

SAMUEL BUCKNER

@ buckner.c.samuel@gmail.com (239) 565-3802 samuelcbuckner.com samuelcbuckner bucknercsamuel

EDUCATION

Ph.D., Aeronautics & Astronautics | University of Washington

Sept. 2021 - Present GPA: 3.71/4.0

- Advisor: Behçet Açıkmeşe (Autonomous Controls Laboratory)
- Fellowships: NSF Graduate Research Fellowships Program (GRFP), Achievement Rewards for College Scientists (ARCS)

B.S., Aerospace Engineering | University of Florida

Awarded Dec. 2020 (*Summa Cum Laude*) GPA: 3.80/4.0

SKILLS

General: GN&C, Convex Optimization, Robotics, Dynamics & Modeling, Simulation, Machine Learning

Programming: Python, Julia, C/C++, MATLAB/Simulink, Git, Unix/Linux, \LaTeX

Software: Robot Operating System (ROS), Systems Tool Kit (STK), Unreal Engine, SolidWorks, LabVIEW, ArduPilot

Hardware: Machining, 3D Printing, Prototyping, Soldering

WORK EXPERIENCE

Graduate Pathways Co-Op | NASA Johnson Space Center

June 2022 - Present Houston, TX

Rotation #3: eVTOL Model Predictive Control (short duration)

- Developed a 6-DoF model predictive control framework with sequential convex programming for a switched dynamics eVTOL system.

Rotation #2: Lunar Trajectory Optimization

- Continued on previous tour to develop terrain scanning formulations based on a novel theory of constrained conic intersections.
- Developed multiple approaches for different fidelity levels: 3-DoF lossless convexification and 6-DoF sequential convex programming.
- Published several conference papers, with one approach selected for flight implementation in a future lander mission.

Rotation #1: Lunar Trajectory Optimization

- Consulted with Astrobotic to develop multiple new convex-optimization-based guidance algorithms to model state triggered constraints (STCs) for real-time, autonomous precision landing in a lunar environment.

GN&C Intern | Blue Origin

Jan. 2021 - Sep. 2021 Kent, WA

Rotation #2: New Glenn Navigation Team

- Developed Simulink/C++ (flight code) implementations of VAR forecasting for autonomous vehicle state prediction & estimation.
- Performed 3σ MC performance analyses, implemented uplink data compression methods and conducted noise sensitivity studies.

Rotation #1: New Glenn Fluid Controls Team

- Developed Simulink unit testing suites and toolkits for fluid control applications, performed off-nominal and uncertainty controller response studies and improved plant dynamics modeling validated against CFD results.

Pathways Co-Op | NASA Johnson Space Center

Aug. 2018 - Aug. 2020 Houston, TX

Rotation #3: Autonomous GN&C Systems

- Co-developed 6-DOF platform robot C++ codebase with PID Control, trajectory sequencing, and OptiTrack+LiDAR sensor integration.

Rotation #2: Flight Dynamics

- Developed Python/C++ lunar ascent simulator incorporating linear tangent guidance and high-fidelity sensor models.

Rotation #1: Integrated GN&C Analysis

- Conducted trade studies on algorithms for optimal control allocation and parachute deployment used for the SpaceX Crew Dragon.

Fit2Fly Research Associate | NASA Langley Research Center



May 2019 - Aug. 2019 Hampton, VA

- Developed a Python multi-UAV software-in-the-loop (SWIL) simulator with modifications for SRD-280 netted flight demonstration.
- Implemented algorithms for UAV radio frequency tracking including blob detection and PyTorch image classification (98% accurate).



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RESEARCH EXPERIENCE

Graduate Research Assistant | Autonomous Controls Laboratory (ACL)

-  Aug. 2021 - Present
-  Seattle, WA
- Developed a general-purpose branched trajectory optimization framework for contingency planning in the presence of unknown multimodal uncertainty distributions, building on the concept of decision deferral (DDTO) with sequential convex programming (SCP).
 - Extended DDTO for perception-based landing scenarios using an algorithm that adaptively recomputes as needed (Adaptive-DDTO).
 - Developed multiple algorithms for efficient terrain scanning operations during lunar landing scenarios using a novel theory of constrained conic intersections.
 - Side research: stochastic trajectory optimization, multiple-object tracking, lexicographic control allocation

Undergraduate Research Assistant | Advanced Autonomous Multiple Spacecraft (ADAMUS) Laboratory

-  Apr. 2018 - Nov. 2020
-  Gainesville, FL
- Developed a CubeSat flight software involving a ROS (Robot Operating System) framework for the Drag-Deorbit Device (D3) mission.
 - Created software modules for radio telemetry linking, GPS navigation, command & data handling, software updates and failsafe reboots.

PUBLICATIONS

[1] **Buckner, Samuel C**, Joshua Shaffer, John M Carson, Breanna J Johnson, Ronald R Sostaric, and Behcet Acikmese (2024). "Constrained Visibility Guidance for 6-DOF Powered Descent Maneuvers with Terrain Scanning using Sequential Convex Programming". In: AIAA SCITECH 2024 Forum, p. 1759.

[2] Echigo, Kazuya, Oliver Sheridan, **Samuel Buckner**, and Behçet Açıkmeşe (2024). "Dispersion Sensitive Optimal Control: A Conditional Value-at-Risk-Based Tail Flattening Approach via Sequential Convex Programming". In: *IEEE Transactions on Control Systems Technology*.

[3] Shaffer, Joshua, Chris Owens, Theresa Klein, Andrew D Horchler, **Samuel C Buckner**, Breanna J Johnson, John M Carson, and Behcet Acikmese (2024). "Implementation and Testing of Convex Optimization-based Guidance for Hazard Detection and Avoidance on a Lunar Lander". In: AIAA SciTech 2024 forum, p. 1584.

[4] Hayner, Christopher R, **Samuel C Buckner**, Daniel Broyles, Evelyn Madewell, Karen Leung, and Behçet Açıkmeşe (2023). "HALO: Hazard-Aware Landing Optimization for Autonomous Systems". In: IEEE. 2023 IEEE International Conference on Robotics and Automation (ICRA), pp. 3261–3267.

[5] Mceowen, Skye, Abhinav G Kamath, Purnanand Elango, Taewan Kim, **Samuel C Buckner**, and Behcet Acikmese (2023). "High-Accuracy 3-DOF Hypersonic Reentry Guidance via Sequential Convex Programming". In: AIAA scitech 2023 forum, p. 0300.

[6] Bonk, Ryan, Ryan Bowers, **Samuel Buckner**, Cameron Byrd, Hannah Crayton, Kyle Tam, Taylor W Thomas, and Jordan Wallis (2020). "Fit2Fly: A Proof of Concept for Testing the Commercial Feasibility of Unmanned Aerial System Operations". In: AIAA Scitech 2020 Forum, p. 0740.

[7] **Buckner, Samuel**, Carlos Carrasquillo, Marcus Elosegui, and Riccardo Bevilacqua (2020). "A Novel Approach to CubeSat Flight Software Development Using Robot Operating System (ROS)". in: 34th Annual AIAA/USU Small Satellite Conference.