FULL CIRCLE

ARIZONA STATE UNIVERSITY

ARIZONA STATE UNIVERSITY COLLEGE OF ENGINEERING AND APPLIED SCIENCES

SPRING 2003

ASU – ENGINEERING CLEAN, FRESH WATER FOR A THIRSTY WORLD.

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Crouch's Comments

Dean Peter Crouch

Nine months after President Michael Crow's arrival at ASU, it's an exciting time for the university. President Crow has captured the imagination of the public, community leaders, and the Arizona Board of Regents. He is forging a brave new vision for ASU: The New American University. This vision includes judging the university by the quality of students it graduates rather than the ones it accepts, embedding the university deeply within the community, and making use-inspired research a top priority.

Along with the presidents of NAU and U of A, President Crow has proposed Changing Directions to the Board of Regents. This policy initiative will effect changes in the Arizona state university system for years to come. ASU is grappling with some immediate effects of Changing Directions and with President Crow's interpretation of it. President Crow's concept paper on the subject envisages the continued growth of ASU to 70,000 students by the year 2020. This growth will bring challenges to the entire ASU community, in particular to the College of Engineering and Applied Sciences. For example, this College is committed to working with ASU East to relieve some of the pressure on the College through the inexorable growth of student numbers. We look forward to a continuing and deeper relationship with ASU East in the near future.

President Crow's principal challenge to the College has been to raise the ranking of the College to the top 25 in the nation, as measured by *U.S. News and World Report*. Currently the CEAS graduate program ranks around 50, and I'm proud to note that the undergraduate program is ranked number 37. To achieve top 25 status, this College, with the help of the administration, is looking at particular strategies prerequisite for such a move. Some of these include decreasing the student/faculty ratio and increasing available research space, as well as increasing the number of faculty, increasing external research funding of the College, and improving the quality of students admitted to CEAS.

An additional important strategy for improving the College's national and international respect as measured by our peers will be to increase our financial independence from state funding. Thus, the College will become more entrepreneurial in regards both to research and technology transfer, and to educational programming. The College is developing aggressive programs in professional and executive education through distance delivery and weekend format face-to-face instruction on its own, with business partners, and with the W.P. Carey School of Business on the ASU Main campus.

Many of the ideas expressed above continue to be planned throughout the remainder of the year. Consistent with President Crow's request, we look forward to beginning to execute many strategies next year and in years to come. I look forward to updating you on our progress in subsequent issues of Full Circle.

P Crouch

Contents

ASU joins new Six Sigma Federation

CEAS will provide Six Sigma due diligence and train industrial engineering graduate students in Six Sigma through the Six Sigma Federation.

The Six Sigma management strategy has improved quality and the bottom line for General Electric, Ford, DuPont, and many other large companies doing billions of dollars in business. The Six Sigma Federation aims to make Six Sigma available to the 36,000 mid-size and millions of small businesses in the United States.

"The College is looking forward to a strategic partnership with the Six Sigma Federation," CEAS Dean Peter Crouch said.

Over the last 20 years Six Sigma has experienced tremendous growth and change. Generation one Six Sigma, as practiced at Motorola, focused on defect reduction. Generation two Six Sigma, as practiced at General Electric, focused on cost reduction. Generation three Six Sigma focuses on value creation.

"First and second generation were like plugging leaks. Now we're not just stopping water from running out but adding to the cup," said Mikel Harry, president and chairman of the board of the Six Sigma Management Institute.

The Six Sigma Federation is a collection of companies and institutions focused on the dissemination and advancement of Six Sigma. It aims to not only to train people in the Six Sigma management strategy and to assist companies in implementing it but also to create new knowledge about Six Sigma. The Federation will advance Six Sigma in service, transactional, manufacturing and government enterprises around the world.

"The College of Engineering at ASU has the capability and capacity to facilitate the aims of the Federation and to play a major role in the future of Six Sigma on an institutional scale," Harry said. "The current leadership of [ASU President] Michael Crow and [CEAS Dean] Peter Crouch is extremely progressive in that it wants to reach out to the world and take part in the evolution of a revolution."

(Above) Dr. Mikel speaks on the future of Six Sigma at the Engineering Excellence Technology Symposium (Below) Mikel Harry, left, receives an Engineering Excellence award from Dean Peter Crouch.

After a company recognizes a need for Six Sigma, it must then do "due diligence" to determine how and who will implement it. The Six Sigma Due Diligence Leadership Program at ASU is designed to make it simple for executives to get the information they need.

Executives will walk away from the Six Sigma Due Diligence Leadership Program with implementation and deployment plans as well as a specific focus for their company. In addition, participants will learn how to set goals for Six Sigma that are consistent with their company's strategic plan and how to recognize players from pretenders in the Six Sigma arena.

The first Six Sigma Due Diligence Leadership Program will be held April 28-May 1 at the ASU Downtown Center in Phoenix. Harry and Phong Vu, former director of corporate Six Sigma at Ford Motor Company, will lead the program. This program has open enrollment; future offerings can be focused on one company if desired.

To learn more about the Six Sigma Due Diligence Leadership Program, go to http://www.eas.asu.edu/cpd/programs/executive/sixsigma.html or call 480-965-1740.

Arizona Biodesign Institute includes five CEAS researchers as center directors

Building on its high quality research programs in biomedical science and engineering, ASU has launched the Arizona Biodesign Institute, a world-class research institute intended to produce devices, materials, tools and techniques for improving human health.

"The Arizona Biodesign Institute and facility will be the cornerstone of our research infrastructure in this vital and burgeoning field," said ASU President Michael Crow.

The Arizona Biodesign Institute will be completed by Fall 2004.

Five CEAS researchers will lead four centers within AZBio:

Colleen Brophy, research professor of bioengineering and vascular surgeon at the Veterans Administration Hospital in Phoenix, will lead the Center for Protein and Peptide Pharmaceuticals. The center will create protein-based drugs for diseases such as cancer and vascular disease.

Frederic Zenhausern, associate research professor of engineering, will lead the Center for Applied NanoBioscience. The center will create a new generation of biological tools based on nano and microscale technologies that will improve human health.

Jiping He, associate professor of bioengineering, will lead the Center for Neural Interface and Brain Control. The center will work to understand the interface between neural implants and the brain, to control assistive devices by thought, and to develop new microdevices for neural implants using biomaterials and nano/MEMS technology.

James Abbas and **Ranu Jung**, associate professors of bioengineering, will lead the Center for Rehabilitation Neuroscience and Rehabilitation Engineering. The center will design, develop and evaluate technology to counteract the effects of neurological disorders.

ASU has launched the Arizona Biodesign Institute, a world-class research institute intended to produce devices, materials, tools and techniques for improving human health.

ASU plans to build a complex of five buildings to house the Institute; groundbreaking on the first occurred this spring.

To learn more about the Arizona Biodesign Institute, go to http://www.azbio.org/.

Center for Applied NanoBioscience opens its doors to campus, community

A dozen patents in silver frames line one bright white wall; on others hang research posters with colorful photos and diagrams. Microscopes, oscilloscopes and a band saw sit in the laboratories, a mixture of shiny metal and dull plastic. In the background, the ventilation system hums tunelessly as visitors speak in hushed voices.

The crowd at this open house includes students, staff and faculty from across the ASU campus as well as industry partners. The researchers use mini-presentations on laptop computers to explain their work, and visitors stare into microscopes. To many, the nano-scopic world of the researchers in the Center for Applied NanoBioscience is as foreign as Jupiter, but this open house makes the research more concrete.

They study small things here – tiny things – things less than one hundredth the diameter of a human hair. The Center's mission is to apply advances in nanoscience, molecular biology, and genomics to a new generation of biological tools based on nano and microscale technologies—to make tiny devices that will improve human health. Biochips, small devices that can detect, purify and analyze biological material, are one focus. One chip in development, for example, separates blood cells from other blood components, then removes and purifies DNA from the cells.

The Center for Applied NanoBioscience opened its doors Feb. 20 with a ribbon cutting ceremony and open house that honored Motorola's and General Dynamics' contributions to the facility renovation. The Center's researchers, including Director Frederic Zenhausern, come to ASU from Motorola Labs in Tempe.

The Center is one of eight in the Arizona Biodesign Institute (AZBio), which combines ASU's top biomedical science-related programs to form a world-class research institute.

To learn more about the Center for Applied Nanobioscience, go to http://www.azbio.org/centers/nanobioscience.html

Dr. Zenhausern shows a compact platform designed to rapidly detect low pathogen levels for applications such as biowarfare.

CREATE advises industry on high-tech facilities

A typical office building includes about 15 essential systems, such as air conditioning, plumbing, and electricity. A semiconductor wafer fabrication facility, however, incorporates more than 100 vital systems. And yet, the 1999 International Technology Roadmap for Semiconductors (ITRS), a report that charts the direction of the semiconductor industry for the next 10-15 years, includes only three lines describing facility requirements.

In 2000 Allan Chasey, director of CREATE (Construction Research and Education for Advanced Technology Environments) formed a working group to study future semiconductor facilities and to search for solutions to challenges presented in the 2001 edition of the ITRS.

Chasey is now leading an international team supporting the 2003 rewrite edition of the ITRS. "I volunteered to help manage the working group because this is what CREATE is supposed to be about," he said.

CREATE is a partnership between the Del E. Webb School of Construction and 33 companies to perform research relating to project delivery of cleanrooms and other specialized facilities, and to educate its members about the results. CREATE has focused on silicon wafer fabrication facilities, but recently they have begun to examine biotechnology and other clean manufacturing facilities.

A new workshop series, called "So You Think You Want Bio," to inform economic developers, real estate brokers, constructors and building owners about the unique requirements of biotechnology buildings. The first workshop, "'Bio Tech' Facilities and Infrastructure Support," was held this winter. Future seminars will discuss planning and zoning issues, interfacing with utility companies, and R&D facilities.

To learn more about CREATE and "So You Think You Want Bio," go to http://create.asu.edu.

Allan Chasey director of CREATE hosts a workshop on BioTech Facilities and Infrastructure Support.

CREATE is a partnership between the Del E. Webb School of Construction and 33 companies to perform research relating to project delivery of cleanrooms and other specialized facilities.

CEAS researchers help determine ozone violation boundaries for state of Arizona

For several years the Arizona Department of Environmental Quality (ADEQ) has worked with the CEAS Environmental Fluid Dynamics Program (EFDP) to model air pollution in the Valley. So, when the Environmental Protection Agency created a new ozone standard, ADEQ knew just who to call.

The new standard requires that the average ozone concentration over eight hours be less than 85 parts per billion. A network of 25 air pollution monitoring stations around the Phoenix area provides data on ozone concentrations, but "as extensive as the monitoring network is, it can't possibly answer the question in every instance of how far the elevated 8 hour ozone concentrations extend," said Peter Hyde, evaluation unit manager in the ADEQ air quality division.

The new standard requires that the average ozone concentration over eight hours be less than 85 parts per billion.

A numerical model based on data from the monitoring stations can predict what is happening in areas outside the network. Using monitoring station data, weather information, emissions inventories, and atmospheric chemistry, EFDP's Sang-Mi Lee, research assistant professor of civil and environmental engineering, and Susanne Grossman-Clarke, postdoctoral research associate, developed a model of changing ozone concentrations across central Arizona. The model predicts high ozone concentrations in urban areas, as expected, but also in rural northwestern Maricopa County.

Joe Fernando director of the EFDP.

"This really points to the importance of the modeling," said Joe Fernando, director of the EFDP. "Now we know that there might be a possibility of elevated ozone in the west, so ADEQ can put their monitors there, if they decide to, and see whether the model is right."

The researchers will use the next couple months to refine their model. In July the state will report the area not in compliance with the new standard to the EPA.

To learn more about the Environmental Fluid Dynamics Program, go to http://www.eas.asu.edu/~pefdhome/.

ASU and U of A team up to prepare future workforce

ASU and the University of Arizona have a longstanding rivalry and find few reasons to play on the same team. But in April CEAS Dean Peter Crouch and Tom Peterson, Dean of the College of Engineering and Mines at University of Arizona, hosted a joint Industry Advisory Council in Tucson.

ASU and U of A have worked with Northern Arizona University to provide the tri-university Masters of Engineering program. In a time where the economy has weakened, both colleges have relied on many of the same industry partners to enhance and sustain research and education. By meeting jointly, the universities hope to find more opportunities to partner with each other.

The members of the advisory councils of both ASU and U of A also served as judges and supporters in the Mathematics, Engineering, Science Achievement (MESA) Program's statewide science and engineering competition for youth. MESA is a national college preparation program that stimulates interest in math, science and engineering, and prepares students to pursue and obtain a higher education.

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The MESA program targets low income, first generation, and minority middle and high school students to help them succeed in college, through academic advising, after school enrichment programs, and tours of university and industry sites. Recently AZ MESA received a Golden Star Award for Best Practices from the AZ Commission for Postsecondary Education and the 2002 Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring sponsored by the National Science Foundation.

To learn more about MESA, go to http://www.eas.asu.edu/cor/.

Anderson-Rowland receives two educator awards

Last fall Mary Anderson-Rowland, Associate Dean of Student Affairs, received the 2002 Society of Women Engineers Distinguished Educator Award for her inspiration of students and contributions to the engineering profession. In February she received the Outstanding Engineering Educator of the Year award as part of the state's National Engineers Week celebration.

"Dr. Mary Anderson-Rowland has been a long time and vigorous supporter of minority and women's programs," Dean Peter Crouch said. "The College would not have these strong programs today if Mary had not provided the leadership in early years when there was little or no support."

Anderson-Rowland joined the ASU faculty in 1966 and in 1974 became the first female engineering professor. In 1993 Anderson-Rowland became the first woman to be appointed an associate dean of CEAS.

Since the beginning of her career, Anderson-Rowland has focused on students. She helped start the ASU student section of SWE in 1975 and still serves as their faculty advisor. In 1981 Anderson-Rowland began the Graduate Career Change Program, through which she has mentored more than 80 career change adults, mostly women, as they earned master's degrees in industrial engineering.

In 1993 she instituted the Women in Science and Engineering (WISE) Center, an organization that runs programs for female students on the ASU campus and in local middle and high schools.

She has also supported programs that encourage minorities in engineering, including MESA and the Minority Engineering Program.

"Because I strongly believe that the engineering profession has so much to offer, I want to help as many potential engineering students as possible, including underrepresented women and ethnic minorities, to consider and embrace engineering as a career," Anderson-Rowland said.

Dr. Mary Anderson-Rowland, Associate Dean of Student Affairs.

To learn more about the Office of Student Affairs, go to http://www.eas.asu.edu/~sasp/.

Program helps high school girls WISE-Up to engineering and construction fields

Adzoa Kwawu first envisioned herself as an ASU Engineering student when she was 16 years old. Her mother signed her up for the WISE-Up (to the choices for women in engineering and construction) Program, a unique camp for rising 11th and 12th grade girls.

"The WISE-Up Program was so beneficial to me. It helped me make the decision to go ahead and be an engineer," Kwawu said. Today she is president of the ASU student chapter of the National Society of Black Engineers (NSBE) and anticipates graduating with a degree in civil engineering in May 2004.

The WISE-Up Program introduces young women to engineering and related fields through hands-on exploration and industry tours. Since 1994, roughly 450 high school girls from around Arizona as well as other states have participated in WISE-Up.

Kwawu had no idea what to expect from the camp. "I thought I would meet a whole bunch of girls and that there would be fun activities. I was hoping there would not be a lot of lecturing," she said. "It actually turned out a lot like I hoped."

"Our labs taught us competition and teamwork," she said.

The girls toured the wind tunnel and got to check out the moon buggy. One area that really impressed Kwawu was the environmental lab. "I thought that was really exciting and maybe I would do something like that," she said. "It was neat talking about water quality, especially in a place like Arizona where everyone drinks bottled water."

In order to build confidence in their abilities, the program also provides reassurance to the girls about math and science. Kwawu recalls a professor who came to talk to her group: "She reassured us not to worry and that we would get the mathematical concepts. She even offered if we had any questions to come see her. When I came to college, I kept that in mind and actually took her calculus class."

Last summer Kwawu returned to WISE-Up to work as a night counselor. "I took the girls to work on their robotics project, which was so much cooler than when I went through. WISE-Up has really evolved since I attended," she said.

"I hope the college continues to offer programs like WISE-Up for girls who know they might want to be engineers or those who really aren't sure," Kwawu said.

This summer the WISE-Up program will be offered July 7 – 11, and the application deadline is May 9. Tuition for this residential camp is $500; some scholarships are available. Intel has sponsored WISE-Up since 1996.

To learn more about all the College of Engineering and Applied Sciences Summer Institute camps, including WISE-Up, go to http://www.eas.asu.edu/cor/summer.

Adzoa Kwawu is a junior Civil Engineering major; President of ASU's NSBE chapter; and mentor for young girls who are interested in engineering.

"The WISE-Up Program was so beneficial to me. It helped me make the decision to go ahead and be an engineer"

ASU hosts student civil engineering conference

On a typical sunny day, boats of all shapes and sizes dot Tempe Town Lake as children learn to row and sailors catch pleasant breezes.

On April 5 those boats included canoes made of concrete, which can mean only one thing: civil engineers on the water.

On April 3-5 ASU hosted the American Society of Civil Engineers (ASCE) Pacific Southwest Regional Conference attended by more than 550 civil engineering students from 17 schools in Arizona, Nevada, Hawaii and Southern California. "We're excited to have the conference now, especially with Tempe Town Lake available to host the canoe races," said Shane Sweeten, a senior civil engineering major and co-chair of the conference planning committee.

The conference is an opportunity for students to showcase their knowledge and skills in friendly competition. In the best-known event, the concrete canoe competition, each school designs and builds its own canoe made of concrete to certain specifications, then brings it to the conference to race against other schools. Teams receive points for their technical paper and presentation of the canoe in addition to how well it races.

Students also competed in the steel bridge building event, in which they design and build a scaled-down model of a bridge to fit a scenario. Each team brings its bridge to the conference in pieces. After racing to put the bridges together, the bridges are tested for deflection and efficiency as well as judged on aesthetics and economy of design.

The steel bridge building competition was held at Tempe Beach Park, as were several other events. Display boards explained the engineering principles behind the events for the general public, especially children. Additional events, including the quiz bowl, water resources design and environmental design, were held on the ASU campus. Winning teams in the concrete canoe and steel bridge events will compete at the national conference in San Diego in June. Local engineers and ASU alumni served as event judges.

"It's exciting to see so many people involved," said Cortni Sable, a senior civil engineering major and co-chair of the conference planning committee. "We've had an incredible amount of support from the local engineering industry."

Sable and Sweeten have been working on the conference for more than a year, doing everything from fundraising to answering emails from participants. Although the planning committee includes professional engineers from the local ASCE Younger Members Forum and professors from the Department of Civil and Environmental Engineering, the students have done the majority of the work.

ASU Civil Engineering students Amir Mehrnia and Jared Wegner practice their rowing skills on Tempe Town Lake. The canoe is made of concrete.

Sable and Sweeten's greatest challenge has been balancing their roles as conference organizers and as students, but in the end it's all worth it. "We're showcasing the university to potential graduate students. It's a great marketing tool," Sable said. "Students who have helped plan this event have learned a great deal about project management and volunteer organization. These skills will carry with them well into their professional years."

To learn more about the ASU chapter of ASCE, go to http://www.eas.asu.edu/asce

Creative female engineers win diversity scholarships from Texas Instruments

Marnie Figiel, Jennifer Desai and Nazanin Darbanian received $15,000 each for their creativity through electrical engineering.

In their presentations the three described complex diagrams, explained their results, and answered questions from the audience. During breaks in the meeting they milled around, making contacts and elaborating on their talks. Nothing is strange about this picture, except that these were three female graduate students presenting their work to an entirely male group of executives.

Last fall these women, Marnie Figiel, Jennifer Desai and Nazanin Darbanian, each received a $15,000 Texas Instruments Diversity Scholarship. The amount of money doesn't matter so much as that it enables them to keep doing what they love—expressing their creativity through electrical engineering.

All three work with Sayfe Kiaei, professor of electrical engineering, on projects for Connection One, a National Science Foundation Industry/University Cooperative Research Center. Connection One aims to design communication circuits and systems that enable smaller, more integrated communication devices.

The students design circuits for different pieces of the project, and then use computer simulations to determine how well they work. Successful designs may then be submitted for fabrication through industry design competitions or as a test circuit through industry partners.

The students design circuits for different pieces of the project, and then use computer simulations to determine how well they work.

"RF circuit design is a demanding area which lets engineers use their creativity and knowledge to come up with innovative solutions for what people really need," Darbanian, a master's student, said. She is designing low noise amplifiers for multi-standard wireless transceivers, which allow a single chip to be used in many applications, such as cell phones, GPS and wireless LANs.

Desai, a Ph.D. student, and Figiel, a master's student, both work on the power management team. Wireless electronics need to consume as little power as possible—so that they spend less time on a charger—and increasingly they must fit into ever smaller spaces. The women are working to put a power management system on chip, right beside the circuits it powers.

Desai has designed several power management system components, including a power amplifier and a charge pump. "There's no right answer, no one way to do anything," Desai said. "You learn as much as you can, make the design, then learn something new."

Figiel remembers receiving diagrams of circuits to copy when an undergraduate at ASU. Now she's creating rather than reproducing, and enjoying it. "I like where I'm headed," Figiel said. "It's an interesting opportunity to design and possibly get something fabricated.

All three women enjoy their work because they are designing something new. "A design is like artwork to an engineer," Desai said. "People say engineers have no creativity, but to come up with new ideas they must." Engineers' creativity may be more practical than that of a sculptor, but without it many technological innovations would never have occurred.

All three women plan to work in industry, although eventually Figiel and Darbanian may become professors as well. No matter what, they will keep looking for the new idea, the different perspective, and the extra insight that will solve the problem at hand.

To learn more about Connection One, go to http://www.connectionone.org.

CLEAN WATER

More than one billion people around the world do not have access to clean drinking water. Many of them live in third world countries where the contaminants are natural—arsenic, lead, other heavy metals. In more developed areas, contaminants from industrial plants, government sites and gas stations have seeped into the water supply. Current water treatment plants do not remove all these contaminants, and no one knows how large a problem some could be. Add to that drought conditions in the American West and elsewhere, and overcoming the problem of polluted water can seem insurmountable. But it's not.

When Jim Beckman returned to ASU in 1997 after working at ASU Research Park for several years, he wanted to research something different. Something globally interesting. Something no one else was working on.

Dr. Jim Beckman

"We have a unit that costs less than RO to buy and almost nothing to operate," Beckman says. "It's a nice device for a home. It's great for third world countries. There's virtually nothing to break down."

He settled on desalination, the process of removing salt from water.

Since the 1950s, reverse osmosis has been the method of choice for desalination. Researchers worked on improvements to RO rather than new techniques. Beckman, an associate professor of chemical engineering, decided to start from scratch.

"Keep it simple" became the motto for his laboratory. In nature, evaporation is simple. When liquid water becomes water vapor, anything dissolved in the water is left behind—thus the nasty film on your body after perspiration evaporates. A machine that could evaporate seawater and recondense it somewhere else would remove salt other dissolved particles in the water.

Chloride ions in seawater are corrosive to metal, and glass is brittle, so Beckman chose plastic as his material. He chose steam as a heat source since it is readily available, but waste heat and solar energy would work as well.

Several years of trial and error later, Beckman's laboratory has created the NEWT Double Helix Tower, which takes in seawater (40,000 parts per million salt) and spits out water with a salt concentration of only five parts per million, too small to taste. A paper cutter is the most advanced tool used in the construction of the Tower, familiarly called Dewy. The plastic in the device is the same type used to make the political signs that sprout in vacant lots around election time. Other components include cotton and nylon gauze, packing tape, insulating foam and silicone.

"We have a unit that costs less than RO to buy and almost nothing to operate," Beckman says. "It's a nice device for a home. It's great for third world countries. There's virtually nothing to break down."

Beckman has coined the word "dewvaporation," a combination of "evaporation" and "dew formation," to describe how Dewy works. Each of Dewy's modules contains a heat transfer wall that divides the module into two compartments, one for evaporation and one for dew formation. An external pump sends dirty, salty water into the evaporation compartment. Heat coming through the wall causes the water to evaporate into an upward stream of air provided by an external blower, much like the sun dries laundry on a clothesline.

At the top of the module, the humid air mixes with a stream of steam and flows into the dew formation compartment. The air cools as heat goes through the wall to the evaporation compartment, and pure liquid water—dew—forms. The clean water flows out of the bottom of the device, and the air cycles through the module again. Concentrated salt water or even salt crystals exit the other side of the device.

But Dewy doesn't only remove salt from water. It takes out everything—arsenic, mercury, ethanol, green food coloring. "We haven't found water we can't treat," says Victor Banks, a masters student in Beckman's lab.

The demonstration models in Beckman's lab each contain 20-30 modules and can

process more than 100 gallons of water per day. Beckman hopes people will eventually be able to buy this size at a hardware store for home water purification.

Because of its modular construction, larger Dewys can be built by hooking up several smaller ones. Over spring break Beckman's lab installed five Dewys at the Salt River Project Coronado Generating Station near St. Johns, Arizona. The power plant dumps used cooling water into evaporating ponds on the site; the Dewys process this water. Beckman is also working with the Bureau of Reclamation and the City of Phoenix to install a Dewy that can process 10,000 gallons of water per day at a Phoenix water treatment plant.

Beckman has started a spinout company, L'Eau, to commercialize Dewy. This fall the device will go on a world tour, visiting Mexico, Ghana, Israel, Singapore, Australia, the International Desalination Association Convention in the Bahamas, and several locations in the United States.

"This device has fulfilled everything I dreamed of in 1997," Beckman says. "I'm sorry that it has come later rather than sooner, but we have learned a lot on the road least traveled by."

c e a s

Paul Johnson didn't believe in his own project at first. Many groups had attempted to create systems that removed chemicals from water through the activity of bacteria. None worked well. Yet Johnson, an associate professor of civil and environmental engineering, and his collaborators had designed such a system for the fuel additive methyl tert-butyl ether (MTBE).

Adding MTBE to gasoline creates a cleaner burning fuel, which reduces air pollution. But the suspected cancer-causing agent pollutes water, giving it a foul taste and odor. Conventional cleanup is expensive because it requires pumping water out of the ground, removing the MTBE, and pumping water back into the earth. Johnson's MTBE-removal system, designed in collaboration with Shell Global Solutions and the Naval Facilities Engineering Service Center, is an underground bio-barrier that removes MTBE from groundwater using bacteria in the soil.

Dr. Paul Johnson

"We don't have a reactor vessel or something that we design and have control of. We have whatever Mother Nature gave us,"

Photographic services provided by Kenneth Sweat (Engineering Technical Services)

Many species of bacteria will use oxygen to break down organic compounds like MTBE if extra oxygen is available. Thus, Johnson's system uses injection wells to deliver air or pure oxygen to the subsurface. In areas that contain insufficient bacteria for the amount of MTBE, additional microbes can be injected with the gas.

"We don't have a reactor vessel or something that we design and have control of. We have whatever Mother Nature gave us," Johnson says. "A lot of times we have to make a lot of educated guesses."

A leak in an underground tank at a service station on the Ventura County Naval Base in Port Hueneme, Calif., had released gasoline, and thus MTBE, into the groundwater there. The contaminated area, more than a mile long, is one of the largest in the country. As such, many researchers have performed experiments related to MTBE cleanup there. After extensive laboratory testing, and several pilot-scale studies over three years on the base, Johnson and colleagues were ready for a large scale study.

The groundwater at Port Hueneme naturally flows about one foot per day toward the Pacific Ocean. By setting up the bio-barrier in the flow path of the MTBE-contaminated water, no energy would be needed to bring the water to the treatment system. The best place to do this, however, was on the parade grounds at the naval base. Parade grounds are the heart of every military installation. Troops practice drills there, and the grounds are the site of a variety of events and ceremonies. Fencing off a 600ft by 50ft rectangle required special permission, and a ceremony was held to mark the completion of construction.

But being on the naval base was easier than working at a gas station, Johnson says. "We could spend all day out on the parade grounds. As long as we could work with people marching and doing their exercises and everything else, we pretty much had free rein. Whereas, if we had been at a service station site, we would have had to worry about people driving in and out and trucks coming with gasoline and the station owner getting mad about us messing with business and not being able to poke holes over here because there's a big pipeline that runs through there."

The large scale bio-barrier demonstration included 252 gas injection wells and 174 monitoring wells spread over 500 feet. In the center of the system, where MTBE concentrations are the highest, the researchers added microorganisms to break down the contaminant and oxygen to use in the reaction. Further out, researchers only injected oxygen to stimulate existing bacteria, and the researchers injected air at the system's edges where the MTBE concentration was smallest. This approach is more cost-effective than simply adding microbes along the system's length.

It's also effective. At Port Hueneme, water flowing into the bio-barrier contains MTBE in concentrations of up to 10 milligrams per liter. On the other side, the contaminant is undetectable. The Navy plans to install two more systems at Port Hueneme, and Shell Global Solutions has applied the technique at more than a dozen sites. The bio-barrier was the National Ground Water Association's Remediation Project of the Year in 2001 and the Department of Defense Environmental Security Technology Certification Program's Project of the Year in 2002.

"A few years ago most people would have said that you can't treat MTBE in situ by biodegradation," Johnson says. "What we've been able to do is put in a system that does both those things plus has fairly low operating costs."

c e a s

Alumna works to improve diversity in engineering

Maria Reyes, CEAS Alumn & president of College Alumni chapter receives a competitive fellowship.

With a B.S.E in Civil Engineering in 1991 and M.S.E. in Civil Engineering in 1999, Maria Reyes is promoting diversity in the engineering profession with an emphasis on the educational experience.

In order to fulfill this mission, she focuses on her own leadership qualities. This year she received one of only 20 fellowships to the National Hispania Leadership Institute (NHLI). The NHLI program is an intensive learning experience that provides training in public policy, leadership, and strategic management as well as race, class and gender issues. The program emphasizes a holistic approach to leadership.

While at ASU, Reyes found she was unlike most of the engineering students. "The percentage of minority students in engineering when I got there was significantly lower than it is now," she said. "The hardest thing was not knowing where you fit in. You called yourself an engineering student, yet there weren't that many that looked like you."

But Reyes found a support network in the student chapter of the Society of Hispanic Professional Engineers. "It was a place of camaraderie to meet other students that were struggling with the same cultural and social issues that you were struggling with. We came together and worked together as a network of peers."

"Students can get lost, and very talented students who have potential can get lost," she said. As the Director of the NASA Center for Success in Math and Science at Estrella Mountain Community College, Reyes helps them find their way. "I had a passion for working with students even when I was a student."

"I do a lot of this work for my children," she said. "They are going to find a whole different experience than I had."

To learn more about the diversity programs in CEAS, go to http://www.eas.asu.edu/~cedar/.

"The hardest thing was not knowing where you fit in. You called yourself an engineering student, yet there weren't that many that looked like you."

Alumnus assists start-up companies in Northern Arizona with incubator

Many CEAS alumni have started their own companies, but Richard Baron (B.S. Industrial Engineering 1983, M.B.A. 1990) has gone even further. He is the president of the Northern Arizona Technology and Business Incubator (NATBI), a 501 c (3) non-profit organization that helps start-up companies become successful.

Baron is the founding president of NATBI, which he started in Flagstaff, Ariz., in June 2001 after working as a consultant for the Arizona Technology Incubator in Scottsdale. The incubator has already graduated one company, Aspen Communications, and three are currently in the program. The companies' products include a new polymer for contact lenses, a footwear traction product, and a painting accessory.

"I love the variety of jobs," Baron said. "I'm running a start-up organization, and I work with technical entrepreneurs to create new products."

After graduating from ASU, Baron worked in technical sales. He sold equipment to other industrial engineers, including fellow ASU alumni. He worked in business development, marketing, and international technical sales before founding NATBI. In addition to his degrees from ASU, he received a Master of International Management degree from The American Graduate School of International Management in 1989.

One of NATBI's long-term goals is to start five spinoff companies from the three public universities in Arizona. "Universities are preachers of knowledge. Spin-offs are another form of knowledge, a practical application," Baron said. NATBI also plans to support Native American entrepreneurs by helping establish business incubators on reservations.

In October 2002 NATBI received an Excellence in Rural Development Award from former Governor Jane Hull. The incubator was also highlighted in the *AZBusiness* Magazine "Who to Watch in 2003" program.

"We're trying to keep the brainpower in the local area," Baron said. "If you help the economy of a community, it helps everybody."

To learn more about NATBI, go to http://www.natbi.org or call Baron at 928-213-9234.

Richard Baron '83 & '90 alumn and entrepreneur

"We're trying to keep the brainpower in the local area," Baron said. "If you help the economy of a community, it helps everybody."

ASU alumni see the forest for the trees

Steve Lasswell, Bill Pearson and Marvin Kleine can see through rain, sleet, hail, snow, dust, clouds, smoke, night, and yes, even foliage. Thanks to their part in the creation and facilitation of synthetic-aperture radar at Intelligence, Surveillance, and Reconnaissance (ISR) Systems, a division of Lockheed Martin Management and Data Systems (M&DS) in Goodyear, Arizona, this vision plays a key role in national intelligence, civil space and advanced technology communities. Their vision extends into the future, too, through a partnership with CEAS to foster student development and recruit for Lockheed Martin.

Lasswell, of M&DS Engineering and Technology, serves on the CEAS Dean's Advisory Council. His longstanding relationship with CEAS began as an undergraduate in Electrical Engineering (B.S. 1971). Upon graduation, he returned to ASU part-time to answer questions arising in his early career and earned a M.S. in Electrical Engineering in 1976. His motivation to remain involved with ASU is a love of the industry and its future.

Convinced of an impending shortage in U.S. engineering talent, Lasswell said, "We're motivated to help get kids interested in engineering and then to help them stay in engineering."

One program that excites students and Lockheed Martin alike is the ASUSat Lab, where students from high school through Ph.D. programs work together to create small satellites. A five-year $150,000 gift from Lockheed Martin helped create ASUSat1, a 13-pound nanosatellite, which was launched in January 2000. Funding has also supported each ASUSat Lab project since. In addition, Lockheed Martin employees serve as mentors and coaches for the students.

The ASUSat Lab atmosphere fosters teaming, something vital to Lockheed Martin. "We like to see that they [recent graduates] had to work with other students to deliver a product of some kind," said Pearson (B.S. Industrial Engineering 1970, M.B.A. 1976), Technical Operations Site Manager and corporate recruiter.

Aside from the ASUSat Lab, ASU offers a variety of teaming projects. Kleine discovered them firsthand when he returned to ASU to earn his Ph.D. in Physics and Astronomy in 1994. He observed that his professors "really showed the value of bringing all different skills and all different levels of education together to solve projects." This philosophy influences his management style as a Chief Engineer working on 'special programs.' "The kind of fun stuff we can't talk about," he said.

Professor Helen Reed holds final payment of $150,000 pledge from Lockheed Martin.
(l – r) Paul Johnson, Associate Dean of Research, Bill Pearson, Lockheed Martin, Janita Gordon, Director of Development, Steve Laswell, Lockheed Martin, Marvin Kleine, Lockheed Martin and Robert Peck, chair of MAE department.

Convinced of an impending shortage in U.S. engineering talent, Lasswell said, "We're motivated to help get kids interested in engineering and then to help them stay in engineering."

For Kleine the greatest reward is personal interaction. "From the design classes, you actually get to go in every month. You have meetings. You're talking to the kids, finding out about them," Kleine said. "They get to see you interacting, your motivation for putting in your time to help them. You get a lot out of it both ways."

Lasswell said that ISR Systems in Goodyear has the highest percentage of graduate degrees of any Lockheed Martin location. A pipeline of talent is essential, and ASU provides much of that. Kleine said, "We're getting the best of the best and they are really making contributions right away to what we do." Pearson added, "We are pleased with the product we are seeing."

To learn more about the ASUSat Lab, go to http://nasa.asu.edu/ASUSat/index.html.

Two female faculty receive CAREER boost

One is developing a biomaterial that could be used as a drug delivery device. The other is creating a virtual environment in which companies can collaborate. Their research is vastly different, but Alyssa Panitch, assistant professor of bioengineering, and Teresa Wu, assistant professor of industrial engineering, have both received CAREER Awards from the National Science Foundation.

The CAREER Program recognizes and supports the early career development activities of faculty members who are most likely to become the academic leaders of the 21st century.

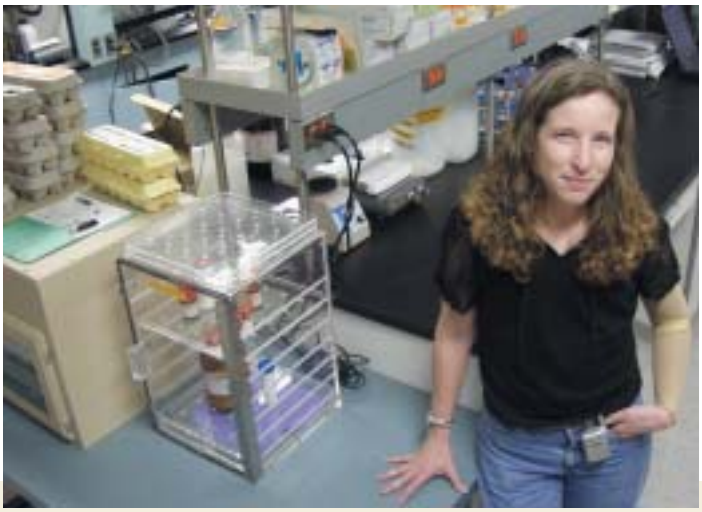
"The fact that we have gotten CAREER awards in two totally different arenas illustrates the diversity of research in the College," Dean Peter Crouch said. "CAREER awards bring much prestige to the College and help jump start the careers of faculty who get them."

In her CAREER proposal, Panitch proposes to create hydrogels—soft, pliable materials that can be injected as a liquid into the body, where they will solidify. They can also be spread over a wound like ointment. Panitch has designed a hydrogel that will gradually release drug molecules.

"If we can release the proposed drugs in a controlled manner, there are several different diseases that we could think about trying to cure," Panitch said.

Panitch's first target for this system is cardiac bypass surgery improvement. In the procedure leg veins are used to bypass clogged blood vessels around the heart. But the veins often contract when removed from the leg, which can lead to failure of the transplant. A hydrogel that releases a molecule that keeps the vein relaxed could improve the chances of a successful surgery.

Teresa Wu, recipient of CAREER Award from NSF, works on a web-based, secure, shared information space



Alyssa Panitch, recipient of CAREER Award from NSF, works on creating hydrogels for medical applications.

The educational component of Panitch's CAREER proposal reaches out to Scottsdale Community College. She is developing a seminar/lecture course at SCC with two instructors there; selected students will be able to work in ASU bioengineering labs.

Wu, on the other hand, researches collaborative product development. When several companies work together on a project, problems arise as group members with different goals communicate through technology.

Wu first plans to create a web-based, secure, shared information space that allows all parties involved in a product's development to communicate with one another. Second, she will develop decision support software that will compare companies competing for a collaboration opportunity and reject unqualified candidates. Third, Wu will use the modeling tool Petri Net to summarize the goals and plans of all collaborators and synthesize them to find potential conflicts. Finally, Wu will develop a negotiation mechanism to resolve these conflicts.

"I hope this will have some impact to industry collaborations, because that's the trend. Now a lot of companies are making operations distributed, so the design is being distributed, the manufacturing is being distributed," Wu said.

In her educational plan, Wu proposes to create simplified versions of these different software tools for use with students. She also hopes to reach middle and high school students through CEAS K-12 outreach programs.

Go to http://ceaspub.eas.asu.edu/biomatlab to learn more about Panitch's work,

Go to http://ceaspub.eas.asu.edu/twu/ to learn more about Wu's work.

Professor honored by IEEE Computer Society for distributed computing work

Personal digital assistants ride around Stephen Yau's laboratory strapped to remote-controlled toy monster trucks.

They look like normal PDAs, but these personal digital assistants incorporate reconfigurable context-sensitive middleware. This software, in development in Yau's lab, allows the PDAs to do the right thing at the right time and at the right location while the PDAs' environments are dynamically changing.

Designing this middleware is only the latest project in a long and productive career. In April the Institute of Electrical and Electronics Engineers (IEEE) Computer Society honored Yau, professor of computer science and engineering, with the Tsutomu Kanai Award. The award, named for the former president of Hitachi, recognizes an individual who has made a lasting contribution to the field of distributed computing. Yau has worked in the area for more than 30 years.

"As distributed systems software became more important, I gradually switched my research into that area," Yau said. "When you're working with an emerging technology, you can do a lot more."

Distributed computing systems are comprised of multiple computing units interconnected by networks or data switches. Yau has worked to solve both practical and theoretical problems related to software design and development techniques. He used and advocated object-oriented design techniques before they were widely accepted and his work led to practical, easy-to-use distributed software development methods that integrate software components from various sources.

Over the years Yau has mentored 90 Ph.D. students and 115 M.S. students; has served as president of two professional organizations and editor-in-chief of Computer, the IEEE Computer Society's flagship publication; has published more than 170 papers; and has established three annual or biennial international conferences in the field of software and applications.

Yau has accomplished much of this while serving as an administrator as well as a researcher and educator. In 1972 he became chair of the Computer Sciences Department at Northwestern University, which merged with the Electrical Engineering Department during his tenure. He headed the Computer and Information Sciences Department at the University of Florida from 1988-1994 before coming to ASU to chair the Department of Computer Science and Engineering, a position he resigned in 2001.

Former chair of CSE, professor Yau continues to engage in cutting edge research.

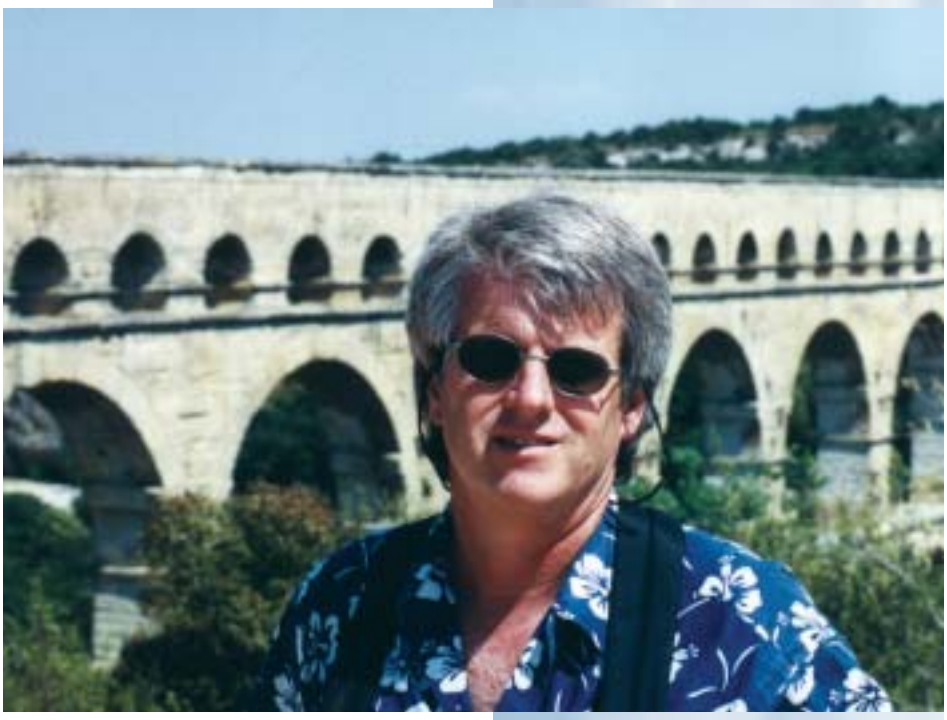
"Now I have more time for research and other scholarly activities," Yau said. "Usually once people are in administration, their research slows down or they give it up. Instead, I put in overtime so that I could still push forward on research, mentor students, and play various leading roles in professional activities. Some might call me a workaholic."

Yau was presented with the Tsutomu Kanai Award, which includes a $10,000 honorarium, at the International Symposium on Autonomous Decentralized Systems in Italy April 9-11. Previous award recipients include Bell Labs' Kenneth Thompson, inventor of UNIX; C. V. Ramamoorthy, professor emeritus at the University of California, Berkeley; and Alfred Z. Spector, vice president of IBM Research.

To learn more about Yau's work, go to http://www.eas.asu.edu/~rcsm/.

Distributed computing systems are comprised of multiple computing units interconnected by networks or data switches.

Chasing Aqueducts: Professor examines water distribution history in ancient Europe



Larry Mays, joins engineering historians to study water.

Larry Mays has written or edited 11 books on water resources engineering, both textbooks for students and handbooks for practicing engineers, and is working on two more. They are thick tomes, full of information, diagrams, and numbers. But he wants to write a book without any equations in it.

Ten years ago Mays, a professor of civil engineering, took a side trip while attending a conference on the island of Crete. In the ruins at Knossos, he saw a 4000-year-old water distribution pipe beneath a grate in the street. Since then Mays has visited ruins of water systems across Europe and Turkey. These trips, and his library research, became a chapter on the history of water systems in his latest book, which recently won an honorable mention award from the Association of American Publishers.

"I'm not sure that a lot of structures we build nowadays will be around 2000 years from now," Mays said. "These people were able to do this without modern mathematics, computers, etc. Engineers today rely so heavily on those things."

Traditionally classicists and historians have studied ancient water systems, focusing on who built them and why. As a hydraulic engineer, Mays is fascinated with how the aqueducts, canals, storage tanks and pipes were built and operated.

"I'm not sure that a lot of structures we build nowadays will be around 2000 years from now," Mays said. "These people were able to do this without modern mathematics, computers, etc. Engineers today rely so heavily on those things."

This summer Mays will travel to Greece, but he also wants to examine ruins in Egypt, Mexico, and the Middle East. When he has gathered enough information, he'll write a book on ancient water systems with no equations in sight.

"There's a lot out there to learn, there's a lot to write about that hasn't been, and, from my end of it, there are still a lot of places to go visit and study," Mays said. "It's very closely connected to my field, but it's a much softer side to it."

To learn more about Mays' books and travels, go to http://www.public.asu.edu/~lwmays/.

Accolades

Gary Aller, director of the Alliance for Construction Excellence, received the "Man of the Year" award from the Construction Management Association of America's Arizona Chapter in December. Aller received the award for his work on the Alternative Project Delivery Methods legislation, which allows public agencies to use the contracting methods Design-Build, Construction Manager at Risk, and Job Order.

Nicholas Findler, professor emeritus of computer science and engineering, received a finalist commendation in the Takeda Foundation's 2002 Takeda Techno-Entrepreneurship Award Competition. Findler is developing a method to convert complex systems into multi-agent systems.

The National Ground Water Association has named **Paul Johnson**, interim associate dean of research and associate professor of civil and environmental engineering, as the new editor of the journal *Ground Water Monitoring and Remediation*. Johnson will serve a three-year term as editor.

Helen Reed, professor of aerospace engineering and director of the ASUSat Lab, received the 2003 Faculty Service Award from the ASU Alumni Association in March. The award recognizes extraordinary contributions to Arizona State University that have significantly enhanced the well-being and reputation of ASU within the community at large.

William Saric, professor of aerospace engineering, has received the American Institute of Aeronautics and Aerodynamics Fluid Dynamics Award. Saric, in collaboration with Reed, has developed a way to reduce turbulent airflow over an airplane wing, leading to reduced fuel consumption.

Ann Conley, Cristina de la Vara, and **Shareen T. Islam**, undergraduates in the department of computer science and engineering, received funding from the Computing Research Association through the Collaborative Research Experience for Women in Undergraduate Computer Science and Engineering program for their work with Professor Joseph Urban. The student researchers are developing a web-based program to track the progress of students in the department's two-semester software engineering project capstone sequence.

Edwin J. Vandenberg, research scientist the Harrington Department of Bioengineering, received the 2003 Priestley Medal from the American Chemical

Society in March. Eighty-four year-old Vandenberg was honored for discoveries he made at Hercules, Inc.; he now collaborates with Vincent Pizziconi, professor of bioengineering, on biomedical polymers.

Matthew Witczak, professor of civil engineering and head of the Advanced Asphalt Group, was named to the Asphalt Institute Roll of Honor in December. The award recognizes individuals who have made substantial, time-proven contributions to the asphalt industry. The Advanced Asphalt Group received the 2002 Research Award from the Rubber Pavements Association in February.

FULL CIRCLE

Spring 2003

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Arizona State University vigorously pursues affirmative action and equal opportunity in its employment, activities and programs.

CALENDAR OF EVENTS

April 11, 8 a.m.
2nd Annual Entrepreneur Competition Awards Ceremony
To learn more: http://www.eas.asu.edu/innovation/final-pres.htm

April 22, 6 p.m.
Coalition of Minority Engineering Societies and the Society of Women Engineers (CEMSWE) Awards Banquet at the Hilton Airport Hotel
To learn more: http://www.eas.asu.edu/~cemswe or call 480-965-6882.

April 25, 12:30 p.m.
Engineering Alumni Chapter Scholarship Endowment Golf Tournament at Trilogy Golf Club
To learn more: http://www.eas.asu.edu/golf

April 26, 10 a.m.-2 p.m.
Art Ventures in Engineering at the Heard Museum
Junior high and high school students will learn about geometry in Native American rug weaving
To learn more: http://www.eas.asu.edu/~wise or call 480-965-5837

May 16, 5:30 p.m.
College of Engineering and Applied Sciences Convocation at Wells Fargo Arena
To learn more: call Susan Borgers at 480-965-1724 or email her at sborgers@asu.edu

June 17-20
2003 Mechanics and Materials Conference
Applied Mechanics and Materials Divisions of the American Society of Mechanical Engineers
To learn more: http://www.eas.asu.edu/~cpd/conference.html

CEAS Programs for incoming ASU freshmen

July 21-August 1
Minority Engineering Program (MEP) Summer Bridge Program
To learn more: call Luis Santos-Rivas at 480-965-4328

August 17-21
Women In Science and Engineering (WISE) Summer Bridge Program for incoming female freshmen
To learn more: call Shawna Fletcher at 480-965-5837

CEAS Summer Camps for junior high and high school students

To learn more about any of these programs: http://www.eas.asu.edu/cor/summer or call 480-965-4665

June 9-20
Arizona Summer Transportation Institute for 10th and 11th grade students

June 16-20
DNA-Techs^2 Camp for 10th-12th grade students to learn about bioengineering

June 21, 28, July 12, 19, 26 (Five Saturdays)
Aiming for Success (AIMS) Camp for 7th and 8th grade students to learn about web design

June 30-August 8
American Indian Science and Engineering Society Summer Scholars Bridge Program for 10th-12th grade students

July 7-11
ROBOTS Camp for 11th and 12th grade students

July 7-11
WISE-UP Camp for 11th and 12th grade girls

July 14-16
Students Recycling Used Technology (StRUT) Camp for 7th and 8th grade boys

July 16-18
Women in Applied Science and Engineering Teams Camp for 7th and 8th grade girls

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CRESMET director Don Evans to retire

After a 38-year career at ASU, Don Evans, founding director of the Center for Research on Education in Science, Mathematics, Engineering and Technology (CRESMET), will retire June 30.

Evans started at ASU as an assistant professor on the Faculty of Mechanical Engineering. He researched high temperature gas dynamics, then solar energy. In the late 1980s, while vice chair of the Department of Mechanical and Aerospace Engineering, Evans became interested in education.

"Industry and government were telling people in engineering education that they needed to make changes," Evans said. "The engineering workplace was changing, and we needed to address that in the educational process."

The College asked Evans to take over its freshman engineering course, ECE 106—the predecessor to the current ECE 100. He added computers and computer modeling to the curriculum over the eight years he taught it.

Ten years ago, ASU joined the NSF Foundation Coalition, a project to improve engineering education. Evans has led ASU's part of the Coalition, which focused on campus-based curriculum reform for the first five years, then on dissemination and assessment of programs. In 1994 Evans became the director of the Center for Innovation in Engineering Education, which was formed as an adjunct to the Coalition.

Four years ago he orchestrated the formation of CRESMET, a collaboration between CEAS, the College of Education and the College of Liberal Arts and Sciences. CRESMET conducts about $3 million annually in research grants and contracts in educational research.

Don Evans, founding director of CRESMET

After his retirement Evans hopes to continue working with CRESMET on a part time basis, as well as build a wood/metalworking workshop and travel. "I haven't had much time in the last 15 years for my hobbies," Evans said. "I hope to catch up."

Go to http://www.eas.asu.edu/~cresmet to learn more about CRESMET.