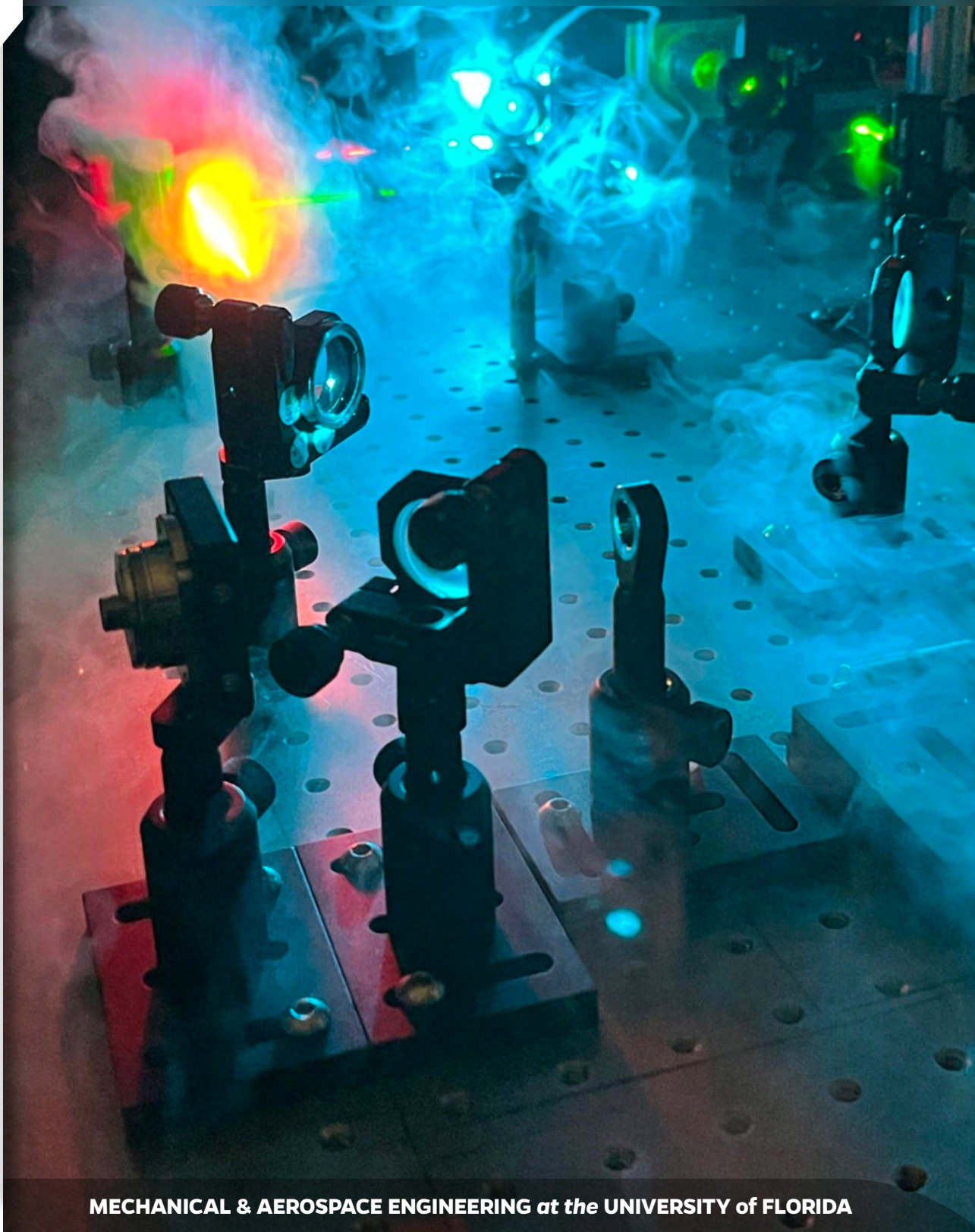
UF

MAEmomentum

2024

NEXT GENERATION OF TRAILBLAZERS

UF MECHANICAL & AEROSPACE ENGINEERING NEW FACULTY ARE FORGING NEW PATHS TO SUCCESS THROUGH GROUNDBREAKING RESEARCH, CREATING STUDENT SUCCESS, AND TRAILBLAZING NEW IDEAS IN ENGINEERING.



MECHANICAL & AEROSPACE ENGINEERING *at the* UNIVERSITY of FLORIDA

MAE *momentum* is a publication of the Department of Mechanical and Aerospace Engineering at the University of Florida.

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From Our Chair

I would like to personally thank you for taking the time to read our MAEMomentum 2024 Magazine. This magazine is our second annual magazine for the department. With a new semester in full swing, opportunities are available for us all to lean in and welcome new and exciting ventures that lie ahead of us.

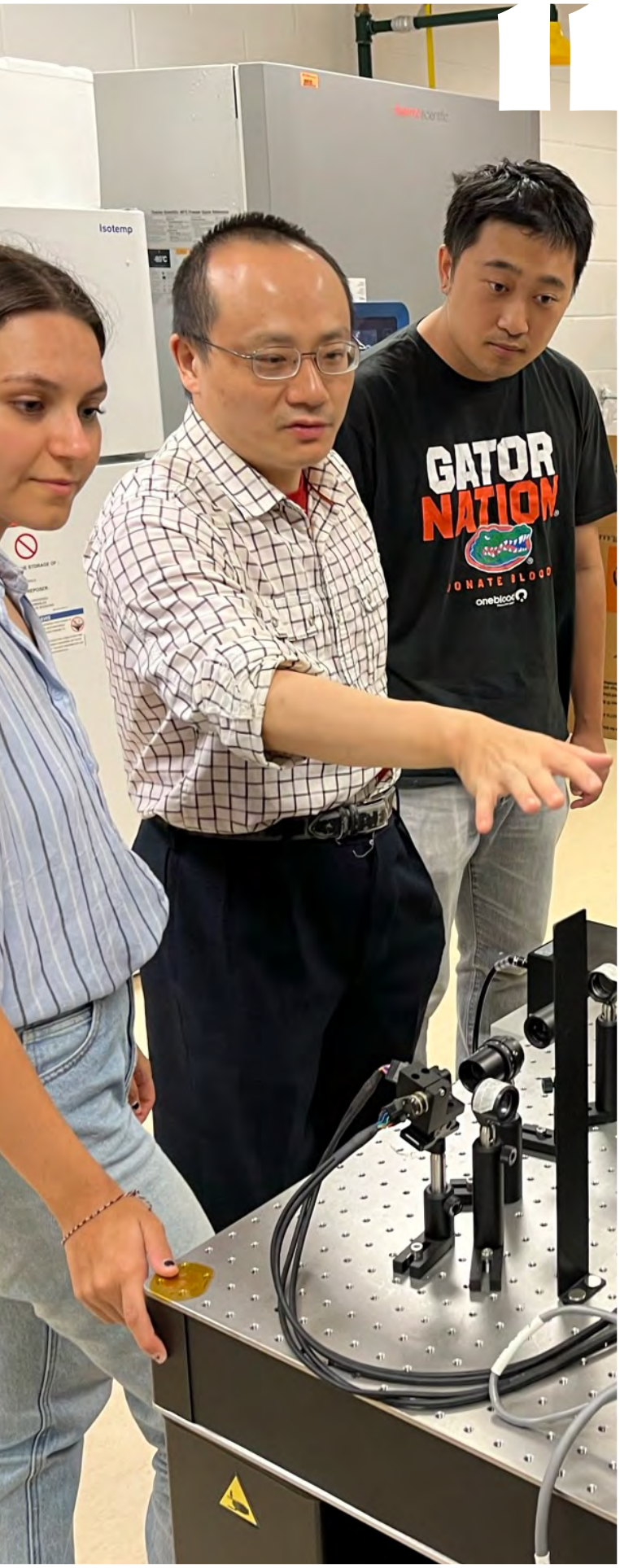
This edition's feature story focuses on our incredible next generation faculty who are trailblazing new ideas in Engineering, forging new paths to success through groundbreaking research, and creating pathways for student success.

The future success of the Department of Mechanical and Aerospace Engineering (MAE) is poised for remarkable growth and achievement. Our ongoing new faculty searches signify a commitment to assembling a diverse and talented team that will invigorate our academic programs and research endeavors. Concurrently, our efforts in increasing student recruitment will ensure a vibrant and dynamic community within MAE, fostering creativity and collaboration. Moreover, our focus on groundbreaking research initiatives, coupled with strategic collaborations with industry partners, will yield impactful innovations and solutions to complex engineering challenges. As we strive for excellence, the dedication of our highly productive staff will continue to elevate MAE to the highest echelons of academic and professional achievement, positioning us as leaders in the field of mechanical and aerospace engineering. The collective synergy of these efforts promises an exciting trajectory of success and influence for our department in the years ahead.

MAEMomentum showcases the collaborative effort from our staff, faculty, and alumni to shoot for the stars and continue to show excellence in their work every day. On behalf of the faculty and staff of the department, I want to thank our MAE alumni for their commitment to excellence in creating the top tier standard that our department has today.

It is indeed a great time to be a Gator Engineer!

Warren Dixon, PhD
Distinguished Professor
Dean's Leadership Professor and Department Chair



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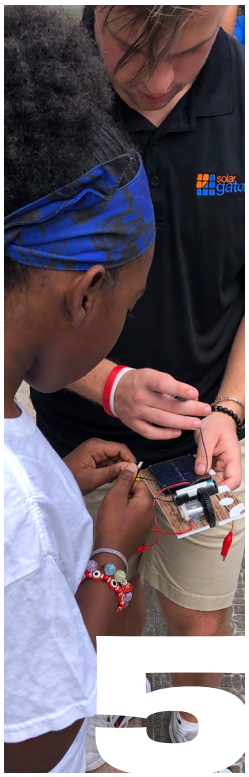


MAE
UNIVERSITY OF FLORIDA

Active Federal & Industry Grants
145

Research Expenditures
20.4M

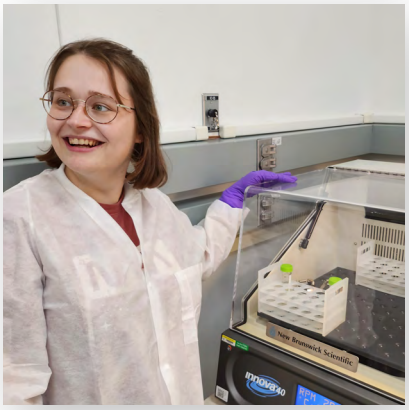
Active Grants Over $1M
19

A CLOSER LOOK

The University of Florida Department of Mechanical and Aerospace Engineering is unwaveringly committed to cultivating a dynamic ecosystem of learning, collaboration, discovery, and innovation. We aspire to shape generations of visionary engineers and pioneer solutions to Florida's and the world's grand challenges. We are committed to being leaders in education, pioneers in research, and drivers of economic impact. We are catalysts for transformative change in mechanical and aerospace engineering and beyond. Ultimately, we aim to shape the future of our fields and to inspire a new era of engineering possibilities, creating a better world for all.

2,701
Enrolled

4
Forbes ranks UF No. 4 among the nation's best public universities



47%
of undergraduate MAE students are from underrepresented groups

25%
of undergraduate MAE students are female
% of engineers that are female nationwide:
mechanical engineers = 10.1%
aerospace engineers = 15.2%

7
7 Distinguished Alumni added in 2024

Above:
Swamp Launch Rocket Team Members

ENGINEERING IMPACT: MAE STUDENT GROUPS EMPOWER COMMUNITIES

Swamp Launch Rocket Team

The Swamp Launch Rocket Team at the University of Florida's Mechanical and Aerospace Engineering Department plays a crucial role in bridging the gap between advanced engineering education and the local Gainesville community. Their outreach initiatives, such as the educational event held last spring, demonstrate their commitment to inspiring and engaging the younger generation in STEM fields. By hosting approximately 50 students from Queen of Peace and Prince of Peace academies, the team provided a hands-on introduction to rocketry, allowing these young learners to experience the thrill of engineering firsthand. The event began with an informative PowerPoint presentation on rocketry, followed by a practical session where the students built their own rockets. This hands-on approach not only sparked curiosity but also provided a tangible understanding of engineering principles. A tour of the Mechanical and Aerospace Engineering labs offered students a glimpse into the cutting-edge projects and sophisticated machinery utilized at UF, reinforcing the connection between academic theory and real-world application. The day culminated with a rocket launch at Flavet Field, where students could see their creations in action. This final activity was a powerful demonstration of the learning process and the excitement of engineering achievements. By organizing such events, the Swamp Launch Rocket Team fosters a sense of wonder and possibility among young students, highlighting the importance of community engagement in cultivating future innovators and engineers. Their efforts not only support educational growth, but also enhance the community's appreciation for science and technology.

Below:
Students at Queen of Peace Academy, building rockets with Swamp Launch Rocket Team

Left: Students participating in race car building activity with Solar Gators

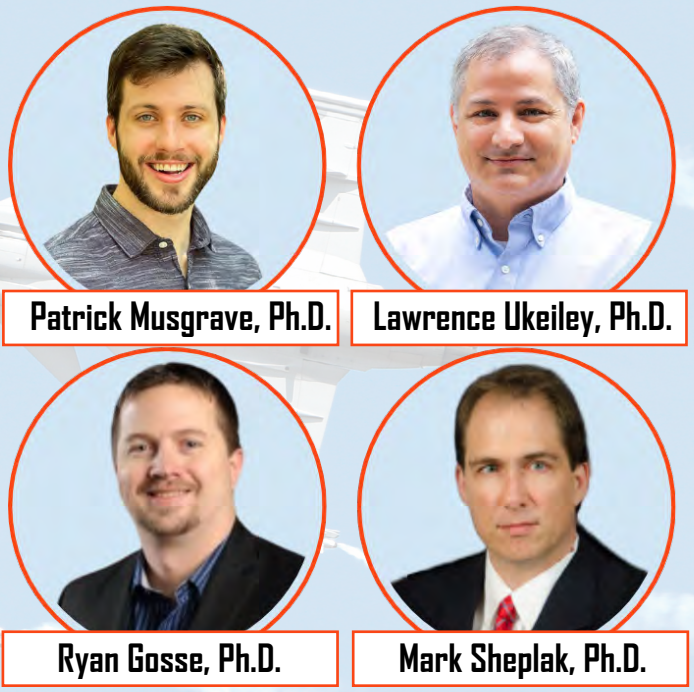
Solar Gators

The Solar Gators team at the University of Florida's Mechanical and Aerospace Engineering Department significantly contributes to the Gainesville community through their outreach efforts with local elementary and middle school students. By partnering with organizations that promote community engagement, such as Hands On Gainesville, they have extended their impact to schools like Howard Bishop Middle School, the North Central Florida YMCA, and the One Room Schoolhouse. These collaborations allow the Solar Gators to introduce young learners to the fundamentals of engineering and renewable energy, offering a glimpse into the innovative work being done at UF, while engaging students in interactive and educational activities. The team's commitment to fostering a passion for STEM extends beyond local schools, as evidenced by their virtual outreach efforts aimed at reaching children in broader areas. By demonstrating their solar car and facilitating hands-on engineering activities, the Solar Gators not only inspire students but also promote the value of engineering education. These community-focused events are crucial in shaping the future generation of engineers, helping to spark interest in STEM fields and providing students with the tools and motivation to pursue their own scientific and technological aspirations.

UF collaboration on new RESEARCH CENTER OF EXCELLENCE: Air Force awards $5M to FAMU-FSU College of Engineering

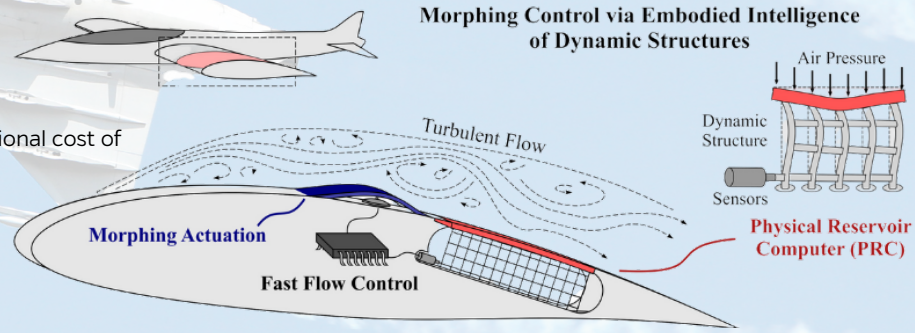
At the University of Florida, the Engineering faculty are buzzing with excitement as news spreads of their latest achievement in aerospace engineering. Collaborating with the Florida A&M University-Florida State University College of Engineering, UF has secured a prestigious $5 million grant from the Air Force Office of Scientific Research. This funding establishes the "AEROMORPH: Aerospace Morphing via Integrated Sense, Assess and Respond" Center of Excellence (COE), aimed at revolutionizing high-speed flight and morphing aerospace vehicles.

Dr. Musgrave working with students in his lab.



Key UF researchers on the 5 million dollar grant from the Air Force Office of Scientific Research

"In this COE, we will establish how the embodied intelligence of a physical structure can sense and respond to unsteady flows. By harnessing this intelligence, a vehicle's physical body will be able to quickly react to vortices and shockwaves, yielding greater agility at a fraction of the computational cost of current methods," explains Patrick Musgrave, an Assistant Professor in Mechanical and Aerospace Engineering at UF.



Managed by Florida State University under the leadership of Dr. William Oates, the center will delve into morphing structures, distributed sensing, and advanced control systems critical for next-generation aerospace technology. Lawrence Ukeiley, Professor in Mechanical and Aerospace Engineering at UF, details their approach: "We will characterize what is sensed by the physical body and link it to specific unsteady flow phenomena, which could be used for flow control or vehicle control. The characterization will be embedded in data-driven approaches using both stochastic and machine learning methodologies. Additionally, we will use other information metrics to understand the robustness of the output signals."

As the project gains momentum, the University of Florida will contribute significantly to the future of aerospace innovation, bridging academia with the pressing needs of national defense and civilian aerospace sectors alike. Musgrave emphasizes the collaborative nature of the endeavor, highlighting opportunities for students and researchers to work directly with scientists at the Air Force Research Laboratory (AFRL) at both Eglin Air Force Base in Florida and Wright-Patterson Air Force Base in Ohio. "This COE will provide opportunities for undergraduate and graduate students to participate in cutting-edge interdisciplinary research and contribute to the Air Force mission."

The key researchers on this grant from the University of Florida include Patrick Musgrave, Lawrence Ukeiley, Ryan Gosse, and Mark Sheplak.

With NASA Funding: Dr. Jacob Chung Blazes A Trail to The Stars

As humanity presses on in the greatest and most ambitious adventure in its history, as our species extends its presence in space and travels ever farther into the wondrous depths of the universe, Dr. Jacob Chung continues to live and thrive on the cutting edge of what is possible.

Chung's influence on the quest of exploration at the final frontier is so crucial. NASA has given the MAE professor $5.3 million in research grants over the past 20 years, and he also made UF a national hotspot for NASA's cryogenic thermal-fluid management program.

"For thermal management, my lab at the University of Florida is the most advanced, the pioneering lab in NASA," he said. "What I feel very proud of is, I put the University of Florida on the map of NASA's thermal management system."

The main focus of Chung's lab is the management, transport, handling, and storage of cryogenic propellant fluids in terrestrial, reduced gravity, and microgravity conditions alike. The real-world impact of this research is invaluable to the space travel industry because cryogenic propellant fluids are used in the life support systems, thermal management, power, and propulsion of spacecraft. A reliable supply of these fluids is critical for space missions, and therefore, the fluids must be managed effectively.

The propellants are liquid oxygen and liquid hydrogen, which both must be maintained at extremely cold temperatures in order to stay liquid (about -200˚C and -270˚C, respectively). The liquid fuel combustion system in engines involves mixing the oxygen, which acts as an oxidizer, and the hydrogen, which acts as a fuel, and the ensuing combustion provides thrust for the engine. Transporting the propellant from storage tanks to the engine, however, is difficult because the transferring pipes are usually around room temperature, and the engine could get damaged if the propellant isn't still in liquid form. The challenge of chilling down the pipes and controlling the cooling of the propellants is a vital part of the processing procedures that Chung works on designing and is the focus of one of his lab's three main projects.

The second project has a similar aim, but applies to chilling down the storage tanks for the propellant. In the case of the pipes, they can utilize the forced flow of the liquid to cool them down, but this method isn't feasible for the storage tanks. Instead, they use a cold spray on the walls of the tank to chill it.

The third project is about developing and manufacturing a coating or special surface for the storage tanks that would prevent pool boiling by controlling the number and type of nucleation sites, where micro-bubbles form in the liquid.

All three of these projects are providing research that will be indispensable to space missions as they aim to send humans increasingly far from home. Chung said that the most gratifying part of conducting his research is achieving new findings and contributing knowledge that no one has known before.

"If you're a researcher, and your mission is to find out the heat transfer process, or whatever physical phenomenon, you don't know. So that's what the joy is," he said. "You discover something which has not been known before."

Since the launch of his time at UF in 1998, Chung's work and research has rocketed to heights as dizzyingly impressive as the cosmos itself. After pioneering space cryogenic thermal management research, his lab remains the most well-equipped facility nationwide in this field. The expertise and demonstrated accomplishments of the lab are similarly unmatched.

In addition to this, his achievements include earning the College of Engineering Research Excellence Award (1988, while on the faculty of Washington State University), the UF Herbert Wertheim College of Engineering Doctoral Dissertation Advisor/Mentoring Award (2008), and the ASME Heat Transfer Memorial Award (2014). He has also authored and co-authored over 170 journal papers and one book, is a fellow of the American Society of Mechanical Engineers (ASME), and is a member of the American Association for the Advancement of Science.

2022 UF Pool Boiling and Helium Subsurface Pressurization Microgravity Flight Experiment Team

Gator Engineers are Bringing Home Gold:
The Medal-Worthy Successes of Our Faculty

Our distinguished faculty are reaching new heights in their fields. Like Olympians chasing gold, these exceptional professors have achieved remarkable milestones through groundbreaking research and transformative teaching, embodying a spirit of dedication and excellence. On the global stage of academia, they inspire, lead, and set new standards, shaping the future of engineering through their pursuit of knowledge, innovation, and mentorship.

The ASME Fluids Engineering Award, established in 1968, is a prestigious honor that recognizes excellence in fluid dynamics and brings distinction to institutions, like UF's department of Mechanical and Aerospace Engineering. Dr. Balachandar's receipt of this award, presented by the Fluid Engineering Division, celebrates his pioneering work in multiphase flows. His achievement highlights the department's role in advancing fluid engineering and inspires future engineers.

Professor SA Sherif won the prestigious 2024 ASME Frank Kreith Energy Award. This esteemed accolade, established in 2005, celebrates individuals whose pioneering efforts significantly propel society towards a secure energy future, particularly through innovations in conservation and renewable energy.

Professor Jacob Chung won the Exceptional Public Service Medal from NASA last month. The award is among the highest honors bestowed by the NASA Glenn Research Center Awards Office and is an acknowledgement of significant contributions to NASA's mission and purpose.

Professor John Schueller won the Cyrus Hall McCormick - Jerome Increase Case Gold Medal, from the American Society of Agricultural and Biological Engineers. One award is given every year to "Honor exceptional and meritorious engineering achievement in agriculture that has resulted in new concepts, products, processes or methods that advanced the development of agriculture."

Professor Yong Huang won the The Albert M. Sargent Progress Award, established by the Society of Manufacturing Engineers (SME), honors individuals who have made significant contributions to the field of manufacturing. This award highlights advancements in manufacturing technologies, processes, and research that push the boundaries of what's possible in the industry.

Photo credit: ACerS

Professor Ghatu Subhash won the 2024 Murray Medal from the Society for Experimental Mechanics . This is the highest award in the SEM. He also won the 2024 James I. Mueller Memorial Award, the highest award bestowed by the Engineering Ceramics Division of the American Ceramic Society for his significant contributions to the field of engineering ceramics. Prof. Subhash gave conference plenary lectures at the annual technical meetings of these Societies.

Advancing Material Science: Professor Subhash's Legacy in Research, Innovation, and Mentorship

For decades, Prof. Subhash and his students have pursued investigation into the dynamic behavior of ultrahard ceramics and transparent materials which have broad applications in a variety of industries as high temperature resistant materials and protection materials against impact and blast. Their research brought thermodynamic perspective and highlighted the role of temperature in the observed anomalous deformation behavior of boron carbide under shock loading, an issue that remained unresolved for almost a quarter century. Their research has also provided a mechanistic rationale to elaborate the superior impact behavior of certain transparent ceramics compared to single crystal materials which have better mechanical properties but inferior impact resistance to the former. Prof. Subhash has also used his expertise to investigate the reasons behind the impact resistance of

Prof. Subhash in discussion with a former student on his patented test method the "Dynamic Hardness Tester"

America's oldest fort, the Castillo de San Marcos in St Augustine, Florida, during the seize of 1702 by the British. By comparing the impact responses of other relevant materials and their properties, they rationalized why Coquina, the material with which the Spanish fort was built, remained intact despite cannonball assaults by the British. These research results formed the core of his James Mueller Award Lecture of the American Ceramic Society (ACerS).

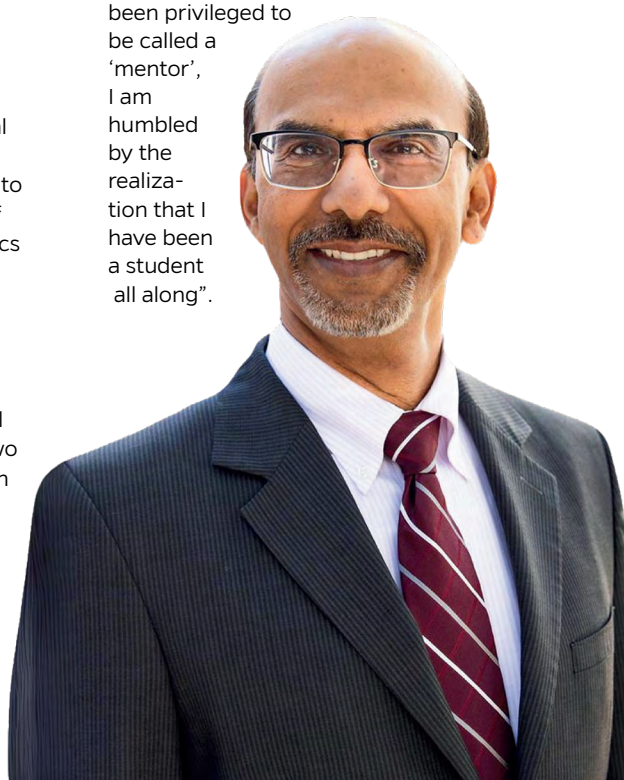
In addition to the above prestigious award, Prof. Subhash has received numerous accolades from many professional societies including the 'Significant Contribution Award' by the American Nuclear Society (ANS) for developing net-shaped nuclear fuel pellets. His commitment to education has resulted in SEM 'Frocht Award' for outstanding achievements as an educator, UF College of Engineering 'Teacher/Scholar of the Year', 'MAE Researcher of the Year', American Society of Mechanical Engineers (ASME) Student Section Advisor Award, 'Society of Automotive Engineers (SAE) Ralph R. Teetor Educational Award', American Society for Engineering Education (ASEE) 'Outstanding New Mechanics Educator' award, and 'Commendation Letters' from the Michigan Legislature and the Governor. Prof. Subhash is a Fellow of ASME, SEM and ACerS, and currently serves as the Editor-in-Chief of an international journal, 'Mechanics of Materials'.

"I dedicate these prestigious awards to my students who have been the bedrock of my success. Their creativity and hard work have brought these recognitions to me. I have been fortunate to have many intelligent students pursue graduate studies under my supervision. They have risen to the challenge every time and solved some complex problems in my field", Prof. Subhash said.

Prof. Subhash works closely with his students to develop innovative experiments and model material behavior. They have developed new techniques to test soft materials (e.g., polymer gels) under dynamic conditions and investigated damage development due to single bubble cavitation and collapse in biological tissues (e.g., brain tissue). In addition to developing comprehensive mechanistic models to describe their behavior under multiaxial loading, they have also created a new experimental tool called 'Millipede bar' to reduce the capital cost and footprint of dynamic testing equipment. These topics formed the foundation for his Murrey Lecture at the Society for Experimental Mechanics (SEM) Annual Conference.

Prof. Subhash and his students have co-authored 220 peer-reviewed journal articles, 80 conference proceedings, two books, 6 book chapters and 7 patents in the areas of mechanics, physics, chemistry, and materials. He has delivered hundreds of talks at international venues and universities across the world, and delivered 2-day specialized technical courses for engineers/scientists on 'Dynamic Response of Materials' at General Motors, Johns Hopkins University, and professional conferences. He has graduated/advised 41 PhD students,16 MS students and more than 50 undergraduate students. His undergraduate mentees have also conducted independent research, co-authored peer-reviewed journal articles, received prestigious NSF and DOD fellowships to pursue their PhD. His graduate students have received 'Best Paper' awards for their research at professional society competitions. His former students are employed at universities (in the US, China, and India), national laboratories, and in defense/automotive/aerospace industries. For his outstanding mentorship, he was awarded the UF Doctoral Dissertation Advisor/Mentoring Award (2021).

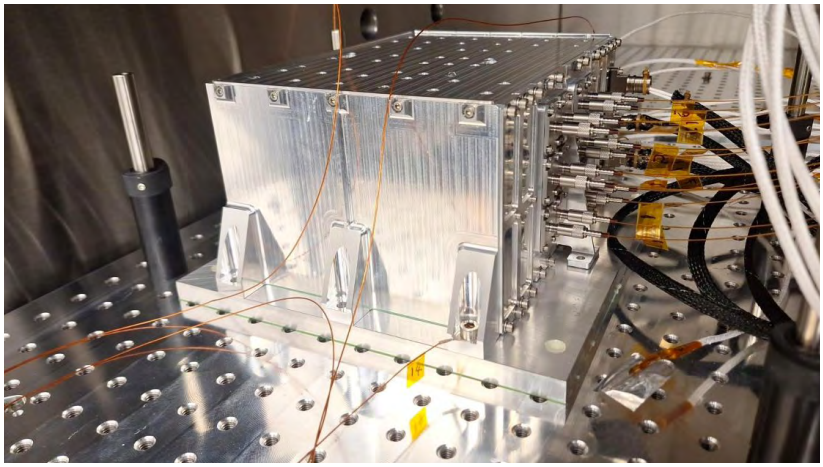
Professor Subhash's approach to successful mentoring of students can be epitomized in his writeup for 2021 UF Advisor/Mentoring Award nomination where he stated, "Although I have been a 'mentor' to many students, I must admit that my students have taught me more than I can ever thank them for. I have been blessed to have interacted with some of the most brilliant students in the US. I have benefitted immensely from their knowledge, skills, drive, and ingenuity. They have provided inspiration for many of the new ideas in my successful grant proposals. My students have been the bedrock of my professional success. Although I have been privileged to be called a 'mentor', I am humbled by the realization that I have been a student all along".



John Conklin, Ph.D.

UF to play key role in groundbreaking Laser Interferometer Space Antenna mission

The University of Florida's Herbert Wertheim College of Engineering, in partnership with NASA, is making a significant contribution to the Laser Interferometer Space Antenna (LISA) mission — a groundbreaking endeavor that the European Space Agency (ESA) has now formally adopted.



Each of the three LISA spacecrafts will be equipped with two of the Charge Management Devices like this prototype pictured above. Credit: UF/PSSL, Lea Bischof

UF is the only academic institution in the United States to be awarded a contract to develop hardware that will fly on the LISA mission.

LISA, set to launch in the mid-2030s, is an innovative gravitational wave observatory for detecting waves at frequencies beyond ground-based detector capabilities. It involves three spacecraft orbiting the sun, aiming to advance the understanding of the universe, including the origins and evolution of massive black holes. NASA's contributions include crucial technologies for LISA, with UF's Precision Space Systems Laboratory developing the Charge Management Device.

"The adoption of LISA marks a huge leap for astrophysics," said John W. Conklin, Ph.D., the principal investigator at UF's Precision Space Systems Laboratory. "Our Charge Management Device work showcases the Department of Mechanical and Aerospace Engineering's important contributions to NASA's mission."

The Charge Management Device, controlled by the spacecraft's computers, emits ultraviolet (UV) light with exact timing and intensities. The UV light is channeled through custom-designed, multi-core optical fiber cables to release photoelectrons from LISA's "test masses" (golden cubes that are freely floating inside the spacecraft without any physical contact). These cubes, acting as "gravity sensors," serve as end mirrors for laser beams that are integral in detecting gravitational waves.

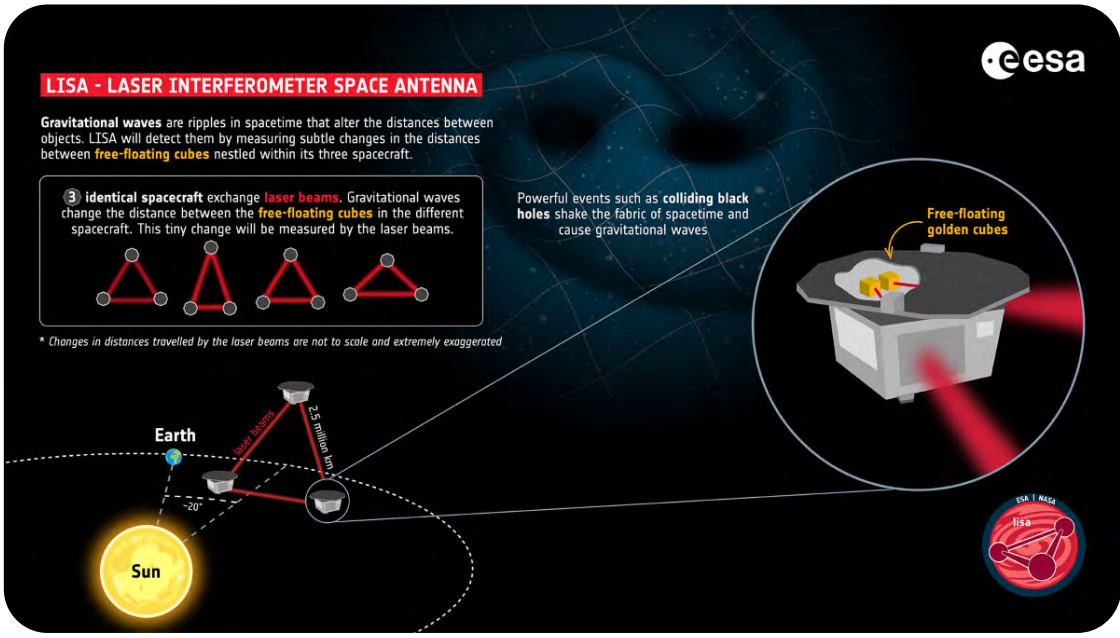
Maintaining the electrical neutrality of these gravity sensors is vital to minimize forces that could disrupt the accurate detection of gravitational waves. LISA needs to operate in an environment virtually free from any external forces — less than one-quadrillionth of Earth's gravitational pull. This level of sensitivity is comparable to detecting the minute weight of a single large virus or a small bacterium.

Each Charge Management Device uses 12 UV light-emitting diodes (LEDs), with six devices needed across three LISA spacecraft. The devices must operate reliably for the duration of the LISA mission and meet strict standards for weight and power.

UF's Department of Physics, within the College of Liberal Arts and Sciences, is also contributing to the mission by supporting the development of LISA's telescopes that will beam the laser between the spacecraft. This team's effort involves ensuring the telescope's dimensional stability against temperature fluctuations to a picometer scale.

"ESA's adoption of LISA paves the way for a deeper understanding of our universe," said Peter Wass, Ph.D., the program manager at the Precision Space Systems Laboratory. "At the University of Florida, we're deeply proud of our role in this groundbreaking mission."

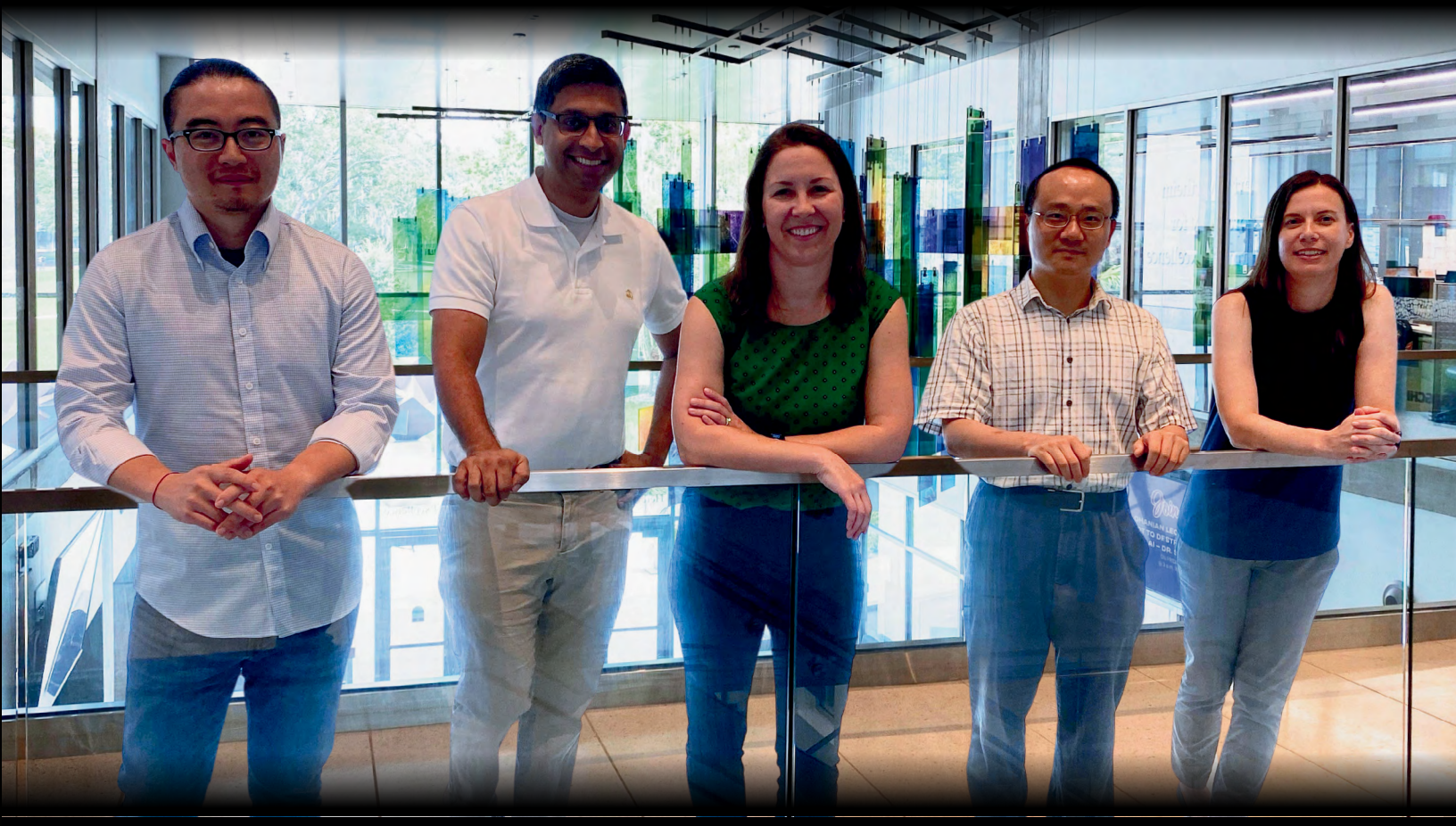
The LISA mission will revolutionize researchers' understanding of the universe, enhancing scientific knowledge beyond what can be obtained through electromagnetic waves. The University of Florida's involvement in LISA is a major contribution, offering unique opportunities for students and faculty. It positions the Herbert Wertheim College of Engineering at the forefront of aerospace engineering and scientific discovery, showcasing the university's dedication to pioneering research.



How the LISA mission will detect gravitational waves by using laser beams and free-floating cubes. Credit: ESA/ATG Medialab, CC BY-SA 3.0 IGO

NEXT GENERATION OF TRAILBLAZERS

The Next Generation of Mechanical and Aerospace Engineering Faculty is Marked by Assistant Professors Who Are Revolutionizing Biomechanics



The future of Mechanical and Aerospace Engineering brims with anticipation as our next generation of faculty pioneers groundbreaking research. With a blend of innovative ideas and cutting-edge technologies, these emerging scholars promise to revolutionize how we perceive and interact with the world around us. Their work holds the key to unlocking new frontiers in mechanics, space exploration, and beyond. With their passion and expertise, they're poised to push the boundaries of what's possible, ushering in an era of unparalleled discovery and advancement. The Department of Mechanical and Aerospace Engineering eagerly awaits the transformative impact of their research on our field, our students, and society as a whole.

Jessica Allen

UF MAE assistant professor Dr. Jessica Allen recently submitted a proposal that won her a CAREER Award from the National Science Foundation. The NSF presents this award to early-career faculty who "serve as academic role models in research and education and lead advances in the mission of their department or organization." It is a prestigious award presented by the NSF, and comes with a five-year federal research grant.

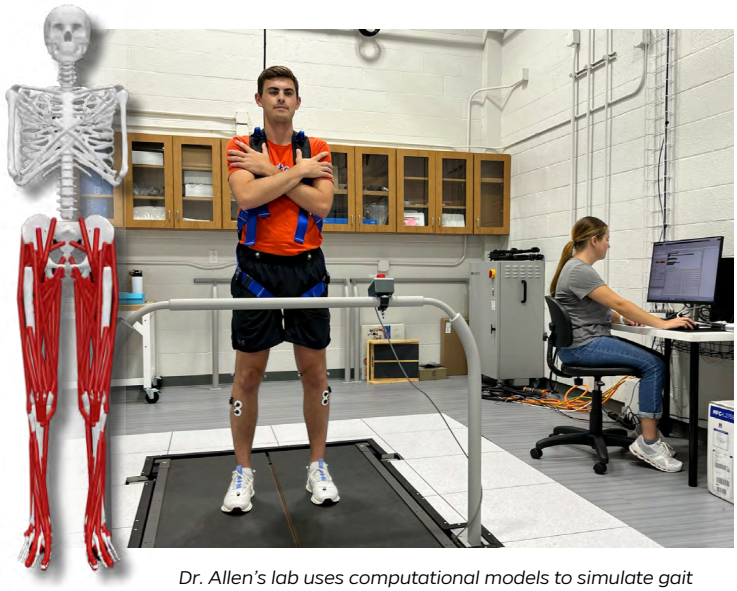
Allen's proposal was centered on developing better computational models for simulating gait rehabilitation. The computational modeling approach that Allen and her lab use is referred to as neuromechanical modeling, as it focuses on modeling the interactions between the nervous system and the "mechanical" system of muscles and bones. These models could allow for clinical simulations of certain rehab procedures or prosthetic devices on digital versions of patients, to best match the intervention to the patient's impairments.

"They hold a lot of promise to be implemented into clinical settings as a digital twin of an individual to improve rehabilitation design and prescription," Allen said. "But the current state of the art is that the process of simulating rehabilitation is not very good, and that's what we're trying to improve."

She explained that specifically, the existing optimization approach needs improvement. An optimization approach is essentially a method of identifying a problem and suggesting a target to aim for. For example, a stroke victim who has lost control of muscles in their legs could aim to optimize their balance and walking ability as suggested by a simulation.

"If you think about humans, they're very complex robots. Instead of having a motor at each joint, they have muscles, and that provides slight complications to how you might model it," she said. "You have many, many muscles, but only a few joints, and so you have to learn how to control all those muscles to achieve whatever your goal is."

However, current optimizations used in neuromechanical simulations are limited because they don't simulate the



Dr. Allen's lab uses computational models to simulate gait and balance rehabilitation.

rehabilitation process or take into account qualities of each individual's nervous system that may limit improvements during rehabilitation.

"Current approaches only tell us what is the impairment to target. They don't necessarily account for whether a person can make that change or how they would do so over time," Allen said. "What we want to do is model the rehab process over time and implement qualities of an individual subject that might influence how that trajectory might occur. The current state of the art might predict that they can totally walk normally after rehab, but given their current state, what is an actual realistic outcome?"

She said that the ultimate goal of this type of research is to develop models for rehabilitation design and prescription models that would eventually be used in real-world clinical applications.

"The motivation is to try to get this eventually into something that is feasible to help clinicians prescribe personalized rehab interventions or to help engineers develop better devices for rehab, and in a way that is accepted by clinicians and by patients," she said. "It's fun to do this stuff, but we don't want to just have our stuff happen on our computer, we want it to make its way out into the world. One of the things that we're trying to do with this award is find out from clinicians what they need to know or see from these to provide confidence. And then, what do patients need to know to be comfortable with a computer playing a role in their rehab process."

Allen noted that good communication between collaborators will be crucial as a key to reach that desired result.

"A lot of times, especially as engineers, we are prone to sitting in our silo. We may interact some with our clinical collaborators, but not quite enough, and so just providing opportunities to have more collisions and meaningful conversations, meaningful collaborations, and meaningful input going both ways I think will help a lot," she said.

Ultimately, Allen sees a bright future for this project and is eager to use this award and UF's outstanding resources to make an impact and bring positive change to the field of neuromechanical modeling.

"I'm optimistic. This is a project that I'm really excited about; I've

been thinking about doing this for a long time," she said. "I've only been at UF for two years, and moving to UF, with the people around as well as all the computational resources, the clinical nearness, I knew that it was going to enhance the feasibility for my group to be able to do these types of problems."

Amor Menezes

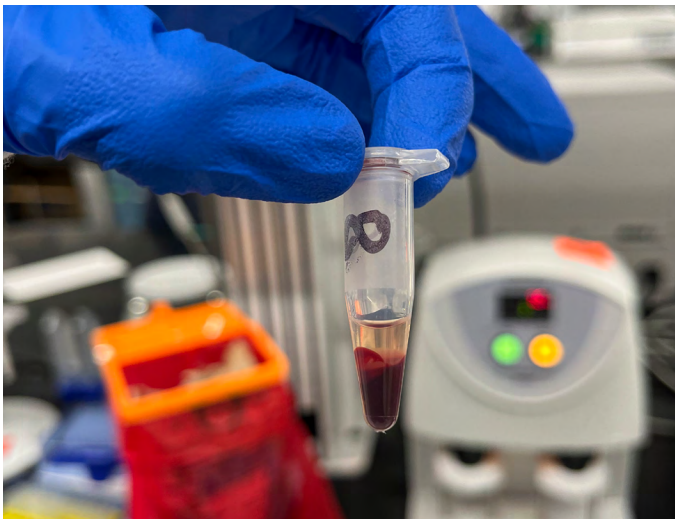
UF MAE associate professor Dr. Amor Menezes has won a CAREER Award from the National Science Foundation. This is the foundation's most prestigious award in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization.

Menezes received this honor for his work in the areas of modeling and control of biological systems. The proposal that won the award is titled "Enabling Functional Biological Programs."

The award will enable the systematic development of techniques and tools to accomplish artificial biological regulation. These synthetic programs will control biological protein and molecule production, and will profoundly impact human health, climate targets, energy supplies, food security, agriculture, supply chain resilience, and national security.

Menezes explained that there are complex biological interactions at multiple structural and temporal scales, as well as nonlinearities, stochasticity, non-modularity, and measurement difficulties when organisms are alive. Consequently, synthetic programs often have unintended behaviors and limited functionality. To increase program functionality, this project will add new control programs that are external to the biology, resulting in a "cyber-biological system." Output biological protein and molecule production will be regulated via external sensing, computation, and actuation.

"The research goal of this project is to further the state-of-the-art via a unique yet broadly applicable testbed of blood coagulation control," Menezes said. "This will enable functional programs for mammalian systems that have multiple interacting cells, proteins, and small molecules, and that encompass multiple functions and timescales while subject to multiple disturbances."



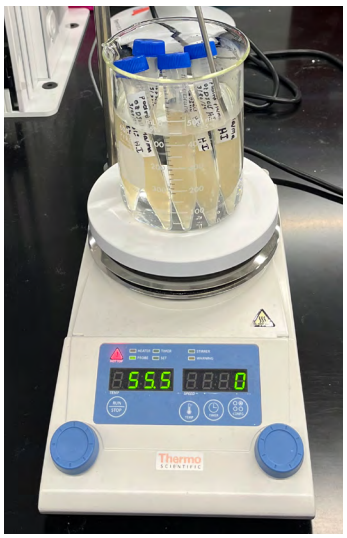
A whole blood sample prior to analysis

The project will address knowledge gaps in control, analysis, and diagnostics. Nonlinear control advances will apply to nonnegative systems beyond biology, such as manufacturing plants, thermodynamics, air traffic flow, multi-agent communication, network congestion, filtering, sampled data, and economics. Testbed experiments will drive integration.

"If successful, this project will be significant because it will directly facilitate the coming bioengineering revolution," he said. "My long-term goal is to create, deploy, and validate new technologies to control biological system performance at scale, to realize the immense societal and economical promise of such systems."

With the money from this award, Menezes also plans to raise awareness for the vast possibilities of biological control systems and to continue staying at the cutting edge of the field. One such effort is his coordination of a workshop, "Advances in Cybermedical Systems," to be held at the 2024 American Control Conference. While there, Menezes will speak about controlling coagulation, and will highlight some of the work for which he won the CAREER Award. Further educational outreach for this project will involve adding blood clotting concepts to a popular game to stimulate bioengineering interest in youth, increase clotting knowledge, and facilitate diverse student interactions.

Overall, Menezes expressed tremendous gratitude for the award. "I am incredibly honored and humbled to receive this award," he said. "I know that receiving it is really a reflection of the fantastic people around me who have been so very instrumental in my success, and I am truly grateful to them because my application would not have been awarded without them."



Left: Student analyzing clot strength in whole blood samples in Dr. Menezes' Lab.

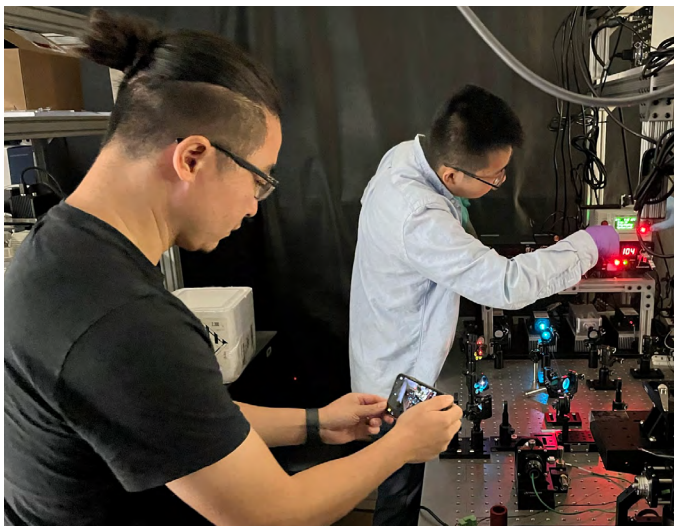
Right: A whole blood sample prior to analysis

Jing Pan

Dr. Jing Pan, a UF MAE assistant professor, won a CAREER Award from the National Science Foundation last month. This honor is the most prestigious award for early-career faculty granted by the NSF, and comes with a federal research grant.

Pan's winning proposal was about developing a biosensing technology for monitoring chemicals and biomolecules in bodily fluids, such as blood, sweat, or saliva. This technology will help patients with compromised immune systems, which cause a substantial number of deaths every year and are one of the costliest conditions to diagnose and manage. It will also allow medical professionals to make better clinical decisions with more information about the disease trajectory of patients.

Currently, most medical diagnostic tests only give a single point measurement, and getting the result usually takes hours, or even days. This is inadequate for patients who are unstable and who suffer from severe injuries or systemic immune malfunctions. In situations like intensive care units and emergency care, for example, patients' conditions can change more quickly than they can be measured. This issue was especially prevalent during the COVID-19 pandemic, during which many patients died due to a rapid deterioration of organ functions that was difficult for doctors to track.



Student aligning lasers for a biosensor platform being developed in Dr. Pan's Lab

"However, if we rush to interfere with the immune system blindly, we risk breaking the delicate balance in patients' bodies even faster, as disease trajectories and medical conditions differ from person to person," Pan said. "We really need a technology that can help us see the hidden dynamics in patients' bodies to enable adaptive and personalized medical interventions."

Pan explained that the main goal of his project is to develop sensors that can continuously monitor molecular indicators of immune status in the body.

"Similar to how, to use thermostats to control indoor environments, we first need to have sensors to measure the current temperature and humidity, if we want to better treat and control immune response to disease, we need to know its current status and past trajectory," he said. "This is difficult because immune effector molecules are usually in small quantities in our body, and it takes a long time to accurately measure low-abundance analytes in complex body fluids."

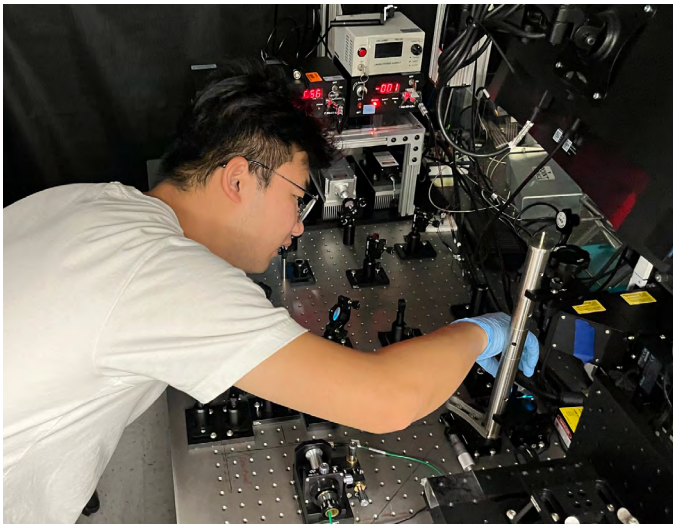
Pan and his Biodesign Lab work to develop cutting-edge biotechnology and medical technology with the purpose of addressing challenges in fields such as healthcare, the environment, and agriculture. Their technological focus is often on molecular devices and nanoscale tools, such as the nanoparticles they're creating for the NSF project that will serve as miniature sensors to continuously monitor the states of biological systems.

His team proposed a mechanism to combine nanomaterials, nanostructured surfaces, and novel biorecognition elements to achieve accurate and rapid measurement. They plan to develop a prototype device that can be used for continuous immune modulator monitoring at the point of care. That technology would be broadly applicable to the measurement of biomarkers across many different physiological processes.For example, they also plan to advance engineering education (which is an aspect of the CAREER Award) by using the technology they develop to better understand the anxiety students experience during exams.

"There are many theories and experimental studies to understand the cause and the consequences of test anxiety in engineering education, but most methods use self-reported survey instruments to measure stress and anxiety," Pan said. "We, in collaboration with Dr. Idalis Villanueva Alarcón from the UF Department of Engineering Education, propose to use biosensors to monitor the physiological component of anxiety, such as stress biomarkers in saliva, which is more objective and reflects real-time stress behaviors in students."

He also said that he intends to use this project as an opportunity to collaborate with physicians and clinical scientists in order to address clinical challenges and improve patient outcomes. "I'm excited," he said. "With the support from the NSF, now we can finally start developing the technology and benchmarking it with the current state of the art."

Student in Dr. Pan's lab builds prototypes to control laser light that transduces biological signals to digital signals.



Xin Tang

MAE assistant professor Dr. Xin Tang won three significant awards this past year, receiving grant money from the National Institute of Health (NIH), the National Science Foundation (NSF), and the Air Force Office of Scientific Research (AFOSR).

The NIH granted Tang a prestigious Maximizing Investigators' Research Award (MIRA R35), which essentially has the goal of increasing scientific productivity of early-career investigators by giving investigators stability and flexibility. This has the intended effect of encouraging more efficient use of funding to promote the career development of new investigators provided by the NIH's National Institute of General Medical Sciences. Tang's project for this grant aims to establish a solid theoretical foundation of mechanobiology and promote the innovation development of new therapeutic strategies that leverage these mechanobiological theories.

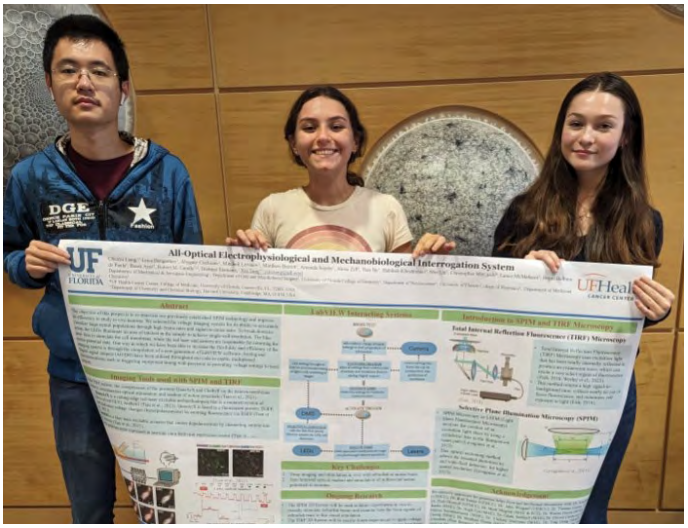
All cells in our bodies are affected by mechanical forces, which heavily influence the cells' intracellular biochemical signaling and gene expression. The process by which cells sense and transduce mechanical stimuli from their microenvironment into intracellular signaling and gene expression is called mechanotransduction, and the failure to properly regulate mechanotransduction is a key factor of various pathologies.

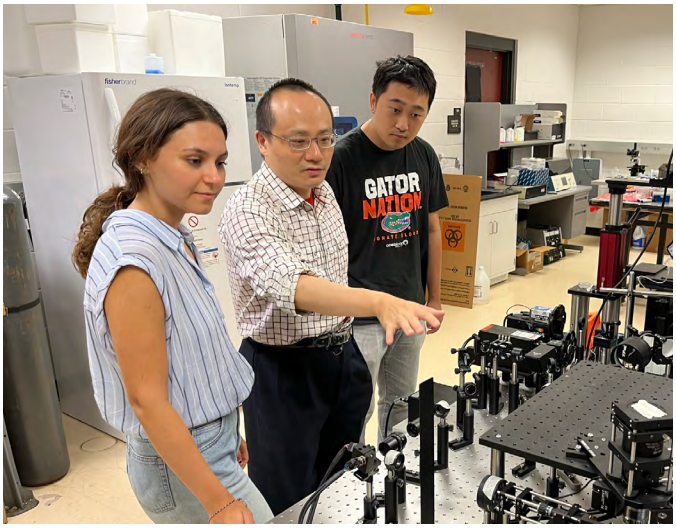
"Currently, a major knowledge gap in the biomechanics field is that how mechanotransduction takes place in cells is not understood," Tang said. "In this MIRA R35 project, we will create a multidisciplinary research pipeline to systematically elucidate the mechanotransduction process and to establish a theoretical foundation to bridge the knowledge gap."

He explained that the research pipeline will focus particularly on decoding the mechanically regulated biochemical waves and chaos in human tissue cells, since these biochemical waves link the extracellular mechanical forces with intracellular biochemical signaling, thereby serving as a functional nexus.

"The success of this project will enable tackling a variety of critical and challenging scientific questions regarding the interplay between mechanical forces and cell signaling," Tang said.

Award winning students of Dr. Tang's lab presenting BioPhotonics research.





Dr. Tang mentoring students on the scientific principles and functions of a customized optical microscopes in his lab.

For the NSF grant, his project will aim to create a novel experimental-computational framework that will enable optical interrogation of mechano-electrical dynamics of neurons in a mechanobiologically guided, multiscale, and non-invasive manner. Essentially, Tang's team hopes to develop a new mechanobiology-guided, all-optical, and machine-learning-powered system to measure multi-scale neural dynamics in mechanical microenvironments at an unprecedented speed. Dr. Kejun Huang of the Computer and Information Science and Engineering (CISE) Department will serve as a co-primary investigator (co-PI) with Tang on this project.

The dynamics of electrical signals are an essential phenotype of many cell types (especially neurons), serving as both a functional regulator to mediate neural behavior and as a physiological indicator of the cellular states of neurons in health or disease. Therefore, quantitative recording and manipulation of electrical dynamics in neurons could provide insights that would advance the current understanding of the function and behavior of nervous systems.

Like most living cells, neurons sense their surrounding biomechanical and biochemical microenvironments, and they respond to mechanical signals by adapting and changing their cellular states.

"However, past neurobiology research, in particular in vitro studies, has mostly studied neurons cultured in rigid petri dishes, which have dramatically different mechanical microenvironments compared to those in soft brains and peripheral tissues," Tang said. "As such, the physiological relevance of recorded membrane voltage dynamics in labs and neural behavior in nature remain unknown."

For the AFOSR project, Tang will research how the brains of vertebrates compute signals received by the eyes, and how they make corresponding cognitive decisions.

"We are all living in a dynamic world and need to make different decisions all the time, such as deciding which food to eat or which hotel to live in," Tang said. "A long-standing puzzle in neuroscience is how the brain senses and computes the eye-received signals to generate cognition and behavior. A deep understanding of this process will provide important insights of how our brain mechanistically functions and interprets our surrounding world."

For the project that includes Prof. Jose Principe as co-PI from the Department of Electrical and Computer Engineering (ECE), Tang plans to develop a synergistic experimental-computational platform to capture the electrical dynamics in a zebrafish's brain while the fish is sensing and computing visual signals. The zebrafish was chosen as the study sample because the species's brains are structurally and functionally similar to human brains.

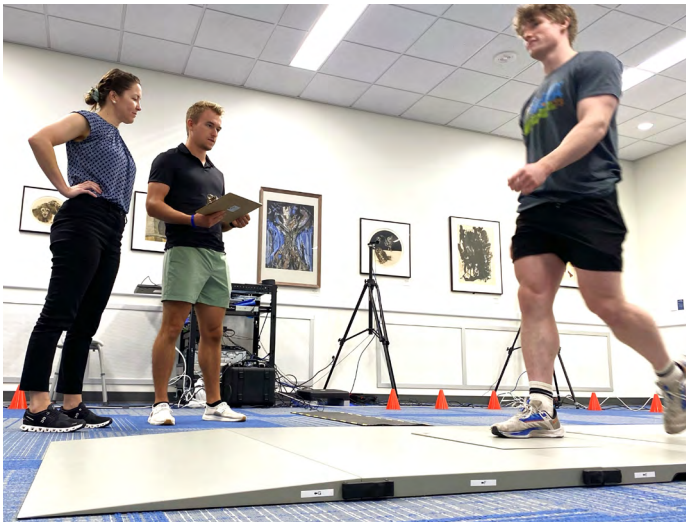
"The success of this project will bridge the current technology gaps and provide important answers to the critical knowledge gaps in understanding cognitive behaviors," Tang said.

Kerry Costello

Assistant Professor Dr. Kerry Costello, of the Department of Mechanical and Aerospace Engineering, is leading the charge in revolutionizing biomechanics research. Her work emphasizes leveraging cutting-edge technology and innovative methodologies to enhance our understanding of human movement.

Traditionally, biomechanics research has relied on small sample sizes due to the labor-intensive process of placing reflective markers on study participants for motion capture. Costello's research, however, is breaking new ground by utilizing technology that leverages advanced machine learning techniques to analyze high-speed video data.This approach eliminates the need for physical markers, enabling faster data collection and the potential for larger, more inclusive study samples. This advancement allows researchers to better account for variables such as age, sex, and disease severity, providing a more comprehensive understanding of biomechanics and its implications.

One of Costello's significant projects involves the development of a human movement databank (Florida Moves or FLoMo). This initiative aims to create a vast repository of human movement data, including demographics and clinical information, to facilitate extensive biomechanics research. This fall, Costello's team will deploy a mobile biomechanics lab to community locations through a Pepper Center pilot project grant. This project, called Shared Strides, is set to collect data from individuals with knee osteoarthritis at various sites, including UF, Oak Hammock, and



Dr. Costello and her team observe biomechanics of walking with portable force platforms, filmed by high-speed video cameras.

Dr. Costello's team captures biomechanics during typical activities of daily living.

the Gainesville Senior Center. By bringing data collection into the community, the project aims to increase participation accessibility, particularly for older adults and those with osteoarthritis. The goal is to generate larger sample sizes that will enable more precise analyses and interventions tailored to individual patient needs.

In addition to her community-focused efforts, Costello is actively engaged in analyzing physical activity related to knee osteoarthritis. Her team is examining data from the Multicenter Osteoarthritis Study (MOST) and conducting local data collections to understand how physical activity patterns influence disease progression. This research is supported by an Investigator Award from the Rheumatology Research Foundation, which has recently been renewed for a third and final year. These studies are critical in identifying how physical activity and wearable sensor data can be used to develop targeted interventions for osteoarthritis.

Costello's collaborative work extends to sports and joint health, where she partners with Orthopaedics, Physical Medicine and Rehabilitation, and UF Athletics. This research spans the spectrum from college athlete performance to recovery after injury or joint replacement. Her dedication to advancing biomechanics is mirrored by her commitment to mentoring future scientists. Her research group includes promising MAE Ph.D. students like Peter Schaefer, Ryan McCloskey, and Alexandra Chertok, along with undergraduate students such as Sean Leapley and Zoe Struk, who have been recognized with the MAE IDEA fellowship and UF AI Scholars awards. Through her groundbreaking research and mentorship, Kerry Costello is significantly advancing the field of biomechanics, paving the way for more effective treatments and interventions in human movement science.

ALUMNI NEWS

Above: MAE Distinguished Alumni in attendance at the 2024 MAE Annual Celebration of Distinguished Alumni & Awards Banquet

2024 MAE DISTINGUISHED ALUMNI

The Department of Mechanical and Aerospace Engineering at the University of Florida proudly recognizes seven distinguished alumni from the class of 2024, each exemplifying the highest standards of engineering excellence and leadership in their respective careers.

Ms. Shitarria Battle:
BSME '10
Ms. Battle serves as the Chief Engineer for the Command and Control, Battle Management, and Communications (C2BMC) Systems Development branch within the Missile Defense Agency. Her exceptional leadership in managing a $450M program involving over 100 personnel across multiple states highlights her technical prowess and strategic acumen in critical defense systems development.

Mr. Stephen Kowkabany:
MS '98
Mr. Kowkabany's diverse career in fire protection and process safety, leading him to serve as the Executive Vice President at Vertex, reflects his interdisciplinary approach and global impact in engineering solutions.

Mr. Bill Reuter:
BSA '84
Mr. Reuter's distinguished career as a Navy strike-fighter pilot and subsequent leadership in both coaching and organizational development underscores his commitment to leadership excellence and strategic business consultancy.

Dr. Benjamin Boesl:
BSAE '04; MS '09, Ph.D '09
Dr. Boesl has excelled as an engineer, materials scientist, and educator, contributing significantly to materials science and engineering research. His role as an Associate Professor and Associate Chairperson at Florida International University underscores his dedication to advancing knowledge and fostering collaboration in academia.

Dr. David Mills:
MS '10; Ph.D '14
Dr. Mills is the President of IC2, focusing on innovative precision instrumentation solutions. His expertise in microelectromechanical systems (MEMS) highlights his dedication to cutting-edge engineering applications.

Mr. Sean Dotson:
BSME '97
Mr. Dotson is a seasoned entrepreneur and executive in the industrial machinery industry. His success in founding and growing RND Automation into a prominent robotics and automation firm demonstrates his innovative spirit and commitment to advancing manufacturing technologies.

Mr. John Sullivan:
BSME '83
Mr. Sullivan's remarkable journey from Pratt & Whitney to Collins Aerospace, leading major systems on the Boeing 787 Dreamliner, showcases his extensive experience and impact in the aerospace industry.

MAE
UNIVERSITY OF FLORIDA

These distinguished alumni embody the values of the Department of Mechanical and Aerospace Engineering, showcasing excellence, leadership, and innovation. Through their outstanding achievements, they inspire current and future engineers, making significant contributions to their fields and communities. The department takes immense pride in their accomplishments and celebrates their exemplary careers as shining examples of what it means to be great engineers.

ENGINEERING THE FUTURE: STEVEN BOTWINIK'S TRAILBLAZING JOURNEY AT LOCKHEED MARTIN

The phrase "homegrown talent" is a familiar one to sports fans—and when it comes to Steven Botwinik, it applies equally well to aerospace engineering. From his beginnings as a University of Florida MAE student to his current role as Vice President of Advanced Programs Execution and Transition at Lockheed Martin's Sand Lake Road facility, Botwinik has had a productive and rewarding career in Orlando.

Botwinik received a Bachelor of Science degree in Aerospace Engineering in 1995. His immersion in UF's rigorous academic environment laid the groundwork for a career characterized by critical thinking, problem-solving, and a pursuit of knowledge.

After graduating, he joined Lockheed Martin as a full time employee, just weeks after Lockheed and Martin Marietta merged. He spent nearly a decade as a mechanical engineer, working on pilotage and targeting sensor systems for such iconic aircraft as the U.S. Army's Apache helicopter and joint-service F-35 fighter. His transition into strategic roles, including managing internal research and development efforts and spearheading business development initiatives, showcased his versatility and leadership acumen.
In his current role at Lockheed Martin's Missiles and Fire Control division, Botwinik leads an Advanced Programs team dedicated to pushing the boundaries of technological innovation. Under his leadership, the team has undertaken groundbreaking projects, from developing laser weapons that defeat incoming threats to revolutionizing missile propulsion systems for enhanced speed and range.

Despite his demanding schedule, Botwinik remains deeply connected to his alma mater, serving on UF's Dean's Advisory Board. Recognizing the importance of industry-academic collaboration, he mentors students and provides invaluable insights into the engineering profession, ensuring that future generations are well-equipped to tackle the challenges of tomorrow.

Botwinik's perspective on Florida's defense ecosystem underscores the state's pivotal role in national security. With its strategic location and robust infrastructure, Florida serves as a hub for innovation and collaboration in defense-related industries, with Lockheed Martin playing a central role in supporting the state's economy and defense capabilities.
For aspiring engineers, Botwinik offers sage advice gleaned from years of experience. He emphasizes the importance of seeking mentorship, gaining practical experience through internships, and nurturing a passion for continuous learning. By engaging with industry professionals and leveraging academic resources, aspiring engineers can chart a course for success in the dynamic field of aerospace engineering.

Steve Botwinik, Ph.D.

Steven Botwinik's journey from UF graduate to vice president at Lockheed Martin is a testament to the transformative power of dedication, expertise, and a relentless pursuit of excellence. His pioneering work in advanced technologies not only advances the capabilities of defense systems but also inspires future generations of engineers to reach for the stars. In the ever-evolving landscape of aerospace engineering, Botwinik stands as a hometown champion of innovation and leadership, guiding the way toward a brighter and more secure future.

MATT SOBIESKI WINS UF's 40 UNDER 40 AWARD

Matt Sobieski (BSAE '09, BSME '09) is a proud engineer, MBA graduate, management consultant, and operations leader who believes that strong relationships are the foundations for success. His degrees in aerospace and mechanical engineering from UF laid a strong analytical foundation that was further complemented by a globally recognized MBA from Emory's Goizueta Business School. Matt is an intentional and strategic leader who is passionate about helping others realize their full potential. As a consultant, he has helped dozens of companies streamline and simplify their operations, reducing inefficiencies, preserving jobs, and helping create positive working environments. He's inspired to make the world a better place to live and work in and he knows that starts with individual leaders doing their very best each and every day to foster an inclusive and supportive environment. This goes far beyond consulting with clients; as a member of the External Advisory Board, a mentor and executive coach inside and outside of work, Matt is determined to help people in his life achieve their very best. When Matt isn't working, volunteering, or spending time with his wife Katie and boys Peter and Wally, he enjoys traveling to new countries and restoring/repurposing old houses, furniture, and machines.

Matt Sobieski

"The time I spent at UF, like many, were some of the best years of my life and Gainesville is a place I cherish due to the lifelong friends and transformative experiences. To be recognized by an institution so near and dear to my heart is a highlight of my personal and professional life. When I looked at the profiles of my fellow classmates in the 40 under 40 group, I am both humbled and never prouder to be part of the Gator Nation."

UF MAE Alumnus Mitchell Waldman: A JOURNEY OF SERVICE, LEADERSHIP, AND INNOVATION

Mitchell "Mitch" Waldman's long and illustrious career practically brims with prestige and honor.

The UF MAE alum served for nearly 30 years in a variety of executive positions with the federal government, including as deputy assistant secretary of the Navy, director of cost engineering and industrial analysis for Naval Sea Systems Command, and deputy program manager for the Navy's Amphibious Warfare Programs. He achieved a prominent role on the nationwide stage when he became national security advisor to former Senate Majority Leader Trent Lott.

Moving to the private sector, he transitioned to Northrop Grumman, one of the largest aerospace and military technology companies in the world. There, he was the company's corporate director for acquisition policy before eventually becoming vice president of business development of advanced programs and technology for Northrop Grumman's Aerospace Systems sector. In that role, he worked to design the architecture, concepts, and opportunities for aircraft (manned and unmanned), space systems, and directed energy systems.

This was followed by a 10-year stint at Huntington Ingalls Industries, the largest military shipbuilding company in the country, where he served as executive vice president of government and customer relations. He spearheaded HII's interactions with the executive and legislative branches of government, business and trade associations, think tanks, and universities, while also leading its corporately funded research and development.

Finally, Waldman is currently offering strategic and advisory services to aerospace and defense clients as principal of M Barnet Advisors.

He has received the Distinguished Civilian Service Award from both the US Navy and the State of Mississippi, as well as the Architect of the Year Award from the DC City Council of Engineering Societies.

As his career has shot like a rocket into a universe of success, Waldman has come to realize the importance of maintaining contact with the swampy launchpad of his professional life. While he initially didn't pursue much of an ongoing relationship with UF after graduating in 1982 with a bachelor's in mechanical engineering, he decided to commit to building a connection with his alma mater after his 2011 Outstanding Alumnus Award (the department's highest honor for alumni) brought him back to campus. A fellow alum, Dr. Knox Millsaps (who is now head of the Naval Air Warfare and Weapons Department of the Office of Naval Research), reached out and reconnected Waldman with David Hahn, the MAE department chair at the time.

"Ultimately, after nearly three decades, I realized that the foundation upon which I built a successful career was originally laid at UF, and it was time to start giving back, I call it: time, talent, and treasure," he said.

He credited his UF MAE experience as an essential element in the development of the skills that would serve him well as an executive in government and industry.

"It really struck me that many of the skills and interests and, certainly, competence that I had with regard to not just my technical acumen, but also my management and leadership acumen, was really rooted in Florida," he said. "It's those three areas. And you can directly link that acumen to classes, you can link that to student groups, and you can link that to student projects and competitions. And all those things really help an entry level engineer start out and get into the field and really open many different professional pathways."

Mitchell Waldman

One of the main ways he remains actively engaged with UF MAE is through his role as chair of the department's External Advisory Board, which provides guidance and advice to MAE and assists with strategic initiatives. This entails volunteering time and service to support efforts like consideration of curriculum, ABET accreditation, and other significant department issues by consulting with the department chair and faculty.

"It's an honor to be engaged with that. I've been engaged for a decade with the External Advisory Board," he said. "We're here to support the department and its alignment with the college and university. And sometimes we can help with that alignment because of the perspective we bring."

As for the future, particularly the future of his relationship with UF MAE, he acknowledges that it likely will (and should) evolve over time, but remains sure as ever that he will continue investing his time, talent, and treasure in it.

"Well, I hope so. I'm honored to serve," he said when asked if this relationship will continue to develop. "So I'm planning to continue to be useful and contribute."

A major reason for his determination is his steadfast conviction that it's his generation's duty to elevate the upcoming crop of engineers and industry leaders.

"Part of the responsibility of my generation is to also raise the next generation. I think about that in business, and I think about that in academia. There absolutely is a need to think about succession planning. You do yourself, your organization, and maybe a society a disservice by not thinking about succession planning, who comes next, and bringing those people up and training them and helping them move forward," he said. "So yes, I still see a level of engagement for me. I suspect it will change over time as I follow through on my commitment and responsibility to raise the next generation of leaders."

"It's an honor to be engaged with that. I've been engaged for a decade with the External Advisory Board. We're here to support the department and its alignment with the college and university. And sometimes we can help with that alignment because of the perspective we bring".

- Mitchell Waldman

HELLOS & GOODBYES

WELCOME NEW FACULTY: Exciting New Additions

We're excited to welcome our new faculty members to MAE! Their unique expertise and innovative spirit will bring fresh perspectives and energy to our department. We look forward to their contributions in advancing research, enriching our academic programs, and inspiring our students.

Alison Dunn

Alison C. Dunn is the Robert and Jill Peterson Associate Professor of Mechanical and Aerospace Engineering at the University of Florida. Directing the Bio/Materials Tribology Laboratory, her aim is to emulate and exploit surface properties and structures to control sliding interfaces using experiments and theory. She works on soft materials like hydrogels and silicone, as well as insect cuticle and hardened steel. She spent the first 10 years of her faculty career at the University of Illinois (UIUC), where she won the NSF CAREER award in 2018 and the ASME Burt L. Newkirk Award in 2019.

James Fairbanks

James Fairbanks earned his B.S. in Mathematics at the University of Florida and his Ph.D at the Georgia Institute of Technology in Computational Science and Engineering. He studied under the supervision of Professor David A. Bader, while supported by the National Defense Science and Engineering Graduate (ND-SEG) Fellowship. He then worked at the Georgia Tech Research Institute on Data Analysis and High Performance Computing as applied to scientific computing and data science problems in healthcare. social science, epidemiology, biology, and physics problems. His work focuses on using programming language theory and algebraic techniques for designing and developing large scale software for technical computing problems.

Rushikesh Kamalapurkar

Rushikesh Kamalapurkar received his M.S. and his Ph.D. degrees in 2011 and 2014 from the Department of Mechanical and Aerospace Engineering at the University of Florida. After working for a year as a postdoctoral researcher, he was appointed as the 2015-16 MAE postdoctoral teaching fellow. From 2016 to 2024 he served as a member of the faculty of the School of Mechanical and Aerospace Engineering at Oklahoma State University. In 2024, he joined the faculty of UF MAE, where he directs the Systems, Cognition, and Control laboratory. His research interests are intelligent, data driven control and operator-theoretic machine learning. His work has been recognized by the 2022 OSU CEAT Excellent Scholar Award, a 2017 election to the grade of IEEE Senior Member, a 2015 UF MAE Best Dissertation Award, and a 2014 UF MAE Outstanding Graduate Research Award.

Kurt Schulze

After graduating from UF with a degree in Nuclear Engineering, Kurt Schulze served thirty years as a dedicated career Naval Officer involved in building, fixing, and operating ship engineering plants. During his naval career, he obtained a PE license in Mechanical Engineering in the states of California and Florida. He came back to UF to get a Ph.D. in Mechanical Engineering in 2014. Since 2018, he has been passionately teaching an array of undergraduate ME courses and HVAC technical electives.

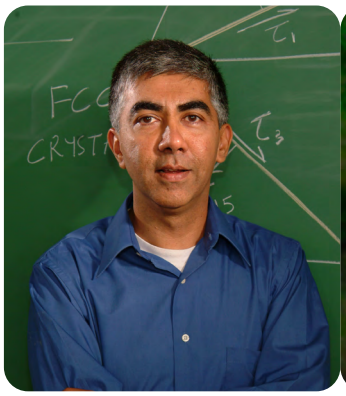
Youngsup Song

Youngsup Song earned his B.S. and M.S. degrees in Mechanical Engineering from Yonsei University, South Korea, where he developed MEMS sensors and nanochannels. He then worked as a researcher at the Korea Institute of Materials Science, focusing on electrochemical synthesis of thermoelectric materials. In 2016, he began his Ph.D. in Mechanical Engineering at MIT, specializing in wettability and phase change heat transfer for energy applications. Prior to joining the department, he was a postdoctoral researcher at Lawrence Berkeley National Laboratory, researching thermal energy storage.

RETIRING FACULTY: Celebrating Their Impact

As we bid farewell to Dr. Nagaraj Arakere and Dr. Bhavani Sankar, we reflect on their remarkable legacies in the Department of Mechanical and Aerospace Engineering at the University of Florida. Their dedication, innovation, and mentorship have profoundly shaped our community. Their commitment to excellence and passion for engineering have inspired countless students and colleagues. We express our deepest gratitude for their invaluable contributions and celebrate their illustrious careers with immense pride. They will always remain a cherished part of our Gator Engineering family.

Nagaraj Arakere
28 years at UF



Bhavani Sankar
38 years at UF

FACULTY ROSTER

Abbitt III, John D
Aifantis, Katerina
Allen, Jessica
Angelini, Thomas
Balachandar, Sivaramakrishnan
Barke, Simon
Brooks, Jonathan
Cardenas-Lailhacar, Cristian
Carroll, Bruce
Chen, Youping
Chung, Jacob
Conklin, John
Costello, Kerry
Crane III, Carl D
Dickrell, III, Daniel
Dixon, Warren
Dong, Ting
Dunn, Alison
Fairbanks, James
Fan, Zhonghui Hugh
Fitz-Coy, Norman
Greenslet, Hitomi
Griffis, Michael
Guralnik, Dan
Houim, Ryan
Huang, Yong
Ifju, Peter G
Kamalapurkar, Rushikesh
Kim, Nam Ho
Kumar, Ashok
Lind Jr, Richard
Mei, Renwei
Menezes, Amor
Miller, Steven AE
Moghaddam, Saeed
Mohseni, Kamran
Musgrave, Patrick
Niemi, Sean
Pan, Jing
Persad, Umesh
Petersen, Alicia
Petersen, Chris
Ramos Zuniga, Jose Humberto
Rao, Anil
Ridgeway, Shannon
Roy, Subrata
Rubiano, Andres
Sarntinoranont, Malisa
Scheffe, Jonathan R
Schueller, John Kenneth
Schwarze, Thomas
Segal, Corin
Sheplak, Mark
Sherif, SA
Shi, Jingjing
Shin, Jaejeong
Song, Youngsup
Spearot, Douglas
Subhash, Ghatu
Tang, Xin
Taylor, Curtis
Trainham, James
Traum, Matthew J
Ukeiley, Lawrence
Wang, Yu
Wass, Peter James

Faculty Highlight

A Personalized Approach to Mentoring: Dr. Douglas Spearot Earns The 2023-2024 Herbert Wertheim Doctoral Dissertation Advisor/Mentoring Award

In the academic realm, mentorship plays a pivotal role in shaping the next generation of researchers. Dr. Spearot, who has been an academic advisor for over 19 years, received the honored Herbert Wertheim Doctoral Dissertation Advisor/Mentoring Award for the 2023-2024 academic year.

Dr. Spearot practices a very personalized approach to mentoring, deviating from conventional group meetings. He opts for one-on-one sessions with his students, taking the meetings out of his office and into their own workspaces. This approach allows him to observe firsthand how students manage their data, organize simulations and theories, and navigate through various analytical tools such as Python, Excel, or Matlab.

"I like to see how students are working with their computing systems and how they're managing data. Meeting in their office eliminates distractions and fosters a more natural and focused environment for discussing their work." – Dr. Spearot

When asked about maintaining a balance between providing support and allowing students to develop independence in their research, Dr. Spearot responded emphatically in support of individualized attention without micromanaging. He meets with each student once a week to review their progress, address challenges, and set goals for the following week. Once goals are set, it becomes the responsibility of the students to navigate and complete their plans.

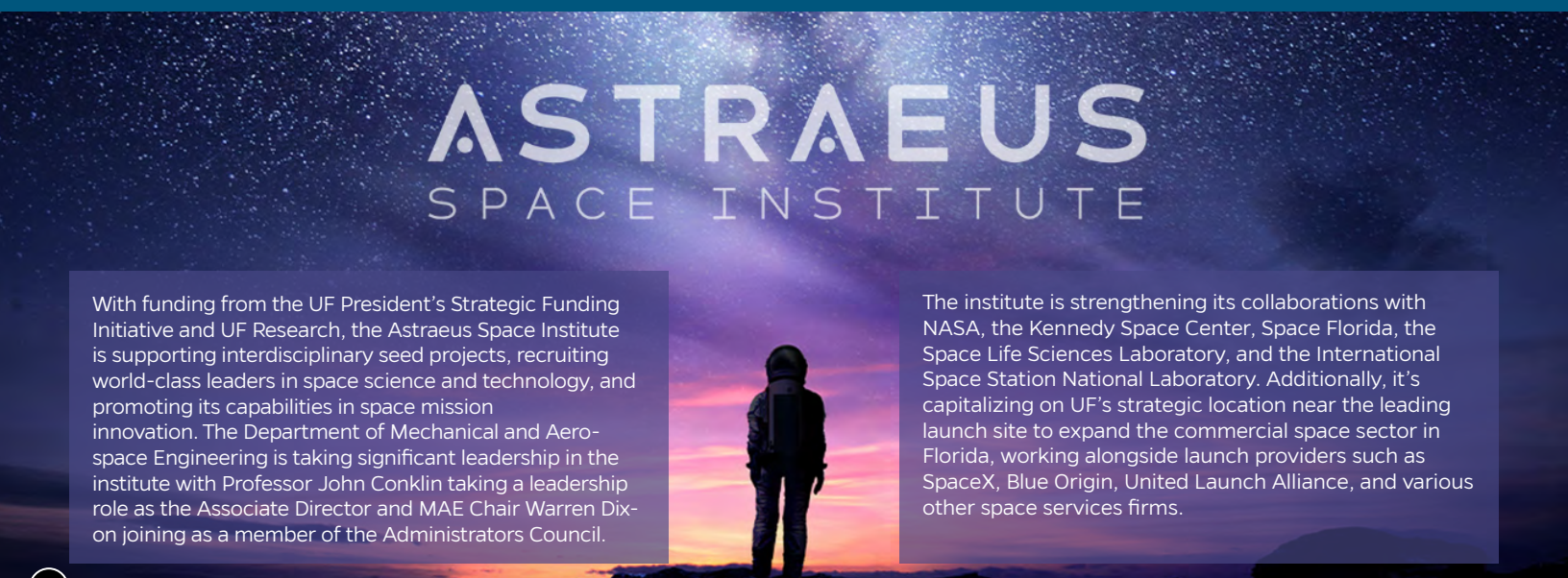
"There's a balance where you give students the attention they need, but then you let them go figure it out. Go fail. And then we can talk about what worked or what didn't work."

– Dr. Spearot

Close relationships and individualized attention continue with celebrations of his students' successes. Dr. Spearot celebrates successful dissertation defenses with small luncheons, where the location is chosen by the students. When this wasn't possible during the pandemic, he organized a graduation hooding ceremony at his house for students who successfully completed their PhDs. It was held outside near his pool with Dr. Spearot, his wife, the students, and a guest of their choice.

Congratulations Dr. Douglas Spearot on this remarkable achievement and thank you for opening the door to share your thoughts and experiences with us! MAE is fortunate and proud to have such considerate and insightful faculty members like you contributing to our academic community.

Douglas Spearot, Ph.D.



With funding from the UF President's Strategic Funding Initiative and UF Research, the Astraeus Space Institute is supporting interdisciplinary seed projects, recruiting world-class leaders in space science and technology, and promoting its capabilities in space mission innovation. The Department of Mechanical and Aerospace Engineering is taking significant leadership in the institute with Professor John Conklin taking a leadership role as the Associate Director and MAE Chair Warren Dixon joining as a member of the Administrators Council.

The institute is strengthening its collaborations with NASA, the Kennedy Space Center, Space Florida, the Space Life Sciences Laboratory, and the International Space Station National Laboratory. Additionally, it's capitalizing on UF's strategic location near the leading launch site to expand the commercial space sector in Florida, working alongside launch providers such as SpaceX, Blue Origin, United Launch Alliance, and various other space services firms.

TEACHING CAPSTONE

"Ruminating" on Interdisciplinary Innovation: Dr. Matthew Traum Leads MAE Capstone Teams in Tackling Cow Stomach Simulators

In 2023, American cattle production reached $88.4 billion, making it the top agricultural industry in the U.S. according to the USDA. Cows are ruminants with four-compartment stomachs that digest vegetation most animals cannot consume, including human food production byproducts like seed coats, shells, and stems. Cow's capacity to derive nutrition from human food waste motives detailed studies of cow digestion. Dr. Antonio Faciola, Associate Professor of Ruminant Nutrition in the IFAS Animal Sciences Department, approached MAE's capstone program with a unique challenge: develop a modern artificial cow stomach simulator to mimic the mechanical, thermal, and biochemical processes of digestion for use in ruminant nutrition research.

The Si-Moo-Lator™ was designed with cleaning accessibility in mind using a easily scrubbed steel vessel to avoid cross contamination between experiments.

Artificial systems that mimic cow digestion allow researchers to test nutrients, supplements, and additives under controlled conditions, providing faster more robust results compared to testing with live cows. Dr. Faciola's lab currently tests with eight 40-year-old legacy cow stomach simulators, which are difficult to maintain. So, MAE capstone students were challenged to modernize these units, making them more user-friendly, speeding up experimentation, reducing cleaning time, and dropping maintenance requirements. Answering this call, Dr. Matthew J. Traum, an MAE associate instructional professor, was confident his EML4502 Capstone students could solve this problem. In Spring 2024, he formed two student senior design teams — MooTech™ and SiMooLation™ — to design, build, and test new cow stomach simulators.

Exploring Different Approaches in Parallel

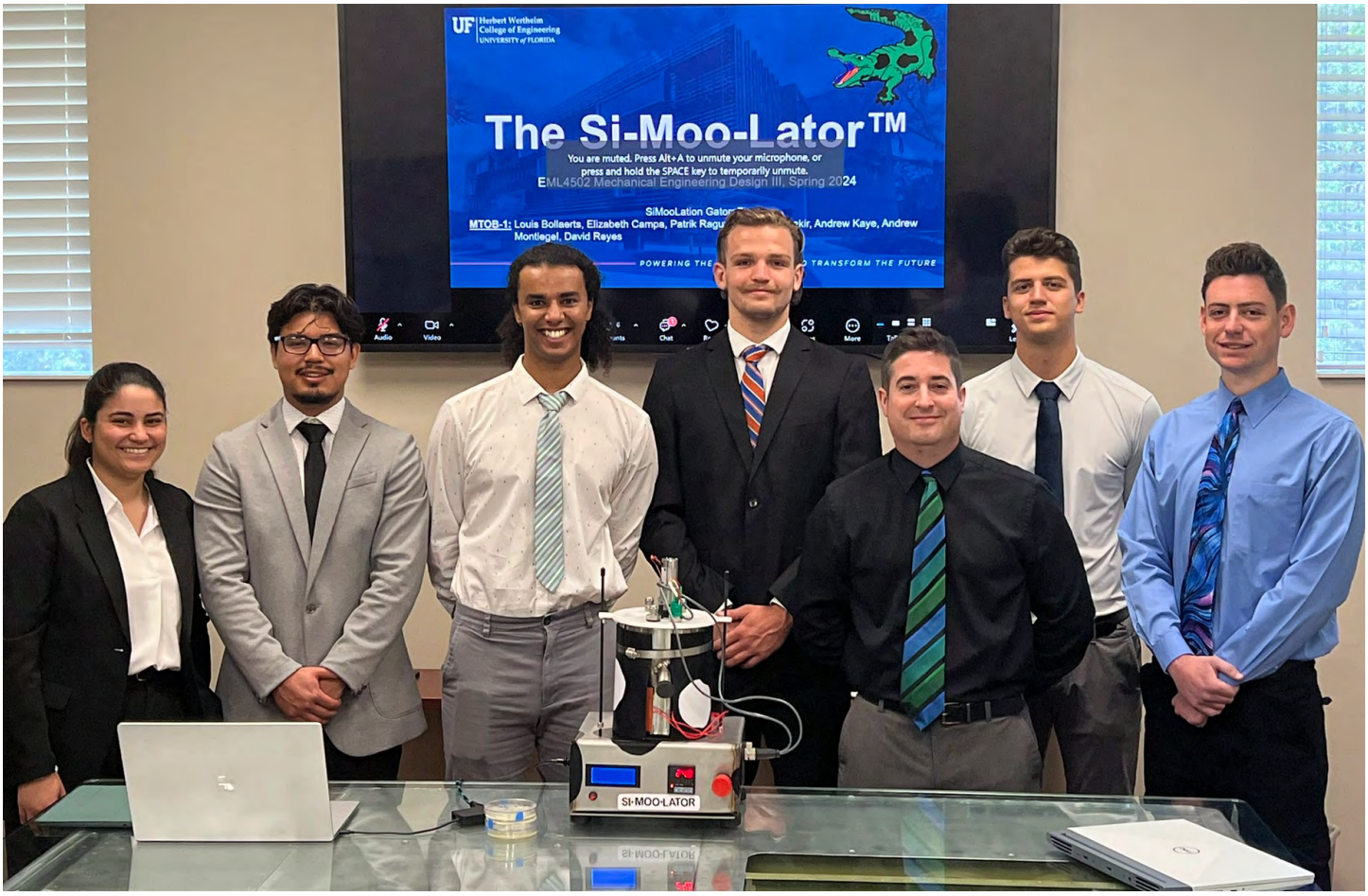
Both teams built benchtop simulators based on the Rumen Simulation Technique (RUSITEC), a proven in vitro method for simulating rumen microbial processes. "Having multiple teams work from the same customer requirements allows for deeper exploration of design possibilities while offering the customer a range of options," Dr. Traum explained.

This approach also provides valuable teaching moments, as students can compare and learn from different design choices. For example, both teams faced the challenge of maintaining the digestion chamber at cow body temperature of 38°C (101°F). MooTech™ used a heated water bath for better thermal stability, but it required longer warm-up times. SiMooLation™ used contact heaters for faster heating but sacrificed visibility of the digestion chamber contents.

Interdisciplinary Research

This project involved interdisciplinary collaboration between Dr. Faciola and his students, Engineer III Stan Pych from UF's Chemistry Depart-

Matthew Traum, Ph.D.



Above: Student members of the SiMooLation senior design team pose completed cow rumen prototype

ment, and Dr. Traum and his MAE capstone students. Enthusiasm to be working across disciplinary boundaries on a project with real impact was evident.

"The capstone students were enthused; they were there extra hours all the time," Mr. Pych said. "It's clear the students loved this project."

The collaboration also sparked new research opportunities. ME senior Anissa Mansouri, a member of MooTech™, is using the simulator for her undergraduate honors thesis, comparing results between the new and legacy systems. Her leadership as Fall 2025 ME Capstone Program Manager will help new student teams build on this work and move the simulators toward commercialization.

Above: UF ME Capstone students interact with UF Animal Science graduate students in Dr. Faciola's Ruminant Nutrition Laboratory to learn about cow digestion research.

MAE Capstone Vision and Impact Toward Entrepreneurship

Dr. Traum envisions the cow stomach simulators becoming the foundation for a student-led entrepreneurial venture. "I am totally convinced that this is going to be the next big Ag-Tech startup company," he states. Dr. Traum aims to mentor a student-founded startup to enter the $25K UF Big Idea business plan competition in Spring 2025. If successful this MAE spin-off could secure a place in Newberry's planned AgFoodTech Park, a new incubator capitalizing on Alachua County's agricultural heritage to develop new farming and food production technologies. The long-term goal is to establish an AgTech company that manufactures cow digestion simulators to meet growing agricultural research demand in this field.

Right: UF maintains cattle herds whose microbiomes inoculate the cow rumen simulators.

SOCIAL PRESENCE

CELEBRATING ACHIEVEMENTS AND OUR GATOR ENGINEER COMMUNITY

Over the past year, we've seen remarkable growth across all platforms in audience size, post frequency, engagement, impressions, and video views. **But it's more than just social media — it's about building a connection.** Our platforms reflect our efforts to bring together students, faculty, staff, alumni, and industry partners to grow connections, celebrate shared achievements, and uplift the Gator Engineers community.

Over the past year, our social media channels have highlighted groundbreaking research, student ingenuity, and faculty accomplishments. From the Solar Gators team's triumphant completion of the Electrek American Solar Challenge to heartfelt send-offs for esteemed faculty members Dr. Bhavani Sankar and Dr. Nagaraj Arakere, every post tells a story of passion, dedication, and excellence.

Through engaging visuals, compelling narratives, and a welcoming, authentic voice, our social media presence fosters a sense of belonging and pride within the MAE community. It also serves as a bridge, connecting us with the broader engineering community and showcasing the impact of our work both here in Gainesville and on a global scale. Our goal remains steady: to connect with our community while serving as a conduit to the wider world.

Reflecting on our social media highlights from 2024, we're reminded of the strength of our community and the value of sharing our journey. Join us and stay connected with MAE at the University of Florida through our social media channels.

facebook.com/UFMAE instagram.com/UFMAE linkedin.com/school/UFMAE x.com/uflmae youtube.com/@UFMAE

DEVELOPMENT

WELCOME TO THE NEW MAE HEADQUARTERS

In last year's edition of MAE Momentum magazine, we shared our exciting plans for a 142,000-square-foot academic building in the heart of UF's main campus. This year, we are proud to announce that what was once a concept has now started to become a reality! The new home for Mechanical and Aerospace Engineering has arrived in the form of our newly completed phase 1 of the engineering building, currently dubbed NEB.

Phase 1 included nine faculty offices, six design class labs, two storage rooms, and one break room.

Faculty have already begun moving in, and students are actively engaging in labs and classes in our state-of-the-art spaces. We can't wait to see the incredible innovations that will come from this new chapter.

Moving forward, we are gearing up for Phase 2, which will feature the main office suite and our first student village dedicated to our aeronautical students. Keep an eye out for all the exciting things to come!

CHECK OUT ALL THE WAYS TO GET INVOLVED

GIVING WITH PURPOSE

Each year, more than 2,200 students make the Department of Mechanical and Aerospace Engineering (MAE) their home and rely on the resources provided, such as academic advisors, faculty, and staff for their academic success. The vision for MAE is to continue to grow the department through hiring world top talent as new faculty and to support the students and faculty with an inspiring environment.

Create a Lasting Legacy

Endowments starting at $100,000 offer a wonderful opportunity to leave a permanent legacy within the Mechanical and Aerospace Engineering Department. But where does the money go, and what does it support?

Your contributions help us recruit and retain top-tier faculty, support student groups, and enhance experiential learning. This funding fosters cross-collaboration among students, preparing them for successful careers. It also supports mentorship programs, first-generation students, lab equipment, graduate fellowships, and professorships, paving the way for excellence.

Your generosity creates lasting memories and a pathway to success for future generations.

FY24

Endowments

$15.3M

Remember Dr. Bernard Leadon

Did a professor at UF have a lasting impact on your life? Share your story with us! Many alumni are currently honoring their memories through the Dr. Bernard Leadon Memorial Fund. Dr. Leadon, a beloved professor in the Department of Mechanical and Aerospace Engineering, was known for his passion for teaching, mentorship, and his unwavering dedication to student success. His work not only shaped the careers of countless engineers but also left an indelible mark on the department and the university as a whole.

Our goal is to raise enough funds to name a lab after this renowned professor, ensuring his legacy continues to inspire future generations.

If Dr. Leadon influenced your journey and you'd like to contribute, join fellow alumni in celebrating his life's work. Every contribution, no matter the size, helps set this legacy in motion. Your generosity will be greatly appreciated.

Support Renovations Happening at NEB

Imagine students excitedly saying, "Let's meet in the Joe Smith Lab," a place named in your honor, where they will tackle groundbreaking projects and develop skills that will serve them throughout their careers. Your contribution can make this vision a reality, leaving a legacy that not only enhances our students' experiences but also cements your place in the history of MAE.

We invite you to follow along and take part in our journey to provide state of the art facilities, for state of the art students—where your legacy can shape the future of engineering education and innovation for generations to come.

Name a UF Rocket!

Ever thought about naming a rocket? Join our alumni in the "Name a Rocket" initiative and leave your mark at UF!

The University of Florida boasts some of the best rocket launch student teams. On thrilling launch days, these rockets soar into the sky, a testament to the hard work and collaboration of our students. If this reminds you of someone you know, don't miss the chance to name one of our mini rockets designed by UF student teams.

How to Get Your Mini Rocket: By making a gift of $10,000 to the Mechanical and Aerospace Engineering Department, you can name a UF rocket. While the naming is symbolic, the impact is real. Your named mini rocket, designed by MAE students, will be displayed on the wall in the new MAE Headquarters at 1064 Center Drive. It will serve as a lasting reminder of your generosity, inspiring students and faculty alike.

What Does Your Gift Support? Your contribution supports the reconstruction and renovation of the NEB building (MAE Headquarters), including groundbreaking research, advancements in rocket technology, and student team designs. It also helps create opportunities for experiential learning with state-of-the-art equipment, fostering interdisciplinary research, collaboration, and social interaction.

Be a part of this exciting journey and help shape the future of aerospace engineering at UF!

Scan here

or visit mae.ufl.edu/engage for more information on donating:

THANK YOU

The generosity of individuals like you has built the foundation for future generations of Gator Engineers to pursue their academic dreams.

For more information on how engage in all things MAE, please reach out to:

Mary Church, Senior Director of Development at mchurch@eng.ufl.edu

UF Herbert Wertheim College of Engineering
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