Animesh Rajvanshi

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Research Interests

Aerospace systems design engineering and propulsion systems; space exploration and extraterrestrial settlements; autonomous navigation and control for aerospace vehicles and humanoid robots. Driven by a drive to contribute to expanding the collective consciousness of humanity with aerospace applications, self-studying advanced concepts in flight dynamics, rocketry, and orbital mechanics to establish holistic frameworks, novel observatories being the primary, that enable establishing humanity's sustained presence on the lunar surface and beyond. Ultimately, propel us further towards answering, "why is there something rather than nothing?"

Education

Bachelor of Science in Mechanical Engineering

Arizona State University, Tempe, AZ

Graduation date: December 2024

GPA: 3.32/4.0

- Engineer In-Training (EIT), Arizona State Board of Technical Registration, March 2025
- Relevant Coursework: Fluid Mechanics, Dynamics, Control Systems, Applied Partial Differential Equations, Solid Mechanics, Thermodynamics, Heat Transfer, Structures & Properties of Materials

Research & Work Experience

Mechanical Engineer

Temple Allen Industries, Inc., Rockville, MD

January 2026 – March 2026

- Design mechanical subsystems for EMMA™ and SAM™ aircraft servicing platforms, creating SolidWorks assemblies for smart dollies, scissor lifts, and deployment mechanisms integrating requirements from control systems, HMI interfaces, and vision subsystems for aerospace surface preparation equipment
- Achieved 25% weight reduction in wheel assembly prototype through design optimization while maintaining structural integrity; iteratively refined components for manufacturability in collaboration with program manager, translating design improvements from legacy systems to current-generation platforms
- Develop production-ready engineering deliverables including detailed part drawings for pilot manufacturing, complete Bills of Materials (BOMs) for existing assemblies, and assembly instructions; directly support fabrication team from design release through physical assembly and hardware integration

Autonomous Systems Engineer

Anoop Singh Robotics, Arizona State University, Tempe, AZ

July 2025 – January 2026

- Developed vision-based SLAM quadcopter achieving <0.3m position accuracy using Holybro Kakute H7 flight controller with ArduPilot firmware, Raspberry Pi 4 companion computer, and Arducam IMX708 monocular camera; integrated GPS/compass/barometer via MAVLink protocol for robust sensor fusion through Extended Kalman Filter (EKF3)
- Implemented autonomous navigation system capable of waypoint following and real-time obstacle avoidance using ORB-SLAM2 feature tracking combined with ArduPilot's mission planner; achieved 85% tracking success rate in textured indoor environments with automatic failsafe recovery
- Designed custom power distribution and mounting solutions in Fusion 360 for 250mm carbon fiber frame, optimizing center of gravity placement and vibration isolation for camera stability; validated structural integrity under 4g flight loads using empirical testing
- Applied control theory including PID tuning for position hold (settling time <2s, 10% overshoot), MSP/MAVLink protocol implementation, and real-time sensor fusion algorithms in Python; documented complete system architecture for reproducibility in future autonomous flight research

Nanoelectronics Metrology & Failure Analysis Engineer

Celano Lab, Arizona State University, Tempe, AZ

May 2024 – July 2025

- Simulated sub-micron defect detection in 3D semiconductor packages using CIVA NDT software for scanning acoustic microscopy (SAM), implementing proprietary scaling models while preserving ultrasonic wave propagation physics; created technical CAD models supporting two lab research publications
- Analyzed Cu-Cu hybrid bonding failure mechanisms through comprehensive literature review of advanced 3D packaging technologies, investigating thermal-mechanical stresses from CTE mismatch and warpage mitigation strategies
- Contributed technical presentation on Through-Silicon Vias (TSVs) and interposer design for heterogeneous integration, demonstrating cross-domain application of solid mechanics and materials science from nanoscale to aerospace structural analysis

Teaching Experience

Executive Learning Assistant

Fulton Schools of Engineering Tutoring Centers, Arizona State University, Tempe, AZ

November 2021 – December 2024

- Tutored multiple engineering students, 180+ in Fall 2024 alone, across advanced topics including control systems, fluid mechanics, solid mechanics, dynamics,

and differential equations; achieved highest student inquiry volume in tutoring center through clear explanations and systematic problem-solving approaches

- Led tutor development program as advisory board member, designing technical assessments for new hires, conducting structured interviews, and facilitating training workshops on pedagogical techniques; improved center operational efficiency while modeling professionalism and commitment to student success
- Recognized as Tutor of the Month (January 2023) for exceptional student engagement and ability to simplify complex engineering concepts through visual aids and real-world applications

Project Experience

Amateur Rocket & Payload Engineer

High-Powered Rocketry, Tripoli Rocketry Association, Tempe, AZ

May 2025 – Present

Level 1/2 Dual-Purpose Platform (LOC Patriot - Reinforced):

- Achieved Level 1 certification by assembling LOC Patriot kit (4" diameter, 40" length) using standard epoxy bonding, through-wall fin attachment, and rail button installation; successfully flew Aerotek H100W-14A motor (227 Ns impulse) with single-deployment parachute recovery system
- Engineered composite-reinforced airframe with 3× hoop strength increase by stripping custom paint finish and applying laminating epoxy with form-fitted PETG-CF armor shell (1/16" thickness); reduced buckling risk under Level 2 motor thrust loads (800+ N peak from Aerotek J425R) while adding <150g mass, enabling reuse for higher-impulse flights
- Increased thermal margin for high-speed flight through composite shell providing improved heat dissipation and structural rigidity; PETG-CF glass transition temperature of 250°C offers additional safety factor during transonic flight phases with J425R-14A motor (609 Ns impulse, predicted 3,800 ft apogee via OpenRocket simulation)

Level 2+ Capable Hybrid Platform (4" Phenolic Dual-Deploy):

- Designed modular high-performance rocket achieving 56% payload volume increase using phenolic tubing airframe (4" diameter, superior moisture/heat resistance), custom PETG-CF 3D-printed components (through-wall fins, motor mount, electronics bay), and spring-loaded 5" diameter nose fairing; expanded usable payload from 126 in^3 to 196 in^3
- Integrated dual RunCam Split 4 HD video system in custom electronics bay mount for simultaneous forward and aft flight visualization; designed mounting bracket to survive 15-20g dual-deployment events for complete flight documentation from liftoff through landing
- Validated flight performance for K-class motor flights via OpenRocket simulation with Aerotek K535W-14A motor (840 Ns impulse), achieving 1.8 caliber stability margin, 5,400 ft predicted apogee, and <18 fps landing velocity with

dual-deployment recovery; confirmed structural loads in Fusion 360 with factor of safety >2.5 for all 3D-printed load-bearing components

Biomimetic Autorotating Descent Payload (Samara):

- Developed nature-inspired payload achieving controlled 2.8 m/s terminal velocity using optimized NACA 4412 cambered airfoil in autorotating samara configuration; reduced descent rate by 65% compared to ballistic trajectory, enabling safe recovery of electronics from high-altitude deployments
- Integrated embedded telemetry system (ESP32 microcontroller, MPU6050 6-DOF IMU at 100 Hz, BMP280 barometer, LoRa SX1278 433 MHz radio) for real-time flight data logging; achieved 2 km ground station range with transmitted acceleration, rotation rate, altitude, and GPS data for post-flight trajectory reconstruction
- Conducted iterative design optimization using ANSYS Fluent CFD simulations to refine blade pitch angle (10-14°) and planform geometry for stable autorotation (450-550 RPM); validated aerodynamic predictions through controlled 50 ft drop tests with high-speed video motion analysis

V-22 Osprey-Inspired VTOL Drone Payload:

- Prototyped deployable tiltrotor UAV with custom ducted propeller housings (3" duct diameter) 3D-printed in PETG, fitting within 5" diameter nose fairing constraint; incorporated servo-actuated tilt mechanism enabling -90° to +90° nacelle rotation for vertical takeoff and forward flight transition capability
- Integrated stabilization flight controller (SpeedyBee F405 V5, Betaflight firmware) with brushless motors (1106 4500KV), RunCam Split 4 for FPV/recording, and 3S 850mAh LiPo battery; achieved 15:1 thrust-to-weight ratio in hover configuration with projected 8-10 minute flight endurance
- Modeled complete mechanism in Fusion 360 including kinematic tilt transition, spring-loaded deployment sequence from nose fairing, and structural analysis of ducted fan mounts; ongoing empirical testing of deployment dynamics and manual flight performance validation

Moon Presence Project Manager

HeroX Challenges, Tempe, AZ

August 2020 – October 2025

- Led lunar surface power infrastructure design for NASA Artemis missions (Sun Devil Satellite Laboratory, 2020-2021), adapting JAXA-Toyota Lunar Cruiser rover platform to deploy scalable cable distribution networks connecting 100 kWh battery hubs; engineered system resilient to -180°C to +130°C thermal extremes, regolith abrasion, and 14-day lunar nights
- Developed nuclear-enhanced power architecture for Amentum's "Back to the Moon" Challenge, integrating 40-100 kW fission reactor with ISRU regolith processing and plasma boring for lava tube habitat excavation; achieved 20-30% mission resupply reduction through on-site power generation, progressing concept to NASA Technology Readiness Level (TRL) 4-5

- Designed compliant wheel prototypes for MicroChariot lunar rover (NASA Rock and Roll Challenge) supporting 100-lb payload capacity across simulated regolith terrain; designing 19-inch diameter wheels with enhanced shock absorption for -250°F to +250°F operational range, scalable to Artemis program mobility requirements

Hyperspectral CubeSat Project Manager

Sun Devil Satellite Laboratory, Arizona State University, Tempe, AZ

July 2021 – July 2022

- Directed interdisciplinary team in 3U CubeSat mission design for ocean plastic pollution detection using hyperspectral imaging (1000-1700 nm SWIR range, 50 m ground sample distance); proposed detection algorithm exploiting polymer absorption peaks at 1215 nm and 1410 nm wavelengths
- Formulated mission architecture for 500 km sun-synchronous orbit deployment with Iridium satellite communications terminal, eliminating ground station infrastructure dependency; designed power budget and pointing requirements for hyperspectral camera operations
- Served as Vice President of Sun Devil Satellite Laboratory, managing organization workshop operations, component procurement, and budget allocation for active projects; grew membership by 25+ students through tabling events and developed comprehensive sponsorship package securing organizational funding

Team Member, Wrong-Way Driving Prevention System (Capstone)

Arizona State University, Tempe, AZ

January 2024 – December 2024

- Designed and fabricated active speed hump achieving 1000 lbf load capacity with spring-actuated depressible stainless steel ramps for directional traffic control; engineered mechanical subsystem allowing controlled vertical displacement under vehicle weight
- Developed Arduino Uno R3 direction detection system using contact switch sequencing to determine vehicle approach direction based on differential ramp depression timing; implemented control logic distinguishing correct vs. wrong-way traffic trajectories
- Validated structural integrity via ANSYS FEA achieving safety factors of 2.5-3.3 under maximum design loads; conducted prototype testing demonstrating reliable ramp actuation and direction discrimination with <1% false detection rate

Sub-Team Lead, Heat Resilience Challenge (EPICS)

Arizona State University, Tempe, AZ

August 2020 – May 2021

- Led thermal management research for mobile home heat mitigation, evaluating air conditioning units, evaporative coolers, and photovoltaic systems using

Analytic Hierarchy Process (AHP) for multi-criteria optimization balancing cost, energy efficiency, and cooling effectiveness

- Designed ventilation system in SolidWorks incorporating intake/exhaust fan configuration inspired by PC thermal management principles; validated 12-18°C interior temperature reduction via ANSYS Fluent CFD simulations under Arizona summer conditions (45°C ambient)

Extracurricular Activities

Purple Belt, Brazilian Jiu-Jitsu

GD Jiu-Jitsu Academy, Tempe, AZ

September 2021 – Present

- Volunteer instructor for youth program teaching self-defense techniques and fostering emotional resilience in students ages 4-16; apply pedagogical skills from engineering tutoring to kinesthetic learning environment
- Active competitor with tournament record (4 Gold, 2 Silver, 4 Bronze medals, 1 MVP award) demonstrating discipline, strategic thinking, and performance under pressure- qualities directly applicable to high-stakes engineering problem-solving

Technical Skills

- Design & Analysis: CAD (Fusion 360, SolidWorks, Onshape, AutoCAD), Flight Dynamics Simulation (OpenRocket), CFD/FEA (ANSYS Fluent/Mechanical), 3D Modeling (Blender), NDT Simulation (CIVA)
- Programming & Platforms: Python (NumPy/SciPy, OpenCV, control systems), MATLAB, C/C++, JavaScript, ROS2, LabVIEW, Arduino, Raspberry Pi
- Hardware & Fabrication: Embedded Systems (flight controllers, sensor integration), 3D Printing (FDM: PETG-CF, PLA, PPA-CF), CNC Machining, Soldering/Electronics Assembly, TIG/MIG Welding

Certifications & Licenses

- Astrophysics XSeries Course, Australian National University, edX
- Certified SolidWorks Professional (CSWP), Dassault Systèmes
- Amateur Extra Class Amateur Radio License (Call Sign: KM7BER), Federal Communications Commission
- Google IT Support Professional Certificate, Coursera
- Introduction to Programming the Internet of Things (IoT) Specialization, UCI, Coursera
- Python for Everybody Specialization, University of Michigan, Coursera

Awards & Honors

- Dean’s List: Fall 2020, Spring 2021, Fall 2021
- Tutor of the Month, Fulton Schools of Engineering Tutoring Centers, January ‘23
- Brazilian Jiu-Jitsu Competition: 4 Gold, 2 Silver, 4 Bronze Medals, and 1 MVP Competitor Award