

The **Bridge**

Harnessing Puget Sound's Tides for Renewable Energy

Puget Sound's tides are among the largest in the continental US. They are coupled to strong currents that ebb and flood twice per day. In Admiralty Inlet, the main entrance to Puget Sound, flow can exceed 8 knots between Whidbey Island and the Olympic Peninsula. For the past two years, a team of University of Washington researchers has been collecting data on these currents to inform a proposed renewable energy project.

The Snohomish County PUD proposes to deploy two underwater "hydrokinetic" turbines on the seafloor as a pilot project to collect environmental and performance data. Before the deployment, planned for 2013, a site must be selected and the baseline environmental conditions characterized, which is where the UW team comes in.

The research is a project of the Northwest National Marine Renewable Energy Center, a Department of Energy-funded partnership between UW and Oregon State University. At UW, the center collaborators are the College of Engineering, Applied Physics Laboratory (APL), and School of Oceanography. In addition to the field data collection, led by



The research team launches a Sea Spider, which will rest about 200 feet deep on the seafloor and collect data for three months or more. CEE Assistant Professor Jim Thomson is at left (blue jacket).

Jim Thomson, APL senior oceanographer and assistant professor of civil and environmental engineering, the center also is conducting numerical and laboratory studies of tidal hydrokinetic turbines.

Field data collection uses seafloor tripods, called Sea Spiders, which are deployed for three months at a depth of 200 feet or more. The internally logged data is offloaded during regular recovery and redeployment. Researchers use the tidal current data to estimate the available kinetic power density, which scales with the velocity cubed (just like wind power). Predictions suggest the 30-foot-diameter turbines will have maximum power outputs of about 500 kW each, enough to power about 350 homes.

In addition to measuring the tides, the UW team has been measuring underwater noise, water quality, marine mammal activity, fish passage, seabed composition, and biofouling (e.g., barnacle attachment, algae growth) conditions. The underwater noise measurements



The monitoring data will guide site selection for a demonstration project that will place two 30-foot-wide tidal turbines at the entrance to Puget Sound.

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Message from the Chair

Greg Miller

Before getting down to this edition's nitty gritty, I encourage you to check out our new departmental website: <http://www.ce.washington.edu>. The redesigned site provides a more dynamic view of CEE activities and people and offers several new features especially for alums and friends of the department (just follow the Alumni & Industry header link).

In the previous edition of *The Bridge*, I focused on the need for UW CEE to grow to meet student and societal demands. Just about the time I wrote this chair's message, a confluence of events occurred that highlights the good news/bad news aspect of the context we're operating in right now. On the good news front, I learned that more than 650 UW freshman identified CEE as one of their two choices for a major. Whether one looks at data from the US Bureau of Labor and Statistics (projecting that civil engineering will have the largest growth in employment among all engineering fields) or publications like *Money Magazine* (listing environmental engineering and civil engineering as the number 5 and 6 top careers to pursue in the US), it is evident that students are receiving clear signals that CEE is a great career choice.

On the bad news front, however, we have nowhere near the capacity to handle 650 new CEE students, and we received reports of potential state budget cuts likely to be the worst we have experienced yet. Quite the conundrum: booming demand, but diminishing support to take advantage of the opportunity this presents.

Fortunately, one of the good things about being an engineer is having learned not to panic in the face of difficult problems. We are taking several actions that will allow us not just to survive, but ultimately to thrive. First, we are working to improve the efficiency of our undergraduate and graduate curricula so that we can better handle the present number of students and give some

Continues on back cover.

New Faculty Member Studies Environmental Impacts on Health

Rebecca Neumann will join Civil & Environmental Engineering as an assistant professor this summer. Rebecca has been a NOAA Climate and Global Change postdoctoral fellow at Harvard University. She earned her doctorate from the Massachusetts Institute of Technology with a thesis project focused on understanding one of the major human health problems in Bangladesh: arsenic-contaminated groundwater.



Neumann's research seeks to understand how land-surface modifications and management decisions affect human and environmental health by altering the fluxes of water, nutrients, carbon, and contaminants in underlying soils. Her work recognizes that soils are the critical interface between the atmosphere, land surface, and subsurface; and that soil fluxes often control the quality of food and water resources.

Prior to graduate school, Rebecca worked as an environmental engineering consultant for EG&G Technical Services. She holds a BS in CEE and BA in art and art history from Rice University. ■

Meet Jill Klein, CEE Grants Manager



Jill, originally from California, has been in the Seattle area for over 30 years and has worked at the UW for 15 years, since 2008 as grants manager with CEE. Her family includes a daughter, Katharine, who recently graduated from Bard College, and her mom, Beverly. Their two cats, Olive and Zoe, run the household. Jill enjoys yoga, music, and other recreational activities. ■



Earthquake Double Take

When an alarm interrupted the April 11 meeting of the Japan Society of Civil Engineering, Steve Kramer, professor of geotechnical engineering, held his camera over his head, pointing backwards, and caught a shot of everyone looking up at the speakers and lights swinging back and forth. Keith Palmer, a CEE doctoral student, was at a conference in Hokkaido when the 9.0 magnitude earthquake hit Sendai. Read more at <http://www.ce.washington.edu/news/index.html>.

Nuclear Energy Is the Timely Topic for the May 19 Evans Lecture

Dr. Gail H. Marcus, an independent consultant on nuclear power technology and policy, will speak on “Nuclear Power: Past, Present and Future” for the 2011 Daniel L. and Irma Evans Lectureship in Civil and Environmental Engineering. Within the context of the recent nuclear crisis in Japan, Marcus will explore the evolution of nuclear power from its earliest days to its growth into

Marcus was the first woman in the United States to earn a doctorate in nuclear engineering.

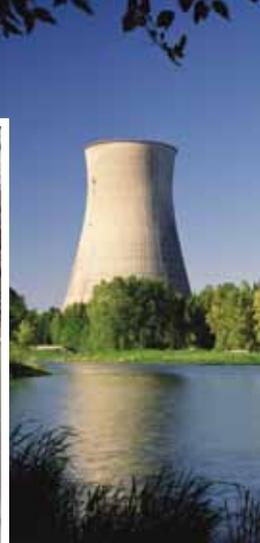
a global industry, and will consider how current events might affect future nuclear power developments.

Marcus was the first woman in the United States to earn a doctorate in nuclear engineering. She held senior management positions with the Congressional Research Service, the Nuclear Regulatory Commission, and the Department of Energy, and assignments abroad in Tokyo

and Paris. Her last position was deputy director-general of the Organization for Economic Cooperation and Development Nuclear Energy Agency in Paris. She also served as the president of the American Nuclear Society and on a National Academy study of nuclear engineering education. Marcus earned SB and SM degrees in physics and a ScD in nuclear engineering from the Massachusetts Institute of Technology.

The Daniel L. and Irma Evans Lectureship aims to expose students and practitioners of civil engineering to the concepts, concerns, and methods of other disciplines that they will encounter in their professional careers and thus broaden their understanding of the challenges and opportunities they may face. The Evans’ three sons established the endowment in 1982 to memorialize the human values and broad societal outlook of their parents.

The lecture is Thursday, May 19 at 4:30 PM in Kane 220. It is free and open to the public, and a reception will follow. If you would like to join us, please RSVP to Heather Wilson at (206) 543-8883 or hwilson@u.washington.edu. ■



Farewell to James “Jack” Herndon

On January 19, 2011, exactly twelve years to the day after James “Jack” Herndon started as the “scientific instructional technician” for Civil & Environmental Engineering, he retired as the “program operations specialist.” This title encompassed several roles, though officially he was CEE’s lab and facilities manager.

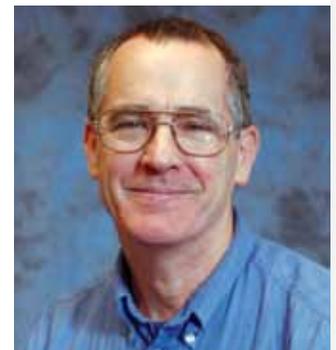
During his first years with the department, Jack focused on managing the Environmental Engineering and Teaching labs. His introduction into facilities management occurred with the first upgrade to the third-floor teaching lab in More Hall. Subsequent projects included remodeling the Geotech offices, a building electrical upgrade, and creation of the More Hall computer lab. He oversaw roof replacements on More and Wilcox halls in addition to scores of remodels, upgrades, and repairs to labs and office space in these buildings and the Wilson Ceramic and Harris Hydraulics laboratories.

Jack also served for many years as the department representative and chair of the College of Engineering’s

Safety Committee and as a college representative for the UW Health and Safety Committee.

Jack’s service did not end with his job description. He coordinated CEE’s participation in several events benefiting the community, including the holiday food and fund drives for the University District Food Bank, and the Ride in the Rain and Bike to Work competitions. Jack also strove to increase awareness of environmental concerns regarding energy efficiency, waste reduction, compost collection, and recycling.

“I have been interested in how CEE is perceived not only within the UW, but to the community at large. I am proud to have been part of a group doing so much groundbreaking, excellent work in a worldwide setting. I am sorry I now have to leave it behind,” Jack said. ■



Truss Bridge Inspections

New Triage Method Speeds Evaluation of Gusset Plates

Since the 2008 collapse of the I-35W Bridge in Minneapolis, older steel truss bridges across the US have become a priority for inspection and load rating. Several studies have indicated that some undersized gusset plates on the bridge were a possible cause of the collapse. Gusset plates connect the truss members at the joints as demonstrated in Figure 1.



Figure 1: Gusset plate at joint.



Figure 2. One of three WSDOT bridges used to develop the TEP for gusset plate evaluation.

State departments of transportation (DOTs) regularly inspect bridges and make load ratings to determine whether a bridge needs to be posted with a weight limit. Prior to the collapse of the Minneapolis bridge, gusset plates were routinely inspected for corrosion but were not evaluated for their load capacity as part of typical bridge rating procedures.

In response to the collapse, the Federal Highway Administration (FHWA) now requires that state DOTs load rate all steel truss bridges and include the strength of the gusset plate connections in their evaluation,

a necessary step toward ensuring the safety of critical infrastructure.

Washington State has more than 120 truss bridges under DOT jurisdiction and many more that are the responsibility of counties and cities. Each one has many gusset plate connections, so inspection is a daunting, expensive task. While the failure of the I-35W Bridge is cause for concern, the small number of failures overall for the many truss bridges in service indicates that the vast majority of gusset plate connections are safe.

denoted the Triage Evaluation Procedure (TEP), which has saved the state considerable resources.

The CEE research team included faculty members Jeffrey Berman, Charles Roeder, and Dawn Lehman, along with graduate students Bo-Shiuan Wang and Aaron Olson. To develop the TEP, they studied a variety of representative truss bridge joint geometries to evaluate the stress state in the gusset plates and its dependence on joint configuration, load distribution, and other parameters. The researchers selected a critical joint from the I-35W Bridge and several from three Washington State bridges (Figure 2), based on their approximate maximum stresses determined from global analyses.

Once the research team had identified the critical joints, they developed high-resolution finite element models to study the stress. These rigorous analytical models (Figure 3) have been validated against results from other analytical studies and older research reports. The models are subassemblages of truss bridge joints that reasonably approximate the boundary conditions for the truss

Working with the Washington State DOT and FHWA, UW CEE researchers have developed an approach to rapidly identify gusset plate joints that may be of concern and quickly eliminate the vast majority of safe gusset plates from need for further investigation. WSDOT and their consulting engineers are already using this approach,

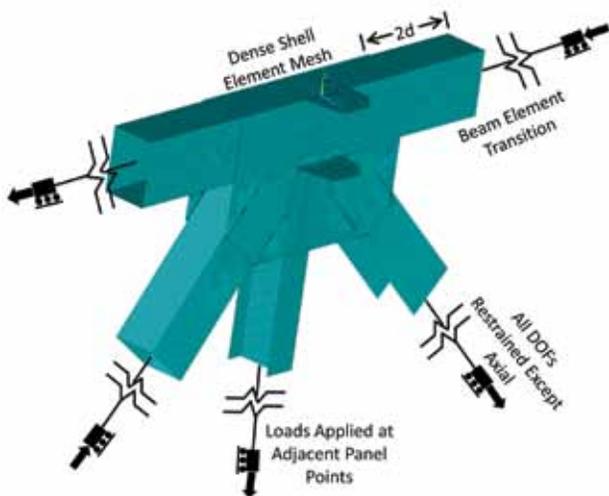


Figure 3. Example of finite element model and boundary conditions for truss bridge joints.

elements, through which loads are applied to the joint.

The team used the models in a parametric study to investigate how the load distribution in the truss members, the gusset plate thickness, and general joint geometry influence the maximum stress in the plate (Figure 4). Observations indicated that the

elastic buckling) and is an excellent filter for use in the TEP.

The researchers then developed a simple spreadsheet for evaluating whether a gusset plate was likely to yield under the loads used for load rating bridges. The resulting procedure is conservative, fast to employ, and will identify truss bridge joints

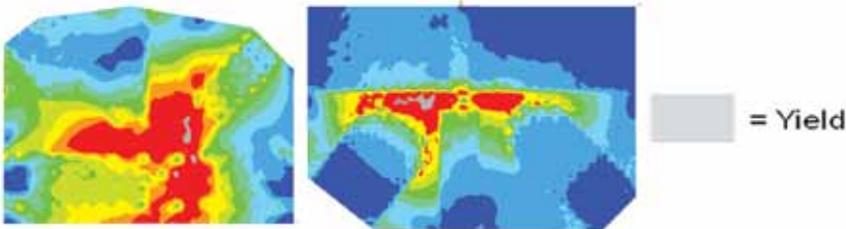


Figure 4. Stress contours (Von Mises stress) in the gusset plates for two of three joints at the onset of gusset plate yielding.

stress state in the plate is complex and that considerable interaction occurs between the stresses generated from the different connected elements. Despite the complexity, the research demonstrated that a single calculation could be used to conservatively estimate the onset of yielding anywhere in the gusset plate. Initial yielding occurs before any failure (such as fracture or in-

that may have high stresses for more detailed evaluation. Of the three WSDOT bridges studied, only one joint required additional analysis beyond the TEP, after which it was deemed safe. The researchers are continuing to investigate truss bridge joints to develop more refined evaluation methods and to investigate the strength of the older riveted connections found in these bridges. ■

Harnessing Puget Sound's Tides

(continued from front cover)

are important, as marine mammals use sound to communicate and navigate. Federal regulators need to ensure that turbines will not alter the ambient noise at levels or frequencies that would affect marine mammals. Noise analysis suggests that the turbine noise would be minor compared with ship traffic noise in the area.

Building on two years of data collection and analysis, the UW team will evaluate the turbulence at the site to estimate the survivability of the turbines and to remove factors

that can contaminate noise measurements. The team will assemble environmental monitoring equipment built around cabled real-time nodes that support a suite of sensors, including video cameras, hydrophones, and current meters, and will develop protocols for turbine installation.

The work in Admiralty Inlet was presented at the 2010 fall meeting of the American Geophysical Union. More information is available at <http://depts.washington.edu/nnmrec>. ■

Awards and Accolades

Julie Vano Awarded AWRA Fellowship

Julie Vano, CEE PhD student in hydrology, water resources, and environmental fluid mechanics, received one of two American Water Resources Association (AWRA) Washington Chapter 2010 fellowships.

WTS Scholarship Recipient Presented at RITA-USDOT Event

Kari Watkins, PhD student in transportation engineering, received the Women's Transportation Seminar Puget Sound Chapter 2010–11 Helene M. Overly Memorial Graduate Scholarship. Watkins gave a poster/podium presentation on the OneBusAway research project at the RITA-USDOT Demonstration and Exhibition on April 6 in Washington, DC.

Erica Wygonik Receives Two Awards

Erica Wygonik, graduate student in transportation engineering, was a member of the UW student team that won the National 2011 American Institute of Certified Planners (AICP) Student Project Award in Contribution of Planning to Contemporary Issues for their Seattle Bike-Share Feasibility study. Wygonik has also been named the 2011 Outstanding Young Civil Engineer in the Public Sector by the American Society of Civil Engineers (ASCE) Western Region.

Kunal Vaswani Wins AC Fellowship

Kunal Vaswani has been awarded one of only eight 2011–12 American Concrete Institute (ACI) Foundation fellowships. The competition is intense, and Vaswani is the first UW student to win this award – no small feat!

Bo Li Wins NALMS Presentation Award

Bo Li, graduate student in environmental engineering, received the North American Lake Management Society (NALMS) Best Student Presentation award for her "Spokane River Phosphorus Bioavailability" talk given at the 2010 NALMS Symposium.

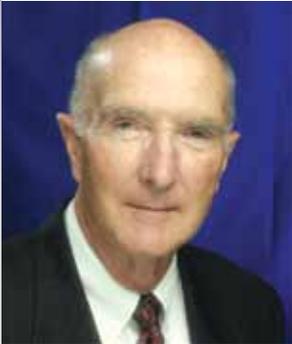
Yao-Jan Wu Honored with Two Awards

Alum Yao-Jan Wu (PhD 2010), representing the UW/WSU TransNow center, received the Outstanding Student of the Year award at the 15th Annual Council of University Transportation Centers (CUTC) Awards Banquet on January 22 in Washington, DC. In addition, Yao-Jan received the 2nd annual installment of the Michael Kyte Award, given at the Region X Reception on January 25 in Washington, DC, held in conjunction with the Annual TRB Meeting.

Rinehimer Receives AGU Outstanding Student Paper Award

CEE doctoral student J. Paul Rinehimer has been awarded the American Geophysical Union (AGU) Outstanding Student Paper award for his oral presentation titled "Observations of ebb flows on tidal flats: Evidence of dewatering?" at the 2010 AGU Fall Meeting held December 13–17, 2010 in San Francisco. ■

Tom Gibbs Will Address CEE Graduates at June Ceremony



Over a distinguished career in environmental engineering, Charles V. “Tom” Gibbs (’54 BS, ’66 MS) created numerous innovative and lasting environmental legacies for the Puget Sound region and nationally. He will reflect on his experiences and send our 2011 graduates off on their own careers at the department’s June 12 graduation ceremony.

Gibbs led construction of Metro’s acclaimed cleanup of Lake Washington and Puget Sound, earning a commendation from the White House in 1971, and later oversaw the development of the award-winning Metro Transit program. Gibbs also managed Milwaukee’s ambitious and successful water pollution abatement program, which transformed the downtown riverfront into a dynamic urban destination. In 1969, Gibbs spearheaded creation of the National Association of Clean Water Agen-

cies, and he played a significant role in the development of the original Clean Water Act in 1972. Later in his career he was executive vice president and director of water practice at CH2M Hill.

Gibbs led construction of Metro’s acclaimed cleanup of Lake Washington and Puget Sound.

Gibbs also has been active in community service for both economic development and environmental organizations. As a board member of the Washington State Major League Baseball Stadium Public Facilities District, he was instrumental in the design and construction of SAFECO Field. Among his many honors is UW Engineering’s 2009 Diamond Award for Distinguished Achievement in Industry. ■

New Student Fund to Honor Emeritus Professor Billy Hartz

Students today rely on their computers for almost everything. From making “friends” to solving complex engineering problems, the home computer or laptop is an integral part of our lives. It didn’t used to be that way. While Al Potvin (MS ’66, PhD ’68) was a structural mechanics graduate student in CEE, a “computer” meant an entire room of hardware — an IBM 7094 unit that ran from floor to ceiling and was programmed by meticulously organized sets of punch cards.

One of Potvin’s first assignments with the IBM 7094 came while he was a research assistant for Emeritus Professor Billy Hartz. As chair of structural mechanics (a position that no longer exists), Hartz was a leader in this field and encouraged its growth through both invited lecturers and guest instructors from Boeing. Hartz also brought to the UW one of the first finite-element computer programs

(the ELAS), which he acquired from the Jet Propulsion Laboratory in California. Potvin was given the task of installing, maintaining, and updating the ELAS program and it was through this experience that he gained the skills that lead to his PhD dissertation and his 35-year career as one of ExxonMobil’s lead experts in finite-element analysis and software engineering.

While reflecting on his career and his decision to establish a fund in honor of Professor Hartz, Potvin noted that “nobody gets through life without help. You say to yourself, “I owe somebody something for my success. How can I pay this forward?”

This new fund will support and encourage students to investigate emerging ideas in the areas of computer structural analysis. Potvin hopes that students will use such ideas and concepts to provide breakthrough technologies in unforeseen areas of commerce.

Potvin also hopes that other students of Professor Hartz will be inspired to donate to this fund. The goal is to eventually endow it as a scholarship or fellowship. If you are interested in honoring Billy Hartz and would like to make a contribution to this fund, please contact Megan Ingram at 206.685.1378 or mkingram@uw.edu. ■

Connect With Your Classmates

Curious about what your friends have been up to? Log on to the Alumni Updates section of the new CEE website, and while you are there, add or update your information. Let’s grow this site! <http://www.ce.washington.edu/alumni/directory.html>

Officer Works in the Everglades by Day, Earns UW Master's Degree by Night

Troy Collins, a major in the US Army Corp of Engineers (USACE), spends his days in the Florida Everglades, working with the Corps to save this damaged ecosystem by restoring its free-flowing waters. While based in the southeast most corner of the nation, he's also a graduate student at the UW, connecting to a classroom 2600 miles away. Major Collins is earning a master's degree through the UW's Online Graduate Program in Construction Engineering.



Major Troy Collins (left) in the field on a USACE project.

"The online program is ideal in allowing me to complete my graduate studies while fulfilling my career goals with USACE," Collins said.

Major Collins chose the program because of the UW's reputation and because he is able to continue his studies while traveling — an important aspect for someone who relocates an average of once

every 18 months. The program also provides continuing education credits for professional engineering licenses and augments his construction knowledge.

Major Collins earned a bachelor's degree ('79) in biological and agricultural engineering from Rutgers University and is a licensed civil engineer in several states. Earlier in his career he ran his own general construction firm in Florida, and with USACE has managed military and civilian construction projects in Washington, Virginia, and Texas, and in Iraq and Afghanistan. Receiving his master's degree will match his education to professional licensure. It also allows him to lead by example and encourage junior engineers to keep proficient during their careers.

"The online program is ideal in allowing me to complete graduate studies while fulfilling my career goals."

Major Collins has been able to apply information learned in the online program to his Everglades restoration construction management projects. "I highly recommend the program to anyone wishing to achieve a graduate degree in construction especially if trying to do so while working a busy job!" he said.

For more information regarding the UW's Online Graduate Program in Construction Engineering, visit <http://www.coneng.uw.edu/>. ■

Corporate Connections a Win-Win

Industry support for Civil & Environmental Engineering is critical to turning out top-flight engineers and pursuing transformative research as we compete against peer universities for the best and the brightest. A gift to CEE is an investment in the future.

Sponsorships

Sponsorships of student project teams are a great way to gain visibility on campus and face time with potential future employees. Many regional and national events such as the Concrete Canoe and Steel Bridge competitions draw crowds and media coverage.

Scholarships and Fellowships

Financial support for undergraduate and graduate students provides tuition, books, and stipends, which are crucial in recruiting top students.

Sponsored Research

CEE researchers are solving problems in transportation, construction, geotechnical and structural engineering, mechanics, water resources, and the environment. Your company can be a part of the solution by supporting research in your area of interest.



The Corporate and Foundation Relations (CFR) team in the College of Engineering is committed to connecting companies to students, faculty research, and programs. We encourage your company to explore a partnership with us.

To make a gift or learn more about finding ways to give, please contact Charles McLien III at cwmclien@u.washington.edu or 206.616.8315. ■

The Bridge

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The Bridge

5th Annual CEE Career Fair Draws a Crowd

More than 30 companies and 300 graduate and undergraduate students participated in the 5th Annual CEE Career Fair on January 20 in the Gould Hall Commons. The event connects civil and environmental engineering students and graduates with employers and industry representatives. The feedback we have received through our follow-up survey indicates we are on the right track to meet this objective. Employers who attended reported they met with between 30 and 100 or more students and that they were knowledgeable, qualified, and engaged. With such great attendance, and several last-minute employer registrations, the only "negative" response we received was the need for a larger venue.

The 2012 CEE Career Fair is tentatively scheduled for January 19. Online employer registration generally opens around October 1 – be sure to submit your registration early! ■



Chair's Message

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breathing room to grow, at least on the margins. Second, we are increasing our use of fee-based models for our professional MS-level programs. These models can generate new revenues to both cushion the effects of the coming state cuts, and in the longer term provide a mechanism for leveraging demand to drive growth.

Third, we have been participating in the development of a comprehensive plan for the evolution of the College of Engineering's space and facilities. At the heart is a focus on providing the "Big Engineering" disciplines (e.g., CEE, ME) with a new and modern home. Although having a plan and having the funding to carry out that plan are two different matters, I see this effort as a major first step in addressing our longstanding facilities issues in terms of both quality and quantity.

As each of these steps takes shape, I will have more to share with you about how we will keep CEE moving forward. We have a big job ahead of us, and the next few years will continue to be challenging, but I'm confident that we're on a good path for the long run. ■