

# HIGHFLIGHT

WILLIAM E. BOEING DEPARTMENT OF AERONAUTICS & ASTRONAUTICS

**Professor Jim  
Hermanson flies  
with the Blue Angels**

**2026** ALSO IN THIS ISSUE

Charlie Higgins' legacy of aviation safety

The SOC-i CubeSat is now orbiting Earth

Eye-tracking for tailored autonomy

Nature's shock absorbers

*Lcdr Lilly Mon*

**W**

## Dear A&A Alumni and Friends,

In these times of rapid change, the University of Washington's William E. Boeing Department of Aeronautics & Astronautics continues to demonstrate why engineering research matters, not just for advancing technology, but for addressing humanity's most pressing challenges.

This issue showcases how federal investments in fundamental research create cascading benefits for society. The National Science Foundation alone has catalyzed five breakthrough projects featured in this issue of *Highflight*: Assistant Professor Amir Taghvaei's bacteria-inspired nanoengines that could revolutionize medical devices and energy systems; Assistant Professor Karen Leung's eye-tracking technology making autonomous systems more trustworthy; our alum Alexis Harroun's rotating detonation engines preparing for orbital flight; and NSF CAREER Awards for Assistant Professors Karen Leung and Ed Habtour advancing robotics and structural resilience.

These investments demonstrate a crucial truth: Public funding of university research creates entire industries. Every technology developed for space, from Harroun's efficient propulsion systems to our SOC-i CubeSat training the next generation, yields applications that improve life on Earth. Bart Boom's gannet-inspired shock absorbers could make car crashes more survivable. Gary Lai's journey from UW student to lunar resource pioneer shows how education transforms not just individual careers, but humanity's future.

Our work extends beyond the laboratory through partnerships that multiply impact. Professor Justin Little leads the UW research for the newly-formed Space Force SPAR Institute, strengthening ties between academia and national security. The generosity of donors like the Varanasis and Condit's enables exceptional students to thrive. And yes, Professor Jim Hermanson's Blue Angels flight reminds us that engineering can inspire joy and wonder, which is something we all need!

Whether developing sustainable energy solutions, creating resilient infrastructure, or designing systems that protect human life, our community remains committed to engineering for the public good. The challenges of the next several decades demand nothing less than sustained investment in research and education.

### **Mehran Mesbahi**

*J. Ray Bowen Professor for Innovation in Engineering Education and Interim Chair*

# HIGHFLIGHT

WILLIAM E. BOEING DEPARTMENT OF AERONAUTICS & ASTRONAUTICS | 2025



#### **CREDITS:**

Mehran Mesbahi

*J. Ray Bowen Professor for Innovation in Engineering Education and Interim Chair*

Amy Sprague

*Highflight Content and Communications Manager*

UW Creative Communications

*Graphic Design*

#### FOLLOW US:

 [facebook.com/UWaeroastro](https://facebook.com/UWaeroastro)

 [instagram.com/UWaeroastro](https://instagram.com/UWaeroastro)

 [youtube.com/UWaeroastro](https://youtube.com/UWaeroastro)

 [tiktok.com/@UWaeroastro](https://tiktok.com/@UWaeroastro)

 [linkedin.com/company/37137487](https://linkedin.com/company/37137487)

 [aa.washington.edu](https://aa.washington.edu)

#### CONTACT US:

(206) 543-1950

[aafirstdesk@uw.edu](mailto:aafirstdesk@uw.edu)



**LEADING INTO THE THIRD SPACE AGE:**

## **Gary Lai** named 2025 A&A Distinguished Alum

Gary Lai (B.S. '99), who has redefined commercial spaceflight and now aims to harness lunar resources for humanity's future, is our 2025 Distinguished Alumni Award recipient. This award recognizes graduates who have made substantial contributions to aerospace while demonstrating intellectual curiosity, exploration, integrity and service.

When Gary Lai arrived at the UW in the late 1990s, his path to aerospace was anything but traditional. Born in Hong Kong and raised in New York City, Lai had switched from finance at Cornell to pursue his true calling in aerospace engineering, following his girlfriend Natalya (now his wife of 25 years) to Seattle.

The timing proved fortuitous, as Seattle was becoming the epicenter of commercial space with companies like Kistler Aerospace, SpaceX and Blue Origin emerging. Professor Adam Bruckner's recommendation landed Lai an internship at Kistler Aerospace, launching his career. "Kistler was the last job interview I've ever had," Lai says. "Every other position since has been through the network I built from that first position."

After graduating, Lai joined Blue Origin as its 18th employee. Over 20 years, he rose from systems engineer to chief architect of New Shepard, the reusable suborbital vehicle that made commercial space tourism reality. His team achieved five

successful launches and landings of the same booster within a single year, earning him the prestigious Stellar Award. The Blue Origin team won the 2016 Collier Trophy, and Lai received the Museum of Flight's 2023 Pathfinder Award.

In 2022, Lai flew aboard New Shepard himself. "It was the most intense experience of my life," he recalls. "The experience taught me to be more present in my daily life, that living more fully is better than living safely."

Today, as co-founder and CTO of Interlune, Lai is developing methods to harvest lunar resources for Earth applications. "We are living through the third major transformation in the space industry," he explains, "driven primarily by commercial investment and innovative entrepreneurs. Launch costs have dropped by a factor of ten since I started my career."

Lai credits UW's project-based learning, particularly the Dawgstar satellite project, for preparing him for industry. His advice to students emphasizes both technical depth and systems thinking: "The aerospace engineers that become the most impactful leaders are systems engineers, integrating the work of specialized teams." From UW student to space pioneer to lunar entrepreneur, Lai's trajectory proves that success in aerospace demands both specialized knowledge and the ability to see the bigger picture.



# EYE-TRACKING FOR TAILORED AUTONOMY

## NSF funds research to help us create autonomous systems that can adjust to individual comfort levels

The future of trustworthy autonomous systems may lie in a pair of specialized eyeglasses. A&A Assistant Professor Karen Leung, with co-Principal Investigator Anat Caspi, director of the Allen School's Taskar Center for Accessible Technology, received a \$300,000 National Science Foundation grant to explore how eye-tracking glasses could help autonomous vehicles and robots better understand and adapt to human comfort levels. Undergraduate researchers are carrying out this work in Leung's Control and Trustworthy Robotics Lab (CTRL), including A&A's Senna Keesing, computer science student Marc Alwan, and electrical engineering student Kyshawn Savone-Warren.

This work stems from a simple observation: people aren't identical in their comfort levels around autonomous systems. "I've watched how people interact with autonomous systems in their daily lives," Leung explains. "What makes one person perfectly comfortable might make another quite nervous. We need to bridge this gap."

The key insight is that our eyes reveal our concerns. Where we look, how long we focus on potential hazards, and what we monitor for safety all provide crucial data about our comfort

zones. By understanding these gaze patterns, autonomous systems can learn to adapt to individual preferences without requiring explicit programming or constant verbal feedback.

The research team's approach involves sensor-equipped eyeglasses that observe how individuals scan their environment. These insights help autonomous systems understand each person's unique safety preferences and adapt accordingly. Picture an autonomous wheelchair that learns whether its user prefers to give other pedestrians a wide berth or is comfortable with closer encounters, all while maintaining core safety standards.

This research tackles a crucial challenge in autonomous mobility: earning public trust. Traditional autonomous systems operate with fixed safety parameters, potentially making some users uncomfortable while frustrating others with overcautious

*Photos by Dennis Wise. 1. Marc Alwan models the eye-tracking glasses which register real-time gaze data on a connected smartphone; 2. Senna Keesing puts on a sensor-equipped helmet to track movements and speed; 3. Kyshawn Savone-Warren monitors data collection during a collision-avoidance exercise; 4. Another collision-avoidance exercise with the helmet and glasses to combine the data of movements and gaze patterns; 5. The customized helmets; 6. Kyshawn Savone-Warren, Senna Keesing and Marc Alwan with the specialized equipment used to study human-robot interactions.*

behavior. Leung's team aims to create more nuanced systems that can recognize and respond to individual comfort levels.

Beyond wheelchairs, this research could transform how delivery robots navigate college campuses or how autonomous vehicles interact with pedestrians in urban environments. The project combines advances in computer vision, human behavior understanding, and adaptive control systems.

The NSF grant, jointly supported by the Dynamics, Controls, and System Diagnostics and Mind, Machine, and Motor Nexus Programs, underscores the project's interdisciplinary significance. Leung's team is particularly focused on including diverse perspectives in their research, actively engaging underrepresented groups in robotics and fostering collaboration between computer vision, controls, and robotics researchers.

"We're not just developing technology," Leung notes. "We're working to create autonomous systems that truly understand and respect human preferences. That's the key to building trust."



## Karen Leung wins NSF CAREER Award

Assistant Professor Karen Leung's NSF CAREER Award recognizes her pioneering work in helping autonomous systems understand complex human social dynamics. The prestigious five-year grant supports her CTRL Lab research developing data-driven safety models that enable mobile robots to navigate safely alongside humans in hospitals, airports, and urban environments.

"Real-world interactions are shaped by factors incredibly difficult to model like uncertainty, social norms, contextual cues," Leung explains. "We need systems that learn from this complexity while being transparent about their safety-conscious decisions."

Her CAREER project encompasses three interconnected areas: generating safety-critical data on human behavior at interaction boundaries, creating interpretable models for regulatory approval, and developing "socially-aware" control strategies that consider the system's influence on others' safety.

Beyond the related eye-tracking research featured here, Leung's team will deploy algorithms at Harborview Medical Center, where robots must navigate around patients and staff in high-stakes environments.





## NATURE'S **Shock Absorbers**

### Seabird-inspired aerospace adaptations can raise resilience upon impact.

What if the secret to building safer aircraft and cars lies in the neck of a diving seabird? That's what A&A Ph.D. student Bart Boom discovered when he started studying how gannets plunge into the ocean at 70 miles per hour without breaking their necks.

His research, inspired by the efficient and smooth water entry of these remarkable seabirds, is opening new possibilities for shock-damping designs in aerospace, automotive, and robotic applications, potentially making your next flight smoother and your car safer in an accident.

#### **The mystery of the gannet's neck**

When northern gannets hunt, they transform into living projectiles, diving from heights of 100 feet to hit the ocean at 70 miles per hour. Their long, slender necks and pointed beaks slice through the water's surface, but beneath their streamlined feathers lies an engineering puzzle that Bart Boom is intent on solving: how do these birds survive thousands of high-velocity impacts without injury?

The biological features of the gannet are counterintuitive to conventional engineering, Boom explains, "If you look at CT scans of the gannet's neck, it's highly segmented with 15

vertebrae. Based on the current engineering principles, the neck is not designed to withstand the axial loading of hitting water at extreme velocities. But it does. And finding out why will have profound implications for engineering impact-resilient and aerodynamically stable structures for aerospace, automotive and robotic systems."

While aerospace engineers have long believed that structures should be as stiff as possible for stable flying and efficient surface breaching, the gannet's segmented neck suggests a different approach entirely. Boom says, "This bio-inspired design challenges everything we thought we knew about impact resistance. The long neck is cleverly segmented to do the job incredibly well. We want to understand why and how we can replicate this remarkable engineering system."

#### **The experimental setup**

Boom teamed up with water entry expert Professor Tadd Truscott at KAUST Splash Lab, and vertebrate swimming expert Professor Frank Fish at West Chester University. Both have extensive experience in hydrodynamic morphology and water entry analysis.

Their lab setup at the Splash Lab included a plexiglass water tank for clear observation, with two high-speed cameras capturing every millisecond of impact. Bright backlighting ensured maximum visibility, while remote sensing equipment provided precise measurements.

The team designed prototypes consisting of a head and body segment connected with springs of varying stiffness. By dropping these "divers" from different heights, they could test how spring stiffness affected performance. They also swapped out the head to examine the effects of different head shapes.

"One camera focused on the air-water interface while the other captured the air cavity created as the prototype displaced water," Boom explains. "This allowed us to see exactly what happens during those crucial milliseconds of impact."

### Significant findings

The results exceeded expectations. The segmented design showed a dramatic reduction of over 50 percent in maximum impact acceleration and 94 percent in the speed at which the acceleration is changing, or jerk, leading to significant improvement in overall impact resistance.

To put this in perspective, jerk is what causes whiplash in car accidents. A 94 percent reduction could mean the difference between walking away from a crash and serious injury. Truscott explains, "For a given impact, you might think that adding a spring damps out the impact, but the impulse, or energy loss, is the same and only stretches out the impact. The result is that the peak forces are lower."

The research reveals something else remarkable: the sleek geometry of the diver's head facilitates efficient water entry, and while springs lower peak force across all designs, the effect is even greater for less efficient head geometries.

### Where is this research going?

Boom's faculty adviser, Assistant Professor Ed Hattour in A&A's Illimited Lab, explains the overarching vision: "The gannet teaches us how intelligent segmentation can reduce shock energy by stretching it over time. This could revolutionize how we protect aircraft, automobiles, robots, and bridges from impact damage, without the weight and expense of current damping systems."

Next, Boom will analyze the gannet's complex muscle-tendon structure that binds the segmented vertebrae. "This network appears to control how shock energy moves through the neck," he explains. "By understanding these connections, we can design lighter, more efficient impact protection systems for everything from aircraft to automobiles, without the bulk and expense of traditional dampers."



## Ed Hattour wins NSF CAREER Award



Assistant Professor Ed Hattour, who guides Bart Boom's gannet research and directs A&A's Illimited Lab, recently received an NSF CAREER Award for developing engineering theories that harness nature's irregular geometric patterns. The five-year grant supports his work creating biomimetic systems that match the energy and material efficiency found in biological designs.

"Current bio-inspired engineering overlooks the intrinsic geometric irregularities found in nature," Hattour explains. "These distinctive patterns give biological systems their remarkable capabilities."

His CAREER research focuses on two applications: self-propulsive locomotion without actuators using stingray-like structures, and impact energy attenuation using seabird neck-like structures without traditional damping materials. This work promises to influence everything from energy harvesting systems that capture ocean waves to smart materials providing shock absorption without conventional mechanisms.



# The perfect angle:

## ADITYA DEOLE USES SUNLIGHT TO BETTER TRACK SPACE OBJECTS

A&A Ph.D. student Aditya Deole knows that objects are easier to identify and track if you can see them clearly. He brought this simple insight to A&A's Robotics, Aerospace and Information Networks (RAIN) Lab to improve how we locate and track uncontrolled satellites and debris in the vastness of space.

Deole's research addresses a critical challenge in space operations. Machine learning systems used to locate objects in space are trained on diverse images with varying lighting conditions. However, their real-time accuracy fluctuates significantly depending on the angle of sunlight during actual missions.

Deole discovered that these machine learning systems perform most reliably during actual missions when the sun is positioned behind the observing spacecraft, requiring specially designed trajectories to approach objects from optimal viewing angles.

"Sunlight affects image quality," Deole explains. "The best tracking happens when the sun is behind the observer, ensuring the target is well-lit."

This insight led Deole to develop a sophisticated system that plans spacecraft trajectories not just for fuel efficiency, but for optimal observation angles. The approach has significant implications for space debris removal, satellite servicing and lunar navigation.

"If we want to track uncontrolled objects like debris, we need some baseline knowledge about them," says Deole. "We train neural networks on simulated images of satellites and debris under various conditions, then design approach paths that maximize recognition accuracy."

By combining machine learning with traditional trajectory planning, Deole's work addresses a fundamental challenge:

reliability. His methodology can measure the uncertainty in neural network predictions, then develop controllers that adjust for these limitations in real time.

"Machine learning has rarely been used for space object tracking because there are no guarantees that it will work, and space missions demand precision," Deole notes. "Our focus was on understanding when these algorithms might fail."

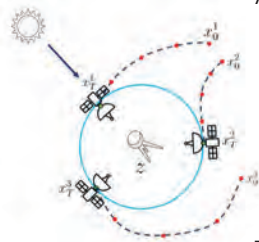
Professor Mehran Mesbahi, Deole's faculty adviser, describes the research as "a breakthrough in how spacecraft can see and respond to objects in space."

Mesbahi explains that Deole's approach works on two levels: first measuring how well machine learning algorithms perform under different conditions, then designing flight paths that position spacecraft for optimal sun angles during critical operations. This integration, Mesbahi notes, "creates a robust system for autonomous space missions that experts previously considered too risky."

Deole's methodology extends beyond space applications to autonomous vehicles, robotics and other fields where machine perception guides movement under varying environmental conditions.

"It's about optimizing planning while accounting for neural network biases," Deole explains. "In space, that means sunlight. On Earth, it could be camera angles or sensor placement. The key is understanding when and where a system performs best and planning accordingly."

As space becomes increasingly congested with active satellites and debris, methodologies like Deole's will be essential for safe and efficient operations. His work exemplifies how the UW continues to lead in developing practical solutions to complex aerospace challenges, in this case, just catching some rays from the perfect angle.



# Bacteria- inspired nanoengines

**PROFESSOR AMIR TAGHVAEI  
EXPLORES POWER AT THE  
SMALLEST SCALE WITH SUPPORT  
FROM THE NSF**



From the warmth of sunlight powering Earth's processes to the microscopic motors driving cells, the natural world demonstrates remarkable efficiency in harnessing energy from temperature and chemical differences. Assistant Professor Amir Taghvaei has received a National Science Foundation (NSF) grant with UC Irvine's Professor Tryphon Georgiou to unravel these principles and apply them to engineered systems.

"Look at any living cell," Taghvaei says. "It's filled with tiny molecular motors that convert chemical energy into mechanical work with remarkable efficiency. We're trying to understand the mathematics behind these processes, both in nature and in engineered systems."

The research delves into a fascinating question: What's the maximum power we can harvest from temperature differences and chemical variations at the nanoscale? It's a question that bridges biology and engineering, with implications for both fields.

Think of a hot spring, where microorganisms thrive by exploiting temperature differences in their environment. Or consider the enzymes in our cells, which act as microscopic engines powered by chemical reactions. These natural systems have evolved over billions of years to operate efficiently at the smallest scales.

"We're not just studying these systems. We're developing mathematical frameworks to understand their fundamental limits," Taghvaei notes. "This knowledge could help us design better artificial nanoscale engines that approach the efficiency we see in nature."

The project brings together three mathematical disciplines — stochastic control, nonlinear filtering, and optimal transport — to establish performance bounds for these tiny engines. By understanding these limits, engineers can develop more efficient nanoscale devices for various applications, from medical technologies to energy systems.

Beyond the laboratory, this research carries significant implications for future technology. As our devices become smaller and more sophisticated, understanding how to efficiently harness energy at the nanoscale becomes increasingly crucial. The principles discovered through this research could influence the development of new medical devices, advanced sensors, and energy-harvesting systems.

"This isn't just about mathematical models," Taghvaei emphasizes. "It's about understanding the fundamental principles that could drive future technological breakthroughs. Nature has been running these experiments for billions of years. We're just beginning to understand how to apply these lessons to our engineered systems."

*Bacteria use temperature variations to move. Their tiny flagella, powered by chemical reactions, propel them through their environment, naturally harnessing energy at the microscopic level.*



**From wind shear to security:**

## Charlie Higgins' legacy of



# AVIATION SAFETY

When colleagues reflect on Charles "Charlie" Higgins' (BS, '71) career at Boeing Commercial Airplanes, they describe a leader who brought people together to solve problems that matter. His collaborative approach to aviation safety has transformed industry standards and saved countless lives.

"Charlie's extraordinary leadership has produced worldwide benefits for aviation, engineering, safety and security," says Alan Mulally, Higgins' longtime colleague and former President and CEO of both Boeing Commercial Airplanes and the Ford Motor Company. "His career-long contributions provide global benefits for people, and for current and future aviation products and services."

In the 1980s, wind shear was responsible for numerous aviation disasters. Higgins brought together experts from across the industry to develop life-saving solutions that would benefit all commercial aviation. His work earned recognition from Representative Norman Mineta in congressional testimony and Boeing's prestigious "President's Award for Contributions to Aviation Safety."

As Chief Project Engineer for the 777 in the 1990s, Higgins pioneered testing innovations that set new standards for aircraft development. "Charlie's vision transformed how we test and certify commercial aircraft," says Chester Ekstrand, who worked closely with Higgins as Boeing Vice President and Director of Flight Crew Operations. "The Systems Integration Lab he pioneered allowed us to test full airplane systems a year before assembly—something that had never been done before."

Following several high-profile aviation incidents in the late 1990s, Higgins became Boeing's Vice President for Airplane and Aviation Safety. "Charlie has always been driven by his moral compass," says Lars Q. Andersen (BS, '68), a former Boeing Vice President. "He inspires others to work toward what is right."

Higgins established the Commercial Aviation Safety Team (CAST), bringing together the FAA, airlines, manufacturers, and pilots' associations. CAST achieved an 83% reduction in fatal airline accident risk across all carriers, earning the 2008 Collier Trophy.

When the September 11 attacks changed aviation security requirements, Higgins led industry-wide response efforts, coordinating worldwide enhancements to flight deck security and establishing lasting frameworks for aviation security risk management.

Mulally captures what makes Higgins' legacy so powerful: "Charlie has consistently inspired and enabled people to work together to accomplish what has never been done before. His unique ability to bring together diverse perspectives around shared goals has made aviation safer for everyone who travels through it." The department was fortunate to host Higgins this past year as a guest speaker for our undergraduate seminar. We were proud to showcase an alum who is a powerful example of how engineers can work together across organizational boundaries to improve an industry.

*Main image: The 777's first flight in 1994 marked a new era in aircraft development. Under Charlie Higgins' leadership as Chief Project Engineer, the program established testing methodologies and certification processes that became industry standards worldwide. Photo credit: Boeing Dreamscape - K58552, CC BY 2.0.*

# Alum prepares to make space history



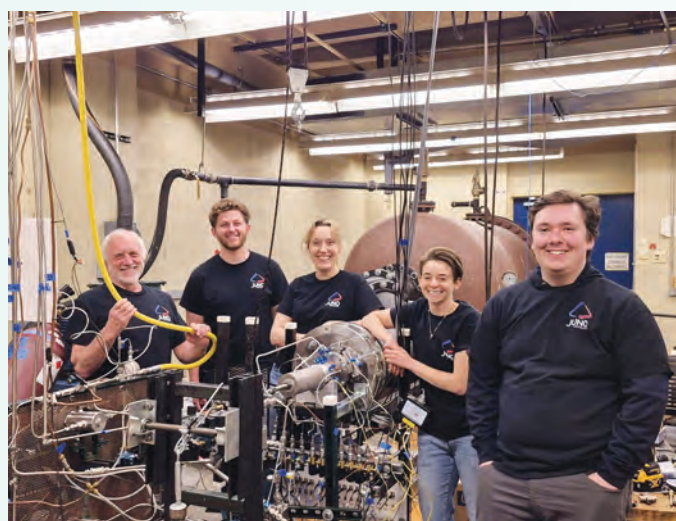
**Alexis Harroun (BS, '17) will be first to launch a rotating detonation rocket engine for an orbital flight.**

When Alexis Harroun steps into mission control this summer, she'll be watching her company's advanced propulsion technology fire in space for the first time. Her startup, Juno Propulsion, is preparing to launch the first U.S. orbital flight of a rotating detonation rocket engine, a milestone of aerospace history that will cap off a journey that began in our department nearly a decade ago.

Harroun co-founded Juno Propulsion with Ariana Martinez, whom she met as a Ph.D. student at Purdue University. There, Harroun continued the rotating detonation research that began during her undergraduate work with Professor Carl Knowlen.

Now, Harroun is working again with Knowlen through funding from Washington state's Joint Center for Aerospace Technology Innovation. "What's exciting is seeing this come full circle," Knowlen explains. "Alexis's passion for this technology grew out of our lab work together, and now we're collaborating to turn that early research into something that will fly in space." Their collaboration centers on a technology that could transform space propulsion.

The technology at the heart of Juno's mission represents a fundamental shift in rocket propulsion. Traditional rocket engines burn fuel in a controlled combustion process. Rotating detonation engines, by contrast, use a continuous wave of detonations that spin around the engine at incredible speeds in controlled explosions that are far more efficient than conventional burning.



"We are developing propulsion systems that use this rotating detonation engine technology as the key differentiator," Harroun explains. The result is a thruster that could dramatically reduce the fuel needed for satellite maneuvers, making space missions more affordable and opening up new possibilities for exploration.

Her thruster uses non-toxic propellants, ethane and nitrous oxide, that are safer to handle than traditional toxic rocket fuels. This approach makes the overall propulsion system 30 percent smaller in volume, 15 percent lighter in mass, and requires 40 percent less power than conventional solutions.

While Japan's space agency flew a rotating detonation engine on a suborbital flight in 2021, Juno's mission will be the first to test the technology in orbit, a much more demanding environment where the engine will need to operate for months, not minutes.

After launching on one of NASA's rideshare missions, the satellite will circle Earth 14 times per day, but the team will only be able to communicate with it three to six times daily when it passes over ground stations. During those brief windows, Harroun and her team will send commands to test different aspects of their propulsion system.

For Harroun, the mission represents more than just a business milestone. It demonstrates how the collaborative spirit between university researchers and entrepreneurs, supported by strategic government funding, can tackle the biggest challenges in space exploration.

NASA's recent \$500,000 TechLeap Prize to Juno Propulsion validates years of government investment in this technology. Combined with support from Washington state's Joint Center for Aerospace Technology Innovation and a \$275,000 National Science Foundation seed fund grant, these public investments have transformed undergraduate research into a company poised to make aerospace history. Harroun's engine and the founding of Juno Propulsion serve as proof that government funding of university research creates not just knowledge, but entire industries.

*Professor Carl Knowlen, Juno intern Ben Cabot, Alexis Harroun, Ariana Martinez and A&A graduate student Ben Fetters in A&A's Rotating Detonation Engines Lab.*



# Professor Jim Hermanson FLIES WITH THE BLUE ANGELS

In the buildup to Seattle's Seafair 2025, Professor Jim Hermanson experienced what thousands of spectators witness from the ground, but from the back seat of a Blue Angels F/A-18 Super Hornet. The rare flight opportunity gave him a firsthand look at the precision flying and advanced technology that make the Navy's premier flight demonstration squadron a Seattle summer tradition.

For Hermanson, who has spent more than a decade connecting UW students with Navy career opportunities, the flight represented both a personal milestone and a powerful teaching tool. Professor Hermanson shared more of his amazing experience.

## What was it like flying with the Blue Angels?

As the canopy came down on that F/A-18, I had one of those "am I really doing this?" moments. But what followed was absolutely phenomenal. Major Scott Laux, my pilot, kept us in constant communication throughout the flight, warning me before each maneuver, explaining what we were doing. Having an aeronautical engineer as a passenger who understood the physics of aviation seemed to energize him too. We pulled everything from gentle 2-g turns to an almost-vertical afterburner takeoff to a crushing 7.5-g turn that had me pressed hard into my seat. In addition to the afterburner takeoff, we

performed a full loop. Looking "up" at the ground was an incredible experience.

## What surprised you most up there?

Flying inverted was surreal. Reaching for something in the cockpit becomes completely disorienting when the ground below is above you. And I learned to appreciate the importance of proper muscle tensing for high-g maneuvers. We did turns with increasing g-levels of 2, 4, 6 and 7.5. During a 4-g turn, I did not properly tense up and started to "grey out" as my vision faded. Major Laux explained that it's at 4 g's that most people start to experience that effect. Lesson learned! Happily, with suitably-tensed muscles, all of the higher-g maneuvers went fine, though the sudden loading at 6+ g's was intense!

## How did this rare opportunity come about?

This was years in the making. I've been supporting Navy outreach at the UW for over a decade, and I'd always ask about the possibility of flying with the Blues. It finally came together this year with help from Admiral Ian Johnson and Commander Anna Padleckas, whose visit to our campus last April I hosted. These opportunities are incredibly limited — essentially once-in-a-lifetime.



### **This isn't your first Navy experience though, is it?**

Not at all. This experience caps off over 15 years of extraordinary Navy experiences. It began in earnest when I was department chair in 2010 with a submarine embark on the USS San Francisco out of San Diego. We dove, cruised underwater, resurfaced, and I got to tour all of the compartments forward of the reactor and propulsion spaces. Then in 2019, I flew out to the USS Theodore Roosevelt aircraft carrier, which included an arrested landing, a full day observing shipboard operations, and a catapult launch takeoff. Each experience has given me incredible stories to share with our students during numerous Navy recruitment briefings.

### **How did your Navy connection begin?**

When I graduated from high school, I was torn between two strong career aspirations. One was to join the Navy and drive submarines; the other, to explore outer space. I chose the latter and have focused my academic and industry career on working in aerospace. At the same time, I have always pondered that "path not taken" and have been delighted to experience many aspects of a Navy career first-hand.

### **What consistently impresses you across all these experiences?**

Three things always stand out: the cutting-edge technology, the seamless teamwork and dedication of all involved, and the critical importance to national security. Whether it's a submarine, aircraft carrier, or the Blue Angels, I see engineering at its most advanced and people working together flawlessly in high-stakes environments. I tell students that military careers offer the chance to work with "the real stuff" — hands-on with

technology that pushes boundaries while serving something essential to our country's defense.

### **How does this connect to your work at the UW?**

This experience gave me direct experience with aerospace technology at its most extreme. I teach propulsion courses, and now I can share real-world examples of these principles in action with our students. There's nothing quite like experiencing 7.5 g's or flying on afterburners to understand the engineering challenges involved.

In the end, I'd like to impart two considerations to our students. The first is to be flexible and open to different career choices and experiences, and work to develop your own path. It will be a good one! The second is to identify what you really want to do, and do what it takes to get you there. You'll always be glad you did!



*Clockwise from top left: Professor Hermanson right after takeoff; Hermanson flying inverted in the Blue Angels' F/A-18 Super Hornet; Hermanson and Major Scott Laux before takeoff.*

# The SOC-i CubeSat IS NOW ORBITING EARTH

When Qishi "Jackson" Zhou watched a faint streak illuminate Seattle's southern horizon on July 3, 2024, he was witnessing years of student dedication soar into orbit. Aboard Firefly Aerospace's Alpha rocket was SOC-i (pronounced "Sockeye"), a shoebox-sized satellite designed and built entirely by University of Washington students.

"Watching that rocket from Seattle, knowing our satellite was aboard was surreal," recalls Zhou, an A&A Ph.D. student and team lead for the A&A CubeSat Team (AACT). "In that moment, everything we'd worked for became real."

Selected as one of just 18 projects for NASA's highly competitive CubeSat Launch Initiative, SOC-i, the Satellite for Optimal Control and Imaging, represents both a remarkable technical accomplishment and a transformative educational experience. While its primary mission is to test innovative spacecraft attitude control technology (essentially how satellites orient themselves in space), the project's true value lies in what it taught the students who built it.

"This evolved into an environment where students could apply classroom knowledge to real-world challenges, navigate ambiguity, and learn through trial and error," Zhou explains. The twelve-member team navigated countless technical hurdles, often with limited documentation from graduated team members, transforming theoretical concepts into flight hardware now circling Earth every 90 minutes.

Kent Fukuda, who developed flight software for radio communications, captures the team's determination: "When I ran into issues while testing the communication systems, the team helped me push through and find creative solutions. The most exciting moment was when we finally got SOC-i to successfully send guidance, navigation and control data during testing. It gave us hope that it wouldn't just be a flying brick."

The mission continues to provide valuable lessons. While the team has detected signals confirming SOC-i is transmitting, establishing robust communication remains challenging — exactly the kind of real-world problem that makes space engineering so powerfully educational.

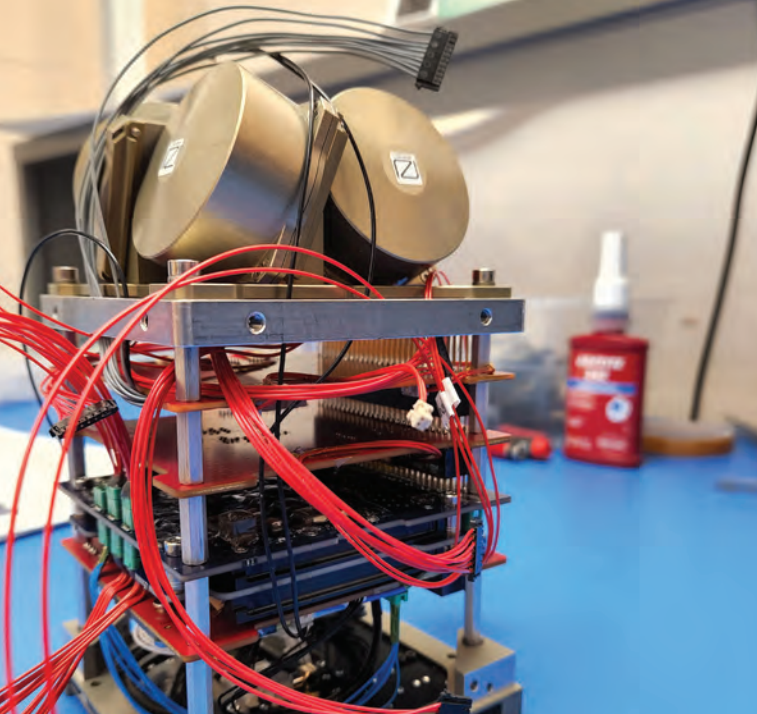
"Our investigation suggests SOC-i may be experiencing either power management adjustments or software reset sequences, both common challenges in satellite operations," Zhou notes. The team continues monitoring while collaborating with other universities and amateur radio communities worldwide in tracking efforts. "Our students are learning to troubleshoot complex systems remotely, collaborate across institutional boundaries, and document findings for future missions."

The project has already launched careers. Founding team members who established AACT in 2018 now work at Blue Origin, Amazon Prime Air, SpaceX, and Impulse Space. They credit their CubeSat experience with shaping their trajectories, and current team members are finding similar value.

"AACT gave us a chance to produce tangible work and support data collection for researchers," says team member Sam Mansouri. Brooke Yommarath adds, "There is a brighter future ahead for the aerospace industry with everyone who contributed their time, skill, and passion for SOC-i."

As the team prepares their comprehensive mission report for NASA, they're already planning future CubeSat development. "At AACT, we prioritize student development alongside technical goals," Zhou emphasizes. "I'm incredibly proud of how our team rose to meet every challenge."

For now, a piece of UW ingenuity continues circling our planet. Each time SOC-i passes overhead, it carries the collective intelligence and aspirations of every student who contributed to its journey as proof that hands-on education can literally reach toward the stars.



"Watching that rocket from Seattle, knowing our satellite was aboard was surreal. In that moment, everything we'd worked for became real."

- Qishi "Jackson" Zhou



## SOC-i origins

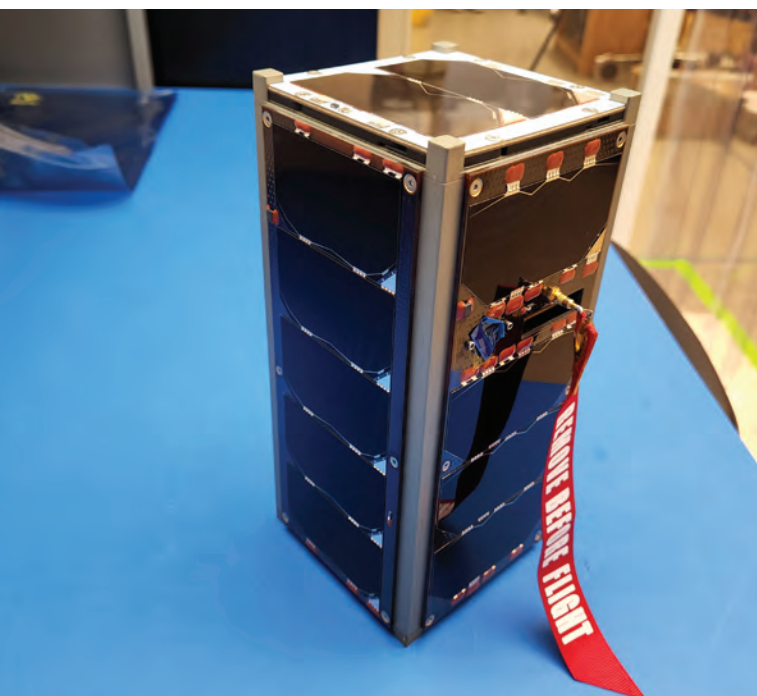
The A&A CubeSat Team was founded in 2018 by Ph.D. students Charlie Kelly and Taylor Reynolds, who envisioned establishing long-term satellite engineering opportunities within the A&A department. They secured a highly competitive spot in NASA's CubeSat Launch Initiative in 2020, equivalent to \$300,000 in launch integration services. Leadership later transitioned to Henry Brown before current team lead Qishi "Jackson" Zhou took the helm. The founders, along with former structures team member Zephyr Pitre, attended the July 3 launch at Vandenberg Space Force Base, watching their educational vision literally take flight.

---

### Team members:

The SOC-i send-off team included undergraduates Francisco Flores-Martinez and Joshua Rolfe (aeronautics & astronautics); Mikhail Mazukabzov and Owen Fairbairn (astronomy); Brooke Yommarath (chemical engineering); Jack Stern (applied physics); Arshan Rezai, Sam Mansouri, and Ethan Ingalls (electrical & computer engineering); Michal Kozubczyk (electrical engineering-Bothell Campus); Kent Fukuda (mechanical engineering); and Zico Holmer (pre-social sciences). Professor Alvar Saenz Otero serves as faculty adviser.

---



*Top to bottom: The SOC-i CubeSat before full assembly; Arshan Rezai (left) and Francisco Flores-Martinez fit it into the official housing; the prepared CubeSat.*

HIS STORY TO TELL:

## Professor Emeritus Reiner Decher chronicles family history as part of a post-WWII technological migration



A truck flips on a war-torn German road in 1945. A terrified family watches as their three-year-old son nearly dies. For six-year-old older brother Reiner Decher, this moment would become the pivot upon which his family's entire future balanced, and unknowingly, a small but crucial piece in the global redistribution of aerospace knowledge that would shape aviation for decades to come.

"We came within a couple of inches of having spent six or seven years in the Soviet Union," reflects Decher, now A&A Professor Emeritus. This near miss forms the emotional core of his newly published book, *The Fate of Nazi Germany's Jet Engineers*, which weaves his family's remarkable story into the larger context of post-WWII technological migration.

At the center of the personal narrative stands Reiner's father, Siegfried "Sig" Decher — a brilliant engineer who designed the control system for Germany's first operational jet engine. As the war ended, Sig became one of thousands of pawns in a technological talent redistribution conducted by the victorious Allies.

The Russians, Americans, and French each pursued different strategies to acquire German engineering talent. While the Russians forcibly relocated 3,000 engineers and their families at gunpoint, the Americans recruited selectively, bringing only about two dozen experts to their laboratories as part of Operation Paperclip. The French, desperately rebuilding their devastated aviation industry, sought entire engineering teams.

Through a combination of timing, luck, and an American evacuation that rescued his hospitalized younger son and his wife from what was to be the Soviet Occupation Zone, Sig eventually found himself first in France, then in the United States in 1954. At the Lycoming Gas Turbine Division of AVCO Corporation, he rose to become Director of Research and Development, where he pioneered critical innovations in high-bypass engine technology.

"While he was not alone in advancing this technology, he was the first to run and patent the high-bypass engine design we use on

all jet airliners today," Reiner Decher notes with pride. "That first engine is now on display at the National Air and Space Museum in Washington D.C."

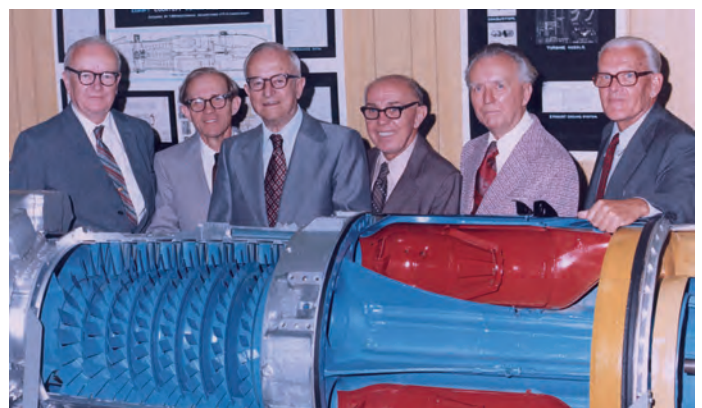
While researching his book, Decher tracked down the families of other displaced engineers, filling in historical gaps to understand how these migrations shaped global aviation development. The scattered German expertise seeded crucial innovations across nations: in Russia, engines for the massive Bear turbo-prop bomber; in France, propulsion systems for the supersonic Concorde and later versions of the Boeing 737; in America, gas turbine engines that would power the iconic Huey and Chinook helicopters and many other aircraft.

"Had the Americans decided to move all these German engineers to the West," Decher observes, "the Russians might really have been delayed in their efforts to build a jet engine industry."

*Professor Emeritus Reiner Decher taught in our department from 1967 to 2001.*



At top, Siegfried and Reiner Decher in France around 1940. Below: Decher's book cover; Reiner Decher in France around 1947; A reunion for the 25th anniversary of the Lycoming plant in Stratford, CT., in 1976. Siegfried Decher (far right) and five colleagues pose with the axial flow compressor blading and red burner of the Jumo 004 engine, the technology they had helped develop during wartime.





# Fellowships supporting A&A excellence

**The generosity of our donors continues to propel aerospace innovation through strategic fellowship support. We celebrate a new faculty endowment and continuing student commitments that empower our most promising researchers, as examples of the profound impact alumni and friends make on our department.**

## Varanasi fellowships for faculty support and graduate education

When Rao (Ph.D. '68) and Usha Varanasi (Ph.D. Chemistry '68) decided to expand their support for A&A, they looked toward faculty support to ensure we continue to deliver top education and research. Having established a graduate student fellowship years ago, the Varanasis have now created an endowed faculty fellowship focused on structures and composites, the field where Rao built his distinguished aerospace career.

### Faculty fellowship in structures and composites

Professor Marco Salviato, the faculty fellowship's inaugural recipient, brings the forward-thinking approach the Varanasis envisioned. His research into advanced composites addresses fundamental challenges in creating lighter, more resilient aerospace systems.

"This support allows me to expand our investigations at the intersection of materials science, structural mechanics and computational modeling," Salviato explains.

The five-year fellowship will amplify his research capacity while creating richer learning experiences for his students, who will engage with advanced testing methods and international collaborations. "They'll develop the creativity and confidence needed to become leaders in the field," he notes.

### Graduate student fellowship

Ph.D. student Mira Tipirneni, our recent Varanasi Fellow, is transforming how aerospace manufacturers test aircraft coatings. Her computational models predict rain erosion on aircraft surfaces, work that could significantly reduce the industry's reliance on costly physical testing.

"Mira's research is crucial for aerospace engineering's future," says Professor Antonino Ferrante, her adviser. "We're enabling development of more durable and efficient aircraft."

Tipirneni has helped develop a sharp interface method for compressible two-phase flows, advancing beyond traditional

methods that struggle to capture precise boundaries between water droplets and air. Her Boeing partnership research has demonstrated remarkable accuracy in various testing scenarios.

## Condit fellowship: Advancing flight control innovation

Ph.D. student John Berg, our recent Condit Fellow, tackles one of commercial aviation's most complex challenges: developing control systems that simultaneously manage multiple aircraft objectives. Made possible through Phil and Geda Condit's (B.S. '77) generous support, this fellowship recognizes exceptional doctoral candidates demonstrating outstanding research potential.

Berg's dissertation employs a sophisticated flexible wind tunnel model to study the balance between four critical control objectives: maneuver load alleviation, gust load alleviation, handling qualities, and passenger ride comfort.

"What sets John's research apart is his attention to real-world applications," says Professor Eli Livne, one of Berg's co-advisers. "By anchoring his work in FAA certification requirements with comprehensive modeling and wind tunnel testing, he's creating a robust framework for future flight control system design."

**If you are interested in exploring options to support our department with a gift, please contact Caitlin Christian, [caitlk2@uw.edu](mailto:caitlk2@uw.edu) or (206) 616-0403.**



*Top cluster: Mira Tipirneni, Professor Marco Salviato and Usha and Rao Varanasi. Bottom: John Berg (left) and Geda and Phil Condit with Engineering Dean Nancy Allbritton and Professor Kristi Morgansen.*

2025 A&A UNDERGRADUATE SHOWCASE WINNERS



**Fundamental Discovery**  
Dena Villaseñor



**Applied Innovation**  
Kyshawn Savone-Warren



**Applied Innovation**  
Senna Keesing



**Scientific Communication**  
Matthew Idso



**The People's Choice Award**  
Annika Singh



**The People's Choice Award**  
Neha Saripella

2025 A&A GRADUATE RESEARCH SHOWCASE WINNERS



**Fundamental Discovery +  
The People's Choice Award**  
Hannah Shipman



**Applied Innovation**  
Kazuki Mizuta



**Scientific Communication**  
Isaac Remy

AWARDS



**Husky 100**  
Grace Pardini



**Fulbright Fellowship**  
Thomas Key



**NSF Graduate Research  
Fellowship Program**  
Senna Keesing

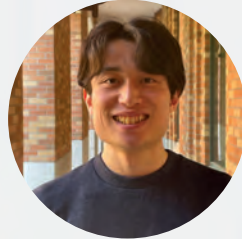
## 2025 A&A STUDENT EXCELLENCE AWARDS



**Undergraduate Research Excellence**  
Dena Villaseñor



**Master's Research Excellence**  
Jichen "Sam" Yao



**Doctoral Research Excellence**  
Kazuki Mizuta



**Teaching Excellence**  
Thomas Key



**Undergraduate Service Excellence**  
Erika Wood



**Graduate Service Excellence**  
Kuang-Ying "Eddie" Ting

## BEST PAPER AWARDS

A&A Ph.D. candidate Skye Mceowen and her co-authors captured two top honors at the 2025 AIAA SciTech Conference for their paper "Auto-tuned Primal-dual Successive Convexification for Hypersonic Reentry Guidance." Mceowen won the Graduate Student Paper Competition in the Guidance, Navigation, and Control division for her presentation, while the entire team received the Best Paper Award for Atmospheric Flight Mechanics.

The research introduces Auto-SCvx, a versatile algorithm that solves complex trajectory optimization problems with applications extending far beyond aerospace. By demonstrating the algorithm's power through hypersonic reentry guidance, one of the most challenging problems in spaceflight, the team showcased a tool that could transform how engineers approach optimization across multiple domains.

Co-authors include Daniel J. Calderone (University of New Mexico), Aman Tiwary (UW mechanical engineering), A&A graduate student Jason S. K. Zhou, recent graduates Taewan Kim (Ph.D. '24) and Purnanand Elango (Ph.D. '25), and Professor Behçet Açıkmüşe. The research received support from the Office of Naval Research, NASA, and NASA Johnson Space Center.



**AIAA Best Paper**  
Skye Mceowen

## DEPARTMENT FELLOWS



**Boeing and Teslow Fellow**  
Kuang-Ying "Eddie" Ting



**Boeing and Teslow Fellow**  
Samet Uzun



**Varanasi and Oates Fellow**  
Kevin Manohar



**Condit Fellow**  
Spencer Kraiser

# HIGHFLIGHT

TEL: 206.543.1950  
aafrontdesk@uw.edu  
WEB: aa.washington.edu

**WILLIAM E. BOEING** DEPARTMENT OF AERONAUTICS & ASTRONAUTICS

**W** | WILLIAM E. BOEING DEPARTMENT OF  
**AERONAUTICS & ASTRONAUTICS**

UNIVERSITY *of* WASHINGTON

211 Guggenheim Hall, Box 352400, Seattle, WA 98195-2400



**WHAT IF MATERIALS  
COULD THINK?**



**WHERE DOES PHYSICS  
MEET POSSIBILITY?**



**WHAT POWERS  
TOMORROW?**

# Find out.

**APPLY TO A PROFESSIONAL AEROSPACE  
PROGRAM TO ADVANCE YOUR CAREER**

[aa.washington.edu/professional](http://aa.washington.edu/professional)

# W