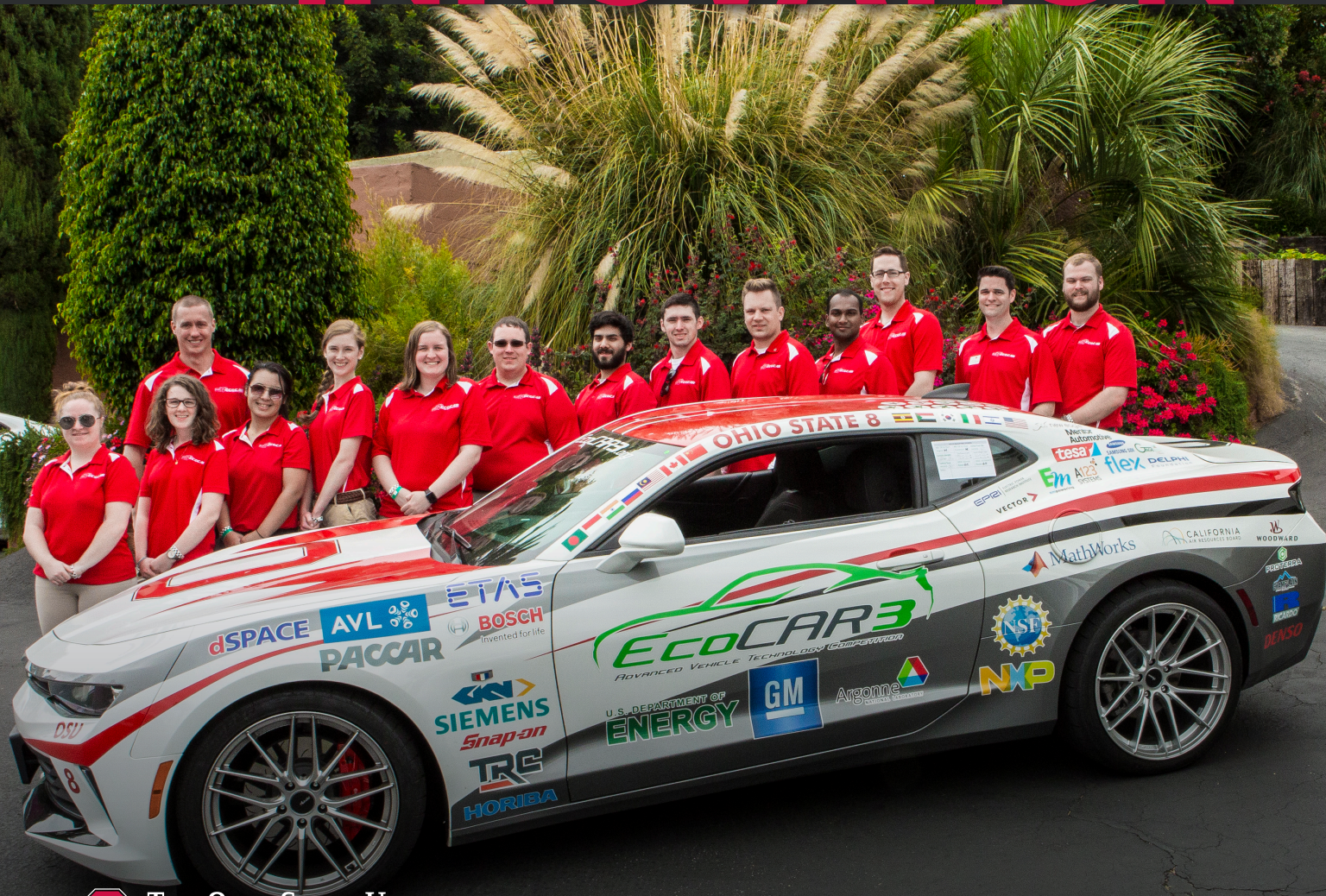


2019

# UNDERGRADUATE INNOVATION



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF ENGINEERING

**DEPARTMENT OF MECHANICAL  
AND AEROSPACE ENGINEERING**





*Students put their skills to the test with senior capstone projects. The experience begins with a formal design and culminates in prototype testing.*

# Message from Associate Chair for Undergraduate Education

## BLAINE LILLY

**A**s we enter the last year of the decade, this seems to be a fitting time to look back over the past seven years since we converted to a semester calendar and reflect on the resulting changes to our curriculum.

Our undergraduate programs in aerospace and mechanical engineering continue to thrive, with the average entering GPA of our students increasing every year. In our undergraduate programs, annually we currently enroll 75 students in aerospace engineering and approximately 240 students in mechanical engineering. These numbers are essentially the maximum enrollment we can comfortably teach per year, so we continue to turn away about 50% of the students who wish to enroll. These students typically move to another engineering department and stay at Ohio State.

**Our undergraduate curricula are known to be two of the most demanding in the university, but they are also recognized for the extensive opportunities they afford students to engage in experiential learning.**

In mechanical engineering all entering students spend their first semester learning basic machine tool use and microprocessor coding in ME 2900, and continue to apply these skills through the remainder of their time here. Our senior capstone design courses have seen a continual change for the better in the scope and sophistication of the student projects since the introduction of ME 2900 in 2012. The mechanical engineering capstone is a two-semester experience, in which students can choose one of several tracks depending on their interest.

Our aerospace engineering program provides a very strong hands-on experience during the final year, when seniors enroll in year-long sequences in experimental projects and aerospace design. The aerospace program is home to several interdisciplinary teams, including the very successful Buckeye Space Launch Initiative and the Design/Build/Fly program.

This academic year our Undergraduate Studies Committee is re-examining our curricula in both programs. Along with many of our peer institutions, we are taking a hard look at the number of required courses as opposed to electives, with an eye to the latest revisions to the ABET criteria.

### **Blaine Lilly**

*Associate Chair for Undergraduate Education  
Department of Mechanical and Aerospace Engineering*



*Cover: Ohio State EcoCAR 3 team with their award-winning redesigned Chevrolet Camaro at the Advanced Vehicle Technology Competition. Credit: U.S. Department of Energy.*





## Four-peat! Ohio State wins national EcoCAR 3 competition

The Ohio State University won first place in the final year of EcoCAR 3, an Advanced Vehicle Technology Competition, sponsored by the U.S. Department of Energy and General Motors Co. This is the fourth consecutive win for the Buckeyes.

EcoCAR 3 is a four-year collegiate automotive engineering competition that challenges 16 North American universities to redesign a 2016 Chevrolet Camaro to further reduce its environmental impact while maintaining the iconic Camaro performance and safety.

In addition to the coveted first place trophy and bragging rights, the Buckeyes will also take home \$33,000 to further support the university's advanced vehicle

technology program.

"This year the students excelled at both the pre-competition deliverable, the oral report, and the presentations," said Ohio State team faculty advisor Shawn Midlam-Mohler. "Our students are able to build a great car, but they're also able to communicate in both written and oral communication—the thought process, the design, the validation—all of that effort that goes into building a car."

"But our overall team philosophy focused on building students instead of building a car."

Ohio State's team was in first place going into the



competition and earned 895 out of 1,000 overall points.

“The biggest challenge for Year Four was really just creating a vehicle that was better than we had in Year Three and being able to get at this performance aspect of a hybrid-electric vehicle while also focusing very heavily on reducing emissions,” said Briana Antinoro, co-communications manager for the team. “We get very hands-on, we work with every component within the car.”

Ohio State’s crew won 18 awards, including the NSF Diversity, Inclusion and Equity Award, the NSF Outstanding Advisor Award (Midlam-Mohler) and the first place NSF Innovation Award.

Individual team members also earned awards, including electrical team lead Kerri Loyd who received the General Motors Rookie in Engineering Award.

One feature that set apart the Buckeyes’ vehicle from their competitors is its electrically heated catalyst that reduced startup emissions by 85 percent.

“We actually had fuel economy that was 20 percent higher than our next competitor in that area,” said team lead and engineering manager Brandon Bishop.

West Virginia University and the University of Alabama

took second and third place in the competition, respectively.

In addition to sweeping all four years of EcoCAR 3, in 2014 the Buckeyes also captured top honors in the final year of the EcoCAR 2: Plugging In To The Future competition.

“EcoCAR3 is a great program that fosters future generations of automotive engineers and business people, encouraging them to become true innovators,” said Ken Morris, General Motors vice president of Global Product Programs. “This year’s winners—and all the teams—are proof of that. It’s a competition that GM is proud to support.”

The Ohio State EcoCAR sponsors include Parker-Hannifin, Cooper Tires, Clean Fuels Ohio, Transportation Research Center, TE Connectivity, Johnson Controls, Parker, Tremec, Ford, Honda, 3dparts.com and Modern Driveline.

The EcoCAR 3 competition is sponsored by the U.S. Department of Energy and General Motors, and a number of other industry members.

*contributions by Allison Mellor, Ohio State EcoCAR team*



*Ohio State EcoCAR 3 team at the awards ceremony. Photo: EcoCAR 3*

## TEAM AND VEHICLE STATS

- **Team members:** 60+ undergraduate and graduate students from 14 countries
- **Majors represented on team:** 11 majors
- **Architecture and engine:** Parallel-Series Plug-in Hybrid-Electric Vehicle with 2.0L direct injection engine - 120kW
- **Total power:** 340 horsepower
- **Fuel economy:** 42 MPGge
- **Electric range:** 40 miles
- **Fuel:** E85 and grid electricity



# Virtual reality could be the future of mental health in space

**M**ental well-being, while important for all humans, is especially crucial for astronauts due to the intense nature of their environment, said aerospace engineering student Nick Salamon. It is particularly vital on long-haul missions to the moon or NASA's future journey to Mars.

"The crew will be in a cramped environment, far away from Earth. It's probably going to take a big toll on their mental health," he said, noting that an astronaut in a compromised mental state could make a mistake that ends the mission or even worse, the lives of the crew. "So why not try to apply VR, since it's so convincing, to expose them to different environments that might help calm them down and provide entertainment?"

Under the guidance of advisor and Neil A. Armstrong Chair John Horack, Salamon produced his first manuscript, "Application of Virtual Reality for Crew Mental Health in Extended-Duration Space Missions." The paper quickly caught the attention of others in the field and in the fall of 2017 he traveled to Adelaide, Australia to present his initial work at the International Astronautical Congress (IAC), the world's largest gathering of space professionals. Soon after, Salamon reached another milestone: his first-peer reviewed publication. His paper was published in the interdisciplinary space journal *Acta Astronautica*.

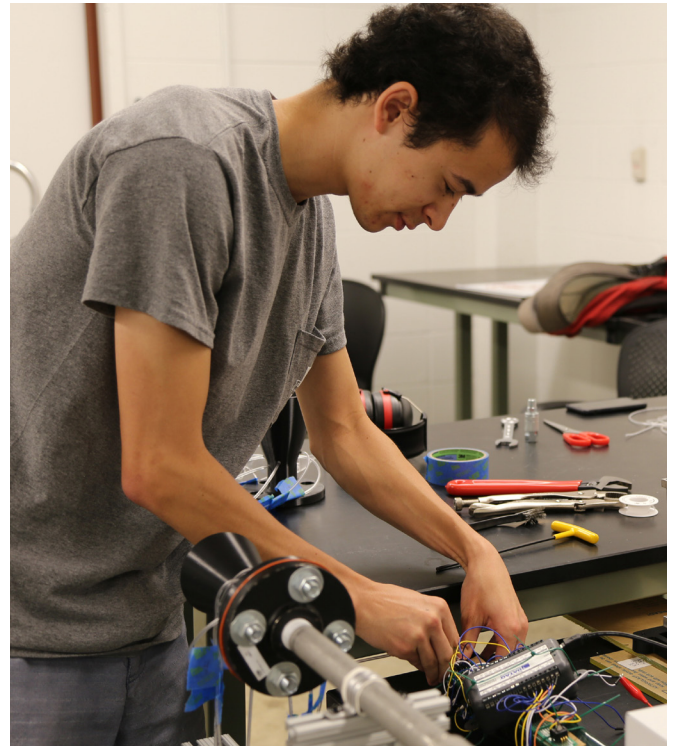
Salamon says the versatility of VR technology makes it ideal for many different applications in space, including relaxation, exercise and socialization.

Salamon's undergraduate research was funded by Ohio State's Battelle Center for Science, Engineering and Public

Policy. Without the support and opportunities provided by the center, Salamon said his work on VR would not have been possible.

*by the College of Engineering*

**READ MORE:** [go.osu.edu/uivirtual](http://go.osu.edu/uivirtual)



*Nick Salamon working in the lab*



# Standout athletes shine on the court and in the classroom

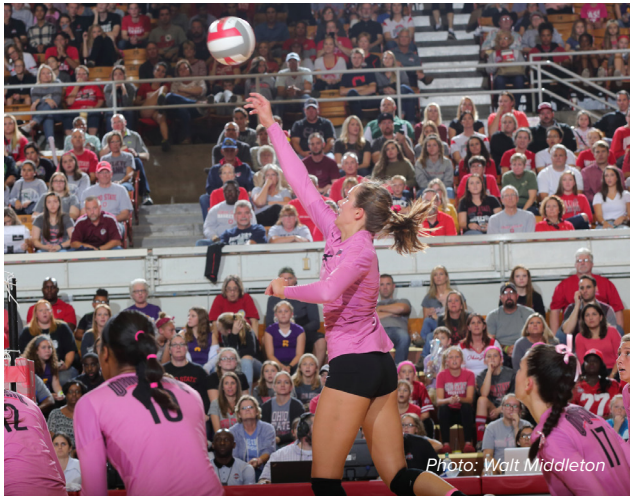


Photo: Walt Middleton

Luisa Schirmer, top, and Nicolas Szerszen, below left, are skilled in volleyball and mechanical engineering



Being future-focused is what brought both Nicolas Szerszen and Luisa Schirmer to The Ohio State University. These fourth-year standout varsity volleyball players with aspirations of playing professionally each knew that they also wanted to be mechanical engineers.

They not only balance the demanding workload facing many students approaching graduation, but also juggle rigorous athletic schedules.

Blaine Lilly, associate chair for undergraduate programs, describes the complementary match between engineering and athletics. “Our student athletes tend to be among our best students because they are already highly disciplined when they arrive on campus. Luisa and Nic are both quite outstanding athletes and students.”

That engineering and athletics go hand-in-hand is no secret to these two athletes. The finesse and articulation used in engineering are also essential on the volleyball court. “Because of engineering, I am able to analyze my play and have an analytical mindset to becoming a better athlete,” said Schirmer.

Even group work takes on a whole new meaning when Szerszen looks at it through the athletic lens. “I think the team spirit is pretty similar in both sports and engineering,” he said.

But for all their recognition, both Buckeyes remain modest and look to the future. Volleyball is currently a very large part of each of their lives, and at the same time they realize the significance of being equipped with a mechanical engineering degree from Ohio State.

**READ MORE:** [go.osu.edu/uiathletes](https://go.osu.edu/uiathletes)



# Engineering the next mission: Department veteran and military students balance service and studies

Service to country and engineering have a lot in common for many department veteran and military students. For these Buckeyes, betterment of society is at the heart of each.

“Although engineering and military service each have a different focus, they have the same goal: safety of the public,” said Abiel Kiflu, undergraduate mechanical engineering student and member of the Army Reserve.

This unique perspective can enhance students' educational experience and bring new ideas to the classroom.

Balancing academics and military service, or transitioning from duty to campus life, does have its challenges.

Serving this need is The Ohio State University Office of Military and Veterans Services. Staff there provide a range of specialized support for military-affiliated faculty, staff and students. Not only does the office help students navigate university systems, but it also houses the volunteer Community Advocate Program.

Mechanical engineering student Haelie Egbert is among over two dozen volunteer advocates who support veterans and military students across campus. “As an advocate, I help connect veterans and military students to resources and experiences to boost their academic and professional success,” she said.

Egbert, an Ohio Air National Guard member, supports students throughout the College of Engineering, where

her role allows her to serve as a liaison.

According to the Office of Military and Veterans Services, a common challenge for students is working through the seemingly competing philosophies of military service and pursuit of higher education. Military duty focuses on service to others, while college success often depends on prioritizing self, they described.

Rather than battling against this and other challenges, advocates like Egbert aim to reframe them into opportunities. “The two perspectives don’t have to be opposed,” she noted. “For example, military students and veterans are often experts in teamwork and working toward common goals. Seeing higher education as a way to collectively succeed can fill students with a sense of community and accountability.”

**READ MORE:** [go.osu.edu/uimilitary](https://go.osu.edu/uimilitary)



*Some of the many department-affiliated veterans and military students*



# Newly-launched Bridge to Excellence program pays it forward

**S**ix high-achieving undergraduate students comprise the first cohort of the Bridge to Excellence program.

The competitive pilot initiative targets third-year undergraduate students and focuses on enhancing their academic careers through scholarship and professional development.

The students, from both mechanical engineering and aeronautical and astronautical engineering majors, have received scholarships and stipends to enable participation in departmental activities, specifically research or other project-related programs. Funds were awarded based on academic achievement, financial need, leadership potential and evidence of previous participation in and

service to the community and the school.

Participants have the opportunity to attend professional development seminars on topics such as networking, time management and applying for fellowships and graduate school to further their career-readiness.

The pilot initiative was funded by engineering alumnus Bob Bero (BS ME '66, MS ISE '69), who, after a lifetime of success, remains grateful for the opportunities he has received due to his college experiences.

Associate Professor Rob Siston leads and mentors the students in the one-year program.

**READ MORE:** [go.osu.edu/uibridge](https://go.osu.edu/uibridge)



*The first cohort of the Bridge to Excellence program, with Rob Siston, back row on left*



*Faculty, staff, graduate students and undergraduate students were among attendees at the department's first Reception for Women.*

## Inaugural Reception for Women hosted by the department

**T**he Department of Mechanical and Aerospace Engineering held its first Reception for Women during autumn semester 2018.

Attended by faculty, staff, graduate students and undergraduate students, the event included networking and the opportunity for students to meet department leadership.

Welcoming the group, Department Chair Vish Subramaniam expressed his commitment to supporting women in mechanical, aerospace and nuclear engineering.

“Enhancing diversity and improving inclusion in

engineering is paramount for addressing the issues facing today’s society,” he said later.

“The department aims to support women in their academic and professional endeavors to make the world a better place, whether that’s through advancing nuclear safety, designing components for spacecraft or discovering new ways of treating cancer.”

“We want women to not only leave here with a degree, but enable them to achieve excellence and graduate ready to be future leaders in their fields by breaking barriers that prevent their full participation.”



*“Enhancing diversity and improving inclusion in engineering is paramount for addressing the issues facing today’s society. The department aims to support women in their academic and professional endeavors to make the world a better place, whether that’s through advancing nuclear safety, designing components for spacecraft or discovering new ways of treating cancer.”*

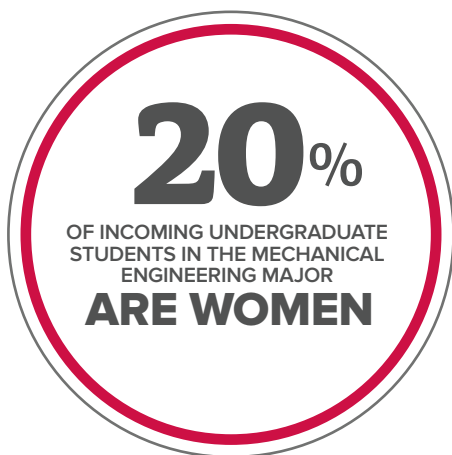
**- VISH SUBRAMANIAM**

*Chair, Department of Mechanical and Aerospace Engineering*

It was announced at the event that 20 percent of incoming undergraduate students in the mechanical engineering major are women, according to the Undergraduate Advising Office.

“This is the first time our mechanical engineering major has reached such a high rate of enrollment by women,” said Blaine Lilly, associate chair for undergraduate education. “It’s certainly an achievement and we hope to continue making the department a welcoming place for not only women, but all students.”

After this successful inaugural gathering, future events were planned.



# Department undergraduate programs rank among top 20 in U.S.

In *U.S. News & World Report's* 2019 Best Colleges rankings, several departments within The Ohio State University College of Engineering placed among the top programs in the nation. Overall, Ohio State's undergraduate engineering program ranks 16th among public universities nationwide and first in Ohio.

The Department of Mechanical and Aerospace Engineering's two undergraduate programs ranked in the top 20. The aeronautical and astronautical engineering program placed at 15th and mechanical engineering at 20th.

Other top 20 engineering undergraduate programs at Ohio State include the Department of Food, Agricultural and Biological Engineering's undergraduate program (7), industrial/manufacturing engineering (14), materials engineering (14) and computer engineering (16). Electrical engineering and chemical engineering programs also received enough nominations to appear in this year's rankings, at 23rd and 27th, respectively.

The publication's rankings of undergraduate engineering programs accredited by ABET, the internationally-recognized Accreditation Board for Engineering and Technology, Inc., are based solely on the judgments of deans and senior faculty at peer institutions. Those same respondents also were asked for nominations of the 15 best engineering programs in specialty engineering areas. Those receiving the most mentions in each appear on the site ranked



in descending order as long as the school/program received seven or more nominations in that specialty area.

The College of Engineering's graduate program was ranked first in Ohio and 16th among all public universities in *U.S. News & World Report's* 2019 Best Graduate Schools issue.

*excerpts by the College of Engineering*



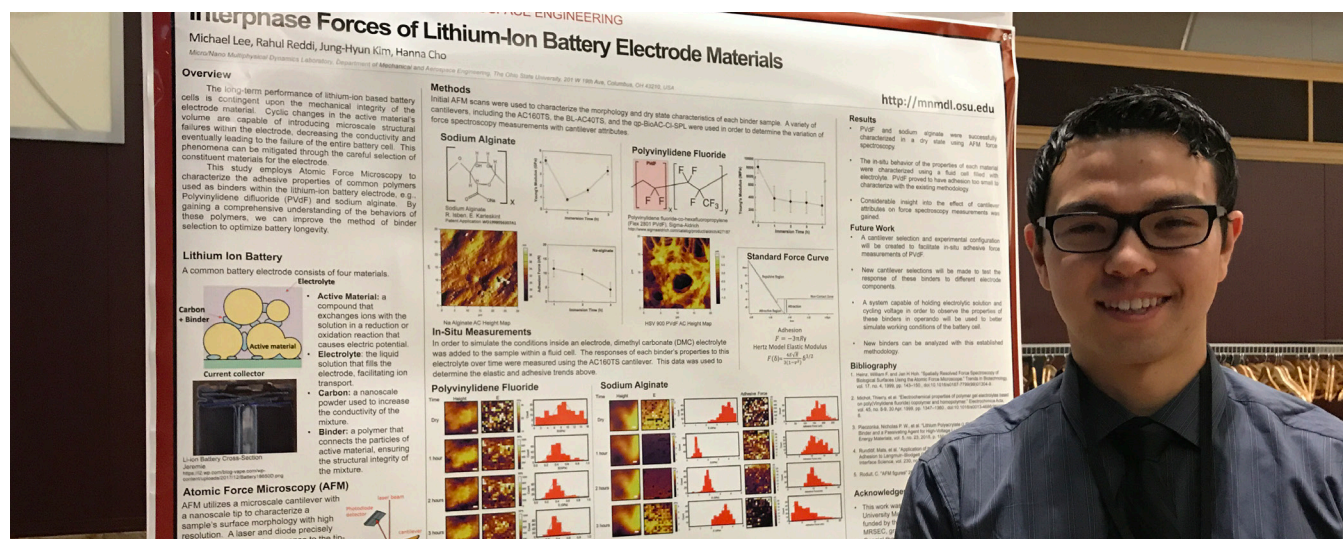
# Department undergrads honored at Denman Research Forum

**B**uckeye engineers were celebrated as undergraduate researchers for their outstanding presentations at the 23rd annual Denman Undergraduate Research Forum. As one of the largest events of its kind in the country, the Denman Forum gives undergraduate students the opportunity to showcase their research, scholarship and creative activities to the Ohio State community and beyond.

In 2018, nearly 800 students from across the university presented their projects on a wide range of disciplines. Fourteen engineering students received honors in their categories, including four students from the Department of Mechanical and Aerospace Engineering.

Michael Lee, a mechanical engineering major advised by Hanna Cho, won first place in the materials engineering category for his work, "In-situ characterization of lithium-ion electrode polymers via atomic force microscopy."

First place in the mechanical and aerospace engineering category went to aeronautical and astronautical engineering major Ian Chamberlain, advised by Kiran D'Souza, for his project, "Simulating UAV ingestion by a turbofan engine using LS-DYNA." Mechanical engineering students Gene Li, also advised by Cho, and Peter Vuyk, advised by Ryan Harne, took home second and third place prizes, respectively.



Michael Lee, a mechanical engineering major, won first place in the materials engineering category at the 2018 Denman Undergraduate Research Forum

# Flipping the classroom: Faculty find success through technology-enhanced teaching

Tapping into the technological savvy of today's students, Professor Emeritus Yann Guezennec is leading a new initiative in the Department of Mechanical and Aerospace Engineering aimed at increasing student success through technology-enhanced teaching. The results have been significant.

Utilizing e-learning tools, such as prerecorded lectures and online quizzes, Guezennec successfully piloted the flipped classroom model to deliver instruction for a core undergraduate class.

The flipped classroom model focuses on better use of faculty time in the classroom and its success is rooted in exposing students to concepts multiple times. Because recorded lectures are available throughout the semester, students can replay them while studying. By delivering new content and corresponding quizzes online, the class meeting time becomes an interactive session for solving examples and answering questions.

At the end of the semester, Guezennec was an advocate for technology-enhanced teaching and learning. "The flipped classroom experiment was very successful with better learning outcomes for students and faculty," he noted.

After the impressive pilot offering, Guezennec was quick to share his model of success with department colleagues.

Since autumn 2016, other faculty members have used the flipped classroom model to teach the same course, all with similarly favorable results.

Department Chair Vish Subramaniam praised the results

of the initiative. "We wanted to not only save faculty time, but also increase student learning outcomes. The pilot has proven that both are possible, and we predict that technology-enhanced teaching and learning will give the department an edge in reaching today's students," he said.

The flipped classroom model contributes to the rest of the department's technology-enhanced teaching initiative. Faculty are investigating how time-saving elements of the model can be reused for teaching elective courses whose small enrollment numbers often result in course cancellation.

Another option for reuse of materials is distance education, which Guezennec and other department faculty have been involved with for over 20 years.

Guezennec is impressed with the results of the initiative so far. "All the faculty who have tried the flipped classroom model have consistently seen successful results," he said.

"Technology available to us is changing rapidly and our teaching methods must evolve with it. The flipped classroom approach is a great opportunity for faculty to enhance quality of teaching while improving student outcomes."

**READ MORE:** [go.osu.edu/uiflip](https://go.osu.edu/uiflip)





# Experiential learning emphasizes technical and professional skills

**E**xperiential learning is one of the distinguishing traits of the Department of Mechanical and Aerospace Engineering. Interactive classes, student-designed and -built capstone projects and student-led competition teams provide opportunities to gain experiences in solving complex, interdisciplinary problems. It is the goal that students graduate equipped with not only technical knowledge, but also the interpersonal and professional skills needed to succeed in the modern engineering field.

## INTERACTIVE CLASSES

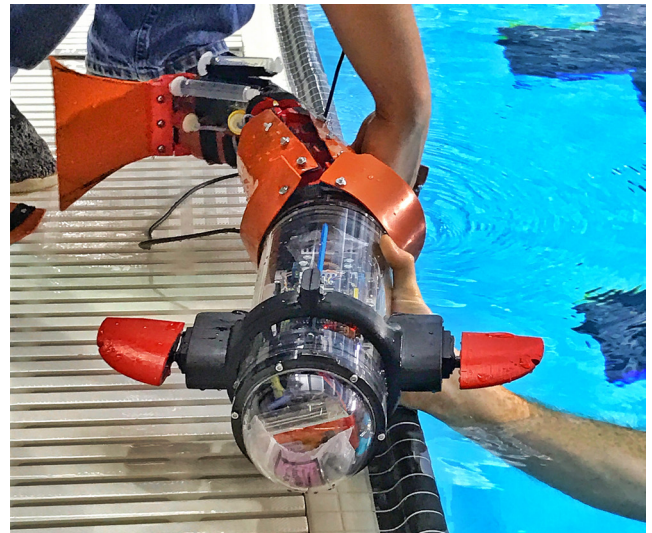
Coursework rooted in foundational research and combined with thought-provoking experimental work advantages the learning process during students' undergraduate education. With access to research experts and clinical faculty dedicated to excellence in teaching, students can expect to develop a well-rounded skill set that can take them to careers in industry or prepare them for continuing their academic pursuits.

## CAPSTONE PROJECTS

Answering some of today's most pressing engineering questions begins with a thorough understanding of the design process. Each undergraduate student dedicates two semesters to developing, prototyping and testing a project through a formal group design experience. This culminating project reinforces technical skills while further developing proficiency in teamwork and introducing project management components.

## COMPETITION TEAMS

Students in the department are excited to put their engineering skills to the ultimate tests. By creating the world's fastest electric vehicle, launching a far-reaching rocket and developing an underwater robot, students voluntarily challenge themselves to achieve faster, stronger and better. Open to all majors, backgrounds and skill levels, participants apply research and classroom concepts to design, fabricate, manage and compete with projects created on these teams.



*Students designed and built this Robotic Fish capstone project in 2018*



## FOUR BUCKEYES CHOSEN AS UNIVERSITY INNOVATION FELLOWS

### Mechanical engineering undergraduate joins highly selective program

The student entrepreneurship and innovation culture at The Ohio State University is beginning to flourish, and four undergraduates want to ensure that momentum is maintained.

Liyang Feng, Juan Tramontin, George Valcarcel and Kai Vogeler have been named University Innovation Fellows, a highly-selective program that empowers student change-agents to increase campus engagement with innovation, entrepreneurship, creativity and design thinking. They are part of a cohort of 258 students from 64 schools in nine countries.

Feng is a computer science and engineering major, Valcarcel an industrial systems engineering major, Vogeler a mechanical engineering major and Tramontin is a logistics management student with an engineering minor. Each is enrolled in Ohio State's Integrated Business and Engineering honors program. At the beginning of the school year, they launched a new organization, Interdisciplinary Resource for Innovative Students (IRIS), where students come together to ideate and prototype solutions to everyday problems.

University Innovation Fellows (UIF) at each school work to ensure that their peers gain the knowledge, skills and attitudes required to compete in the economy of the future and make a positive impact on the world. To accomplish this, Fellows advocate for lasting institutional change and create opportunities for students to engage with innovation,



*Left to right: advisor Peter Rogers, Liyang Feng, Juan Tramontin, George Valcarcel, Kai Vogeler and advisor Jay Sayre*

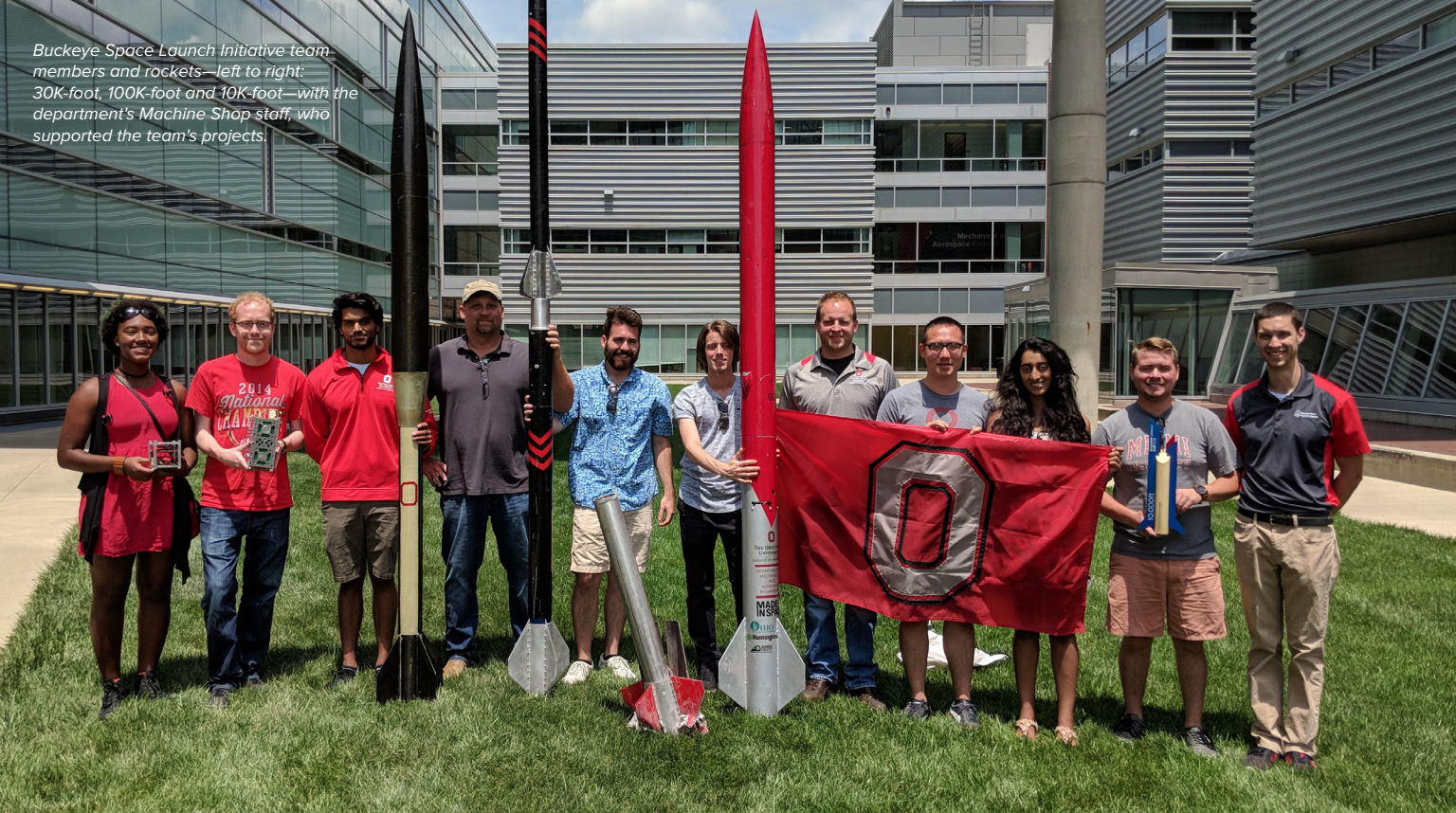
entrepreneurship, design thinking and creativity at their schools. The program is run by Stanford University's Hasso Plattner Institute of Design (d.school).

The group's first focus is to formalize the UIF program at Ohio State, working with faculty and administrators to ensure Ohio State students participate every year. Simultaneously they are auditing the university's existing open collaboration spaces and innovation labs across campus with the intent of creating a network of such locations and recommending additional resources.

Fellows receive year-round mentorship and represent the program and their schools at national conferences and events.

*by the College of Engineering*

*Buckeye Space Launch Initiative team members and rockets—left to right: 30K-foot, 100K-foot and 10K-foot—with the department's Machine Shop staff, who supported the team's projects.*



## UNDERGRADUATE HONORS, AWARDS AND RECOGNITION

### STUDENTS

- Outstanding students were among those honored at the department's annual Honors and Awards Ceremony in April – [go.osu.edu/uiawards](https://go.osu.edu/uiawards)
- Kayla Watson was named a national Brooke Owens Fellow – [go.osu.edu/uiwatson](https://go.osu.edu/uiwatson)
- Four department students were honored at the annual Denman Research Forum – [go.osu.edu/uidenman](https://go.osu.edu/uidenman)

### STUDENT PROJECT TEAMS

- Baja Buckeyes achieved 44th place out of 95 at Baja SAE Kansas
- Buckeye Space Launch Initiative landed first place at the Spaceport America Cup – [go.osu.edu/uibsl](https://go.osu.edu/uibsl)
- Design/Build/Fly (DBF) flew to 28th place at the American Institute of Aeronautics and Astronautics (AIAA) competition – [go.osu.edu/uidbf](https://go.osu.edu/uidbf)
- Ohio State EcoCAR 3 won the national EcoCAR 3 competition – [page 4](#)
- Formula Buckeyes SAE earned 36th place at Formula SAE Michigan
- Underwater Robotics was awarded the Judge's Award for Best Presenter at RoboSub 2018



# STANDOUT ALUMNUS | MIKE SNYDER

## Building a future in space

For Mike Snyder, the sky's never been the limit. It's more like a destination.

Snyder is co-founder, chief engineer and managing director of Made in Space, a California-based company that lives up to its name.

**"Our primary goal is to live and work in space eventually," said Snyder, who earned his bachelor's and master's degrees in aeronautical and astronautical engineering from Ohio State in 2009 and 2011, respectively. "We want to colonize space."**

It's a big goal, for sure, but Snyder talks about it in definitive terms. To him, people living and working in space is just a matter of time. And Made in Space is helping to lay the groundwork.

While still a student at Ohio State, Snyder met the company's three other founders through a Silicon Valley technology accelerator and they formed Made in Space in 2010. Their first mission was to develop a 3D printer that could work in space. They perfected their invention by experimenting with it on multiple parabolic flights, in which an airplane flies nearly straight up and noses down over and over to create periods of weightlessness.

In 2012, NASA awarded Made in Space a grant to place the 3D printer on the International Space Station. Now, Snyder's team uses it to make everything from parts for NASA to an artist's 3D representation of the sound of laughter. They also print tools for the space station, projects from college



*Mike Snyder is a 2018 recipient of the William Oxley Thompson Award from The Ohio State University Alumni Association.*

design students and experimental items for commercial customers.

The next masterpiece for Made in Space is Archinaut, a satellite-3D printer-robot creation designed to build big structures in space. NASA gave the company \$20 million to develop the system capable of not only printing out panels, beams and other parts, but putting them together to make things that serve a function in space.

He says Archinaut could be constructing projects in space within three years. Beyond that, Snyder predicts, the possibilities are limitless.

**READ MORE:** [go.osu.edu/uisnyder](http://go.osu.edu/uisnyder)

*by Bob Beasley for Ohio State Alumni Association*



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COLLEGE OF ENGINEERING

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2019

# UNDERGRADUATE INNOVATION

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*Student instructors in the Machine Shop are key to integrating functional projects and experiences in the undergraduate curriculum*

