BRADEN K. OH

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ACADEMIC HISTORY

- **University of Michigan** - Ph.D. Pre-candidate, Aerospace Engineering
- **Olin College of Engineering** - B.S. Engineering: Physics (2023); GPA: 3.95/4.0
- **La Canada High School** - High School Diploma (2017); GPA: 4.61/4.0

RESEARCH EXPERIENCE

Plasmadynamics & Electric Propulsion Laboratory, Ph.D. Student — Aug 2023-present
Electric propulsion research laboratory at University of Michigan

- Developing ultra-high power density Hall effect thrusters running on condensing propellants and support infrastructure to facilitate high mass flow rate thruster testing.

Olin Satellite + Spectrum Technology & Policy Group, Research Team Lead — Aug 2020-present
Satellite systems and telecommunications research laboratory

- Wrote MATLAB-based tool for evaluating megaconstellation compliance with FCC interference regulations by performing dynamic interference-to-noise (I/N) calculations.
- Wrote radiation mitigation plan and shielding requirements for the multi-university SWARM-EX CubeSat by building radiation environment model and performing total ionizing dose analysis.
- Collaborated with NASA experts to develop the first framework for estimating single event effect (SEE) rates in CubeSats and published the framework at the Small Satellite Conference.
- Secured in-kind donation of wire harnessing components from Glenair Inc., designed spacecraft interconnect harness, and wrote accompanying system diagrams.
- Wrote Python tool with GUI to calculate link budget and power flux density of orbital spacecraft transmitters.
- Conceived, manufactured, and experimentally tested a novel method for affixing deployable CubeSat solar panels without fasteners.
- Verified OneWeb's constellation compliance with FCC regulations by performing static I/N calculations and co-authored a paper reporting the findings.
- Delivered orbital debris assessment report and accompanying NASA DAS re-entry simulation for SWARM-EX.

Olin Plasma Engineering Laboratory, Principal Investigator — 2018-2023
Self-directed undergraduate team developing Hall thrusters and heaterless cathodes

- Founded and led undergraduate research group.
- Lead-authored award-winning paper published by ASEE in 2020 and follow-on paper presented at the International Electric Propulsion Conference in 2022.
- Secured funding, academic, and laboratory resources from NASA, MIT, Busek Co., Draper Labs, C. Lal Alloys, the Massachusetts Space Grant, and the Babson Olin Wellesley (BOW) Consortium.
- Wrote institutionally-approved project curriculums to engage students from other institutions.
- Fabricated hardware by hand in Olin College machine shop and materials science labs.
- **Heaterless Cathodes (2022-23 academic year)**
  - Assembled a team of 7 students from Olin, Wellesley, Brandeis, and the University of Virginia.
  - Designed and manufactured a turbopump based high-vacuum chamber for cathode testing.
  - Secured funding from Draper Labs and the Massachusetts Space Grant.
  - Coordinated literature review and design/manufacturing activities.
  - Currently designing and manufacturing a heaterless cathode prototype.
- **50mm Electromagnet Hall Thruster (2021-22 academic year)**
  - Assembled a team of 6 students from Olin, Wellesley, and Brandeis University.
  - Secured a BOW Presidential Innovation Grant to fully fund thruster development.
  - Designed and manufactured a 300W Hall effect thruster.
  - Developed and patented a novel 3D printed propellant diffuser.
  - Performed live-fire tests at the MIT Space Propulsion Lab in May 2022.
- **19.5mm Permanent Magnet Hall Thruster (Fall 2018)**
  - Founded a team of 4 Olin College students and faculty advisor.
  - Created all CAD models and manufacturing diagrams.
  - Manufactured cathode and Boron Nitride components in Olin's machine shop.

PEER REVIEWED PUBLICATIONS

- **Design, Fabrication, and Testing of an Undergraduate Hall Effect Thruster**
  – Journal of Electric Propulsion, *lead author*, 2023. [Open Access]
  – Unreviewed version presented at the 37th International Electric Propulsion Conference (IEPC), 2022.
- **Undergraduate Demonstration of a Hall Effect Thruster: Self-Directed Learning in an Advanced Project Context**
  – American Society of Engineering Education Annual Conference Proceedings, *lead author*, 2020. [Open Access]
  – Earned the Aerospace Division Distinguished Student Paper Award.

OTHER PUBLICATIONS

- **(Accepted) Initial Testing of a 3D Printed Azimuthal Gas Diffuser for Hall Thrusters**
  – Proceedings of the AIAA SciTech Forum and Exposition, 2024.
- **The Current and Future State of Non-Geostationary Orbit (NGSO) Fixed-Satellite Service (FSS) Interference Regulation Metrics**
  – AIAA ASCEND, 2023. [AIAA ARC]
- **Interference-to-Noise (I/N) Compliance Validation of Telesat, OneWeb and SpaceX's 2020 Ka-Band NGSO FCC Processing Round Applications**
  – Proceedings of the AIAA SciTech Forum and Exposition, 2023. [AIAA ARC]
- **CubeSat Radiation Hardness Assurance Beyond Total Dose: Evaluating Single Event Effects**
  – Proceedings of the AIAA/USU Small Satellite Conference (SSC), *lead author*, 2022. [Open Access]
- **Coordinating Development of the SWARM-EX CubeSat Swarm Across Multiple Institutions**
  – Proceedings of the AIAA/USU Small Satellite Conference (SSC), *second author*, 2021. [Open Access]

CONFERENCE PRESENTATIONS

- **2023 American Physical Society (APS) Division of Plasma Physics**
  – Spectral Characterization of an Educational Hall Effect Thruster, *poster*, 2023.
- **2023 Draper Research Symposium**
  – Developing a Low Cost Plasma Thruster, *oral and poster*, 2023.
- **2023 AIAA SciTech Forum**
  – Interference-to-Noise (I/N) Compliance Validation of Telesat, OneWeb and SpaceX's 2020 Ka-Band NGSO FCC Processing Round Applications, *oral*, 2023.
- **35th AIAA/USU Small Satellite Conference (SSC)**
  – CubeSat Radiation Hardness Assurance Beyond Total Dose: Evaluating Single Event Effects, *poster*, 2022.
- **37th International Electric Propulsion Conference (IEPC)**
  – Design, Fabrication, and Testing of an Undergraduate Hall Effect Thruster, *oral*, 2022.
- **2022 CubeSat Developers Workshop (CDW)**
  – 3U CubeSat Hinge Design and Analysis for Dual Deployable Solar Panels, *poster*.
  – Analysis of Single Event Effects in Small Satellites, *poster*.

PATENTS

- **Additively Manufactured, Azimuthal Gas Diffuser for Hall Thrusters**
  – US Provisional Patent Application No. 63/340566, filed May 11, 2022.

AWARDS & SCHOLARSHIPS

- **NSF Graduate Research Fellowship** — Five-year graduate funding fellowship awarded on demonstrated potential for significant research achievements in STEM. Awarded in 2023.
- **Draper Labs Top Senior Capstone** — Draper Labs Research Symposium, 2023.
- **Babson College Foundry Fellow** — Incubator-like funding award from the Babson Weissman Foundry, 2023.
- **Co-Chair, SIGBOVIK 2022** — Co-chair of Carnegie Melon University's SIGBOVIK conference. Held online, April 2022.
- **Massachusetts Space Grant Undergraduate Research Awards** — Funding awards for 2021 and 2022.
- **BOW Consortium Presidential Innovation Grant** — Funding grant awarded by the Babson-Olin-Wellesley College Consortium for the 2021-22 Hall thruster research project.
- **ASEE 2020 Aerospace Division Distinguished Student Paper Award** — ASEE, 2020
- **Olin Scholarship** — Half-tuition merit scholarship awarded by Olin College in 2017.
- **BSA Eagle Scout** - Awarded by the Boy Scouts of America, 2012

SOCIETIES & ASSOCIATIONS

- *Member,* **Electric Rocket Propulsion Society** — 2022-present.

- *Student Member,* **American Association of Aeronautics and Astronautics (AIAA)** — 2021-present.
- *Principal Investigator,* **Olin Plasma Engineering & Electric Propulsion Lab** — 2021-2023.
- *Student Researcher,* **Olin Satellite + Spectrum Technology & Policy Group** — 2021-2023.
- *Founding Member,* **Olin Rocketry** — 2017-2021.

WORK & ACADEMIC EXPERIENCE

Blue Origin / Honeybee Robotics, Blue Alchemist R&D Intern — Summer 2023
Research and development internship advancing lunar resource utilization

- Performed fundamental experimental research for Blue Alchemist, an end-to-end, in-situ resource utilization (ISRU) system that extracts oxygen, iron, silicon, and aluminum from lunar regolith to produce solar cells.
- Conducted chemical and metallurgical experiments to create novel technique for silicon extraction and purification.
- Built automated temperature control and data acquisition systems for ultra-high temperature furnace.
- Performed scanning electron microscope (SEM) and spectroscopic studies of ISRU extraction products.

Blue Origin, Student Engineering Team Subject Lead — Sep 2022-May 2023
Olin College senior capstone team developing rocket assembly tools for Blue Origin

- Designing lift and transport system to assist technicians moving heavy batteries to laboratory and installation locations.
- Performing analyses to drive system requirements, such as high-torque motor requirements.

Busek Co. Inc., Electric Propulsion R&D Intern — May 2022-March 2023
Hall effect thruster and cathode plasma source research and development internship

- Studied principles of hollow, inductively coupled plasma, and electron cyclotron resonance cathodes.
- Coordinated partnership with Olin College materials science laboratory for testing and consulting.
- Conducted live-fire Hall thruster and cathode testing and operated high-vacuum chambers.
- Assisted mechanical design of laboratory model cathodes by designing hardware, drafting manufacturing drawings, and assembling manufactured hardware.
- Designed and conducted material experiment to investigate root cause of thruster hardware failure.
- Assisted acquisition of high-resolution handheld 3D scanner by conducting purchasing, acquisition, and training activities for COTS systems.
- Collected 3D scan data of channel wall erosion in thrusters subject to lifetime testing.

Olin College, Course Assistant — Jan 2022-present
Teaching assistant for core academic classes

- **Thermodynamics & Transport Phenomena:** Lead weekly recitation-style support sessions outside of scheduled class time to assist students in problem sets, projects, and exams.
- **Astronomy & Statistics:** Created a structured project and lecture to teach Monte Carlo simulation of spacecraft radiation effects; support students through the process of literature reviews, technical writing, and computational data processing and interpretation in small group settings during and outside of class periods.

NASA Jet Propulsion Laboratory — Summers 2017 & 2018
Systems engineering internships on robotic NASA flagship missions to Mars and Europa

- **Mars 2020/Perseverance Entry Descent & Landing Intern (2018)**
  – Wrote and performed flight software system V&V procedures in a flight system hardware testbed.
  – Developed automation capabilities for Entry, Descent, and Landing (EDL) simulation engines.
  – Delivered Python scripts to perform autonomous state configuration of a simulated spacecraft and documentation for all source code, in addition to software test procedure and anomaly report.
- **Europa Fault Protection Intern (2017)**
  – Wrote JavaScript based interactive data visualization software to aid in fault tree analysis (FTA).
  – Analyzed the use of SysML as a tool to model spacecraft fault protection systems.
  – Wrote high-level FTA templates used by Europa Clipper, Europa Lander, and Psyche missions.
  – Delivered SysML training document and cost/benefit analysis, standalone visualizer application and source code, and Excel FTA templates for four mission phases.

NASA CubeQuest Challenge, Team Lead & Systems Engineer — 2014-2017
Centennial Challenge program commissioning teams to build CubeSats capable of achieving lunar orbit

- Founded and led a team of ∼40 high school students from across the country.
- Secured ∼$650,000 of in-kind support and eventual merger with MIT team.
- Lead-authored a technical design document package submitted to first CubeQuest tournament.
- Trade-studied COTS CubeSat propulsion and optical communication technologies and led subsystem design teams.
- Coordinated product acquisition and shipping efforts for crowdfunding campaign.

SKILLS & CERTIFICATIONS

Laboratory	Scanning electron microscope; induction furnaces; vacuum chamber design and operation; live cathode, Hall thruster, and ECR device testing; analog instrumentation, including calibration curves.
Software	Python; MATLAB; STK (L1 Certification); LTspice; LaTeX; NASA DAS; TRAD OMERE.
Fabrication	Rapid prototyping w/ laser cutter and FDM/SLA/DMLS 3D printers; basic machine shop and sheet metal tools; manual & CNC mill; manual & CNC plasma cutting; MIG welding; brazing.
CAD	Fusion 360 CAD/CAM, Solidworks, KiCAD (PCB design), Autodesk Inventor Certified User.
Certifications	FCC ham radio General license (2022); STK L1 (2021); LDS Bishop's Storehouse system certification for forklift operation (2020); NASA JPL certifications for radiation (2018) and ESD environments (2017).

NOTABLE SELF-DIRECTED PROJECTS

White papers and/or video clips available at *vaguesalutations.github.io*

- **Estimating the Probability That the Explosion of an Ink Sphere Produces a Dictionary**
  – Developed a computational approach for evaluating enormous factorials with mathematicians at Texas A&M and Brigham Young Universities to establish the first estimate for the probability of an explosion printing a dictionary. Published by Olin College Frankly Speaking, November 2022. [Article]
- **Solving Double Execution of Java's paint() Method by Counting to the Heat Death of the Universe**
  – Led 20-author collaboration to publish methods for counting down to the heat death of the universe in 36 computer languages at Carnegie Mellon University's SIGBOVIK conference, April 2022. [Proceedings] [PDF]
- **Cat Toy Laser-based Free Space Optical Communications Link**
  – Designed analog transmitter and receiver circuits for extracting binary data encoded in an amplitude-modulated pet store laser and wrote supporting waveform encoder/decoder scripts in Python.
- **Free-falling RC Car Attitude Control System**
  – Developed PID control system for a RC car that used quad-copter motors to spin 3D-printed reaction wheels during free fall, enabling the car to land flat on its wheels.
- **Carbon Fiber Rocket Body Tube Winder**
  – Built power and command bus for a carbon fiber filament tube winder and manufactured ∼30g tubes with diametric compressive yield strengths exceeding 5.5 MPa.