-like robots with flexible propulsion systems.
- Guo, J., Bode-Oke, A., **LengKong, T.**, & Dong, H. "Agile Maneuvering: Damselfly Backward Flight and Its Aerodynamic Mechanism." *APS Division of Fluid Dynamics Meeting Abstracts*, November 2024. Co-authored conference proceedings examining aerodynamic mechanisms enabling damselfly backward flight, including analysis of wing kinematics, vortex dynamics, and force generation.
- **LengKong, T.** "Aerodynamics of Backward Flight in Damselflies." *Fall Engineering Expo*, University of Virginia, 2024. Poster presentation on computational fluid dynamics results and analysis of damselfly backward flight, including analysis of wing kinematics, vortex dynamics, and force generation.
- **LengKong, T.** "Hydrodynamic Effects of Fin Shapes in Bio-robotic Platforms." *Undergraduate Research Symposium*, University of Virginia, 2024. Presented research investigating how fin shape variations affect hydrodynamic performance in bio-robotic underwater vehicles.
- **LengKong, T.** "K-5 Teacher Development Program Effectiveness in STEM Education." *Undergraduate Research Symposium*, University of Virginia, 2023. Presented findings from federally funded educational research examining effectiveness of teacher professional development programs in computer science education.

MANUSCRIPTS IN PREPARATION

- **LengKong, T.**, et al. "Parametric Study of Damselfly Gliding: Sweep and Angle of Attack Effects on Aerodynamic Performance for Micro Aerial Vehicle Applications." Targeting *International Journal of Micro Aerial Vehicles*. First-author manuscript investigating optimal gliding configurations of damselflies through computational fluid dynamics analysis with focused applications for micro aerial vehicles.
- **LengKong, T.**, et al. "Machine Learning Prediction of Karman Vortex Street Dynamics in Bio-inspired Manta Ray Robots." Targeting *Bioinspiration & Biomimetics*. First-author manuscript applying machine learning techniques to predict vortex dynamics and optimize thrust generation for a manta ray robot.

PROFESSIONAL EXPERIENCE

Engineering Intern | One Moment Air Racing | Norfolk, VA | June - August 2024

- Performed aerodynamic force calculations for P-51 Mustang flight control systems, contributing to aircraft modifications for air racing competition
- Designed CAD models and carbon fiber components, balancing aerodynamic performance with structural requirements and weight constraints
- Analyzed mechanical systems and developed 3D-printable aircraft components for rapid prototyping; bridged theoretical aerodynamics with practical manufacturing considerations
- Gained experience accounting for material properties, fabrication methods, and real-world operational constraints in design decisions

PERSONAL PROJECTS

Autonomous VTOL Delivery Drone

- Designing and fabricating hybrid vertical takeoff and landing aircraft with 5kg payload capacity and 1.5-hour flight endurance for package delivery applications
- **Hardware Development:** Selected and integrated custom flight controller, GPS module, telemetry systems, brushless motors and ESCs, servo actuators for control surfaces, and lipo battery systems
- **Electronics Integration:** Wired and programmed Pixhawk flight controller with custom parameter tuning for hybrid VTOL flight profile; configured MAVLink telemetry for real-time vehicle state monitoring
- **Autonomous Systems:** Implemented GPS waypoint navigation and geofencing for autonomous mission execution; programmed return-to-home and automated landing sequences for flight safety
- **Real-time Monitoring:** Integrated FPV camera system with live video transmission for flight monitoring and package delivery verification
- **System Testing:** Conducted ground testing of all electronic systems and motor configurations; iterative flight testing to validate autonomous control algorithms and refine transition maneuvers

TECHNICAL SKILLS

Programming & Machine Learning

Python (NumPy, PyTorch, Matplotlib, Pandas, SciPy), MATLAB, R, C++, Fortran, Simulink; PyTorch for deep learning; MATLAB ML, Deep Learning, and Reinforcement Learning toolboxes; UVA Rivanna Supercomputer for HPC for large-scale CFD simulations and machine learning

Engineering Software & CFD

SolidWorks (CSWA Certified), Autodesk Fusion 360 (CAD + FEA), Autodesk Maya for biological system modeling and kinematic analysis; Granta EduPack for material selection; In-house CFD flow solver (Picar3D), Ansys Fluent, Converge CFD, Autodesk CFD; Tecplot 360

Electronics & Embedded Systems

Raspberry Pi, Arduino microcontrollers; Pixhawk flight controller, pressure sensor arrays, IMU integration, GPS modules; circuit design and prototyping, PCB layout, soldering and electronics assembly; pressure sensor arrays and interfacing, signal conditioning, analog-to-digital conversion, multi-channel data acquisition

Fabrication & Experimental Methods

3D printing, laser cutting, carbon fiber composites; wind tunnel testing, towing tank experiments, sensor calibration; data acquisition systems, experimental validation

AWARDS & HONORS

- **Harrison Grant** - Damselfly gliding aerodynamics and fish schooling ML research (2025)
- **Dean's Undergraduate Engineering Research Fellowship** - Damselfly backward flight research (2024)
- **QuestBridge Scholar** - Full ride undergraduate scholarship through national match program
- **Dean's List** - All semesters; academic excellence recognition for GPA of 3.4 or higher

LEADERSHIP & TEACHING

- **Teaching Assistant - Computer-Aided Design** - Holding office hours and grading for undergraduate CAD course; mentoring students through CAD fundamentals including part modeling, assemblies, and design intent
- **Teaching Assistant - Statics** - Conducting office hours and grading; helping students understand force equilibrium, free body diagrams, trusses, frames, and centroids
- **Research Mentor** - Onboarding new undergraduate researchers in Flow Simulation Research Group
- **STEM Activity Intern - Computer4Kids** - Developed STEM curricula for K-12 students from underserved communities; taught elementary students basic electronics, middle schoolers programming and game design, high schoolers robotic design