Alejandro Pelaez-Duque

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EDUCATION

Brigham Young University, Ira A. Fulton College of Engineering, Provo, Utah**:** Apr 2027
Bachelor of Science, *Computer Engineering*, Research Focus in Autonomous Aerial & Ground Systems
Minors in Mathematics and Computer Science **GPA: 3.87**

- Relevant coursework: **Graduate level** Autonomous Aircraft, High-Performance Computing. **Senior level** Control Systems, Robotics & Autonomy, Applied Machine Learning.

PUBLICATIONS & PRESENTATIONS

Publications

1. **Alejandro Pelaez**, Randal W. Beard, "COAST: Safe Flight Corridor Planner for Fast and Robust Snap Minimized Trajectories," *2027 American Control Conference (ACC).* [Submitted October 2026] arXiv:2611.22447
2. **Alejandro Pelaez**, Dallon Gunn, Brady Moon, "What Transfers to Road Topology? A Controlled Study of Foundation-Model Representations Across Architectures and Geographic Domains," Manuscript in preparation
3. Curtis C. Johnson, Carlo Alessi, Egidio Falotico, **Alejandro Pelaez**, Cameron Collyer, Randon Sandall, Marc D. Killpack, "Zero-shot Whole-Body Manipulation with a Large-Scale Soft Robotic Torso via Guided Reinforcement Learning," Manuscript in preparation
4. Muhammad Taha, Caleb Fears, **Alejandro Pelaez**, Gregory Nordin, Adam Woolley, Troy Munro, "3D Printed, Peltier Sensor for Measurements Within Small Scale Thermal Systems," *International Thermal Conductivity Conference & International Thermal Expansion Symposium (ITCC/ITES 2026)*. [Accepted and presented by Muhammad Taha; not yet published]
5. Muhammad Taha, Mitchell Martin, Caleb Fears, Nathan Smith, **Alejandro Pelaez**, Adam Woolley, Gregory Nordin, Troy Munro, "Development of Miniaturized Thermoelectric Element for Temperature Control in Microfluidic Systems," Manuscript in preparation

Research Presentations

1. **Alejandro Pelaez**, Randal W. Beard, "COAST: Real-Time Autonomous Aerial Planner with Safety Guarantees for Fast and Robust Trajectories" Poster Presentation, 2026 SHPE National Convention, Indianapolis, October 2026. **(2nd Place Podium, Undergraduate Poster Competition)**
2. **Alejandro Pelaez**, "Safe Flight Corridor Planner for Fast and Robust Snap Minimized Trajectories," Oral Presentation, *BYU IMMERSE*, Brigham Young University, Provo, UT, July 2026.
3. **Alejandro Pelaez**, "Self-Clearing Channels," Oral Presentation, *BYU IMMERSE*, Brigham Young University, Provo, UT, May 2024.

RESEARCH EXPERIENCE

Autonomous Aerial Systems Research Assistant *Feb 2026-Present*
BYU MAGICC (Multiple Agent Intelligent Coordination and Control) Lab, Dr. Randy Beard (RPI Alum) - Provo, UT

- Engineered a C++ online trajectory planner using KD-Tree spatial projections and B-Spline kinodynamic bounding, achieving **sub-10ms computation times** for real-time autonomous UAV navigation.
- Integrated simulated LiDAR point clouds with OSQP-based Quadratic Program within a RViz environment, ensuring dynamically feasible, obstacle-avoiding flight paths through continuous-space Safe Flight Corridors.
- **Authored manuscript** on snap-minimized trajectory optimization submitted to the American Control Conference (ACC), demonstrating the system's speed and advantages over state-of-the-art planners.

Computer Vision & Neural Networks Research Assistant *Aug 2025-Present*
BYU FROST (Field Robotic Systems) Lab, Dr. Brady Moon (CMU Alum) - Provo, UT

- Spearheaded a systematic empirical comparison of vision foundation models (SAM 2.1, DINOv3, and C-RADIOv3) for satellite road network extraction, culminating in a first-author journal manuscript (in preparation).
- Evaluated architectural augmentations and cross-domain generalization across 3,300+ global satellite images, demonstrating that SAM 2.1 improves out-of-domain topological routing (APLS) by over 4 points compared to prior state-of-the-art baselines.
- Engineered a controlled Python evaluation pipeline on an **NVIDIA RTX PRO 6000** GPU to isolate encoder features, proving that foundation-model pretraining paradigms impact graph connectivity significantly more than downstream decoder complexity.

Robotics and Control Research Assistant *Sep 2026-Present*
BYU RAD (Robotics and Dynamics) Lab, Dr. Marc Killpack (Georgia Tech Alum) - Provo, UT

- Developed evaluation methodology for RL-based controller against PID and MPC methods.
- Tested and tuned MPC controller and cost function in 1, 3, and 6 DOF scenarios.

Microfluidics and Materials Science Research Assistant Feb 2024-Jun 2025

BYU Electrical Engineering, Dr. Greg Nordin (USC Alum) & Dr. Troy Munro (KU Leuven/USU Alum) - Provo, UT

- Collaborated with Mechanical Engineering department towards progress of conference and journal papers by providing microfluidic 3D prints within 3 days of print request and within 1 week of design request.
- Mentored **2 undergraduate students** towards effective implementation of plans for research project and best practices by holding weekly accountability meetings and goal planning sessions.
- Developed electronic automation platform to streamline device preparation and reduce human error. Removed human preparation and sped up process from **2 days to 4-6 hours**.

PROFESSIONAL EXPERIENCE

Software Engineer Intern *Jun 2025-Aug 2025*

Bank of New York (BNY) Mellon - Pittsburgh, PA

- Collaborated with business team to develop proprietary OpenAI based agent (BNY's ELIZA) for team needs, saving over **$150k** in resources through redirecting user traffic to AI agent instead of business team.
- Leveraged MS Power BI API and SQL databases to create financial report for high value user access, decreasing process time by **52%** through streamlining UX.

Electromagnetism and Optics Laboratory Assistant *Jan 2024-May 2024*

BYU Department of Physics and Astronomy - Provo, UT

- Mentored 56 students in proper understanding of electromagnetic phenomena and elemental circuitry.
- Demonstrated lab procedures through detailed explanation and examples leading to 100% completion rate.

Licensed Commercial Electrician *May 2022-Feb 2024*

W Systems Electrical Contracting - Draper, UT

- Motivated coworkers to increase performance output by producing 80% of assigned units, incident-free, following OSHA guidelines despite being 1 of 4 workers within group.
- Entrusted with testing and troubleshooting to ensure quality electric layout and proper functionality of over 15 apartment units.

TECHNICAL PROJECTS

Autonomous Robotic Fleet - Independent

- Developing fleet of cars from scratch. Drafted circuitry sketch and sensor connections (distance sensors, IMU, servos).
- Prototyped circuit in breadboard and tested functionality with voltmeter and sensor mock code.
- Designed custom two layered PCB in KiCad. Learned Fusion 360 and designed car enclosure to exact fitting of components.
- Iterated through 3D prints until final product was up to measurements. Currently learning to export URDF file into python with goal of simulating environments for RL training (PyBullet, Pytorch).

RC Wi-Fi Based Communication Vehicle - Independent

- Used ESP32's as TX/RX systems. One ESP acted as the user input, while the other actuated sensor signals within RC car.
- Utilized pointers, memory allocation, and FSMs to reduce latency time.
- Learned Wi-Fi networking protocols (MAC address connections, and packet sending and receiving) to connect ESPs together. Reduced latency time to <=100ms.

Self-Leveling Drone - Independent

- Built, soldered, and tested a drone with use of a transmitter/receiver controller and a gyroscope/accelerometer to detect changes in orientation and tilt (C++/Arduino).
- Learned drone architecture (microcontroller -> ESC -> brushless motors) and basic control systems through integrating a gyroscope to control motor speed and drone tilt using PID control.

LEADERSHIP EXPERIENCE

Society of Hispanic Professional Engineers Chapter Leadership: Vice-President, President, Secretary Apr 2023-Present

- Directed fundraising efforts of **$60k+** for helping members attend yearly national convention.
- Coordinated travel itineraries with university's travel office for 50+ students
- Grew club membership by **35%** through pitching club benefits at seminars totaling over 400 people.

Young Men's Advisor Jan 2023-Jan 2024

- Aided in development of over 20 low-income immigrant and multicultural young men in social and academic settings. Led by example in showing youth how to take advantage of academic opportunities.
- Organized youth camps tailored to needs of youth. Funded these experiences through city-wide fundraisers.

HONORS AND AWARDS

- Placed **second nationally** in SHPE's National Convention undergraduate research competition – Poster.
- Placed **third nationally** in IBM/Qualcomm sponsored jeopardy-style national STEM competition with over 200 competitors.
- **HSF Scholar**. Accepted to the Hispanic Scholarship Fund, a prestigious program with 14% acceptance rate.
- BYU Scholarship recipient (2022-present) for High Academic performance.

SKILLS

Languages: Python, C/C++, MATLAB
ML/Robotics: PyTorch, OpenCV, ROS, PyBullet, IsaacSim
Embedded: Arduino, ESP32, Raspberry Pi
Design: KiCad, Fusion 360, OpenSCAD
Systems: Docker, Apptainer, Git, Linux