William Baldwin Smith V

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Education

- **University of Virginia**, *Master of Engineering in Mechanical Engineering: GPA: 3.97* *Charlottesville, VA*, *2021 - 2023*
- **University of Virginia**, *Bachelor of Science in Mechanical Engineering; GPA: 3.67* *Charlottesville, VA*, *2018 - 2021*

Skills Summary

- **Languages/Libraries**: C/C++, Python, MATLAB, Java, R, OpenCV, GStreamer, PyTorch, NumPy, Matplotlib
- **Tools**: ROS, Linux, Git, Docker, Simulink, SOLIDWORKS, Autodesk Inventor, Ansys
- **Hardware**: Arduino, Raspberry Pi, NVIDIA Jetson, ESP32

Experience

- **Applied Research Associates, Inc.**, *Staff Scientist I, ISR, ASIRT* *Raleigh, NC*, *Oct 2023 - Present*
  - Implemented a visual inertial odometry system to predict the 6 DoF displacement of a UAV for GPS-denied localization. Developed GStreamer pipelines to set up an RTSP server with muxed video and MISB 0601 formatted metadata for communication between the drone and base computer.
  - Led integration effort to deploy urban geolocalization algorithms on servers and embedded systems. Optimized and cross-compiled algorithms for an embedded processor to directly interface with onboard sensors. Developed an asynchronous processing pipeline to pass data from sensors to different stages of the algorithm.
  - Improved map creation with parallel computing, to increase generation speed by more than 100x, and efficient compression techniques, to reduce global map size by 75%. Implemented a particle filter for state estimation to constrain the search region, leading to improved accuracy and speed.
  - Researched machine learning-based depth estimation models to obtain passive ranging for every pixel in the image. Implemented a PCA-based correction to restore depth scale through consecutive panned or zoomed images. Trained an ensemble model to estimate camera intrinsics and extrinsics of wild images.
- **University of Virginia**, *Graduate Research Assistant* *Charlottesville, VA*, *Mar 2021 - Mar 2023*
  - Developed a method to improve robotic mapping of buildings with millimeter resolution and high accuracy. Researched methods to quantify mapping quality to improve inspections by minimizing environmental uncertainty. Improved path planning techniques to guarantee reliable autonomous mapping with online trajectory optimization to ensure desired resolution and accuracy.
  - Researched a whole-body planner for mobile manipulators using Lie theory and optimization. Modeled robots using screw joints and Lie theory to find kinematic constraints. Formulated the optimization with pose constraints and other smoothing costs to guarantee smooth and continuous motion.
  - Investigated a system for heterogeneous multi-robot cooperation in a human-centric environment for performing inspection and maintenance in a shipboard environment. Assigned different tasks to robots to minimize mission time by sharing beliefs to increase collaboration and understanding of the environment and situation.
  - Designed and built unmanned ground vehicles with varying embodiments to carry a robotic manipulator. Implemented low-level and high-level control algorithms to allow basic autonomy with various tasks.
- **NASA Langley Research Center**, *Engineering Intern, Autonomy Incubator* *Hampton, VA*, *June 2017 - July 2017*
  - Designed and developed a radio-controlled rover as part of a team of three interns. Constructed to meet target specifications, including: carry at least 50 pounds, weigh under 15 pounds, and be stable in defined environments.

Projects

- **Mobile Manipulation Motion Planning**: Trajectory planning for mobile manipulators to result in smooth and continuous motions. Presented at the Mobile Manipulation: Emerging Opportunities and Contemporary Challenges workshop at RSS 2025. (2023-2025)
- **Multi-Stage High Precision Mapping**: INFO (2021-2023)
- **Additive Manufacturing with Extruded Clay via a Mobile Manipulator**: INFO (2022)
- **Autonomous Campus Vehicles**: Designed an autonomous golf cart by modifying a standard electric golf cart with drive by wire controls. Implementation of SLAM for a sparse, outdoor environment by fusing depth cameras and LiDAR to create a globally accurate map for navigation. Integration of convoying between the leading vehicle and following vehicles with shared location beliefs and visual correction. (2021-2022)
- **Visual Servoing for Shipboard Inspection and Maintenance**: INFO (2021)

Publications

[1] **Smith, W.**, Singh, S., Rudy, J., Guan, Y., "Whole Body Planning of Mobile Manipulators Leveraging Lie Theory based Optimization," en, in *RSS 2025 Workshop: Mobile Manipulation: Emerging Opportunities & Contemporary Challenges*, Jun. 2025. [Online]. Available: https://openreview.net/forum?id=7ZRclFFHSK&noteId=7ZRclFFHSK.

[2] **Smith, W.**, Qin, Y., Singh, S., Burke, H., Furukawa, T., Dissanayake, G., "A multistage framework for autonomous robotic mapping with targeted metrics," *Robotics*, vol. 12, no. 2, 2023, ISSN: 2218-6581. DOI: 10.3390/robotics12020039. [Online]. Available: https://www.mdpi.com/2218-6581/12/2/39.

[3] **Smith, W.**, Qin, Y., Furukawa, T., Dissanayake, G., "Autonomous Robotic Map Refinement for Targeted Resolution and Local Accuracy," in *2022 IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR)*, 2022, pp. 130–137. DOI: 10.1109/SSRR56537.2022.10018686.