SPENCER FOLK

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EDUCATION

2019-*present*   **University of Pennsylvania**, *Ph.D. Candidate, Mechanical Engineering*   Philadelphia, PA
Advisors: Dr. Vijay Kumar, Dr. Mark Yim

2019-2022   **University of Pennsylvania**, *M.S., Robotics*   Philadelphia, PA

2015-2019   **Lafayette College**, *B.S., Mechanical Engineering*   Easton, PA
Graduated Summa Cum Laude

SKILLS

Programming and Development	Python, C++, Git, ROS, Docker, MATLAB, Mathematica
Design and Fabrication	SOLIDWORKS, Laser Cutting, 3D Printing, Soldering
Simulation and Analysis	ANSYS Fluent, ANSYS Mechanical
Communication	LaTeX, Microsoft Office, Adobe Premiere Pro

RESEARCH EXPERIENCE

2022-*present*   **Wind Estimation and Planning for Urban Air Mobility**   Mountain View, CA
Ames Research Center, National Aeronautics and Space Administration (NASA)
– Developing fast computational fluid dynamics code to rapidly generate large datasets of simulated urban winds to enable real-time wind field prediction using deep learning.
– Synthesizing receding horizon optimal control schemes that leverage local wind field predictions from deep neural networks to reduce energy consumption and crash rates by upwards of 30% for UAVs operating in windy urban environments.
– Performing analyses and experiments in support of NASA missions for safe, efficient, and sustainable aviation in urban environments.

2019-*present*   **Graduate Research on Aerial Robotics**   Philadelphia, PA
GRASP Lab, University of Pennsylvania
– Investigating state-of-the-art methods in deep learning, state estimation, and robot motion planning to enhance situational awareness of multirotor UAVs in cluttered windy environments to fly safer and more efficiently.
– Tooling classical filtering methods for online system identification of UAV aerodynamics and actuator dynamics, enabling adaptive control schemes and fault detection.
– Building and maintaining a popular aerial robotics simulator, *RotorPy*, providing an entry point for learning motion planning, state estimation, and control algorithms for aerial robots.
– Frequently managing teams of undergraduate and graduate students supporting our projects.

2019   **Undergraduate Research on Ethorobotics**   Easton, PA
Department of Mechanical Engineering, Lafayette College
– Modeled the movement of Archerfish in schooling and hunting sequences with Markov Decision Processes and stochastic differential equations.
– Replicated fish swimming on a 5-DoF robotic fish to successfully elicit specific social behaviors among Archerfish, culminating in a journal paper in *Biological Cybernetics*.

2017-2019	**Design and Fabrication of 3D-Printed UAVs**	Aberdeen, MD

United States Army Research Laboratory

- Designed, manufactured, and assembled size-scalable 3D-printed quadrotor UAVs that reduced part and fastener count by 58%, satisfying Army requirements for a mission-specific UAV available on demand within 24 hours of request.
- Developed a routine using textbook rotorcraft mechanics that appropriately sized and outfitted a quadrotor to optimize for mission parameters like range, endurance, loiter time, and payload capacity.
- Applied deep learning to identify max endurance and max range flight speeds for 3D-printed UAVs based on flight data, enabling efficient flight for aircraft accounting for often unmodeled effects like profile drag, rotor-rotor interference, and rotor-frame interference.

LEADERSHIP AND MENTORING

2020-*present* **Virtual High School Mentoring**

Polygence

- Fostering curiosity and interest in STEM among high school students by guiding them through self-motivated projects, which have included designing a gimbaled rocket, solar-powered UAV, and an aerial landmine detection system.

2020-2022 **Teaching Assistantships**

University of Pennsylvania

- Graduate courses: Advanced Robotics (600 level).
- Undergraduate courses: Control for Autonomous Robots (400 level), Vibrations (300 level), Statics and Strengths of Materials (200 level).

2021 **Vice President, Mechanical Engineering Graduate Association**

University of Pennsylvania

- Upheld a sense of community through the COVID-19 pandemic by organizing virtual events ranging from Zoom trivia nights to wellness challenges.

2018-2019 **Chapter President, Tau Beta Pi (PA-E)**

Lafayette College

- Organized chapter and community events, communicated with headquarters to maintain national standards, and represented the chapter at national and district conferences.

PUBLICATIONS

Folk, S., Melton, J., Margolis, B. W. L., Yim, M., & Kumar, V. (2025). Towards Safe and Energy-Efficient Real-Time Motion Planning in Windy Urban Environments. *International Conference on Robotics and Automation (ICRA) 2025.* [Conference]

Folk, S., Melton, J., Margolis, B. W. L., Yim, M., & Kumar, V. (2024). Learning Local Urban Wind Flow Fields from Range Sensing. *IEEE Robotics and Automation Letters.* [Journal]

Sanghvi, H., **Folk, S.**, & Taylor, C. J. (2024). OCCAM: Online Continuous Controller Adaptation with Meta-Learned Models. *Conference on Robot Learning (CoRL).* [Conference]

Zhang, H., Srikanthan, A., **Folk, S.**, Kumar, V., & Matni, N. (2024). Why change your controller when you can change your planner: Drag-aware trajectory generation for quadrotor systems. *arXiv preprint arXiv:2401.04960.* [Preprint]

Weakly, J., Li, X., Agarwal, T., Li, M., **Folk, S.**, Jiang, C., & Sung, C. (2024). Bistable Aerial Transformer: A Quadrotor Fixed-Wing Hybrid That Morphs Dynamically Via Passive Soft Mechanism. *Journal of Mechanisms and Robotics*, 16(7), 071016. [Journal]

Folk, S., Paulos, J., & Kumar, V. (2023). RotorPy: A Python-based Multirotor Simulator with Aerodynamics for Education and Research. *The Role of Robotic Simulators for Unmanned Aerial Vehicles – ICRA 2023*. [Conference Workshop]

Brown, A. A., Brown, M. F., **Folk, S. R.**, & Utter, B. A. (2021). Archerfish respond to a hunting robotic conspecific. *Biological Cybernetics*, 115(6), 585-598. [Journal]

INVITED TALKS

"Towards Safe and Efficient Real-Time Motion Planning in Windy Urban Environments"

East Coast Meetup, Dronecode Foundation, Philadelphia, PA.	March 2025
MEAM Departmental Seminar Series, University of Pennsylvania, Philadelphia, PA.	February 2025
Nikolai Matni Group, University of Pennsylvania, Philadelphia, PA.	October 2024

"Learning-Based Methods for Real-Time Wind Prediction in Urban Environments"

Intelligent Robot Motion Lab x *FAST Group*, Princeton University, Princeton, NJ.	May 2024

HONORS AND AWARDS

2019   **Graduate Assistance in Areas of National Need (GAANN) Fellowship**
University of Pennsylvania
Awarded to "graduate students of superior ability planning to pursue the highest degree in their course of study."

2019   **Karl J. Ammerman Prize**
Lafayette College
Awarded to the "most deserving student in the mechanical engineering department, as selected by the faculty of the department."