Innovation

COLLEGE OF ENGINEERING AND ARCHITECTURE /Fall 2006

Building a Better Treadle Pump and Solving Real Problems

Story on page 15

WASHINGTON STATE UNIVERSITY

World Class. Face to Face.

College of Engineering and Architecture

From the Dean's Desk

As some of you know, earlier this year, I accepted the challenge of leading the College of Engineering and Architecture as dean. I feel very fortunate to step into this position at this time in our College—there are many great opportunities for us for the next five to ten years, and I am very excited about the possibilities for our college to make a strong and positive impact in our state and nation.

The importance of our college in educating tomorrow's leaders is becoming increasingly evident. In the past year, a committee of the National Academies of Engineering put out a call to arms—*Rising Above the Gathering Storm*—that summons us to action to increase interest in engineering as a way to maintain our nation's competitiveness. The *American Competitiveness Initiative* also strives to increase support for research in new technologies, to strengthen education, and to encourage more entrepreneurship in engineering and sciences. Our nation's governmental and business leaders are beginning to see that engineering is more relevant than ever in solving our daunting 21st century problems, and interest in producing more engineers is high at both the state and national levels.

In this edition of *Innovation*, I am pleased to provide you with some exciting examples of how we are rising to the challenge. We're working to increase interest and bring a broader variety of our population to the engineering fields. We're better preparing our students for the 21st century workplace that they will encounter, and, most importantly, we're training these students so that they can begin to solve daunting challenges ahead.

One of the greatest challenges for engineering education across the country is informing the layperson as well as the graduating high school senior about engineers' impacts on society and the just-plain-fun nature of engineering as a career. We are making a significant effort to inform K-12 educators and students about engineering through our NY'EE and HY'EE summer camps for Native American and Hispanic youths, our SWEET program that gives engineering research experience to K-12 teachers (p. 18), our collaborations with the College of Education to place engineering and math graduate students in junior high and high school math classes to help develop appropriate curricular materials (p. 17), and now a 5th year engineering program that will allow engineering students to receive teacher certification. We need to do more and continue to look for ways to reach out to K-12 education so that more students know about engineering.

At the undergraduate level, we also want to significantly improve retention of engineering students in the major, especially in the first two years—the time during which they have not typically taken many engineering classes. Our students need to see the impact that engineers make—that they are the drivers of innovation that fuels our economy and improves quality of life. We are strongly promoting experiential learning opportunities through engagement in a variety of activities, including research experiences that let undergraduates work face-to-face with our faculty on interesting and important research projects (p. 20), participation in one of our excellent student clubs or student activities such as Engineers Without Borders (p. 16), participation in the Entrepreneurship Program, or working on senior design projects that put them in direct contact with industry engineers, working on real engineering problems (p. 13). Architecture and construction management are also seeing innovations that will positively affect our students' preparedness for the 21st century workplace (p. 18).

Students graduating with engineering degrees have a wide range of potential careers ahead of them. Their opportunities are great, interest in engineering among entering freshmen appears to be on the rise, and state budgets are improving, In fact, the state legislature recently provided us with three additional faculty members in civil engineering, mechanical engineering, and construction management to increase retention in those high demand fields.

When I was young, the launch of the Sputnik started the dramatic effort in the United States to solve the technological challenge of putting men in space. This national effort led to our becoming technological leaders, as well as economically dominant. Today, we don't have such a dramatic example as Sputnik. But the compelling need is there and becoming increasingly recognized. I would love to hear from you as we begin to focus on these challenges. These are truly exciting times, and I'm looking forward to helping this college rise to the occasion—as we have so often before.

Candis Claiborn

Candis Claiborn Named Dean of WSU College of Engineering and Architecture

Candis Claiborn has been named dean of the Washington State University College of Engineering and Architecture. Claiborn served as interim dean of the college for the past year.

"I am very pleased that Dr. Claiborn, an outstanding researcher and teacher, has stepped forward to lead the College of Engineering and Architecture, a key unit in achieving the vision of the university strategic plan," said Robert Bates, WSU provost and executive vice president. "With Dr. Claiborn's demonstrated leadership and solid grounding in the academic and research programs of the college, I expect the regional and national prominence of WSU Engineering and Architecture to advance significantly during her tenure as dean."

Prior to accepting the position of interim dean, Claiborn served as associate dean of the college. She joined the WSU faculty in 1991 and is a well-known researcher in the area of air quality. At WSU, she has collaborated with other researchers in the Laboratory for Atmospheric Research to study atmospheric-biospheric interactions of trace gases, and recently developed a research program in atmospheric aerosols in collaboration with her colleagues in the Laboratory for Atmospheric Research, as well as others from the School of Public Health at the University of Washington, the Chemistry Department at Eastern Washington University, and Lawrence Berkeley National Laboratory.

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Innovation

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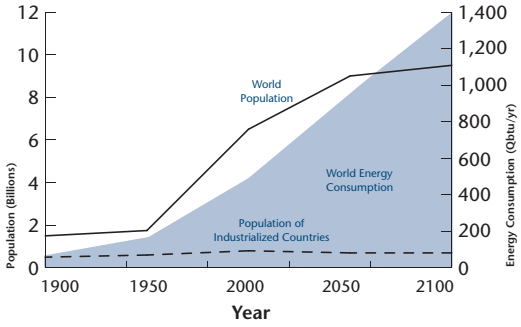
ON THE COVER

Travis Meyer works on a treadle pump as Malawians look on, near Lilongwe, Malawi.

Photo by Jeff Evans

Energy Research Initiative Gets Underway



Energy Projections:
"Global Energy Perspectives"
ITASA / WEC

Population Projections:
United Nations
"Long-Range World Population Projections: Based on the 1998 Revision"

With support from the WSU Office of Research, the College of Engineering and Architecture has started a new initiative in Energy Research. The effort brings together researchers with a variety of research strengths and from a variety of disciplines to work on problems such as finding new energy sources that use sustainable materials, optimizing energy transmission, implementing clean energy that won't contribute to global warming, and using nanotechnology in developing alternative energy systems.

"Energy is the single most important challenge that we face, impacting everything from convenience in communications to large-scale uses in industrial applications," says Grant Norton, who who is heading up the effort. "Both generation and efficient use of power and energy are at the center of a wide variety of engineering and societal problems that will persevere through the upcoming century."

At its inaugural workshop last spring, researchers from disciplines ranging from sociology to chemical engineering and architecture came together to present their research and brainstorm.

"Our challenge at WSU is to join individual research activities in a coordinated approach to solve problems, which are at their heart interdisciplinary," said Norton. "Our goal is to take the individual pieces of the jigsaw puzzle and put them together in such a way that we can make a significant impact."

Golden Grads Visit Campus. *Alumni from the classes of 1936, 1946, and 1956 attended this year's Golden Grad celebration. Would you like to return to campus to see old friends and learn about exciting happenings in the College of Engineering and Architecture? Mark your calendars for your golden, silver, or platinum reunion on April 25, 2007.*

College of Engineering and Architecture Appoints Development Director

Mark Hermanson, a Washington State University alumnus with close to 15 years of fundraising and higher education experience, has been appointed executive director of development and external relations for the College of Engineering and Architecture at Washington State University.

Hermanson has a bachelor's degree in hotel and restaurant administration and a master's of education in educational leadership and counseling psychology from WSU.

Since 2000, he has worked in development at the University of Idaho, most recently as senior director of development for the College of Natural Resources where he led and managed the fundraising activities of the college. Previous to his years at Idaho, he worked as assistant/associate director at the Compton Union Building at WSU.

"We are pleased that Mark Hermanson has agreed to join our college," said Candis Claiborn, dean of the College of Engineering and Architecture. "As we push ahead with exciting efforts to transform the student experience to better prepare our students for the 21st century workplace, I believe he will play a key role and will make a significant difference in helping the college reach its goals."

Hermanson replaces Devon Anderson, who took a new position as vice president of corporate and foundation relations for the WSU Foundation.

CEA names 2006 outstanding students, faculty, and staff

Michael Wolcott

Russell V. Westphal

Anjan Bose Outstanding Researcher Award: Michael Wolcott, Lousiana-Pacific Professor of Wood Materials and Engineering

Wolcott, on the WSU faculty since 1996, is an international leader in the area of composite materials produced from natural fibers, where his work has led to the development of advanced materials that better withstand aging processes, reduce manufacturing costs and pollution, and provide better performance. He has received more than $17 million in funding from numerous federal agencies, including the Office of Naval Research, the Department of Energy, the USDA, and the Federal Highway Administration. He holds three patents—a low-density cellular wood plastic composite and its formation process, a portable bridge system, and a method of forming paper and board products from a reed plant. Wolcott has been actively engaged with industry to commercialize his research and has participated in projects for more than 45 companies. He has also received numerous national awards for research excellence, including the prestigious Society of Wood Science and Technology's George Marra Award (in 1991 and 1995), and he has been an invited keynote lecturer at renowned international conferences. He has 43 refereed publications in national and international journals and books, and his work is highly cited.

Wolcott is the first winner of the Anjan Bose Outstanding Researcher Award, which was created by the Advisory Board for the College of Engineering and Architecture along with friends and alumni to honor Dr. Anjan Bose for his service to the college as dean. To acknowledge Dr. Bose's support of faculty scholarship and to honor his internationally renowned reputation for research, the award will annually recognize and reward the top faculty researcher in the college.

Outstanding Teaching Faculty: Russell V. Westphal, professor and area coordinator, School of Mechanical and Materials Engineering, WSU Tri-Cities

Westphal teaches a broad range of courses within the mechanical engineering major, including statics, fluid dynamics, heat transfer, thermodynamics, and mechatronics, and his students range from sophomores to graduate students. He has a background in a wide range of disciplines and has contributed to 67 articles and publications.

Westphal is unusual in that he often doesn't require his students to take exams, wrote his nominators. He argues that the workplace doesn't require its employees to complete problems for a boss in 50 minutes without communicating or using resources, so he provides students with the option of doing a project rather than take an exam. Once students have fundamental skills in a senior-level course, he also allows them to choose the direction of the course. For instance, in his thermal systems course, the class chose to learn about the combustion process and jet engines.

He has risen to the challenge of teaching distantly through the Washington Higher Education Telecommunication Systems (WHETS). Because of the nature of the WHETS classes, for instance, Westphal held 'office hours' by providing students with his home phone number and invited them to call collect so they wouldn't have to pay for long distance charges. "While most teachers find it very difficult to be effective using WHETS, he is able to teach classes that students find exceptional," wrote one nominator.

Westphal has advised the student chapter of ASME on the Tri-Cities campus for the past 12 years, and he is also a faculty advisor for senior projects.

"Dr. Westphal is a brilliant professor with an ability to convey to students the knowledge and information that is difficult to understand and in most cases unintuitive. He has managed to do so while constantly improving the teaching effectiveness over WHETS," wrote his nominators.

Westphal is a graduate of WSU ('78 B.S. Mech. Eng.). He says that his teaching is inspired by his undergraduate experiences with his WSU professors, who included **Dick Crain, Jack Kimbrell, Jack Smetana, Gus Plumb, Clayton Crowe, David Stock,** and **Tom Burton.**

Outstanding Sophomore: Brian Walkenhauer, civil engineering, Yakima, Washington

Outstanding Junior: Sean Michael Collison, computer engineering, Veradale, Washington

Outstanding Senior: Jessica Jahn, biological systems engineering, Davenport, Washington

Outstanding Teaching Assistant: Hoki Lee, mechanical engineering, Suwon, South Korea

Staff Excellence Awards: Mary Anne Brown, academic coordinator, School of Architecture and Construction Management, and Judy Croskey, principle assistant, School of Architecture and Construction Management

Employee of the Year: Giac Pham, information technology systems specialist, School of Mechanical and Materials Engineering

Wolcott Gives First Annual Bose Lecture

Composite materials produced from renewable polymers and natural fibers will play an increasingly important role in building construction, transportation, and packaging materials world-wide as our society faces geo-political and environmental concerns from our heavy dependence on oil. **Michael Wolcott,** Lousiana-Pacific Professor of Wood Materials and Engineering, discussed "The Evolution and Future of Renewable Composite Materials" at the first annual Anjan Bose Outstanding Researcher Lecture last spring on the WSU campus.

Wood-based composites were originally developed as a way to make better use of resources and avoid pollution caused by the disposal of mill residues, Wolcott told the group of faculty, staff, and students. In the past several years, researchers at the Wood Materials and Engineering Laboratory have been leaders in efforts to improve durability of the materials and in the development of extrudable forms of natural fiber composites that can be easily processed into complicated structural forms. These renewable materials are going to play an increasingly important role in the development of fuels, chemicals, and polymers as we work toward a bio-based economy and lifestyle, Wolcott said.

Spring Shines on First Annual CEA Open House

The public came to see presentations ranging from robotics to a project to develop a decal applicator for Boeing Company airplanes at this spring's first annual College of Engineering and Architecture Open House. The two days of activities included graduate research posters and demonstrations, undergraduate senior design presentations, student club displays, and an awards luncheon. Events were held throughout the engineering buildings—Sloan, Dana, and the Engineering, Teaching, and Research Laboratory. "The engineering fields will be of increasing importance in the 21st century globally competitive workplace," said **Bob Olsen,** associate dean of undergraduate and student services for the College of Engineering and Architecture. "This open house provided the opportunity for the public to become more aware and interested in these important fields." Mark your calendars for next year's open house, scheduled for **April 18–20, 2007**.

You're Invited...To Make a Difference for our 21st Century Engineers and Architects

Your support touches all aspects of campus life, from scholarship support to student internships, mentoring, and professional development. Gifts enhance academic programs, faculty development, technological upgrades, and other current needs. Your support helps bridge the gap between state-appropriated funds and what is needed to provide the very best educational experience. It also helps support special projects for students and faculty that otherwise could not be offered. For more information about giving to the College of Engineering and Architecture, contact Mark Hermanson, executive director of development and external relations, at 509-335-4733, and your inquiry will be directed to the appropriate individual.

Greg Kessler, director, School of Architecture and Construction Management

Miller, Hull Receive Alumni Achievement Award

David Miller FAIA and Robert Hull FAIA were each honored with a WSU Alumni Achievement Award from the Washington State University Alumni Association at a ceremony held in April at the School of Architecture and Construction Management. Co-founding partners of Miller/Hull Architects in Seattle, both received their bachelor of arts in architecture from WSU in 1968.

The duo's projects have provided significant contributions to the field and have garnered more than 100 national, regional, and American Institute of Architects (AIA) awards and citations over the past 25 years. In 2003, Miller/Hull was named AIA Firm of the Year, the highest award bestowed upon an architectural firm from the American Institute of Architects. Both Miller and Hull are fellows of the American Institute of Architects and act as professionals, educators, guest speakers, and industry experts. Miller, who serves as professor of architecture at the University of Washington, worked on the WSU Shock Physics Institute on the

Left to right: Jud Preece, WSU Alumni Relations and Alumni Association, Robert Hull, David Miller, and Greg Kessler.

University's Pullman campus. Hull's educational emphasis is in the area of school construction and his work has benefited numerous educational institutions and community centers. Together they have demonstrated their commitment to their alma mater by establishing the Miller/Hull Architecture Endowment, which will support graduate architecture scholarships and internships.

Gregory Kessler, director of the School of Architecture and Construction Management, wrote in his nomination of Miller and Hull, "We are honored to be able to nominate these two alumni jointly as their collaborations have yielded some of the most provocative modern architecture in the United States." Kessler noted that the highly creative and dedicated architects represent the principle that the most significant and meaningful work evolves from discourse and a common desire to create environments that embrace human life. "This joint nomination reflects the collaborative nature of two alumni who, together, have inspired leadership and served as role models for many young architects, both regionally and nationally," said Kessler. "They embody all of the values and aspirations faculty seek in representing excellence from Washington State University."

"We are honored to be able to nominate these two alumni jointly as their collaborations have yielded some of the most provocative modern architecture in the United States."

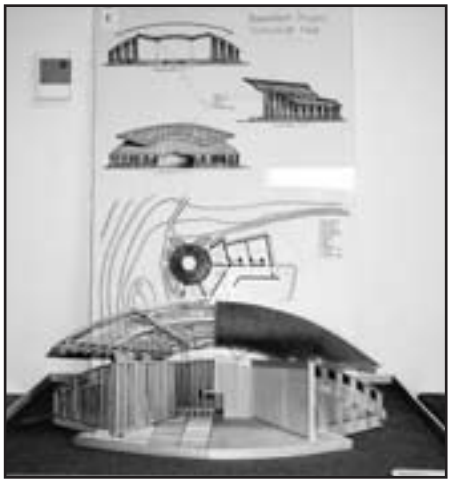
WSU Spokane Students Selected for Habitat for Humanity "Green Home"

by Barb Chamberlain

Students at the Interdisciplinary Design Institute at Washington State University Spokane completed designs for the first-ever sustainable green Spokane home for Habitat for Humanity. The winning designs were selected in a juried competition, and the home was constructed primarily using student labor. The home was designed by **Carson Schultz, architecture student,** and interior design students Anna Robbins, Anna Brayton, and Jennifer Frost. A second design was selected for consideration for a future home site; the house was designed by interior design students Angela Reeves, Lindsay Mellum, and Adrianne Serroels,

and **architecture student Celeste Isensee**. Both designs incorporate straw-bale construction techniques, thus utilizing a locally grown agricultural byproduct.

Students Exhibit Designs for Sunnyside Park Band Shell



A group of third-year architecture students have created designs for a possible band shell for Sunnyside Park in Pullman. The band shell project came about after a rainy Fourth of July celebration a few years ago in which a local band lost some of its sound equipment, said Kurt Dahmen, Pullman's recreation superintendent. Organizers of the event began discussing a need for a band shell at the park, located on an approximately 25-acre site on the west side of Pullman. They decided to ask students to come up with designs. A total of 15 students in Michael Owen's architecture design class worked on the projects. The students were shown the site and then came up with their designs. The band shell will include a stage area, restrooms, storage, and a concessions area. The student projects are a starting point for the city project. City officials will then come up with a final design and determine funding.

Award-Winning Home Featured in *Sunset Magazine*

Canyon House

A house designed by Paul Hirzel, associate professor in the School of Architecture and Construction Management, was featured in the March issue of *Sunset Magazine* as one of the winners in the American Institute of Architects and *Sunset*'s Western Homes Award Competition. Hirzel received the merit award for the design of "The Canyon House," a vacation home on a 40-acre property overlooking the Clearwater River in Juliaetta, Idaho. The home is one of 13 from across the West that received acclaim out of 250 submissions. "Its simple outline and rustic materials echo the shape and character of the rural surroundings…the footprint of the house is minimal because rooms overlap as they stairstep down the slope," wrote the *Sunset* judges. Hirzel's home design has also received the prestigious AIA Housing Committee Award and the AIA-Seattle's honor award.

CM Students Craft a Winning Idea to Build the Great Pyramids

A team of construction management students came up with the award-winning bid for the Great Pyramid Bid Competition, sponsored by the Northwest Construction Consumer Council. The competition between the University of Washington Husky Construction Management Program and the Washington State University Cougar Construction Management Program was held during the council's spring meeting. The program was based on Craig B. Smith's book *How the Great Pyramid was Built,* soon to be featured in *National Geographic* and on the History Channel. Both schools were given a detailed request for a proposal on building the great pyramid today with current construction materials and methods on a site in Nevada. The teams submitted an execution plan, current estimate, project schedule, and safety/quality plan for the proposed project, and then the members of the association voted on the best proposal. Washington State University was awarded the project based on their presentation and submittal documents. The Cougar team included **Beth Duffus, Jesse Canzler, Aaron Wilson,** and **Michael Davolt**. The faculty advisor for the Cougar team was **Rick W. Cherf**. The association hopes to make the competition an annual event for construction management students in the region.

Mike Owen Retires

***Mike Owen** retired after 22 years of hard work and dedication as associate professor of architecture. The School of Architecture and Construction Management held a retirement reception in April at the Lewis Alumni Centre.*

Claudio Stockle, chair, Department of Biological Systems Engineering

Center for Bioproducts and Bioenergy Launched

Helping Washington Move to a Bioeconomy

The price of gas is the first sign that many of us have noticed that indicates we might want to rethink our dependence on fossil fuels.

Environmental effects and geopolitical realities mean more than ever that society will be required to move beyond fossil fuels—in fact, the process has already begun. With increasing need for the substantial use of alternative energy, a new, interdisciplinary Center for Bioproducts and Bioenergy has been established.

"We hope this center will lead the state forward as it transitions to a bioeconomy," says **Shulin Chen**, interim director of the center and a professor in biological systems engineering.

Building on existing strengths at Washington State University, the center will research and develop bioproducts and bioenergy, and develop systems and technologies that will grow and use regional biomass to produce fuels, chemicals, energy, and materials. The center will also serve as a catalyst for technology transfer to help establish a strong bioenergy industry in the state. Finally, the center will provide a research and education program in this important and emerging field.

Washington State University Pilot-Scale Manure Digester

Chen has led research in recent years showing that Washington has great potential for getting much of its energy needs met from biomass. Conducting an inventory, Chen and his colleagues found that approximately 16.9 million tons of biomass in the state could provide about 15.5 billion kilowatt hours of electricity, or enough electricity to provide about fifty percent of Washington's annual residential consumption. Chen's group has also led work to develop an anaerobic digestion system that captures methane gas from dairy manure.

Researchers from the Wood Materials Engineering Laboratory will also contribute to the center because of their background in developing biomaterials from recycled and virgin wood resources. Researchers from the School of Chemical Engineering and Bioengineering also have done considerable research in converting biomass to chemicals and nutraceuticals.

"The agriculture industry is a major cornerstone of the state economy, and the great variety of crops offer great opportunity for using a variety of biomass," said Chen. "Producing high value products from crop biomass will also benefit our farmers by bringing new revenue to rural communities."

Air Pollution from Farm Fields? Researchers Measure Nitrogen Emissions

Working with researchers in the Laboratory for Atmospheric Research, **Claudio Stockle** received a grant from the USDA's National Research Initiative Competitive Grants Program to measure and model gaseous losses of nitrogen from irrigated crops in central Washington. The researchers will study emissions of NH_3 (ammonia), N_2O (nitrous oxide), and NO (nitric oxide) from the croplands in the region. The croplands are intensively managed with high inputs of nitrogen, setting the stage for gaseous losses of nitrogen from the soil and crop canopy; these emissions are not well understood. Nitrous oxide, which is about 300 times more effective a greenhouse gas than carbon dioxide, contributes to global warming, and ammonia is a pollutant that affects atmospheric chemistry and contributes to the acidification of ecosystems. In the photo, **Brian Rumburg** (left), a postdoctoral fellow with the Laboratory for Atmospheric Research, and **Jeff Price**, participating in a Summer Research Experience for Undergraduates, are setting up retro-reflectors for the long-path ammonia spectrometer.

Dick Zollars, interim director, School of Chemical Engineering and Bioengineering

Students Tackle Alternative Fuel Solutions

While words like biomass and biodiesel were barely part of our vocabulary a few years ago, increasing concerns about oil supplies and its geopolitical and environmental impacts are making people consider alternatives. Two groups of chemical engineering students are getting a jump on what promises to be a major question for their future: finding answers to energy problems.

"Our generation is going to have to face these issues," says student Jonathan Windsor.

In the first project, students worked to find new uses for glycerin, a byproduct of the biodiesel production. For every 10 pounds of biodiesel produced, approximately one pound of glycerin byproduct is also produced. Production of the plant-based and environmentally-friendly fuel promises to be ramping up, particularly in Washington where legislators have recently proposed mandating use of a small percentage of it in all of its vehicles. Companies have traditionally sold the glycerin, which is used in soaps, lubricants, and cosmetics, at low prices. Seattle Biodiesel, with whom the students are working, sells the glycerin as a low grade fuel for industrial boilers. As production increases substantially, however, the problems of what to do with the glycerin waste and how to find more value for it are becoming increasingly important.

"There's a huge increase in biodiesel that has to be produced," said Dick Zollars, who is advising the students on the project. "You're going to have to do something with the glycerin."

Burning the glycerin for energy is the least desirable alternative because it burns very poorly.

"Our generation is going to have to face these issues."

The students looked at possibly cleaning up the crude glycerin to recover the catalyst that is first used to produce the biodiesel—essentially recycling it. Another alternative they considered is avoiding having glycerin as a byproduct through the use of "supercritical" methanol. Using the supercritical methanol, which is under high pressure and temperature, the glycerin that forms is decomposed into smaller molecular products. Little research has been done on this method, and it hasn't been scaled to industrial use, the students said. Furthermore, the cost of the high pressures and temperatures required might be prohibitive. Finally, the students looked to reform the glycerin into hydrogen. Some of the hydrogen could be recycled back into heating the initial reaction, and the rest could be sold for use in fuel cells or burned on site for electrical generation and sold back to the power companies.

As part of the project, the students did an economic analysis of each idea and presented their results to Seattle Biodiesel. Students on the project included **Jonathan Windsor, Jesse Jensen, Ivan Kravtsov, Maria Negrete,** and **Chris Taylor.**

In the second project, students worked with a southeast Washington industry to determine a way to use agricultural waste as an alternative fuel to propane, which has more than doubled in price in the last few years. The region holds promise for making use of the waste because of its heavy concentration of agricultural activity. Some of the most common agricultural waste in Benton County near the Tri-Cities includes waste from wineries, mint, wheat straw, grass clippings, asparagus, alfalfa, and wood—"anything you can think of," said student **Tyson Henry**. Trying to make use of the waste has been difficult, though, because of the cost and energy required to collect it. Working with the Port of Benton and BRB Seed Company, the students investigated possible ways to create a less expensive source of fuel than the propane or natural gas that the seed company currently uses to run their dryers.

In particular, they worked to develop a recipe of agricultural waste materials that could be used to create a liquid fuel through the process of gasification. Gasification is an older technology that has been used in other parts of the world to create liquid fuel from coal or wood. The process involves burning material in a limited oxygen environment to create gases. The gases are then sent to a reactor to create a liquid fuel, such as ethanol. During World War II, the Germans ran their military on fuels created from coal gasification. However, it hasn't been done at the industrial scale using agricultural waste, the students said.

To make the project viable, the students worked to develop a recipe that could provide the highest energy output.

Students visit FruitSmart, a fruit ingredient processor and supplier in Prosser, Washington, as part of their project to use agricultural waste for fuel.

Higher energy producers would include seed waste, for instance, because of the natural oils included in the seed. At the same time, however, the students had to consider the emissions of potentially harmful pollutants that their recipe might produce. In burning seeds, for instance, pollutants such as nitrous oxide and sulfur dioxide are emitted.

To make such a fuel viable, the students also had to determine how to create a product that would have the most consistent energy output over growing seasons. So for instance, their recipe had to take into account the ending of the cranberry season and the beginning of the wheat harvest.

At the same time, the students had to consider the cost of transporting the waste to a central area, to see if it would be economically viable.

"We don't see it being very cheap," said Henry.

But as the cost of using fossil fuels continues to rise, the alternatives may eventually be worth considering, said the students.

Students on the project included **Brian Esparza, Tyson Henry, Metasebia Ashenafi, Karah Hoard,** and **Kathryn Gehrett**. Both groups of students presented their final project to company representatives last spring.

The students hope that they can make a difference in the world of alternative fuels. Whether their solution gets adopted or not will come down to economics, says Windsor.

"It really comes down to what is the most economic plan with the best payback," he says.

New Faculty will Focus on Bioengineering and Environment

Welcome to new faculty in the School of Chemical Engineering and Bioengineering. These new faculty members will increase research strengths in the department in fuel cells research and bio/environmental research. New faculty members include:

Su Ha joined the School of Chemical Engineering and Bioengineering in 2005, where his research is focused on electrochemical systems for energy conversion and storage, including Proton Exchange Membrane (PEM) fuel cells, bio fuel cells, fuel reforming for hydrogen production, and catalysis. He received his master's and doctoral degrees in chemical engineering from the University of Illinois, Urbana, and his bachelor's degree in chemical engineering from North Carolina State University.

Nehal Abu-Lail comes to WSU from Duke University's Center for Biologically Inspired Materials and Material Systems. She has been working there for the past three years as a postdoctoral fellow, where her research was focused on single-molecule spectroscopy of proteins and lateral force microscopy studies of polymers and lubricants. She received a doctorate in chemical engineering from Worcester Polytechnic Institute in Massachusetts. Her undergraduate work in chemical engineering was completed at Jordan University of Science and Technology.

Haluk Beyenal comes to WSU from Montana State University's Center for Biofilm Engineering, where he was an assistant research professor and received the college's outstanding researcher award in 2005. His research is focused on biofilms, microbial fuel cells, microsensors, and bioremediation. Beyenal studied chemical engineering at Hacettepe University in Ankara, Turkey, receiving his doctorate there in 1997.

Reid Miller Retires

Reid Miller, former dean for the College of Engineering and Architecture and a professor of chemical engineering since 1984, has retired. Miller served as dean of the college from 1984 to 1995. After that, he taught undergraduate courses and graduate courses, receiving consistently high ratings for his teaching. He maintained an active research program, directing several graduate students in projects involving the measurement of important environmental properties. "Dr. Miller has an open door policy, and the door is really open—except in the winter when it's cold in the hall, and it's only 'ajar,'" wrote one student. In 2006, Miller received the Pacific Northwest American Society for Engineering Education Teaching Excellence Award, and was cited for his "long-standing commitment to engineering education." He also received the College of Engineering and Architecture's Outstanding Teaching Award in 2005 and the department's American Institute of Chemical Engineers Outstanding Teacher Award six times.

The graduating class of 2002 organized a student award for teaching excellence, naming it for Miller. Starting in 2007, the College of Engineering and Architecture's teaching award will also be named for Miller.

David McLean, chair, Department of Civil and Environmental Engineering

Summer Barbecue on the Deck? Researchers Make Sure You're Safer

Excerpted from *Washington State Magazine*

Testing a railing at the WMEL.

Researchers at the Wood Materials and Engineering Laboratory are developing design guidelines for making residential decks safer. Working with colleagues Frank Woeste and Joe Loferski at Virginia Tech University, the WMEL researchers, including Don Bender and David Carradine, recently published an article on their findings in the International Code Council's *Building Safety Journal,* read by approximately 40,000 building inspectors and officials throughout the United States.

The deck is the most dangerous part of a house, with more injuries and loss of life than any other part of the home structure, says Bender, director of the WMEL. Except for hurricanes and tornadoes, more injuries may be connected to deck failures than all other wood building components and loading cases combined. There is little coverage on residential decks in the national building codes, says Bender. And, because they look relatively easy, homeowners attempt to add on decks themselves rather than work with a professional.

Except for hurricanes and tornadoes, more injuries may be connected to deck failures than all other wood building components and loading cases combined.

"Many decks collapse before they reach their code-required design load," he says. "In fact, we're lucky that we don't load the decks to their designed capacity."

Based on experiments conducted at Washington State University and Virginia Tech University, the group calls for carefully staggering lag screws or bolts to attach a deck to the house and prescribes exact distances for the bolt spacing. The researchers also recommend structural supports near the house. Using hardware similar to a 'seismic tie down,' they also tested improved ways to make deck railings safer. The group's recommendations on deck ledger connections were recently incorporated into the Virginia and Indiana state building codes and were submitted for inclusion in the International Residential Code at a hearing in March 2006. They will be voted on at the fall 2006 meeting.

Colf Speaks on Construction at the 2005 Robert Cheatham Lecture

Richard W. (Dick) Colf, executive vice president of Peter Kiewit Sons' Inc. spoke on "Construction: The Coming Boom" at last fall's 2005 Cheatham Lecture.

Colf offered plenty of practical advice and tips for students as they get ready to enter the construction field, including understanding costs and knowing how to manage numbers. He also told students that they should be forthright, have a passion for business, practice public speaking, and be on time as often as possible.

After graduating in 1966 from WSU with a bachelor's degree in civil engineering, Colf went to work for Peter Kiewit Son's Inc., one of the largest construction companies in the United States. During his career, he has worked on and supervised many construction projects, including highways, levees, jetties, oil industry facilities, and dams. He was a job superintendent on a levee job at Lewiston, Idaho, for the U.S. Corps of Engineers. He also spent two years in Alaska as superintendent overseeing construction of the Trans-Alaska pipeline, where he was in charge of the installation of 22,000 vertical support members on the northernmost 220 mile section of the pipeline. Colf also led the Northwest District to an unprecedented 10 consecutive years as the company's top performing district. He is currently executive vice president of Kiewit with oversight for the company's projects in the western and midwestern United States, including Alaska and Hawaii, as well as in Canada.

The Cheatham Engineering Management lecture series was established to honor the late Robert A. Cheatham, a

devoted WSU alumnus and key player in establishment of the WSU Foundation. Cheatham was an engineer and corporate manager with the Bechtel Corporation.

Jim Clark Gives Lanning Lecture

Water is undervalued and demand continues to increase. We need to practice better conservation and get better at reusing it.

That was the message from Jim Clark ('75 B.S. Civil Eng., '76 M.S., Environ. Eng.), who gave the 2006 Lanning Distinguished Lecture last spring. As vice president and project director of Black & Veatch Corporation, Clark manages planning, design, and operations projects for water and wastewater utilities and municipalities throughout North America.

Fresh water is becoming an increasingly scarce resource, with about 1.3 billion people who don't have access to clean drinking water, Clark told the group. However, he is optimistic that as populations continue to expand, nations become industrialized, and demand grows, innovators are going to be able to solve the looming water shortage problems of the 21st century. Water reclamation, particularly, is critical to sustainability. People are going to have to realize how much water they waste and adjust to reusing water.

Clark was the senior process engineer and a project manager on the City of Los Angeles Hyperion Treatment Plant, completed in 1999. The American Public Works Association named the 15-year, $1.1 billion wastewater treatment project one of the 10 most outstanding public work projects of the 20th century on a list that also includes the Golden Gate Bridge, Panama Canal, and Hoover Dam. The project significantly improved water quality in Santa Monica Bay. The entire project had to be completed while the facility was still in operation, without violating permit conditions, a feat that one of Clark's colleagues compared to disassembling and re-assembling a jumbo jet in mid-flight. He is a former president of the Water Environment Federation, a global water quality organization, and in 2004 was named one of the 50 most influential people in public works by *Public Works* magazine.

Sponsored by WSU's College of Engineering and Architecture, the Lanning Lecture, established in 1988, is funded by civil engineering alumnus Jack Dillon '41 and honors his late wife, Frances Lanning Dillon. The lectures are meant to help students gain knowledge of the civil engineering profession beyond the academic dimension.

ASCE Wins Chapter Award

The WSU ASCE Student Chapter was selected by the ASCE Committee on Student Activities to receive a Letter of Honorable Mention for its outstanding work during 2005. The group was honored for its work on a variety of activities, from community service projects to professional meetings and social activities.

"It's great that this group's efforts and considerable accomplishments this past year are being recognized at the national level," said Dave McLean, chair of Civil and Environmental Engineering. Advisors for ASCE are **Dave Pollock** and **Shane Brown.** Chapter officers were **Brian Walkenhauer, Ryan Beemer, Adrienne Nikolic, Brandon Billing,** and **Mike Miraglio.**

Dan Dolan, a WSU professor of civil and environmental engineering, is featured in a Public Broadcasting Service (PBS) one-hour documentary entitled Disaster-Resistant Housing *that has begun airing on televisions stations in the United States. On the program, Dolan, an expert in low-rise building design, showed an experiment on a building wall that simulates how homes respond to natural disasters such as earthquakes and hurricanes. The test was conducted and filmed at the WSU Wood Materials and Engineering Laboratory. In the experiment, he introduced stress loads onto the wall until it failed, simulating actual natural disaster stress. The test is used by building designers and contractors to help them determine how to construct buildings to avoid such failures. Dolan is involved in writing and updating design and building codes in the United States.*

Behrooz A. Shirazi, director, School of Electrical Engineering and Computer Science

David Bakken

Anjan Bose

Carl Hauser

NSF Grant to Support WSU Research on Power Grid Cybersecurity

A team of researchers from Washington State University's College of Engineering and Architecture has been selected to play a major role in a National Science Foundation-sponsored research initiative intended to address the challenge of protecting the cybersecurity of the nation's power grid.

WSU was named as one of four universities that will participate in a new five-year collaborative research effort supported initially by an NSF grant of $7.5 million. Other collaborators are Cornell University, Dartmouth College, and the University of Illinois at Urbana-Champaign (UIUC). UIUC will serve as the home of a national center to be called Trustworthy Cyber Infrastructure for the Power Grid (TCIP).

The TCIP center will be dedicated to developing new technologies for the electric power grid's cyber infrastructure, making it more secure and robust. The solutions created are expected to be adaptable for use in other critical infrastructure systems. Nearly $1 million of the NSF grant money has been pledged to support WSU research, which is the largest subaward outside the center's home at UIUC.

The research by the WSU School of Electrical Engineering and Computer Science will be led by **Carl Hauser** and **David Bakken,** associate professors of computer science, and **Anjan Bose,** Distinguished Professor of Power Engineering and a member of the U.S. National Academy of Engineering.

"This center brings together security-related research by 19 faculty members and senior researchers, together with their students at the four institutions," Hauser said. "Their combined expertise in distributed computing, simulation, modeling, cybersecurity, power engineering, and energy policy will be leveraged to help secure the power grid's cyber infrastructure."

Hauser noted that the center will have a 14-member industrial advisory board from the electric power industry that will help ensure that the research addresses real-world problems.

The award was one of 36 grants totaling $36 million announced by the NSF as part of its 2005 Cyber Trust program. Cyber Trust is the centerpiece of the NSF's cybersecurity efforts. TCIP is one of only four center-scale awards granted in the history of the Cyber Trust program and the only one supporting research at a university in the Pacific Northwest. The Department of Energy and the Department of Homeland Security also have pledged to join NSF in funding and overseeing TCIP.

The awards come at a time of increased public and government concern over the vulnerability of the nation's power grid. The August 14, 2003, blackout that affected an estimated 50 million customers in the Northeast and Canada demonstrated the fragility of the grid and raised concerns about the ease with which terrorists might take advantage of that weakness.

The WSU researchers have been designing and developing GridStat, a communication system intended to improve the security, efficiency, and reliability of the power grid. Poor communication of operational data has been recognized as a major contributing factor to all recent blackouts. GridStat is designed to overcome this problem. It delivers status information to participants in the power grid in a much more flexible and robust manner than is possible today. GridStat is the first operational implementation of such a flexible system. It has been deployed for two years in a technology demonstration project using real power grid data from Avista Utilities.

"We have been working on identifying and solving the power grid's communication problems since 1999 and are excited to be taking GridStat to the next level with this award," Bakken said.

Bill Sanders, director of both the UIUC's Information Trust Institute and the new TCIP center, said "WSU has a long history of providing research advances for the electric power grid's communication system. Their excellent interdisciplinary

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"What Can I Produce?" Drives Education Efforts in the College of Engineering and Architecture

Ahmad Bayomy, a senior in bioengineering, has seen firsthand the necessity for a better wheelchair. His brother is a popular tenth grader who enjoys playing music, ping-pong, and juggling and zips around in his wheelchair at a blistering clip. Bayomy would like to develop a wheelchair that would allow wheelchair users, including his brother, to lift themselves to a height that society sometimes demands.

Bayomy's project is part of a unique senior design course, taught jointly between the College of Engineering and Architecture and the College of Business. The idea is that by bringing together students in business and engineering to develop a real product with commercial potential, the students will be better prepared for the 21st century world of engineering. Bringing engineering students together with business students in a common design project class emerged from ongoing work of academic leaders to improve engineering education and to draw students into this important field.

There is considerable debate about whether we are producing enough engineering graduates, and increasing concern about outsourcing and global competition, says **Denny Davis**, professor of bioengineering and codirector of the Engineering Education Research Center. Some argue that we are not producing enough engineers, while others say we're overproducing them.

What is clear is that the number of American students interested in engineering has remained flat in the past several years, and that engineering doesn't seem to have the appeal that it once had. Years ago, engineers were the guys in white shirts with their sleeves rolled up in Mission Control sending people to the moon. They designed the great dams of the West and made us healthier and wealthier than ever before. Their biggest contribution, says Bob Olsen, associate dean of undergraduate and student services, might have been sanitation engineering, saving millions of us from contagious diseases.

Wheelchair team from left to right: Nick Rapagnani, Sepideh Zolfaghari, and Ahmad Bayomy. Ben Eilers is not shown.

To today's youngsters, though, 'sanitation engineering' often elicits a unanimous "ew." Electrical and computer engineering don't fare much better. At the Intel Science Fair in 2004, for instance, *Time* magazine reported that 50,000 American students participated while six million Chinese students did. A recently released report by U.S. business leaders calls for the need to increase the number of students graduating in engineering and science as a way for American companies to stay competitive in a global marketplace. The report, *Tapping America's Potential: The Education for Innovation Initiative*, notes a decrease in American students who are interested in science, engineering, and math, and calls for improvements in curricula in these fields, particularly in primary and secondary grades. Once they get to the university, retaining students in engineering is also challenging. Nationally, fifty percent of students who start in engineering don't complete that degree.

The 21st Century Engineer

At the same time, Davis spent a year working with the Boeing Company, where he saw the increasing need for closer ties between business and engineering. In addition to getting more students interested in engineering, Davis and other faculty have heard increasing calls from industry leaders about the need for better prepared engineers and architects.

Employers are clear that they are looking for a certain kind of engineering graduate, says Davis, and that new engineering graduates must work to solve some big 21st century problems in areas such as energy, the environment, security, and bioengineering. In fact, employers often are going overseas to find the real problem solving skills they want.

"They would hire every one they could find with passion and abilities to innovate and solve problems, and business sense. And there are not many engineering graduates with the needed characteristics," says Davis.

Among the qualities they are looking for are passion, an attitude of innovation, good business sense, teamwork and communication skills, and curiosity. In today's global market, industry can't win with their manufacturing—whatever they produce can be made cheaper elsewhere. Rather, says Davis, they have to capitalize on intellectual property.

"The engineers who are going to succeed have to be able to communicate with other people," says Davis. "If we don't innovate, we're dead. The only way to compete is innovation."

The college is working to expand its existing strengths to attract more students to engineering, keep them, and better prepare them to be ready to work and innovate in the 21st century work place. In addition to having excellent technical skills that they already get in CEA, students will increasingly need the

real-life and bigger picture experiences to be successful. As you'll see in this special section, Innovating in Education, the college is ramping up efforts to provide real-world, meaningful projects for all of our students. These include a number of initiatives, from providing living-learning communities that encourage students to excel (p.19) to making computer programming projects more meaningful (p. 18), better training of graduate students and high school teachers for teaching (p. 17), and teaching skills for successful entrepreneurship (p. 17).

"Science Rocks"—Native American High Schoolers Take on Engineering and Science

Left to right: *Hajime Fuchida (WSU ChE masters student), Nixyàawii student Briana Spencer, and Professor Bernie Van Wie.*

With support from a National Science Foundation grant, **Bernie Van Wie**, a professor in the School of Chemical Engineering and Bioengineering, is showing high school students from underrepresented groups, including students at the Nixyàawii Charter High School near Pendleton, Oregon, how to build environmental nanosensors that detect heavy metals and other pollutants in lakes and streams surrounding Native lands. The students learn about fabricating sensors at the nanoscale, then build electrodes, coat them with a sensitive membrane, and use a simple hand-held voltmeter to measure concentrations in various water samples. By interacting with graduate students doing cutting edge research and by placing learning in a societal and environmental context, researchers hope to pique the interest of the students in how engineering, science, and a college education can help them solve important problems in their communities. And how do the students feel about the work? "Science rocks," said one student.

A Wheelchair that Will Make a Difference

Back in Davis' class, taught jointly with business professor Jerman Rose, the students were asked to produce a real product that will meet client needs and have business value.

Originally, Bayomy's team looked at developing advanced materials for use in wheelchairs, walkers, and other durable medical equipment. Working with their sponsors at St. Luke's Rehabilitation Center in Spokane, they discussed their clients' needs. They traveled to Spokane several times to meet with industry experts. In addition, they interviewed people who use wheelchairs, including Yousef, about their lifestyles and how they might benefit from a wheelchair that could rise in height.

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Students demonstrate their "Biopotential Educator" tool, designed to support neuroscience experiments in middle and high school classrooms. Similar to a Lego-style kit, the tool allows students to plug together circuitry to better understand muscle signals and other neuroscience concepts.

Meet Our 21st Century Innovators

To become the globally competitive engineers and architects of tomorrow, our students will need to be entrepreneurial and innovative, excellent communicators, team players, possess engineering management skills, be life-long learners, and be aware of the societal and global contexts in which they work. Here are a few students that fit the bill:

You Know More than Your Own Backyard

Andrew Whitaker, a junior in electrical engineering, is spending six months to a year in China to gain fluency in the language and to learn about the culture. He hopes to learn the language well enough to discuss technical engineering problems with colleagues around the world.

"Almost everyone in the world can speak two languages, except in America. I thought Chinese would be a good challenge and would be useful, considering its standing in the world."

Last year, Whitaker was named the outstanding first-year Chinese student. He recently was one of three students at WSU to receive the highly competitive David L. Boren Undergraduate Scholarship from the National Security Education Program, which provides students with $10,000 per semester for up to two semesters to live in China and study the language, culture, and issues related to global security. After graduation, he hopes to work for an engineering company, perhaps one that is expanding its operations in China. He would also consider working for the U.S. government and has recently begun considering the possibility of graduate school.

"He knows that's the future," says **Bob Olsen**, associate dean of undergraduate and student services.

The College of Engineering and Architecture has instituted several initiatives to encourage a global view and foreign language fluency. Students who complete two years of a foreign language and an approved study abroad program in the same language can now get general education credit that counts toward their engineering degree. The college is also working to institute certificates in Chinese and Japanese studies for CEA majors. The program will offer CEA majors a structured opportunity to incorporate East Asian studies into their curriculum.

Andrew Whitaker

You Solve Real Problems

Building a Better Treadle Pump—One Step at a Time

From *Washington State Magazine*

The first thing that Jeff Evans, a recent graduate in entrepreneurship, had to do when he started his senior project was to check a map and find the location of Malawi. Since then, he and engineering students **Travis Meyer, Kyle Kraemer,** and **Dan Good** have learned a lot more about this African country, the third poorest in the world, and they've developed a treadle pump that they hope will make a positive difference for people there. The group traveled to Malawi in March to test out their product. Working with Peter Wyeth, associate scientist in international programs, Trent Bunderson, associate director of International Programs who has lived in Malawi for the past 18 years, and faculty advisors **Denny Davis** and Jerman Rose, the team of students was part of a unique entrepreneurship class

Below Right: *Travis Meyer works on a treadle pump as Malawians look on, near Lilongwe, Malawi. Photo by Jeff Evans.*

Below Left: *Students, left to right: Raphael (unknown last name) of the Land Resource Center, Dan Good, Jeff Evans, Kyle Kraemer, and Travis Meyer, in front of two versions of the treadle pump.*

sponsored jointly by the College of Business and College of Engineering and Architecture. The class requires groups of students from different disciplines to design real products and develop a plan for an associated potential business venture.

The treadle pump that the farmers currently use in Malawi is basically a "Stairmaster that sucks up water," says Evans. Compared to using buckets to irrigate their crops, using the pump dramatically reduces irrigation time, allowing them to irrigate twice as much cropland. For poor farmers, a better irrigation system can mean more than just a little extra money. It can be the difference between malnutrition and being able to feed their families.

The students worked to develop a pump that can be made locally and that is also lightweight. They chose to build their pump primarily out of PVC, which is commonly available in Malawi. They worked with two nonprofit agencies, Total Land Care and the Land Resource Center, to test their pump and learn about the business culture—all factors that will determine whether their product will be feasible and useful.

Meyer has recently formed a nonprofit organization and hopes to raise funds to make the project viable. Davis and Rose are seeking funding to support a second team of students to develop and test the manufacturing and business plan in their joint course.

For more information: www.mtp4life.org or davis@wsu.edu.

You and Your Colleagues Come from Varied Backgrounds

Fausto Guillen

Quiet and polite, **Fausto Guillen** doesn't brag about his accomplishments. But the little that he says reveals his steely determination to achieve his and his family's dream.

Did you know?

According to statistics posted on the Latino/a Education Achievement Project (LEAP) Website, enrollment of Latino students in K-12 public schools in Washington state increased by 192 percent between 1986 and 2001, compared to 12 percent growth of non-Hispanic white students during the same period.

Guillen is the first in his family to graduate from either high school or college. His parents, Luis and Felipa, moved to the United States in 1993 with their 11 children with the dream of having their younger children attend college. Luis works in the apple orchards or travels to Alaska to work in fish processing. Felipa runs a daycare business. Fausto was 14 when he arrived in Manson, Washington. There he struggled his freshman year of high school as he worked to complete his academics and also master English.

At WSU he studied mechanical engineering. He was on the President's Honor Roll five times and graduated with a 3.37 GPA. He has received several scholarships, and was selected as one of four annual recipients of the Boeing Scholars Award. For Guillen, going to college was always a priority. His parents made the difficult move from Mexico so he and his siblings could become educated. Guillen was the first, but his siblings are now following in his footsteps. Guillen plans to work for a few years to pay off student loans and to learn more about options in the engineering field. Then he would like to return to school for a master's degree or doctorate.

Students Alex McDonald and Joshua Horky survey EWB's first project, the relocation design of a potable well system for a nonprofit group that works on the Yakama Indian Reservation.

You Care About More than Just Equations

Engineering Students Design Schools for Tsunami Victims

From *Washington State Magazine*

A group of six students in civil and environmental engineering worked with Washington State University's new student group of Engineers Without Borders and Asiana Education Development (AED), a Seattle-based nonprofit organization that runs schools for orphans in Sri Lanka, to design two schools that will be rebuilt in the region destroyed by the December 2004 tsunami. The organization is working to rebuild nine of its schools that were destroyed.

When built in the next year, the schools, which will cost a total of about $100,000, will hold approximately 720 students and contain about two dozen classrooms.

Student **Alex McDonald** started the WSU chapter of Engineers Without Borders two years ago. Hoping to find a way to be of service to the community, McDonald stumbled upon the organization, formed in 2000, that does community-based, sustainable engineering projects around the world. The WSU

group's initial project was the relocation design of a potable well system for a non-profit group that works on the Yakama Indian Reservation.

The school projects were submitted to the EWB's Puget Sound Professional Partners group in Seattle for further review and then they will be passed along to AED. The Seattle professional group also provided the students with initial site information and is managing the projects. Students who participated on the two projects included **Ben Hoppe, Robyn Lee, Dan Westley, John Farleigh, Joshua Horky,** and **Mathew Ellis.**

You Can Eat Spaghetti and Meatballs with an Important Client

Students participating in the Harold Frank Engineering Entrepreneurship Institute spend a week in "Communications Boot Camp," where they learn a variety of important business skills, from small talk and elevator speeches to formal presentations. That includes being comfortable eating at a business lunch. "When you come away (from a lunch), you don't want people to come away thinking you have excellent etiquette," says Stefany Unda, a WSU career counselor who, along with Janina Robbins, led an etiquette lunch for the students. "It's part of an overall goal. It's establishing a really strong foundation to build relationships that will later go into work related matters."

Researchers Work to Spark Engineering Passion

Graduate students Sita Dantuluri and Andy Wekin, along with faculty member Denny Davis, participate in CREAM. The program brings together graduate students from engineering and math who will work with a middle or high school teacher.

Washington State University researcher Denny Davis and colleagues have been awarded a three-year, $1.5 million grant from the National Science Foundation that seeks to improve student interest in math in secondary grades and better understand the factors affecting student interest in engineering and science careers.

Through the recently established Engineering Education Research Center, researchers in the College of Engineering and Architecture, College of Education, and College of Sciences will work with area high school math teachers to develop curriculum materials that illustrate exciting engineering applications that are relevant to students' lives. The hope is that the program, entitled Culturally-Relevant Engineering Applications in Mathematics or CREAM, will increase student interest in engineering as it increases math literacy. The program brings together graduate students from engineering and math who work in conjunction with a high

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EERC Takes the Lead to Build Engineering Pipeline

The need to attract more students to engineering, retain them, and best prepare them for a global marketplace has precipitated increased interest in addressing educational issues in engineering. As a result, the College of Education and the College of Engineering and Architecture established the Engineering Education Research Center in January 2005, one of about a dozen or so such centers nationwide. Many educators, especially in the pivotal primary and secondary education grades, are unfamiliar with engineering, and are tentative about discussing engineering in their classrooms. At the same time, many engineering faculty are not familiar with educational materials and methods that support the success and attraction of a diverse cross-section of students in engineering. The Center is facilitating research collaboration to address major challenges faced by university and K-12 educators, while also building a community of educators working together on these issues. Denny Davis, professor of bioengineering, and Gerald Maring, of the College of Education, are codirectors. "Our vision is to become the research engine that drives improvements in the engineering education pipeline," says Davis.

Architecture and Construction Management: School, Industry Cooperate to Craft Savvy Students

by Cynthia King,
reprinted from *WSU Today*

Walls are coming down in the architecture and construction management professions. Early communication and cooperation are tunneling through traditional barriers between the various disciplines that create our built environment. Designers are forging bridges to builders, contractors to owners, financers to those in charge of continuing building maintenance. And WSU is offering innovative programs to educate and prepare these types of forward-thinking professionals.

Cost and time savings resulted during various phases of design and construction of the Walt Disney Concert Hall in Los Angeles, above, because of cooperation among all parties involved, according to one of the industry presenters at the WSU symposium. (Photo courtesy of M.A. Mortenson Company)

This was the message delivered at the first Integrated Education Symposium sponsored by the WSU School of Architecture and Construction Management (ACM). The goal and even the process of the symposium series is all about integration and collaboration. Leaders from the architecture and construction industries

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Researchers Help Students Jump the Computer Science Hurdle

With support from the Office of Undergraduate Education and the College of Engineering and Architecture, a group of faculty members in computer science is working to improve student success in introductory computer science courses, an area where many students traditionally struggle.

To solve a wide disparity in abilities, the faculty members are implementing a placement exam that will separate students. Those who have no programming experience will take a more basic course that prepares them for the introductory courses.

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Computer scientists are using ideas from architecture to help their students understand important concepts.

Teachers Construct Their Engineering Toolkit

Industry and government leaders are realizing the importance of attracting bright students to engineering in order to stay competitive in a global marketplace. But students often remain unaware of engineering in junior high school and high school because their teachers aren't always familiar with the field. Researchers in the School of Chemical Engineering and Bioengineering have been running a teacher training program called SWEET (Summer at WSU, Engineering Experiences for Teachers) for the past several years that allows 12 junior high school and high school science teachers to spend six weeks working with engineering faculty in laboratories learning about engineering, hands-on research, and developing a teaching module based on their experience. This year's group of teachers learned about nano-scale devices, environmental sensors, protein separation, biomechanics, or hydrogen fuel cells.


Shane Brown *Kip Findley*

If you have an anchor in a boat on a lake, and you throw it overboard so that it sinks, will the lake level go up, down, or stay the same?

Shane Brown, clinical assistant professor in the Department of Civil and Environmental Engineering, and **Kip Findley,** undergraduate research professor in the School of Mechanical and Materials Engineering, want engineering students to be able to answer questions like these. Brown and Findley are working with other faculty members in their departments to come up with new ways of teaching engineering that will help students develop a better and deeper understanding of these concepts.

Basing work on research that was done to improve physics education several years ago, Brown and Findley are working to develop teaching modules for engineering that are easy for faculty to implement and will help students develop a better understanding of engineering concepts.

"These problems make the student realize they don't understand the concept."
—Shane Brown

In physics, researchers found that while students could plug numbers into equations, they often had a faulty understanding of the concept underlying the equation. Researchers developed assessments to gauge what students were actually learning and developed teaching modules that focused on getting students to actually learn the concept and understand their misconceptions.

For instance, students are asked about a father who is skating with his daughter. When the father and daughter push off of each other, students often think that the father exerts greater force. Correct answer: Forces are equal because *for every action, there is an equal and opposite reaction*.

"These problems make the student realize they don't understand the concept," Brown says.

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Students Build a Community for Engineering Success

The College of Engineering and Architecture has recently established a "living-learning" community in Gannon-Goldsworthy Residence Hall specifically for freshmen interested in engineering. Living-learning communities, where students with similar academic interests room together, have been shown to increase student retention by increasing student social capital, or student networks, with engineering students and faculty. The more students have a social tie to a community, the more successful they are, says **Shane Brown,** clinical assistant professor of civil and environmental engineering. Supported by the Office of Undergraduate Education, Brown and his colleagues this year will implement a plan in which faculty, graduate students, and

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Students Find World of Research through REU Program

The College of Engineering and Architecture and the Graduate School are working to increase interest among faculty members throughout the college to offer research experiences for undergraduates.

"Most undergraduates don't know what doing research is like," said **Dave Bahr**, associate professor in the School of Mechanical and Materials Engineering who has headed up the REU program for the past seven years. "We expect them to make decisions about their careers, but (when they graduate), they haven't had experience in research or if they do, it's only in their very last semester."

Students who participate in research experiences are more likely to go on to graduate school. For instance, since the School of Mechanical and Materials Engineering's Characterization of Advanced Materials program started, 80 percent of students have gone on to graduate school, 49 percent of whom were women or minority students. This summer's 13 students came from all over the country to participate, and the program recently received a three-year renewal of more than $200,000. It involves professors and interdisciplinary projects from five departments, including chemistry and materials, civil, mechanical, and chemical engineering. The MME program also worked with the Department of Civil and Environmental Engineering's Laboratory for Atmospheric Research undergraduate research program and held joint events, including an end-of-the summer poster session.

The REU program helps students learn what the world of academia and research will really be like. Unlike in classrooms or in their labs, the students who do research learn that there is no right or easy answer.

2006 REU students with faculty members David Field and Kip Findley at left.

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Researchers Team Up to Improve Math Education in Engineering

A team of Washington State University researchers in mathematics and engineering programs, including **Sinisa Mesarovic** and **Hussein Zbib,** recently received $1 million of a $2.2 million grant from the Department of Energy to improve mathematics education for engineers and to study the mathematics of multiscale problems. The group, led by Alexander Panchenko, assistant professor of mathematics, includes researchers from the Pacific Northwest National Laboratories and Oregon State University,

Traditional engineering has been based on using coarse mathematical models to solve physical problems, says Mesarovic. That worked well when people were building cars, airplanes, buildings, and bridges. But as engineers get into micro-electronics and nanoscale problems, they need to use more detailed models that bridge length and time scales, called multi-scale models. These complex models can be applied to a variety of scientific and engineering problems, from power grid security to climate change. The problem is that engineers are often poorly prepared in the mathematics necessary to understand these models.

Mesarovic sees students in his upper-level engineering class who are shocked when they have to use mathematics. They expect that once they survive their entry-level math classes that they never need to use it.

"Many students don't know what math is for," he says. "They think it's a skill for its own sake, like knitting or riding a bike, instead of being a fundamental way of looking at physical reality. They don't know that engineering begins and ends with math."

Mesarovic and Panchenko hope to bring a wide range of mathematical tools that are not part of the traditional curriculum to engineering students. For math students, they hope to give them a better idea of the relevant physical problems that they might address.

As part of the grant, the researchers will be reforming graduate curriculum and developing a graduate course in multiscale mathematics, computing, and engineering. They also will develop a seminar series, textbooks, and a four-week summer school in multiscale mathematics. This spring, they held a workshop on multiscale modeling of materials at the University of Puget Sound in Tacoma.

"What Can I Produce?"

Continued from page 14

The students found that there have been a lot of advances in frame materials and seat cushions for wheelchairs. Powered wheelchairs have the functionality that many users desire. Unfortunately, they're too expensive for most people. The user is limited by what insurance will pay for and by what's approved by public and private insurance. Oftentimes, that's a manual wheelchair. "The crazy challenge," says Bayomy, "is getting insurance coverage."

When they investigated a height-adjusting manual wheelchair, they found that only two companies have designed them. One was a cumbersome 80 pounds. The other wheelchair raises the user into a standing position. Bayomy's group has worked to develop a light-weight wheelchair that will lift the user, keeping him or her seated.

In his designs, Bayomy has kept in mind the struggles that his brother might have in simple tasks, like reaching for a door knob or making his way through an entrance. The students also talked to medical supply providers, disability practitioners, and other professionals to make sure their wheelchair will meet industry standards.

"On a personal level, Yousef has inspired me in a number of ways," says Bayomy. "As a user, he provided a lot of ideas. Also, having seen him over the years, I am more able to think in terms of the needs and desires of a person using a wheelchair."

"Three credits is misleading," says Bayomy. "This project can be a full-time job. But," he adds, "we're all passionate."

Because the class includes students from business and all fields of engineering, the group came together with different talents and different backgrounds. The diverse team had a technical side, but they also had to have a viable business plan. Bayomy had to become familiar with financial projections and markets.

"Every engineer should have a business background. This has given me a good foundation," he says.

Bayomy was on a team of undergraduates, including College of Business senior Nick Rapagnani and bioengineering senior **Sepideh Zolfaghari**, that took fourth in the national Spirit of Entrepreneurship and Enterprise Development (S.E.E.D.) Collegiate Entrepreneurship Venture Forum in Santa Barbara, California, this spring. (A fourth member of their original team, **Ben Eilers**, a mechanical engineering student, graduated in December and did not attend the California competition.) The group became a limited liability company, or LLC, in April and is working on the difficult FDA approval process for their wheelchair.

What Can I Produce?

When Davis teaches a class, students most often ask what they have to do to get a good grade. Davis and other faculty in the College of Engineering and Architecture want to shift the paradigm, so that someday students will walk into their introductory classes and think about a different definition of success: "What can I produce that has real value?"

Architecture

Continued from page 18

are volunteering their time to participate with the school in the symposium. Their mantra is that their industry—and, indeed, our culture as a whole—is less confined by traditional boundaries and must form new alliances and mindsets in order to succeed and thrive.

Building on strength

Happily, ACM is positioned well to enhance such collaboration.

"Our school is one of the few to have both the disciplines of architecture and construction management," said **Greg Kessler,** associate professor and director of ACM. "We have the unique opportunity to use that as a strength and to build on the interdisciplinary aspects."

The symposium series is one way the school is building on that strength. Students from all the school's disciplines participated in a day of presentations from architecture and construction management practitioners. While the semester's first symposium focused on an overview of where the industry is headed, subsequent spring gatherings offered specifics on integrating design and communication and on collaborative delivery systems. The three-semester symposium is providing hands-on instruction in the integrated approach for students during the fall, with opportunities in spring 2007 to work with industry leaders who practice such collaboration.

Anchor

Continued from page 19

The modules that the researchers develop will be in mechanics of materials, dynamics, and statics. There, they hope to impact the greatest number of engineering students and improve student retention.

And, in case you're still wondering, the lake level goes down. When the anchor goes overboard, it displaces less water than when it is in the boat. The volume of the water displaced when the anchor is in the boat is greater than the volume of water displaced by the anchor itself because the anchor is denser than water and rests on the bottom of the lake.

Computer Science

Continued from page 18

In the basic course, **Chris Hundhausen**, assistant professor in the School of Electrical Engineering and Computer Science, is borrowing teaching methods from architecture in hopes of making students more successful. He received a prestigious National Science Foundation Career Development award to develop a studio-based approach to teaching computer algorithms.

In architecture, students are given a problem. They then get together in a studio space, where they produce drawings and then build models of their project. At the same time, they actively engage with other students and faculty during the design process. The students then participate in a "design crit," in which students present their designs for feedback and discussion.

In computer science, there aren't models or scale drawings. Hundhausen has worked to develop tools that will help students better visualize the algorithms that they are working to develop. Using a software program that he developed, called ALVIS, students can construct their own visual solutions to an algorithm. As in architecture, Hundhausen works to emphasize a collaborative relationship among the students—they are required to develop their algorithms in pairs, rather than alone. He has also worked to have students use their visual solutions as a means of talking with peers and faculty about their algorithm.

Hundhausen hopes that the new methods used in the remedial class will help students have a better grasp of programming when they get to the first introductory class in the computer science major.

Meanwhile, **Kelly Fitz**, assistant professor in the School of Electrical Engineering and Computer Science, has begun working with the other computer science faculty to implement a mentoring system. Understanding each assignment and resulting computer program is essential, says Fitz, because the programs build on each other throughout the courses. Therefore, when students fail to complete their first assignment, they are more likely to keep failing. Furthermore, students can spend many hours figuring out that they haven't succeeded. They also can turn in an assignment, thinking they have been successful when they are not. A culture that has often encouraged students to pull all-nighters exacerbates the problem, he says. When the students are rushed and sleep-deprived, they aren't able to learn or get help through the assignment.

Fitz is implementing a process where students get checked for progress on their assignments. Students meet regularly with a senior student in computer science who has successfully completed the course. The older student can notice when the student has done something wrong or is not on schedule.

Researchers

Continued from page 17

school teacher in classrooms for an entire school year. The researchers hope that the students will leave high school more math ready, but also thinking about engineering as a career choice, says Davis.

"Math teachers don't have the time to develop these curriculum materials," says Davis. "We need to work with them."

Working with diverse groups of teachers and students from Pullman, Pasco, and Omak high schools, the researchers hope to encourage involvement in engineering and math from underrepresented groups of students. Giving math and engineering graduate students exposure to the K-12 school system will also perhaps influence some to a future career in secondary or higher education.

In addition to Davis, the project team for the grant includes: Gerald Maring, codirector of the Engineering Education Research Center, Sandra Cooper (mathematics education), Guy Westhoff (teaching and learning technology), Jennifer Beller (assessment and evaluation), and Janae Landis (mathematics engineering science achievement, or MESA, program).

Engineering Success

Continued from page 19

undergraduates will meet regularly with new students at the residence halls. These informal sessions will provide opportunities for interaction as well as assistance with classes. The efforts will be assessed to see if students show greater success in their classes. "Research shows that those students with high social capital are far more likely to be successful and to be retained," said Brown.

REU Program

Continued from page 20

"They gain ownership in an individual project and are given freedom to explore tangents," says **Kip Findley**, who serves as the codirector of the program and as an undergraduate research professor.

"Some (of the students) like it, and some don't," added Bahr, "but it helps them better pick careers that are right for them."

Researchers can fairly easily add a supplement to their grants that allows for undergraduate research. Bahr is working to streamline and coordinate that process for faculty so that more undergraduates have the opportunity to participate.

Continued from page 12

research, involving both computer science and power engineering faculty, was instrumental in our team's obtaining funding for this project."

The funding will support further development of GridStat concepts and integration with technologies developed by other collaborators. WSU research will extend trust management concepts to provide more dynamic and adaptable access control for grid communications.

Floyd and Judy Rogers Receive the Alumni Achievement Award

By Casey Hanson

Floyd ('73 B.S. E.E., '74 B.S. C.S.) and Judy (Lee Huie) ('74 B.S. C.S.) Rogers were presented with the Washington State University Alumni Achievement Award last fall in Seattle. The event honored the Rogers, who have made extraordinary contributions to the School of Electrical Engineering and Computer Science by creating two Huie-Rogers Endowed Chairs in Computer Science. These chairs were established out of their desire to impact the economy of Washington by advancing software engineering research that have applications in all facets of private and public sector advancement.

Dr. Behrooz Shirazi, director of the School of Electrical Engineering and Computer Science, with Judy and Floyd Rogers in Seattle at the reception in their honor.

WSU Awarded HP Technology Grant

By Casey Hanson

Washington State University has been selected as one of 40 colleges and universities nationwide to receive the 2006 HP Technology for Teaching grant, designed to transform and improve learning in the classroom through innovative uses of technology. Awarded to the WSU School of Electrical Engineering and Computer Science, the grant will provide an award package of HP products and a faculty stipend valued at more than $69,000.

Grant projects through this program will impact more than 4,000 students during the 2006–2007 academic year. Each of the HP Technology for Teaching grant recipients will use HP wireless Tablet PC technology to enhance learning in engineering, math, science, computer science, or business courses.

Chris Hundhausen, WSU assistant professor, was awarded the grant in response to a proposal entitled "Using HP Mobile Technology to Support a Human-Computer Interaction Design Studio," which was inspired by the design studio commonly used in architecture education. The project will explore a "studio based" approach to teaching an undergraduate course on human-computer interaction design. In addition to a weekly lecture, the course will revolve around a weekly 150-minute "design studio" that emphasizes conceptual user interface design activities.

WSU Robotics Club Takes Top Honors

The WSU Robotics Club took home top honors in the Seattle Robotics Society's Robothon held at Seattle Center last fall. Teams from throughout the Northwest, including private groups and student teams, participated in the competition. The WSU club brought home the Judges' Choice award for "Eddie," the autonomous robot that the team designed and built during the last two years.

The autonomous robots have to be able to negotiate a task, making decisions along the way. No remote control is used, so that along with its mechanical maneuverability, the robot's computer and electrical systems become critical to success. The challenges of making an intelligent robot are numerous and of considerable interest in the robotics community; at the Seattle event only one robot successfully completed the obstacle course.

Eddie is a wheeled vehicle that measures about three feet tall and weighs less

than 50 pounds. A series of circular touch sensors stare out from its top, looking like giant eyes. A camera sits on top of the sensors. Information from the sensors, the camera, and sonar are collected in Eddie's computer. With the use of an internal compass, the robot's computer then gives instructions to two steering controls and six wheel motor controls that direct the robot's movements.

The robot project allowed the students to apply the skills they learn in class to a real project and to the physical world, said **Brent Allen,** president of the club and an electrical engineering major. Allen says he may go on to get involved in the robotics field, but he adds, "most of the skills we learned are applicable to a lot of engineering." Besides Allen, officers in the club during 2005–2006 were **Sean Collison,** treasurer, **Nick Juliano,** vice president in charge of mechanical engineering, and **Dan Strother,** vice president in charge of electrical engineering. This club is supported by and includes students from both the School of Mechanical and Materials Engineering and from the School of Electrical Engineering and Computer Science.

Schweitzer Donates Equipment to Protect University System

By Casey Hanson, WSU College of Engineering and Architecture

Washington State University is upgrading the electrical distribution system on its Pullman campus, thanks to the donation of state-of-the-art digital protective relays, meters, and communication devices from Schweitzer Engineering Laboratories, Inc. (SEL). The donated equipment, worth more than $178,000, includes six distribution protection relays, 44 overcurrent/reclosing relays, 60 revenue metering systems, eight communication processors, and six system computing platforms. The devices are being installed in the WSU Power Plant and the East Campus Substation. The installation benefits WSU by replacing old protective relays, some of which are more than 44 years old. The upgrade will also replace meters with new technology that will enable energy studies and usages for each building. SEL will provide engineering analysis and technical support. "These upgrades will reduce safety hazards for WSU staff who work on these systems, improve the reliability of our power distribution systems, and significantly enhance our ability to diagnose and resolve power disruptions that may occur," said Lawrence Davis, associate vice president for WSU Facilities Operations.

SEL president and founder **Ed Schweitzer** said donating the equipment to upgrade WSU's Power Plant and East Campus Substation created a unique opportunity for both parties.

"It shows the high level of cooperation between WSU and SEL and will reap many benefits for both organizations," he said. Schweitzer taught electrical engineering courses at WSU before founding SEL and said he still gets excited about teaching and creating hands-on learning environments for students.

The donation provides an opportunity for students to assist in the programming and installation of SEL equipment. Senior electrical engineering students studying power distribution are using the equipment in their design projects, gaining knowledge and experience by developing the required diagrams and programming the digital protective relays. WSU instructors will continue to incorporate the equipment into senior design projects for several semesters.

SEL provided two courses, taught at SEL University for one week, for three WSU Facilities Operations engineers. The courses gave the engineers an introductory overview of the relay equipment used in the installation and its theory of operation and application.

WSU is working with SEL on planning a ribbon-cutting ceremony to be held once installation is complete, which is expected to be this fall or early next spring.

Bose Named 2006 Regents Professor

Anjan Bose, distinguished professor of power engineering, was one of five Washington State University faculty members to earn promotion to Regents Professor, an honor that recognizes sustained accomplishment in teaching, scholarship, and public service. Bose, who is a former dean of the WSU College of Engineering and Architecture, came to WSU in 1993. A member of the U.S. National Academy of Engineering, he is an internationally recognized technical leader and researcher in power grid control.

Hussein Zbib, director, School of Mechanical and Materials Engineering

Researchers Determine Star Material of Idaho State Gem

Researchers from the School of Mechanical and Materials Engineering have for the first time determined the cause of the "star" in Idaho's famous star garnet, the official state gem of the Gem State. Idaho is one of only three places in the world that are known to have star garnets.

While simple curiosity initialy instigated the research, the work promises to be of interest, particularly in high technology industries, says **Grant Norton,** professor in the School of Mechanical and Materials Engineering and associate dean of research and graduate programs for the College of Engineering and Architecture. Crystals with the garnet structure are used in solid-state lasers and are being studied for use in radiation detectors.

Norton and a colleague first wondered about the stars' origins after walking into a local jewelers a few years ago. While there was suspicion of their origin, nobody really knew what caused them.

Using donated garnets from the jewelers, Norton and **Maxime Guinel,** a graduate student in materials science, used transmission electron microscopy to determine conclusively for the first time that the star is caused by inclusions of rutile, a mineral composed of titanium oxide, in the garnet. The star can either contain six rays or four, based on the orientation of the tiny needles of rutile. They also determined the microstructural characteristics that affect the quality of the star. Their results were published in the *Journal of Materials Science.*

Kennedy Named to Board of ASM International Materials Society

Molly Kennedy, a graduate student in the School of Mechanical and Materials Engineering, has been named as one of three student representatives nationwide to serve on the ASM International Board of Trustees. ASM is the largest materials society in the United States. She participated in the ASM's annual meeting in Seattle in May and will serve on the board for a one-year term.

Originally from Olympia, Kennedy received her undergraduate degree in materials science and engineering at WSU. During her undergraduate years, she was active in the student chapter of American Society of Materials/The Materials Society (AMS/TMS). The chapter won several excellence awards.

She participated in a Research Experience for Undergraduates before earning her master's degree in materials science and engineering, studying residual stress in thin films. She is now working on a doctorate. As a graduate student, she is studying mechanical properties and failure in thin films. She remains active in the student chapter of the Materials Research Society. In 2005, she was named the outstanding teaching assistant in the School of Mechanical and Materials Engineering. She has also received the GPSA Teaching Assistant Excellence Award and the President's Leadership Award, which recognizes outstanding leadership and service to the WSU campus and community. After completing her doctorate Kennedy hopes to work as a postdoctoral fellow in a national laboratory or become a university professor.

"Molly's selection to the board is recognition of her dedication to the field and her professionalism," said David Bahr, Kennedy's advisor and an associate professor in the School of Mechanical and Materials Engineering. "We're very proud of her, and we're confident that she will provide excellent contributions from a student perspective for the board."

Poetry Contest Brings out Creative Engineers

The WSU student chapter of the Materials Research Society held a poetry contest to celebrate materials in engineering. "For an engineering club to hold a poetry contest is perfect," said **David Field,** advisor to the student club and associate professor in the School of Mechanical and Materials Engineering. "It's sort of like an English club holding a bridge-building competition." He adds: "It seems like it doesn't really fit, but it's something that is a lot of fun for us, and we have some tremendously creative people." Looking for ways to provide a little stress relief for engineering students, several students in the club

decided to organize the poetry contest after learning about another university's similar event. Last year's poetry contest, the club's first, was recognized in the *MRS Bulletin*, the Materials Research Society's newsletter, along with some of the winning entries.

Winner of the "Engineering Homework" category, by Annette Cavalieri, undergraduate program coordinator:

Headache from homework
Picture graduation day
Math, more math, oh my

Student helps Ensure Diamonds Stay Forever

A Washington State University graduate student hopes his undergraduate research project results in a few less broken hearts. In the project, sponsored by Pounders Jewelers and Hi-Rel Laboratories in Spokane, **Colin Merriman** worked with **David Bahr** and **Grant Norton,** professors in the School of Mechanical and Materials Engineering, to better understand the problem of losing diamonds out of ring settings. Every year, millions of dollars worth of diamonds or fine gems are lost when they fall out of their gold ring settings because of corrosion at the microscopic level of the material holding them in place. The gold is particularly susceptible to corrosion when it is bent to hold the gemstone. Merriman studied the corrosion resistance of three types of 18K gold, immersing the materials in a variety of liquids that people commonly use, including a cleaning solution, pool water, and hot tub water. He found that, contrary to popular belief, the higher karat gold alloys do corrode, suffering from intergranular failure. Merriman also found that a new type of white gold, made up of palladium and gold, was far more corrosion-resistant than the traditional nickel white gold and yellow gold alloys. He recently published a paper on the work in *Gold Bulletin,* the trade journal of the World Gold Council.

BRIEFS:

The **WSU Student Chapter of Material Advantage** received an award and a $250 prize for the Most Creative Recruitment Strategies during the organization's March Membership Challenge. One of their activities was a "Materials Olympics," where students froze racquetballs with liquid nitrogen and raced down the hallways, balancing them on plastic spoons. The first, second, and third place finishers received gold, silver, and bronze medals (anodized keychains). The gold and bronze medals were created by sputtering surfaces of the medals. Liquid nitrogen ice cream was also served.

Professors **David Bahr** and **Grant Norton** were among 300 scientists and engineers who traveled to Washington, D.C., in March to meet with congressional representatives. They were joined by **Molly Kennedy,** a graduate student in the School of Mechanical and Materials Engineering. The trip was sponsored by the Federation of Materials Societies. During the trip, Bahr, Norton, and Kennedy met with legislators, including Cathy McMorris, Patty Murray, and staff from Maria Cantwell's and Brian Baird's offices. The researchers asked the legislators to support the American Competitive Initiative, which is meant to improve engineering education and to interest more students in the field. They also asked the legislators to support research in critical areas, such as energy. "I hope that we helped to raise the profile of critical issues and show our legislators how they relate specifically to their districts," said Norton. "In engineering, we haven't always been successful at being advocates for ourselves in terms of the importance of this field. I hope we helped to raise awareness to make the case for technology."

Scott Whalen was recently awarded a best presentation award at the 2005 ASME International Mechanical Engineering Congress and Exposition in Orlando, Florida. The paper, "Characterization of a Liquid-Vapor Phase-Change Actuator," by S.A. Whalen, C.D. Richards, D.F. Bahr, and R.F. Richards, was the first best presentation award ever granted from the MEMS division, and the only one selected from over 100 presentations and technical papers. Whalen, who received his doctorate in 2004 in mechanical engineering, is a member of the technical staff at Sandia National Laboratories in Albuquerque, New Mexico. The presentation was based on the work of his doctoral dissertation, "Cycle work from a MEMS heat engine and characterization of the liquid-vapor phase change actuation mechanism" as part of the P3 Microengine Project at Washington State University.

Ready, Set, Launch

Engineering students took aim with tennis ball launchers in the basement of the Engineering Teaching and Research Laboratory. As part of Mechanical Engineering 316, a systems design class, the students competed to see how accurately they could shoot tennis balls into a garbage can. They were scored based on how many of their tennis balls landed inside a can that was 10 to 20 feet from their launcher. The project aimed to teach students about applying engineering designs. The students were given a vague assignment, said **Lloyd Smith,** associate professor in the School of Mechanical and Materials Engineering. The design process then required the students to clarify the project and come up with customer needs and specifications. After that, the students evaluated concepts, came up with a preferred design, and built it. The students were graded on a report on the design and a presentation. The final part of their grade was the competition.

College of Engineering and Architecture:

A Look at the Numbers

Enrollment by campus

Campus	Fall 2004 Undergrad	Graduate	Total	Fall 2005 Undergrad	Graduate	Total
Spokane	32	49	81	43	35	78
Vancouver	49	9	58	30	5	35
Tri-Cities	90	50	140	76	47	123
Pullman	2141	373	2514	2254	341	2595
EUS/DDP	2	48	50	3	78	81
Total	**2314**	**529**	**2843**	**2406**	**506**	**2912**

Total CEA degrees granted in FY 2006

411 bachelor's, **120** master's, **32** doctorates

Compared to FY 2005

392 bachelor's, **113** master's, **30** doctorates

FY2006 Permanent Faculty

126, including branch campuses.

New Hires

David Gunderson, Associate Professor, Architecture and Construction Management
Skender Luarasi, Assistant Professor, Architecture and Construction Management
Jason Peschel, Assistant Professor, Architecture and Construction Management
Nehal Abu-Lail, Assistant Professor, Chemical Engineering and Bioengineering
Haluk Beyenal, Assistant Professor, Chemical Engineering and Bioengineering
Lawrence Brewer, Assistant Professor, Chemical Engineering and Bioengineering
Wenji Dong, Assistant Professor, Chemical Engineering and Bioengineering
Mohamed ElGawady, Assistant Professor, Civil and Environmental Engineering
Thomas Jobson, Associate Professor, Civil and Environmental Engineering
Pizhong Qiao, Associate Professor, Civil and Environmental Engineering
Jeremy Rentz, Assistant Professor, Civil and Environmental Engineering
Diane Cook, Professor, Electrical Engineering and Computer Science
Lawrence Holder, Professor, Electrical Engineering and Computer Science
Anantharaman Kalyanaraman, Assistant Professor, Electrical Engineering and Computer Science
Alireza Aghili, Assistant Professor, Engineering and Computer Science, Vancouver
Jeongmin Ahn, Assistant Professor, Mechanical and Materials Engineering
Konstantin Matveev, Assistant Professor, Mechanical and Materials Engineering
Sergey Medyanik, Assistant Professor, Mechanical and Materials Engineering
Cara Poor, Assistant Professor, Civil and Environmental Engineering

Retirement

Michael Owen, School of Architecture and Construction Management
Reid Miller, School of Chemical Engineering and Bioengineering
Halvor Westberg, Department of Civil and Environmental Engineering
Timothy Troutt, School of Mechanical and Materials Engineering

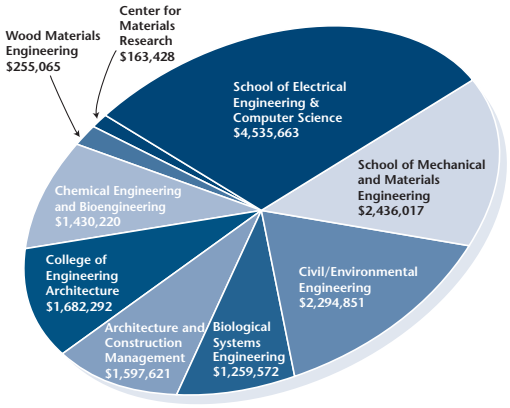
Of the 16,769 alumni for whom the college has addresses, a total of 3,068, or about 18.3 percent, gave to WSU in FY 2006.

CEA's private endowment grew to $34.6 million in June 2006, from $28.1 million in June 2005.

Income from the endowed funds, plus gifts, provided scholarships totaling $617,378 to 802 graduate and undergraduate students.

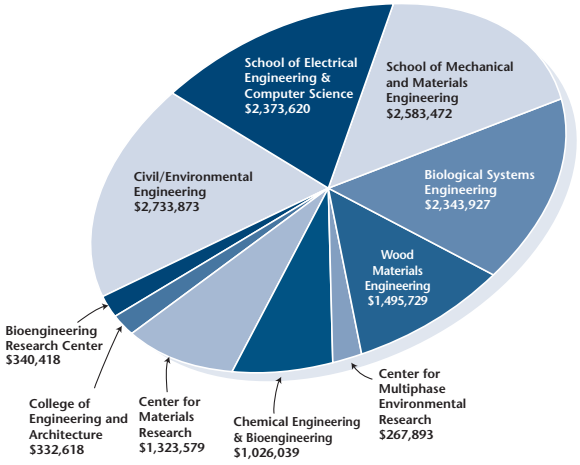
State Allocations to Departments/Units, FY 2006

Total $15,654,729
(FY05 Total: $14.7 million)



Grant Expenditures by Department/Unit, FY 2006*

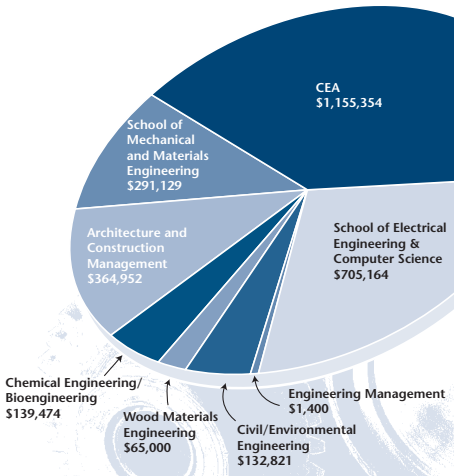
Total $14,821,168
(FY05 Total: $17.47 Million)



*Fiscal year not closed

Private Gifts by Department/Unit, FY 2006

Total $4.19 million*
(Total in FY05: $6.58 million) *
* Private grants and new pledges to departments totaling $1.34 million were not included in department gift totals.



The College of Engineering and Architecture Honor Roll of Donors

In appreciation for all gifts to the College from June 30, 2005, to July 1, 2006.

We are proud to recognize alumni, friends, corporate, and foundation partners whose generosity ensures that the College will maintain excellence in our undergraduate education and graduate research programs. Our staff has made every effort to ensure the accuracy of this Honor Roll. If you discover an error or omission, please call the Office of Development and External Relations at 509-335-3342 to report the correction. These lists include those who made gifts of $100 or more between June 30, 2005, and July 1, 2006.

The Laureates of Washington State University

$1 million and above in cumulative gifts

Alias Wavefront
Battelle
Boeing Company
Harold Curtis
Harold '48 & Diana Frank
Charles Harrison '44 & Margit Harrison '40
Hewlett Packard Company
Warren Lindsey '75
Raymond '58 & Beverly Lorenz
Louisiana-Pacific Corporation
Mentor Graphics Foundation
Microsoft Corporation
Floyd '73 & Judy (Huie) '74 Rogers
William '17 & Lilian Saupe
Melvin '28 & Ruth Smith
Tektronix, Incorporated
W. M. Keck Foundation
Weyerhaeuser Company Foundation

The Benefactors of Washington State University

$100,000 or more in cumulative gifts

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Alcoa Foundation
Douglas '73 & Loretta (Salvadalena) '72 Allred
Analogy, Incorporated
Warren '66 & Jackie (Disbro) Anderson
George '41 & Ruth '42 Andrews
ARCO Products Company
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Avant! Corporation
Avista Corporation
Bison Systems
William '23 & Evelyn Bugge
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Callison Architecture
Carl M. Hansen Foundation
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Celia P. Michel Trust
Celotex Research & Development
Raymond '49 & Anne '51 Chase
Cisco Systems, Incorporated
Clint '87 & Fiona Cole
Crane/Eldec Corporation
Roger Ray & Anastasia Czerniakiewicz
Waite '66 & Patricia Dalrymple
Neal '46 & Joan Degerstrom
DeVlieg Foundation
Diab-SDS
Digital Equipment Corporation
Eastern Washington Masonry Promotion Group
Eve Rockwell Little Trust
Manson Fisher '21
Flow International Corporation
Fluke Corporation
Gary '68 & Sandra (Jones) '69 Fryer
General Telephone Northwest
James '41 & Theresa Gibson '41
Eugene Gochnauer '34
James '47 & Carol (Wenzel) Graybill
Hamilton Sundstrand
George '42 & Lucille Hardgrove
Honeywell, Incorporated
ICF Kaiser Hanford Company
Intel Foundation
Key Tronic Corporation
Gale Kicha
Kiewit Companies Foundation
Wallis '68 & Marilyn (Vinup) '64 Kimble
Kenneth King '29
Kresge Foundation
Lewis '88 & Sarah (Modisett) '89 Lee
Wenzel & Julanne Leff
Herman Lindholm '37
Jane Logan
Longview Fibre Company
Ralph '13 & Gladys '14 Lowry
Lucent Technologies, Inc
M.J. Murdock Charitable Trust
Gary Manchester '65
Lyle '34 & Ruth Marque
Cornell '38 & Louise Meek
Henry '24 & Celia '24 Michel
Jack & Alice Morris
Lacey '26 & Margaret Murrow
Ralph '53 & Phyllis (Moser) Nansen
Uriah '59 & Janice Orr
PACCAR Foundation
PacifiCorp
R. Chester & Muriel '40 Peach
Poe Construction, Incorporated
Puget Sound Energy
Jeffrey & Patricia (Mcginnis) '78 Raikes
Roger Ray '72
O. H. '33 & Mary Reaugh
Ruth Verne Reaugh
William '63 & Linda Renn
John '48 & Amy (Allen) '54 Roberson
Ellen Roberts '73
June Roberts
Ronald McDonald House Charities of Spokane
Loyd & Carol Rummer
Schweitzer Engineering Laboratories, Incorporated
Edmund '77 & Beatriz Schweitzer
SGI
Silvaco International
Laurence Smith '58
Mary Jane Smith '58
Society of Manufacturing Engineers Education Foundation
Harry Stern & LaVonne Stern
Anna Straub
Eric '85 & Kathryn (Simon) '86 Straub
Mary Suksdorf
Eugene '69 & Linda Voiland
Watkins-Johnson Company
Wayne and Gladys Valley Foundation
Western Wireless Corporation
Westinghouse Electric Corporation
John '39 & Beulah (Wadham) '40 Wills

Platinum Associates

$10,000 or more in annual gifts

Douglas '73 & Loretta (Salvadalena) '72 Allred
AREVA T&D Company
Avista Corporation
AWR Engineering Group
Boeing Company
Carl M. Hansen Foundation
Scott '72 & Linda Carson
DeVlieg Foundation
Edgewood Log Structures
Elk Group, LP
Benjamin '62 & Nancy (Thomas) '61 Ellison
David '63 & Sara Ensor
Jean Ferguson '46
Fidelity Charitable Gift Fund
FMC Food Tech, Incorporated
Harold '48 & Diana Frank
Gary '68 & Sandra (Jones) '69 Fryer
Genie Industries
James '47 & Carol (Wenzel) Graybill
Steven '80 & Karen (Ramerman) '82 Grote
Hamilton Sundstrand
Terrence '61 & Eileen Heng
Hewlett Packard Company
ISTE
Brian '90 & Smaranda Lieuallen
Raymond '58 & Beverly Lorenz
Clifford '47 & Betty McNeal
Microsoft Corporation
Miller/Hull Partnership
MulvannyG2 Architecture
Claude '49 & Patricia (Viancour) Munsell
Ralph '53 & Phyllis (Moser) Nansen
James '58 & Janet Pope
Raintree Foundation
Phillip Ricker '82 & Marion Shimoda
John '48 & Amy (Allen) '54 Roberson
Ellen Roberts '73
Floyd '73 & Judy (Huie) '74 Rogers
Schweitzer Engineering Laboratories, Incorporated
Edmund '77 & Beatriz Schweitzer
Skanska USA Building, Incorporated
Strandex Corporation
Trex Company
Eugene '69 & Linda Voiland
Wayne and Gladys Valley Foundation
Paul Weir '74
Weyerhaeuser Foundation

Crimson Associates

$5,000 to $9,999 in annual gifts

AIST Foundation
Alcoa Foundation
Warren '66 & Jackie (Disbro) Anderson
Lyle '51 & Betty Appleford
Helen Austin
Bechtel Foundation
Berschauer Phillips Construction
Patrick '76 & Shawn Berschauer
Louis '49 & Dorothy Black
Boeing Company
BP Foundation, Incorporated
ChevronTexaco Matching Gift Program
Clint '87 & Fiona Cole
Comtech AHA Corporation
Waite '66 & Patricia Dalrymple
Digilent, Incorporated
James Ewing '78
Marion Garrett
GLY Construction
Paul Hohenschuh '64 & Marjorie Winkler
Intel Foundation
Itani & Itani Development
Rafik & Marysue Itani
Leroy '78 & Anne Kilcup
Mechanical Contractors Association of Western Washington
Perteet Engineering, Incorporated
Richard Perteet '64
Poe Construction, Incorporated
Charles Poe '83
Puget Sound Energy
Gaymond '63 & Cindy Schultz
Verizon Foundation
Vista Engineering Technologies, LLC
Wagstaff
World Vision, Incorporated
Yost Grube Hall Architecture

Silver Associates

$2,500 to $4,999 in annual gifts

Henry '67 & Doris (Johnson) '67 Asmussen
Louise Bhagat
Bradford Blue
James '78 & Donna (Mcdonald) '77 Boulanger
Capital Trust Company of Delaware
CH2M Hill Foundation
CH2M Hill Hanford Group, Inc.
Coughlin Porter Lundeen
Craig '83 & Lisa (Coble) '84 Curtis
Robert '45 & Dorothy (Fisher) Dalrymple
Donald '57 & Gwendolyn (Burnett) Dewey
Ellison-Mahon Aircraft, Incorporated
ExxonMobil Foundation
Fluor Foundation
Global Impact
Eugene Gochnauer '34
Hedeen & Caditz, PLLC
Arnold '78 & Carolyn Hedeen
John & Martha Hirth
John '66 & Kathy Howell
George '67 & Margaret Huang
Robert Hull '68
IBM International Foundation
Integrus Architecture, PS
Isothermal Systems Research, Inc.

Ralph '50 & Betty (Jensen) Jackson
JK Group, Incorporated
Kiewit Companies Foundation
Gary Manchester '65
Masonry Industry Promotion Group
David Miller '68
Sylvia Mittendorf
Patriot Fire Protection, Incorporated
PG & E Matching Gifts Program
Frederick '56 & Rita (Smith) Poe
Sellen Construction
Shell Oil Company Foundation
Norman '78 & Susan (Saldin) '78 Strong
Roger Swann '81
Chifong Thomas '71
Laura Watson '00
Gerald '72 & Lynn (Black) '72 Winkler
Richard & Diane Zollars

Presidents Associates

$1,000 to $2,499 in annual gifts

AGC Memorial Scholarship Foundation
American Electric Power Company, Incorporated
Dorman Anderson '63
Sandra Anderson '61
Ruth Andrews '42
Robert '79 & Deborah (Cohen) '79 Askins
Associated General Contractors of Washington Education
Jean Austin '39
Robert '80 & Betty Baca
Eugene '56 & Mary Becker
Eric & Nancy (Baker) '69 Berger
Kenneth & Theresa (Buckingham) '79 Bergsman
Betty Berry
Ronald '64 & Linda Birum
William '64 & Patricia Blanton
John '80 & Karen Bowers
Brice Consulting
Michael '71 & Susan (Dunn) '71 Brice
Robert '64 & Nancy Bridge
Ronald '76 & Maureen Bunnell
Steven '78 & Donna Burnstead
John '81 & Erin (Cowan) '82 Byrne
Dale Call '86
William '51 & Wanda Carney
David '73 & Jocelyn Carson
Don '52 & Patricia Cassady
Chinook Pharmacy, Incorporated
Seung '84 & Ran Cho
Fredric '64 & Mary Christiansen
James Cole '89
Columbia Paint & Coatings
ConAgra Foundation
Robert '50 & Joan (Macleod) '50 Congdon
James '79 & Diane Coughlin
John '77 & Peggy Cuddy
Navin '85 & Rita Dimond
Tad '84 & Tanya Donohue
Roger '75 & Marilyn Droz
Donald Dunbar '63
Dupree Building Specialties, Incorporated
David '79 & Deborah Ellenz
Martin '68 & Connie Ellison
Joseph Eschbach '76 & Margaret Brandeau
Esvelt Environmental Engineering
Larry '60 & Sherry (Maize) '64 Esvelt
John '61 & Donna (Buboltz) '63 Fabian
Mikael & Wanda (Darnell) '81 Garrett
GeoEngineers, Incorporated
Global Sulfur Systems, Incorporated
Gold Reserve Corporation
William '56 & Joy (Vanasse) '58 Goodenough
Steven Goold '88
Robert '59 & Charleigh Grossman
Douglas '90 & Julia (Simmons) '81 Hamrick
Doug '80 & Anna Hanson
Gerald '78 & Ann Hardy
Gerald '68 & Linda (Goble) Harteloo
Gerald & Dolores Hedeen
Ronald '74 & Carol (Norine) Henricksen
Steven '72 & Linda (Timmons) '72 Hermann
Hi-Rel Laboratories, Incorporated
Jessica Hsu
Huibregtse Louman Associates, Incorporated
Eric Hustvedt '83
Jon Inouye '86
J.E. Dunn Construction
Richard '57 & June Jaquish
James Jerde '67
Stanley '51 & Mary Johann
Jeffrey Jones '90
Dale '63 & Shizue Kaku
David '70 & Donna (Tyler) '70 Kehle
James '78 & Carol Kelly
Barry '81 & Betsy (Mccallum) '81 Kenney
James '80 & Lisa King
Lester '41 & Juanita King
Preston '62 & Karen (Howe) '64 Kirkendall
Don '91 & Dena Kopczynski
Dana '77 & Susan Korf
George & Sandra La Rue
James Lafferty '44
Gwen Lamb
Lancs Industries, Incorporated
David Langstaff
Robert '60 & Bonnie Large
H. H. Larison
Eric '84 & Norma Jean LaRock
Jerrold & Georgene LaRue
R. Eric Leber & Lori Ramonas
Richard '80 & Ola Leland
Steven '86 & Jeanne (Filer) '86 Lunde
Charles '60 & Joan Mackdanz
Master Builders Education Foundation
Raymond McGraw '77 & Julie Griscom
McKinstry Charitable Foundation
James McPherson '89
David '65 & Barbara (Vonbracht) '65 Meyn
George Miller '50
Stephan Moen '82 & Yik Seh Wong
James Moore '59
Donald '55 & Nanette Moors
Morgan Stanley & Company, Incorporated
Michael '74 & Cathy (Carter) '73 Mosman
Jace Munson '83
Mung & Quyt Nguyen
Gary '77 & Julie Nordlund
Paul '74 & Denise Nordlund
Northshore Rotary Foundation
Rodney '85 & Kathleen Osborne
Charles O'Shea '43
Pacific Life Insurance Company
Philip '72 & Eileen Peistrup
Stanley '76 & Linda '78 Peterson
Ghery '75 & Marilyn (Vanhoose) '75 Pettit
Dean '80 & Dorie (Knight) '80 Peyton
Phillip Phythian '56
Robert Pierce & Kim Zentz '88
Ponderay Valley Fibre, Incorporated
Stephen '85 & Nancy Porter
John '70 & Eleanor Ramage
Kenneth '70 & Janet Ramble
Robert & Heidi Rapp
David Rash '78
O. H. '33 & Mary Reaugh
Robert '77 & Mary Rieck
James '65 & Jo Ann (Klossner) '66 Roberts
Charley Rosenberry & Robin Appleford
Evett '72 & Susan '71 Ruffcorn
Alfred Salzano '85 & Jamie Vanica
Robert '54 & Darlene Sanders
Sanjoy Sarawgi '04
Sasol North America, Incorporated
Garth '51 & Jo Ann Schimelpfenig
Eric '85 & Elizabeth (Farneman) '89 Schneider
Karl Schneider '93
Michael Schroeder '67
David Seamans
Robert '59 & Margaret Settle
Shea Homes, Incorporated
Glen '51 & Imogene (Lewis) Sherwood
Kenneth & Charlene Shindle
Robert Siegfried '42
Charles Simonyi
R. Daniel Sloan '52
Paul '82 & Rebecca Smith
Paul & Melanie '87 Sobotta
Steven '82 & Karen (Curtis) '82 Speer
SRG Partnership, PC
Mark St. Clair & Sharon Jones '81
Ronald '78 & Heidi (Bock) '79 Stanley
Steven '82 & Lori Sunich
Gerald '59 & Elizabeth (Giedt) '60 Swan
Terry Swann '82
Louis '79 & Kathleen (Fowles) Szablya
Tesoro Petroleum Corporation
Thomas Cook Fitzgerald Architects
Charles '81 & Susan Tilton
Donald '85 & Susan (Hadwiger) '86 Tilton
United Way of Kitsap County
David Van Tuyl '82
Michael Vixie '72
Richard '61 & Kay Wagner
Washington Group Foundation, Inc.
Alec & Rachel Willis
Albert Wolfkiel '89
Hussein & Marcia Zbib

Bryan Society

$500 to $999 in annual gifts

Alcoa, Incorporated
Michael '84 & Susan Ambrose
Mark '73 & Patty (Mosman) '74 Anderson
Ronald '65 & Jonnie (Streit) '65 Anderson
Joel Andren '00 & Yuanyuan Hui '01
Joseph '50 & Rose Andreotti
George '63 & Jeannine Antypas
Amit Bandyopadhyay & Susmita Bose
David Barber '80
Thomas '57 & Sandra Barlow
Michael & Louisa Barnsley
James Bartroff '68 & Marci Clark
Richard '64 & Joyce Baur
Lawrence Borden '42
David '80 & Carol (Sigrist) '81 Borgens
James Botko '67
Lawrence '67 & Mary Boyd
BP Amoco Foundation, Incorporated
K. Duane '81 & Terri Brelsford
Brown Contracting & Development
Delbert '57 & Karla Brown
Eric '76 & Lisa (Smith) '76 Brown
Stephen '85 & Rene (Polcuch) '84 Brucker
Dieter '62 & Anke '84 Burger
William Burke '83
Nick Busch '88
James Bussell '85
Gerald Campbell '57
Boyd '60 & Dinah Carlson
Christopher '75 & Geraldine (Mclean) '77 Carlson
Candis Claiborn
James Clark '75
Jeffrey '79 & Carolyn (Richardson) '80 Clark
Charles Cole '47 & Mary Loski
Condron Homes, LLC
Corey Condron '91
Corporate Pointe Developers
Steven '84 & Tana Cory
Brett '92 & Valerie '93 Crump
Allen '49 & Susan Daniels
Randall Darden '82
Decagon Devices, Incorporated
Donald Deierling '50
Gary '71 & Leslie '80 Demich
Richard '69 & Linda '68 Detering
Steve '84 & Paige Dietrich
Mac '57 & Ghada Dillsi
John '59 & Roberta (Roberts) '59 Doolittle
Paul '88 & Karen Elkin
William '78 & Diana (Kalmbach) '78 Erickson
Chad '76 & Colleen (Hulbert) '77 Fisher
Peter '69 & Janet (Larsen) '69 Flones
Gerald '59 & Arlene Fox
General Construction Company
John '72 & Linda (Powell) '72 Goetz
Robert '67 & Linda Grass
Dale & Marie (Tellessen) '72 Griffin
William Guckenburg '88
Larry '65 & Marlene Gunnoe
Brooks '52 & Marilyn (Thompson) Gunsul
Hanson Industries, Incorporated
Bruce '73 & Lois (Bell) '70 Harris
John '70 & Beverly (Leaton) '70 Hastig
Charles Heaton '91
Gregory '80 & Constance (Roberts) '81 Henshall
Himalaya Homes, Incorporated
Richard '68 & Cheryl Hoagland
John '84 & Suzanne (Kaufmann) '84 Hodge
Dan Houk '81
Howard S. Wright Construction Company
Grant '79 & Sandra Hubrich
Hudson Bay Insulation Company
Inland Northwest AGC
Intergrated Engineering Solutions
Thomas Jaske '78 & Karen Hartman
Ralph Jeffords '75
Donald '79 & Louisa Johnson
Donald Johnson '43
Arthur '51 & Carol Johnston
Merle Johnston '41
Douglas '57 & Janette (Witkowski) '58 Jonas
Clifford '53 & Jeanne Jones
David '61 & Marilyn Jones
Evan '80 & Susanne (Brady) '80 Jones
David Keltgen '95
Jonathan '70 & Marion (Seely) '69 Kennedy
Michael '76 & Jean Kimbrell
Rex '68 & Ellyn Kiner
John Korn '80
Kevin Kreiter '79
Mike '64 & Katherine Kunz
Delbert '78 & Debbie LaLuc
William '82 & Kelly (Dewey) '82 Lawrence
Michael '75 & Debra (Carlson) '75 Leslie
Lexmark International, Incorporated
Brent '89 & Karen Lince
William '56 & Janice Link
Whitney '81 & Karla Lippincott
Lydig Construction, Incorporated
Max J. Kuney Company
McCarthy
Micron Technology, Incorporated
Douglas Miller '79
Forrest Miller '70 & Linda Sferra
James Minor '76 & Carol Doi
Moceri Construction, Incorporated

Mortenson
National Semiconductor Corporation
Archie '57 & Lora '90 Neal
Steven '90 & Solvei (Vedvick) '90 Neiger
Dale '67 & Elaine Nelson
Northrop Grumman Litton Foundation
Kent '79 & Bonnie Oliver
Howard '65 & Juldine Olsen
John Olsen '86
Marc Olson '84
Lloyd '59 & Nancy (Howard) '58 Osborn
Karsten '70 & Carol Overa
PACCAR Foundation
Pannonius Foundation
Zakir '76 & Chitra Parpia
Bert '63 & Sonya Pence
Joseph '84 & Arlene Prather
L. Stephen Price '75 & Cherri DeFigh-Price '75
Paul '73 & Mary Rashford
Steven Reynolds '88
Brian Rhodefer '77
Miguel Rodriguez '97 & Janice Pennock
Gordon '47 & Barbara Rogers
Dave & Jeanette Roubinet
Thomas '68 & Sandra Rousseau
Greg '74 & Marsha (Alexander) Royer
Steve Savage '85
Richard Schneider '84 & Shelly Bethke
Aaron Schutt '96 & Marissa Flannery
Mary Schweitzer
Sharon Sheridan
Richard '74 & Shellie Silliman
Roland Skala '00
Andreas '82 & Paulette (Kusterer) '82 Skibiel
Gerald '69 & Linda Smith
Martin '65 & Barbara (Rowe) '66 Snoey
Marilyn Spear '49
Alice Spitzer '66
William '81 & Eva Strand
Richard '74 & Deborah (Gomness) Szabo
Tektronix Foundation
Greg '79 & Marisela Therrien
John '53 & Mary Thirkill
David '71 & Rosario Thomas
David & Clarissa (Wheeler) '91 Thomas
Jean Thornton '48
University Mechanical Contractors, Incorporated
Larry '71 & Carolyn Van Hees
Robert '42 & Beatrice Wachter
Alan '85 & Dawn (Kopp) '85 Wakeley
Kenneth Wasserman '83
James '50 & Donna (Durgan) '51 Weller
Russell '78 & Kathleen Westphal
Lawrence Wiberg '74
Wilcox Construction, Incorporated
Wilbur Wilhelm '43
Jeffrey Williams '80
Jeff '81 & Patricia Wilson
Mary Lue Wilson '64
Tim '93 & Lynn Woodley
Jim Wu '96
Lyle Wulff '61
David '52 & Dolly (Glenn) '51 Yates
Donald Young '62
Roger '70 & Janet (Henry) Young
William '72 & E. Jo (Eabert) '72 Zemke

Tower Club

$100 to $499 in annual gifts

LeRoy '65 & Rosemary Abelson
Joseph Absalonson '03
Absolute Engineering, LLC
John '83 & Sandi Adami
AHBL, Incorporated
John Ahlers '75
Dean Allen
Edward '69 & Cheryl (Love) '68 Allender
Robert '63 & Shirley (Stephenson) '64 Allert
Alliant Techsystems Community Foundation
Robert '69 & Anita (Love) '68 Allison
Alpine Ridge Construction, Incorporated
American Express Foundation
Amgen Foundation
AMSTED Industries, Incorporated
Dean Anderson '94
J. Anderson '57
James '61 & Elizabeth (Walker) Anderson
Michael Anderson '01
Ralph '58 & Judith Anderson
Scott Anderson '72
Thomas Andriesen '86
Martin Andrus '72
Kevin '95 & Catherine (Haugen) '94 Apgar
Michael '57 & Gayle Archer
Architects Brown Connally Rowan
Archtectural Services, Incorporated
ARCOM
Kevin '86 & Sarah (Hales) '93 Ard
Dennis '64 & Judy Armstrong
Richard '59 & Joyce Asimus
C. Douglas '65 & Tamara Auburg
Peter '87 & Sarah (Henderson) '88 Ayers
Matthew & Kelly (Larsen) '99 Bachelder
Lance Baird '80
Franklin '80 & Mary (Strother) '80 Baker
Nirmala Balasingam '98
Surendran Balendra '05
Walter Balinski '67
Robert '87 & Cherene Balmelli
John '50 & Gloria (Bellingar) '47 Bang
Kevin '77 & Badeea Barbee
Alexander Barber '82
George & Anne Barker
Barnard Construction Company, Incorporated
Albert '42 & Evelyn Barnes
Todd Barringer '80 & Laura Jackson-Barringer '80
James '74 & Marsha Bates
Bayley Construction
Donald '60 & Alene (Johnson) '62 Bea
Douglas '80 & Barbara Beach
Steven '75 & Barbara (Ames) '74 Becken
Jay '77 & Tamara (Barden) Becker
William Becker '62
Robert '80 & Julie Beebe
Bernard Bell '63
Jeffrey '90 & Karen '90 Beman
William Bender '81
A. Ben '78 & Lorna Bennett
Frederick '66 & JaneAnn Bennett
William '73 & Linda (Morr) '73 Benshoof
Edward '59 & Lois Bentley
Forrest '50 & Lorraine (Glover) '51 Bentley
Brian Berg '73
Katherine Berg
William Berg '84
Randall '80 & Casey Bergstrom
Patrick Berry '95
Larry '62 & Carol Bertholf
Leland '55 & Janet Besel
Lawrence Bettinzoli '76
Phillip '76 & Julie (Georgeson) Beyl
Robert Bignold '56
Todd '91 & Mary Billings
Elwin Biorseth '50
Arthur '63 & Judy Bisig
Black & Veatch
Philip '68 & Janet Blaschke
Steven '85 & Diane Bliesner
Daniel '84 & Carrie Bodnar
Thomas Boitano '83
Randall '74 & Linda Bolster
Fred '68 & Carlene Bonar
Rex Bond '76
Worcester Bong '80
David '50 & Joanne Bonsteel
Mark '69 & Sandra Booker
Delmar '50 & Barbara Borgens
Robert '43 & Jean Boring
George '60 & Judy (Champlin) '59 Borsheim
Box Canyon Fruit
Philip '84 & Charlene Boyd
Robert '58 & Wilma (Cooley) '58 Boyden
Donald Boynton '65
BP Amoco Corporation
Wayne '58 & Barbara (White) '58 Bradford
Joshua Brager '03
Gregory Brands '82
Mike '81 & Sharon (Mitchell) '80 Brendle
Carl Brenne '74
Richard '86 & Nancy Brigman
Francisco Brito '77
Sherlyn Brockway '88
Timothy Brockway '92
Leanne Brodzinski '86
Darwin Broman '50
Thomas '86 & Donna (Titus) '87 Brouns
Craig '80 & Denise Brown
David '71 & Barbara (Chamberlain) '71 Brown
David '82 & Marla (Anderson) '78 Brown
Garrett Brown '94
Norman '80 & Kimberle Brown
Richard '76 & Venita (Vanhamme) '78 Brown
Paul '87 & Vicki Brundage
Jeff & Jane Brune
Glen Bruser '84
William Bryant '95
Grant '92 & Carol (Verbrugge) '92 Buckingham
John '47 & Blanche Buckingham
Stan & Guynethia Buckley
Donald '81 & Ann (Butterfield) '81 Bucklin
Walter '48 & Joan Buehler
Gerald '65 & Sue (Holderness) '65 Buettner
Ramsey Buoy '93
Gerald '69 & Nancy Burnett
Clarence '54 & Nancy (Hollinsworth) '54 Burris
Joey '86 & Kathy Burton
Daniel '97 & Kori (Rowell) '97 Burwell
Henry '71 & Marilyn (Barber) '67 Burwell
Frank '84 & Deborah Busch
Stephen '73 & Donna Busch
Christopher '79 & Terry Bushnell
Debra Butler '82
Jeff Buzzard '94
C. Douglas Auburg Rentals
Myron Calkins '42
Gene '76 & Peggy (Mckee) '76 Callan
Charles Callen '86
Ronald '57 & Karen (Reinertsen) Cameron
Jon '92 & Mary Campbell
Orville '51 & Phyllis Campbell
Wallace '56 & Sally Campbell
CampusPoint Corporation
Camwest Development, Incorporated
Dennis '64 & Lynn Cannon
James '87 & Marta Cappa
Charles '53 & Dora Caprye
Ronald Cardwell '90
Curt '80 & Mary (Culpepper) '81 Carlson
Robert '76 & Dorothy '03 Carrell
Gregory '82 & Terri Carter
William '88 & Colleen Casey
Robert '82 & Janet Cass
Richard '77 & Sharlene Cassidy
CDK Construction Services, Incorporated
Christopher '73 & Diane Cedergreen
Centex Homes
Cessna Foundation, Incorporated
Kenneth Chaplin '44
J. Michael '69 & Carolyn (Schulz) Chapman
L. D. Charf '66
Wan '83 & Tammy Chee
Daryl '71 & Sharon Chesterman
LumAn Chet '97
Bradley '78 & Donna Childress
Kris Chopper '83
Marion '74 & Sara Christensen
Chi-Jen '72 & Regina (Tai) '75 Chung
David '82 & Janet Clark
Druery '58 & Janet Clark
Lois Clark '37
Dan Clawson '91
Clearwire Corporation
Robert Clem '58
William '59 & Glenda Clemans
Marvin '62 & Marcia (Herman) '61 Clement
Michael Clifton '73 & Caroline Bonner-Clifton
Dennis '69 & Marica Clinkenbeard
Pamela Clover '89
Robert '74 & Linda (Moyer) '73 Coble
James '84 & Kathleen Cole
Christopher '95 & Karin Collisson
Computer Accounting Systems, Incorporated
Lori Comstock '78
ConocoPhillips
Michael Cook & Michelle Bruno '86
Roland '56 & Carol Cook
Patrick '00 & Anna Cooley
Cooper Industries
Christopher '97 & Julie (Rogers) '98 Coppock
Corporate Transltions, Incorporated
Kevin & Kathleen (Olsen) '85 Corrigan
John Cossano '82
Micheal Coward '80 & Pamela Richmond
William '52 & Gladys Cowell
Wayne '69 & Carmen Craney
Michael '74 & Leslie Creighton
John Cripe '81 & Amy Freeman '82
Robb '75 & Huong Crocker
W. Timothy Croghan '80
Mitchell '85 & Mary Crowe
Jerry '69 & Stephanie Crumrine
Rona Culp '81
John Cunningham '80
Seth Cutler '00
Ronald Dailey '78
DaimlerChrysler Corporation Fund
William & Tracy (Anderson) '03 Daly
Douglas '74 & Susan Danielson
Gary '75 & Nancy Danielson
David Evans and Associates, Incorporated
Arthur Davidson '38
Chris Davies '85
Dean '84 & Sandra Davies
Corey & Tanya (Schober) '97 Davis
H. John Davis '74
Michael '83 & Donna Davis
Thomas '62 & Georgia Davis
Walter '90 & Annette Davis
Marlowe Dawag '94
Clifford Day
DCV Consultants
Degerstrom Converters
Sam '75 & Ellen (Matsumoto) '75 Deleganes
Robert & Pamela Derkey
Judith DesHarnais '82

Gerald '79 & Lynn (Massmann) '79 Desmarais
Francis '51 & Elizabeth Desposato
Carl '82 & Sue Deusner
Devasco International, Incorporated
Randall '74 & Marlene DeVoto
Timothy '87 & Bonnie DeWitt
Martin Dick '90 & Kirsten Gunderson-Dick
Greg & JoAnn Diener
Dennis '81 & Laura (Holland) Dieni
James '79 & Debi Dill
Richard Dill '74
Robert Dlugosh '71
Aimee Do '02
Philip '92 & Vicki Dobbin
Floyd Dodge '57
Jerry '69 & Carol (Rader) '69 Doerr
David '03 & Linda '04 Dostal
William '84 & Mary Dowdell
Daniel '83 & Greta Doyle
Robert '71 & Marcella (Irwin) '73 Dragnich
Greg '83 & Denise (Fluke) '83 Drevniak
Donald Dubois '57 & Antoinette Martinez
Thomas '86 & Joyce Duffy
David '81 & Tamera Duke
Fred '89 & Karen (Semon) Duke
Norman '73 & Kathryn Dull
Michael & Barbara (Bennett) '68 Dully
Darrel '67 & Judy (Swanson) '67 Duncan
Kermit '61 & Marguerite Duncan
Jack '68 & Jennifer Dunlap
Thomas Dunn '82
John '66 & Wilma Dunsmoor
Shawn Dunsmoor '87
Frank & Janice Duval
Richard '67 & Judith Dyer
EasyMatch
David '84 & Lorenza Egaas
David Eids '81
Mark '83 & Amy Eisenmann
Thomas '91 & Sharon Eldridge
Donald Elias '77 & Judith Frost '77
Marc Elkins '96
Jeffrey '86 & Bonnie Ellis
Sean Emam '91
Craig '90 & Shannon (Anderson) '89 Emerick
Frederic '51 & AnnaBelle Emery
Dennis Eng '89
Peter '63 & Leilani Eng
Mark '81 & Barbara Engel
James '51 & Alice Englund
Donn '64 & Donna (Olsen) '66 Ennis
Douglas '74 & Patti (Howes) '76 Ensor
Edward Epperson '65
Richard '65 & Nancy (Heglin) '65 Erickson
Steven & Teresa (Fleming) '84 Erickson
Lester Erikson '41
Peter '85 & Tara Eschbach
C. Charles '56 & Laura Evans
Jane Evans
Chad '85 & Mari (Muth) '86 Everitt
Expedia, Incorporated
Factory Mutual Insurance Company
Carl '52 & Mary Fahlstrom
Fair Isaac Corporation
Hao Fang '94
Hao Feng '00 & Ying Chen '01
Robert Ferguson '76
Christopher '85 & Joni Feryn
Peter '78 & Nancy Fiala
Brian Fillion '87
Leonard '50 & Nancy Finnell
Jeffrey Fisher '82
Jerome '82 & Mary Fisher
Delbert '70 & Illa Fitzsimmons
Gerald '67 & Virginia Fleming
Jay Fogarty '75
Stephen '82 & Susan (Kimmerle) '80 Foltz
Michael '87 & Leslie Forbis
David '64 & Pauline Ford
Stephen Ford '83
Graham Forsyth '68
Brian '02 & Barbara Fox
Framatome ANP, Incorporated
Syd '77 & Margaret (Oberg) '77 France
Frank Coluccio Construction Company
David '76 & Charlene Franklund
Christopher Fransen '82
Eric Franson '93
Jeffrey Franson '90
Bryan Freeman '82
Charles '89 & Chantelle (Chase) Freeman
Daniel Freeman '81
David '76 & Jerilyn '76 Freimuth
Harold Fresn '71
Jeffrey '89 & Laura Freund
William '83 & Carolyn Fry
Fryer Industries, Incorporated
Chengjun Fu '98
Pat '87 & Ilsa Fuhrer
Ronald '84 & Jennifer '91 Galbraith
GAMA
Garco Construction
Charles '43 & Donna (Berkeley) Gardner
Owen '42 & Helen Gardner
Lloyd '49 & Helen (Grohs) Garretson
David & Yvonne (Meyer) '83 Gauntt
Stanton & Beatrice (Murata) '65 Gee
General Construction Company
General Electric Foundation
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Creating a Legacy of Excellence

Raymond and Beverly Lorenz

Raymond ('58 Electrical Engineering) and Beverly Lorenz know that a quality education is a basic need. To support this need they established the *Raymond and Beverly Lorenz Distinguished Professorship in Electrical Engineering or Computer Engineering*, which will provide an opportunity to enhance academic and research programs in the School of Electrical Engineering and Computer Science.

Ray retired after 32 years of various project and management positions in the Communications, Radar and Infrared Engineering Divisions with Hughes Aircraft Company and Mission Assurance Management with Contel Corporation. For the past 15 years, Ray and his wife, Beverly, have been active vacation and residential real estate investors in the Orlando, Florida, area.

Supporting EECS went hand in hand with his work ethic of "finding a need and filling it." Whether it's designing critical components for aircraft, serving as mission assurance manager of payloads on space shuttle launches, or providing for a quality education at Washington State University, Ray's commitment to excellence is unsurpassed.

The Lorenzes, recognized as Laureates at the Washington State University Foundation Gala in October 2006, have created a legacy of excellence through their creation and support of a distinguished professorship in the School of Electrical Engineering and Computer Science.

For information about creating your legacy, contact the CEA Development Office at 509-335-3342.