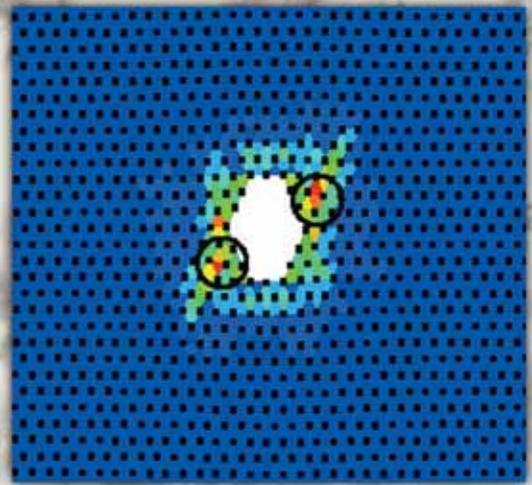


EEEC

NEWSLETTER



FALL & WINTER



# Civil and Environmental Engineering at its Finest... Scales

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**5** New AIS Lab Established

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## CEE Department Head

JIM GARRETT



“This past March, our Civil and Environmental graduate program was ranked 7th in Environmental Engineering and 10th in Civil Engineering by U.S. News and World Report.”

As I begin my first letter to you all as department head, I feel that a bit of personal introduction is appropriate. I essentially “grew up” in CEE, which at the time I was here was just called “CivE.” I was an undergraduate from 1978-82 and a graduate student from 1982-86. **Professor Chris Hendrickson**, who started when I was a sophomore, was my undergraduate advisor and **Professor Steve Fenves** was my Doctoral Advisor. I still remember visiting the Department Head’s Office (at that time, the head was **Professor Dwight Sangrey**) to help assemble and “turn on” one of the first IBM PCs to arrive on campus. Little did I know I would eventually be sitting in that office! I rejoined the department as an Assistant Professor in 1990, served as the Associate Dean of the Engineering College from 2000-06, and recently became the CEE department head this past June. I met my wife, Ruth Ann (CE ’83), working for **Professor Larry Cartwright**, who at the time was the CEE Lab Manager and is now a beloved Teaching Professor. I had to laugh the other day when one of Larry’s current undergraduate employees was surprised to learn that he was on a path that could lead him one day to become the head of the department. I am truly honored to be given the opportunity to be the current head of this tremendous department.

As you will see from the contents of this newsletter, we have been extremely busy and productive since the last newsletter. Several new people have joined our CEE faculty and staff. A number of our faculty members have won national awards. Many of our faculty members have won large research grants in a diverse range of topics. Our AIS faculty have been busy organizing an International Conference on Computing in Civil Engineering to be held here in Pittsburgh in July; the dinner will be in honor of Emeritus Professor Steve Fenves, who turns 75 this year. In November, we announced that we will be offering an MS program in Global Sustainable Construction, which builds on our core strengths in Advanced Infrastructure Systems and Green Design.

This past March, our Civil and Environmental graduate program was ranked 7<sup>th</sup> in Environmental Engineering and 10<sup>th</sup> in Civil Engineering by U.S. News and World Report. The undergraduate program was ranked this past fall as 12<sup>th</sup> in Civil and 13<sup>th</sup> in Environmental Engineering. All of these rankings went up from the previous year. In November, we hosted an Accreditation Board for Engineering and Technology (ABET) visit that required a tremendous amount of preparation and by all estimates went very well.

While the department today is recognized as one of the top 10 Civil and Environmental Engineering departments in this country, our goals are to reach even higher and to gain even more recognition for the exciting cutting-edge research we do and the innovative education programs we offer. Our goals for the next year or two are to: 1) continue to actively assess and revise our undergraduate program so as to strengthen the fundamental critical thinking, problem solving, communication and project management skills they will need to survive in the ever flattening world they face when they graduate; 2) increase the size of M.S. and Ph.D. programs in the department so as to have an even greater impact in research and graduate education; 3) expand the existing centers in the department related to Urban Water Quality (WaterQUEST), Atmospheric Particulates (CAPS), Engineering Sustainability, and Sensed Critical Infrastructure (CenSCIR); 4) build our faculty in the area of Computational Materials Modeling; 5) offer innovative graduate educational programs that build on, and combine, our core strengths (e.g., Global Sustainable Construction); and 6) explore one or two specific international graduate educational opportunities that build off of and enhance one or more of our core strengths.

During these last six months, one of the changes we made is in the format and content of this newsletter itself. Staff member, **Nichole Dwyer** along with **Dan Hart**, who helped us with the newsletter design, have worked tirelessly on this current newsletter. Our goal is to make it visually appealing, interesting and informative. We hope you enjoy this new format and look forward to receiving your comments.

Before I conclude, I must recognize and thank **Chris Hendrickson** for his ten years of enthusiastic and effective service as department head of CEE. During his tenure, we hired a number of creative and energetic new faculty members, we started several new cutting-edge research centers, and we launched a new graduate program in Advanced Infrastructure Systems. Chris is spending this year on sabbatical, but sending us many interesting trip reports from his international visits to CEE programs. We present a short article on his trip to Istanbul later in this newsletter.

In summary, this has always been an exciting and innovative department, noted for its collegial atmosphere and aggressively interdisciplinary activities. We have an impressive heritage, and an even more exciting future ahead of us. It is my intention to work tirelessly to enable everyone associated with this department — students, faculty, staff, and alumni — to achieve an even greater level of pride in what they personally and we collectively are able to accomplish.

Please send me your feedback and interesting news. My colleagues and I very much appreciate hearing from you and sharing your news and experiences. •

# Civil and Environmental Engineering at its Finest... Scales

**N**anoscale research focuses on processes that occur at the finest length scales from individual atoms to tens of nanometers. The inset image on the cover for this issue illustrates the nucleation of atomic scale defects that are ultimately responsible for macroscopic effects like ductility and fatigue fracture of metals. Often, the high surface area to volume ratio of nanoscale particles and devices makes them behave differently than their microscopic or macroscopic counterparts. These behaviors can be both beneficial for the environment or pose potentially negative consequences. Other times, nanoscale devices are useful because their compact size and low costs make them easy to deploy in locations previously inaccessible or uneconomical. The following examples highlight some of the ways in which CEE faculty are enhancing our understanding of nanoscale systems.

Dislocations, which are defects in a crystal lattice, are responsible for the strength and ductility of crystalline solids such as Nickel, and predicting their emergence under load is important for understanding material behavior and failure. **Professor Amit Acharya** is developing theories and computational models of dislocations at the atomic level and higher in crystalline materials. The image shown in figure 1 shows dislocation nucleation predictions for a nanoindentation of a perfect FCC Ni crystal, based on research performed by Professor Acharya in collaboration with Ronald Miller at Carleton University, Canada. The conditions under which dislocations emerge in a perfect crystal lattice are not well-understood, in contrast to the understanding of the conditions under which preexisting dislocations move. Dislocation motion is governed by the local stress level. In the absence of better theory, dislocation nucleation has also been assumed to be dependent on local stress. However, Professor Acharya has shown the feasibility of a nucleation criterion related to the local gradient of the stress exceeding a material-specific value. The images in Figure 1 and on the cover inset show a comparison of the maximum (resolved shear) stress (colored contours, where red indicates the highest magnitudes) with the actual locations of defect nucleation as predicted by an atomistic simulation and using the stress gradient-based criterion being developed by Professors Acharya & Miller. The comparison demonstrates that the stress-based criterion is not an accurate predictor of nucleation. Prof. Acharya's research has shown that the stress-gradient based criterion he has developed, on the other hand, accurately predicts the location and the type of nucleated defect.

A significant amount of roof degradation and damage goes undetected until a major amount of damage has already occurred and the damage is visible. While moisture penetration is a prevalent problem for all building envelope systems, including foundation and



Professor Amit Acharya

basement floor slabs, its impact is the most fatal to roof systems. **Professor Jim Garrett**, CEE department head, is working with CMU collaborators **Metin Sitti** (Mechanical Engineering) and **Omer Akin** (Architecture) to explore a nanotechnology-based high sensitivity, low cost and compact sensor to detect the presence of moisture between the outer layers of a roofing system and its underlying support structure. A version of this sensor has been designed and manufactured by Professor Metin Sitti.

The team explored several different membranes with nanometer sized pores into which water could be collected: polycarbonate, cellulose acetate and polyester (nylon). These materials are flexible and inexpensive, and show a highly sensitive change in resistance in response to water adsorption inside their nano-pores. To be able to detect the change in resistance of the membrane in response to uptake of moisture, an electrode is deposited over this material and used to detect resistance changes in this material as it takes on different levels of moisture.

The team characterized the sensors by comparing their output values with those from a commercial humidity sensor. For example, for the polycarbonate membrane, resistance changes from 4.7 megaohms to 3.3 megaohms when the relative humidity changes from 35% to 92% at room temperature. It is anticipated that these membranes can be manufactured in large sheets with arrays of electrodes deposited onto them for deployment on roofs and in other parts of the building envelope. Further testing of this concept using an array of these sensors is still in progress.



Professor Greg Lowry

Demonstrating the environmental benefits of nanotechnology, **Professor Greg Lowry** and his co-workers have recently received several research grants to synthesize, characterize, and evaluate the fate and mobility of reactive polymer-coated iron-based nanoparticles, which can be used for

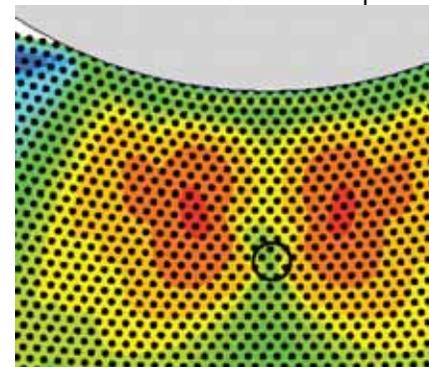


Figure 1: Maximum stresses compared to actual defect location found using atomistic simulation

Continued on page 4 >

## Civil and Environmental Engineering at its Finest... Scales

remediating groundwater contaminated with chlorinated organic solvents (see image on cover). Sites containing these carcinogenic contaminants, present as Dense Non-aqueous Phase Liquids (DNAPLs), are ubiquitous in the US and the world. Prof. Lowry's research is showing that novel nanotechnologies can be used to effectively remediate these sites at a lower cost than conventional remediation methods. He is part of a multi-disciplinary team, including **Professors Robert Tilton** (Chemical Engineering), **Krzysztof Matyjaszewski** (Chemistry), and **Edwin Minkley** (Biology). Graduate students from CEE **Navid Saleh**, **Tanapon Phenrat**, **Hye-Jin Kim** and these departments are working together to develop reactive Fe<sub>0</sub>/Fe-oxide nanoparticles coated with triblock copolymers that allow the particles to seek out subsurface contaminants so that they are used efficiently. This process is inspired by drug delivery schemes that directly target drugs to the diseased tissues. The effects of nanoparticle addition on microbial health and diversity are being determined in an EPA target sponsored project. Polymer architectures to improve targetability are being evaluated in an NSF study. In a DOD sponsored project directed by Prof. Lowry, in collaboration with Tissa Illangasakare at the Colorado School of Mines, studies the fundamental hydro-geochemical processes affecting the ability to contact these reactive particles with residual DNAPL, and measures the effects of treatment with these particles on mass emission from the DNAPL source zone. Results from these studies will improve the eventual field application of this technology. Results from this study will be used to guide policy decisions related to the potential ecological and human health risks associated with the burgeoning use of nanotechnologies.

In the field of air pollution, scientists and regulators have become concerned about progressively smaller and smaller particles until "ultrafine" nanoparticles, defined as particles whose diameter is less than 100 nm, are a major area of research interest today. Their small size has several implications for human health and the Earth's climate. Toxicological studies have shown that, once inhaled, nanoparticles can spread rapidly throughout the body leading some to suspect that they may be more harmful than larger particles.

Airborne particles have always been important to the Earth's climate as they are the "seeds", known as cloud condensation nuclei, onto which water condenses to form cloud droplets. Human

emissions have increased the number of cloud condensation nuclei since preindustrial times, making clouds brighter and potentially less likely to rain. Not all atmospheric particles are good cloud condensation nuclei: nanoparticles are small enough that their surface tension hinders their growth. Only the largest and most soluble nanoparticles in the atmosphere have a chance to become a cloud droplet. **Professor Peter Adams** and his research group have been developing models of airborne particles that predict the number, composition, and sizes of particles present around the globe. These models are then embedded into global climate models to see how much cloud condensation nuclei concentrations have increased, how much brighter that makes clouds, and how much the brighter clouds have offset global warming from greenhouse gases. Combustion sources are known to emit a large number of nanoparticles to the atmosphere, but nanoparticles can also form spontaneously in the atmosphere during "nucleation" events. In a nucleation event, a non-volatile gas such as sulfuric acid reaches a supersaturated concentration. Molecules of the gas then cluster together until a new particle is formed. Again, the small size of the nucleating cluster means that surface tension effects tend to destabilize it. Exactly how the clusters overcome this barrier to growth is still the subject of debate since nucleation events are observed to occur in the atmosphere at sulfuric acid concentrations lower than simple theories would predict. During the multi-year Pittsburgh Air Quality Study, CEE **Professor Cliff Davidson** and co-workers observed that nucleation events



Professor Peter Adams

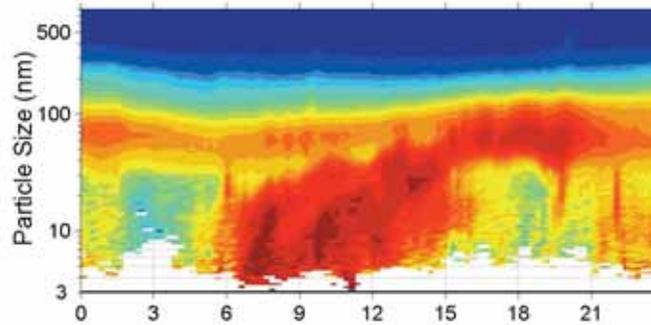


Figure 2: Measurement of a nucleation event in Pittsburgh on July 27, 2001. Time of day is on the horizontal axis and particle size on the vertical axis. Warmer colors indicate higher numbers of particles observed of that size and at that time. The figure shows that high numbers of freshly nucleated clusters (<10nm) were observed just after sunrise (about 6 AM) and continued to form through midafternoon.

occurred in Pittsburgh on one out of three days. [Figure 2 shows an example of one such observation for July 27, 2001.] This was something of a surprise as conventional wisdom was that nucleation events tended to occur only in more pristine parts of the atmosphere. Subsequent modeling work by Prof. Adams and others is suggesting that a mixture of sulfuric acid, mostly from coal power plants, and ammonia, mostly from agricultural sources, is responsible for the nucleation events. Ironically, current air pollution regulations will likely increase the number of atmospheric nanoparticles from nucleation events, although it is not yet clear whether this is a health concern.

In summary, while Civil Engineering is often depicted as the engineering profession concerned with the mega-scale, we are also a profession with many concerns that require attention to the nano-scale. This short article highlights some of those concerns being researched here in Civil and Environmental Engineering. •

## New AIS Lab Established

An Advanced Infrastructure Systems (AIS) Sensors Laboratory has recently been established in the Department of Civil and Environmental Engineering. This lab contains a variety of test equipment, such as high-speed data acquisition systems, arbitrary signal generators, signal amplifiers, power amplifiers, multiplexers, and oscilloscopes. Scientific engineering software are also available such as LabView, MATLAB, and FEMLAB software. The lab also has a variety of sensor devices, such as piezoelectric materials, accelerometers, and strain gauges. In addition, the lab hosts a variety of Radio-Frequency Identification tagging technologies and a phase-based 3D imaging system. •



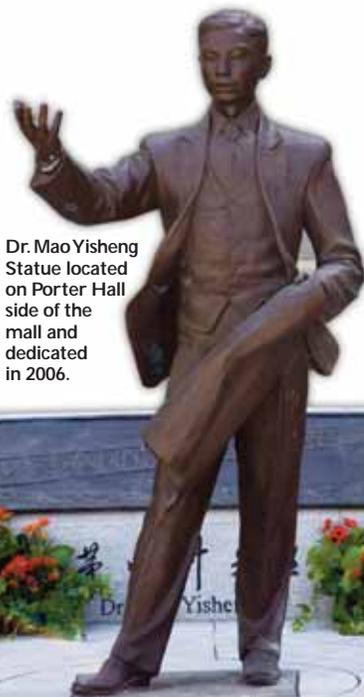
AIS LAB  
DISSERTATION AWARD  
NEWEST STAFF

## Mao Yisheng Outstanding Dissertation Award

The “Mao Yisheng Outstanding Dissertation Award” was established in 2006 by the faculty of the Department of Civil and Environmental Engineering. Named in honor of **Dr. Mao Yisheng** who was the first recipient of a PhD from the Carnegie Institute of Technology in 1919, the award will annually recognize a PhD recipient in CEE who has written an excellent dissertation. Awardees will have done innovative civil and environmental engineering research that is likely to have significant impact, as did the dissertation and career of Mao Yisheng. After completing his degree, Mao went on to design two of China’s most famous modern bridges—the Qiantang River Bridge near Hangchow and the Yangtze River Bridge at Wuhan. He also led the structural design of the Great Hall of the People in Beijing. Mao was a distinguished scholar of the history of science in China as well as a faculty member at five universities and president of four. •



Dr. Mao Yisheng Statue located on Porter Hall side of the mall and dedicated in 2006.



## ABET Visits CEE in Early November 2006

On Nov 5-7, 2006, the department hosted an evaluator and observer from the Accreditation Board for Engineering and Technology (ABET) who evaluated the department on a number of criteria, such as students, objectives, program outcomes, faculty, facilities, and institutional support. Specifically, they evaluated whether the department achieved its stated educational objectives, achieved its desired program outcomes, has processes in place to assess achievement of educational objectives and program outcomes, and has the faculty and facilities to deliver its curriculum. The last accreditation visit occurred in November 2000. While the final results of the visit will not be known until July 2007, the early indications are that CEE will retain accreditation status until the next general review scheduled for 2012. The department thanks all who participated in the preparation of the self-study document, and in organizing, preparing for, and participating in the ABET visit.

## Welcome to a new CEE staff member Cornelia Moore!

**Cornelia Moore**, CEE receptionist and Graduate Admissions Coordinator, came to us after working as the Department Administrator for Oral Medicine and Pathology at the University of Pittsburgh. Cornelia is a TaeKwondo enthusiast and gold medal winner: During the 2006 National TaeKwondo Championships at the Cleveland Convention Center in Cleveland, OH, Cornelia won 2 gold medals, one in kyorugi (sparring) and another in poomse (forms) in the female heavyweight division. *Congratulations Cornelia!*



## Andy Award Nomination

**Patty Langer**, Assistant to Dept. Head Jim Garrett, was recently nominated for a University Andy Award, which is named for Andrew Carnegie and Andrew Mellon. These awards recognize the spirit of teamwork and dedication embodied by Carnegie Mellon’s staff. Patty was nominated for the category related to dedication. Her nomination stated, “Patty is exceptionally dedicated to our Department of Civil and Environmental Engineering. She tirelessly devotes herself to the undergraduates in our program, making sure each and every person feels welcome and well-served by the department.” •

## Department Head visits with Arizona Alumni Chapter for an Exclusive Behind-the-Scenes Tour of the Cardinals Stadium

By Adrian Cain

Few people in Pittsburgh might guess that a visit to Arizona in July would be ideal, but that's exactly what CEE Head **Jim Garrett** had in mind when he traveled to meet with the Arizona Alumni Chapter for a behind-the-scenes tour of the newly constructed Cardinals Stadium in Glendale, Arizona. Garrett was invited to tour the stadium by alumnus **Dan Streyle**, CE '75, the lead project engineer of the stadium project. Along with approximately 60 alumni, the group was treated to a tour of the stadium structure and main seating areas, luxury sky boxes, and Cardinals locker room.



In addition to being the home field for the Arizona Cardinals, the newly constructed multi-use facility will play host to the 2007 Fiesta Bowl and the 2008 Super Bowl. The stadium was featured on Discovery Channel's *Extreme Engineering*. The television program highlights architectural and engineering marvels from around the world and documents how each project changed the definition of what was thought possible. The world-class venue features not only a retractable roof but is also the first stadium in North America to feature a fully retractable grass playing surface. Perhaps the most impressive element of this project was the record setting roof lift. Over the course of three days, two giant Brunel trusses, each 87' tall at their center span and 700' long were lifted to a height of 120' to their final locations. Another interesting feature is that the entire playing surface is supported on a 400 ft. long by 234 ft. wide tray that is able to be moved on 13 rails into and out of the stadium so that a natural playing surface can be maintained. "While Dan would be quick to point out that this project took many people to complete, it is my belief that his leadership and experience played a significant role in its success and on time completion," said Garrett after touring the facility.

During the visit, Garrett was able to spend time with local alumni and provided a general update on the university, the College of Engineering, and the Department of Civil and Environmental Engineering. After speaking to the group, Garrett commented, "We have an impressive group of alumni in Arizona and I would like to thank them for making me feel welcome and for being such an important part of the university. This is a great time for Civil and Environmental Engineering at Carnegie Mellon and I want to encourage all alumni to take an active role in the university's continued success." This was the first major effort by the Arizona Alumni Chapter and given its great success, the future looks bright for our alumni in sunny Arizona. •

ARIZONA CHAPTER  
SPRING PROJECT  
ALUMNI NEWS

Pictured at this event are:  
Tushith Islam (CEE '04, '05), Jaime Wright (CEE '06), Semiha Kiziltas, Chris Gordon (CEE '06), and Chung Yan Shih.

## Alumni and Current Students Meet at International Computing Conference held in Montreal

In June 2006, a number of CEE faculty and students attended the International Conference on Computing in Civil and Building Engineering held in Montreal. One of the co-organizers of this conference, hosting over 600 attendees, was **Professor Hugues Rivard** (CEE '97), who is currently a Professor in the Dept. of Construction Engineering at the École de Technologie Supérieure (ETS) in Montreal, Quebec. On the first night of the conference, several CEE faculty (**Jim Garrett**, **Burcu Akinci**, and **Lucio Soibelman**) and students attending the conference joined local and visiting alums at an alumni dinner sponsored by the College of Engineering and hosted by Jim Garrett, who also received the 2006 ASCE Computing in CEE award during this conference. •



## Spring 2006 Design and Construction Project

Every spring, a group of students, mostly CEEs and a few architects, participate in a course led by **Larry Cartwright** called "Design and Construction". During the four months of this course, the students meet with clients, determine needs, propose concepts, do detailed design and construct the final selected design.

The Spring 2006 Design and Construction project was a small parklet for the Tepper School of Business on Carnegie Mellon's campus. The site was at the corner of Frew and Tech Streets. The MBA Class of 2002 donated \$35,000 to build an outdoor meeting area with a shelter for people awaiting rides. The accepted design was of three intersecting circles. The eastern circle had a diagonal sidewalk with two semi-circular gardens. The center circle had perimeter benches and a hexagonal table with six fixed seats. The western circle includes

perimeter seating and a low circular seating wall that is covered with a cantilevered glass roof. There are four bollard lights on the site, each with a convenience AC outlet.

The walking surfaces are terra cotta colored paving bricks and concrete. All of the structural steel work for the

benches and cantilevered roof structure was done in-house. The steel was powder-coated a silver color. The glass roof was ½ inch, tempered, shatter-resistant glass fabricated by Emerald Glass in Pittsburgh. The powder-coating and glass fabrication were the only tasks not done by the students. The structural steel for the roof was the most challenging task. The roof was sectioned, pitched and sat above an arc section. The structural steel had to be made exactly to specification so as to accommodate the glass panels. Many accurate welding jigs were fabricated to assure precision of the columns, braces and frames.

The University horticulturist specified the site plants. A granite monument was located in on of the semi-circular gardens to commemorate the MBA Class of 2002 and the 14 CEE students who completed the project. The client was very satisfied with the final product shown in photo above. •



Spring 2006 Design and Construction project

## ALUMNI NEWS

**A. Rasim Akdogan** (CE '85) writes to let us know that he is currently living in Ankara, Turkey. He is doing business in general contracting, energy distribution and retail with network investments, manufacturing medical supplies, manufacturing yachts, and finance. •

This a photo of the 42 meter sailing ketch Rasim Akdogan recently built.



## ALUMNI AWARDS



Congratulations to **Roseanna Neupauer**, Ph.D., P.E., M.ASCE, (CE B.S. '89) who was awarded the ASCE Walter L. Huber Civil Engineering Research Prize "for significant contributions to the advancement of probabilistic modeling of environmental contaminants." Roseanna is now an Assistant Professor in Civil, Environmental and Architectural Engineering at the University of Colorado at Boulder.



Congratulations to **Jon D. Fricker**, Ph.D., P.E., M.ASCE, (CE Ph.D. '80) who was awarded the ASCE Harland Bartholomew Award "for significant contributions to urban planning and transportation development." Jon is currently a Professor of Civil Engineering at Purdue University.



Congratulations to **Sara Wadia-Fascetti**, Ph.D., M.ASEE, (CE B.S. '90) who was awarded the ASEE Sharon A. Keillor Award for Women in Engineering Education. Sara, Associate Professor of Civil and Environmental Engineering and Associate Vice Provost for Faculty Advancement at Northeastern University, received the Sharon Keillor Award in recognition of her effectiveness as an educator in and outside the classroom.

### David J. D'Appolonia

#### Alum and Remediation Engineering Pioneer (1944-2006)

**David J. D'Appolonia** was a pioneer in environmental geotechnology and remediation engineering and an entrepreneur. Dr. D'Appolonia, who earned his BS in Civil Engineering from Carnegie Mellon University in 1965, died unexpectedly just before Thanksgiving. He was 62.

David was the son of former civil engineering professor Elio D'Appolonia whose outstanding work in geotechnical engineering was acknowledged by Carnegie Mellon in 1983 by the awarding of an honorary degree. David completed his PhD at the Massachusetts Institute of Technology in 1968 also specializing in geotechnical engineering. He subsequently joined the MIT faculty as an Assistant Professor. David returned to Pittsburgh in 1972 and founded Engineering Construction, Inc., a geotechnical contracting firm specializing in ground improvement and earth construction. ECI became one of the first hazardous waste remediation contractors in the United States. In 1980, David founded D'Appolonia Waste Management Services, a remediation engineering and contracting firm, which was sold in 1984 to International Technology Corporation, now one of the largest environmental contractors in the world. In recent years, he had been working to help build small, technology-related companies as an investor and advisor. David was an early investor in FreeMarkets.

David's ongoing interest was in helping others by helping them to help themselves. He cared passionately about Pittsburgh and was imbued with the entrepreneurial spirit, helping others by helping them to learn.

The Department of Civil and Environmental Engineering is proud of his achievements and mourns his passing. We extend our condolences to his wife Eileen Maclair D'Appolonia, his parents, Elio and Tina D'Appolonia and his children, Christine, Caroline, and Amy and to his grandchildren. •

## Chris Hendrickson Attends the Future of CE Education Workshop in Istanbul, Turkey



In the first week of October, 2006, **Professor Chris Hendrickson** spent a week in Istanbul, Turkey, a city of about 11 million people (according to the Turkish census; Hendrickson states that “other sources claim the population is nearer to 14 million”).

According to Hendrickson, Istanbul “reminds me of Rome — Mediterranean climate, lots of traffic, bustling streets and empire ruins but with minarets and water.” Hendrickson notes that there were many very good restaurants, often waterside or with views along the Bosphorus. Unemployment (10.8% is the official statistic) and under-employment (5% is the official statistic) are issues, although the economy has been growing since 2001. Development continues along the Bosphorus and traffic congestion is a major cost to the urban area.

While there, Hendrickson did a talk on the Central Artery/Tunnel (i.e., “The Big Dig”) at Istanbul Technical University. The Civil Engineering Department there is a large, well established department with eighty faculty members. He met with Carnegie Mellon alumna **Esin Ergin** (CEE '05), who he says “appears to be settling in very well —her appointment was finalized this fall and she has research plans and collaborators.”

The main reason for Hendrickson to be in Istanbul was to attend the Workshop on Future of Civil Engineering Education, which was a mixture of talks and discussion. Professor Adnan Akay from Mechanical Engineering spoke about the new Civil, Mechanical and Manufacturing Innovation Division at NSF, finalized on September 30, 2006, but with a program re-orientation still to come. The talks given by US participants varied in what was emphasized, with the most attention given to the ASCE Body of Knowledge (BOK) proposals and the ‘renaissance engineer’. According to Hendrickson, “curricula reform is a major issue across Europe but less so in Canada. Also, matching enrollments and job openings is a major issue in Europe.” Hendrickson spoke on sustainability engineering. Faculty from several other schools also spoke on sustainability: UBC (Susan Nesbit) and Cincinnati (Jim Uber).

While touring Istanbul, Hendrickson walked from Europe to Asia on the second Bosphorus Bridge (shown in the photograph). He also attended a briefing on and tour of the Bosphorus subway project (officially referred to as the Istanbul Strait Crossing portion of the Marmaray Project) which is 55 m underground. The project is being conducted by an international project team, consisting of four partners from Turkey and Japan, with assistance from US consultants. Seismic issues are a key factor affecting the design of the subway and Istanbul is apparently overdue for a major earthquake. •



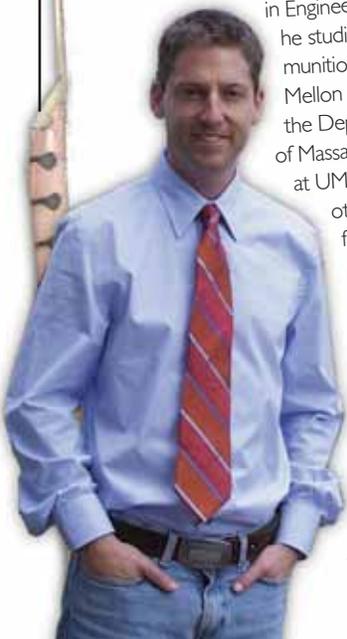
CE WORKSHOP

RESEARCH

ACADEMIC NEWS

### Kelvin Gregory Joins CEE

**Kelvin Gregory**, an Assistant Professor and newest faculty member of CEE, joined us in August 2006. Professor Gregory received his Ph.D. in Engineering from the University of Iowa where he studied the biogeochemical transformations of munitions compounds. Kelvin comes to Carnegie Mellon University from a post Doctoral Position in the Department of Microbiology at the University of Massachusetts with Professor Derek Lovley. While at UMass, Kelvin investigated microbial fuel cells and other environmental electrode biotechnology for remote energy generation and environmental restoration. Kelvin specializes in engineering applications of environmental microbiology and his ongoing research interests include anaerobic bacteriology, energy generation, bioremediation, biofilms and environmental sensing. During the fall, Kelvin has been establishing his laboratory, training students, and preparing to teach the Spring Fluid Mechanics course. We are extremely pleased to have Kelvin as part of our faculty in CEE and welcome him to Carnegie Mellon. •



### Nanoparticulate Paper Published in ES&T



PhD student Navid Saleh

**Professor Greg Lowry** and PhD student **Navid Saleh's** nanoparticulates research done in collaboration with toxicologists at the USEPA was featured in a special focus issue (July 15, 2006) in *Environmental and Science and Technology* on the environmental and health effects of nanotechnology.

Nanoparticulate  $TiO_2$  found in consumer products such as sunscreens and used in water purification were exposed to mouse microglia in vitro. These particles were found to enter the cell, and to cause oxidative stress. While these in vitro exposures do not directly demonstrate toxicity to neurons, they do indicate the potential for them to be neurotoxic. Further studies are underway to directly measure the toxicity of these particles to neurons.

Long, T., Saleh, N., Tilton, R., Lowry, G. V., Veronesi, B. (2006) “Titanium Dioxide (P25) Produces Oxidative Stress in Immortalized Brain Microglia (BV2): Implication of Nanoparticle Neurotoxicity” *Environ. Sci. Technol.* 40 (14) 4346-4352. •

## FACULTY NEWS BITS

### Cliff Davidson Honored



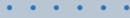
**Professor Cliff Davidson** was recently selected to receive the 2006 Association of Environmental Engineering and Science Professors (AEESP) Outstanding Contribution to Environmental Engineering and Science Education Award. The purpose of this award is "to recognize and honor the development of innovative teaching methods, including the application of these methods in the classroom and the dissemination of methods to the academic community." A plaque will be presented to Professor Davidson in honor of the achievement along with a financial award of \$500.



### Jacobo Bielak Receives \$1.5M NSF Grant



**Professor Jacobo Bielak** and his colleagues at Georgia Tech, UC Santa Barbara, UT Austin, and UT El Paso recently received a \$1.5 million NSF grant entitled "NEESR-SG: High-fidelity site characterization by experimentation, field observation, and inversion-based modeling". The main objective of this research is to develop the capability for estimating the geological structure and mechanical properties both of individual sites and of complete basins, and to demonstrate this capability on the nees@UCSB (nees.ucsb.edu) site at the Garner Valley Downhole Array (GVDA). This project represents an unparalleled opportunity to couple state-of-the-art field experimentation with state-of-the-art computational tools for the purpose of imaging the subsurface at resolutions and length scales until recently unattainable.



### Burcu Akinci Awarded \$1M Army Contract



**Professor Burcu Akinci** leads a large team from Carnegie Mellon that has received a \$1 million indefinite delivery contract from the U. S. Army Corps of Engineers Engineering Research and Development Center (ERDC) entitled "Indefinite Delivery Contract for Research Support of the Area of Engineering Processes for Facility Delivery Activities and Facility Management." This IDC will allow the US Army Construction Engineering Research Lab in Champaign, IL to establish contracts with faculty at Carnegie Mellon related to the research on advanced sensing and information technology usage during the facility delivery and operation processes.



### Greg Lowry and Team Receive EPA-STAR Grant



The US EPA has awarded **Professor Greg Lowry** and his colleagues, **Professors Robert Tilton and Edwin Minkely** at CMU, Dr. Pedro Alvarez at Rice University Center for Biological and Environmental Technology (CBEN), and Dr. Christopher Kim at Chapman University a 3-year Science to Achieve Results grant for \$400,000 to investigate the fate and ecological effects of iron nanoparticles used for groundwater remediation. This project will determine the environmental and microbial fate of nanoiron and its metal oxide oxidation product (magnetite) under environmental conditions, and what effect surface coatings present on nanoiron (and many other nanoparticles) will have on the rate and extent of oxidation, their mobility after reaction (and hence potential exposure risk), their interactions with soil bacteria, their effect on the soil microbial health and diversity under natural environmental conditions, or on human health.

### Green Design Awarded \$1.5M Grant from NSF

**Professors Chris Hendrickson, Scott Matthews, Lester Lave, Mike Griffin and Jeremy Michalek** received a grant from NSF to study the life cycle infrastructure effects of alternative fuels in the United States. The team's infrastructure focus is a key departure from research being done elsewhere, which ignores the need to build new fuel delivery and distribution infrastructure, and the associated cost and environmental impacts of the infrastructure. The five year award is funded at \$1.5 million.



### Dave Dzombak Named New Associate Dean



**Professor Dave Dzombak** was appointed in July 2006 as Associate Dean of Graduate and Faculty Affairs for CIT. In this position, he will oversee the faculty promotion & tenure process and address graduate student issues. Dzombak, a professor of civil and environmental engineering and co-director of the new Center for Water Quality in Urban Environmental Systems (WaterQUEST), has conducted leading-edge research in the areas of aquatic chemistry, water and wastewater treatment, abandoned mine drainage remediation, river and watershed restoration, and hazardous waste site remediation. Dzombak is also an alum, having received his B.S. in 1980 and his M.S. in 1981 in Civil Engineering from Carnegie Mellon. He received his Ph.D. in 1986 from MIT



### Chris Hendrickson Named an AAAS Fellow



**Professor Hendrickson** was recently named a fellow of the American Association for the Advancement of Science (AAAS). Hendrickson, the Duquesne Light Professor of Engineering at Carnegie Mellon, was named a fellow for his outstanding contributions to the field of engineering planning and management, including design for the environment, systems performance, construction project management, finance and computer applications. The AAAS is the world's largest general scientific society and publisher of the journal *Science*.



### Earthquake Team Wins SC06 HPC Analytics Challenge

**Professor Jacobo Bielak** and his students **Leonardo Ramirez-Guzman** and **Ricardo Taborda-Rios**, along with other members of a team of scientists and engineers from Carnegie Mellon, the University of California, Davis, the University of Texas, and the Pittsburgh Supercomputing Center, won the Analytics Challenge Award at SuperComputing 2006. They were recognized for integrating sophisticated computational methods on massive amounts of data to support critical thinking and reasoning, leading to new insights and understanding in the context of applied challenges. The goal of the team's work is to realistically simulate earthquake ground motion, and thereby better assess the seismic hazard to populated earthquake-prone basins. •

## TRIP REPORT

## International LifeCycle Assessment and Management Conference

Washington D.C. • October 4-6, 2006

*Troy Hawkins, Cortney Higgins, Anny Huang, Paulina Jaramillo, Joe Marriott, Vanessa Schweizer, Aurora Sharrard, and Heather Wakeley*  
**Civil & Environmental Engineering / Engineering & Public Policy,**  
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**A**bout 200 academic, government and business professionals gathered October 4 - 6 at the AED Conference Center in Washington D.C. for the International LCA/LCM 2006 Conference.

In a soul-searching keynote on October 5th, **CEE Professor Scott Matthews** shocked attendees with the statement "LCA is dead". Matthews went on to explain that as a community, U.S. LCA researchers have done a terrific job at developing tools, methods, and software but have not adequately developed an audience for their LCA research. Matthews' message was met with comments of both agreement and hope for increasing public interest in LCA research. During the comment period Tom Gloria of Five Winds International provided an encouraging counterpoint to Matthews' perspective by describing the rapid growth in contracts for LCA research his company has received in recent years.

Breakout sessions at this year's conference included LCI databases, inventory and interpretation methods, analytical tools, LCA in decision-making, impact methods, and international activities. Other sessions were devoted to specific LCA applications such as buildings, energy, recycling, waste management, automobiles, chemical products, and seafood.

This was the fifth U.S.-based InLCA/LCM Conference since the first one was held in Arlington, Virginia in 2000. Two of these were web-based, virtual conferences. The next InLCA/LCM Conference is planned for October 1-5, 2007 in Portland, Oregon. For more information visit: <http://www.lcacenter.org/inlca.html>.



Heather Wakeley, CEE PhD student



Aurora Sharrard, CEE PhD student



Joe Marriott, CEE PhD student

LCA/LCM  
 AIS PROJECT  
 ASHE AWARD

### ASHE Outstanding Highway Engineering Award Presented to Elfatih Ahmed

The American Society for Highway Engineering, ASHE, annually presents an Outstanding Highway Engineering Award. The award recognizes the first time application of new technology.

This year's award was presented to CEE graduate student **Elfatih Ahmed**, currently working as Principal for A&A Consultants, Inc., a dynamic, rapidly-growing engineering firm located on the North Shore of Pittsburgh, PA. Elfatih's project addressed the problem with very soft, saturated alluvial deposits at the embankment fill site. A high strength, light weight fill material was needed for the bridge approaches. The project team proposed the use of shredded tires for the embankment fill. The benefits of using "tire shreds" for the fill include providing an environmentally sound method of disposing a persistent waste product. The project demonstrated that waste tires, in the shredded form, can be utilized as an effective roadway embankment fill.

### Troy Hawkins Attends Gordon Research Conference

This year's Gordon Conference, held at Queen's College, Oxford, UK, was centered on Industrial Ecology. For those who are unfamiliar with Gordon Research Conferences, the philosophy behind them is that a small group of research scientists gather to share ideas and stimulate one another toward groundbreaking research in their field.

As a student, Troy especially enjoyed the opportunities this arrangement provided to connect with more



## AIS Project Course

The Advanced Infrastructure Systems (AIS) program in CEE focuses on the exploration and application of emerging Information and Communication Technologies (ICT) to physical infrastructure systems and the processes to design, build, and operate those systems. The goal is to make these systems able to continuously determine their conditions, perform self-assessment and support proactive decision making that improves their performance, increases their life spans and reduces life-cycle costs and impacts.

As part of their graduate studies in AIS, students take a two-semester project course in which they propose, design, and implement an advanced sensor network. In the Fall of 2005, the students worked with **Susan Finger** to do the background research in order to write a proposal to the Steinbrenner Institute to create "A Sensor Network for the Solar Decathlon House." In the Spring of 2006, they worked with **Chris Henrickson, H. Scott Matthews, and Lucio Soibelman** to design, implement and test the sensor network. The aim of the project was to demonstrate the sustainability concepts of a solar house by monitoring and visualizing the energy consumption, comfort levels and occupancy in the house. The solar house monitored, called Pittsburgh Synergy, was originally built for the DOE Solar Decathlon Competition by a group of students from Carnegie Mellon University, the University of Pittsburgh and the Art Institute of Pittsburgh.

A total of nine students participated in this project. AIS Master's Students: **Baber Farooq, Ben Ferguson, Tuan Nguyen, Mark Rau, Kedar Sawant, Jennifer Wong, and Jaime Wright.** Electrical and Computer Engineering Master's Students: **Richard Allison and Jovan Williams.**

The students designed and deployed the data acquisition system. They installed sensors and its wiring, assembled and installed the



National Instruments Field Point System

National Instruments FieldPoint data acquisition with its Ethernet, input/output, pulse, and power supply modules, and programmed the data acquisition software in LabView. They designed and developed the data management system with its MySQL database, linked it to the LabView interface, and installed the servers that record all the data being generated. Finally they developed the user interface for the Kiosk that allows solar house visitor's to interact with the database. The same interface developed for the Kiosk is available on line at the URL: <http://aisproject.cive.cmu.edu/>.

## Undergraduates Investigate Water Quality in Panther Hollow

Panther Hollow Lake, a 100 year old constructed lake used in the early 1900s for recreation, is located in Schenley Park. Upstream from the lake is a dense urban area including the university, a golf course, and residential areas. The Pittsburgh Parks Conservancy (PPC) is investigating the potential to restore Panther Hollow Lake as an amenity for fishing and boating. In the summer of 2006, Civil and Environmental Engineering (CEE) students designed and initiated an intense monitoring program for the Lake and its tributaries. Microbiological, chemical, and physical parameters were monitored (using some of the same kits that CEE sophomores use in 12-252 each fall!). In the fall of 2006, the undergraduate team presented their results to the PPC, leading to a request for additional study during summer 2007.

Students involved in this project were sophomores **Alan Eaton** (shown in the photo), **Elena Goldstein, Amanda Mitchell, and Meenah Park,** MS student **Kristen Wright,** and PhD student **Mary Schoen.** This project is supervised by **Dr. Jeanne VanBriesen,** and funded by the Pittsburgh Parks Conservancy and the Center for Water Quality in Urban Environmental Systems (Water QUEST) at Carnegie Mellon University. •



Alan Eaton

senior researchers. Participants in the Gordon Research Conference came with an open mind to new ideas and a desire to discuss the next steps for industrial ecology research. Troy travelled with partial support from a Fenves Travel Scholarship.

## Fall 2006 Senior Design Class

The Senior Design Class (12-401) is taught each fall. The class builds a structure according to specifications with a different theme each year. This year's theme was based on the 13<sup>th</sup> century middle ages. The best designed bridge is shown, which was made of all wood and rope, built with hand tools and no fasteners. This bridge was the lightest and most creative design.

From left to right: **W. Yao, S. Williams, M. Cornwall, B. Jones and L. McCarthy**





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Inquiries concerning application of these statements should be directed to the Provost, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-6684, or to the Vice President for Enrollment, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-2056. Obtain general information about Carnegie Mellon University by calling 412-268-2000.

Carnegie Mellon University publishes an annual campus security report describing the University's security, alcohol and drug, and sexual assault policies, and containing statistics about the number and type of crimes committed on the campus during the preceding three years. You can obtain a copy by contacting the Carnegie Mellon Police Department at 412-268-2323. The security report is also available at [www.cmu.edu/security](http://www.cmu.edu/security).

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**CEE Newsletter  
Fall-Winter 06/07**

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