Steve McGuire

2027 Arapahoe Ave Apt 1
Boulder, CO 80302
814-777-3957

mcguire.steve@gmail.com • US Citizen

Education

The University of Colorado at Boulder Boulder, CO • PhD, Aerospace Engineering Systems
> **Thesis:** Autonomous On-Line Learning of Assistant Selection Policies for Fault Recovery
>
> **Robotics Interests:** Human-Robot Interaction · Decision making under uncertainty · Perception · Camera Calibration · Estimation

The University of Colorado at Boulder Boulder, CO • MS, Aerospace Engineering Systems

The Pennsylvania State University University Park, PA • Bachelor of Science, major in Computer Engineering, minor in Math, 2003

Honors and Awards

- NASA Science and Technology Research Fellowship, 2015, *Augmented Reality Telepresence for Robotic Exploration*
- Selected for a NASA Science and Technology Research Fellowship, 2013
- Recipient of Air Medal, with Strike/Flight Numeral 1 for combat missions flown in support of Operation Iraqi Freedom

Selected Projects

Role: **Lead Researcher**
- DARPA Subterranean Challenge: A competition designed to have a human-robot team exploring complex underground environments, with autonomous robotic exploration a primary operating modality.
- SmartBases: A collaboration with the US Army to expand the role of autonomous vehicles to solve transportation problems on military bases.
- Autonomous Fault Recovery via Online Assistant Learning: A reinforcement-learning approach to better understand the potential humans that might aid a robot in distress and make better decisions about which human to request assistance from.
- TRAADRE: TRust in Autonomous ADvisors for Robotic Exploration: A human factors study investigating user response to advice sourced from either an autonomous agent or a human operator.
- Sythetic immersive vision for UAV operations: A prototype of a synthetic vision system for UAV pilots that immerses the pilot into a full VR environment, with camera views stitched into a photosphere locally rendered to avoid latency issues.

Role: **Technical Mentor**
- DRAGON: Deployed RF Antennas for GPS-denied Optimization and Environmental Navigation: Aerospace senior design project to build a fully autonomous solution to GPS-denied navigation using deployable RF ranging beacons.
- RAVEN: Rover and Air Visual Environment Navigation: Aerospace senior design project that mutually visually servoed between a ground vehicle and a UAV asset with narrow-FOV cameras.

Role: **ROS/Open Source Contributor**
- *camera_aravis*: A pipeline for using an open-source USB3Vision stack; contributions included adding support for machine vision cameras and features such as triggering, including ROS updates.
- *gs_pipeline*: A pipeline for image processing operations capable of using hardware blocks commonly present on systems-on-chips via a GStreamer framework; the end product was implemented as a ROS node.

Pilot Certifications

- *Fixed wing*: Commercial single and multiengine land
- *Rotary wing*: Commercial rotorcraft helicopter
- *Instrument*: Instrument airplane and helicopter
- *Instructor*: Rotorcraft helicopter
- *UAS*: Remote pilot

Work History

The University of Colorado at Boulder (August 2019 - present)
Postdoctoral Research Associate
Research Interests:
- Communications Lead, DARPA Subterranean Challenge
- Semantic scene understanding through multi-modal sensor fusion
- Practical challenges in field robotics deployments

The University of Colorado at Boulder (August 2015 - August 2019)
Graduate Research Fellow
Research Interests:
- Human-robot teaming with particular focus on issues in planetary exploration
- Statistical methods of recovering from autonomy failures

- Self-calibration of intrinsic and extrinsic properties of sensors

The University of Colorado at Boulder (January 2015 - July 2015)
Graduate Student / Research Assistant
- Assisted with practical requirements of conducting field tests of research algorithms on actual mobile robots
- Reverse engineered a Linux acquisition layer for a newly released depth camera where the vendor only supports Windows 8.1
- Designed and implemented an integration layer between standalone vision research code and a ROS-based control system for entry into the Amazon Picking Challenge
- Designed a prototype system for exploring the use of miniature hydraulic controls in mobile robotics

The University of Colorado at Boulder (August 2014 - December 2014)
Graduate Student / Teaching Assistant
- Created assignments, grading rubrics, and instructional materials in support of a sophomore aerospace Matlab class
- Conducted several hours of one-on-one and small group instruction per week teaching basic techniques in Matlab

Astrobotic Technology, Inc. (November 2012 - August 2014)
Avionics Engineer
- Designed integrated hardware and software solutions needed to develop a Moon landing system, culminating in four months of field testing aboard a propulsive lander sponsored by NASA
- Flew local helicopter testing missions as precursors to propulsive lander testing
- Designed, implemented, and field tested a ARM7-based landing sensor data acquisition hardware system, including custom interface hardware and custom software extensions to a bare-metal RTOS written in C++
- Designed and implemented a 20'x30'x20' robotic gantry crane for simulating sub-Terran gravity, requiring authoring of specifications, interaction with external contractors, and custom software creation
- Co-authored several NASA proposals and served as technical contributor for Moon landing efforts
- Designed, implemented, and field tested a pit exploration robot for creating 3D models of lunar sinkholes via a suspended scanning lidar
- Earned rotorcraft certified flight instructor certificate

United States Marine Corps (January 2005 - July 2012)
Captain, Helicopter Pilot
- Qualified as a CH-53E Super Stallion heavy lift helicopter pilot
- Deployed in support of Operation Iraqi Freedom, 2009
- Served as squadron computer support personnel, responsible for system upkeep and creative computer problem solving
- Earned three individual decorations for custom software work, including a squadron flight schedule presentation system, a remote-site training support system, and a document management package
- Earned civilian flight qualifications in airplane single engine, airplane multi-engine, rotorcraft, and instrument privileges

ENSCO, Inc. (April 2004 - January 2005)
Software Engineer
- Designed sensor support software for ENSCO, Inc.'s DARPA Grand Challenge 2004 entry, including high-speed lidar and obstacle avoidance
- Created board-specific Linux kernel drivers to support a data acquisition requirement
- Diagnosed and improved a problematic networked remote-sensor application, enabling live monitoring of remote sensors via long-range networks
- Developed Geographic Information System workflows for data analysis using ESRI ArcGIS components under Java

PAPERS AND PUBLICATIONS

- Michael Kasper, Steve McGuire, and Christoffer Heckman. *A Benchmark for Visual-Inertial Odometry Systems Employing Onboard Illumination*. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2019, pp 5256-5263.
- Steve McGuire, Padraig Michael Furlong, Terry Fong, Christoffer Heckman, Daniel Szafir, Simon Julier, and Nisar Ahmed. *Everybody Needs Somebody Sometimes: Validation of Adaptive Recovery in Robotic Space Operations*, IEEE Robotics and Automation Letters, Jan 21 2019, DOI: 10.1109/LRA.2019.2894381.
- Steve McGuire, Christoffer Heckman, Daniel Szafir, Simon Julier, and Nisar Ahmed, *Extrinsic Calibration of a Camera-Arm System Through Rotation Identification*. ArXiv, https://arxiv.org/abs/1812.08280.
- Steve McGuire, Michael Walker, Jamison McGinley, Nisar Ahmed, Daniel Szafir, and Torin Clark. *TRAADRE: TRust in Autonomous ADvisors for Robotic Exploration*. Robotics Science and Systems Autonomous Space Robotics Workshop, 2018.
- Steve McGuire, Padraig Michael Furlong, Christoffer Heckman, Simon Julier, and Nisar Ahmed, *Failure is Not an Option: Policy Learning for Adaptive Recovery in Space Operations*. IEEE Robotics and Automation Letters, July 2018, vol 3, issue 3, pp 1639-1646, DOI: 10.1109/LRA.2018.2801468.

- Steve McGuire, Padraig Michael Furlong, Christoffer Heckman, Simon Julier, Daniel Szafir, and Nisar Ahmed. *Teamwork Across the Stars: Machine Learning to Overcome the Brittleness of Autonomy*. IROS Workshop on Human-Robot Collaboration: Towards Co-Adaptive Learning Through Semi-Autonomy and Shared Control, Daejon, Korea, 2016.
- Lu Ma, Juan M. Falquez, Steve McGuire, and Gabe Sibley. *Large Scale Dense Visual Inertial SLAM*. Field and Service Robotics (FSR), 2015
- *Multiple Robot Fault Diagnosis Using Decision-Theoretic Particle Filters*. Undergraduate Honors Thesis, The Pennsylvania State University, 2003.
- *A Modular Multi-Function Rover and Control System for EVA*. Presented at the Fifth Annual Mars Society Convention, Boulder, CO, 2002.
- *A Framework for Distributed Rover Control and Three Sample Applications*. NASA Ames Research Center, Code IC, Computational Sciences Division Paper Number 298, 2001.

Service

- Organizing committee member, *Autonomous Space Robotics* Workshop, Robotics Science and Systems Conference 2018.
- Technical advisor, CU Boulder Aerospace Engineering Sciences Department, *DRAGON: Deployed RF Antennas for GPS-denied Optimization and Environmental Navigation*, 2018-2019.