

# JOEY CARPINELLI

Research Software Engineer

joseph.carpinelli@icloud.com · (202) 660-2578 · github.com/jdc-pub · carpinelli.sh · Cambridge, MA

---

## EXPERIENCE

---

Robotics & AI Institute · Software Engineer

Feb 2024 – Present

Cambridge, MA

- Drove requirements gathering and architecture decisions of multiple software projects, including kinematics & dynamics solvers (C++ and Python), inverse-dynamics impedance controllers (C++), motor controller drivers (C++), and motion planning software suites (C++ and Python).
- Independently designed and developed real-time control laws abstractions using C++ concepts and templates.
- Developed lock-free data structures (C++) and accompanying primitives for IPC (ROS, DDS) in real-time control threads.
- Led the evaluation of third-party software and hardware products, informing \$500k in purchasing decisions.
- Identified and resolved process friction across four research teams, resulting in substantially more reliable infrastructure and a new senior lab manager hire.
- Represented the full Software Engineering team to senior leadership in multiple company-wide meetings.
- Created and co-led bi-weekly Research Software Reading Group to share knowledge across the institute.

NASA Johnson Space Center · Integrated GN&C Analyst

Jul 2021 – Jan 2024

Houston, Texas

- Supported Orion's Launch Abort System GN&C development, analysis, and verification as full-time employee.
- Integrated flexible structure model with linear and nonlinear simulation frameworks (MATLAB, C++).
- Conducted frequent dynamical studies through large-scale monte-carlo simulations; authored 150 pages of technical reports in 2022.
- Used linear analysis to analyze vehicle performance, verify stability margins; validated linear models.
- Served as backup regression data approver for simulated Orion Launch Abort System performance.
- Led development for polarity tests; created novel 6DOF kinematics simulation (Julia, Python); represented Orion GN&C at multiple lab tests in three states.
- Developed LaTeX packages and classes to improve technical writing workflows.

Space Systems Laboratory · Graduate Research Assistant

Aug 2019 – May 2021

College Park, Maryland

- Led core robot software development (C++, Orocos, ROS, CAN) as Graduate Assistant under Dr. Dave Akin.
- Developed novel Julia package to generate C++ codes for kinematics solvers; implemented and merged required changes to Symbolics.jl.
- Achieved substantially improved intermediate Jacobian performance over Orocos iterative solvers; implemented improved inverse-kinematics algorithm.
- Created C++ interfaces (templates) and implementations for control, including force/torque control.
- Maintained operator GUI (Python); served as certified diver for Neutral Buoyancy Research Facility maintenance.

## EDUCATION

---

University of Maryland, College Park · Master of Science in Aerospace Engineering

College Park, Maryland

- Research assistant under Dr. Akin; space robotics (manipulator) software lead and primary robot operator.
- Halo orbit & invariant-manifold research project with Instructor Barbee; now open-source as GeneralAstrodynamics.jl.
- Research emphasis in space robotics systems, prioritized dynamics & controls in coursework and performant solver implementations (C/C++, Julia) in research.

- Undergraduate Research Assistant under Dr. Akin at SSL; software lead during third year.
- Implemented inertial and viscous friction compensation for SSL's MGA Exoskeleton (Galil, UART).

## INTERNSHIPS

---

NASA Johnson Space Center · Cooperative Intern

Jan 2017 – Dec 2020

Houston, Texas

- Cooperative internships across avionics, flight operations, and flight dynamics groups.
- Cumulative 2 years of full-time work, spread across 4 years undergraduate and graduate study.

Space Systems Laboratory · Undergraduate Research Assistant

Jan 2017 – Aug 2019

College Park, Maryland

- ROS/Orocos software lead in summer after third undergraduate year, under supervision of Dr. Akin.
- Implemented inertial and viscous friction compensation for SSL's MGA Exoskeleton (Galil, UART).

Harris Corporation · Electrical Engineering Intern

May 2016 – Aug 2016

Bowie, Maryland

- Implemented rain attenuation ITU Propagation Model components; MATLAB functions written to implement model calculations, C# used to gather terrain data.
- Developed VBA workflows for automatic data processing procedures.

SRI International · Data Annotation Intern

May 2015 – Dec 2015

Princeton, New Jersey

- Annotated images and videos for deep learning research applications.
- Designed LED Array and circuit layouts for gaze tracking project using Eagle CAD.

## PROJECTS

---

Git Ents · Personal

2026

- A collection of Git extensions in Rust that collectively provide local-first forge infrastructure.
- Recently released `git-vendor`: an alternative to Git submodules and subtrees with in-source content.
- Currently developing `forge`: local first issues, comments, code reviews, and releases, all in Git's object database.
- Currently developing `git-kiln` and `git-hearth`: reference implementations for a cross-language build system and container alternative that leverages Git's object store for replicable and verifiable builds and environments.

metalogue · Personal

2026

- Experimental wrappers (with safe abstractions) around Metal API bindings in Rust.

GeneralAstrodynamics.jl · JuliaAstro

2021

- Metapackage for three subpackages; provides general calculations, visualizations, halo orbit solvers, and invariant manifold solvers; integrated with the SciML Julia ecosystem.
- Presented at JuliaCon 2021: Going to Jupiter with Julia.

EphemerisSources.jl · JuliaAstro

2023

- Metapackage for four subpackages; provides utilities for fetching and parsing ephemeris data from Horizons and JPL's publicly available Generic Kernels.
- Related paper published in the Journal of Open Source Software.

GalacticPotentials.jl · Personal	2022
<ul style="list-style-type: none"> <li>• Provides select scalar potential field equations commonly used in galactic dynamics research; integrated with the SciML Julia ecosystem.</li> <li>• Selected potentials are ported from popular galactic dynamics Python packages gala and galpy.</li> </ul>	
PolynomialGTM.jl · Personal	2021
<ul style="list-style-type: none"> <li>• Provides approximate polynomial model for longitudinal flight dynamics of a passenger plane.</li> <li>• Model is integrated with the SciML Julia ecosystem.</li> </ul>	
DocumenterQuarto.jl · Personal	2023
<ul style="list-style-type: none"> <li>• Integrates Documenter.jl syntax with Quarto for automatic package documentation.</li> </ul>	
rich-admonitions · Personal	2023
<ul style="list-style-type: none"> <li>• Extends rich (Python) with callout or admonition blocks.</li> </ul>	
module-hygiene · Personal	2023
<ul style="list-style-type: none"> <li>• Provides an <code>__export__</code> key for namespace hygiene in Python.</li> </ul>	
block-scopes · Personal	2023
<ul style="list-style-type: none"> <li>• Allows for local or block scoping in Python through the <code>with</code> keyword.</li> </ul>	

## PUBLICATIONS

---

EphemerisSources.jl: Idiomatic Ephemeris Sourcing and Parsing in Julia · Journal of Open Source Software	2024
<ul style="list-style-type: none"> <li>• Paper presents multiple software packages which ease solar system ephemeris fetching, caching, and interpolation.</li> </ul>	
Advancing The Robotics Software Development Experience · ArXiv	2024
<ul style="list-style-type: none"> <li>• Described software performance improvements achieved through writing core solver algorithms in Julia.</li> <li>• Presented poster at International Conference on Robotics and Automation (ICRA) in 2024.</li> </ul>	

## PRESENTATIONS

---

Going to Jupiter with Julia · JuliaCon 2021	2021
<ul style="list-style-type: none"> <li>• Presented a Julia package I developed (<code>GeneralAstrodynamics.jl</code>) which provides astrodynamics calculations and modeling tools for researchers.</li> </ul>	

## SKILLS

---

### Programming Languages

- Experienced in C++, Rust, Python, Julia, MATLAB.
- Proficient in C, C#.

### Tools

- Experienced in Git, GitHub Actions, Docker, Dev Containers, CMAKE, Bazel, Typst.
- Familiarity with GDB, Eagle CAD.

### Frameworks

- Experienced in ROS, CAN.
- Familiarity with Metal.