

# David Brown

Applied Mathematician & Chief of Staff

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## Summary

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I develop intelligent navigation systems and mathematical models for high-altitude balloons and aerospace applications, combining theoretical mathematics with practical engineering solutions. Currently serving as Chief of Staff at Urban Sky while completing dual degrees at Harvard.

## Education

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### Harvard University

*M.S. Applied Mathematics (Aerospace Engineering/Machine Learning)*

**Cambridge, MA**

*Expected May 2025*

- GPA: 3.945/4.0 (Major GPA: 4.0)
- Honors: Magna Cum Laude with Highest Honors in Applied Mathematics
- HBS Fellowship: Roberts Family / Technology Innovation Fellow
- Awards: John Harvard Scholarship Award (2022), Thomas T. Hoopes Thesis Award (2025)

### Harvard University

*B.A. Applied Mathematics, Secondary in Astrophysics*

**Cambridge, MA**

*Expected May 2025*

- Relevant Coursework: Machine Learning, Optimal Control Theory, Space Systems Engineering, Signal Processing, Fourier Analysis, Differential Equations, Engineering Data Analytics

## Experience

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### Urban Sky

*Chief of Staff*

**Denver, CO**

*May 2025 – Present*

- Ensure timely completion of all company goals and objectives
- Continue leadership over balloon navigation research and development

### Simulations Engineer

November 2022 – May 2025

- Conducted scientific studies into trends in wind behavior, historical shifts, and forecasting accuracies
- Managed small team in development of several multimillion-dollar AFWERX/SBIR government contracts
- Developed high fidelity model of balloon system operating in a chaotic and dynamic 3D space
- Leveraged Optimal Control Theory to develop AutoPilot system to intelligently navigate transitions of complex nonlinear dynamic systems in real-time environments
- Started Machine Learning Sector for controlling balloons using classical ML and reinforcement learning
- Leading business development opportunities for humanitarian and sustainable development

### Simulations and Modeling Intern

May 2022 – November 2022

- Modeled balloon flight behavior by creating custom simulator
- Created tool for analyzing flight viability of any location in the US based on wind and geographical conditions
- Government contracting support (Phase 1 and 2) for proposal development and research

### Maxar

*Aerospace Engineering Analyst Intern*

**Herndon, VA**

*June 2023 – August 2023*

- Simulation and Modeling team tasked with enabling space agents to make intelligent decisions in complex environments

- Developed tools for fully customizable space-based simulator including high fidelity multibody transfer, satellite-based observation and communication, and Kalman Filter based predictions
- Implemented optimization algorithms to solve complex orbital transfers with up to 60% reductions in fuel costs
- Leveraged Machine Learning to eliminate costly planning procedures, achieving 98% faster flight planning
- Presented work to over 200 Applied Machine Learning experts

## Research

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### Stratospheric Station Keeping Study

*Advisor: Professor Marianna Linz*

**Harvard University**

*January 2023 – Present*

- Collaborated with Urban Sky to model general zero-pressure balloon behavior over extended flight durations
- Created algorithm to determine altitude adjustment decisions to keep balloons over a target region
- Mass simulation using ERA5 Wind Data to identify major trends behind global viability of navigation
- Investigating applications to deforestation monitoring in Amazon Rainforest and wildfire prevention in Australia

### Incorporating Imperfect Information via Attention for Learning

*Advisor: Professor Demba Ba*

**Harvard University**

*May 2024 – Present*

- Devised framework to differentiate ground truth from imperfect information in machine learning
- Applied framework to balloon navigation to develop state-of-the-art controller
- Implementing model for use on real high-altitude balloons; seeking provisional patent

## Publications

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- **Brown, D.**, Linz, M., Leidich, J. “Seasonal and geographic viability of high altitude balloon navigation.” *Nature Scientific Reports*, 2024. [doi:10.1038/s41598-024-71445-9](https://doi.org/10.1038/s41598-024-71445-9)
- **Brown, D.**, et al. “Optimizing operating altitudes of high altitude balloons for navigation.” *Nature: Communications Earth & Environment*, 2024. (In Review)
- **Brown, D.**, et al. “Flight Safety of launching a high altitude balloon through airspace.” Preprint, 2024.

## Skills

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**Languages:** Python, C, Java, MATLAB, Arduino, Git

**Software:** ArcGIS, PyTorch, TensorFlow, STK, GMAT, QGIS, CAD, CATIA Cameo

**Technical:** Microcontrollers, 3D Printing, Milling, Laser Cutting, Machine Shop

## Activities & Leadership

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- Harvard Students for Exploration and Development of Space
- Harvard Rocket Propulsion Group Lead
- Harvard Space Law Society
- Space Generation Advisory Council
- Student Astronomers at Harvard-Radcliffe
- Harvard Peer Advising Fellow
- Fine Art, Astro, & Underwater Photography
- Eagle Scout (2019)