MARYLAND MECHANICAL ENGINEERING | **FALL 2022**

METRICS

UMD MECHANICAL ENGINEERS ARE DEVELOPING TOOLS AND TECHNOLOGIES THAT CAN HELP ENSURE A LIVABLE FUTURE.

Addressing the Sustainability Challenge

DEAR FRIENDS,

Earlier this year, our campus presented its new Strategic Plan, in which one of the stated guiding principles is Service to Humanity. This plan's bold vision is to improve the lives of every person on Earth. Meanwhile, it has been seven years since the UN General Assembly put forth the 17 Sustainable Development Goals (SDGs) with the aim of pointing the way towards a better, more equitable, and sustainable future. While progress across the 17 SDGs depends in part on policy decisions, it also hinges to a great extent on technological innovation. Without new and in some cases revolutionary approaches to meeting human and societal needs, it will be difficult to protect the planet while also ensuring a desired quality of life for all.

Sustainability is the great challenge of our time, and it is one that directly involves engineers. In this issue of *Metrics*, our aim is to provide a snapshot of work being done here. This work has the potential to foster sustainability and support societies around the globe in achieving the 17 SDGs. As you will see, it is an aspiration that guides many of our faculty and undergirds the activities of our laboratories and research centers.

Our Center for Environmental Energy Engineering (CEEE) is dedicated to reducing the environmental footprint of the cooling and heating technologies that are essential not only to comfort but to the preservation of food and medicine. Over three decades, this pioneering center has worked to research and test solutions that can then be implemented by industry, while also training successive generations of researchers to enter the field and make their own contributions. CEEE recently celebrated a milestone—its 30th anniversary. I hope you will join me in congratulating CEEE Co-founder and Director Reinhard Radermacher, Co-director Vikrant Aute, Co-director Yunho Hwang, Co-founder Michael Ohadi, and other members of the CEEE team.

Other UMD mechanical engineering faculty are achieving breakthroughs involving other facets of sustainability as well. For example, Teng Li and his students have been perfecting a process for engineering super-hard wood, which can then be used as a viable—and in some ways even superior—alternative to metal, ceramic, or plastic materials. Tremendous ecological benefits could be achieved if products made from such hardened wood come to replace plastic disposables.

While Teng Li's research supports sustainable consumption, his fellow UMD faculty member Miao Yu is harnessing robots and artificial intelligence to help ensure a sustainable food supply. In multiple projects funded by the U.S. Department of Agriculture and the National Science Foundation, Yu and a multi-institutional team of researchers have set their sights on revolutionizing aquaculture in the Chesapeake Bay, with both environmental and economic benefits.

Engineering meets game theory in the work of Steven Gabriel, who has been modeling novel strategies for achieving equitable and eco-friendly use of shared resources, such as rivers and waterways. Amid rising interest in hydrogen as an alternative to fossil fuels, Katrina Groth is applying her expertise in risk assessment towards identifying any potential safety gaps. Finally, we pay a visit to the Center for Sustainability in the Built Environment (City@UMD), where Jelena Srebric and her team of researchers are developing novel ways to provide effective ventilation and clean water in complex urban environments.

All of this is only a brief sampling. Many other faculty members in the department are engaged in research and curriculum efforts that in one way or another connect with the UN's SDGs. Sustainability, indeed, is one of the defining interests of our unit, and we anticipate that this will be even more true as we progress into the future—one that engineers are doing their part to shape.

Best regards,

B. Balachandran

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METRICS

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Addressing the Sustainability Challenge

UMD MECHANICAL ENGINEERS ARE DEVELOPING TOOLS AND TECHNOLOGIES THAT CAN HELP ENSURE A LIVABLE FUTURE.

Artists and visionaries dream it, while activists campaign for it. But it is engineers who will do—and are already doing—much of the work needed to solve the critical problems affecting the globe and its inhabitants, from ensuring adequate food and water to developing carbon-free energy sources, protecting biodiversity, and lifting millions out of poverty.

At the University of Maryland's (UMD) Department of Mechanical Engineering, faculty apply their expert knowledge and skills to the big-picture priorities of our time—priorities summed up by the 17 United Nations Sustainable Development Goals (SDG). In the labs and classrooms of Martin Hall on the UMD campus, and the adjacent C.D. "Dan" Mote Engineering Lab Building, practical solutions are taking shape. In the following pages, we invite you to join us as we highlight the impactful work that is in progress at UMD—and the gifted, dedicated faculty who are undertaking it.

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UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

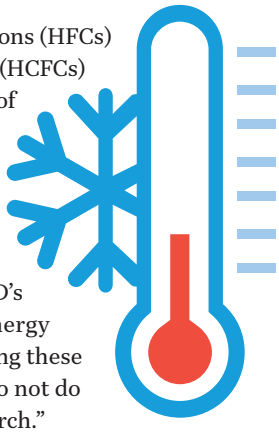
1. No Poverty 2. Zero Hunger 3. Good Health and Well-Being 4. Quality Education 5. Gender Equality 6. Clean Water and Sanitation 7. Affordable and Clean Energy 8. Decent Work and Economic Growth 9. Industry, Innovation, and Infrastructure 10. Reduced Inequality 11. Sustainable Cities and Communities 12. Responsible Consumption and Production 13. Climate Action 14. Life Below Water 15. Life on Land 16. Peace, Justice, and Strong Institutions 17. Partnerships for the Goals

MARYLAND IS CREATING SOLUTIONS

Reducing Emissions Through Refrigeration Technology

Without refrigeration, the way we live would be very different. Not only would food and dairy products quickly spoil, but medicines and vaccines could not be stored safely. Unfortunately, modern refrigeration systems come with a steep environmental cost.

In fact, the hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) used as coolants are up to tens of thousands times more potent than carbon dioxide when it comes to warming up the atmosphere, notes Minta Martin Professor Reinhard Radermacher, who directs UMD's Center for Environmental Energy Engineering (CEEE). "Replacing these fluids with refrigerants that do not do that is a big focus of our research."



Housed in the mechanical engineering department, CEEE is a consortium with a focus on finding solutions that are both economically feasible and environmentally responsible. With funding from the Department of Energy (DoE) and other sources, this center's researchers have been exploring the use of solid refrigerants as an alternative to liquids and gasses, in collaboration with Ichiro Takemuchi of the Department of Materials Science and Engineering. Another alternative, isobutane, already accounts for the majority of refrigeration systems in Asia and Europe; with funding from 35 of the largest Airconditioning Federation System manufacturers around the globe, CEEE is helping to refine the technology.

A collaboration with UMD Chemical Engineering Professor Chunsheng Wang, meanwhile, focuses on a radical new approach involving electrochemical compression. Simply put, the idea is to use processes from a fuel cell to compress a gas without moving parts. "A fuel cell has hydrogen and oxygen on different sides of a membrane. When the hydrogen passes to the oxygen, it produces water, and the energy that is released in the process provides power," Radermacher explains.

"We use a similar approach, except that there is hydrogen on both sides. When we apply a voltage, the membrane starts compressing from one side to the other."

Developing new coolant systems is only one part of the puzzle. The ecological footprint of refrigeration also includes the manufacturing process. Air conditioners, refrigerators, and freezers tend to be large, bulky items, and producing them requires a significant expenditure of labor and energy. Again, CEEE is helping to mitigate the environmental costs, in this case by engineering systems that are much smaller, more light-weight, and easier to produce.

"There are about 100 billion air conditioners in service as of now; by 2050, there may be three to five times as many. We're exploring ways to build these five billion air conditioners so they are half the size and a third of the weight of current technologies," Radermacher said.

"That will make it much more feasible to build such a large quantity of air conditioners without a similar increase in the amount of energy consumed," he said. CEEE's research in this and other areas directly supports the UN Sustainability Goals of Climate Action and Responsible Consumption and Production, and indirectly contributes to achieving others, such as Zero Hunger, No Poverty, Good Health and Well-Being, and Sustainable Cities and Communities.

Cutting Down on Plastic Waste With Knives Made of Wood

Earlier this year, Keystone Professor Teng Li's laboratory in the department underwent a surprising transformation, turning into something you might see on the Food Network. As a TV crew set up their cameras, Li and a postdoctoral researcher carefully arranged vegetables and fruit on the stainless steel surface.

The occasion? CNBC reporter Shomari Stone wanted to see first-hand whether knives made of hardened basswood—an innovation Li and his group have been refining for years—are sharper than stainless steel or plastic cutlery, as Li and his team have claimed. The wood used in the knives is treated via a process—involving heat, compression, and a mineral oil coating—that is designed to preserve cellulose, which has a higher strength-to-density ration than ceramics, metals, or plastics, while removing other substances, notably lignin, that soften the wood. Li and his collaborators, including Bo Chen, Ulrich H. Leiste, William L. Fourney, Yu Liu, and Qiongyu Chen, have published details of the process in the journal Matter.

Chop! As the cameras rolled, the knife engineered by Li and his team sliced effortlessly through cucumbers, tomatoes, carrots and apples. A stainless steel knife handled the same tasks more sluggishly, and a plastic knife quickly broke into pieces.

If such knives are able to cut their way into the consumer marketplace, they could help alleviate a major threat to global ecosystems. In the United States alone, about 40 billion plastic knives, forks, and spoons are used and disposed of each year, and most of it does not get recycled—either because it's too contaminated for the recycling stream, or because users simply toss it out with the trash. A significant amount ends up in waterways, endangering species and potentially affecting water quality.

With their superior strength and their biodegradability, Li's knives promise a win-win for consumers and the environment. "Not only are these knives sharper, but they're environmentally friendly and can help lead us to a sustainable future," he said.

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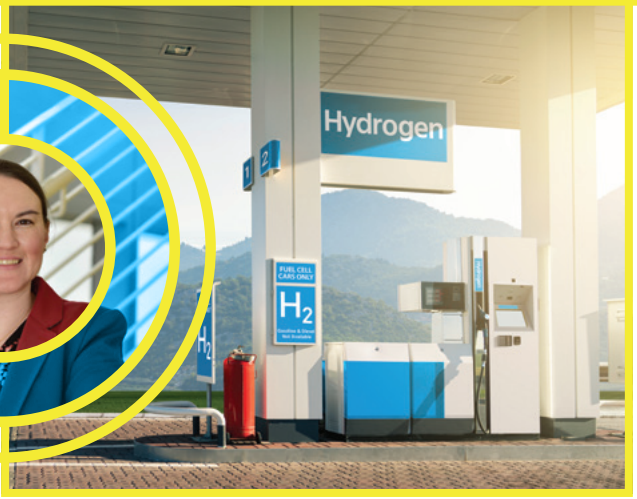
IN FOCUS



The Promise and Challenge of Hydrogen Power

WITH TRANSPORTATION ACCOUNTING FOR ABOUT A THIRD OF THE NATION'S TOTAL GREENHOUSE GAS (GHG) EMISSIONS, ACCORDING TO ENVIRONMENTAL PROTECTION AGENCY ESTIMATES, ACHIEVING SUSTAINABILITY REQUIRES TRANSFORMATIONS IN THE WAY WE GET AROUND.

While electric vehicles (EV) can help lower emissions, they come with inherent limitations, notes Katrina Groth, associate professor of mechanical engineering and assistant director of the Center for Risk and Reliability.

EVs aren't always necessarily carbon-neutral, since the power plants used to generate electricity may produce emissions. Current battery technologies, moreover, can't support certain uses, like long-haul trucking or industrial operations. "Forklifts in a warehouse may need to be operational 24/7; you don't have time to charge them for 8 to 12 hours at a time," Groth said. "Driving a big rig across several states isn't feasible if you have to stop and recharge too often."

Given these constraints, it's no wonder that many are looking to hydrogen fuel cells, which are entirely emissions-free, as an alternative. Major companies such as Hyundai and Toyota are becoming involved, and at least 1,000 commercial fuel cell vehicles are already on the road in California. Closer to home, some Washington, D.C.-area post office facilities are now using hydrogen-powered forklifts.

The catch? Hydrogen presents safety challenges that differ from those posed by gas-powered engines. Not only is hydrogen flammable, like gasoline, Groth said, but its properties make it more prone to leaks than is the case with other fuels. That doesn't mean that hydrogen-powered vehicles can't be safe, but it does mean that engineers must understand and find ways of addressing the particular safety challenges. "The last thing we want to do is decarbonize and kill people in the process," she said.

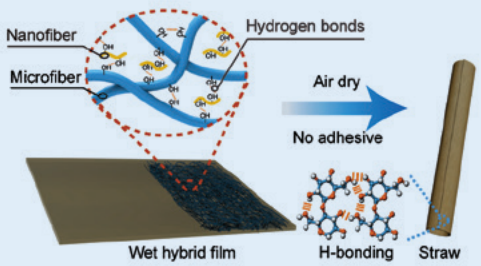
As a risk and reliability expert with specific expertise concerning hydrogen, Groth's role is to ask the tough questions that can ensure safe adoption of this promising new technology. Ways to mitigate the risk include checking leaks, making sure that the hydrogen components are leak-tight and assembled appropriately, and confirming the materials used are actually compatible with hydrogen. Containment should be avoided: just as propane tank should not be stored in a house, hydrogen vehicles need space and ventilation. Should fuel cell-powered vehicles become the norm among everyday consumers, we may need to rethink how we design our garages.

"When folks are excited about a brand-new technology, they don't really want to think about how things could go wrong. But that's part of an engineer's job," said Groth, whose work has been supported by grants from the National Renewable Energy Lab and Electric Power Research Institute, as well as by the National Science Foundation which awarded her a CAREER Grant in 2021.

"If we don't, then systems will fail, and that hinders successful adoption in the long-run. Many in the hydrogen community are involved in technology development and they're right to be excited about it; I provide a balancing force."

Li's hardened wood research is only one example of the alternative technologies he and his students are helping to engineer.

In 2019, they unveiled the successful results of a project centered around manufacturing straws from cellulose.



"THE GOAL IS TO DEVELOP TECHNOLOGY, TOOLS, AND INFRASTRUCTURE TO HELP SHELLFISH FARMERS ACHIEVE SUSTAINABLE PRODUCTION."

UMD Mechanical Engineering Professor Miao Yu (left) discusses software for controlling a remotely operated underwater vehicle and its on-board sensors with Keshav Rajasekaran (Ph.D. '21).
PHOTO: JOHN T. CONSOLI/UNIVERSITY OF MARYLAND

Using Robots for Sustainable Aquaculture

While Li's research could transform the tools and implements we use to consume food, research by a fellow UMD ME faculty member could help ensure that we have an abundant, sustainable food supply in the first place. With $10 million funding from the USDA NIFA Sustainable Agricultural Systems Program, Professor and former Maryland Robotics Center Director Miao Yu is leading an ambitious, multi-institutional effort aimed at utilizing advanced technology to boost aquaculture production in the Chesapeake Bay and nationwide.

"The goal is to develop technology, tools, and infrastructure to help shellfish farmers achieve sustainable production," Yu said. "With the aid of advanced technologies, including robotics, AI, and sensor networks, they can understand their farms better and achieve precision farming practices."

After first conducting experiments that utilized an underwater drone tethered to a boat, the team is now expanding the effort to establish monitoring capabilities that can provide continuous underwater environmental sensing and periodic autonomous surveys. The goal, Yu says, is to build a monitoring infrastructure that, in the future, will also include autonomous surface and underwater vehicles that can coordinate with each other to collect data, which farmers will then be able to access in real time. "They'll be able to track salinity, water temperature, and other parameters important to shellfish farming," Yu said.

All stages of the farming process can be optimized using such technologies, she noted. Before planting, the sensors and robots can be used to identify the best locations to distribute oyster seeds. Farmers can then track growth and collect crop inventory data, And when they're ready to harvest, mobile robots can be sent out to locate the market-sized oysters, while a computer program is used to determine the optimal path for a dredging vessel. Although the immediate focus is on oysters, the approach can ultimately be used to benefit other forms of aquaculture.

The environmental benefits are twofold. Oysters filter the Bay's waters and sift out excess algae, and increased production can enhance this filtration process. Moreover, aquaculture provides an eco-friendlier alternative to more common sources of protein, with emissions that are only a fraction of those produced by cattle farming.

"There is research suggesting that replacing even 10% of our meat consumption with shellfish is equivalent to removing a hundred million cars from the road," Yu said. "And shellfish have incredible nutritional benefits: they're not only a source of protein, but provide Omega 3 and many nutrients and minerals. They're superfoods." Several team members including University of Maryland Center for Environmental Science (UMCES) biologist Matt Gray and economist Lisa Wanger, are working on quantifying the benefits.

Besides UMD and UMCES, researchers from the Fraunhofer Center for Experimental Software Engineering, Georgia Tech, Louisiana State University, the Pacific Shellfish Institute, the University of Maryland Eastern Shore, and Virginia Tech are collaborators for this effort. Their work aligns with multiple UN Sustainability Goals—including no poverty; zero hunger; good health and well-being; clean water and sanitation; decent work and economic growth; industry, innovation and infrastructure; reduced inequality; sustainable cities and communities; responsible consumption and production; climate action; and life below water.

ENVISIONING SUSTAINABLE CITIES

OF THE 8 BILLION PEOPLE ON OUR PLANET, MORE THAN HALF LIVE IN URBAN ENVIRONMENTS, and the percentage has been rising steadily. The UN projects that cities and towns will account for around 68% of the world's population by 2050, with the largest increases being seen in Africa and Asia.

In the 1950s, the global urban population stood at around 751 million. That means a growth rate of around 450% in less than a century.

With numbers like these, a sustainable planet necessarily means sustainable urbanization. The Center for Sustainability in the Built Environment (City@UMD) harnesses advanced research capabilities, including experimental approaches as

Incentivizing Sustainable Behavior in River Systems

While Radermacher, Li, Yu and other UMD mechanical engineers focus on technological advancement, their colleague Steven Gabriel is drawing lessons from game theory to tackle another aspect of the sustainability equation: how to incentivize behavior that yields mutual gain rather than benefiting some stakeholders at the expense of others. This work is funded by the NSF through a three-year grant (NSF Award # 2113891).

The question has direct relevance to topics such as water resource management. "In the case of a river, you might have communities located upstream that are conducting economic activities that impact the communities downstream—for example, increasing the amount of sediment, and thus affecting water quality, or decreasing the quantity of water," Gabriel said. "The downstream communities don't want the sediment or other pollutants or may want a larger quantity of water. The upstream communities can potentially benefit economically from a coordinated set of water-management decisions with their downstream neighbors."

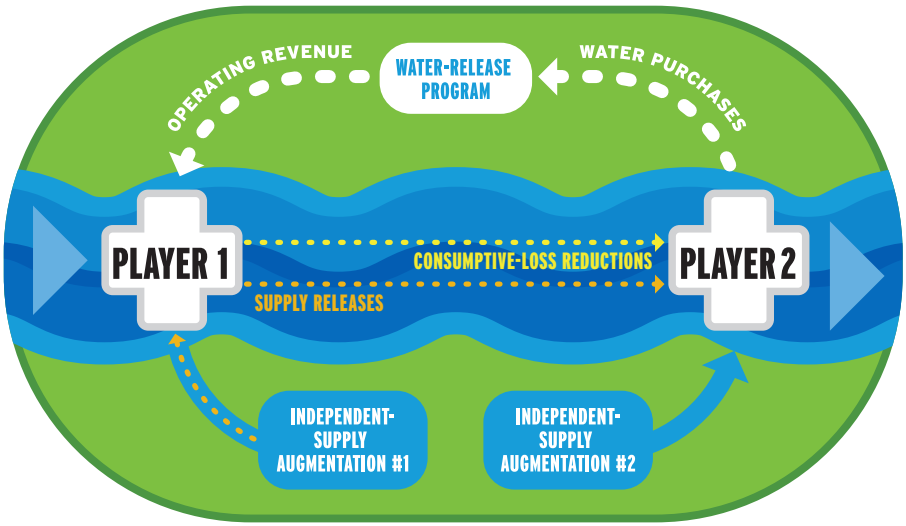
For example, what if the downstream communities pay for the upstream ones to make infrastructure improvements that mitigate the problem, whether of water quality, quantity, or both? "We've been running models that calculate whether communities stand to benefit as a result, and the models suggest that the answer is yes," said Gabriel. He and his doctoral student, Nathan Boyd, have run the numbers in test cases that include Tennessee's Duck River. Gabriel, Boyd, and CEE co-PI Kaye Brubaker will also build models to analyze water quality issues for the Anacostia river in the Washington, DC area.

"By paying for the improvements, the downstream communities get a cleaner river or one with more water—which can potentially bring them economic benefits. And the upstream communities get to continue what they are doing and receive an economic benefit as well," Gabriel said.

His work in this area takes its inspiration from mathematician John Nash and his concept of "non-cooperative games," in which all players act to maximize their own individual benefit assuming that others are doing the same. Such Nashian, non-cooperative games differ from the actions of a trade league or cartel, whose members agree to advance the good of the group even if it means sacrificing individual priorities.

"The reality is that people only cooperate under certain conditions, and we also can't always assume a situation where a government entity tries to anticipate and regulate everyone's behavior," Gabriel said. "That's why we're seeing such an interest in the use of incentives, with carbon credits being a well-known example in power markets. If you use too much carbon (beyond your allowance), you pay; you use less than allowed, you get a credit. My work is somewhat related to this notion."

"In a scenario where everyone's inclination is to act in their own economic self-interest, can we use market mechanisms to induce beneficial actions? That's the fundamental question we're attempting to answer," he said.



well as modeling and simulation, with the aim of developing sustainable, distributed systems that can ensure health and comfort, utilize energy more efficiently, and ensure a clean water supply.

Headed by Professor Jelena Srebric, Margaret G. and Frederick H. Kohloss Chair at UMD, this unique center has conducted groundbreaking research on a wide range of topics related to global sustainability goals, with support from agencies such as the National Institutes of Health (NIH) and the National Science Foundation (NSF).

Currently, a major focus of the center is on developing personalized air cleaning devices for educational settings, providing an analytical tool for performance assessment of novel water desalination technologies, and investigating energy efficient ways to clean air in public buses and railcars. "Each of these projects includes both technological innovations and a set of users/stakeholders who test the technology and send feedback for improvement," Srebric said.

Small, distributed devices, such as the air cleaners, could prove crucial to the protection of urban populations amid perturbed weather and climate patterns, Srebric said. "These small devices can provide clean air, sustainable air conditioning and/or clean water during different types of outages and extreme demand events. The City@UMD team is focusing on lowering barriers for adoption of such systems."

To learn more, visit CITY.UMD.EDU

Tiny Structures, Large Potential

SIDDARTHA DAS'S NANOCHANNEL RESEARCH SHEDS NEW LIGHT ON INTERACTIONS.

Nanochannels—tiny, tube-like structures that can be "functionalized," or put to some particular use, by grafting them onto other materials—hold considerable promise as a means of energy generation, harvesting, storage, and conversion. By converting mechanical and chemical energies into electricity, for example, nanochannels that are charged and filled with liquid could potentially be used as a power source.

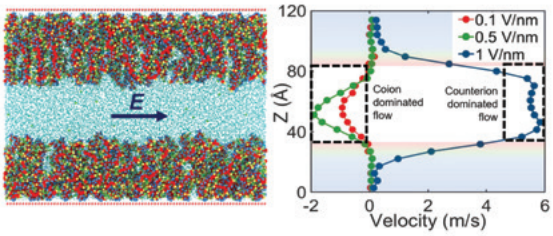
More needs to be understood, however, about how doing so affects the behavior of molecules and ions in the system. With renewed funding from the U.S. Department of Energy, associate professor Siddhartha Das and his team of postdocs and graduate students are using atomic-level simulations to gain new insights.

The team, Das says, has been able to pinpoint, with unprecedented precision, the ways in which differently charged polymer molecules, in the presence of ions with different charges, will regulate energy harvesting, storage, and conversion.

"Imagine that you could create a tool that not only interprets the interactions but can tell you the detailed environmental story, what's happening in the environment of these bodies, and how the environment is affected as they interact with each other," Das said. "That level of resolution is being achieved by our group."

The atomistic approach being pioneered by Das and his students has resulted in several published papers appearing in journals like ACS's *Nano*, *Matter*, and *Macromolecules*.

A member of the UMD mechanical engineering faculty since 2014, Das is a Fellow of the Institute of Physics and also a Fellow of the Royal Society of Chemistry.



Cannabis and the Human Heart

WITH USE OF THE DRUG ON THE RISE, MORE UNDERSTANDING IS NEEDED ABOUT HOW IT IMPACTS THE CARDIOVASCULAR SYSTEM.

Cannabis use is on the rise, but much remains to be understood about how the drug affects health—and particularly how it might impact the human cardiovascular system. To help fill in that research gap, UMD mechanical engineering assistant professor Eleonora Tubaldi is partnering with Jean Jeudy, MD, a diagnostic radiology expert and professor at the University of Maryland School of Medicine (UMSOM) and Timm-Michael Dickfeld, MD, a cardiac electrophysiologist expert and professor at UMSOM, in a bid to use machine learning and advanced computing to obtain hitherto elusive answers.

"Our goal is to uncover the hidden links between cannabis use and cardiovascular health," Tubaldi said. "We aim to determine whether there are morphological changes, changes in the structure or configuration of the heart chamber, or clinical values that are modified because of cannabis use."

PHOTO: AL SANTOS

New Work by Graham, Colleagues Aids Design of Cooler Electronics

STUDY IDENTIFIES GAPS IN CURRENT THEORIES ON INTERFACIAL HEAT TRANSFER.

When cell phones, electric vehicle chargers, or other electronic devices get too hot, performance degrades, and eventually overheating can cause them to shut down or fail. New work by Maryland Engineering's Dean Samuel Graham, Jr. and a multi-institutional team of collaborators could open up avenues for engineers as they seek to manage heat flow in such devices.

Using Raman Spectroscopy, high-energy resolution electron energy-loss spectroscopy, and a technique known as time-domain thermoreflectance, Graham and colleagues observed phonon modes that only exist at the interface between silicon (Si) and germanium (Ge), and were able to determine the role played by these modes in heat transfer.

As a result of their work, detailed in a paper published earlier this year by *Nature Communications*, the modes can now be considered when engineering thermal conductance at interfaces for electronics cooling and other applications where phonons are majority heat carriers at material interfaces.

The research showed experimentally that decades-old conventional theories regarding interfacial heat transfer are not complete and the inclusion of these phonon modes is warranted, Graham said.

"Interfacial phonon modes should exist widely at solid interfaces," he said. "The understanding and manipulation of these interface modes will give us the opportunity to enhance thermal conductance across technologically-important interfaces, for example, GaN-SiC, GaN-diamond, -Ga2O3-SiC, and -Ga2O3-diamond interfaces."

"These results will lead to great progress in real-world engineering applications for thermal management of power electronics," Graham said.

Commented co-author Zhe Cheng, a PhD graduate of the George W. Woodruff School of Mechanical Engineering who is now a postdoc at the University of Illinois at Urbana-Champaign (UIUC): "The discovery of interfacial phonon modes suggests that the conventional models of heat transfer at interfaces which only use bulk phonon properties are not accurate. There is more space for research at the interfaces. Even though these modes are localized, they can contribute to thermal conductance across interfaces."

Zhe Cheng (left), currently a postdoctoral researcher at the University of Illinois, collaborated with Maryland Engineering's Dean Samuel Graham, Jr. on new research detailed in *Nature Communications*.

The paper co-authors also include researchers at the Georgia Institute of Technology, Notre Dame, University of California Los Angeles, University of California Irvine, Oak Ridge National Laboratory, and the Naval Research Laboratory. The research was supported financially by the U.S. Office of Naval Research under a MURI project and by the U.S. Department of Energy.

A version of this story was originally published by the Georgia Institute of Technology.

Safe Storage

DEVELOPING COVID-19 VACCINES IS ONE CHALLENGE. ANOTHER: KEEPING THEM PROPERLY REFRIGERATED.

The pace was unprecedented. In December 2021, only one year after scientists had identified the virus that causes COVID-19, the first vaccines won emergency authorization. But new challenges then arose, including how to transport, distribute, and store them.

As Yunho Hwang, a research professor at the UMD mechanical engineering department, explains, each vaccine came with its own set of specifications, including the correct temperature range for storage. Some of the vaccines had to be stored at "very low, deep-freezing temperatures," he said.

While clinics and pharmacies were used to storing vaccines for diseases such as chickenpox or the flu, they often struggled to sort out the new requirements. It's a challenge that continues today, as pharmaceutical companies develop hundreds of new vaccines intended to inoculate patients against the many COVID-19 variants.

To help prevent bottlenecks and costly errors, Hwang and colleagues at the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) have been working to develop a practical set of guidelines for COVID-19 vaccine refrigerated transportation and storage. The results of their work, which was undertaken on a volunteer basis out of the a desire to assist the nation's pandemic response, are available on the ASHRAE website.

THE PROJECT AIMS TO INFORM STAKEHOLDERS—INCLUDING PHARMACIES, CLINICS, AND GROUND AS WELL AS AIR TRANSPORTATION SERVICES—ABOUT THE TECHNOLOGIES THEY CAN USE TO MEET THE SOMETIMES UNUSUAL STORAGE NEEDS FOR NEW VACCINES.

Among other types of guidance, the project aims to inform stakeholders—including, pharmacies, clinics, and ground as well as air transportation services—about the technologies they can use to meet the sometimes unusual storage needs for the new vaccines.

"The drug companies know the temperature requirements," Hwang said. "As engineers, our job is to know what equipment is needed to meet those requirements. We try to explain what technologies are available. For example, for the lower temperatures, say -60 to -80 Celsius, a household refrigerator will not be adequate, since it can only go down to about -15 Celsuis. So special refrigeration equipment is needed."

Without such information, clinics and other distributors may end up having to discard portions of their vaccine supply because of improper storage—and, indeed, situations like this often happened during the initial scramble to distribute the urgently-needed medicine. Hwang and his collaborators hope the guidelines they have drawn up will ensure a smoother and more effective vaccine delivery process in the future.

The work is rewarding because it has a direct benefit to society, Hwang noted. "We're helping to ensure future readiness in case of public health crises, such as pandemics," he said.

"At the same time, I was able to collaborate with other volunteers with an interest in helping develop solutions in this area," Hwang added.

A UMD faculty member since 1993, Hwang is co-director of the Center for Environmental Energy Engineering (CEEE). He served as chair of ASHRAE's Refrigeration Technology Committee for Comfort, Process, and Cold Chain in 2020-2021. Founded in 1894, ASHRAE is a global society that works to advance human well-being through sustainable technology for the built environment.

CEEE: Commemorating Three Decades of Innovation

THE CENTER FOR ENVIRONMENTAL ENERGY ENGINEERING (CEEE), WHICH SPECIALIZES IN DEVELOPING ECO-FRIENDLY HEAT PUMP AND REFRIGERATION TECHNOLOGIES, CELEBRATED THREE DECADES OF IMPACTFUL WORK AT A SPECIAL ANNIVERSARY CELEBRATION ON JUNE 9.

The gala event, delayed one year due to the COVID-19 pandemic, was attended by approximately 80 guests, including Maryland Engineering's Dean Samuel Graham, Jr., UMD Mechanical Engineering Chair Balakumar Balachandran, and representatives of NASA, the Department of Energy, Daikin Industries, and other leading companies and organizations.

In a recorded message, UMD President Darryll J. Pines—who served as dean of Maryland Engineering from 2009 to 2020—extended his congratulations. "During my time at the University of Maryland, I have watched CEEE make significant strides to contribute to decarbonization, including partnerships with some of the world's largest HVAC, energy, tech, and automotive companies," he said. "Government research laboratories have recognized this expertise and sponsored research to meet industry carbon neutrality goals."

Awards of recognition were presented at the event to NIST Fellow (retired) David Didion and former UMD aerospace engineering chair William Fourney for their role in establishing CEEE, and to Minta Martin Professor of Mechanical Engineering Michael Ohadi, a CEEE co-founder and leader of the Advanced Heat Exchangers and Process Intensification consortium.

Dr. Radermacher was presented with a special commemorative gift by UMD mechanical engineering research professors Vikrant Aute and Yunho Hwang, and by mechanical engineering senior faculty specialist Jan Muehlbauer.

PHOTO: STEPHANIE S. CORDLE

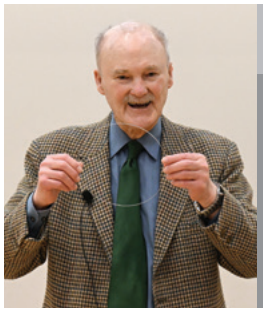
Incentive Awards Program, Engineering Lab Building Named for Mote

When C.D. "Dan" Mote, Jr. arrived at the UMD in 1998 to begin his tenure as president, he made what he calls a stunning observation: Of the 4,000 freshmen in that year's incoming class, only 40 came from public high schools in Baltimore. His determination to boost those numbers led to establishment of the Incentive Awards Program, which provides financial support, mentorship, and a close-knit community to promising students from Baltimore City and Prince George's and Montgomery county schools facing challenging circumstances.

In recognition of his pivotal role, the IAP is now known as the C.D. Mote, Jr. Incentive Awards Program. Meanwhile, the university's Engineering Laboratory Building at UMD has also been renamed in his honor. The building is home to some of Maryland Engineering's most important experimental research facilities, including the Advanced Propulsion Research Laboratory and the Center for Advanced Life Cycle Engineering.

"We are proud to honor my mentor and friend, former UMD President Dr. Dan Mote, through the namings of the C.D. Mote, Jr. Engineering Laboratory and C.D. Mote, Jr. Incentive Awards Program," said UMD President Darryll J. Pines at a ceremony in October 2021. "Your service to our university can never be fully measured, but it will always be gratefully remembered."

Mote was UMD's president from September 1998 through August 2010. He is president emeritus of the National Academy of Engineering (NAE) and currently serves on the UMD faculty as Regents Professor and Glenn L. Martin Institute Professor of Engineering.



DIETER LECTURE

MARYLAND ENGINEERING INAUGURATED ITS NEW GEORGE DIETER LECTURE SERIES IN MECHANICS AND MATERIALS WITH A LECTURE BY DR. JOHN W. HUTCHINSON, ABBOTT AND JAMES LAWRENCE PROFESSOR OF ENGINEERING EMERITUS AT HARVARD UNIVERSITY.

Hutchinson's lecture, "New Developments in Shell Stability," highlighted recent work by Hutchinson and his collaborators. The lecture series, which honors former Dean of Maryland Engineering Dr. George E. Dieter, was established through a collaboration between the departments of material science engineering and mechanical engineering.

Dean Graham Receives Top ASME Award

ASME HAS SELECTED DEAN GRAHAM AS THE RECIPIENT OF THE 2022 ALLAN KRAUS THERMAL MANAGEMENT MEDAL.

The American Society of Mechanical Engineering (ASME) has selected Samuel Graham, Jr., Dean of Maryland Engineering, to receive the 2022 ASME Allan Kraus Thermal Management Medal "for expertise in the thermal engineering of wide bandgap semiconductor devices and interfaces, including heterogeneous integration methods for thermal management." The award will be formally presented during the International Technical Conference on Packaging and Integration of Electronic and Photonics Microsystems Conference and Exhibition taking place from October 25-27, 2022, in Garden Grove, CA.

Established in 2009, the Medal recognizes an individual's significant contributions in thermal management along with their dedication to the field of thermal science and engineering. All awardees have demonstrated their contributions to thermal management through product development, seminal papers, patents, and leadership of research and development programs.

Graham's commitment to innovation, research, and education is clearly established in his work with micro and nano engineering. His research on organic and flexible electronics is primed to provide important data for future displays and wearable devices. Additionally, Graham's groundbreaking studies on the thermal analysis of Gallium Nitride (GaN) high-electron mobility transistors is critical for a wide range of applications such as the fabrication, packaging, and reliability of modern RF communications, solar blind sensors, radar systems, and power electronics.


PHOTO: STEPHANIE S. CORDLE

His research efforts have been acknowledged with the National Science Foundation CAREER Award as well as his serving on the advisory board of the Engineering Science Research Foundation of Sandia National Laboratories and the Emerging Technologies Technical Advisory Committee of the U.S. Department of Commerce. He also serves on the Board of Directors for the Institute of Nuclear Power Operations.

"I am sincerely honored to receive the ASME Allan Kraus Thermal Management Medal. This is a recognition of the research efforts of my students, post-docs, and collaborators that I have worked with over my career," Graham said. "I am passionate about continuing to foster collaborative endeavors toward applications for the thermal management of emerging electronic systems."

LEARN MORE go.umd.edu/kraus

AGONAFER, DUTT JOIN UMD FACULTY

The UMD Department of Mechanical Engineering welcomes new faculty members **DAMENA AGONAFER** (left) and **AVIK DUTT** (right). Dr. Agonafer, whose research explores the intersection among thermal-fluid sciences, interfacial transport phenomena, and renewable energy, has been named a Clark Faculty Fellow and associate professor in the department. He received his Ph.D. from the University of Illinois-Champaign. Dr. Dutt, who received his Ph.D. from Cornell University, has joined the faculty as an assistant professor. His research interests include quantum engineering, photonics, and non-linear optics.

UMD Mechanical Engineering Chair and Minta Martin Professor Balakumar Balachandran (left) was presented with the 2022 Robert Scanlan Medal at the EMI 2022 conference, held at The Johns Hopkins University in June. Pictured with Professor Balachandran are ASCE Engineering Mechanics Institute (EMI) President, Professor Sankaran Mahadevan of Vanderbilt University (center) and ASCE EMI Treasurer, Professor Michele Barbato of UC Davis.

Balachandran Receives Robert H. Scanlan Medal

BALAKUMAR BALACHANDRAN, DISTINGUISHED UNIVERSITY PROFESSOR, MINTA MARTIN PROFESSOR AND CHAIR, HAS BEEN AWARDED THE ROBERT R. SCANLAN MEDAL, WHICH IS GIVEN BY THE AMERICAN SOCIETY OF CIVIL ENGINEERS' (ASCE) ENGINEERING MECHANICS INSTITUTE (EMI). HE IS THE FIRST UMD FACULTY MEMBER TO RECEIVE THIS DISTINCTION.

"It was my good fortune to serve with Bob Scanlan as a colleague at Princeton and to continue our friendship over many years thereafter," said Earl H. Dowell, William Holland Hall Distinguished Professor at Duke University and a member of the U.S. National Academy of Engineering, commenting on the award. "Professor Scanlan was a preeminent pioneer in aeroelasticity and wind engineering and I know he would be pleased that Professor Balachandran is receiving the Scanlan Medal for his own distinguished career in nonlinear dynamics, vibrations, and system identification."

"Those of us who have had the pleasure of knowing Bala and Bob are especially pleased that these two outstanding scholars are forever linked by this award," he said.

Balachandran has chaired the UMD mechanical engineering department since 2011. He is a fellow of the American Society of Mechanical Engineers (ASME) as well as of the American Institute of Aeronautics and Astronautics (AIAA). In 2021, he received ASME's J.P. Den Hartog and Lyapunov Awards in recognition of his achievements as an engineer, researcher, and educator.

"In addition to his textbooks, which have become the reference for advanced research on nonlinear vibration mechanics and its application to nonlinear aeroelasticity, Professor Balachandran has single-handedly and very boldly initiated a number of research areas in the domain of nonlinear vibrations with applications to various engineering problems and which attract a growing interest," said Roger Ohayon, Professor Emeritus at the Conservatoire National des Arts et Metiers (CNAM), Paris and a member of the French Academy of Sciences.

"The development of his research hinges on a deep understanding of the complex field of nonlinear dynamics and bifurcations, initiated by scientists such as Poincaré," he said. "Professor Balachandran contributions highlight a broad scientific culture that spans applied mathematics, nonlinear mechanics and vibrations, fluid-structure interactions such as nonlinear aeroelasticity, experimental mechanics."

LEARN MORE go.umd.edu/scanlan

Groth Receives Landis Award

Katrina Groth, associate professor and associate director of the Center for Risk and Reliability, has been awarded the Landis Yount Member Engineering Achievement Award, a highly competitive national-level award from the American Nuclear Society (ANS). It is one of the only national-level awards in the field that is given in recognition of engineering achievements with significant technical merit.

In recognizing Groth, the ANS cited her sustained technical excellence in nuclear safety, probabilistic risk assessment, and human reliability analysis.

LEARN MORE go.umd.edu/landis

Hash Hashemian (left), chair of the ANS Honors and Awards Committee, presents the Landis Young Member Engineering Achievement Award to UMD associate professor of mechanical engineering Katrina Groth.

FACULTY RECOGNITIONS

Professor SHAPOUR AZARM is serving this year as Vice Chair of the American Society of Mechanical Engineers (ASME)Technical Committee on Publications and Communications.

BALAKUMAR BALACHANDRAN, Distinguished University Professor, Minta Martin Professor and Chair, has been named a Fellow of the Royal Aeronautical Society, the oldest aeronautical society in the world.

Associate Professor SIDDHARTHA DAS was elected a Fellow of the Institute of Engineering Technology (IET), based in the United Kingdom.

Professor and Dean of UMD's Clark School of Engineering SAMUEL GRAHAM, JR. has been elected Chair of the Emerging Technologies Technical Advisory Committee of the Bureau of Industrial Security, US Department of Commerce. In addition, Graham was selected to deliver the Hawkins Memorial Lecture at Purdue University during the fall.

Professor KENNETH KIGER has been named a Distinguished Scholar-Teacher by UMD. The Distinguished Scholar-Teacher Program honors faculty who have demonstrated outstanding scholarly achievement as well as outstanding accomplishments as teachers, and is considered one of the most prestigious honors offered by the university.

FACULTY PROMOTIONS

VIKRANT AUTE has been named a Research Professor. He was previously a Research Scientist at the UMD ME department.

STEVEN MITCHELL has been promoted to Senior Lecturer.

AMIR SHOOSTARI has been promoted to Research Professor.

RYAN SOCHOL has been promoted to Associate Professor.

GRADUATE STUDENT SPOTLIGHT

Elizabeth Jordan

ELIZABETH JORDAN'S PH.D. RESEARCH FOCUSES ON OPTIMIZATION AND DECISION SUPPORT TOOLS RELATED TO THE COVID-19 PANDEMIC.

Elizabeth Jordan grew up in a family of engineers and, from a young age, she enjoyed tinkering and completing handiwork around her house. She knew that engineering was the right fit for her, but she didn't know where she wanted to pursue her degree until she toured the UMD campus.

"When I went on the UMD campus tour, we were led into the Terps Racing shop, and I fell in love with it immediately," said Jordan. "I told myself that if I ended up at UMD, I would be a part of Terps Racing."

At that moment, Jordan decided that the department of mechanical engineering at UMD was the right fit for her.

"I wanted to get a degree that would be broad enough to offer lots of different opportunities after graduation," said Jordan. "Mechanical engineering gives me a solid foundation, and from here, I can go wherever I want."

Now, Jordan is a Ph.D. student with a research focus on optimization and operations research models and is advised by Professor Shapour Azarm. Jordan's current research analyzes the impact of the COVID-19 pandemic on aviation repair. In modeling an aircraft maintenance scheduling tool, Jordan is looking at just one system of many. Her goal is to develop a complex model of multiple systems integrated together. The data that these multifaceted systems produce can be used to predict future cases and optimize mitigation efforts, which can translate to real-world applications such as allocating hospital resources.

"This is a huge undertaking, and I'm just looking at a piece of it," said Jordan. "However, we can't overlook all of the effects that this has on different aspects of our lives."

Along with her research, Jordan works as an intern for GE Aviation. During the interview process, Jordan's employer noted that she was an exceptionally strong candidate because of her background in Terps Racing. Jordan was a member of the testing and electronics sub-team for the Baja Team in Terps Racing for over four years, and she became the sub-team leader during her senior year. Not only did Terps Racing make Jordan a strong job candidate, but it also gave her hands-on experience in testing and manufacturing.

"For me, Terps Racing connected the dots between what we learn in class and the applications in the real world," said Jordan.

This real-world connection continued throughout her internship because Jordan filled multiple roles at GE Aviation. She started her internship working on the preliminary designs of an engine. The next year, she worked on stress and vibration analysis of the turbine blades, and now, she is working on engine performance analysis. Starting with Terps Racing as an undergraduate and then working through the different stages of engine design in her internship brings Jordan's experiences full-circle.

"UMD has so much to offer; we are given all the tools we need to pursue our dreams. That sounds cliché, but it's true," said Jordan. "UMD gives you the car, and you just have to sit at the wheel and drive."

GRADUATE STUDENT AWARDS

Ann G. Wylie Dissertation Fellowship
GHAZAL ARABI DARREHDOR, RISHI ROY

NSF Graduate Research Fellowship
OLIVIA YOUNG

The Marvin Roush Fellowship in Risk and Reliability
ANDRES RUIZ-TAGLE PALAZUELOS

Future Faculty Fellowship
RISHI ROY

Society of Tribologists and Lubrication Engineers Fellowship
TURASH HAQUE PIAL

Clark Doctoral Fellows Program
ADIRA COLTON, CAMILLE LEVINE, JESSE PARREIRA, ANTHONY JONES, ELIZABETH JORDAN

Promise Engineering Institute/ASEE Delta Professional Development Mentorship Program
SARJANA ORADIAMBALAM SACHIDANANDAM

Best Thesis Award
LALITH DHARMALINGAM

Best Dissertation Award
HARNOOR SACHAR

Three Minute Thesis Award Finalist & Engineering School Winner
RISHI ROY

Engie Graduate Fellowship in Engineering
BRIAN O'MALLEY, CHENG-YI LEE

University Nuclear Leadership Program Fellowship
CAMILLE LEVINE

UNDERGRADUATE STUDENT SPOTLIGHT

Amaya Caggino

AS A MEMBER OF THE CLARK SCHOLARS PROGRAM, AMAYA IS ABLE TO TAKE FULL ADVANTAGE OF THE EDUCATIONAL AND RESEARCH OPPORTUNITIES IN THE DEPARTMENT OF MECHANICAL ENGINEERING.

Senior mechanical engineering student Amaya Caggino is a member of the second cohort of the A. James Clark Scholars Program, which provides need-based scholarships to students who show leadership and academic potential. Because of this, Caggino had the chance to meet the other 10 members of her Clark Scholar's cohort to grow connections and become familiar with the UMD campus before her classes even began. Right away, she felt supported academically, socially, and financially at UMD.

The backing of the Clark Scholars Program allows Caggino to take full advantage of the educational and research opportunities offered on campus. For instance, the program requires that Caggino meet with her advisor regularly. Because of this, Caggino formed a close relationship with her freshman advisor, Fitzgerald Walker.

"He must see something in me because he's recommended me for a bunch of different organizations and clubs. He's provided a lot of advice, and having that support was really helpful in my transition to college," said Caggino.

One of the organizations Walker recommended to Caggino was the Mechanical Contractors Association of Metropolitan Washington (MCAMW) student chapter at UMD. Initially, Caggino didn't think that she was interested in construction, but through the program, she learned that it was her passion, and she quickly became a crucial member of the team.

"The organization is really cool because it allows us to take what we learn in our classes and apply them to real life," said Caggino.

Through the program, Caggino built leadership skills, competed in national competitions, and traveled across the country to attend conferences. At the most recent conference, Caggino was awarded the inaugural Thomas J. Wanner Scholarship of $5000. Additionally, her connections at MCAMW earned her two summer internships with the Poole and Kent Corporation.

Caggino has also taken full advantage of multiple other programs offered at UMD, such as the First-Year Innovation and Research Experience (FIRE); Engineers Without Borders (EWB); the Diversity, Equity, and Inclusion Committee; the Mechanical Engineering Unit Self-Review Committee; the Honors Program at UMD; and the ClarkLEADERs program.

"I think it's awesome that there are so many organizations at UMD that allow you to really put yourself out there, meet different people, build connections, and have experiences that you typically wouldn't have in a classroom setting," said Caggino.

The Clark Scholars program also offers Caggino the chance to give back to the UMD community through a service-learning project. The Clark Scholar cohorts have collaborated to develop, propose, and plan a bioretention garden to collect stormwater runoff. Caggino hopes to take part in the construction of the garden before graduation. Overall, the Clark Scholars Program encouraged Caggino to explore different opportunities at UMD, and it's helped define her college experience.

"I feel super lucky that things worked out the way that they did because it's nothing that I would have planned," said Caggino. "Being at UMD and a Clark Scholar, I've been able to take risks because I know that there are people here to support me and help me through these big decisions."

Amazon Lab126 Diversity in Robotics and AI Fellowship
SARA HONARVAR

Graduate Student Summer Research Fellowship
RISHI ROY

Graduate School Outstanding Research Assistant Award
ZHAOXI YAO, CATHLEEN NEEDHAM, JUNGHO KIM

IPC Student Scholarship
DEEPAK BONDRE

ANS Washington DC Local Section George P. Shultz and James W. Behrens Graduate Scholarship
CAMILLE LEVINE

IMAPS Foundation's Steve Adamson Student Recognition Award
SURAJ RAVIMANALAN

Maryland Robotics Center (MRC) Graduate Research Assistantship
LASITHA WEERAKOON

2021 Roberta Ma Scholarship Award
CHENG-YI LEE

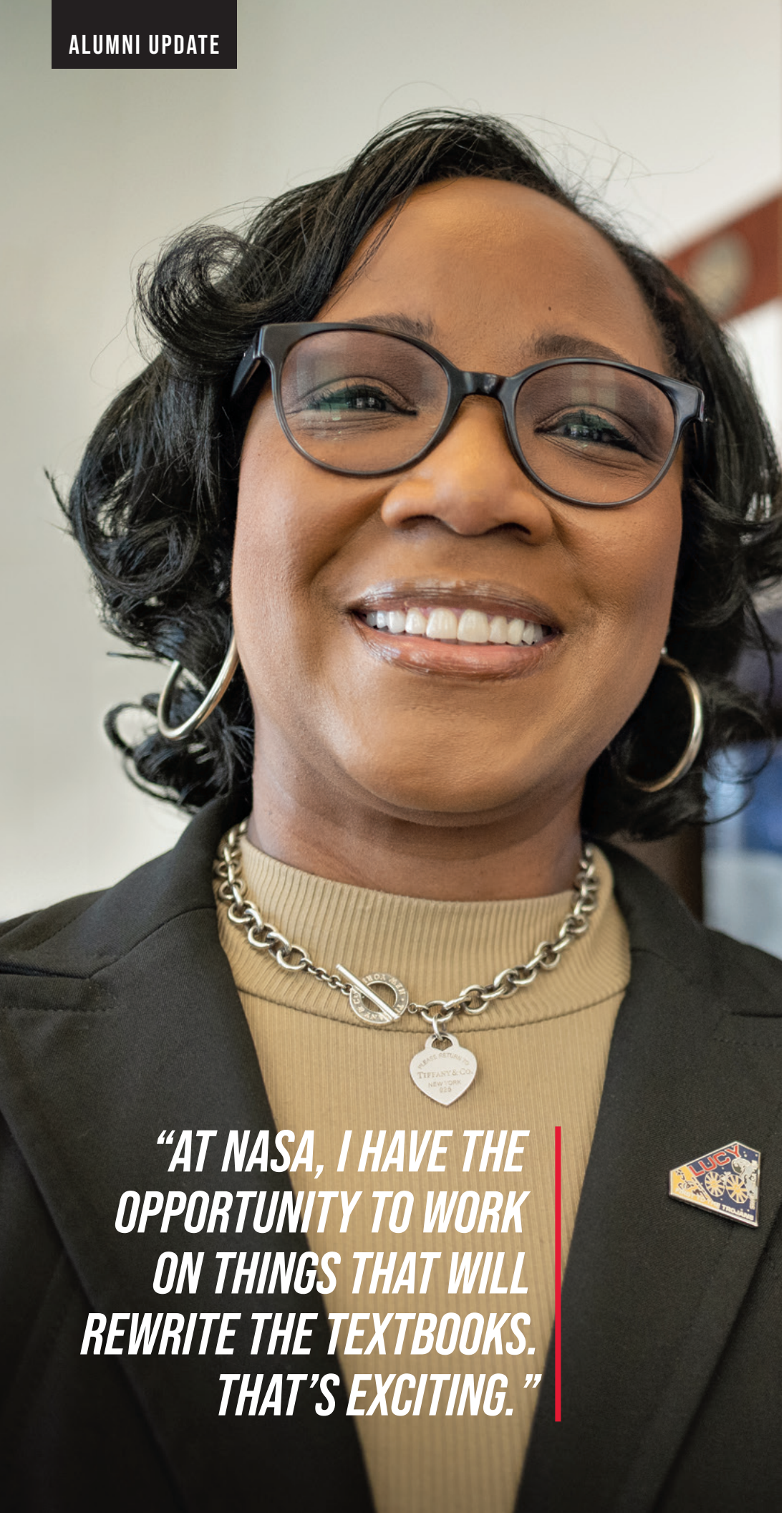
Best Teaching Assistant Award
RISHI ROY

ATE-HEFAT 2021 Best Session Paper Award
JAMES TANCABEL

Northrop Grumman Graduate Teaching Fellowship
VINCENT PAGLIONI

Dean's Summer Fellowship
SEBASTIAN ROMO DUENAS

Society of Tribologists and Lubrication Philadelphia Scholarship
DEEPAK BONDRE



Leadership Forged by Experience

A ROLE MODEL FOR ASPIRING STEM STUDENTS, NASA'S DONYA DOUGLAS-BRADSHAW KNOWS THAT BOTH SKILLS AND RESILIENCE ARE NEEDED FOR SUCCESS.

No one would describe Donya Douglas-Bradshaw's childhood as easy. Growing up in modest circumstances on Maryland's Eastern Shore, she spent hours working in fields alongside her relatives, helping to earn a livelihood.

Although she faced many disadvantages, Douglas-Bradshaw (B.S. '94, mechanical engineering) also had strengths that would take her far. Teachers noticed her prodigious math skills, which ultimately won her a college scholarship. At 10 years old she resolved that someday she would work for NASA—and in the coming years, her grit and determination would help her achieve that dream.

Today, she is deputy director for planning and business management at the Goddard Space Flight Center's Engineering and Technology Directorate. It's her latest role in a NASA career that has also included managing the Lucy Mission and serving as a thermal engineer for Space Technology-5, a 2006 mission that launched three 25kg satellites into orbit. Prior to Lucy, she was the project manager for the ICESat-2 ATLAS instrument. ATLAS, the largest and most technologically advanced instrument built in-house at Goddard, launched successfully aboard ICESat-2 on September 15, 2018.

Over the course of her career, she has authored or co-authored over 20 publications in research and development of capillary pumped loops, loop heat pipes, and variable emittance coatings. "At NASA, I have the opportunity to work on things that will rewrite the textbooks," she said. "That's exciting."

PHOTO: NASA/REBECCA ROTH

Stepping Up to the Plate in Challenging Times

Douglas-Bradshaw's drive and determination were very much in evidence during 2020, when the COVID-19 pandemic forced sudden and radical changes in the way we work and interact. The crisis, unprecedented in recent history, occurred during her time with the Lucy Mission, which aimed to launch a spacecraft that would travel four billion miles over twelve years to collect data on Jupiter's Trojan asteroids, as well as on one asteroid in the main asteroid belt.

For one thing, its team was distributed around the country: the spacecraft provider, Lockheed Martin, and the mission's principal investigator were both based in Colorado; the navigation team operated out of a facility in California; and the instrument teams had one team in Arizona and two in Maryland. On the East Coast, meanwhile, Douglas-Bradshaw and her team at NASA-Goddard were responsible for managing the entire undertaking.

The COVID-19 lockdowns imposed daunting constraints, but the Lucy team adapted. Many rose early or went to bed late so they could meet virtually with their colleagues across the United States. The team developed a method called "over the shoulder," with a Zoom video session pointed at a computer so the engineers could follow the data and look at the trends. Using an iPad and a GoPro camera, an engineer would walk around in the clean rooms, providing video for the mission assurance personnel. Through creative collaboration of this kind, the team was able to stay on schedule; in fact, Lucy lifted off the very second its launch window opened.

The mission lived up to the motto that Douglas-Bradshaw had inscribed on the spacecraft: Lucy Strong!

And COVID-19 wasn't the only test of that strength: in May 2020, the murder of George Floyd at the hands of Minneapolis police set off intense social unrest. While staying on top of the Lucy Mission, Douglas-Bradshaw also had to weather the anxiety and fear engendered by these events.

"My kids had to go out every day to their jobs," she said, "Would they get pulled over? I worried about them. And I was trying to figure out how to cope with my anxieties without burdening the team."

As it turned out, the team's care and support were exactly what helped get her through. "People contacted me of their own volition, sending me emails of encouragement, letting me know they were allies. It reminded me that we were Lucy Strong, and that we weren't just coworkers but a family."

Leadership With a Vision

With her work on the Lucy Mission now behind her, Douglas-Bradshaw is bringing her leadership skills to NASA's largest directorate, one that encompasses approximately 1,200 civil servants and many thousands of contractors. "It's bigger than some entire NASA centers," she notes.

"What I'm looking to bring to the Engineering and Technology Directorate, drawing from my experience as a Project Manager, is the ability to identify business and project management practices that we can apply to our institution, in order to increase our efficiency and achieve our strategic goals," she said.

Meanwhile, she continues to be an advocate for greater female and minority representation in the space industry, and has served as chair of NASA Goddard's Women's Advisory Committee. She also remains involved in education and outreach programs. Such activities are in line with a motto that is close to her heart: to whom much is given, much is required.

Douglas-Bradshaw has received numerous awards in recognition of distinguished achievement and outstanding leadership, and has been featured in national publications such as *Upscale Magazine* and *Black Enterprise*. She was also listed as one of THEGRIO.COM Top 100 History Makers in the Making. "I've been blessed with capabilities and skills, and I really view it as my duty to use my skills and my talents for the betterment of work, society, and my community," she said. "Mentorship has been essential to my success at every stage of my career, and so I feel a great responsibility to give back."

"I believe in helping others become the best that they can be."

LEARN MORE go.umd.edu/douglas-bradshaw-feature

Onyekwere-Lyons Wins Gold at Commonwealth Games

WHILE COMPLETING HER B.S. IN MECHANICAL ENGINEERING AT UMD, Chioma (CiCi) Onyekwere-Lyons also made her mark in Terrapins track and field, breaking a 14-year school record in weight throw and a 34-year record in discus, and medaling in a succession of NCAA and Big Ten championships. She soon went on to make her mark in the international arena, taking home the gold medal in discus at the African Championships in 2018—a title she would successfully defend four years later, while also racking up first place at the African Games in 2019.

Now CiCi has taken her athletic career to even greater heights, this summer, she won gold at the Commonwealth Games in Birmingham, U.K. with a throw of 61.70m—a personal best. She is the first Nigerian to win gold in the discus throw at the Games.

CONGRATULATIONS, CICI!

Reyes Inducted Into Innovation Hall of Fame

José Reyes (M.S. Nuclear Engineering '84, Ph.D. Nuclear Engineering '86), co-founder and chief technology officer of NuScale Power, was formally inducted into the University of Maryland's Innovation Hall of Fame (IHOF) during a ceremony in December 2021.

NuScale co-founder and CTO José Reyes (left), pictured here with UMD mechanical engineering department chair Balakumar Balachandran, was honored for his role in the development of Small Modular Reactor (SMR) technologies that could help ensure clean water and sustainable energy.

The recognition is in honor of his work in co-designing the first Small Modular Reactor (SMR) to receive Nuclear Regulatory Commission design approval.

Speaking at the ceremony, Reyes said the initial impetus for his work on SMRs came as he attended an International Atomic Energy Agency meeting in Vienna, while on sabbatical as an Oregon State University professor.

"I met with delegates from different member states, and kept hearing that 'we really need nuclear power in our country, but we can't afford a 1000-megawatt nuclear plant and don't have the grid to support one of that size,'" Reyes recalled.

Nuclear power, he said, can meet needs that go well beyond electrical power production.

"About 5.9 billion people live in energy poverty," Reyes said. "About 800 million people don't have access to clean water. Air pollution contributes to five and a half million deaths globally each year. More than 1 billion tons of food are being lost or wasted due to lack of refrigeration—just not having the power to get it from farm to market."

"Those are the challenges. Not only do we have to meet these challenges, but we have to do so using carbon-free energy," he said.

Prior to co-founding NuScale in 2007, Reyes served as head of Oregon State University's department of nuclear engineering and radiation health physics. He directed the Advanced Thermal Hydraulic Research Laboratory and was the co-director of the Battelle Energy Alliance Academic Center of Excellence for Thermal Fluids and Reactor Safety in support of the Idaho National Laboratory mission. Dr. Reyes was OSU's principal investigator for the AP600 and AP1000 design certification test programs sponsored by the U.S. Nuclear Regulatory Commission, the U.S. Department of Energy, and Westinghouse. He currently serves as a Professor Emeritus in the School of Nuclear Science and Engineering.

He is a co-inventor on more than 110 patents granted or pending in 20 countries. He has received several national awards including the 2013 Nuclear Energy Advocate Award, the 2014 American Nuclear Society Thermal Hydraulic Division Technical Achievement Award, the 2017 Nuclear Infrastructure Council Trailblazer Award, and the 2021 American Nuclear Society Walter H. Zinn Medal. He is a fellow of the American Nuclear Society and a member of the National Academy of Engineering. He has served as a United Nations International Atomic Energy Agency (IAEA) technical expert on passive safety systems.

LEARN MORE go.umd.edu/jreyes

ALUMNI ACCOMPLISHMENTS

KEVIN BELLAMY (B.S. '84) was named General Manager of Value Dry Waterproofing.

LORENZO CREMASCHI (Ph.D. '04) was named Director of Undergraduate Research for Auburn University's Department of Mechanical Engineering. He is a former student of Dr. Reinhard Radermacher.

DONYA DOUGLAS-BRADSHAW (B.S. '94) was promoted to Deputy Director for Planning and Business Management of the Engineering & Technology Directorate at NASA-Goddard Space Flight Center, the agency's largest directorate.

DELMAR GILLUS (B.S. '93) led the negotiating team that authored and ultimately passed the Climate and Equitable Jobs Act in the State of Illinois. He was also named a 2022 Notable Leader in Sustainability by Crain's Chicago Business Journal.

SHEILA GLESMANN (B.S. '87) was awarded a Small Business Innovation Research (SBIR) grant to assess the feasibility of the Department of Energy's smart energy data platform (VOLTTRON) for use in greenhouses/indoor farms.

NuScale Power Corporation, with Co-Founder and Chief Technology Officer **JOSÉ REYES** (M.S. '84, Ph.D. '86, nuclear engineering), started publicly trading on the New York Stock Exchange under ticker symbols "SMR" and "SMR WS."

RAJA SUNDARARAJAN (M.S. '98) was named Executive Vice President of External Affairs for American Electric Power.

VISITING COMMITTEE MEMBERS

Jay De Veny (B.S. '91)
Kathy Eberwein (B.S. '88)
Brian Gearing (B.S. '96)
Howard Harary
Steve Hogan (B.S. '85)
Roberto Horowitz
Asif Hussain (B.S. '94)
Bob Kaplan (B.S. '82)
Maria Korsnick (B.S. '86, nuclear engineering)
Nancy Margolis (M.S. '81)
Michael Miller (B.S. '79, M.S. '84)
Jim Moreland (B.S. '88)
José Reyes (M.S. '84, Ph.D. '86, nuclear engineering)
Alex Severinsky (M.S. '67 Ph.D. '75, electrical engineering)
ToniAnn Thomas (B.S. '82)
Kon-Well Wang
David Wilson

EMERITUS MEMBERS

Aris Cleanthous (B.S. '96)
George Dieter*
Charley Kilmain (B.S. '85)
G. Lee Lushbaugh, Jr. (B.S. '74)
T.G. Marsden (B.S. '87)
John Miller (M.S. '70)
Sheila Mortazavi (B.S. '95)
Hratch Semerjian
Sheldon Shapiro*
Susan Skemp
Tom Stricker (B.S. '89, electrical engineering)
Ward Winer
Manolo Zúñiga (B.S. '83)

*DECEASED

HAVE NEWS TO SHARE?

Contact Heidi Sweely, Director of External Relations, at **hsweely@umd.edu**

Sharing with our students

EACH YEAR, MECHANICAL ENGINEERING ALUMNI GIVE BACK TO THE CLARK SCHOOL COMMUNITY.

By volunteering to take part in ME department events, many of the Clark School's most notable alumni provide students a valuable opportunity to engage and learn about their professional journeys.

Our many thanks to the alumni who participated as Career Paths speakers, on Ask Me Anything panels, as Nibble & Network table hosts, and as Design Day judges.

If you'd like to volunteer for one of our events, please contact Heidi Sweely at hsweely@umd.edu

"NIBBLE & NETWORK"

A roundtable event, "speed-dating" style, for alumni to share tips and tricks for post-graduation success.

Hakan Beygo (B.S. '88)
SENIOR DIRECTOR, FREDDIE MAC

Charles Grody (B.S. '20)
CEO, HYDRAZE, INC.

Rani Harrison (B.S. '94)
VENTURES, ECOSYSTEM & ACQUISITIONS, IBM CONSULTING

Todd Moore (B.S. '85)
SALES MANAGER, CARROLL AIR SYSTEMS

Ben Lawless (B.S. '85)
PROGRAM MANAGER, POND & COMPANY

Curt Watson (B.S. '76)
RETIRED, CEO-THE INFINITY GROUP, WOOD GROUP

Dot Zukor (M.S. '77, Ph.D. '82)
RETIRED, ASSOCIATE DIRECTOR FOR EARTH SCIENCES, NASA GODDARD SPACE FLIGHT CENTER

CAREER PATHS SPEAKERS (FALL 2021 ONLY)

Alumni share their career trajectories and lessons learned in 45-minute presentations for undergraduate students.

Robert Aikins (B.S. '06)
FOUNDER, ALIGNED INVESTING

Charles Clinton (M.S. '98)
VICE PRESIDENT OF ENGINEERING, MESO SCALE DIAGNOSTICS

Brian Gearing (B.S. '96)
PARTNER, CROWELL & MORING LLP

Jonathan Miner (B.S. '82)
RETIRED, VICE PRESIDENT OF RESEARCH & DEVELOPMENT, BISSELL HOMECARE

Chioma "Cici" Lyons (B.S. '16)
EXTERIOR LIGHTING DESIGN & RELEASE ENGINEER, FORD MOTOR COMPANY

Balaji Panchapakesan (Ph.D. '01)
PROFESSOR OF MECHANICAL ENGINEERING, WORCESTER POLYTECHNIC INSTITUTE

ASK ME ANYTHING

Alumni join this moderated panel series to answer students' questions about life and engineering.

Robert Aikins (B.S. '06)
FOUNDER, ALIGNED INVESTING

Jay De Veny (B.S. '91)
VICE PRESIDENT - VEHICLE TECHNOLOGY, HYZON

Donya Douglas-Bradshaw (B.S. '94)
DEPUTY DIRECTOR - ENGINEERING & TECHNOLOGY DIRECTORATE, NASA GODDARD SPACE FLIGHT CENTER

Susan Edwards (B.S. '00)
DIRECTOR OF OPERATIONS, PHOENIX OPERATIONS GROUP

Rani Harrison (B.S. '94)
VENTURES, ECOSYSTEM & ACQUISITIONS, IBM CONSULTING

David Hatwell (B.S. '97)
FOUNDING PARTNER & PRESIDENT, THE AEGIS COMPANIES

Beth LeBrun (B.S. '12)
PRODUCTIVITY MANAGER, NEWELL BRANDS

Dunstan Macauley (B.S. '95)
DIRECTOR OF MECHANICAL ENGINEERING, SETTY & ASSOCIATES

Matt McCathorine (B.S. '05)
CO-FOUNDER & MANAGING PARTNER, IMPYRIAN

Sarah McComb (B.S. '94)
SENIOR TECHNICAL ADVISOR, NATIONAL TRANSPORTATION SAFETY BOARD

Tarik Reyes (B.S. '95, nuclear engineering)
PRESIDENT, GLOBAL HEALTH AND FINANCIAL SOLUTIONS SECTOR, PERATON

Bridget Russell (B.S. '15)
SENIOR QUALITY ENGINEER, INTEGRA LIFESCIENCES

DESIGN DAY JUDGES

Many thanks to our alumni who served as judges for the bi-annual showcase of senior capstone design projects.

For more information, visit
go.umd.edu/design-day

Bailey Benedick (B.S. '19)
RESEARCH & DEVELOPMENT TEST ENGINEER, INTRALOX

Hakan Beygo (B.S. '88)
SENIOR DIRECTOR, FREDDIE MAC

Charles Clinton (M.S. '98)
VICE PRESIDENT OF ENGINEERING, MESO SCALE DIAGNOSTICS

Megan Cowie (B.S. '20)
MECHANICAL ENGINEER, INTRALOX

Tony Davenport (B.S. '92)
NORTH AMERICAN REGIONAL MANAGER, PHOENIX INTEGRATION

John Drager (B.S. '64)

Susan Edwards (B.S. '00)
DIRECTOR OF OPERATIONS, PHOENIX OPERATIONS GROUP

Topaz Elliott (B.S. '03)
PATENT EXAMINER (MECHANICAL), UNITED STATES PATENT AND TRADEMARK OFFICE

Elliott Flick (B.S. '89)
VICE PRESIDENT OF COMMERCIAL PROJECTS, CONSTELLATION ENERGY

Alex Folk (B.S. '96)
SENIOR OPERATIONS ADVISOR, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Jeff Gair (M.S. '16, Ph.D. '17)
FOUNDER & CEO, SCINETICS, INC.

Sheila Glesmann (B.S. '87)
ENGINEER/BUSINESS OWNER, SINC ENERGY

Charles Grody (B.S. '20)
CEO, HYDRAZE, INC.

Ben Lawless (B.S. '85)
PROGRAM MANAGER, POND & COMPANY

Bill Leasure (B.S. '66)

Barry McQuay (B.S. '83)
SENIOR PROJECT MANAGER, THE WHITING-TURNER CONTRACTING COMPANY

Larry Ramsey (B.S. '69, M.S. '80)
CONTAMINATION CONTROL ENGINEER, NASA GODDARD SPACE FLIGHT CENTER

Tarik Reyes (B.S. '95)
PRESIDENT, PERATON

Sebastian Silvani (B.S. '95, M.S. '98)
RESEARCH ENGINEER - AUTONOMOUS VEHICLES, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

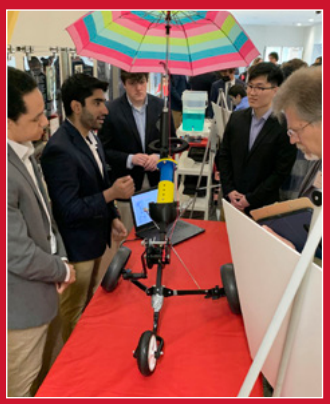
Dorothy Zukor (M.S. '77, Ph.D. '82)
RETIRED, ASSOCIATE DIRECTOR FOR EARTH SCIENCES, NASA GODDARD SPACE FLIGHT CENTER

DESIGN DAY 2021-2022

In addition to the People's Choice Awards and the Social/Environmental Design Impact Award, the department selected six teams as recipients of Linda Schmidt Innovation Awards in honor of the late Professor Schmidt.

FALL 2021

SPRING 2022



Maria Korsnick (B.S. '86) is welcomed into the Dean's Circle for the A. James Clark School of Engineering by Dean Samuel Graham and President Darryll Pines on May 9, 2022.

PHOTO BY GREG FIUME

Maria and Michael Korsnick

THE KORSNICKS HAVE ESTABLISHED A NUCLEAR ENGINEERING INNOVATION AWARD AT UMD TO HELP BUILD A PIPELINE OF TALENT IN THE FIELD.

For alumna Maria Korsnick (B.S. '86, nuclear engineering), the climate crisis is the greatest existential threat of our time. Amid rising sea levels, changing weather patterns and severe storms, drought, famines, and natural habitat loss, the world is coalescing around the need to dramatically—and urgently—reduce carbon emissions to mitigate the worst effects of a changing climate. It's a race against the clock, and one Korsnick says we cannot afford to lose.

"There is a solution that sits at the core of all affordable, serious, and realistic plans to decarbonize not only our electric sector, but entire economies," explains Korsnick. "Nuclear carbon-free energy." She and her husband Michael, who also has a nuclear energy background, recognize an urgency to building the nuclear engineering talent pipeline now and, from her vantage point as President and CEO of the Nuclear Energy Institute—the policy organization of the nuclear technologies industry—Korsnick sees an opportunity for the University of Maryland (UMD).

The current fleet of nuclear reactors in the United States is the backbone of modern clean energy generation, and new reactor designs are foundational to a net zero-carbon future, Korsnick said. Thanks to decades of innovation, the advanced nuclear reactors that will be operational by 2030 will look very different from the reactors of today. New reactors will come in all sizes, makes, and models. They'll have the flexibility to modify output and the versatility to pair perfectly with variable sources like wind and solar. They will offer carbon-free energy to the world's largest cities as well as remote, rural communities.

The demand for carbon-free solutions like these create not only great opportunities, but a great need for a skilled workforce prepared for tomorrow's technology—a workforce that UMD is uniquely positioned to help build. UMD boasts a unique combination of assets: close proximity to the Nuclear Regulatory Commission, a campus-based research and test reactor, and both a nuclear engineering minor and reactor operator training program. These assets also support UMD's ongoing commitment to the global fight against the climate crisis.

In Korsnick's view, as society realizes the growing imperative of nuclear energy, these assets will attract students to study nuclear engineering, and to do so at UMD. They are the foundation to reestablishing the A. James Clark School of Engineering's commitment to nuclear energy, expanding its faculty base, and even reinstating the nuclear engineering major program.

To jump start this vision, the Korsnicks have established the Nuclear Engineering Innovation Award. Their goal is that financial incentives will expand students' interests in nuclear engineering, increase the pipeline of talent for the burgeoning nuclear industry, and build the case for Maryland Engineering and the University of Maryland to dedicate more resources to this effort. Maria and Michael desire to see UMD students at the heart of the nation's work in leading the world in nuclear power production and reliability.

LEARN MORE go.umd.edu/neia

INTERESTED IN MAKING A GIFT?

Visit **enme.umd.edu/give** or contact Heidi Sweely at **hsweely@umd.edu**

A. James Clark
School of Engineering

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College Park, MD 20742

PHOTO: AL SANTOS

Save these dates

OCTOBER 22
Homecoming
(Maryland vs. Northwestern)

OCTOBER 30–NOVEMBER 3
ASME International Mechanical Engineering Congress & Exposition
(Columbus, OH)

DECEMBER 6
Fall Design Day

MAY 9
Spring Design Day

MAY 22
Main Commencement

MAY 23
College Commencement

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