Harsh Desai

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EDUCATION

University of Michigan — **Ann Arbor, MI, USA**
Master of Engineering, Space Systems Engineering | GPA: 3.79/4.0 — August 2024–December 2025

Vellore Institute of Technology (VIT) — **Vellore, India**
Bachelor of Technology, Mechanical Engineering | GPA: 7.78/10 — July 2019–July 2023

RESEARCH EXPERIENCE

Space Physics Research Lab, University of Michigan — **Ann Arbor, MI, USA**
Research Assistant — February 2026–Present
Project: Lunar Vehicle Active Charge Control System (LVACCS) Testing Rig Characterization | Supervisor: Dr. Omar Leon

- Validated high-voltage power interface controls through rigorous failure mode analysis of a 1300V discharge box to ensure hardware safety during high-throughput plasma source characterization
- Developed Python-based GUIs that reduced manual test interactions from 15 steps to 5 and automated plasma ignition sequences, streamlining remote control data logging and power supplies for experimental repeatability, preparing the facility for testing Spacecraft Charging Device hardware
- Characterized remote Hollow Cathode ignition workflows to improve test repeatability, achieved 98.6% data synchronization across data streams and saved 15 minutes of post-run processing for high-fidelity predictive plasma modeling

Summer Intern — May 2025–July 2025

- Developed "TestBedz", a full-stack web platform for spacecraft qualification testing that collapses multi-round requirement negotiations into structured submissions for thermal-vacuum, vibration, and electromagnetic interference (EMI) testing cycles
- Facilitated requirement flowdown for satellite hardware testing by implementing a role-based matching platform that ensures compatibility between hardware profiles and facility operational limits for 6 test-type profiles

Climate and Space Sciences and Engineering(CLaSP), University of Michigan — **Ann Arbor, MI, USA**
Research Assistant | Supervisor: Dr. Cheng Li — September 2025–December 2025
Project: Uranian Tropospheric Cloud Resolving Model

- Trained in running cloud-resolving(CRM) simulations on Great Lakes HPC cluster, exploring mechanistic interpretation of sensitivity to methane abundance/profile, latent-heating and microphysics settings, and gravity
- Investigated interactions between latent heating and sedimentation by simulating Uranian cloud behavior by exploring the coupled effects of phase-change thermodynamics and sedimentation using vertical velocity and methane condensation diagnostics

Solar and Heliospheric Research Group, University of Michigan — **Ann Arbor, MI, USA**
Graduate Student Research Assistant | Advisor: Prof. Stefano Livi — January 2025–December 2025
Project: FPGA Design Implementation for Solid-State Detector (SSD) Readout Chain

- Developed a digital readout roadmap for solid-state detectors by sizing components against scientific detection targets, bridging mechanical sensor design with high-speed programmable logic implementation
- Simulated an increase in available pulse digitization rates from 1 MSPS to 125 MSPS to support high-fidelity particle energy resolution by integrating a Zmod ADC 1410 path into a Zynq-7000 programmable logic architecture
- Achieved functional correlation between MATLAB golden models and Vivado co-simulations for high-speed digital signal processing paths using a Model-Based Design approach in MATLAB HDL Coder
- Evaluated hardware timing limitations for a 125 MHz system clock by performing post-synthesis Register-Transfer Level (RTL) analysis, identifying path constraints (Worst Negative Slack failure) within the Zynq SoC architecture

Climate and Space Sciences and Engineering(CLaSP), University of Michigan — **Ann Arbor, MI, USA**
Research Assistant | Supervisor: Dr. Mojtaba Akhavan-Tafti — May 2025–July 2025
Project: A multi-cadence Tsurutani-Smith (TS) directional-discontinuity analysis of the Rivera et al. PSP-Solar Orbiter conjunction

- Synchronized temporal alignments across three data cadences (1s, 10s, 60s) to identify solar-wind event matches by shifting Parker Solar Probe timestamps to correlate with Solar Orbiter observations using a Python-based process (pyspedas library)
- Quantified magnetic field mismatch metrics and structural evolution within solar-wind streams by implementing the jump-detection methodology across the cadences and 180-second lags

L3Harris and University of Michigan — **Ann Arbor, MI, USA**
Communications Lead, Uranian Orbiter and Probe Mission Study — September 2024–May 2025

- Led communications subsystem design for the mission, managing 15 requirements for DSN connectivity and fault tolerance through a high-fidelity requirements traceability matrix
- Achieved a 16% ($450M) reduction in projected preliminary mission costs by conducting an architectural trade study through an orbiter-only spacecraft configuration using heritage five-instrument suite and by capping the payload budget

ACADEMIC PROJECTS

Space Instrumentation Calibration & Ion-Optics Series
Graduate Course: SPACE 571 | Supervisor: Prof. Stefano Livi July 2025–December 2025

- Optimized operating bias for Channel Electron Multipliers (CEM) by mapping pulse-height distributions and amplifier gains within a high-fidelity laboratory instrumentation calibration series
- Generated high-fidelity transmission functions to quantify energy resolution and angular acceptance for a cylindrical electrostatic analyzer (ESA) by extracting moments from energy-angle lab scan data
- Modeled ion-optical system metrics for an Einzel lens and Beam Expander geometries by using SIMION and SRIM simulations to calculate Full Width at Half Maximum values and filter responses

Spatial Ion-Electron Temperature Correlation
Graduate Course: SPACE 477 | Supervisor: Prof. Xianzhe Jia January 2025–April 2025

- Evaluated energy equation resolution(Ion-Electron temperature comparison) within the Space Weather Modeling Framework by tracing ion spatial distributions across the magnetosheath using global multi-fluid Magnetohydrodynamics (MHD) models
- Characterized reconnection-driven heating by identifying peak electron temperature excursions during simulated shock events using high-fidelity (HYPERS) hybrid model to evaluate convective transport dominance

LEADERSHIP AND ACTIVITIES

CANSAT 2022 (NASA & AAS)
Ranked 7th worldwide out of 42 teams (team's best). August 2021–July 2022

- Engineered a 10 m unidirectional tether-deployment mechanism using a DC motor and custom worm-gear spool, enabling non-backdrivable load transfer and controlled descent of a 2 mm braided-nylon payload line
- Built a servo-actuated ejection and stabilization stack: elastic-lid release with torsion-spring lock for parachute deployment, plus a dual-servo 2-axis gimbal maintaining a fixed 45◦ downward south-facing camera vector

Spaceport America Cup/International Rocketry Engineering Competition (IREC) in 2021
Placed 23rd globally and 5th in Asia-Pacific April 2020–July 2021

- Launched a Mach 0.9 solid-motor sounding rocket to a 10,000-foot target altitude
- Developed an integrated flight simulator to optimize sounding rocket trajectories, incorporating computational fluid dynamics (CFD) back-end data into a student-researched and developed (SRAD) flight software suite

CANSAT 2021 (NASA & AAS)
Placed 13th globally and 7th in Asia-Pacific August 2020–July 2021

- Design and simulation of the mono-wing payloads, implementing Blade element Theory, and complex transient CFD simulations for descent, for multi-parameter design optimization.
- Engineered a real-time telemetry acquisition framework for an atmospheric re-entry vehicle by building custom ground control software to monitor dual maple seed-inspired payload deployments using MATLAB

SKILLS

- Programming Languages: Python, MATLAB (learning), Verilog (learning), VHDL (learning)
- Tools: SIMION, SRIM, Amptek DPPMCA, FPGA Design Workflow, AMD Vivado, MATLAB HDL Coder & DSP Toolbox, NI VISA(PyVISA and PyMeasure), SPENVIS, SWMF & Magnetosphere-Ionosphere Models(MAGE, SWMF, HYPERS), Google Data Studio
- Hardware:GPIB/IEEE-488, USB-serial, serial data logging, Vacuum Chamber Operation(CTI-Cryogenics Hi-Vac, Roughing pump: Operated at 1 mTorr), Keithley DAQs and SMUs, TDK Lambda PSUs, High Voltage Switching Operations
- Mechanical Engineering Tools: ANSYS (GUI/TUI): Fluent, Mechanical; PyANSYS, OptiSlang, OpenFOAM, SolidWorks, Fusion 360, AutoCAD, Autodesk Inventor, SpaceClaim, MIDO, Xflr5, RocketPy, OpenRocket

INTERESTS

Space Instrumentation, Plasma diagnostics instrumentation, DAQ systems and digitizers, HV test automation, Detector design and readout, Calibration traceability, Low-noise signal-chain reasoning, Testing and control workflows, Ion optics and detector characterization