JOSHUA ECKELS

PhD Student in Aerospace Engineering

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EXPERIENCE

Electric Propulsion & Machine Learning Intern

NASA Jet Propulsion Laboratory

06/2025 – 08/2025 Pasadena, CA, USA

- Designed and deployed a novel machine learning algorithm to accelerate physics solvers (~20% faster).
- Upgraded and automated a 2D CFD codebase for simulation of Hall thruster plasma physics.

Electric Propulsion Modeling & Simulation Intern

NASA Glenn Research Center

06/2024 – 09/2024 Cleveland, OH, USA

- Implemented and deployed efficient reduced particle-in-cell model of thruster plume and spacecraft erosion.
- Developed algorithm for detection of transient start-up arcing in vacuum chamber propulsion testing.

High-Voltage Firmware Validation Intern

Tesla

06/2021 – 09/2021 Palo Alto, CA, USA

- Developed Python automation framework to validate high-voltage battery firmware and system integration (>20 scripts, 200 hrs testing over 5 vehicle platforms).

Ultrasonics R&D Engineering Intern

Los Alamos National Laboratory

06/2020 – 08/2020 Los Alamos, NM, USA

- Constructed a novel and efficient (10x speedup) processing method for ultrasonic defect detection based on convolutional neural networks.
- Automated FEA, deep-learning, data analysis pipeline.

EDUCATION

PhD Aerospace Engineering

University of Michigan (4.0 GPA)

08/2021 – 12/2026 Ann Arbor, MI, USA

- Thesis: *Model error and uncertainty quantification in electric propulsion and plasma systems*

BS Mechanical Engineering

Rose-Hulman Inst Tech (4.0 GPA)

08/2017 – 05/2021 Terre Haute, IN, USA

TECHNICAL SKILLS

	(years)
Python	7+
numpy, scipy, pytorch, etc.	
Open-source	7+
linux, vcs, ci/cd, etc.	
Scientific computing	6
hpc, mpi, slurm, etc.	
Other languages	5
fortran, c, c++, js, java	
Finite-element	4
cfd, ansys, plasmas, etc.	
Fabrication	2
cnc, laser cutting, etc.	

AWARDS

NSTGRO fellowship, 2023
NASA space technology award

R&D100 award, 2022
Los Alamos patented technology

Heminway prize, 2019
Academic award for top of class

RESEARCH INTERESTS

Electric propulsion, predictive models for design, test, and optimization of Hall thrusters

Plasma physics, accelerating kinetic particle-in-cell methods for low-temperature plasmas

Reduced-order modeling, data-driven methods for accelerating complex models

Uncertainty quantification, Bayesian methods for model validation, sensitivity analysis, and experimental design

SELECTED PUBLICATIONS

T. Marks, **J. Eckels** et al, Uncertainty quantification of a multi-component Hall thruster model at varying facility pressures.
2025 Journal of Applied Physics

J. Eckels et al, Hall thruster model improvement by multidisciplinary uncertainty quantification.
2024 Journal of Electric Propulsion

J. Eckels et al, Predicting local material thickness from steady-state ultrasonic wavefield measurements using a convolutional neural network.
2022 Ultrasonics

CONFERENCE PRESENTATIONS

Data-driven acceleration of Hall thruster simulations with a sliding-window method.
2025 39th Int Electric Propulsion Conf

Dynamic mode decomposition for particle-in-cell simulations of a Hall thruster and plume.
2024 38th Int Electric Propulsion Conf

Optimal experimental design to learn reduced-fidelity models for porous electrosprays.
2023 AIAA SciTech Forum

Simulation-based surrogate methodology of electric field for electrospray emitter geometry design and uncertainty quantification.
2022 37th Int Electric Propulsion Conf

Application of a U-net convolutional neural network to ultrasonic wavefield measurements for defect characterization.
2021 39th Int Modal Analysis Conf

OPEN-SOURCE CONTRIBUTIONS

Adaptive Multi-Index Stochastic Collocation
2025 eckelsjd/amisc
- Ground-up implementation of an efficient, multidisciplinary surrogate method using sparse grids.

Hall Thruster Predictive Modeling
2024 JANUS-Institute/HallThrusterPEM
- Ground-up implementation of a predictive engineering model for a Hall thruster.

Uncertainty Quantification Utilities
2024 eckelsjd/uqtils
- Ground-up implementation of useful tools for uncertainty quantification and Bayesian methods.

Template for Python Scientific Computing
2023 eckelsjd/copier-numpy
- Customizable template for Python scientific computing numpy-based projects.

1D Fluid Simulation of a Hall Thruster
2023 UM-PEPL/Hallthruster.jl
- Small code contributions and extensive stress testing and automation of built-in modules.