Caleb M. Harris

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EDUCATION

Georgia Institute of Technology, Atlanta, GA
  Master's of Science in Aerospace Engineering   Dec 2019
University of Memphis, Memphis, TN
  Bachelor's of Science in Mechanical Engineering   May 2017

EXPERIENCE

Georgia Institute of Technology, Atlanta, GA   August 2017 - Present
Graduate Research Assistant

- Third year graduate researcher in the Transformative Aviation Concepts division of the Aerospace Systems Design Laboratory (ASDL) under Dr. Dimitri Mavris. Completed a diverse set of projects for sponsors, internal research, and personal interest. Projects have focused on autonomous navigation of aerial robotics, multi-agent operations for search and rescue, hardware testing for aerial robotics indoor operations, deep learning and computer vision for object detection, and cost-capability and technology infusion studies for rotorcraft and eVTOL.
- Led the internal DroneX Hardware team. Conducted indoor and outdoor trajectory, control, and state estimation tasks with Pixhawk, CrazyFlie and DJI systems. Utilized Raspberry Pi and Nvidia Jetson CPUs. Tested in simulation environments including MATLAB, GAZEBO, FlightGoggles, and AirSim.

Express Drone Parts, LLC, Memphis, TN   April 2017 - August 2018
Research and Design Assistant

- Assisted in robotics division to design, test, and fly various unmanned systems for applications such as package delivery, search and rescue, and education.

KEY PROJECTS

Methods for Predicting Power Line Locations to Improve Aircraft Safety   October 2019 - Present
Sponsored by the FAA

- Utilizing satellite data, electrical grid data, and additional indicators to predict the location of power lines. Goal is to develop a wire database which the pilot or avionics suite could use to prevent wire strike accidents.

Deep Learning for UAS Navigation in a Cluttered Environment   January 2019 - Present
Special Topics Master Project

- Applying deep learning techniques for obstacle avoidance on quadcopter with a single camera. Safe paths in 2-D via A* path-planning and optimal trajectories via nonlinear Model Predictive Control. An End-to-End framework is capable of navigating cluttered environments efficiently and safely.

PyCATE: Python Environment for Rotorcraft Cost-Capability Tradeoffs August 2017 - August 2019
Sponsored by the U.S. Army Research Lab

- Developed a Python-based framework for multidisciplinary analysis and cost-capability comparison of advanced rotorcraft concepts. Integrated three tools for cost, reliability, and sizing and performance analysis.

UAS Swarm Selection for Monitoring Migrant Border Crossings   August 2017 - May 2018
Aerospace Systems Design Lab Grand Challenge

- Developed a simulation environment to conduct operations analysis on the use of UAS swarms and surface fleet assets in monitoring the Mediterranean for migrant ships. Served as Chief Engineer, in charge of outlining the structure of the Java-based code for the UAV agents using finite state machines, the swarm architectures using Reynold's flocking behaviors, and the heuristic path-planning techniques.

KnightFlyer: A Reconfigurable VTOL Aircraft   September 2017 - May 2018
AHS 35th Student Design Competition, sponsored by U.S. Army Research Lab

- Led aerodynamics, dynamics, and control team. Used CFD, Matlab, and FlightLab to investigate the dynamics and control laws of an unmanned tipjet, stopped rotor concept. Conducted sizing and off-design performance analysis using NDARC and coordinated results into a multi-disciplinary analysis environment for design comparison and optimization. Received 2nd place in the Graduate Competition for the KnightFlyer design and report.

SKILLS AND EXTRA-CURRICULAR ACTIVITIES

- Computer Skills: Python, MATLAB, VBA, C++, Java, PyTorch, TensorFlow, ROS, Linux, Git
- Certifications: FAA Part 107 Remote Pilot Certification
- Mentor Experience: AgTech Summer Youth Program - Quadcopter Design and Flight Class, STEM Tutor - University of Memphis Naval ROTC Program

KEY COURSES

- Aerospace Engineering: Linear Control, Optimal Control, Aircraft Flight Dynamics
- Computer Science and Robotics: Planning and Decision-Making for Autonomy, Adaptive Control and Reinforcement Learning, Robotics Research Intro
- Computational Science and Engineering: Machine Learning, Modeling & Simulation

PUBLICATIONS AND CONFERENCES

CONFERENCE PROCEEDINGS

- C. Harris, M. Sokollek, L. S. Nunez, J. T. Valco, M. Balchanos, and D. Mavris. "Simulation-based UAS Swarm Selection for Monitoring and Detection of Migrant Border Crossings". 2018 AIAA Conference.

TECHNICAL REPORTS:

- M. Kirby, G. Cinar, A. Harish, C. Harris, and D. Mavris. "eVTOL Sizing and Performance Study for Urban Air Mobility Applications, ASDL Contributions", *Technical Report for NASA Glenn Research Center*, (Submitted).
- J. Robinson, C. Harris, K Collins, B. Ahn. and D. Mavris. "Cost-Capability Assessment and Technology Evaluation for Future Vertical Lift Aircraft", *Technical Report for US Army Research Lab*, May. 2019.

PRESENTATIONS:

- C. Harris. "Obstacle Avoidance for UAS via Imitation Learning", Presented at Aerospace Systems Design Laboratory's Annual External Advisory Board, April 2019.
- C. Harris, and M. Sokollek. "UAS Swarm Selection for Monitoring and Detection of Migrant Border Crossings", Presented at Aerospace Systems Design Laboratory's Annual External Advisory Board, April 2018.
- C. Harris. "Diffuser Optimization for Harnessing Hydrokinetic Energy", Presented at Posters at the Capital, Tennessee State Capitol, March 2017.
- C Harris, D MacPhee, M Carlisle. "Aerodynamic Analysis of Morphing Blades", Poster Presentation at 69th Annual Meeting of the APS Division of Fluid Dynamics, November 2016.