SCHOOL OF
MECHANICAL AND AEROSPACE ENGINEERING
College of Engineering, Architecture and Technology

BUILT TO SOAR

DRIVEN TO LEAD

2026 NEWSLETTER | OKLAHOMA STATE UNIVERSITY

DEAR FRIENDS OF MAE,

x x x

This past February marked my one-year anniversary as MAE head, and I consider it a true privilege and honor to lead this school alongside such remarkable faculty and staff. When I stepped into this role in February 2025, I could not have asked for a better introduction to the MAE family, and this newsletter captures exactly why I am so excited about what lies ahead. The pages of this issue tell a story of students and faculty pushing boundaries, earning national recognition, and doing work that matters well beyond our campus.

Our students are at the heart of it all. One team is heading to NASA's Johnson Space Center to test a one-handed tool dock designed for astronaut spacewalks. Three graduate students earned prestigious national awards in materials science and aerospace engineering. Another team took first place at the Riata Business Plan Competition for an innovative 3D-printing startup. Through Speedfest, our internationally recognized aircraft design competition, students are designing, building and flying high-speed racers judged by industry professionals. Our propulsion program has grown to the point where capstone students are designing and testing turbojet engines from scratch, with five papers accepted to ASME Turbo Expo in a single year. The breadth of talent in this program never ceases to impress me.

Our faculty are equally remarkable. One of our own was named an ASME Fellow, joining fewer than 4,000 engineers worldwide to have earned that distinction. Others are advancing spacecraft reentry prediction with NASA Ames, installing Oklahoma's first university high-velocity cold spray system and leading a NASA-funded multiscale modeling project for next-generation aerospace materials. Faculty are also making strides in battery modeling, data center cooling, electric aerial vehicles, radiation-resistant ceramics, 3D neural probes and weather-sensing UAS research, reflecting the caliber of work happening right here in Stillwater and Tulsa.

We are also excited about our new aerospace engineering undergraduate program and the continued expansion of our unmanned flight research laboratory at OSU-Tulsa. That momentum is reflected in our enrollment: as of Fall 2025, MAE became the largest academic unit on the OSU campus, surpassing 1,500 students. The national tailwinds behind aerospace, from the Artemis program to the expanding role of UAS, are inspiring a new generation of engineers, and we are proud to be where so many of them are choosing to build their futures.

None of this happens without the generosity of our alumni and donors. Your support, shown through gifts like the Bullet Racing donation and your presence at events like Fall Frenzy, is woven into every achievement on these pages and a powerful reminder that the MAE family's impact echoes across generations.

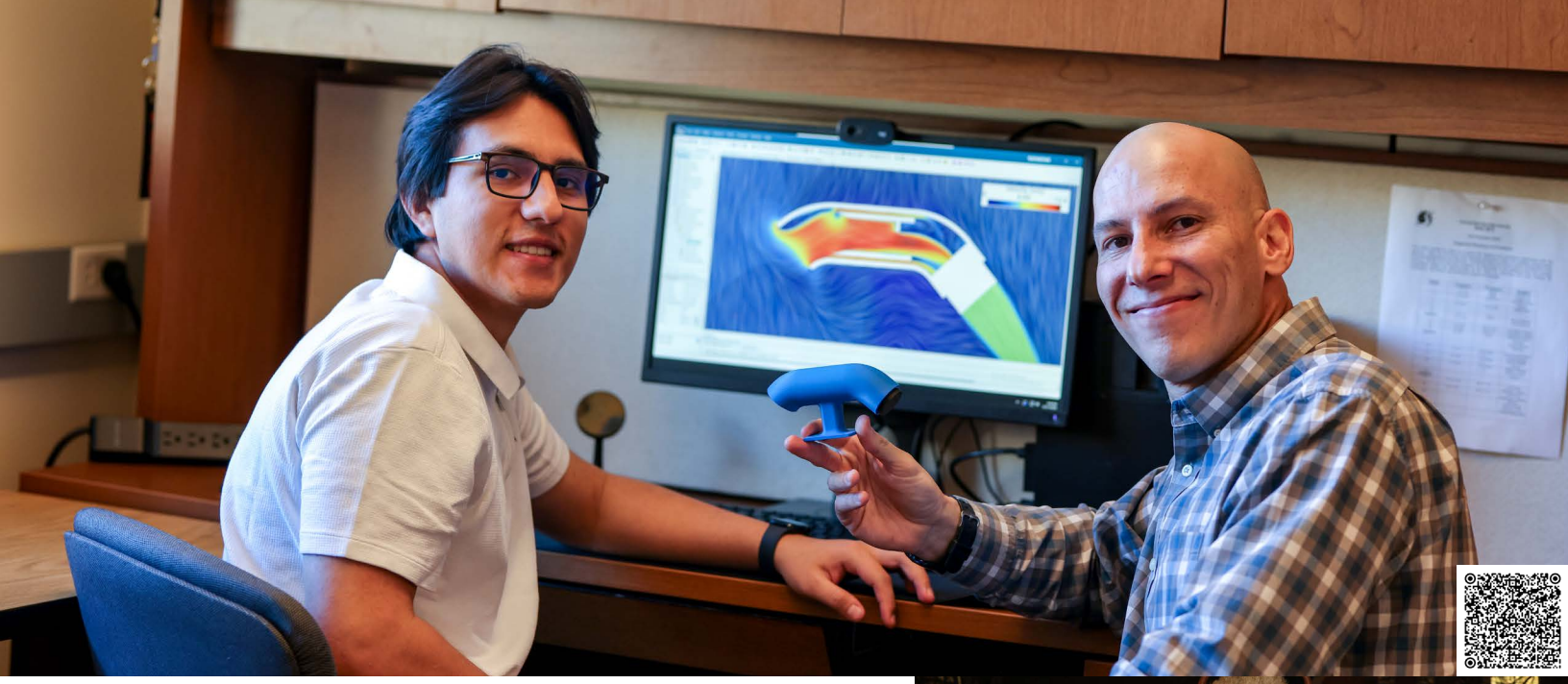
Thank you for reading, for your continued support, and for being part of the MAE story.

WITH

COWBOY PRIDE,

RASIM GULDIKEN

Ph.D. John Brammer Endowed Professor and Head



OSU GRADUATE STUDENT EARNS NATIONAL RECOGNITION AT AMS CONFERENCE

Eduardo Michel, a master's student in mechanical and aerospace engineering at, earned third place in the Aviation, Range and Aerospace Meteorology Conference student competition at the 2026 Annual Meeting of the American Meteorological Society.

Michel presented research titled "Weather-Sensing UAS Design Choices and Measurement Quality: Initial Insights from Two Large-Scale Intercomparison Studies." The work examines how design choices in weather-sensing unmanned aircraft systems influence the accuracy of atmospheric measurements. By combining data from major field campaigns with computational fluid dynamics simulations, the research explores ways to improve the reliability and standardization of observations collected by weather-sensing UAS platforms.

The study was co-authored with Dr. Gustavo B. H. de Azevedo and Dr. Jamey D. Jacob. Judges commended Michel's presentation for its clear organization, strong visuals and thoughtful discussion of future research directions.

The recognition marks a milestone for Eduardo and the Aircraft and Atmospheric Interactions Research Laboratory, where he became the first student from the group to earn national recognition for conference research presentations. His work reflects both individual achievement and collaborative mentorship within the lab.

Through guidance from faculty mentors, particularly Azevedo, Eduardo has focused on developing the ability to clearly connect complex ideas and communicate technical research effectively. That emphasis on communication has been central to presenting sophisticated aerospace and atmospheric research in ways that resonate with both researchers and practitioners.

Eduardo's interest in engineering began early through a curiosity about building and experimentation, supported by encouragement from a physics teacher. Although he initially considered pursuing medicine, that early interest eventually led him toward engineering and research.

At the College of Engineering, Architecture and Technology, Eduardo credits the MAE department's supportive environment with strengthening his research skills, critical thinking and ability to communicate complex ideas. His success reflects the collaborative culture within the department, where faculty mentorship and research opportunities work together to prepare students for advanced scholarly work and professional impact.

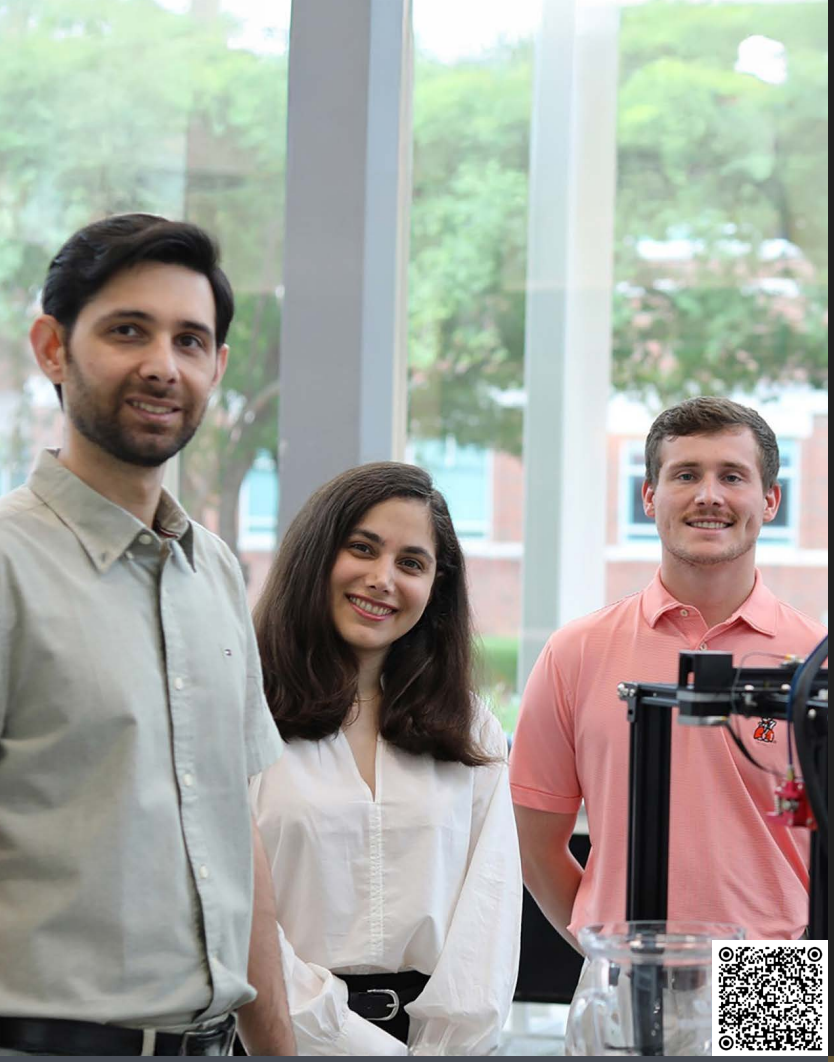
OSU STUDENTS DESIGN TOOL TO SUPPORT FUTURE NASA SPACEWALKS

A student team is helping shape the futureof space exploration.

Selected by NASA for the 2026 Microgravity Neutral Buoyancy Experiment Design Teams Challenge, OSU students designed a device that could make astronaut spacewalks safer and more efficient. Their project, H.O.R.I.Z.O.N., is a fully mechanical tool dock that allows astronauts to stow and retrieve tools with one hand, a major advantage in the demanding conditions of microgravity.

Guided by Dr. Alyssa Avery, MAE teaching assistant professor, the interdisciplinary team developed the device through rapid prototyping, engineering analysis and hands-on testing. Early prototypes have already demonstrated the ability to securely hold tools while meeting strict safety requirements.

Next, the team will travel to NASA Johnson Space Center to test their design in the Neutral Buoyancy Laboratory, where astronauts train underwater for space missions. Their work could influence equipment used in future missions supporting the Artemis Program.



MAE STUDENT WINS MAJOR BUSINESS PLAN COMPETITION, ADVANCES TO INTERNATIONAL ENTREPRENEURSHIP STAGE

An interdisciplinary student research team of Soroosh Farsiani, Mahla Hosseini and William Petty won first place in the 2026 Riata Center for Innovation and Entrepreneurship's Business Plan for their startup, SCIVINCE, an innovative 3D-printing technology.

This achievement follows a first-place finish and $4,000 in the Big City and High-Tech business track at the Riata Business Competition in January 2025, as well as first place and $21,000 in the High Growth Division at the Oklahoma Entrepreneur's Cup in April 2025.

Conventional printers need support structures and struggle to print complex geometries. SCIVINCE uses multi-axis, counter-gravity printing that prints materials in multiple directions, eliminating the need for support structures and reducing material use and production time.

This project began as an idea under Dr. Hadi Noori, who worked with undergraduate and graduate students to develop the prototype.

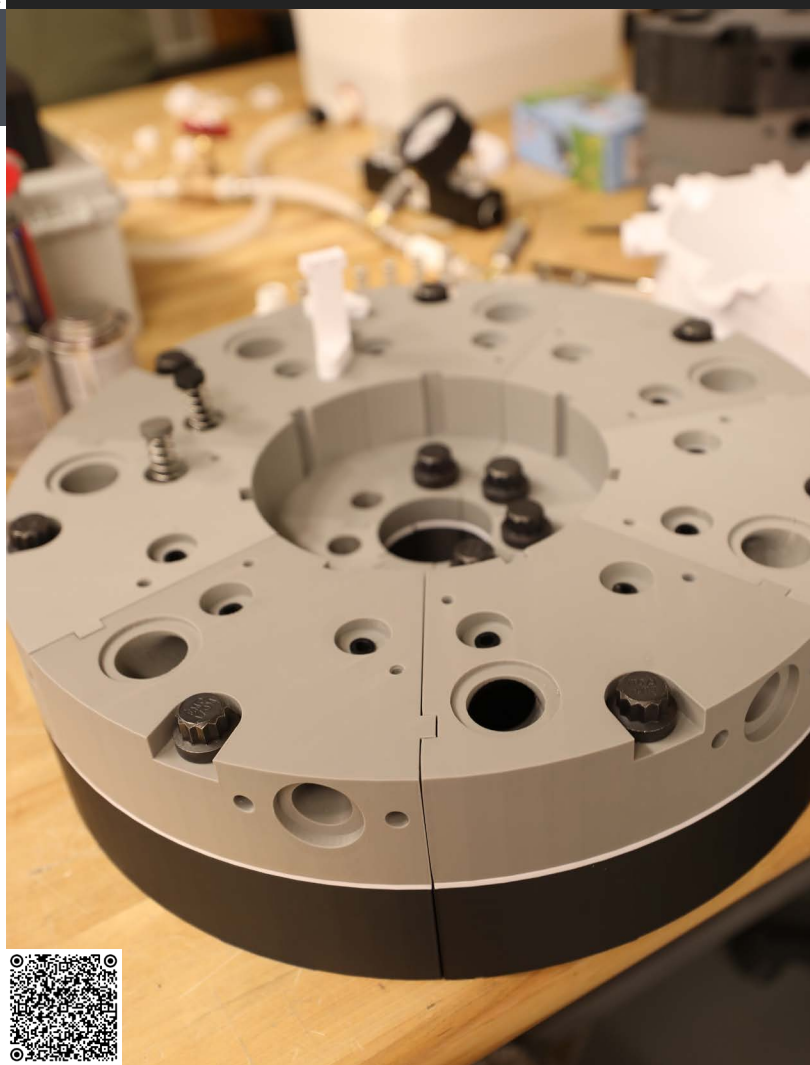
STUDENTS ACHIEVE SUCCESSFUL CREATION OF PROTOTYPE CVD ENGINE

Taking advantage of the opportunity to produce a product based on design parameters provided by a company in the industry, students worked alongside AmeriBand, LLC, to develop a prototype engine.

The AspireCVD design uses a continuously variable displacement design that changes piston stroke length, adjusting the engine's power output based on a driver's command. The team developed an innovative wobble plate that alters piston displacement by changing its angle, allowing the engine to optimize fuel use.

Mechanical engineering technology students Jack Chartier, Ian Greshley, Jayden Wall and Dax Yosten, along with mechanical engineering students Austin Landrum and Jacob Schindall, worked on the project during the 2024-25 term.

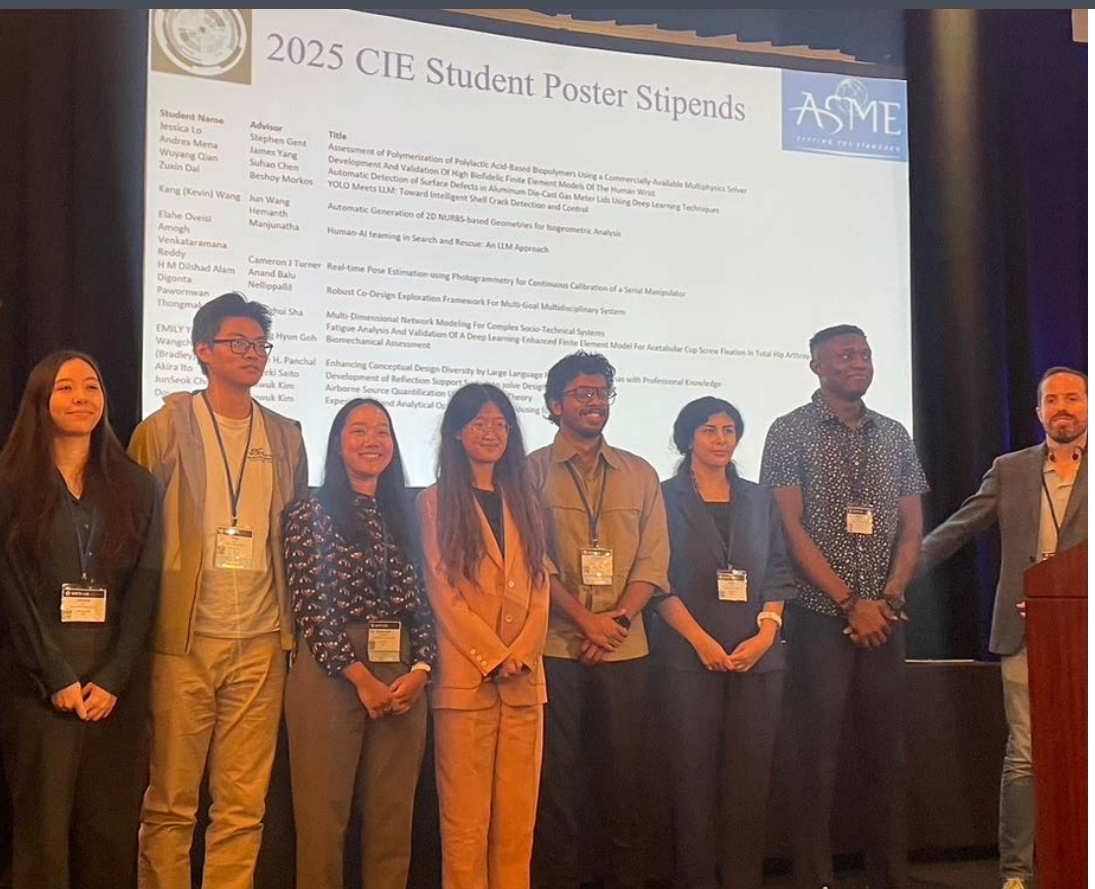
The student-designed prototype engine validated the research concept beyond computer simulations, providing the students with valuable experience collaborating with an industry client and solving complex engineering challenges.



IHUMAN LAB RECEIVES NVIDIA AND NEURABLE RESEARCH GRANTS

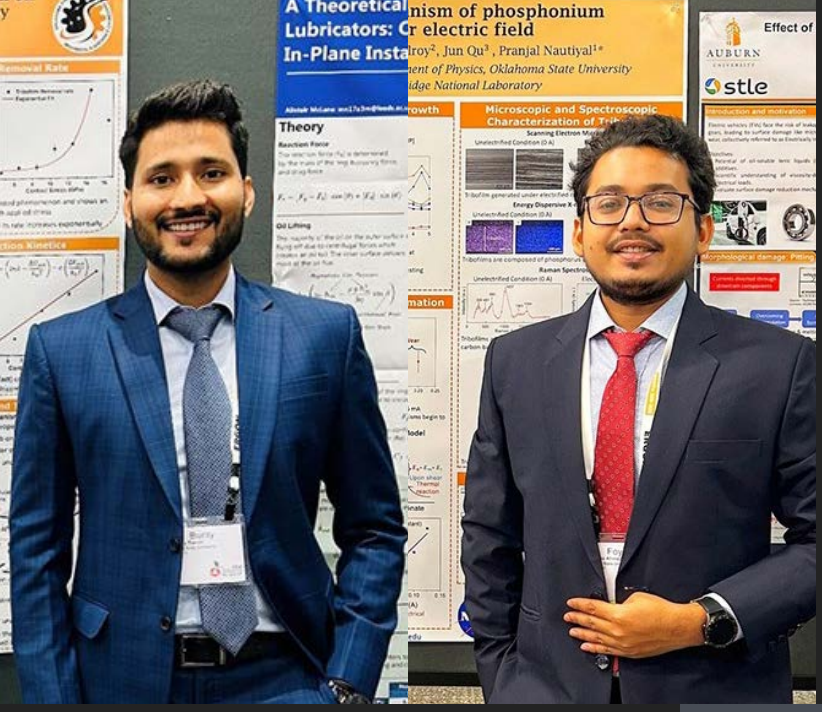
The iHuman Lab at Oklahoma State University continues to advance research at the forefront of AI, robotics and human-centered systems. Recently, the lab was selected for the highly competitive NVIDIA Academic GPU Grant Program (acceptance rate ~20%), receiving four RTX PRO 6000 Blackwell Max-Q GPUs. This award enhances the lab's computational capabilities, supporting research in Neuroadaptive Robust Teleoperation with Formal Guarantees and enabling graduate students to tackle complex challenges in intelligent robotic systems.

In addition, the lab received the Neurable Research Grant, granting access to a professional-grade 12-channel EEG system with 24-bit precision and 500 Hz sampling. The award includes perpetual research licenses, IRB support and membership in a global network advancing brain-computer interface technologies. This support strengthens the lab's work in cognition, AI-driven neural modeling and neuroadaptive systems, expanding its impact in neuroscience and human-centered AI research.



GRADUATE STUDENT RECOGNIZED AT ASME IDETC

Graduate students in the iHuman Lab continue to achieve national recognition. Elahe Oveisi, a Ph.D. student, earned a Graduate Poster Travel Award at the American Society of Mechanical Engineers International Design Engineering Technical Conferences, where she presented her paper, "Human Factor Analysis of Helicopter Accidents using Large Language Models." Her research exemplifies the integration of AI with human factors analysis in safety-critical aerospace systems.



STUDENT AWARDS & RECOGNITIONS

Members of the Nautiyal research group earned several notable distinctions this year:

Foyez Ahmad received the South-Central Sun Grant's 2025 Summer Graduate Research Fellowship to support research on sustainable biobased lubricants for electric vehicles.

At the Society of Tribologists and Lubrication Engineers Annual Meeting, Tomar won the Platinum (1st place) poster award for his work on mechanocatalytic alloys, while Ahmad earned the Silver (3rd place) award for his poster on ionic liquid lubricants under electric fields.

BUNTY TOMAR RECEIVES THE SAPPHIRE AWARD FOR RESEARCH SUCCESS

Bunty Tomar showcased the research prowess of graduate research assistants through his expertise in advanced materials, earning the Graduate Excellence in Materials Science Sapphire Award from the American Ceramic Society.

His expertise lies in materials to withstand extreme environments such as intense heat, heavy mechanical loading and severe wear. He also studies energy-efficient and low-temperature manufacturing processes, which was published in the prestigious Nano Letters Journal.

Tomar gave an award-winning presentation on novel approaches to generate protective coatings using only ambient air by activating the catalytic properties of multicomponent alloys. This generates wear-resistant carbon coatings directly from ambient air.

He credits the supportive academic environment he is in for allowing him to thrive. Dr. Ritesh Sachan and Dr. Pranjal Nautiyal have been inspirational mentors in a collaborative culture within the laboratory.

TURBOJET RESEARCH LEADS TO STUDENTS DESIGNING ENGINES FOR CAPSTONE PROJECTS

Turbo engine design expertise has greatly expanded for students to the point that they can now design, fabricate and test a turbojet engine as their Senior Design capstone project.

Collaborations with aircraft manufacturers W9er Engineering and Astrium have provided students with the chance to study company-specific aircraft requirements such as air pressure, mass flow rate and rotational speed for engine compressors.

They have also worked on developing an airframe, modifying a turboprop gearbox, creating custom parts and testing the engine to measure performance data.

Working with companies to meet specific standards provides students with real-world experience in meeting complex engineering tasks.

This represents a broad push to involve more undergraduate students in turbine research alongside graduate research assistants who tackle more complex systems. The earlier students get involved with this type of research, the more skills and experience they have when they graduate.

STUDENT SUCCESS IS REPRESENTED IN NUMEROUS PAPERS ACCEPTED BY ASME

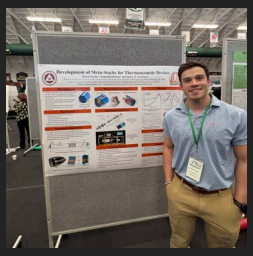
Five student papers were accepted to be presented during the 2025 American Society of Mechanical Engineers Turbo Expo, with one published in the AMSE journal during the conference.

The topics ranged from propellers, ducted fan inlet distortion and turboelectric power for unmanned aircraft. Two of the papers originated shortly after Dr. Kurt Rouser arrived at OSU in 2016.

Rouser stuck with those ideas and, as the program's efficiency expanded, discovered answers to those questions as student research capabilities evolved over the years.

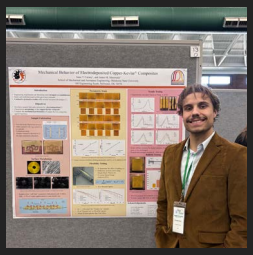
This was the largest number of papers produced by OSU students accepted by AMSE, showcasing the university's continued growth in propulsion research. The growth has also led to more students gaining early experience in their college careers, especially through opportunities to be mentored by upperclassmen.

> I ALSO SEE THE SHEER NUMBER OF STUDENTS WHO ARE PUBLISHING PAPERS AND THEN LEAVING HERE WITH A WORKING KNOWLEDGE OF THE INDUSTRY THEY ARE GOING INTO.
>
> -DR. KURT ROUSER



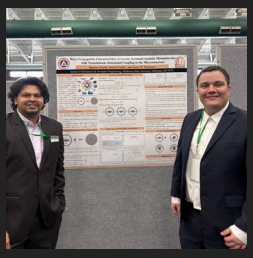
MASON SNYDER (B.S.)

DEVELOPMENT OF META-STACKS FOR THERMOACOUSTIC DEVICES



ISAAC CARNEY (M.S.)

MECHANICAL BEHAVIOR OF ELECTRODEPOSITED COPPER-KEVLAR® COMPOSITES



DIGONTA CHANDA (M.S.)

DANIEL CUELLAR (B.S.)

WAVE PROPAGATION CHARACTERISTICS OF LOCALLY RESONANT ACOUSTIC METAMATERIALS WITH TRANSLATIONAL-ROTATIONAL COUPLING IN THE MICROSTRUCTURE

OSU-TULSA LAUNCHES AEROSPACE ENGINEERING PROGRAM

The MAE programs at OSU-Tulsa are entering an exciting new phase of growth with the launch of a Bachelor of Science in Aerospace Engineering.

After 25 years of successfully offering the Bachelor of Science in Mechanical Engineering and serving the Tulsa region's workforce needs, this new program marks a significant milestone for engineering education in Northeastern Oklahoma. The Aerospace Engineering program is supported by the addition of new faculty, Dr. Kevin Li and Dr. Anthony Comer, whose aerospace expertise strengthens both teaching and research in areas critical to the industry's future.

MAE STUDENTS AT OSU-TULSA EARN TOP HONORS

MAE students at OSU-Tulsa continue to demonstrate outstanding leadership, service and technical engagement.

For the second-consecutive year, the ASME student section received the OSU-Tulsa Student Organization of the Year Award, along with the nationally recognized American Society of Mechanical Engineers Student Section Achievement Award, highlighting the chapter's strong alignment with ASME's mission.

In 2025, the group was also honored with the OSU-Tulsa Program/Event of the Year Award for its leadership and volunteer support of the Tulsa Engineering Challenge, where MAE students mentored local K-12 participants through hands-on engineering activities designed to promote STEM awareness and inspire future engineers.

> WE BRING THE KNOWLEDGE AND SKILL SET TO MODEL, BUILD AND TEST COMPLEX VEHICLES, AND WE SEE THESE AS PLATFORMS THAT OTHER RESEARCHERS AND BUSINESSES CAN USE TO SOLVE THEIR PROBLEMS.
>
> -DR. ANTHONY COMER

WHERE IDEAS LIFT OFF

At the OSU-Tulsa campus, the Simulation to Flight Applied Research (S2FAR) Laboratory is turning aerospace ideas into flying reality. Located in the Helmerich Research Center, the lab focuses on taking aerial vehicle concepts from simulation to flight, giving students and researchers the chance to design, build and test unmanned aircraft that tackle real-world challenges.

Led by Dr. Anthony Comer, MAE assistant professor, the team uses small-scale unmanned aerial vehicles as powerful research tools to study advanced flight control systems, digital twin modeling and next-generation vertical takeoff and landing aircraft. Their work spans applications from agricultural drones to life-saving rescue aircraft concepts.

Through hands-on prototyping and flight testing near Tulsa's Skyway36 Drone Port, students gain rare experience moving ideas from computer models to real flight. The lab's collaborative research is helping position OSU as a growing hub for unmanned aerial systems innovation.

WARP SPEED

We're excited to announce the launch of our new Formula SAE student organization, WARP SPEED, at the Tulsa Campus, joining the global community of teams competing in the FSAE collegiate design series.

This is led by MAE students at OSU-Tulsa, who are instrumental in forming the team, and is supported by Dr. Raman Singh, Dr. Srinivas Swaroop Kolla and Dr. Anthony Comer. This hands-on program allows student teams to design, build and race a small formula-style car while gaining real-world experience in mechanical and electrical design, manufacturing, project management, sponsorship outreach and teamwork. The team will compete in the upcoming Formula SAE competitions, showcasing our innovation and engineering excellence. We invite students from all disciplines to get involved and help us build a competitive car and a strong foundation for years to come.

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I’VE HAD MORE INTEREST FROM AEROSPACE COMPANIES AS I REACHED OUT FOR THE CLUB. I’M ALSO ABLE TO HELP TEACH MY PEERS A LOT OF WHAT I HAVE GOTTEN TO LEARN MYSELF.

-BRUCE LAMOREAUX

PETE’S PROPULSION POSSE PUSHES PROPULSION TO GREATER HEIGHTS

Jet propulsion research has steadily progressed since Dr. Kurt Rouser joined OSU in 2016. It has grown to the point that a new student organization, Pistol Pete’s Propulsion Posse, was created in 2025.

Expanding to include other majors, including non-engineering, P4 members work in teams to design jet engine systems for the Aerospace Propulsion Outreach Program competition, sponsored by the U.S. Air Force.

Underclass students can join the organization, learning from older students who serve as mentors. This allows freshmen and sophomores to gain hands-on experience in design reviews, manufacturing and engine testing, giving them more experience than was possible before P4.

The progress that propulsion research has made under Rouser has led to students being able to fully design, manufacture and test a micro-turbojet engine from scratch.

This program provides students with practical propulsion experience and strengthens OSU’s ties to industry and the military.

PRASAD’S LAB PROVIDES STUDENTS WITH AIRCRAFT VELOCITY SIMULATION EXPERIENCE

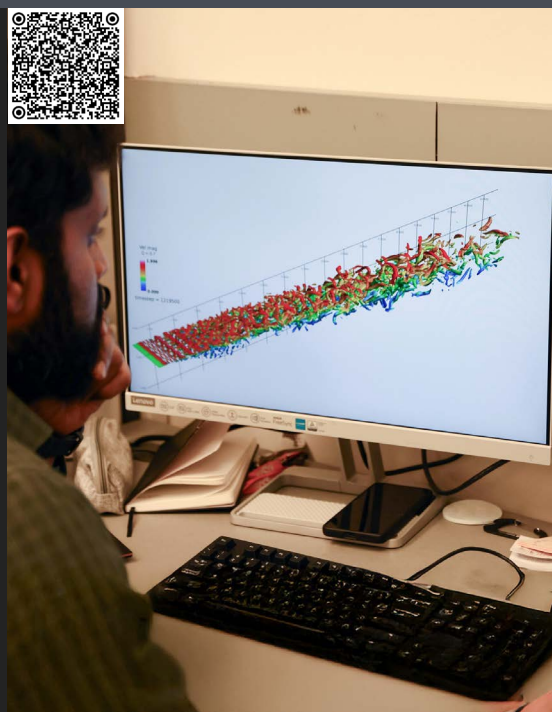
The Flow Physics Simulation Laboratory, overseen by Dr. Chitrarth Prasad, provides students with experience simulating aircraft component velocities using high-fidelity computer simulations.

They learn to analyze how air moves around wings, jets and other components. This research produces three-dimensional simulations that generate large datasets, revealing details beyond those of traditional experiments.

This work involves collaboration with NASA and the U.S. Department of War, such as heat transfer in supersonic and hypersonic flights, reducing jet noise and drag reduction on wings.

One research endeavor in 2025 examined acoustic waves created when jets such as the F-35B Lightning with vertical landing and takeoff capabilities lift off the ground.

Through coursework and research, students apply fundamental concepts to tackle modern aerospace challenges, equipping them to solve complex aerodynamic problems in aviation, defense and emerging technologies.



BUILDING COMMUNITY IN MAE: GRADUATE ACTIVITIES COMMITTEE TAKES OFF

This spring, the MAE Graduate Activities Committee began building something many graduate students quietly crave: a stronger sense of community.

Helping lead this effort are Samantha Bratcher and Foyez Ahmed, whose energy and commitment have turned a simple idea into meaningful opportunities for connection. With support from MAE faculty, the committee is organizing gatherings every second or third Friday to give graduate students time to step away from their research and deadlines to meet one another as colleagues and collaborators.

The first event was an MAE Graduate Student Luncheon. The informal setting made it easy for students from different research groups to introduce themselves, share experiences and discover common ground beyond their labs.

The second gathering introduced a new format focused on research exchange. Students sat at round tables and paired off for quick three-minute conversations to explain their work. The fast pace encouraged clear communication while sparking curiosity and potential collaborations across disciplines.

What makes these events special is their simplicity: they create space for conversation, connection and shared purpose. By establishing a regular rhythm of gatherings, Samantha and Foyez are helping build relationships that will strengthen the MAE community now and support professional networks long after graduation.

GRADUATE PROGRAM INITIATIVES

Master's 'Along the Way' Launched Fall 2025

Introduced in fall 2025, students enrolled in the Direct-to-Ph.D. doctoral program (75 hours after a bachelor's) have the opportunity to receive a coursework-only master's (M. Eng) while continuing to work on their Ph.D.

Students can apply to the initiative when they have completed enough coursework. The program has already graduated its first M. Eng, providing an immediate benefit to doctoral students.

Accelerated Master's Programs Launched Spring 2026

Starting spring 2026, undergraduate students in their junior year have the option to opt into an accelerated master's program in Mechanical & Aerospace Engineering.

Students have the option to pursue a master of science or a master of engineering. The accelerated programs will provide undergraduate students with a jump-start on their graduate careers, allowing up to nine hours of graduate coursework to be applied toward both their undergraduate and graduate degree requirements.

TINY HOUSE OFF GRID AT CEAT SENIOR **DESIGN EXPO**

The Center for Integrated Building Systems -affiliated, Senior Design team's Off The Grid-Tiny House showcased remarkable progress at the 2025 OSU CEAT Senior Design Expo on April 25th, 2025. Their progress included designing and fabricating an efficient DC fan coil system, building an insulated enclosure for two 175-gallon above-ground thermal energy storage tanks and integrating this system with a 300-gallon below-ground tank to aid with thermal regulation.

Team members include Brian Douglas, Adam Mason, Reece Fuller, Conor Winn, Garon Kourt, Thomas Nye and DJ McArthur. CIBS support included M.S. student, Gabriel Parker and Ph.D. student, Pouria Moghimi, as well as advisor Dr. Jeffrey Spitler, for their hard work and creativity in bringing this vision to life. The team also appreciates the generous donations from Midea Group and A. O. Smith Corporation, along with support from CEAT and the OG&E Energy Technology Chair.

SUMMER BRIDGE COURSE

The Summer Bridge course featured presentations by Pouria Moghimi, Hamid Ikram and Zayed Mostafa, with Dr. Christian Bach as the advisor. The session included a refrigeration setup, single fin heat transfer, a CIBS lab tour and thermocouple calibration. Moghimi discussed his research on residential-scale water-based thermal energy storage, while Ikram presented his M.S. project on chiller retrofitting and solar power integration. CIBS students provided introductory insights into mechanical engineering, research procedures and the principles of thermal and fluid science in HVAC systems. The program concluded with a personal introduction from Bach, highlighting his role at OSU.

CIBS

75TH ANNIVERSARY

American Society of Heating, Refrigerating and Air-Conditioning Engineers OSU Student Branch celebrated it's 75th anniversary of its charter on January 23rd, 1950. It was chartered as "Oklahoma A. and M. College Student Branch of Oklahoma Chapter of The American Society of Heating Ventilation Engineers." ASHRAE is an international organization dedicated to advancing human well-being through sustainable technology for the built environment. All CIBS students are members of the OSU Student Branch.

SOPHIE HAWKINS RECEIVED AN **ASHRAE SOCIETY SCHOLARSHIP**

Sophie Hawkins received an ASHRAE Society Scholarship for the 2025-2026 award year. She is majoring in mechanical engineering and was awarded the $7,000 Charles E. Henck Scholarship. This scholarship highlights her exceptional academic achievements and extracurricular involvement. It also recognizes her dedication to HVAC&R and reflects her hard work and commitment to ASHRAE.

CIBS 2025 SPRING STRATEGY & FALL **PROJECT PROPOSAL UPDATE MEETING**

The Industry Advisory Board met at Oklahoma State University for the Center for Integrated Building Systems spring and fall 2025 meetings, engaging with faculty and students to review project updates and upcoming initiatives. Students presented progress on 2025 projects, while faculty outlined proposals for 2026 and beyond. Each meeting included strategic discussions with CIBS leadership on planning efforts through 2029. These biannual gatherings are essential for aligning research with industry needs and strengthening collaboration between academia and industry partners.

CIBS WENT TO ASHRAE WINTER CONFERENCE IN **ORLANDO FLORIDA**

ASHRAE is an international society of more than 50,000 heating, refrigerating and air-conditioning professionals from over 132 nations dedicated to serving humanity and promoting a sustainable world.

Members from CIBS were there attending various technical sessions and committee meetings throughout the event, all having to do with the latest research in the HVAC world.

CENTRAL OKLAHOMA ASHRAE SCHOLARSHIP AWARDED TO **RASHEED SHITTU**

Rasheed Shittu, a Ph.D. student from the CIBS, achieved well-deserved recognition. He was selected for The Central Oklahoma ASHRAE Scholarship for the 2025-2026 academic year.

His research and leadership within the ASHRAE student chapter, along with his contributions to advanced building energy

CIBS GRADUATIONS IN 2025:

DIPA SAHA

WORKING FOR AAON AS R&D ENGINEER

JULFIKAR ALI

WORKING AT AAON

GABRIEL PARKER

WORKING FOR KCL ENGINEERING

TAJWAR HAQUE

FINISHED M.S., NOW PURSUING PH.D.

FACULTY

STUDENTS DEVELOP A METHOD TO PREDICT SPACECRAFT BEHAVIOR DURING REENTRY

Research led by Dr. Kursat Kara and Ph.D. students Shafi Al Salman Romeo and Ashraf Kasem aimed to improve the prediction of how spacecraft capsules perform during atmospheric entry. This research was conducted in collaboration with the NASA Ames Research Center as part of the NASA Early Stage Innovations program.

Their creation of a framework called Data-Fusion-based Nonlinear Parameter Identification combines experimental test data with advanced computer simulations. This helps better understand the dynamic stability of vehicles or determine when a capsule can naturally correct its motion during descent and keep its heat shield facing the airflow during atmospheric entry.

DF-NPI integrates traditional methods like wind tunnel testing, ballistic experiments and computer simulations using probabilistic modeling and Bayesian methods to create a more complete picture of capsule behavior on entries.

NASA RESEARCH ENDEAVORS SHOWCASE CEAT'S INTERDISCIPLINARY PROWESS

Dr. Andy Arena led three interdisciplinary projects in collaboration with NASA. Alongside Dr. Brian Elbing, Dr. John Hu and Dr. Ritesh Sachan, these projects showcased MAE success in collaboration with other schools in CEAT.

Elbing and Arena developed specialized windscreens for balloon sensors designed to detect infrasound signals in Venus' atmosphere. This allows for a greater opportunity to study seismic activity on the harsh Venusian surface.

Hu helped lead an exploration of cybersecurity mesh infrastructure in support of NASA's transition to a zero-trust security model that continuously verifies devices and users on complex data networks.

Sachan co-led efforts to develop high-temperature, multi-element silicide coatings, useful for protecting spacecraft in extreme environments.

These projects represent interdisciplinary collaboration, hands-on student involvement and represent OSU's growing role in support of NASA's technological innovation and future missions.

BUILDING THE FUTURE OF FLIGHT, ONE SCALE AT A TIME

Designing the next generation of aerospace materials requires seeing the big picture and the smallest details. With support from a three-year, $750,000 NASA grant, OSU researchers are advancing multiscale modeling techniques that could dramatically speed up how high-performance aerospace materials are designed, tested and certified.

The science PI is Assistant Professor Wei Zhao and Professor Andrew Arena, director of the Oklahoma Space Grant Consortium and Oklahoma NASA EPSCoR, is the administrator of this project. The co-investigators include Dr. Pankaj Sarin, associate professor for the School of Materials, Mechatronics and Manufacturing Engineering and Dr. Peter Attar, associate professor at OU.

The collaborative project tackles a longstanding challenge: predicting how materials behave across microscopic and structural scales under real-world conditions. By combining GPU-accelerated computing, reduced order modeling and experimental validation, the team is creating faster, more accurate tools capable of analyzing full-scale aerospace structures.

Aligned with NASA's Vision 2040, the work supports sustainable aviation, lighter airframes, improved propulsion systems and advanced composite manufacturing, while reducing reliance on costly physical testing. The project also immerses students in cutting-edge computational and materials research, helping position Oklahoma as a growing hub for aerospace innovation.

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EVERY TEST HELPS US MOVE CLOSER TO A FUTURE WHERE WEATHER UAS ARE AS TRUSTED AND ESSENTIAL AS THE BALLOONS WE’VE RELIED ON FOR THE LAST 100 YEARS.

-DR. ALYSSA AVERY

STUDYING THE SKIES CLOSEST TO EARTH

A new research laboratory at OSU is advancing the study of how weather and aircraft interact in the lowest layer of the atmosphere.

The Aircraft and Atmospheric Interactions Research Laboratory, known as A_2IRLab, brings together researchers and students to study weather-sensing unmanned aerial systems and the effects of low-altitude weather on emerging aircraft technologies. Led by Dr. Alyssa Avery and Dr. Gustavo B. H. de Azevedo, the lab focuses on the atmospheric boundary layer, the region extending from the surface to roughly 5,000 feet where most small aircraft and future advanced air mobility vehicles will operate.

Because traditional weather observation tools collect limited data in this region, the lab combines field experiments, laboratory testing and computer simulations to improve sensing technologies and atmospheric measurements.

Through interdisciplinary research and hands-on student training, A_2IRLab aims to strengthen aviation safety while expanding scientific understanding of the dynamic lower atmosphere.

TINY DRONES, BIG FORECASTS

Dr. Alyssa Avery and Dr. Gustavo B. H. de Azevedo, along with their students, are exploring whether miniature drones could transform how scientists observe the lower atmosphere.

The team is studying weather-sensing unmanned aerial systems small enough to fit in the palm of a hand. The devices, which weigh less than a pound, could eventually provide frequent atmospheric measurements that strengthen weather forecasting and improve public safety.

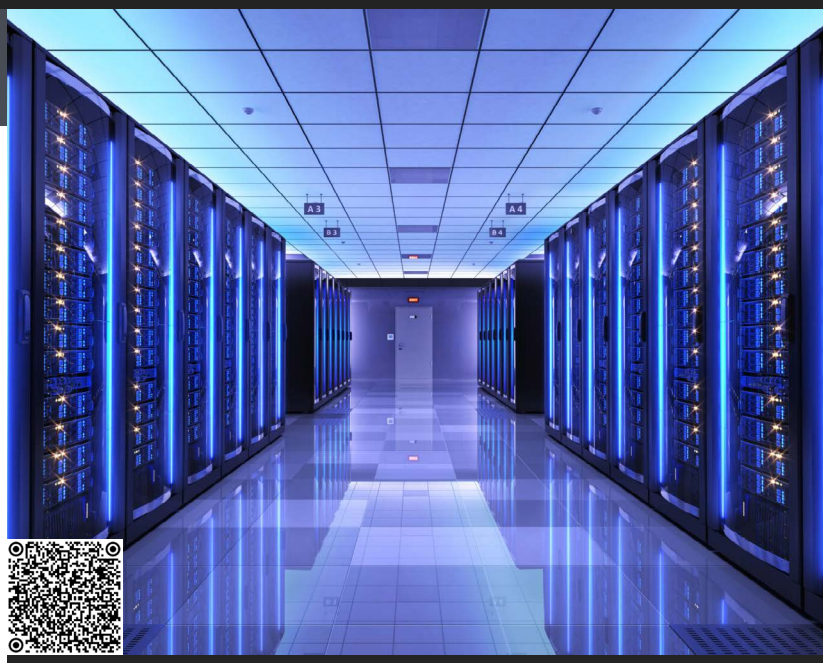
The research is supported by the National Oceanic and Atmospheric Administration and the National Weather Service. The team is collaborating with Virginia Tech and industry partner GreenSight to test the aircraft in controlled environments and real flight conditions.

BRAIN SCAN RESEARCH GOES TO THE NEXT DIMENSION

Dr. Shuodao Wang contributed to a collaborative study on innovative 3-D neural probes, published in Nature Electronics, in collaboration with seven universities and Boston Children's Hospital.

The research led to the development of neural probe arrays that can simultaneously measure brain signals at multiple depths and locations, providing greater detail for neural mapping.

The devices start as flat electronic structures that are rolled into cylindrical shapes, forming flexible probes that can reach deeper into the brain. This innovative design allows researchers to overcome limitations of traditional 2-D probes, which fail to capture neural activity across multiple layers of the brain.



DISCOVERING WAYS TO SEPARATE NITROGEN FROM NATURAL GAS

A multidisciplinary engineering project is underway under the oversight of Dr. Prem Bikkina of the School of Chemical Engineering and Dr. Kaan Kalkan of MAE to discover viable ways to extract nitrogen from natural gas.

Many natural gas wells produce fuel that contains extra nitrogen, lowering its value and making it difficult to process using existing techniques. Currently, systems are large, costly and typically only viable at major processing facilities.

The OSU team is exploring an approach based on "wettability-driven" bubble formulation. This takes advantage of the tendency of nitrogen bubbles to form more easily than methane at certain liquid-solid interfaces, allowing gases to separate while still in the vapor phase.

An affordable and scalable solution to nitrogen extraction could increase the marketability of stranded natural gas resources worldwide by maximizing the use of cleaner-burning fuel and reducing waste.

MORE EFFICIENT DATA CENTER COOLING

Dr. Ardeshir Moftakhari led an effort to make data centers safer, more efficient and more resilient through improved cooling techniques.

This addresses the growing challenges caused by rising digital demand and AI, which require data centers to operate continuously while generating significant heat. Cooling systems represent half of a data center's energy use, and failures can quickly trigger shutdowns that risk data loss, cause service disruptions and costly damage.

In collaboration with Penn State University and industry partners, this research developed intelligent fault-detection tools and advanced cooling controls that identify problems before they escalate.

The team created a digital twin to simulate failures, test responses and improve real-time system adaptation.

By combining simulations with physical testing, the team had a goal of designing cooling systems that remain stable during equipment failures, power disruptions or cyber security risks.

MULTIDISCIPLINARY EFFORT LEADS TO INNOVATIVE WEIGHTLIFTING SYSTEM

The Resistive Engagement and Alignment Reinforcer - Gluteal and Erector Activation Rig (REARGEAR 2.0) is the result of multiple avenues of expertise coming together to engineer a better weightlifting system.

Dr. Jerome Hausselle of MAE, Dr. Jason Miller of the School of Kinesiology, Applied Health and Recreation and Dr. Harshvardhan Singh of the Human Performance and Nutrition Research Institute worked with students: Iris Borunda, Ian Craft, Alec Murray, Bruce Smith and Ronnie Walker on a project that won first place at Senior Design in fall 2025.

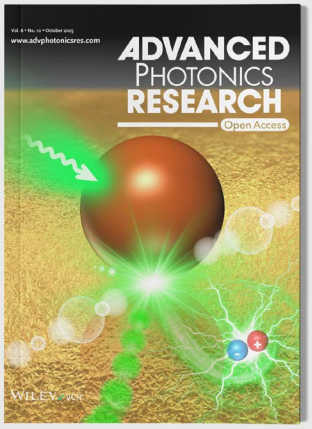
Traditional weightlifting uses the same load throughout a movement, even though muscles experience different forces during lifting and lowering phases. REARGEAR 2.0 addresses this by using a pneumatic, air-powered resistance system that allows different resistance levels during each phase of a repetition.

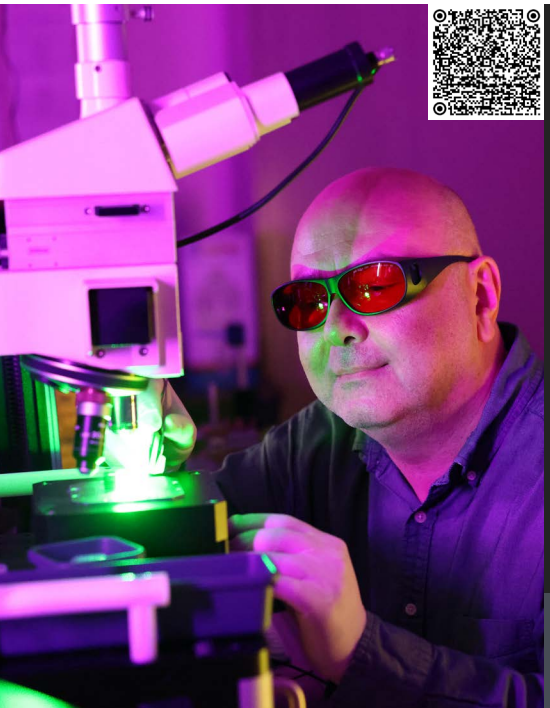
This enables greater resistance during the lowering phase and lighter resistance during the lifting phase, improving performance while reducing injury risk.

MAE RESEARCH FEATURED ON JOURNAL COVER

A recent publication from Dr. Kaan Kalkan and his research team was selected as the front cover article for Advanced Photonics Research, a high-impact scientific journal. The featured work highlights groundbreaking findings on a nanosphere (Cu_2O)-film (Au) hybrid resonator, which traps visible photons and transfers their energy to create electron-hole pairs in gold. This resonant enhancement enables detailed monitoring of interband transitions in gold for single Cu_2O particles. The team also observed reverse-process fluorescence from gold with exceptionally large Purcell factors in single particles.

The cover art for this publication may also be viewed on the journal's website: **www.advphotonicsres.com**





SEEING CARBON DIFFERENTLY

Carbon is the backbone of life and one of the most versatile building blocks in materials science. Dr. Kaan Kalkan is exploring that versatility by studying an emerging carbon allotrope derived from a petroleum-based precursor using a proprietary process. Though the material appears similar to graphite, advanced Raman spectroscopy reveals a very different story.

Kalkan's analysis shows graphene-like layers stacked with subtle rotational offsets, creating weaker bonding and larger spacing between layers - features that could unlock valuable electrical, mechanical and thermal properties. Using a nondestructive laser-based technique that has helped drive Nobel Prize-winning discoveries, Kalkan is revealing how small structural differences at the atomic level can lead to big changes in material performance.

Supported by an energy industry grant, this research highlights OSU's growing strength in nanostructured materials and fuels new possibilities for advanced carbon-based technologies.

BAIR STUDIES THE MATERIAL COMPOSITION OF BATTERIES

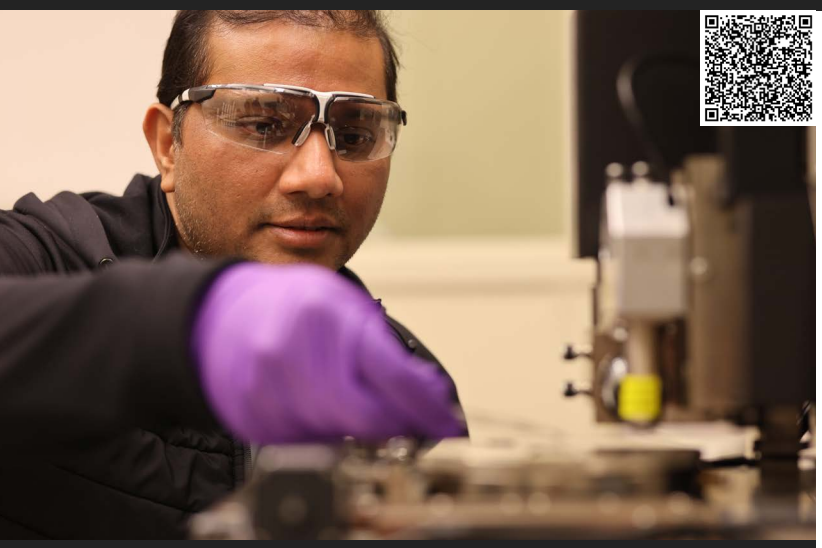
Dr. Jake Bair studied how a battery's material composition affects its lifespan, aiming to predict performance before a battery is even constructed.

Bair used phase-field exploratory modeling, a computing method that analyzes how battery materials change during charging and discharging cycles to examine the atomic-scale arrangement of materials such as lithium ions and nickel-based alloys.

Working with industry partner Ten-Nine Technologies, Bair created models of battery composition, enabling engineers to evaluate battery lifespan through its microstructure.

This project involved Bair's team developing modeling tools capable of handling several material phases. They then tested different particle sizes, orientations and configurations to determine which compositions could withstand temperature limits and chemical reactions to improve battery effectiveness.

Through this research, students gained experience in advanced battery design, computational modeling and material analysis.



RESEARCHING HOW TO CREATE SYNTHETIC METASTABLE MATERIALS

Dr. Ritesh Sachan's expertise in atomic-scale microscopy and materials composition led to a research project studying synthetically created metastable materials.

These are materials that exist in temporary states but can transform under extreme pressure, such as graphite forming into a diamond.

In collaboration with Kansas State University and the University of Nebraska, the team aimed to uncover the mechanisms that stabilize these non-natural phases.

The OSU cohort created thin films containing combinations of boron, carbon and nitrogen to simultaneously generate material phases using a high-throughput process.

Then, using aberration-corrected microscopy, the team analyzed the atomic structures to identify defects that alter the material's makeup.

The goal of this research was to bridge the gap between synthesis and performance, enabling the potential for purer diamonds and new materials for high-temperature, high-voltage and quantum applications.

SACHAN LEADS STUDY OF CERAMICS CAPABLE OF WITHSTANDING EXTREME RADIATION

The expertise of Dr. Ritesh Sachan in how radiation affects ceramics led investigations into advanced ceramic materials designed to withstand extreme radiation, a critical challenge for the next generation of nuclear systems and space technologies.

Sachan's team studied a newly discovered class of advanced ceramic materials to see if structural integrity and performance under intense radiation exposure differs.

Conventional materials can form defects when exposed to radiation, which weakens the materials over time. This limits the lifespan and safety of reactors, spacecraft and other high-radiation systems.

By studying irradiated ceramics at the atomic level, the team aimed to classify materials that could improve durability and resistance to radiation damage.

This leads to safer nuclear energy production and more resilient technology for operations in harsh environments.

CEAT INSTALLS OKLAHOMA'S FIRST UNIVERSITY HIGH-VELOCITY COLD SPRAY SYSTEM

CEAT researchers are advancing the future of manufacturing with the installation of a high-velocity cold spray system: the first at an Oklahoma university.

Funded by the NSF through its Major Research Instrumentation Program, the new equipment will support multidisciplinary research and workforce training in additive manufacturing within the college.

Led by MAE Professor Dr. Sandip Harimkar and an interdisciplinary team comprised of fellow MAE faculty, Drs. Pranjal Nautiyal, Aurelie Azoug and Chitrarth Prasad, as well as Industrial Engineering and Management Associate Professor, Dr. Chenang Liu, the system allows scientists to accelerate tiny powder particles at supersonic speeds, causing them to bond together and form durable structures without melting the material. The process enables faster production, fewer defects and greater energy efficiency than many traditional manufacturing methods.

Beyond research, the system will provide hands-on learning opportunities for students while strengthening collaborations with industry and regional partners such as Tinker Air Force Base. The technology positions OSU as a leader in next-generation manufacturing innovation.

WHICH EVTOL WORKS BEST?

With more than 1,100 electric vertical takeoff and landing aircraft designs currently under development, researchers are still determining which configurations perform best for different missions.

Dr. Atanu Halder, MAE assistant professor, is working to answer that question through a research project funded by the United States Army. The work aims to develop a computational framework to evaluate multiple eVTOL aircraft designs and identify the configurations best suited for specific operational needs.

By combining machine learning models with multidisciplinary optimization techniques, Halder's research will analyze aircraft performance and optimize critical design components. The work has implications for both civilian and military applications, including urban air mobility, emergency response and logistics.

The project will also strengthen student learning in CEAT by connecting classroom fundamentals with real-world aerospace design challenges while contributing to OSU's growing leadership in advanced aerial systems research.

MIKE XIANG NAMED **ASME FELLOW**

Dr. Yujiang "Mike" Xiang was named a Fellow of the American Society of Mechanical Engineers, one of the world's most prestigious engineering organizations.

Only about 4,000 engineers have received this distinction since the 1960s. This fellowship recognizes Xiang's contributions to mechanical engineering research and reflects the impact of faculty in advancing innovation and educating future engineers.

His expertise lies in digital human modeling, biomechanics of lifting and gait, muscle fatigue modeling and the design and optimization of exoskeleton systems. He focuses on understanding human movement and improving ergonomics and human-machine interactions to develop assistive technologies.

Xiang has long been active with ASME, organizing symposiums on human modeling and simulation for the organization's International Design Engineering Technical Conferences. He is currently the chair of the Advanced Modeling and Simulation session within ASME's Computers and Information in Engineering division.

NAUTIYAL **KEYNOTE**

Dr. Nautiyal delivered several invited presentations, including a keynote webinar for Surface Ventures and a talk at the joint meeting of the Central Oklahoma ASME Section. He was also elected Chair of the Nanotribology Technical Committee for the Society of Tribologists and Lubrication Engineers (STLE), where he will lead planning for the 2026 Nanotribology Symposium.

DR. HAOTIAN LIU'S **LEADERSHIP IN ASHRAE**

In 2025, Dr. Liu was selected as one of seven Track Chairs for the American Society of Heating, Refrigerating and Air-Conditioning Engineers Annual Conference, overseeing technical program development for the Research Summit Track. This role involved curating research-focused content for the June 21-25, 2025 conference.

Most recently, Dr. Liu led the review and revision of ASHRAE/American National Standards Institute Standard 41.3-2025: Standard Methods for Pressure Measurements as Subcommittee Chair of SSPC 41.3. The updated standard, released in November 2025, plays a key role in shaping industry measurement practices.

MAE FACULTY AND ALUMNI CONTRIBUTE TO NASA'S 50TH ANNIVERSARY SCIENTIFIC BALLOONING HANDBOOK

This past year marked the 50th anniversary of NASA's Scientific Ballooning Handbook, a foundational reference widely used in the scientific ballooning community. To commemorate the milestone, NASA released a newly updated 50th Anniversary Edition in December 2025. Faculty and alumni from OSU's MAE department made significant contributions to this landmark publication, authoring content in Chapter 15: Solar Balloons and Chapter 17: Instrumentation.

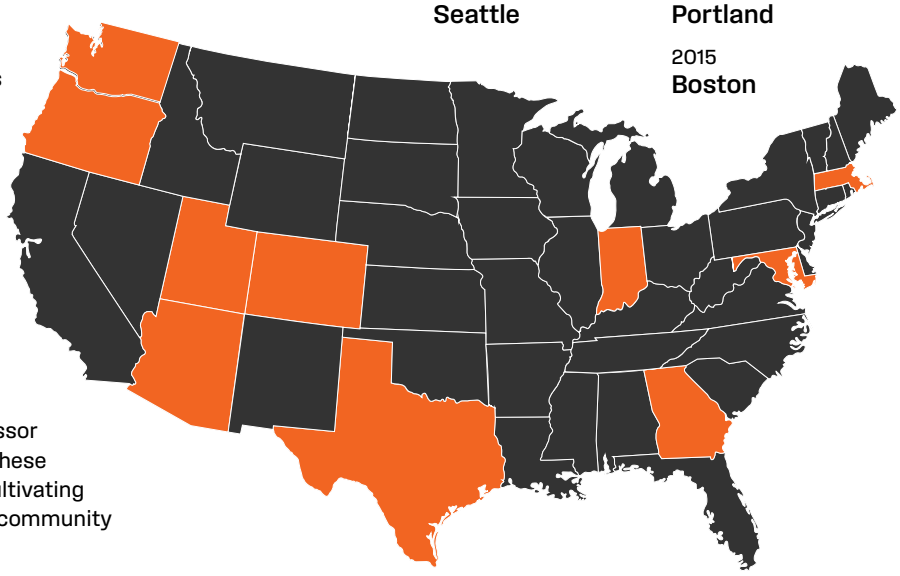
Co-authors include MAE graduates Zach Yap, Taylor Swaim and Emalee Hough, along with MAE faculty members Dr. Jamey Jacob and Dr. Brian Elbing. These chapters highlight the department's extensive work with high-altitude solar balloons over the past five years and reflect MAE's continued impact on advancing aerospace research and education at the national level.

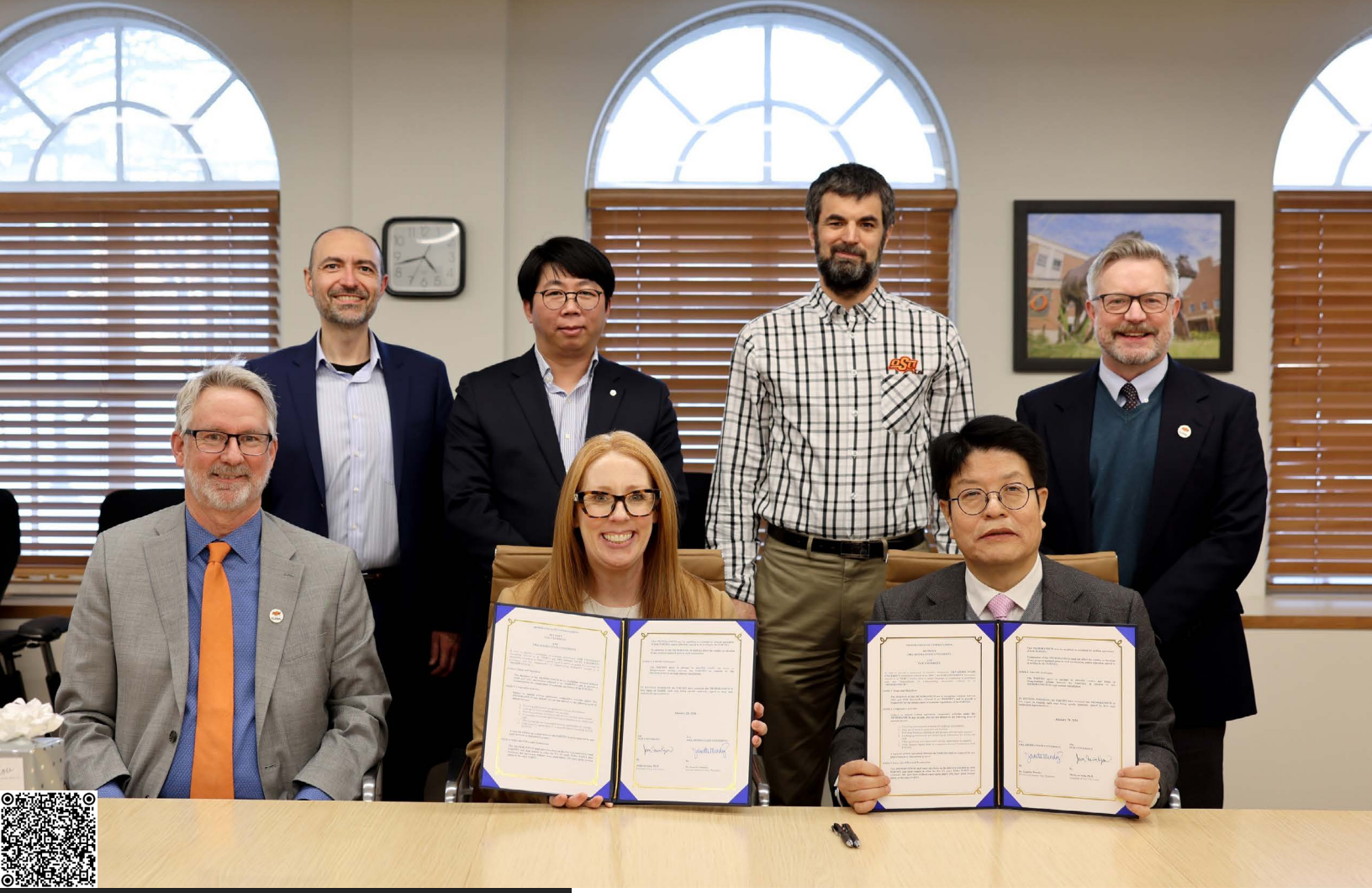
MAE'S LONGSTANDING PRESENCE AT THE APS DIVISION OF FLUID DYNAMICS ANNUAL MEETING

Over the past decade, OSU MAE has established a strong and sustained presence at the American Physical Society Division of Fluid Dynamics Annual Meeting, one of the premier international conferences in the field. For more than 11 consecutive years, MAE faculty and students have actively participated in the meeting, with group photos documenting the department's growing involvement and impact.

This continued engagement highlights not only MAE's commitment to research excellence, but also the lasting professional influence of its graduates. Many former MAE students now attend the conference as professionals representing other organizations, including at least one alumnus who has gone on to become a professor and remains a regular participant. Together, these milestones reflect the department's role in cultivating talent that contributes to the fluid dynamics community well beyond graduation.

2023 **Washington D.C.**
2022 **Indianapolis**
2021 **Phoenix**
2020 **Virtual**
2019 **Seattle**
2018 **Atlanta**
2017 **Denver**
2016 **Portland**
2015 **Boston**





“

I AM ESPECIALLY ENTHUSIASTIC ABOUT THE PRACTICAL, HANDS-ON LEARNING OPPORTUNITIES THAT EXTEND BEYOND THE CLASSROOM, ALLOWING OUR STUDENTS TO APPLY THEIR STRONG FUNDAMENTALS TO REAL-WORLD PROBLEMS WHILE COLLABORATING WITH PEERS GLOBALLY ON THE FORMULA SAE AND BAJA EV TEAMS.

-DR. RASIM GULDIKEN

DRIVING INNOVATION WORLDWIDE:

OSU and Inje University unite through SAE

x x x

OSU is expanding its global engineering footprint through a new partnership with Inje University in South Korea, creating fresh opportunities for students and faculty to collaborate, compete and innovate. The Memorandum of Understanding establishes joint research initiatives, faculty and student exchanges, and hands-on training programs, with a particular focus on Society of Automotive Engineers competitions and electric vehicle development.

At the center of the collaboration is an annual short course hosted at OSU, where students from both universities will work side by side on thermal systems and vehicle design challenges. The partnership aligns naturally with Formula SAE and Baja SAE teams, strengthening technical analysis, design methodologies and cross-cultural teamwork.

As OSU advances its electric vehicle initiatives and plans its first electric Formula SAE racecar, the collaboration offers students real-world engineering experience with global reach, preparing them for careers in an increasingly international and electrified automotive industry.

“

YOU GET TO BE A PART OF SOMETHING, LIKE THE WHOLE THING. YOU HAVE SO MUCH INPUT. IF YOU DESIGN IT, YOU BUILD IT, AND YOU GET TO SEE IT ACTUALLY PHYSICALLY WORK.

-AIDAN ROGERS

A LEGACY AT **FULL THROTTLE**

x x x

Every great race starts with a spark, and for OSU's Bullet Racing team, that spark now carries the legacy of alumnus Bob Lembcke. Thanks to an endowment from his sister, CEAT alumna Mary Davey, Bob's lifelong passion for motorsports is fueling the next generation of engineers.

The endowment provides lasting support for Bullet Racing's operations, travel, safety equipment and growth, empowering students to design and build nearly 90% of a formula-style race car from the ground up. Competing against more than 120 universities worldwide, the team offers students an unparalleled, hands-on engineering experience - one that mirrors real-world vehicle development from concept to competition.

As Bullet Racing expands its facilities and develops a new electric vehicle platform, Bob's name now rides with every lap and every design iteration. It's more than a tribute, it's a reminder that engineering thrives where passion, purpose and innovation meet.

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