Where’s the Donor Roll?

We are proud and thankful for our alumni, friends, and 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, 2014, to June 30, 2015, at vcea.wsu.edu/honorroll.
**ENROLLMENT**

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<tr>
<th>Undergraduates</th>
<th>Master’s</th>
<th>Ph.D.s</th>
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<td>4,359</td>
<td>272</td>
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**DEGREES GRANTED**

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<th>Master’s</th>
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<td>651</td>
<td>110</td>
<td>49</td>
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Since opening its doors in 1890, Washington State University has bestowed more than 20,000 engineering and architecture degrees.

- **Faculty:** 217
- **Intellectual Property Disclosures:** 40
- **Total Research Expenditures:** $28 Million

**FACULTY AWARDS & HONORS**

- **1 Presidential Early Career Award for Scientists and Engineers**
  - Susmita Bose

- **1 Presidential Faculty Fellow**
  - Shira Broschat

- **2 National Academy of Engineering Members**
  - Anjan Bose • John P. Hirth

- **20 Early Career Development & Young Investigators**
- **28 Faculty Fellows**

**RESEARCH FUNDING BY SOURCE**

- Federal: 75%
- Private Industry: 6%
- Private Nonprofit: 3%
- Other: 2%
- State of Washington: 14%

*Numerous Voiland College 2014 data sources*
As we celebrate the 125th anniversary of Washington State University, I’m pleased to share our latest edition of Innovation. In this celebratory issue, we look back at our accomplishments and forward into our exciting and promising future.

Land Grant History
We are so very proud of our land-grant history and the contributions that all of you from the Voiland College have made to make the state of Washington a better place to work and live. You have been a part of this valuable work—building our state infrastructure, powering our lives, developing new materials, or designing beautiful and landmark buildings. We have been dam builders and bridge builders, cleaned up pollution, and developed wood and plastic products for the building industry. You, our alumni, are leaders in our state and nation’s most important industries in aerospace, manufacturing, construction, information technology, and power.

Grand Challenges
At the same time, we are proud of the hard work we are doing as we move forward into this next century, addressing the greatest challenges in energy, the environment, and health. As a nation, it is more important than ever to tackle these challenges with enthusiasm and hard work. With our strong tradition of teaching hands-on, practical skills, we are preparing our students to be the leaders to face these challenges.

Research
I hope you’ll enjoy reading some of the history of our 125 years of research. Our important work continues in the areas of advanced materials, air and water resources, sustainable infrastructure, catalysis, and the smart electric power grid. Our researchers are working to develop novel bio-based plastics, develop new sustainable building materials, improve understanding of air pollution, and even make jet fuel hydrocarbons from fungi.

Remembering President Floyd
As we face what promises to be our exciting future, we did, sadly, have to leave someone behind. How sad and ironic that in a year of such great success, we also faced the huge loss of our dear friend when President Elson S. Floyd passed away in June. Much of our success came about because of his wise leadership and guidance. We will fondly remember his generosity and caring spirit, and we know how much of a difference he made to this state.

I look forward to continuing Dr. Floyd’s important vision and work for the university as we move forward in furthering the Voiland College’s research, educational, and outreach goals.

Thank you for your support, and Go Cougs!

Sincerely,

Candis Claiborn

Institute of Technology faculty and staff, 1954
From its start, fundamental knowledge along with practical acumen to produce practical results were a key part of WSU’s materials program. Clarence Zener, inventor of the Zener diode, a precursor of the modern digital age, initiated WSU’s program in metallurgy in 1935. In 1949, WSU’s Wood Materials and Engineering Laboratory (WMEL) was founded. The WMEL was an integral part of WSU’s materials science and engineering program and an early contributor to sustainable resource use from forests.

WSU materials researchers had major impacts on the development of structural materials for a wide range of applications. John Hirth did fundamental theoretical and experimental research on line defects (dislocations), which provided key understanding of deformation of materials and their behavior at the atomic level. WMEL researchers developed nondestructive testing methods that revolutionized production of high quality engineered wood composites. Ultrasonic veneer grading technology was key to the development of the I-joist material that now claims about 30 percent of the market for floor supports in single-family homes. In 2001, the WMEL became the Composite Materials and Engineering Center (CMEC), which continues to develop new building materials and innovative structural systems for economic viability, sustainability, and public safety. CMEC has been a leader in recycling wood and plastic into new composite materials, and 40 percent of commercial wood-plastic composite products use formulations developed there.
"Plastics...There’s a great future in plastics.” That line from the 1967 movie The Graduate could be revised to say that the future is now in bioplastics. Washington State University, in collaboration with Iowa State University, recently established the first industry and university cooperative research center devoted to the development of biologically based plastics.

“Making plastics is not new, but making them from renewable materials rather than from petroleum is a growing area of interest in research and in industry,” said Michael Kessler, Berry Family director.

“There are advantages of bioplastics from an environmental, economic, and even performance standpoint, and the field is growing exponentially,” he said. “I am confident that this center will address many of the critical issues in bio-based polymers and composites which will lead to a more sustainable future.”

With support from a National Science Foundation grant, the Center for Bioplastics and Biocomposites will work with industry and university partners to increase the use of biologically based, sustainable materials in the marketplace.

The five-year award creates a cooperative research center that brings together partners to conduct research that is particularly relevant for industry and has a high potential for commercialization. There are about 60 such research centers in the United States, including another at WSU that is focused on the design of integrated circuits. Industry partners also provide support for the center.

Research in the new center will be focused in the areas of synthesis and compounding of bioplastics and biocomposites, bio-based products, processing, medical applications, and computer modeling of processing techniques. In addition to 17 faculty members from WSU, the center includes researchers from ISU as well as over 25 industry partners such as 3M, Boeing, ADM, Hyundai Motor Group, Ford, Solvay, and Eco Products.

Researchers have developed a new way to use plant oils like olive and linseed oil to create polyurethane, a plastic material used in everything from foam insulation panels to tires, hoses, and sealants. The researchers, led by Michael Kessler, Berry Family Director and Professor in the Voiland College’s School of Mechanical and Materials Engineering, have published a paper on the work in the journal ACS Applied Materials & Interfaces.

Polyurethane is extremely tough and corrosion and wear resistant, but researchers would like a more environmentally friendly alternative to the petroleum-based product. About 14 million tons of polyurethane were produced in 2010, and production is expected to increase by almost 30 percent by 2016.

While there are already some polyurethanes made from plant materials, Kessler’s research group developed a new method that uses vegetable oils to create materials with a wide range of flexibility, stiffness, and shapes. Plant oils are inexpensive, readily available, renewable, and can be genetically engineered.

In the study, the researchers made polyurethane using olive, canola, grape seed, linseed, and castor oils. While other researchers have struggled with using petroleum-based solvents, the WSU researchers, working with colleagues from Iowa State and Cairo universities, didn’t use solvents or a catalyst in their production.
WSU RESEARCHER NAMED NAI FELLOW

Amit Bandyopadhyay, a Washington State University researcher who developed a way to make tools out of moon rock and artificial bone on a 3-D printer, has been named a fellow of the National Academy of Inventors (NAI). The second NAI fellow in the state of Washington, he joins an elite group nationwide that includes 21 Nobel Prize winners, 21 inductees of the National Inventors Hall of Fame, and 10 recipients of the U.S. National Medal of Science.

“Dr. Bandyopadhyay is a strong researcher who sees beyond the lab and into lives that his technologies can improve,” said Anson Fatland, associate vice president of economic development. “This is a great recognition that speaks to the quality of faculty and innovations coming from Dr. Bandyopadhyay’s lab and WSU overall.”

Bandyopadhyay holds 10 patents; he develops materials to enhance the safety and durability of joint implants for people with fractures and bone disorders.

“Dr. Bandyopadhyay is one of the Voiland College’s innovation leaders in the field of advanced materials,” said Candis Claiborn, dean of the WSU Voiland College of Engineering and Architecture. “His research promises to provide real-world solutions for the critical national challenge of an aging population—and to help build a stronger economy for the state and region while it positively affects peoples’ daily lives.”

Bose receives Woman to Watch award

Professor Susmita Bose was recognized as a “Woman to Watch in Life Sciences” during the Washington Biotechnology and Biomedical Association’s annual Life Science Innovation Northwest conference on July 1 in Seattle. The award recognizes women “who are thought-leaders in their fields and shaping the future of their industries,” according to the organization. The WBBA is a Washington life sciences trade association that includes more than 650 member organizations.

Bose conducts research in medical materials, including 3-D printing of bone-like materials to make implants more biocompatible and less prone to infection. She holds three patents for medical devices, is a co-inventor on five active patent applications, and has published more than 200 journal articles. She recently received a five-year, $1.8 million National Institutes of Health grant to improve the way bone implants integrate into the body.

“This work could have a profound effect for younger patients and for those who undergo revision surgeries where bone volume is compromised,” said Bose.

“A few extra years for these hip or knee replacements can make a tremendous difference,” said research team member Amit Bandyopadhyay, also of the Voiland College’s School of Mechanical and Materials Engineering.

Bandyopadhyay and Bose have been leaders for more than a decade in 3-D printing of bone materials and improved materials for bone implants. In preliminary studies, they have used nanomaterials to make coatings that are stronger and more biocompatible than those currently available. The grant will allow them to further test the new coatings. Others on the team are William Dernell of the WSU College of Veterinary Medicine, physicians from Stanford University and the University of Washington medical schools, and students from a variety of disciplines.

Getting them back on their feet—faster!

Washington State University researchers are working to improve materials used in hip and knee replacements so that they last longer and allow patients to quickly get back on their feet after surgery. Led by Susmita Bose, professor in the School of Mechanical and Materials Engineering, the researchers have received a five-year, $1.8 million National Institutes of Health grant to improve the way bone implants integrate into the body.

The researchers will mix ions commonly found in the body—such as magnesium, zinc, and calcium—into their coatings. They also will add tiny amounts of medicine, such as antibiotics or osteoporosis medications, to the coatings. They already have received patents on their innovative method of delivering medicine to a patient, which could be used like a time-release drug to fight infection or to build bone strength.

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The Laboratory for Atmospheric Research (LAR), was established in 1950 as was one of the first air pollution laboratories in the United States. Early work in the lab began because of odor complaints about pulp and paper mills. Don Adams took on the small lumber mill project, unaware that the work would launch the lab and determine the rest of his career.

In the mid-1950s, Adams developed and patented analyzers that measured atmospheric gases—low-tech, plywood contraptions that his family called “birdhouses.” With clothes pins holding the filter paper to measure pollutants, the researchers would fly planes through pollution plumes, occasionally shutting off the plane’s front propeller to take measurements.

In the 1960s, LAR researchers led an extensive study of atmospheric pollution in the Spokane area from aluminum plant emissions and demonstrated for the first time that pine trees were dying from the plant’s sulfur emissions. The group had a national reputation for its work, especially for its development of instrumentation to detect and monitor air pollution, which continues to this day.

The State of Washington Water Research Center was established in 1964 by federal legislation along with 54 other water centers and institutes throughout the United States and territories. The agency’s main missions are to facilitate water research across the state, to train and teach by supporting students’ involvement in the center’s research projects, and to provide education and outreach to the community. The Water Research Center fosters research on the state’s water-related problems while providing research experience to graduate and undergraduate students.
Direct measurements show lower local methane emissions

A team led by Washington State University researchers found that methane emissions from local natural gas distribution systems in cities and towns throughout the United States have decreased in the past 20 years with significant variation by region. The researchers found that upgrades in metering and regulating stations, changes in pipeline materials, better instruments for detecting pipeline leaks, and regulatory changes have led to methane emissions that are from 36 percent to 70 percent lower than previous Environmental Protection Agency (EPA) estimates when the data gathered for this study are combined with pipeline miles and number of facilities. The study showed significant variation by region, with some areas showing higher than average emissions because of large differences in the age and type of pipe in different parts of the United States.

The study, published earlier this year in Environmental Science & Technology, was led by Regents Professor Brian Lamb in WSU’s Laboratory for Atmospheric Research with assistance from Conestoga-Rovers and Associates, an engineering and environmental consulting firm. It provides the most comprehensive direct measurements yet of emissions from the distribution system. With a series of partner studies, it is helping to determine the natural gas industry’s contribution to U.S. greenhouse gas emissions and global warming. The distribution system includes underground natural gas pipelines as well as metering and regulating facilities and customer meters in cities and towns.

The study was done in coordination with major natural gas utilities and the Environmental Defense Fund (EDF) and was sponsored by the American Gas Association, Con Edison, EDF, National Grid, Pacific Gas & Electric, and Southern California Gas.

Researcher wins Fulbright chair to study Arctic change

Von P. Walden is expanding international collaboration on research into thinning sea ice as the 2015 U.S. Fulbright Arctic Chair in Norway. Walden, a researcher in the Voiland College’s Department of Civil and Environmental Engineering, is spending four months at the Norwegian Polar Institute (NPI) in Tromsø, a small city north of the Arctic Circle, and is collaborating with colleagues throughout the country.

The Arctic has experienced some of the greatest effects of a changing climate, including dramatic reductions in sea ice. Walden has collaborated with NPI for a year to understand sea ice formation in the Arctic Ocean. Institute scientists have been conducting experiments aboard a ship frozen in the ice since January.

Walden works in WSU’s Laboratory for Atmospheric Research and joined the Arctic ship in May to make measurements of the atmosphere. The award, among the most prestigious Fulbright appointments, allows him to analyze data and improve atmospheric modeling in the Arctic as part of the ongoing collaboration.
Back in 2011, a 204-page report gave a water supply and demand forecast for the Columbia River Basin.

Called the *Columbia River Basin Long-Term Water Supply and Demand Forecast*, the report was developed with the help of Washington State University researchers, including Voiland College Civil Engineering Professor Jennifer Adam, and was the most comprehensive look at predicted changes in surface water supplies in eastern Washington over the next 20 years. The report was meant as a guide for developing new water supplies in eastern Washington.

The water supply issue took on more urgency this summer when Washington Governor Jay Inslee recently declared a statewide drought emergency. While the state received an average rainfall precipitation during the past year, higher than normal temperatures and very little snow means that water supplies that traditionally depend on melting snowpack are affected. Computer models predict that climate change will make just such scenarios increasingly common in the future.

As part of the 2011 study, the WSU researchers developed a forecast for water supply and demand and assessed how future economic and environmental conditions, including water scarcity, will affect agricultural productivity. The researchers integrated three computer modeling programs, bringing together climate predictions, water management scenarios, and economics to better understand water supplies, demand for irrigation, unmet demand, and future crop yields.

"With experiments you can only observe what has already happened,” says Adam. “The nice thing about modeling is you can test changes that haven’t occurred yet. If we evoke a change, we think the model can tell us what that change would cause.”

To better understand how crop yields will be affected by climate change, Adam worked closely with her colleagues, including Claudio Stöckle in the Department of Biological Systems Engineering and Michael Brady in the School of Economics. Kirti Rajagopalan, a graduate student in the Department of Civil and Environmental Engineering, and Georgine Yorgey and Chad Kruger with the Center for Sustaining Agriculture and Natural Resources also worked on the project.

“There are several competing factors that have positive and negative impacts,” Adam says. “Our science is teasing out the effects.”

The researchers are continuing their work and will soon publish the 2016 report, as the state legislature requires an updated forecast every five years. With sophisticated computer models, the researchers are taking a closer look at water supplies and impacts on specific crops, including dryland and irrigated crops. The 2016 forecast aims to provide scientific information to help state leaders make better decisions about where and how to fund water supply projects.

For excellence in mentoring and motivating students, WSU associate professor Jennifer Adam received a 100 Inspiring Women in STEM award from *INSIGHT into Diversity* magazine. This annual award celebrates women in science, technology, engineering, and mathematics who encourage female involvement in STEM fields. Adam was honored in the magazine’s September edition.

“Jennifer Adam is an amazing example of a faculty member who leads by example while guiding her students with kindness, compassion, and understanding,” said Sarah Anderson, a student who supported Adam’s nomination. “She encourages the female students under her tutelage but also minority and international students as exemplified by her diverse research group.”

With WSU since 2008, Adam, associate director for the State of Washington Water Research Center, conducts research in hydraulic modeling, the hydrologic impacts of global change, Earth systems modeling, and land and atmosphere interactions. She is currently leading a multidisciplinary team of approximately 40 faculty and student researchers in the development of a computer modeling platform called BioEarth. Adam is passionate about interdisciplinary research and actively collaborates with faculty in biological systems engineering, chemical engineering, earth and environmental sciences, geology, atmospheric sciences, economics, political science, computer science, and biology.

“She always strives to put students first,” said Anderson. Adam has won several departmental and college teaching awards, including the Voiland College of Engineering and Architecture’s Reid Miller Teaching Excellence Award and the Leon Luck Faculty Award as the Most Effective Professor in the Department of Civil and Environmental Engineering in 2014.

“Adam mentors and leads by setting the example,” Anderson said. “She shows her students how to obtain the mentoring and training they need by doing so herself and sharing that process with her students.”
From WSU’s earliest days, engineering and architecture students and faculty led its infrastructure design, starting with the Pullman campus. Civil engineering students developed the campus’ contour mapping, designed the water and sewer system, and surveyed roads. Professor Waller, in civil engineering, led the campus lighting project in 1911 and supervised a student’s design of the hydraulics building. The first architecture class was offered in 1911, and WSU’s was one of the earliest architecture programs in the western United States. WSU’s first architecture professors, Rudolph Weaver and Stanley Smith, were also the campus architects, so they designed many of WSU’s early buildings, including Carpenter, Wilson, McCroskey, and Stimson Halls; the president’s house; and the cattle barn that later became the Lewis Alumni Center. Smith designed Troy and Waller Halls, Hollingberry Fieldhouse, North-South Hall, and the Engineering Shops building.

Many Voiland College alumni went on to design and build state and national infrastructure, from the BART system in California to Washington floating bridges and iconic buildings, like Seattle’s Bullitt Center. That tradition continues, and our researchers continue to lead in providing innovative approaches to benefit the public by pioneering changes to the design and construction of the built environment.
WSU leads team to determine state’s iconic architecture

The Hanford nuclear site, Seattle’s Bullitt Center, and the historic center of the Washington State University Pullman campus are among the most significant and representative architectural sites in the state of Washington, according to WSU researchers.

The team, led by Phil Gruen, director of WSU’s School of Design and Construction, is part of the Society of Architectural Historians’ (SAH) Archipedia Classic Buildings project, an online encyclopedia that aims to feature 100 significant buildings from each of the 50 states. The project selected Gruen to coordinate and select Washington's sites. He is working with former graduate student Robert Franklin; they expect to complete the work by the end of summer 2016.

“This 100 list is trying to present a story, or several stories, of the state through the built environment,” Gruen writes in the SAH blog.

“We’re constituting a very different way of thinking, or at least raising the question about how one understands a built environment,” he adds. “Is it just about aesthetics and famous people, or is it about the significance of the site and its stories in relation to American culture or history? This is one of the challenges of creating Archipedia, because it’s not just buildings; it’s the most represented spaces and places. Everything counts.”

The Archipedia project started with an award-winning print series called Buildings of the United States, which contains more than 13,000 building histories, maps, pictures, and essays, according to the SAH. Gruen says he hopes the Archipedia project will enlighten the general public about architecture.

“Information about architecture should be accessible,” he says. “It shouldn’t be arcane in terms of its information, it should be understandable and it should be talked about in ways that anyone can understand.”
Researchers designing supply chain for novel building material

WSU researchers have received a United States Department of Agriculture Forest Service Wood Innovation grant to analyze and design a complete resource-to-use supply chain for an environmentally friendly wood building material that could replace steel and concrete in buildings.

The research will bring together engineering and design faculty at WSU along with a lumber mill in Colville (Vaagen Bros. Lumber), a cross-laminated timber (CLT) manufacturer in Columbia Falls, Montana (SmartLam), and an advanced systems manufacturer in Spokane (Berg) on a test project to create a pilot supply chain in the United States for CLT. The goal is to bring the material to urban design and construction teams in the Pacific Northwest.

CLT has been called “plywood on steroids.” The material is created by stacking layers of lumber with the grain facing in alternating directions and binding them together using a urethane-based resin to create a strong and stable engineered wood panel. It’s more sustainable and less energy intensive to make than steel or concrete. CLT can be used as structural walls, floors, and roofs. The wood material has been used to build tall buildings in Europe, but it could also be used in a variety of buildings, such as warehouses or low-rise housing.

“It’s beautiful,” says Todd Beyreuther, assistant research professor in the WSU Composite Materials Engineering Center, who is leading the project. While builders in Europe have been using CLT for more than a decade, the technology has only recently begun to be adopted in the United States. There are only two building panel CLT manufacturers in North America, which are both in Canada. U.S. building codes began including standards for the material in 2015. Industrial project partner SmartLam is manufacturing CLT industrial mats and will leverage this project and another Forest Service grant to add building panel manufacturing capabilities.

During the past decade, WSU has been conducting leading research on CLT product development and on developing customizable methods of creating the material that are similar to 3-D printing. Two buildings on the WSU campus include CLT, including the new WSU Brelsford Visitor’s Center and the PACCAR Environmental Technology Building, currently under construction.

“We have ongoing projects related to CLT product development and engineering. Now we are looking at the supply chain,” says Beyreuther. “This is how we are going to connect the dots and get the material from the forest into buildings.”

The $250,000, two-year grant will leverage investments from industry partners, resulting in a total of $650,000 in support.

The Pacific Northwest is particularly well-suited for development of a CLT industry because of large tracts of dense national forest land in need of restoration, says Beyreuther. While providing a boost to rural communities, a CLT industry could provide opportunities for timber utilization, ecological restoration, and fuel reduction.

The building industry uses techniques that have changed little in the past century, he adds. So, lumber comes from the mill and then is cut and used by builders on site for their building purpose. The researchers aim to make the CLT manufacturers a more integrated part of the building design team. The researchers will work to use advanced manufacturing techniques to improve efficiency, so that, similar to the aerospace industry, prefabricated CLT panels could arrive at a building site ready to be assembled.

“The building industry is just beginning to keep pace with the optimization, quality control, and customization processes that have been realized by the automotive, shipbuilding, and aerospace industries,” he says.
Catalysis/Energy Conversion

Built upon a long history of expertise in fossil-fuel production, WSU’s chemical catalysis group is focused on the development of advanced catalysis and reaction engineering systems that enable the more effective use of existing fossil resources, mitigating environmental impact of transportation fuels and removing carbon dioxide from the atmosphere, while also enabling a future that makes more effective use of materials that were previously considered waste. During the past decade, the Voiland College has become a leader in this area of strategic importance to industry—especially in the state of Washington.

Scientist earns top national award for biofuels research

Professor Xiao Zhang received a prestigious National Science Foundation Faculty Early Career Development (CAREER) award for his work in converting tough plant material to liquid fuels. He is developing an innovative chemical pathway to convert lignin to open chain hydrocarbons similar to those that make up jet fuel.

The results will lead to new processes for producing sustainable fuel and improving the economic and environmental sustainability of biorefinery operations.

“This is a potentially transformative technology, which can lead to large scale utilization of lignin,” said Zhang, assistant professor in the Voiland School of Chemical Engineering and Bioengineering at WSU Tri-Cities.

Lignin is a complex component of plants that gives them rigidity. In the paper industry, millions of tons of lignin are already used as fuel for generating electricity. Researchers are interested in converting lignin to liquid fuel, but current methods require a lot of hydrogen and a tremendous amount of energy.

“They have to invest a lot of energy to make energy, which in our opinion is not the best way to go,” Zhang said.

The $500,000, five-year CAREER award will allow Zhang, Pacific Northwest National Laboratory collaborators, and industrial partners to develop a new method to break apart the tough ring of the lignin molecule at mild temperatures. This will simultaneously produce value-added chemicals suitable for carbon fiber production.

“It’s a very recalcitrant molecule,” he said. “If the process were straightforward, everyone would have thought of it already.”
From fungus to fuel: WSU Tri-Cities biofuels research takes flight

Washington State University researchers have found a way to make jet fuel from a common black fungus found in decaying leaves, soil, and rotting fruit. The researchers hope the process leads to economically viable production of aviation biofuels in the next five years.

The researchers used Aspergillus carbonarius ITEM 5010 to create hydrocarbons, the chief component of petroleum, similar to those in aviation fuels. Led by Birgitte Ahring, director and Battelle Distinguished Professor of the Bioproducts, Sciences, and Engineering Laboratory at WSU Tri-Cities, the researchers recently published their work in *Fungal Biology*.

Fungi have been of interest for about a decade within biofuels production as the key producer of enzymes necessary for converting biomass to sugars. Some researchers further showed that fungi could create hydrocarbons, but the research was limited to a specific fungus living within a specific tree in the rainforest, and the actual hydrocarbon concentrations were not reported.

Ahring’s group has previously been successful in using standard Aspergillus fungi to produce enzymes and other useful products, which have been patented and are under commercialization, so they decided to look into A. carbonarius ITEM 5010’s potential for biofuels. Fungi are complex microorganisms and are not always easy to work with, Ahring said. They have a complex biology that is often poorly understood.

“Not many people in this world actually do this,” she said. “The molecular biology piece of it is complicated.”

The researchers were assisted by Kenneth Bruno, a researcher at the U.S. Department of Energy’s Pacific Northwest National Laboratory, who developed a method essential for the genetic manipulation of A. carbonarius. The research received funding from the Danish Council for Strategic Research under the program for energy and environment.

Using fungi for hydrocarbon and biofuels production is better than other methods because they do the work themselves, bypassing multiple complicated chemical processes required by other biofuel production methods. Fungi also have great potential to create the fuel at low cost, Ahring said.

The researchers are now working to optimize the fungi’s hydrocarbon production and improve biochemical pathways through genetic engineering.

“It’s very promising,” she said. “I think that the fungus-based fuels are something that is going to happen. It’s a tremendous opportunity.”

Birgitte Ahring, right, and Ph.D. student Malavika Sinha look at a new mutant of Aspergillus carbonarius.
Wang named to Washington Academy of Sciences

Yong Wang, Voiland Distinguished Professor in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering, has been named a member of the Washington Academy of Sciences.

With WSU since 2009, Wang is an internationally known researcher in energy and renewable fuels whose work has had a significant impact on improving energy efficiency in the chemical and fuels industries. He holds a joint position at Pacific Northwest National Laboratory.

Wang’s work ranges from fundamental to applied research in catalysis and reaction engineering to improve the conversion of biomass and hydrocarbons to fuels and chemicals. Improving the efficiency of catalysts, which are used in many industries to chemically transform and create products and fuel, is important to increasing supplies, reducing costs, and improving environmental impacts of petroleum-based and alternative fuels.

A WSU alumnus (’92 M.S., ’93 Ph.D. Chem E), Wang is a fellow of the American Association for the Advancement of Science (AAAS); the Royal Society of Chemistry (RSC), which is the largest chemical sciences organization in Europe; the American Institute of Chemical Engineers (AIChE); and the American Chemical Society (ACS). The Chinese Institute of Engineers named him the 2006 Asian American Engineer of the Year. He is the recipient of three prestigious R&D 100 awards (1997, 1999, and 2008), which annually recognize the 100 most significant and innovative new technologies that have been introduced in the marketplace. He is also a recipient of the Presidential Green Chemistry Award and twice was named Pacific Northwest National Laboratory’s Inventor of the Year. He has more than 200 peer-reviewed publications, more than 100 invited presentations, 92 issued U.S. patents, and six edited books and topic journals issued on novel materials and reaction engineering for fossil and biomass conversions.

Murdock grant to fund next-generation science at WSU

By Will Ferguson, College of Arts & Sciences

A battery-powered car that gets you from Pullman to Seattle on a single charge. Flexible electronics that can be sewn into clothing. An affordable transportation fuel made from hydrogen and carbon monoxide. Washington State University researchers are a big step closer to making these futuristic technologies a reality thanks to a $521,800 grant from the M.J. Murdock Charitable Trust.

The grant will help purchase X-ray and UV photoelectron spectroscopy instruments found nowhere else in the Pacific Northwest. One of these will be housed in the Voiland School of Chemical Engineering and Bioengineering and will help researchers investigate the mechanisms of catalytic reactions and test materials and devices in the environments where they will be required to function.

“One of our present research topics is to produce gasoline or diesel fuels catalytically from two simple gases, hydrogen and carbon monoxide, under environmentally friendly conditions,” said Norbert Kruse, Voiland Distinguished Professor. “The possibility of producing a range of important chemical products from only two gases is most fascinating, and the two photoelectron spectrometers will help develop the respective nano-sized catalysts.”

The Murdock grant will help WSU faculty attract lucrative new grants and top-notch young faculty and graduate students.

“We anticipate that this equipment will allow us to perform hitherto unimaginable research funded by the federal government and industry and to develop new technologies that will fuel the economy,” said James Petersen, director of the Voiland School.
While electricity came to the Pacific Northwest at the turn of the century, demand grew rapidly in the 1950s. Washington Water Power, which later became Avista, came to Washington State College in 1953 looking for help constructing a spillway for the proposed Clark Fork River dam in Montana. By December 1954, researchers built a miniature of the dam in an old WWII-era Quonset hut behind Dana Hall. The researchers then built a model of the Middle Snake River at Pleasant Valley, one-fiftieth the size of the real dam at 12 feet high and 25 feet wide.

With no room in the Quonset hut, the model was built outside. Eventually, demand was so high for the researchers’ work that Albrook Laboratory was literally built around the dam models as studies were being conducted.

A frenzied pace continued in the lab through the 1970s as dams around the western United States and throughout the world were constructed. Among the dams modeled at Albrook were the Rocky Reach (1961), Priest Rapids, Wells, and Wanapum dams. The dam models were not only useful to industry, but became one of Pullman’s largest tourist attractions. At one time, there were two models side-by-side—one for a dam in Pakistan and the other on the Snake River.
Earlier this year, Governor Jay Inslee, Senator Maria Cantwell, Congresswoman Cathy McMorris Rodgers, and Pat Hoffman, assistant secretary for the U.S. Department of Energy’s Office of Electricity Delivery and Energy Reliability, came to Pullman to talk smart grid and power engineering at WSU’s first-ever energy summit.

It wasn’t just a lucky coincidence that brought state and national leaders to campus to get a firsthand look at research laboratories in WSU’s Energy Systems Innovation Center. Rather, the highly successful event was a culmination of a longtime public–private partnership that has built and propelled WSU’s power program to a leadership position in the United States.

WSU’s history in power engineering goes back to the earliest days in electric power and energy systems in the state of Washington, beginning with testing of hydroelectric dam models in the 1930s, development of aluminum cables and wires in the 1950s, and power grid protection in the 1970s. Starting in the 1990s, WSU led efforts to develop a smart electric power grid— even though the term “smart grid” actually came later.

As the power industry entered the 21st century, industry leaders realized that they were and are facing an aging workforce and dramatic changes in technology. Clamoring for more and better-trained power engineers, leaders around the state joined a partnership with WSU to advance clean technology and to expand the power engineering program.

During the past five years, industry, state, and university support of the program has grown dramatically—which has led to real impact. Washington state developed the Engineering Expansion Initiative (EEI), which allocated significant annual funding to increase the number of engineering and computer science students and graduates.

Industry involvement has also been critical to attracting top faculty, educating the future workforce for the Washington economy, and enhancing the program’s reputation, says Chen-Ching Liu, director of the Energy Systems Innovation Center. “It is industry that has helped to build these programs to what they are today,” he says.

There are more than 30 companies and entities supporting the power program at WSU, with several additional members joining every year. Industry supporters include small public utility districts, such as Pend Oreille PUD, and larger utilities like Tacoma Power and Snohomish County PUD, which provide support to undergraduate programs through the power engineering partnership. Larger companies and national labs, including Avista, Alstom Grid, Idaho National Laboratory, Megger, M.J. Murdock Charitable Trust, Itron, Pacific Northwest National Laboratory, Puget Sound Energy, and Schweitzer Engineering Laboratories, support research, facilities, and graduate students.
Since 2010, private and industry support has had a major impact on WSU’s power program.

- Establishment of the **Energy Systems Innovation Center**. The center, led by Chen-Ching Liu, Boeing Distinguished Professor of Electrical Engineering at WSU, is taking a leading role in addressing one of the greatest technological challenges of the 21st century—demand for clean and reliable energy. The center consists of more than 30 WSU faculty members and collaborates with a wide range of government and industry partners.

- Created new laboratories, including the Smart Grid Demonstration and Research Investigation Lab (SGDRIL), the Laboratory for the Integration of Power Electronics (LIPE), and the most comprehensive “smart city” power laboratory in the United States.

- **Eleven** power engineering faculty members have been hired, making for one of the largest programs in the United States. Total research expenditures by the power engineering faculty have doubled in the last four years.

- WSU launched the **first** online professional master’s degree program in electrical power engineering in the United States.

- The National Science Foundation awarded a grant to WSU to provide scholarship support for undergraduate and master’s students in electric power engineering, providing 19 student scholarships per year over five years.

- Enrollment increased to more than **90 undergraduate students and 55 graduate students**, and WSU saw a dramatic increase in postdoctoral fellows and visiting scholars due to the high-level international recognition of the Energy Systems Innovation Center.

- For two years in a row, WSU students received the greatest number of scholarships in power engineering of any school in the United States. **Eleven** WSU students from the Pullman and Vancouver campuses received the prestigious Institute of Electrical and Electronics Engineering scholarship in power engineering out of 184 scholarships awarded nationwide in 2013. In 2014, WSU students received **nine** scholarships, which was tied for the highest number of scholarships.

- A week-long industry practicum for students has grown to **20** participants, with an enrollment increase of 50 percent expected in the next year.

- The development of an undergraduate power protection teaching lab that is unparalleled in the United States.

- WSU hosted an **inaugural energy summit**, held April 2015, with guest speakers including Washington Governor Jay Inslee, Senator Maria Cantwell, and Representative Cathy McMorris Rodgers, as well as Imre Gyuk, energy storage program manager, and Pat Hoffman, assistant secretary for the U.S. Department of Energy’s Office of Electricity Delivery and Energy Reliability.
The electric power grid and electronic communications are increasingly intertwined and interconnected as part of our complex 21st century U.S. infrastructure. But when an extreme event like a large snowstorm or hurricane brings down part of the network, it’s pretty clear what can happen: chaos.

WSU researchers from disciplines as far-flung as sociology and electrical engineering will make the deeply connected systems more robust with a National Science Foundation grant to improve the electric power grid and its communications structure. As part of the $1.2 million, three-year grant, the researchers will be working to analyze and design more resilient power and communication networks.

Power and communication networks are two of the most critical infrastructures of the nation and are highly interdependent, says Anjan Bose, Regents Professor in the School of Electrical Engineering and Computer Science. Communication networks transport data for the power system. But, at the same time, they require power to operate successfully. A power failure can cause failures in the communications networks, which can then contribute to a worsening power failure. Ten to fifteen years ago, the data requirements of the power grid were simple and the communications system was an integral part of the grid.

“Now, the smart grid means that communications are ubiquitous—right up to the home meter and inside the home—and are complex systems on their own,” he says.

With the new grant, the researchers will develop a new paradigm for understanding the complex interdependence between communication and power networks to better predict what will happen in extreme events and to strengthen critical elements to prevent cascading failures.
From Research to Reality

From the beginning, Voiland College researchers and alumni have brought their products to the marketplace with significant impact on the economy. One of the college’s early engineers, Homer Dana, developed an early facsimile machine and an emotional stress meter (lie detector). He also helped to design the Great Depression-era Mason City Project, which measured that community’s electricity consumption and led to innovations in community and economic development.

Other products that came out of the college include improved particleboard, oriented-strand board, and wood I-joists that are commonly used in homes today. Voiland College researchers pioneered the development of nondestructive test methods for wood materials, and two of its faculty members started a company that is the leading producer of lumber and veneer grading equipment in the world. Our alumni developed the technologies for 3-D printing, have saved thousands of lives through the invention of Automated External Defibrillator devices, designed digital protection for the electric power grid, and co-founded Microsoft.

In the past five years, college leadership has focused on and significantly increased our entrepreneurship and commercialization activities, doubling new invention disclosures every year. Voiland College faculty brought in a million dollars in the past two years through commercial development programs or direct partnerships with industry.
Developing Entrepreneurial Engineers

Washington State University has been selected to participate in an innovative program to build entrepreneurship into undergraduate engineering education. WSU is one of 25 U.S. institutions selected by the National Science Foundation-funded National Center for Engineering Pathways to Innovation (Epicenter) to join the Pathways to Innovation Program. The program helps institutions incorporate innovation and entrepreneurship into undergraduate engineering education.

As part of the program, a team of WSU faculty and academic leaders will participate in a two-year process to assess current offerings and develop new strategies for building entrepreneurship efforts. Program teams receive access to models for integrating entrepreneurship into engineering curriculum, custom online resources, guidance from a community of engineering and entrepreneurship faculty, and membership in a national network of schools with similar goals.

“If you want to transform the world, an idea isn’t enough,” says Howard Davis, director of the Harold Frank Engineering Entrepreneurship Institute, who will lead WSU’s efforts. “You need to be able to implement your idea, and that’s where entrepreneurship comes into play.”

With support of the Pathways program, the WSU team will align and coordinate efforts across the university to allow more students to gain entrepreneurial experience.

In the past year, the Voiland College of Engineering and Architecture has established the Frank Innovation Zone (FIZ) to foster the development of entrepreneurial skills in more students and provide them with access to a wide range of hands-on learning experiences (see related story on page 32). WSU is also working to initiate a minor in entrepreneurship that removes the prerequisites and allows a broader range of students to be included.

Frank Program Helps Students Succeed

The Frank Engineering Entrepreneurship Institute gives students the opportunity to bring their entrepreneurial dreams to life. Listed below are some 2015 student business successes:

- Harold Frank Engineering Entrepreneurship teams swept the WSU Business Plan competition, led by Go-KEFI, an experience-based travel website.
- Go-KEFI won Startup Weekend Spokane, the Inland Northwest business plan competition, and made it to the Sweet 16 round of the University of Washington Business Plan Competition.
- Co-Optical, which developed a wearable, noninvasive blood glucose measuring technology, took second place in the WSU Business Plan Competition and won a cash prize in the UW competition. They also received a grant from Venture Well.
- Tribotex, a WSU student team, competed in the Rice University Business Plan Competition in April and took a top technology prize at the UW Business Plan Competition.
- Neufinity was named the best technology venture in the WSU Business Plan Competition. The technology is a fusion of two sensors detecting electrical activity and blood flow in the brain and using the signal to interface with a computer. They have applied for a provisional patent.
WSU/Alaska Airlines partnership plans biofuel test flight

WSU News Service

Alaska Airlines is teaming up with the Washington State University-led Northwest Advanced Renewables Alliance (NARA) to advance production of alternative jet fuel made from forest residuals, the tree limbs and branches that remain after a forest harvest.

The airline intends to fly a demonstration flight next year using 1,000 gallons of alternative biofuel being produced by the NARA team and its many partners. The planned flight signals a growing interest in the aviation industry for a viable alternative to conventional fossil fuel.

NARA's focus is on developing alternative jet fuel derived from post-harvest forest residuals. Residual treetops and branches are often burned after timber harvest. By using these waste materials as the feedstock of a biojet fuel supply chain, NARA and its aviation industry partners seek to reduce fossil fuel use and greenhouse gas emissions as well as bolster sustainable economic-development potential in timber-based rural communities located throughout the Pacific Northwest.

“Alaska Airlines is thrilled to partner with NARA to help further promote sustainable aviation biofuels,” said Joe Sprague, Alaska Airlines senior vice president of external relations. “Sustainable biofuels are a key to aviation’s future and critical in helping the industry and Alaska Airlines reduce their carbon footprint and dependency on fossil fuels.”

NARA is a five-year project supported by the U.S. Department of Agriculture National Institute of Food and Agriculture. Comprised of 22 organizations from industry, academia, and government laboratories, its mission is to facilitate development of biojet and bioproduct industries in the Pacific Northwest using forest residuals that would otherwise become waste products. A key task of the project is to evaluate the economic, environmental, and societal benefits and impacts associated with such developments.

“Developing alternative jet fuel made from forest residuals represents a significant economic challenge with considerable sustainability benefits,” said Michael Wolcott, NARA co-director and Regents Professor in WSU’s Department of Civil and Environmental Engineering. “While the price of oil fluctuates, the carbon footprint of fossil fuels remains constant. NARA efforts to engage stakeholders from forest managers to potential fuel users like Alaska Airlines to lay the foundations for a bio-based, renewable fuel economy, is exciting work that we believe will benefit society in the years ahead.”

Entrepreneurial success stories

Formed in 2015, Behaviometrics is commercializing machine learning, smart environments, and health care technologies. Based on research supported by the National Science Foundation, National Institutes of Health, and Washington state, the company builds software to understand data that is gathered in our instrumented life, including in health care monitoring, organizational efficiency, and home power use.

Sandyclock is the world’s first task-based scheduling software. Leveraging cloud services, Sandyclock enables employees, schedulers, managers, and accountants to watch labor expenses in real-time, add or remove labor hours as needed, and easily view labor and event costs with simple, powerful reporting and visualization tools. Formed in 2012 from United States Department of Agriculture-funded research by WSU Professor Li Tan, Sandyclock has raised more than $100,000 in angel funding and has worked with several state of Washington partners to beta test and refine its software in commercial environments.

Protium Innovations enables portable energy storage in the form of liquid hydrogen to eliminate renewable energy generation waste. Formed in 2014 with National Science Foundation, Washington state, and industry-funded research, Protium opens up a new opportunity for renewable energy producers, empowering them to capture the full capacity of their power generation plants. Protium owns several foundational technologies that will enable renewable producers to increase the value of their energy and to create a new market for selling their excess capacity.

Voiland College commercialization efforts since 2010

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Aerospace partnerships mean results
Alyssa Patrick, WSU Economic Development

Mixing stainless steel with titanium is an idea that gives Amit Bandyopadhyay equally a headache and an adrenaline rush. In 20 years of research on additive manufacturing—or 3-D printing—Bandyopadhyay has experimented in printing bone material, moon rock, and plastics, but never two different metals at once.

The challenge came to Bandyopadhyay, a researcher at Washington State University, from Aerojet Rocketdyne, a Seattle aerospace company looking for new, more efficient, and cost-effective ways to manufacture parts for satellites. The cross-state connection was made thanks to the Joint Center for Aerospace Technology Innovation (JCATI), an initiative launched by Washington’s Office of Aerospace to continue spurring growth of one of the state’s most vital economic sectors.

JCATI’s mission is to facilitate university–industry partnerships that advance research in new technologies and workforce development in the sector.

In the case of Aerojet Rocketdyne, the company was looking to simplify the manufacturing process of satellite parts that were made of different metals. While engineers at the company were using 3-D printing to fabricate sections of the part, they then had to weld the separate sections together. Existing specialty 3-D manufacturing companies are not doing any multi-material metal manufacturing, and would likely say it is impossible, making it a perfect opportunity for a university lab.

“In a lab, we can help a company find out if something is doable, or if a concept is worth pursuing,” Bandyopadhyay said. Presenting these kinds of applicable challenges to his graduate students also makes working with industry a priority for Bandyopadhyay.

“Students are the number one product of a university,” Bandyopadhyay said. “If we supplement their education with real-world opportunities that have three companies chasing after them at once, we know we have really done our job.”

Aerojet’s relationship with WSU continues today because both sides have taken the time to understand each other’s motivations and needs. This has included visits back and forth across the state—Bandyopadhyay sitting down with the Aerojet professionals in their offices, and Aerojet professionals touring the labs and visiting with WSU students.

“The benefit of JCATI is more than the money,” Bandyopadhyay said. “The funding is helpful to get the parties to the table, but the more important thing is facilitating relationships that otherwise might not happen.”

Roger Myers, executive director of Aerojet Rocketdyne and chair of the JCATI board, also listed interacting with students as one of the primary reasons industry should be working with universities. Though he has been in industry for decades now, Myers maintains relationships with universities across the country.

“Understanding how you transition from research to development is an important part of university–industry relationships,” he said. “Faculty at WSU have a better understanding of industry needs than other universities I have worked with. WSU is very innovative in its relationships and ability to be agile.”

After two years of working together on JCATI-supported projects, Aerojet gained a deeper understanding of the possibilities of additive manufacturing, and identified new techniques for manufacturing satellites. Bandyopadhyay and his graduate students were able to publish a paper on their findings and open a new avenue of possibilities for 3-D printing.
As part of its land-grant mandate to educate students in practical skills, from its beginning WSU taught mechanic arts, which included engineering, mineralogy, mining, and metallurgy. Classes included advanced algebra, geometry, trigonometry, calculus, dynamo mechanics, and metallurgy. Electrical engineering students took courses in telegraph instruments, lamp testing, and steam engines while students learned about basic manufacturing working in a forge. Civil engineering students did much of the contour mapping and surveying for campus roads and streets as well as design of the campus sewer system. Today, research opportunities, active student clubs, a new co-op and internship program (see page 24), and the new Frank Innovation Zone (page 32) mean that our students more than ever are graduating “work-ready, day one.”
Co-op program builds career connections

The Voiland College of Engineering and Architecture has started a program to provide professional experience and build future employability for students through internships and co-ops. The program, which was done informally in the past, will help students with professional preparation, including developing successful job search strategies, creating a social media presence, capitalizing on networking opportunities, crafting an effective résumé, and honing interview skills.

The National Association of Colleges and Employers reports that 97 percent of employers planned to hire interns or co-op students in 2014, and that 82 percent of the co-op students went on to work full-time for their employer.

We recently spoke with Voiland College co-op coordinator Sandra Brabb.

What is your role at Voiland College?

I work with students, industry, and the university to put a cooperative education program together where students can work full-time during the academic year and maintain full-time status. We want our students to be job ready on day one, and so they need industry experiences prior to graduating.

The other half of what I do is helping students learn how to successfully find jobs and prepare for that search. I am teaching professional skills that will benefit students such as networking, résumé writing, and interviewing skills.

What is the new co-op program all about?

Experiential learning is a key educational component that we want to provide in the Voiland College. One option that isn’t available yet at WSU is cooperative education, which allows students to work full-time during the academic year, get paid, and earn credit for the experience. They can work as many as three terms, or 12 months. The credits are intended to count toward their degree. Students will need to enroll in a specific course, and that course will allow them to be viewed as full-time students. Students need a mentor at their workplace, job duties that are related to their major, and to develop goals and objectives for the term. They also will need to write a reflection piece.

In the current system, students can earn academic credit with an internship, but enrolling for two or three credits only designates them as part-time students.

A co-op education program recognizes students during the academic year as full-time students. With the exception of a two-credit co-op course, students will not enroll in any other courses during the term of their co-op. This program will help both undergraduate and graduate students understand industry requirements and be well trained in their particular field.

What is most exciting about the program?

Allowing students to have these experiences in a real-world work environment is fantastic. It’s really exciting to help students get that practical experience, apply the theory they learned in the classroom to hands-on learning, and then get a job when they graduate. The companies are really excited to have our students, and I enjoy working with the students because they are excited about getting a job in their field before they graduate. It’s very fulfilling.

What are your challenges?

There are always challenges, like convincing a company, especially a smaller one, that a co-op is a win-win for both students and employers. We also want to make experiential learning a requirement rather than just recommended in our programs. We also need faculty on board because they will handle academic curriculum for the co-op course.

What is your goal?

To have 100 percent of our students in an internship or co-op before graduation, and 100 percent with a job offer by graduation. I am setting the bar very high!
Women who become computer scientists end up in high-paying, interesting jobs where they tackle challenges that make a difference in the world. So why are fewer girls studying computer science than 30 years ago?

Aiming to change attitudes, the WSU Broadening Participation in Computing Club received a grant from Symantec and the National Center for Women & Information Technology to introduce girls to computer science. The grant supported a workshop for girls at this summer’s Cougar Quest summer camp.

The U.S. Department of Labor anticipates approximately 1.2 million computing-related job openings by 2022, but demand far outpaces the supply of graduates. The summer program, led by Voiland College students in computer science, introduced younger girls to engaging, hands-on programming projects. Presentations discussed research and career opportunities for women in computer science, as well as recommending classes and activities to help girls succeed in the field.

“We want to break down stereotypes, give students creative programming experience, and inspire them,” says Jessamyn Dahmen, one of the students who led the summer program.

Jessamyn Dahmen, a WSU computer science graduate student who uses technology to understand cognitive health in the elderly, has received a National Science Foundation Graduate Research Fellowship. The award provides funding for three years and opens doors to internships and research collaborations. Dahmen said her work is different than the popular online brain training gaming website Lumosity, which is focused on exercising the brain. “I am looking into using machine learning and gaming,” she said. “If you give someone a game that is capable of assessing their mental health, they might want to play it more than, say, take a test.”
Rocket Club Competes in International Contest

A group of Washington State University engineering students shot for the stars, building a rocket that launched in southern Utah this summer in an international competition. WSU’s student chapter of the American Institute of Aeronautics and Astronautics participated for the first time in the Intercollegiate Rocket Engineering Competition, a five-day event that included student teams from the United States and around the world. The competition required students to launch rockets carrying a 10-pound payload to 10,000 feet and then recover them. The 21-student WSU team worked on the project throughout the past year.

“Building rockets is an excellent way to not only to learn to design, build, and fly, but also to meet people in your major and to network,” said Paul Flerchinger, the club's president and a junior in mechanical engineering. “Not many people can say they built a rocket that flies two miles into the air.”

WSU Student Team Tackles Clean Tech Challenge

A Washington State University student team will spend the next year designing what they hope will be the world’s best hydrogen fueling station for a chance to win $1 million—and to change the world. Led by Jacob Leachman, assistant professor in WSU’s Voiland College of Engineering and Architecture, the student team is competing in the U.S. Department of Energy’s H2 Refuel H-Prize competition.

The H2 Refuel H-Prize is challenging America’s innovators to deploy an on-site hydrogen generation system, using electricity or natural gas, to fuel hydrogen vehicles that can be used in homes, community centers, retail sites, or similar locations.

“If we are successful in developing this technology, everyone will have access to cleaner energy,” said Leachman.

Hydrogen-powered cars that run on electricity are an environmentally cleaner, more fuel-efficient method of transportation, says Leachman. What is limiting the new cars’ development and utilization in the United States is the lack of small-scale, cost-effective refueling infrastructure. While eight major car companies have developed hydrogen-powered cars, there are very few hydrogen fueling stations open to the public—most of which are in California. None of them meet the size and efficiency criteria laid out for the competition.

WSU researchers and students are making a splash with their hydrogen innovations. During the past several years, they have designed a liquid-hydrogen-powered airplane. Last year, WSU students took first prize in an international competition for their design of an economical hydrogen fueling station. WSU researchers are also starting to commercialize their liquid hydrogen storage technology.

Designs for the competition are due in October, and winners will be announced in October 2016. Leachman is looking for students and supporters who are passionate about this revolutionary technology and want to help make the WSU entry a success.
Everett students finish 2nd in national competition

A group of Washington State University mechanical engineering students from Everett took second place in a student design and manufacturing competition at the national American Society of Engineering Education (ASEE) conference this year with their unique idea to harvest electricity from rainwater.

It was the first time that the group of five students had the opportunity to attend and compete at a large conference, said Xiaopeng Bi, interim program coordinator and a clinical associate professor at WSU North Puget Sound at Everett. The students created two designs for a generator that could potentially create energy from unused water from rain gutters, washing machines, or showers.

“The idea is very simple,” said Bi. “It’s something that everyone would be able to think of, but nobody has.”

Approximately 4,000 people annually attend the conference, which was held this year in Seattle. The competition is sponsored by the manufacturing division of ASEE.

The Everett mechanical engineering program emphasizes strong hands-on training, says Bi. The students were enrolled in a manufacturing processes course earlier this year in which they created a variety of windmills. Bi initially suggested that they could enter their windmill prototypes in the competition because it called for a design of an energy-related project. The students instead challenged themselves with a new idea of rainwater energy harvester, developed two designs, and built prototypes for a gutter system.

With a limited budget, they used low-cost materials, including a $1 DC motor, LED lights, and a simple microcontroller for their demonstration system. The team worked long hours on the project, including weekends, to make it happen, he said.

While the students designed, manufactured, and tested the prototypes, they also gained experience presenting and demonstrating their system at a national conference, says Bi.

It was an opportunity to show the students how they compared with students from other universities around the country.

“Even though Everett’s mechanical engineering program is relatively young, we are trying to provide the highest possible quality education,” he said. “I am glad to see that students gained confidence from the competition. They showed everyone what they can do while they also had the chance to learn from other university students.”
A unique wooden sculpture made by Washington State University students was featured at the Bellevue Arts Museum. The large-scale art installation, entitled *Night Blooming*, was part of the art museum’s *Knock on Wood* exhibition, and was featured in the museum’s third-floor exterior courtyard. Made from salvaged timber, the sculpture was designed by Taiji Miyasaka, associate professor of architecture, and David Drake, fabrication labs manager in the School of Design and Construction, and built by graduate and undergraduate architecture and interior design students.

A student team from the Washington State University construction management program took third place at the regional Associated Schools of Construction student competition, the largest construction management competition in the United States. It was the fourth year in a row that the commercial team from WSU placed in the competition, which is held annually in Nevada. More than 1,300 students from 44 universities and 17 states participated.

Sarah Waldo is among 105 students nationwide to receive a Science to Achieve Results (STAR) fellowship from the U.S. Environmental Protection Agency. A doctoral student in civil and environmental engineering, she will receive support for her research into factors influencing greenhouse gas emission and absorption in agricultural fields. “To look at science and policy together appeals to me,” said Waldo. “I like learning about the world through science and research but I was also motivated by wanting to make a difference by science that has impact. Keeping in mind how research can inform policies to protect the environment or human health is important.”

Expanding engineering programs in Everett and Bremerton allow more place-bound and non-traditional students from across the state to pursue engineering, meeting growing industry needs and solving grand engineering challenges. Pictured are the Bremerton students taking a field trip of Washington State Ferries.
Thank you! With your support, Voiland College successfully achieved its five-year, $125 million Campaign for Washington State fundraising goal by helping raise more than $130 million in private donations.

Gifts provided direct support for faculty through chairs and distinguished professorships, investments in research and facilities, help with new construction projects and laboratory improvements, funding for students through scholarships, and donations to the college’s excellence funds that provide discretionary dollars for its highest needs.

In the past five years, Voiland College established 73 new endowments to provide long-term support for undergraduate scholarships, operational support, faculty, and research.

“The impact of this support is far reaching and boosts every aspect of the college with tangible and visible outcomes,” said Candis Claiborn, dean of Voiland College of Engineering and Architecture. “Each and every donation helps us improve lives through our research, addresses the grand challenges that face this nation, and educates the next generation of engineers and architects who will innovate and inspire us.”

$1,065,091,919 Thank You Cougs!

Washington State University Foundation
Construction on the new PACCAR Environmental Technology Building is underway. When it opens later this year, the 96,000 square foot building, designed by LMN Architects, will be a hub for faculty from engineering, the sciences, and allied fields for cutting-edge, interdisciplinary environmental technology research and education. The building will house research programs in renewable materials, sustainable infrastructure, water quality, and atmospheric research and will feature laboratories, faculty office space, an auditorium, and student lounges for a highly engaging research experience. The building includes renewable materials and technologies that have been developed at WSU, such as wood composites, recycled concrete, and pervious pavement, and is designed to achieve Leadership in Energy and Environmental Design (LEED) Gold certification. The building, named in recognition of PACCAR’s support of the school, is set to be the “greenest” building to date on WSU’s Pullman campus.

Voiland College celebrates new name

The historic naming of the Voiland College of Engineering and Architecture last fall included a joyous celebration with about 800 students, alumni, faculty, staff, and friends.

Gene and Linda Voiland and their family members were on hand for the festivities. As the new name was unveiled, the Cougar marching band played the Cougar fight song while mascot Butch waved to the crowd. Wearing crimson Voiland College of Engineering and Architecture t-shirts, hundreds of students from the college’s 40 student clubs eagerly displayed and explained their hands-on work to alumni and friends—from architectural models to a student-built unmanned aerial vehicle, a robotic submarine, and a car powered by chemical reactions.

“The Voiland name is synonymous with excellence, vision, accountability, and integrity,” said Dean Candis Claiborn. “These are also values that are core to the Voiland College’s mission.”
WSU alumni and donors have stepped up to support students in the Voiland College during *The Campaign for WSU: Because the World Needs Big Ideas*.

During the 2014-15 school year, more than 700 young men and women received scholarships from one of the many endowments that have been created for graduate and undergraduate engineering, architecture, construction management, and computer science students.

For Laura Harris King, creating an endowment honors the tremendous impact the Voiland College of Engineering and Architecture had on her life.

When Harris King (’83) began studying engineering at WSU, she was one of the few women in her program. Initially discouraged, Harris was told by some that she would never make it in her field. Fortunately, she found mentoring and positive support from her professors, Servet Duran and Bruce Masson, who helped guide her through those difficult times to not just succeed, but thrive in both her academic and professional fields.

Together with her proud “Cougar Mom,” Louise McAllister, they recently created a unique mother-daughter endowment that helps academically gifted engineering students with financial need make ends meet.

For the architecture grads in the class of ’58, setting up a scholarship fund is a way to show their appreciation for the lifelong friendships that were made at WSU.

When the architecture class of ’58 gathered for their 50th class reunion, the alumni decided that they wanted to provide to others an opportunity like they had received. Their fundraising efforts resulted in a new scholarship that has been awarded to four students since 2011.

“Escalating college costs make scholarships more important than ever, and can have a significant impact for students who are struggling financially,” says John Schneider, associate dean, Voiland College of Engineering and Architecture. “Those who receive scholarships, even small ones, are much more likely to go on to graduate.”

One of those graduating students was Haily Holt, who received multiple scholarships through the School of Electrical Engineering and Computer Science, including the Regents Scholarship, the Boeing Endowment for Women in Engineering, and a scholarship through the Harold Frank Engineering Entrepreneurship Institute.

“Receiving these scholarships has helped me immensely,” said Holt, who graduated in May and is now working for Hewlett-Packard in Vancouver, Washington.
**Boeing Scholars Program builds great engineers and ideas**

For more than a decade, teams of engineering, business, and, more recently, communication students have worked on tricky and sometimes sticky problems for The Boeing Company. They developed soap residue detectors to improve Boeing paint jobs that were peeling prematurely. They built a camera enclosure to protect the company’s expensive cameras, looked at ways to recycle carbon fiber airplane parts, and designed the smallest possible workout room on a commercial airplane. Students even studied how to transport large animals in cargo holds most efficiently. (Just how many elephants can you fit in a Boeing 747?)

They also discussed ideas and budgets, planned projects, designed and built prototypes, talked with their mentors, and, finally, prepared their presentations.

The program, which is unique to Washington State University, has now become a permanent part of WSU senior design projects, thanks to a Boeing endowment.

The program provides students with two-year scholarships as well as internship opportunities between their junior and senior years. During their senior year, students from diverse backgrounds participate in an interdisciplinary course, collaborating with Boeing scientists and engineers on a real-life aerospace industry project. The program, which was the brainchild of WSU alumnus Scott Carson, who retired as Boeing Commercial Airplanes president and CEO in 2009, brings disparate groups together, simulating the engineering work environment.

“It’s refreshing to see the students’ new ideas,” says Terry Waldron (’78 BS ME), a senior manager in customer support engineering with Boeing Commercial Airplanes. “I’ve had wonderful experiences. What the students develop is fresh, new, innovative, and creative—and it’s certainly worth thinking about.”

Waldron has worked with WSU for about 20 years, first on the School of Mechanical and Materials Engineering advisory board and then for the Boeing Scholars program. The program is one of the company’s most important WSU collaborations, he says, and it has thrived with excellent WSU partnership.

The program’s interdisciplinary nature is excellent training for the workplace and one of its most critical components, he says.

“We always think we have great ideas, but they won’t go anywhere without a business case,” he says. “How do we communicate this idea and help to tell the story? The Boeing Scholars program combines the talents of students from a variety of disciplines.”

At the same time, the program provides a Boeing mentor, so that students “stay between the lines” with their ideas.

“It’s all about the experience and the learning,” Waldron says.

The student teams struggle with all the same things they would encounter working in industry, says Howard Davis, professor in the Voiland School of Chemical Engineering and Bioengineering who manages the program along with Marie Mayes in the Carson College of Business.

Students have to manage team dynamics, from finding the time to meet to overall project management. They often make mistakes and sometimes even have to completely switch their focus.

“They have to meet the challenges of scoping their project, trying to figure out what their customer needs, and executing their plan,” Davis says. “These are very multidimensional problems that they’re trying to work.”

The value of this program can’t be overstated, said Candis Claiborn, dean of the Voiland College of Engineering and Architecture.

“Guided by their professors and mentored by Boeing engineers, these students are getting their first real-world industry experience,” she says. “When they finally finish their projects and make their presentations in front of a daunting group of Boeing executives, you can see that they have been transformed.

“We’re so grateful for Boeing’s decision to endow this program and to ensure that generations of future students will benefit.”

**FIZ heats up**

WSU’s Frank Innovation Zone (FIZ) got underway in 2015 and is bubbling with activity as students do 3-D printing, build robots or rockets, solder, cut, and sometimes even make mistakes. FIZ provides a centrally located, multidisciplinary, collaborative space and tools where students can translate their ideas into working designs, build class projects, or pursue club activities. “It’s wonderful to see the students working on projects in the FIZ,” says John Schneider, associate dean in the Voiland College of Engineering and Architecture. “They are busy, excited about what they’re doing, and want to stay as long as they can. This is the hands-on experience that makes our students such valuable contributors in the real-world workplace.” FIZ was established with support from the Raintree Foundation, founded in 1993 by Harold R. Frank.
Kirks give back

Associate Professor of Construction Management, Max Kirk (’77), and his wife Evelyn (’77), have long histories with WSU, and now they are planning to leave a legacy as well.

Max and Evelyn are giving an estate gift to the construction management department for programmatic support.

“WSU is the cornerstone of my life. If it wasn’t for the professors who mentored me as an undergraduate, I wouldn’t be sitting here today. Giving back is paramount for me,” Kirk said.

Max and Evelyn met as undergraduates at WSU in 1975. Evelyn earned a degree in speech therapy, and Max earned a bachelor of science in construction management in 1977. He then entered the workforce as a project manager and estimator in the Pacific Northwest. After eight years in industry, he started on the path toward education, and came back to WSU as a professor in 2001.

“Teaching at WSU was my first way of giving back. I had such good mentors when I went to school here that I wanted to be that person for other students, to teach what I have learned over the years,” Kirk said.

“I’ve attended and guest-lectured at several other universities and WSU has more vitality than most of them. In these hard financial times, we are glad to be able to leave behind a gift that will help the future of WSU,” Kirk said.

Thank you, Kiewit!

Kiewit Corporation, one of the largest construction companies in North America, provided support to renovate the construction management program’s primary teaching classroom and the Department of Civil and Environmental Engineering’s Laboratory for Asphalt Technology.

This project was spearheaded by Scott Cassels (’81), executive vice president of Kiewit.

The construction studio project included aesthetic upgrades as well as technological improvements, such as new projection screens, a smart podium, and technology to allow remote access to students and industry experts for a more interactive classroom.

In the asphalt lab, the project entailed facilities renovations as well as upgrading testing equipment. The new equipment will allow research and testing of asphalt paving materials under specific environmental and engineering conditions.

“We so appreciate the support provided by Kiewit,” says Voiland College Dean Candis Claiborn. “The Construction Management and Civil Engineering programs at WSU have a long history of producing graduates who are work ready, day one. Support for this project will help us continue to turn out our top-quality graduates.”
Celebrating 125 Years

In the 1890s, just a handful of students studied engineering back when Washington State University (then Washington State College) opened its doors in Pullman, Washington.

Today, WSU’s Voiland College of Engineering and Architecture celebrates its 125th anniversary by providing world-class education to more than 4,300 undergraduate and graduate students at campuses around the state.

125 years, and counting.