

MISSOURI
S&T



**MECHANICAL AND
AEROSPACE ENGINEERING**
INVENT THE FUTURE

MODERNIZING
MISSOURI MANUFACTURING

PAGE 8 - 9

MESSAGE FROM THE CHAIR



Dear Friends:

2024 was another outstanding year for Mechanical and Aerospace Engineering at Missouri S&T. Starting with record research awards, to another record first-time enrollment (in both Aerospace and Mechanical programs), add on record starting salaries for our

graduates and four new faculty, optimism for the future abounds. It is a great time to be an S&T MAE Miner.

We had another year of record new research awards - \$16.1 million. That is more than \$700,000 for each of our tenure and tenure track faculty, thanks to continued growth in advanced manufacturing research and high speed flows. We also reached a five-year high in expenditures per faculty, increased our annual citations per faculty to a new department record, and seven of our faculty were named as being in the 2% of researchers in their field.

The excitement extends to our enrollments. Both our mechanical and aerospace programs had record new undergraduate student enrollments in Fall 2024, surpassing the Fall 2023 records. While there is great excitement for new students, our graduates are also setting records, with both programs having average starting salaries for B.S. holders exceeding \$78,000.

Our students are also achieving new heights - literally. Our student Small Satellite Team deployed

their cubesat, the Multi-Mode Mission (M₃), into space on SpaceX's Transporter 10 last March. The design team also received new funding, enabling a second and third deployment in the near future. We could go on about the other 20 design teams and their achievements. Suffice it say, our students are doing engineering while learning engineering.

Looking forward, our new faculty hires, rapid expansion of faculty research, the opening of the advanced manufacturing research and development facility (the 'Protoplex') and record enrollments, MAE at Missouri S&T continues to focus on making lives better through research in improved infrastructure, resource sustainability, energy conversions, AI and autonomous systems, and advanced manufacturing, including biomanufacturing.

I invite you to explore these and many other highlights from 2024 or read our annual report and learn how the people of MAE are developing knowledge and innovations to tackle some of our world's most pressing problems with amazing drive and creativity.

Respectfully,

Dr. Dave Bayless, P.E., F-ASME and NAI

Chair and Professor, MAE at Missouri S&T



Mechanical and
Aerospace Engineering
Department

MECHANICAL AND AEROSPACE ENGINEERING BY THE NUMBERS

mae.mst.edu

RANKED NEAR THE TOP

MECHANICAL ENGINEERING #63

AEROSPACE ENGINEERING #41

U.S. News & World Report (2023-24)

35 Full-time faculty members

116,000 ft²

LAB SPACE

PROTOPLEX

A hub for manufacturing research and development (Opens 2025)

1,700+

MAE student enrollment

7 GRADUATE CERTIFICATES

Start earning college credit toward your master's degree.

(Learn more: distance.mst.edu)

19%

MAE department undergraduate female engineers

7

WORLD'S TOP 2% SCIENTISTS
Stanford University (2023)

\$16M

Research Awards (CY 2024)

7 DEGREE PROGRAMS

MECHANICAL ENGINEERING

- Bachelor of Science (B.S.)
- Master of Science (M.S.)
- Doctor of Philosophy (Ph.D.)

AEROSPACE ENGINEERING

- Bachelor of Science (B.S.)
- Master of Science (M.S.)
- Doctor of Philosophy (Ph.D.)

MANUFACTURING ENGINEERING

- Master of Science (M.S.)

\$78,000+

MAE B.S. holders average starting salaries

COLLEGE OF ENGINEERING AND COMPUTING

cec.mst.edu

16 ABET-accredited engineering programs

CEC total engineering enrollment **4,966**

53rd

U.S. PUBLIC ENGINEERING PROGRAM

\$61.1M

New research awards

NEW FACULTY



DR. BO MI LEE

Dr. Bo Mi Lee is an Assistant Professor in the Department of Mechanical and Aerospace Engineering at Missouri University of Science and Technology. Before joining Missouri S&T, Dr. Lee was a postdoctoral associate at the University of Central Florida and the University of California, Davis. Dr. Lee received her Ph.D. in Structural Engineering from the University of California, San Diego, in 2019.

Dr. Lee was the recipient of the UCF Pre-eminent Postdoctoral Program (P₃) Award, the Rising Stars Women in Engineering from the 2019 Asian Dean's Forum, the Best Paper Award from ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS) in 2018, and a dissertation fellowship from UC San Diego in 2019, among others.

Dr. Lee's research interests include multifunctional materials, stimuli-responsive nanocomposites, and data-driven approaches for enhancing advanced sensor technologies, biomedical systems, and energy solutions.



DR. JACOB MILLER

Dr. Jacob Miller is a Professor of Practice in the Department of Mechanical and Aerospace Engineering at Missouri University of Science and Technology (Missouri S&T) and a Facilities Engineer at Brewer Science, located in Rolla, MO. Dr. Miller has worked for over 25 years in Manufacturing Engineering. For 17 years, Dr. Miller worked at the Y-12 National Security Complex, supporting R&D prototype development, process creation, and design of experiments. Dr. Miller has in-depth experience with traditional machining, additive manufacturing, metal casting, forming, forging, and parametric CAD/CAM design.

Dr. Miller's commitment to education is evident through his teaching experience, ranging from undergraduate courses like Introduction to Manufacturing Processes Lab to graduate-level courses such as Explosives Handling and Safety. His approach emphasizes hands-on learning, group collaboration, and effective communication, ensuring students are well-prepared for the challenges of the engineering profession.

Dr. Miller is a researcher with three U.S. Patents and numerous peer-reviewed publications and conference presentations to his credit. His expertise extends to explosive dynamics, combustible dust, and airborne release fractions (ARF) / respirable fractions (RF).



DR. CHAOYING PEI

Dr. Chaoying Pei is an Assistant Professor in the Department of Mechanical and Aerospace Engineering at Missouri University of Science and Technology. She graduated with her Ph.D. in Aeronautical and Astronautical Engineering from Purdue University. She also holds a Master's degree in Inertial Technology and Navigation Instruments and a Bachelor's degree in Instrumentation and Optoelectronic Engineering from Beihang University, Beijing.

Dr. Pei was the recipient of the prestigious Bilsland Dissertation Fellowship from Purdue University. She also earned multiple awards during her education, including honors in national and international competitions such as the American Mathematical Modeling Competition and the "Feng Ru Cup" innovation event at Beihang University.

Dr. Pei's research interests include control theory, optimization techniques, and guidance, navigation, and control (GNC). Her work focuses on integrating advanced optimization and machine learning approaches to solve complex challenges in aerospace systems, such as multi-stage optimization, real-time trajectory planning, and distributed control systems.

FACULTY PROMOTION



DR. PHILLIP MULLIGAN

Assistant Professor

PhD: Missouri University of Science and Technology, 2016

Research Interests: Explosives engineering, force protection, virtual reality and weapon design.

Promoted to assistant professor in 2024



DR. JONGHYUN PARK

Professor

PhD: University of Michigan, Ann Arbor, 2009

Research Interests: Advanced li-ion battery, beyond li-ion battery, energy storage system, renewable energy system, grid energy storage, nano, macro-mechanics of materials, self-assembly of nanoparticles, nanostructure, multiphysics, multiscale experiment and simulation.

Promoted to professor in 2024

FACULTY BY RESEARCH AREA

Thermal-Fluid Sciences

Aerodynamics

Daoru (Frank) Han
Serhat Hosder
Davide Viganò

Fluid Dynamics

Daoru (Frank) Han
Serhat Hosder
Zhi Liang
Davide Viganò

Propulsion

Daoru (Frank) Han

Energy Conversion and Transport

David Bayless, P.E.
Kelly Homan
Umit Koylu
Jonghyun Park
Xiaodong Yang

Design and Manufacturing

Manufacturing

Richard Billo
Jacob Miller
Ming Leu
Frank Liou
Anthony Okafor
Jonghyun Park

Systems Design

Mechanical Engineering Focus

Ryan Hutcheson
Ming Leu
Phillip Mulligan
J. Keith Nisbett
Yun Seong Song
Daniel Stutts

Aerospace Engineering Focus

Warner Meeks
Donna Jennings
Henry Pernicka
Jillian Schmidt

Multidisciplinary analysis/Optimization

Serhat Hosder
Yezad Anklesaria

Materials and Structures

Solid Mechanics

K. Chandrashekhara
Lokeswarappa Dharani
Daniel Stutts

Engineering Materials

K. Chandrashekhara
Lokeswarappa Dharani
Bo Mi Lee
Jonghyun Park
Xiaodong Yang

Explosives and Energetics

Jacob Miller
Phillip Mulligan

Dynamic Systems and Control

Controls

Douglas Bristow
Xiaosong Du
K. Krishnamurthy
Smriti Nandan Paul
Chaoying Pei
Yun Seong Song
Daniel Stutts

Nonlinear Dynamics

Nishant Kumar

Astrodynamics

Donna Jennings
Smriti Nandan Paul
Henry Pernicka

Structural Dynamics

Aerospace Structures

Henry Pernicka
Daniel Stutts

Vibrations/Acoustics

Daniel Stutts

Machine Learning

Xiaosong Du

FACULTY ACHIEVEMENTS



SEVEN MAE RESEARCHERS AMONG TOP 2% IN THEIR FIELDS

A total of seven faculty of Missouri S&T Mechanical and Aerospace Engineering Department are among the top researchers in their field as measured by their career research records, and five researchers were among the best in their fields in 2023, according to a recent analysis of standardized citation indicators of the Elsevier Data Repository published by Stanford University.

Aerospace Engineering

- Dr. Serhat Hosder, James A. Drallmeier Centennial Professor of mechanical and aerospace engineering (Both)

Mechanical Engineering

- Dr. Douglas Bristow, William E. Walker III Professor and director of the Center for Aerospace Manufacturing Technologies (career)
- Dr. K. Chandrashekhara, Curators' Distinguished Professor of mechanical and aerospace engineering (both)
- Dr. Umit Koylu, professor of mechanical engineering (career)
- Dr. Ming C. Leu, Curator's Distinguished Professor, Keith and Pat Bailey Distinguished Professor and former director of the Intelligent Systems Center (both)
- Dr. Frank Liou, Michael and Joyce Bytnar Professor and interim director of the Intelligent Systems Center (both)
- Dr. Xiaodong Yang, professor of mechanical and aerospace engineering (both)



MAE FACULTY HONORED WITH CEC AWARDS

Two faculty were honored during the College of Engineering and Computing's Fall 2024 awards ceremony.

Dean's Educator Award: Dr. Douglas Carroll, Professor of Mechanical and Aerospace Engineering, was honored for his excellence in teaching and dedication to student success.

Patent Recognition: Dr. Jonghyun Park, Professor of Mechanical and Aerospace Engineering, was acknowledged for securing a patent in the past year, highlighting his innovative research contributions.



MAE FACULTY HONORED DURING THE 2024 MISSOURI S&T STAFF APPRECIATION DAY

The Outstanding Faculty Award recognizes a faculty member who is actively engaged in supporting staff across campus. The 2024 award went to **Dr. Daoru (Frank) Han**, associate professor of mechanical and aerospace engineering and director of the Gas and Plasma Dynamics Laboratory.

TWO MAE FACULTY HONORED FOR OUTSTANDING ACHIEVEMENT AND SERVICE

Two esteemed faculty members from the Department of Mechanical and Aerospace Engineering at Missouri S&T were recommended for their significant achievements and service.

Dr. Jill Schmidt - For her sustained excellence in two of the following areas: teaching, research, and service, earning the Faculty Achievement Award

Dr. Jonghyun Park - For his exemplary, sustained service to the university and to his profession, earning the Faculty Service Award



DR. DOUGLAS BRISTOW APPOINTED AS INAUGURAL WILLIAM E. WALKER III PROFESSOR

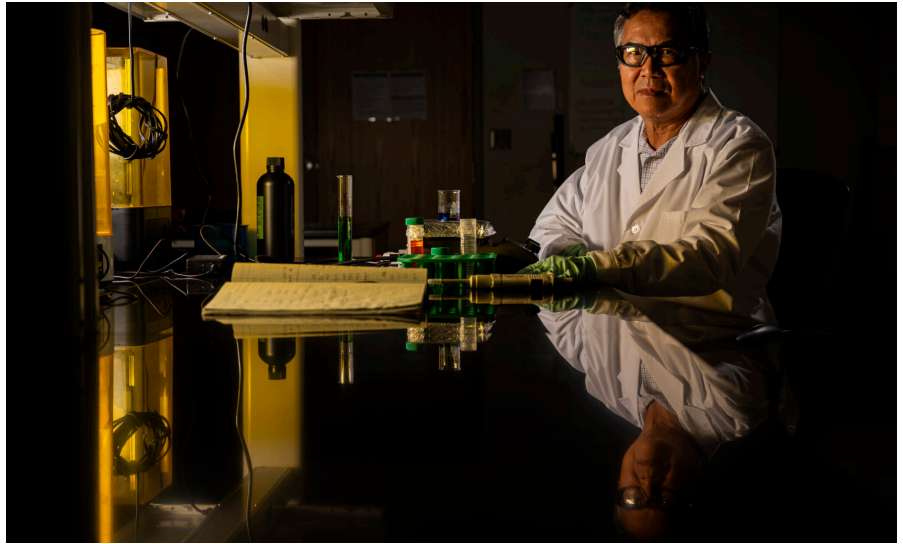
Missouri S&T is proud to announce the appointment of Dr. Douglas Bristow as the inaugural William E. Walker III Professor of Mechanical and Aerospace Engineering. This distinguished professorship, supported by the William E. Walker III Endowment Fund, recognizes Dr. Bristow's exceptional contributions to the field and his unwavering dedication to advancing engineering education.

Dr. Bristow has been a member of Missouri S&T's faculty since 2008. He was named the director of the Center for Aerospace Manufacturing Technologies (CAMT) in May 2016, leading initiatives in aerospace manufacturing innovations and technology advancements. His journey at Missouri S&T began as an assistant professor, with subsequent promotions to associate professor in 2014 and professor in 2020.

The William E. Walker III Endowment Fund, established in 2022, provides crucial support to students, faculty, and the Mechanical and Aerospace Engineering department. The endowment honors the legacy of William E. Walker III, a 1981 graduate of Missouri University of Science and Technology with a Bachelor of Science degree in Mechanical Engineering. William, who passed away on December 2, 2022, at 65, was a devoted alumnus and a lifelong supporter of his community. William's visionary leadership and commitment to innovation continue to inspire through this endowment.

As the William E. Walker III Professor, Dr. Bristow will continue leading pioneering research while expanding his efforts to inspire and educate the next generation of engineers.

S&T MANUFACTURING EXPERT NAMED CURATORS' DISTINGUISHED PROFESSOR



Dr. Ming C. Leu working in a Missouri S&T laboratory. Photo by Michael Pierce/Missouri S&T.

Dr. Ming C. Leu, a longtime faculty member at Missouri S&T, has been named a Curators' Distinguished Professor of mechanical and aerospace engineering.

The University of Missouri Board of Curators awards this title to outstanding faculty members with established reputations in their field of study.

Leu, a member of the S&T faculty since 1999, is the university's Keith and Pat Bailey Distinguished Professor of Integrated Product Manufacturing. He was the founding director of S&T's Center for Aerospace Manufacturing and has also served as director of the Intelligent Systems Center.

"Being named a Curators' Distinguished Professor is a special honor that I will always cherish," Leu says. "I am fortunate that my professional journey led me to Rolla, Missouri, and I have been able to work with such a supportive group of students and colleagues. I hope they know they have played important roles in my life and in my success as a researcher and educator."

An expert in additive manufacturing, 3D printing, smart manufacturing, robotics and cyber-physical systems, Leu's work has been published in hundreds of academic journals and conference papers, book chapters, and other publications. He has been granted five U.S. patents for his inventions and has one patent pending.

Leu has been awarded several professional honors on the university, national and world stage. He is a recipient of the International Freeform and Additive Manufacturing Excellence (FAME) Award; the American Society of Mechanical Engineers' (ASME) Milton C. Shaw Manufacturing Research Medal; the ASME Blackall Machine Tool and Gage Award; the International Symposium on Flexible Automation's Hideo Hanafusa Outstanding Investigator Award; and the University of Missouri System President's Award for Leadership, among others.

Before joining the S&T faculty, Leu was a program director for the National Science Foundation and held faculty positions at the New Jersey Institute of Technology and Cornell University. He has served as a visiting professor at universities in Singapore, China, Taiwan and South Africa, and he has been a professional consultant for companies around the world.

Leu is a Fellow of the Society of Manufacturing Engineers, the International Academy of Production Engineering and ASME. He earned three degrees in mechanical engineering, including a Ph.D. from the University of California, Berkeley, a master's degree from The Pennsylvania State University, and a bachelor's degree from National Taiwan University.

S&T RESEARCHER AWARDED GRANT TO STUDY TURBULENCE AT HYPERSONIC SPEEDS

A researcher from Missouri S&T has been awarded \$200,000 from the National Science Foundation to study how turbulence behaves at high speeds and how it could be used to make hypersonic vehicles more effective.

“When people think of turbulence, they often focus on its downsides,” says Dr. Davide Viganò, an assistant professor of aerospace engineering. “However, turbulence can also be beneficial. This project will focus on how we can harness it to develop better hypersonic engines.”

To travel at hypersonic speeds, which are over five times the speed of sound, engines need fuel to be mixed with air as quickly as possible, and Viganò says that is where turbulence will come into play.

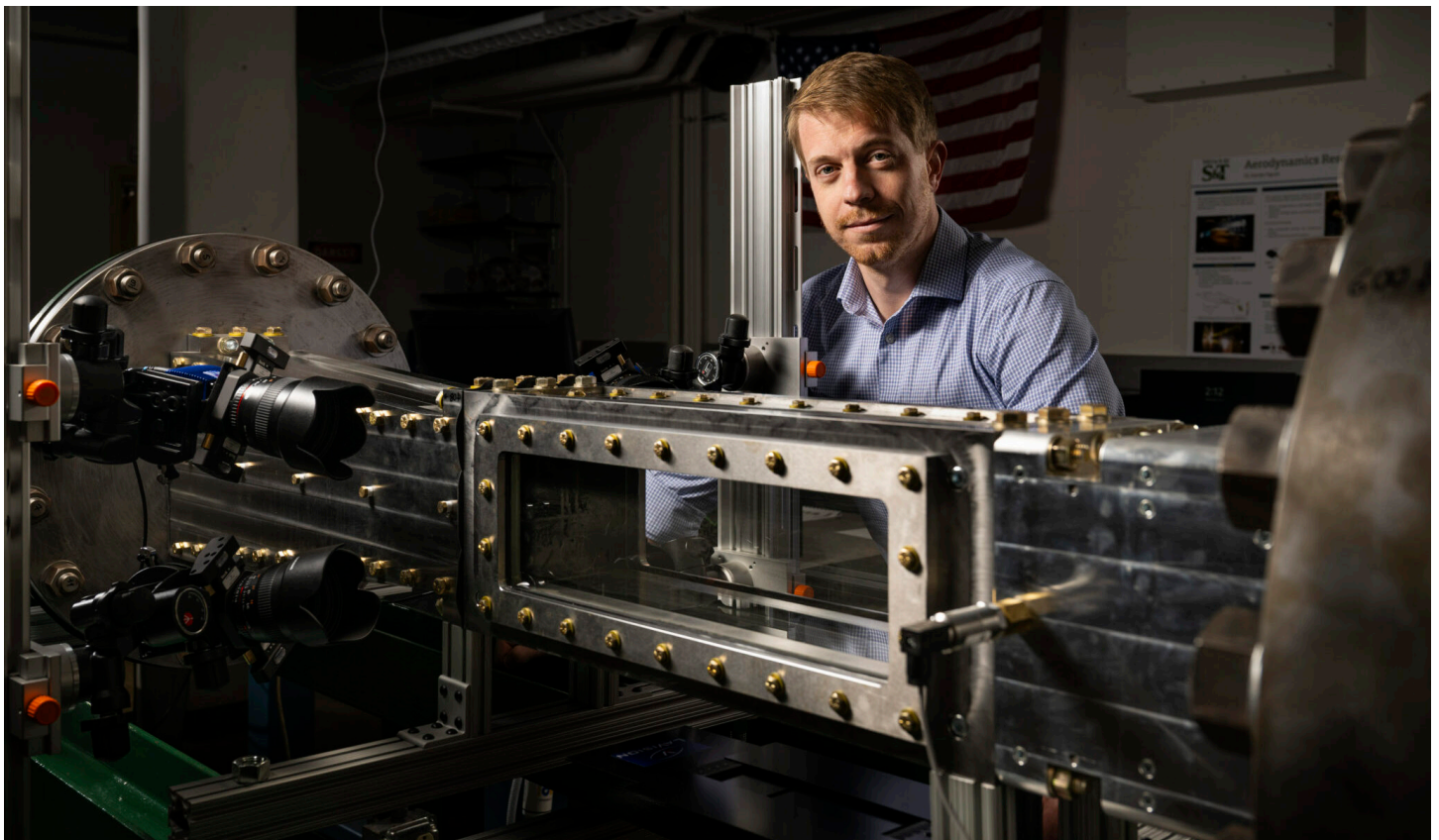
“In these engines, the fuel must be injected, dispersed and mixed with the incoming air before combustion can occur,” he says. “By studying turbulence at high speeds, we can understand how the swirling and chaotic motions can be used to mix the fluids most effectively.”

For the study, Viganò will use Missouri S&T’s supersonic wind tunnel and advanced laser-based techniques to better understand how turbulence is produced.

“As hypersonic flight advances, this technology will redefine the possibilities for global travel and space exploration,” he says. “The research we are doing now will have significant implications for this form of flight in the future.”

The funding Viganò received from NSF will also go toward a new summer camp for high school students. The camp will launch next summer and focus on multiple STEM topics.

Findings from Viganò’s study will be incorporated into an S&T graduate course focusing on turbulent flows.



Dr. Davide Viganò works with Missouri S&T’s supersonic wind tunnel. Photo by Blaine Falkena/Missouri S&T.

MISSOURI S&T PROFESSOR'S MICRO RESEARCH PROJECT RECEIVES MAJOR AIR FORCE GRANT



Dr. Zhi Liang from Missouri S&T is researching something so small that it can't be seen by the naked eye, but its implications could be so large that the Air Force Office of Scientific Research recently awarded him a three-year, \$600,000 grant.

Liang's research team is studying microdroplets of fuel that range from a few micrometers to 50 micrometers in size. To put that in perspective, the typical size of a human hair follicle ranges from 50 micrometers to 100 micrometers.

"Advanced propulsion systems like scramjets, detonation engines and rocket engines operate in extremely high pressure and high-temperature environments," says the associate professor of mechanical and aerospace engineering. "And we are working to better understand how these harsh environments affect the dynamics and evaporation of fuel microdroplets."

The Air Force is funding the project as part of its Defense Established Program to Stimulate Competitive Research initiative.

By developing models and running experiments, Liang says he aims to predict how single droplets are mixed with air and how engine combustion could be improved.

"The better we can understand what is actually happening at this micro-level, the better researchers will be able to address the performance of propulsion systems and have results that could benefit hypersonic vehicles and traveling in space," he says.

Although the topic of microdroplets in advanced propulsion systems has been researched by other engineers in recent years as well, Liang says his project will be the first one of a large magnitude that includes both multiscale modeling and droplet-scale experimental components.

"This is fundamental research," he says. "We aim to have the work we are doing now eventually published in high-impact academic journals and then used to help with more practical applications."

Liang, who serves as the project's principal investigator (PI), says the Missouri S&T research team, which will include him, as well as one graduate student and one undergraduate student, will focus on the modeling components of the project.

Dr. Shyam Menon, an associate professor of mechanical engineering at Louisiana State University, will serve as a co-PI. His group, which will also include two students, will handle the experimental aspects of the project and use a high-pressure, high-temperature test chamber, among other types of equipment.

MISSOURI S&T CONSORTIUM WINS GRANT TO MODERNIZE STATE'S DEFENSE MANUFACTURING

Using technology to strengthen the global competitiveness of Missouri manufacturers while supporting the defense industry is one of the primary goals of a three-year project recently awarded \$5 million by the U.S. Department of Defense's Office of Local Defense Community Cooperation.

The grant establishes the Missouri Defense Manufacturing Consortium, a partnership of colleges and universities, companies, and manufacturing organizations led by Missouri S&T. Other consortium members include Lockheed Martin, a large manufacturer with a defense equipment division; Caterpillar, a heavy equipment manufacturer; America Makes, a public-private partnership for additive manufacturing technology and education; the Missouri Association of Manufacturers; and Ozarks Technical Community College.

"In order for Missouri to remain globally competitive in manufacturing, we must modernize the technology used by our state's manufacturers," says Dr. Richard Billo, director of the Kummer Center for Advanced Manufacturing at Missouri S&T, who also oversees the Missouri Protoplex and is the lead researcher for the consortium. The Protoplex will serve as an organizational and physical hub for advanced manufacturing when it opens in 2025.

The consortium will provide training and education to at least 200 Missouri manufacturers to increase the number of engineers and tradespeople skilled in digital advanced manufacturing technologies as they are applied to two traditional methods of manufacturing: Casting, a process during which metal is heated

until it's molten, and then poured into a die, or mold, and forging, which uses automated or manually applied compression to reshape metal that's been heated to the stage of being plastic.

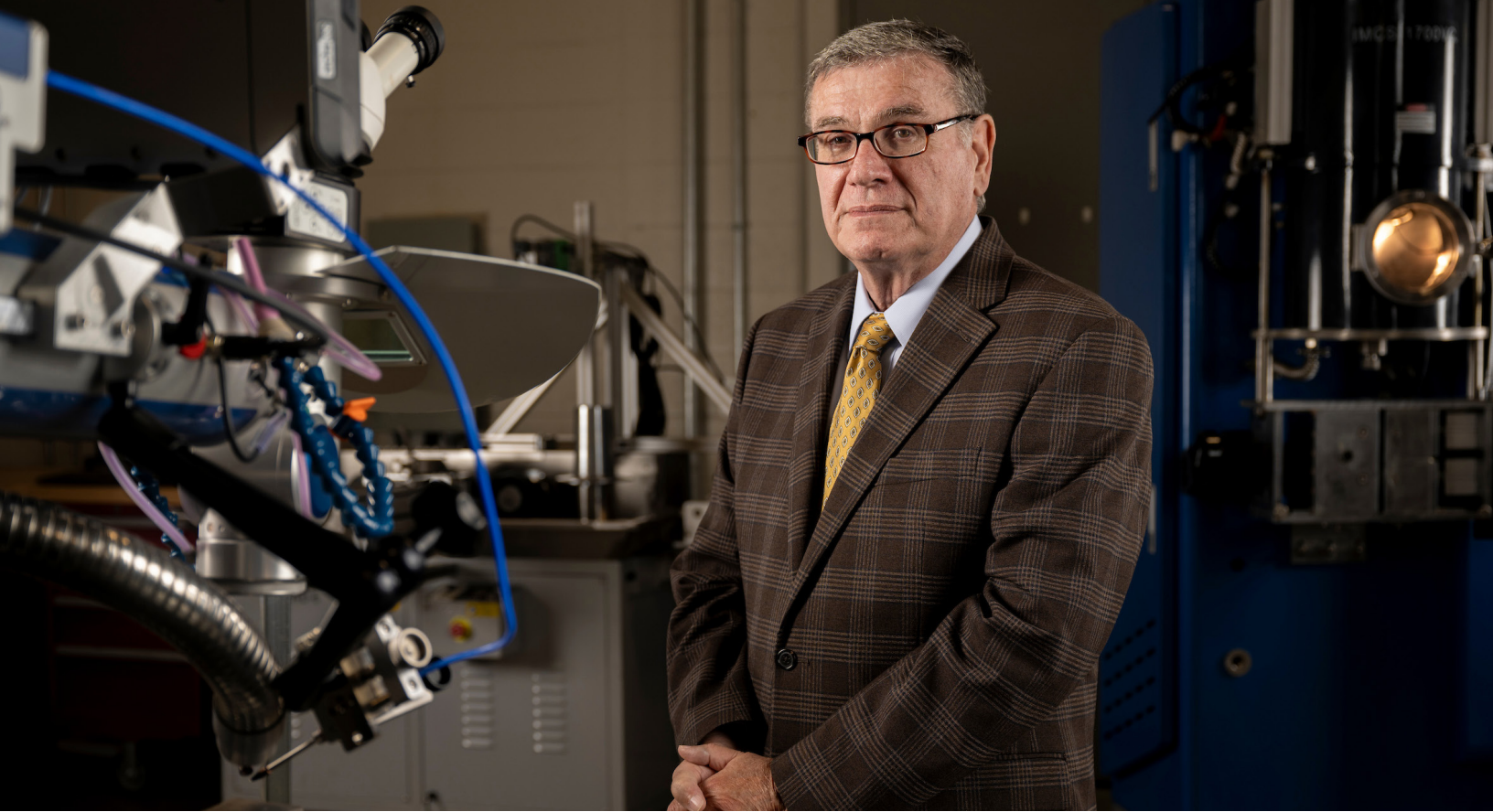
Although popular, both methods are difficult for producing small quantities of parts quickly and at a low cost. These attributes are important for companies to competitively produce replacement parts for older equipment. By providing training on new and emerging technologies, the consortium plans to lessen the severe shortage of workers skilled in using advanced manufacturing technologies to repair, remanufacture and replace castings and forgings for the defense industry.

The consortium also hopes to combat what many see as the erosion of U.S. leadership in casting and forging manufacturing.

Specifically, the technical training and education offered by the Missouri Defense Manufacturing Consortium will be complemented by outreach activities provided by a team that includes OTC's Robert W. Plaster Center for Advanced Manufacturing, the America Makes Manufacturing USA Institute and Missouri S&T's Kummer Center for STEM Education to at least 5,000 K-12 students in more than 50 underserved counties across Missouri.



Attendees at Missouri S&T's open house in October got an up-close look at some of the digital advanced manufacturing technologies the university believes will help Missouri manufacturers remain globally competitive. Photo by Michael Pierce, Missouri S&T.



STATE OF MISSOURI AWARDS \$9.1 MILLION FOR HIGHER ED COLLABORATION TO BOOST MANUFACTURING

Three Missouri higher education institutions are working together to modernize the state’s manufacturing industry and develop its workforce, with \$9.1 million in Missouri’s fiscal year 2025 budget being awarded to support their efforts.

“Missouri desperately needs more engineering and technical students educated in emerging advanced manufacturing technology to address the shortage of employees in this industry,” says Dr. Richard Billo, director of Missouri S&T’s Kummer Institute Center for Advanced Manufacturing. “We are thrilled to work closely with our colleagues in the state’s community colleges to improve the employee pipeline and help our state’s manufacturers become — and stay — globally competitive with innovative products and processes.”

The funding comes as part of the Department of Higher Education and Workforce Development’s MoExcels Workforce Initiative. Missouri S&T will serve as the lead institution for the project titled “Bridging the Manufacturing Critical Skills Gap.” Partner institutions include East Central College (ECC) and St. Charles Community College (SCC).

An advisory board of leaders in the manufacturing sector provided S&T with a list of critical skills needed by their companies and others. Based off these recommendations, S&T will modernize its undergraduate manufacturing curriculum and incorporate new technologies and equipment to ensure the university’s training and education is well-aligned with the needs of Missouri manufacturers.

S&T will also host manufacturing summer camps for students, as well as manufacturing professional development initiatives for K-12 teachers.

The university’s Kummer Center for STEM Education and SCC will visit hundreds of elementary schools with S&T’s STEM Mobile — a STEM outreach van that will be filled with equipment for manufacturing education — and provide hands-on experiences for thousands of Missouri students as young as nine years old.

East Central College

ECC will construct a Center for Advanced Manufacturing, which will be part of its new campus in Rolla. The facility, which will include state-of-the-art equipment, classrooms and laboratory space, is expected to be completed in late 2025.

St. Charles Community College

SCC will take part in joint K-12 outreach efforts with Missouri S&T, focusing on rural areas to spread awareness about the manufacturing profession and different career paths.



The Missouri S&T Lunar Biotech team earned second-place accolades in the Lunar Life Odyssey 2 challenge. The team, from left, includes Hannah Keely, Peter Obidi, Dr. David Bayless (team advisor), Josh Hickman, Jesse Fletcher and Alireza Fallahi. Photo courtesy of Jesse Fletcher.

COULD BLUE-GREEN ALGAE LEAD TO HUMANS' SUSTAINED PRESENCE ON THE MOON?

Will bacteria that is commonly called “blue-green algae” growing on a window screen eventually play a major role in humans having a sustained presence on the moon?

A group of student researchers from Missouri S&T thinks so, and their Lunar Biotech team’s project was recognized for having one of the top innovations at the Lunar Life Odyssey challenge, sponsored by Jacobs Space Exploration Group — one of NASA’s primary contractors.

Fletcher says the blue-green algae, which is actually a cyanobacteria, was part of a bioreactor the team created that could potentially recycle human waste, wastewater and gases into usable resources, such as oxygen, potable water and proteins for potential consumption.

The S&T team earned second-place accolades in November 2023 for the Lunar Life Odyssey challenge, which was focused on developments to support humans eventually living on the moon.

S&T’s project was similar to technology that professionals have already developed for living in space, but Fletcher says the team’s work would be a significant improvement to what is already in use.

“Similar technology already exists and is used on the International Space Station,” he says, “but it is not biotech, and it is heavier and requires more energy to transport and operate. Our work could

make space travel — and one day having a sustained presence on the moon — more efficient and less expensive.”

The Lunar Biotech team has been developing this project for several years, and Fletcher says he is excited to see this work continue, and he hopes to see even more members join the team.

“I wanted to do undergraduate research ever since I came to Missouri S&T, and this team provides me with unique experiences that test my critical thinking skills and help me be a better engineer,” he says. “It is a great group that is working to solve important problems.”

Other members of the team include: Alireza Fallahi, a Ph.D. student in mechanical engineering from Tehran, Iran.

Joshua Hickman, a December graduate with a bachelor’s degree in mechanical engineering from Wright City, Missouri.

Hannah Keely, a December graduate with a bachelor’s degree in mechanical engineering from Holts Summit, Missouri.

Peter Obidi, a Ph.D. student in mechanical engineering from Abuja, Nigeria.

Dr. David Bayless, professor and chair of mechanical and aerospace engineering, serves as the team’s advisor.

IN BRIEF

Dean’s Ph.D. Scholar Award

- Xiangkai Zeng
- Jeremiah Rittenhouse

Dean’s Ph.D. Scholar Award

- Tao Liu

Undergraduate Research Conference Poster

- 1st Place – Henry Tien

Oral Category

- 1st Place – Allie Dingfield
- 3rd Place – Joshua Gary

Future Research Pioneers Program

- 1st Place – Peter Montgomery
- 2nd Place – Stone Simpson
- 3rd Place – Parker Wideman
- 4th Place – Caleb Roberts
- 5th Place – Eliana Stanislawski
- 5th Place – Aidan Dollar

MAE Academy Awards

Past Presidents’ Scholarship

- Tyler Rowden

McGovern Scholarship Award

- Reese Sherman

AMAE Scholarships

- Christopher Hunt
- Hayden Krumpelman
- William Mayo
- Allison Miller
- Melissa Parker
- Andrew Sadler
- Eliana Stanislawski
- Patrick Steinkamp
- Matthew Traum

Graduate Teaching Awards

- Zachary Boeringa
- Jeremiah Rittenhouse

Senior Design Leadership Award

- Hunter Boswell
- Hollis Waites

Senior Design Mentorship Award

- Josh Muller
- Tunay Turk

TEDxMissouriS&T Speaker

- Coleman Goulding - “Beyond Limits: Space Age Insights for Life”

Graduate Research Symposium

- 1st Place – Tunay Turk
- 3rd Place – Haotian Tang

MECHANICAL AND AEROSPACE ENGINEERING STUDENTS PITCH THEIR STARTUP CONCEPTS FOR SCHOLARSHIP PRIZES

Missouri University of Science and Technology's Department of Mechanical and Aerospace Engineering proudly announces the achievements of its students in the university's third annual Startup Challenge, held on November 11, 2024.

The first-place prize of \$5,000 was awarded to "EcoBioCapture," a business concept developed by Ph.D. students in mechanical engineering, Alireza Fallahi and Niloofar Zendehtdel. Their project focuses on sustainable carbon capture, wastewater remediation, and renewable energy production through advanced algal bioreactors, aiming to assist farming operations in meeting emissions regulations while producing supplemental livestock feed.

Securing the second-place prize of \$3,000 was "PolliBots: Robotic Vanilla Pollination System," presented by team members including junior in mechanical engineering, Tohajie Raet. Their innovative solution addresses the labor-intensive process of vanilla pollination by introducing robotic automation.

The third-place prize of \$1,000 went to "C-App," an application designed to customize breathing masks for ICU babies using advanced 3-D scanning and printing technology. The team includes senior in mechanical engineering, Mikayla Massie.

The Startup Challenge, co-sponsored by Kummer Student Programs and Career Opportunities and Employer Relations, provides students with the opportunity to present business models to a panel of judges with entrepreneurial experience. Participants completed a series of learning modules and collaborated with faculty or staff mentors in preparation for the competition.



Noah Johnson won first place in S&T's first Micro Grand Challenge in April. He proposed sodium rather than lithium-ion batteries to store wind and solar power. Photo by Sam Wright, Missouri S&T.

S&T EVENT CHALLENGES STUDENTS TO IMPROVE ENERGY STORAGE

Noah Johnson, a rising sophomore in mechanical engineering from Washington, Illinois, won first place in S&T's first Micro Grand Challenge in late April.

The challenge gave students just a few hours on a Sunday afternoon to propose a way of storing the energy generated by sun and wind without relying on lithium-ion batteries, which are widely used and almost impossible to recycle, or to propose new methods of developing and recycling lithium batteries.

Johnson is a Kummer Vanguard Scholar, a program supported by the \$300 million gift June and Fred Kummer made to Missouri S&T in 2020. His solution is to use sodium instead of lithium-ion batteries. Sodium batteries check nearly all the environmental boxes, but they don't store as much energy.

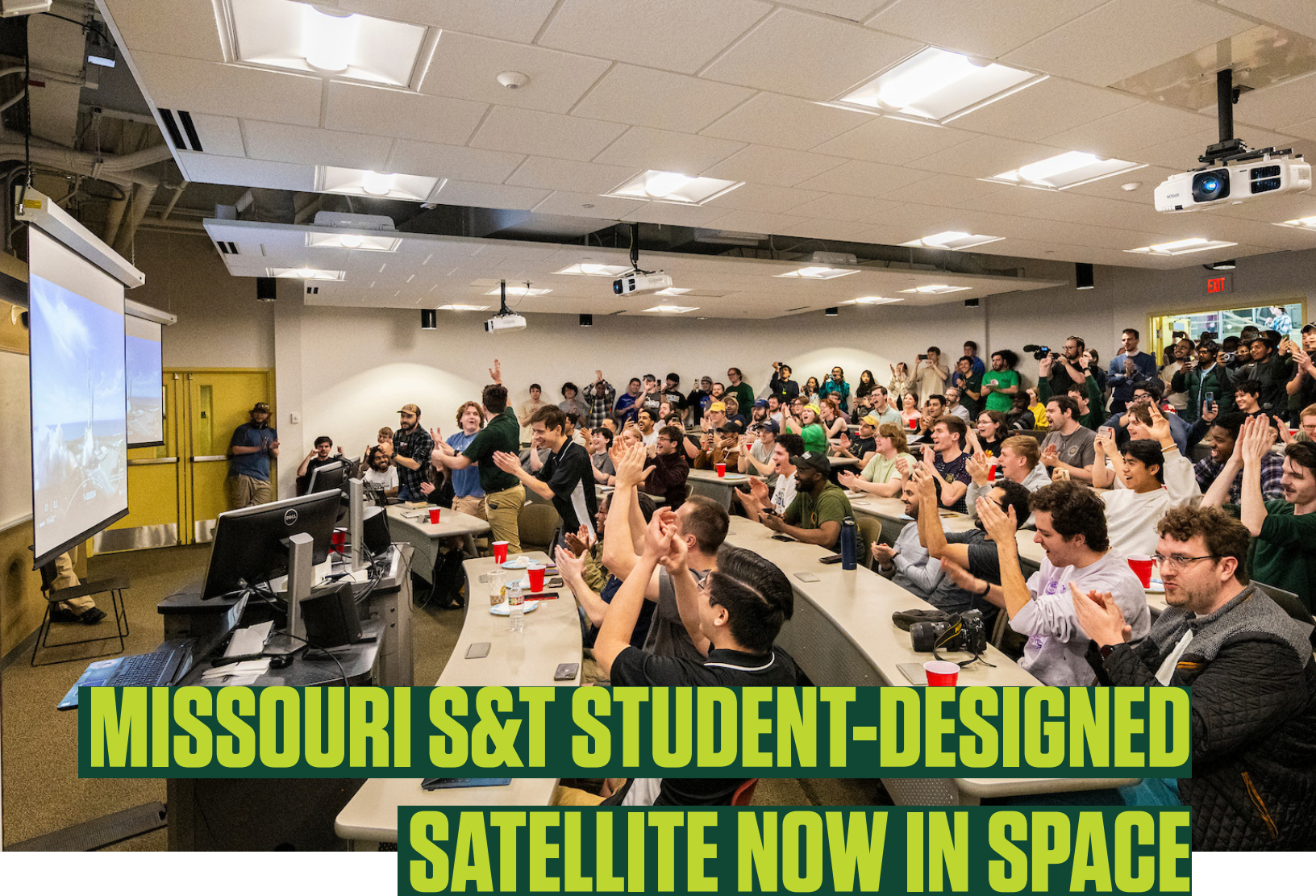
That shortcoming is what Johnson will address through research in the fall, working under the supervision of Dr. Shelley Minter, director of the Kummer Institute Center for Resource Sustainability and professor of chemistry. Minter organized the challenge in partnership with Kummer Student Programs and the Opportunities for Undergraduate Research Experiences (OURE) program.

"The problem is that the sun doesn't always shine, and the wind doesn't always blow," says Minter, who kicked off the challenge with a brief presentation of the issues associated with energy storage. Then participants teamed up with graduate students and post-doctoral fellows in the center to work on a solution, which they presented to a panel of three judges – a dean, a member of the faculty and a lay person.

Johnson says the challenge appealed to him because it combines two of his favorite things: mechanical engineering and research.



From left: Startup Challenge winners Alireza Fallahi and Niloofar Zendehtdel with EcoBioCapture; Tohajie Raet and Adam Camerer with PolliBots; and Zachary Oakes and Mikayla Massie with C-App.



MISSOURI S&T STUDENT-DESIGNED SATELLITE NOW IN SPACE

A Missouri S&T student-designed satellite is now in space and revolving around the Earth — thanks to some help from a SpaceX rocket.

On Monday, March 4, several members of the Missouri S&T Satellite Research Team were in California and watched in person as SpaceX's Falcon 9 rocket, which was carrying the team's small, cube-shaped satellite, lifted off from Vandenberg Space Force Base as part of the Transporter-10 mission.

Even more members of the team, along with other S&T students, faculty and staff excited about the mission, attended S&T's launch party in Toomey Hall and let out loud cheers as the rocket successfully took off into space.

Emily Doddemeade, a senior in aerospace engineering from Highlands Ranch, Colorado, and the mission's project manager, says the team refers to this satellite initiative, which is part of NASA's Undergraduate Student Instrument Project, as the Multi-Mode Mission, or M³.

Doddemeade says the satellite launch was an interdisciplinary effort that required a large amount of collaboration.

"It's amazing to consider how many moving parts and disciplines are involved in something like this," she says. "You really have to take a systems engineering perspective for this instead of thinking about just one major. I have learned so much with my experiences on the team."

Drake Beaman, a junior in aerospace engineering from Pleasant Hill, Missouri, who is the project's chief engineer, says this satellite launch was several years in the making, as S&T students first began working on this NASA-funded project in 2016.

He says the satellite will test an experimental thruster that was developed in the Missouri S&T Advanced Plasma Lab in partnership with Froberg Aerospace, but it will first take a week to get acclimated to space.

The propulsion system includes both chemical and electric components and will be fed a liquid propellant, he says. The thruster will be fired multiple times in space for 30-second bursts.

Once the team had everything ready to go for the satellite earlier this year, Doddemeade and Beaman, as well as Rayan Barghchoun, a December aerospace engineering graduate from St. Charles, Missouri, and Dr. Hank Pernicka, Curators' Distinguished Teaching Professor of aerospace engineering and the team's advisor, traveled cross-country to load the satellite into a deployer at the Firefly Aerospace facility in Austin, Texas.

From there, the satellite took a trip inside the deployer to Vandenberg Space Force Base where it was integrated into the Falcon 9 rocket by SEOPS, LLC, before eventually going into space.

After the satellite completes its autonomous tests, its data will be sent to Iridium Communications, which specializes in satellite communications, and then transferred to the S&T team.



Watch M3 launch into space at go.mst.edu/spacex

MISSOURI S&T RESEARCHERS SET TO WORK IN LUNAR GRAVITY FOR NASA PROJECT



Dr. Daoru Han, second from left, oversees a group of students rehearsing how to test the team's technology for separating moon regolith materials in lunar gravity conditions. Pictured, from left, are Marissa Verduin, Han, Trey Brown, Charles Wood, and Justin Viers. Photo by Michael Pierce/Missouri S&T.

A team of researchers from Missouri S&T examining how to enrich materials needed for construction on the Moon will soon experience what gravity is like on Earth's closest celestial companion while testing their technology.

"We have made fantastic progress on our technology to separate the Moon's regolith, or surface-level materials, and the next natural step will be to see how it will operate under lunar gravity conditions," says Dr. Daoru Han, an S&T associate professor of aerospace engineering and the project's principal investigator. "For humankind to one day have a larger presence on the Moon, we will need to find the most sustainable and economical methods to use the resources it has available."

Han says this flight test project is part of a recently funded extension for a \$2 million NASA grant the university received in 2022. In spring 2025, Han, along with other S&T scientists and student researchers, will travel to Fort Lauderdale, Florida, to take part in at least two flights with Zero Gravity Corporation (Zero-G), a company NASA contracts with for flight tests through its Flight Opportunities program.

The S&T researchers will work with a box about the size of a soda vending machine that will have built-in gloves for the team to use when operating their prototype technology.

They will have multiple 20-second windows on each flight when Zero-G's modified Boeing 727-200 aircraft will perform aerobatic maneuvers known as parabolas that will allow the team to experience lunar gravity, which is one-sixth of Earth's gravity; Martian gravity, which is two-fifths of Earth's gravity; and microgravity, or free-fall, conditions.

During this time, up to four S&T researchers will be aboard the flight and focus on how different materials simulating moon regolith are manipulated with a magnetic separator and sorted with an electrostatic sieve in lunar gravity and record the results.

Several S&T student researchers, scientists and faculty members are currently rehearsing how to best operate the technology and see how it works during the 20-second reduced-gravity windows, albeit they are now on the ground and experiencing the Earth's gravity.

Han says the group's excitement is continuing to grow as they get closer to the flights, and they will be ready to go once it's showtime.

"It has always been my dream to work on a project like this and conduct research for NASA, and now I am doing it before I even

graduate from Missouri S&T," says Trey Brown, a senior in aerospace engineering from Rolla, Missouri. "To think that my name is going to be related to research like this, while it will ultimately contribute to future human-built structures on the Moon, is amazing."

Jonah Little, a senior in aerospace engineering from Sullivan, Missouri, shared similar sentiments.

"The work we are doing is for the future of lunar exploration," he says. "As an undergraduate student, I am already part of a project enabling something so monumental. The experiences you can gain as a student at Missouri S&T are truly unmatched when compared to other universities."

Other students on the research team include:

- Joshua Eiter, a senior in aerospace engineering from Chatham, Illinois
- Blake Coffman, a junior in aerospace engineering from St. Louis
- Lindsay Manteufel, a senior in aerospace engineering from Neenah, Wisconsin
- Marissa Verduin, a junior in Aerospace Engineering from Chatham, Illinois
- Justin Viers, a senior in aerospace engineering from Dexter, Missouri.
- Charles Wood, a master's student in materials science and engineering from Galena, Missouri.

Co-principal investigators from Missouri S&T joining Han on this project include Dr. David Bayless, professor and chair of mechanical and aerospace engineering; Dr. William Schonberg, professor of civil engineering and Dr. Jeffrey Smith, professor of materials science and engineering. Peter Bachle, a senior research associate for mechanical and aerospace engineering, and Mitch Cottrell, an engineer and machine shop supervisor for mechanical and aerospace engineering, have provided support as well.

Dr. Fateme Rezaei from the University of Miami and Dr. Kirby Runyon from the Planetary Science Institute are also involved with the research.

ACADEMY OF MECHANICAL AND AEROSPACE ENGINEERS WELCOMES SEVEN NEW MEMBERS

At its 29th induction ceremony, Missouri S&T Academy of Mechanical and Aerospace Engineers welcomed seven professionals with ties to Missouri University of Science and Technology into its ranks.



TRAVIS W. HARTMAN

Travis W. Hartman of Troy, MO, Senior Engineering Manager of Toyota Motor North America, earned a bachelor's degree in mechanical engineering in 2004 from the University of Missouri-Rolla (UMR). While a student at UMR, Travis completed a co-op for Toyota and accepted a full-time position with Toyota upon graduating summa cum laude. Travis's more than 20-year career at Toyota has included a wide variety of experiences in the automotive manufacturing field from raw materials to the final product. Some career highlights include moving to Japan for two years, working in design for manufacturing in Toyota City and learning the Japanese language. Other memorable roles included the launch of the latest Tundra model change in San Antonio and leading plant modifications at Toyota's battery manufacturing plant in Greensboro, North Carolina. He currently works as Senior Engineering Manager at Toyota Missouri and oversees facilities in six states across the U.S. while also wrapping up his MBA in Leadership.



RAJ JAYACHANDRAN

Raj Jayachandran of Dearborn, MI, Technical Specialist of Core Crash Safety from Ford Motor Company, earned a PhD degree in engineering mechanics in 1991 from the University of Missouri-Rolla (UMR). Upon graduating from UMR with a doctoral degree in Engineering Mechanics, Raj joined Massachusetts Institute of Technology (MIT) as a post-doctoral associate and worked on constitutive modeling of plastic materials developing explicit numerical approach in ABAQUS finite element code. In 1993, he moved to Detroit to establish his career at Ford Motor Company. For all these years, he has developed and applied his expertise in vehicle crash simulations to design vehicle structures to meet or exceed federal motor vehicle safety standards (FMVSS). In 2016, he received Henry Ford Technology Award for his work on highly efficient crush can design for crash energy absorption with 2" reduction in vehicle structure by morphing its section along the length using the finite element method. Through his work at Ford, he has secured about a dozen patents related to design of vehicle structures. Currently, Raj is a technical specialist in Core Crash Safety department of product development center at Ford Motor Company. Raj volunteers as national Technical Coordinator for North South Foundation more than 15 years now and works with a team of professors and professionals conducting yearly educational contests promoting learning journey for children of kindergarten to high school. He also is the Founder, Teacher, President and on the Board of Directors of CafeMI Inc., a non-profit local community organization of volunteers coaching math and public speaking on Saturdays for elementary and middle school children living in and around Canton, MI for more than 10 years.



MICHAEL MUNSELL

Michael Munsell of Clayton, MO, Equity Partner of Patent Attorney from Armstrong Teasdale LLP, earned a bachelor's degree in mechanical engineering in 1993 from the University of Missouri-Rolla (UMR). Mike was a co-op with McDonnell-Douglas while at UMR and worked there for a short time before starting law school at Mizzou. He practiced patent law for 10 years with Senniger Powers, then moved his law practice to Armstrong Teasdale in 2007. Mike has prosecuted hundreds of patents through the US Patent Office and many foreign patent offices. Mike's current practice involves more general client counseling and management, including assisting clients with corporate, employment, litigation, as well as IP portfolio management. Mike is a member of the Missouri bar and the USPTO bar. Mike serves on the Board of Directors of the Alpha Iota Education Foundation and enjoys golf and hikes with his family across the country.



DAVID NEELY

David Neely of St. Louis, MO, Senior Director Program Chief Engineer T₇A of Boeing Defense, Space and Security-Air Dominance, earned a bachelor's degree in mechanical engineering in 2004 from the University of Missouri-Rolla (UMR). Dave Neely is the Program Chief Engineer of the T₇A Red Hawk Trainer. He leads the engineering team working on the Flight Test, EMD and LRIP portions of the T₇A Advanced Pilot Training along with development and implementation of the Ground Based Training Devices. Prior to this role he was the Senior Director of Manufacturing and Safety in Phantom Works. In that role, he led the development of the future production system along with the material readiness and production hardening activity. He was responsible for program stand up and prototyping in St. Louis, Mesa, and Philadelphia. In other roles he was the Enterprise Technology Integration Director. He leads program and project reviews on center R&D technologies as well as managing Enterprise Technology Programs. The Director of Autonomous Behaviors for Boeing Research and Technology where he was part of the transformation of Boeing R&D and led one of the Enterprise Technology Programs which focus on development and delivery of products and capabilities to programs. Prior to that, Dave was the Director of Engineering for Boeing NeXt, an organization that was laying the foundation for a next-generation mobility ecosystem in which autonomous and piloted vehicles can safely coexist. Dave was responsible for managing cross-enterprise engineering teams and bringing engineering support to NeXt's Future Mobility programs. He has held various leadership roles across the company. Dave was Chief Engineer for the Boeing NeXt Cargo Air Vehicle Program. In this role, he focused on technical design, build and test spirals to increase the pace of learning while working to shape the future market. He served as Senior Manager for the Integration of Advanced Operations and Quality in Boeing's Phantom Works. He has held various leadership roles across the company and his work has supported the F-15 Eagle, C-17, and 777X programs, among others. Neely also holds a master's of business administration from Washington University. He joined Boeing in 2005.



JACK PENNUTO

Jack Pennuto of Shelby Township, MI, President of KUKA Robotics Corp., earned a bachelor's degree in mechanical engineering in 2004, and a master's degree in mechanical engineering in 2005 from the University of Missouri-Rolla (UMR). Jack joined KUKA Robotics as President in 2023, overseeing all engineering, sales, and service activities in the United States. He currently serves on the Board of Directors for the Manufacturing Futures Institute at Carnegie Mellon University. For the prior five years he was the Director of Sales & Applications for TRUMPF Laser Technology, located in Plymouth, Michigan. At TRUMPF he was responsible for applications, sales, and industry management for the North American region. Before that, Jack worked for twelve years at Mestek, Inc., and its subsidiaries, in various roles across application engineering, project management, sales, and corporate development. He served the last three years as Sr. Vice President. Originally from Chicago, Jack came to Rolla to study mechanical engineering and swim. As an undergraduate, he was a 23 time All-American, Gale-Bullman Award winner, NCAA Postgraduate Scholar, and later served as an Assistant Swim Coach during graduate school.



BILLIE F. SPENCER, JR.

Billie F. Spencer, Jr. of Urbana, IL, Professor and Newmark Endowed Chair in Civil Engineering of University of Illinois Urbana-Champaign, earned a bachelor's degree in mechanical engineering in 1981 from the University of Missouri-Rolla (UMR). Upon graduating from UMR magna cum laude, Bill continued his education at the University of Illinois at Urbana-Champaign in the Department of Theoretical and Applied Mechanics. He then spent 17 years teaching at the University of Notre Dame before returning to Illinois in 2002. The focus of his research and teaching activities is structural dynamics. His greatest sense of professional accomplishment is found in the successes of his students. Bill is an avid radio control airplane pilot, currently serving as the president of the Champaign County Radio Control Club. His favorite planes are warbirds, particularly his giant-scale P-47 Thunderbolt, and P-51D Mustang.



DARRIN L. TALLEY

Darrin L. Talley of Spring, TX, Vice President of Corporate Strategy & Planning in Exxon Mobil Corporation, earned a bachelor's degree in mechanical engineering in 1988 from the University of Missouri-Rolla (UMR). Darrin has had a diverse career at ExxonMobil across a range of assignments with varying geographic, business and technical scope. He has worked in supply and logistics in South America and Asia, managed refineries in Texas and Singapore, and served as President of ExxonMobil's Research and Engineering company. He assumed his current position as Vice President, Corporate Strategy & Planning in 2022. Darrin also earned an MBA from the University of Pittsburgh. He serves as the Chair of the University of Houston's Energy Advisory Board which is composed of energy industry experts and leaders serving to advance energy education and research.



Pictured, from left, are Dr. David Bayless, Travis W. Hartman, Dr. Raj Jayachandran, David Neely, Dr. Billie F. Spencer, Jr., Michael Munsell, Darrin L. Talley, Jack Pennuto, John T. DeRuntz (President of AMAE 2024-25)



FUTURE-READY LABS: PROGRESS, PARTNERSHIPS, AND OPPORTUNITIES

To date, the campaign has received \$121,000 including funds allocated from our existing AMAE accounts and generous matching gifts from Craig Barnes.

The Mechanical and Aerospace Engineering (MAE) Department at Missouri University of Science and Technology (Missouri S&T) has initiated the “Future-Ready Lab Renovation Campaign” to upgrade its facilities and accommodate increasing student enrollment. The campaign aims to enhance experiential learning by providing state-of-the-art equipment and spaces for students and faculty.

Significant advancements have been made in two critical laboratories:

Aerospace Experimental Labs: Through the efforts of Academy of Mechanical and Aerospace Engineers (AMAE) member Jacopo Frigerio and Van’s Aircraft, the department has acquired a wing and center section to enhance wing bending experiments. The upgraded experiment is scheduled to be available to students at the start of the Fall 2025 semester.

Mechanical Controls Labs: Collaborations within the department have led to finalized layouts and investment plans. The goal is to complete the lab in Rolla by August 2025. Dr. Doug Bristow, director of the Control Systems Lab, highlighted that the upgrades will introduce new PLC automation experimental platforms and modernize the space with new furniture. These improvements aim to expose students to the latest hardware and software for automation, preparing them for advanced networked automation solutions.

As of December, 2024, the campaign has secured \$121,000, which is one-third of the target amount. This includes funds from existing AMAE accounts and generous matching gifts from Craig Barnes. Mr. Barnes has pledged a \$150,000 matching gift, doubling contributions as long as matching funds remain available.

The department invites alumni and friends to support the campaign. Donations can be made through various channels, and contributors are reminded to seek any available company matching support. Additionally, leveraging professional networks to engage companies and other potential donors is highly encouraged. For assistance with non-cash donations, individuals can contact Tom Turpin in S&T Advancement.

The Future-Ready Lab Renovation Campaign is making substantial progress toward enhancing the MAE department’s facilities to support its growing student body and advancing research capabilities. Continued support from alumni, friends, and partners is crucial to achieving the campaign’s goals and ensuring that Missouri S&T remains at the forefront of engineering education.



Make a donation at go.mst.edu/amaespecialproject

INSIDE THIS ISSUE

1 MAE by numbers

2 Faculty and research areas

4 Faculty achievements

10 Student successes

14 Academy updates

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