V. Hunter Adams

LAST UPDATED 12/29/2024

Personal Website

Please see Hunter's website for documentation of everything he's done and built since 2015.

Education

Cornell University
BA, Physics — August 2011 - December 2014
MS, Aerospace Engineering — January 2015 - June 2017
PhD, Aerospace Engineering, Advised by Mason Peck — June 2017-December 2019

Research and Professional Experience

Lecturer, Cornell University — January 2020 - Present

Electrical and Computer Engineering

ECE 4760: Digital Systems Design with Microcontrollers: This is a project-based laboratory class focused on bare-metal microcontroller programming and prototyping. The course includes three guided laboratory assignments and concludes with a four-week independent design project. My professional responsibilities include assembling and delivering all lectures, designing all laboratory assignments, and designing/debugging electronics and embedded C programs in the laboratory with the students. Through this class, I have advised **119 student projects**.

- Course webpage
- Course demo code (>200 stars on GitHub)
- Course lectures (>150,000 views on YouTube)
- Student projects from 2022-present.
- Student projects from 2021

ECE 5760: Advanced Microcontroller Design and System-On-Chip: This too is a project-based laboratory class for which I have the same set of professional responsibilities as ECE 4760, but based on FPGA's rather than microcontrollers. Through this class, I have advised **58 student projects**.

- Course webpage
- Course lectures (>47,000 views on YouTube)
- Student projects from 2020-present

ECE 4920: ECE Technical Writing: I help students write magazine and journal articles about their projects from my two design courses. Since 2022, I've gotten **27 student-written articles published from 66 student-authors**, **two of which were cover articles**.

- Course webpage
- Published student articles

Mechanical and Aerospace Engineering

MAE 4160/5160: Spacecraft Technology and Systems Architecture (Spring, 2020): This course offers a survey of contemporary space technology from subsystems through launch and mission operations, all in the context of spacecraft and mission design. The course is modeled off the NASA Systems Engineering Handbook.

- Course materials

Monarch Chip-Satellites — January 2015 - July 2020

PhD Candidate

- I designed, built, debugged, and tested gram-scale spacecraft called "chipsats."
- Gained competence in embedded systems programming, electronics prototyping, printed circuit board design/assembly, and channel coding
- Performed Earth-science experiments with these chipsats in collaboration with plant scientists and veterinarians at Cornell. I deployed chipsats on the surface of the Earth (in vineyards and dairy farms) where they gathered environmental data. I then used these datasets to substantiate claims that chipsats will be good tools for conducting similar experiments on other planets and celestial bodies.

Cosmoptera, Inc. — January 2019 - July 2020

Co-Founder and CEO

- Co-founded a company with my PhD advisor, Mason Peck, to commercialize the Monarch Chip-Satellites that I developed during my PhD.

- Deployed 20 chipsats at Cornell's research vineyard in Lansing, NY to perform distributed environmental sensing. Successfully gathered five weeks of environmental data.
- Deployed 10 Monarchs onto dairy calves at Sunnyside Farms in Scipio Center, NY to monitor activity levels.
- Closed the company to accept my current lecturing position in the Electrical and Computer Engineering department at Cornell.

Violet Satellite Project   February 2013 - January 2015
Program Manager
- Managed a team of 30 engineers constructing a high-agility satellite, and acted as liaison to project sponsors at the Air Force Research Laboratory.
- The spacecraft project ("Violet") was part of the University Nanosat Program.
- The faculty advisor for the project was Mason Peck, who later became my PhD advisor.

SpaceX   June 2014 - August 2014
Dragon Development Intern
- Wrote a de-orbit simulation in Python to support Dragon re-entry.
- Designed and built a rig that simulated the environmental conditions to which Dragon propulsive components would be exposed after a water landing. The rig was used to perform corrosion tests on components from the Dragon capsule to determine reusability for subsequent missions.

Cornell Laboratory for Elementary Particle Physics   May 2012 - September 2013
Research Assistant
- Wrote software in C++/Python to analyze data from the Compact Muon Solenoid particle detector at the European Institute for Nuclear Research (CERN).

Publications

- Probabilistic Packet Transmission Through a Limited-lifetime Deletion Channel with Arbitrary Deletion Probability. [first author] EngrXiv. 2020.
- Theory and Applications of Gram Scale Spacecraft. PhD Dissertation. 2020.
- R-Selected Spacecraft. [first author] AIAA Journal of Spacecraft and Rockets. 2020.
- A Scalable Packet Routing Mechanism for Chip-Satellites in Coplanar Orbits. [first author] IEEE Transactions on Aerospace and Electronic Systems. 2020.
- A Probabilistic Network Formulation for Satellite Swarm Communications. [first author] AIAA Guidance, Navigation, and Control Conference. 2018.
- Interplanetary Optical Navigation. [first author] AIAA Guidance, Navigation, and Control Conference. 2016.
- Lost in Space and Time. [first author] AIAA Guidance, Navigation, and Control Conference. 2017.
- Data Prognostics Using Symbolic Regression. [first author] EngrXiv. 2015.

Teaching Experience

Lecturer (Cornell University)
- ECE 4760, Digital Systems Design with Microcontrollers, spring 2021-present
- ECE 5760, Advanced Microcontroller Design and System-On-Chip, fall 2020-present
- ECE 4920, Technical Writing, fall 2021-present
- MAE 4160, Spacecraft Technology and Systems Architecture, spring 2020

Guest Lectures (Cornell University)
- ENGRG 1050, Enginering Seminar, Oct. 16 2023, "Love letter to embedded systems"
- MAE 6530, Space Exploration Engineering, fall 2023, "R-selected Spacecraft"
- MAE 4220, Introduction to IoT, spring 2022, 2023, 2024, "Power management in IoT systems"
- MAE 4220, Introduction to IoT, spring 2021, 2022, 2023, 2024 "Electrical/mechanical engineering in IoT systems"
- GOVT 3042, The Politics of Technology, spring 2020, "Chipsats and spacecraft politics"
- ECE 6680, Bio-inspired Coordination of Multi-Agent Systems, spring 2020, "Chipsats: swarms in space"
- MAE 4060, Introduction to Spaceflight Mechanics, fall 2019, "Attitude Sensing Technologies"
- MAE 3780, Mechatronics, fall 2019, "C for folks that prefer Matlab"
- MAE 4060, Introduction to Spaceflight Mechanics, fall 2019, "Orbit and Constellation Design"
- NBA 5070, Entrepreneurship for Scientists and Engineers, fall 2019, "Customer Discovery"
- NBA 5640, Entrepreneurship & Business Ownership, spring 2018, "Monarchs for vineyard monitoring"
- MAE 6060, Spacecraft Attitude Dynamics, Control, & Estimation, spring 2018, "Estimation methods"

Teaching Assistant (Cornell University)
- MAE 3780, Mechatronics, fall 2019 (Lab TA)
- MAE 4160, Spacecraft Technology and Systems Architecture, spring 2019 (TA)
- MAE 6060, Spacecraft Attitude Dynamics, Control, and Estimation, spring 2018 (TA)
- ASTRO 1104, Our Solar System, spring 2017 (TA)
- MAE 3260, System Dynamics, spring 2016 (Lab TA)

OUTREACH AND STUDENT ENGAGEMENT

Student Project Advisor   January 2018 - Present
- Through ECE 4760, I have advised 119 student projects.
- Through ECE 5760, I have advised 58 student projects.
- I have graduated 45 MEng students across 33 projects. These include collaborative projects with 7 departments at Cornell and 4 outside companies/organizations.
- I have 15 active MEng students across an additional 10 projects.
- I advise four student project teams, one of which I co-founded with Chris Batten (CUAUV, AutoBike, AutoBoat, and C2S2).
- I am faculty advisor to the Cornell Maker Club, with Joe Skovira.
- I have advised a handful of independent study projects, one of which was covered by CNN.

Syracuse Museum of Science and Technology   October 5, 2024
- Presented to public audience about space exploration before a presentation of an IMAX movie in which I am featured.

Public Works Talk   April 5, 2023
- Public presentation about my gram-scale spacecraft research.

New Zealand Chipsat Workshop and Hackathon   March 16 - March 17, 2019
- Developed a version of the Monarch chipsat that was capable of interfacing with new sensors.
- Developed a series of tutorials for using that chipsat, and put together development kits for a hackathon hosted at the University of Auckland.

NYC Maker Faire   September 23 - September 24, 2017
- Co-hosted a chip-satellite booth at the NYC Maker Faire.
- Developed spacecraft hacker kits for Maker Faire visitors to use at the event and at home.

Intrepid Museum   July 17, 2016
- Co-hosted a chip-satellite booth at the Intrepid Sea, Air & Space Museum.

FELLOWSHIPS AND GRANTS
- Cornell Scale-Up and Prototyping Award, 2019
- National Science Foundation Innovation Corps Fellowship, 2018
- Cornell Commercialization Fellowship, 2018
- New York Space Grant, 2017

HONORS AND AWARDS
- Canaan Family Award for Excellence in Academic Advising, 2022
- Robert '55 and Vanne '57 Cowie Teaching Award, 2023
- Best Presentation in Session, 2017 AIAA SciTech conference
- Best Presentation in Session, 2016 AIAA SciTech conference

INVITED TALKS
- "Spacecraft for vineyard monitoring." Cornell University Robotics Seminar, 28 April 2020, Zoom, Ithaca, NY.
- "Science of Cosmos: Seven Wonders of the New World." Carl Sagan Institute Science of Cosmos web series, 20 April 2020. Remotely recorded and available at https://www.youtube.com/watch?v=83gtXl5m8Ao
- "Tales of Commercialization." Cornell entrepreneurship event, 6 February 2020, Upson Hall, Ithaca, NY.
- "Monarchs for vineyard monitoring." Technology and business mixer, 3 September 2019, Big Red Barn, Ithaca, NY.
- "Customer Discovery Lessons Learned." Rev hardware accelerator program, 6 June 2019, Rev Ithaca Startup Works, Ithaca, NY.

- "Distributed vineyard sensing with Monarchs." Rev Hardware Heroes January Networking Night, 30 January, 2019, Rev Ithaca Startup Works, Ithaca, NY.
- "Space Exploration with Chip-Satellites." Carl Sagan Institute Coffee Hour, 13 December 2018, Upson Hall, Ithaca, NY.
- "Monarch Customer Discovery." Cornell commercialization fellows reception, 13 December 2018, Upson Hall, Ithaca, NY.
- "Monarchs: Lab to Customer." Technology Entrepreneurship at Cornell mixer, 5 December 2018, Upson Hall, Ithaca, NY.
- "Customer Discovery Lessons Learned." High Value Talent Retreat, 26 October 2018, Remote.
- "Monarchs for digital agriculture." Cornell Engineering College Council annual dinner, 25 October 2018, Lab or Ornithology, Ithaca, NY.
- "History, State of the Art, and Future of Gram-Scale Spacecraft." Breakthrough Femtosatellite Workshop, 29 September 2018, Grand Hotel, Bremen, Germany.
- "Monarch Chip-Satellites." Cornell Multi-Robot Symposium, 14 March 2018, Upson Hall, Ithaca, NY.

CONFERENCE TALKS

- "Distributed, In-Canopy Environmental Sensing with Monarchs." Nelson J. Shaulis Digital Viticulture Symposium, 17 July 2019, Anthony Road Winery, Penn Yann NY.
- "A Probabilistic Network Formulation for Satellite Swarm Communications." AIAA SciTech, 9 January 2018, Gaylord Palms, Kissimmee, FL.
- "Lost in Space and Time." AIAA SciTech, 5 January 2017, Gaylord Texan Hotel, Grapevine, TX.
- "Interplanetary Optical Navigation." AIAA SciTech, 8 January 2016, Manchester Grand Hyatt, San Diego, CA.

INVITED WORKSHOPS

- Starshot Communications Workshop, 8-9 May 2020, Zoom.
- Breakthrough Femtosatellite Workshop, 29 September 2018, Grand Hotel, Bremen, Germany.

COMMITTEES

- Masters of Engineering Committee, Cornell ECE. December 2023-present.
- Cornell Project Team Taskforce. Feb. 2021-present.
- Commercialization Fellowship Advisory Committee.

THINGS I'VE BUILT

RP2040 (Raspberry Pi Pico) projects
- GATT server on Pi Pico W
- GATT client on Pi Pico W
- Digital Galton Board on RP2040 (written up as lab assignment)
- Custom serial bootloader for the RP2040
- Worm-like serial bootloader
- CAN driver implemented with PIO on RP2040
- Non-blocking UDP transmitter using PIO on RP2040
- AM radio voice transmission with PWM on RP2040
- Birdsong synthesizer implemented on RP2040 (written up as lab assignment)
- Stepper motor driver written in PIO assembly for RP2040
- VGA driver written in PIO assembly for RP2040
- Decision making in animal groups on the move (written up as lab assignment)
- PID control of an inverted pendulum with a reaction wheel (written up as a lab assignment)
- Cricket chirp synthesis and synchronization with RP2040 (written up as lab assignment)
- Animating Boids and a predator with RP2040 (written up as a lab assignment)
- Realtime Audio FFT to VGA Display with RP2040
- Resistive touchscreen to VGA display with RP2040
- PID control of 1D helicopter with RP2040 (written up as lab assignment)

PIC32 microcontroller projects
- Enigma machine emulated on PIC32
- Boids algorithm on PIC32 (written up as a lab assignment)
- Realtime audio spectrogram on PIC32 (written up as a lab assignment)
- Zoom-interactive robot on PIC32 (written up as a lab assignment)
- Particle systems on PIC32

DE1-SoC FPGA projects

- Lattice-Boltzmann accelerator and visualizer
- Multiprocessor drum synthesizer on the DE1-SoC
- Verilog VGA driver for the DE1-SoC
- GFSK demodulation in Verilog on the DE1-SoC
- Mandelbrot visualizer on the DE1-SoC
- Lorenz system solver/visualizer on DE1-SoC (written up as a lab assignment)

CC1310 microcontroller projects

- Monarch chip-satellite

Raspberry Pi projects

- GFSK demodulator on Raspberry Pi for use with CC1310 microcontroller

Mathematical projects

- Picasso, by way of Fourier
- Attempting to understand something beautiful
- Bayesian approach to analyzing differences in proportions