

THE GEORGE WASHINGTON UNIVERSITY SYNERGY

SCHOOL OF
ENGINEERING
& APPLIED SCIENCE



Connecting
the Dots

Opportunities to Build
Links Back to SEAS



The Future is Bright

With an engineering or computer science degree in hand, SEAS graduates look forward to bright career prospects.

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EDITOR
Joanne Welsh

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Eleanor Kaufman Khan

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Connecting the Dots:
Opportunities to Build Links Back to SEAS

by Dean David S. Dolling

SEAS DEPARTMENTS

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PROFILE

Chair: Igor Efimov
202-994-3740

www.bme.seas.gwu.edu

Undergraduate students: 217

Graduate students: 53

Annual research expenditures: \$2.4 million

FACULTY

Igor Efimov, **PROFESSOR AND FELLOW OF HRS, AHA, AND AIMBE**

Emilia Entcheva, **PROFESSOR AND FELLOW OF AIMBE**

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David Lee, **ASSOCIATE PROFESSOR**

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Chung Hyuk Park, **ASSISTANT PROFESSOR**

Jason Zara, **ASSOCIATE PROFESSOR**

Vesna Zderic, **ASSOCIATE PROFESSOR**

RESEARCH AREAS**BIOMEDICAL IMAGING**

Efimov, Entcheva, Kay, Li, Loew, Zara, Zderic

CARDIOVASCULAR ENGINEERING

Efimov, Entcheva, Kay

CELL AND TISSUE ENGINEERING

Entcheva, Lee, Papa

MEDICAL INSTRUMENTATION

Efimov, Entcheva, Li, Zderic, Zara

ROBOTICS AND AUTOMATION

Entcheva, Li, Park

THERAPEUTICS AND DIAGNOSTICS

Papa

Studying Asthma

According to the Children's National Health System, asthma is the leading, serious, chronic illness among children in the U.S., and it is the third-ranking cause of hospitalization for children under the age of 15.

Unfortunately, it also is often difficult to diagnose—and the mechanisms by which people develop asthma, or by which an asthma attack will occur, are not well understood. However, Dr. Zhenyu Li hopes that his research team will be able to shed light on these mechanisms through a project they are conducting under a four-year National Institutes of Health grant.

Dr. Li and his research group use micro- and nano-technologies to build medical devices that can be used for biological research or for disease diagnosis. He has made significant breakthroughs in designing “lab-on-a-chip” technologies to diagnose other diseases, and his current project builds on some of these previous successes.

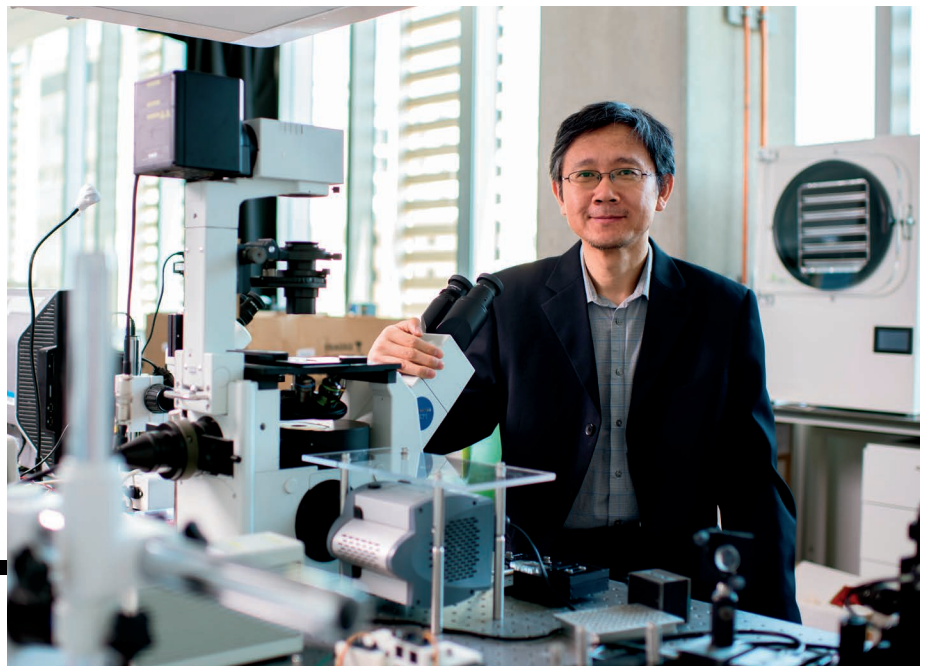
“Asthma is a very complex condition, and there are a number of potential triggers for it, such as air pollution, smoke, exercise, pets, mold, and many others,” notes Dr. Li. “How the genetics of a particular individual and their behavior interact with the potential triggers is poorly understood.”

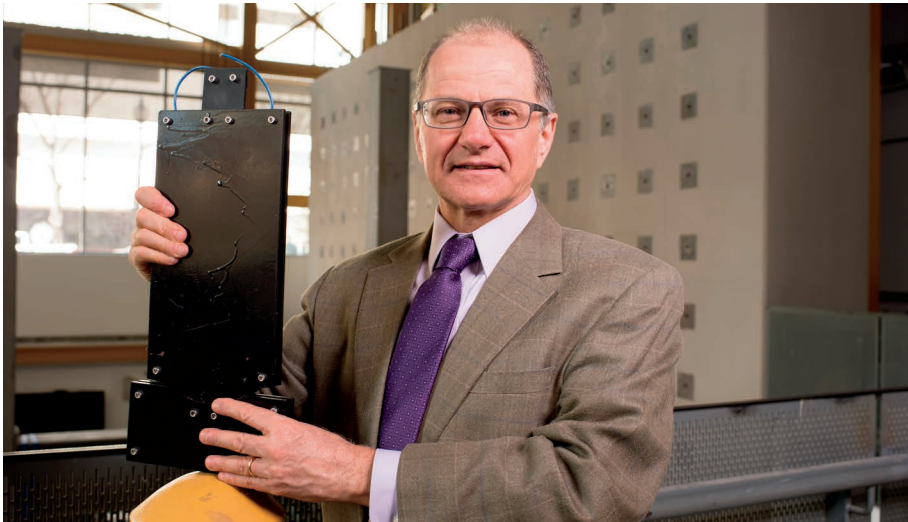
No research tools exist currently to allow researchers to objectively quantify the environmental factors with behaviors and biological response. To remedy this, Dr. Li's team plans to deploy wearable and portable sensors into the daily life of the children who participate in this study to monitor their activity levels and their exposure to environmental triggers.

Because it is not possible to build a sensor that can monitor all the potential triggers of asthma, Dr. Li's team is developing two sensors to monitor air pollution gases in the environment. The wearable sensor monitors formaldehyde—which is found in carpets, paints, tobacco smoke, and gas engine exhaust—and the ambient temperature and humidity. The portable sensor monitors ozone and nitrogen dioxide.

Dr. Li cautions that the sensors are not being developed for commercial use. “This is a research tool. Our goal is to develop a deployable sensor set for pediatric asthma researchers to use in their clinical studies,” he explains.

The team already has developed the prototypes for both the wearable and portable sensors, and they have tested the sensors' performance in the labs. The sensors have performed well, detecting the relevant concentration ranges for the target gases that are normally present in a city environment. Now the team is working with participants in the study to test the sensors' usability and their performance outside the lab. Dr. Li collaborates on this project with Dr. Mona Zaghoul of the Department of Electrical and Computer Engineering, and Dr. Dinesh Pillai of the Department of Pediatrics and Integrative Systems Biology and Children's National Medical Center.





The Arc of an Idea

After buildings and infrastructure are damaged by an earthquake, they have to remain closed until building officials can assess the integrity of the structure. In the case of massive earthquakes that cause widespread damage, this process can take months, temporarily leaving millions of people without lodging or access to other buildings.

Dr. Pedro Silva has developed a hypothesis about a novel shear wall design that he believes will mitigate damage from earthquakes, thereby decreasing the number of buildings that have to be closed following an earthquake. He will soon begin testing his design in the Science and Engineering Hall's high bay.

When a typical shear wall is constructed it is cast as a unit with the wall's footing. This construction has its advantages, but it limits the wall's ability to dissipate energy from the earthquake, so the damage to the wall often creates permanent deformations in the building, causing the building to be closed after an earthquake. To address this problem, engineers more recently have proposed decoupling the wall from its footing, creating what is called an unbounded post-tensioned shear wall, or UPSW. Unfortunately, the standard UPSW design creates a design disadvantage of its own.

"The limitations of UPSW design are that a structure that experiences less damage experiences higher levels of wall displacement, which can affect non-structural components like windows and doors," explains Dr. Silva. "So, you can still come to work because it will be safe, but you might not have windows, for example."

To limit this non-structural damage, some engineers have proposed incorporating energy dissipation devices into the UPSW design; however, the devices are for one-time use, so the building will not remain resilient if it sustains after-shocks or subsequent earthquakes. But what if the UPSW design—which limits structural damage to the building—could be altered to allow the wall to dissipate unlimited amounts of energy time and time again?

Dr. Silva believes he has found a solution for that. He proposes changing the interface between the wall and the footer from a flat surface to a curved surface. "With this approach, the amount of energy that can be dissipated has been proven numerically to be far superior to a flat wall. It reduces the displacement of the wall by a magnitude of 10 times less than the UPSW with the flat construction," claims Dr. Silva.

To test his hypothesis experimentally, Dr. Silva plans to build two types of models in the high bay—one with a single wall and one with double walls—and submit them to forces that simulate an earthquake. He is confident, however, that the experimental results will confirm his hypothesis. "If the experimental tests can confirm the numerical results, this will give engineers the confidence to implement this system into design practice," he notes.

PROFILE

Chair: Majid Manzari
202-994-4901

www.cee.seas.gwu.edu

Undergraduate students: 86

Graduate students: 54

Annual research expenditures: \$1.1 Million

FACULTY

Arzhang Angoshtari, **ASSISTANT PROFESSOR**

Sameh Badie, **PROFESSOR**

Leila Farhadi, **ASSISTANT PROFESSOR**

Samer Hamdar, **ASSOCIATE PROFESSOR**

Russell Hemley, **RESEARCH PROFESSOR**

Tianshu Li, **ASSOCIATE PROFESSOR**

Zhenxian Liu, **ASSOCIATE RESEARCH PROFESSOR**

Majid Manzari, **PROFESSOR**

Rumana Riffat, **PROFESSOR**

Kim Roddis, **PROFESSOR**

Danmeng Shuai, **ASSISTANT PROFESSOR**

Pedro Silva, **ASSOCIATE PROFESSOR**

RESEARCH AREAS

ENVIRONMENTAL AND WATER RESOURCES ENGINEERING

Farhadi, Riffat, Shuai

MATERIALS

Hemley, Li, Liu

MECHANICS

Angoshtari, Manzari

STRUCTURAL/GEOTECHNICAL/EARTHQUAKE ENGINEERING

Badie, Manzari, Roddis, Silva

TRANSPORTATION SAFETY ENGINEERING

Hamdar

PROFILE

Chair: Robert Pless
202-994-7181

www.cs.seas.gwu.edu

Undergraduate students: 214

Graduate students: 443

Annual research expenditures: \$3.6 million

FACULTY

Xiuzhen "Susan" Cheng, **PROFESSOR**

Hyeong-Ah Choi, **PROFESSOR**

Mona Diab, **PROFESSOR**

James Hahn, **PROFESSOR**

Rachelle Heller, **PROFESSOR**

Lance Hoffman, **DISTINGUISHED RESEARCH PROFESSOR
AND FELLOW OF ACM**

David James, **PROFESSOR OF PRACTICE**

Claire Monteleoni, **ASSOCIATE PROFESSOR**

Bhagirath Narahari, **PROFESSOR**

Gabriel Parmer, **ASSOCIATE PROFESSOR**

Robert Pless, **PROFESSOR**

Rahul Simha, **PROFESSOR**

Poorvi Vora, **PROFESSOR**

Timothy Wood, **ASSOCIATE PROFESSOR**

Abdou Youssef, **PROFESSOR**

RESEARCH AREAS**ALGORITHMS AND THEORY**

Cheng, Choi, Youssef

ARTIFICIAL INTELLIGENCE AND ROBOTICS

Cheng, Diab, Monteleoni, Pless

BIOINFORMATICS AND BIOMEDICAL COMPUTING

Cheng, Hahn, Simha

COMPUTER SECURITY AND INFORMATION ASSURANCE

Cheng, Choi, Hoffman, Narahari, Simha, Vora

DIGITAL MEDIA

Hahn, Heller, Pless, Vora, Youssef

NETWORKING AND MOBILE COMPUTING

Cheng, Choi, Narahari, Simha

PERVASIVE COMPUTING AND EMBEDDED SYSTEMS

Cheng, Narahari, Simha

SEARCH AND DATA MINING

Youssef

SOFTWARE ENGINEERING AND SYSTEMS

Narahari, Parmer, Wood



Keeping Information Flowing

When a catastrophic event occurs—such as a terrorist attack, an earthquake, or even a small meteor attack—first responders need to have timely and reliable communication with each other and with people affected by the event, so they can perform their crucial work as efficiently and effectively as possible. However, the communications networks on which they normally rely are often severely damaged or rendered entirely non-functional by the catastrophe.

Following the September 2001 terrorist attack, the 9/11 Commission recommended that the U.S. government develop a broadband public safety network for this purpose. Congress established the initiative under the direction of the National Institute of Standards and Technology, which set about funding projects to modernize public safety communications under the Public Safety Innovation Accelerator Program.

Dr. Hyeong-Ah Choi and her research team received one of the grants and have been working for two years to develop a more resilient broadband public safety network. “The first responders need to be able to communicate with each other, but if the cell tower has been knocked out, you need to bring in mobile base stations,” Dr. Choi explains. “You have to decide the best locations for the mobile base stations, and that depends on where the first responders are located. But the first responders move around, so we are developing an algorithm that shows where to place the base stations so that good connectivity is provided to the first responders in a dynamic way.”

The team’s goal is to have a public safety network that intelligently adapts and extends its coverage to ensure the availability of the services, bandwidth, quality of service level, and reliability required by the first responders wherever they go, at the time that they need it. For example, while one first responder may be transmitting a video feed of the disaster area via a head-mounted video camera, another may be monitoring the temperature of the rubble, and a third may be downloading a three-dimensional model of the building interior. All of this information will need to be communicated, with the responders moving all the while.

Although extensive research has been conducted for commercial broadband networks, it is not particularly suited to Dr. Choi’s task, because communication via a public safety network is by nature less predictable and more dynamic than that in a commercial network. Her team is using and developing a variety of tools to explore this new territory, including algorithms, optimization, stochastic analysis, graph theory, and distributed and hybrid protocol design.

Dr. Choi is enthusiastic about the project, and particularly about its potential to make a valuable contribution to live-saving disaster response tactics. However, she is also motivated by the desire to teach her students.

“Research and education are tightly connected,” she remarks. “I like to develop good research and help my Ph.D. students grow and be able to develop their own careers through their research experience working with me.”

Keeping the Lights On

The blackout that hit parts of the northeastern U.S. and Ontario, Canada, in August 2003 affected an estimated 55 million people, most of whom lost power for several hours or more.

At the time, Dr. Payman Dehghanian was a high school student in Iran. Although he clearly did not personally experience the effects of the blackout, he followed the news about it closely and ended up deciding to study power systems engineering partly as a result of seeing the havoc the blackout wreaked.

Now a new assistant professor at SEAS, Dr. Dehghanian studies power system resilience in the face of extreme weather conditions or cyberattacks that can compromise national security.

“We didn’t see such phenomena before as frequently as we do now,” states Dr. Dehghanian. “In recent years, several catastrophic, extreme weather conditions happened, resulting in massive electricity outages. And regarding cyberattacks, people were thinking about them as a purely academic and theoretical topic until a few years ago, when one actually happened in the capital of Ukraine in December 2015.”

The U.S. will need to learn to better predict and detect these events and to mitigate their consequences if we are to improve our resilience to them. For his part, Dr. Dehghanian is helping by researching both the planning and operations of power systems to create a more resilient and sustainable electric grid.

On the planning side, he investigates how the U.S. can make the most of environmentally-friendly, renewable energy resources such as wind and solar power and how to most effectively store the energy from these renewables for use in day-to-day operations and during emergencies. By providing alternative sources of electricity, these energy resources potentially can reduce our vulnerability to extreme weather events or cyberattacks.

On the operations side, he is looking at tools to provide a faster recovery from a destructive event and is using advanced data analytics to try to develop real-time decision making support tools to aid system operators who must respond quickly to the unfolding events.

According to Dr. Dehghanian, primary attention to resilience within the power systems engineering domain focuses on scenarios involving outages of single pieces of equipment or outages of two or three elements. What sets Dr. Dehghanian’s research apart is that he tries to characterize and respond to large-scale, catastrophic outages—like the 2003 blackout—that affect interdependent systems, such as transportation, health care services, communications, and other sectors.

“Everyone’s lives are highly dependent on electricity,” says Dr. Dehghanian. “Although these events are rare, they have a high impact when they happen. So my research is groundbreaking. It aids a proactive preparedness for such events and helps keep the lights on at all times.”



PROFILE

Chair: Suresh Subramaniam
202-994-6083

www.ece.seas.gwu.edu

Undergraduate students: 92

Graduate students: 308

Annual research expenditures: \$3 million

FACULTY

Shahrokh Ahmadi, **TEACHING PROFESSOR**

Lawrence Bennett, **RESEARCH PROFESSOR AND FELLOW OF APS**

Robert Carroll, **PROFESSOR**

Payman Dehghanian, **ASSISTANT PROFESSOR**

Edward Della Torre, **PROFESSOR AND FELLOW OF IEEE AND APS**

Milos Doroslovacki, **ASSOCIATE PROFESSOR**

Tarek El-Ghazawi, **PROFESSOR AND FELLOW OF IEEE**

Kie-Bum Eom, **PROFESSOR**

Robert Harrington, **PROFESSOR AND FELLOW OF IEEE**

Hermann Helgert, **PROFESSOR**

Howie Huang, **ASSOCIATE PROFESSOR**

Can Korman, **PROFESSOR**

Nicholas Kyriakopoulos, **PROFESSOR**

Tian Lan, **ASSOCIATE PROFESSOR**

Roger Lang, **PROFESSOR AND FELLOW OF IEEE**

Ahmed Louri, **PROFESSOR AND FELLOW OF IEEE**

David Nagel, **RESEARCH PROFESSOR**

Volker Sorger, **ASSOCIATE PROFESSOR**

Suresh Subramaniam, **PROFESSOR AND FELLOW OF IEEE**

Guru Venkataramani, **ASSOCIATE PROFESSOR**

Mona Zaghoul, **PROFESSOR AND FELLOW OF IEEE**

RESEARCH AREAS

APPLIED ELECTROMAGNETICS

Bennett, Della Torre, Korman, Lang, Sorger

COMMUNICATIONS AND NETWORKS

Doroslovacki, Helgert, Lan, Louri, Subramaniam

COMPUTER ARCHITECTURE AND HIGH-PERFORMANCE COMPUTING

El-Ghazawi, Huang, Louri, Venkataramani

ELECTRIC POWER AND ENERGY

Dehghanian, Harrington

MEMS/NEMS, ELECTRONICS, AND PHOTONICS

Ahmadi, Korman, Louri, Nagel, Sorger, Zaghoul

SIGNAL AND IMAGE PROCESSING, SYSTEMS, AND CONTROLS

Carroll, Doroslovacki, Eom, Harrington, Kyriakopoulos

PROFILE

Chair: Thomas Mazzuchi
202-994-2353

www.emse.seas.gwu.edu

Undergraduate students: 107

Graduate students: 1151

Annual research expenditures: \$1.5 million

FACULTY

Hernan Abeledo, **ASSOCIATE PROFESSOR**
Joseph Barbera, **ASSOCIATE PROFESSOR**
David Broniatowski, **ASSISTANT PROFESSOR**
Jonathan Deason, **PROFESSOR**
Royce Francis, **ASSOCIATE PROFESSOR**
Erica Gralla, **ASSISTANT PROFESSOR**
Thomas Mazzuchi, **PROFESSOR**
Joost Reyes Santos, **ASSOCIATE PROFESSOR**
Shahram Sarkani, **PROFESSOR**
Ekundayo Shittu, **ASSISTANT PROFESSOR**
Zoe Szajnfarber, **ASSOCIATE PROFESSOR**
J. Rene van Dorp, **PROFESSOR**

RESEARCH AREAS**CRISIS, EMERGENCY, AND RISK MANAGEMENT**

Barbera, Broniatowski, Gralla, Santos, van Dorp

ECONOMICS, FINANCE, AND COST ENGINEERING

Santos, Shittu, van Dorp

ENGINEERING AND TECHNOLOGY MANAGEMENT

Deason, Sarkani, Shittu, Szajnfarber

ENVIRONMENTAL AND ENERGY MANAGEMENT

Deason, Francis, Shittu

KNOWLEDGE AND INFORMATION MANAGEMENT

Broniatowski

OPERATIONS RESEARCH

Abeledo, Gralla, Mazzuchi, Sarkani,
Shittu, van Dorp

SYSTEMS ENGINEERING

Broniatowski, Gralla, Mazzuchi, Santos,
Sarkani, Shittu, Szajnfarber, van Dorp

An Ounce of Prevention

Dr. Joost Santos has been a fan of Benjamin Franklin's aphorism "An ounce of prevention is worth a pound of cure" since he first heard it in grade school. In a sense, that maxim sums up his latest study, a cost-benefit analysis of disaster mitigation grants that he conducted for the National Institute of Building Sciences (NIBS).

Dr. Santos studies disaster risk management, developing hybrid models from the fields of systems engineering and economics to learn how to predict the ripple effects of disasters across interdependent infrastructure and economic systems. His models combine optimization and probabilistic risk analysis techniques from systems engineering with the Leontief economic input-out model to try to answer a variety of questions, such as how to minimize production disruptions in the aftermath of disasters or how to allocate emergency responders across highway networks following a disaster.

"The novelty of the extended Leontief model is its ability to predict and forecast how failures in one system can cascade to other systems due to their interdependencies," remarks Dr. Santos. "If we are able to better understand that, then we'll be able to better assess and manage the dire consequences of a disaster."

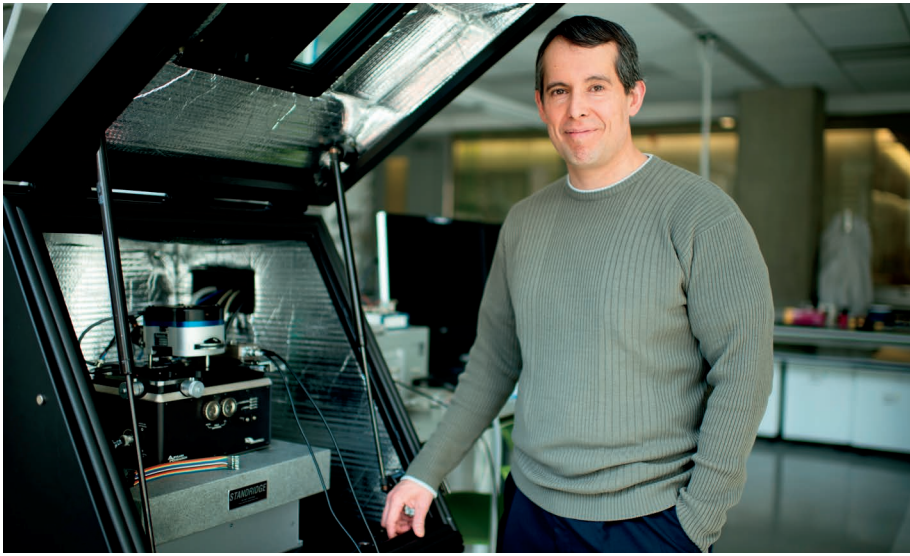
For example, when a hurricane sweeps through an area and causes widespread flooding or the failure of the electric power system, there will be cascading effects to the economy because some of the affected work sites may be manufacturing plants that have to be shut down. The resulting cessation in output automatically will create failures in other systems.

Dr. Santos' recently completed project for NIBS estimated the benefit-to-cost ratio of grants from FEMA, the U.S. Economic Development Administration, and the U.S. Department of Housing and Urban Development in mitigating the consequences of disasters. He and his colleagues from SPA Risk, the University of North Texas, the University of Colorado-Boulder, Indiana University-Purdue University Polis Center, and Imagecat collected 23 years of data on grants the three agencies provided to mitigate floods, hurricanes, earthquakes, and fires. The researchers also looked at international building codes (I-Codes) for non-residential buildings, combined the FEMA data with the I-Codes, and computed a 6:1 benefit-to-cost ratio for mitigation funding: every one dollar investment toward exceeding the I-Codes will save the U.S. six dollars in future disaster costs.

Putting this result in perspective, Dr. Santos explains, "The ratio is quite significant, because it's a multiplier of six. If we're talking about Hurricane Katrina, for example, business interruption losses alone were estimated to be \$45 billion. Investing \$7.5 billion before Hurricane Katrina would have wiped out those losses."

This study was particularly satisfying to Dr. Santos because of its potential impact on policy. "I appreciate how output from my research is directly contributing to policy," he says. "Those ratios are a big deal, because Congress uses them in making budgetary decisions on future disaster risk management investments. We expect this study to receive a lot of attention."





An Engineer's Friend

We all need friends, and who among us wouldn't appreciate a friend who does the hard, unglamorous, behind-the-scenes work that allows us to shine? Dr. Santiago Solares is that friend. He does the behind-the-scenes materials and measurement science research that other engineers can rely on to build the nano-scale devices that amaze the rest of the world.

As a materials scientist, Dr. Solares is most concerned with being able to measure and describe for other engineers the properties of the materials they are going to use to build nano-scale systems. "If you want to build a safe bridge, you need to know the properties of steel and concrete," says Dr. Solares. "So for small technologies, such as the design of a futuristic nano-machine, you also need to know those properties—how much you can push it, how much you can deform it, how much abuse it will take, or how it will change over time. But a lot of things are not yet measurable at that scale."

And the challenges to being able to measure and describe these properties at the nano scale are significant. One of the challenges is the tools. According to Dr. Solares, the inadequacy of the tools—they simply cannot be made any smaller than they are—is a reason that many people tend to shy away from this research. "They're the best available but they're not as good as what we have at the larger scale, not even close," he states. "It's like changing a tire on your car with a wrench that is three times the size of your car."

That presents another challenge: since the tools don't allow the materials scientist to really see what he is doing, he always has to infer indirectly the behavior of the materials. And the behavior of the materials is what fascinates Dr. Solares.

Right now, he and his lab are using atomic force microscopy to study what happens to polymer solar cells in real life conditions. Polymer solar cells are cheap and easy to make, and they could be attractive to consumers because they are flexible and can be bent and twisted without cracking; but they can be deformed only up to a point and for a limited time. Eventually, all that bending and twisting can make them malfunction or stop working completely. Dr. Solares' lab is trying to study from the nano-mechanical point of view to what point specifically the solar cells can be abused and still maintain their functionality or, alternatively, how to prevent their malfunction, knowing that they will be abused a bit.

Dr. Solares is no stranger to the real-life applications of his work. He spent seven years working in industry before turning to academic research, and he uses examples from industry to emphasize to his students the importance of learning well the limits of various materials and systems. "In the context of teaching, I can tell students exactly why they should learn this and I give them examples of serious things that happen when people don't learn, because I have seen industrial accidents," he says. "Not knowing your subject is dangerous."

PROFILE

Chair: Michael Plesniak
202-994-6749

www.mae.seas.gwu.edu

Undergraduate students: 225

Graduate students: 144

Annual research expenditures: \$4.4 million

FACULTY

Elias Balaras, **PROFESSOR**

Lorena Barba, **ASSOCIATE PROFESSOR**

Philippe Bardet, **ASSOCIATE PROFESSOR**

Kartik Bulusu, **ASSISTANT RESEARCH PROFESSOR**

Ken Chong, **RESEARCH PROFESSOR AND FELLOW OF ASME, AAM AND SEM**

Andrew Cutler, **PROFESSOR**

David Dolling, **PROFESSOR AND FELLOW OF AIAA AND ROYAL**

AERONAUTICAL SOCIETY (UK)

Charles Garris, **PROFESSOR AND FELLOW OF ASME**

Stephen Hsu, **PROFESSOR AND FELLOW OF ASME**

M. Ashraf Imam, **RESEARCH PROFESSOR AND**

FELLOW OF ASM INTERNATIONAL

Michael Keidar, **A. JAMES CLARK PROFESSOR OF ENGINEERING AND FELLOW OF APS**

Saniya LeBlanc, **ASSISTANT PROFESSOR**

James Lee, **PROFESSOR AND FELLOW OF ASME**

Taeyoung Lee, **ASSOCIATE PROFESSOR**

Megan Leftwich, **ASSISTANT PROFESSOR**

Yongsheng Leng, **PROFESSOR**

Chunlei Liang, **ASSOCIATE PROFESSOR**

Michael Plesniak, **PROFESSOR AND FELLOW OF ASME, AIAA,**

AAAS, AIMBE AND APS

Kausik Sarkar, **PROFESSOR AND FELLOW OF ASME, ASA,**

AIMBE AND APS

Yin-Lin Shen, **PROFESSOR**

Murray Snyder, **PROFESSOR**

Santiago Solares, **PROFESSOR**

Adam Wickenheiser, **ASSISTANT PROFESSOR**

Lijie "Grace" Zhang, **ASSOCIATE PROFESSOR**

RESEARCH AREAS

AEROSPACE ENGINEERING

Cutler, Dolling, Garris, Keidar, T. Lee, Plesniak, Wickenheiser

BIOMEDICAL ENGINEERING

Balaras, Bulusu, Keidar, J. Lee, Leftwich, Liang, Plesniak, Sarkar, Zhang

DESIGN AND MANUFACTURING OF MECHANICAL AND AEROSPACE SYSTEMS

Garris, Leng, Shen

FLUID MECHANICS, THERMAL SCIENCE, AND ENERGY

Balaras, Barba, Bardet, Bulusu, Cutler, Dolling, Garris, Hsu, Keidar, LeBlanc, Leftwich, Liang, Plesniak, Sarkar, Snyder, Wickenheiser

MECHATRONICS, ROBOTICS, AND CONTROLS

J. Lee, T. Lee, Wickenheiser

SOLID MECHANICS AND MATERIALS SCIENCE

Chong, Hsu, Imam, LeBlanc, J. Lee, Leng, Solares, Zhang

Connecting the Dots

Opportunities to Build
Links Back to SEAS

by Dean David S. Dolling

When was the last time you visited an old friend? When did you last talk, and laugh, with someone from your childhood, your old neighborhood, or maybe someone from your college or graduate school days at SEAS?

These conversations always spark moments of reflection and memories of old connections. And they can *rekindle* those connections, too.

Your memories of SEAS—memories of your professors and classmates—are also connections back to SEAS.

The same sorts of experiences that you probably remember still happen every day at SEAS. Every day, someone triumphs over a stubborn problem set or a vexing question. Every day, someone in SEAS celebrates a research victory, large or small. Every day, someone steps forward to help a struggling student. And every day, we move one step closer to that next innovation.

As I recount for you some of the triumphs that we've had here over the last year, I hope you'll find in these examples some opportunities for connections back to SEAS. There are so many ways to connect, and one of these might be yours.

Research

Research at SEAS is stronger than ever, and it creates many options for partnership or philanthropy. Last year, SEAS research expenditures increased more than 19 percent over the previous year. With nearly \$16 million in fiscal year 2017 research expenditures, our expanding array of projects offers a wide menu of opportunities for involvement. One of these options is to help undergraduates who want to get a taste of research.

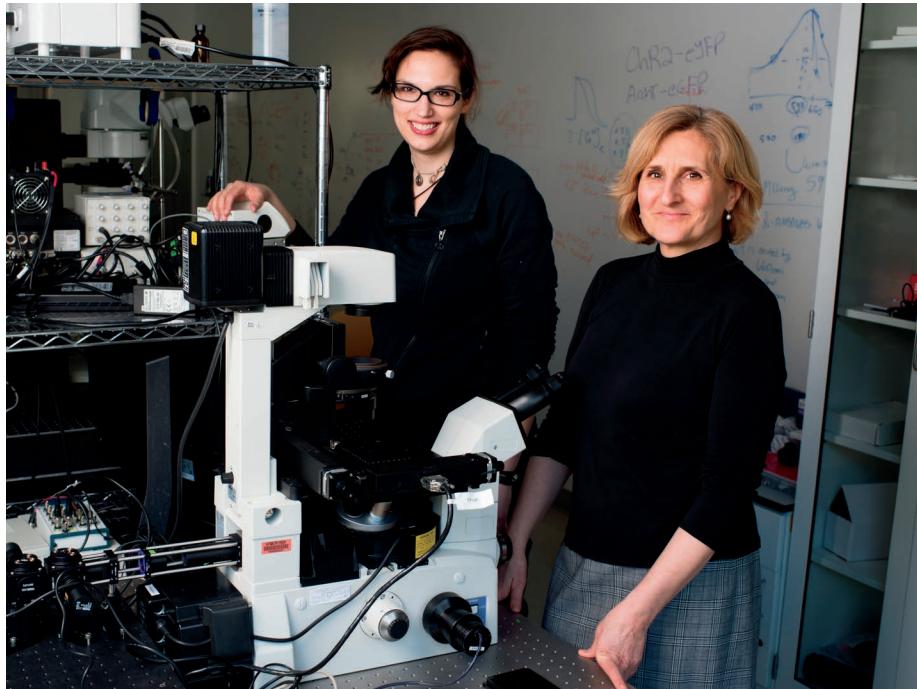
Demand for undergraduate student involvement in faculty research is growing across the U.S., but participation is relatively uncommon at most research universities. SEAS students, however, are especially fortunate, because they're able to participate in research at an unusually high rate. And, they often are given the chance to co-author academic papers, and even travel with faculty to present their research at conferences. Louise Lu is an example of an undergraduate student who has had a variety of research experiences. You can read about her on page 21.

Funds to support student travel and participation in conferences come out of the faculty members' research budgets, but I supplement them when I can with money from the Dean's Excellence Fund. If you would like to help open the world of research to our students by contributing to the fund, please let me know.

Our graduate students, of course, are already engaged in research, taking knowledge and tools from that experience to prepare for their next—or first—professional step. Jaclyn Brennan, whose story is on page 20, is an example of just one of the many talented graduate students working and studying currently at SEAS. Jaclyn has a fellowship, and at the graduate level, fellowships are key for recruiting top students. The greater the number of fellowships SEAS can offer, the greater the number of doors we open for promising students.

Students aren't alone in benefitting from funding to augment research opportunities. Our faculty also benefit. For example, additional lab equipment is helpful to them, so if you have the means to fund research equipment for use in our labs, I would love to hear from you.

Mr. Nicholas Paleologos (BS '69) has done just that in the Science and Engineering Hall's high bay. With his generous gift, we



SEAS faculty like Dr. Emilia Entcheva (right) provide research opportunities for SEAS students, from undergraduates through postdoctoral researchers.

were able to purchase equipment such as a portal frame, sophisticated actuation systems and data acquisition software, hydraulic jacks and pumps, and scissor lifts. This equipment allows us to conduct large-scale research in the high bay and compete for grants that would otherwise be out of our grasp. Dr. Sameh Badie successfully bid for a grant from the National Academy of Sciences and the Transportation Research Board and is now conducting research on a concrete bridge deck panel project using the equipment that Mr. Paleologos' gift paid for.

The project is serious, state-of-the-art research, but it's been great fun to watch, too. Dr. Badie's goal is to develop pre-cast bridge deck panel systems for highway bridges that reduce construction time and cost and simultaneously increase the lifespan of the bridge. The panel he built and is testing is 36 feet long. He and his team built the entire structure in the high bay and are testing it there, too. In one phase, they delivered more than four million cycles of cyclic load to the structure, using the high bay's portal frame and actuator to test the bridge's service load conditions. You can watch a video about the high bay and Dr. Badie's project—complete with time-lapse photography—at www.seas.gwu.edu/highbay-bridge-video.

Other SEAS research projects present opportunities for partnerships with investors or collaboration with external labs. Dr. Michael Keidar's research with cold plasmas is a great example of how a successful partnership expands the research that we're able to do here at SEAS.

Last September, GW and U.S. Patent Innovations, LLC (USPI) signed a \$5.3 million corporate research sponsorship agreement to fund expanded research into the cold plasma technology developed in Dr. Keidar's lab. The contract, by the way, is the largest corporate research funding agreement in GW history. Cold atmospheric plasma technology shows promise in targeting



High bay



Students present their research at the annual SEAS Student Research and Development Showcase.

cancerous cells without harming surrounding healthy tissue, and through GW's partnership with USPI, Dr. Keidar hopes to build cold plasma devices that eventually will be used to treat a range of cancers. More details of Dr. Keidar's partnership with USPI are on page 14.

At SEAS, we're also conducting a range of other cutting-edge research under a growing number of federal grants. One of these projects addresses cyber security, a topic that affects all of us. Working under a \$1.47 million grant that they received last fall from the Office of Naval Research, Drs. Tian Lan and Guru Venkataramani are studying how customized software packages could individualize security in cyber systems.

When software companies release updates meant to address security flaws in their programs, they often inadvertently create new security loopholes that can be exploited down the line. Dr. Lan and Dr. Venkataramani aim to develop ways to eliminate those new loopholes before they can be exploited. As a recent *GW Today* story explains, "Dr. Lan and Dr. Venkataramani believe system security could be improved with customized versions of essential software that only include features a specific user or company needs. These slimmer programs would cut out features that could someday provide a backdoor for those seeking to do harm."

Innovation

The spirit of discovery and innovation that is alive in our labs and research is thriving throughout the school. In fact, one of my priorities for SEAS is an initiative to nurture and grow the seeds of innovation that already exist among our students and faculty.

In late 2016, we hired Ms. Annamaria Konya Tannon as the school's chief evangelist for innovation and entrepreneurship, and one of her first projects was the renovation of the old machine shop in Tompkins Hall to create an Innovation Center for the university. The Innovation Center, which we share with GW's Office of Innovation and Entrepreneurship, serves as a sort of "one-stop-shop." There, students can meet mentors to help them develop their ideas, teammates to help build their projects or companies, and even potential investors to help fund the projects.

To foster an innovation ethic here at SEAS, Ms. Konya Tannon and her team are building a pre-seed fund and providing mentorship for "classroom-grown" projects. They're hosting student-run start-up companies in the center's incubator lab and are at work creating a small maker space, as well.

With a focus on the social impact of innovation, the center recently sponsored "George Hacks," a medical hackathon, and has begun offering a medical innovation track with a focus on innovations for the disabled and elderly communities. Likewise, this year's SEAS Innovation Challenge was dedicated to innovation to support Puerto Rico in the aftermath of Hurricane Maria.

The innovation team sponsors a robust series of talks and workshops, too. Its popular "Ask a..." series has included "Ask an MBA," "Ask a Lawyer," and "Ask a Working Mom." Recent workshops have covered coding, web design, resume building, digital art, and design thinking.

As "STEM" (science, technology, engineering, and math) evolves to incorporate the

arts and become "STEAM," the center has launched an artist-in-residence program with Dr. James Sham of GW's Department of Fine Arts and Art History. Last semester, the team also showcased two Danish artists, Rose Eken and Camille Raymann, in the first "Artist Talk" program, as well as Ariel Kagan and Jenna Riemenschneider of GW's Sustainability Collective, who shared their experiences at UNLEASH, a global innovation lab held in Denmark.

Reaching across disciplines is a key approach for the center. They've been collaborating not only with other GW schools but also with students and faculty from Georgetown University. And internally we've launched the SEAS Dean's Council of Women in Technology, which is an umbrella organization for female student leaders in STEM.

As you can see, the Innovation Center is a hub of activity. The opportunities to get involved with the center are almost as varied as the ideas that are germinating there. If you have business or technical experience you'd like to share as a mentor or as a guest lecturer, we want to meet you. If you're looking for potential partnerships, we can introduce you to students and others with a range of talents. If you seek potential investment opportunities, we're ready to pitch them to you.

Our innovation initiative is young, but it's expanding rapidly and is infused with a spirit of purpose and confidence. If you'd like to join our innovation efforts here at SEAS, I urge you to contact Ms. Konya Tannon at annamaria@gwu.edu.

JOHNNY CHOU



Students participated in last November's undergraduate hackathon, Hackital.



SEAS alumna Paige Atkins (*far right*) joins SEAS students (*left to right*) Taryn Faherty, Isabel Verghese, Emma Crockett, and Lindsay Ryan at the 2017 Women in Engineering event.

Women in Engineering

A second successful initiative underway at SEAS is our Women in Engineering initiative. With an already strong female enrollment, SEAS continues to build an environment that will encourage even more women to choose to study here. Our goal is to be the nation's top school for graduating women with undergraduate degrees in engineering and computer science.

This is an attainable goal. As of 2015, SEAS ranked number five in the nation for the percentage of Bachelor of Science degrees we award to women—and with women comprising 41.5 percent of our graduates, we were just one-tenth of a percentage point behind the third and fourth ranked schools.

A number of the SEAS faculty—of whom more than 20 percent are women—are dedicated to this effort, as are our students and a growing number of alumnae who are eager to help.

Our most recent success in this area is a \$300,000 Clare Boothe Luce undergraduate research grant from the Henry Luce Foundation. The grant will give eight SEAS undergraduate women the chance to pursue research with faculty mentors, hone their professional skills, and establish themselves as university leaders.

The program is open to sophomore women, who began applying this semester for its eight slots. The first cohort of four students will start its research this summer and will continue through spring 2020. The second cohort of four students will start the project in summer 2019 and finish in spring 2021. Each student will receive \$37,500 total for two years.



Dr. Rachelle Heller

As part of the experience, students will write blog posts about their research several times throughout the program, travel with their mentors to a conference or meeting, and present their work at the annual SEAS Student Research and Development Showcase and the university-wide GW Research Days. They will also “pay it forward” by speaking to local students at the Washington School for Girls and acting as role models.

This is a tremendous opportunity for our women students, and a feather not only in the school's cap, but also in the cap of Dr. Rachelle Heller, who led the team that developed the proposal for the grant. Dr. Heller is a computer science professor, the former associate provost for academic affairs at GW's Mount Vernon Campus, and the former leader of the Elizabeth Somers Women's Leadership Program. The Clare Boothe Luce research scholarships come at a time when SEAS has really begun to hit its stride in recruiting and retaining women, thanks in part to Dr. Heller's long term commitment and contributions to this goal.

These research scholarships will be particularly helpful with retention, but there is always more to do—and there are always more students to help. If you can see yourself playing a role in this endeavor, please contact me at dolling@gwu.edu.

With scholarship and fellowship money, we can offer more opportunities of the sort that the Clare Boothe Luce Program provides. With alumnae help, we can pair more of our students with mentors, host more Women in Engineering networking events, and send more of our women students to conferences and competitions, giving them the chance to present their work, build their confidence, and expand their nascent career networks.

All of these opportunities open doors for SEAS students—from the scholarships and fellowships that allow students to attend SEAS in the first place, to on-campus engineering and computer science research and extra-curricular activities, to external learning experiences.

They also build connections, both for students and for you. I hope you'll consider building a connection back to SEAS.

Jillian Miles

Exploring **HERE & ABROAD**

As Jillian Miles reminisces about her college application process, she mentions one of her visits to campus, recalling, “I knew with the Science and Engineering Hall opening soon, I would have a lot of opportunities in STEM [science, technology, engineering, and math].”

Jillian certainly has had a number of opportunities at SEAS, but she’s done her part, too, and has wisely made the most of them.

Now a senior majoring in systems engineering, Jillian initially wasn’t sure what she wanted to study at SEAS. During an introduction to engineering course her first year, she was given a simple optimization problem to solve, and as it turned out, it also solved the question of a major for her. “I saw what they were doing, and they showed us how you can apply this to hundreds of fields,” she remembers. “It felt to me so expansive, and like a tool kit I could apply to any field I wanted to go into.”

Jillian declared her major and began to soar. At the end of her freshman year, she was selected as a Clark Engineering Scholar, a prestigious honor for a SEAS undergraduate.

“I remember our first banquet as a freshman and listening to the seniors and wondering why I was in the program,” she says quietly. “With every event in the program— alumni speakers, leadership boot camps, etc.—it’s built up my confidence to a point where I know that as a senior, I’m capable of doing amazing things in my future, too. Without the program I don’t think I would have found that confidence in myself.”

One thing often leads to another in life, and that was the case for Jillian with the Clark Scholars Program. The program requires the students to participate in a study abroad, so Jillian chose to study at the University of Cape Town in South Africa. She had two short-term homestays while there, and they made quite an impression on her.



Speaking of the homestays, she remarks, “One was in a township, so I saw the remnants of apartheid and the unique problems that they face now because of it. That’s a lesson I won’t forget. You see a whole other world that is different from your own, but then you start talking to people and you start to realize how similar your needs and desires are.”

As her study abroad wound down, one thing led to another again, and she found herself presented with the opportunity to do research for the summer in Kampala, Uganda. Dr. Murray Snyder, the director of the Clark Scholars Program, put her in touch with a faculty member from the Engineering Management and Systems Engineering department, Dr. Erica Gralla. Dr. Gralla leads a research project in Kampala that monitors changes in Ugandan agricultural market systems for the U.S. Agency for International Development. She interviewed Jillian over Skype and selected her to help with research for the summer. The only “obstacle” for Jillian was how to tell her parents.

“I thought, ‘My parents are gonna kill me if I get back from Cape Town for two weeks and turn around and go to Uganda, but

I can’t pass up this opportunity,’” Jillian says with a laugh. “One thing I love about GW is the focus on study abroad, so why wouldn’t I do this?”

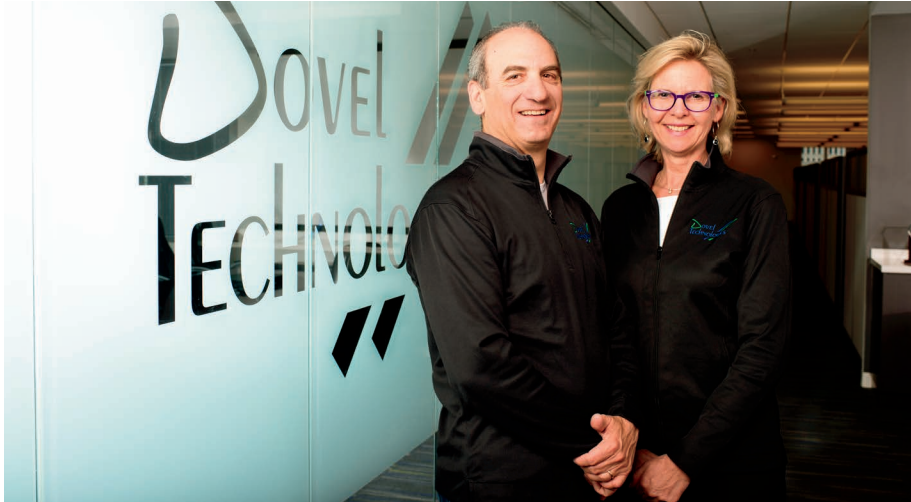
Back at GW in the fall, Jillian resumed her classes and usual activities, which include the SEAS Student Peer Advisory Network and the GW ballet group, Balance. “I love Balance,” she states. “It was the first organization I joined at GW, and it’s been my release throughout college.”

Jillian is aware of the unique combination of activities and experiences that have comprised her college years and is grateful to GW and SEAS for the opportunities she has had.

“GW, and especially SEAS, has been such a catering environment,” she concludes. “When I was a GW tour guide, the thing I would say at the end [of each tour] was, ‘I’ve told you a lot about my experiences, but if you go up and ask any other student how SEAS has been an enabling environment to them, they will each have their own unique story on how SEAS has been integral to their lives.’ It’s amazing that almost every kid who walks through here has a similar list of how much they’ve been given by the school.”

Dov & Elma Levy

Unafraid of **A CHALLENGE**



Dov Levy grew up in Tel Aviv, Israel, and studied at the University of Tel Aviv. One summer during college, he and a friend had to conduct a mapping exercise for a class, and Dov knew right then that he wanted something different.

“We were mapping outside in Israel’s summer, and that’s when we said, ‘There’s absolutely no way we’re going to do this kind of stuff for the rest of our lives. Computers have to be in cool places to work, so we want to be where the computers are,’” says Dov.

So, Dov decided to do his graduate study in computer science—but he wasn’t sure where. Family friends living in Washington, D.C. suggested that he come study at GW, and they invited him to live with them while he did. He landed in D.C. in the middle of December, and soon found himself homesick and missing his girlfriend Elma terribly.

Dov and Elma had spent the previous year together, when Elma was living and working in Israel. But Elma had since returned to her home country, The Netherlands, and was ready to begin a new job there—at least until she got a call from Dov’s friends in the U.S., asking her to come visit Dov.

“I had a job lined up in Amsterdam and was going to start the first week of January,” Elma recalls. “After that phone call, I told my

parents, ‘Well, plans have changed. I’m giving up on everything here and I’m flying to the United States.’” And that’s what she did.

Dov worked on his graduate degree, while Elma studied for her American nursing license, and they married that year. Money was extremely tight, so Dov started working as a software developer at the same time. After graduating in 1983, he began working for a company that built games for Apple-Macintosh. The company went out of business, so he began working for another start-up, and *that* company went out of business. He went to a third company, and the same thing happened again.

“So I come home to Elma one day,” Dov recounts, “and I say, ‘This country is very strange. You don’t have any job security. The companies all go out of business. How about if we start our own company? Then at least we will have some control over our destiny.’” And so they did.

In 1987, they founded Integrated Data Corporation (IDC), the predecessor to their current company, Dovel Technologies. The attic in their home was the IDC office, and Dov and Elma were the sole employees. Dov managed the company’s technical direction, and Elma managed the corporate governance of the business.

Initially, they used outside consultants as necessary, but in 2000, they decided they

needed to begin hiring employees. That meant building the company’s infrastructure: putting in place an accounting system, adding human resources functions, creating an advisory board, and more. As the business scaled up, Dov and Elma hired a chief executive officer but remained with the company. In 2005, they changed the company name to Dovel Technologies.

Today, Dovel has more than 1,000 full-time equivalent employees and is projected to do \$200 million in revenue in 2018. The company provides technology solutions for the federal government across various sectors, but the majority of its revenue comes from information technologies Dovel has built or manages in the health IT market. Currently, Dovel manages the FDA’s Emergency Operations Network Incident Management System, and the development of grantsolutions.gov, which administers \$80 billion worth of grants for the federal government. Dovel also has hundreds of employees working at the National Institutes of Health through its subsidiary, MCS.

With the company maturing and growing, Dov and Elma more recently have found time to do other things they love and to reconnect to SEAS and GW. Both are members of the SEAS National Advisory Council. They have participated as hosts for GW’s Dinner with Alumni Program and as mentors for the New Venture Competition, and they have established a scholarship for engineering students. Elma serves as a mentor for a Clark Engineering Scholar, a mentor for the National Science Foundation I-Corps Program at GW, and a mentor-in-residence for GW’s Office of Innovation and Entrepreneurship.

In January, the couple also accomplished a goal they had had for years: summiting Mt. Kilimanjaro in Tanzania. After a six-day hike up, they reached the 19,341-foot summit on January 30. Perhaps the philosophy that guided Dov and Elma as they grew Dovel also helped guide them on the trek up Mt. Kilimanjaro: “You have to always be a little bit outside your comfort zone—not too far, just enough to feel the butterflies in your stomach, because it means you’re learning something new and you’re growing,” Elma advises.

News



Dr. Michael Keidar

USPI Awards \$5.3 Million for Dr. Keidar's Plasma-Based Cancer Therapy

GW and U.S. Patent Innovations, LLC (USPI) signed a \$5.3 million corporate research sponsorship agreement last September to fund expanded research in cold atmospheric plasma technology co-developed by Dr. Michael Keidar of the Department of Mechanical and Aerospace Engineering. The contract is the largest corporate research funding agreement in GW history.

Studies have shown that cold atmospheric plasma technology can be used to target cancerous cells without harming normal biological tissue. This finding could revolutionize cancer treatment, and USPI's funding for this technology will enable Dr. Keidar to expand his research in this rapidly emerging field.

The newly funded initiative expands the research collaboration between Dr. Keidar and Jerome Canady, chairman of the USPI board of managers and noted surgeon. Together Dr. Keidar, Dr. Canady, consulting scientists, and other subsidiaries of USPI will explore potential applications for cold atmospheric plasma in the treatment of breast, brain, gastrointestinal, colorectal, ovarian, cervical, lung, and skin cancers.

"[This funding] will allow us to move more aggressively toward understanding the

mechanisms of plasma and also to build adaptive cold plasma devices that will eventually translate into commercial products," Dr. Keidar said. "This partnership will accelerate the translational part and bring devices to clinical use much faster than they would otherwise."

Cold atmospheric plasma-based instruments resulting from prior collaborations between Drs. Keidar and Canady have already shown promise in the treatment of cancer. In January 2017, a surgical team used the Canady Helios™ Cold Plasma Scalpel to selectively kill cancerous tissue during a two-stage liver resection in a patient with advanced inoperable liver cancer. The innovative technology allowed the surgical removal of the cancerous tissue without damaging the blood supply to the remaining liver.

Cold atmospheric plasma can be tailored for an individual person or cancer type in ways chemotherapy cannot. Researchers can monitor how plasma species interact with cells and can record information about the interaction. Based on the response, engineers can modify the plasma's composition and ideally improve the outcome.

Dr. Keidar believes plasma has a self-adaptive mechanism that allows it to target cancer cells without human intervention. A continuing partnership with USPI will improve

GW's ability to advance research in this field. Under the agreement he plans to delve further into cold plasma's adaptability and individualization, he said.

Dr. Canady's team will apply for an FDA investigational device exemption to start clinical trials on the cold plasma scalpel later this year.

EDITOR'S NOTE: This article is adapted from the *GW Today* article "GW Signs \$5.3 Million Agreement to Research Plasma-Based Cancer Therapies."

The Success of SEAS Online Graduate Programs

SEAS continues to expand its online graduate programs in response to increased demand for new degree programs and more options in the way the programs are delivered. If student enrollment and *U.S. News & World Report* rankings are any indication of their success, then it seems that the SEAS online programs are, in fact, meeting the demand—and exceeding expectations.

Online graduate programming at SEAS actually goes back to 2001, when the Department of Engineering Management and Systems Engineering (EMSE) offered its first online master's degree program through its Online and Off-Campus Programs Office (EMSE-OCP).

As interest in online programs increased, EMSE-OCP began expanding its programs step-by-step from the original degree program in engineering management. Today, the online offerings also include the Master of Science in systems engineering, the Doctor of Philosophy in systems engineering, and two new degrees: the Doctor of Engineering in engineering management, and the Master of Engineering in cybersecurity policy and compliance. The newest program, the Master of Engineering in climate change engineering and policy, will launch in fall 2018.



“Seventeen years ago we were pioneers in engineering distance education,” said Dr. Shahram Sarkani, director of online and off-campus programs for SEAS and EMSE. “We built up gradually, and now enrollment remains robust with more than 1,000 students.”

The department's new Doctor of Engineering program grew to 150 students in 36 months, while the Master of Engineering program climbed to more than 250 students in 18 months.

In January, the *U.S. News & World Report* released its 2018 rankings of online graduate programs. The EMSE online graduate programs in systems engineering, cybersecurity policy and compliance, and engineering management are ranked #26 in the nation in the report.

Dr. Sarkani believes that the programs' success and increasing enrollment are due to several factors, including the EMSE-OCP's long history, wide-ranging experience, and name recognition; the thousands of successful alumni who have earned degrees; and the comprehensive student services EMSE-OCP offers.

“Since 2001, our goal has been to take intellectually stimulating online degree programs, in relevant fields where the SEAS faculty has expertise, and in a convenient format, to working professionals seeking to update their knowledge and advance their careers anywhere in the world,” Dr. Sarkani stated. “We are accomplishing this goal semester after semester. Rather than bringing students to GW, we take GW to the world.”

Dr. Lumb Leads Successful Effort to Create Highly Efficient Solar Cell

Dr. Matthew Lumb and a team of researchers are working to develop an innovative and highly efficient solar cell that is capable of capturing nearly all of the wavelengths in the solar spectrum.

In a study published last July in the journal *Advanced Energy Materials*, the team announced that it had designed and constructed a prototype for a new solar cell that integrates multiple cells stacked into a single device. The new design is capable of capturing long wavelength light in the solar spectrum typically wasted in conventional solar cells. The prototype converts direct sunlight to electricity with 44.5 percent efficiency. The world record for efficiency currently stands at 46 percent, but with further development, the new approach holds the promise of significantly higher efficiencies in the future due to the greater light capture.

The new device uses concentrator photovoltaic (CPV) technology that employs lenses to concentrate sunlight onto tiny, micro-scale solar cells. Because of their small size—less than one millimeter square—solar cells utilizing more sophisticated materials can be developed cost effectively. The stacking procedure employs micro-transfer printing to precisely assemble conventional, high efficiency solar cell materials with compounds based on the GaSb (gallium antimonide) platform, more commonly found in infra-red (IR) applications such as IR lasers and photodetectors.

The stacked cell acts almost like a sieve for sunlight, with the specialized materials in each

layer absorbing the energy of a specific set of wavelengths. By the time the light is funneled through the stack, just under half of the available energy has been converted into electricity.

“Around 99 percent of the power contained in direct sunlight reaching the surface of Earth falls between wavelengths of 250 and 2500 nanometers, but conventional materials for high-efficiency multi-junction solar cells cannot capture this entire spectral range,” explained Dr. Lumb, the lead author of the study and a research scientist in the Department of Electrical and Computer Engineering. “Our new device is able to unlock the energy stored in the long-wavelength photons, which are lost in conventional solar cells, and therefore provides a pathway to realizing the ultimate multi-junction solar cell.”

This particular solar cell is very expensive. However, Dr. Lumb and his team believe it was important to show the upper limit of what is possible in terms of efficiency. Despite the current costs of the materials involved, the technique used to create the cells shows much promise. Eventually a similar product may be brought to market, enabled by cost reductions from very high solar concentration levels and technology to recycle the expensive growth substrates.

In December of last year, Dr. Lumb was awarded a \$1.4 million Advanced Research Projects Agency-Energy (ARPA-E) grant to lead a consortium of researchers in a new research effort to develop a high performance CPV module. This module will contain mechanically stacked solar cells assembled using the transfer printing approach, but unlike current commercial CPV modules, it will be fully integrated with conventional flat plate photovoltaic technology. The goal of this marriage of concentrator and flat plate components is to produce an extremely high efficiency solar module capable of capturing both direct and diffuse light.

“These new hybrid photovoltaic modules have the potential to harvest more energy from the sun than ever demonstrated before and increase the commercial competitiveness of concentrator photovoltaic technologies in a broad range of applications,” said Dr. Lumb.

Working alongside him under the new grant are his collaborators, the Naval Research Laboratory, Northwestern University, MIT, and the companies Veeco and X-Celeprint.

Dr. Matthew Lumb





Jonathan Kolbeck

Building GW's First Cube Satellite

When NASA launches GW's cube satellite, GW-SAT, probably in late 2019 or 2020, GW's Micro-Propulsion and Nanotechnology Lab (MpNL) and members of the GW-SAT team hope to be the first team of researchers and students to demonstrate the three-axis stabilization capabilities of a propulsion device developed by the MpNL.

In 2016, NASA accepted a proposal from Dr. Michael Keidar, the MpNL director, to launch GW-SAT as part of NASA's CubeSat Launch Initiative. NASA will provide the launch for free, but the GW-SAT team, a largely student-run project, will be responsible for the design, construction, testing, and documentation of the cube satellite—and for its cost.

A cube satellite, or CubeSat, is a very small satellite that includes a simple communications system to send information back and forth to users on the ground. GW-SAT will be a three-unit CubeSat, which is roughly half the size of a shoebox.

Onboard GW-SAT will be 12 micro-cathode arc thrusters developed in the MpNL. The micro-cathode arc thruster is a micro-propulsion system designed to propel and control these miniature satellites in space. Dr. Keidar's team successfully demonstrated the plasma thruster in 2015 when the U.S. Naval Academy launched a rocket carrying a satellite with four of these thrusters. Now the GW-SAT team has set its sight on demonstrating that its

plasma thruster system can achieve three-axis stabilization.

"When a CubeSat is in space, you want to be able to point the camera toward a certain point, but usually CubeSats don't have a propulsion system so they just tumble around in space in their orbit, and their motion is kind of random. To get exactly the images we want, we have to have control over all three axes in order to control the CubeSat's position in space and be able to aim the satellite at a specific point," explained Jonathan Kolbeck, a doctoral student working under Dr. Keidar and the manager of the GW-SAT project.

Although the team has already passed the preliminary design review stage, much remains to be done before launch. "We're currently in the critical design review phase," stated Mr. Kolbeck. "This is the design we're going to fly, and in this phase it goes to reviewers at NASA and other stakeholders."

At that point, the student team will have six to seven months to put the whole spacecraft together and program it from the computer side. The CubeSat will then go to the U.S. Naval Academy for testing of a simulated launch. "The CubeSat then comes back to us and we'll package it and send it to NASA. We expect to send it to NASA by March 2019, and then we'll wait for NASA to give it a launch date," Mr. Kolbeck concluded.

GW-SAT has a secondary mission, as well. While in low Earth orbit, the CubeSat will carry out a scientific earth observation mission in partnership with Costa Rica Institute of Technology (TEC). To test the radio systems of the CubeSat, a remote solar-powered ground station built by TEC will gather data about a wetlands area in Costa Rica and then save the data to a file for downloading when the GW-SAT is within range of the ground station. Meanwhile a ground station built on GW's Foggy Bottom campus will also communicate with the CubeSat.

Mr. Kolbeck has high hopes for the program and believes that the project will generate a plethora of scientific papers. He also has high praise for the project team. "We have 35 students currently working on it who volunteer their time to do this, and they include physics, law, and MBA students, as well as many SEAS students" he said. "The CubeSat is being built entirely by GW students."

Research Galore

Nearly 100 undergraduate and graduate students presented research posters and competed for more than \$30,000 in prize money at the 2018 SEAS Student Research and Development Showcase. The Showcase was held February 21 in the Science and Engineering Hall, during the national Engineers' Week celebration.

Now in its twelfth year, the Showcase has become the top research competition at the school, challenging students to present often highly technical results in a concise format and a brief presentation to panels of judges comprising SEAS faculty and industry experts.

Top prizes this year went to the following students:

Graduate Theoretical Research:

Boxiao Cao of the Department of Civil and Environmental Engineering (CEE) won \$5,000 for his project, "Formation of 2D Ice Confined by Hydrophobic Nanopore." Boxiao is advised by Dr. Tianshu Li.

Graduate Experimental Research:

Mohamed ElGhoraiby, also of CEE, won \$5,000 for "Laboratory Characterization of a Liquefiable Soil." Mohamad is advised by Dr. Majid Manzari.

Undergraduate Research:

Shannon Toole, Aidan Murray, and Pannie Xu, all students in the Department of Biomedical Engineering, received the \$2,000 prize for their project, "Symmetrical Cluster Analysis for Thermographic Breast Cancer Detection." They are advised in their research by Dr. Murray Loew.

Randolph A. Graves Founder's Award:

Dietrich Reidenbaugh, an undergraduate in the Department of Computer Science, was awarded the \$500 Randolph A. Graves Founder's Award for implementing a digital scoring process for the Showcase.

Separately, GW's Office of Innovation and Entrepreneurship (OIE) awarded \$3,000 AccelerateGW I-Corps Site Program grants to 17 Showcase participants at the conclusion of the Showcase. The AccelerateGW I-Corps Site Program is funded by the National Science Foundation and managed by OIE. The program provides grants to GW students, faculty, and staff who have great



Dean Dolling (center, left) and keynote speaker Anirudh Kulkarni (center, right) join 2018 SEAS Student Research and Development Showcase winners and supporters.

technology and want to explore the potential for commercializing it.

The awards ceremony was preceded by the event's keynote address, delivered by Mr. Anirudh Kulkarni, a SEAS alumnus and the founder and chief executive officer of CVP, a business and technology consulting firm. Mr. Kulkarni (BS '86, MS '88) is also a member of the SEAS National Advisory Council.

Mr. Kulkarni said he is "continuously in awe" of the things SEAS and its students are achieving. He encouraged students, as they move into the professional world, to commit to every task—no matter how big or small—with the same level of integrity and drive.

"We're engineers; we have great ideas," he said. "It's really important to think about making commitments and following through on commitments because that, in the real world, is what counts. Ideas, trust me, are easy. It's the execution and the delivery of that with high integrity that really matters."

SEAS thanks Mr. Kulkarni and our 2018 Showcase sponsors: Leidos, RiVidium, Hegarty Research, iCES Corporation, Tangible Security, and Mr. T. Richard Stroupe. GW's Office of Innovation and Entrepreneurship also provided support through its administration of the National Science Foundation I-Corps Site Program grants.

All Hands Needed for Mars Exploration

Dr. Dava Newman has spent the last couple of decades thinking about how to get to Mars. Unsurprisingly, she has developed a number of ideas about what will be necessary to achieve this daunting goal, and she shared them with a packed house at the 2017 Frank Howard Lecture, "Human Exploration from Inner to Outer Space."

According to Dr. Newman, a deputy administrator of NASA during the Obama administration, the U.S. needs to foster radical changes in technology and increase partnerships with industry and university leaders to reach its goal of putting an astronaut on Mars in the 2030s.

Since the 1960s, humans have pushed the boundaries of technology, attempting to learn more about Mars. In the past 15 years, we have made significant knowledge leaps, Dr. Newman said, but so much more is required.

For starters, NASA needs to figure out how to land a craft carrying four to six astronauts on Mars and take off at the end of the mission.



Dava Newman

To develop these new technologies, NASA is funding industry leaders such as SpaceX, and counting on these partnerships to foster a competitive business environment where innovation thrives, according to Dr. Newman.

"To really be successful, it'll take the integration of the science missions, human exploration missions, and the technologies," said Dr. Newman. "Today we know how to land one metric ton. For the first human mission, [we'll need] 10 to 20 metric tons. It doesn't scale; it's not linear; and we don't know how to do it."

For the past 17 years astronauts have been living on the International Space Station for short term stays; however, to get humans to Mars, we will need to figure out how to keep our astronauts safe and well for longer term stays. Dr. Newman said this includes considerations such as building a habitat, supplies, and infrastructure that they cannot bring from Earth, creating new space suit technology and life support systems, and developing the ability to grow food in space.

Dr. Newman devoted part of her talk to the topic of teaching the STEM (science, technology, engineering, and math) fields. She believes the American education system has discouraged students from pursuing STEM, and she called for a broader and more inclusive approach.

Adding art and design fields to the traditional STEM rubric, Dr. Newman prefers to think of the Mars mission as a "STEAMD" effort. Space exploration requires talents from artists who can illustrate the places humanity has never traveled, and NASA needs historians who can recount where we have been, she said.

Dr. Newman ended her talk with a few examples of exciting new technologies in development. One in particular is the James Webb Space Telescope, which has 18 articulating mirrors and will launch in 2019.

"It's going to be 100 times more powerful than Hubble, and it's really going to look for the answer to dark energy and dark matter. That's 96 percent of the universe," commented Dr. Newman. "It's kind of unsatisfactory that we only know four percent [currently]. So let's go find out what the 96 percent is out there."

EDITOR'S NOTE: Portions of this article are excerpted from the *GW Today* article "NASA Must Invest in Technology, Diversity to Get to Mars."

New Faculty



Dr. Payman Dehghanian

After earning his PhD in electrical engineering from Texas A&M University in 2017, Payman Dehghanian joined SEAS in January 2018 as an assistant professor in the Department of Electrical and Computer Engineering. He conducts research on power system reliability assessments and asset management tools; power system resilience enhancement; weather-driven modeling; and electrical cybersecurity. Dr. Dehghanian was named the 2016 Best Engineering Graduate Student in the State of Texas by the Texas Engineering Foundation Board of Trustees, and he received the 2015 IEEE-HKN Outstanding Young Electrical Engineer Award, presented by the Educational Activities Board of the Institute of Electrical and Electronics Engineers.



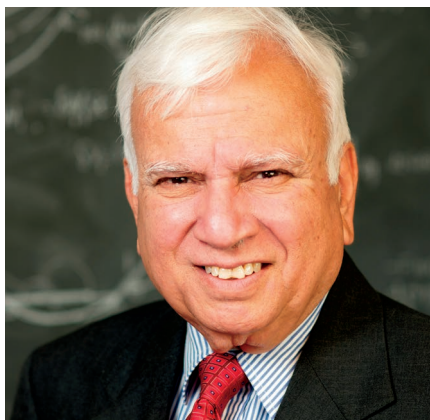
Dr. Anne-Laure Papa

Anne-Laure Papa joined SEAS last fall as an assistant professor in the Department of Biomedical Engineering. After receiving her PhD from the University of Bourgogne, France, Dr. Papa served as a post-doctoral fellow at Brigham and Women's Hospital and the Harvard-MIT Program of Health Sciences and Technology. Following that, she served as a post-doctoral fellow at Harvard University's Wyss Institute for Biologically Inspired Engineering. Dr. Papa conducts research in engineering novel therapeutic platforms at the interface of chemistry, biology, and medicine. Her work focuses on disease processes, particularly in cancer and vascular diseases, with the goal of designing targeted translational therapies and new diagnostic methods.



Dr. David James

David James is an assistant professor of practice in the Department of Computer Science. He is a teacher, researcher, and songwriter who focuses on the intersection between art, music, and computing, and he builds courses that use Black music aimed at retaining and recruiting students who have been underrepresented in computer science and information technology. Dr. James earned his PhD in information science and technology from Syracuse University, and he served as research advisor and teaching fellow for undergraduate students at the University of Pittsburgh's iSchool Inclusion Institute, which has the goal of exposing underrepresented students to careers in computing.



Transitions

Dr. Muhammad Haque, a longtime faculty member of the Department of Civil and Environmental Engineering, retired from GW in May of last year.

After completing his PhD at Colorado State University and working briefly at the University of British Columbia (Vancouver, Canada), Dr. Haque joined SEAS in 1978 as a research associate. He rose through the ranks over the years, becoming a full professor in 1996. SEAS wishes him well in his retirement.

Honoring Success

At its biggest faculty awards ceremony yet, SEAS honored six professors in 2017 for excellence in teaching and research. It was the ninth annual ceremony for the awards, which Dean David Dolling established in his first year as dean of SEAS.

"We've developed the tradition of this faculty awards presentation, in part, because honoring their hard work and achievements is right and proper, and in part, because I believe that success breeds success," Dean Dolling explained.

Dr. Murray Snyder, of the Department of Mechanical and Aerospace Engineering (MAE), received the SEAS Distinguished Teacher Award, and **Dr. Saniya LeBlanc**, also of MAE, received the SEAS Outstanding Junior Teacher Award.

Both were recognized for the "real-world" focus of their instruction and their efforts to prepare students to problem solve in their careers. Dr. Snyder leads the Clark Scholars Program for SEAS, as well as the school's mini-Baja and rocket teams. Dr. LeBlanc worked with her colleagues, Dr. Ekundayo Shittu and Dr. Volker Sorger, to create GW's Nanotechnology Fellows Program during her first year at SEAS.

The SEAS Distinguished Researcher Award was shared by **Dr. Suresh Subramaniam** and **Dr. Kausik Sarkar**.

Dr. Subramaniam is a member of the Department of Electrical and Computer Engineering faculty and an internationally-recognized scholar in optical networking. He has made numerous pioneering contributions to optical network architectures and resource allocation algorithms. In addition to achieving a record of continuous success in research funding, he frequently is invited to serve in leading roles in conferences and journals.

Dr. Sarkar, who serves on the MAE department's faculty, is a prolific scholar in acoustics and flows of bubbles, drops, liposomes, and nanoparticles, with applications to biomedical flows, ultrasound imaging, and ultrasound induced drug delivery, therapy, and tissue engineering. Dr. Sarkar has achieved an impressive funding and publications record, and he has been named a fellow of four top national professional societies since joining GW in 2011.



The SEAS Outstanding Junior Researcher Award was also shared by two faculty members, **Dr. Tim Wood** and **Dr. Megan Leftwich**.

Dr. Wood is an associate professor in the Department of Computer Science who works at the intersection of computer networks and operating systems. He has six patents and several open source project releases, including OpenNetVM, which has been used by researchers at IBM, HP Labs, and Intel. Dr. Woods' work has been funded by the National Science Foundation, Google, Yahoo, Comcast, and Amazon.

Dr. Megan Leftwich, an assistant professor in the MAE department, has built an impressive and diverse research program. She conducts research across a variety of topics related to the experimental study of geophysical and biological fluid flows. Her range of topics—which includes, for example, the fluid mechanics of human birth and sea lion locomotion—is innovative and unconventional, and her research has been featured in the *New York Times*, *Smithsonian Magazine*, and *Wired* magazine.

SEAS congratulates our winners of the 2017 Faculty Research and Teaching Awards.



Dr. Snyder



Dr. LeBlanc



Dr. Subramaniam



Dr. Sarkar



Dr. Wood



Dr. Leftwich

In Memoriam

Dr. Galip Arkilic, professor emeritus of SEAS, died peacefully at his home on September 25, 2017. He was 97 years old. Dr. Arkilic started his career in industry and moved to GW in 1958. In 1963, he was elected full professor. He served as the chairman of the Department of Engineering Mechanics from 1966 to 1969, as assistant dean of SEAS from 1969 to 1974, and as a long-time faculty representative to the Engineer Alumni Association. Dr. Arkilic was elected emeritus upon retiring in 1990. In retirement he continued to live an active life, traveling throughout his beloved U.S. He is survived by his wife of more than 60 years, Ann Arkilic; their four children, Victor, Dennis, Layla, and Errol; and five grandchildren.

Achievement



Jaclyn Brennan

A COMPASS Maker

Students in STEM (science, technology, engineering, and math) fields are often in the enviable position of having numerous potential career paths following graduation. Sometimes, however, the networking and job selection process can seem a bit daunting when the possibilities are plentiful.

Jaclyn Brennan, who is studying for her doctoral degree in biomedical engineering, has decided to try to make the task a bit less daunting, not just for her but for her STEM peers, too. Last fall, she launched COMPASS, a professional networking organization for GW graduate students in STEM fields.

“COMPASS helps graduate students like me identify next steps after graduation, specifically through networking. The unique thing about the organization is that it spans all GW colleges that are STEM-related,” she explains. “COMPASS organizes a variety of professional and social events to help graduate students explore and prepare for their future careers. We host networking socials, skill-building work-

shops, and career talks by GW alumni or local professionals.”

Perhaps Jaclyn sees so many possibilities, because she already has pursued a number of them successfully. Prior to coming to GW for her doctoral studies, she spent a year in France as a Whitaker International Fellow and six months working for the biotechnology company MedImmune. Jaclyn used her fellowship as an opportunity to pursue research on cardiovascular cells at Ecole Polytechnique. At MedImmune she worked in a cell culture and fermentation lab, helping to scale up vaccine development. She credits both experiences with preparing her for her doctoral studies.

“The Whitaker Fellowship made me realize I was happiest working in an interdisciplinary field with a diverse team of researchers,” she says. “And at MedImmune, I learned that in order to be at the forefront of innovation, I needed to pursue a PhD.”

Jaclyn decided to do her doctoral degree at GW because it is close to federal agencies and research centers such as the National Institutes of Health and the National Institute of Standards and Technology, and to many hospitals and medical centers. She also was drawn to the possibility of pursuing science policy here in the nation’s capital. “Washington, D.C. just seemed like the perfect hub for my PhD,” she concludes.

Now in her fourth year at GW, Jaclyn works as a graduate research assistant in Dr. Igor Efimov’s cardiac electrophysiology lab, where she investigates how the pacemaker functions in the heart to help improve its functionality under failing conditions. Jaclyn is enthusiastic about her time in the lab and the possibilities it has created for her.

“It’s been absolutely phenomenal. I’ve loved my experience in [Dr. Efimov’s] lab,” she exclaims. “He always has a lot of great ideas and gives us opportunities to pursue them. He also has so many international and interdisciplinary collaborations, so in my three years in his lab, I’ve had the opportunity to do research in Bordeaux, France for a summer, travel to a lab in Munich, Germany to teach other doctoral students our experimental techniques, and visit a start-up in California to learn about cardiac cell reprogramming, a technique that we are now implementing in our lab at GW.”

Building Connections

Duncan d’Hemecourt can imagine himself pursuing a number of interests following his graduation, but the topic that seems most appealing and intriguing to him right now is space. He started working on GW’s cube satellite project, GW-SAT, last summer and it has sparked his interest in the space industry to a degree that he never imagined it would.

“There are new opportunities for universities and private individuals to test their ideas in space right now, because of the exciting growth of the commercial space industry,” says Duncan.

Now in his final year of a five-year, combined Bachelor of Science/Master of Science program in electrical engineering, Duncan continues to find and create opportunities for himself. In addition to being a very good student and a hard worker, he is adept at building connections across his department.

He believes that SEAS makes this easy to do, and he recommends that other students not be shy about building connections, too. “It’s not difficult to approach a professor here,”

Duncan d’Hemecourt



Duncan argues. “People are very inviting. The professors always know other people, so it’s important to take the initiative to go talk to them.”

That’s how he got involved with the GW-SAT project. Dr. Can Korman, the associate dean for research and graduate studies, recommended that Duncan speak to the project manager. Duncan followed up, and now he is working with a team of students to program and wire the satellite. With his interest in space growing, he subsequently found a position in the Space Exploration Division at Johns Hopkins Applied Physics Laboratory, where he will intern this summer.

Duncan took on other research projects, too, after SEAS faculty recommended him for different positions. Last summer, he was recommended for work in Dr. Roger Lang’s lab. And during the previous summer, he served as an intern for the Naval Research Laboratory, making that connection while doing research for Dr. Volker Sorger.

Duncan’s research experience continues to reap rewards—and some awards—for him. Last year his team won the school’s Pelton Award for Outstanding Senior Project. He and teammates Sam Cowin and Eli Andrew worked on a dynamic traffic management system that could use smart phones in drivers’ cars to optimize traffic flow. Their project also advanced to the semi-final round of GW’s 2017 New Venture Competition.

When asked to reflect on what he has learned over nearly five years, Duncan replies, “The main thing I have learned in college has been how to learn efficiently.” He pauses and adds, “And the importance of connecting with others.”

At Home in the Lab

In 2011, when Louise Lu was a high school student, she and her family immigrated to the U.S. and settled in Northern Virginia. Just two years later, Louise had to start looking for her next new home when she began her search for a college. Her search ended at GW.

“The new [Science and Engineering Hall] really attracted me, but GW offered me very generous financial aid, which is exactly what I needed,” she recalls.



Louise Lu

With an interest in art and architecture and an aptitude for math and physics, Louise decided to study civil engineering. She dove into her studies and into opportunities outside of her classes, thriving during her four years and getting an introduction to a breadth of research fields within civil engineering.

The summer after her freshman year, Louise took an internship with SK&A Structural Engineers here in Washington, D.C. During her sophomore year, she completed a semester of study abroad at Korea University (KU) and followed that up with a research internship assisting with a vibration control project at a KU lab. That was a turning point for Louise.

“GW helped me to land on that experience at KU, and that was my first research experience,” says Louise. “At that point I realized that I actually enjoyed research and I like being in a lab environment. I changed my whole point of view after that, and now most of my experience is in research. GW also gave me the funding to pay me while I was doing research in Korea.”

Louise says that her summer research at KU taught her how to think as an academic researcher and helped inspire her to focus on structural engineering. So, when she received a prestigious fellowship the following summer from the National Science Foundation’s Undergraduate Research Fellows Program, she decided to undertake structural computation research at the University of Southern California.

Louise’s curiosity pushed her beyond that research field, too. During her time at SEAS, she also has worked in two other labs in the Department of Civil and Environmental Engineering. In Dr. Danmeng Shuai’s environmental engineering lab, she learned about wastewater treatment technology, and in Dr. Samer Hamdar’s Center for Intelligent Systems Research Lab, where she currently works, Louise is constructing a laboratory-scale autonomous electric vehicle.

Referring to this range of research experiences, Louise adds, “These have all enabled me to see different disciplines within the engineering field.”

Although Louise has focused on research as a college student, she also has served as a teaching assistant for two undergraduate courses and has been involved in campus activities, including the Women’s Leadership Program, the Global China Connection, and GW’s student chapter of the American Society of Civil Engineers.

When asked what she has enjoyed most about her activities, Louise steers the question back to her department and its professors and students. “I really don’t know what I would become without my department,” she remarks. “All the professors know us by name; it’s like a family. The professors and students have all been really encouraging, caring, and inspiring. I will always remember my professors and classmates after I graduate.”

News

Supporting the SEAS Transformation

SEAS thanks our alumni and friends whose generous gifts support new funds or programs that are helping to further the SEAS transformation. The following list includes those gifts received since April 1, 2017:

Dina Al-Sabah (SEAS BS '97, MS '99, GWSB MBA '01) created the Dina Al-Sabah Annual Scholarship to support students with a demonstrated interest in innovation.

The **American Bureau of Shipping** made an additional gift to support Dr. Stephen Hsu's research on icephobic material behavior.

W. Scott Amey (MS '75) and his wife, Deborah, made an additional gift to support the Knowledge in Action Career Intern Fund (KACIF) at SEAS. KACIF is a highly competitive program that provides grants of up to \$3,000 to GW undergraduate and graduate students pursuing internships that are necessarily unpaid.

Sidney O. Dewberry (BS '51) made a generous contribution to support the Department of Civil and Environmental Engineering.

The **Henry Luce Foundation** has awarded GW a \$300,000 Clare Boothe Luce Program undergraduate research grant. The grant provides funding for promising female SEAS students to pursue research with guidance from faculty mentors, hone their professional skills, and establish themselves as university leaders.

Mark Hughes III (CCAS BS '69, SEAS MS '77) has made a very generous gift to support the SEAS Dean's Excellence Fund.

Leidos made a gift to support the SEAS Industry Partners Program and sponsored the New Student Getaway, Society of Women Engineers, National Society of Black Engineers, Association for Computing Machinery, SEAS Student Research and Development Showcase, a Leidos information session, and collaborative research in the area of data analytics.

Dov (MS '83) and Elma Levy made a gift to the SEAS Dean's Fund and the GW Innovation Center.

The **March of Dimes Foundation** is supporting work by Dr. Lijie "Grace" Zhang on a 3D bioprinting smart nanostructured soft tissue graft for spina bifida repair and neurological function recovery.

Reginald Mitchell (BS '65) established the Reginald S. Mitchell Endowed Scholarship, which will provide a merit- and need-based undergraduate scholarship for students who demonstrate an interest in working in the railway or airline industries.

The **Nelson (BS '85) & Michele Carbonell Family Foundation** continues its support of the Nelson & Michele Carbonell Engineering Endowed Scholarship for students at SEAS.

Çağatay Özdogru (MS '91) established the Çağatay Özdogru Scholarship Fund, which will provide merit-based scholarships for undergraduate students at SEAS, with preference to students studying electrical and computer engineering.

Nicholas Paleologos (BS '69) and his wife, Suellen, augmented their support of the Paleologos Scholarship Fund with a generous gift to support scholarship awards for undergraduate students pursuing a degree in civil engineering.

Orville Standifer Jr. (BS '67) made a bequest intention to provide annual support to SEAS. Mr. Standifer first began giving to SEAS in 1979.

The **Water Environment & Reuse Foundation** is supporting work by Dr. Rumana Riffat to improve understanding of the factors that affect hydrolysis and to evaluate technologies and approaches to increase hydrolysis rates during anaerobic digestion.

The **World Bank** funded an outreach program through the GW Innovation Center to host female entrepreneurs from the MENA (Middle East and North Africa) region on GW's campus.

Five New Members Inducted into Hall of Fame

On October 27, 2017, Dean David Dolling inducted a SEAS faculty member and four alumni into the GW Engineering Hall of Fame, celebrating the successes of the school's community.

The Hall of Fame was established in 2006 and now has 71 members. Counted among them are corporate leaders, entrepreneurs, researchers, members of the National Academy of Engineering, an Oscar winner, a former astronaut, a former Member of Congress, and the youngest person to be named a Fellow of the IEEE. SEAS is pleased to introduce our newest members:

Abdullah Almojel (DSc '97) is the president and managing director of Global Dimension for Education and Training, the organization he founded in 2012 to build institutional capacities for educational and training organizations for Saudi and Gulf Cooperation Council countries. In 2001, the Saudi Minister of Higher Education selected Dr. Almojel to be his Deputy Minister for Cultural Relations, a position he held for eight years. He also is a founding member of the executive leadership team of the King Abdullah University for Science and Technology.

Retired Lieutenant General Thomas Bostick (PhD '16) is senior vice president of Intrexon Corporation's Environment Sector. He accepted the position in 2016, after retiring from a 38-year career with the U.S. Army. General Bostick's U.S. Army career culminated in service as the 53rd U.S. Army Chief of Engineers and Commanding General of the U.S. Army Corps of Engineers. In this role, he was responsible for most of the nation's civil works infrastructure and military construction and for hundreds of environmental protection projects. Before his command as the U.S. Army Chief of Engineers, General Bostick served in a variety of command and staff assignments with the U.S. Army, most notably as the Deputy Chief of Staff, G-1, responsible for total Army personnel and manpower. In 2017, he was honored with election to the National Academy of Engineering.

Christine Mann Darden (DSc '83) is a retired NASA director and aerospace engineer and an internationally recognized



Left to right: Abdullah Almojel, Thomas Bostick, Christine Mann Darden, GW President Thomas LeBlanc, Dean David Dolling, David Ray (Raytheon), and Richard Ivey

authority in the field of sonic-boom minimization. She began her career at NASA as a data analyst and became known as one of NASA's "human computers" in the '60s and '70s. Her story features in the 2016 bestseller, *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race*. In 1999, Dr. Darden became a member of the Senior Executive Service at NASA. She served as the director of strategic communications and education before retiring in 2007.

Dr. Rachelle Heller is a professor of computer science at SEAS. She joined GW in 1985 and has served the school and university in various leadership roles throughout her career. She initiated two enormously successful programs—the SEAS Student Peer Advisory Network and the much-loved New Student Getaway—and she laid the groundwork for the school's expanded study abroad program. Her real passion is bringing women into STEM (science, technology, engineering, and math) fields and in developing their leadership capacities. She accomplished this most notably in her former roles as the associate provost for academic affairs at

GW's Mount Vernon Campus and as leader of the Elizabeth Somers Women's Leadership Program, where she mentored and guided nearly 1,000 young women.

Richard Ivey (MEA '89) is worldwide vice president of research and development for Diagnostics Systems at the global medical technology company Becton Dickinson. Mr. Ivey leads a research and development team of more than 400 engineers and scientists who are spread over six sites worldwide. Mr. Ivey has successfully led Diagnostics Systems to deliver more than 15 new instrumented diagnostic platforms for the company. He also established Becton Dickinson's R&D presence in China. He has received multiple U.S. and worldwide patents for his work in the field of bacterial sepsis detection.

During the ceremony, Dean Dolling also presented the school's 2017 Distinguished Industry Partner Award. "Tonight, we honor the commitment of our partner Raytheon to engineering education at SEAS," he said, noting that the award celebrates the benefits that both industry and academia receive when they form strong partnerships.

As a SEAS Industry Partner, **Raytheon** has sponsored SEAS senior design projects and activities hosted by the school's student mentor program, and it has begun working with SEAS to create career mentoring relationships and employer site visits for students. Raytheon also has begun supporting select faculty research topics, including a grant for "Big Data" research conducted by Dr. Howie Huang of the Department of Electrical and Computer Engineering, and a grant to Dr. Michael Keidar of the Department of Mechanical and Aerospace Engineering. Dr. Keidar's research team is developing GW's cube satellite as part of NASA's CubeSat Launch Initiative.

Making SEAS Proud

GW honored four SEAS alumni in 2017 for service, professional achievement, and entrepreneurial achievement, respectively.

In April, **Dean Coclin (BS '84)** received the Alumni Outstanding Service Award for his years of active service to the university's alumni community. Dean is a founding member of the Luther Rice Society Advisory Council, which he led as its chair from 2010 to 2014. He remains very active in it, planning events, recruiting new members, and even hosting events in his home. Dean also is a member and co-chair of the Boston Regional Alumni Chapter, and a member of the GW Alumni Association Board of Directors. He also served on the GW Council of Chairs from 2012 to 2014.

At the Alumni Outstanding Service Awards ceremony, Dean David Dolling paid tribute to the depth of Dean's active commitment to the Boston alumni chapter, stating, "As I like to say, Dean 'brings' GW to Boston so



Dean Coclin (right)

Vicki (center) and Karl Gumtow (right)



alumni and friends there can connect to GW when they can't *get* to GW."

At GW's annual New Venture Competition, also held in April, Dean Dolling presented the GW Distinguished Entrepreneurial Achievement Award to SEAS alumni **Karl (BS '92) and Vicki (BS '91) Gumtow**. After gaining experience in senior management positions at Booz Allen Hamilton and SRA, Karl and Vicki decided to start their own company. In 2009, they launched CyberPoint, a cyber security company that provides technical consulting and services to help enterprises protect critical networks, assets, and infrastructure. CyberPoint began with two employees—Karl and Vicki—and as it grew, they began spinning off companies. By 2017, they had spun off five. In 2015, *Inc. Magazine* named CyberPoint to its list of 5,000 fast growing, privately held companies, based on the company's growth and revenues.

In addition to their work as entrepreneurs, the Gumtows spend a great deal of time and energy working as philanthropists to help build the Baltimore community, where they live. Their \$1 million pledge, made through CyberPoint in 2015, will establish a charitable endowed fund through the Baltimore Community Foundation to support educational initiatives and other causes.

In October, SEAS was able to celebrate the accomplishments of yet another alumnus. This time, the school celebrated **Rodolfo "Rudy" Rodriguez (MS '69)**, who was honored at GW's annual Distinguished Alumni Achievement Awards ceremony.

Rudy is a gifted and prolific researcher and inventor who has co-invented or managed the development of several products that have changed the way health care is practiced in the U.S. Over the course of his career at Baxter International, Beckman Coulter, and Becton Dickinson, he was so successful at developing new technologies that he was awarded the R&D 100 Award four times for one of the "100 Most-Significant New Technical Products of the Year." He also was elected in 2016 to the National Academy of Engineering "For inventions to analyze blood and separate blood components that enable widespread clinical therapies."

When he retired in 2001, Rudy founded Advanced Animal Diagnostics, where he serves as the company's chief scientific officer. He had seen what diagnostic equipment could do for veterinary practice and he knew that it could make critical advances in livestock production and animal care.

SEAS congratulates Dean, Karl and Vicki, and Rudy on their well-deserved recognition.

Rodolfo "Rudy" Rodriguez (center)





Kevin Kelly

NAC Update

My term as SEAS National Advisory Council (NAC) chair began in April 2017, and I am thrilled to play a leadership role in advancing the mission of GW's engineering school. Joining me as vice-chair is long-time SEAS volunteer and donor **Aran Hegarty (MS '97)**.

At the NAC meeting in October, the council had the opportunity to meet with current undergraduate and graduate students and learn first-hand some of the strengths of the student experience at SEAS and some of the

opportunities that students have at SEAS. Over the upcoming year, we as a council will focus on supporting developmentally enriching programs at SEAS that will help recruit and retain the brightest talent, particularly in under-represented areas.

In July 2017, we were also pleased to welcome to the NAC three new members, who are all active volunteers at SEAS. I'm happy to introduce them here:

Anirudh Kulkarni (BS '86, MS '88)

Anirudh is the founder and CEO of CVP. He has over 20 years of experience in business and technology consulting, strategy development, change management, and advanced technology strategy. Anirudh's specialties include e-commerce, customer relationship management, operations and IT alignment, organizational transformation, and operations research. His industry expertise lies in government, media, telecommunications, and financial services.

Elizabeth D'Andrea (DSc '06)

Elizabeth was the former program manager for the Electromagnetic Railgun Program at

the Office of Naval Research. Previously, she was the program executive for the Department of Defense Counter-Narcoterrorism Technology (CNT) Program for the Deputy of Defense for Counternarcotics Office. As the program executive for CNT from 2001 to 2006, she directed capabilities to support the CNT operations for combatant commanders and host nations. She directed the development of technology and special systems to enhance the counter-narcoterrorism capabilities of the military and civilian drug law enforcement agencies.

Mark Mykityshyn, Friend

Mark is the executive chairman and CEO of Tangible Security, a technology-enabled cyber security firm that serves both the federal government and commercial markets. Mark has over 30 years of experience in the aviation, aerospace, defense, cyber, and national security industries as a naval aviator, consultant, academic researcher, and operator. He has co-founded and managed three companies, including both venture capital and private equity funds that were focused on building technology companies that serve these industries. Mark also serves on the GW Research Advisory Board.

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- ▶ Flexibility to support the SEAS program of your choice
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- ▶ No change in lifestyle since your gift comes from leftover funds



Thank You

SEAS thanks our alumni who donated their time to GW during calendar year 2017. The following alumni volunteered on campus or throughout the country or world during 2017.

Erkinay Abliz

Sana Al-Hajj

Emily Alexander

William Alexander

Beverly Allen

Miguel Alvarez

W. Scott Amey

Huda Asfour

Paige Atkins

Serena Aunon-Chancellor

William Austen

Christian Benz

Dimitri Bleifer

Auguste Boova

Franklin Bourdeau

William Brittle

Deborah Butterfly

Nelson Carbonell

Jessica Castillo

Edward Chesnut

Atiq Chowdhury

Emily Cleary

Dean Coclin

Gennaro "Gene" Colabatistto

Gregory Colevas

Terry Collins

Matthew Cusack

Richard Cyr

Elizabeth D'Andrea

Nolan Danchik

Aleksandra Desansky

Donald Dinger

Minha Do

Thomas Doherty

William Edison

Hatem Elbidweihy

Amr ElSawy

Loretta Evans

Jack Ferrell

Barbara Fleming

Michael Fleming

Arush Gadkar

Sukhdeep "Gulu" Gambhir

Amit Garg

Solome Girma

Randolph "Randy" Graves

Brian Gross

Tamara Guthrie

Jon Halpern

Alexandra Halvordson

Gazelle Hashemian Kimiavi

Aran Hegarty

Todd Hetherington

John Holmblad

Mark Hughes

Samantha Hurley

Naeem Hussain

Rafael Jaimes

Kumar Jeev

Ashok Jha

Li Jiang

Pedram Kanzi

Amit Kapoor

David Karlgaard

Martin Kaszubowski

David Keever

Kevin Kelly

Kimberly Kessler Murray

Sassan Kimiavi

Matthew Knouse

Anirudh Kulkarni

Andrew Lacher

Rory Lamond

Simon Lee

Dov Levy

Elma Levy

Renee Lewis

Dunling Li

Jiaoyan Li

Philip Lopreiato

Anthony Lyons

Joseph Mancuso

Patrick Marolda

Lataunja Martin

Josephine Mascher

Scott McQuade

Erin Mignano

Asghar Mostafa

Mark Mykityshyn

Marjan Nabili

Jonathan Nahill

Richard "Dick" Norman

Kristy Ortiz

Nicholas Paleologos

Mary Pastel

Hetal Patel

Giovanna Patterson

Alexsis Petrikis

Charles Polinger

Artie Polk

Gaby Porras

Randa Radwan

George Reynolds

Manny Rivera

Christina Rodgers

Rodolfo "Rudy" Rodriguez

Brian Schmanske

Fatima Senghore

Rohit Sharma

Winslow Sheffield

Marija Stefanovic

Mitchell Stevens

Lolita Street

T. Richard Stroupe

Lalita Subramanian

Mansi Talwar

Shravalya Tirumala Valet

Howard Tischler

Mayur Vador

William "Bill" Varner

Indrajeet "Jeet" Viswanathan

Huachuan Wang

Leyu Wang

Charles Watt

Prem Wells

Ahmed Weshahy

Bradley Whittington

Carl Wick

Christopher Wiernicki

Matthew Wilkins

Bin Zhang

Taisen Zhuang

Mary Zikria

Happenings

Amrith Aakre, BA '03 (applied science & technology), was featured in 2018 Legal List of Leading Women Lawyers in New York City. She presently is the legal director of the Sikh Coalition, providing legal and policy assistance to members of the Sikh community. She formerly served as the assistant state attorney in Cook County, IL.

Abdullah Alabbas, DSc '92 (electrical engineering), serves as the assistant deputy minister for electricity in the Government of Saudi Arabia's Ministry of Energy, Industry & Mineral Resources.

Jessica Aresta-DaSilva, MS '11 (engineering management), recently received a promotion at Plains All American, L.P. / Midstream Energy Company as a lead incident investigator. Jessica credits her GW education and eight years of progressive career experience for her promotion.

Rachael Bevill, BS '15, MS '17 (biomedical engineering), wed **Joey Burns, BS '17 (computer science)**, on November 4, 2017. The two left for Germany three days later to begin a nine-month residency in Stuttgart, Germany working for the Max Planck Institute for Intelligent Systems (MPI-IS). Rachael is a 2017 recipient of the Whitaker International Fellowship, a funding opportunity for emerging U.S. leaders in biomedical engineering. She will research the use of haptic devices and social robotics to improve the well-being of children with autism spectrum disorder, under the mentorship of Dr. Katherine Kuchenbecker, MPI-IS director of the Department of Haptic Intelligence. Joey will serve as the IT administrator for the MPI-IS Haptic Intelligence and Physical Intelligence Departments.

Nelson Carbonell, BS '85 (electrical engineering), and his wife, Michele, and Kevin Pelphrey, all of the GW Autism and Neurodevelopmental Disorders Institute received a Research and Innovation Award at the Melwood Ability Awards, held December 7, 2017 at MGM National Harbor. The awards recognize Greater Washington's individuals and institutions making a lasting impact on people with disabilities.

Richard Ira Crouthamel, DSc '96 (engineering management), has been named associ-

ate editor of the *Geoscience Data Journal*. Richard is also the executive director of the International Environmental Data Rescue Organization, which has been locating, imaging, and digitizing historic hydro-meteorological observations from 15 developing countries for the past dozen years.

Amir Faghfoory, BA '02 (computer science), is in private practice in tele-psychiatry in Los Angeles, CA.

Charles Garris, MS '97 (mechanical engineering), co-authored the peer-reviewed article "The United States Patent System and Engineering Education: An Alliance for Innovation" with his father, Charles Garris Jr., a professor of mechanical engineering here at SEAS. The two published the paper in the *Journal of the National Academy of Inventors'* October 2017 special issue, "Technology & Innovation Curricula."



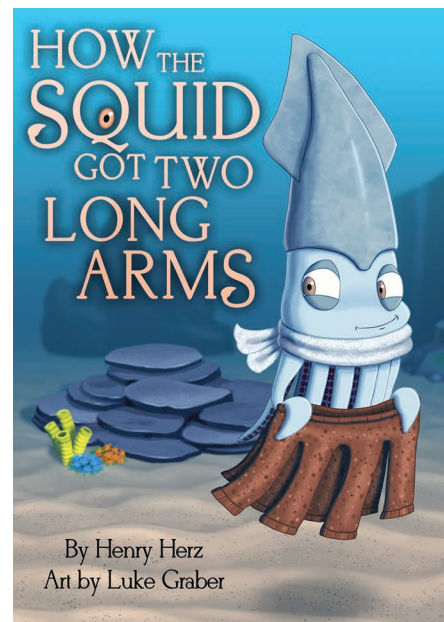
Kenneth Geisinger, MS '70 (operations research), is retired and volunteers as a classroom mathematics aide at St. Joseph's Catholic School in Bradenton, FL. Before his retirement, he worked as an operations research analyst for the U.S. Army Concepts Analysis Agency and for the Federal Aviation Administration. Kenneth is pictured with his wife, Jeanette.

Edward Gold, BS '76 (electrical engineering), relocated to the Tucson, AZ area in 2016, after accepting a job as principal supplier quality engineer with Raytheon Missile Systems Company.

Ahed Gondal, MS '15 (systems engineering), moved to Arizona last year to work for Raytheon Missile Systems as a senior systems engineer II. This opportunity allows him to be at the forefront of technology in the defense industry. Moving from the green hills of Northern Virginia to the desert of Arizona has been an interesting change,



and a chance for his wife and him to explore the southwestern region of the U.S. (Photo above)



Henry Herz, MS '84 (operations research), has had three children's picture books published in the last year: *How the Squid Got Two Long Arms* (Pelican Publishing); *Alice's Magic Garden* (Familius Publishing); and *Good Egg & Bad Apple* (Schiffer Publishing).

Forbes quoted **Christyl Johnson, PhD '12 (systems engineering)**, in the October 18, 2017 article "NASA's Dr. Christyl Johnson Shares Her Career Path and Advice for Advancing Women in STEM."



On January 30, 2018, after a six-day hike, SEAS National Advisory Council members **Dov, MS '83 (computer science)**, and **Elma Levy** summited Mt. Kilimanjaro in Tanzania. (Middle photo, left column)



Foscolo Liano, MS '88 (civil engineering), is the owner of Grupo Muratori and representative of MK4 Postensioning System in Guatemala, Central America. His company is building two of the main bridges in the country, Benqueviejo (90 meters long) and Chetumal (150 meters long). (Bottom photo, left column)



On June 2, 2017, **Alessandra (DeSarno) Kelly, BS '10 (systems engineering)**, and husband William Kelly welcomed a baby girl, Evelyn Anne Kelly, to their family. (Top photo, above)

Elliott Kugel, MS '83 (computer science), was named as one of "America's Top 250 Wealth Advisors" in the October 24, 2017 issue of *Forbes* magazine. Elliott is a managing director of investments at Merrill Lynch in Bridgewater, NJ, and resides in Skillman, NJ.

Naill Momani, DSc '02 (engineering management), recently joined German Jordanian University as associate professor of risk and business continuity management. The university has established the organization Excellence in Business Continuity and Crises Management, and Naill is interested in partnering with classmates in the crises management domain to offer professional and academic qualification in the MENA region.



Christine Predaina, MS '08 (engineering management), received the Emerging Leader Award from the Society of Women Engineers "For exhibiting true leadership capabilities while developing the next generation of engineering trailblazers; and for advancing an innovative approach to systems engineering collaboration." Christine is the director of program management operations for Northrop Grumman's Technology Services sector.

Manuel Pérez Quiñones, DSc '96 (computer science), is the associate dean of the College of Computing and Informatics at the University of North Carolina at Charlotte. He recently received the Computing Research Association's 2018 A. Nico Habermann Award.



Michaela Stanch, BS '17 (civil engineering), was the recipient of the 2017 George Ellowitz Prize from SEAS. The prize is given to a SEAS student who demonstrates passion for and excellence in the humanities and social sciences. The recipient is given funds to go on a trip to pursue his/her passion further. Michaela went to Peru to study agriculture, Incan and Pre-Incan architecture and design, and fiber arts. She worked on a potato and tuber farm in southern Peru, visited Machu Picchu, and learned weaving and knitting from textile masters at El Centro de Textiles Tradicionales del Cusco.



Vivek "Vick" Taneja, DEng '18 (engineering management), is the co-founder and

president of Dynamo Technologies, which was recently recognized as #374 on *Inc.* 500's 2017 annual ranking of the fastest-growing private companies in America. The company was also awarded the Small Emerging Contractor Advisory Forum's 2017 Government Contractor of the Year Award. Dynamo Technologies provides cloud adoption and solution engineering, program planning and oversight, business intelligence and data analytics, and infrastructure support and modernization services to U.S. federal government and commercial customers.



Michael Treasure, DEng '18 (engineering management), has received an AccelerateGW I-Corp Program admission and grant and has decided to put all of his efforts into his new startup, Zyleck Technologies, Inc. The startup is a direct result of his PhD research work on vehicle utilization and optimization in the Transport Network Company (TNC) model. From his doctoral research, Dr. Treasure has been able to successfully demonstrate that his Lymousine TNC model is up to 50 percent more efficient than the model employed by other companies. Lymousine is now available in the Atlanta, GA market, but Dr. Treasure and his team are working through AccelerateGW to bring the service to Washington, D.C.

Rob Versaw, MS '15 (systems engineering), was selected last year as a member for the Forbes Technology Council. Rob



also recently founded his own company, Green SE3D, which provides a solution for realtors and landscape architects to help their clients visualize what their yards could look like.

In addition, Rob was named head product adviser and board member for a blockchain start up, Blockbox App.

Chris Wiernicki, MS '83 (civil engineering), was named the Massachusetts Maritime Academy's Person of the Year on September 21, 2017.



George Wilamowski, Jason Dever, and Steven Stuban—all of whom earned their PhD degrees in (systems engineering)—received 1st Place in the Defense Acquisition University's 2017 Hirsch Research Paper Competition. Dr. Wilamowski also presented a brief on the research paper "Using Analytical Hierarchy and Analytical Network Processes to Create Authorization, Authentication, and Accounting Cyber Security Metrics." The three co-authors donated the proceeds to the Semper Fi Fund.

Mohammad Zahid, MS '03 (telecommunications), served in the Pakistan Air Force (PAF) as an aeronautical engineer. After his retirement from PAF as a group captain, he joined the Institute of Space Technology in Islamabad as an assistant professor. There, he teaches avionics-related courses to undergraduate students in the avionics program. Mohammad and his wife and son live in Islamabad.



In Memoriam

SEAS alumna and National Advisory Council emeritus member **Giovanna "Gio" Patterson, MS '91 (computer science)**, passed away on January 28, 2018. Gio most recently served as vice president for Booz Allen Hamilton's health business at the National Institutes of Health.

Contact Us

SEAS ADMINISTRATION

David S. Dolling
Dean
202-994-6080

Rumana Riffat
Associate Dean for Academic Affairs
202-994-8591

Can E. Korman
Associate Dean for Research
and Graduate Studies
202-994-2245

Bhagirath Narahari
Associate Dean for Undergraduate
Affairs and Programs
202-994-6719

GW SERVICES

Alumni House
1-800-ALUMNI-7

SEAS SUPPORT SERVICES

Deanah McLeod
Assistant Vice President
Development and
Alumni Relations, SEAS
202-994-6059

Buthaina Shukri
Senior Associate Director of
Development, SEAS
202-994-4121

Mary Harvey
Associate Director of Development,
SEAS
202-994-4051

Durriyyah Jackson
Associate Director, Development
and Alumni Relations, SEAS
202-994-4036

Elizabeth Mellen
Associate Director, School Alumni
Programs, SEAS
202-994-1858

Joanne Welsh
Director
Communications
202-994-2050

Chalvonna Smith
Director
SEAS Career Services Center
202-994-4205

Jonathan Ragone
Director
Undergraduate Advising and
Student Services
202-994-7133

Brittany Wright
Director
Graduate Admissions
202-994-6158

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