

Seokhyeon Byun

Portfolio: seokhyeonbyun.com | LinkedIn | shyen96@vt.edu | (703) 587-7014

Education

Virginia Tech — Bachelor of Science in Aerospace Engineering
GPA: 3.39/4.00; Upper-division GPA: 3.78/4.00

Graduated: May 17, 2025

Research Experience

Research & Developer Intern, Space@VT — SuperDARN, Blacksburg, VA Jun 2024 – Sep 2025

- Built a parallel-processing Python pipeline integrating NOAA solar X-ray irradiance (SunPy/API) with SuperDARN ground-scatter data to monitor shortwave fadeout (SWF) impacts across North America; produced X-ray coverage plots confirming affected regions.
- Developed a Flask-based visualization and monitoring tool (pyDARN, NumPy, Pandas, Matplotlib, Plotly, Linux) with live radar feeds and historical archives; automated data retrieval and processing via cron jobs.

Research Assistant, STARBELT Lab — Drone Simulation for Synthetic Data Generation Jun 2025 – Aug 2025

- Investigated methods for generating synthetic aerial data for Vision-Language Model (VLM) training; evaluated trade-offs between photorealistic rendering and physics-accurate simulation in open-source platforms.
- Developed a web-based CesiumJS–React–Next.js environment using Google Photorealistic 3D Tiles to visualize georegistered drone flight paths from GPX data; automated FPV video capture via FFmpeg to produce reproducible visual datasets.
- Built and analyzed an NVIDIA Isaac Sim 4.5 pipeline to assess the Fabric Scene Delegate–PhysX conflict; designed a Python/OpenUSD/PhysX obstacle course with per-rotor control and encapsulated the workflow in a reproducible Docker container (Ubuntu 22.04 + ROS2 Humble).

Senior Capstone — In-Space Additive Manufacturing in Microgravity

Aug 2024 – May 2025

- **Autonomy & Controls subteam Lead:** Conducted trade studies of machine learning architectures (PointNet, YOLO4D, CNN variants such as VGG16/18 and ResNet) for autonomous defect detection in in-space additive manufacturing; identified a CNN-based inspection approach as the optimal balance between classification accuracy, onboard computational limits, and integration feasibility for the Non-Destructive Evaluation (NDE) system.
- Designed an inspection pipeline enabling real-time optical/IR defect classification under spacecraft computing, mass, and power limitations.
- Defined Fault Detection, Isolation, and Recovery (FDIR) logic and Command & Data Handling (C&DH) links across the payload AI computer, onboard computer, satellite bus, and ground systems.
- Performed systems level design to ensure the payload met Blue Canyon Technologies X Sat Venus bus constraints (~60 W, 17×16×27 in, ~78 kg; 13.6 Ah; S band <2 Mbps); **1st place** in VT Space Senior Design Expo 2025 and **2nd nationally** in the COSMIC Capstone Challenge (presented at **NASA Goddard**).

Undergraduate Research Assistant, NAVAIR Project, Virginia Tech

Aug 2019 – Dec 2019

- Reviewed publicly available technical reports, accident investigations, and historical operational records of the Lockheed L 1011 TriStar to identify airworthiness issues and recurring system level deficiencies.

Publications & Conference Submissions

- Tejas Vinod, Erika Ashley, **Seokhyeon Byun**, Julian Drake, Timothy McEvoy, David Ward, Dora Erdogan, Steven Meadows, Jay Sabharwal, Larsen VanOfferen, Kevin Shinpaugh. *Project Daedalus: A Spacecraft Concept for In-Orbit Manufacturing, Assembly, and Inspection of Aluminum Structures*. **AIAA SciTech Forum 2026**, Orlando, FL. **Abstract accepted**; full manuscript due Dec 2025.
 - Technical paper on an ISAM payload integrating in-space 3D metal printing, laser welding, and AI-based NDE with FDIR under BCT X-Sat Venus bus constraints.
- J. Michael Ruohoniemi, Shibaji Chakraborty, **Seokhyeon Byun**, Joseph B. H. Baker. *Striking a Balance Between R & O in Adapting SuperDARN HF Research Infrastructure to Space Weather Operations*. **AGU2025, Abstract**

submitted (Jul 2025).

- Investigation of solar-flare–driven shortwave fadeout (SWF) events using SuperDARN HF radar data; developed the lower-ionosphere X-RAP model to quantify HF signal attenuation and prototyped a near-real-time SWF alert system for North America.

Projects

- STEM Hub — AI-Powered Formula Search & LaTeX Generator** May 2024 – Nov 2024
- Next.js (Server Actions), Google Gemini API, Vercel AI SDK, LangChain; direct/multi-step search and image to LaTeX conversion; custom LaTeX cleaning/validation for rendering edge cases; deployed on Railway.
- Sound-to-Text Transcriber** Mar 2023
- Created an audio-to-text transcription tool for YouTube content using Python and the OpenAI Whisper API, improving accessibility of online content for multilingual audiences using AI-driven speech recognition.
- Aerospace Community Q&A Platform** Jan 2021 — May 2021
- Developed a Stack Overflow–style Q&A platform for aerospace engineering students and professionals using Django, HTML/CSS, and Bootstrap, with authentication, role-based permissions, and full CRUD functionality backed by PostgreSQL.

Awards & Honors

- **1st place** — Virginia Tech Space Senior Design Expo (Project Daedalus), 2025
- **2nd nationally** — COSMIC Capstone Challenge (presented at **NASA Goddard**), 2025
- **Two-Star Major General Award** — Military AI Competition (Army Surveillance prototype), 2022
- **Emerging Leaders Scholarship (Virginia Tech Corps of Cadets)**, 2017–2020

Work Experience

- Crew Chief of UH-60 Black Hawk Helicopter**, Army Aviation Command — Feb 2021 – Aug 2022
Republic of Korea
- Performed diagnostics on turboshaft engines, APUs, and in-flight vibration systems during tactical missions; improved reliability by 15% and reduced unscheduled maintenance by 20%.
 - Built an object-detection application using Python, OpenCV/YOLO (software prototype) for a military AI competition; awarded a **Two-Star Major General Award**.

Leadership & Technical Organizations

- 3DPAC — 3D Printed Aircraft Design Team**, Virginia Tech 2024 – 2025
- Participated in design, fabrication, and flight testing of 3D-printed aircraft; learned additive manufacturing and aerodynamic analysis with XFLR5 and OpenVSP.
- Virginia Tech Corps of Cadets** 2017 – 2020
- Completed leadership training emphasizing discipline, teamwork, and service; recipient of the Emerging Leaders Scholarship.
- InspireFly — Student CubeSat Design Team**, Virginia Tech 2017 – 2018
- Contributed to early-stage CubeSat mission design and payload trade studies; gained foundational experience in interdisciplinary aerospace teamwork.

Relevant Coursework

Space Vehicle Dynamics, Space Vehicle Design, Orbital Mechanics, Sensor Algorithms & Autonomous Navigation, System Dynamics & Controls, Experimental Methods, Aerodynamics & Compressibility, Thin-walled Structures, Aerospace Structures, Upper-atmosphere & Space Weather, Statics & Stability

Skills

Programming: MATLAB, Python, JavaScript, TypeScript, SQL (PostgreSQL, SQLite), HTML5, CSS3
Simulation & Analysis: NVIDIA Isaac Sim, ROS2, Cesium, XFOIL, O3DE, XFLR5, OpenVSP
Web & Frameworks: Matplotlib, NumPy, Pandas, React, NextJS, AstroJS, Flask, Django, FastAPI, TailwindCSS
Tools: Docker, Git, Linux, SolidWorks, Fusion 360, Onshape, Mathematica, SSH, Shell Script