FALL 2020 | THE A. JAMES CLARK SCHOOL OF ENGINEERING

METRICS

MECHANICAL ENGINEERING AT MARYLAND

SPECIAL FEATURE

COVID-19: Responding to the Pandemic

Advancing Aquaculture Through Mechanical Engineering

Shellfish farming gets high-tech boost in new project led by UMD's Miao Yu

Chair's Message

Mechanical Engineering Chair Bala Balachandran (left) speaks with former A. James Clark School Dean and current UMD President Darryll J. Pines at a Maryland Day event in 2018.

Dear Friends,

Let me begin with the most important topics: health and well-being. The past months have been a challenging time for all of us; my wish is that you are well, and safe.

As the pandemic spread, the adaptability, versatility, and generosity of our unit came to the fore. We transitioned to a fully online mode and continue to develop new approaches to learning, with support from campus teaching innovation grants. The student crisis fund benefited from the contributions of faculty, staff, and our alumni.

Our faculty identified multiple avenues for contributing our expertise to the response effort, whether by developing more up-to-date models of pandemic outcomes, devising cheaper and more accessible forms of testing, or mitigating the risk posed by airborne particles. You'll read about some of these efforts in this issue of *Metrics*. For a big-picture view of where engineering is headed in the post-COVID era, we spoke with National Academy of Engineering president emeritus (and former UMD president) C. Dan Mote, Jr. and Alex Severinsky, inventor of the hyperdrive power-amplified internal combustion engine power train, and a member of UMD's Innovation Hall of Fame (IHOF) and the unit's Visiting Committee.

As Dr. Mote, Jr. and Dr. Severinsky have observed, the essence of engineering lies in our capacity to devise practical solutions to problems both large and small. Our faculty continue to exemplify this attribute, even amid the disruptions arising from COVID-19. A case in point: mechanical engineering professor Miao Yu is leading an ambitious, multi-institution program that could galvanize shellfish aquaculture, not only ensuring a livelihood for people in coastal areas, but also reducing ecological damage and providing an alternative, long-term source of food. This project (featured in our cover story this issue) is a signature example of the power engineers have to bring about transformative changes, and it is this kind of big thinking that we seek to foster in the department.

I would also like to share with you some news that makes all of us proud. On July 1, Darryll J. Pines, dean of the A. James Clark School for 11 illustrious years, became president of UMD. All of us who have known President Pines through the years, whether as colleagues, students, or friends, know of his penchant for daring vision and his equally remarkable capacity to turn vision into action. At the Clark School, he has also been instrumental in efforts to achieve greater diversity and equality of opportunity within engineering. President Pines' fearless leadership will be a welcome asset to our university. Please join me in congratulating him, and UMD.

Again, I wish you all well; may the near future bring better circumstances for all of us.

B. Balachandran

Balakumar Balachandran
MINTA MARTIN PROFESSOR AND CHAIR
DEPARTMENT OF MECHANICAL ENGINEERING

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Engineering the Future of Shellfish Agriculture Through Robotics and More

Well-managed oyster farming supports a healthier Chesapeake Bay—and it also promises to help revive the economy in coastal areas, which include some of Maryland's poorest communities.

The name Chesapeake comes from the Algonquin language, though the precise translation remains a matter of debate. Popular lore has it that the name means "great shellfish bay."

Whether that interpretation is accurate or not, the Chesapeake Bay is certainly renowned for its shellfish, most notably its super-sized, succulent oysters. For centuries, they have provided sustenance, and a livelihood, to people along the Bay shores. In recent years, following a decline that almost killed off the industry, the fabled oysters are back, in a big way. And a decision by the State of Maryland to authorize aquaculture in all of its counties has enabled many working in the trade to open up their own, small-scale shellfish farms. Shellfish aquaculture offers a sustainable way to harvest the Bay's bounties and support the coastal economy. But reaping those benefits fully depends on bringing shellfish aquaculture—still characterized by outdated methods and technologies—into the 21st century. A multi-disciplinary, multi-institutional team led by UMD mechanical engineering and Institute for Systems Research (ISR) faculty member Miao Yu is helping to bring about the technological advancements needed for that to happen.

In June, Yu and her colleagues won a $10 million grant from the United States Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) to spearhead the use of advanced science and engineering tools in shellfish aquaculture, an industry that has lagged in comparison to land-based farming despite its enormous potential. The grant is one of the largest ever awarded by the USDA to a public university, reflecting the long-term significance of this research.

"Up to this point, we haven't really explored the potential of shellfish aquaculture because it still relies on antiquated technologies—in some cases, tools that go back hundreds of years," Yu said, "By developing and incorporating advanced technologies into shellfish farming, including the use of underwater drone monitoring and smart harvesting, we can bring about a major boost in production."

CENTURIES-OLD METHODS DUE FOR AN OVERHAUL

Shellfish are superfoods. Protein-rich, they also provide omega-3 and a panoply of nutrients and minerals, including zinc, copper, iron, and magnesium. Depending on the way they are prepared (with or without butter, for example), they can be a low-fat food, and a healthy substitute for meat from land-based animals.

Besides their culinary appeal, they also play a critical role in maintaining the overall health of the Bay. Oysters, for instance, act as natural water filters, sifting out excess algae; an individual oyster can filter up to 50 gallons of water per day, according to the Chesapeake Bay Foundation. Their shells provide habitat for other organisms, such as mussels and sea anemones—and thus indirectly support the fish species that feed on those smaller organisms.

(CONT. PAGE 2)

(CONT. FROM PAGE 1)

The practice of farming oysters and other bottom-culture shellfish hasn't changed much over the decades, however. Production typically involves random planting of oyster seed in farm plots. After two to four years of growth, a towed dredge is used as the primary tool for harvesting, with machinery dragging a net across the bottom of an ocean, bay, or other body of water to scrape up and collect buried shellfish. It's a hit-and-miss procedure, akin to vacuuming with a blindfold on: you might manage to suck up some of the dirt, but you're just as likely to waste electricity and bump into walls.

Indeed, the process is not only imprecise, but can wreak ecological havoc by damaging reefs, which are important habitats for oysters and other aquatic species.

Shellfish farmers are aware that the technologies and methods they use have serious shortcomings, but until now, they haven't felt they have better options, Yu explains. "Agricultural mechanization is listed as one of the twenty 20th-century Transformational Engineering Achievements by the U.S. National Academy of Engineering. To build on that, in land-based agriculture, drones are being used to achieve precision farming," she said. "That hasn't happened yet in underwater farming, in part because the underwater environment is more difficult, involving currents, turbidity, and other complications. It's a challenging environment for sensing, imaging, and navigation."

Yu and her team hope to change that by synthesizing recent advances in the fields of sensing and imaging, robotics, computer vision, artificial intelligence, and agricultural automation. The USDA funding will support the team in developing new, smart technologies and a sustainable management framework to help enhance productivity and profitability for both farmers and coastal economies while better protecting fragile aquatic ecosystems.

"We need to modernize the technology," said Yang Tao, a bioengineering professor at UMD and collaborator on the grant. "Drone-based technologies for crop surveying and early disease detection, vision-guided crop cultivation, and GPS-guided harvesting—these technologies exist for land agriculture; why shouldn't they for shellfish aquaculture, too?"

"It's a great opportunity for us to help the coastal communities of the U.S. and Maryland, including the Atlantic, Pacific, Gulf, and Chesapeake," Tao said.

EXPERTISE FROM ACROSS FIELDS ... AND UNIVERSITIES

Besides Yu and Tao, researchers on the USDA NIFA grant include: Nikhil Chopra (UMD), Yiannis Aloimonos (UMD), Don Webster (UMD), Matt Parker (UMD), Cathy Liu (UMD), Matthew Gray (University of Maryland Center for Environmental Science), Jonathan van Senten (Virginia Polytechnic Institute), Brian Callam (Louisiana State University), Bobbi Hudson (Pacific Shellfish Institute), and Yuanwei Jin (University of Maryland Eastern Shore), as well as researchers from Fraunhofer USA's Center for Experimental Software Engineering. Among UMD faculty, the A. James Clark School of Engineering; College of Agriculture and Natural Resources; and the College of Computer, Mathematical, and Natural Sciences are all represented on the grant.

Together, the team's combined expertise covers sensing and imaging, robotics and artificial intelligence, automation for agriculture and seafood, aquaculture extension, shellfish biology, environmental sciences, economics, and software development.

Yu, for example, has a background in fiber optics sensing, acoustic sensing, and imaging—all of which will be needed in order to help drones navigate the Bay's

DOING GOOD WITH ROBOTICS

As the UMD-led team moves forward with research and experiments designed to help bring shellfish aquaculture into a new era, they will be building on initial work conducted by Miao Yu and colleagues during her past tenure as director of the Maryland Robotics Center (MRC) at UMD.


Yiannis Aloimonos


Nikhil Chopra


Yang Tao


Miao Yu

Four of the researchers, including Aloimonos, Chopra, Tao, and Yu, are faculty affiliates of the MRC, which supports a wide range of research in robotics. One of MRC's signature initiatives, Do Good Robotics, was launched in Fall 2018, during Yu's tenure, to use robotics and AI solutions to address the pressing global issues of food security, environmental health, and human health. As part of this initiative, agriculture and aquaculture robotics was identified as one of the key focus areas. In a 2019 Do Good Robotics Symposium, robotics experts, entrepreneurs, and students from around the globe were brought together to share ideas and knowledge about how robotics technologies can be leveraged for the benefit of society and the planet.

murky depths and conduct environmental and crop inventory monitoring in the oyster farms. She is also a former director of the Maryland Robotics Center (MRC), where underwater robotics has been a major focus area.

"We have extensive experience in drone navigation and object recognition, but this project will give us the opportunity to develop new techniques and theories for underwater computer vision and robotics," said Yiannis Aloimonos, a collaborator on the grant and UMD professor of computer science with a joint appointment at the University of Maryland Institute for Advanced Computer Studies. "The underwater environment is very noisy with poor lighting, which presents many challenges we'll have to overcome to be successful."

Nikhil Chopra, professor of mechanical engineering at UMD and an ISR faculty affiliate, will use machine learning techniques to train the aquatic robots to map out the underwater terrain on their own—and avoid bumping into rocks. Ultimately, he said, the goal is for the vision and sonar-equipped drones to do this autonomously, with a minimum of human supervision; shellfish farmers will be able to give them instructions via software on a computer or laptop, perhaps even a mobile phone.

"We want the drones to be able to move around and make decisions the way you or I do when navigating a room," he said. "We take steps to avoid bumping into walls and chairs, and we'll be training the drones to avoid obstacles in their environment."

The machines may also be able to assist the farmers by scoping out areas that look promising for oyster cultivation, Chopra said.

For farmers, it's essential to know when to harvest and where exactly the market-sized oysters are; having this information available can support them in making predictions about inventory and revenue, thus helping them stay in business. As Yu explains, "smart harvesting" involves the use of the oyster inventory maps created by the drone monitoring to discover growth areas, as well as oyster distribution and size. "We'll create an optimized path for the dredging vessel to perform high-efficiency precision harvesting, by only dredging the areas that have the market-sized oysters. This helps increase the harvest animal rate and eliminates a lot of wasted effort and resources, while minimizing environmental impact," she said.

In conjunction with the research effort, the USDA grant also supports an ambitious effort to promote education and awareness about the economic and health benefits of aquaculture and the promise of new technologies. The team's education partner, UMES, is an historically black, 1890 land-grant institution. Through this partnership, the team plans to prepare undergraduate students, particularly socially and economically disadvantaged and first-generation college students in rural coastal areas, to become a skilled workforce in the American aquaculture industry. Maryland 4-H will serve as an additional education partner by developing and delivering a summer camp and robotics competition.

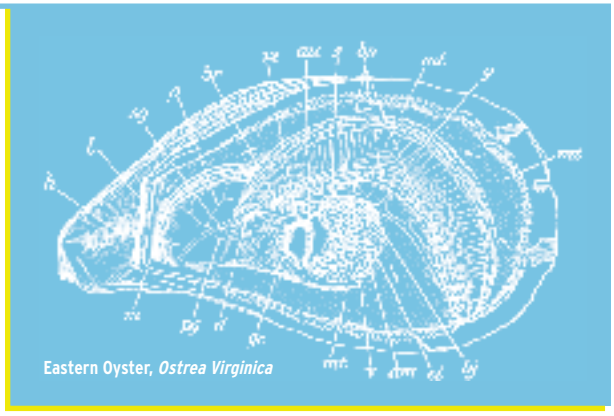
All this, the researchers hope, will inject game-changing momentum into an industry that experts believe could do much to protect the planet, while ensuring a sustainable, long-term food supply. The Food and Agriculture Organization of the United Nations (FAO) has ranked the U.S. high for potential industry growth of this high-quality and nutritious protein source; upgraded technologies and methods could spur that growth to begin taking off.

"While we're not in immediate danger of running out food, we do have to look for sustainable ways of producing food for the growing population. Aquaculture is one of the solutions that could be beneficial for future generations," Yu said. "Our project aims to bring about the necessary conditions for that to happen."

DID YOU KNOW?

- Oysters break down nitrogen and sediment that would otherwise clog up the waters. It currently takes about a year for the Chesapeake Bay's remaining oysters to filter 19 trillion gallons—an amount equivalent to the entire water volume of the Bay. In years past, they could filter it in a week.
- Restored oyster reefs at Harris Creek on Maryland's Eastern Shore remove an amount of nitrogen equivalent to 20,000 bags of fertilizer—a service valued at more than $1.7 million. It takes about 10 days.
- Aquaculture oysters also assist restoration efforts by fostering marine life and filtering water, even though they don't build reefs.

Sources: The Chesapeake Bay Foundation; Yale School of the Environment



Eastern Oyster, *Ostrea Virginica*

A PATH FORWARD

HOW CAN MECHANICAL ENGINEERS BEST RESPOND TO THE COVID-19 PANDEMIC? TWO DISTINGUISHED EXPERTS SHARE THEIR VIEWS.

MOTE: COVID-19 AND ENGINEERING'S GRAND CHALLENGES

Long before the coronavirus pandemic, engineers were applying their skills and expertise to bringing about improvements in medicine, including vaccines. Indeed, the National Academy of Engineering (NAE) has included "Engineer Better Medicines" and "Advance Health Informatics" among its 14 Grand Challenges, regarded widely as an essential set of roadmaps for students and researchers alike.

Both health-related Grand Challenges have direct applicability to COVID-19; the first includes the development of vaccines, while information and records concerning the spread of the virus would be part of the second. "Both of these areas will be enriched by the knowledge discovered during the identification and treatment of the COVID-19 virus," says C. D. "Dan" Mote, NAE president emeritus, Regents Professor, former UMD president, and a current member of the UMD mechanical engineering faculty.

Mote foresees that a "specialized population of experts" will concentrate their efforts on developing a vaccine—or, should effective vaccines prove temporarily elusive, coming up with adaptations that will enable people to resume going about their lives.

In the coming years, "a great volume of information will be gathered about the virus," Mote said. "We can expect a great deal will be written about its transmissibility and behavior, its health effects on all types on patients, humans and creatures, diagnostic evidences, and long-term health issues. This will inform care and treatment of people going forward. Pandemics are particularly dangerous in our globally connected, 21st-century world. Some engineering programs may concentrate on the disease, some on the vaccines and their side effects, some on the manufacture and creation. It's a big topic area."

How important the virus becomes as a field of research depends on when—and how soon—a fully effective vaccine is developed, Mote said. Just as few engineers today focus on smallpox, research interest in COVID-19 will ebb somewhat when the disease is brought under control. It will not disappear, however, for a new chapter in the global human health preservation and treatment has opened.

"If a sufficiently effective vaccine is not created, meaning that the virus persists under certain circumstances after the vaccine is created, then other corrections in behavior or living circumstances will be implemented to reduce the likelihood of infection until suitable vaccines are created," Mote said. "These cannot be predicted in advance, which is one reason creating and testing vaccines is normally a lengthy process. And one thing seems to be always true, the more you learn about a problem, the more that there is to do about it."

SEVERINSKY: DEMAND REMAINS STRONG FOR MECHANICAL ENGINEERS

Dr. Alex Severinsky, inventor of a power train that revolutionized the hybrid car industry, first began brainstorming the idea during the oil crisis of the 1970s—a disruption that sent the world economy into a tailspin. Today, amid another global upheaval, Severinsky urges aspiring young engineers to anticipate the new areas of research and innovation that may arise as a result of the COVID-19 pandemic.

These are unsettling times for students in engineering, as in other fields. The pandemic impacted the availability of summer internships in 2020, and could continue to do in the coming year. The job market has contracted as companies face disruptions to the supply chain, delayed or cancelled contracts, and the costs of transitioning their workforces to an online environment.

But mechanical engineering remains a wise career choice, says Severinsky, who was inducted into UMD's Innovation Hall of Fame in 2008. He is no stranger to volatile circumstances, having emigrated to the United States from the former Soviet Union in 1978. Like many émigrés, he arrived with few resources—and in the middle of a recession. He had to rebuild his life and career nearly from scratch.

"Activities involving mechanical engineers will remain stable or increase," Severinsky says. "There is a continuous need for mechanical engineers, and industry has an ongoing need for new people to replace those who retire or leave the field. The question is where to go, and what specific areas to study in order to prepare for the new opportunities."

Even if internships prove elusive, aspiring engineers can still make headway by using their time to research industries and emerging areas of interest, and then acquiring the domain-specific knowledge needed to work in those fields, Severinsky said.

Over the next few years, he predicts, many companies will be looking to mechanical engineers to devise inventive solutions that can help with the COVID-19 response—for example, ways of reducing virus propagation in public spaces through an overhaul of air conditioning and ventilation systems, or using ultraviolet light to decontaminate facilities.

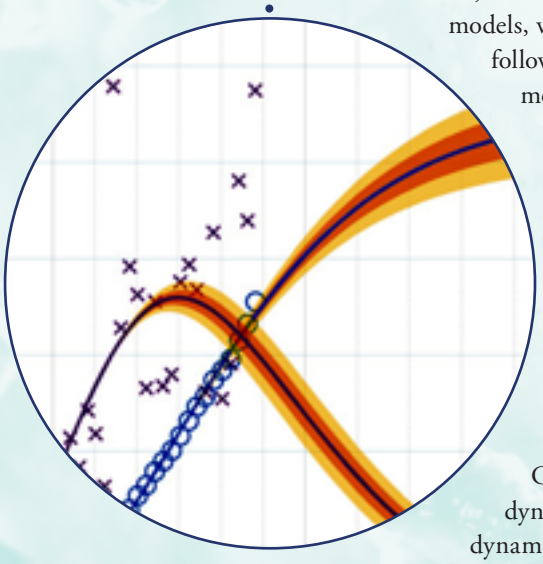
Practical solutions to the crisis will, by necessity, involve mechanical engineers, often in collaboration with bioengineers, epidemiologists, doctors, and entrepreneurs. "We should be leaders in this area of research," he said.

He also encourages students to think about going beyond four years and completing a master's degree. Industry places a high value on master's level expertise, and a bachelor's degree alone no longer carries the weight it once did. "The undergraduate degree will get you in the door," he said. "But to gain more status in the profession, you need the advanced degree."

BALACHANDRAN LEADS ENDEAVOR TO IMPROVE COVID-19 FORECASTING

Forecasting the course of a pandemic is no simple task, but applying tried and tested models can help. A team led by mechanical engineering Department Chair Dr. Bala Balachandran is applying the Logistic Model, widely used for modeling population trends, and the Generalized Logistic Function Model, developed in 1959 to assist in studying plant growth, to project trends based on the data available so far.

"These models are not new, but the application to this particular problem is," said Balachandran, who is also a member of the Applied Mathematics and Scientific Computation Program. Collaborating with him on the study are UMD postdoctoral researcher Xianbo Liu and Ph.D. candidate Xie Zheng.



Dr. Bala Balachandran's team is testing a combination of models with the aim of yielding more reliable pandemic forecasting.

So far, actual COVID-19 trends align closely with the results produced by the models, with the peaks occurring as predicted, and the case counts following the model's curve. Because of their approach's success in modeling the actual outcomes so far, Balachandran and his team are hopeful that it can deliver reliable forecasts.

Apart from statistical models based on the Generalized Logistic Function, Balachandran and his group have developed an original, extended compartmental model with time delays and other features to study the COVID-19 dynamics. The team is using this model to answer a crucial question. How long or short is the "tail," or downward slope, that follows a peak in the plot of daily infection increments versus time.

"Based on the data we have available, we want to be able to identify a model that can be used to predict the dynamics of COVID-19 going forward. This is an example of data-driven dynamics," said Balachandran, who has been studying data-driven dynamics in the context of other dynamics, including chaotic dynamics and rapid transitions such as extreme waves.

(Liu, X., Zheng, X., and Balachandran, B., COVID-19: Data-driven dynamics, statistical and distributed delay models, and observations, Nonlinear Dynamics, *2020. //doi.org/10.1007/s11071-020-05863-5)*

Free Planning Software for Clinics

As federal, state, and local officials scrambled to set up emergency medical clinics to deal with the COVID-19 pandemic, the University of Maryland offered free software tools and other resources to help model and design these clinics for more efficient and effective processing under conditions of high demand.

The helpful resources—originally designed for scenarios such as the H1N1 flu—are the product of research conducted from 2005–2013 by Professor Jeffrey W. Herrmann (mechanical engineering/Institute for Systems Research), an operations research expert who has worked extensively with the U.S. Centers for Disease Control and Prevention (CDC) and other organizations. The resources include: a Clinic Planning Model Generator, Clinic Surge Planning Model, Alternative Care Site Planning Model, and Vaccine Allocation Model.

>> FOR MORE INFORMATION, VISIT https://go.umd.edu/clinic-resources.

PHOTO: KEN RUBIN

STRIKING UP THE BAND AGAIN—SAFELY

As the COVID-19 pandemic spread in early 2020, musicians and band directors were quick to realize the implications for live music. In order for bands and vocalists to resume practicing and performing together in person, more needed to be known about the risks—and how to mitigate them.

"The more we understand about the trajectory of aerosols in situations such as indoor rehearsals and concerts, or outside at a sporting event, the more we'll be able to devise methods for keeping performers and spectators safe, while enabling us to continue to enjoy live music," explains UMD mechanical engineering professor Jelena Srebric, who is acting associate dean of research at the A. James Clark School of Engineering.

Srebric and University of Colorado-Boulder mechanical engineering professor Shelly Miller are conducting twin studies commissioned by the College Band Directors' National Association and the National Federation of State High School Associations. Their goal: measuring the behavior of particles emitted when a brass player sounds a note, or when a soprano lifts her voice in song.

Working out of a specially equipped chamber near UMD's College Park campus, Srebric and her team have been running tests on clarinets, euphoniums, flutes, French horns, oboes, saxophones, trombones, trumpets, and tubas, while also measuring the aerosols emitted by actors and vocalists.

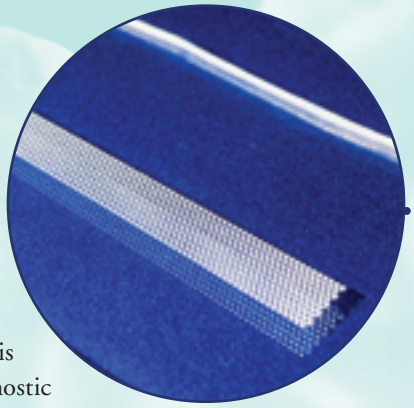
Instruments vary considerably when it comes to aerosol emissions, the researchers found. The oboe, for instance, is a particle powerhouse—thanks to the high-pressure action of its double reeds. Flutes, despite their breathy timbre, turn out to send relatively few particles into the surrounding air.

Meanwhile, actors and vocalists alike can fill a space with aerosols, particularly at moments of peak intensity (as in a declaimed monologue, pop song, or hymn).

The good news: in all cases, emissions can be cut to much safer levels by performing with a mask on—or, in the case of the oboe, using a bell cover. Based on the studies' findings, the sponsoring organizations have drawn up guidelines—supplemented with posters and videos—for schools, colleges, and other organizations involved with live music.

For Srebric, there is satisfaction in knowing her work will be put to immediate, practical use. "It's such a great cause," she said. "A world without music is no good!"

BETTER, CHEAPER COVID-19 TESTS



A small plastic chip could yield big improvements in COVID-19 testing.

One of the biggest obstacles to containing the coronavirus threat is the lack of ready access to large-scale, inexpensive, and accurate testing to effectively and efficiently diagnose and track the virus. UMD mechanical engineering professor Don DeVoe and Ian White, associate professor and associate chair of the Fischell School of Bioengineering, are working are working to address this need by developing an exceptionally cost-effective and rapid diagnostic test for SARS-CoV-2, the virus that causes COVID-19.

The team's approach relies on a small plastic chip that incorporates microfluidics technology to detect multiple COVID-19 nucleic acid targets.

To test for COVID-19 and other respiratory diseases, the team's system utilizes a compact and reusable reader. This proprietary reader takes the place of existing test readers that cost in excess of $10,000 and are bulky, the size of a tabletop printer or larger.

The team's compact reader and disposable chips could provide reliable test results in less than 15 minutes.

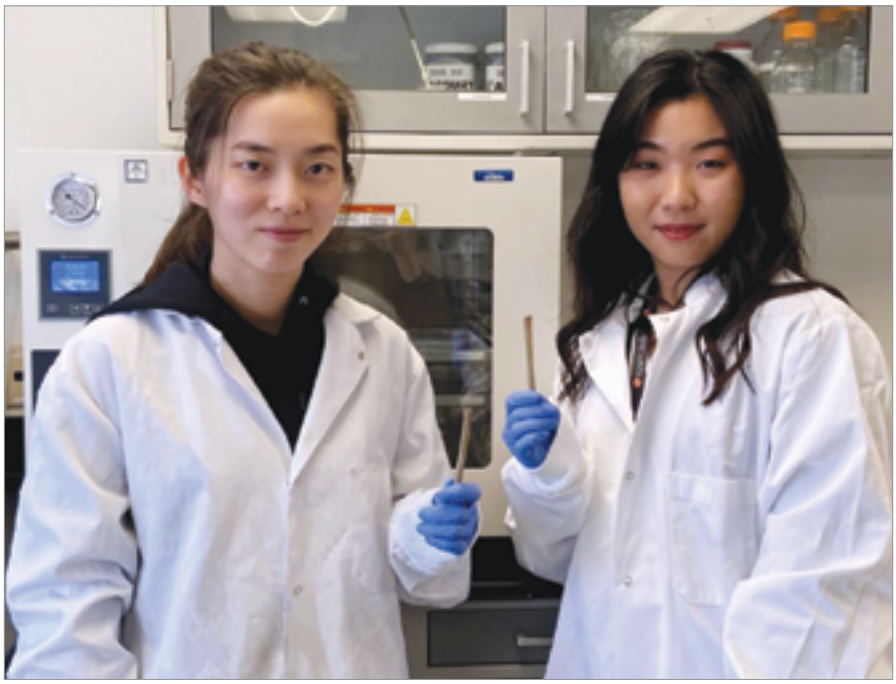
"To get our country back to a high level of functionality, improved surveillance will be critical to knowing who is exhibiting an active infection, symptomatically or not," adds DeVoe. "It is critical that we have a way to test a lot of people cheaply and frequently."

Building a Better, Eco-Friendlier Straw

Convenient as they are, plastic straws pose great harm to the environment. More than half a billion straws are consumed daily in the United States alone, going directly into the trash after a single use. Most recycling machines can't recycle them in any case, due to their shape and size.

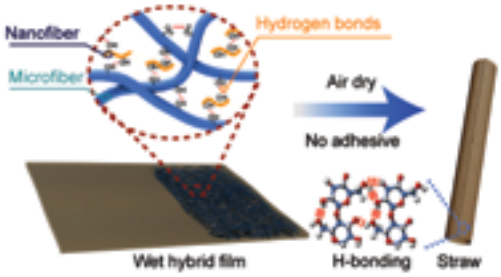
So far, efforts at a solution have foundered. Eco-friendly substitutes have proven costly and ineffective, and their poor biodegradability makes them only a slight improvement over the plastic variety.

Now, a team of researchers in the University of Maryland's materials science engineering and mechanical engineering departments have published a paper that details a new approach—one that makes use of the residue, known as bagasse, that is left over after juice is extracted from sugarcane. The paper recently appeared in *Advanced Functional Materials*.



The paper's co-authors include Xizheng Wang (left) and Claire Li.

"We have designed all-natural, biodegradable straws by hybridizing nanofibers and microfibers from bagasse," said UMD postdoctoral student Xizheng Wang, co-lead author of the new paper. "This approach provides a promising alternative to petroleum-derived plastic straws."



Working under the guidance of Keystone Professor of Mechanical Engineering Teng Li and Minta Martin Professor of Materials Science Engineering Liangbing Hu, the researchers found that a wet film could be made from the hybridized fibers, then rolled into shape. When the film dries, it naturally seals as a result of hydrogen bonding among the fibers, without the need for a binder.

Straws produced using this method are strong and durable, conduct water effectively, and degrade naturally after disposal. They are also inexpensive to make, since bagasse is a waste byproduct of the sugar industry and can be obtained for little cost, Wang said.

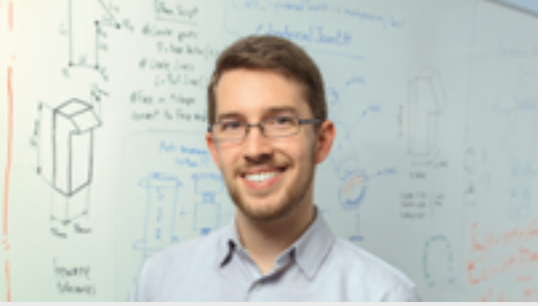
As part of their research, the team conducted extensive modeling and simulations designed to assess the properties of hybridized micro and nanofibers. According to Zhenqian Pang, co-lead author of the paper, the results clearly demonstrate the benefits of hybridization.

"We found that cellulose nanofiber has the highest level of strength and cellulose microfiber the lowest, but the results are opposite with regard to failure displacement," he said. "When we calculated the mechanical properties of hybrid fibers, we found they inherit the advantages of both."

In addition to Wang and Pang, the paper's authors include Chaoji Chen, Qingxin Xia, Yubing Zhou, Shuangshuang Jing, Ruiliu Wang, Upamanyu Ray, Wentao Gan, Claire Li, Gegu Chen, and Bob Foster, as well as faculty mentors Li and Hu. The team is now working to refine the new straw design.

"We are making progress improving the stability of our straws in water and reducing the material cost," Li said. "Both factors are crucial to the success of these straws as a commercial product in the future."

More than half a billion straws are consumed daily in the United States alone, going directly into the trash after a single use.



Fuge to Lead ARPA-E Project on Heat Transfer and Inverse Design; Contributes to AI/ Machine Learning Research

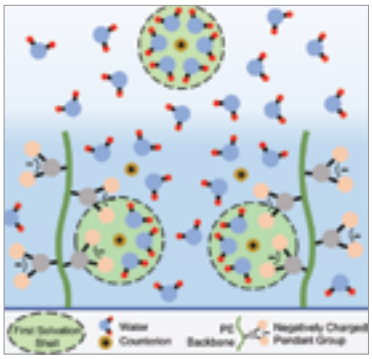
A University of Maryland (UMD) research team led by Assistant Professor Mark Fuge has been awarded a grant through the ARPA-E Differentiate Program to develop inverse design tools that improve the energy efficiency of heat transfer surfaces, yielding order-of-magnitude reductions in time and computational cost. Heat transfer systems are used to boost the efficiency of energy conversion systems, but current design methods are slow, taking months or years of development.

The UMD team, which also includes UMD Mechanical Engineering Department Chair Bala Balachandran and Soheil Feizi, assistant professor of computer science, aims to streamline the process through direct mapping from given environments and performance metrics to design variables or materials. The team will test its tools on turbine blade components and heat exchangers.

Fuge is also a technical subcontractor on two additional ARPA-E Differentiate Awards, with the Raytheon Technologies Research Center (RTRC) as the lead. In one project, Fuge, along with UMD's Patrick McCluskey (professor, mechanical engineering) and John Dickerson (assistant professor, computer science) will partner with RTRC to develop AI-accelerated search techniques to quickly discover new power converter circuit designs, such as those central to the performance and reliability of the national electric grid. In the other, Fuge and RTRC will use machine learning to accelerate the analysis and design of high-efficiency multi-stage compressors, such as those used in power generation or aircraft propulsion.

DAS PUBLISHES RESEARCH ON POLYELECTROLYTE BRUSHES

Highly charged, densely grafted polyelectrolyte (PE) brushes can now be studied at an unprecedented level of atomistic details, thanks to an all-atom molecular dynamics simulation created by Associate Professor Siddhartha Das and a team of UMD researchers. Among other findings, the team was able to demonstrate that highly charged, densely grafted brushes trigger an ultra-confinement effect that alters their structure and properties. "There is also a triggering of a water in salt-like scenario where, around the PE brushes, the water molecules in the hydration shell of the ions get replaced by the functional group from the brushes," Das said.



The journal Matter *published the team's findings in June.*

CALCE Researchers Develop New Solution for Detecting Counterfeit Parts

Machine learning could determine electronic component authenticity with a new detection system that can automatically detect evidence of counterfeiting from images. The Center for Advanced Life Cycle Engineering (CALCE) is working with Intelligent Automation, Inc (IAI) to assist Defense Microelectronics Activity (DMEA) in developing a counterfeit detection system called DATUM, or "Determining Authenticity and Trustworthiness of Microelectronics Parts."

DATUM is a software solution to detect counterfeit parts using machine learning and machine vision algorithms, going beyond traditional approaches. The system will classify differences between original design and device under test to guarantee all changes are authorized by analyzing traditional radiography images, tomography acoustic images, and spectroscopy images. This technology will reduce the time and effort required to screen components while strengthening anti-counterfeit measures.

CALCE and IAI will work on developing the DATUM system by generating images and data relating to the counterfeit detection process, defining defects for algorithm testing, and analyzing process change notice (PCN) data to distinguish counterfeit parts from genuine parts.

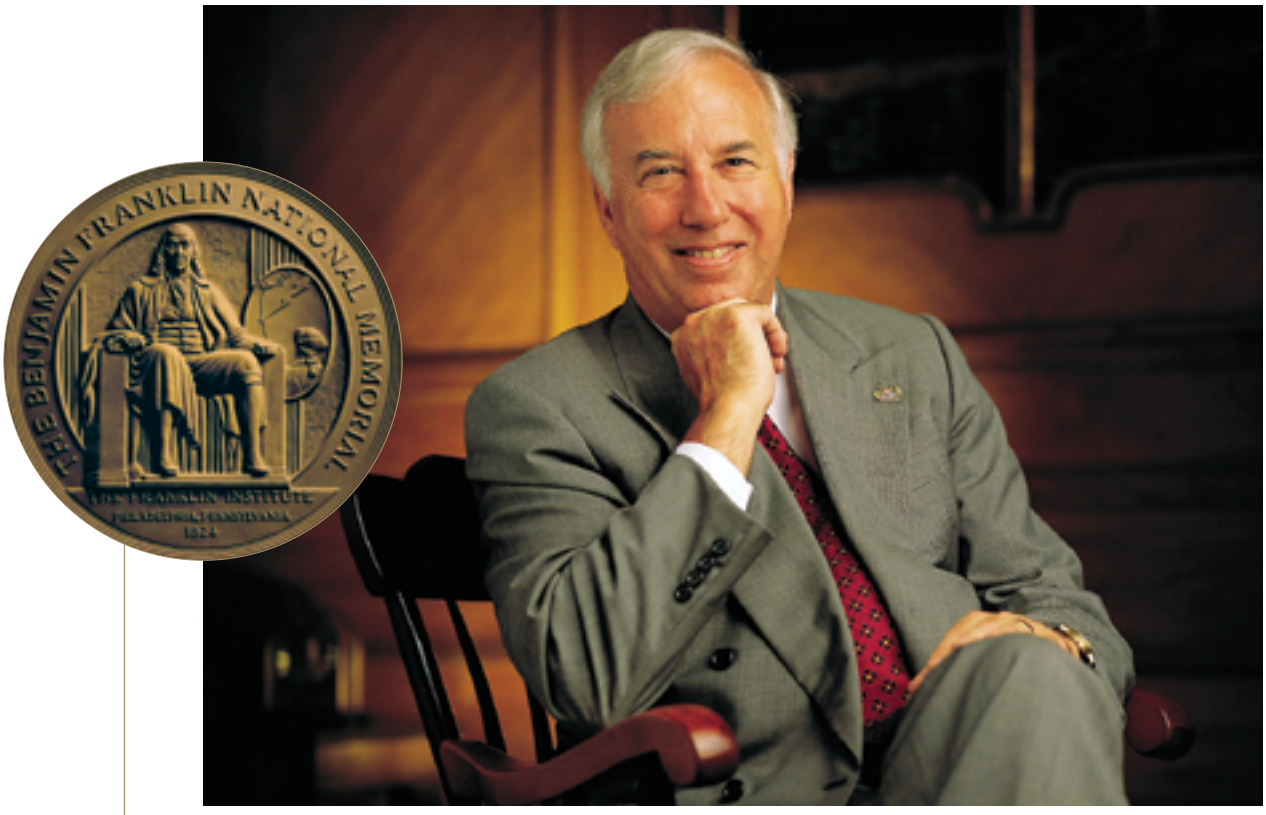
Complex Systems: Better Understanding the Risks

Monitoring the reliability and overall health of large, complex engineering systems—such as ships or nuclear power plants—can be tricky. These systems are designed to be resilient, and failures are rare. Their scale and complexity means they can't be tested in the way that, for instance, a smaller component can, such as a light bulb.

A doctoral researcher at UMD's mechanical engineering department, Austin Lewis, has been working with his faculty mentor, Assistant Professor Katrina Groth, to pioneer a new approach.

"Complex engineering systems are large-scale systems that have human, hardware, and software components all interacting with each other," Lewis said. "It can be very hard to determine how, when a single component fails, this impacts the system at large. We are using Bayesian modeling methods that take advantage of conditional probabilities and causal relationships to identify how those individual components—hardware, human, software—factor into the overall health of the system that we're studying."

A paper by Lewis, with Groth as co-author, has now been published as the cover story in the latest issue of Algorithms.



C. Dan Mote, Jr. to Receive 2021 Benjamin Franklin Medal in Mechanical Engineering

Recognizing his contributions to the understanding of practical systems, the Franklin Institute has awarded a 2021 Benjamin Franklin Medal—one of the most prestigious honors in the engineering field—to C. Dan Mote, Jr. Regents Professor and Glenn L. Martin Institute Professor of Engineering. He is one of only eight members named to the Franklin Institute Awards Class of 2021.

The Institute highlighted Mote's "early research on rotating disc stability, which transformed sawing technology while reducing wood waste." The breakthrough has since been applied to drive belts, computer disks, and other axial-moving materials. Meanwhile, skiers credit Mote for advances in both speed and safety: the modern-day shaped ski and quick-release bindings both originated in research conducted by Mote, who was the first to measure the forces that skiers experience on their lower legs and knees.

Mote served as the president of the University of Maryland from 1998 to 2010 and is president emeritus of the National Academy of Engineering, a role he held from 2013 to 2019.

As a Franklin Institute Awards recipient, Mote joins the ranks of some of the most celebrated scientists of the past two centuries, from Nikola Tesla and Thomas Edison to Stephen Hawking and Jane Goodall.

Fuge, Sochol Receive NSF CAREER Awards

The National Science Foundation (NSF) has awarded two Faculty Early Career Development Program (CAREER) Awards to faculty in the mechanical engineering department. Assistant Professor Mark Fuge received the $500K award for his project, "Learning Design Representations: The Effect of Differential Geometric Manifolds on the Inference of Design Structure." The award will enable Fuge to expand his research at the intersection of engineering design and machine learning, with the goal of enabling computers that learn how to design complex systems like new aircraft or vehicles.

Assistant Professor Ryan Sochol, meanwhile, received a CAREER award for his project,"High-Aspect-Ratio Multi-Material Three-Dimensional Microstructures via Microfluidic Direct Laser Writing". The award will support Sochol's research in the area of additive nanomanufacturing (or "3D nano-printing") with multiple materials.

Eleonora Tubaldi Joins UMD Department of Mechanical Engineering

Dr. Eleonora Tubaldi joined the Department of Mechanical Engineering in Spring 2020 as an assistant professor. She comes to the department with an extensive background in the interface of nonlinear dynamics, soft materials science, and fluid-structure interactions for applications in biomechanics, prosthetic design, and nonlinear mechanical metamaterial.

Tubaldi's research interests are inspired by nature's complex relationships between soft materials, such as tissue, and their fluid interactions. A member of the American Society of Mechanical Engineers Dynamics & Control System & Structures (DCSS) Technical Committee, she has authored several peer-reviewed international journal papers, and serves as an associate editor for *Mechanics Based Design of Structures and Machines*, and as a reviewer for *Journal of Fluids and Structures* and several other journals.

FACULTY PROMOTIONS

NIKHIL CHOPRA and **PETER CHUNG** have been promoted to the rank of Full Professor.

MICHAEL AZARIAN has been promoted from Associate Research Scientist to Research Scientist, while **JAN MUEHLBAUER** has been promoted from Faculty Research Specialist to Senior Faculty Specialist.

JIAZHEN LING has been promoted to Associate Research Professor, while **XINAN LIU** has been promoted to Research Professor.

The A. James Clark School of Engineering has named Professor **JELENA SREBRIC** as Acting Associate Dean of Research.

FACULTY AND STAFF RECOGNITION

Associate Professor **SIDDHARTHA DAS** was inducted as a Fellow to the Royal Society of Chemistry, United Kingdom. Das was also invited to contribute a paper to the inaugural Physical Chemistry Chemical Physics Emerging Investigators-themed issue.

Assistant Professor **YANCY DIAZ-MERCADO** was invited to be the Keynote Speaker for the Control of Robotic Systems Rapid-Interactive Session at the 2020 American Controls Conference, internationally recognized as a premier scientific and engineering conference dedicated to the advancement of control theory and practice.

Professor **STEVEN A. GABRIEL** has been an active external advisory board member for Sandia National Lab's Grand Challenge on cybersecurity, dubbed SECURE. Dr. Gabriel was also a panelist and contributor to an effort at the National Renewable Energy Lab on R&D portfolio selection for the U.S. government.

Assistant Professor **KATRINA GROTH** has been named to the editorial board of Elsevier's *Reliability Engineering & System Safety*, an international journal devoted to the development and application of methods for the enhancement of the safety and reliability of complex technological systems.

Department of Mechanical Engineering Director of Academic and Student Affairs **KERRI POPPLER JAMES** was unanimously elected to a leadership role on the American Society of Engineering Education's (ASEE) Continuing Professional Development Division (CPDD).

Associate Professor **JIN-OH HAHN'S** work on novel devices to unobtrusively determine cardiovascular function was nominated as a finalist for the 2019 UMD Invention of the Year Awards.

Adjunct Professor **VASILIY KRIVTSOV** published two new papers in *Reliability Engineering & System Safety*.

Emeritus Professor **EDWARD MAGRAB'S** book *Advanced Engineering Mathematics with Mathematica* published in March 2020 by CRC Press.

Unusual Season No Deterrent to Terps Racing

Each year, participants in the A. James Clark School of Engineering's award-winning Terps Racing program dedicate their time to designing, building, testing, and racing Formula-style racecars and Baja-style off-road vehicles in a series of collegiate competitions. In 2020, things were a little different.

"The season was definitely flipped on its head," said Baja Team Captain Abby Meyer. "But our teams adapted, and we still saw a lot of success."

Events this season were virtual, with teams logging in to online platforms to demonstrate their capabilities in static areas such as design, cost, and sales presentation. Though no races could be held—and performance categories such as acceleration, endurance, maneuverability and traction were not measured—the ingenuity and effort required to achieve high-performance results were very much in evidence.

Some events opted not to rank teams. The Baja SAE competition did, however, and Terps Racing finished fourth, with 270.61 points. UMD also participated in this year's Formula event (not ranked), earning a 20/20 rating in the cost category.

"I was incredibly impressed by the team's ability to not let the cancellation of the dynamic (racing) events diminish their efforts on the remaining events," said Baja team faculty advisor Scott Schmidt. "Running a team virtually was not easy, but the leadership and level of effort the team displayed preparing for this was impressive, and results showed it paid off. It is times like these that make my job as the team advisor truly rewarding and energize me to help the team achieve bigger, better things next year."

Jessica Rosenthal (left), 2020 Formula IC Team Captain and Abby Meyer, 2020 and 2021 Baja Team Captain, in a photograph taken last year.

With an eye to long-term goals, the teams dedicated some of their time this season to making improvements to existing vehicles, and the Baja team completed a brand-new, all-wheel-drive redesign, with few carry-over parts from past incarnations.

In the coming year, for the first time, the Baja and Formula teams will both pursue a two-year design cycle. They will continue to make improvements on the current cars—already a year into development, with the hope of racing them in June 2021—while also building a new car for each team that will be raced in June 2022. "This will improve overall designs and allow for more testing time and practice with our vehicles," said Meyer, who will continue as team captain. Wes Nicholson will be taking over as Formula Team captain from Jessica Rosenthal, who graduated in May and now works for electric car start-up Rivian.

More than 120 UMD students participate in Terps Racing each year, striving to design and build cars that will endure rough, punishing terrain. In the process, they gain experience in hands-on engineering, team building and collaboration, project management, marketing, and much more. The program is sponsored by Northrop Grumman, Leidos, Boeing, the Washington, D.C. Section of SAE, and generous alumni and local businesses.

>> TO LEARN MORE AND GIVE, VISIT racing.umd.edu

GRADUATE AWARDS AND HONORS

Best Paper Award:
SARA LYON, **PAUL NATION**

Irwin Centennial Research Committee Travel Award:
JONATHAN KORDELL, **JACK (YU-HSIANG) YANG**, **ARTUR ROMAN**

American Society of Nondestructive Testing Graduate Fellowship:
SEYED FOUAD KARIMIAN

HULKA Energy Research Fellowship:
KIRAN RAJ GOUD BURRA

NDSEG Fellowship:
JOE FESER

Best Poster Award in Component-Level Thermal Management Track:
SEVKET UMUT YURUKER

Best Student Presenter Award:
GARGI KAILKHURA, **ELLERY KLEIN**, **SAI VATHSAVAI**

Engie Chuck Edwards Memorial Fellowship:
JAMES TANCABEL

Graduate Student Summer Research Fellowship:
HAN ZHOU

AEE 2019 Best Community Service Award:
DEVASHIS SHRESTHA

Three Minute Thesis Competition:
STAR (BYEOL) KIM, **AUSTIN LEWIS** (finalist)

Flush With Excitement

MECHANICAL ENGINEERING ALUMNUS LEADS TEAM TO SUCCESS AT PITCH DINGMAN COMPETITION

By Pablo Suarez

The rogue flushes that startle users of motion-controlled toilets in public restrooms helped a team of UMD engineering and business students clean up at the 2020 Pitch Dingman business competition.

Their startup, Hydraze, an automatic system that aims to eliminate "phantom flushing" in commercial buildings and save millions of dollars in wasted water, secured the $15,000 grand prize at the University of Maryland's annual "Shark Tank"-style contest. The team of now-alumni, all Spring 2020 graduates, included leader Charles Grody (mechanical engineering), Jack Sturtevant (computer engineering), Tuvia Rappaport (aerospace engineering), and Roger Mao (operations and quality management, finance). All were members of UMD's QUEST honors program.

"My favorite part about winning the competition was that it gave us the funds to turn our idea into a reality," Grody said. "We used the money to help us start a pilot at the Hyattsville Busboys and Poets to prove our technology and demonstrate the potential savings."

The competition, now in its 10th year, was hosted by the Dingman Center for Entrepreneurship at the Robert H. Smith School of Business. Initially scheduled for early March, the competition was postponed and eventually moved online in compliance with the coronavirus outbreak restrictions. Despite the change, over 500 students, faculty, alumni, and guests tuned in on Zoom to watch teams vie for $30,000 in seed funding.

"Our mission is to make entrepreneurs of all kinds more successful, and our Dingman Center team remained committed to providing students with a spotlight to pitch their ideas," said Holly DeArmond, MBA '17, Dingman's managing director. "To our entrepreneurs: Your hustle, perseverance and resilience are to be commended."

As in previous years, Pitch Dingman applications opened at the start of the academic year, with a late-September quarterfinals phase where alumni entrepreneurs selected 10 semifinalists. At the November semifinals, the field was narrowed to five finalists.

During the finals, a panel of judges composed of entrepreneurs and innovators assessed each startup's current level of success, plan for using the funds and overall growth potential.

Hydraze, the water conservation company whose automatic flushes are prompted not by a motion sensor, but a mechanism on the latch of the bathroom stall's door, plans to use the Pitch prize money for marketing and development.

Other winners in the competition included AlgenAir (second place) and Door Robotics (third place).

David Quattrone MBA '05, co-founder and CTO of CVENT, and wife Robyn, accompanied by credit union SECU and Parsons Ventures, helped fund the competition. Quattrone also served as a judge for the competition. He was joined by Matt Fishlinger '07, founder and chief operating officer, Gramercy Risk Holdings; Aurelia Flores, founder and chief executive officers, Perfect Digital Connect; Tom Parsons '93, MBA '10, president, Parsons Ventures; Angela Singleton, director, TEDCO Builder Fund; and Becky Smith, executive vice president and chief strategy and marketing officer, SECU.

A version of this story first appeared in Maryland Today.

>> LEARN MORE AT hydraze.io

UNDERGRADUATE AWARDS AND HONORS

Clark School Future Faculty Fellow/GSG Outstanding Representative Award/Kulkarni Fellowship/Goldhar Travel Award: **GUARAV KUMAR**

Outstanding Research Assistance Award/Clark School Future Faculty Fellow: **HARNOOR SINGH SACHAR**

Summer Research Fellowship: **DAVID CATALINI**

1st Prize for Artistic Merit, 2019 Combustion Art Competition: **SRIRAM BHARATH HARIHARAN**

CEEE Best Student Consortium Presentation Award: **FABIO BATTAGLIA**

Ann G. Wylie Dissertation Fellowship Award, Graduate School Outstanding Research Assistant Award: **AZIN MOUSAVI**

Academic Achievement Awards: **DANIEL KIRCHNER**, **JOHN LATHROP**, and **ROBERT NAWROCKI**

Chairman's Awards: **KRISTEN EDWARDS**, **CHARLES GRODY**, **HANNAH LOBELL, SYED TAQUI MAHMOOD**, **NATHAN RAVER**, **JESSICA ROSENTHAL, MARY SMITH**, and **THOMAS STREETT**

A. James Clark School of Engineering Leadership Award: **HANNAH LOBELL**

Dean's Award: **KRISTEN EDWARDS**

Outstanding Engineering Co-op/Intern Award: **GARRETT GREENWELL**

ALUMNI-RUN COMPANY VERTEX AEROSPACE ESTABLISHES NEW SCHOLARSHIP IN ENGINEERING

PHOTO: COURTESY OF VERTEX AEROSPACE

Vertex Aerospace CTO Rommel Zara (first on left) and President & CEO Nick Teti (second on left) established a new scholarship for freshman aerospace and mechanical engineering majors. Here, their team is standing with the Magnetospheric Multiscale Observatory and its blanket technicians."

Vertex Aerospace President and CEO Nick Teti (B.S. '85) along with Vice President and CTO Rommel Zara (aerospace engineering '00) have created a merit-based scholarship for freshmen at the University of Maryland (UMD) who are pursuing either mechanical or aerospace engineering.

Growing up in Maryland, Teti came from a family of accountants and expected that accounting was the career he would pursue. However, when an older friend attending UMD suggested he consider engineering—noting that Teti enjoyed fixing things—Teti replied, "What's engineering?"

That question would pave the way to a career. Arriving at UMD in 1979, Teti studied mechanical engineering and worked a variety of co-op and internship jobs to support his education. Teti credits those experiences—and a stint at the National Institute of Standards & Technology, where he developed a particular interest in thermal engineering—with helping him land his first position as a thermal engineer at NASA.

Four years later, Teti took a job as thermal engineer at Swales Aerospace (now Northrop Grumman Innovation Systems). He spent nearly 20 years with the company, working on everything from the shuttle program to the Earth Observing-1 satellite mission.

At Swales, Teti hired Zara as a co-op student and later brought him on full-time. Two quickly formed a professional relationship with lead roles on satellite builds for THEMIS and TacSat-3. They noted the aerospace industry had a particular need for their specialized expertise in thermal engineering design, analysis, and testing, and they founded Vertex Aerospace to address that need. The company now holds contracts with a wide range of government and industry customers.

Maryland roots run deep at Vertex Aerospace, and the team includes seven other alumni from across engineering and physics. Teti and Zara strive to help develop the next generation of engineers through mentorship and development, leveraging their fifty plus years of combined experience in the field.

Establishing the Vertex Aerospace Scholarship in Engineering is a natural extension of this commitment. Acknowledging the founders' deep ties to both UMD and the state, the scholarship is awarded to one student from the eastern shore and one student from the western shore of Maryland each year. Its first recipients are Alvin Darby III (mechanical engineering) and William Cook (aerospace engineering).

"Our business is in Maryland. The majority of our employees are from Maryland, and we both feel that our careers have been very fulfilling," explained Teti. "I've never not had work since I graduated 35 years ago, so not only did [the University of Maryland] help us get jobs that allowed us, and our company to grow, but I'm also hiring these quality engineers [from UMD] to make our company better."

The New Reality of Virtual Internships

For Camille Levine, one of the most valuable aspects of an engineering education is that it provides transferable knowledge: as she notes, "you're learning how to learn." It's a toolkit which, according to Levine, the student can then bring to bear on the specific engineering domain of his or her choice.

Mechanical engineering is a particularly diverse field, Levine said, encompassing everything from thermal dynamics and heat transfer to electronics and coding. It's also a field that combines three of her long-standing fascinations: math, science, and computers.

"When I was considering majors, I looked for one that has a heavy dose of all three," Levine said. "And that would be mechanical engineering."

Her UMD experience hasn't been limited to the classroom and lab: she's also been an active participant in engineering-related clubs and activities, including the Gamera solar-powered helicopter program, and more recently, Engineers Without Borders. As part of the latter, she's been drafting an Occupational Safety and Health Administration (OSHA) curriculum for safety officers, and also helping to develop a solar electricity system for schools in Sierra Leone. Internships have kept her summers busy—even following the COVID-19 pandemic and the resulting lockdown. During the summer of 2020, in fact, she interned with the Nuclear Regulatory Commission (NRC) and participated in a virtual inspection of a nuclear materials licensee in the construction sector. "Nuclear inspections are done on a timetable, and they're not something you can postpone for a few months," she said. "Since on-site inspections weren't possible during lockdown, the solution was to go virtual."

Scholarships have played an important role in Levine's academic career, freeing up time for her to devote to her studies and extracurriculars. She's landed several scholarships at UMD, including the prestigious Louis R. Daudt Endowed Scholarship, established by the late Louis Daudt (B.S., mechanical engineering '41) to support undergraduate students in mechanical engineering. Daudt, who served in the Navy during World War II and went on to a 42-year career at DuPont, retained a lifelong pride in his alma mater; he was particularly enthusiastic about the Solar Decathlon team's victory in 2007.

"One thing I would like donors to know is that scholarships make a huge difference to students, even if the financial burden to the donor is relatively small," Levine said. "Thanks to the scholarships I've received, I've been able to pursue a college education and lay the foundations for a successful career. My experience makes me want to give back; once I'm well-established, I hope to continue the chain and help support future students."

Camille Levine's summer internship with the Nuclear Regulatory Commission (NRC) took place remotely and included a virtual plant inspection.

Interested in Making a Gift?

Check out **enme.umd.edu/give** or contact Heidi Sweely, Director of External Relations, at **hsweely@umd.edu**.

MECHANICAL ENGINEERING VISITING COMMITTEE

George Dieter
Brian P. Gearing (B.S. '96)
Howard Harary
Steve Hogan (B.S. '85)
Roberto Horowitz
Robert A. Kaplan (B.S. '82)
Charley Kilmain (B.S. '85)
Maria Korsnick (B.S., Nuclear Engineering '86)
G. Lee Lushbaugh, Jr. (B.S. '74)
Nancy Margolis (M.S. '81)
T.G. Marsden (B.S. '87)
Michael W. Miller (B.S. '79, M.S. '84) *Chair*
James D. Moreland, Jr. (B.S. '88)
Sheila Mortazavi (B.S. '95)
Alex Severinsky
Susan H. Skemp
ToniAnn Thomas (B.S. '82) *Vice Chair*
Kon-Well Wang
David Wilson
Manolo Zuniga (B.S. '83)

EMERITUS MEMBERS

Aris Cleanthous (B.S. '96)
John Miller
Hratch Semerjian
Sheldon Shapiro*
Tom Stricker (B.S., Electrical Engineering '89)
Ward O. Winer, P.E.

* Deceased

RECOGNITIONS

RYAN BERKE (B.S. '08) received the U.S. Air Force Young Investigator Research Program (YIP) award to develop an innovative method for measuring high-cycle engine fatigue

PREETI CHAUHAN (M.S., Ph.D. '12) took a new position as Technical Product Manager for Data Center Quality and Reliability at Google

KATHRYN GAULKE (B.S. '92) was promoted to Vice President of Integration Services for Millennium Engineering & Integration Company

CHRISTINE GILBERT (B.S. '06, M.S. '11, Ph.D. '12) received an NSF CAREER award to study highly flexible plates near a free surface

BRAD GRATTON (B.S. '15) was promoted to Mechanical Project Engineer at Mueller Associates

SAM GRIFFITH (B.S. '11) was promoted to Owner and President of National Jet Company

ZHENG JIA (Ph.D. '14) received the 2019 Extreme Mechanics Letters Young Investigator Award for his paper on nanoscale silicon-based actuators

LEILA LADANI (M.S. '05, Ph.D. '07) was appointed as the Director of Arizona State University's Polytechnic School in the Ira A. Fulton Schools of Engineering

PRADEEP SHARMA (M.S., Ph.D. '00) was named a 2020 Guggenheim Fellowship recipient for his work, "Why Do Some People Hear Music Better Than Others? An Engineering and Physics Perspective."

Have News to Share?
Contact Heidi Sweely, Director of External Relations, at hsweely@umd.edu.

Alumni on Campus

CAREER PATHS SPEAKERS

FALL 2019

John Benton | B.S. '01
Principal Engineer
Manitowoc Crane

Les Bookoff | B.S. '90
Partner
Bookoff McAndrews

Dan Diehl | B.S. '90
Chief Executive Officer
Aircuity

Rajender Ratnakar | M.S. '93
Chief Strategy Officer
DuPont

Hala Tomey | ME '97
Mechanical Engineer
Johns Hopkins University – Applied Physics Laboratory

Kathy Phelan Weber | B.S. '04
Reliability Project Engineer
Stanley Black & Decker

SPRING 2020

Stephen Chung | B.S. '13
Engineer, Urban Air Mobility
Hyundai Motor Group

Charley Kilmain | B.S. '85
Senior Manager of Mechanical Systems, Bell

David Wilson
Chief Innovation Officer and Principal Vice President
Bechtel

Bob Wunderlick | B.S. '84, MBA '01
Owner
Wunderlick Consulting

Dorothy Zukor | M.S. Nuclear Engineering '77, Ph.D. '82 (virtual)
Retired, Associate Director of Earth Sciences Division
NASA

FALL 2019 DESIGN DAY ALUMNI JUDGES

Andrew Akers | B.S. '09
Development Operations Manager
Intralox

Kashyap Alur | B.S. '10
Lead Engineer
Intralox

Nathaniel Fikru | B.S. '15
Space Hardware Quality Engineer
Northrop Grumman

Sam Hollenbach | B.S. '07
Innovation Engineer
Under Armour

Laleh Jalali | B.S. '89
Co-Founder and Senior Patent Attorney
Alliance IP

Ricardo Katz | B.S. '79
Senior Consulting Engineer
Unified Technologies

William Leasure | B.S. '66

Matt McTigue | B.S. '93
Solution Architect
Delta Risk

John Nguyen | B.S. '84

Gerald Perada | B.S. '05
Innovation Operations Manager
Bechtel

Russell L. Werneth | B.S. '64, M.S. '68
Hubble Space Telescope Outreach Engineer
NASA

BRAND SAVIOR

ENTREPRENEUR ALEX MEHR (PH.D. '03) IS REINVIGORATING ICONIC, BUT STRUGGLING, BRICK AND MORTAR BRANDS THROUGH "CREATIVE REINVENTION" IN E-COMMERCE.

It may not seem like the logical next step for former NASA engineer and Zoosk founder Alex Mehr (Ph.D. '03), but he is now co-owner and president of Dressbarn. The mechanical engineering alumnus has been on an unusual trajectory since leaving NASA and founding the online dating app Zoosk in 2007.

As an engineer turned entrepreneur, Mehr spent the last decade building and launching over 30 products and companies through online platforms, along with fellow investor Tai Lopez and University of Maryland (UMD) alumnus Shayan Zadeh (M.S., computer science '02). Then, in 2019, Mehr and Lopez turned from creation to reinvention: they established a parent company, Retail Ecommerce Ventures, and began rapidly acquiring well-known retail brands and turning them into e-commerce powerhouses.

Dressbarn is just one of several beleaguered brands acquired by Mehr and Lopez in the last year. Additional brands include Pier 1 Imports, housewares retailer Linens 'n Things, collectible purveyor The Franklin Mint, The Book People and Modell's Sporting Goods. Meanwhile, Mehr launched the health food online store FarmersCart to respond to the need for food delivery during the COVID-19 quarantine.

Mehr's mission to "acquire well-known distressed retail brands and transform them into e-commerce success stories," is built, in part, on the belief that well-established, but failing businesses, are not failing because of the quality of the brand.

"There is a lot of value behind these brands," said Mehr. "But they haven't transformed to the modern way of doing business, which basically means e-commerce, selling things online."

The COVID-19 pandemic has accelerated the trend. "People are now spending even more time at home, cocooning, so they are buying more home goods, and those are most likely going to be bought online through e-commerce," he said. Now Mehr is moving swiftly to salvage as many of these brands as he can, along with their legacies and loyal customer bases.

Such long-term macro-trends are a crucial factor in his business choices. "I call this 'trend stacking'," he said. "You want to choose the best opportunities that are at the intersection of multiple macro trends."

Reinventing existing brands, in many cases, can make more sense that building new brands from the ground up. "My expertise is in building brands online from scratch," Mehr said. "But two to three years ago, I started thinking that maybe starting from scratch is not the fastest and the smartest way to build brands, but these [existing] brands have huge followings built over many years, so the work there is done."

It also has a more personal meaning for Mehr. "If nobody does anything over the next 10 years, a lot of iconic brands that we grew up with—and which took decades to get into the psyche of everyone and were part of our lives—will not be there for our grandchildren," he said. "It feels like I'm saving something people care about."

"UMD BROUGHT ME TO THIS GREAT COUNTRY AND GAVE ME A PLATFORM AND AN OPPORTUNITY," SAYS ALEX MEHR.

THIS SUMMER, HE DECIDED TO PAY THAT FORWARD IN A BIG WAY, WITH A GIFT OF $500,000 TO THE DEPARTMENT.

GIFT FROM MEHR ESTABLISHES TWO FUNDS AT UMD

This contribution is supporting graduate student fellowships in engineering decision-making and systems optimization, as well as providing operating funds for the Design Decision Support (DDS) Laboratory.

A. JAMES CLARK
SCHOOL OF ENGINEERING

Department of Mechanical Engineering
2181 Glenn L. Martin Hall
4298 Campus Drive
University of Maryland
College Park, MD 20742

SAVE THESE DATES

PHOTO: JOHN T. CONSOLI

UPCOMING EVENTS

Mtech Fall Forum

NOVEMBER 16-19, 2020
International Mechanical Engineering Congress & Exposition (virtual)

DECEMBER 8, 2020
Design Day (virtual)

DECEMBER 20, 2020
Winter Commencement
University Ceremony
Spring 2020 graduates are invited to participate

MAY 21, 2021
Spring Commencement
University Ceremony

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Above: Mechanical Engineering team wins 2nd place at Alumni Cup, Spring 2020.