

# Joey Carpinelli | Technical Résumé

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## Professional Experience

### GN&C Engineer @ NASA Johnson Space Center (JSC) July 2021 — Present

- Supports Orion's Launch Abort System GN&C development, analysis, and verification
- Reduced, analyzed, and implemented flexible body (structure) model (MATLAB, C++)
- Uses monte-carlo simulations for parameter tuning; improved vehicle performance noticeably
- Uses linear analysis to analyze vehicle performance, verify stability margins; validates linear models
- Serves 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: Texas, Colorado, Florida

### Research Assistant @ Space Systems Laboratory (SSL) August 2019 — May 2021

- Graduate Assistant under Dr. Dave Akin; led manipulator software development (C++)
- Developed novel Julia package to generate symbolic manipulator kinematics models; implemented and merged required changes to `ModelingToolkit.jl`; intermediate Jacobian performance substantially improved over `Orocos` iterative solvers; implemented fast inverse-kinematics algorithm
- Created C++ templates, and controller implementations, including force/torque and Cartesian control
- Maintained operator GUI for all manipulators; primary operator for neutral-buoyancy testing
- Maintained neutral buoyancy facility as diver; received open water certification in 2017

### Inertial & Viscous Friction Compensation Project January 2017 — August 2017

- Independent study to implement Dr. Carignan's inertial and viscous friction compensation for Maryland-Georgetown-Army (MGA) exoskeleton within SSL; used Galil, Python, ROS, UART

### Intern @ Harris Corporation May 2016 — August 2016

- Automated Excel task with VBA; 20 worker hours → 2 minute runtime
- Worked with one other intern to implement rain attenuation ITU Propagation Model; MATLAB functions written to implement model calculations, C# used to gather terrain data

### Intern @ SRI International May 2015 — December 2015

- Collected and annotated data to train deep-learning algorithms; improved process with scripting
- Designed LED Array and circuit layouts for gaze tracking project using Eagle CAD

## Education

### M.S. in Aerospace Engineering @ University of Maryland

- Research assistant under Dr. Akin; space robotics (manipulator) software lead, primary operator
- Halo orbit & invariant-manifold research project with Professor Barbee; released as open source tools
- Emphasis in space systems, prioritized dynamics & controls in coursework

### B.S. in Electrical Engineering @ University of Maryland

- Emphasis in control theory, prioritized software in coursework through four computer science classes
- Undergraduate Research Assistant under Dr. Akin at SSL; manipulator software lead as junior

## Technical Skills

### Computer Programming

- Productive in C++, used for robotic manipulator control software
- Experienced with Julia, used for astrodynamics research; hobbyist FOSS
- Experienced with Python, used for post-simulation analysis & scripting at NASA JSC; hobbyist FOSS

### Circuit Design

- Undergraduate digital & analog lab experience, including Verilog, SPICE, PSpice, Xilinx, oscilloscopes
- Internship experience using Eagle CAD to design PCB for gaze-tracking project

### Modeling & Simulation

- Experienced with linear model reduction, linear analysis, and nonlinear analysis methods

## FOSS Projects

### [SolarSystemSurrogates.jl](#)

*An ongoing experiment that I'm excited about. This package will provide surrogate models for solar system ephemeris data. Fingers crossed!*

### [AstrodynamicalModels.jl](#)

*Model generation — with optional state transition matrix dynamics — through `ModelingToolkit.jl`.*

### [GeneralAstrodynamics.jl](#)

*General calculations, visualizations, iterative & analytical periodic orbit solvers, and orbit-manifold solvers. Presented at [JuliaCon!](#)*

### [HorizonsAPI.jl](#)

*A word-for-word wrapper for the JPL Horizons REST API. Fetch solar system ephemeris for free!*

### [HorizonsEphemeris.jl](#)

*A user-friendly wrapper around the word-for-word wrapper for the JPL Horizons REST API.*

### [PolynomialGTM.jl](#)

*Implements publicly available polynomial models for NASA's Generic Transport Model using `ModelingToolkit.jl`.*

### [module-hygiene](#)

*Provides an `__export__` key, and an associated `cleanup` function to reduce namespace clutter.*

### [block-scopes](#)

*Provides a single context manager, `only`, which creates block-style scopes within Python. This package isn't unique — it's just for fun!*

### [rich-admonitions](#)

*Extends the excellent terminal formatting package `rich` with Julia-style Markdown admonition blocks!*

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