

Nicholas Ohi, Ph.D.

Autonomous Robotic Systems, Robotic Decision-Making

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📍 Morgantown, WV, USA

Nicholas Ohi is a recent Ph.D. graduate in Aerospace Engineering from West Virginia University. He has authored and co-authored **10 peer-reviewed publications**, led the development of robot autonomy capabilities for **3 grant funded research projects** and **2 award winning NASA competition robots**, and has provided guidance and mentorship for robot autonomy and systems engineering for **more than half a dozen** other projects, competitions, and student teams.

Nicholas' goal is to improve the capabilities of autonomous robotic systems both here on Earth and for space exploration. His graduate research focused on improving autonomous robotic decision-making when faced with unmodeled sources of uncertainty that robots are likely to encounter in complex real-world situations. He also has extensive experience developing robotic autonomy capabilities and robotics systems engineering as well as hundreds of hours of robot field testing through the NASA Sample Return Robot Centennial Challenge (SRRC), the NASA Robotic Mining Competition (RMC), and a NASA EPSCoR funded research project to improve future Mars rover autonomy.

Nicholas takes a multi-disciplinary, systems-level approach to robot autonomy, combining hardware and software, planning and perception, to create integrated, working, real-world autonomous systems. His strength is his ability to work across the many different domains of engineering involved in autonomous robotics and communicate clearly with other team members of different technical backgrounds to solve challenging problems and make autonomous robots work in the real-world.

Nicholas is searching for a career that will enable him to leverage his multi-disciplinary robotics background to help improve humanity's scientific understanding of both the universe and our own planet, as well as to help improve the lives of all people, through bringing robot autonomy into the real-world.

Education

Doctor of Philosophy (Ph.D.), West Virginia University (WVU)

Dec 2022

- Major: Aerospace Engineering
- Dissertation Title: [Improving Robotic Decision-Making in Unmodeled Situations](#)
- Research Experience: decision-making under uncertainty, decision-making under ambiguity, task planning, mobile robot field testing, system architecture, systems integration
- National Science Foundation Graduate Research Fellow (NSF GRFP), 2016-2021
- NASA West Virginia Space Grant Consortium Graduate Research Fellow, 2019-2021
- GPA: 4.0

Bachelor of Science (BS), West Virginia University (WVU)

May 2016

- Majors: Mechanical Engineering, Aerospace Engineering
- Summa Cum Laude, WVU Honors College
- Order of Augusta (WVU's highest student award)
- GPA: 3.98

Experience

Adjunct Lecturer, Department of Mechanical and Aerospace Engineering (MAE), West Virginia University (WVU) 2023-Present

- Collaborating on decision-making under uncertainty research with WVU colleagues

NSF GRFP Fellow, Graduate Research Assistant, West Virginia University (WVU) 2016–2022

- Leader of “soft autonomy” research team
 - Led discussions and brainstorming sessions on decision-making under uncertainty and novel approaches to robot autonomy
 - Performed both applied and fundamental research to improve robotic decision-making in complex real-world situations
 - Coordinated with other subteams to design and implement autonomy capabilities across large, interdisciplinary research projects, including robotic pollination, improving Mars rover autonomy, and underground mine safety
 - Coordinated and leads robotic field testing efforts
- Autonomy lead for WVU team in 2017 NASA Robotic Mining Competition (RMC)
 - Developed mission-planning, motion planning, task execution, and drive system control software for WVU robot in 2017 RMC
 - Custom autonomy software developed in C++ using the Robot Operating System (ROS), leveraging experience and software architecture concepts developed for Robot Cataglyphis in the NASA Sample Return Robot Centennial Challenge
 - Designed and managed software architecture, set interface standards between different software modules, and coordinated development across software team members
 - Led system integration efforts, field testing, and system-level debugging
 - Over 100 hours of robot field testing experience with fully autonomous robot excavating and delivering sand, rocks, and simulated lunar regolith
- Robotic Systems Engineering
 - Extensive experience creating, testing, and debugging ROS based autonomous robotic systems
 - Focus on full system understanding and communication with team members with diverse expertise to coordinate system integration and testing to support research objectives
 - Detailed understanding of how hardware and software interact, able to cross many engineering domains and debug complex, system-level problems
 - Experience includes: sensor and actuator interfacing, power circuit design and debugging, Linux and ROS system configuration, custom serial device driver code, mobile robot drive control code, dead reckoning state estimation code, high-level task planning code for robot autonomy
 - Experience working both in simulation and on real hardware, rapidly prototyping autonomy capabilities in simulation and then deploying them onto real-world robots
- Mentor to other graduate students and undergraduate students, providing guidance about research and graduate school
- Designer and System Administrator of WVU Robotics high performance computing (HPC) server cluster
- Lab safety lead
- Lab IT coordinator
- Research Advisor: Dr. Yu Gu

Visiting Student Researcher, NASA Jet Propulsion Laboratory (JPL), Pasadena, CA Jan–Apr 2019

- Developed Mars rover Fast Traverse autonomy and state estimation capabilities for wheeled ground rover to improve traversal speed and autonomy for upcoming NASA Mars Sample Return Mission
- Supported robot mission planning, autonomy development, system integration, and field testing for team CoSTAR competing in DARPA Subterranean (SubT) Robotics Challenge
- JPL Mentor: Dr. Ali-akbar Agha-mohammadi

Undergraduate Research Assistant, West Virginia University (WVU) 2014–2016

- Lead programmer for WVU team that won the NASA Sample Return Robot Centennial Challenge
 - Developed high-level mission planning, motion planning, task execution, drive system control, and health and status management software for WVU robot Cataglyphis
 - Custom autonomy software developed from ground up in C++ using the Robot Operating System (ROS)
 - Designed and managed software architecture, set interface standards between different software modules, and coordinated development across software team members
 - Led system integration efforts, field testing, and system-level debugging
 - Over 500 hours of robot field testing experience with fully autonomous robot performing sample search and retrieval task in large natural outdoor environments
- Developed flight software for GNSS navigation experiment flying onboard the Simulation-to-Flight 1 (STF-1) CubeSat, West Virginia's first spacecraft mission, <http://www.stf1.com/>
 - Worked in conjunction with NASA IV&V to create reliable, fault tolerant flight software
 - Software developed in C using NASA's core Flight Executive / core Flight System (cFE/cFS)

Summer College Intern, NASA IV&V Program, Fairmont, WV May–Aug 2014

- Project: Robotics Image Processing and Interpretation (RIPI)
- Led team of college and high school interns in characterizing, testing, and documenting a variety of computer vision algorithms to develop a knowledge base and in-house computer vision testing system for NASA IV&V
- Software developed in C++ using OpenCV

Summer College Intern, NASA IV&V Program, Fairmont, WV May–Aug 2013

- Project: Robotics Virtual Interactive Evaluation and Understanding (R-VIEU)
- Designed and managed the development of a prototype 3D robotics software simulation tool and then evaluated how a tool like it could be used for Independent Verification and Validation (IV&V) at NASA
- Software developed in Python and utilized Blender 3D modeling and animation software

Skills

- **Programming Languages:** C, C++, Python, Matlab, Bash
- **Software Packages and Libraries:** ROS1, ROS2, C++ STL, Numpy, Scipy, Matplotlib, Boost, Eigen, OpenCV, CMake
- **Other Software:** Ubuntu Linux, Microsoft Windows, Git, SSH, \LaTeX , Microsoft Office, Gazebo
- **Robotics Theory:** Finite State Machine (FSM), Markov Decision Process (MDP), Partially Observable Markov Decision Process (POMDP), Reinforcement Learning, Bayesian Probability, Bayes Filtering, Dead Reckoning State Estimation
- **Robotics Algorithms:** Value iteration, Q-Learning, Deep Q Networks (DQN), Monte Carlo Tree Search (MCTS), Linear Kalman Filter (LKF), Extended Kalman Filter (EKF), Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO)
- **Robotics Engineering:** Custom serial and TCP/UDP device drivers, motor controller power circuitry, sensor interfacing and instrumentation, sensor calibration, PID feedback control tuning, combined hardware and software system debugging
- **Computer Engineering:** Desktop computer and rack mount server component selection and assembly, Raspberry Pi and Arduino microcontrollers, Linux networking, Linux server administration (SMB and NFS file share, Torque/PBS job scheduler), parallel computing / multi-threading, Monte Carlo simulations
- **Computer Aided Design (CAD):** Solidworks, FreeCAD, Autodesk Inventor
- **3D Printing:** Rapid prototyping and functional engineering parts, materials: PLA, ABS, PETG, and TPU
- **Machining and Tools:** Basic machine shop training, drilling and tapping, tolerancing, drill press, band saw, sheet metal break, CNC router, hand tools
- **Creative Software:** Adobe Premiere Pro, Photoshop, Illustrator, Lightroom, After Effects, GNU Image Manipulation Program (GIMP)
- **Non-technical:**
 - Research publication and proposal writing and peer review
 - Entertainment-based, science and engineering video writing, hosting, filming, and production

Publications

Author and co-author of **10 peer-reviewed publications**, accepted to venues including the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), the IEEE Robotics and Automation Letters (RA-L), and the Journal of Field Robotics. Reviewer for **14 peer-reviewed submissions**, at venues including RA-L, IROS, CASE, AIM, ICAR, SciTech, and Acta Agronomica.

[Google Scholar](#)

citations: 151

h-index: 7

i10-index: 7

Peer-reviewed journals

- [1] Slip-Based Autonomous ZUPT Through Gaussian Process to Improve Planetary Rover Localization
Cagri Kilic, Nicholas Ohi, Yu Gu, Jason N Gross
IEEE Robotics and Automation Letters 6.3 (2021), pp. 4782–4789, IEEE
- [2] Terrain-Aware Path Planning and Map Update for Mars Sample Return Mission
Gabrielle Hedrick, Nicholas Ohi, Yu Gu
IEEE Robotics and Automation Letters 5.4 (2020), pp. 5181–5188, IEEE
- [3] Robot Foraging: Autonomous Sample Return in a Large Outdoor Environment
Yu Gu, Jared Strader, Nicholas Ohi, Scott Harper, Kyle Lassak, Chizhao Yang, Lisa Kogan, Boyi Hu, Matthew Gramlich, Rahul Kavi
IEEE Robotics & Automation Magazine 25.3 (2018), pp. 93–101, IEEE

- [4] Cataglyphis: An autonomous sample return rover
Yu Gu, Nicholas Ohi, Kyle Lassak, Jared Strader, Lisa Kogan, Alexander Hypes, Scott Harper, Boyi Hu, Matthew Gramlich, Rahul Kavi
Journal of Field Robotics 35.2 (2018), pp. 248–274
- [5] Development of a Microgravity Research Team Project Course
John M Kuhlman, Barrett Dietzius, Gina Eberhart, Charles Gary, Steven Kosko, Joshua Milam, Nicholas Ohi
Journal of Thermophysics and Heat Transfer 30.3 (2016), pp. 622–634, American Institute of Aeronautics and Astronautics

Peer-reviewed conference proceedings

- [1] Flower Interaction Subsystem for a Precision Pollination Robot
Jared Strader, Jennifer Nguyen, Christopher Tatsch, Yixin Du, Kyle Lassak, Benjamin Buzzo, Ryan Watson, Henry Cerbone, Nicholas Ohi, Chizhao Yang
2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2019
- [2] Improved Planetary Rover Inertial Navigation and Wheel Odometry Performance through Periodic Use of Zero-Type Constraints
Cagri Kilic, Jason N Gross, Nicholas Ohi, Ryan Watson, Jared Strader, Thomas Swiger, Scott Harper, Yu Gu
2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2019
- [3] Design of an Autonomous Precision Pollination Robot
Nicholas Ohi, Kyle Lassak, Ryan Watson, Jared Strader, Yixin Du, Chizhao Yang, Gabrielle Hedrick, Jennifer Nguyen, Scott Harper, Dylan Reynolds
2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018
- [4] Simulation-to-Flight (STF-1): A Mission to Enable CubeSat Software-based Validation and Verification
Justin Morris, Scott Zemerick, Matt Grubb, John Lucas, Majid Jaridi, Jason N Gross, Nicholas Ohi, John A Christian, Dimitris Vassiliadis, Anand Kadiyala
2016 AIAA Science and Technology Forum and Exposition (SciTech), 2016

Workshop papers

- [1] A Rover and Drone Team for Subterranean Environments: System Design Overview
Ryan Watson, Nicholas Ohi, Scott Harper, Cagri Kilic, Chizhao Yang, Jacob Hikes, Matteo De Petrillo, Jared Strader, Gabrielle Hedrick, Hayden Nichols
2018 RSS Workshop on Challenges and Opportunities for Resilient Collective Intelligence in Subterranean Environments, 2018

Select Presentations

Space Trusted Autonomy Seminar, Space Science and Technology Partnership: Feb 2023
NASA, USAF, USSF, NRO

Personal Interests

Content Creator, *Coil Labs* YouTube channel

2020–Present

- <https://www.youtube.com/c/CoilLabs>
- 1.6k subscribers and 88k views
- Entertainment-based science and engineering videos focused on Tesla coils and high voltage electricity
- Experience designing and building loosely coupled resonant transformers (i.e., Tesla coils), zero voltage switching (ZVS) inverters, feedback-driven half-bridge and full-bridge high frequency inverters, vacuum tube RF amplifiers, class C and class E RF amplifiers
- Over 10 years of experience working with high voltage electricity
 - High voltage safety, electrical isolation, high frequency skin effect, parasitic capacitance and inductance, EMI/RFI shielding, RF grounding
- Project interests: high voltage generation, wireless power transfer, wireless communication, mass drivers (i.e., coil guns and rail guns), induction heating, voltage multipliers, pulse power

Awards and Honors

Final Challenge Prize (\$750,000) Winner, Lead Programmer, NASA Centennial Challenge (Sample Return Robot Challenge), [News Article](#) Sep 2016

Order of Augusta, West Virginia University, [News Article](#) Apr 2016

Outstanding Senior, West Virginia University Apr 2016

Graduate Research Fellowship Recipient, National Science Foundation Graduate Research Fellowship Program (NSF GRFP), [News Article](#) Mar 2016

Level-2 Prize (\$100,000) Winner, Lead Programmer, NASA Centennial Challenge (Sample Return Robot Challenge), [News Article](#) Jun 2015

Level-1 Prize (\$5,000) Winner, Lead Programmer, NASA Centennial Challenge (Sample Return Robot Challenge), [News Article](#) Jun 2014

Professional Societies

Student Member, Institute of Electrical and Electronics Engineers (IEEE) Robotics and Automation Society (RAS) 2017–Present

Member, West Virginia University Laurel Chapter of the Mortar Board National Honor Society 2015–2016

Member, Sigma Gamma Tau: Aerospace Engineering Honor Society 2015–2016

Member, West Virginia University Alpha Chapter of Tau Beta Pi: The Engineering Honor Society 2014–2016

Service and Volunteering

Mentor, WVU University Rover Challenge (URC) undergraduate robotics team 2017–Present

Directed Study Instructor, National Youth Science Camp (NYSC) 2017–2019

Invited Speaker, Day in the Park, NASA's Independent Verification and Validation (IV&V) Program 2017, 2020, 2021

Mentor , Mountaineer Area Robotics (MARS 2614) FIRST Robotics Competition (FRC) high school robotics team	2011–2021
Mentor , FIRST Lego League (FLL) middle school robotics teams	2016–2018
Referee , West Virginia Robotics eXtreme (WVRoX), FRC Event	2016, 2018
Judge , FIRST Lego League (FLL)	2011–2015
Volunteer Member , Friends of Deckers Creek (FODC) Youth Advisory Board (YAB), Non-profit watershed conservation organization	2007–2011