NICK LAFARGE

Astrodynamics Researcher | Software Engineer

CONTACT

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nick-lafarge

Nicholas-Lafarge

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SUMMARY

- Ph.D. candidate in aerospace engineering seeking full time employment starting May 2023.
- Diverse skills in astrodynamics, autonomy, machine learning, GN&C, and low-thrust systems.
- Experienced software engineer, passion for numerical methods.
- Creative problem-solver; proven collaboration and leadership skills

DISTINCTIONS

NASA Space Technology Research Fellowship (NSTRF/NSTGRO)

Proposal selected in 2019 to support Ph.D. studies (4 years).

NASA Pathways Intern Award

Awarded for excellent performance as a Pathways intern at Johnson Space Center (2018).

EXPERTISE

Astrodynamics

Software Engineering

Numerical Analysis

Machine Learning

Spacecraft GN&C

EDUCATION

Ph.D. - Aeronautics & Astronautics Engineering — **Exp. May 2023**
Purdue University - West Lafayette (IN)

- NASA Space Technology Research Fellow (NSTRF/NSTGRO). **GPA: 4.0**
- Major area: Astrodynamics, Advisor: Prof. Kathleen Howell

Research title: *"Reinforcement Learning Approaches for Autonomous Guidance and Control in a Low-Thrust, Multi-Body Dynamical Environment"*

M.S. - Aeronautics & Astronautics Engineering — **May 2020**
Purdue University - West Lafayette (IN)

- Major area: Astrodynamics, Advisor: Prof. Kathleen Howell, GPA: 3.74.

B.A. - Mathematics (Computational) and Japanese — **May 2014**
University of Colorado Boulder - Boulder (CO)

- Minor in computer science, academic year (2011-12) in Osaka, Japan.

WORK EXPERIENCE

Graduate Pathways Intern — **2018 - Present**
NASA Johnson Space Center, Houston (TX)

GN&C Autonomous Flight Systems Branch (three 10-17 week tours)

- Developed prototype flight software supporting onboard relative navigation. Integrated component into onboard Kalman filter simulation.
- Implemented a distributed optimization library in Julia for LIDAR retroreflector pattern generation for Orion rendezvous and docking.
- Collaborated with Orion flight software team in investigating anomalous trajectory targeting behavior at entry interface for Artemis 1.

Flight Path Control Intern — **Summer 2017**
NASA Jet Propulsion Laboratory, Pasadena (CA)

- Developed an automated trajectory design tool for multi-body orbits and introduced a novel tree partitioning approach for Poincaré maps.
- Supported MONTE software development for mission design.

Founder / Software Engineer — **2015 - 2017**
TookTech LLC, Boulder (CO)

- Lead Android application development for OpenSnow, helping them surpass 20,000 active Android users.
- Supported client needs and business growth via creative custom software solutions within an allocated budget.

Software Engineer — **2014 - 2016**
Amadeus Consulting, Boulder (CO)

- Built custom software for numerous clients in Python and Java
- Engineered data science solutions for Google and VidVita, supporting web scraping, data processing, and data analytics tools.

PROGRAMMING

Python	Expert
MATLAB	Advanced
Java	Advanced
Julia	Intermediate
C++	Beginner

LANGUAGES

English	Native
Japanese	Intermediate
Spanish	Beginner
Latvian	Beginner

ACTIVITIES

Journal Peer Reviewer

2020, 2022

Reviewed for Acta Astronautica and the Journal of Spacecraft and Rockets

Conference Session Chair

2022 AIAA SciTech Forum

Session: AI and Machine Learning for Astrodynamics

Private Pilot License

2016

Airplane Single Engine Land

CO/WY Japanese Speech Contest

2013

Fist place in highest category for non-native speakers

RESEARCH EXPERIENCE

Graduate Researcher — **2016–Present**
Purdue University, West Lafayette (IN)

- Introduced novel onboard guidance and control techniques for low-thrust spacecraft under multi-body dynamics via machine learning.
- Researched low-thrust trajectory design for libration point orbits.
- Managed a multi-year, inter-university engineering research project.
- Presented research at four international conferences.

Visiting Technologist (NSTRF/NSTGRO) — **2020-2022**
NASA Goddard Space Flight Center, Greenbelt (MD)

Collaborated with the Navigation and Mission Design Branch (three tours)

- Consulted with mission designer engineers to apply research in higher-fidelity simulation in a mission recovery scenario (*Summer 2022*).
- Spearheaded investigation into autonomous low-thrust maneuver planning for multi-body orbit stationkeeping (*Winter 2020-21*).
- Lead research team in evaluating reinforcement learning efficacy for low-thrust guidance and control in cislunar space (*Summer 2020*).

TECHNICAL SKILLS

- **Specialties**: High-performance scientific computing, data visualization.
- **Software development**: Object-oriented design, parallel processing.
- **Communication**: LaTeX (expert), technical presenting.
- **Tools & Platforms**: Linux, Git, SQL, Android app development.

PUBLICATIONS

JOURNAL PUBLICATIONS

- **LaFarge, N. B.**, Miller, D., Howell, K. C., & Linares, R., "Autonomous Closed-Loop Guidance using Reinforcement Learning in a Low-Thrust, Multi-Body Dynamical Environment". *Acta Astronautica*, vol. 186, 1–23, 2021.

CONFERENCE PUBLICATIONS

- **LaFarge, N. B.**, Howell, K. C., and Folta, D. C., "Adaptive Closed-Loop Maneuver Planning for Low-Thrust Spacecraft using Reinforcement Learning", *International Astronautical Congress*, Paris, France, 2022.
- **LaFarge, N. B.**, Howell, K. C., and Folta, D. C., "An Autonomous Stationkeeping Strategy for Multi-Body Orbits Leveraging Reinforcement Learning," *AIAA SciTech Forum*, San Diego, CA, 2022.
- **LaFarge, N. B.**, Howell, K. C., and Linares, R., "A Hybrid Closed-Loop Guidance Strategy for Low-Thrust Spacecraft Enabled by Neural Networks," *AAS Spaceflight Mechanics Meeting*, Charlotte, NC (Virtual), 2021.
- **LaFarge, N. B.**, Miller, D., Howell, K. C., and Linares, R., "Guidance for Closed-Loop Transfers using Reinforcement Learning with Application to Libration Point Orbits," *AIAA SciTech Forum*, Orlando, FL, 2020.