Dean’s Message

The College of Engineering and Architecture is a major research engine at WSU, and we play an important role in building the prosperity and economic vitality of our state and region. Engineers are the ones who are working to solve critical issues in energy, environment, health, and security. The students that we educate are the ones who are going to solve these challenges.

As many of you know, the last few years have brought us the recession with significant challenges and significant reductions in state support for higher education. These dramatic reductions in state resources, which have totaled an incredible 52 percent in the past four years, challenged us to become leaner and more focused than we ever have been.

I can report that we in the College of Engineering and Architecture have risen to this great challenge. In the past several years and in spite of dramatic budgetary constraints, our research funding, as well as graduate and undergraduate student enrollments, have all increased steadily.

The good news is that state leaders are now recognizing the crucial work of our engineering and computer science graduates in driving the state’s economy. Facing increasing industry demand for engineers and computer scientists, and programs that are at or over capacity, the state legislature this year agreed to provide $3.8 million each to WSU and the University of Washington to increase capacity specifically in engineering and computer science programs. You can read more on page 2 about WSU’s Engineering Initiative, which will allow us to hire many new faculty members and open our engineering programs to over 30 percent more students in these high-demand fields.

With support that we receive from the Engineering Initiative as well as from you, our alumni and friends, we remain more focused than ever on moving forward with a research-led vision for educational excellence in the college. This vision has become the cornerstone of our portion of The Campaign for Washington State University: Because the World Needs Big Ideas.

In particular, we are focusing on our signature interdisciplinary themes, where we have a near-critical mass of excellent faculty, world-class facilities, and strong, existing research programs. In fact, these have been the traditional areas of strength and focus in the college. And they answer challenges in energy, the environment, and health that are critical for our state and nation’s future.

These programs include research in advanced materials (page 3), smart grid power networks (page 6), sustainable infrastructure (page 8), renewable energy and energy conversion (page 11), air and water quality (page 13), and engineering for health (page 15). I hope you’ll enjoy reading about some of the exciting advances we’re making in each of these areas.

While our vision is centered on building these research programs, I want to emphasize that we continue to focus on our undergraduate mission. Our reputation, which is built on these research strengths, remains critical to undergraduate education. Our final priority area, in fact, is in developing our future leaders and entrepreneurs (page 18) who will address our critical national challenges.

These focus areas are near the tipping point in terms of becoming top programs, and a small investment promises to have a big impact. They present multiple opportunities, are in fundable areas of research growth, and are expanding.

We are investing strategically and are aligning the college structure for maximum operational efficiency. We are promoting interdisciplinary research and will focus our future investments in these signature areas. All of our faculty hires, including those that come about with the new Engineering Initiative support, will be aligned with strategic priorities.

We have worked to hone our budget so that it is performance driven and uses scarce resources more strategically. Our effort aims to be collaborative—with no small thinking.

I hope you’ll join me in supporting our efforts in this important work. I so greatly appreciate your support and collaborative spirit as we face the hard work that lies ahead.

As our alumni and friends, you are truly the ones who are making the difference in helping us to reach our goals.

Please feel free to share your news with us or to come for a visit. I look forward to hearing from you.

Sincerely,

Candis Claiborn
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Where’s the Donor Roll?
We are proud and thankful for our alumni, friends, corporate, and foundation partners whose generosity ensures that our college will maintain excellence in undergraduate education and graduate research programs. Please take a moment to see who gave to the college from July 1, 2011, to June 30, 2012, at www.cea.wsu.edu/alumni.
Both Washington State University and the University of Washington have been allocated $3.8 million each from the Washington State legislature to increase the number of engineering and computer science students and graduates.

The initiative aims to address a shortage of Washington state engineers and will result in a more than 30 percent increase in the number of students in WSU’s engineering programs.

The state’s universities have not been graduating enough engineers to fill industry demand, including in the aerospace industry. According to a recent Kauffman Foundation report, high tech employment in Washington has increased by 400 percent since the mid-1970s, with Washington ranked second in the United States in the number of high tech jobs. At the same time, Washington ranks near the bottom in the number of engineering and computer science degrees per number of high tech jobs.

With state support that was provided for education in high demand fields, WSU has increased the number of its certified engineering majors by 75 percent since 2004 to 870 students. This has been despite an overall decrease of state support for WSU by 52 percent in the past four years. Student interest in engineering has also increased. The programs, however, are now at capacity.

In a report to Governor Christine Gregoire earlier this year, the Washington Council on Aerospace recommended that the state increase its engineering capacity to meet engineering needs in the aerospace industry. As a result, Gregoire asked both UW and WSU administrators to develop plans to expand their engineering and computer science programs. The proposals were submitted to and approved by the governor and legislature this spring. Under the plan, the state allocated the extra cost required to educate engineering and computer technology students.

The state support will result in a more than 30 percent increase in the number of students who will be able to study in WSU’s engineering programs. The initiative will allow the college to enroll a total of 425 new students and hire 20 to 25 new faculty members to teach additional courses. In addition to the Pullman campus, the WSU engineering programs in Bremerton, Everett, and Vancouver will expand, allowing place-bound students to improve skills that are needed in industry. Approximately two-thirds of the new students will be undergraduates.

“Our state leaders have recognized the need for engineers in solving our critical challenges and in helping the state economy,” says Candis Claiborn, dean of the WSU College of Engineering and Architecture. “A workforce that is educated in high-demand technology fields is more important than ever for the success of the Washington state economy.

“We look forward to educating and graduating more students to join the workforce and to drive innovation in Washington State.”

In Washington, the gap between demand and supply is greater in computer science and other fields of engineering than in all other fields.
Advanced Materials

WSU’s long history of excellence in materials research has had and continues to have broad impacts on industries around the state and region. Our researchers are developing materials to address, particularly, the generation and efficient use of power and energy.

Research includes development and better understanding of composite materials for airplane manufacturing, new battery technologies, sustainable building materials from renewable resources, and crystal growth that is important for high tech solar and semi-conductor manufacturers.

More than 40 percent of the $1 billion wood-plastic industry in North America uses material formulations developed at WSU, and WSU’s Composite Materials Engineering Center has more than 30 patents on inventions in areas such as nondestructive evaluation of wood materials, wood plastic composites, and composite materials processing.

At the Center for Materials Research, WSU researchers developed the best crystals for radiation detection in the United States. The center is also actively involved in the growth of materials for solar cells by improving the quality of cadmium telluride and other materials for converting sunlight to energy. The center has outstanding facilities for materials growth and equipment for finding and eliminating defects in materials.

Industry in the Northwest is heavily reliant on the materials research that comes out of WSU. Our work directly impacts the Washington State economy and is important to Northwest and U.S. interests.

Student Entrepreneur is Semifinalist in Clean Tech Open

TriboTeX, a company started by a Washington State University materials science graduate student, is one of about 150 semifinalists around the United States in a national and prestigious clean technology business competition.

Clean Tech Open, the nonprofit organization that runs the competition, works to enable innovation in the clean tech industry, according to their website. Their annual business plan competition is meant to provide training and support to fledgling entrepreneurs. A total of 17 companies from the Northwest were named semifinalists this year.

As a graduate student, Pavlo Rudenko has worked to develop a business based on his research on lubricants. He is working to use nanotechnology to develop more efficient and environmentally friendly additives for lubricants. He started TriboTeX earlier this year to further develop and begin producing his bio-based lubricant that can reduce friction and increase machinery efficiency.

The work is important because of the huge amount of energy lost to friction, he says. In cars, for instance, one third of an engine’s mechanical energy is lost. If that energy could be recovered, it would provide more energy than all of the oil that the United States currently imports. If lubrication can be improved, it will dramatically reduce fuel consumption and costs, he says.

The winners of the competition will be announced in November.

Rudenko’s company is the second WSU start-up that has been a semifinalist in the prestigious competition. GoNano Technologies, started by Grant Norton, a faculty member in the School of Mechanical and Materials Engineering, and David McIlroy, a physics professor from the University of Idaho, received the honor two years ago. In 2010, a prominent technology website also named WSU as one of the top 10 universities in the United States for clean technology.

“We’re proud to see that another start-up coming out of WSU is gaining recognition through the prestigious Clean Tech Open competition,” said Candis Claiborn, dean of the College of Engineering and Architecture. “This project is another great example of our efforts in the College of Engineering and Architecture, where much of our research is focused on tackling national challenges in energy, the environment, and health through clean technology innovations and entrepreneurship.”
Washington State University researchers have developed a new technology that could triple the capacity of lithium-ion batteries, which as anyone who owns a cell phone or laptop knows, can be frustratingly limiting.

Led by Grant Norton, professor in the School of Mechanical and Materials Engineering, the researchers have filed patents on the nanoscale-based technology, which also allows the batteries to recharge many more times and more quickly than current models. They expect to bring it to the market within a year.

In particular, the researchers have developed an anode made of tin, rather than the carbon used currently. Rechargeable lithium ion batteries are made up of two electrodes, the cathode and an anode. During charging, the lithium ions move from the cathode to the anode. The anode holds the lithium ions and stores the battery’s energy. When the battery is used, the ions move from the anode to the cathode, discharging electrons and creating an electric circuit.

The new tin anode has the potential to store almost three times the energy of graphite.

Norton and postdoctoral researcher Uttara Sahaym developed the novel material a little over a year ago while working on a project to mitigate tin whiskers, which are tiny whiskers that grow on tin-plated electronics. The whiskers, which can sometimes grow as long as 10 millimeters, are a pesky problem in microelectronics because they create short circuits that can cause catastrophic damage. Yet, despite the fact that tin whiskers have been causing problems for more than 60 years, researchers have been unable to come up with ways to entirely avoid them.

Norton and his group decided to turn the problem on its head and see if they could control the growth of tin whiskers, instead of trying to get rid of them. They applied the work to developing a tin-based anode for batteries.

With support from the WSU College of Engineering and Architecture’s Emerging Technology Fund, which is funded by private donations, the researchers have started building and testing the batteries.
T\textsc{racy (Jianying) Ji}, a doctoral student in the School of Mechanical and Materials Engineering, has been recognized as the Boeing and Flightglobal Engineering Student of the Year (ESOYA). It is the first time that a WSU student has received the prestigious award.

Boeing and Flightglobal have held the ESOYA competition since 2005 as a way of encouraging students in aerospace engineering. Open to any engineering student around the world, competitors are judged on the potential impact of their research on the aerospace industry. Ji was one of two students and the graduate level winner of the award.

After receiving a master's degree at Beijing University of Chemical Technology, Ji came to WSU in 2009 to pursue her doctorate. Her advisor in China suggested that she work with Katie Zhong, professor in the School of Mechanical and Materials Engineering. Since arriving in 2009, she has published eight papers and has filed for a patent.

Working with Zhong, Ji is working to develop a new type of battery that would be lighter, safer, and more environmentally friendly than current lithium ion batteries.

Boeing has been working to develop an all-electric airplane, in which more electronics will be powered through battery technology. The technology, however, remains a limiting factor.

Ji is working to develop a new electrolyte for batteries that is made out of an environmentally-friendly soy protein. Electrolytes are the part of the battery that allow for the movement of electrons between the anode and the cathode to create electricity. Usually, electrolytes are liquid acid solutions. The electrolyte solution can leak and create a fire hazard.

“In some portable electronics, the batteries can reach temperature as hot as 200 degrees Celsius—hot enough to cook eggs,” says Zhong. “That’s a big safety concern.”

Batteries also create an environmental hazard for disposal.

Ji’s soy protein-based electrolyte is solid and lighter weight than traditional electrolyte materials. She has tested combining the soy protein with more traditional electrolyte materials and was able to have high conductivity, producing a material that could be disposed of more easily. It could also reduce the battery weight.

“The safety issue can be solved, and the battery is lightweight and more environmentally friendly,” says Zhong. “This work is very practical and highly needed in the industry.”

Last year, Ji achieved another global honor. She was selected as one of the top 50 graduate students and/or postdoctorates from around the world invited to attend the inaugural World Materials Summit Student Congress.

This summer, she received support to attend Singularity University, a California-based university that brings about 80 graduate students from around the world together with business leaders to address global challenges and develop entrepreneurial ideas in advanced technology.

Ji and members of her team are invited to Boeing in Seattle later this fall for an awards presentation. She gives credit to her research group for much of her success. Led by Zhong, the group includes students Bin Li, Weston Wood, Brooks Lively, and Tian Liu.

“I am very happy to receive this great honor, and I am very proud of my group,” she says. “My advisor has given me the freedom to pursue various projects without objection and provides insightful discussions about the research. She is my best role model for a scientist, mentor, and teacher.”

“What’s more, our group members help each other, and they are a valuable source of ideas and motivation.”

Materials science and engineering doctoral student Samantha Lawrence is the first Washington State University recipient of the U.S. Department of Energy National Nuclear Security Administration Stewardship Science Graduate Fellowship (DOE NNSA SSGF). The fellowship program provides financial support and professional development for doctoral science and engineering students who are focused on stewardship science. Stewardship science relates specifically to the nuclear stockpile.

Lawrence receives full tuition and required fees, a yearly stipend, attendance at yearly conferences, and the potential to renew the fellowship for up to four years. Lawrence is in her third semester at WSU. She graduated magna cum laude with a bachelor’s degree in metallurgical and materials engineering in December 2010 from the Colorado School of Mines.
Smart Grid Power Networks

With a long history and national reputation in power engineering and collaborative, interdisciplinary research, researchers in the College of Engineering and Architecture have led the development and incorporation of new technologies aimed at improving the efficiency and reliability of electric power and energy systems.

WSU organizes the largest conference and the largest short course on power grid protection in the United States. We also recently hosted the first-ever conference on a key smart grid component, synchrophasors, which play an increasingly significant role in helping the power grid run efficiently. WSU has signed a memorandum of understanding with ICAP, a professional standards organization, to develop and implement a smart grid test program. The Smart Grid Demonstration and Research Investigation Laboratory (SGDRIL) will be a national testing lab for smart grid technology.

The recently established Energy Systems Innovation Center (ESIC) continues this tradition as a leading center of excellence, both nationally and internationally, for research, education, technological innovations, and technology transfer in energy systems, including smart grids.

WSU’s Energy Innovation Center
Focused on Smart Grid System

Team to consider economy, sociology along with traditional engineering

By Katie Roenigk, Moscow-Pullman Daily News staff writer

Throughout his 30 years working in the energy industry, Washington State University professor Chen-Ching Liu said he has never experienced the level of collaboration that is now taking place in the field.

“This is really the best time and the most exciting time that I’ve seen,” Liu said this month at his office on the Pullman campus. “You have new challenges and new technology, and support from the government, industries, and universities. They’re all coming together, which is very unique.”

Liu arrived in Pullman last fall to start WSU’s new Energy Systems Innovation Center (ESIC), a major program that he says will build on the strong foundation of power education that already exists at the university and in the Pacific Northwest.

“This is indeed an energy state,” Liu said. “Particularly in the power technology, we’re playing a very significant role nationally and internationally.”
He mentioned Schweitzer Engineering Laboratories in Pullman, the Pacific Northwest National Laboratory in Richland, the Alstom Grid in Redmond, and the Bonneville Power Administration, which is based in the region.

“When you look at all of that together with the rich resources we have, we are really an important area for the energy field,” Liu said. “So it’s only natural that the universities step up to the plate and play a significant role in facilitating the cooperation.”

He has several goals for the ESIC, which will go beyond the creation of new technologies to create a power grid built on economic, sociological, and engineering concepts.

“We’re looking at the broader electric energy issues,” Liu said. “We have to understand what works for people, how we can create economic incentives and assure privacy will be guaranteed.”

The effort will require the expertise of a diverse group of professionals, Liu said. In addition to eight engineers, the ESIC faculty team includes 18 experts in sociology, economic science, and psychology who will take into account the more human factors that can have an effect on the way a new innovation works.

“We build technology, but technology doesn’t run autonomously—there are people involved,” Liu said, describing, for example, a power grid that can be operated remotely from a control center. “The computer and communication technology will have to have good decision support elements so they interact more effectively.”

A successfully integrated technology would be good for the state, Liu added, pointing out the export-heavy economy that exists in Washington.

“We’re already leading in exporting power technology,” Liu said. “But through the center we’ll create the technology to help kick off new startups, then we educate the workforce to fuel the needs of the industry.”

He anticipates that 50 percent of the power engineering workforce will have to be replaced over the next five years.

“And where are those people going to come from?” Liu said. “That’s an issue. If we don’t produce good talents to fuel industry needs, the talent will come from other places.”

Through the ESIC, however, Liu said the pool of 40 undergraduates who leave WSU each year with a bachelor’s degree in power engineering will grow to 60 annually. When it comes to graduate degree-seekers, he said he expects an increase from 50 to 80 students each year.

“So that’s the workforce solution,” Liu said, adding that interest in the field has become more popular of late. “Now with climate change and the environment and the smart grid, renewables I think are appealing to the new generation of students. So enrollment is up now, but to solve the workforce issue it’s going to take a sustained effort.”

His center already has made contact with schools like ETH Zurich in Switzerland and the University of Strathclyde Glasgow in Scotland, as well as the School of Electrical Engineering at Wuhan University and the State Key Lab in Power Systems at Tsinghua University in China. WSU students also will collaborate with other institutions in the United States through the Power Systems Engineering Research Center.

Anjan Bose, Regents Professor in the School of Electrical Engineering and Computer Science, has been appointed as a senior advisor to the U.S. Department of Energy where he is leading an effort to coordinate research on electric power grid technologies.

One of the Department of Energy’s highest priorities is to expand the electric transmission system and to increase its reliability and efficiency, and several different DOE divisions and programs have been involved in this effort. Bose has been called to coordinate ongoing smart grid research among these different programs.

“Because there are so many changes happening on both the technology and policy sides in the electric energy industry, it’s not an easy task to envision what the future grid will look like,” said Bose. “There’s a lot of research work already initiated by DOE and by industries that are moving this forward.

“My task is to coordinate the research that is already going on and to try to lay out the road map of what additional work is needed and on where the country needs to be going in electric power research.”
Recycling the 520 Bridge
By Alyssa Patrick, CEA intern

The demolition of Seattle’s 520 Floating Bridge is expected to create enough waste material to fill the interiors of 67 Boeing 747s. But if designers respond to a challenge from a graduate architecture student at Washington State University, they may yet find a way to turn it into something usable.

As part of her thesis and required final design project, Sara Strouse, a student in the WSU School of Design and Construction, developed a design competition that she hopes provides lessons on reuse and sustainability. The competition encouraged entrants to find creative uses for the materials from the old bridge.

“I wanted to find out if I could get the idea of adaptive reuse more recognized through the use of competition, as well as broadening the audience of my thesis,” Strouse said.

The American Institute of Architects (AIA) Seattle Gallery displayed the winning entries and co-presented the competition. NBBJ, KSI Architecture and Planning, the WSU School of Design and Construction, and Kiewit/General/Manson, A Joint Venture, are sponsors. Kiewit/General/Manson is the contractor on the bridge project.

The new bridge is scheduled to open in 2014, at which time the existing bridge will be decommissioned and removed.

Paul Hirzel, a faculty member in the School of Design and Construction and chair of Strouse’s graduate committee, said the multiple dimensions of this project made it relevant and full of potential.

“Infrastructure is of big interest in the United States right now, and encouraging the reuse of an existing structure versus demolition contributes to sustainability measures that are becoming more and more critical,” he said.

The jury for the competition included the well-known architect and WSU graduate, Robert Hull.

“I hope to get both designers and the general public to start viewing public projects as opportunities for something greater, and competitions as ways to encourage innovation amongst designers,” Strouse said.

The AIA is displaying winning entries through October.
NSF Early Career Award

Research for Better Building Materials

Vikram Yadama, assistant professor and extension specialist in the Department of Civil and Environmental Engineering, recently received a prestigious National Science Foundation CAREER award for his work to develop unique, sustainable building materials from wood strands.

With the five-year, $400,000 grant, Yadama and his colleagues aim to develop better sustainable building materials made from lignocellulosic fibers, or wood-based material. In particular, they are working to expand knowledge on the design and manufacturing of wood-based composite products for use in net zero energy construction, particularly for the outer shell of buildings, which is called a building’s envelope.

According to the NSF website, the Faculty Early Career Development (CAREER) Program offers that agency’s most prestigious awards for junior faculty for outstanding research and integrated education and research efforts.

Yadama holds a doctoral degree in civil engineering from Washington State University, a master’s degree in wood science and technology from Virginia Polytechnic Institute and State University, and a bachelor’s degree in forestry from Iowa State University.

Emerging Demand for Woody Biomass for Biofuels and Composites focus of Seattle Symposium

Industry leaders in wood materials from throughout the world gathered in Seattle this spring to discuss the use of woody biomass for eventual production of jet biofuels.

Washington State University’s International Wood Composites Symposium collaborated for the first time with the Northwest Advanced Renewable Alliance (NARA) to present “Managing the Woody Biomass Supply Chain—Impact on Your Business.” The symposium focused on global trends, competing demands and opportunities in the woody biomass supply chain, and its impacts on business success.

For almost 50 years, Washington State University’s Composite Materials and Engineering Center (CMEC) has hosted the annual symposium, an industry-focused forum for wood composite panel/engineered wood product producers, suppliers and researchers. Participants come from more than 20 countries.

With support from NARA, this year’s symposium focused for the first time on the latest developments in the fields of biofuel and bioenergy as well as on wood and wood-based composite products.

Last fall, NARA, a broad alliance of private industry and educational institutions that is led by Washington State University, received a $40 million grant from the U.S. Department of Agriculture for the development of aviation biofuels and petrochemical substitutes. The grant aims to address the urgent national need for a domestic biofuel alternative for U.S. commercial and military air fleets.

NARA researchers envision developing a new, viable, aviation fuel industry using wood and wood waste in the Pacific Northwest where forests cover almost half of the region. The project is also focused on increasing the profitability of wood-based fuels through development of high-value, bio-based co-products to replace petrochemicals that are used in products such as plastics.

“Bringing researchers together with industry leaders at the Wood Composites Symposium is an important first step,” said Vikram Yadama, symposium organizing committee co-chair. “We believe this is the type of public-private partnership that is essential for successful development of a biofuels industry and clean energy economy with a positive economic impact for the region.”
Vision for WSU Smart Farm Grows

You would think that an organic farm is sustainable and environmentally friendly—just because it’s an organic farm.

But farming, it turns out, has many challenges when trying to increase sustainability and pursue net-zero energy and water footprints.

For the past several years, teams of engineering, architecture, and construction management students have been working with students and faculty across campus on the smartFARM project, aimed at creating a sustainable organic farm that incorporates smart design and engineering for food and energy production.

WSU’s organic farm, located about 1.5 miles from the main Pullman campus and operated through the Department of Crop and Soil Sciences, got underway in 2003, becoming a certified organic farm in 2004. In 2006, WSU began offering the first organic agriculture major in the United States. The organic farm and its agriculture program have grown since then. In addition to providing continuing teaching and research, the organic agriculture program now includes Community Supported Agriculture (CSA), which allows community members to buy shares and receive produce from the farm, as well as weekly attendance at the Pullman Farmer’s Market. Food from the farm gets donated to local food banks, and about 1,000 people visit each season. Plans call for expanding the farm to eventually include animals.

At the WSU organic farm, students have developed designs for functional spaces that will minimize energy and water use. The project also works to integrate organic methods of pest control and plant and animal management. The real-life project will be incorporated with WSU’s capital planning.

Because of expected future expansion of the Pullman Regional Airport as well as the growth of the organics program, a new and larger property for the farm was recently acquired.

Laurie Mooney, a landscape architecture graduate student, has developed a master plan for the new property, currently located on 17.3 acres off Animal Sciences Road, with an expansion potential of 30 acres. Students from Engineers Without Borders are developing an alternative energy test site on the farm, installing a wind turbine and solar panels.

Graduate students under the direction of the Integrated Design Experience (IDeX) and the Integrated Design Lab (IDL) in the Institute for Sustainable Design have developed designs for a community center, a multi-student caretaker residence, and a passive greenhouse on the site. The proposed community center building will include a kitchen for cooking classes and serve as the pickup point for the CSA members.

A group of architecture and engineering students also designed a residence for the site that would be able to accommodate up to six organic agriculture students that work on the farm.

In partnership with faculty and students in the organic agriculture program, graduate architecture and engineering students have also collaborated on a design for a passive aquaponics greenhouse. Aquaponics combines aquaculture, or raising fish, with hydroponics, growing plants in water, in a sustainable food system. The challenging project aims to create a net zero energy solution for the site, says Todd Beyreuther, an instructor for IDeX, director of the IDL, and clinical assistant professor in the School of Design and Construction.
Renewable Energy and Energy Conversion

The generation and efficient use of power and energy are at the center of a variety of ongoing engineering and societal problems. Catalysts, which are critically important to more than 35 percent of the global GDP, are an important key to increasing energy efficiency and in contributing to a clean environment. In partnership with the Pacific Northwest National Laboratory, WSU is positioned to be a national leader in developing, testing, and using catalysts to advance society.

A New Catalyst for Ethanol Made from Biomass

From PNNL press release

Researchers in the Pacific Northwest have developed a new catalyst material that could replace chemicals currently derived from petroleum and form the basis for more environmentally friendly products including octane-boosting gas and fuel additives, bio-based rubber for tires, and a safer solvent for the chemicals industry.

To turn bio-ethanol into other useful products, researchers at the Department of Energy’s Pacific Northwest National Laboratory and at Washington State University have developed a new catalyst material that will convert it into a chemical called isobutene. And it can do so in one production step, which can reduce costs.

To make sustainable biofuels, producers want to ferment ethanol from nonfood plant matter such as cornstalks and weeds. Currently, bio-ethanol’s main values are as a non-polluting replacement for octane-boosting fuel additives to prevent engine knocking and as a renewable replacement for a certain percentage of gasoline.

Reported by researchers in the Institute for Integrated Catalysis at PNNL and in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering at WSU, the findings appeared in the Journal of the American Chemical Society.

“Isobutene is a versatile chemical that could expand the applications for sustainably produced bio-ethanol,” said chemical engineer Yong Wang, who has a joint appointment at PNNL in Richland and at WSU in Pullman and leads research efforts at both institutions.

WSU Grad Student Receives PNNL Distinguished Fellowship

Ryan Renslow, a Washington State University engineering doctoral candidate, recently received the Linus Pauling Distinguished Postdoctoral Fellowship at the Pacific Northwest National Laboratory (PNNL) in Richland. He is researching electrochemically active communities of microorganisms, called biofilms, to discover the mechanism behind extracellular electron transfer and how this allows cell-to-cell and cell-to-mineral interactions in subsurface sediments. Renslow is a graduate student with Haluk Beyenal, associate professor in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering.

According to the PNNL website, the Linus Pauling fellowship is aimed at “next generation scientists and engineers who will push the boundaries of science to world-recognized discoveries.” The fellowship provides recipients full funding for their major research projects.
New Use for Wheat Straw

Students’ design nabs second in international competition

A group of Washington State University students has taken second place in an international hydrogen design competition with an innovative design for a power plant that can produce heat, hydrogen, and electric power from wheat straw.

The annual Hydrogen Student Design Contest challenges university students to design hydrogen energy applications for real-world use. This year’s competition required that students design a power plant system that produces electricity, heat, and hydrogen for their university campus using local materials. In their first time competing, the WSU team placed second among 20 teams from around the world, including teams from Asia, Europe, and North America.

Whitman County is the top producer of wheat in the United States and produces about 650 million pounds of wheat straw that almost nobody wants. After the wheat is harvested, most of the wheat straw is either burned or tilled underground, and there is little economic incentive to harvest it.

The students developed a plan to make the wheat straw into a valuable resource for the campus and community. In particular, their plan calls for collecting the wheat straw and then using a heating method called pyrolysis to break it down into biochar, a material that is similar to charcoal. From the biochar, the students developed methods for extracting hydrogen and breaking it into base components that have value. The students developed plans to use the hydrogen for fuel-cell powered buses, for heating and electricity, and to produce fertilizer.

The facility could produce enough hydrogen to cut down the natural gas requirements of the WSU steam plant, add 4.4 megawatts of electricity to Pullman’s power grid, and heat nearby greenhouses. Furthermore, the system could provide enough hydrogen to power Pullman’s entire fleet of transit buses as well as WSU’s fleet of work vehicles. Hydrogen fuel cell-powered buses already run in some cities, and the only waste product from the vehicles is water.

The process is highly beneficial for the entire community, said team member Brennan Pecha, a graduate student in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering. The system minimizes air pollution, creates clean energy to supplement the power grid, and gives Whitman County farmers a use for their waste straw. The resources needed for such a facility are readily available on the WSU campus.

Jacob Leachman, assistant professor in the School of Mechanical and Materials Engineering, initially suggested the idea of the contest to students. The students also sought help from Manuel Garcia-Perez, associate professor in biological systems engineering, and Su Ha, associate professor in chemical engineering who works in fuel cells.

“We had all the pieces to make this happen—along with a really good group of students,” said Leachman.

As part of the competition, the team had to develop a feedstock analysis and technical design. They also had to address safety and code compliance issues, conduct an economic and environmental analysis, and develop a business and marketing plan.

“This could actually work,” said Leachman. “It’s rare that you get an opportunity for such a win-win. You can help the farmers, and Pullman could become far and away the most energy efficient city in the country.”

And the project could do even more. A week and a half before the final project deadline, the group got their full system analysis working and came to Leachman with a problem. They didn’t know what to do with all of the hydrogen the system was producing.

“Jake Bair said it best,” said Leachman. “’We’ve got too much hydrogen.’”

The students came up with the idea of creating ammonia fertilizer. The students still only ended up using 14 percent of the wheat straw in the county.

Students on the project included Brennan Pecha (ChemE), Jacob Bair (ME), Eli Chambers (ChemE), Cale Levengood (ME), and Shi-Shen Liaw (BioSysE).

The contest was supported by the U.S. Department of Energy, National Renewable Energy Laboratory, U.S. Combined Heat and Power Partnership, the World Hydrogen Energy Conference 2012, and the International Association for Hydrogen Energy.

The students won cash to attend a meeting in the San Francisco Bay Area of the California Hydrogen Business Council. Leachman is working to get support for further research and to someday make the project a reality.
AIR AND WATER QUALITY

Air and Water Quality

The most compelling societal issues worldwide stem from the challenge of sustaining our lifestyles and economies in the face of finite resources and a fragile environment. A large part of the sustainability equation means addressing challenges to our environment—maintaining the health of our finite water, air, and soil resources, especially in light of the impacts of global change. In WSU’s College of Engineering and Architecture, our research strengths include the Laboratory for Atmospheric Research (LAR), one of the earliest and one of the most prestigious air quality research groups in the United States.

Eastern Washington Desert a Stand-in for Mars Environment

WSU air-quality researcher to lead field studies in support of NASA’s Mars mission

By Robert Strenge, WSU News

Rural eastern Washington will become a testing ground in support of a mission to explore the Martian atmosphere for potential evidence of life under a recently funded NASA project developed by scientists from Cornell University, the Jet Propulsion Laboratory at the California Institute of Technology, and Washington State University.

The proposed mission is intended to help determine whether periodic plumes of methane gas previously detected within the Martian atmosphere are the product of biological or other activity, such as volcanism.

The focus of the mission will be on detecting, locating, and characterizing the sources of methane or other potentially biogenic plumes on the planet’s surface, which could greatly increase our understanding of Mar’s climate and biological history. The mission is also expected to provide new technologies with possible applications in the exploration of other planetary bodies within our solar system, including Earth, the surface of Saturn’s moon Titan, and the subsurface ocean of Jupiter’s moon Europa.

Proposed by Don Banfield, a senior research associate with the Cornell Department of Astronomy; Michael Andrew Mischna, a scientist with the JPL in Pasadena; and Brian Lamb, Regents Professor and Boeing Distinguished Professor of Environmental Engineering with the Laboratory for Atmospheric Research at WSU, the project was initially funded by NASA with a grant of $1.1 million.

New Type of Sidewalk Appearing on WSU Pullman Campus

By Matt Haugen, WSU News Service

A new section of sidewalk outside Sloan Hall on the WSU campus may be a first step in solving vexing urban problems from storm runoff to pollution and water conservation. It’s called pervious concrete, and it allows water to run through a sidewalk rather than across it.

Liv Haselbach, a WSU researcher in the Department of Civil Engineering, is leading an effort to install the sidewalk and see if it could become a permanent addition all across campus.

“For us, it’s a really big deal. If this kind of sidewalk can be used all across campus, we’re hoping that it’s going to save the university money in many ways,” said Haselbach.

A “normal” sidewalk acts as a barrier to water, preventing it from entering the ground. The pervious concrete, with its gaps between the concrete materials, acts as a filter, allowing water to pass through, preventing run-off to storm drains and other infrastructure.

During the winter months in Pullman, the pervious concrete also prevents melting water from pooling and freezing, so the university can spend less on deicer and sidewalk maintenance.

Haselbach admits that the pervious sidewalks are more expensive to install, but as sidewalks need to be replaced on campus anyway, she sees the investment in the infrastructure to be worth it.

Haselbach said the water that is filtered through the sidewalks will make its way to plants and be able to cut down on the amount of irrigation needed to water vegetation.

In addition to the Department of Civil Engineering, WSU Capital Planning and Development, Facilities Operations, and Environmental Health and Safety are also working on the pervious project.
Professor Brian Lamb recently presented a workshop for high school agriculture and science teachers at WSU’s Cook Agronomy Farm. The teachers were invited to tour the farm and attend climate change workshops with about 40 scientists as part of the Regional Approaches to Climate Change (REACCH) program. REACCH is an interdisciplinary project led by the University of Idaho and funded by the U.S. Department of Agriculture that focuses on enhancing the sustainability of agriculture in the Pacific Northwest during climate change. Over the next four years, REACCH scientists are collecting information from 50 sites at public research and private farms in the region. The goal is to better predict the potential impacts of climate change on farming and to develop solutions. Lamb presented his work measuring greenhouse gas fluxes in farm fields. He and his colleagues are studying changes in carbon storage and greenhouse gas emissions as a variety of cropping techniques and growing practices are tested at these sites.

In particular, the electric power grid is including more renewable energy sources than ever before, which impacts the way that the grid will operate in the future. Most of the renewables are geographically constrained and are not located where the energy users are and where load growth is taking place.

With the growth in information technologies, the future grid will also enable more direct decision-making by energy users. With more smart meters, controllers and electric cars available, private customers as well as corporations will be able to decide on how they schedule their own electric load for their homes, buildings, and factories.

“These are all things that will impact the grid, and we want to make sure that the grid grows in those directions to accommodate the changes that society will be making towards a cleaner and more sustainable energy future,” he said.

Bose has been involved in working on the electric power grid for 40 years, first in industry as an engineer and then in academia. He is a member of the US National Academy of Engineering and a Fellow of the IEEE. He has won numerous awards, including the Outstanding Power Engineering Educator Award (1994), the Third Millennium Medal (2000), and the Herman Halperin Electric Transmission & Distribution Award (2006) from the IEEE. He has also been named a distinguished alumnus of the Indian Institute of Technology, Kharagpur (2005) and the College of Engineering at Iowa State University (1993).

During his yearlong assignment, Bose is continuing his WSU appointment and is continuing to conduct research and advise graduate students on a part-time basis.
First the Smartphone, Now the Smart Home

Technology anticipates, meets our needs for health, efficiency

By Eric Sorensen, WSU science writer

We have all heard of the smartphone and, any day now, most of us will have one. Not far behind: the smart home.

Writing in the journal *Science*, Washington State University’s Diane Cook says it won’t be long before our homes act as “intelligent agents” that use sensors and software to anticipate our needs and tend to tasks that improve our health, energy efficiency, and even social media.

Many homes are already halfway there, with computer chips helping microwave popcorn, record TV shows, and turn on coffee makers and thermostats.

“If you have a programmable thermostat, you have the beginnings of a smart home,” says Cook, a WSU professor of electrical engineering and computer science. “What we’re trying to do is get the home to take over the job of programming it.

“We want your home as a whole to think about what you need and use the components in it to do the right thing,” she says.

Cook has been applying artificial intelligence in test homes since coming to WSU in 2006. Sites around the Northwest, including 18 apartments in Seattle, already show that the technology can help monitor aging-in-place elderly residents and alert caregivers if they are not completing ordinary activities like rising, eating, bathing, and taking medications.

Similarly, homes can be designed to automatically regulate energy use, the source of nearly half a consumer’s energy diet. Smart home technologies can run washers at off-peak times, turn off unneeded appliances, and put out lights in empty rooms without residents having to make conscious choices. Many communities, including Pullman, are already testing such concepts through the use of smart meters.

While the smart phone lets people take their social media with them, the home could in effect act like a car’s Bluetooth, facilitating hands-free conversation from any room. For that matter, says Cook, cameras would let residents “Skype from anywhere.”

But while the technology is available, technologies like smart meters and in-home cameras raise privacy concerns for many Americans. The technologies, like so many others, face a classic challenge of being accepted and adopted, says Cook.

She has seen that in particular with the elderly participants in her studies.

“Ultimately,” she says, “when people get a better understanding of what these technologies do and see a usefulness that counterbalances their skittishness, adoption will start. I’m guessing some technologies will gain momentum once they’re starting to be used.”

Cook’s work is funded by the National Institutes of Health, the National Science Foundation, and Washington State’s Life Sciences Discovery Fund.

Engineering for Health

Engineering technology plays an increasingly important role in maintaining and improving health. Research in the College of Engineering and Architecture is increasing fundamental understanding about biomaterials, molecular and cellular biological processes, and biomechanics that will lead to improvements in health and the quality of life for millions of Americans.

College researchers are working to better understand the spread of disease and the behavior of pathogenic bacteria, to improve daily living as we age through the development of health-assistive smart environments, and to make our lives as pain free as possible.
Researchers Aim to Speed Computing, Lower Energy Use

By Daniel Estep, CEA Intern

A group of Washington State University researchers have received an $800,000 National Science Foundation grant for work to improve the speed and lower the power use of computer processors.

Led by Associate Professor Partha Pande from the School of Electrical Engineering and Computer Science and collaborators from the Georgia Institute of Technology and the Rochester Institute of Technology, the team also includes associate professors Deukhyoun Heo and Benjamin Belzer.

The implications of the technology will be felt around the world, says Pande. The majority of the processors designed today are multi-core, which means they are made up of several processing cores. One of their major performance limitations stems from the multi-hop nature of inter-core data exchange. That is, data has to move around several cores, slowing down the processor and wasting energy.

The researchers hope their research in on-chip wireless communication networks will significantly improve the speed of such processors while also reducing power consumption.

Since receiving his doctorate from the University of British Columbia in 2005, Pande has focused his research on network-on-chip, which is the enabling technology for integrating many embedded cores on a single chip.

He realized there were limitations with multi-core processors with growing levels of integration, including high power consumption and delays in processing. In 2007, he began looking into a new solution that will shift the paradigm with on-chip wireless links.

Multi-core processors traditionally use multi-hop wired connections between nodes. The proposed architecture will use wireless shortcuts to communicate between the distant nodes instead. This means single-hop links effectively bypass the intermediary nodes and will directly connect one node to another.

“The big question is how to design the single-hop shortcuts,” Pande said. To solve this question he and his two collaborators, WSU associate professors Deukhyoun Heo and Benjamin Belzer, are working to introduce the so-called Small World Architecture.

“Small World Architecture uses communication highways to improve multi-core processor performance,” Pande said. “You have regular, wired links, but you also need to establish long range shortcuts. The wireless links are those shortcuts.”

Along with designing the wireless shortcuts, Pande and his team also need to design a low power transceiver, on-chip antennas, and communication protocols for the wireless shortcuts to work. Once these are in place, the concept can be applied on a much larger scale.

Hoping to Find Answers for Our Degenerating Cartilage

Researchers in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering have received a National Science Foundation grant for work they hope will someday lead to better treatments for the significant number of people who are disabled by injury or degeneration of their cartilage.

Working with Regeneron Pharmaceuticals Inc., Professors Bernie Van Wie and Nehal Abu-Lail are studying how mechanical and biochemical stimuli promote the growth of healthy cartilage.

Regeneron scientists Vincent Idone, Aris Economides, and Hyon Kim are experts in regenerative medicine, especially as it applies to cartilage and bone diseases.

Unhealthy and degenerating cartilage is a significant and increasing health issue for much of the U.S. population, leading to arthritis and injury. Joint replacement surgery is done about...
Researchers Work to Better Understand Battle Wound Infections
by Alyssa Patrick, CEA Intern

When a soldier is wounded in battle, treatment is sometimes delayed and infection can quickly set in.

Infection means that the wound can become chronic and require further medical treatment, sometimes for years.

With a $1 million grant from the Department of Defense, a WSU research team is hoping to better understand the mechanism by which bacteria become attached to wounds as biofilms and cause such chronic infections.

Haluk Beyenal, an associate professor in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering, is leading the interdisciplinary team of five researchers who aim to gain a fundamental understanding of what happens when a wound is affected by biofilms. Beyenal has been studying the behavior of biofilms for 16 years.

“We want to find a good potential inhibitor and discover how it interacts with the wound surface,” Beyenal said.

Finding out how that interaction works will help provide a strategy to prevent the biofilm development that causes military personnel to suffer from chronic wounds, he said.

The project provides a unique interdisciplinary approach that will improve understanding of biofilms from the nano- to the macro-scales. The other researchers on the project include Nehal Abu-Lail, assistant professor in the Voiland School; Douglas Call, Veterinary Microbiology and Pathology and Allen School for Global Animal Health; Paul Majors, Pacific Northwest National Laboratory (PNNL) and Environmental Molecular Sciences Laboratory; and Boel Fransson, Department of Veterinary Clinical Sciences.

The team members are specialized in the use of different unique tools that haven’t been used for research on biofilms before, says Beyenal. This adds another unique aspect to their research, further enhancing their ability to create a comprehensive understanding of biofilms.

The research project will span over two years and will be conducted in labs at WSU and PNNL.

The researchers will use a unique centrifuge bioreactor process method invented at WSU to grow cartilage tissue starting with adult stem cells. The centrifuge bioreactor allows the researchers to grow and study a large amount of cartilage cells compared to other methods and to put the cells under stress, mimicking the types of stresses that our cartilage might naturally undergo.

The researchers will also use an atomic force microscope (AFM) to study the cartilage functionality and mechanical properties on the cell surface. WSU doctoral student Chrystal Bailey has joined the team to focus on the AFM work.

The work is funded by a National Science Foundation EAGER (Early Grant for Exploratory Research) award. Companion support is coming from Regeneron through an industrial internship for WSU doctoral student Arshan Nazempour.

“The results could have potentially high societal impacts that could be transformative in guiding regenerative treatments,” said Van Wie.
Future Leaders and Entrepreneurs

Solutions to today’s formidable challenges in energy, the environment, and human health will be determined by our students who become engineers, computer scientists, and architects. Engineers of the 21st century will need new skills to compete in a globally competitive workplace and to solve the grand challenges that lie ahead. Fundamental research discoveries may have little impact without a labor force that is prepared to apply technology, business skills, and cultural understanding in a global market.

As a destination university, we are proud to give our students an experience-enhanced education that prepares them to graduate work-ready from day one. WSU’s emphasis on student clubs and hands-on activities promotes student-centered learning and enhances the classroom experience. WSU provides more opportunities for undergraduates to participate in research than any university in the Northwest. The Daily Beast ranked WSU as among the top 25 colleges in the nation in educating technology leaders.

Imagine Tomorrow

Students propose energy solutions, compete for $100k

By Hope Tinney, WSU News

Nearly 450 students from across the Pacific Northwest took up the challenge this spring to imagine a more sustainable, fuel-efficient tomorrow. Their ideas ranged from using neodymium magnets to enhance nuclear fusion reactors to using compostable diapers made from common kitchen supplies.

Washington State University’s fifth annual Imagine Tomorrow problem-solving competition attracted 112 student groups from 46 high schools in Washington, Oregon, Idaho, and Montana to present their ideas for transitioning to alternative energy sources. The students competed for more than $100,000 in prize money in four categories: behavior, biofuels, design, and technology.

Raising the bar

“Every year I think it can’t get any better—and it does,” said Craig Parks, WSU psychology professor and member of the Imagine Tomorrow steering committee. “The bar just keeps going up.”
Once again, imagination, innovation, creativity, and enthusiasm were abundant in projects that ran the gamut from top-drawer, sophisticated research to ideas that were ingeniously simple, said Parks. The CUB Senior Ballroom on the WSU Pullman campus was buzzing with energy and excitement as students explained their ideas to more than 120 judges from a variety of industries and universities. The top sponsors, which also sent judges, included Boeing, Bank of America, Weyerhaeuser, and the Northwest Alliance for Renewable Resources (NARA).

**Scientists connect with students**

“It’s exciting and energizing to be part of this and to talk with students about their projects,” said John Palmer, a technical fellow with Boeing. Palmer said he appreciated having such a large judging corps, and a streamlined judging system, so that the judges—nearly all of whom are working scientists—could spend more time talking with students.

WSU Regents Professor Mike Wolcott, a co-project director for NARA, said he was pleased that the competition attracted students with diverse career goals, not just those focused on careers in science and technology. “We need everyone to understand science and technology,” Wolcott said. Scientific and technological literacy is critical to understanding not only the challenges facing society, he said, but also the intense public policy debates over how to meet those challenges.

**Surrounding states participate**

This was the first year that students from surrounding states were invited to the competition, an expansion made possible by funding from NARA, a WSU-led alliance of university, industry, and government labs dedicated to help create a woody biomass to biojet fuel and bioproducts industry in the Pacific Northwest.
On a beautiful day in mid-May, campus is very, very quiet. After finishing their classes the week before, most students have left their studies far behind. But in a dark lecture hall in ETRL 101, a group of students are still sitting in class focused on learning as much as they can about the world of entrepreneurship and tech ventures.

The 12 students are part of the Harold Frank Engineering Entrepreneurship Institute. The program, which got underway in 2005, invites junior level engineering and business students who are interested in technological entrepreneurship to learn the tools they will need to pursue their ideas. More than 100 students have participated in the program, which was made possible by a $3 million gift from the late Harold Frank (’48 BS EE).

“Harold Frank’s vision and generosity created a legacy that we are only beginning to recognize,” says Kevin Randolph, the new director of the program. “These 12 Frank Fellows, and those that have come before, are creating a legacy of leadership, creativity, and economic development that is multiplying Harold’s gift not only in monetary terms, but also in terms of touching lives.”

Students participating in the institute spend their first week in “entrepreneurship boot camp.” There they learn a variety of important business skills, from small talk and elevator speeches to formal presentations. The students also learn etiquette, so that they can be comfortable in social situations, such as formal receptions, lunches, and dinners.

“Success comes not just from what you know but from how you relate to others and how you communicate,” said Randolph. “We want the Frank Fellows to be comfortable in situations where there might be embarrassment or where they might feel intimidated.”

Since most people only get one chance to make a good first impression, the students also practice their personal “elevator pitch.”

“Tell me about yourself” is probably the question asked more than any other in their career, says Randolph. The students practice this skill with each other, on videotape, and then in professional, social, and business situations.

The students, who have the opportunity to visit with local entrepreneurs and successful WSU alumni, learn the nuts and bolts of beginning a start-up from patent law and intellectual property to keeping the books and hiring employees.

Brad Dawes, a senior in accounting who is a Frank Fellow, is working to start an on-campus accounting business called Crimson Accounting. The business will provide bookkeeping, consulting, and payroll services for local businesses while allowing students to get professional experience. He is part of a group of students who placed in this spring’s WSU Business Plan competition.

Dawes said the program provides the opportunity for students from different disciplines and different perspectives to collaborate, which improves their overall products, services, or designs. He also values the chance to talk with professionals.

“They can tell you things like how they got their first clients, which is the type of thing that we’re working on,” he said.

After the boot camp, the students headed to Silicon Valley where they met and networked with successful entrepreneurs and venture capitalists, some of whom are WSU alumni. In 2010, the Daily Beast named WSU as among the top universities in the country for developing successful technology industry leaders.

“There are very few opportunities for any college students to sit down and hear first-hand from CEOs and industry leaders about their success and failures,” says Randolph. “The students who come out of the Harold Frank program learn the real-world applications for their skills, as well as the teamwork and communication abilities that they’ll need to develop something that we all want and need.”

“The trip was inspiring,” says Summer Holt, a senior in civil engineering. “We saw that you can do anything if you put the work into it. We left thinking that we can start our own business and be successful.”

This year, she and her fellow Frank students will spend the year working to fully develop their business ideas as part of their senior capstone design projects. Their work culminates in entering the WSU business plan competition—and in perhaps someday bringing their ideas to market.

“After going to San Francisco, I don’t want to work in a cubicle the rest of my life,” she says. “I want to be part of creating something.”
Using Liquid Hydrogen Fuel
Students building high-altitude unmanned plane

A group of WSU students is working to build a unique High Altitude Unmanned Aerial Vehicle plane—only the third to be built in the world and the first at a university.

The team hopes that the plane, unmanned and powered by liquid hydrogen, will be able to fly at 65,000 feet, or about 12 miles above the earth, for several days at a time at temperatures that hover at minus 76 degrees Fahrenheit.

“This is a chance to do something no one else is doing at a university,” says Jacob Leachman, assistant professor in the School of Mechanical and Materials Engineering who is leading the student project. “We’re competing for the national championship—and we’re the only ones competing.”

“This is why I’m here—to expand my knowledge and apply what I’m learning and to be part of something that could be huge,” adds Eric Barrow, a senior in mechanical engineering who signed onto the project.

Leachman and the students came together to begin working on the project this spring. The students wanted a new and interesting challenge after having participated in the WSU student chapter of American Institute of Aeronautics and Astronautics (AIAA). AIAA sponsors a competition to design and build remote-controlled airplanes.

At the same time, Leachman, who does research in hydrogen and energy conversion, has developed a small pressurizer that he thinks might be useful for an unmanned, hydrogen-powered, high altitude plane. NASA designs of the HALE (high-altitude, long endurance) planes currently use a cumbersome 400 pound helium tank that serves to pressurize the hydrogen so that it can be used for fuel. Leachman would like to replace the 400-pound tank with his pressurizer that is a little smaller than a pen. He asked the

New School of Design and Construction Gets Underway

The new School of Design and Construction, which brings together WSU’s architecture, construction management, interior design, and landscape architecture programs, is getting underway.

Including four disciplines in one academic entity is unlike any other design program in the United States, and the unique program presents a huge opportunity for collaboration, says Gregory A. Kessler, who will serve as director of the new program.

“We have every discipline that is required for the built environment, including engineering,” he said.

The program expands the integration and collaboration that have been a hallmark of the School of Architecture and Construction Management (ACM) for the past several years.

The school holds an integrated symposium that brings architecture and construction management students together to work on projects. Architecture students have also worked with engineering and landscape architecture students on the Integrated Design Experience, a year-long project that has students develop integrated design solutions. The students most recently worked with the Washington State ferries system to design environmentally-friendly updates and sustainable, low impact development for Washington ferry terminals.

Students in the new program will benefit from learning the language, viewpoints, and values of different disciplines, says Kessler. Such an environment prepares the students for the workforce that they will encounter when they graduate.

“The students learn that by working together, they can create better work,” he said.

At the undergraduate level, the new program’s first year is going to be highly collaborative. Later, students will focus on their specific disciplines. Then, the students will come together collaboratively again for their senior capstone design projects. A series of integrative courses are beginning in the fall of 2012 and 2013.

The students have also been brought together physically in Carpenter and Daggy Halls. The new entity is called the School of Design and Construction. The program is administered by the College of Engineering and Architecture (CEA) and the College of Agricultural, Human, and Natural Resource Sciences (CAHNRS).

A celebration to kick off the new school was held in September, which also commemorated one hundred years of architecture at WSU. Events included lectures, academic events, and a barbecue for alumni and friends.
Student Receives Award at Power Engineering Conference Abdur Rehman, a senior in electrical engineering, received a second place award for his poster, “The Cost to Benefit Analysis of Direct Load Control in Smart Grid Applications,” at the 2012 IEEE Power and Energy Society Transmission and Distribution Conference. Working with his advisor, Anurag Srivastava, assistant professor in the School of Electrical Engineering and Computer Science, Rehman has been conducting his research on the use of Direct Load Control (DLC) by utilities companies to reduce blackouts and brownouts. After graduating from WSU Rehman hopes to continue to devote his time and effort to developing tools that will help consumers become better at energy conservation. “I want to make a difference in people’s lives and power engineering is the best way I can.”

WSU Alumna Recognized by American Society of Civil Engineers Adrienne Nikolic has been named one of the 2012 New Faces of Engineering from the American Society of Civil Engineers. The award recognizes diverse, global, and talented engineering students and engineers age 30 or under who are making their mark on the world with achievements that represent the bold and humanitarian future of engineering. Nikolic received her bachelor’s degree in civil engineering in 2006 from Washington State University. She later went on to get a master of science degree in engineering from Johns Hopkins University. Since 2011, she has worked for Ernst and Young LLP as a senior in their Advisory Services, Power and Utilities Practice in Philadelphia, Pennsylvania. There she works with power and utilities clients to improve their business performance and assists with executing enterprise-wide performance transformation initiatives. Nikolic said she learned at WSU that in life there are no substitutes for hard work and perseverance. “Always push yourself beyond your comfort zone—you’re the only one truly capable of limiting yourself,” she says.

Computer Science Undergrad Receives Boren Award to Study in China Philip Pitts, a sophomore computer science and Chinese language and culture major and member of the Honors College at WSU, has been selected to receive the prestigious Boren Award for International Study. Only 161 applicants from a pool of 1,014 received the national scholarship, which provides $20,000 for one year. Pitts, originally from Genesee, Idaho, is studying at the Harbin Institute of Technology in the northeast region of China.

The Boren Award focuses on skills vital to national security. Pitts says this will help him achieve his goal of working for the Federal Bureau of Investigation (FBI) as a cyber-security intelligence analyst. Funded by the National Security Education Program (NSEP), the Boren Award pays for undergraduate study abroad experiences, specifically those focused on learning a language in a country pivotal to U.S. foreign interests.

Duvil Receives the Bullitt Environmental Fellowship Ricardi Duvil, a graduate student in the Department of Civil and Environmental Engineering, has received a prestigious Bullitt Environmental Fellowship. The award provides $100,000 to graduate students interested in pursuing leadership positions in environmental study. Selection is based on qualifications such as being an outstanding, environmentally knowledgeable graduate student from a community underrepresented in the environmental field, who has demonstrated exceptional capacity for leadership and scholastic ability.

Guenther Receives Award for Unselfish Cooperation Alex Guenther (’86 MS, ’89 PhD) is the recipient of the American Geophysical Union (AGU) 2011 Yoram J. Kaufman Unselfish Cooperation in Research Award. Guenther, a senior scientist and section head at the National Center for Atmospheric Research in Boulder, Colorado, is a leading researcher in the area of volatile organic compound emissions from the biosphere to the atmosphere.

According to the AGU website, the award recognizes “broad influence in atmospheric science through exceptional creativity, inspiration of younger scientists, mentoring, international collaborations, and unselfish cooperation in research.” Guenther was cited, particularly, for his efforts in mentoring students and researchers who are beginning their careers.

Although there are still examples of science being advanced by individuals working in solitude, the collaborative approach in the manner of Yoram Kaufman is increasingly necessary,” wrote Guenther in a response to receiving the award in the EOS newsletter. “I learned this as a graduate student with Brian Lamb and others in the Laboratory for Atmospheric Research (LAR) at Washington State University in Pullman. The LAR team is one of the best examples of unselfish and effective cooperation that I have experienced.”
Donors Provide Support to Attract and Keep Star Faculty Members

Thanks to generous donor support, three new professorships have been recently established in the College of Engineering and Architecture. They are the George and Diane Conniff Distinguished Professorship, Jim and Diane Coughlin Distinguished Professorship, and Paul Hohenschuh Distinguished Professorship.

How they work
Most chairs and professorships have typically come from an endowment established in a donor’s estate plan. A new annual gift mechanism allows a donor to fund faculty and students immediately, says Don Shearer, associate director of advancement for the College of Engineering and Architecture. The professorships employ a unique gift mechanism that allows the donor to commit a specific gift amount equal to what the annual payout of an endowment would be for a set period of years to support a faculty position or a scholarship. In so doing, the donor is able to immediately see the gift’s impact.

Who are the recipients?
David G. Pollock, associate professor in the Department of Civil and Environmental Engineering and Jim and Diane Coughlin Distinguished Professor. Pollock, at WSU since 1997, is a popular professor who received the college’s Reid Miller Outstanding Teaching Faculty Award in 2008, as well as several departmental teaching awards. He is highly regarded as a mentor, curricular advisor, and academic advisor for the American Society of Civil Engineers Club.

Kelvin Lynn, Boeing chair of advanced materials, director of the WSU Center for Materials Research (CMR), and George and Diane Conniff Distinguished Professor. Lynn, world-renowned for his positron (antimatter) annihilation research, pioneered the design of positron beams and constructed the first prototype. In 2000, he and his colleagues received a $1.1 million W.M. Keck Foundation grant to develop a stream of positrons. He and his colleagues in the CMR are helping industries around the world with the challenge of growing better crystals. He is a fellow of the American Association for the Advancement of Science (AAAS) as well as the American Physical Society.

Cornelius (Neil) Ivory, Professor in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering and Paul Hohenschuh Distinguished Professor. A faculty member at WSU since 1989, Ivory is a well-known researcher in the area of bioseparations, where his work is focused on the development of novel systems to enable molecular-level protein separations and purification. The work has important implications in a variety of areas ranging from separations of radionuclides for national defense to purification of proteins that are used in pharmaceuticals and other health-related applications. Ivory holds five patents, with several others pending, and has more than 80 refereed publications.

How does a professorship help the college?
Professorships are meant for the recruitment or retention of world-class, internationally-recognized faculty members and provide annual funding support for materials, equipment, staff, graduate student salaries, or other support that furthers the faculty member’s research or teaching program. For Pollock, for example, extra funds can provide critical support for developing new teaching tools and online tutorials that help students learn difficult concepts. Or it might allow faculty members to attend workshops and conferences on engineering education or provide opportunities for students to go on site visits to engineering projects in the Northwest.

“Without this support, we’re more limited,” Pollock says. “This is an opportunity to really make things better.

“We want to make a tangible difference that will help our students with their preparation for engineering practice. That, to me, is when we will have achieved the goal of this new professorship.”

Thanks!
“We thank these generous donors for their support and investment in the College of Engineering and Architecture and WSU,” said Candis Claiborn, dean of the College of Engineering and Architecture. “These gifts allow us to grow the reputation of our programs and better support our faculty, which is then passed along to our students in the form of a challenging education, engagement, and research opportunities.”

Want to find out more?
Please contact Don Shearer, associate director of advancement in the College of Engineering and Architecture, at 509-335-4733 or don.shearer@wsu.edu.
SCHOLARSHIPS continued from back cover

“Well, it might seem that would cause me some bad feelings toward Dr. Sorenson, but it was actually the correct decision—choosing to continue my engineering education,” he says.

Laufman says that Sorenson saw potential in him. In fact, he credits Sorenson, along with Professor Jack Kimbrell, with giving him the opportunities that would lead to his successful career.

Both he and Marlene were working at WSU. Very soon, though, Marlene was required to terminate employment when she became pregnant.

“Between work, a baby, a heavy study load, and with few financial resources, we really didn’t have the opportunity to participate in too many social activities during those years,” he says.

Having a family and carrying a heavy class load was difficult.

“Graduation would have been impossible without the jobs obtained within WSU, for which we are most grateful,” he said. “Consequently we were moved to assist others that might be experiencing similar circumstances.”

Joining the Space Race

When Laufman arrived at WSU, the Soviet Union had recently deployed Sputnik, the first spacecraft to orbit the earth, in 1957. Devastated and surprised by the Soviet Union’s preeminence, Sputnik spurred a generation to action, especially in engineering and science.

“That impacted me,” he said. “I wanted to be part of our recovery to dominance in space technology.”

In 1961, Laufman did his senior research project on a space station concept that originated with Dr. Werner Von Braun. With the space race in full swing, Laufman received several offers in the aerospace industry upon graduation. His first position was in rocket propulsion development, and he soon went on to related engineering positions at Hercules, Lockheed, and Aerojet-General Corporations. His job involved development of the technology to propel a rocket payload into orbit by optimizing the ratio of fuel weight to inert (steel and insulation) weight of the launch vehicle. The programs he worked on encompassed military as well as space exploration, including the Apollo Moon Missions.

“I wasn’t quite in the front seat of the space race,” he says. “But I was in the car.”

In 1995, he co-founded United Paradyne Corporation. The company is involved in fueling rockets that send astronauts and satellites into space, including the Space Shuttle. As his engineers prepare for launches, they carefully monitor the health of the fuel system from their control room close to the launch pad. On one occasion, one of his engineers had to call for Mission Control to abort a launch countdown, due to discovering another contractor’s malfunctioning component, which saved a mission and most probably the shuttle astronauts themselves. The engineer later received a NASA commendation.

“There is nothing more exciting than a countdown,” says Laufman.

Laufman retired in 2004 but remains on the board of directors of United Paradyne.

“Providence allowed me to fulfill my boyhood dream, and my years at WSU were a very major factor in realizing that goal,” he said.

When Laufman returned to the WSU campus in 2010 as a Distinguished Alumnus Lecturer and keynote speaker to the MME graduates, he had the chance to tour labs and speak with students and faculty.

“I was truly amazed with the advanced research and educational opportunities available in the College of Engineering and Architecture,” he says. “We are humbled to provide help to the next generation of graduates in reaching their dreams.”

Want to know more about providing scholarship support in the College of Engineering and Architecture? Please contact Don Shearer, associate director of advancement, at 509-335-4733 or don.shearer@wsu.edu.

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students to work with him to develop a way to test the idea.

Leachman wanted to give students a valuable, hands-on experience in developing a cutting-edge technology. Hydrogen-powered UAVs are of significant interest because unlike satellites, they can return to earth and be re-used. A hydrogen-powered craft is also more environmentally friendly than those depending on fossil fuels—with the only waste product being water. Hydrogen has a higher specific energy than carbon-based fossil fuels, so if it can be harnessed for new uses, it would provide more energy without pollution. Such unmanned vehicles have numerous applications, ranging from weather monitoring to forestry and military applications.

“It’s a really exciting industry, and it is projected to double in size in the next decade,” says Leachman.

With financial support from alumni gifts, the group of mechanical and electrical engineering students will first develop a small, remote-controlled plane that uses a hydrogen fuel cell. After that, they aim to build a larger model and run it on liquid hydrogen. With its rural location with little airplane traffic, WSU is at an advantage for testing such an experimental plane, says Leachman.

“This is a unique experience for a highly motivated team,” he says. “If successful, the accomplishment will be self-evident.”

If you are interested in supporting the project, please contact Don Shearer, associate director of advancement for the College of Engineering and Architecture, at don.shearer@wsu.edu or 509-335-4733.
WSU’s College of Engineering and Architecture (CEA) is committed to providing a high-quality engineering and architecture education for the people of our state today, while enabling groundbreaking research to help us anticipate and address critical issues facing society tomorrow.

With ongoing success in clean technologies, such as smart environments, power grid, advanced materials, and sustainable design, WSU was ranked by the CleanTech Group as among the Top 10 Clean Technology Universities in the country. Now the CEA will build on these advances to meet sustainable energy and human health challenges while continuing advanced environmental research. By focusing our efforts in these directions, we help change lives for the better.

At the same time, boosting self-sufficiency is paramount as state support for higher education decreases. Along with universities around the nation, WSU must transform the way it operates to accommodate changes in the way research and education are funded.

Public/private partnerships will enable us to attract and keep the highest quality faculty members who produce the vibrant research and excellent undergraduate and graduate education that has been our tradition. And, as the cost of education rises, public/private partnerships will be the key to providing the scholarships, graduate assistantships, and student services so critical to attracting the brightest and most capable students to our programs.

Engineers and architects are at the forefront of creating and implementing the big ideas that shape our future. That’s why the WSU College of Engineering and Architecture has established a $125 million goal to advance solutions for sustainable design, energy, environment, and health through The Campaign for Washington State University: Because the World Needs Big Ideas. Our aspirations are high but achievable with the generous support of alumni and friends. We seek your participation as we apply our knowledge and innovation to improve the well-being of our state, nation, and world—ensuring a sustainable world for our children and grandchildren.

### Reaching Our Goal

**With Your Help**

- **FACULTY EXCELLENCE**
  - Sustainable Energy and Design: $52 million
  - Environmental Technologies: $12 million
  - Engineering for Health: $6 million
  - Educating Tomorrow’s Leaders and Innovators: $9 million
  - World-Class Faculty: $16 million

- **STUDENT SUCCESS**
  - Undergraduate Scholarships: $31 million
  - Graduate Fellowships: $15 million
  - Research Scholar Awards: $15 million

- **PROGRAMS AND FACILITIES**
  - Sustainable Energy and Design: $42 million
  - Environmental Technologies: $29 million
  - Engineering for Health: $4 million
  - Educating Tomorrow’s Leaders and Innovators: $3 million

**TOTAL**: $125 million
Couple’s Long Ago Challenges Lead to Support for Student Scholarships

Paul (’61 ME) and Marlene Laufman remember the challenges of struggling to pay for college. In 1959, they were a young married couple who would soon be having children. Paul might not have made it to his degree in mechanical engineering without the support they received from WSU.

The couple has recently started a scholarship endowment that will provide support for students, especially those who have transferred from community college or are married.

“Returning resources to an institution that played such an important role in one’s life, and for the purpose of ‘paying forward’ that assistance to a new generation, seems to us to be a responsibility rather than a donation,” he said. “We wanted to express our gratitude to the educational and work opportunities WSU provided, and in the form of assistance of the kind we obtained.”

Laufman, who grew up in Longview, Washington, aspired to be an engineer from a young age, enjoying math, science, and drafting classes in high school. After attending community college at Lower Columbia Junior College, he came to WSU with the goal of playing baseball for legendary coach Buck Bailey. When he got to WSU, he was immediately challenged by WSU’s difficult mechanical engineering program. While he had done well in high school and at the junior college, he wasn’t prepared for the demanding WSU curriculum. Out of a few hundred students that started in the program, only 29 went on to graduate.

“I kind of floundered through my first (sophomore) year at WSU,” he says.
Professor Harry Sorenson soon presented him with a choice: baseball or mechanical engineering. At the time, Laufman felt that with his family and limited resources, he simply couldn’t pursue his baseball dreams.