



# MADHAV SEHGAL

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## SUMMARY

M.S. Aerospace Engineering student (Space Systems) at the **University of Michigan** with hands-on experience supporting **aerospace system design, integration, and test**. Experienced in **requirements development, (V&V), environmental testing (TVAC, vibration), MBSE, thermal, vibration and structural analyses, CFD, Fluid Flow Analysis** and **multidisciplinary trade studies** on **industry-sponsored programs**. Seeking a **full-time Aerospace / Systems Engineer** role starting **May 2026**.

## EDUCATION

### University of Michigan

*Master of Science in Aerospace Engineering (Concentration: Space Systems)*

Coursework: Rocket Propulsion, Structural Dynamics, Finite Element Method, Systems Engineering.

Graduate Student Instructor: AERO/ SPACE582 (Spacecraft Systems Engineering)

**Ann Arbor, MI**

*May 2026 (Expected)*

(GPA: 3.25/4.00)

### Amity University

*Bachelor of Technology in Aerospace Engineering (Hons. In Spacecraft Engineering)*

Coursework: Aerodynamics, CFD, FEM, Propulsion, Structures, AFCS, Vibrations, Spacecraft Dynamics.

**Uttar Pradesh, India**

*May 2024*

## CERTIFICATION

**INCOSE Associate Systems Engineering Professional (ASEP) Certification**

Feb 2026

## SKILLS

**Analysis & Simulation:** FEM, CFD, ANSYS, ABAQUS, Structural Dynamics, Thermal Desktop, FEM

**Testing & Validation:** Vibration testing, Wind-Tunnel, NDT, Thermal-Vacc Testing, Test-to-Analysis Traceability

**Systems & MBSE:** Requirements Development, V&V, CONOPS, FMEA, WBS, Trade Studies, Risk Analysis, SysML, MagicDraw

**CAD & Modeling:** SOLIDWORKS, CATIA V5, AutoCAD, Fusion 360, GD&T

**Programming:** Python, MATLAB, C/C++, Flask, HTML/ CSS, JavaScript

## WORK EXPERIENCE

### Space Physics Research Lab (SPRL), University of Michigan

*Systems Engineering Intern*

**Ann Arbor, MI**

*May 2025 – Aug 2025*

- Led **structural and environmental testing** activities, including **vibration testing**, through test setup and configuration tracking.
- **Improved test readiness and compliance** by aligning system functionality with **real hardware validation campaigns** (TVAC, vibration, NDT) and applicable **GEVS and MIL standards** by coordinating **test planning, readiness reviews, and data traceability** across **TVAC and vibration testing**.
- **Bridged technical and operational requirements** by developing system-level **CONOPS** after thorough trade studies and analyses.

### Gas Dynamics Imaging Laboratory, University of Michigan

*Graduate Student Researcher*

**Ann Arbor, MI**

*May 2025 – Aug 2025*

- **Eliminated experimental-numerical inconsistencies** by synchronizing high-fidelity supersonic **SBLI wind-tunnel datasets** with corresponding **CFD meshes and sampling locations**.
- **Established test-to-analysis traceability** by developing repeatable, uncertainty-aware **data processing and validation pipelines** to support rigorous model verification and developed the model with **99.6% accuracy**.

### Centre for Airborne Systems, Defence Research & Development Organisation (DRDO)

*Engineering Research Intern*

**Bangalore, India**

*May 2023 – June 2023*

- Designed a 3D model of a drogue and probe-based air-to-air refueling pod system for the IL-78MKI using **CATIA**, improving fuel transmission efficiency by 15% through the integration of a **magnetic connection system**.
- Conducted **CFD and vibrational analysis** using **ANSYS** to simulate performance under real-world operational conditions, verifying structural integrity and system reliability by developing advanced **mathematical models** to optimize the refueling process, increasing operational efficiency, and reducing fuel transmission losses by 10%.

### Advanced Systems Laboratory, Defence Research & Development Organisation (DRDO)

*Structural Research Intern*

**Hyderabad, India**

*May 2022 – June 2022*

- Designed a high-fidelity **3D space launch vehicle model** in **SolidWorks**, improving simulation accuracy by 20% for **critical load and stress analyses**, contributing to design optimization for weight and strength.
- Executed **FEA** on major launch vehicle structures, conducting **static, dynamic, and modal analyses** in ANSYS Workbench and **APDL** to validate resilience against **launch-induced loads**, supporting certification and **safety reviews**.
- Verified simulation accuracy through **MATLAB-based** hand calculations, ensuring consistency across validation methods and achieving a 98% match between simulations and experimental data.



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## PROJECT EXPERIENCE

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### Identification & Characterization Expedition for Debris Tracking

University of Michigan

Systems Engineer (Project Lead)

Aug 2024 – Apr 2025

- Led **structural and thermal design efforts** for a small satellite mission by defining load paths, material selections, and structural configuration to survive **launch and on-orbit environments**. Developed and evaluated **structural and thermal analysis models** to assess stress response, stiffness, and thermal behavior under representative mechanical and environmental loading conditions.
- Developed system-level artifacts, including **FMEA, WBS, trade studies, and risk matrices** to support design decisions and safety assessments and **optimized constellation performance** by conducting **architecture trade studies**.

### Lunar Position System using MBSE (Northrop Grumman)

University of Michigan

Systems Engineer

Aug 2025 – Dec 2025

- **Reduced architectural ambiguity** by developing **SysML-based system architecture models** in **MagicDraw** to capture system structure, interfaces, and functional relationships.
- **Ensured a verifiable design baseline** by establishing **requirements traceability** between stakeholder needs, system requirements, and verification methods (analysis, inspection, test).

### Shockwave–Boundary Layer Interaction Control in Supersonic Inlets (CFD)

Amity University

Student Researcher

Sep 2023 – May 2024

- Developed and validated **3D RANS CFD models** of a **Mach 3 supersonic inlet** to investigate shock–boundary layer interaction (SBLI) induced separation and pressure losses, using **SST k- $\omega$  turbulence modeling** and **mesh-independence studies** to ensure credibility.
- Designed and simulated **passive micro-vortex generators (MVGs)** and **active air-jet-assisted MVGs (AMVGs)** to modify shock structure and boundary-layer momentum, enabling controlled shock redirection and improved near-wall flow behavior.
- Quantified flow-control effectiveness using **Mach number contours, total pressure recovery, pressure distortion metrics, and schlieren-density analyses**, demonstrating **2 $\times$  pressure recovery** with active flow control relative to passive configurations.
- Verified numerical accuracy by benchmarking against **published reference studies**, strengthening confidence in CFD predictions for **compressible-flow and high-speed inlet applications**.
- Presented results at **international conferences** and **first author** for multiple **published** and **in-press Springer publications**.

### Miniature Amity Satellite System (3U CubeSat)

Amity University

Team Lead

Dec 2022 – May 2024

- Led the end-to-end design and deployment of a 3U CubeSat for space debris detection and ozone imaging, the first CubeSat developed at the university. Coordinated subsystem integration across structure, payload, communications, and ground operations.
- Designed and implemented a cross-Yagi ground-station antenna, supporting mission communications and data downlink.

### NASA Human Exploration Challenge

Amity University

Team Lead

Sep 2020 – March 2023

- Led a multidisciplinary team over three years, responsible for the **design, CAD modeling, and structural and thermal analysis** of a human-powered lunar rover managing system integration and team execution. Authored key systems documentation, including **PDR, FMEA, and Preliminary Failure Analysis (PFA)**.
- Awarded **NASA Safety Award (2021)** and **1st Runner-Up in STEM Engagement (2022)**, the first national recognition for the university.

## PUBLICATIONS

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Published: 6 | Accepted: 2 | In- Review: 4 | In-Press: 1

- Numerical Study of Shock Train Effects on Mixed Compression Air Intake Performance, Springer, 2026. DOI: [https://doi.org/10.1007/978-981-96-7480-0\\_26](https://doi.org/10.1007/978-981-96-7480-0_26)
- Numerical Study of Shock-Wave/Boundary-Layer Interaction Control Using Variable Pressure and Inlet Size, Springer, 2024. DOI: [https://doi.org/10.1007/978-981-96-8500-4\\_23](https://doi.org/10.1007/978-981-96-8500-4_23)
- Comparative Study of Natural Frequency of a C-141a-il Airfoil Wing and Cantilever Beam: Simulation and Experimental Investigation, Springer, 2023. DOI: [https://doi.org/10.1007/978-981-97-1306-6\\_28](https://doi.org/10.1007/978-981-97-1306-6_28)
- Revolutionizing Space Infrastructure: Lagrangian Bases for Sustainable Satellite Operations, Refueling Hubs, and Multiplanetary Mission Support Base Establishment, 2023 Regional Student Conferences, 2023. DOI: <https://doi.org/10.2514/6.2023-77024>
- Engineering using wireless sensor network to study dynamic discovery and avoidance using position verification method in code cloning., International Journal of Inventions in Electronics & Electrical Engineering, 2019. DOI: <https://doi.org/10.13140/RG.2.2.23473.61>
- RFID Adaptor For Detecting And Handling Data/Occasions In The Internet Of Things., International Journal of Innovations in Applied Sciences & Engineering, 2018. DOI: <https://doi.org/10.13140/RG.2.2.36816.74>