Annika Thomas

E-mail: annikat@mit.edu
Web: annikathomas.com

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA — September 2021 - Present
Ph.D. Student, Mechanical Engineering
Major in Robotics; Minor in Space Systems
Advisor: Prof. Jonathan P. How

S.M. in Mechanical Engineering
Advisors: Prof. David Trumper and Prof. Kerri Cahoy
Awards: Brookfield Design Fellowship, Martin Design Fellowship, NSF GRFP Fellowship

Columbia Engineering, New York, NY — September 2019 - May 2021
B.S. in Mechanical Engineering
Awards: Distinguished Undergraduate Researcher, Dean's Award

The College of Idaho, Caldwell, ID — September 2016 - May 2019
B.S. in Mathematics and Physics
Minors in Spanish and Psychology
Awards: Gipson Fellowship, Athletic Scholarship, Dean's Award

PUBLICATIONS

[1] SOS-Match: Segmentation for Open-Set Robust Correspondence Search and Robot Localization in Unstructured Environments.
Annika Thomas*, Jouko Kinnari*, Parker C. Lusk, Kota Kondo, Jonathan P. How.
International Conference on Intelligent Robots and Systems (IROS), 2024.

[2] PUMA: Fully Decentralized Uncertainty-aware Multiagent Trajectory Planner with Real-time Image Segmentation-based Frame Alignment.
Kota Kondo, Claudius T. Tewari, Mason B. Peterson, **Annika Thomas**, Jouko Kinnari, Andrea Tagliabue, Jonathan P. How. *International Conference on Robotics and Automation (ICRA)*, 2024.

[3] Global Localization in Unstructured Environments Using Semantic Object Maps Built from Various Viewpoints.
Jacqueline Ankenbauer, Parker C. Lusk, **Annika Thomas**, Jonathan P. How
International Conference on Intelligent Robots and Systems (IROS), 2023.
Finalist for Best Paper in Safety, Security and Rescue Robotics.

[4] Protecting Satellites in Low Earth Orbit: An Overview of Hazards and Policy Solutions.
Annika Thomas*, Dansil Green*, Kristen Ammons, Laman Jalil, Joe Kusters, Kerri Cahoy
Massachusetts Institute of Technology Science Policy Review, Volume IV, 2023.

[5] Innovative Structural and Mechanical Satellite Systems.
Annika Thomas.
S.M. of Mechanical Engineering at Massachusetts Institute of Technology Thesis, 2023.

[6] The AEROS Mission: Characterizing Multi-Spectral Ocean Measurements through Small Satellite Connectivity.
Cadence Payne, Pedro Miguel da Silva Pinto, Madeline Loui, **Annika Thomas**.
MIT Portugal Program Conference, 2023.

[7] Introducing Experimental Design to Promote Active Learning.
Yevgeniy Yesilevskiy, **Annika Thomas**, Jessica Oehrlein, Melissa Wright, Michael Tarnow.
American Society for Engineering Education, 2022.

Publications Before Ph.D.

[8] Real-time Estimation of Electron Dynamics in Hall Effect Thrusters using an Extended Kalman Filter.
Christine Greve, **Annika Thomas**, Manoranjan Majji, Kentaro Hara.
AIAA Propulsion and Energy Forum, 2020.

[9] Real-time Estimation of Low-Temperature Electron Dynamics.
Annika Thomas, Christine Greve, Kentaro Hara.
Stanford SURF Lightning Talks, 2020.

[10] Searching for Evidence of Dark Matter Interaction in Olivine.
Annika Thomas, Ethan Brown, Morgan Schaller, Kelly Odgers, M. David Frey.
Rensselaer Polytechnic Institute Summer Research Symposium, 2019.

[11] Investigating Bubble-Gas Clump Association to Understand the Conditions of Massive Star Formation
Annika Thomas, Katie Devine.
College of Idaho Student Research Conference, 2019.

[12] Magnetomechanics of Magnetic Shape Memory Micropumps.
Annika Thomas, Sierra Sandison, Andrew Armstrong, Peter Mullner.
Idaho Conference on Undergraduate Research; NSF Research Experience for Undergraduates Symposium, 2018.

[13] Harmonics of Hula-Hoop Hypocycloid Motion.
Annika Thomas, Zoe Hern, Jim Dull.
College of Idaho Student Research Conference, 2018.

[14] Imaging M33: Astronomy, Optics, and Electronics.
Annika Thomas, Heidi Waterman, Tyler Truksa, Christian Jensen, Natash Dacic, Joe Daglen, Jim Dull.
College of Idaho Student Research Conference, 2018.

[15] Visually Classifying Yellowballs to Understand their Role in Star Formation.
Annika Thomas, Katie Devine.
College of Idaho Student Research Conference, 2018.

[16] Developing Diagnostics for Sugar Beet Powdery Mildew.
Annika Thomas.
British Society for Plant Pathology Newsletter, 2018.

Preprints

[17] ROMAN: Open-Set Object Map Alignment for View-Invariant Global Localization.
Mason B. Peterson, Yi Xuan Jia, Yulun Tian, **Annika Thomas** and Jonathan P. How.
Arxiv Preprint, 2024.

Research Experience

MIT Aerospace Controls Laboratory May 2023-Present, Cambirdge, MA
Ph.D. Student (Supervisor: Jonathan P. How)
Worked on global localization in unstructured environments from aerial and ground viewpoints [3], leveraged segmentation and language modeling for mapping and localization in open-set settings [4][17], incorporated uncertainty in multiagent trajectory planning [2]. Currently developing a hierarchical SLAM system leveraging Gaussian Splatting for scene understanding.

MIT STAR Laboratory Jun 2022-May 2023, Cambridge, MA
S.M. Student (Supervisor: Kerri Cahoy)
Led mechanical design, assembly, and integration of BeaverCube2 3U CubeSat, an Earth-observing nanosatellite equipped with onboard AI for task planning, segmenting, and characterizing satellite imagery with machine learning to optimize downlink decisions [5], and analyzed thermal and structural functional requirements of BeaverCube2 and AEROS [5][6].

MIT Precision Motion Control Laboratory Aug 2021-May 2023, Cambridge, MA
S.M. Student (Supervisor: David Trumper)
Modeled and designed feedback control system for suspension of a novel magnetically-levitated reaction sphere for satellite attitude control [5].

Columbia Engineering Jan 2021-Jan 2022, New York, NY
Research Assistant (Supervisor: Yevgeniy Yesilevskiy)
Redesigned the mechanical engineering lab course, MECE E3018, at Columbia University to promote active learning [7].

Stanford Plasma Dynamics Modeling Laboratory May-Sep 2020, Palo Alto, CA
Visiting Researcher (Supervisor: Kentaro Hara)
Predicted plasma flow in spacecraft propulsion systems using extended Kalman filtering [8][9].

Rensselaer Polytechnic Institute Brown Research Group May-Oct 2019, Troy, NY
Visiting Researcher, NSF REU (Supervisors: Ethan Brown and Morgan Schaller)
Designed an indirect detection technique for weakly interacting massive particle dark matter [10].

Boise State University Magnetic Materials Laboratory May-Jul 2018, Boise, ID
Visiting Researcher, NSF REU (Supervisor: Peter Mullner)
Designed using SolidWorks and machined biomechanical micropumps, including characterization tests and a user interface to control flow rate [12].

College of Idaho Star Formation Research Lab Feb-May 2019, Caldwell, ID
Independent Study (Supervisor: Katie Devine)
Visually classified Yellowballs to refine their radius measurements and performed statistical analysis of regression [15].

College of Idaho Observational Astronomy Dec 2017-May 2018, Mayhill, NM; Caldwell, ID
Independent Study and Field Work (Supervisors: Joe Daglen and Jim Dull)
Collected and analyzed exoplanet data and performed specroscopy, operated telescopes, imaged M33 galaxy [14].

Industry Experience

MIT Lincoln Laboratory, Group 76 May-Aug 2022, Lexington, MA
Engineering Intern, Control and Autonomous Systems
Implemented object detection, obstacle avoidance and trajectory planning algorithms for autonomous vehicles, developed a state space model of an inverted double pendulum.

Awards

Best in Theme, Long Duration Mars Simulation at the Moon, NASA RASC-AL 2024
Finalist, Best Paper in Safety, Security and Rescue Robotics, IROS [3] 2023
GRFP Fellowship, National Science Foundation 2023
Outstanding GRA, MIT Fraternaties, Sororities and Independent Living Groups 2023
Selected from over 100 graduate residential assitants for service to the community
Martin Fellowship for Design, MIT 2022
Brookfield Fellowship, MIT 2021
Distinguished Tutor, Columbia Tutoring and Learning Center 2021
Developed teaching materials to support students from low-income backgrounds
John K. Mladinov Scholarship, Columbia Named Scholarships 2020; 2021
U.S. Bank Academic All-Conference Award, Cascade Collegiate Conference 2017-2019
Selected for service and academic excellence while captain of Varsity Women's Golf
Math and Physical Sciences Department Scholarship, College of Idaho 2017
Awarded to an outstanding student in the MAPS department
Presidential Merit Scholarship, College of Idaho 2016-2019

Teaching and Leadership Experience

Research Mentor, Polygence — Feb 2022 - Present
Providing mentorship for students to pursue independently led research projects related to robotics, Lunar architecture, machine learning and aircraft/spacecraft design.

Invited Lecturer, MIT First Year Graduate Seminar — Sep 2024

Teaching Assistant: Stochastics; Product Design (Qualifying Exams), MIT — Sep 2023-Jan 2024

Invited Speaker, Women in Engineering Showcase, MIT — Aug 2023
Presented on segmentation for robotic mapping and localization in extreme environments

Instructor, Beaver Works Summer Institute, MIT — June 2023

Instructor, MIT Women's Technology Program, MIT — June 2023

Instructor, Summer High School Program for Engineers, Columbia — May-Aug 2021
Taught advanced robotics and multivariable calculus to 30 students

Service & Extra-curriculars

NASA Lunar Autonomy Challenge, MIT Team Lead — Sep 2024-Present
Leading a team of 12 students to perform surface mapping, autonomous robotic operation, localization, orientation, path planning, and object detection on the Lunar surface using IPEx

MIT AeroAstro Communication Lab, Fellow — May 2024-Present
Provide one-on-one support to undergraduate and graduate students at MIT for journal papers, conference presentations, lab reports, research posters, theses, and job applications.

MIT Housing & Residential Services, Graduate Residential Assistant — Aug 2023-Present

NASA RASC-AL Lunar Mars Analog, MIT Operations Lead — Aug 2023-May 2024
Led integration of multi-agent robotics and AI into architecture for autonomous operations

MIT Graduate Student Council, Volunteer — Aug 2021-Present

MIT Graduate Association of Mechanical Engineers, Volunteer — Aug 2021-Present

Reviewer: IEEE Robotics and Automation Letters (RA-L) — 2024

Reviewer: IEEE International Conference on Robotics and Autonmation (ICRA) — 2023; 2024

Invited Panelist, Mechanical Engineering Graduate Seminar, MIT — Oct 2023

Invited Panelist, Beaver Works Summer Institute, MIT — June 2023

Press & Media

Designing for Outer Space (MIT News) — 2024

AEROS CubeSat Launches to Study Ocean Health (MIT Aero/Astro) — 2024

AEROS CubeSat Mission presented at MIT Portugal Program (MIT Aero/Astro) — 2023

Living the Life I Used to Dream About (Featured at TechGirlz Conference) — 2022

2022 - Year in Review (College of Idaho Annual Scholarship Gala) — 2022

Prestigious Graduate Schools Await Recent Alumni (College of Idaho Newsletter) — 2021

A Laboratory Fit for Lockdown (Columbia Magazine) — 2021

Program alumna pays it forward by helping new students learn to SURF (Stanford) — 2021

Annika Thomas Works on Plasma Engines for Space Propulsion (Stanford) — 2020

Finding the Way: The Thomas Tutors (College of Idaho Magazine) — 2018

Selected Invited Talks

MIT Perception and Localization Seminar: Open-Set Object-Based Localization — Oct 2024

John F. Kennedy High School: Computer Vision in Astronomy — Oct 2024

TEDxBoston: Robotics and Regolith: Building Habitats from Moon Dust — July 2024

MIT Media Lab (Roxbury Latin): Vision in Space — June 2024

TEDxMIT: Collaborative Vision Systems for Space Exploration — Apr 2024

Universidad del Valle de Guatemala Women in Engineering Program
From Pathology to Path Planning: Exploring New Frontiers in Robotics — Apr 2024

Skills

Languages English (*native*), Spanish (*advanced*)

Programming Python, PyTorch, C/C++, ROS, Java, Matlab, R Studio, Mathematica, HTML

Technical Expertise Computer Vision, SLAM, Localization, Pose Estimation, 3D Geometry, Tracking, Neural Rendering, Reconstruction, Linear Algebra, Optimization, Deep Learning