



# C E E E

## UPDATE

*Spring 2018*



**PRINTING PARTS  
THAT DON'T BREAK:  
FROM PROCESSING TO PERFORMANCE 8**

# CEE LETTER FROM THE DIRECTOR



## LINDA NOZICK

Dear Alumni and Friends,

First, I cannot say thank you enough for your support on Giving Day, March 16. Thank you for your action and continued engagement with the school.

In this issue we have a feature on how water quality is assessed by using a “prototype pathogen panel.” Associate Professor Ruth Richardson leads this testing effort with the help of a colleague at Northwestern University and Dr. Monroe Weber-Shirk which is showcased in the article, “Rapid Testing for Waterborne Diseases,” on page 4.

We also feature the research of CEE Assistant Professor Greg McLaskey who studies the mechanics of friction, earthquakes, fractures and other processes that generate sounds and vibrations in large-scale rocks (page 6). Recently, he is interested in studying the flow of underground fluids to determine how to map them. Very interesting!

3D printing is a rising technology, and Associate Professor Derek Warner has been working with students to produce a variety of pieces via this means. On page 8, “Printing Parts that Don’t Break: From Processing to Performance,” shows the series of production.

In June 2017, Professors Philip Liu and Christine Shoemaker retired, and together their careers culminated in a joint event held in July 2017. Read about them and what

they are up to in post-CEE retirement on pages 10-13. If you took CEE 5950: Construction Planning and Operations starting in 2001, you must know Dr. Paul Carr. He too decided to retire and did so on December 31, 2017. Paul was instrumental in teaching this course as he structured it to provide students with knowledge about all of the phases of construction management. The class was exciting, challenging and professionally facilitated.

As Giving Day was inspiring for all of you, as well as students, faculty and staff, we reached out to ask three alumni who serve on CEE’s Advisory Council to share their feelings on why they give back.

We provide updates on our students’ experiences, faculty awards, and the staff changes that have occurred.

My sincerest thanks for reading this issue, staying connected to the school, and attending our events. Please keep in touch.

Linda K. Nozick  
Professor and Director



## ABOUT THE COVER

Students in Associate Professor Derek Warner’s course CEE 6725: *3D Printing Parts that Don’t Break: From Processing to Performance* smile as they display a successful

aluminum casing from a 3D printed mold. From left to right: Marissa D’Amelia ’17, Emilie Camera ’17, and Han Hao ’18. Read more about Warner’s course and see a spread of photos explaining the motives and process in this issue.

# TABLE OF CONTENTS

## FEATURE STORIES

**RAPID TESTING FOR WATERBORNE DISEASES.....4**

**LABORATORY EARTHQUAKES & SUBSURFACE FLUID FLOW.....6**

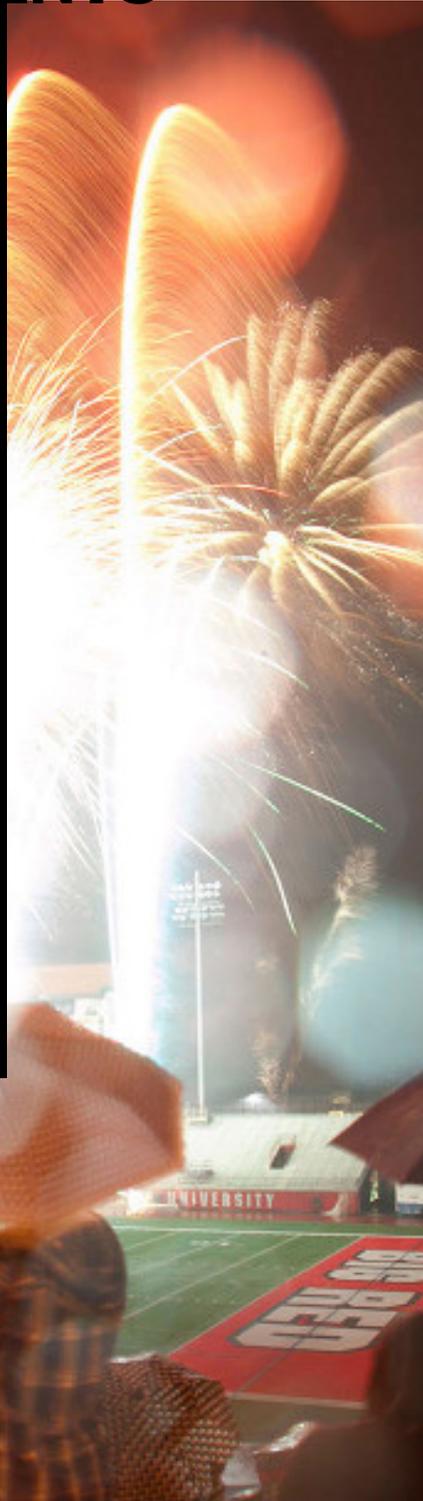
**LAB SPOTLIGHT  
PRINTING PARTS THAT DON'T BREAK.....8**

**ALUMNI  
GIVING BACK:  
IN THEIR OWN WORDS.....10  
SPOTLIGHTS.....12**

**NEWS  
MACHINE SHOP.....14  
STAFF & POSTDOCS.....14  
FACULTY.....15  
STUDENTS.....16**

**RETIREMENTS  
PHILIP LIU.....18  
CHRISTINE SHOEMAKER.....20  
PAUL CARR.....22**

**ANNOUNCEMENTS  
NEW TO CEE.....23**



## CEE UPDATE

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# RAPID TESTING FOR WATERBORNE DISEASES

*By Syl Kacapyr*



**W**aterborne diarrheal diseases are responsible for two million deaths each year, with the majority occurring in children, according to the World Health Organization. In some areas of developing nations, the only way to assess water quality is to use personal judgment.

“People rely on looking, smelling or tasting, but you can’t really tell, biologically, whether it’s safe or not safe from contamination,” says Ruth Richardson, a Civil and Environmental Engineering (CEE) associate professor who is working to develop a rapid test for waterborne diseases.

The idea for the test emerged after Richardson met Sera Young, Ph.D. ’08 and an assistant professor of global health studies at Northwestern University who had been a research scientist at Cornell. Young was examining water insecurity in developing nations, but didn’t have a way to measure water quality. Richardson had a background in techniques for assessing quality, but mostly in bioremediation and bioenergy.

So the two formed a partnership—along with CEE senior lecturer Monroe Weber-Shirk—and used a seed grant to merge their research interests. They started with a first-of-its-kind study that linked quantitative assessment of water quality to people’s perceptions of how safe it was. Their study, “Evaluating human sensory perceptions and the compartment bag test assays as proxies for the presence of concentration of *Escherichia coli* (*E. coli*) in drinking water in Western Kenya,” was published in the *American Journal of Tropical Medicine and Hygiene*.

“There definitely is a correlation, but it isn’t foolproof enough that you should just trust it,” said Richardson. “There were people who rated their water quality at the top level and they had a high level of fecal bacteria in it.”

Seeing the need for a rapid water quality test, Richardson began working on a prototype pathogen panel, a tool that could measure a dozen different waterborne viruses, bacteria and protozoa. She did this using polymerase chain reaction (PCR), a technique she had become familiar with through previous microbiology projects.

With PCR, enzyme-mediated reactions replicate the DNA of target organisms, such as *E. coli*, making billions of copies of their DNA until it reaches a detectable level. The concentration of the organism in the sample can then be compared to known standards in order to determine whether a water source contains dangerous levels.

Richardson’s prototype was a success, and now she is using

it as part of several other research projects. One project is using the pathogen panel to assess Honduran water filtration plants. The plants being tested are engineered by Cornell’s AguaClara program with the goal of bringing clean drinking water to rural communities.



Another project will assess water quality in Hudson River Valley tributaries, where pollution and sewage discharge remain a concern. According to a 2017 report from the non-profit Riverkeeper, 21 percent of Hudson River estuary samples failed to meet federal safe-swimming guidelines.

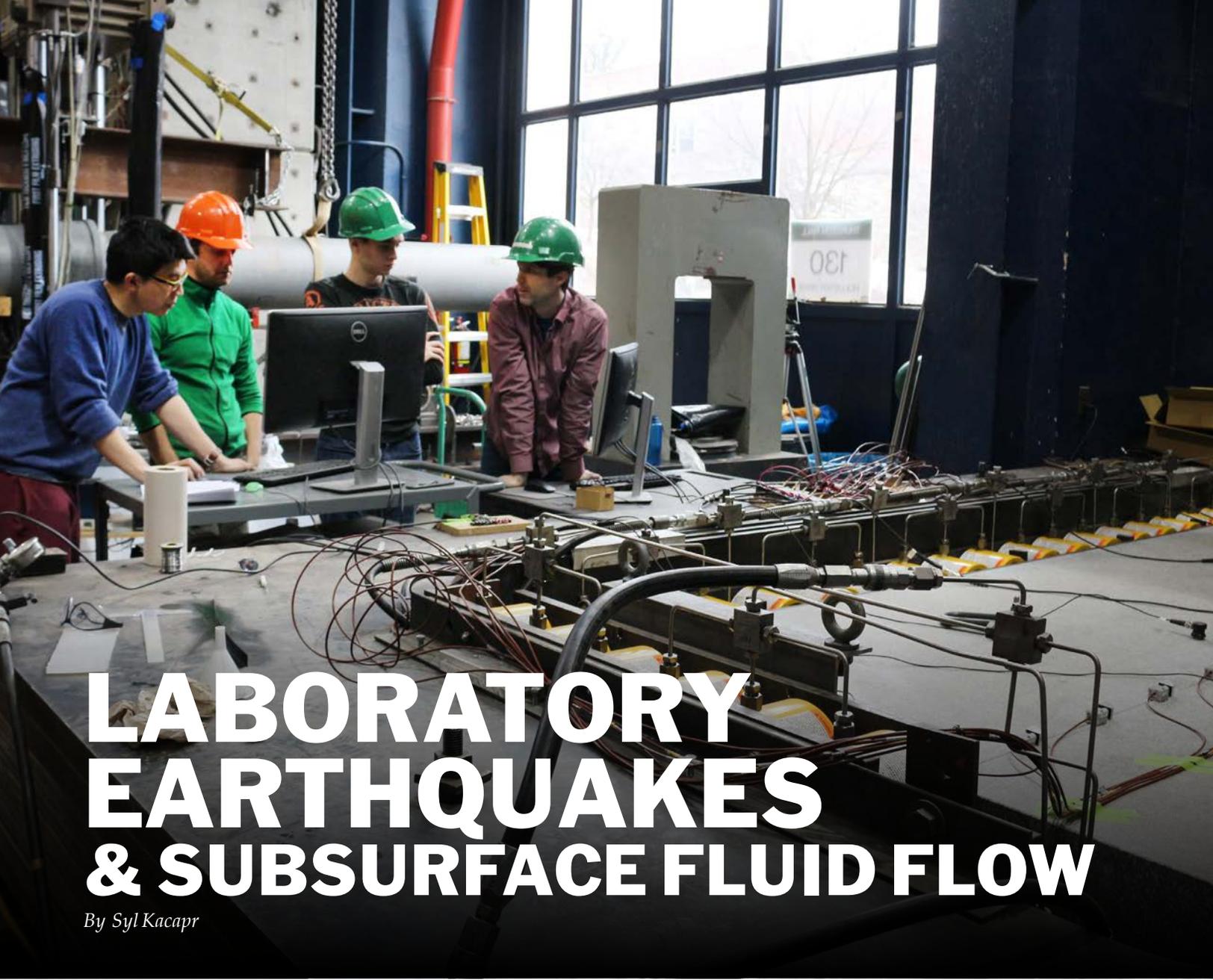
And while Richardson’s pathogen panel is not yet the rapid test she had originally envisioned, she’s received funding from the National Science Foundation to partner with Biomeme, a Philadelphia-based startup that provides a quick-testing platform that can be combined with her panel. Richardson plans to test the new platform at New York state parks this summer.

“Swimming beaches normally just measure fecal indicator bacteria, they don’t measure pathogens and the methods take a day to get the results back,” explains Richardson, adding that her test could provide instant results while also helping to identify the sources of harmful pathogens that are discovered.

Such a test would be useful in places like Lake George’s popular state-owned Million Dollar Beach, which has experienced several closings over the past several years because of the presence of *E. coli* in the water, the source of which has not been determined by officials.



Left to Right: Justin Bae ’18, Orville Delatorre ’19, and Associate Professor Ruth Richardson collect water samples for testing at Buttermilk Falls State Park in Ithaca, New York.



# LABORATORY EARTHQUAKES & SUBSURFACE FLUID FLOW

By Syl Kacapr

**CEE** assistant professor Greg McLaskey studies the mechanics of friction, earthquakes, fractures and other processes that generate sounds and vibrations in large-scale rocks. Lately he has been interested in studying how fluids might flow through networks of underground joints and fractures, and how the fluids can potentially trigger earthquakes.

Better understanding subsurface fluid pathways is important for a range of energy applications, including enhanced geothermal heating systems, which could reduce reliance on hydrocarbons such as oil, gas and coal. Little is understood about the dynamic between such systems and earthquakes.

“I want to know how the act of pressurizing a fault with fluid potentially cause an instability like a tremor to occur,” asks McLaskey. “On a mechanical level, how can we model

it? What are the relevant parameters? Maybe there’s a way you can change the operation of an enhanced geothermal system or a wastewater disposal project that will minimize seismic risk.”

To answer these questions, McLaskey is using a first-of-its-kind machine to simulate the pressure that is exerted on rocks deep below the surface. The biaxial rock-squeezing machine, as McLaskey calls it, is a 3-by-5-meter steel frame lined with dozens of hydraulic jacks. When a sample such as a slab of granite is placed inside, the jacks use the steel frame as an anchor and each apply up to 100 tons of force on the sample.

“What I do is I basically make earthquakes in a lab,” says McLaskey. “I create conditions that are sort of similar to what happens a couple kilometers down in the earth by squeezing rocks. And I’m trying to do this at the biggest scale possible in a lab.”



*Opposite page: McLaskey discusses with students and visitors the implications of signals recorded during the generation of laboratory earthquakes in the Bovay Laboratory. The 3 meter granite sample (gray, on right side of photo) is squeezed with a machine that applies 2.2 million lbs. of force. This simulates the conditions a few kilometers deep within the earth. [1] left to right: James Strait, Manager of Technical Services for the Bovay Laboratory Complex, graduate student Chun-Yu Ke, and McLaskey discuss setup. [2] McLaskey prepares sensors on the granite sample.*

McLaskey hopes to link patterns that he sees in the lab with any patterns that emerge from seismicity often observed near wastewater disposal wells associated with oil and gas operations or during geothermal energy operations. He says miniature tremors, too small to be felt by humans at the surface, can provide valuable information if they can be recorded and analyzed—an effort his co-investigators on the seed grant are conducting.

“So if in the lab I see sequences of tremors that are migrating in a distinctive way, that’s something we can potentially record in the field as well,” says McLaskey. “If I can figure out that sequence is being driven by a specific mechanical process and we see the same thing in the field, that gives us a good indication the same process is happening.”

To simulate water circulating through a fault deep within the earth, McLaskey says he is using a smaller-scale rock-squeezing machine and conducting experiments on a transparent plastic sample “so you can actually see how fluid is propagating through this rough interface.”

As the machine begins to squeeze, a clicking noise can

be heard, indicating the sample’s fault has slipped. Video footage reveals the water briefly getting sucked backwards toward the point of injection before beginning to spread again, which was a surprise to McLaskey the first time he saw it. He says the backward motion of the water is due to suction caused by the fault slipping.

“Once you start mixing fluids and fractures, the physics and the mechanics get very complicated and we really don’t fully understand it,” says McLaskey, who is working to build models of the phenomena he observes in the experiments.

“It definitely gives the research more of a sense of purpose, that I can develop a model in a lab and actually test it against field observations,” says McLaskey. “That’s cool.” ■



# PRINTING PARTS THAT DON'T BREAK: FROM PROCESSING TO PERFORMANCE

Associate Professor Derek Warner's CEE 6725 class has been busy 3D printing plastic patterns: tensile bars and a real-life airplane component and then building two-part sand molds around them. On Tuesday, April 17, on the SUNY Cortland campus, the class reassembled their molds and filled them with liquid structural grade aluminum alloy. Vaughn Randall, department chair and associate professor of art and art history at SUNY Cortland, facilitated the lab activity.

"Casting day was particularly exiting this year, given the backdrop of large snowflakes," said Warner. "We will next machine the parts (they need to be removed from the gating system), heat treat them, and mechanically test and load until they break."

Novel additive manufacturing (AM) techniques are appealing in that they offer improved design flexibility, the capability to produce multi-functional components, and an economical route for low-volume production runs with less material waste. Warner's course is aimed at giving students a knowledge base to understand the connection between various AM techniques and the mechanical performance of AM metallic components. ■



[1] Left to right: Students Sarah Leach '18 (CEE), Omar Shahid '18 (CEE), Nathalie Keney '18 (MAE), Justin Hansen '18 (BME), and Michael Rose '18 (BME) stand prepped with safety gear, ready to pour metal, with Associate Professor Derek Warner. [2] Zhaozhuo Hou '18 (CEE) and Hansen smile after removing successful casting from molds. [3] Shahid and Chris Prendys '18 (CEE) display their casting. [4] Students fill molds with aluminum alloy. [5] A student skins oxide film from molten aluminum alloy in a crucible. [6] Associate Professor Derek Warner carefully carries a sand model from mold making location to the metal pouring location. [7] SUNY Cortland host Professor Vaughn Randall instructs students on the metal pouring technique.

## GIVING BACK: IN THEIR OWN WORDS

By Jeannette Little

We often hear stories of individuals or groups “giving back” to their communities or to a cause that is important to them. Reasons vary from person to person, based on their unique experiences and interactions with individuals and organizations. The *CEE Update* production team decided to reach out to three alumni who serve on the school’s advisory council to ask them why they have decided to give back. Below, verbatim are their answers to some of the questions asked.



**KRISTIN  
BARBATO**

**B.S. 1994**  
Founder,  
Build Edison



**VERONICA  
O. DAVIS**

**M.Eng. 2003**  
Partner and Principal  
Planning Manager,  
Nspiregreen, LLC



**JAMES  
McCORMICK**

**B.S. 2005, M.Eng. 2006**  
Senior Project Manager,  
Hunter Roberts  
Construction Company

### Can you talk about your current work and any current projects that you are working on?

**KB:** After years working in corporations and government, I’m branching out as an entrepreneur! My new company, Build Edison, helps cleantech companies commercialize and scale their technologies faster with customers, advisory and financing. Maybe we can help the engineers at Cornell as they tackle new technologies in the built environment and start companies of their own.

**VOD:** I co-own Nspiregreen, LLC, with my friend Chanceé Lundy. Nspiregreen is a planning and design studio located in Washington, D.C. We specialize in multimodal transportation, community planning, and climate/resiliency planning. I oversee our transportation and urban planning projects. For example, I was the principal-in-charge for Vision Zero Action Plan for the District of Columbia and Alexandria, Virginia. Vision Zero is about reducing the number of traffic fatalities and serious injuries to zero.

**JM:** I’m currently the senior project manager building

the graduate hotel on Cornell's Tech Campus in NYC. It's very fulfilling to be building a structure which will help Cornell reach its goal of being a world leader in the tech/entrepreneur graduate school sector.

### **When you received the invitation to serve on the school's advisory council, what was your initial reaction?**

**KB:** I was so shocked and honored! The advisory board at my college? Wow! Then, it hit me... geez, I'm old. But after all those initial thoughts, it became clear that this was going to be a great way to help continue the CEE programs with the perspective of my professional years.

**VOD:** My initial reaction was what did I get myself into. However, I saw it as an opportunity to help the school continue to excel as well as increase the enrollment by underrepresented minorities (Black, Latino, Native American).

**JM:** Pride. I'm thrilled that my opinions and experiences are valuable to Cornell University. The advisory board gives the faculty an additional source of information to understand if the curriculum and overall CEE experience is still relevant in the professional world. I was also excited to be included in the group with other outstanding engineers and interact with them throughout the weekend.

### **Why do you give of your time, talent and resources to the school?**

**KB:** I give my time and efforts because I want to see Cornell's programs continue to be relevant and shape progress in our fields. This is part of our legacy.

**VOD:** I give back because it is something my parents and grandparents instilled in me. I give to CEE, because the experience prepared me for the workforce and for life. I want others, particularly, underrepresented minorities to have the opportunities that I had while at Cornell. Ezra Cornell founded the university because he wanted a place "where any person can find instruction in any study." I want others, particularly, underrepresented minorities to have the opportunities that I had while at Cornell.

**JM:** The same answer as for the previous question.

### **If you were to offer advice to graduating (undergrads and grads) students entering the workforce, what would you say?**

**KB:** Three statements of advice:

- 1) Take a course or two that is not related to your major but satisfies some crazy curiosity you have. It's fun trying something different and Cornell has so many options. ("I would found an institution...")
- 2) Engage with real-world professionals either in a job or a project. They can also provide guidance on what types of study is relevant to your interest.
- 3) Enjoy the area surrounding Cornell! The campus is beautiful and in the middle of amazing natural terrain. That is after all what we are doing as civil engineers, be part of our environment!

**VOD:** Find mentors. My mentors have helped me grow as a person and as a professional. Two of my mentors have been in my life for most of my professional career.

**JM:** Aside from working hard, focus on listening and asking questions. Seek opportunities to collaborate on things outside of your main job. The more you do this, the faster your perspective will widen, which makes for fast career growth and a more fulfilling life.

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While students at Cornell, Barbato first felt "overwhelmed by Cornell," but quickly adapted as she met other "extraordinary" and "impressive" students. She combined her ease for math and science and an interest in design to settle on the desire to design structures, therefore obtaining her degree in structural engineering.

Davis came to Cornell to receive a Masters of Regional Planning (M.R.P.) and a law degree, however, she soon changed course once she discovered CEE's M.Eng. program and obtained the M.Eng. and M.R.P. degrees at the same time. She credits the M.Eng. program for giving her a "strong foundation for becoming an engineer and a business owner."

With all three, their academic lives and career paths are different. CEE is grateful to its alumni and friends who share their time, knowledge and resources to support the school. Their engagement, and yours, not only enriches the school, but as McCormick said, provides a sense of "pride" in knowing that one's "opinions and experiences are valuable to Cornell University." Involvement is a good thing. Get connected. Become engaged with CEE. ■



## ANDREW SHAKALIS M.Eng.'16

### Tell us about your current work and projects.

I'm a senior engineer at Thornton Tomasetti, in the Weidlinger Applied Science practice, working on undersea acoustics problems. The work is more based in engineering mechanics and physics/theory, rather than a strict design-sense kind of work. The applied science practice is part of the 'cutting edge' R&D groups within the discipline of mechanics and materials.

### Why did you choose Cornell?

Cornell stuck out to me not only because of the proximity to home (NYC), but also had tremendous architecture and physics programs. I was still on the fence on where to go, and decided to apply to the engineering school. I had no idea about what to study when I got to Cornell. But, thankfully, the first few years allow an undergraduate to find out what they enjoy most. I sat in on several architecture classes, but found myself drawn to the

"structural concepts" courses they had. Similarly, physics classes were flashy, but sometimes very unintuitive. So, civil wound up being a combination of interests in architecture and physics. It's a common enough compromise, so I've seen.

### Was there a particular professor who inspired you?

Within CEE, Associate Professor [Derek] Warner's Solid Mechanics classes kind of sealed the deal that I would enjoy working in engineering mechanics. Though not a class, the two years I spent in the Bovay Lab was extremely useful in creating a practical skillset to go along with the knowledge of some esoteric mechanics subjects. To that extent, the now retired Tim Bond was a great inspiration, too, because of his thoughtful approach towards teaching — letting the students fail first, so that what they're learning has immediate practical value. Tim (and the lab as a whole) provided a design and analysis experience outside of classwork that was not only interesting, but also of great importance, and with an impeccable group of people.

## JING ZHUANG B.S.'10

"They grow up so fast" said Jing Zhuang PE, is referring to her latest project: Equinox Tower at 35 Hudson Yards, part of the largest private real estate development in the history of the United States, located over a working rail yard on Manhattan's west side. Zhuang is a senior structural engineer at Skidmore Owings and Merrill (SOM) in New York. On Thursday, October 5, 2017, Zhuang visited Assistant Professor David Kammer's Modern Structures class where she gave a lecture titled "Tracing the Evolution of Structural Systems." Zhuang says: "I think it's important to learn about structural engineering history so that we are aware of solutions engineers found for problems that are still relevant today. I hope that knowing about these past solutions will spark new ideas that build upon them and advance our field." Later that day Zhuang gave an informal career conversation talk with undergrad and graduate students.

### **Why did you choose Cornell?**

I was interested in both architecture and engineering and chose Cornell because it has excellent programs in both. I found that Cornell was very accommodating in allowing me to diversify my coursework, true to its “any person, any study” motto.

### **Could you expand upon the quote from your Career Conversations talk: “When you are in school you have a problem set, you’re done with the work. But when you are working in the field, you have to be flexible.”**

I think this is reflected more at the architecture school, where an assignment goes through multiple iterations and you are continuously working on it. I found that this has also been the case at work. It might be a little frustrating for new engineers at first, to see parts of their work become irrelevant as new information comes in, when other trades have clashing requirements, or a client changes their mind. It can be hard to not take it personally, but it is all part of the process for delivering a complete, coordinated project.

### **Can you talk a little bit about a current project that you are working on?**

I’ve been working through the shop drawings and day-to-day construction questions now, after analyzing, designing, and documenting for the last couple of years. It’s been grueling but we can’t wait for the structure to top out next spring. We’re about 50% of the way there in terms of construction (the final structure will be 1,000 feet above the platform covering the railyard).



## **SETH CONDELL M.Eng. '98**

### **Tell us about your current work and projects.**

I currently have several roles at Parsons. I have an operational role and business development role as the NY / NJ Regional Bridge Practice Lead, with a staff of roughly 60 engineers and CADD staff. In this role I am responsible for the technical excellence of our project delivery teams, as well as the profit and loss of our regional bridge practice. I also have a project management role and in this capacity I am the design manager for the \$1.5B replacement of the Goethals Bridge between Elizabeth, NJ, and Staten Island, NY. The project is replacing the 1928 steel cantilever truss, the first bridge built by the Port Authority of New York and New Jersey, with a dual cable stayed bridge, totally approximately 7,300 feet in length from end to end. I am particularly passionate about the project, because when I was an M.Eng. student at Cornell (1997-98),

our design project was in fact the design of the Goethals Bridge replacement. So in a sense, I have been tied to the project since my time at Cornell and I’m very excited, proud, and also humbled to be leading a great team to effectuate positive change in the region’s infrastructure network.

### **Why did you choose Cornell?**

Having a strong background in science and mathematics, engineering seemed a natural career for me. Also, having grown up building our house and enjoying putting things together, taking them apart, and being the son of a DIY father, building was always a part of my life. I think that having that hands-on experience and enjoying being able to look back at something physical that I had a part in creating drew me to the practical design side of engineering. Cornell’s M.Eng. program was centered around a design project which held an attraction for me as compared to a M.S. program that was solely centered around theory.

### **Was there a particular professor who inspired you?**

CEE classes were great, and the professors excellent, of course, but I very much enjoyed the teamwork and comradery of the design project. At that time, the design project was a group exercise that engaged the structures, geotech, and management students. The open ended nature of the project allowed me to challenge myself to conceive of solutions, coordinate with classmates and tackle a real-world problem—one that I have the good fortune to see coming to fruition today. ■

## CEE MACHINE SHOP: MAKING A DIFFERENCE



Above, Simran Rastogi '18 and Equipment Technician Tim Brock, in the CEE Shop.

Our students, faculty, and staff benefit greatly through your involvement and support. We have a current initiative to build an endowment fund to support the CEE Shop operations.

From the time CEE moved into Hollister in 1959, the school has had a machine shop. Through the years, our faculty and students have been trained by top skilled professionals. A few that you might remember are David Francis “Red” Powers, Paul Jones, Ed Phalan, John Yost, Glenn Darling, Lee Virtue and currently, Tim Brock, Paul Charles and John “Jack” Powers.

The shop continues to serve as a cornerstone for CEE lab courses, student projects and faculty research. It is heavily utilized to support student research and our valued student project teams, such as ASCE Steel Bridge and Concrete Canoe, AguaClara, Engineers for a Sustainable World, and the Earthquake Engineering Research Institute Seismic Design.

This fund will be used to cover annual expendables, repairs and upgrades of equipment. There is a need to purchase a variety of modern equipment, including 3D printers, laser cutters, and a computer numerical control milling machine. Modernizing the Shop will dramatically increase the capability and functionality of building and testing of apparatus in our undergraduate lab courses.

You may recall your exciting days training and experimenting with tools in the shop. Remember the fun you had with the drill presses, lathes, drills, welding equipment, table saw and band saw? Your support of this endowment will insure current and future students have the same learning experience and enjoyment.

To make a contribution, go to the bottom of the CEE homepage at [cee.cornell.edu](http://cee.cornell.edu) and click on the button “Support CEE.” Feel free to contact Tony Simione at [ams637@cornell.edu](mailto:ams637@cornell.edu) with any questions. Thank you in advance for considering giving a gift.

## STAFF & POSTDOC NEWS



### PAUL CHARLES

Each year, the Cornell Engineering Alumni Association presents recognition awards to students, faculty, staff and researchers for various accomplishments. At their annual dinner held in April 2017, Paul Charles was recipient of The Cornell Society of Engineers Achievement Award, recognizing his mentoring of students on their team and research design projects. Charles is CEE’s technician/facilities coordinator for Hollister Hall; he has been with the school for 16 years. As Charles works with the students, he is able to take their vision, share his technical knowledge and create an instructive atmosphere to enhance their education and build their ultimate design. “I enjoy working with the students in the shop and providing them with guidance on their designs to come up with the best, most efficient layout possible for what they are trying to make,” said Charles. “It is a very gratifying work experience.”



### JULIANNE QUINN

Juilanne Quinn '17, a postdoctoral associate in Professor Patrick Reed’s group, has been named the first place recipient of the Universities Council on Water Resources (UCOWR) 2018 Ph.D. Dissertation Award in the category of Natural Science and Engineering. Each year, UCOWR recognizes two outstanding Ph.D. dissertations on water issues, one in Water Policy and SocioEconomics, and the other in Natural Science and Engineering. Quinn’s research focuses on better characterizing risks in water resources systems to inform the design of robust multi-objective control policies.



## **WILFRIED BRUTSAERT**

Cambridge University Press has published a translated version of Brutsaert's

classic textbook, "Introduction to Hydrology," into Chinese. Because of Brutsaert's contribution to evaporation research, he was hailed as "Mr. Evaporation." The book is a culmination of more than 40 years of hydrology teaching and research.



## **CHRISTOPHER EARLS**

Professor Earls partnered with two Cornell architecture professors for

the winning project in the 2018 City of Dreams Pavilion Design Competition, which will be built on Governors Island in New York. Selected from five finalists, the winning project, dubbed "Oculi," features a series of elevated circular structures made of deconstructed metal grain bins, a structure that is widely found abandoned in the rural landscape of the northeastern U.S. Each structure offers a wide oculus to the sky and each opening "tracks the path of the sun, producing a range of shadow patterns augmented by color and sound," according to a media release. The interior walls will be painted to resemble the colors of the daytime sky.



## **DAMIAN HELBLING**

Helbling received an NSF CAREER Award for his project: "A meta-omics approach

to discover the determinants of micropollutant biotransformations performed by wastewater microbial communities." Helbling will study the biochemical mechanisms by which man-made organic chemicals break down during wastewater treatment. Helbling will also lead an education and outreach initiative in collaboration with the Cayuga Lake Floating Classroom, Cornell Diversity Programs in Engineering, and AguaClara. The \$500,000 award will fund research and educational activities through 2023.



## **PHILIP LIU**

Class of 1912 Professor of Engineering Emeritus Philip Liu was given the Hamaguchi

Award for Enhancement of Tsunami/Coastal Disaster Resilience from the Port and Airport Research Institute (PARI) in Japan. Commemorating World Tsunami Awareness Day of November 5, the "Hamaguchi Award" for individuals and/or organizations that have made significant scientific or pragmatic contributions to the enhancement of coastal resilience against tsunami, storm surge and other coastal disasters, to raise people's awareness of disaster resilience. The award is named after Mr. Hamaguchi Goryo who protected and saved a village from a tsunami about 150 years ago.



## **ROBERT NEWMAN**

Newman joins CEE full-time as a senior lecturer in engineering management with

25 years of management experience in technology-driven enterprises. This

includes seven years as a successful CEO and various other high-level leadership roles across five industries working within multinational companies ranging in size from three to 13,000 employees.



## **THOMAS O'ROURKE**

At a ceremony in Mexico City, Mexico, on September 28, 2017, Professor

O'Rourke was inducted into the Academia de Ingeniería México, or Mexican Academy of Engineering. The Academia is the equivalent in Mexico to the National Academy of Engineering in the U.S. It is an honorific academy whose members also provide advice for government. Each year, a small number of foreign members are elected. O'Rourke gave his inaugural lecture on "Ground Deformation Effects on Subsurface Pipelines and Infrastructure Systems," and in his presentation advocated for greater collaboration between U.S. and Mexican engineers on earthquakes and hurricanes, both of which transcend borders and have devastating effects on the infrastructure of both countries.



## **MONROE WEBER-SHIRK**

This past year, Weber-Shirk was promoted to senior lecturer and senior research associate in

the School of Civil and Environmental Engineering.

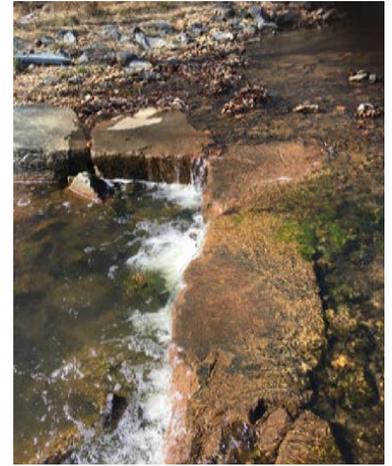
# CEE STUDENT EXPERIENCE



## BECKER GLOBAL EDUCATION FUND

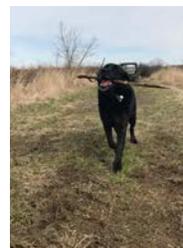
Saurav Sharma '19 is a recent recipient of the Becker Global Education Fund, which enabled him to travel to Kathmandu, Nepal, this past December. Founded in 2014, the primary objective of this scholarship is to provide CEE undergraduate students an opportunity to expand their world view and in turn enlarge the possibilities for civil and environmental engineering. The award underwrites a student's ability to travel, preferably outside of the United States, to participate in educational or professional activities.

"I want to start by saying how thankful I am to be a recipient of the Becker Global Education Fund," said Sharma. "I learned so much over the past month by being present on site. I also got to apply a lot of things I learned in class. For the past month, I have been working alongside a group of engineers that designed a sewage treatment plant that is being built in Kathmandu. Even though this project started almost five months ago, it is at its peak right now. Since this method includes various steps, I was exposed to many engineering techniques that were being applied in order to complete a certain task. I am extremely glad of what I could make out of this fund, and I have never been more motivated to work to become an innovator and leader in this field."



## HANDS-ON STREAM RESTORATION

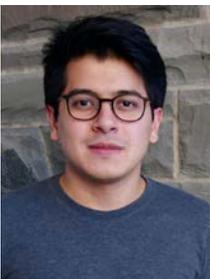
Michael Rolband, CEE professor of practice and president of Wetland Studies and Solutions, Inc., took his class (CEE 5022) to Virginia to tour ongoing and completed stream restoration projects. "The trip provided insight for our own designs of the Wiehle South stream in Reston, VA, which is in need of remediation due to erosion caused by runoff from urban development," said Cameron Afzal, an M.Eng. student in environmental and water resources systems.





## GRADUATE STUDENTS EXPLAIN STRUCTURAL ENGINEERING TO KINDERGARTNERS

During the second week of February, Ph.D. candidates Justyna Kosianka (left) and Yolanda Lin (right) co-taught a structural engineering mini-course to curious kindergartners at Beverly J. Martin Elementary School in Ithaca, NY. “Although we were a little nervous going in, not having much experience presenting to an early elementary audience, we were excited,” said Kosianka. Their community outreach visit was organized through the Graduate Student School Outreach Program at Cornell University. Lin described that “in the last lesson, we introduced the effects of natural disasters, and students had the opportunity to test their own newspaper and pasta structures against a simulated flash flood (using a bucket of water in a large tank) and an extreme snow load of many structural engineering textbooks!” Both are research structural engineering students in the Earls Group.



## JUAN CARLOS MARTÍNEZ MORI

Martinez Mori was awarded a fellowship through the Dwight David Eisenhower Transportation Fellowship Program (DDETFP). He is a first-year Ph.D. student in Systems Engineering, working with CTECH co-PI and CEE Assistant Professor Samitha Samaranyake. His research interests are in the development of algorithmic solutions for networked transportation systems. In particular, he is interested in the integration of on-demand mobility with public transportation, as a first/last mile solution. The

DDETFP is a Federal Highway Administration program that awards fellowships to students pursuing degrees in transportation-related disciplines. The program advances the transportation workforce by helping to attract the nation’s brightest minds to the field of transportation, encouraging future transportation professionals to seek advanced degrees, and helping to retain top talent in the U.S. transportation industry.



## DARA KARAĆ '18

Karać is recipient of the 2017 Moles Scholarship, a scholarship awarded annually by CEE to a deserving and academically qualified junior or senior studying civil engineering with high academic standings and expressed interest to pursue his/her career in the construction industry.



## AURORA NAMNUM '19

Namnum received the 2017-18 Clark Construction Scholarship, a prize awarded annually through CEE to a top civil engineering junior who has shown an interest in and an aptitude for construction.



## SHIYAO SUN '18

Sun received a Co-Op Student of the Year Distinguished Honor. Cornell’s Engineering Co-op program provides opportunities for students to advance and apply their knowledge and skills in the context of industry, government, and society, enabling them to make well-informed choices about their academic and career paths. As part of the program, students work 28 weeks or more with a firm or business, typically in their junior year. Sun worked with Public Service Enterprise Group in Hicksville, NY, a diversified energy company. The Co-Op Student of the Year Award is presented to one student each year. The nominations for the awards are submitted by supervisors who have worked closely with a Co-Op student that they feel has demonstrated leadership, initiative, and innovation in the Co-Op position.

# CEE RETIREMENTS



## PHILIP LIU

Philip Li-Fan Liu was born in China and moved to Taiwan with his family when he was two years old. He grew up there and received his B.S.C.E. in 1968 from National Taiwan University. After mandatory military service, he was offered a full scholarship from Brown University to study applied mathematics and a full research assistantship to join the Parson's Hydrodynamic Laboratory at the Massachusetts Institute of Technology (MIT). In August 1969, Liu arrived in Cambridge, MA and started his 46-year academic career in the United States.

During his first year at MIT, Liu worked under the supervision of Professor Lynn Gelhar to investigate turbulent airflows in a circular pipe whose wall was covered by a layer of porous material. He gained knowledge and experience in measuring turbulent flows, using the hot-wire velocimetry. In the summer of 1970, Liu joined Professor Chiang C. Mei's group to study water wave theories and their applications to coastal engineering. In 1971, Liu wrote his M.S. thesis on viscous damping of water waves within a bounded domain, using the boundary layer analysis. After participating in several projects, Liu focused his research on breaking wave induced coastal currents in the vicinity of a breakwater for his doctoral research. He developed the first combined refraction and diffraction wave theory, enabling the quantitative evaluation of the driving mechanism of a coastal current system.

In the summer of 1974, Liu completed his Ph.D. at MIT and moved to Ithaca, NY, where he was appointed as an assistant professor in Civil and Environmental Engineering at Cornell University. He was promoted to full professor in 1983 and was then honored with an endowed professorship in 2008—the Class of 1912 Professor of Engineering. Liu served as the associate director of the school from 1985-86, and as the associate dean for undergraduate studies in the College of Engineering from 1986-87. He then served as director of CEE from July 1, 2009 to June 30, 2015.



During the first five years of his tenure at Cornell, Liu worked with Professor James A. Liggett on developing a new numerical method—the Boundary Integral Equation method, with applications to groundwater and water wave problems. They published a monograph in 1982 titled, “The Boundary Integral Equation Method for Porous Media Flow.”

With continued support from Cornell University and external funding agencies, including the NY Sea Grant program, National Science Foundation, Army Research Office, and Office of Naval Research, Liu was able to maintain a formidable program in coastal oceanography and engineering. Liu has graduated 32 Ph.D. students whose theses covered a wide range of topics including groundwater flows, water wave theories, tsunamis dynamics, wave-breaking processes, sediment transport processes, and interactions of water waves with structures. A numerical model, COMCOT (Cornell-Multi-grid-Coupled-Tsunami-Model), based on nonlinear shallow water wave theory, was developed by several of Liu's Ph.D. students and has been used internationally in



developing tsunami warning systems and tsunami hazard maps. Another numerical model, COBRAS (Cornell-Breaking-Waves-and Structures), based on the Reynolds Averaged Navier-Stokes equations, is also widely used internationally as a tool for preliminary design of coastal structures, and for conducting research in wave-solid interactions, including water waves generated by a landslide.

Liu has taken the leadership role in organizing several important post-tsunami field studies, including the 1992 Flores Island (Indonesia) tsunami and the 2004 Indian Ocean tsunami. The data collected from these surveys is valuable in understanding tsunami dynamics, and results were reported in *Nature* and *Science*, respectively.

Liu has been actively promoting tsunami research by organizing workshops and meetings. In the last ten years, he has been organizing annual South China Sea Tsunami Workshops (SCSTW), providing a forum for tsunami researchers in the South China Sea region to exchange knowledge and experience and to develop the tsunami hazard mitigation program. Since 2007, nine workshops have been conducted in six different cities, in four different countries.

Liu is a member of the National Academy of Engineering

(USA), an Academician of Academia Sinica (Taiwan), a Fellow of the American Geophysical Union, and a distinguished member of the American Society of Civil Engineers. He also received the ASCE Walter L. Huber Civil Engineering Research Prize (1978), the J. S. Guggenheim Fellowship (1980), the ASCE John G. Maffatt & Frank N. Nichol Harbor and Coastal Engineering Award (1997), the ASCE International Coastal Engineering Award (2004) and the Alexander von Humboldt Research Award (2009). Most recently, he was awarded the Hamaguchi Award for Enhancement of Tsunami / Coastal Disaster Resilience (2017).

Since 2007, Liu has been honored with the Kwoh-Ting Li chair professorship at the National Central University (NCU) in Taiwan. This endowed chair is the highest-level professorship in the university. Since 2015, Liu has been the Vice President for Research and Technology, and Distinguished Professor in Civil and Environmental Engineering at the National University of Singapore, where he has established an active coastal research group.

On June 30, 2016, Liu officially retired from Cornell and was appointed as the Class of 1912 Professor in Engineering, Emeritus. After retiring from his current position at NCU, Liu will eventually reside in the U.S. with his wife, Christine Shoemaker, to be near their children and grandchildren. ■





## CHRISTINE SHOEMAKER

It is interesting how Christine Shoemaker's childhood experiences forged a path to a successful academic career. She was raised by a single mother under difficult financial circumstances until she was nine years old. Although her mother was very intelligent, she had been forced to leave school at the age of 12 to do farm work during the Great Depression. This experience resulted in her mother's deep sense of loss over a lack of a full formal education. It was this sentiment that inspired Shoemaker at a young age to plan for an advanced degree in science. When her mother remarried, Shoemaker enjoyed a fuller family life with her parents, and at that time she also had the opportunity to attend better schools that enabled her to win a Regents' Scholarship to UC Davis, where she majored in mathematics. With this fellowship, she spent one year studying at the renowned Goettingen University in Germany (speaking only German). Her year abroad intensified Shoemaker's concern for social issues. As a result, she became involved in the anti-Vietnam War protest movement in 1965 when she returned to Davis, California. She continued to major in mathematics and loved the subject, but she wanted her future research to be focused on something that could have a more direct impact on society than pure mathematics.

Hence, Shoemaker sought a graduate school program in mathematics that would enable her to address socially important issues. She was accepted to study with the famous applied mathematician Richard Bellman, the "father

of dynamic programming," at University of Southern California. At the time there was prejudice about accepting female Ph.D. students, so it was remarkable that Bellman was broad-minded enough to accept Shoemaker. Knowing her social interests, Bellman suggested Shoemaker do her Ph.D. on applications of optimization to "integrated pest management," which involves using ecological methods and little use of pesticides for crop pest control. Shoemaker's Ph.D. dissertation and papers on using dynamic programming were the first published papers in this area. During her graduate school years, Shoemaker continued to be very active in the anti-Vietnam War protest, helping to organize monitors and safety measures for large marches in Los Angeles, CA, attended by tens of thousands of people.



After a one-year postdoc at Cornell, Shoemaker joined the CEE faculty as an assistant professor in environmental engineering. In 1973, there were about 200 faculty in the College of Engineering, and Shoemaker was the only tenure-track female faculty member.

"At that time," said Shoemaker, "I had read studies that showed there was widespread prejudice in the U.S. against hiring female faculty in physical science, so it was remarkable to me that I was hired by CEE. It was even more remarkable that in 1985, I was appointed by the Dean of Engineering as Chairperson of the Department of Environmental Engineering, after a favorable poll of the 18 Environmental Engineering faculty members. As a woman at Cornell, I never felt discriminated against by my department."

Shoemaker eventually replaced her research on integrated pest management with application of her mathematical background to the research area of Environmental and Water Resource Systems (EWRS), started in CEE by Professors



Walter Lynn and Peter Loucks, and which Professor Jery Stedinger later joined. It was a tremendous help to her research to be part of this very strong EWRs group at Cornell. Decades later, Shoemaker's academic grandson Pat Reed joined Cornell EWRs, further strengthening the group.

In this water-related research, Shoemaker focused on dynamic programming algorithms for optimizing groundwater remediation, modeling the subsurface biochemistry of acid rain, and calibration of complex environmental models of contaminated groundwater, and models of polluting nutrient transport in watersheds. For the calibration applications, she also developed new surrogate global optimization algorithms, publishing papers in both applied mathematics and environmental engineering journals. Because environmental models are computationally expensive, she also developed algorithms for parallel computing. Her research funding from NSF came from the Directorate for Computer and Information Science and Engineering as well as from the NSF Environmental Engineering and Hydrologic Sciences Programs.

In her teaching, Shoemaker taught existing courses, including undergraduate Numerical Analysis, in which she introduced the use of "clickers" to encourage active learning. Using this system, students respond instantly to questions about the lecture by clicking on a hand-held device. The idea is to keep the students' interest (very important in a dry topic like numerical analysis) and to help the professor

know if students are having trouble understanding. She also developed a new course on heuristic methods for optimization that drew about 80 graduate students annually for 12 years from across the College of Engineering and the Department of Computer Science.

She has graduated 32 Ph.D. students, most of whom were in CEE working on environmental problems, and some majoring in applied mathematics or operations research and information Engineering (graduate fields in which Shoemaker was a member). With co-workers Computer Science Professor David Bindel and Applied Mathematics Ph.D. student David Eriksson, she developed an open-source software toolbox, PYSOT, for the surrogate global optimization algorithms she and co-workers developed over previous years. Since its initial launch in 2017, PYSOT has had over 18,000 downloads.



Shoemaker's research has resulted in many awards across multiple disciplines. She was elected to the National Academy of Engineering (CEE Section), as a Distinguished Member of ASCE, and has won both a Hinds Award and a Lifetime Achievement Award from the American Society of Civil Engineers. In addition, her interdisciplinary research was recognized by her election to "Fellow" (an honor awarded to typically less than 0.02% of society membership) to the following professional societies: INFORMS (operations research), SIAM (applied mathematics), and AGU (hydrology).

In August 2015, Shoemaker joined the National University of Singapore while on leave from Cornell, and she officially retired from Cornell on June 30, 2017, to remain at the National University of Singapore (NUS) for a few more years. The time in Singapore has been an exciting adventure, but she still treasures her years as a member of the Cornell CEE faculty. Shoemaker and her husband, Professor Phil Liu, will eventually return to the U.S. after their retirements from NUS to be closer to family. ■



## PAUL CARR '76

Paul Carr, Adjunct Associate Professor, joined the faculty in CEE in the fall of 2000, where for years he supervised M.Eng. students in CEE 5910, Engineering Management Project, Practice Management for the Consulting Professional, and CEE 5920, Engineering Management Project, Contract Dispute Resolution for Architects, Engineers and Constructors. Dr. Carr also taught CEE 5950: Construction Planning and Operations each Fall semester from 2001 through when he retired from active teaching in December 2017.

Prior to teaching for CEE, Dr. Carr was chief executive officer of Bernier, Carr and Associates, P.C. for 18 years, an

architectural, engineering and construction management firm located in Jefferson County, New York. Carr brought a vast amount of skill to the classroom that made learning about project management very engaging for the students.

Dr. Carr is a graduate of Cornell University, earning his Master of Engineering degree in 1976. He received his Ph.D. in civil engineering, construction engineering and management from Virginia Polytechnic Institute, Blacksburg, Virginia, in 2000 where he studied and taught before joining the faculty at Cornell.

During his tenure at Cornell, Dr. Carr was awarded the Cornell University College of Engineering Excellence in Teaching Award 2003-04 and again in 2014-15. In addition, Dr. Carr was awarded the Virginia Tech Department of Civil Engineering Myers-Lawson School of Construction, Outstanding Alumni Award 2006, and the Rochester Institute of Technology 2008 Distinguished Alumni Award College of Applied Science and Technology.

Carr said, "I have loved these past years teaching and interacting with so many bright and ambitious students. It has been a joy to be allowed to teach at Cornell, with so many wonderful faculty and staff colleagues."

Dr. Carr will continue to be available to advise, counsel and provide professional assistance to the hundreds of students who studied under his guidance. (pgc3@cornell.edu) ■



*Left to Right: Paul Carr in 2003 with graduate students Matthew Jessel BS '03, M.Eng. '04, MBA '05, Justin Morehead BS '03, M.Eng. '04, and Christina Lupher M.Eng. '04, who also served as advisees for in Carr's course CEE 591 / 592 Management Practice for the Design Professional.*

# NEW TO CEE



## **MEGAN KEENE**

Megan Keene joined CEE in May of 2017 as an accounts representative after working at Cornell in the University Budget Office for just over four years. She holds a bachelor's degree in business administration and a master's degree in corporate finance, and she is a lover of animals.



## **ANDREA IPPOLITO M.Eng. '07**

Andrea Ippolito joins the school as the first Executive Director for the Engineering Management Program working alongside Professors Patrick Reed, Ricardo Daziano, and Francis Vanek. One of the goals of this position is to modernize the program to best serve our students,

which includes increasing partnerships with industry and government and improving connections with the 900+ program alumni. Prior to her appointment, Ippolito served as a Presidential Innovation Fellow based out of the White House Office of Science and Technology Policy and director of the Department of Veterans Affairs Innovators Network. She is a co-founder of Smart Scheduling, a software application acquired by athenahealth in 2016, and co-leader of MIT's Hacking Medicine. Ippolito holds a B.S. in biological engineering and an M.Eng. in biomedical engineering from Cornell, as well as a M.S. in engineering management from MIT.



## **MICHAEL ROLBAND '80, M.Eng. '81, M.B.A. '82**

A new position of professor of practice has been established in the college and the first person to have been hired in CEE in this role is Michael Rolband. Rolband founded Wetland Studies and Solutions, Inc. in 1991, based in Gainesville, Virginia. It

grew into a 150+ person consulting firm with four offices focused in the Mid-Atlantic, and is now a subsidiary of the Davey Tree Expert Company. Wetland Studies and Solutions, Inc. is a recognized leader in the natural and cultural resources issues, dealing with the Clean Water Act and the Chesapeake Bay Act. They support public infrastructure and private development, wetlands delineation, archeology, stream and wetland banking,

storm water and floodplain analysis, erosion control, stormwater permits and inspections, and wetlands and stream restoration design with all the engineering and science disciplines needed to implement such work on a turn-key basis. The professor of practice position aims to bring industry experience into the classroom and Rolband brings a wealth of career experience in environmental engineering, business ownership and management to our educational programs. Rolband is a Cornell CEE graduate and holds a B.S. in engineering, M.Eng. and M.B.A.



## **STACEY SHIRK**

Stacey Shirk is CEE's new finance specialist, having joined the staff in February of this year. She is a certified research administrator (CRA) and has been at Cornell for 18 years, most recently as the team lead in the sponsored research administration center for Computing and Information Science.

Her role provides critical financial administration support and post-award management of faculty grants and contracts.



## **JIM STRAIT**

Jim Strait is the new Bovay Lab Manager and he joined the staff in April 2017. This is Strait's first position at Cornell. Strait brings a strong mechanical skillset from previous jobs that he worked at in the Ithaca area, notably: Macom Technology Solutions as a mechanical test engineer, Kionix, Inc. as a test engineer, and

BorgWarner Morse TEC. Strait holds a B.S. in electrical mechanical engineering technology from Rochester Institute of Technology.



## **CELIA SZCZEPURA-MCLEAN**

Celia Szczepura-McLean joined the staff in August 2017. She fulfills the position of Center Manager in the school and currently works closely with principle investigator, Associate Professor and Director of Systems Engineering at Cornell, Oliver Gao, on the initiatives and goals of the Center for Transportation,

Environment, and Community Health (CTECH). Celia has 18 years of Cornell administrative management experience. Her last role before joining CEE was as the director of administration for the Robert Frederick Smith School of Chemical and Biomolecular Engineering, where she worked for four years.



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