ART meets Engineering
As part of the College of Engineering’s quest to transform engineering, we are committed to educating Renaissance engineers for the 21st century world. It makes perfect sense, then, to look to Renaissance faculty to guide these future engineers on their way.

In this issue of Engineering Impact, you will be introduced to wonderfully creative men and women who not only bring talent to the classroom and research laboratories, but are guided by their own Renaissance spirit in their pursuit of dance, photography and a variety of other art forms. The discipline and creativity required to execute a flawless rumba or solve a woodworking problem all come into play in their lives as engineers.

N.W. Dougherty, a professor of civil engineering at the University of Tennessee, described the artist/engineer well when he wrote in 1955: “The ideal engineer is a composite ... He is not a scientist, he is not a mathematician, he is not a sociologist or a writer; but he may use the knowledge and techniques of any or all of these disciplines in solving engineering problems.”

The pairing of art with science is implied in a variety of ways in our strategic plan, which is now squarely in its implementation phase. There is an update on that in this issue as well.

Leonardo da Vinci set the wheels in motion long ago with his marriage of engineering and art. His curiosity and ingenuity spanned the domains of mathematics, civil engineering, anatomy, and well beyond. As you read this magazine, you’ll see this same curiosity, zest for life, and abundant ingenuity at play in our students, faculty, alumni, and friends.

Leah H. Jamieson

John A. Edwardson Dean of Engineering
Ransburg Distinguished Professor of Electrical and Computer Engineering

FROM THE DEAN

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Associate Dean, Graduate Education and Interdisciplinary Programs
Associate Dean, Research
Associate Dean, Resource Planning and Management
Associate Dean, Undergraduate Education
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Klod Kokini
Audeen Fentiman
Melba Crawford
Vince Brails
Mike Harris
Tori Reed-Roaks
Sharon Whitlock
Amy Noah
Christopher Martin
Rabi Mohtar
Caroline Percifield
David Carmichael
Nancy Hannibal

Schools, Departments, and Divisions

Aeronautics and Astronautics
Agricultural and Biological Engineering
Biomedical Engineering
Chemical Engineering
Civil Engineering
Construction Engineering and Management
Electrical and Computer Engineering
Engineering Education
Engineering Professional Education
Environmental and Ecological Engineering
Industrial Engineering
Materials Engineering
Mechanical Engineering
Nuclear Engineering

Tom Shih
Bernie Engel
George Wodicka
Arvind Varma
Kathy Banks
Makarand Hastak
Ragu Balakrishnan
David Radcliffe
Dale Harris
John Sutherland
Joseph Pecky (interim)
Keith Bowman
Anil Bajaj (interim)
Ahmed Hassanein

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On the cover: Industrial Engineering Professor Yuehwern Yih leads a double-life. She is also a competitive ballroom dancer with her husband, Daniel Dilley. The duo was photographed in the Purdue Memorial Union’s North Ballroom. Story on page 10. (Photo by Andrew Hancock)

Moving? Alumni should send change-of-address notices to Development and Alumni Information Services, Purdue University, 403 West Wood St., West Lafayette, IN 47907. Other readers may send address changes to Engineering Impact (see contact information at left).

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Featuring: Around the Fountain, Milestones, Prime Numbers, and News from Across the College of Engineering

The Hidden Talents of Our Artistic Faculty

How Visual Arts Inform Engineering
Reflections of an Acoustic Engineer

Nuclear Engineering Students Run the Class

Rock Musician and Engineer Philip Zumbrun
A Lighting Engineer Finds His Calling

Park Engineer Combines Visual Thinking and Engineering

Presidential and Trustees Scholarship Update

Three Perspectives on the Intersection of Art and Engineering
Solo guitar acts, a Metallica cover, the fancy footwork of Purdue’s nationally ranked Indian Raas dance troupe. This was “Engineering’s Got Talent,” a chance before the end of the spring semester for students, faculty and staff to cut loose and put creativity on display.

Dance Club. “In classes, you have to do things a certain way. But if you want to be yourself, be unique, you can go off and sing about ‘Star Wars’ or you can dance.”

For the eight Purdue Raas dancers who took the stage, the show was a chance to share a bit of their native Indian culture and have fun. “Get ready to move your feet,” they warned as they launched into a highly charged and tightly choreographed routine set to pumping Bollywood music.

The group, which was formed at Purdue in 2008, has won several national competitions. It includes members from across the College of Engineering and the University, among then graduating biomedical engineering senior Apoorva Kalasuramath, who this fall entered Georgia Tech’s doctoral program in nanomaterials and nanomedicine.

“We dance to keep our culture alive and it’s good cardio,” she said. “People are usually surprised when they see us dance.”

Mike Harris, associate dean for undergraduate education and show emcee, joined in the fun, at one point singing out his thanks to the participants. “Wow!” he said as the show concluded. “Who knew engineers had so many hidden talents?”

Linda Thomas Terhune
A miniature device capable of converting ultrafast laser pulses into bursts of radio-frequency signals could be a step toward making wires obsolete for communications in homes and offices of the future. Such an advance could enable all communications, from high-definition television broadcasts to secure computer connections, to be transmitted from a single base station, according to Minghao Qi, assistant professor of electrical and computer engineering.

Ordinarily, the continuous waves of conventional radio-frequency transmissions encounter interference from stray signals reflecting off of the walls and objects inside a house or office. However, the pulsing nature of the signals produced by the new “chip-based spectral shaper” reduces the interference that normally plagues radio frequency communications.

“We envision a single base station and everything else would be wireless,” Qi says. “This base station would be sort of a computer by itself, perhaps a card inserted into one of the expansion slots in a central computer. The central computer would take charge of all the information processing, a single point of contact that interacts with the external world in receiving and sending information.”

Researchers have shown that an advanced cooling technology being developed for high-power electronics in military and automotive systems is capable of handling roughly 10 times the heat generated by conventional computer chips.

The miniature, lightweight device uses tiny copper spheres and carbon nanotubes to passively wick a coolant toward hot electronics, according to Suresh Garimella, the R. Eugene and Susie E. Goodson Distinguished Professor of Mechanical Engineering.

This wicking technology represents the heart of a new ultrathin “thermal ground plane,” a flat, hollow plate containing water.

Similar “heat pipes” have been in use for more than two decades and are found in laptop computers. However, they are limited to cooling about 50 watts per square centimeter, which is good enough for standard computer chips but not for “power electronics” in military weapons systems and hybrid and electric vehicles, Garimella says.

The new type of cooling system can be used to prevent overheating of devices called insulated gate bipolar transistors which are high-power switching transistors used in hybrid and electric vehicles. The chips are required to drive electric motors, switching large amounts of power from the battery pack to electrical coils needed to accelerate a vehicle from zero to 60 mph in 10 seconds or less.

Potential military applications include advanced systems such as radar, lasers and electronics in aircraft and vehicles. The chips used in the automotive and military applications generate 300 watts per square centimeter or more.
More than 100 scientists from international universities, research labs, industries, and public and private policy-making agencies gathered at Purdue in May for a joint U.S.–French symposium exploring sustainable water management and agriculture in an era of climate and global change. Among the topics were water resource management under shortages and climate extremes, impact of human activities on agricultural water quality, drinking water quality, and the impact of climate change on ground water.

The event was organized by Purdue’s Global Engineering Program and the Office for Science and Technology of the French Embassy in Chicago. The partnership is considered a model for future bi-national partnerships in other areas of research and other regions of the world.

**Bridge building competition**

Civil Engineering students in 46 teams from across the United States attended the 2010 National Student Steel Bridge Competition at Purdue on Memorial Day Weekend. Participants had to comply with a battery of requirements, including criteria that specify how quickly to erect the bridges as well as guidelines regarding the weight, strength, aesthetics and restrictions related to environmental considerations. The spans measured roughly 20 feet long by 3 feet wide. (Photo by Mark Simons)

**New center to create models, simulations to improve solar cells**

Purdue will continue its leadership in alternative energy research with a new center to improve photovoltaic solar cells.

The Network for Photovoltaic Technology will be led by Muhammad Alam, professor of electrical and computer engineering, and Mark Lundstrom, the Don and Carol Scifres Distinguished Professor of Electrical and Computer Engineering. It is part of a national effort to bring alternative energy technologies to the marketplace. It is funded by the Semiconductor Research Corporation (SRC), a university-research consortium for semiconductors and related technologies.
Faculty Promotions

To professor from associate professor

David Corti, associate professor of Chemical Engineering
Jie Shan, professor of Civil Engineering
Cheng-Kok Koh, professor of Electrical and Computer Engineering
Peide Ye, professor of Electrical and Computer Engineering
Eric A. Stach, professor of Materials Engineering
Carl R. Wassgren, professor of Mechanical Engineering

To associate professor from assistant professor

Daniel A. DeLaurentis, associate professor of Aeronautics and Astronautics
Inseok Hwang, associate professor of Aeronautics and Astronautics
John H. Lumkes, associate professor of Agricultural and Biological Engineering
Ann E. Rundell, associate professor of Biomedical Engineering
Robert J. Connor, associate professor of Civil Engineering
Jianghai Hu, associate professor of Electrical and Computer Engineering
Steven Wereley, professor of Mechanical Engineering
Barrett S. Caldwell, professor of Industrial Engineering
Mark R. Lehto, professor of Industrial Engineering
Mithuna S. Thottethodi, associate professor of Electrical and Computer Engineering
Alejandro H. Strachan, associate professor of Materials Engineering
Cagri A. Savran, associate professor of Mechanical Engineering
2010 FACULTY EXCELLENCE AWARDS

Mentoring
Doraiswami Ramkrishna (ChE)
Nominated by Arvind Varma

Research
Osman Basaran (ChE)
Nominated by Doraiswami Ramkrishna

Advising
Judy Liu (CE)
Nominated by M. Katherine Banks

Engagement/Service
George Chiu (ChE)
Nominated by Carolyn A. Percifield

Leadership
Kathleen Howell (AAE)
Nominated by Tom J-P. Shih

Dean A.A. Potter Award
Jason Weiss (CE)

Early Career Research
Eric Nauman (ME)
Nominated by George T. Chiu

Team Award
Engineering Research Center for Structured Organic Particulate Systems
Led by Gintaras “Rex” Reklaitis/ChE
Osman Basaran/ChE
Ben Amotz/Chemistry
Stephen Beaudoin/ChE
Teresa Carvajal/Industrial and Physical Pharmacy
Mike Harris/ChE
James Litster/ChE
Martin Okos/ABE
Rodolfo Pinal/Industrial and Physical Pharmacy
Doraiswami Ramkrishna/ChE
Lynne Taylor/Industrial and Physical Pharmacy
Venkat Venkatasubramanian/ChE
Carl Wassgren Jr./ME and Pharmacy
Nominated by W. Nicholas Delgass
Douglas Adams was named the Kenninger Professor of Renewable Energy and Power Systems by the Purdue Board of Trustees in April.

Jean Paul Allain, assistant professor of nuclear engineering, has been selected to receive funding under the American Recovery and Reinvestment Act as part of the Department of Energy Office of Science Early Career Research Program. His award is for "Harnessing Nanotechnology for Fusion Plasma-Material Interface Research in an in-situ Particle-Surface Interaction Facility."

Venkataramanan (Ragu) Balakrishnan, has been named head of the School of Electrical and Computer Engineering.

Kathy Banks, the Bowen Engineering Head and Jack and Kay Hockema professor of civil engineering, won the 2010 Rudolph Hering Medal given by the American Society of Civil Engineers. Banks received the medal for her role as co-author of "Model Development for Biotrickling Filter Treatment of Graywater Simulant and Waste Gas: I," published in the Journal of Environmental Engineering in October 2008.

Arden Bement, the David A. Ross Distinguished Professor of Nuclear Engineering and former head of the School of Nuclear Engineering, has been named director of the Purdue Global Policy Research Institute.

Darcy Bullock, professor of civil engineering, was named director of the Joint Transportation Research Program, which collaborates with the Indiana Department of Transportation on research and educational programs.

James Cooper, the Jai N. Gupta Professor of Electrical and Computer Engineering, has been named interim director of the Birck Nanotechnology Center, a Discovery Park facility he helped lead during its startup. Cooper succeeds Timothy Sands, who was selected in February as Purdue’s executive vice president for academic affairs and provost.

Melba Crawford has been named associate dean of research. She served as assistant dean for research from 2006 to 2008 and as interim associate dean from January 2009 to June 2010. With faculty appointments in agronomy, civil engineering, and electrical and computer engineering (by courtesy), she holds the Purdue Chair of Excellence in Earth Observation and is director of the Laboratory for Applications of Remote Sensing.

Nicholas Delgass, the Maxine Spencer Nichols Professor of Chemical Engineering, is the recipient of the inaugural North American Catalysis Society (NACS) Award for Distinguished Service in the Advancement of Catalysis.

Vincent Drnevich, professor of civil engineering, has been named a distinguished member of the American Society of Civil Engineers.

Audeen Fentiman, professor of nuclear engineering and associate dean for graduate education and interdisciplinary programs; and Eckhard Groll, professor of mechanical engineering and director of Purdue’s Office of Professional Practice, have been selected as fellows by the American Council on Education.

Suresh Garimella, the R. Eugene and Susie E. Goodson Distinguished Professor of Mechanical Engineering, and Jay Gore, the Vincent P. Reilly Professor in Combustion Engineering and director of the Energy Center in Purdue’s Discovery Park, received 2010 Jefferson Science Fellowships from the U.S. Department of State, where their expertise and insights will help guide U.S. foreign policy. Each fellow spends one year at the U.S. Department of State or the U.S. Agency for International Development for an on-site assignment in Washington, D.C., that also may involve extended stays at U.S. foreign embassies and missions. The fellowships began Aug. 1.

Garimella and Mamoru Ishii, the Walter Zinn Distinguished Professor of Nuclear Engineering, each received a 2010 Heat Transfer Memorial Award from the American Society of Mechanical Engineers (ASME).
Carol Handwerker, the Reinhardt Schumann Jr. Professor of Materials Engineering, received the Application to Practice Award from The Minerals, Metals and Materials Society (TMS) in February. She was recognized for “technical contributions and leadership in the development and adoption of lead-free solders across a wide range of industrial sectors.”

E. Daniel Hirleman, professor and William E. and Florence E. Perry Head of Mechanical Engineering, was named dean of the School of Engineering at the University of California, Merced. He assumed that position Aug. 15. Anil Bajaj, the Alpha P. Jamison Professor of Mechanical Engineering, is serving as interim head.

P.K. Imbrie, associate professor of engineering education, has been named director of the College of Engineering Honors Program.

Monika Ivantysynova, the Maha Named Professor in Fluid Power Systems, received the 2009 Joseph Bramah Medal from the Institution of Mechanical Engineers’ Mechatronics Informatics and Control Group for her “outstanding commitment to international fluid power research and education, particularly in the field of hydrostatic pumps and motors.”

Klod Kokini, associate dean for academic affairs and professor of mechanical and biomedical engineering, has been named to the Women in Engineering ProActive Network (WEPAN) board of directors.

C.S. George Lee, professor of electrical and computer engineering, received the 2010 George Saridis Leadership Award from the IEEE Robotics and Automation Society.

Mark Lundstrom, the Don and Carol Scifres Distinguished Professor of Electrical and Computer Engineering, received the 2009 IEEE Aldert van der Ziel Award in recognition of a distinguished career in education and research.

Rabi Mohtar, director of the Global Engineering Program and professor of agricultural and biological engineering, received the 2010 Kishida International Award from the Association of Agricultural and Biological Engineers (ASABE). He was cited for “outstanding contributions toward food and fiber production, improved living and education of people outside the United States of America.”

William Oakes, director of EPICS and associate professor of engineering education, has been named a fellow of the National Society of Professional Engineers.

Dimitrios Peroulis, associate professor of electrical and computer engineering, received a 2010 Murphy Award, the University’s highest undergraduate teaching honor.

David Radcliffe, the Epistemology Professor of Engineering Education was named the Kamyar Haghighi Head of the School of Engineering Education, effective May 1.

Karthik Ramani, the Donald W. Feddersen Professor of Mechanical Engineering, has been named a fellow of the American Society of Mechanical Engineers.

Gintaras “Rex” Reklaitis, the Burton and Kathryn Gedge Distinguished Professor of Chemical Engineering, received the 2010 George Lappin Service Award from the American Institute of Chemical Engineers (AIChE).

Fabio Ribeiro, professor of chemical engineering, has been appointed as an editor of the Journal of Catalysis.

Kaushik Roy, the Roscoe H. George Professor of Electrical and Computer Engineering, received the Humboldt Research Award from Germany’s Humboldt Foundation.

Farshid Sadeghi was named as the Cummins Professor of Mechanical Engineering by the Purdue Board of Trustees in April.

Vladimir Shalaev, the Robert and Anne Burnett Professor of Electrical and Computer Engineering, received the Max Born Award from the Optical Society of America. It is presented to a person who has made outstanding contributions to physical optics, theoretical or experimental. Shalaev was also recognized with the 2010 Willis E. Lamb Award for Laser Science and Quantum Optics for his pioneering studies of optical metamaterials and plasmonic nanostructures.
Tom I.P. Shih, professor and head of the School of Aeronautics and Astronautics, received the Distinguished Engineering Educator Award from the Engineers’ Council of San Fernando Valley.

Joseph Sinfield, assistant professor of civil engineering, has been selected by the National Academy of Engineering to participate in the 2010 U.S. Frontiers of Engineering Symposium.

Arvind Varma, the R. Games Slayter Distinguished Professor and head of the School of Chemical Engineering, has been named a fellow of the Industrial and Engineering Chemistry (IEC) Division of the American Chemical Society (ACS).

Babak Ziaie, professor of electrical and computer engineering, has been invited to join the University of Southern California (USC) Biomimetic MicroElectronic Systems Engineering Research Center (BMESERC) Scientific Advisory Board.

NSF CAREER Awards

- **Xinyan Deng (ME):** “Theory and practices of flapping flight: from biological to robotic insects.”
- **Bumsoo Han (ME):** “Multi-scale cell-fluid-matrix interactions during freezing/thawing of biological tissues.”

- **Krishna Madhavan (ENE):** “Advancing engineering education through learner-centric, adaptive cyber-tools and cyber-environments.”
- **Sanjay Rao (ECE):** “Towards automated and assurable enterprise network migration.”
- **Vijay Raghunathan (ECE):** “A hardware-software approach to enabling in-situ visibility and control in wireless embedded systems.”
COVER STORY

ART
All come together in the work of an engineer, where art meets science, left brain meets right brain, and creativity becomes innovation that has the power to change the world. Introducing three engineers whose talents range far beyond the stage of classroom and laboratory.

> continued on next page
Yuehwern Yih’s life is a complicated mambo.

The fancy footwork involved in choreographing work as a leading health care engineer and nationally ranked ballroom dancer was never more evident than last spring, when Yih set aside her academic work and put on her dancing shoes to coach Purdue’s Latin and Ballroom competitive dance team for two performances on national television.

Contacted by the producers of ABC’s “Dancing with the Stars” at the end of April, the “Crew from Purdue” had one weekend — with finals and commencement looming — to pull an audition tape together, another week to rehearse a mambo number, and a third week to prepare a cha-cha routine for the championship dance-off against UC San Diego, Rutgers, and Utah Valley University (Purdue placed second; Utah Valley first). This involved daily rehearsals in the morning, afternoon, and evenings that stretched to 1 a.m. to perfect a formation routine (as opposed to performances by couples).

The rigors of professional, competitive dancing are familiar to Yih, a native of Taiwan, who aspired as a child to be a ballet dancer but was told by her parents to put studies first. Good thing, she says with intense sincerity, or she is sure she would be a dancer today. Instead, she studied industrial engineering, took up ballet during doctoral studies at the University of Wisconsin, and today is working to streamline health care delivery systems to improve patient care quality and cost effectiveness.

A Purdue faculty member since 1989, Yih jokes that when she received the job offer, she checked the phone book to be sure the area had a ballet school. Her life, in fact, has been guided by dance. She declined
to marry unless her mate shared her passion for dance, and she found a fitting partner in software engineer Daniel Dilley, with whom she competes nationally. Dilley also coaches the Purdue competitive ballroom team, which Yih founded in 1995.

Yih and Dilley have placed highly enough as amateurs that they opted last year to turn professional for tougher competition. They dance in the American Rhythm division, which includes cha-cha, rumba, swing, mambo and bolero. Once or twice a month, they travel to National Dance Council of America events as far afield as California and Florida and fit in sessions with coaches in Chicago when possible. In their down time, they dance at home — in a living room they converted into a mirrored dance studio.

Yih’s dancing is as precise as her engineering. In competition, one small slip — a split-second miss on connecting with a partner’s hand — can set off a perilous chain reaction. “Like any system, recovering from a breakdown takes a lot of effort,” Yih says. “Dancing is the coordination of many different things. There is no single element you can ignore. Like many systems that have many different components, when one is out of sync, the whole system will suffer.”

In health care, one small slip in the management process — be it communication between doctor and patient or errors in lab tests — and the system may suffer. The latter challenge occupies Yih’s time as a researcher.

Yih’s latest research has been focused on error modeling and quality control for clinical laboratory tests. Physicians rely on the lab results to diagnose diseases and adjust medications. Errors in laboratory process can cause misdiagnosis, ineffective treatment, drug overdose, and more. She is working with partners at Mayo Clinic and Roche Diagnostics to model the error components in the measuring process including the samples, calibrators, calibration process, and equipment components. The model will be able to identify where most of the errors occur and which quality control policies might offer the most effective protocols for clinical laboratories.

Yih, who believes firmly that engineers need to embed themselves in the environment they’re studying, has established a system engineering fellowship with Mayo Clinics that provides a four-year fellowship for a Purdue industrial engineering doctoral student with two years at Purdue and two at Mayo. Mayo physicians will work closely with Yih and the student to formulate a dissertation topic with direct relevance to future clinical practice.
When computer engineer David Ebert travels for business and pleasure, he seeks out the nearest hiking trails, favoring those with dramatic vistas and breathtaking terrain. His favorite spot of all being the Canadian Rockies. Along with his favorite hat, he also always carries a camera to satisfy a longstanding love of nature photography.

Ebert, the Silicon Valley Professor of Electrical and Computer Engineering and director of a prestigious homeland security center at Purdue, began hiking and taking photographs of nature as an undergraduate at the Ohio State University. In the 20 years that have elapsed, he has amassed hundreds of images of breathtaking mountain scenery. In many of them, clouds blanket alpine valleys, blow off mountain summits, or spread like fish scales across an open sky.

This is no accident. It is a strategic melding of personal art and professional science. Since graduate school, Ebert has been exploring algorithmic representations of how to simulate natural phenomena like wood and water, cloud and fog, and the textures and patterns of lighting. As a computer graphics and visualization specialist, his research explores the effective communication of information like clouds through graphics rendering, modeling, abstraction, animation, and perceptualization.

“I’ve always been fascinated by the beauty and complexity of nature and that led me into both photography of nature and my research,” he says. “On the graphics and visualization side, everything that I do is about how to convey information from an image and generate the image; on the photography side, it is focused on representing and capturing that information. Sort of the converse.”

Ebert’s cloud and steam simulations have appeared in television commercials and films, including the 2005 Disney movie “Valiant.” He teamed with a filmmaker while at the University of Maryland, Baltimore County for a class that matched fine arts with computer graphics. And he does what he calls “hobby research” on movie special effects. Each of his creations has a unique footprint that Ebert can easily recognize — “I’ll see a commercial and say, ‘Hey, that’s my steam!’”

Ebert has long been fascinated by the intersection of art and science. As an elementary school student in Sandusky, Ohio, he made wine for a science project, inspired by the vineyards that surrounded his hometown and the draw of chemistry. As an adult, he remains fascinated by the science of winemaking and puts his imagination to the test in the kitchen.

Ever the engineer, Ebert likes creativity with a sharp focus. As director of Purdue’s Visual Analytics for Command, Control, and Interoperability Environments (VACCINE), a department of the Homeland Security Center of Excellence, he is developing specialized software to help homeland security and emergency personnel respond to and manage a variety of calamities, from disease outbreaks to economic crises.

In his own laboratory, Purdue Rendering and Perceptualization Lab (PURPL), projects include illustration and photography-inspired visualization of flows and volumes, a challenge that fellow engineer Leonardo da Vinci took on centuries ago. He also borrows directly from art, applying stippling techniques and medical illustration for best effect.
“Simulating hand-drawn illustration techniques can succinctly express information in a manner that is communicative and informative,” he explains. “By combining the principles of artistic and scientific illustration, we explore several feature enhancement techniques to create effective, interactive visualizations of scientific and medical data sets.”

Over the years, Ebert has worked in and out of the entertainment industry. In 2000, during a sabbatical year at Stanford University, he joined forces with the video game company Electronic Arts to help with real-time modeling and rendering technology in products designed for PlayStation 2. Although Ebert, who doesn’t play video games, saw it as a job, several of his graduate students were elated when the company gave him its library, which includes such popular titles as Tiger Woods, Madden Football and Medal of Honor.

No matter the project, art is an integral piece of Ebert’s success.

“To be successful, you need to have an appreciation of aesthetics and design or you may come up with a great algorithm (or photograph or glass of wine) that no one will use,” he says. “It has to be well designed.”
The human body is about 60 percent water. In the case of Ernest (Chip) Blatchley, though, it is more than that. He is 60 percent water inside, and nearly 100 percent water outside.

As an environmental engineer, Blatchley works to improve water quality. As an avid water sports athlete, he has played on it his whole life. It comes as little surprise, then, that one of this engineer’s creative endeavors was building a sea kayak seven years ago that is as beautiful as it is functional.

Blatchley grew up in West Lafayette, the son of two Purdue faculty members. His father was in aviation technology; his mother, in nursing. He canoed on the Wabash River with his Boy Scout troop, sailed on Lake Freeman with his father, swam competitively in high school, and joined the crew club during his freshman year at Purdue. He rowed throughout his undergraduate years and continued during graduate school at the University of California, Berkeley.

“I have always been connected to water and always interested in water,” Blatchley says. The pull was strong enough to lead him to civil engineering studies with a focus on environmental engineering.

Blatchley’s research in the School of Civil Engineering focuses on ultraviolet disinfection of drinking water. He has also done work on swimming pool chemistry. Much of the UV experimentation is done using flat-plate collimated beam systems, which Blatchley developed in the mid-1990s. They provide a highly uniform, collimated beam of radiation that is ideal for photochemical experiments.

Flat-plate collimators, which are constructed using hardwood lumber, can be found at the intersection of craft and engineering. Blatchley’s original motivation for developing these systems stemmed from a lack of acceptable devices on the market. Unable to find collimators that produced an acceptable beam, Blatchley built several of the devices for his own laboratory. Other researchers heard about these systems by word of mouth, and as a result, he has been hired to produce collimated beams for roughly 20 laboratories in the United States, Canada and Europe. His Memorial Day Weekend was spent, in part, building a collimated beam system to fill an order.

Blatchley began woodworking as a hobby during graduate school in the 1980s. His first project was a coffee table...
built on the porch of the apartment he shared with his wife. A self-taught artisan, he has now made much of the furniture in the couple’s home: beds, dressers, bookcases, desks, tables, many picture frames. His latest project is a bed frame. Like many of his projects, he tackled the strip-built sea kayak — which was constructed in the family’s sunroom — by reading a book about how to do it. It gets its beauty from cedar strips; its strength from fiberglass and epoxy.

“I read books, make mistakes, read more books, make more mistakes,” he says, with a grin. “There is a lot of problem solving in woodworking. It’s a challenge and I enjoy learning. I have learned a lot, but still make mistakes often, which means that I’m still learning.”

Blatchley also continues to learn about engineering. In May, he and 12 students traveled to Kenya to install a sand filter for water treatment they designed and built for use at a girls school. The project, a service-learning class focused on water treatment in developing countries, is part of an agreement between Purdue and Kenya’s Moi University.

Blatchley is fascinated by such global partnerships and the growing focus on global water-quality research, which he says will require a lot of learning on the part of engineers.

“The level of student interest in this topic is very high and there are many opportunities. There is a whole different set of constraints when you are working in Africa (or other developing countries),” he says, listing the political and socio-economic factors that come into play.

“We can pursue issues at the interface between traditional academic engineering work and the social sciences, bringing together the physical and social sciences. Engineers are not always good at that because we apply math and physics to solve a problem, but sometimes ignore the rest,” he says. “We are the ones who need to do the learning.”

When he’s not making furniture, collimated beams or water filters, Blatchley can be found on a bike or cross-country skis. An avid athlete, he recently competed in a local triathlon and each winter takes part in the legendary American Birkebeiner 50K cross-country ski race in Wisconsin (his 2010 time was 4 hours 16 minutes, though he says he doesn’t really do it to compete and is glad just to make it from start to finish). Once in a while, he can be found on the water, paddling his strip-built cedar kayak.

“There’s a great satisfaction that comes from building something and using it,” he says.
Interdisciplinary Engineering: Imagine the possibilities

When I graduated from college 35 years ago, an engineering education that included an arts component like acoustics or theater was the exception. I am told that this combination now makes up the largest group of students in the Interdisciplinary Engineering Program.

I was drawn to the blend of art and engineering by an interest in college radio and music and was, in fact, the first to graduate from Purdue as an acoustical engineer in interdisciplinary engineering. My major included the study of mechanical engineering, electrical engineering, physics and design. I apply it in my daily work as an acoustical engineer working on room acoustics, ventilation system noise reduction, and sound isolation between spaces for facilities including theaters, performing arts mixed-use projects, civic buildings and broadcast music and film studios. It is a fascinating field.

The design of concert music venues, for example, has benefited greatly from research in human perception, helping us define what really matters acoustically. This has resulted in a reduction in the size of dedicated concert halls to a maximum of 2,500 seats, to enhance important parameters like early reflected sound and acoustical intimacy. In larger venues, the sound-reflecting surfaces are simply too far away to deliver these important categories of reflection in time for the human mind to find it most pleasurable.

My projects keep me in close touch with the arts and raise the question: Is room acoustics design itself an art or a science? I explored the interface of art and science in a chapter for the book, “Acoustics: Architecture — Engineering — The Environment”:

“Room acoustics is a combination of both art and science. Scientific theory plays an important role in defining acoustical measurements and analysis techniques. Still, the best acoustical theory must be combined with creativity, intuition, and experience to be implemented effectively.”

My acoustical design colleagues have degrees in music, mathematics, physics, ocean engineering, mechanical, electrical, civil engineering and, yes, acoustical engineering. We work in a variety of locations, but at least half the people who hire us are architects. And who better to identify with the art in architecture and appreciate the vision, than someone educated in interdisciplinary engineering and allied arts?

Now, more than ever, building projects need to be an integrated whole. Elements like lighting, thermal comfort, technical infrastructure, acoustics and visual interest need to interplay in a successful project. This is where interdisciplinary engineers — especially those who meld art and engineering — can make a real contribution.
On Finding Future Engineers in the Art Classroom

Robert Sabol is a professor of visual and performing arts at Purdue and chair of the Department of Art and Design. He is the current president-elect of the National Art Education Association (NAEA) and an NAEA Distinguished Fellow. He is the recipient of the Manual Barkan Memorial Award for Exemplary Research in Art Education and twice received the Patti and Rusty Rueff School of Visual and Performing Arts Excellence in Teaching Award.

Did you ever think that learning how to solve engineering problems could begin in an art classroom? Have you ever thought about the commonalities engineering and the visual arts share? If not, please consider this.

The field of engineering is concerned with the application of scientific knowledge to understand problems and create unique solutions to solve them. In order to solve problems, engineers must access the creative and imaginative reaches of their mentalities. In a very real sense, they become “artists” by exploring multiple possibilities, redefining problems, expanding their understanding of those problems, and by using materials and processes in creative and inventive ways. In short, they create something that didn’t exist before. They have to be open to a full range of possibilities and accept that the unknown is part of the problem while learning from trials and mistakes. They have to be open to using the unexpected as a workable solution. These are things visual artists do whenever they create a work of art.

In art classrooms, students are not only given permission but encouragement to use their imagination as a source of content. They “learn to see.” They are taught to tolerate ambiguity, explore what is unknown, create multiple solutions to problems, and evaluate products free from the confines of convention. They depend upon an array of mental habits including observing, envisioning, innovating, and reflecting, not generally emphasized elsewhere in schools. They are dependent upon their creativity and higher-order thinking skills involving comprehension, application, analysis, problem identification, synthesis of knowledge and evaluation of the products of creation. These processes may sound surprisingly familiar to any engineer. Studies have demonstrated positive relationships between increased standardized test performances and students who are engaged in art classes. Although it probably has never been studied, it is equally likely that engineers who are engaged in the visual arts may produce better solutions to engineering problems.

Perhaps you’ve never thought of yourself as an artist and maybe you’ve never considered how much engineering and the visual arts have in common, but perhaps you should. If you wonder from where the next generation of engineers will come, look in the art classroom. When you look at works of art, consider the quality of their engineering, and the next time the rest of us view the products of engineers, we will consider their merits as works of art.
Nuclear Know-How

Students educate high school science teachers

On an April weekend best known for Purdue’s Spring Fest celebration and Bug Bowl, a dozen nuclear engineering students took 18 Indiana high school science teachers back to school.

The teachers were participants in the inaugural Nuclear Science Teacher Workshop, hosted by the student chapter of the American Nuclear Society (ANS). They had the chance to expand their knowledge of nuclear physics and technology through a series of interactive lectures and tours of various labs. They also saw the state’s lone nuclear reactor, housed on the West Lafayette campus. And each participant received a teacher handbook to assist them in lesson and experiment planning.

For Lenka Kollar, a graduate student in nuclear engineering and the ANS outreach chair, the timing of the workshop could not have been better. As an example, she points to President Barack Obama’s advocacy for nuclear power and February 2010 announcement of more than $8 billion in federal loan guarantees to build the first nuclear power plants in three decades.

“Loan guarantees supplied by the government will help ensure that nuclear power plants are built in the U.S. to supply clean electricity and reduce our dependence on coal and oil,” Kollar says.

While nuclear engineering students understand the opportunities provided by nuclear power, Kollar says many people are skeptical about it as a power source because of a lack of education on the subject. Subject knowledge, though, wasn’t a particular problem for the visiting high school teachers. Many of their questions related to the changing political landscape on the energy policy front, Kollar says.

Roy Streater was one of three science teachers from Indianapolis’ Ben Davis High School.

“I was really blown away by their presentation,” says Streater, a physics teacher. “The students did a wonderful job. Everything was well organized. The notebook they provided had great information and resources. And the activities were well constructed and helped clarify some of the concepts.”

Made up of both graduates and undergraduates, the Purdue ANS chapter works to encourage high school students to pursue careers in the STEM disciplines (science, technology, engineering, and math). Of the nearly 80 student members on campus, 20 participated in outreach activities last year. ANS visited four local high schools, talking to 16 chemistry and physics classes. The group also participated in three other outreach events on campus and attended the Lugar Collegiate Energy Summit in Indianapolis.

The opportunity to inspire teachers resonated with several of the ANS students. “Many of our high school science teachers inspired us. We think these teachers are in a great position to turn their students toward STEM fields, as well,” says Kollar. And she should know. She chose graduate studies in science over a one-time desire for a career in marketing. ■ William Meiners

Indiana high school science teachers tour the Purdue nuclear reactor during the inaugural Nuclear Science Teacher Workshop. The event was hosted by the Purdue student chapter of the American Nuclear Society. (Courtesy photos)
Purdue Takes the Lead with Inaugural eVGrand Prix

With three little words, Purdue rolled into position as a world leader in April: “Drivers, power up!” commanded President France A. Córdova.

And the University’s inaugural Electric Vehicle Grand Prix race was under way, 17 go-karts humming around the track, vying for top place in the 80-lap event at the Purdue Grand Prix track.

In the race, the first collegiate electric go-kart race in the nation, vehicles approached speeds of 45 mph, finessed the zigs and zags of the chicane, tangled in pile-ups, and overtook one another with appreciative air horn blasts from the stands. More than just a spectator event, however, it signaled Purdue’s significant leadership in the emerging world of electric vehicles.

The Purdue eVGrand Prix, six days before the traditional Purdue Grand Prix, was conceived as part of a $6 million grant awarded to the University in 2009 for creation of the Indiana Advanced Electric Vehicle Training and Education Consortium (I-AEVtec). The consortium is led by Purdue and includes Ivy Tech Community College, Indiana University-Purdue University Indianapolis, the University of Notre Dame, Purdue Calumet and IU Northwest. The group is charged with educating and training the workforce needed to design, manufacture and maintain the electric vehicles of tomorrow. Two of the teams competing in the race represented Ivy Tech; the others were from Purdue.

The consortium will develop certificate and associate degree programs for vehicle technicians, bachelor’s and master’s degree programs for electric vehicle design and manufacturing engineers, and a certificate program in electric vehicle safety for emergency responders. It also will contain an outreach program to secondary schools and a website to provide information on electric vehicles to the general public. An estimated 2,000 people attended the eVGrand Prix.

“The development of course material in various aspects of electric vehicle technology is not enough,” says Jim Caruthers, professor of chemical engineering and I-AEVtec director. “We need also to excite young people about this technology so that they will begin to dream about how they can be part of this green revolution in transportation. The eVGrand Prix is an excellent way to engage students in the emerging electric vehicle technology and have a good time as well.”

The Grand Prix was organized by students from the Electric Vehicle EPICS teams and those enrolled in electric vehicle courses. Multidisciplinary teams designed and built the energy-efficient karts. The winners were judged not only on who crossed the line first, but also on power efficiency, kart design and community outreach.

David Rozovski, an industrial engineering doctoral student aspiring to become a test pilot and astronaut — and driver for IE Racing 1 — stood by his vehicle at halftime during the race. The break, 40 laps in, was required of all teams so that their karts could take on freshly charged batteries.

“It was a fantastic experience. We learned a tremendous amount through the build process and the race,” said Rozovski, who is profiled in the fall 2010 issue of Industrial Engineering Impact magazine. “I believe the event is going to have tremendous impact on electric vehicles in the future, not only from an innovation standpoint but also because the individuals exposed to the event will apply it to what they do when they leave Purdue.” ■ L.T.T.
Depending on your generation and personal tastes, Philip Zumbrun’s burgeoning career could be either wildly dissonant or perfectly harmonious.

Graduating in May 2010 from Purdue’s Interdisciplinary Engineering Program, Zumbrun earned a degree in acoustical engineering, a discipline traditionally associated with noise control and the reduction of unwanted sound.

As a producer at Sonic Iguana Studios in Lafayette and veteran pop-punk musician, Zumbrun has the volume set to loud, bringing joy to fans of the genre — and likely annoyance to their parents.

Zumbrun first discovered an affinity for math and science at the rigorous Covenant Christian High School in Indianapolis, where he also immersed himself in music, playing a variety of instruments in several area rock bands.

“I was led to Purdue by academics, and became fascinated by the idea of acoustical engineering,” he says. “It seemed like the perfect place for my love of math, science, and music to meet.”

As a Boilermaker, Zumbrun founded the Purdue chapter of the Audio Engineering Society, worked behind the scenes as a theatre technician in numerous Hall of Music productions, served as an engineering ambassador and peer mentor, and completed two initiatives in the EPICS program.

In his off time, he also guided the band Highway Magic as lead guitarist, vocalist, songwriter, booking agent, and producer for more than 150 live performances and three albums.

Today, Zumbrun continues to advance his musical career with a less demanding role in his new band, It’s All Happening, which includes several members of his former act and complements his work at Sonic Iguana.

“It’s easy to look at music purely as a form of art and self-expression, but there’s a lot more to it,” he says. “I like to sit down with bands and examine what they’re trying to accomplish with their sound.

“Through acoustical engineering, I help them identify the particular steps and techniques needed to produce that sound and accomplish what they want.”

Zumbrun credits mechanical engineering professor J. Stuart Bolton and theatre and sound design professor Rick Thomas for helping him make the link between disciplines, and the EPICS program for helping him put it to work.

“The key benefit I took from EPICS was an understanding of the engineering design process, which is very similar conceptually to the recording process,” he says. “There are a lot of connections between engineering and music, from math to the physics of sound. I didn’t really think about them when I started, but learned about them at Purdue.”

Those same lessons are now proving valuable for the bands Zumbrun produces at Sonic Iguana, which was founded in 1990 by local musician Mass Giorgini and has carved out a niche as one of the leading pop-punk recording studios in the Midwest.

“Having a technical mindset and applying it to the arts helps make the creative process more intentional and specific,” Zumbrun says. “And when you look at music from a business standpoint — making an album that will sell — it’s absolutely critical.”

Eric Nelson
With interests that span both the art and science worlds, Ian Boze never imagined he would find a major that combined his two passions.

As the first student in Purdue history to major in lighting engineering through the Multidisciplinary Engineering (MDE) program, Boze, like most engineers, enjoys “taking things apart and figuring out how they work,” but he is also a theater enthusiast.

“When I found the (lighting engineering) major, I was a little skeptical,” says Boze, a junior from Toledo, Ohio. “I wondered how it was really going to work.”

Offered through the School of Engineering Education, the MDE program allows students to experience the core engineering courses but tailor the major to satisfy their specific interests.

For Boze, this flexibility has allowed him to pursue both interests in a realistic way.

“When I started looking at colleges, I didn’t really want to make theater my job, so I chose engineering,” Boze says. “After my first year of engineering, I missed theater too much. I asked if it was possible to double major in theater and engineering, and my advisor looked at me like I was crazy. Then she told me there was a better option.”

The lighting engineering program and a theater minor have fostered Boze’s appreciation for the artistic aspect of engineering. “I find that I’m more invested in what I’m doing,” he says. “I know there is an end product. It’s not just a math problem anymore.”

Boze says this unique major helps him bridge the gap that often occurs between engineers and customers.

“It’s such an asset for a company to have an engineer who is also able to understand and talk to a customer in plain language, then turn around and have an equally intelligent conversation with engineers,” he says.

Highlighting his versatility, Boze has been able to market himself differently than many engineers. “I take the electrical engineering classes so I know the technical aspect, but I also take theater classes so I know what light can actually do,” he says.

Boze used his diverse background over the summer as an electrics department intern at Weathervane Playhouse in Newark, Ohio.

Mackenzie Greenwell

Ian Boze combined interests in theater and engineering to become Purdue’s first major in lighting engineering. He is also pursuing a minor in theater. (Photo by Andrew Hancock)
What’s in Your Toolbox?

Park engineer blends visual thinking, linear logic

Lisa Schafer (BS ’83) translated a degree in architectural engineering into a career as a park engineer overseeing parks planning and design for the City of Cincinnati. She uses the same visual thinking skills in her personal artwork, shown in detail as the backdrop on the facing page. (Courtesy photos)
As a child, Lisa Schafer created her own secret garden and hundred-acre wood near the family home in southern Indiana. Years later, she’s still making magical outdoor spaces, most recently overseeing parks planning and design for the City of Cincinnati. She retired from that position in June.

Schafer (BS ’83), a self-described visual thinker, was torn between art and science when choosing a college major. She found a happy medium in the interdisciplinary engineering program, where she studied architectural engineering, which is now housed in the School of Civil Engineering. “I thought it would bring the creative and the technical into play,” she says.

With an engineering degree in her toolbox, Schafer rounded out her creative skills with a master’s in digital design from the University of Cincinnati’s College of Design, Architecture, Art and Planning and studies at the Art Academy of Cincinnati.

In her daily work as a park engineer for one of the nation’s top urban park systems, Schafer drew on both creative processes and the methodology of engineering. In helping implement Cincinnati’s 2007 Centennial Master Plan, she was involved in improving wayfinding throughout the park system, engaging in restoration and historic preservation, implementing sustainable technologies, and installing sculpture and art elements.

She views all tasks through an artist’s lens.

“There are times when my problem solving gets very creative,” she says. “I look at every aspect of our parks as if I were painting or photographing them. I’m constantly adding or editing out elements to make visiting a Cincinnati park a more enjoyable experience.”

Schafer refers to the influence of painting for personal reasons. She is an artist in her own right and has shown her paintings at galleries around Cincinnati. She is currently working on large modern mixed media pieces.

“I love the effects of the chemistry involved in breaking the rules of more structured art forms,” she says, revealing the duality of the engineer/artist.

“I am continually influenced by the surrounding environment, and constantly contemplate its interpretation. For me the creation of art offers a tremendous sense of discovery. It is a journey built upon the sum of my experiences,” she writes on her website.

Schafer’s first job post-Purdue was on a bridge-building project. She then worked in marketing and consulting before moving to Ohio in 1991 when her husband, Bryan (BS ’82, biomedical engineering; MSM ’91), took a job in Procter & Gamble’s pharmaceuticals research and development division. By that time, the couple had two children.

Creativity is not a solitary venture for Schafer, who recently teamed with her husband to create an electronic greeting card iPhone application (www.pennygreetings.com). The project came about because she wanted to send her (now grown) children Valentine’s Day cards and couldn’t find any quirky enough. Necessity being the mother of invention, she went to work.

“When it doesn’t exist and you want it, I figure that means there’s an opportunity to create it. So we did,” she says.

Schafer didn’t have to reach far into her toolbox for the project — she had the creativity and her husband contributed the technical skill. Engineer that she is, she advises everyone to carry a well-stocked kit, including a healthy supply of creativity.

“Today, when I mentor, I ask one question, ‘What tools are you putting in your toolbox?’ I explain, ‘You’re building a life and you’re going to need skills in that box that will help you build it.’ I’m still adding to and editing my toolbox,” she says. ■ L.T.T.

To view website: www.lisaschafer.com
The University recently celebrated the completion of its highly successful $5 million Presidential and Trustees Scholarship Endowment Challenge, which matched gifts in support of scholarships to attract high-achieving high school students. As expected, the College of Engineering played a significant role in this challenge.

Of the more than 90 newly funded endowments university-wide, Engineering established an impressive 50. The endowments will fund merit-based scholarships for high school students from across the nation.

One recipient, an incoming student in the Honors First-Year Engineering Program, clearly conveys the impact of the scholarships. "With your aid, I have become not only a first-generation high school graduate, but a first-generation college student," the student shared. "With your help, I can get an education and end the cycle of poverty in my family." Giving all students access to a quality education, honoring family members, remembering the difference a scholarship made in their own lives — these are a few of the reasons donors support the college.

The college celebrates the success of the scholarship challenge, which is part of the University’s $304 million Access and Success campaign, and thanks each donor who helped make it happen. It is the generosity and foresight of these donors that is changing the face of engineering at Purdue and opening doors to qualified and eager students.

To support scholarships like these or make a gift to the College of Engineering, please contact Amy Noah at (765) 494-0164 or arnoah@purdue.edu.

Thank You
A. M. King Aeronautics and Astronautics Scholarship
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William and Sally Dunton Scholarship in Aeronautics and Astronautics
William C. Cleveland Scholarship in Electrical and Computer Engineering
William C. W. Mow Scholarship in Electrical and Computer Engineering

Wanted: Scholarships for Emerging Urban Leaders

Newest matching opportunity seeks to assist students from urban public schools

With the successful completion of the $5 million Presidential and Trustees scholarship initiative, Purdue is now calling on alumni and friends to consider participating in the Emerging Urban Leaders scholarship challenge. This program seeks to leverage an anonymous donor’s $3 million contribution to reach out to students from urban public schools who have been historically underrepresented at Purdue with preference for the following cities: Indianapolis, Gary, East Chicago, Hammond and Chicago. It should be noted that schools in other urban areas may also be considered.

Scholarships will be based on broadly defined merit with a preference for those pursuing majors in science, technology, engineering, and mathematics (STEM). The goal of the Emerging Urban Leaders scholarship is to prepare a diverse set of future leaders for career challenges in the 21st century.

Alumni and friends can participate by establishing scholarship endowments in support of Emerging Urban Leaders for $25,000 (payable over five years). The amount committed (including any corporate matching funds) is eligible for a 1:1 match as long as matching funds are available.
Inviting transformation that brings occasional discomfort, the College charts new territory in implementing its strategic plan.

“And now for something completely different.” That segue phrase familiar to fans of the British comedy team “Monty Python’s Flying Circus,” also is apt for what the College of Engineering is accomplishing with its strategic plan for 2009–2014, “Extraordinary People, Global Impact.”

“As we execute this plan, we are pushing ourselves to think and act very differently,” says Leah Jamieson, the John A. Edwardson Dean of Engineering. “We are forging novel collaborations, thinking much bigger, taking calculated risks, and exploring ‘blue ocean’ possibilities. We are taking long-held practices, shaking them at their foundations, and intentionally putting ourselves off balance to gain new perspectives. These new perspectives will generate original solutions.”

Now squarely in its implementation phase, the strategic plan’s vision is for the College to “be known for our impact on the world.” It will be achieved by accomplishing three goals:

- Graduates effective in the global context
- Research of global significance
- Empowering our people and enriching our culture.

The plan’s key actions are portrayed in four stories, distilled from the work of more than 400 contributors from inside and outside the College:

Story No. 1: Always@PurdueEngineering

This story tells of the Purdue Engineering experience beginning early in life and continuing throughout it, weaving a positive, life-changing thread. Beginning as early as preschool, children will be introduced to basic engineering concepts and, as they grow, gain increasing understanding about how engineers change people’s lives for the better everywhere in the world.

When Robert Newcomb (BSEE, ’55) was young, such outreach efforts were still in Purdue’s future. His early education in engineering happened when he worked in his father’s business. “My father had the business of making record players and P.A. systems. I started studying radio as a kid,” Newcomb says.

Today, after serving on the faculty at Stanford and the University of California, Berkeley, he is at the University of Maryland. His strong, lifelong allegiance to Purdue Engineering remains, however, and is enriching Purdue undergraduates in SURF, the Summer Undergraduate Research Fellowship program, for which he created an endowment.

As the “Always@PurdueEngineering” story continues to unfold, new teaching methods are being put into place to foster lifelong engineering education. The College’s “Engineer of 2020” initiative is developing well-rounded “renaissance” engineers with preeminent technological knowledge, but also critical abilities like leadership, teamwork, communication, effectiveness in multicultural environments, and other attributes. Purdue Engineering also is forging new interdisciplinary professional master’s programs, personalized Ph.D. programs, and support for career-long learning.

And, like Robert Newcomb, College alumni are increasingly acting on the lifelong ties that bind them to Purdue and their experiences in Engineering. They are circling back to campus to share knowledge gained in their professions, to create corporate partnerships, to collaborate in and support needed research, and to show generosity that students feel every day.

Story No. 2: ChangetheWorld@PurdueEngineering

This story asks us to imagine faculty and students whose research shapes the world, faculty who are not only connected to technology, but to its implications for our economy, infrastructure, human development, national security and international relations. It asks us to imagine research that is strengthened by deep partnerships with industry, federal agencies, and national and international labs.

Among key actions in “ChangetheWorld@PurdueEngineering” is the creation of a Systems of Systems Institute to lead the world in understanding and explaining intricate connections
that exist in healthcare, energy, aerospace enterprises, transportation, defense, etc. In addition, this story addresses efforts that already are enriching our collaborations and use of the Web in enhancing our research and sharing it with others.

**Ed Schreck** (BSIE '71), now retired as CIO of Accenture and chair of the School of Industrial Engineering Advisory Council, points to the revolutionary HUBzero technology first developed at Purdue as a shining example of both global research collaborations and effective Web use. This unique Purdue technology helped pave the way for last fall’s $105 million National Science Foundation grant for the Purdue-led Network for Earthquake Engineering Simulation, NEES.

“HUBzero is a powerful technology capability that is enabling new models for innovation and collaboration,” Schreck says. “We are among the trailblazers. The HUBzero technology is supporting many multidisciplinary research collaborations; and ongoing R and D is continuing to expand its collaborative work capabilities.”

**Michael McClennan**, a senior research scientist in Purdue’s Rosen Center for Advanced Computing, says Purdue’s HUBzero technology is enabling global research collaborations that appear destined to lead to exponential growth in collaborative Web-based research. “We just released HUBzero as open source in April, so we’re still in the early stages with respect to the outside world,” he says. “In addition to the hubs outside Purdue, we have 24 hubs hosted here. Of these, 12 are in full production, and the rest are still under construction or not yet publicly announced. The 12 sites in full production have had about 390,000 visitors in the last year. The bulk of these, some 250,000, were at nanoHUB.org, but GlobalHUB.org had 66,000, thermalHUB.org had 20,000, pharmaHUB.org had 10,000, etc. It adds up.”

**Story No. 3: Innovate@PurdueEngineering**

This story highlights how we are using a three-layered “innovation ecosystem” to change our traditional research culture to one that connects creativity and risk-taking to high-impact outcomes and engagement.

The base layer is the “idea zone,” where intellectual risk is supported and rewarded. The top layer is the “exchange zone,” where we partner with industry, defense, policymakers, global labs and governments. The middle layer is the “collaboration zone,” where the top and bottom meet to discern how and by whom problems are solved and topics of interest are addressed.

“Innovate@PurdueEngineering” envisions the College as “the” destination for students and world-class faculty who will often work together on risk-taking research. It emphasizes entrepreneurship, economic development, and a continual quest to benefit society.

**Marcy Alstott**, (BSME ’79), vice president of operations for Laserjet Enterprise Solutions at Hewlett-Packard, is a strong advocate of disciplinary diversity.

“As a long-term employee in the high-tech industry, I’ve seen the advantage of multidisciplinary problem solving with great products like computers, robotics, networking systems and, most recently, printers,” Alstott says. “The challenges are always at the cross-sections. How do you dissipate heat as electronics get smaller? How do you send a print signal from your cell phone? Solving those problems adds measureable worth to products and companies.”

**Story No. 4: OurPeopleOurCulture@PurdueEngineering**

This story envisions a culture characterized by courage — the sheer guts — to make revolutionary cultural changes that support boundless thinking and ultimately facilitate stories 1, 2 and 3.

**Jenna Rickus**, (BSABE ’95) and associate professor of agricultural and biological engineering, agrees that it will take courage to abandon the familiar and reorder priorities.

“As an institution, our biggest challenge and most important step will not be to create the new world, but to tear down the old one. With e-mail, online access, easy and frequent travel, everyone is overloaded. Faculty must have the freedom to devote energy to their big ideas. To find this time, energy and inspiration, we must stop doing some of the lower priority, lower impact activities.”

To that end, key actions within this story that will foster big ideas include a learning community for new faculty, a bigger capacity for leadership sabbaticals and fellowships, and the creation of an “Influencers in Residence” program.

Ambitious research will be rewarded through a post-award process and the creation of “mental space,” through research semesters, team teaching, and the banking of research credits. Some, but not all, of this story’s key actions include a “Staff of 2020” program to elevate the skills of support staff who bolster the efforts of faculty; the creation of a Center for Diversity, where new synergies are fostered and rewarded; and progress assessment through external reviews and report cards each semester.

The ultimate goal in “OurPeopleOurCulture@PurdueEngineering” is to “engage our people to transform our culture because empowered people radiate passion that energizes them to change the world.”

— Amy Raley
Imagination and Knowledge

As engineers search for solutions to the world’s challenges, they apply a technical and tightly focused thought process. To succeed, though, they often have to think out of the box, draw on creative approaches, and look beyond their disciplines.

Question
Albert Einstein said, “Imagination is more important than knowledge.” Do you agree? To what extent can the arts and imaginative thinking influence engineering?

Answer: While imagination can lead to big breakthroughs, I do not think it is necessarily more important than knowledge.

Yes, creativity is important, particularly when considering problems from different angles and developing ideas that don’t build on what has been done. But creativity cannot replace knowledge. Perhaps Einstein was referring to creativity being more important in making major paradigm shifts — I would agree with that.

Knowledge is the foundation of our work. We can make contributions based on knowledge, building on what we know, substantiating it, validating it, advancing on it, and working toward success. Creativity may come into play in our quest, but knowledge is the major player.

Arts and imaginative thinking certainly can lead us to look at a problem in a different way and provide insights on solving it. It may prompt us to bring other aspects to engineering design, and that could lead to greater impact, interest, and a longer appeal time. So, yes, creativity is very important.

Sometimes people align creativity solely with the arts. People in the arts are creative, but engineers are too. We may experience and express creativity differently, but it’s there, it’s part of our souls as well.

Melba Crawford
- Associate Dean of Engineering for Research
- Professor of Agronomy
- Professor of Civil and Electrical and Computer Engineering
- Chair of Excellence in Earth Observation
- Purdue University
**Rafael Smith**

- BS '09, industrial design
- Product Designer
- Über Shelter Inc.
  Indianapolis, Indiana

**Answer: To address problems on a global scale, you need both imagination and engineering, both creativity and design, both paper napkin sketches and implementation skills.**

You also must envision your goal and why you are pursuing it. This holistic thinking results in solutions with the greatest social impact.

The design process I have been part of for the portable disaster shelter (Über Shelter) began with paper and pen. What followed was months of conceptualizing, sketching different ideas, pinning papers up, sitting back and looking at designs, and mixing one concept with another. A huge part of the process is your imagination, visualizing what might be.

When I moved from imagination to design, engineering helped me turn ideas into reality.

Design independent of imagination is shortsighted, and so is imagination without design. “Design thinking” is the new term, the new model, where we see products as systems. Not just in use, but beyond — in solving global problems.

Exposure to fine art and conceptual abilities had everything to do with coming up with shelter concepts. Design skills enabled me to translate those to the technical, engineering work. And knowing my goal of providing housing for people in times of disaster brought it together holistically.

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**Stephen Weintraut**

- BSCE '71
- Executive Vice President, Retired
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  Indianapolis, Indiana

**Answer: Both are key. You need imagination to think outside the box and knowledge to make it happen.**

I believe engineering is influenced by the arts and creative thinking to a great extent. Exposure to good music or great paintings, for example, is uplifting, inspiring and can expand your thinking. When you’re working on a project, some of these artistic influences come to the forefront — balance, proportion, shapes, and light. The magic comes in balancing aesthetics with cost efficiency as you turn ideas into reality.

The arts make us want to create a beautiful bridge, for example, not just a way to cross the river.

Many of today’s elegant design concepts are possible because of new developments in materials and structural analysis. Materials such as high-strength steel and concrete, plastics and carbon fibers allow for thinner, sleeker, sophisticated structures. Computer analysis opened the door to design of indeterminate structures as well as other possibilities.

Artistic insights, material know-how and structural knowledge are all part of the equation. As the famous bridge designer Robert Maillart said, “Art challenges existing ideas in meaningful ways, leading to innovation.”

I think that says it very well.

Interviews by Kathy Mayer

What's your take on this issue?
Write to us at peimpact@purdue.edu
I am a maker.

I think work should be about making things work better. Faster. Smaller. Smarter. So I build bridges between what's known and what's not. I tinker. I toil. I write poetically in an abundance of languages (including code). I hack. I dissect. I have an insatiable desire to un-complicate the complicated. I am easily inspired. I believe that just because it hasn't been thought of doesn't mean it won't be. Potential is my thrill ride. Imagination is my most-used tool. I am a maker. And I am what moves the world forward.

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