

Carnegie Mellon University

SUMMER 2014

# CEE NEWS

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## THE ADAPTATION CHALLENGE

**CEE PREPARES FOR A  
GRAND CHALLENGE IN  
CIVIL AND ENVIRONMENTAL  
ENGINEERING**





Dear Alumni and Friends,

In August we welcomed a diverse group of outstanding undergraduate and graduate CEE students to the 2014-2015 academic year. CEE has 100 undergraduate students (43% female) in the sophomore through senior classes, and 227 full-time equivalent graduate students (44% female). Our graduate enrollment includes 67 PhD students and 160 MS students spanning our three focus areas of graduate education and research: advanced infrastructure systems; environmental engineering, sustainability, and science; and mechanics, materials and computing.

The lead article for this issue highlights a new cross-department research and education initiative on climate change adaptation for infrastructure. The climate is changing globally and across the U.S., with different types and extent of change in different regions. Sustained deviation from long-term trends has been observed in water temperatures, precipitation amounts, drought duration, storm frequency, wind velocities, snow melt timing, and other phenomena. These changes are affecting civil and environmental infrastructure and leading to demand for infrastructure modification. The capacity for existing infrastructure to accommodate expected climate change is not well understood. Also not well understood are the types of alterations needed in current design guidelines and codes for new infrastructure to account for climate change impacts. There are basic questions to be addressed, and Professors **Peter Adams**, **Thanasis Karamalidis**, **Matteo Pozzi**, **Costa Samaras**, and other faculty members have begun work on these questions with a number of students. In addition, CEE has developed a unique graduate curriculum with three new courses in climate change adaptation.

This issue also features stories on other unique research activities facilitated by our interdisciplinary culture, including a project by Professors **Amit Acharya** and **Jacobo Bielak** on extension of mathematical models for behavior of material defects to describe initiation of fault plane slips in earthquakes; a project by Professor **Hae Young Noh** and ECE collaborators on deployment of sensors that respond to vibration waves for infrastructure monitoring; and several projects related to development of transportation monitoring and control technologies by Professors **Chris Hendrickson**, **Scott Matthews**, **Costa Samaras**, and others.

In other faculty news, the retirement celebration for Professor Emeritus **Larry Cartwright** was a big success, and Professors **Burcu Akinci**, **Greg Lowry**, and **Jeanne VanBriesen** have received chaired professorships. Details and photos are provided within.

Fundraising efforts continue for the Lawrence Cartwright Support Fund for Teaching Professors and the Dr. Elio D'Appolonia Graduate Fellowship Fund. Please consider a special gift of any amount for these permanent-strengthening development efforts of the department.

Our ASCE Student Chapter was recognized by ASCE Region 2 with their 2014 Distinguished Chapter Award. In addition, CEE senior **Chris Ejiofor** received the 2014 ASCE Student Leadership Award in relation to his service as President of our chapter and for his leadership during his undergraduate career. We're very proud of the team spirit and engagement of our CEE undergraduates.

Our CEE Alumni Advisory Council convened in April and provided very helpful guidance about the department vision and mission statements, which I asked them to review to help us launch a renewal of our CEE Strategic Plan. We will be holding our annual CEE Awards luncheon on Sunday, October 12, at which we will be honoring six outstanding alums. More about them in our next issue! You are welcome to join us for any or all of Ceilidh Weekend.

The faculty, students and staff of CEE thank all of our loyal and generous alumni who support the Department in so many and much appreciated ways. We send our best wishes to all of you.

A handwritten signature in black ink, appearing to read "Dave Dzombak".

Dave Dzombak  
Hamerschlag University Professor and Department Head

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## CEE NEWS Alumni Magazine

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## Pittsburgh Professionals Golf to Give Back

Every July, CEE alumnus **Seth Pearlman** (BS '78, MS '79) and over 60 construction, design, and engineering professionals from around the Pittsburgh area tee off together in support of higher education in engineering. For the past eight years, Pearlman has been organizing the Annual Golf Outing at Chartiers Country Club, the proceeds of which help to support CEE students.

The Annual Golf Outing funds the Deep Foundations Institute (DFI) Educational Trust scholarship that is distributed to students in the Civil and Environmental Engineering Department. Recipients are those students with financial need who are interested in the deep foundation industry. Since 2009, ten CEE students have benefitted from the DFI scholarships.



From left to right:  
Tom Levenson – Menard USA  
Ray Henney – SAI Consulting Engineers  
Seth Pearlman – Menard USA  
Justin LaBrozzi – Menard USA

Pearlman, former DFI president and current president of the ground improvement company Menard USA, believes that this scholarship is an important way to encourage new geotechnical engineers. He also says the golf outing is an excellent opportunity for professionals from each facet of the geotechnical field to connect. "We work as a team in this industry—engineers, owners, contractors, equipment, and material suppliers—and it's important that everyone get to know each other on a personal level."



Seth and Julian Pearlman at the 2014 CEE diploma ceremony

As a CEE alumnus, Pearlman is especially committed to this event and has been a leading sponsor since its inception. In an interview earlier this year, Pearlman spoke fondly of his time at CMU saying, "Success is a combination of the school and the person, but having a good foundation really helps." In addition to facilitating the DFI scholarship, he has stayed connected to the university and CEE department by serving on the CEE Advisory Council and through his son **Julian** (BS '14), who is also a civil engineer.

This year's Golf Outing was held at Chartiers Country Club and raised \$60,000 for the scholarship fund. For more information about this event, please visit the DFI website: [www.dfi.org](http://www.dfi.org).

## CEE Hosts ASCE Ohio Valley Student Conference



**CEE's student chapter of the American Society of Civil Engineers (ASCE) was proud to host the 2014 Ohio Valley Conference. Over 300 civil engineering students and faculty from 14 area universities came to Pittsburgh and experienced both Carnegie Mellon University and the region.**



# The Adaptation Challenge

## CEE prepares for the future of civil and environmental engineering

It's deceptively gradual—nearly imperceptible in the short-term—but climate change will have a massive impact on civil and environmental engineering. Global climate has been changing, with different regional impacts. In the northeast U.S., for example, temperatures have risen 2 degrees Fahrenheit and annual precipitation has increased by 5 inches in the past 100 years (see box). Over the next 100 years, a 1-7 degrees Celsius rise in the average global temperature will continue to change the climate, likely altering the frequency of rainfall, hurricanes, tornados, heat waves and other weather conditions around the world. Beyond global and regional trends, scientists can't say for certain how specific areas will be affected, leaving engineers with the daunting task of designing structures like roads, bridges, and sewer systems for an uncertain future.

In response to this impending challenge, CEE has launched a multidisciplinary research and education initiative focused on climate change adaptation for infrastructure. Faculty members across the department are collaborating with

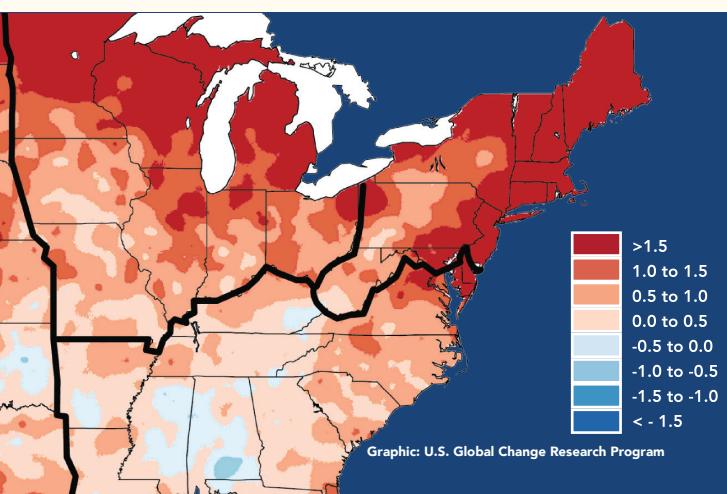


Lake Meade, Colorado

(BS '15) are creating a database of peer-reviewed literature on this topic.

So far, relevant work has been categorized by type of infrastructure, type of literature (e.g. report or journal article), and author. "Essentially, we want to create a map that will allow us to understand how the scientific community is working on this topic," says Pozzi.

The group has decided to make the finished product available online so that researchers at other



### Climate Change in the Northeast U.S.

The 2014 U.S. National Climate Assessment ( ) documents climate change in regions of the U.S. For the Northeast U.S., temperatures increased by almost 2°F (0.16°F per decade) from 1895 to 2011. In the same period, annual precipitation increased by approximately 5 inches, or more than 10% (0.4 inches per decade). Further, the Northeast has experienced a greater increase in extreme precipitation from 1958-2010 than any other U.S. region, with more than a 70% increase in the amount of precipitation falling in very heavy events.

each other and with colleagues from other departments to collect existing literature, investigate local and global effects of climate change, and develop specialized courses to prepare new engineers.

#### ORGANIZING EXISTING KNOWLEDGE

Although the scientific community has long analyzed climate change, climate change adaptation for infrastructure is a relatively new area of research. To help Civil and Environmental Engineering students and faculty generate ideas and inform their existing work, Assistant Professor **Matteo Pozzi**, Assistant Professor **Constantine Samaras**, and undergraduate student **Andrew Bakert**

institutions also can benefit. Samaras says, "The goal is to have a website that presents our ongoing climate change adaptation work and shares existing knowledge with the research community."

#### MAPPING IMPACTS

CEE Assistant Research Professor **Athanasis Karamalidis** is one faculty member who is working to expand this knowledge. With CEE Masters student **Weiqiu Zhang**, he has been mapping

potential climate-related changes in water quality around the world.

Karamalidis explains that a rise in global temperature could have a variety of “cascading effects.” For example, shifts in the amount of rainfall could affect the levels of ground water that many people worldwide use for drinking. Changes in water quality could impact industries, wildlife, and many of our daily activities, so it is important that we understand potential impacts and prepare accordingly.

That’s why Karamalidis and Zhang have been brainstorming the properties in ground water, rivers, lakes, surface water, wetlands, and other water systems that could be altered by climate change. These include pH levels, dissolved oxygen, nutrient content, and the amount of heavy metals. Because effects are unlikely to be uniform, they are also attempting to determine the specific properties that will be affected in each global region.

When the mapping phase is complete, Karamalidis and Zhang will consider how differences in water quality might affect related infrastructure. For example, they might examine how changes in dissolved oxygen will affect the cost of water treatment and the design of water treatment plants. Karamalidis believes that this type of work will allow us to respond to climate change proactively.

“If we will have increased rainfall, perhaps we could come up with sewage networks that use that excess water for the production of energy,” he says. “I’m not just coming to remediate, I’m also interested in taking advantage of these changes.”

### PREDICTING EXTREME WEATHER

While understanding global trends is useful, civil and environmental engineers will most benefit from information about the specific regions in which they work. Of particular concern is the frequency of extreme weather events like

hurricanes, tornadoes, and floods, because of their substantial potential to damage infrastructure systems. To help address this need, CEE Assistant Professor **Matteo Pozzi**, CEE/EPP Professor **Peter Adams**, and CEE Master’s student **Sham Thanekar** (MS ‘15) are working to determine if climate change will affect the likelihood of floods in the Pittsburgh region.

This is a complex problem because a myriad of regional characteristics determine whether a storm will create a flood. “It depends on the system you are observing,” says Pozzi. “Each region has a certain type of terrain at a certain slope, a certain



Image: NOAA

## Weather vs. Climate

**CEE/EPP Professor Peter Adams** says that many people are skeptical about climate modeling because they incorrectly assume that climate is equivalent to weather. “They’ll say, ‘If you can’t tell me the weather 10 days from now, how can you predict what the climate will be like in 100 years?’ But the prediction processes are completely different,” he explains. While weather describes the specific conditions at any given moment—is it raining or not raining—climate is a statistical description of weather trends, like the average temperature of Pittsburgh during summer months.

It is extremely difficult to predict if it will be raining on a specific day next year, but Adams says it’s much easier to predict the probability that the temperature will be between 60 and 80 degrees Fahrenheit. “Have you ever looked at a travel guide before a vacation and gotten the temperature and precipitation ranges for your destination? That’s climate,” says Adams. “Essentially, we’re now trying to update those estimates for 50 years from now when the climate has changed.”

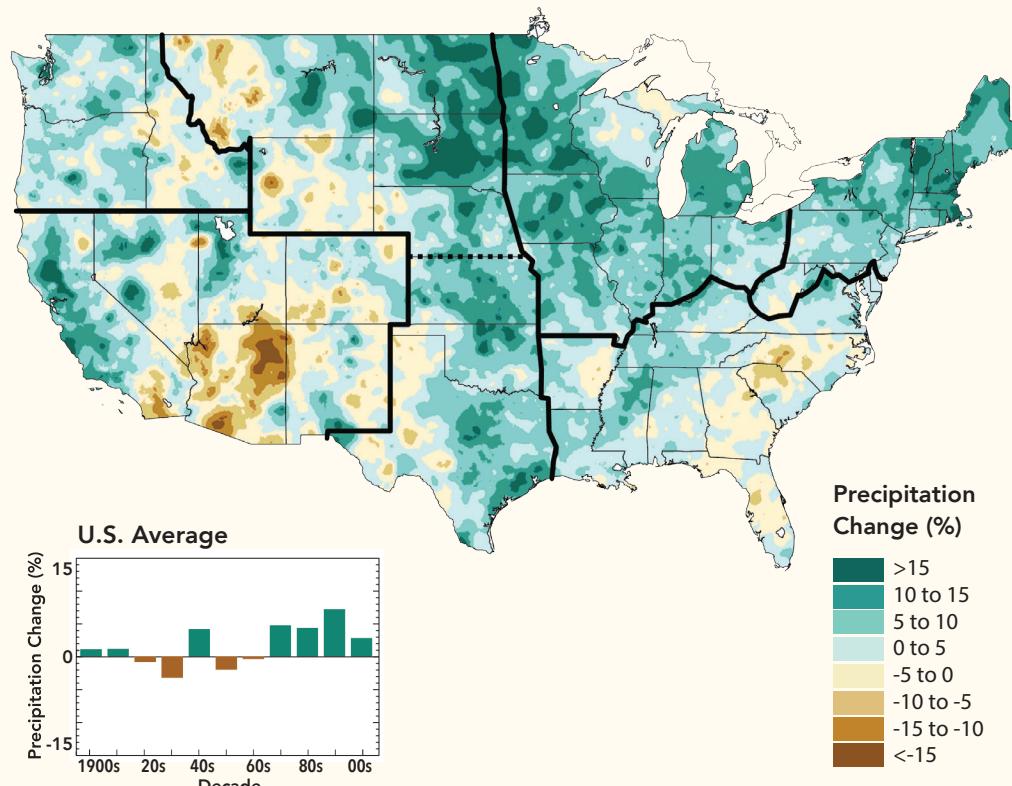


## Constantine Samaras Joins ASCE Committee on Adaptation to a Changing Climate

**CEE Assistant Professor Constantine Samaras** joined the American Society of Civil Engineers' Committee on Adaptation to a Changing Climate to help produce a report titled "Bridging the Gap Between Climate Science and Civil Engineering Practice." It describes climate modeling science, how uncertainty about climate change will impact civil engineering, and challenges for specific infrastructure sectors.

Samaras coauthored two sections on potential impacts for energy and transportation infrastructure and has continued to help revise and shape the remainder of the report. "This document is meant to bring different communities together to examine what civil engineers need from their external partners and what they need to consider for climate change adaptation," he says.

## Observed U.S. Precipitation Change



Graphic: U.S. Global Change Research Program

rate of draining the water, a certain capacity of the sewer system, etc." That means that a dangerous amount of rainfall for Pittsburgh could be harmless in a different city with larger sewers and soil that more readily absorbs water.

Pozzi, an expert in risk analysis, is using all of these factors to build a statistical model of the Pittsburgh region. The model will allow him to determine "critical events," or exactly what type of storm—intensity and duration of rain—is enough to produce a flood. When the model is complete, Pozzi will use projected levels of precipitation to determine how many floods Pittsburgh can expect over the next 100 years. Adams, an atmospheric scientist who has worked extensively with climate models, will provide these estimates.

Unfortunately, technological limitations make this a fairly difficult task. Adams explains that this is because the latest, state-of-the-art climate models are only capable of giving estimates for 100 km x 100 km areas. As this is a large, often non-uniform region, these estimates are somewhat imprecise. "A perfect climate model would have horizontal resolution of about 10 meters to describe clouds and precipitation fully," says Adams, "but we're not going to have the computer processing power for that anytime soon."

In addition, though climate models generally predict that drier climates will have less rain and wetter climates will have more rain, Pittsburgh is located between these two extremes. Adams says that as a result, available climate models yield different estimates of Pittsburgh's future precipitation.

Because of these limitations, Adams will generate several precipitation projections for the project. “We’re providing a best guess estimate with an average of different climate models, but we’re also providing a worst-case scenario and a best-case scenario,” he says. “This will allow infrastructure planners to consider a broad, but still scientifically plausible, range of conditions in their design.”

### THE FUTURE OF THE FIELD

Adams admits that limitations in climate modeling and general difficulties in modeling precipitation in climate models make uncertainty in civil and environmental engineering “something we’re going to have to learn to live with.” To help students navigate this in their future work, CEE is developing a sequence of in-depth climate change adaptation courses.

Samaras is preparing to teach the first of these, a new class called “Climate Change Adaptation,” this fall. He believes that knowledge of this topic is now essential for new engineers. “The climate is changing, but the timing and the magnitude of the impacts vary,” Samaras says. “Designing robust infrastructures is becoming a gray area of judgment that engineers need to communicate to stakeholders and decision makers.”

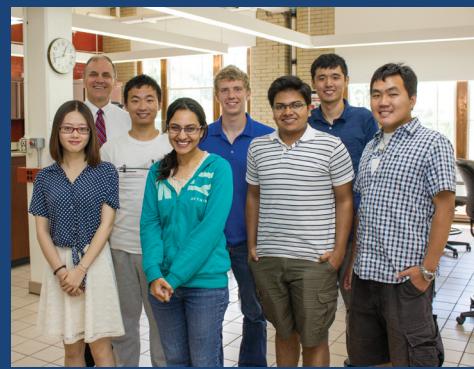
Hamerschlag University Professor and CEE Department Head **Dave Dzombak** believes that this unprecedented gray area will make climate change adaptation “a defining challenge for the field in the 21st century.” Fortunately, CEE is well equipped to find solutions.

“In our department, we have people who work on infrastructure, resilient cities, sensors, water quality, atmospheric modeling, and sustainability. We can all use our individual expertise to collaborate on this topic,” says Karamalidis. Samaras adds that Carnegie Mellon University’s interdisciplinary nature is also an advantage. “We can bring in colleagues from politics to economics to computer science and understand what climate change means within our discipline as well as at a system level. This is very important to our profession and we believe we are uniquely suited to make a difference.”

### CEE SUMMER RESEARCH INTERNS

These climate adaptation projects were a part of CEE’s 2014 summer research internship program which gives undergraduate and masters students paid positions working with CEE faculty.

The internship provides hands-on research experience and practice applying for jobs—all candidates must submit a written application and undergo an interview. This year’s interns presented their work in a departmental poster session in mid-August.



**Top image pictured with Professor Dzombak from left to right:** Weiqiu Zhang, Shujie Zhang, Nemi Vora, Jacob Rice, Sham Thanakeer, Qingyu Fan, Billy Li



# 2014



**ASCE Outstanding Civil Engineering Student Award**

**Christopher Ejiofor and Adefolahan Odunlade**

**H. A. Thomas, Sr. Distinguished Service Award**

**Margo Johnson**

**H. A. Thomas, Sr. Scholarship Award**

**William Elmore**

**James P. Romualdi Civil and Environmental Engineering Award**

**Jeffie Chang**

**ASCE Student Leadership Award**

**Christopher Ejiofor**

**Judith A. Resnik Award (Honorable Mention)**

**Corinne Clinch**

**Outstanding Teaching Assistant Award**

**Jason Marshall**

**Paul P. Christiano Distinguished Service Award**

**Emre Can Kara**

**Mao Yisheng Outstanding Dissertation Award**

**Haydar Karaoglu**



## Even Materials Get Stressed: Acharya's Work on Line Defects

CEE Professor **Amit Acharya** is interested in the causes of stress, but not in the usual sense. Acharya, a professor in CEE's Mechanics, Materials, and Computing (MMC) research group, studies how structural imperfections, or defects, in crystalline materials interact and evolve.

"A defect is essentially when the lattice of a crystalline material gets a little messed up," Acharya explains. "And when the lattice gets messed up, certain parts of the material become stressed. As soon as there is stress in the material, that stress interacts with other defects and forms loops and curves of defects within the lattice called line defects. The most common one is called a dislocation." Acharya is studying how these defects in a material move and spread and making mathematical models that reflect how crystalline materials behave under stress.

"The Holy Grail in manufacturing is to develop material that is high-strength and high-ductility, which means the material can tolerate high levels of stress and won't crack when its stress limits are reached," Acharya says. "For example, people in the auto industry want to make alloys from steel that are as strong as steel but as ductile as aluminum. But even today, there is not a completely predictive theory that can tell you how a simple crystalline material will behave under specified stresses." Understanding the behavior of defects in materials is critical in the predictive design and manufacture of turbines used in power generation and aircraft engines, which operate in high-temperature, high-pressure environments.

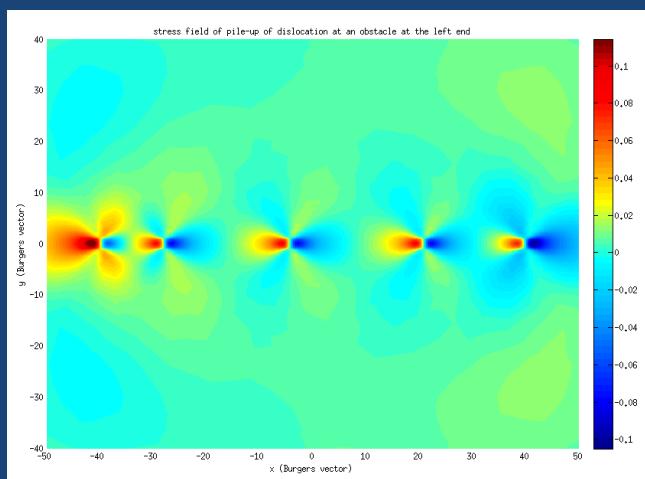
As dislocations form and grow within a material, many of them are also moving. This movement leads to large-scale flow or deformation. Sometimes, Acharya explains, engineers can take advantage of this flow. "When you take a sheet of metal and you stamp it in a shape that will be part of the body of a car, you use that flow to make the metal deform a huge amount. But you also want to do it in a controlled way; if the auto part has deformations that are concentrated in a particular section, it will split," he says. "And to really understand this macroscopic behavior, you have to understand the underlying theory first."

Acharya and PhD student **Xiaohan Zhang** are particularly interested in the process of yielding, which is the threshold applied load required to observe plastic flow. At the scale of an individual dislocation, this translates to the load required to move a single dislocation, the phenomenon called pinning. For almost seventy-five years, scientists have believed that any mathematical model that does not account for the discreteness of the atomic lattice cannot predict such a threshold. Through their theory and careful simulations, Acharya and Zhang show a different mechanism for such a threshold arising from the details of equations describing nonlinear wave propagation.

While it is too early to say whether such a physical mechanism is indeed at play for crystal dislocations, nevertheless Acharya and Zhang take satisfaction in having developed a new class of pattern-forming equations, motivated by and closely related to the mechanics and physics of dislocation behavior, that show pinning.

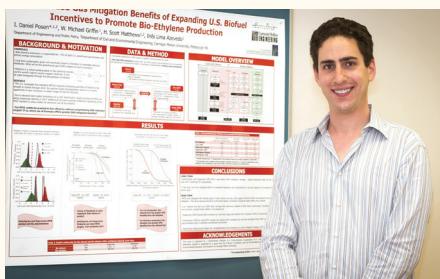
Ultimately, Acharya envisions the group's research being used to aid in the prediction of earthquakes. Acharya and Hamerschlag University Professor **Jacobo Bielak** are collaborating to study this topic, known as rupture dynamics. "In an earthquake, a small region in the fault plane slips," Acharya explains. "The boundary of that slip region is again a dislocation, and the mathematical description is exactly the same as that of a defect nucleating and propagating in a small volume of material. This is the power of general mathematics; you're talking about earthquakes and about defects at the nanoscale, but at some level, they're the same thing!" Modeling the formation, movement, and interaction of defects in crystalline materials can be a useful tool in understanding and anticipating earthquakes.

Acharya is also looking at the behavior of defects in amorphous materials, such as metallic glasses. Unlike a crystalline material, an amorphous material's structure does not follow a pattern, making it particularly prone to defects. "In a crystalline material, you can identify a basic unit cell which can be replicated to fill space without stress," he says. "But amorphous materials don't have that structure or basic units that can fill space without deformation, and therefore the material becomes 'geometrically frustrated'; it becomes stressed and develops lots of defects even without loads. And if we can phrase these kinds of things mathematically, we can then analyze them and develop a better understanding of their macroscopic properties."



**The visualization is of the collective stress field of dislocation line defects that move on a slip plane when an external load is applied. Here the dislocations cause a 'pile up' on encountering an obstacle at the left end. Often the material constitution is such that there are other stronger particles, inclusions etc. that intersect these planes. When this occurs the dislocations cannot go through, and get jammed up against them. A pile up is such a 'traffic jam' as pictured to the left.**

# Student News



## Posen Awarded Best Paper and Best Poster

CEE/EPP PhD student **Daniel Posen** was awarded Best Paper for his presentation at the 2014 Technology Management and Policy Graduate consortium in Lisbon. His paper, *Greenhouse Gas Mitigation Benefits of Expanding U.S. Biofuel Incentives to Promote Biomass use in Chemical Feedstocks*, proposes that credits for the U.S. renewable fuel standard could be applied to bio-ethanol used for bio-ethylene production (in addition to the credits already applied to bio-ethanol for fuel) without compromising on greenhouse gas reduction targets.

Daniel's research was also awarded a prize in the poster competition at the ACS Annual Green Chemistry and Engineering conference in Washington, DC.

## Corinne Clinch Awarded CMWA Scholarship



CEE/BME senior **Corinne Clinch** (BS '14) was awarded the Carnegie Mellon Women's Association (CMWA) Scholarship in honor of **Mary Suresh** and her

dedication to the Health Care Industry. The CMWA Scholarships began in 1964 to honor outstanding women at Carnegie Mellon. The tradition continues today with annual scholarship awards given to selected senior undergraduate women planning a career in health care.

## ASCE 2014 Distinguished Chapter Award

The ASCE student chapter received the Region 2 ASCE 2014 Distinguished Chapter Award, presented by Region 2 Governor Thomas J. Imholte. With an accomplished and enthusiastic group of students, paired with strong leadership, the chapter grew and advanced their reputation and visibility in the region. The CEE chapter was recognized for their achievements, which included a number of service events and hosting the ASCE Ohio Valley Regional Student Conference.



2013-2014 ASCE Chapter with faculty advisor Jim Thompson. Front row (l-r): Erin Persson, Madelyn Gioffre, Miriam Hegglin, Esther Urena, Millard McElwee. Back row (l-r): Margo Johnson, Debra Lin, Remy Behl, Christopher Ejiofor, Fola Odunlade, Paige Sieffert

Thomas J. Imholte (right) presents the chapter award to 2013-2014 ASCE Student Chapter President, Chris Ejiofor.

## Ejiofor Wins ASCE Student Leadership Award



CEE senior **Christopher Ejiofor** (BS '14) received the national 2014 ASCE Student Leadership award for his service to the campus chapter. He also co-organized the 2014 Ohio Valley Student Conference where 15 regional universities competed in a number of civil engineering based events. Ejiofor also worked closely with first year undergraduates and helped them determine which areas of engineering best suited their interests.

Ejiofor credits the Pittsburgh ASCE chapter, which is dedicated to students and their career development, in helping him accomplish his goals. "I am blessed to receive this award," says Ejiofor. "It is truly an honor to be recognized for what I've done, but this award is really for all the people around me who helped me to achieve my goal, from students to CEE staff and faculty. This community has been tremendously supportive of my work through ASCE and I am forever grateful."

## CEE IM Soccer Team Wins Second Place

Two CEE/ECE/EPP graduate student intramural soccer teams are proud to have won second place in the CMU Intramural Indoor Soccer mens' and the co-recreational tournaments. The teams, named Civilization, made it to the championship game of the tournament among 36 teams for the mens' and 24 teams for the co-recreational league.

Civilization includes CEE students **Arka Roy**, **Navid Kazem**, **Suman Giri**, **Chelsea Kolb**, **Kelly Good**, **Erin Dauson**, **Hariprasad Parthasarathy**, and **Eric McGivney**, ECE student **Shih-Chang Hung**, and EPP student **Shelly Hagerman**. Team captain and CEE student **Milad Memarzadeh** remarked on the team, "I believe the great achievement of this tournament was that we showed the CEE culture, unity, and competitiveness to the CMU community."



## Recent PhD Theses

### Djuna M. Gulliver

*Concentration-Dependent Effects of CO<sub>2</sub> on Subsurface Microbial Communities Under Conditions of Geologic Carbon Storage and Leakage*  
Advisors: Kelvin Gregory and Greg Lowry

### Haydar Karaoglu

*Finite Element Simulation of Earthquakes with Coupling Tsunamis in Large Domains*  
Advisor: Jacobo Bielak

### Stacey Marie Louie

*Characterization and Modeling of Macromolecules on Nanoparticles and Their Effects of Nanoparticle Aggregation*  
Advisors: Greg Lowry and Robert Tilton

### Peter Simon

*Social Network Theory in Engineering Education*  
Advisor: Susan Finger



## Sun Presents Green Energy Research at ISSST

CEE student **Yunlin Sun** (MS '14) attended the International Symposium on Sustainable Systems and Technology (ISSST) in Oakland, California. Sun presented her team's research, "Using Wind to Produce Renewable Energy in Southern California", at the conference poster session competition. Their research was based on a project they completed in CEE's Civil Systems Investment Planning and Pricing course and was funded with support from National Science Foundation Sustainability Scholar Awards.

Civil System Investment and Pricing is a graduate course that introduces students to the fundamental principles and quantitative methods used in engineering systems, and how to communicate their results. Instructor **John Matsumura**, senior engineer at the RAND Corporation, included a case study of the applicability of solar dish stirling engine systems in the course's curriculum.

Inspired by this work, Sun and her team investigated whether wind could be a better solution for California's energy needs by comparing the levelized cost of electricity of wind, solar and hybrid systems. They concluded that wind is the most competitive renewable energy for southern California and provided suggestions based on status quo.

"The course has influenced me a lot," Sun said. "The final project is really meaningful and I am so proud of my team." The team, which included **David Zgong** (MS '14), **Xin Fu** (MS '14), **Xiao Huang** (MS '14), **Jing Xue** (MS '14), and **Heming Zhang** (MS '14) were encouraged by Matsumura to publish their work and chose the ISSST symposium as the best avenue to present their results.

Sun says that presenting at the symposium was a positive experience both personally and professionally, allowing her to hone her presentation skills and develop a clearer picture of the next steps for the project. "I met professors from Ireland, England, and other universities within the United States. All the professors and students provided positive feedback," she says.

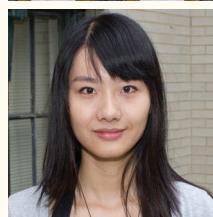
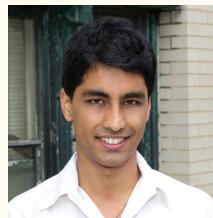
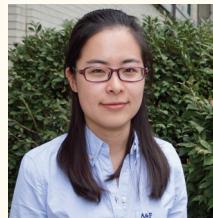
"I want to thank department head **Dave Dzombak**, instructor **John Matsumura**, Professor **Scott Matthew** and my teammates, especially **David Zgong**," said Sun. "CEE is a like a community that you could not only learn from but also like a family. Without the support and encouragement from the CEE department, I don't think I would be able to make it." The CEE department helped support Yunlin's travel to the conference.



Sippe Steel Plant Tour



Graduate Dinner - Dave & Busters



## Fenves Travel Grants Awarded

The Steven J. Fenves Travel Grant was created to provide students the opportunity to present their research at a professional conference. The following students were awarded support to attend various conferences this year.

**Vaibhav Agrawal** – 17th U.S. National Congress on Theoretical and Applied Mechanics in East Lansing, Michigan

**Akanksha Garg** – Materials Research Society Meeting in Boston, Massachusetts

**Suman Giri** – Non-Intrusive Load Monitoring Conference in Austin, Texas

**Bo Gu** – 2014 Construction Research Congress in Atlanta, Georgia

**Navid Kazem** – Gordon Research Conference in Eatontown, Massachusetts

**Milad Memarzadeh** – International Workshop on Structural Health Monitoring at Stanford, California

**Miguel Mora** – International Conference on Computing in Civil & Building Engineering in Orlando, Florida

**Xue Yang** – International Conference on Computing in Civil & Building Engineering in Orlando, Florida

## CEE Community Events



Graduate Student Appreciation Bowling Night



Ice Cream Social



CEE at PNC Park



Senior Dinner



2014 Talent Show



Spring Pancake Breakfast

Soon, banks may not need cameras to spot criminals. That's because CEE Assistant Professor **Hae Young Noh** is developing ways to record and track people's footsteps. The project, which is a collaboration with associate research professor **Pei Zhang** (ECE - CMU Silicon Valley) and associate professor **Lin Zhang** (Tsinghua University), involves analyzing the data collected from floor sensors. "Usually people don't think about it," she says, "how much information they are giving out by just walking around."



## Vibration Analysis: The "Wave" of the Future

The sensors pick up the vibration waves that pass through the floor when someone takes a step. By examining these waves, Noh can figure out how fast someone is moving, their weight, and even their shoe type. "The waveform actually looks different depending on how you walk, whether you're wearing high heels, etc.," she says. For instance, high heels produce higher frequency vibration waves than tennis shoes. When a person is turning, they place more weight on one foot, producing a footstep wave that is noticeably higher than the others.

The sensors can also be used to find people. If you put three sensors in various places along the floor, footstep waves will arrive at each sensor at different times with different amplitudes. The time and amplitude differences can be used to pinpoint a person's exact location. Because of this, many businesses have expressed interest in using this technology for security purposes. Noh says that retailers could also combine sensor data with the information from clothing tags to determine what items customers are actually bringing into the dressing room.

It's even possible to use the sensors with machine learning algorithms that can recognize specific walking patterns and flag people who may be sick, nervous, or lost. This could help businesses identify new customers who need assistance and nursing homes identify patients who need medical attention. This kind of tracking depends on the floor type and the number of people in a space—eventually, individual footstep waves begin to blend together—but Noh says that with enough sensors, she could track hundreds of people.

In very large areas like shopping malls, the sensors use the floor's general vibration level to estimate the number of people and what kinds of activities they're doing. Because these factors greatly influence the amount of electricity and heat used in a building, the sensors are also an excellent, nonintrusive way to monitor energy consumption.

With the help of PhD students **Chandrayee Basu** (CEE) and **Shijia Pan** (ECE) and undergraduate **Amelie Marie Bonde** (CS '14)—who are co-advised by Noh and Zhang—Noh has already published a paper describing this work. Over the next few years, she plans to conduct lab experiments to refine her understanding of sensor data and is also interested in employing this technology in other contexts. "Vibration analysis can be applied to floors, buildings, trains, and different things. Vibration is everywhere," she says. One new project even involves placing sensors inside of clothing so that they can analyze the vibrations of people's muscles.

Because of their many uses, Noh anticipates that sensors will eventually be a standard feature in a myriad of spaces. That means vibrations are quite literally the waves of the future.

## CrowdVibe System



Vibration from different events



### Raw Vibration Data

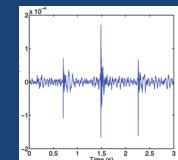


#### Sensing

Existing infrastructural sensors for building vibration monitoring are used.

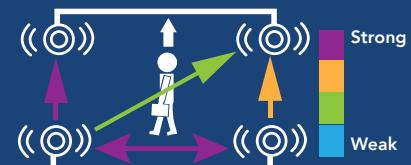


### Occupant Movement



### Footstep Detection and Localization

Individual walking signature is extracted to enable location tracking



### Occupant Tracking

Movement of a group of people can be tracked across an area of interest (e.g. shopping mall)



## Larry Cartwright Retires

After more than 35 years of service to Carnegie Mellon University, CEE Professor Emeritus **Larry Cartwright** (BS '76, MS '87) has retired. During Spring Carnival weekend, many of his students, colleagues, and friends gathered to celebrate his numerous contributions to the Civil and Environmental Engineering Department.

In 1977, Cartwright began his CMU career as the manager of the Civil and Environmental Engineering Laboratories. His propensity for teaching was immediately apparent, and he has since been the instructor for several undergraduate courses including CEE Design, Soils Lab, Materials Lab, and Design and Construction. He has been recognized more than once as an outstanding teacher, including winning CMU's Ryan Award in 1994—an honor given to one faculty member each year for

Often, Cartwright would pepper his engineering instruction with more important lessons about the value of hard work, integrity, and practical thinking. "I learned about life, I learned about how to put things together, and I learned about how to deal with people in a respectful way with high expectations," says alumnus **Keith Sunderman** (BS '83), who was both Cartwright's student and work-study employee. "I like to think that the reason I've been successful is because I know what it takes to get things done—that comes from Larry Cartwright."

These lessons have been so impactful that several alumni said that their time with Cartwright has continued to influence their professional lives. **Sarah Christian** (BS '03), who travelled all the way from Scotland to be at the event, spent a year and a half teaching alongside Cartwright before becoming an instructor herself. She says, "I think of Larry almost every time I teach. He taught me how to ask the students questions to push them farther. I have tried to incorporate that into my own teaching."



**Larry** pictured with many of his former work study students.

demonstrating unusual devotion and effectiveness as an instructor. In 2004 he was appointed as a full Teaching Professor, the highest honor awarded to teaching faculty at CMU.

Though he has many such accomplishments, Cartwright's power as an educator is most evident when talking to his current and former students. Many who attended his retirement celebration commented that he has a uniquely "down to earth" way of explaining material. "Concepts that sound extremely complicated coming from someone else make perfect sense coming from him," says **Chris Fornataro** (BS '09, MS '10). "He teaches you more than theories. He shows you how to use your common sense to be an engineer, not just a number cruncher."

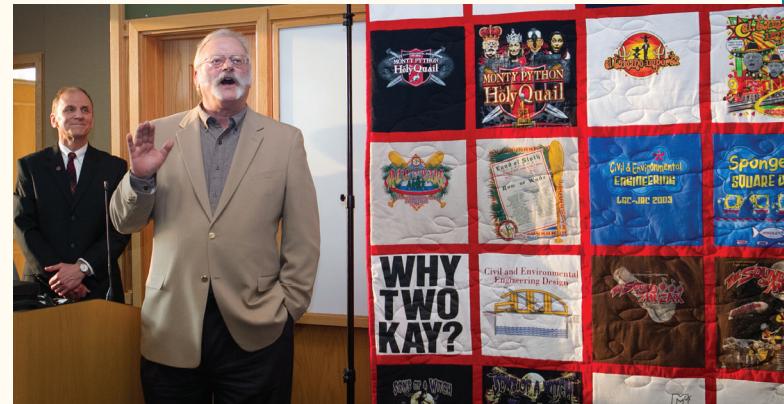
**Larry** was presented with a commemorative quilt featuring the t-shirts from CEE Design capstone course.



**Bobbi Marstellar**

Cartwright has been a mentor and a friend to countless students over the years, and his generosity is a recurrent theme in their stories. For example, **Bobbi Marstellar** (BS '93), who is affectionately described as Cartwright's "daughter," explains how he supported her after her father passed away during her junior year of college. "He's been good to me, really and truly."

True to character, after being presented with several mementos at his retirement party, Cartwright humbly commented that he'd simply done his best. Judging by the full room and the many heartfelt memories, Cartwright's best has been nothing short of exceptional. He exemplifies the Carnegie Mellon University spirit—his heart is truly in his work.





To commemorate Cartwright's contributions to the department, a group of alumni have decided to create the Lawrence Cartwright Support Fund for Teaching Professors. Many of his former students have already contributed more than \$250,000 to the fund, which will be used to provide Teaching Professors in the CEE department with resources for their courses. Even more exciting, if the fund reaches one million dollars it becomes a full Teaching Professorship—the first Professorship for teaching faculty ever at CMU.



## Newly Named CEE Professorships

Professor **Jeanne VanBriesen** has been named the Duquesne Light Company Professor in Civil and Environmental Engineering. VanBriesen is a water quality-engineering expert and focuses her research on environmental biotechnology, studying biotransformation of recalcitrant organic pollutants, pathogen detection and control, monitoring approaches for drinking water distribution systems and formation of disinfection byproducts in drinking water treatment.

In addition to her successful research collaborations with other U.S. institutions, VanBriesen has been very successful in both undergraduate and graduate teaching. Her professional activities and service make her well known in the environmental engineering community, nationally and internationally.

Professor **Greg Lowry** has been named the Walter J. Blenko, Sr. Professor of Civil and Environmental Engineering. Lowry is regarded as a well-known expert in water quality engineering, with a focus on contaminant fate, transport and in situ treatment in sediment and groundwater systems. His research interests broadly include environmental nanotechnology, energy and environment, and environmental remediation.

Lowry is a leader among his peers at institutions in the U.S. and around the world. His research, teaching, and professional service are well known in the environmental engineering and science academic communities, both nationally and internationally.

Professor **Burcu Akinci** has been named the Paul P. Christiano Professor of Civil and Environmental Engineering. Akinci is internationally recognized as a leader in deployment of advanced technologies and sensor-data-driven management in construction. She leads research and education collaborations with colleagues in multiple colleges at CMU and at other institutions around the world. She has been very successful in both undergraduate and graduate teaching, and Akinci's professional service activities are well known in the construction academic community, nationally and internationally.

Akinci is also the co-director of the Smarter Infrastructure Incubator (SII), an interdisciplinary research lab at CMU that aims to advance infrastructure technology through partnerships with Pennsylvania businesses and government agencies.

# Faculty News



## Dzombak and Gregory Speak at State Department Power Course

Hamerschlag University Professor and CEE Department Head **Dave Dzombak** along with Professor **Kelvin Gregory** jointly gave a talk entitled “Energy and Water Nexus” at the Foreign and Civil Service Officer Energy: Power Generation Training Course. Dzombak discussed the significant need for water in electric power production and alternative water sources being developed for this purpose. Gregory’s talk discussed the management of produced water from hydraulic fracturing operations in unconventional gas development.

The course was hosted by the U.S. Department of State Foreign Service Institute and organized by the National Energy Technology Laboratory (NETL). The week-long event, held in Pittsburgh, included participants from the U.S. Department of State’s Foreign Service Institute, U.S. Agency for International Development, U.S. Department of Commerce, and NETL. Additionally, members of the U.S. Department of State’s Bureau of Energy Resources covering the areas of Energy Diplomacy - Office of the Middle East and Asia, Energy Governance and Access - Office of Policy Analysis and Public Diplomacy, and Energy Transformation - Office of Electricity and Energy Efficiency attended.



## Cohon Appointed Co-Chair of DoE Commission



President Emeritus and CEE University Professor **Jared Cohon** has been appointed as a co-chair on the Commission to Review the Effectiveness of the National Energy Laboratories, which will advise Energy Secretary Ernest Moniz on how effectively the Energy Department’s 17 national laboratories are advancing research that aligns with national science, energy, environmental and security goals. The congressionally mandated committee will produce a two-part study, the first part of which is due by February 1, 2015.

Cohon is an expert on environmental and water resource systems analysis, an interdisciplinary field that combines engineering, economics and applied mathematics. His other research interests include environmental and energy systems and policy, multiple criteria decision-making and environmental modeling. He is co-director of the Scott Institute for Energy Innovation at CMU.

## Cohon Receives Carnegie Science Center Award

President Emeritus and CEE University Professor **Jared Cohon** and University of Pittsburgh Chancellor **Mark Nordenberg** recently received the 2014 Carnegie Science Center Chairman’s Award to honor their profound impact on scientific growth in the Pittsburgh region.

Cohon and Nordenberg’s hard work has helped to create joint degree programs and research initiatives between CMU and Pitt that have attracted and educated world-class researchers. “In each case, we can take advantage of the respective strengths of each university to the benefit of both,” says Cohon.

They have also co-chaired and helped to found several successful research centers including the Pittsburgh Life Sciences Greenhouse, which helps to support life sciences companies and create jobs in the region. Centers like these consistently receive funding to conduct cutting-edge research that has helped to make Pittsburgh a leader in scientific and technological innovation.

## VanBriesen - Guest Editor for ASCE Journal



Duquesne Light Company Professor **Jeanne VanBriesen** was invited to be the guest editor for ASCE’s Journal of Environmental Engineering special issue discussing environmental impacts of shale gas development. Papers included in this issue discuss fracking’s effects on water resources and allocation, migration of fluids (liquids and gases) in aquifers and waterways, produced water treatment, and air quality.

## Lowry as Highly Cited Researcher



Walter J. Blenko, Sr. Professor **Greg Lowry** was recently included in the Thompson Reuters Highly Cited Researchers 2014 list, which represents some of the world’s leading scientific minds. Over three thousand researchers earned the distinction by writing the greatest numbers of reports officially designated by Essential Science Indicators (ESI) as Highly Cited Papers—ranking among the top 1% most cited for their subject field and year of publication, earning them the mark of exceptional impact and most influential.

Hammerschlag University Professor Chris Hendrickson hosted a meeting of the National Academy of Engineering’s Committee on Reinvesting in Inland Waterways: What Policy Makers Need to Know, which is part of the Transportation Research Board.

# Lessons in Consulting

CEE's aspiring consultants can now add in-depth professional preparation to their spring schedule. Created by CEE's Environmental Engineering Sustainability and Science (EESS) group, the 12-718 Sustainable Engineering Projects course is specifically designed to help Masters students develop skills relevant to the consulting profession. Though it's only completed its second year, the class has already received positive reviews from both students and employers.

"In one sentence, it is a course where we try to deliver the experience of working on a project in a consulting firm," says course instructor **Janel Miller**. She and course co-creators Duquesne Light Company Professor **Jeanne VanBriesen**, and Professor of the Practice, **Dave Nakles**, have used their knowledge of consulting to make students' experiences authentic. In just 15 weeks, groups of students write project proposals, develop and follow project timelines, work within teams, write progress reports, and present their work.

An introduction to the cost structure and management practices of consulting firms is an important component because it helps students to understand the importance of tracking billable hours and producing quality products on schedule and within a set budget. Nakles notes that most graduating engineers are totally unaware of the cost and profit structure of a consulting firm, often resulting in frustration with, and lack of attention to, the administrative demands of the business. "New consulting engineers need to understand that even the best quality product, if over budget or late, will not be well received," he says.

On projects, students have the opportunity to interact with and work for real-world clients, who have included local nonprofit agencies, for-profit corporations, and CEE professors. In all cases, students are expected to develop usable products and solutions by the end of the course. Professor



Jeanne VanBriesen



Dave Nakles



Janel Miller

VanBriesen says that one of the most interesting projects from last year's class was for an internal client: CEE Associate Professor **Kelvin Gregory**.

The project involved a new approach to manage and treat produced water from shale gas extraction. Produced water contains salts—one of which is bromide, a commodity chemical that has a variety of

engineers typically solve. "This is the way engineers work—you don't just walk into a situation and assume that you can have as much money, concrete, and electricity as you would like," she says.

Working on these types of projects can give students an edge in interviews because it gives them a specific and highly relevant experience to discuss with prospective

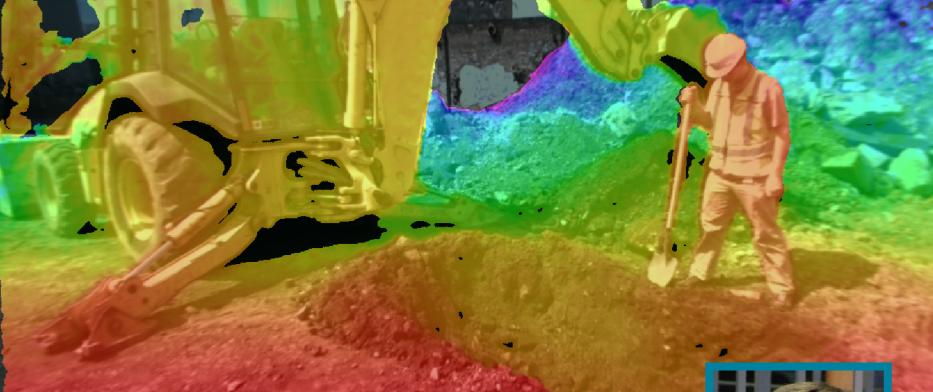
***"New consulting engineers need to understand that even the best quality product, if over budget or late, will not be well received."***

uses. "Kelvin wanted a group to determine if there is enough bromide in produced water that, using either a process he'd developed or a commercial process, you could extract and sell it," says VanBriesen. By the end of the semester, the students were able to show that both extraction methods were capable of producing enough bromide to make a profit.

A particularly challenging project involved creating a design and implementation plan for a low-energy sewage treatment plant in a third world country. The plant must be able to accommodate large population fluctuations and can only be built from materials available in the surrounding area. VanBriesen says that this unusual set of constraints made this project representative of the kinds of problems professional

employers. In fact, Miller says that some employers were so impressed with the course that when they called her for student recommendations, "they spent as much time talking about the course as they did the potential employee!" As a result, student interest in Sustainable Engineering Projects significantly increased after its first year.

Miller and VanBriesen say the course is gratifying for the instructors as well. "It's a lot of work for us to teach this class, but I value seeing the transformation of the students," says VanBriesen. "We're not just here to teach them content—you can read books for that. As instructors, we're here to help them become engineers. To see that happen over fifteen weeks is exciting."



Using less than 10 Watts, the MultiSense S7 3D Camera produces full-frame range images at up to 30 Hz with approximately 1 frame of latency. Above, a single MultiSense S7 range image of about 500,000 points. This view shows the color camera image overlaid with colorized range data with hotter colors denoting closer proximity to the sensor.



## Real-World Robotics

President and CEO of Carnegie Robotics **John Bares** (BS '85, MS '87, PhD '91) is hardly a typical civil and environmental engineer. Over the past 30 years, he has built a career at the forefront of cutting edge robotics research and is now working to bring groundbreaking technologies to the public.

Bares discovered robotics as a CEE undergraduate by chance when he interviewed former CEE (now Robotics) Professor **William "Red" Whittaker** (BS '73, MS '75 PhD '79) for a technical writing project. He says he was immediately captivated by Whittaker's research on robotic manipulators, and "the rest was history." From then on, he pursued a multidisciplinary course of study culminating in a robotics-focused PhD in 1991. Whittaker has remained his mentor and inspiration ever since that first meeting.

After graduation, Bares worked for Mitsubishi Heavy Industries in Japan and as a Research Professor in CMU's Robotics Department before becoming the Director of CMU's National Robotics Engineering Center (NREC) in 1997. While overseeing the development and testing of advanced prototypes, Bares noticed a gap between research and commercial robotics. "At NREC, projects are engineered to a point, but you need to make sure they're cost-effective, hit reliability goals, and address a host of other little details before you can create a final product," he explains.

Inspired to fill this need, he co-founded Carnegie Robotics LLC in 2010—a company that works on the "little details" of manufacturing, supporting, and supplying robotic technologies. In addition to licensing NREC's research, Carnegie Robotics has launched several successful products of its own. Recently, its MultiSense laser/camera sensors were used on many of the robot "heads" for the Defense Advanced Research Projects Agency's (DARPA) humanoid robot challenge.

Though his work has taken him far from construction and soils, he says his civil and environmental engineering training has been useful. "My career has taken me outside the factory—coal mines, agricultural fields, the inside of a supertanker hull—and the various CEE engineering classes I took gave me a deeper understanding of those projects." The problem-solving capabilities he gained have also been integral to navigating the challenges that accompany commercial robotics.

Bares says that tackling these challenges is both difficult and rewarding because companies like Carnegie Robotics will help new technologies transition out of the lab and into our daily lives. "I want to see robotics products going out and being used," he says. "It's the way I want to make an impact on the world."

## Coffelt (PhD '08) Elected as ASCE Fellow

CMU Associate Vice President and Director of Facilities Management Services, **Donald Coffelt** (PhD '08), has been elected as an ASCE Fellow. This prestigious honor is in recognition of his professional accomplishments and contributions to the civil engineering profession.



Coffelt manages a 275-member team and is responsible for the facility services, infrastructure management, and utility operations of the university's 140-acre Pittsburgh campus. Coffelt also serves on the President's Council and is responsible for university-wide sustainability practices. In addition, Coffelt holds an appointment as a CEE adjunct professor, with an expertise in infrastructure management and a special focus on promoting student and faculty access to university facilities for education and research.

An officer serving in the U.S. Coast Guard from 1985 to 2013, Coffelt completed his decorated 28-year career at the rank of captain in the U.S. Coast Guard Reserve. Licensed as a professional engineer in Alaska and Pennsylvania, he is an active member of numerous organizations and professional societies, including ASCE and the Architectural Engineering Institute of ASCE, and is a board member for the Andrew Carnegie Society.



October 9th to 12th

Find out about events, reunions and gatherings at the upcoming Ceilidh Weekend: [cmu.edu/ceilidh](http://cmu.edu/ceilidh)

To register for the CEE Alumni Awards Luncheon that will be held on Sunday, October 12th from noon to 2PM, please contact Ashley Patton [awpatton@andrew.cmu.edu] or visit: [cmu.edu/cee/events/alumni-luncheon.html](http://cmu.edu/cee/events/alumni-luncheon.html)

*Ceilidh* [kay-leē] n. a Scottish Gaelic term meaning "visit or gather"

## Giving Back After Graduation

Next Generation of Service (NGS) is an organization that helps to connect recent college graduates with long-term service opportunities. Participating students receive individualized mentoring and support while searching for, applying to, and navigating positions at nonprofits and service organizations. We recently spoke with NGS founder and CEE alumna **Anna Lenhart** (BS '11) to find out more about how NGS works and what it can offer to graduating students.

### Why did you decide to found Next Generation of Service? What inspired you and how did you come up with the idea?

Between my Junior and Senior years at CMU, I took a year-long leave of absence to serve as an AmeriCorps VISTA at Shakti Rising, a women's empowerment program in San Diego, CA. The experience helped me to integrate the systemic problem solving approach and technological applications I learned at CMU with real-world issues.

When I returned to campus, I noticed that some of my peers were struggling to figure out how they could use their degree to make a difference. I found that students at CMU and at other universities had no idea that there are opportunities to travel and work on issues they care about as a stipend volunteer. I thought a great way to get the word out about national (and international) service programs would be to give students access to peer mentors who have participated in such programs and can speak honestly about their impact.

### What do you hope that students will get out of working with your organization?

First, NGS mentors try to ease students' anxiety about "finding the perfect job" and remind them that they are not the only ones struggling with this decision. Second, we want students to truly consider doing a year of service after they graduate the same way they consider a corporate job and graduate school. Lastly, we want to give students support while they complete applications and navigate the logistics and challenges that accompany a long-term service program—like discussing the decision with parents and living on a stipend.

### How can working in a public service position benefit students and our society as a whole?

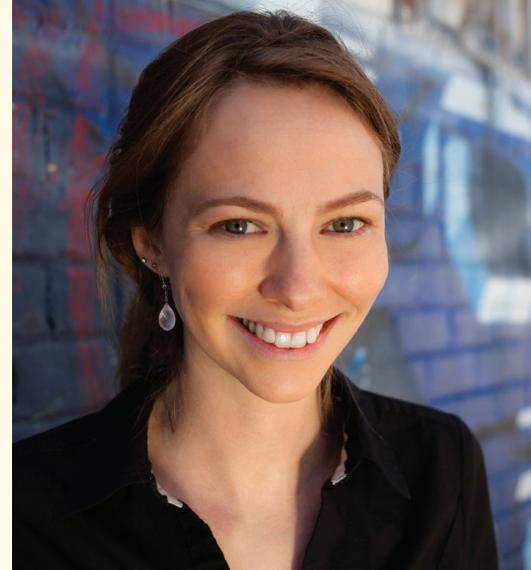
Public service is really a win-win. The majority of non-profits are under funded and understaffed, so a highly competent volunteer can fill the roll of a staff and amplify the organization's mission. Students receive great experience in a wide range of positions, which is exciting for those who desire to be entrepreneurial. Long-term service positions also give them a better understanding of their skill sets, what they like to do, and of a social issue at a deeper level. Students will take this empathy and civic engagement with them into whatever job they have next.

### How do you select the mentors that students are paired with? Why is it important for students to have a mentor?

We recruit mentors from networks of National Service Alumni (AmeriCorps, Peace Corps, etc.) and train them in basic coaching techniques to help young people discover what they are being called to do. When a student signs up for our program, they are matched with a mentor that has similar interests to them. Most students have to use the internet to explore service options, which can be an overwhelming and lonely process, and it is helpful to have a mentor to support you as you sift through the opportunities.

### How do you think your CEE Bachelor's degree prepared you for your experiences after graduation and for your new role as founder of this organization?

First, I cannot overemphasize the importance of systematic thinking and problem solving in the social sector—skills that are at the core of an engineering education. More specifically, CEE at CMU allowed me to have several leadership opportunities in class projects, independent research projects, and within student organizations. I learned how to take initiative, ask for help, and be an empowering rather than managerial leader.



**Anna Lenhart (BS '11)**  
**Founder and Chair of**  
**Next Generation of Service**  
**[ngsmovement.org](http://ngsmovement.org)**

**"We want students  
to truly consider  
doing a year of  
service after they  
graduate the same  
way they consider  
a corporate job and  
graduate school."**

## **Patton Leads CEE's Career Services and Alumni Relations**

**Ashley W. Patton**, Director of Career Services and Alumni Relations, joined the department in May. She works closely with students by providing professional development and skill building counseling to prepare graduates launching their careers. Coupled with hands-on mentoring, Patton is cultivating a strong network of corporate, technical, governmental, educational, and non-profit organizations to develop internship and full-time employment opportunities.



Along with her role as a professional development mentor, Ashley is CEE's alumni liaison who will continue to connect and celebrate our vibrant alumni community.

Ashley holds a BA in Philosophy from Westminster College, and a MS in Professional Leadership, Organizational Influence and Policy from Carlow University. She has a background of service and leadership in a number of non-profit and educational organizations; including The Literacy Council of Southwestern Pennsylvania.

### **What exactly does a Director of Career Services and Alumni Relations do?**

My position has two main goals: 1) helping students navigate a civil or environmental engineering job search and 2) helping alumni remain connected to the department. The two parts are actually well integrated. Students benefit greatly from a more experienced mentor, and many alumni state that helping students (even with something as simple as answering a few questions via email) is one of their favorite volunteer activities.

### **What advice do you have for an alum who wants to stay involved with CEE?**

We love having alumni stay involved with us! There are numerous ways to do this. Alumni are always welcome to attend our community events. If you are not receiving email updates about events please email me at awpatton@andrew.cmu.edu to sign up for the alumni mailing list, and stay informed about great opportunities to have fun with current students, staff and the faculty.

You can also help current students and new graduates get a jumpstart on their careers by offering to provide advice about professional development, career planning, or how to apply to your employer. Navigating the path to their first job can be overwhelming for many students, and mentorship from a professional already established in their field can be an incredible resource to them.

Speaking of careers, alumni are also invaluable resources to us as we work to expand our CEE career fair! This year our career fair is November 11th. If your employer isn't recruiting on campus, acting as an advocate for us is an incredible gift – and all it takes is a quick email referral!

### **What goals do you have for the next year?**

I anticipate dedicating this year primarily to growing our resource base for student and alumni use. I hope to be able to provide proprietary services that are unique to the needs of our industry, rather than just general resources. I also expect to do a great deal of learning – CMU is such a unique place, and the needs of our students and alums are just as special. I hope to hear regular feedback from all of our constituencies about what their needs are, and how we can best serve those needs.

In the future, I hope to be able to say that CEE is a “can’t miss” place to recruit for both local and national companies. I won’t be able to accomplish that goal without the help and support of alumni, though! Our alumni are integral to the future success and current competitiveness of our department, and we truly appreciate the support you give us.

*If you would like more information about getting involved with CEE, Such as participating in the career fair on November 11, please contact Ashley at awpatton@andrew.cmu.edu or call 412-268-2292.*

## **Alumni News**

### **Helbling Joins Cornell**



**Damian Helbling** (MS '05, PhD '08) joined Cornell University's School of Civil and Environmental Engineering as an Assistant Professor earlier this year. Helbling will continue

to investigate water quality as it relates to human and ecosystem health. He is particularly interested in investigating the chemical and biological processes that influence contaminant fate and nutrient cycling in natural and engineered aquatic systems.

Helbling, who was advised by Duquesne Light Company Professor **Jeanne VanBriesen**, did his graduate research on the use of sensor networks within drinking water distribution systems to monitor and control post-treatment water quality. Afterwards, he explored the fate and transport of trace organic contaminants with a particular focus on biological transformation processes for his postdoctoral work at the Swiss Federal Institute for Aquatic Science and Technology (Eawag) in Dübendorf, Switzerland.

### **Patton Accepts ACI Bryan Award**

**Mark Patton** (MS '82, PhD '87) was awarded the Thomas “Tink” Bryan award by the Pittsburgh Chapter of the American Concrete Institute (ACI).



This award is given in recognition of Dr. Patton's commitment, dedication and professionalism in the concrete industry. Dr. Patton currently heads an engineering consulting firm in the Pittsburgh area.



## Engineering on a Global Scale: CEE Students Spend Ten Days in China

There are some things you just can't learn in a classroom. This spring, a group of CEE and MechE undergraduates spent ten days in China to experience international engineering and Chinese culture first-hand.

Two years ago the Mechanical Engineering Department began the trip as part of an initiative to bolster international opportunities for their students. Its rich blend of cultural and educational activities were designed to help students gain both cultural awareness and exposure to professional and academic engineering on a global scale. It was such a success that interest quickly spread to other departments and when the trip was renewed, CEE students were also invited to attend. With support from their home departments and the CIT Dean's office, 22 students—10 MechE and 12 CEE—made up this year's group.

CIT's Assistant Dean for Undergraduate Studies, **Kurt Larsen**, accompanied them to evaluate possibilities for expanding the program in future years. He says that part of what makes the trip so valuable is the sheer amount that students are able to accomplish within the short timeframe. "Every day, we were doing 2-4 major activities. You really couldn't ask for more on a spring break trip."

Students took tours of the facilities at several Chinese companies and learned about each industry's operations and projects. Stops included Tsinghua Solar, a company that develops solar technology for heating and air-conditioning, Beiqi Foton Motor Co. Ltd., a company that designs and produces motor vehicles, Goldwind, a company that manufactures wind turbines, and a water treatment plant.

For **Debra Lin** (CEE '15), the most compelling part of the tours was learning about Chinese green energy initiatives. "Every company seemed to be pushing for less waste, cleaner energy, etc. It definitely made me realize that this is something we need to continue to work toward here in the United States," she says.

Interspersed with industry tours were visits to Peking University (PKU) and Beijing University of Technology, where students attended presentations about faculty research and engineering challenges in China. Though there were many interesting aspects of each school, students say that the most rewarding part of their university experience was spending the afternoon with PKU undergraduates.

**Jianhua Xu** (EPP '05, '07) who is now a PKU Professor, arranged for CMU students to be paired two-to-one with their Chinese peers. During lunch in the PKU cafeteria, CMU students had the unique opportunity to ask in-depth questions about college life in China. "This was my favorite part of the educational side of the trip because it gave me exposure to academics on the other side of the world," says **Nathaniel Joseph** (CEE '15). He adds that what surprised him the most was how many school experiences—like dorm life and on-campus food—seem to be universal.

The group spent the rest of their time abroad immersed in Chinese culture. They sampled authentic cuisine, visited landmarks like the Great Wall of China, and practiced haggling with the shopkeepers at Beijing's well-known Pearl Market. Many students were in awe of China's rich heritage. "Seeing how Beijing formed and visiting the temples was like looking back into the past," says Lin. Larsen notes that one of the most gratifying parts of the trip was watching the group embrace and adapt to these new experiences.

## CEE Welcomes New Staff



**Cathy Schaefer** has joined CEE as the Director of Finance and Administration. Previously, Schaefer served as the Director of Business Operations at CyLab where she was the administrative manager for a \$12M research center, and responsible for the daily operations and strategic initiative implementation. Prior to joining CMU in 2008, Schaefer amassed an impressive background in business operations with consulting, marketing, and organizational development firms.

Schaefer is a graduate of Washington & Jefferson College, with a B.A. in Political Science, and the University of Pittsburgh, Katz Graduate School of Business, with an MBA in Finance. She lives in Squirrel Hill with her husband and two children.



**Beth Hockenberry** will serve as CEE's new Sponsored Research Administrator. Hockenberry joined the department from CMU's Sponsored Projects Accounting Group (SPA) where she originally interned during her undergraduate studies and has been working for the past two years. In her role at SPA, she acted as the CEE and other engineering departments' representative.

Hockenberry graduated from Slippery Rock University with a dual degree in Accounting and Finance and is a native of Kittanning, PA. She also enjoys outdoor sports and is currently training for the Pittsburgh Marathon.

## Marano Accepts New Leadership Position in College of Engineering

CEE's former business manager, Donna Marano, is now working from the College of Engineering Dean's office as the college's first Director of Special Operations. This opportunity will make use of her 30+ years of financial and research administration experience and allow to her contribute to the university on a larger scale.



**Past, Present and Future - Donna pictured with the department heads (and now Dean of the College of Engineering) she has worked with. (l-r: Dean Jim Garrett, Grainger Morgan (EPP former department head), Chris Hendrickson, and Dave Dzombak).**

The recently created Director of Special Operations position is part of the College's efforts to increase support for faculty researchers and business managers across the college. The first major component of the role is to establish and manage the College of Engineering's pre-award office. This new office will act as a resource for faculty engaged in interdisciplinary research as they find, apply for, and secure research funding. Marano's other responsibilities include helping to train new College of Engineering business managers and research administrators and identifying the best practices for various financial processes.

Marano is particularly looking forward to working more closely with the college's business managers. "In the past, we've all helped each other with common



responsibilities. It's a great group of people—bright and hardworking. I'm very excited about this," she says. She has already begun implementing plans to streamline activities such as effort certification and says that these new procedures have been well received.

Though she is enthusiastic about her transition, Marano says that she will always remember her time in CEE fondly. "Many faculty and staff have come to thank me for the help I've given them over the years, but they don't realize how much they helped me. The department was very supportive of me over the years and I really enjoyed working here."



Transportation is on the verge of major changes. Someday soon, we may be able to simply relax and let our cars take care of the majority of driving and navigation. Because these developments require careful planning, researchers like CEE /EPP Hammerschlag University Professor **Chris Hendrickson** are investigating potential improvements to current transportation policies and the potential implications of new vehicle technologies.

## New Age Transportation

Hendrickson is a part of Technologies for Safe and Efficient Transportation, a U.S. DOT University Transportation Center (UTC) housed at Carnegie Mellon University. The center's other CMU members are faculty from CEE, Heinz College, Electrical and Computer Engineering, Robotics, and Computer Science. This group collaborates with researchers from the University of Pennsylvania to develop and investigate a myriad of transportation technologies. One of Hendrickson's current projects involves evaluating the effectiveness of Pennsylvania's vehicle safety inspection program as well as implications of the introduction of connected and automated vehicles.

With funding from the UTC and the Pennsylvania Infrastructure Technology Alliance (PITA) program, Hendrickson, CEE /EPP Professor **H. Scott Matthews**, and EPP Professor **Paul Fischbeck** are examining whether yearly safety inspections actually help to reduce accidents. They're first comparing Pennsylvania's safety statistics to those from states that don't have an inspection program and then use accident report data to determine whether inspections really target the components of vehicles that are likely to fail during accidents.

Another major piece of Hendrickson's work involves studying the logistics and implications of autonomous and connected vehicles alongside Heinz Distinguished Service Professor of Transportation Systems and Policy **Allen Biehler**. Autonomous vehicles drive themselves, while connected vehicles communicate to traffic signals and other cars by sending electronic messages. Hendrickson explains, "A connected car may send a signal to other cars warning them about a dangerous patch of pavement that's coming up." Vehicles can be autonomous, connected, or some combination of the two.



Interior view of an autonomous vehicle

Funded by the Pennsylvania Department of Transportation (PennDot), Hendrickson's research is investigating several aspects of these technologies, one of which is the types of messages that connected vehicles should send and receive. "For example, in 15-20 years, you might get a message on a screen in your car saying 'congestion ahead,' instead of seeing a sign on the highway," he says. Unlike typical highway signs, car screens wouldn't have space constraints, allowing drivers to receive more detailed information and could translate into substantial savings by eliminating the need to maintain large signboards.

More efficient highway messages aren't the only way new vehicle technology could be cost-efficient. With MechE/EPP Associate Professor **Jeremy Michalek** and CEE Assistant Professor **Constantine Samaras**, Hendrickson worked on a Toyota-funded project to estimate energy savings associated with vehicle

automation. Highly automated vehicles use less gas by driving more efficiently—reducing unnecessary idling, stopping, and starting. Additional savings can come from vehicle platooning, which is when a group of connected and autonomous vehicles drive close together on the road, one after the other. The closeness of connected and automated vehicles creates less drag, reducing the amount of gas necessary to push the cars forward. It also means that many more cars can fit on the road at one time, which could help to reduce congestion during peak driving hours.

"This technology is going to transform how transportation works," says Hendrickson. "Aside from congestion, it has the capability to reduce crashes and improve safety. It will take about three decades to make the whole shift, but transportation is going to be much different in the future than it has been for the last 100-120 years."

**Corey Harper**, Hendrickson's current PhD student, has been doing additional research that will help PennDOT to prepare for automated vehicle technology. One line of his work involves assessing the technology's impacts on automotive technician training programs in the Pittsburgh area. Harper says that he developed research-based recommendations for PennDOT suggesting that trade schools and community colleges incorporate more computer science and electronics classes into their curricula. This will be useful for technicians when they do maintenance on the new, computer-driven vehicles.

Harper hopes to continue studying autonomous vehicle technology with Hendrickson and co-advisor CEE



Assistant Professor Constantine Samaras next year. "I think this is a promising technology in the future of transportation," he says. "This will be a good opportunity to help understand the impacts of this technology before it actually hits the road."

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**Dr. Elio D'Appolonia helped to shape the multidisciplinary, creative, problem-solving nature of civil engineering that remains the hallmark of the program at Carnegie Mellon University. He brought excitement to the classroom and to field work. The Dr. Elio D'Appolonia Endowed Graduate Fellowship Fund was created to recognize his impact on the department. The fund focuses on innovation at CMU and was established to support doctoral students in Civil and Environmental Engineering.**

Photo: CMU Archives



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## 2014 CEE Alumni Award Luncheon

Please join us on Sunday, October 12, 2014 as we celebrate four of our outstanding alumni at the annual CEE Alumni Award Luncheon.

**October 12th - Noon to 2PM  
Pittsburgh Athletic Association**

To register: [bit.ly/2014-cee-alumni-awards](http://bit.ly/2014-cee-alumni-awards)

This year we are proud to honor:

**Distinguished Alumni.....Rodney J. Clifton (MS '61, PhD '64)**

**Outstanding Alumni Service ..... Stephen Hinson (BS '97)**

**Recent Alumni Achievement ..... Corinne D. Scown (BS '06)**

**Lt. Col. Christopher K. Raible  
Distinguished Public Service ..... Ross A. Monta (BS '95)**

**Know an alum who should be considered for a CEE Alumni Award?**

Nominations are accepted on a rolling basis, and may be submitted electronically to Ashley Patton at [awpatton@andrew.cmu.edu](mailto:awpatton@andrew.cmu.edu).

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## Congratulations to Our CMU Alumni Award Winners!

**Alumni Distinguished Service Award**  
Joseph DiMario (BS '54)

**Recent Alumni Award**  
Linda Kaplan (BS '07)

CMU Alumni Awards ceremony will be held during  
Ceilidh Weekend on October 10th.