Chris Hayner

Ph.D. student working on Optimization for Robotics at the University of Washington
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Education

June 2026 (expected) **Ph.D.** Department of Aeronautcial and Astronautical Engineering — University of Washington
Co-Advised by Prof. Behçet Açıkmeşe and Prof. Karen Leung

June 2021 **BS** in Applied Physics — University of Washington
Minor in Aeronautical Astronautical Engineering

Publications

Journals

[J1] Kazuya Echigo, **Christopher R. Hayner**, Avi Mittal, Selahattin Burak Sarsılmaz, Behçet Açıkmeşe, Matthew Harris, *"Linear Program Approach to Close Proximity Operation with Element-wise Quantized Control,"* IEEE L-CSS.

Conferences

[C1] **Christopher R. Hayner***, Natalia Pavlasek*, Purnanand Elango, Aman Tiwary, Benjamin Chung, Karen Leung, Behçet Açıkmeşe, *"Active View Planning with Guaranteed Keypoint Coverage,"* 2024 IEEE ICRA. (In Review)

[C2] **Christopher R. Hayner***, Samuel C. Buckner*, Daniel Broyles, Evelyn Madewell, Karen Leung, Behçet Açıkmeşe, *"HALO: Hazard-Aware Landing Optimization for Autonomous Systems,"* 2023 IEEE ICRA.

[C3] Kazuya Echigo, **Christopher R. Hayner**, Avi Mittal, Selahattin Burak Sarsılmaz, Behçet Açıkmeşe, Matthew Harris, *"Convex Trajectory Planning for Proximity Operations using Electric Propulsion with Quantized Thrust,"* AIAA 2023-0493. *AIAA Scitech 2023 Forum.*

[C4] Daniel Broyles*, **Christopher R. Hayner***, Karen Leung, *"WiSARD: A Labeled Visual and Thermal Image Dataset for Wilderness Search and Rescue,"* 2022 IEEE IROS.

[C5] **Christopher R. Hayner**, Timothy Zhou, Neil Gupta, Echo Liu, Parker Mayhew, and Juris Vagners. *"Real-time Human Detection with integration of Visual and Thermal Data from High Altitude sUAS,"* AIAA 2021-0397. *AIAA Scitech 2021 Forum.*

Workshops

[W1] Natalia Pavlasek, **Christopher R. Hayner**, Sarah Li, Behçet Açıkmeşe, Meeko Oishi, and Claus Danielson. *"Generating Blamelessly Optimal Control for Prioritized Constraint Sets,"* 2023 RSS Workshop: Towards Safe Autonomy: New Challenges and Trends in Robot Perception.

Symposium Presentations

[P1] **Christopher R. Hayner**, Echo Liu, Howard Peng. Parker Mayhew, Neil Gupta, Helen Kuni, Juris Vagners, *"An Autonomous Machine Learning Approach to Search and Locate Operations,"* AIAA PNW Symposium 2020.

Reviewer

IEEE/RSJ IROS · IEEE ICRA

Awards and Fellowships

2023 – 2027 NASA Space Technology Graduate Research Opportunities (NSTGRO) Fellow, Article: *Chris Hayner awarded NASA NSTGRO Fellowship*

2022 – 2024 Washington NASA Space Grant Fellowship

2023 AA Student Excellence Award for Doctoral Research, Article: *A&A Student Excellence Awards 2023*

2023 1st Place Poster - UW Graduate Research Showcase, Article: *2023 A&A Graduate Research Showcase*

* Denotes equal contribution

Employment Record

Dec. 2021 - Present **University of Washington** - Graduate Research Assistant

- Participate in research across the Autonomous Controls Laboratory (ACL) and Control and Trustworthy Robotics Laboratory (CTRL).

June - Sept. 2022 **Air Force Research Laboratory** - Graduate Intern

- Worked on vision-based algorithms for alternative forms of navigation for autonomous systems.

Sept. - Dec. 2021 **University of Washington** - Teaching Assistant

- **AA310 Orbital and Space Flight Mechanics:** Worked to develop homework assignments and exam problems for a class of >70 students.
- Held office hours, mentored students to think critically and logically about engineering problems.

June - Sept. 2021 **Applewhite Aero** - Intern

- Tested and tuned various UAV platforms. Integrated a variety of sensors and embedded computing payloads with computer vision algorithms onto UAV platforms. Assisted in the design of UAVs.

Dec. 2018 - June 2021 **University of Washington** - Undergraduate Research Assistant

Projects

Perception-Aware Trajectory Planning [C1],[C2]

- Designed a tightly coupled perception and planning system to determine multiple safe landing sites and plan robust contingency-aware trajectories to them. A video demonstration can be found *here*.
- Developed a method for selecting sensor pointing angle with guarantees on containment of keypoints.
- Implemented successive convex programming (SCP) to solve for a control trajectory.

Real-time optimization-based trajectory planning for spacecraft, [C3], Article: *Tugs in Space*

- Formulated and implemented real-time convex optimization methods to compute trajectories for spacecraft rendezvous, proximity operations and docking with electric propulsion subject to quantized thrust constraints.

Wilderness Search and Rescue, [P1], [C4], [C5], Article: *Hide and Seek: Training a drone to save lives*

- Created and compiled a large visual and thermal dataset for human identification in a wilderness environment.
- Used a variety of computer vision algorithms to train models.
- Tested models on UAV platforms using onboard- and ground-based computing for inference on live thermal and visual imagery.

Aerial Mapping of Fire Behavior

- Created orthomosaic maps and point clouds of land utilizing visual and SWIR UAV based photogrammetry for calculating biomass to predict wild fire propagation.

Drone Based Air Quality Surveys, Article: *Can Trees Clean Jet Pollution*

- Integrated drone-mounted sensors to detect pollutants near SeaTac airfield and surrounding highways.

Ground Penetrating Radar, Article: *Peering into Snow*

- Integrated large GPR payloads as well as RTK GNSS onto UAV with the goal of remotely sensing and mapping snow depth.

Mentorship

Masters Students

Aman Tiwary (MS in Mechanical Engineering at the University of Washington) - Publication **[C1]**

Undergraduate Students

Annika Singh (Now an Intern at Goldman-Sachs)
Avi Mittal (Now a Ph.D. Student at the University of Washington) - Publications **[C3]**, **[J1]**

High School Students

Neil Gupta (Now an Undergraduate at University of Massachusetts Amherst) - Publication **[C5]**
Timothy Zhou (Now an Undergraduate at University of Illinois Urbana-Champagne) - Publication **[C5]**
Saket Gollapudi (Now an Undergraduate at University of Washington Seattle)

Public Outreach

2022 - Current **UW Women of Aerospace** - Worked to expand women's opportunities for leadership and increase their visibility in the aerospace community through mentorship and outreach activities.

2019 **UW Discovery Days Volunteer** - Set up interactive stand for 4th - 8th graders which showed off my lab's current research projects in an effort to increase students' interest in STEM.

Skills

Programming Languages

Competent with `MATLAB`, `Python (PyTorch, NumPy, SciPy)`, `Julia`, `C`. Working knowledge in `C++`.

Frameworks and Libraries

SciKit Learn, PyTorch, CVX, OpenCV

Operating Systems

`Linux (Ubuntu, CentOS)`, `MacOS`, `Windows`

Hardware & Software

Competent in working with EO/IR sensors and embedded systems (NVIDIA Jetson family) as well as Solidworks and Unreal Engine. Participated in and piloted UAV's at a variety of different flight tests.

References

Behçet Açikmeşe

- **Position:** Professor, Aeronautics and Astronautics Department, University of Washington
- **Relationship:** PhD Co-Advisor, Autonomous Controls Lab PI
- **Email:** behcet@uw.edu

Karen Leung

- **Position:** Assistant Professor, Aeronautics and Astronautics Department, University of Washington
- **Relationship:** PhD Co-Advisor, Control and Trustworthy Robotics Lab PI
- **Email:** kymleung@uw.edu

Juris Vagners

- **Position:** Professor Emeritus, Aeronautics and Astronautics Department, University of Washington
- **Relationship:** Undergraduate Advisor, Autonomous Flight Systems Lab PI
- **Email:** vagners@uw.edu

David Shean

- **Position:** Assistant Professor, Civil and Environmental Engineering Department, University of Washington
- **Relationship:** Undergraduate Advisor, Terrain Analysis and Cryosphere Observation PI
- **Email:** dshean@uw.edu