Department of Civil and Environmental Engineering

The Department of Civil and Environmental Engineering (CEE) at MIT is positioned around "big engineering," solving the world's grand challenges through the understanding, creation, and operation of systems with large-scale, tangible effects on people. The department's unique positioning at MIT is anchored on the focus on science, engineering, infrastructure, and environment, a nexus at which small-scale changes can lead to big-scale impacts.

Academic year 2015 marked the continuation of the department's transformation, merging science and engineering principles to solve the grand challenges of our highly uncertain, complex global society. CEE recognizes that major issues such as climate change, resource sustainability, energy management, and urban design require knowledge, skills, and collaboration that go beyond traditional civil and environmental engineering boundaries. These challenges are on huge scales; they require both radically new approaches in thinking across disciplines and a focus on human lives and their conditions, everywhere. The research and education that CEE does today may shape all lives decades from now. The department's objective is become a leader that engages everyone across MIT in this mission and vision of a sustainable future. CEE's ONE@MIT campaign reflects the department's vision of an integrated department whose people work to solve "big engineering" challenges.

The department's focus on "big engineering" is supported by five strategic thrusts that encompass ecology, resources, structures, smart cities, and global systems. These areas refocus the department's efforts to address big societal challenges through intellectual leadership in scholarship and innovation and the application of cutting-edge tools, including genomics, nanotechnology, and computation. CEE's new undergraduate curriculum now offers MIT students the opportunity to blend their educational foundation better, and to prepare themselves for the challenges in sustainability, through many disciplinary studies, built around a solid foundation of mathematics, statistics and data, computation, and hands-on laboratory and field subjects.
The past year was exciting as CEE began to see the fruits of its efforts. Prominent new faculty members joined the department to strengthen strategic priority areas for education and research. Cross-disciplinary research increased, further strengthening CEE's two laboratories and integrating the department's scientific and engineering efforts. CEE opened two new research laboratories in Pierce Laboratory (Building 1), bringing long-sought renovations to the third-floor inventory. And others—including alumni, the media, external university peers, and others within MIT—have begun to take notice.

Yet there still is much more to do. The department must prepare students better not only for the jobs of today, but also for the careers of tomorrow. CEE begins this preparation early, through the new undergraduate program. The department's curricula provide a solid quantitative-based engineering foundation in three major areas—civil engineering, environmental engineering, and systems engineering—plus flexible study tracks that can integrate students' professional interests such as infrastructure materials, architecture and design, atmospheric chemistry, environmental microbiology, and other topics.

Further, CEE combines classroom learning with real-world diagnostics and applications, which is a powerful way to truly understand, invent, and lead with creative design. In this, CEE is working to increase the role of new educational models centered on field trips and other real-world experiences that complement traditional classroom learning. The department has adopted the will and mentality of a driven start-up—using minds, actions, and insights to produce results, and to iterate quickly to incorporate lessons learned. For example, CEE research often begins on the nano scale or with the infinitesimal, but researchers seek opportunities to scale innovations up broadly and quickly. This is what "big engineering" means—solving the world's grand challenges through the creation of systems with large-scale impacts on people and sustainability. The department is training its students in this mindset without regard to whether they are considering careers in government, business, nonprofit organizations, or academia. CEE strives to lead by example and to help set new civil and environmental engineering standards for other academic institutions, industry, and society.

Selected highlights from the past year include these accomplishments:

- Undergraduate student Dimitrios Pagonakis's senior capstone course research focused on topological optimization of structures. He created a new algorithmic script and framework to help city engineers and architects find the best solution for any load-bearing arch, regardless of construction material quality. The work could lead to the use of cheaper, more available materials, such as lower-grade concrete, in the design of stronger, more sustainable arches that leverage the forces of geometric compression. Other colleges produce fine engineers who build things, but CEE may be unusual in that students such as Pagonakis think holistically about making an impact everywhere. Now, governments can use funds to help feed or educate their citizens rather than to buy expensive construction products when cheaper materials will do.
- Undergraduate student Noor Khouri's capstone course work paired microbiology with microfluidics. She devised a new computational tool that can be used to design ciliated microchannels with enhanced mixing performance in microfluidic devices. Microfluidic devices, originally developed primarily for biomedical applications, are beginning to have a considerable impact on environmental engineering diagnostics. Innovations such as Khouri's could lead to new ways to diagnose complex environmental problems associated with climate change.
- Professor Ruben Stocker was selected to lead the high-profile MIT Climate Change Conversation Committee, which included a 10-month listening and learning tour of MIT stakeholders and their concerns about climate change. Stocker submitted the committee's findings to the MIT Conversation Leadership in June.
- CEE alumni also continue to exemplify "big engineering." For example, Carlos Riva '75, chief executive officer of Poseidon Water, appeared in MIT News. His company is responding to one of the worst droughts in California history by developing the largest seawater desalination plant in the Western Hemisphere.

The project is expected to deliver water to businesses and residents in San Diego County later this year. The project is especially noteworthy because it introduces a private-industry model into what has been a traditional government sector. Think of the innovation ramifications across the country and the world as other municipalities seek new public-private partnerships.

CEE also is working hard to strengthen its efforts to engage multiple audiences in the community. One example is the recent Clean Earth Hackathon, conceived and implemented by two CEE post-doctoral associates. It was a unique three-day CEE initiative that invited not only CEE students but also students from other campuses and alumni and industry partners to present real-world sustainability challenges.

In May 2015, five faculty members and Department Head and Professor Markus Buehler traveled to New York City to present current CEE scientific and engineering research results to a conference room packed with alumni from the area. Within the theme of Building a More Resilient NYC through Big Engineering, the presentations ranged from atmospheric chemistry insights to transportation study findings to energy management proposals. One CEE alumnus, Dan Zarilli, New York City Mayor Bill de Blasio's director of the Office of Recovery and Resiliency, served as local host. Zarilli's support of the department's efforts already is leading to his playing a greater role with CEE's work and at MIT in a leadership capacity.

Later in May, Professor Buehler presented the department's vision to more than 100 alumni around the world via a webcast of the Alumni Association's online Faculty Forum. Through a live question-and-answer period, he helped continue a dialogue to inform this very important stakeholder group of the department's new direction and address any concerns they might have about the disruptive innovation.

New CEE social media channels—LinkedIn, Facebook, Instagram, YouTube, and Twitter—are enabling greater dialogue and engagement with many other audiences, especially students and prospective students. The department head has become an active Twitter user under the handle @ProfBuehlerMIT, and this has become an effective way to communicate with students, faculty, alumni, and other stakeholders.

Goals, Objectives, Priorities

The Civil and Environmental Engineering Department has a strong record of leading disruptive innovations. This is continuing through our current vision and strategy. Some examples:

- 1960s: Introduction of "computation" in civil engineering
- 1980s: Expansion to include environmental science, genomics, and microbiology in the department's offerings
- 2015 forward: Emphasis on Big Engineering—Infrastructure, Environment, People to address fundamental questions of challenges civilization faces today

CEE's five long-term strategic objectives are being pursued actively and in parallel. This report articulates the department's accomplishments and remaining challenges by each objective:

- Renew, develop, and implement inspiring educational offerings at the undergraduate and graduate level, including the postdoctoral level, reflecting a continuum of educational goals in all three programs.
- Establish an effective departmental structure.
- Focus on the future of CEE with accelerated faculty hiring and junior faculty development.
- Show leadership in MIT-wide initiatives by engagement across the Institute, defining a clear positioning of CEE at MIT.
- Participate in and contribute to the Environmental Solutions Initiative, new educational programs, the new Institute for Data, Systems and Society, and other initiatives.
- Renew and improve facilities to create new opportunities for exciting research, building new laboratories for both new and current faculty (e.g., for studies in the environment and infrastructure, energy issues, and other areas).

Objective 1: Renew, Develop, and Implement Inspiring Educational Programs at the Undergraduate and Graduate Level

Over the past academic year, CEE awarded 17 PhD, 16 SM, 24 MST, and 37 MEng degrees in the graduate program and 27 SB degrees in the undergraduate program. Of the 17 students to earn a PhD, at least a third have gone on to careers in academia.

Undergraduate Programs

In the fall of 2014, the department hosted the CEE Visiting Committee. The Visiting Committee endorsed many of the updates to the undergraduate curricula that were suggested by Department Head Markus Buehler. One decision was to drop the traditional Course 1-C (Civil Engineering) and Course 1-E (Environmental Engineering) to offer students a more integrated, track-based undergraduate curriculum that would be known as Course 1-ENG. The decision was formally approved by the MIT Faculty Committee on Curricula last year, and the 2015 academic year saw the first full-year cohort of students in the 1-ENG program. The migration to a track-based Course 1 curriculum has been successful, as is evidenced by all but one sophomore choosing the new program. Students not in the program were able to continue with their degree plans despite the transition.

The senior capstone class (1.013 Senior Civil and Environmental Engineering Design) in spring 2015 also changed to allow a more diversified experience, embracing multiple and deeper project experiences, with approximately 10 faculty members from across CEE participating in project supervision. Two winners were selected amongst all projects for the first time this year, Noor Khouri and Dimitrios Pagonakis. Both individual and group approaches to capstone class research are appropriate and successful. The

decision to elect one method over another usually has more to do with the leading faculty member than any other factor.

The new Course 1 educational direction also launched a program that introduces freshmen to the diversity of research in the department. For the first time, MIT freshmen had the opportunity to delve into Course 1 research for credit and to explore the myriad disciplines offered within the department through the CEE Mini Undergraduate Research Opportunities Program (Mini-UROP). The program, which debuted during December in time for the January 2015 Independent Activities Period, was spearheaded by Course 1 graduate students whose mission was to provide freshmen with direct research experience and a comprehensive introduction to Course 1. Each of the 19 participating freshman spent a total of four weeks conducting individual research projects under the guidance of graduate student and postdoctoral mentors.

The Mini-UROPs opportunities emphasize in-depth research into one particular project and feature weekly social events (chalk talks). Students chose from a wide array of research topics, such as soil behavior, sediment transport, coastal processes, smart wireless-sensor systems, and gas-consumption monitoring. For many students, the Mini-UROP program set the stage for longer-term involvement in Course 1 research and a challenging and rewarding undergraduate program.

Graduate Programs

In September 2014, Department Head Markus Buehler formed a new committee to identify a future vision and plan for the nine-month CEE MEng degree and the two-year MST degree. The objective was to define MEng as a high-impact program for the future, with broad buy-in from the faculty. It was assessed against similar School of Engineering programs and found to align best with CEE faculty composition, backgrounds, and interests. Some other modifications also were made to the MST program as a result of the committee's recommendations, primarily concerning the policy, technology, and computation requirements.

The new general examination process that was introduced the previous year went exceptionally well this academic year.

The graduate student committee, GradCom, continues to improve. It has been responsible for many engagements and interactions with the student community. Several initiatives, such as the Mini-UROP, originated from the GradCom group.

Other graduate program initiatives include the Mini-UROPs held over the winter academic break (see Undergraduate Programs). Graduate students were instrumental in the program's success through their leadership and mentorship of the undergraduates.

A new one-minute video series, Talks on REliable Environmental Science (TREES), was launched by graduate student Qingjun (Judy) Yang. CEE is sponsoring and advising on this innovative science and engineering educational project, which was inspired by the popular MinutePhysics videos on YouTube. The objective is to clarify the true science

behind popular environmental topics in an entertaining, animated way for pre-college and college-age students around the world.

In addition, CEE graduate students engaged significantly with the student-led MIT Water Club. With nearly a thousand students, professionals, and academics on its mailing list—and typically drawing more than 250 attendees to its most popular events—the Water Club serves as a forum for discussion and teaching about water technology, policy, and science. CEE graduate student Neha Mehta serves as the club's co-president. Through seed funding provided by CEE, the club introduced the Water Innovation Prize in the fall semester with an Idea Pitch and Generator Dinner. More than 130 students from 12 MIT departments attended the event to identify projects, meet with potential mentors, and connect with team members in preparation for the spring competition. Winning teams received $20,000 in innovation grants.

Another exciting challenge introduced, led and managed by CEE doctoral students (with support from Sustainability@MIT) was the inaugural Clean Earth Hackathon held over Earth Day weekend. Typically, hackathons allow participants to pick their own projects, but this one instead engaged with a variety of organizations to identify a slate of challenges. Eight companies and organizations—including the consulting firm McKinsey, the waste recycler Casella, the research and environmental consulting group the Rocky Mountain Institute, and the Massachusetts Bay Transportation Authority (MBTA)—were among the entities invited to challenge the more than 70 participants to solve their organization's most pressing real-world sustainability problems. The four winning teams were each awarded $1,000. CEE doctoral students Hanny Rivera and Jessica Bryant are considering moving the hackathon to the beginning of the school year to help students better prepare for and conceptualize proposals for the global MIT IDEAS Global Challenge and other start-up contests that run through June.

Postdoctoral Program

The department's postdoctoral committee, formed in AY2014, has continued its path of success, providing a forum for discussion and involvement with the approximately 70 postdoctoral researchers in the department. The committee has made great progress in understanding and addressing the professional and career development needs of CEE's postdoctoral researchers and offering opportunities to contribute to the department's educational programs and the overall enhancement of their MIT and CEE experience.

Specific activities included once-a-semester town halls with the department head, an online survey designed to clarify postdoctoral researchers' needs and interests, and the introduction of teaching fellowships to allow postdoctoral involvement in teaching as part of career development. This has been very successful for postdoctoral researchers as well as for CEE's faculty members and students. There was also a lunch-and-learn series on topics of interest to the postdoctoral researchers, such as web presence, job search skills, networking events, and new plans for mentoring.

Objective 2: Establish an Effective Departmental Structure

The Visiting Committee meeting in the fall of 2014 endorsed the department's new direction and initiatives under the leadership and vision of Markus Buehler. New faculty

hires, increased philanthropic support, and new programs and communications are core components of the new direction.

Relying on the Visiting Committee recommendations, the department embarked on an aggressive faculty search season. There was an unprecedentedly large pool of candidates this year and the department was able to acquire three new junior faculty hires. (Details on the faculty hires are noted under Objective 3.)

Several faculty members have relinquished their tenured faculty positions by retiring, including Professors Nigel Wilson, Fred Moavenzadeh, Jerome Connor, Daniele Veneziano, and Eduardo Kausel. Professor Ed DeLong retired from MIT but moved to another university. Roman Stocker left MIT to accept a position at ETH Zurich.

The administrative staff continues to evolve, resulting in more engagement with all communities—undergraduates, graduates, student prospects, parents, faculty, other MIT faculty and staff, external peers, alumni, and news media—through speaking engagements, seminars, listening tours, surveys, town halls, coffee hours, stories in print and online, and other activities. Additional accomplishments and events are listed elsewhere in this report.

The department strengthened the identities of its two laboratories, the Ralph M. Parsons Laboratory for Environmental Science and Engineering (Building 48) and the Henry L. Pierce Laboratory for Infrastructure Science and Engineering (Building 1). These efforts included community-building activities.
By combining science and engineering knowledge with infrastructure and environmental engineering, CEE is well positioned to help shape the world into what humankind wants it to be. CEE researchers often start small with focused research, but results can often be scaled up to tangible, visible impacts on people and sustainability. The department's mission is to champion these "big engineering" concepts and their use in improving the world and the lives of everyone, everywhere.
For example, it is estimated that by 2030, three out of five people will be living in cities. Urban planners today need to think comprehensively about developing city-wide and interconnected infrastructure systems, including transportation, land, energy, air, and water subsystems. Realizing synergies among subsystems requires knowledge of complex systems, insight, and planning. To make this possible, CEE has refined its areas of focus under five major strategic themes: ecology, resources, structures, cities, and global systems. CEE believes that its work within, and across, these strategic thrusts will help humankind live better, healthier and more productive lives.

MIT Context for the Role of CEE

The department's focus on "big engineering" to support life and society in changing environments is aimed at the core of some of the most urgent problems of our time. CEE is committed to playing a central role to support MIT's leadership in these domains.

CEE's long-term objective in the area of infrastructure, implemented in the Pierce Laboratory, is to become a center of excellence in the design, manufacturing, and operation of infrastructure. Using the diverse expertise of the department's members,

combined with that of colleagues in other MIT departments, we aim to address issues that are critical to society and the environment, such as infrastructure sustainability, resilience to catastrophic events, and durability; lowering energy consumption and decreasing greenhouse gas emissions. A priority is identifying and applying radically new approaches to the design and manufacturing of infrastructure materials. Although CEE has made some progress, significant gaps in the faculty structure exist or will soon emerge in areas of structural engineering and mechanics, transportation, and complex systems.

CEE's long-term objective in the area of environment, implemented in the Parsons Laboratory, is to engineer human adaptation to a changing environment. Human activities are affecting the global environment at rates that are likely to increase dramatically. Although scientists agree on global predictions of rising temperature, rising sea levels, and changes in weather patterns, specific local effects of these global environmental changes on water, agriculture, and food, environmental quality (water and air), natural hazards, and public health are largely unknown. Many of these are closely associated with coastal zones. Specific intellectual questions include what local changes must be made because of global changes, how existing building codes should be modified, how to improve and manage the availability of water, how marine and terrestrial ecosystems respond to global changes, and how local ecosystem services will be affected (e.g., agriculture and food supplies). Significant gaps in investigation exist and are expected to grow with pending faculty retirements in the areas of environmental fluid dynamics and coastal engineering, environmental microbiology, and terrestrial and plant ecology and physiology.

Objective 3: Focus on the Future of CEE: Accelerated Faculty Hiring and Junior Faculty Development

CEE's future success depends in large part on internalizing the department's new vision across the two research laboratories (Pierce and Parsons), developing junior faculty, and attracting top new faculty. Strategic priorities further include fueling emerging frontiers of innovation and creative design, and empowering students and faculty to lead Institute-wide cross-cutting initiatives. Hiring excellent faculty is arguably the most critical component to supporting these activities.
The faculty search process was changed this past year to focus on several necessary criteria that differ from those of searches conducted in previous years:

- Identify the highest-caliber candidates in compelling intellectual frontiers.
- Look for relevance to the vision and domains of CEE, especially those identified as critical needs.
- Build on the strengths that CEE has in areas where CEE can lead. Candidates should be dedicated to educating CEE's students in such a way as to equip them to work as scholars and academic leaders, professionals, and entrepreneurs.
- Find candidates who support and are supported by intellectual communities.

Results from 2014–2015 CEE Faculty Search: New Faculty Hires

Otto Cordero, Admir Masic, Benedetto Marelli, Serguei Saavedra, and Admir Masic all have accepted offers to join the CEE faculty during academic year 2016.

- Otto Cordero joined the CEE faculty on July 1, 2015. Professor Cordero studies natural microbial communities as complex dynamical systems with multiscale structure. He focuses on how microscale ecological interactions at scales of < 100 μm control the assembly and dynamics of communities, their performance, and their ability to process information and respond to abiotic change. A long-term goal is to learn the principles that govern ecological dynamics in microbial systems and to apply this to environmental modeling and engineering.
- Professor Admir Masic will join CEE on September 1 in the Pierce Laboratory from his current position as independent group leader at the Max Planck Institute of Colloids and Interfaces in Potsdam, Germany. He earned his PhD from the University of Turin, Italy. His work is experimental, focused on characterization of structural and mechanical properties, including aging and degradation over long time scales. He uses an in-situ Raman spectroscopy technique and will build an integrated multi-tool instrument (Raman, atomic-force microscopy, a mechanical stage, and so on). He is also interested in the study of natural materials to devise novel strategies for the synthesis of complex, damage-tolerant composites, as well as in the degradation and preservation of artifacts, including buildings of historical and artistic value, and infrastructure.
- Professor Benedetto (Ben) Marelli will join CEE on November 1. He is currently a postdoctoral scholar in the SilkLab at Tufts University. He describes himself as a biomaterialist with a passion for biopolymers. His research group works in the area of structural biopolymers, biomineralization, and self-assembly. By using biofabrication strategies, the research group designs bio-inspired materials that work at the biotic/abiotic interface to prevent or mitigate environmental impacts. He brings a wealth of experience and a strong focus on engineering and innovation from a multiple-scale perspective. Professor Marelli's interests include the mechanical and optoelectronic properties of natural polymers, biocomposites, additive manufacturing, and emerging technologies.
- Professor Serguei Saavedra will join CEE in January 2016. Since earning his PhD in engineering science from Oxford University in 2010, he has served as a postdoctoral fellow in the US and Spain, at the Northwestern Institute on Complex Systems and at the Doñana Biological Station Integrative Ecology Group, respectively. Professor Saavedra brings expertise in theoretical ecology to the department, introducing a strength that is complementary to existing research and education. Currently, he works at the Department of Environmental Systems at the University of Zurich.

Faculty Promotions

Colette Heald was promoted to associate professor with tenure, effective July 1, 2015. Heald's work in biosphere–atmosphere interactions, aerosol sources and transformations, and the connections between atmospheric chemistry and climate

has led to groundbreaking studies that involve the observation of the atmosphere from locations and on scales including ground stations, aircraft campaigns, and satellite sensors with global models of chemistry and climate. In a recent study, Heald demonstrated how ozone can collude with climate change to curb crop yields and threaten global food security.

Marta Gonzalez was promoted to associate professor without tenure, effective July 1, 2015. Marta works in the area of urban computing, with a focus on the intersections of people with the built environment and their social networks. The goal is to design urban mobility solutions and to enable the sustainable development of smart cities. Professor González has injected new tools into transportation research and is a leader in the emergent field of urban computing.

Faculty Retirements

- Professor Eduardo Kausel retired from MIT effective July 2015, but he is staying on as a professor without tenure, retired. A faculty member since 1978 and an MIT alumnus, Professor Kausel has been instrumental in structural dynamics, mechanics, and numerical modeling as well as a leader and recognized authority in the field of soil-structure interaction and soil dynamics.
- Professor Jerome Connor announced his retirement from the MIT faculty, effective July 2015. A faculty member since 1961 and a student of the Institute for 13 years before that, Professor Connor has been instrumental in structural engineering, computational mechanics and intelligent structures.
- Professor Daniele Veneziano announced his retirement, effective September 1, 2015. A faculty member for more than 40 years and an MIT alumnus, Professor Veneziano will remain affiliated with the department by transitioning to professor without tenure, retired, status. In that capacity, he will continue with to teach and advise students.
- Professor Nigel Wilson retired on August 31, 2014. He will remain affiliated with the department by transitioning to professor without tenure, retired, status. In that capacity, he will continue to perform research and advise students.
- Professor Ed DeLong retired from MIT and assumed a new position at the University of Hawaii.

New Joint Appointment

Dan Cziczo of the Department of Earth, Atmospheric and Planetary Sciences was appointed a joint faculty member in CEE. This joint appointment reflects CEE's strategic priority to connect across departments and to foster cross-cutting research and education, and follows three joint appointments that were made in academic year 2014.

CEE Faculty Initiatives

Annual Research Speed Dating Event

CEE held its annual Research Speed Dating event at the MIT Media Lab on February 20, 2015. During this event, which was organized by the CEE junior faculty, faculty members, postdoctoral associates, graduate students, and research associates gave short research presentations followed by a wine and cheese reception. An in-house application developed by graduate students helped track the audience members and participants, creating a network of technical interest groupings.

CEE Cross-Disciplinary Seed Funding for New Faculty Research

To foster cross-cutting collaboration within CEE, and to nurture high-impact projects with great scientific merit and potential, the department established a seed funding program for faculty research that is now in its second year. The program provides a one-year graduate student fellowship for each project selected, and encourages faculty and graduate students to take new approaches to solving grand challenges in energy, environment, and sustainable materials, infrastructure and cities. The initiative will fund two new CEE research projects beginning in fall 2015: Fluid Fragmentation into Droplets Meets Microbiology, submitted by Professors Martin Polz and Lydia Bourouiba, and From Measurement Data to Environmental Information: Interpreting Air Quality Sensors via Data Mining and Knowledge Discovery, submitted by Professors Marta Gonzalez, Colette Heald, and Jesse Kroll.

Objective 4: Leadership in MIT-wide Initiatives: Outward Focus and Engagement

Just as CEE is changing from the inside, so too does it continue to be affected by outside influences. Social media, open online courses, crowd sourcing, non-governmental organizations' initiatives, and grassroots movements are empowering new conversations and research to solve complex problems. This greater inclusiveness enhances CEE's education and work, so the department embraces it and seeks opportunities to leverage its power.

Accomplishments

Institute-wide Faculty Initiatives

In fall 2014, MIT launched a major campus-wide Environmental Solutions Initiative to promote transformative, cross-disciplinary research relating to the environment. A major component is the Abdul Latif Jameel World Water and Food Security Laboratory, established through a major gift from CEE alumnus Mohammed Abdul Latif Jameel. Seed funds for new cross-field environmental research were awarded in spring 2015 to a number of new proposals that include as principal investigators CEE Professors Dennis McLaughlin, Harold Hemond, Jesse Kroll, Colette Heald, Marta Gonzalez, Charles Harvey, Martin Polz, and Benjamin Kocar.

Under the auspices of the Environmental Solutions Initiative, a new MIT Climate Change Conversation Committee was formed to listen and learn about climate

change challenges directly from the MIT community. The committee was chaired by CEE Professor Roman Stocker, who submitted the committee's report to the MIT Conversation Leadership this June. The department was actively involved in many strategic efforts surrounding the Environmental Solutions Initiative, such as educational aspects with plans for an environmental minor, and the search for a permanent director.

Other MIT-wide faculty initiatives included a global risk group, an MITx course, and the Collier Memorial:

- The MIT Forum for Supply Chain Innovation announced in FY2015 the launch of a Global Risk Advisory Group with Infosys. The initial mission is to assist selected businesses across multiple sectors to identify, quantify, and mitigate operational and financial risks. CEE Professor David Simchi-Levi's analytics research in risk will be combined with the industry expertise of multinational corporation Infosys.
- Professor Heidi Nepf was the first CEE faculty member to create an MITx course and participate in edX, the massive online open learning platform created by MIT and Harvard University. Nepf's class serves as an introduction to mass transport in environmental flows, with emphasis given to river and lake systems.
- The new Collier Memorial is a cross-Institute design and engineering project, but it is also a labor of love for MIT Police Officer Sean Collier, who died in the line of duty at the hands of the 2013 Boston Marathon bombers. CEE Professor John Ochsendorf worked with the head of the Department of Architecture and Planning and Professor J. Meejin Yoon to create the memorial, which now stands in the campus courtyard between the Stata Center and the Koch Building at Vassar and Main Streets. Ochsendorf, who has a joint appointment with the Architecture and Planning Department, worked with CEE students and alumni to engineer the memorial in record-breaking time and meet MIT's deadline for the dedication ceremony in April 2015. Many of the challenges of the innovative design were subjects of classroom discussion and activity during both the fall and spring semesters.

Student Outreach

- "What is ONE@MIT research, and its impact on society?" was the pivotal question posed to students and postdoctoral researchers in the second annual Course 1 Video Competition. After a three-month-long call for submissions of two-minute videos, CEE hosted a film showcase on March 12 that attracted students, faculty, and staff. Complete with popcorn and candy, the event featured the official screening of the 10 video entries devised, produced, and edited by CEE students and postdoctoral associates. The first prize of $1,000 was awarded to a team of graduate students—Anjuli Jain Figueroa, Tiziana Smith, Reetik Kumar, and Chi Feng—for their video on the connections between the water cycle and society's pervasive use of the land. Their video, Research for a Thirsty World, specifically highlights efforts to devise sustainable methods of providing reliable hydropower in times of uncertain water flow.

- A summer-themed photo contest using the Twitter hashtag #CEEsummer was under way during the summer of 2015, inviting students, faculty, and staff to submit photos showing their summer activities that reflect CEE's mission.
- The fall 2014 Grilled Cheese Sandwich Dinner, with Department Head and Professor Markus Buehler and Administrative Officer Angela Mickunas serving as chefs, offered undergraduate CEE students a break during study week for final exams.
- Café at ONE was an impromptu cold-beverage serving station set up in the hallways of Building 1 to acquaint freshmen who had not declared majors with Course 1.
- Multiple coffee and doughnut events were held in both the fall and spring semesters to allow graduate students to meet casually with Professor Buehler.

Alumni Outreach

- Markus Buehler participated as the invited guest at a May MIT Alumni Association Faculty Forum webinar, a real-time video presentation and interactive event combined with social networking. More than 100 alumni from all around the world attended.
- Earlier in May, Department Head and Professor Markus Buehler and five faculty members traveled to New York City to present Building a More Resilient NYC through Big Engineering to MIT alumni from the New York–New Jersey–Connecticut area. The invited guest speaker was city official Daniel Zarilli SM '99, director of the New York City Office of Recovery and Resiliency.
- CEE Resource Development hosted a fall alumni breakfast event that attracted approximately 70 alumni to campus. In the spring, CEE again hosted an alumni breakfast to coincide with the extended MIT Commencement Weekend.
- CEE also launched in October a new ONE@MIT e-newsletter for alumni that is distributed quarterly. Newsletter analytics show that open rates of 35% handily exceed the average education industry standard newsletter open rate of only 25%. The launch was largely well received:

  As a two-time graduate ('73 and '74) and former faculty member ('77 through '82) of CEE, I always pay special interest to communications from MIT and CEE. I wanted to give you feedback on what I have seen over the last year or so. There is a greater energy and vitality to the programs/activities and how they are communicated. Kudos! From my perspective, you are doing a great job!" — David B. Ashley '73, '74

Clean Earth Hackathon Event

The department took a leading role in supporting a student-run hackathon held in conjunction with the annual Earth Day that invited not only CEE students, but others from across campus and all over New England to solve real-world sustainability challenges.

CEE CC Mei Distinguished Speaker Series

Professor Lydia Bourouiba took the lead in launching and managing a new CC Mei Distinguished Speaker Series, March–May 2015, to further raise visibility for CEE and its vision beyond MIT audiences. Speakers included:

- "From Sand Castles to Urban Modeling: A Physicist's Naïve Thoughts on Construction and Cities" by Professor Henri Van Damme, MIT CEE visiting professor
- "Explosive Fragmentation" by Professor Emmanuel Villermaux of Aix-Marseille University
- "Modeling and Forecast of Contagion Phenomena in the Age of Big Data" by Professor Alessandro Vespignani of Northeastern University

Social Media Outreach and Statistics

The following statistics reflect growth in awareness and engagement of CEE online. Note the statistics do not include any staff or faculty online accounts. For example, Department Head Markus Buehler also has significant growth in followers of his professional LinkedIn and Twitter accounts.

Departmental Facebook Page

In July 2014, CEE's Facebook posts reached an average of 193 people ("organic," below, is defined as growth without paid advertisement). This increased in 2015 by 108% to an average of 402 people per post. For page "likes," CEE began with an average of 4,568 in July 2014. This increased by 76% in June 2015 to 8,042 page "likes."

	July 1, 2014	June 25, 2015	Percent Increase
Average Organic Post Reach	193	402	108%
Average Page "Likes"	4,568	8,042	76%

Departmental Instagram Page

CEE has an additional presence on Instagram, a social media site known primarily for photos. Although Instagram does not provide analytics, CEE had 128 followers as of June 2015. The department began posting photographs on Instagram in January 2015 and frequently lets students post and manage photos directly to give them ownership of the publicity for their CEE events.

Twitter Activities

In September 2014, @MIT_CEE tweeted, on average, three times a month. This increased by 1,000% from 2014 to 2015 to 33 tweets per month (not including re-tweets). On average, 212 people visited the department's Twitter page in September 2014; in June 2015, 1,568 people visited, an increase of 640%. CEE gathered 53 new followers in September 2014, which later increased to approximately 90 new followers every month.

CEE's tweet impressions (people who click and engage) numbered 5,300 in September 2014. This rose by 481% 30,800 impressions in June 2015. As for "mentions" (other tweets that tag #MITCEE), in September 2014, CEE had approximately 25, but by June 2015, CEE was mentioned an average of 64 times.

	September 2014	June 2015	Percent Increase
Tweets	3	33	1,000%
Profile Visits	212	1,568	640%
New Followers	53	89	67%
Impressions	5,300	30,800	481%
Mentions	25	64	156%

LinkedIn Page

The LinkedIn university page for CEE was launched in March 2015 with 20 followers. In just three months (June 2015), CEE has attracted 135 followers, including 33 people adding us to their university watch boards. An average of 70 page views in March grew to 250 in June (a 257% increase). CEE's average of post impressions, which was 65 in March, was 330 in June, representing an increase of 408%.

	March 2015	June 2015	Percent Increase
Followers	20	135	575%
Page Views	70	250	257%
Average Impressions	65	330	408%

CEE's most popular LinkedIn post, in June 2015, shared an MIT News story about Professor Sussman's class field trip to the MIT.nano building site. This post alone made 981 impressions.

Objective 5: Renovate and Improve Facilities and Build New Opportunities for Exciting Research that Cuts Across the Institute

Development and Fundraising

The department continued to expand its effort to increase philanthropic support for CEE. Department fundraising efforts helped support the goal of providing faculty and students with innovative education and research programs to develop real-world applications that have a large-scale impact on people and sustainability.

CEE development officer Paul Hohenberger continues to lead the resource development effort with alumni, with friends of CEE, and with the central MIT Resource Development Office. He was instrumental in many outreach initiatives, including managing and hosting the Building a More Resilient NYC through Big Engineering event, which required significant faculty organization, coordination, and post-event reporting.

Hohenberger's stewardship activities included support for the Cardinal and Gray Society and the Emma Rogers Society Fall Lecture and Luncheon in Concord, MA. He

leverages the relationships built and strengthened at such events not only to encourage giving to MIT, but also to foster new alumni leadership roles and increased participation within MIT's many boards, programs and initiatives.

Department Head and Professor Markus Buehler continued to expand his philanthropic outreach by hosting a significant number of business, government, and alumni delegations from around the globe to discuss the department's vision and research initiatives. He and Hohenberger also travelled frequently on gift prospect trips to New York City, Washington, DC, and parts of California.

The department received a number of significant new gifts and pledges in FY2015 to support its initiatives. For example, some gifts provided new funding to support the 1-ENG Research Experience Program, which offers both undergraduate and graduate students a great opportunity to learn mentoring and advising, in close collaboration with the faculty advisor. Additional support helped provide much-needed resources to support laboratory and space renovations.

Laboratory Renovations

CEE completed renovations of a state-of-the-art laboratory that focuses on physics of multiphase flow in porous media and other subsurface problems, introducing Professor Ruben Juanes to the Pierce Laboratory from Parsons. The department also expanded on the work of Associate Professor Pedro Reis in elastic geometry and statistics in the Pierce Laboratory with a new structural mechanics laboratory that expands the department's footprint in that area. CEE is also at the beginning phase of a 1,000-square-foot suite of biological laboratories that will offer secluded biosafety level 2+ (BSL 2+) operations for Assistant Professor Lydia Bourouiba as well as a shared space with incoming junior faculty member Benedetto Marelli.

The department's research is diverse and crosses many disciplines. Research volume grew by 15% compared with AY2014. Some of this growth can be attributed to the transfer of MIT's Earth System Initiative research to faculty members' home departments. CEE proposal submission also grew by 7%.

Research Highlights

Urban Transportation Challenges

Assistant Professor Carolina Osorio develops operations research techniques to inform the design and operations of transportation systems. Her research then uses these techniques to mitigate the economic, human health, energy, and environmental impacts of urban congestion, to improve the reliability and robustness of transportation systems, and to enhance the experience of travelers. Recent research focuses on a Manhattan road network containing the Queensboro Bridge area.

Associate Professor Marta González conducts research at the intersection of human dynamics, urban mobility, and transportation design. She built a computational model and algorithm to learn about peoples' travel activity patterns to help cities better

anticipate and remediate congestion. Her work analyzes traces from communications data to infer the usual start and end points of peoples' daily routines. She creates models informed by this anonymized data and evaluates the benefits of traffic management solutions via smart routing applications.

Fluid Dynamics and Disease Transmission

Lydia Bourouiba, the Esther and Harold E. Edgerton Career Development Assistant Professor, is a physical applied mathematician who has experience in fluid dynamics and epidemiology. Defying the traditional view that a sneeze can cause the greatest virus transmission through large droplets, she supports new research that shows that the "sneeze cloud" can carry small droplets much farther away than has been thought. The smaller the droplet, the easier it is to transport, the farther it travels, and the longer it stays in the air. In spring 2015, Bourouiba received an Alumni Class Funds grant in support of a curriculum development project that allows undergraduates to gather their own data sets to enhance understanding of fluid dynamics and its role in various mixing and droplet formation phenomena.

Resilient Electricity-Distribution Systems

Assistant Professor Saurabh Amin's research focuses on building more resilient electricity-distribution systems. "Smart" networked infrastructures can help increase situational awareness and control, plus make a faster response possible if the network is threatened or hacked. Two examples are smart meter data for detection of energy diversion by fraudulent customers and automated control of distributed energy resources in response to contingencies, such as a sudden supply–demand mismatch or a malicious disruption of network components.

Sustainability of the Built Environment

With a particular focus on mechanics, the durability of construction materials, energy management, and sound design in extreme environments, Professor Buyukozturk has catalyzed several multidisciplinary ventures in CEE—all with the goal of advancing the science and engineering of quantifiably sustainable designs for infrastructure. One of the most ambitious ventures is the Sustainability of Kuwait's Built Environment project, announced in 2013 and continuing today. MIT and Kuwaiti researchers and MIT graduate students work together to develop innovative solutions and methodologies for new construction and renovating existing structures.

Hydrology and Energy

Ruben Juanes, the ARCO Associate Professor of Energy Studies in CEE, has been part of the Institute since 2006. His research into underground flows of oil and natural gas brings him into direct contact with energy scientists. He studies flows of all kinds, particularly the simultaneous flow of multiple fluids through porous media. His recent work has focused on carbon capture and sequestration (CCS), a process of great interest to energy companies that are working with coal or gas and seeking to make their operations more environmentally friendly. The "sequestration" part of CCS involves taking carbon dioxide that has been captured at power plants and other sources and injecting it into geologic reservoirs, thereby preventing it from reaching the

atmosphere. Another area his team is working on is verifying mechanistic explanations for anomalous transport, with a goal of creating models that can simulate the subsurface flow of critical fluids with very few parameters.

Spider Silk Research and Applications

CEE Department Head and Professor Markus Buehler and his team have created a synthetic version of a spider's spinneret—the organ that spins spider silk into fibers. The properties of human-made silk could help improve medical technologies. For example, Buehler and his colleagues are working now on adding elastin, a stretchy protein found in human skin and lung tissue, to the silk. Because elastin is a natural component of the human body, scientists may be able to manipulate cells using the silk in such a way as to make the cells grow into new organs that will not be rejected by the recipient's immune system.

Water, Land, Air, and Space

Professor Dara Entekhabi's research spans hydrology, including land–atmosphere interactions, surface water-groundwater interactions, data assimilation, and remote sensing. His research involves both hydrometeorology and hydroclimatology. Recent projects have focused on land-atmosphere boundary layer estimation, remote sensing of precipitation and soil moisture, wintertime climate dynamics, designing and validating ground-based networks, and urban canyon air flow. He is the science team leader for the NASA Soil Moisture Active/Passive (SMAP) satellite, which was launched in January 2015. SMAP will measure soil moisture and soil freeze/thaw status using two instruments: a radar and a radiometer. Several members of Entekhabi's research group are contributing to the development of the retrieval algorithms for the radar instrument and to the flagship SMAP soil moisture product that will combine the radar and radiometer measurements.

Awards and Recognition

Faculty Awards and Recognition

The faculty in CEE have received numerous significant awards, reflecting their excellence and impact within the Institute and beyond.

- Sallie (Penny) Chisholm was appointed Institute Professor, effective July 1, 2015. This special position is a high honor bestowed by the faculty and administration of MIT. Such appointments recognize exceptional distinction, expressed in a combination of leadership, accomplishment, and service in the scholarly, educational, and general intellectual life of the Institute and the wider community. Penny Chisholm is the Lee and Geraldine Martin Professor of Environmental Studies in both CEE and the Department of Biology. As one of the world's top scholars in marine ecology, Penny has been a leader in establishing the field of environmental genomics. Over the years, her work has shifted the understanding of matters ranging from the photosynthetic process to intersections between CEE and Biology, and from gender equity to environmental concerns. In 2015, Penny also delivered the Killian Lecture after

winning the Killian Award the previous year. The Killian Award MIT's highest honor for full-time faculty members, recognizes extraordinary professional accomplishments.

- The National Science Foundation (NSF) announced that Pedro Reis received a 2014 Early Career Award from the NSF's Structural Mechanics and Materials Program for his project, Smart Morphable Surfaces for Aerodynamic Drag Control. With the award, Reis plans to devise and formalize a new class of smart morphable surfaces (smorphs) that can achieve on-demand and reversible topography. The Early Career Award is the NSF's most prestigious award for young researchers.
- Professor Dara Entekhabi was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for contributions to microwave remote sensing of soil moisture. Less than 0.1% of IEEE's voting members are selected annually for this highest grade of membership, widely recognized as an honor and an important career achievement. Professor Entekhabi is the science team leader of NASA's SMAP satellite mission, which was launched in January 2015.
- At the Geological Society of America's meeting in October, Professor Charles Harvey received the O. E. Meinzer Award in hydrogeology for his decades of research on arsenic contamination in the groundwater of Bangladesh. The society's citation specifies three of his papers from Science, Chemical Geology, and Nature Geoscience in which he "proceeded to lead and implement a stunning set of field and laboratory investigations that are the basis of his groundbreaking contributions." In response, Harvey outlined the contributions and creativity of his many graduate students over the years on this extremely complex, interdisciplinary problem.
- Professor David Simchi-Levi and eight colleagues have recently received the 2014 Daniel H. Wagner Prize for Excellence in Operations Research Practice awarded by the Institute for Operations Research and the Management Sciences (INFORMS). They won the prize for a project that used Simchi-Levi's risk exposure index to identify risk and mitigate disruptions in the automotive supply chain. The prize is awarded for a paper and presentation that emphasize innovative, elegant mathematical modeling and clear exposition to describe a real-world, successful application of operations research or advanced analytics. Team members included two of Simchi-Levi's former PhD students—Yehua Wei, now on the faculty at Duke University, and William Schmidt, now on the faculty at Cornell University—and current PhD student Peter Y. Zhang. INFORMS is the largest society of professionals in operations research, management science, and advanced analytics.
- Professor Simchi-Levi, along with three PhD students and five colleagues from Ford Motor Company, also won the Ford 2015 Engineering Excellence Award for "Identifying Risks and Mitigating Disruptions in the Ford Supply Chain." In a three-year research engagement with Ford, Simchi-Levi and his team developed a novel risk-exposure model that assesses the effect of a disruption originating anywhere in a firm's supply chain. Their approach, said Simchi-Levi, defers the need for a company to estimate the probability associated with any specific

disruption risk until after it has learned what effect such a disruption would have on its operations. Simchi-Levi's research was done with two former PhD students and a current systems engineering PhD student.

- In spring 2015, CEE Professor Herbert Einstein received an award at the International Congress for Rock Mechanics in Montreal for "outstanding contributions to rock mechanics." The award was given in recognition of Einstein's many contributions over the years, and particularly the recent symposium on shale. That symposium, hosted by Einstein, was a three-day event featuring discussions on basics and slopes, tunnels and mines, and hydrocarbon extraction.
- In celebration of the Intelligent Transportation Society of America's (ITS America) 25th anniversary, Joseph Sussman has been selected as a member of the 2015 class of the ITS Hall of Fame. Sussman's involvement with the ITS movement dates to the late 1980s, before ITS America's launch. In 1992, Sussman was the only academic member of a five-person writing team that initiated the first ITS Strategic Plan for the US.
- Professor Carolina Osorio Pizano won the MIT Technology Review EmTech Colombia TR35. This annual award is given to young innovators (less than 35 years old) for work that promises to revolutionize the world of technology and business in the future. The EmTech Colombia TR35 awards cover a wide range of sectors including biotechnology, the development of new materials, energy, software, and Internet transport. The award's objective is to recognize the development of new technologies, or the creative application of existing technologies, that address real-world challenges.
- A textbook written by CEE Professor Harold Hemond and co-author Liz Fechner '91, Chemical Fate and Transport in the Environment (third edition 2014), received a 2015 Textbook Excellence Award (Texty) from the Text and Academic Authors Association. In the book, Hemond and Fechner explain the key principles of mass transport, chemical partitioning, and chemical/biological transformations in surface water, soil, groundwater and air.
- Markus Buehler received the American Society of Mechanical Engineers' 2015 Journal of Applied Mechanics Award, which honors the best paper published in the Journal of Applied Mechanics during the two calendar years preceding the award's presentation. Buehler was being recognized for his paper, "Bioinspired Graphene Nanogut," which was co-authored with CEE Research Scientist Zhao Qin and published in the November 2013 issue of the journal.

Student Awards and Recognition

- CEE alumnae Elaine Kung '15 was awarded $5,000 by the MIT engineering honor society Tau Beta Pi to continue her inspiring work on the design of compost toilets in El Salvador. In January, Kung traveled to Santa Ana, the second-largest city in El Salvador, to work on the compost toilet design and involve community members in an exploration of different materials and construction techniques.

Her goal is to reduce the production cost for compost toilets and make them more affordable for the local community.

- Hayoon Chung, a Course 1 senior and UROP student of CEE Senior Research Engineer Eric Adams, won the 2015 Dean A. Horn Award for undergraduate study in marine research. Chung worked with Adams during fall 2014, and following the Independent Activities Period, on the dynamics of intrusion layers that contain small oil droplets from a submerged oil blowout. The winner of the Dean Horn Award is selected each year for excellence in the design and execution of a research project and for clear communication of the results in a well-written paper.
- Graduate student Anna Tarakanova received the award for Outstanding Teaching Assistant from the Department of Mechanical Engineering. This semester, Tarakanova taught 2.002 Mechanics and Materials II with CEE Professor Pedro Reis and two professors from the Department of Mechanical Engineering. "Anna Tarakanova went above and beyond their regular tasks and expectations and [was] instrumental to development of a number of digital education tools," said Reis.
- Two students were named as the 2015 recipients of MIT awards during the MIT Awards Convocation. Environmental engineering science (1E) student Phoebe Whitwell '15 received the William L. Stewart, Jr., Award—an award that recognizes outstanding contributions by an individual student or organization to extracurricular activities during the preceding year. Another 1E student, Majdolene Khweis '15, was one of two recipients of the Laya and Jerome B. Wiesner Student Art Award, which acknowledges outstanding achievements in and contributions to the arts at MIT.
- Freshman Cheahuychou "Chou" Mao received the Freshman Award for Distinguished Achievement in Research for her UROP work, conducted under the supervision of Professor Oral Buyukozturk and Research Scientist Dr. Kunal Kupwade-Patil. Mao employed sophisticated experimental equipment to explore the concept of partially replacing the volcanic ash in traditional Portland cement. She examined the early and late age-curing of hardened cement paste, combining natural Pozzolanic volcanic ash and Portland cement with advanced micro-characterization techniques.
- Three graduate students were selected as honorees for the 2015 biennial celebration of Graduate Women of Excellence. They are PhD candidates Andriani-Ioanna "Nina" Panagiotidou '13 and Xiaojing "Ruby" Fu, and graduate student Jane Chui. The Graduate Women of Excellence celebration commemorates those graduate women who exemplify leadership and outstanding accomplishment.
- Graduate student Jane Chui won an Outstanding Student Paper Award in hydrology at the American Geophysical Union's fall conference in San Francisco in December 2014. The paper, "Interface Evolution during Radial Miscible Viscous Fingering," describes the creation of complex patterns when a less viscous fluid replaces a more viscous one. The interface created from

these patterns affects mixing between the two fluids, making it important to understand for applications such as enhanced oil recovery and microfluidics.

- Anchor QEA, an environmental science and engineering consulting firm, selected MEng candidate Sara Greenberg '15 as one of 10 graduate students from around the country chosen for the company's 2015 Scholarship Program. All recipients must be engaged in research with an aquatic or waterfront emphasis. Greenberg's thesis work focuses on designing a hydrological runoff model to analyze storm water and rainfall runoff into the Malden River and to assess the impact on water quality and human and ecosystem health.
- Julia Longmate, a rising senior, was named one of the 35 MIT undergraduate Burchard Scholars for 2015. The award honors sophomores and juniors who demonstrate academic excellence in the humanities, arts, and social sciences as well as science and engineering. Longmate is editor-in-chief of Rune, MIT's literature and arts magazine, and also does creative writing.
- MEng candidate, Juney Lee '15, received the Marvin E. Goody Award for his work, Structural Design Explorations Using Grammatical Graphic Statics. "Instead of defining parameters and constraints as one would in the conventional CAD paradigm, this approach defines rules and behaviors of form generation," Lee said. The $5,000 prize is awarded to an MIT graduate student who is close to completing a thesis that addresses at least one of these aims: extending the horizons of existing building techniques and materials, encouraging links between academia and the building industry, and increasing appreciation of the bond between good design and good building.
- Doctoral candidate Zeid Alghareeb, who works with Professor John Williams in the MIT Geospatial Data Center, received the 2014 Dr. Mikio Shoji Award for Innovation in Information Technology. Alghareeb was recognized for his research on petroleum reservoir modeling and decision making as well as for his academic performance.
- The MIT chapter of the civil engineering honor society Chi Epsilon welcomed eight new members at its banquet, held Monday, May 13. The CEE students joining the honor society are seniors Margo Dawes, Samantha Hartzell, Majdolene Khweis, and Jessica Parker, and juniors Katherine Adler, Xiao Yun Chang, Julia Hogroian, Wesley Lau, and Olivia Massey.

2015 Annual Departmental Awards: Faculty, Staff and Students

These awards celebrate all that is CEE. This past year the department added several new awards to encourage the local community to identify and further the excellence within the department.

- The 2015 Samuel M. Seegal Prize was awarded to Professor Jerome Connor for inspiring students in pursuing and achieving excellence. This award is shared alternately with the Sloan School and CEE.
- The CEE Leadership Award was established to recognize an undergraduate student, at any level, who has made exemplary contributions to improve the

CEE community, fostered excellence, diversity, and contributed to our culture of inclusiveness. This year, the award was presented to two recipients: Michelle Dutt and Majdolene Khweis.

- The CEE Excellence Award for Staff award recognizes a CEE staff member for excellent contributions to the CEE community, commitment to professionalism, dedication and best practices, as well as fostering a culture of diversity, inclusiveness, and innovation. CEE had such an overwhelming response from the community that the department recognized two recipients, Graduate Student Academic Advisor Kiley Clapper and Senior Administrative Assistant Jim Long of the Parsons Lab.
- The Maseeh Excellence Award in teaching was awarded to Professor Jesse Kroll for his distinguished work leading undergraduates in the senior capstone course and extensive experience mentoring students in TREX, the acronym for Traveling Research Environmental Experiences (TREX) which is a field research course offered during Independent Activities Period.
- The Maseeh Award for Excellence as a Teaching Assistant went to Mohammad Javad and Abdolhosseini Qomi in recognition of their significant contributions to course work and student support.
- The Trond Kaalstad (Class of 1957) Fellowship was awarded to Fatima Hussain and Julia Hopkins. This award recognizes outstanding graduate students who have displayed leadership, contributed significantly to the well-being of the CEE community, or both.
- The Leo (Class of 1924) and Mary Grossman Award was given to Xiao Yun (Jayne) Chang in honor of Mr. Grossman, who had a professional career in highway design and planning. The Grossman Award is given to an undergraduate student with a strong interest in transportation and a strong academic record.
- Samantha Hartzell received this year's Paul L. Busch (1958) Prize, which goes to an undergraduate in environmental science and engineering for academic achievement and contributions to the CEE community.
- The Tucker-Voss Award was established in memory of Professor Ross F. Tucker and Professor Walter C. Voss, who were the first two heads of the Department of Building Construction, Course 17. This year's recipient is Anthony McHugh. In the 1950s, Course 17 merged with the Department of Civil Engineering and the first Tucker-Voss Award was presented. This award is given annually to an undergraduate or graduate student who shows particular promise in the field of building.
- Senior undergraduate student Capstone Course Award winners were Dimitrios Pagonakis and Noor Khouri. Pagonakis won for his research on topological optimization of structures. He created a new algorithmic script and framework to help engineers and architects find the best solution for any load-bearing arch design, regardless of construction material quality. Pagonakis also was honored with a new department award, implemented this year, to recognize outstanding CEE undergraduate research. Khouri won the Capstone Award for her

innovative research pairing microbiology with microfluidics. She devised a new computational tool and universal numerical that can be used to design ciliated microchannels with enhanced mixing performance in microfluidic devices. She is also the recipient of the Juan Hermosilla Prize, a new CEE honor recognizing undergraduate exceptional talent in mechanics, materials, structures, and design.

- James Hunter and Bruce Jones won CEE doctoral thesis and PhD scholar awards, respectively. The latter award, new this year, recognizes postdoctoral researchers' mentoring, teaching, and excellence.
- Professor Daniele Veneziano received the CEE Distinguished Achievement and Recognition Award for exceptional contributions to academic and research programs.

Markus J. Buehler
Department Head
Professor of Civil and Environmental Engineering