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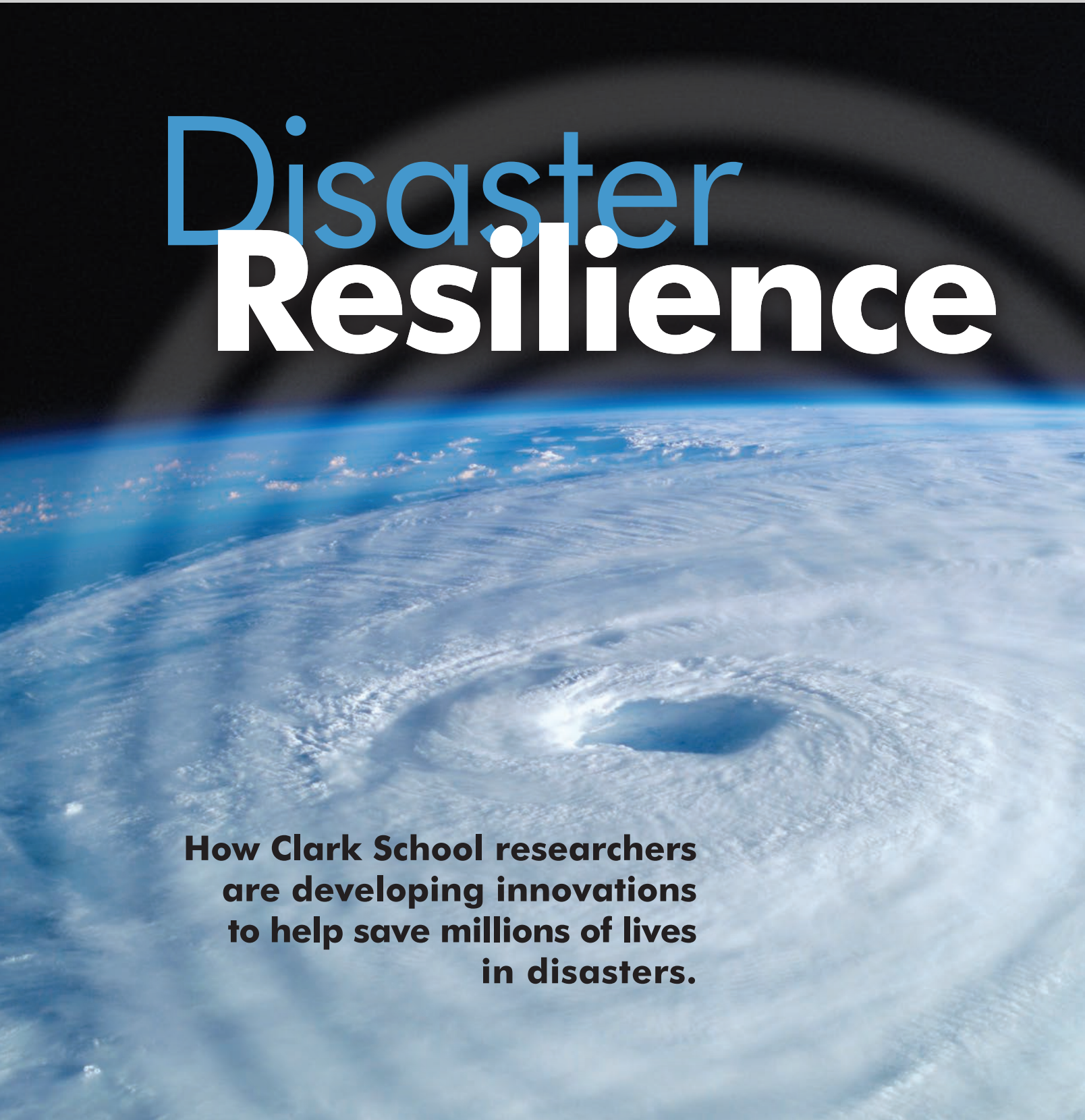
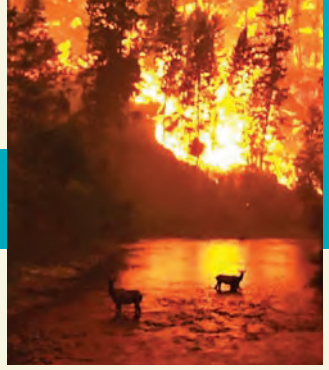
E@M

THE MAGAZINE OF THE A. JAMES CLARK SCHOOL *of* ENGINEERING

Disaster Resilience



How Clark School researchers are developing innovations to help save millions of lives in disasters.



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Please note that ***Engineering @ Maryland*** refers to the A. James Clark School of Engineering by that name in all cases, including stories that describe alumni who graduated before the name was established, in 1994, to honor Mr. Clark's outstanding philanthropy.

COVER PHOTO
Courtesy NOAA

Dear Friends of the Clark School,

In the last decade, natural and human-caused disasters have been an all-too familiar occurrence, both in the U.S. and internationally. These disasters have led to major financial losses and human casualties.

In 2005, Hurricane Katrina left a trail of destruction in its wake, most notably in New Orleans, causing 1,833 deaths and $108 billion in damage. In 2008, after Cyclone Nargis struck Burma, 84,000 people died and 54,000 went missing, while 2.5 million people were left destitute by the storm. Less than two weeks later, nearly 70,000 people were killed when an earthquake rocked central and southern China, and an estimated 5 million people were rendered homeless. In 2010, an earthquake in Haiti resulted in 316,000 deaths, and in that same year, the largest marine oil spill in history took place at Deepwater Horizon, with an estimated 4.9 million barrels of oil discharged into the Gulf of Mexico. In 2011, an earthquake and subsequent tsunami in Japan resulted in 18,500 deaths. In 2012, Superstorm Sandy ravaged the eastern seaboard, inflicting a total of $68 billion in damage. In 2013, Typhoon Haiyan killed 6,021 in the Philippines.

Engineers can play a significant role in developing innovative solutions to help prevent, mitigate, and respond to disaster

Recently, the U.S. Department of Homeland Security (DHS) determined that failing to prepare for extreme weather events has cost the United States $1.15 trillion in economic losses from 1980 to 2010. "According to the U.S. Global Change Research Program, future impacts of climate change project national economic losses on the order of $1.2 trillion through 2050," said Assistant Secretary for Policy at DHS David Heyman at a recent Senate hearing.

Engineers can play a significant role in developing innovative solutions to help prevent, mitigate, and respond to disasters, both natural and human-caused. University of Maryland researchers from the A. James Clark School of Engineering are actively engaged in initiatives to address disaster resilience and help our national and international communities prepare for disaster scenarios.

This issue of E@M showcases these Clark School research innovations, addressing areas as far-reaching as coastal infrastructure, fire resilience, energy, pandemic outbreaks, cybersecurity, unmanned aircraft systems, and other technologies aimed at providing solutions to disaster resilience applications.

We hope you will participate in our Fall 2014 Mpact Week events, which will be focused on the Disaster Resilience theme, on Oct. 16-22. You can learn more at clark.umd.edu/mpact.

Darryll Pines
Dean and Farvardin Professor of Engineering

When Hurricane Katrina roiled the Gulf Coast in 2005, emergency planners in New Orleans anticipated levees would overtop—but not the major breaches that created water walls upwards of 20 feet and flooding in 80 percent of the city. And with that shock to the system, the city's response quickly unraveled into mayhem. The Federal Emergency Management Agency (FEMA) estimates that damages were in excess of $100 billion, to say nothing of the tragedy of 1,800 lives lost; tens of thousands of evacuees; and the challenges of rebuilding the region.

Katrina signaled a watershed moment—in community resilience, in systematic approaches to disaster planning and response, and in the perils of unpreparedness. But its high costs were hardly an anomaly. The United States has lost $1.15 trillion due to inadequate emergency planning for extreme weather events from 1980 to 2010, according to the Department of Homeland Security.

Disaster Resilience

Threats loom from all fronts, both natural and man-made: hurricanes, wildfires, floods, chemical warfare, and cyber attacks. Recent disasters leave us with unforgettable images of destruction: Superstorm Sandy, Typhoon Haiyan, the Haiti earthquake.

"Vulnerability to disaster is growing faster than resilience," said United Nations Secretary-General Ban Ki-moon on a recent International Day for Disaster Reduction.

The University of Maryland's A. James Clark School of Engineering is doing more than stem the tide—it's also serving as a driving force of the current toward resilience. From developing groundbreaking technologies to wielding influence on Capitol Hill, engineering researchers here are leading efforts to prepare for, prevent, withstand, recover, and learn from disasters, both natural and man-made.

Structures and Buildings

As Typhoon Haiyan blasted the Philippines last November, the Pacific Ocean swallowed coastal villages like beach litter at high tide. Sifting through the rubble left by the 370-mile-wide cyclone, which obliterated more than a million homes, made one thing painfully obvious to officials: construction across this disaster-prone archipelago must be rebuilt on a foundation of resilience and climate adaptability.

Structural resilience will only become more vital as climate change exposes vulnerabilities and stresses aging buildings, said Civil and Environmental Engineering (CEE) Professor Bilal Ayyub, Director of the Center for Technology and Systems Management (CTSM). In a widely known study published in the journal "Risk Analysis," Ayyub developed a linear model predicting the potential infrastructure damage of inevitable sea level rise in Washington, D.C.

That link between science and engineering could be called Ayyub's sweet spot. "Extremes are expected—drought, flooding, high winds, bigger storms—and we need to account for those variables with our engineering practices," Ayyub said. A failure to invest in infrastructure safeguards could have disastrous implications for bridges, high rises, and other elements. In a similar vein, Professor M. Sherif Aggour (CEE) tests deterioration and collapse risk of aging structures, such as local parking garages.

Among the distinctions in Ayyub's approach is the balance of engineering models with cost-benefit analysis. He makes a case for designing planned modes of recovery in engineering protocols.

The wild card of infrastructure is the easiest to oversimplify or overlook, yet it's also the most critical: people. Working to reduce exposure to environmental stressors and airborne contaminants, Mechanical Engineering (ME) Professor Jelena Srebric calls population vulnerability the weakest link. "Urban ecosystems can either attenuate or amplify the disaster effects on human population," Srebric said. "For example, a healthy system can reduce the impact of a heat wave on building residents. Several degrees of decrease in local microclimatic temperature is possible with strategic vegetation around building structures." Srebric's work in green roofs has shown that the same plants can function as storm water management.

Srebric and the Building Science Group have also innovated algorithms that address the ebbs and flows of building maintenance over time. In pursuit of the ways ventilation systems can act as a weapon against harmful microorganisms, Srebric's research has demonstrated the effectiveness and energy efficiency of ultraviolate disinfection in upper-room air or ducts in New York City hospitals, among other places.

A CAR FLOATS IN THE WAKE OF A FLOOD DISASTER FOLLOWING HURRICANE SANDY IN CRISFIELD, MD.

PHOTO COURTESY OF MARYLAND NATIONAL GUARD

Coastal Infrastructure

Scientists have long warned of the perils of rising sea levels on the Eastern Seaboard, including New York City's 520-mile-long coastline. Then Hurricane Sandy hit in 2012—and proved them right. The superstorm affected more than 50 million people up and down the coast and caused upwards of $20 billion in damages, dealing a heavy blow to coastal infrastructure.

Policymakers in Washington, D.C., as well as farther afield, from Thailand to Louisiana and the California Delta, turn to the risk and reliability expertise of the Department of Civil and Environmental Engineering at the University of Maryland. "By virtue of location, we are uniquely capable of having an active, participatory role in large federal agencies," said Professor Gregory Baecher (CEE), a committee regular for the National Research Council.

Top of the group's agenda is the push toward a national flood or coastal policy. "The reality is that all of our coastal communities—from Miami to Cape Cod—are at risk to rising sea levels," Baecher said. "It's a matter of when, not if, huge losses will happen in these fragile areas. But we're not going to move Manhattan to the Poconos, or Miami to Arkansas."

Last year, Research Professor Gerry Galloway (CEE), who frequently testifies before congressional committees, served as chair of the National Academy of Sciences' Committee on Levees and the National Flood Insurance Program to author what has been described as a seminal report. The paper recommends updating FEMA's 100-year flood standard, which mandates insurance for property owners who are located within a floodplain that carries a 1 percent chance of flooding annually. Senior Research Engineer Ed Link (CEE), former director of research and development for the Army Corps of Engineers, is an international leader in risk-informed approaches to flooding and, as head of the Interagency Performance Evaluation Taskforce, helped decode Hurricane Katrina's lessons in natural hazards defense.

Risk management in the 21st century implies an inherent shift in mindset. Where prevention was once the goal, Galloway said, recent decades have elevated risk awareness, casting a spotlight on the country's $3 trillion infrastructure deficit.

In addition to his high-level consulting, Galloway is committed to filling in gaps in public understanding of how to behave during a disaster. Last year's F5 tornado that flattened Moore, Okla., killed 24, in part because many lacked a storm shelter—which Galloway said is cheaper than a granite countertop. Even in Tornado Alley, he said, many residents don't know about easy survival tactics like riding out a storm in a bathtub.

A FIRE TORNADO SIMULATION IS USED TO GAIN GREATER UNDERSTANDING OF WILDFIRES AND EXTREME FIRE EVENTS IN ASST. PROF. MICHAEL GOLLNER'S LABORATORY.

PHOTO BY FAYE LEVINE

Fire Protection

Last June, while battling a massive wildfire near Yarnell, Ariz., 19 elite firefighters were overtaken by flames. The report by the Arizona State Forestry Division blames the deaths on a desert thunderstorm that unexpectedly blew the blaze into their path—and a fatal breakdown in communication.

If the simulator under development by Fire Protection Engineering (FPE) Professor Arnaud Trouvé achieves operational status, such failures could potentially be avoided. "Our wildfire simulator would provide valuable information to the command post to help make better decisions," he said, "leading to, for instance, an early evacuation for firefighters at a risk of being trapped."

Trouvé works in computational fluid dynamics to develop quantitative models that can be used to design fire protection systems, forensic analysis, risk analysis, and emergency management. To overcome current limitations—namely, accuracy of physical models and uncertainties with input parameters—Trouvé combines the computational might of modeling software with that of fire sensor technologies.

Weather forecasters have long relied on this type of data assimilation, he explains, but the technology is novel in fire spread dynamics. "Our data-driven wildfire simulator provides a forecast of the fire position that can be used by emergency responders to make informed decisions on how to best fight the wildland fire," Trouvé said. In short: spread resources to areas faster than the blaze can spread. Trouvé and Assistant Professor Michael Gollner (FPE) are collaborating with the University of California-San Diego in a project sponsored by the National Science Foundation to apply their prototype to fire hazards around San Diego, Calif.

Associate Professor Andre Marshall (FPE) deals with what happens next. The task of extinguishing a flame has taken on increased urgency in a country where more than 15 million homes have been built in dangerous fire zones since the 1990s, and most of the worst fire seasons by acres burned in U.S. record have taken place since 2000. Marshall's diagnostic and modeling efforts focus on turbulent flow transport and fire suppression sprays, applying scale-modeling principles to address the problem of unpredictable plume dispersion of sprays from sprinklers. As Director of the Fire Testing and Evaluation Center (FireTEC), Marshall oversees advancements in the suppression of turbulent, buoyancy-dominated flames.

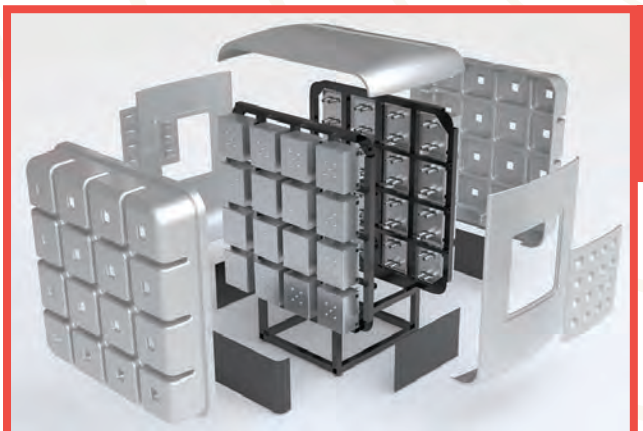
Energy and Grid Resilience

Hurricane Sandy knocked out the power grid for 8.5 million homes and businesses, causing blackouts from North Carolina to New Hampshire. In waterlogged Manhattan, transformers exploded in bursts of sparks. Eric Wachsman, Director of UMD's Energy Research Center (UMERC), believes in the power of a backup plan. Joined with a natural fuel source, his solid oxide fuel cell technology provides baseline energy during grid outages.

"A microgrid that can operate on island mode, such as on the UMD campus, can provide power even if the main grid goes down," said Wachsman. "The more microgrids are distributed, the more resilience you have within each."

Delving deeper into the energy market, rival forces shape—and disrupt—the power supply. That's where optimization research models enter the picture, like those developed by Professor Steven Gabriel (CEE). He strategizes smart energy decisions based on gas market resilience, taking into account possible shocks to the system and wide-ranging variables—from the advantages of building underground power lines, to the likelihood of hydraulic fracturing ("fracking") causing water contamination, to the possibility of an international oil cartel driving up prices.

"As a nation we don't have a carbon policy," Gabriel said. "Each state has its own renewable power goals and profit maximization, and sometimes they compete." Similarly, in his modeling for smart growth, Gabriel analyzes stakeholders with conflicting interests, such as land developers, conservationists, hydrologists, or others concerned with resilience. His optimization research models forge a mathematical approach to ensuring the safety of a system.



THE REDOX CUBE DEVELOPED BY PROF. ERIC WACHSMAN USES SOLID OXIDE FUEL CELL TECHNOLOGY TO PROVIDE OFF-GRID ENERGY.

Emergency **Transportation**

In January, a rare winter storm froze Atlanta in its tracks. Traffic on ice-covered roadways devolved from choked to apocalyptic, with more than 900 car wrecks. The hours dragged on; drivers abandoned or slept in their vehicles overnight.

As the city unthawed under the nation's glare, Georgia's Department of Transportation tapped the Center for Advanced Transportation Technology (CATT Lab) to provide analysis on how "two inches of snow brought the city to a halt," as Michael Pack, Director of CATT Lab, put it. In this and other traffic jams, Pack can pinpoint congestion points and the optimal course of action in real time, from rerouting traffic patterns to directing emergency responders.

Extreme weather conditions colliding with spiking urban populations create a perfect storm of hazardous traffic congestion. Pack envisions the CATT Lab becoming a national research resource—like a National Weather Service for transportation—that could supply targeted data and analysis in a matter of minutes. More and more, habitually jammed areas are turning to engineers for solutions, such as Civil and Environmental Engineering (CEE) Professor Gang-Len Chang, who applies algorithms to monitor traffic and direct emergency evacuations in the resort town of Ocean City, Md.

While weather emergency procedures sometimes begin days prior, man-made threats require snapping into motion. "FEMA and Homeland Security log into the CATT Lab's system to monitor traffic and look for weird patterns," Pack said. "If a bigger incident were to occur, this awareness would inform them how to direct people out of the region." The lab also developed a gaming exercise, called the Virtual Incident Management System, which drops first responders into a world of simulated accidents for an evaluation of how protocol plays out. "It's like 'Grand Theft Auto,' but for the good guys," Pack said.

Professor Ali Haghani (CEE) and Assistant Professor Lei Zhang (CEE) are also focused on emergency transportation solutions, highway congestion mitigation, and intercity systems at UMD's National Center for Strategic Transportation Policies, Investments and Decisions, one of only five national centers supported by the U.S. Department of Transportation.

Professor Elise Miller-Hooks (CEE) likewise has developed tools to optimize disaster preparedness, in particular search and rescue efforts. "We live with very big hazards and, as a society, pretend they don't exist because of their small probability," said Miller-Hooks, who offered the CSX freight railway carrying hazardous materials less than a mile from the U.S. Capitol as an example. By running models to determine the smartest ways to position resources, Miller-Hooks grapples with profound questions. During a catastrophe, how do you decide where to begin search-and-rescue efforts, knowing each decision delays rescue elsewhere?

To help solve those quandaries, Miller-Hooks has developed a multistage mapping system that conceptualizes scenarios while considering variables not accounted for by agencies such as FEMA. That includes the time required to travel to and access victims at a disaster site, combined with the falling rate of survival and potential timeline of structural collapse. Applying the simulation on a hypothetical scenario modeled after the Haiti earthquake of 2010, Miller-Hooks said the winning approach was able to save hundreds more lives than the simulated FEMA approach.

RESEARCHERS ENGAGE IN MONITORING AND MODELING OF TRAFFIC PATTERNS AND EMERGENCIES IN THE CLARK SCHOOL'S CENTER FOR ADVANCED TRANSPORTATION TECHNOLOGY (CATT) LAB.

PHOTO BY AL SANTOS

Unmanned Aircraft Systems

Even in an era when every storm seems to get a name, forecasting remains stilted: meterologists can accurately track a swirling weather system, but the strength of the blow often comes as a surprise. "The ability for computer models to forecast hurricane trajectories has improved steadily, but the forecast of a storm's intensity has not shown the same improvement," explained Aerospace Engineering (AE) Associate Professor Derek Paley, who manipulates global sensor networks to combat that limitation.

Paley brings his expertise in control theory algorithms to help develop networks of autonomous aircraft that can withstand strong winds at low altitudes, gathering crucial intelligence as a storm moves toward landfall. Besides removing human risk from the equation, Paley said, these vehicles are also relatively inexpensive and can form targeted networks with widespread communication reach. On the horizon? Such drones could be deployed to disaster zones, collecting data about survivors and obstacles to assist in search-and-rescue efforts.

That's where UMD's Unmanned Aircraft Systems (UAS) Test Site comes in. Helping to lead the integration of such unmanned systems on a broad scale, a team led by UAS Test Site Director Matt Scassero is collaborating with the Federal Aviation Administration to define safe, efficient, and robust research processes. And at the Maryland Robotics Center, Founding Director and Professor S.K. Gupta (ME) hones in on automation problems that can arise from computerized robotics.

Tackling problems from another angle, Associate Professor J. Sean Humbert (AE) deals in the intersection of flight mechanics and robotic sensory perception. His flapping-wing mechanics can fly or crawl and range in size from an insect to hummingbird, so it's only natural that Humbert looks to biology for secrets, studying bug sensors to replicate behaviors in fine-tuned perceptions. "Insects are great at avoiding fly swatters," he explained. "To fly into small crevices or into a building that has collapsed, sensing obstacles is critical."

Probing the tiniest of cracks brings micro-robots into play. Assistant Professor Sarah Bergbreiter's (ME) devices measure in the millimeters—"just like ants," she explained—and are being developed for rough terrain and to have cooperative capabilities. Manipulations on legs, mechanisms, and actuators intend to push speed and nimbleness. The issue of payload capability is as significant as the robots are miniscule. "Moving forward," she said, "the challenge will be adding sensors at a scale that is useful for first responders."

UNMANNED AIRCRAFT SYSTEMS, SUCH AS THE TRITON (LEFT), CAN BE USED FOR A VARIETY OF DISASTER RESPONSE APPLICATIONS, INCLUDING SEARCH AND RESCUE, WEATHER MONITORING, AND DAMAGE ASSESSMENT.

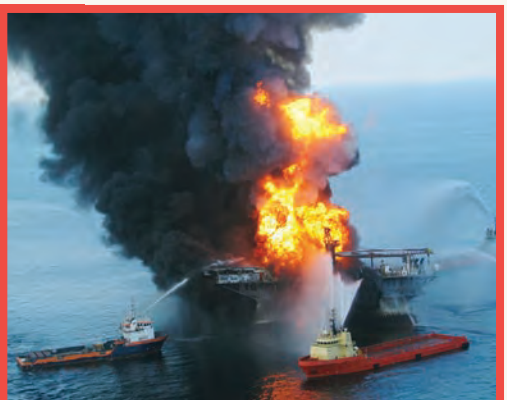
PHOTO COURTESY OF U.S. NAVY

Reliability, Risk, and Resilient Systems

Following the Tohoku Earthquake and Tsunami in Japan, power went out at Fukushima Daiichi Nuclear Power Station. Backup generators failed. Cooling systems failed. Three of six reactors failed, and the disaster quickly spiraled into a major meltdown. Power hydrogen explosions released radioactive material at levels to rival Chernobyl, forcing more than 80,000 evacuations. The calamity showed systemic failure on a colossal scale.

Historically, system breakdowns have provided the impetus for reform, explained Civil and Environmental Engineering (CEE) Professor Gregory Baecher. In the United States, the 1976 collapse of Idaho's Teton Dam killed 11 people, caused more than $1 billion of damage, and was the deadliest in a string of dam failures that gave steam to new systems informed by risk and reliability. Over the decades since, Baecher said, the government's role in risk awareness has grown exponentially, from the Environmental Protection Agency to the U.S. Army Corps of Engineers, which shed its longtime adamance against risk-based systems in the immediate aftermath of Hurricane Katrina.

Meanwhile, this year marks the 25th anniversary of the Center for Risk and Reliability, a research hub boasting the largest and most comprehensive engineering graduate program to grant degrees in the field. A research leader in prognostics, Michael Pecht, mechanical engineering (ME) professor and chair, and Director of the Center of Advanced Life Cycle Engineering (CALCE), is a prolific patent holder whose pivotal research aims to detect system anomalies and degradation. With sensors that give advance alert, system shutdown and safety hazards may be prevented.



THE UNIVERSITY OF MARYLAND OFFERS SIGNIFICANT RESEARCH EXPERTISE IN THE AREAS OF RELIABILITY ENGINEERING AND RESILIENT SYSTEMS TO HELP PREVENT SYSTEMS-RELATED DISASTERS, SUCH AS THE 2010 DEEPWATER HORIZON OIL RIG EXPLOSION.

PHOTO COURTESY OF U.S. COAST GUARD

Pandemic and Biomedical Emergency Response

In 2009, an outbreak in Mexico of the H1N1 influenza virus—or swine flu—spread to more than 120 countries. The World Health Organization declared a pandemic, estimating some 47 million cases. Chatter about quarantines filled morning shows and small talk. Face masks on airplane passengers became de rigueur.

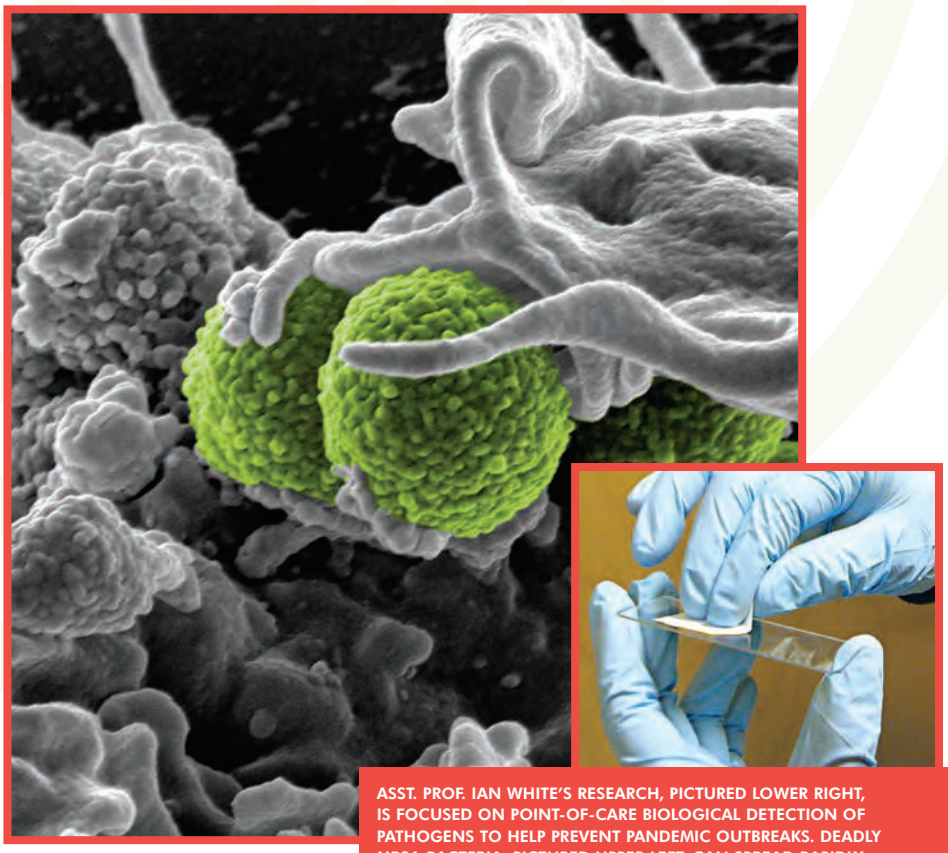
In any public health emergency, rapid detection and identification are essential. Bioengineering (BioE) Assistant Professor Ian White's research hones in on low-cost, easy-to-use solutions, such as the application of inkjet-printed gold or silver nanoparticles onto a strip of paper. "In combination with a handheld spectrometer, the plasmonic nature of the nanoparticles on paper enables chemical identification," White explained, casting a light on abnormalities, including detecting pesticides, explosives, narcotics, and toxins.

The advantage to printing on paper instead of expensive commercial products, such as nanotechnology-based fabrication devices, extends beyond the cost quotient. By using paper, White said, the sensing strip can simply be dipped into water samples for analysis, and can act as a swab to collect particles from a surface. Led by graduate students from White's group, a startup company called Diagnostic anSERS hopes to commercialize the sensor.

Most recently, White has turned his attention to the biological detection of viral pathogens using his chemical sensing platform. One offshoot of this work aims to detect cholera in water using paper that has been patterned with specialized biomaterials and enzymes. Such a tool could help prevent outbreaks, such as the cholera emergency in camps and villages following the 2010 earthquake in Haiti, and could also identify unusual strains of influenza in dense places ranging from dorms and cruise ships to refugee camps.

Distributing resources in the simplest manner possible is a quagmire understood all too well by Associate Professor Jeffrey Herrmann (ME). He zeroes in on how local health officials can effectively prepare for emergencies to optimize limited resources, whether faced with a small pox outbreak or an anthrax attack.

"We've implemented our models in user-friendly Microsoft Excel—just a regular spreadsheet with sophisticated mathematics behind the scenes," Herrmann said. In collaboration with Maryland's Montgomery County, his research group has distributed these models to public health professionals nationwide to help determine the who, what, where, and when of disaster response, from drive-through pharmacies and pop-up clinics to stockpiles at nursing homes and private residences. As for those emergency distribution centers, the research of Professor Gregory Payne and Assistant Professor Christopher Jewell (BioE) could prove pivotal, covering such topics as electronics and phenolics in biomedical diagnostics and biomaterial-engineered vaccination.



ASST. PROF. IAN WHITE'S RESEARCH, PICTURED LOWER RIGHT, IS FOCUSED ON POINT-OF-CARE BIOLOGICAL DETECTION OF PATHOGENS TO HELP PREVENT PANDEMIC OUTBREAKS. DEADLY MRSA BACTERIA, PICTURED UPPER LEFT, CAN SPREAD RAPIDLY IN HOSPITAL SETTINGS.

MRSA PHOTO COURTESY OF NIAID

UNIVERSITY OF MARYLAND RESEARCHERS, LIKE ASSOC. PROF. MICHEL CUKIER, PICTURED RIGHT, ARE WORKING TOWARD INTERDISCIPLINARY, FAR-REACHING SOLUTIONS TO INTERNATIONAL CYBERSECURITY CHALLENGES.

Cybersecurity

The threat of international cyber attacks and the potential damage they could inflict on urban centers also looms on the horizon. UMD researchers at the Maryland Cybersecurity Center are developing innovative, interdisciplinary solutions to help protect our national infrastructure, working in the areas of wireless and network security, secure software, digital forensics, cryptology, as well as cyber supply chain security.

Maryland is also focused on educating the future leaders of the cybersecurity workforce. Last fall, the nation's first undergraduate honors program in cybersecurity was launched in College Park. The program, directed by Associate Professor of Reliability Engineering Michel Cukier, is called the Advanced Cybersecurity Experience for Students (ACES), and was supported through a special industry partnership with Northrop Grumman.

"Cybersecurity is a field where you need to learn all the time," said Cukier. "The threat evolves. A holistic approach is important, so that we get away from a purely technical view. The problem is much more complex—a system-wide problem, where you have many different components, including human behavior."

Cukier has collaborated on research with colleagues in Criminology at UMD to better understand the behavior of cyber criminals in an effort to help guard against their attacks.

Resilient **Communications**

In the immediate aftermath of the Hurricane Katrina disaster, the mayor of New Orleans attempted to manage the disaster from a makeshift command center in a hotel ballroom. But when phone service failed, he and his staff had difficulty communicating their needs to the state Emergency Operations Center in Baton Rouge, and the situation became more chaotic and confused. During the September 11 attacks in 2001, many of those who attempted to reach their loved ones in Washington, D.C., and New York were unable to get through as a result of the cellphone network across the East Coast crashing due to the flood of call attempts.

In the wake of disasters, communications are critical for addressing immediate threats and problems and assessing the situation on the ground. However, disaster conditions can often lead to massive communications outages.

Clark School researchers in the Department of Electrical and Computer Engineering (ECE) and the Institute for Systems Research (ISR) have strong expertise in resilient communications. Professors John Baras and Anthony Ephremides (ECE/ISR) are internationally known for their research in the area of mobile, ad hoc communication networks, which can be employed in disaster situations.

Professor Christopher Davis (ECE/ISR) has done extensive research in the area of wireless optical networks, improving the performance of line-of-sight optical communication links.

Professor Davis and his research group have been focusing on directional wireless communications both in the radio frequency region and also using free space laser communications in the atmosphere. The team is also developing new techniques for high data rate communications between unmanned air vehicles, which could be used to transmit information about conditions in real time during disaster situations.

Clark School researchers have focused on the need for wireless networks to autonomously and dynamically reconfigure themselves to adapt to changes, offering sophisticated solutions for resilient communications and emergency response.

IN THE WAKE OF DISASTERS SUCH AS TYPHOON HAIYAN IN THE PHILIPPINES, COMMUNICATIONS SYSTEMS OFTEN FAIL. CLARK SCHOOL RESEARCHERS OFFER EXPERTISE IN AD HOC NETWORKS THAT CAN BE SET UP IN THE AFTERMATH OF EMERGENCIES.

PHOTO COURTESY OF CDC

Disaster Resilience Research Showcase

The Clark School will hold a weeklong research showcase event in October 2014 to demonstrate its broad expertise in the area of disaster resilience, including the areas included above. For more information, visit www.eng.umd.edu/mpact.

Two Clark School Faculty Members Receive Presidential Early Career Awards

The ocean has been called one of the final frontiers of exploration left on earth. Even with today's technology, many parts of the sea present challenges to exploration and navigation due to extremes in temperature, pressure, and available light. However, new bio-inspired research in sensory technology and unmanned submersible vehicles being developed at the University of Maryland may offer more effective and efficient solutions for maritime applications and exploration.

AEROSPACE ENGINEERING ASSOCIATE PROFESSOR DEREK PALEY, one of two A. James Clark School of Engineering faculty selected for a 2012 Presidential Early Career Award for Scientists and Engineers (PECASE), is an expert in both aerial and submersible unmanned vehicles, and he is applying biological principles from fish to the next generation of autonomous submersible vehicles. These autonomous unmanned vehicles (AUV) have applications from ocean exploration and data collection to anti-submarine warfare and explosive ordinance removal.

Paley, who is the founding director of the University of Maryland's Collective Dynamics and Control Laboratory, became intrigued with autonomous underwater vehicles while working for a scientific consulting company after completing his B.S. in applied physics at Yale. "I quickly knew this was what I wanted to work on. Collective behavior and bio-inspired engineering were related interests that quickly followed," said Paley.

Paley's PECASE nomination was sponsored by the Department of Defense, and most of his research—dynamics and control, cooperative control of autonomous vehicles, adaptive sampling with mobile networks and spatial modeling of biological groups—is based on support from the U.S. Army, the Office of Naval Research (ONR), and the National Science Foundation.

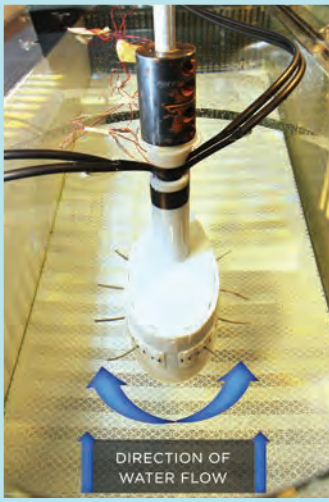
With ONR's support, he is now leading a team of biologists and engineers to improve understanding of the hydrodynamic sensing in fish to improve sensory navigation technology and create a closed-loop control system for undersea autonomous vehicles. Fish use a system of sensory organs located along their sides called the lateral line system. This specialized sensory system enables a fish to detect changes in water currents, such as pressure gradients and flow velocity, providing them with spatial awareness and navigational cues.

Paley and his team have developed a robotic 'fish' with a bio-inspired flow sensing and control system that uses 'whisker' and pressure sensors to detect changes in water flow. The sensors provide data the 'fish' can use to not only detect changes, but use that information to generate a response. When an object is placed near the robotic fish, altering the water flow or direction, the robot can sense the flow changes, use the data to implement dynamic feedback control, and respond by adjusting its heading or altering course to maintain position. This orientation to water currents is known as rheotaxis and the translation into an obstacle wake is known as station-holding—the same method a fish would use to maintain position behind a rock without being swept downstream.

Using artificial lateral line sensor systems in submersible vehicles could enable increased collection of environmental data and allow vehicles to navigate autonomously in areas where traditional sensors such as sonar are unavailable. Teams of these vehicles will be better equipped to explore the dynamic environments of the ocean and provide valuable insights on climate change by collecting information on water temperature, salinity, and density variations.

Paley holds a joint appointment with the Department of Aerospace Engineering and the Institute for Systems Research and is the Willis H. Young Jr. Associate Professor of Aerospace Engineering Education. He received his Ph.D. (2007) in Mechanical and Aerospace Engineering from Princeton University. He is the co-author of Engineering Dynamics: A Comprehensive Introduction and was awarded a National Science Foundation CAREER award in 2010.

www.aero.umd.edu/faculty/paley



ASSOC. PROF. DEREK PALEY'S BIO-INSPIRED ROBOTIC FISH RESEARCH IS AIMED AT HELPING SUBMERSIBLE VEHICLES TO NAVIGATE AUTONOMOUSLY.

PHOTO BY JENNIFER ROOKS

"The impressive achievements of these early-stage scientists and engineers are promising indicators of even greater successes ahead," President Obama said in a White House press release. "We are grateful for their commitment to generating the scientific and technical advancements that will ensure America's global leadership for many years to come."

– President Barack Obama

BERGBREITER RECEIVES PRESIDENTIAL EARLY CAREER AWARD

Mechanical Engineering Assistant Professor Sarah Bergbreiter sees a future built on the industrious work of miniature robots. These microscale robots could explore, build, and execute complex tasks that can't be accomplished with today's technology. Even if that future is distant, Bergbreiter's research in the Lilliputian world of microrobotics could open up a new suite of robotic applications for disaster response, civil infrastructure, and medicine.

Bergbreiter has always been fascinated by robots. She can't pinpoint when exactly the fascination began, but her earliest 'experiments' involved building robots out of Legos and cardboard boxes as a child. Today, she is still fascinated by robots and her work on microrobotic locomotion has earned her both a 2011 National Science Foundation (NSF) Faculty Early Career Development (CAREER) award and an NSF Presidential Early Career Award for Scientists and Engineers (PECASE).

Through her research at the University of Maryland Microrobotics Laboratory, where she also serves as director, Bergbreiter is developing new technologies and methodologies that could improve the fabrication, locomotion, mobility, and sensing capabilities of microscale robots.

Despite Bergbreiter's innate interest in robots, she didn't zero in on microrobotics as a research path until seeing a video on micro-electro-mechanical systems (MEMS) as an undergraduate in electrical engineering at Princeton University.

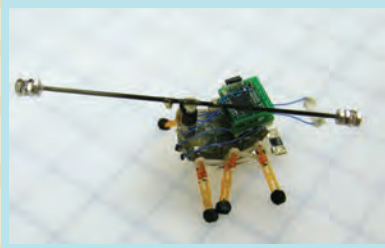
"I thought a microscopic motor was quite possibly the coolest thing I had seen," said Bergbreiter.

She went on to earn both her M.S. (2004) and Ph.D. (2007) degrees from the University of California, Berkeley with a focus on microrobotics. Today, Bergbreiter, who holds a joint appointment with the Department of Mechanical Engineering and the Institute for Systems Research at UMD, is fast becoming one of the leading researchers in the field of microrobotics.

In 2013, she was named one of the top "25 women in robotics you need to know about" by Robohub, and she envisions creating networks of tiny robots that can operate cooperatively to perform a variety of functions from assembly tasks to sensor deployment—like an army of robotic ants.

Bergbreiter sees ants as inspiration for some of her research. Ants are industrious, self-sacrificing workers, and according to her, "They can do some really impressive things when they are cooperating. They can carry your hot dog off at a picnic." Ants can carry 10 to 50 times their body weight, so imagine what scores of heavy-lifting robots could do.

To achieve this goal, Bergbreiter has been developing microrobotic legs based on characteristics of insect locomotion and using visco-elastic materials. Insects use control systems in their legs to prevent themselves from tipping over at high speeds, and by incorporating viscoelastic materials—materials that can stretch in response to stress and pressure but can return to their original shape—Bergbreiter's robots have more dynamic stability control when moving over rough surfaces.



ASST. PROF. SARAH BERGBREITER'S MICROROBOTS COULD BE USED FOR DISASTER RESPONSE, SUCH AS AIDING FIRST RESPONDERS IN SEARCH AND RESCUE EFFORTS.

PHOTO BY REBECCA COPELAND

"If I can build a [robotic] ant that is just as capable as an ant, and lasts as long as an ant, that would be my eureka moment," said Bergbreiter.

In the future, tiny robots equipped with sensors could be used for disaster response such as moving through earthquake rubble to gather critical information for first responders; providing low-cost sensor deployment over civil infrastructures like bridges; minimally invasive surgeries, internal biopsies, and tissue repair; and micro-manufacturing components on a scale that is currently impossible with today's techniques.

Scaling robots down to such small sizes poses challenges for the fabrication processes, materials, mobility, and power supplies, but technologies developed to meet the needs of microrobotics have applications in fields outside the realm of robotics. Improved fabrication techniques and sensor technology can be applied to everything from medical prosthetics to video game applications while microrobotic motors can translate to applications like a cellphone camera's autofocus.

While microrobotics are still limited in the extent of their mobility and applications, Bergbreiter is excited about the developments being made in the field and continued research in bridging work in systems and control with research in microsystems and fabrication.

www.enme.umd.edu/faculty/bergbreiter

About the PECASE

The Presidential Early Career Award for Scientists and Engineers (PECASE) was established by President Bill Clinton in 1996, and they are coordinated by the Office of Science and Technology Policy within the Executive Office of the President. Awardees are selected for their pursuit of innovative research at the frontiers of science and technology and their commitment to community service as demonstrated through scientific leadership, public education or community outreach. The PECASE is the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers.

FIVE NSF CAREER AWARD WINNERS

CHRISTOPHER JEWELL

Assistant Professor of Bioengineering **CHRISTOPHER JEWELL** was selected for a National Science Foundation (NSF) Faculty Early Career Development (CAREER) award for his vaccine design and immunotherapy research.

Jewell is exploring how different biomaterials—such as those present in many experimental vaccines and immunotherapy treatments—interact with the immune system. Jewell's team is using a new approach to study how different structures, concentrations, and combinations of biomaterials affect the organization and function of lymph nodes—the tissues that control immune response. All vaccines must reach lymph nodes to be effective, so the results of their research could lead to new biomaterials that serve not only as carriers, but also as materials that help tune immune response to fight particular diseases.

Jewell and his team are studying polymeric carriers that are important to the vaccine field, as well as new materials they are testing as improved vaccines. Through this research, the team hopes to uncover the reasons why some polymers work effectively as vaccine carriers, while others do not. Additionally, Jewell and his team study how the effectiveness of traditional vaccines—those that do not feature polymeric carriers—compares with that of vaccines that harness these new materials.

DONGXIA LIU

Assistant Professor of Chemical and Biomolecular Engineering **DONGXIA LIU** received an NSF CAREER award for her project, titled "Surface Crystallization of Reactive Oxygen Permeable Hydroxyapatite-based Membranes for Direct Methane Oxidative Conversion."

Methane, the main component of natural gas, can be converted into gases such as ethylene and ethane, which are used to produce commodity chemicals, polymers, and alternative fuels. It has the potential to play a significant role as a raw material for fuel and chemical production, reducing our need for petroleum.

As a resource, Liu says, methane is abundant and much cheaper than petroleum. She explains that the challenge to efficient methane conversion lies with the critical control of oxygen concentration and catalyst activity in the reaction chamber's membrane, which stimulates the process.

Liu's research group is developing a new type of catalytic membrane based on a biomineral called hydroxyapatite (HAP), a major component of teeth and bones. The new material is reactive-separative, meaning it is both a catalyst for the reactions and capable of permeating O_2 in controlled concentrations into the reactor. Liu believes a perfected HAP-based membrane could perform each task at a comparable rate, wasting less methane, preventing the production of greenhouse gases, increasing product yield, and reducing the energy required to obtain the desired results. The technique used to create the membranes allows Liu's team to control their structure at the nanoscale, so they can also be adjusted for different reaction conditions and products.

BAOXIA MI

Civil and Environmental Engineering Assistant Professor **BAOXIA MI** was selected for an NSF CAREER award for her proposal for "Graphene-enabled Synthesis and Surface Modification of Water Separation Membranes."

Mi, who also directs the University of Maryland's Membrane Innovation Lab, is researching the potentials of graphene oxide nanosheets for synthesizing a fundamentally new class of membranes and surface-modifying various existing membranes for high-performance water treatment.

According to Mi, membrane technology is generally considered one of the most effective strategies to tackle water scarcity worldwide; however, high energy requirements and long-term fouling issues have been major obstacles preventing widespread application of this technology.

Mi is optimistic that the graphene-based membrane technology will be very useful not only for drinking water purification and wastewater reuse, but also for renewable energy production, biomedical sensing, and artificial organ development.

Based on her work in graphene-based membrane technology, Mi was recently invited by *Science* to write a Perspective article on the significance and future directions of emerging graphene-based membrane technology. The article, "Graphene oxide membranes for ionic and molecular sieving," appeared in the Feb. 14, 2014 issue of *Science*.

MICHAEL ROTKOWITZ

Electrical and Computer Engineering and Institute for Systems Research Assistant Professor **MICHAEL ROTKOWITZ** is the recipient of a 2014 NSF CAREER Award for "Decentralization and Parsimony for Implementable Control of Massively Interconnected Systems."

The advent of complex interconnected systems has created a need to design and analyze controllers that can observe information from only a small portion of a network but may ultimately affect a large portion of the network. This includes smart building management, multi-vehicle systems and convoys, irrigation networks, large array telescopes, and the power distribution grid. Developing these kinds of controllers is a key challenge in many cyber-physical systems problems.

There is currently an enormous disconnect in decentralized control between celebrated theoretical advances and the concepts that are used for implementation, or even for computation. This is true of both recent advances and more classical results.

Rotkowitz's project pursues the key reasons for this disconnect, along with other impending barriers to the systematic implementation of decentralized control theory, particularly those which will become disabling when applied to massive systems. It undertakes theoretical investigations targeted to advance the field in a manner from which those barriers can be eliminated, along with much farther-reaching benefits, further coupled with computational and algorithmic investigations designed to parlay past and future advances into enabling technologies.

This project further seeks to make broad a impact through collaborations with industry and with experimentalists, and through the creation of software tools for widespread use by non-experts.

STANISLAV I. STOLIAROV

Assistant Professor of Fire Protection Engineering **STANISLAV I. STOLIAROV** was awarded an NSF CAREER Award for his proposal "Understanding Flammability of Charring Polymers." His research will focus on the development of a quantitative understanding of thermally induced charring, a chemical process in combusting organic solids.

Synthetic polymers are ubiquitous, and they can be found in everything from building and automotive materials to consumer goods such as sporting goods and furniture. These polymers are attractive because they are lightweight and are easily processed for a variety of applications, but due to a chemical composition similar to fossil fuels—a high percentage of carbon and hydrogen atoms—they are also inherently flammable. Traditionally, flame retardant additives, in particular, brominated flame retardants (BFRs), have been used to counteract polymers' flammability. BFRs are efficient and inexpensive, but recent concerns have been raised that these additives could have environmental impacts and be potentially toxic.

This concern has caused the flame retardant research community to look more closely to developing environmentally friendly alternatives to BFRs such as char-inducing additives and new charring polymers. Char, which occurs naturally in some polymers and can be induced in others, mitigates polymer flammability by creating a thermal energy barrier on the polymer upon exposure to heat. The barrier slows down polymer degradation and reduces its burn rate.

Stoliarov's research will produce an in-depth understanding of char growth dynamics in a wide range of polymeric systems including a new generation of biodegradable materials. This knowledge could transform the field of flame resistant material design and enable improvements in public safety. The research results will be disseminated to scientists and practicing engineers and utilized to strengthen partnerships with industry and professional organizations.

Maryland to Collaborate with VA, NJ on Unmanned Aircraft Systems Research

In December, the Federal Aviation Administration (FAA) announced the selection of Virginia Tech as one of six unmanned aircraft systems (UAS) test sites to support integration of UAS into the national airspace system. The University System of Maryland, through a Memorandum of Understanding (MOU) signed with Virginia Tech and Rutgers University in September to establish the Mid-Atlantic Aviation Partnership (MAAP), will collaborate and partner with the two other universities on the FAA UAS test site, providing coordinated research and testing. The MOU highlighted the cooperative UAS research conducted by the three institutions, the research and testing proficiencies, and the potential for an efficient integration effort.

"Maryland is home to the world's leading center of UAS activity—the Naval Air Warfare Center Aircraft Division (NAWCAD) at Naval Air Station Patuxent River—and an array of other assets. At both the university level and among federal facilities, Maryland has been performing testing and development of UAS for more than two decades," said Governor Martin O'Malley. "The selection of MAAP as one of the UAS test sites leverages the unparalleled capabilities of three world-class educational institutions to create jobs and generate a significant economic boon to the state, the region and the nation."

The FAA Modernization and Reform Act of 2012 enacted by Congress calls for establishing six unmanned aircraft system research and testing sites in the U.S. Designation as an FAA test site under the federal law requiring integration of UAS by September 2015 carries with it requirements to support research and testing efforts that lead to future regulations governing the use of UAS, especially in the commercial arena, as well as features protecting privacy under such operations.

The mid-Atlantic region contains both uncongested and restricted airspace, as well as proximity to shared air routes and corridors to allow a crawl-walk-run approach to UAS integration. The region also presents all the challenges of land and water domains, as well as the continuum of sea-level to high-altitude operations. There is significant interest in the application of UAS technology in the region, as well, since all three states have a large presence in the agriculture industry, one of the largest projected markets for UAS.

"The combined resources of the Mid-Atlantic states represent a majority share of the UAS research and testing assets in the United States," said Patrick O'Shea, vice president for research at the University of Maryland College Park, the state's

flagship campus. "As a collaborative unit, our significant resources offer tremendous opportunity to satisfy the efforts envisioned by the FAA and the larger UAS community related to this important project."

"From research activities to innovation and economic development, we look forward to significant advances in unmanned vehicle technology in Maryland," said Darryll Pines, University of Maryland Clark School of Engineering Dean and Farvardin Professor.

Maryland's prowess in UAS research, testing and development is reflected in the University System of Maryland and other renowned educational institutions, federal facilities such as the Naval Air Warfare Center Aircraft Division at Naval Air Station Patuxent River and NASA Goddard Flight Center, local airports, and numerous industry partners to support research and testing efforts. The full support of the delegation representing Maryland was mobilized as well to reinforce the critical capabilities that are being brought to bear.

Sens. Barbara Mikulski and Ben Cardin, along with Congressman Steny Hoyer of the Maryland delegation added in a joint statement, "With a number of premier federal assets, outstanding higher education institutions, and strong industry partners, our region leads in the area of autonomous systems. We appreciate all the resources that came together to partner on this effort, which will increase the safety, efficiency, and reliability of our nation's airspace and will support job creation in the region. We will maintain our nation's preeminence in these highly technical areas only by this kind of collaborative approach and look forward to partnering with all stakeholders as this effort moves forward."

In collaboration with MAAP, the University of Maryland team will work closely with the FAA to define research outcomes and processes that will lead to the safe, efficient and robust integration of unmanned systems. That integration will be in stages over several years, with the FAA's rulemaking process guiding the way.

"We have the safest airspace in the world thanks to the FAA and its supporting structures," said Matt Scassero, Director of the UMD UAS Test Site. "This will be an evolutionary process, implementing new technologies with time-tested methodologies to evaluate them, and a proven regulatory environment to enact the rules that will necessarily govern this new industry. We look forward to being a part of this exciting endeavor."

MARYLAND ROBOTICS CENTER RESEARCHERS S.K. GUPTA AND HUGH BRUCK, PICTURED ABOVE ON THE LEFT, HAVE DEVELOPED A ROBOTIC BIRD CALLED ROBO RAVEN, WHICH COULD BE USED FOR A VARIETY OF APPLICATIONS.

THE NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION (NAWCAD) IN SOUTHERN MARYLAND IS PIONEERING EFFORTS TO JOIN THE FORCES OF BOTH UNMANNED AND MANNED AIRCRAFT TO WORK TOGETHER TOWARD COMMON OPERATIONAL GOALS. UCLAS, THE FOLLOW-ON FLEET PLATFORM TO THE X-47B DEMO, PICTURED ABOVE, WILL BE A PRIMARY MARK OF THAT MISSION-SHARING EFFORT.

RESEARCHERS ARE EXPERIMENTING WITH THE USE OF UNMANNED AIRCRAFT SUCH AS THIS YAMAHA RMAX TYPE IIG FOR AGRICULTURAL USE. THESE PLATFORMS ARE EQUALLY WELL-SUITED FOR OTHER NATURAL RESOURCE MANAGEMENT USES.

PHOTO BY JOE PROUDMAN/UC DAVIS; YAMAHA

University of Maryland & Tavis Smiley Announce Social Innovation Challenge Winners

Broadcaster Tavis Smiley and the University of Maryland announced the winners of the $75,000 TS/UM Social Innovation Challenge. The inaugural winners are:

- Alexander Moore and Mike Curtin, DC Central Kitchen (Washington, DC)
- Christopher Brown and Kamilla Kovacs, BUILD Metro DC (Washington, DC)
- Derrius Quarles, Million Dollar Scholar (Chicago, IL)

Each of the three winners will be awarded a $25,000 prize. Additionally, each winning entrant will have an opportunity to be a guest on the Tavis Smiley Network, receive an entrepreneur mentorship at the Clark School's Maryland Technology Enterprise Institute (Mtech), and showcase their innovation at Platform Summit 2014, an event aimed at exploring the role of diversity in the innovation economy.

"The winners' ideas creatively address critical challenges facing the United States and the global community," said Smiley. "Our Social Innovation Challenge is an investment in the minds of the future, and we look forward to seeing the positive change these innovations bring about."

"All of the Social Innovation Challenge entrants offered inspiring ideas for social change through innovation and entrepreneurship," said the University of Maryland's A. James Clark School of Engineering Dean and Farvardin Professor, Darryll Pines. "The winners embody the spirit of innovation we were seeking, and we believe they will make a great impact through their outreach and community efforts."

Announced last summer, the TS/UM Social Innovation Challenge invited aspiring entrepreneurs to develop transformative solutions to affect positive change for individuals and communities across the nation. Entrants were asked to submit innovative ideas targeting the key impact areas of education, hunger, and sustainability. A total of 56 entries were submitted, representing 23 states across the nation, as well as the District of Columbia. The field was narrowed to seven finalists based on the executive summaries and videos the entrants created to describe their social innovations. The seven finalists were interviewed by the TS/UM Social Innovation Challenge panel of judges, who selected the three winners based upon the following criteria: originality and innovation, business model approach, experience of team, potential scalability of business, potential for return on investment, and social impact.

The TS/UM Social Innovation Challenge supports the Tavis Smiley Foundation's initiative to dramatically reduce poverty in America and the University of Maryland's commitment to increase the number and quality of new businesses inspired by competition to create a large and strong new generation of entrepreneurs who benefit society. ■

SOCIAL INNOVATION CHALLENGE WINNERS

DC CENTRAL KITCHEN (WASHINGTON, DC)

DC Central Kitchen provides 5,000 meals to DC's shelters and nonprofits each day and offers culinary training to jobless, at-risk adults. Its latest endeavor is called Healthy Corners, a response to the crises of "food deserts" and inequitable access to healthy food of its kind in America. Through job training, healthy food distribution, and local farm partnerships, DC Central Kitchen offers path-breaking solutions to poverty, hunger, and poor health.

BUILD METRO DC (WASHINGTON, DC)

BUILD is a targeted four-year entrepreneurship and college readiness program for students that are socio-economically most disadvantaged and academically most disengaged. BUILD's mission is to use entrepreneurship to excite and propel disengaged, low-income students through high school to college success. To date, 99 percent of BUILD seniors have graduated high school and been accepted to college, changing their life trajectories.

MILLION DOLLAR SCHOLAR (CHICAGO, IL)

Million Dollar Scholar is an education technology and services solution that creates scholarships for deserving students by offering an instructive web platform that educates high school and college students on how to be successful in the scholarship and grant processes for higher education. Million Dollar Scholar seeks to address both the issues of higher education affordability and the shortage of high school counselors by creating a standardized scholarship and financial aid curriculum that can be made available to students across the nation.

NSF-Funded Project Provides Insight into Animal Behavior

The University of Maryland, in collaboration with the National Geographic Society and Princeton University, has completed its first trial of a new data-gathering system aimed at protecting endangered species. The project, "Remote Imaging of Community Ecology via Animal-borne Wireless Networks," is funded by a $1.8M grant from the National Science Foundation.

Led by Clark School Associate Professor Nuno Martins, the goals of the project are to learn how to design and optimize algorithms for devices that monitor animal behavior, and to better understand and model the mechanisms of social interaction.

With the help of animal experts from the Smithsonian Conservation Biology Institute, 10 white-tail deer in the Shenandoah Valley region of Virginia were outfitted with a collar of wireless devices to capture video, sound, geo-location data, and other information.

PHOTO COURTESY SMITHSONIAN INSTITUTION.

A white-tailed deer in the Shenandoah Valley region of Virginia wears a high-tech collar that allows researchers to monitor its behavior.

The data retrieved from the devices was analyzed to classify normal behavior. This information will help researchers better calibrate the devices for the next phase of testing, when the video and audio recording will only be triggered by unusual events. The ultimate goal is to build collar devices to be worn by a variety of small and large prey and predator animals, such as bears, coyotes, bobcats, and caribou, to record moments of predation, giving scientists a better understanding of wild species behavior. ■

UMD, Children's Consortium Awards $250K for Pediatric Medical Devices

The National Capital Consortium for Pediatric Device Innovation (NCC-PDI), led by the Sheikh Zayed Institute for Pediatric Surgical Innovation at Children's National Health System and the University of Maryland's A. James Clark School of Engineering, announced plans to award $250,000 to individuals and companies seeking to commercialize medical devices for use in children.

The FDA Pediatric Device Consortia grant program is designed to help innovators and entrepreneurs obtain funding to initiate product concepts for commercialization and research. The program will award up to five projects $50,000 each to bring their technology to life.

Last fall, the Clark School and the Sheikh Zayed Institute for Pediatric Surgical Innovation at Children's National Health System received a grant from the U.S. Food and Drug Administration (FDA) to form the NCC-PDI. The $700,000 grant, awarded by the FDA's Office of Orphan Products Development, was the first component of an anticipated five-year award. The consortium will work with the FDA to help innovators effectively navigate existing laws, regulations and agency guidance that protect the health and safety of children.

For more information, visit: www.innovate4kids.org ■

CLARK SCHOOL'S ONLINE GRADUATE PROGRAMS HIGHLY RANKED IN 2014 BY *U.S. NEWS AND WORLD REPORT*

In the *U.S. News and World Report* 2014 Best Online Programs rankings, the University of Maryland's A. James Clark School of Engineering is ranked #14.

As part of its Master of Engineering and Graduate Certificate in Engineering programs designed for working engineers, the Clark School offers seven completely online academic options:

- Bioengineering
- Energetic Concepts
- Fire Protection Engineering
- Nuclear Engineering
- Project Management (also PMI accredited)
- Reliability Engineering
- Sustainable Energy Engineering

Many other academic options are offered via synchronous video-teleconferencing at regional education sites throughout Maryland.

The Clark School's advanced distance learning technologies and Seigel Learning Center have been recognized and featured in national publications, including *Nature*.

For more information about the Clark School distance programs, visit www.advancedengineering.umd.edu. To see the U.S. News and World Report *complete rankings, visit http://www.usnews.com/education/online-education.* ■

UMD TO OFFER NEW MOOCS MULTI-COURSE SPECIALIZATION IN CYBERSECURITY

The University of Maryland is taking a pioneering role in expanding students' learning experiences with Massive Open Online Courses (MOOCs) beyond just one course. In Fall 2014, the university will launch a new multi-course specialization in cybersecurity. Taking advantage of UMD's expertise through the Maryland Cybersecurity Center, the specialization will present students with current topics in cybersecurity, including courses on:

- Cryptographic algorithms and protocols;
- Tools and techniques for developing secure software;
- Human-centered approaches for designing usable secure systems; and
- Elements of hardware security.

This new series will take a unique, interdisciplinary approach to teaching cybersecurity, with professors from across the university, including Gang Qu in electrical and computer engineering, Jonathan Katz and Mike Hicks in computer science, and Jen Golbeck in the iSchool.

Capstone courses, in which students will have the opportunity to apply their knowledge in several of these areas, will finish off both specializations.

"Our multidisciplinary course sequence, drawing on faculty from three different departments on campus, will provide students with a unique opportunity to obtain a comprehensive introduction to this exciting—and growing—field," said Katz, director of the Maryland Cybersecurity Center.

The University of Maryland also offers individual MOOC courses on a variety of topics, from understanding terrorism and developing innovative ideas, to tolerance in religious societies and making better group decisions.

View UMD's full MOOC offerings at www.coursera.org/umd. ■

Oran Receives APS 2013 Fluid Dynamics Prize

Aerospace Engineering Professor Elaine Oran was awarded the American Physical Society (APS) 2013 Fluid Dynamics Prize at the Annual American Physical Society Division of Fluid Dynamics 66th Annual Meeting held Nov. 24-26, 2013, in Pittsburgh, Pa.

The APS Fluid Dynamics prize recognizes major contributions to fundamental fluid dynamics made during a career of outstanding work. Oran was selected for her "seminal contributions to the understanding of reactive flows through computational simulations, especially the deflagration-to-detonation transition in gases and supernovae."

Oran joined the University of Maryland this past summer as a Glenn L. Martin Institute Professor of Engineering. Her research includes work in chemically reactive flows, turbulence, numerical analysis, high-performance computing and parallel architectures, shocks and shock interactions, rarefied gases, and microfluidics, with applications to combustion, propulsion, astrophysical explosions and micro-sensor design.

Oran is both an American Institute of Aeronautics and Astronautics (AIAA) Fellow and an AIAA Honorary Fellow, and a member of the National Academy of Engineering. She is one of four APS award winners from UMD this year. ■

CLARK SCHOOL'S ABTS FEATURED IN DISCOVER MAGAZINE

Research Associate Professor Leigh Abts' (Bioengineering/College of Education) effort to expand the next generation of engineers was featured in *Discover* magazine this past fall.

The article, titled "E is for Engineering: Empowering students to design a more sustainable future," focuses on the need to improve K-12 engineering curriculum as well as create a test to measure outcomes of engineering education.

For the past eight years, Abts, an expert in STEM education, has worked to develop an engineering Advanced Placement (AP) assessment for high school students. Rather than a multiple-choice exam, students will be presented with a problem, develop a prototype, and come up with a solution. He envisions the test as an online portfolio where students submit videos and sketches to show their thought process and problem solving skills.

"It is not enough to measure a student's grasp of the subject matter," Abts said. "Evaluating how that student approaches a problem or task to find workable solutions is more important."

The engineering AP test is currently under review by the College Board. ■

SCHWARTZ APPOINTED CHAIR OF DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Professor Charles W. Schwartz was appointed chair of the Clark School's Department of Civil and Environmental Engineering. Schwartz began his new position on Jan. 6, 2014, succeeding Dr. Ali Haghani who served as department chair since 2003.

"I am delighted to have Dr. Schwartz in this new role," said Clark School Dean and Farvardin Professor Darryll Pines. "Under Dr. Haghani's leadership, the department's research and education activities have grown each year. I look forward to Dr. Schwartz leading the department to even greater national and international prominence."

Schwartz received his B.S., M.S. and Ph.D. degrees in Civil Engineering from Massachusetts Institute of Technology. An international leader in the field of pavement engineering, he has published extensively in the areas of pavement analysis and design, viscoelastic constitutive modeling and pavement material characterization and testing.

Schwartz regularly assists the Maryland State Highway Administration and other local agencies and private firms on pavement-related topics. In the past, he has also been active in the development and implementation of pavement management systems for airfield and highway pavements, including systems at John F. Kennedy, Newark, and LaGuardia International airports, the State of Delaware, and others.

In addition, Schwartz has led major research projects sponsored by the National Academies, the Federal Highway Administration and other infrastructure agencies. Schwartz currently chairs national pavement-related committees for the Transportation Research Board of the National Academies and for the American Society of Civil Engineers. At the University of Maryland, he teaches undergraduate and graduate courses that span the areas of numerical analysis, pavement design and analysis, advanced soil mechanics, computational geomechanics (including pavement mechanics) and civil infrastructure systems.

He is an Associate Editor for the *International Journal of Pavement Engineering* and serves on the editorial boards for the *International Journal of Geomechanics, Transportation Geotechnics* and the *International Journal of Roads and Airports.* He is a co-developer and co-instructor of the recently updated NHI course Geotechnical Aspects of Pavement Design (NHI Course 132040). ■

FELLOWS, SOCIETY MEMBERS AND HONORS

University of Maryland Energy Research Center (UMERC) director Professor **ERIC WACHSMAN** (MSE) has earned the International Association for Hydrogen Energy's (IAHE) Sir William Grove Award for his efforts to develop, improve and commercialize solid oxide fuel cell (SOFC) technology.

Department of Aerospace Engineering Chair and Minta Martin Professor of Aerospace Engineering **NORMAN WERELEY** has been elected a fellow in the International Society for Optical Engineering (SPIE).

Assistant Professor **LIANGBING HU** (MSE/NanoCenter/UMERC) has been named a "Campus Star" by the American Society for Engineering Education (ASEE).The distinction is granted to society members who have demonstrated excellence in engineering education and research.

Materials Science and Engineering Professor and Chair **ROBERT M. BRIBER** has been elected to fellowship in the Neutron Scattering Society of America (NSSA) for "elucidating the structure and dynamics of polymeric and biopolymeric materials and dedicated service to the neutron scattering community."

Department of Mechanical Engineering Professor **PETER SANDBORN** was elevated to Institute of Electrical and Electronics Engineers (IEEE) Fellow, one of the highest distinctions awarded to IEEE members who have achieved innovation and excellence in the field of engineering.

Minta Martin Professor of Engineering and Electrical and Computer Engineering Department Chair **RAMA CHELLAPPA** (ECE/CS/UMIACS/CFAR) was named a 2013 Fellow of the Association for Computing Machinery (ACM). He was recognized for contributions to image processing, computer vision, and pattern recognition.

Research Professor **RAMI KISHEK** (IREAP/ECE) has been named a 2013 American Physical Society (APS) Fellow for "for ground breaking theory of multipactor discharge, and for contributions to the understanding of physics of space-charge-dominated beams." ■

UMD Researcher Helps Arm the Immune System to Fight Cancer

In 2004, a form of cancer known as neuroblastoma claimed the life of Alexandra (Alex) Scott, a little girl who gained national attention for using her lemonade stand to raise money for cancer research. Now, the organization established in her memory, the Alex's Lemonade Stand Foundation (ALSF), has awarded Bioengineering Assistant Professor Christopher M. Jewell a three-year, $375,000 research grant to support the pre-clinical development of a cancer vaccine technology that could give children like Alex a better chance to have a long and healthy life.

Neuroblastoma, the third most common pediatric cancer, causes nerve cells to turn into tumors. The vaccine contains two elements: the antigen that stimulates the T cells to attack neuroblastoma cells, and immune signals, small molecules that mimic the chemical signals immune cells use to communicate. Jewell hopes this approach will result in an army of central memory T cells prepared to destroy neuroblastoma tumors and capable of reactivating if the cancer retutrns.

"Establishing these large populations of immunological memory cells could also help keep patients in remission by rapidly destroying tumor cells that might arise during relapse events," Jewell explains.

Jewell is an expert in immunomodulation, an emerging field that explores directing the body's immune system response to target a specific disease. He believes crafting a biomaterials-based vaccine that not only provides T cells with the weapons to fight neuroblastoma, but also instructions on how, will give oncologists a new, more specific treatment option that relies more on the patient's own defenses than radiation and chemotherapy.

"Cancer vaccines represent a new class of therapies, and biomaterials have great potential to treat cancers like neuroblastoma," says Jewell. "The ALSF's support and the clinical training we will receive through our collaboration with Children's National Medical Center have created an amazing opportunity. This investment will have a lasting impact on my lab's ability to contribute to the pediatric cancer field." ■

CHOPRA RECEIVES INAUGURAL WANG SHICUN AWARD

Aerospace Engineering Professor Inderjit Chopra was awarded the inaugural Wang Shicun Award at the 2nd Asian/Australian Rotorcraft Forum (ARF) and the 4th International Basic Research Conference on Rotorcraft Technology held Sept. 12, 2013. Chopra was awarded for his "outstanding work in education, research and development of rotorcraft technology."

Chopra has served as the Director of the Alfred Gessow Rotorcraft Center since 1991. He is a distinguished fellow in the American Institute of Aeronautics and Astronautics, American Helicopter Society, Aeronautical Society of India and the American Society for Mechanical Engineers. His research focuses on various fundamental problems related to the aeromechanics of helicopters, and he has served as faculty advisor to UMD's Team Gamera.

The ARF award was named for the late Professor Wang Shicun, a distinguished helicopter pioneer in China and responsible for starting a rotorcraft program at Nanjing University of Aeronautics and Astronautics. Shicun was a friend of the late Alfred Gessow, University of Maryland professor and pioneer in the helicopter field. ■

Rattan Khosa Gives Back to Structural Engineering Program

When Rattan Khosa left his home in the Kashmir Valley of India, the country was in a currency crisis, and foreign currency exchange was limited. With only $8 in his pockets and his mind set on fulfilling the American Dream, Khosa set off on his journey to the United States. More than 7,000 miles, one coffee and a sweet roll later, he began his coursework and research at the University of Maryland with just $3.25 remaining. With the help of his supportive parents and encouragement by faculty members, especially his advisor, Dr. Conrad Hines, and fellow students, Khosa graduated with a Master's of Science in Structural Engineering in 1971.

Four decades later, Khosa has decided to give back to the Clark School through an endowed fund. The Rattan L. Khosa '71 Graduate Scholarship in Structural Engineering was established this January to provide awards for graduate students entering or enrolled in the Master of Science program in Civil and Environmental Engineering with a focus on Structures.

"Coming to the U.S. with only a few American dollars to my name was very humbling, but knowing my education would be covered by a generous scholarship made the experience less daunting," said Khosa.

Khosa went on to the University of Chicago, Booth School of Business to earn a Master's in Business Administration in 1979. Armed with valuable knowledge from two undergraduate degrees, two master's degrees, and experience in sales and management in the construction supply industry, he launched his own startup company, AMSYSCO, with his wife, Bharati, in the basement of their home in 1981. The couple's son Neel, who was only four years old when the company was started, serves as a vice president at AMSYSCO.

Now based in Romeoville, Ill., AMSYSCO is a leading supplier of the post tensioning systems and related services on commercial structures such as multi level apartment & condominium high rise buildings, parking garages, office buildings, stadiums. Khosa has woven philanthropy into the culture of AMSYSCO, and a portion of company profits is donated to charitable causes through the KHOSA JG Foundation, a nonprofit organization established in memory of his late parents. The foundation supports scholarships to students at each of Khosa's alma maters in the United Sates, as well as to Kashmiri Pandit students studying in India and around the world.

"The opportunity to make an impact on a student's educational career is a privilege," said Khosa. "It is my hope that this new scholarship will help open doors for structural engineering students in the Clark School." ■

UL Contributes $250K to Fire Protection Engineering Legacy Campaign

UL (Underwriters Laboratories) will make a $250,000 investment in the University of Maryland's Department of Fire Protection Engineering. The gift is the largest single donation in the department's history.

"It is an honor to receive this valued support from such an important industry partner, and we are very pleased to continue this historic relationship with UL," said the current Chair of Fire Protection Engineering at Maryland, Dr. James Milke.

UMD's Department of Fire Protection Engineering, established in 1956 and part of the A. James Clark School of Engineering, offers the only accredited undergraduate program of its kind in the nation and one of only three graduate programs across the U.S.

UL is a global independent safety science company with more than a century of expertise innovating safety solutions, from the public adoption of electricity to new breakthroughs in sustainability, renewable energy and nanotechnology. UL evaluates more than 19,000 types of products, components, materials and systems annually with 20 billion UL Marks appearing on 72,000 manufacturers' products each year.

"The University of Maryland is a pioneer in Fire Protection Engineering," said UL Senior Vice President and Public Safety Officer Gus Schaefer. "As the world continues to evolve, new science through innovative research will help address new risks."

UL will provide input on the department's undergraduate curriculum to help ensure that skills and competencies needed by industry are addressed. Also, UL representatives will participate as guest lecturers in classes and serve on the department's Board of Visitors.

The UMD Fire Protection Engineering Legacy Campaign for the Professor of Practice was initiated by a group of alumni and university leadership. A new, endowed professor of the practice faculty position will ensure that the University of Maryland remains at the forefront of Fire Protection Engineering. ■

CORPORATE PARTNERS DAY

The Clark School hosted the Corporate Partner Summit on Jan. 31, 2014. Industry representatives, students, and faculty gathered to recognize their shared achievements.

PHOTOS BY AL SANTOS

Maryland Students Win First Major League Hacking Championship

The University of Maryland's Terrapin Hackers team was named champion of the U.S. Major League Hacking (MLH) Fall 2013 season. A newcomer to hackathons, the student team topped 110 schools in the United States and around the globe this season, also securing the University of Maryland a spot on MLH's list of "best schools for hackers." The UMD team was also featured on NPR's All Things Considered on March 19.

The MLH champion title was earned based on merit and attendance at five MLH hackathons—24- to 96- hour events in which students collaborate to innovate software, hardware, apps, or working prototypes of a product from scratch. MLH hackathons are organized and run by students with financial backing by tech companies who more and more are using such competitions as prime recruiting grounds.

More than 200 Terrapin Hacker team members competed in at least one of the five events hosted by Rutgers, MIT, Michigan, NYU, and the University of Pennsylvania. Clark School students in the Electrical and Computer Engineering Department won the MHacks event at the University of Michigan this past fall for their intelligent trashcan that can sort trash from recyclable items.

"We placed first at two of the five hackathons," said Terrapin Hackers leader Shariq Hashme, a UMD junior majoring in computer science and electrical & computer engineering. "That's really, really good. It can't be a fluke. We are on to something."

Although most Terrapin Hackers are computer science and/or electrical and computer engineering students, students from a number of other disciplines, including physics and biology also participated. The Terrapin Hackers team is led by Hashme, together with senior computer science majors Ivan Melyakov and Diego Quispe and sophomore computer science major Kunal Sharma. Together, the four students organized transportation and helped with hackathon registration for their UMD group members. The Terrapin Hackers took buses, cars and even planes in order to participate in the five MLH hackathons.

Members of the Terrapin Hackers team were honored by Major League Hacking and presented with a championship trophy for winning the Fall 2013 Hackathon Season.

To help achieve its mission of adding excitement to the field of science, engineering, and technology, the Terrapin Hackers will host Bitcamp, the University of Maryland's first Major League Hackathon.

Planned entirely by a team of undergraduate students, the event will draw more than 750 undergraduate students from across the nation. Bitcamp is different from other university hackathons—instead of emphasizing competition or prizes, Bitcamp values participant experience, collaboration, and storytelling. Bitcamp will take place April 4-6, 2014, in Cole Field House on the university's College Park, Md., campus.

"We are creating a new hackathon experience," said Bitcamp organizer Jeff Hilnbrand, a junior mechanical engineering student at UMD. "Our YOU+TECH theme abandons the traditional judging system in favor of encouraging students to create projects inspired by their own passions and interests, instead of inspired solely by competition."

The Bitcamp planning team has raised funds to cover the costs of all students in attendance. The event is open to students of all disciplines. Listen to the NPR story at: http://ter.ps/BitcampNPR.

Learn more: https://bitca.mp ■

Up in the Air: Does Fracking Create More Pollution Now than Using Natural Gas Will Prevent Later?

Does the process of hydraulic fracturing, also known as fracking, create more air pollution than using the natural gas it collects will prevent? That's the question Department of Chemical and Biomolecular Engineering (ChBE) graduate student Tim Vinciguerra and his research partner, Department of Atmospheric and Oceanic Science (AOSC) graduate student Linda Hembeck, hope to answer.

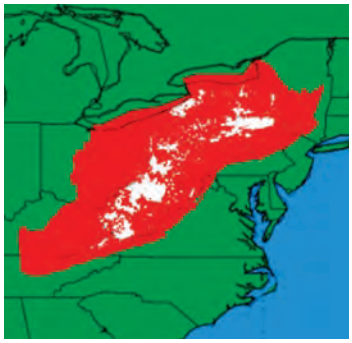
The University of Maryland Council on the Environment (ConE) recently awarded the pair a Green Fellowship for Collaborative Research on the Environment to support their study, "Interfacing Air Quality and Chemical Engineering: Evaluating the Impacts on Health and Energy Due to Increased Fracking Activities." Each $10,000 Green fellowship is shared by two principle investigators, who must be graduate students from different disciplines.

Hembeck and Vinciguerra will project the level of emissions from fracking and other sources in the year 2020. The study's results will predict the positive or negative effects on the economy, humans, livestock, and agriculture, and identify whether there is a "tipping point" at which natural gas extraction through fracking becomes a liability.

Vinciguerra, advised by ChBE professor and chair Sheryl Ehrman, says the special project is related to his dissertation work. "My research is air quality focused," he explains. "I look at trends of pollutants and determine their sources...I also do emissions modeling."

In the ConE Green study, Vinciguerra will use that expertise to collect information on the current emissions levels in the target regions. He will adjust the data, known as an emissions inventory, based on location and source to project conditions in the year 2020. The information will then be transferred to a modeling system called SMOKE that applies it to a grid.

Hembeck will import Vinciguerra's SMOKE data into another modeling system called CMAQ, which uses the same grid scale. CMAQ tracks how the emissions react over time based on meteorology and chemical kinetics data. She will run its results through a final simulation called BenMAP to determine the projected health and economic consequences of the emissions—positive or negative—in the target regions.



A CMAQ model showing the location of shale (red) and wells (white)

"BenMAP looks at changes in ozone and particulate matter to determine health benefits, and then it assigns a dollar value based on mortality and morbidity rates," Vinciguerra explains. "We will compare our projected fracking and natural gas conversion scenario to an as-is scenario to determine these differences."

The study will eventually expand to include all areas on the Appalachian basin that are candidates for future fracking sites. It may also one day recruit collaborators from additional disciplines who can provide perspectives on other potential fracking-related issues, such as groundwater contamination and geological instability. ■

CLARK SCHOOL SENIOR NAMED MARSHALL SCHOLAR

UMD Senior **ERIN HYLTON**, a civil engineering major, has been named a 2014 Marshall Scholar. The scholarship funds two years of graduate study in the United Kingdom.

Hylton has focused her pursuits on water resource engineering and aims to devote her career to improving water resource access and quality in the developing world. She will pursue master's degrees in both hydrology and sustainable development at Imperial College London and water science, policy and management at the University of Oxford.

According to Hylton, "Water is our most basic and precious natural resource, and its allocation must be balanced across a variety of conflicting uses, from irrigation and energy to sanitation and consumption. [I want] to design and execute context-sensitive water management practices that will help propel us toward a sustainable hydrologic future."

Hylton is UMD's second Marshall Scholar. ■

CIVIL AND ENVIRONMENTAL ENGINEERING STUDENTS WIN 2014 ALUMNI CUP

On a rainy Friday afternoon, an enthusiastic crowd of students, faculty, staff, and alumni lined the spiral staircase in the Kim Engineering Building to watch the 2014 Clark School Alumni Cup. For the second consecutive year, the students from the Department of Civil and Environmental Engineering took home 1st place.

Aerospace Engineering and Materials Science and Engineering took 2nd and 3rd place, respectively.

The Alumni Cup is an annual engineering design competition that was started in 2012 by the University of Maryland Alumni Association, Engineering Chapter. The event takes place each year during National Engineers Week, a weeklong celebration held to increase awareness of the field for the general public, students, educators, and parents.

A week before the Alumni Cup, teams of undergraduate students from each of the Clark School's eight academic departments were tasked with designing a machine that could move a CD/DVD at least 2 feet, insert it into a CD/DVD drive, and play the contents of the CD/DVD. With a small stipend, the teams were able to design, build, and test their machines before the competition.

From open flame to lasers, the teams incorporated elements from their respective engineering disciplines into their machine design.

After three exciting rounds, the panel of judges announced the Civil and Environmental Engineering team as the winners with the best overall design, presentation, and team spirit. ■

Jeong Kim Receives Legion of Honor from France, Launches New Business

Clark School alumnus Jeong Kim received the French Legion of Honor, France's highest award, for his contributions to global technology research during his time as president of Bell Labs, a research organization owned by French global telecommunications equipment company Alcatel-Lucent. French Ambassador François Delattre delivered the honor in a ceremony at the French Embassy in Washington, D.C. on Jan. 6.

A successful entrepreneur, Kim founded Yurie Systems, where he pioneered the development of a revolutionary asynchronous transfer mode (ATM) for wireless applications. The ATM switch became a pivotal key in the modernization of telecommunications systems for today's digital market. In 1998, Yurie Systems was acquired by Lucent Technologies for over $1 billion.

Kim's latest entrepreneurial endeavor is Kiswe Mobile, a startup company focused on the intersection of sports and web technology, particularly interactive video. Kim and his co-founders, Wim Sweldens and Jimmy Lynn, hope to raise $1 million to launch the company.

Kim received the first Ph.D. in reliability engineering from the University of Maryland in 1991, and is a Clark School professor of practice. In 2004, he was elected to the National Academy of Engineering. During the same year, Kim was inducted into the Clark School's Innovation Hall of Fame. Kim was the primary individual donor for the Clark School's state-of-the-art research and education center, the Jeong H. Kim Engineering Building. ■

ALUMNUS BRISKMAN ELECTED TO NATIONAL ACADEMY OF ENGINEERING

Clark School alumnus and co-founder of Sirius XM Radio Robert D. Briskman (M.S.E.E. '61) was elected to the National Academy of Engineering (NAE) in February in recognition of his achievements in satellite communications.

Election to the NAE is among the highest professional distinctions accorded to an engineer. NAE membership honors those who have made outstanding contributions to engineering research, practice, or education, as well as those who have pioneered new and developing fields of technology.

Briskman's career has focused on communication satellite systems since their inception. Before his time with Sirius, he was responsible for the development, design and implementation of the Radio Determination Satellite Service provided by the Geostar Corporation. Briskman also worked for the Communications Satellite Corporate (COMSAT) and NASA during the founding of each organization. Briskman received the APOLLO Achievement Award from NASA for the design and implementation of the Unified S-Band System. Before NASA, he was employed by IBM and worked on the design of the first asynchronous buffer system. Prior to his tenure at IBM, Briskman was employed by the Army Security Agency, where he was engaged in communications systems development and analysis. He also served two years of military service as an Electronic Countermeasures Analyst Officer, for which he was awarded the Army Commendation Medal.

Briskman is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and was awarded the IEEE Centennial Medal and the 2008 IEEE AESS Pioneer Award for communications satellite development. Briskman has also been President of the Aerospace and Electronics Systems Society, Director of the National Telecommunications Conference, Chairman of the EASCON Board of Directors, and Chairman of the IEEE Standards Board. He is a Fellow of the AIAA, which gave him its 2007 Aerospace Communications Award of the Washington Academy of Science, past President of the Washington Society of Engineers, and a member of IAA, AFCEA and the Old Crows. Briskman has authored over 50 technical papers, holds many U.S. and foreign patents, served on the Industry Advisory Council to NASA, and is a licensed professional engineer.

Briskman has been inducted into the SSPI Hall of Fame and into the Space Technology Hall of Fame by the Space Foundation. He holds a B.S.E. degree from Princeton University and a M.S.E.E. degree from the University of Maryland, which gave him in 2007 its Technology Business Leadership Award and in 2010 inducted him into the Clark School of Engineering Innovation Hall of Fame. ■

Alumnus Krill Inducted Into IHOF for Naval Fleet Network Technology

Dr. Jerry Krill, a 1978 Ph.D. graduate in electrical engineering, was honored by the Clark School for the revolutionary network technology he designed to aid in U.S. Navy fleet defense at the annual Innovation Hall of Fame induction last November. He was recognized for his technical leadership in developing the sensor network system known as the Cooperative Engagement Capability (CEC), a dynamically reconfigurable data-sharing network that provides a composite, common operating picture for Navy battle groups, allowing them to act as a coordinated, unified whole. Senior Navy leaders have described CEC as "one of the Navy's crown jewels" that greatly enhances the Navy's air defenses.

The Innovation Hall of Fame recognizes Clark School alumni, faculty and associates who have pioneered many of the most significant engineering advances in the past century. For more information, and to nominate an innovator, visit www.eng.umd.edu/ihof. ■

CLASS NOTES

ALEX MEHR, Ph.D. '03, Mechanical Engineering, was featured in the March 3, 2014 issue of *Forbes* magazine in an article titled, "Up-And-Comers: Entrepreneurs Who Want To Find You Love." Mehr is Co-founder and President at Zoosk, a company he launched in 2007, described as the "Amazon of dating." Some 25 million people now use the service, which has pulled in $61.6 million in funding.

ABBY VOGEL ROBINSON, B.S. '02, M.S. '04, Ph.D. '07, Biological Resources Engineering, has taken a new position at the University of Maryland as Director of Communications for the College of Computer, Mathematical, and Natural Sciences.

BOB ANDREWS, B.S. '80, Fire Protection Engineering, was recently interviewed on KENS-TV 5 in San Antonio, Tex., for his expertise regarding the safest methods for transporting oil and analysis of recent rail accidents involving oil transportation. His company, the Bob Andrews Group, provides emergency response services and safety consulting to the oil industry.

PETER H. MICHAEL, B.S. '66, Electrical Engineering, published a new award-winning book titled "Remembering John Hanson," a biography of the largely forgotten Marylander who became the first president of the original U.S. government under the Articles of Confederation in 1781-82. He is also the author of several other books, including two on the Underground Railroad in Maryland, and publishes *Underground Railroad Free Press*, North America's most widely circulated Underground Railroad news publication. He lives near Adamstown, Md. ■

Clark School Alumnus Regan Named CEO of Whiting-Turner

Clark School alumnus Timothy J. Regan was named Chief Executive Officer of the Whiting-Turner Contracting Company. He is the third CEO in the company's rich, 105-year history.

Regan's tenure at Whiting-Turner spans more than three decades, and most recently he served as Executive Vice President of the company. The news of his promotion follows the passing of the company's longtime CEO, Willard Hackerman, who lived until the age of 95.

"Literally every one of us has spent our entire Whiting-Turner career under the steady hand and inspirational leadership of Mr. Hackerman," said Regan in statement issued by the company. "He can never be replaced... he is a legend for his good works."

A 1977 graduate in civil engineering, Regan remains close with his alma matter and currently serves on the Clark School's Board of Visitors. Regan also will serve as the Clark School Spring 2014 Commencement speaker.

Whiting-Turner employs over 2,000 people in 18 states and the District of Columbia, and in 2013, the company brought in approximately $5 billion in revenue. The Baltimore-based company developed several landmark buildings in its home city, including Harborplace, the Meyerhoff Symphony Hall, and M&T Bank Stadium, home of the Baltimore Ravens football team.

In addition to supporting the Clark School's longstanding Whiting-Turner Business and Entrepreneurial Lecture Series, Whiting-Turner has also supported the Whiting-Turner Internship-Scholarship program, University Incentive Awards, the Charles Irish Professorship, and the Charles Irish Laboratory at the University of Maryland.

Whiting-Turner is also a Clark School Corporate Partner, a sponsor of UMD's 2011 Solar Decathlon Team, host of the annual Clark School Alumni Receptions at the Engineers Club in Baltimore, and contributes the service of many Whiting-Turner Leaders on University of Maryland boards, including the Clark School Board of Visitors. ■

UMD Ranked Among Top Schools for Tech Entrepreneurship by StartEngine College Index, Princeton Review

The University of Maryland is the top public school in the U.S. and ranked second overall for tech entrepreneurship, according to the recently released *2013 StartEngine College Index*, as reported in the Silicon Valley publication PandoDaily.

The author, Howard Marks, co-chair of StartEngine, Los Angeles' largest startup accelerator, founder and CEO of Acclaim Games (now owned by Disney), and co-founder of Activision and Chairman of Activision Studios, is eager to fund the most talented entrepreneurs and was tired of having only "gut feelings" and "Top Engineering Colleges" lists to work from, so Marks set off to uncover the top underrated entrepreneurial schools in the U.S.—those that many investors pass over.

Marks used CrunchBase API data, which lists thousands of data points for funding received by founders of companies, cleaned it up and distilled a list of all the colleges and universities in the U.S. with at least 15 alumni who have founded a startup that has gone on to receive investment.

The University of Maryland also once again made The Princeton Review's list of the country's top entrepreneurship programs. In the 2014 list of the "Top 50 Schools For Entrepreneurship Programs," published in *Entrepreneur* magazine, UMD ranks No. 15 for its undergraduate program. The university also ranks No. 16 for its graduate program, up eight spots from the 2013 rankings. ■

UMD Entrepreneurship and Innovation Program Wins National Award for Excellence in Entrepreneurship Education

The United States Association for Small Business and Entrepreneurship (USASBE) has selected the University of Maryland Entrepreneurship and Innovation Program (EIP) as the first-place winner for an Excellence in Entrepreneurship Education award in the Outstanding Specialty Entrepreneurship Program category.

A joint initiative of the The Honors College and A. James Clark School of Engineering's Maryland Technology Enterprise Institute (Mtech), EIP is a two-year, living-learning program for freshman and sophomore honors students that fosters an entrepreneurial spirit, creates a sense of community and cooperation, and develops ethical and innovative leaders.

A leading voice in entrepreneurship research, teaching, and application, with over 1,000 members across the world, USASBE established the Excellence in Entrepreneurship Education Awards to recognize excellence in entrepreneurship education at the programmatic level. Each is awarded on a competitive basis, with only one institution winning in each category during a given year.

"EIP is a growing and dynamic program," said Clark School Dean and Farvardin Professor Darryll Pines. "Few initiatives have made it to this national scale in less than four years. It is a testament to the passion and dedication of EIP Director Jay Smith, who not only lives and breathes the concept of innovative thinking, but also genuinely cares for each and every one of his students." ■

SPRING 2014 ENTREPRENEURSHIP SPEAKERS AT UMD

WHITING-TURNER BUSINESS AND ENTREPRENEURIAL LECTURE SERIES

MICHAEL CHASEN, ***FOUNDER AND CEO, SOCIALRADAR*** **APRIL 3**

Michael Chasen is an entrepreneur, innovator and visionary. He is the CEO and Founder of SocialRadar, a company that is building applications for the iPhone, Android and Google Glass that give you real-time information on the people around you. He also co-founded and was previously CEO for 15 years of Blackboard Inc., a global leader in eLearning.

ABDUR CHOWDHURY, ***CO-FOUNDER AND CEO, PUSHD; CO-FOUNDER, ALTA VISTA SCHOOL; FORMER CHIEF SCIENTIST, TWITTER*** **APRIL 24**

Abdur Chowdhury is the co-founder/CEO of Pushd, working on contextual mobile applications, and co-founder of the Alta Vista School, focused on STEM education for K-8. Previously, he was Twitter's Chief Scientist, co-founder of Summize.com, and AOL's Chief Architect for Search.

SPECIAL CLARK SCHOOL DISTINGUISHED LECTURE:
WAYNE CLOUGH, ***SECRETARY, SMITHSONIAN INSTITUTION*** **MAY 6**

Wayne Clough has launched a new era at the Institution, expanding the Smithsonian's global relevance and helping the nation shape its future through research, education and scientific discovery.

HINMAN CEOS SEMINARS

ESSI NAJAFI **FEBRUARY 6**

Essi Najafi serves as the Director of Operations for Global Engineering Solutions (GES), an award winning engineering, program management and construction management firm in Rockville, Md. He is responsible for both the long-range growth and day-to-day management of the firm's engineering, program management, and construction management services.

GREG REBER **FEBRUARY 20**

Greg Reber is a trailblazer in the information security field and among the first to recognize and address the risks presented by consumer-facing applications. Greg launched AsTech Consulting in 1997, providing real world, effective information security solutions to financial services companies, retail service providers and other Fortune 1000 companies.

ERIC OGANESOFF **MARCH 6**

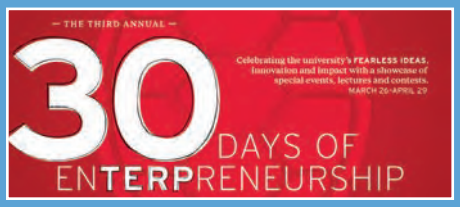
Eric Oganesoff is a FOCUS Managing Director who has conducted over 40 M&A, debt and capital raise transactions with an aggregate value of over $300 million. He has served as the CEO or President of several companies, with over 20 years of senior executive level experience in leading businesses ranging from wireless solutions and software to manufacturing, industrial products, energy and environmental products.

PETER EMMONS **MARCH 27**

Peter Emmons is the founder and CEO of STRUCTURAL, a specialty contracting services company focused on improving, protecting, and repairing infrastructure. Founded in 1976, STRUCTURAL holds the position as the largest specialty concrete repair contractor in the United States and is 34th in *Engineering News-Record* (ENR) magazine's list of the Top 600 Specialty Contractors.

BRIAN HINMAN **APRIL 17**

Brian Hinman is the co-founder of PictureTel, Polycom, 2Wire, and Mimosa Networks, where he currently serves as CEO. His support launched the Hinman CEOs Program at the University of Maryland. Brian holds a B.S.E.E. summa cum laude from the University of Maryland, an S.M.E.E. from MIT, and an honorary Sc.D. from RIT. ■



http://umd.edu/30Days/

IN MEMORIAM

ELAINE GESSOW PASSES AT 88

ELAINE SILVERMAN GESSOW, wife of the late Professor Alfred Gessow, a pioneer in the helicopter field and former chair of the University of Maryland's Department of Aerospace Engineering, passed away peacefully on Jan. 2, 2014, surrounded by family and friends. She was 88. In 1981, Professor Gessow founded the university's Center for Rotorcraft Education and Research and was its director until 1992 when he took emeritus status. The center, renamed in his honor in 1997, is one of the nation's leading institutions of rotorcraft research and education. Mrs. Gessow is survived by her children, Lisa Michelson, Miles Jory Gessow, Andrew Jody Gessow, and Laura Goldman; grandchildren, Dr. Jennifer Michelson, Courtney Michelson, Samuel Gessow, Jeremy Gessow, Danielle Gessow, Julie Gessow, Dr. Jason Goldman, and Dr. Roger Goldman; and three great-grandchildren.

CLARK SCHOOL ALUMNUS AND BOV MEMBER WAGGNER PASSES

University of Maryland A. James Clark School of Engineering Alumnus and Board of Visitors members **CHARLES E. "CHUCK" WAGGNER** passed away on Dec. 17, 2013. He was 81. He received a bachelor of science degree in chemical engineering from the University of Maryland, where he excelled in track and field and was the captain of the University's cross country team. He later obtained a juris doctor degree from Loyola University in Chicago. Waggner enjoyed a distinguished career in the petrochemical industry, first working for Standard Oil then moving to Cosden Oil Company. The majority of his career was spent as a partner and Executive Vice President of Esselen Associates in Darien, Conn., where he worked until his passing. He is survived by his wife of 33 years, Joan: six children: Robert, Sharon, Nancy, Mark, Ellen, and David; step-daughters Christine and Torrey; and 11 grandchildren.

INNOVATION HALL OF FAME INDUCTEE AND ALUMNUS CAMPANELLA PASSES

Clark School alumnus and Innovation Hall of Fame inductee Dr. **S. JOSEPH CAMPANELLA** passed away peacefully on Dec. 19, 2013 in Lakewood Ranch, Fla. He was 86. Campanella was a lifelong resident of the Washington, D.C. area. He earned his BSEE, Magna Cum Laude in 1950 and DEE in 1965 from Catholic University of America, and his MSEE degree in 1957 from the University of Maryland. Campanella served as Vice President and Chief Scientist at COMSAT Laboratories. He was inducted into the Clark School's Innovation Hall of Fame in May 1996 for pioneering work in the development of digital satellite communications technology. He was preceded in death by his wife of 43 years, Philomena, and brother Vincent. He is survived by his son John and daughter-in-law Angela.

WHITING-TURNER PRESIDENT AND CEO HACKERMAN PASSES AT 95

WILLARD HACKERMAN, president and CEO of The Whiting-Turner Contracting Company and a prominent philanthropist, passed away peacefully on Feb. 10, 2014. He was 95. He celebrated his 75th anniversary with Whiting-Turner last year, and has led the company for over five decades. He remained active at work until his death. Under the leadership of Mr. Hackerman, Whiting-Turner has been a longstanding Clark School Corporate Partner. He and his company established the Whiting-Turner Business and Entrepreneurial Lecture Series at the University of Maryland's A. James Clark School of Engineering in 1995, and have offered support to many other Maryland engineering programs and activities. In addition to his wife, Lillian Patz Hackerman, Mr. Hackerman is survived by a son, Steven, and a daughter, Nancy. ■

Mpact WEEK OCT. 16-22, 2014 DISASTER RESILIENCE

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CAN MAKE ALL THE DIFFERENCE.

At the A. James Clark School of Engineering, we are dedicated to recruiting the most talented and diverse undergraduate students and providing them with unique education and research experiences. Most importantly, we believe that these opportunities should be made available to as many well deserving students as possible, regardless of their economic background.

Unfortunately, many Clark School students struggle with tuition costs. For the 2012-2013 academic year:

- More than 600 Clark School undergraduate students received Federal Pell Grants.
- Clark School Pell Grant students had a cumulative unmet need of $3,877,197.
- Almost all Pell Grant recipients have a family income at or below 250% of the poverty line.

Many of these students must delay or abandon their undergraduate education altogether. In an effort to ease the financial pressure on our students, the University of Maryland has created the **TerpStart** Matching Scholarship Program. With a minimum contribution of $30,000 payable over five years, you can establish a scholarship that will help the Clark School's neediest students and give them the chance to follow their passion for engineering.

To ensure that your scholarship has the greatest impact, the University of Maryland will match the spendable income generated each year by the endowment in perpetuity. That means your gift's impact is doubled forever. Your scholarship will support Clark School Students for many years to come.

For more information or to make a gift, contact:
Sammy Popat, Director of Development, Individual Gifts
301-405-0224 or spopat@umd.edu

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