

SPRING 2011

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Engineering Momentum

ACROSS DISCIPLINES. ACROSS THE WORLD.™

 Washington University in St. Louis

Engineering

BOEING & WASHINGTON UNIVERSITY:
Engineering Synergy > 12

>> Brauer Hall Dedicated

> 6

>> Heart of the Issue

> 18

>> Crossing the Divide

> 22





LOPATA GALLERY RENOVATION
A hub for engineering students, faculty, staff and visitors, Lopata Gallery renovations were completed in February 2011. See full story on page 40.
 Photo by GEOFF STORY



WUSTL PHOTO

Contents

SPRING 2011

 Washington University in St. Louis

Engineering


IN THIS ISSUE

- 2 From the Dean
- 4 At a Glance
- 30 Alumni News
- 36 Faculty News
- 39 Student News
- 40 School News

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SPECIAL FEATURE

>> Brauer Hall Dedicated 6

FACULTY FEATURE: IGOR EFIMOV

>> Heart of the Issue 18

STUDENT FEATURE: ENGINEERS WITHOUT BORDERS & ENGINEERING WORLD HEALTH

>> Crossing the Divide 22

ALUMNI PROFILE: ANNA PATTERSON

>> Quit Your Day Job 26

SCHOOL NEWS: PRESTON M. GREEN HALL

>> Going Green 32

COVER STORY BOEING & WASHINGTON UNIVERSITY: Engineering Synergy



> 12



RALPH QUATRANO

In my entire career, I have never met more talented and impressive young men and women than our engineering students. Coming from almost every state and 10 countries, we welcomed 333 freshmen this academic year, selected from some

4,500 applications, which made up the largest, most diverse, and most academically gifted class in the history of the school. In fact, our freshmen had an average ACT composite score of 32.9 and SAT average of 1470! These outstanding 333 students joined a student body of more than 1,800 total.

Today's engineering student is the innovative thinker who wants to utilize his or her quantitative and analytical skills to work across disciplines to solve problems. Our engineering students understand that an engineering education has universal applications, and our recent graduates are pursuing careers in medicine, law, architecture, and business, as well as engineering. Our students also understand that they are citizens in a global society, and they are working to integrate new technology with social needs throughout the world, including technology for social and economic development, improved healthcare, a cleaner environment, and sustainable energy sources, to name a few.

The students featured on these pages are all engineering students working on unique projects that convey their passion and excitement for using their engineering knowledge and skills to make a real difference.

For example, Melissa Holtmeyer, a PhD student in Energy, Environmental & Chemical

Engineering, is working in our Advanced Coal and Energy Research Facility to make power generation from coal either carbon neutral or carbon negative. This advanced research facility sequesters the emitted CO₂ from coal or biomass into algal bioreactors to produce other useful chemicals or products.

Beginning on page 22, you can read about the impressive work our undergraduate students are doing in St. Louis and around the world in organizations such as Engineers Without Borders and Engineering World Health. Just two examples include developing a new sewage system for Ethiopia's Mekelle Blind School and surrounding community and refurbishing medical equipment from the School of Medicine for the Lwala Community Health Center in Kenya.

Other examples are our Biomedical Engineering PhD students Nalin Katta and Matthew MacEwan, who won the Olin Cup business plan competition for their company NanoMed. This company uses electrospun nanofiber materials to create a synthetic surgical mesh capable of repairing and replacing the protective membrane surrounding the brain and spinal cord.

The students highlighted here represent just a few of the many contributions that engineering students have, and will continue to make, toward improving our quality of life. I am extremely proud of our students, and I hope you will take the time to learn more about their work at our website: engineering.wustl.edu.

Ralph Quatrano, PhD
Spencer T. Olin Professor & Dean
 rsq@wustl.edu

I AM AN ENGINEER



COURTESY PHOTO

I AM AN ENGINEER — Left to right: Jonathan Dory (NASA mentor), with Engineering students Andrew Wiens, Katie Burlingame and Christie Powers. Through NASA's Systems Engineering Educational Discovery Program, our students proposed, designed, built, and flew an experiment on the microgravity plane to determine whether higher levels of carbon dioxide accumulate near a person in a zero gravity environment like the International Space Station. This data will help NASA find better ways to monitor carbon dioxide levels and prevent astronauts from breathing in a dangerously high amount of carbon dioxide.



Photo by DEVON HILL

I AM AN ENGINEER — Electricity surged through 18,000 individually soldered components as the first illuminated dance floor in years built by WUSTL Institute of Electrical and Electronics Engineers students. With more than 1 billion colors and 32,000 lumens of LED lights, the wireless computer-controlled modular dance floor includes interactive animations based on music synchronization and pressure sensors. Working with the Olin Business School and the School of Law, the engineering students are in the process of creating a company to market and rent the dance floor.



WUSTL PHOTO

I AM AN ENGINEER — Melissa Holtmeyer, a PhD student in Energy, Environmental & Chemical Engineering



WUSTL PHOTO

I AM AN ENGINEER — Biomedical Engineering PhD students Nalin Katta and Matthew MacEwan, who also is a School of Medicine student

Stay connected & informed about news & events!

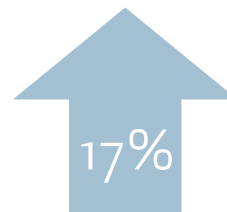
YEAR IN REVIEW

2010

2011



FEBRUARY 2010
Ralph Quatrano was named Dean



JUNE 2010
Faculty achieved record high of \$24.9 million in research expenditures, up 17% from the previous year

JULY 2010

John Fortner and Brent Williams joined the faculty (see p. 36)

SEPTEMBER 2010

Launched two new minors: Systems Science & Engineering and Mechanical Engineering, and new graduate certificate in Construction Management

JANUARY 2011

Mark Anastasio joined the faculty (see p. 36)



FEBRUARY 2011
Lopata Gallery renovations completed (see p. 40)



FEBRUARY 2011
Assistant Professor Caitlin Kelleher received NSF CAREER award, the ninth engineering faculty member to be given the prestigious award since 2005 (see p. 37)

APRIL 2011

Launched new minor in Nanotechnology and graduate certificate in Information Management



MARCH 2011
The National Society of Black Engineers hosted its 37th annual national convention in St. Louis (see p. 39)



AUGUST 2010
Welcomed 333 freshmen, selected from some 4,500 applications, which made up the largest, most diverse, and most academically gifted class in the history of the school



OCTOBER 2010
Dedicated Stephen F. & Camilla T. Brauer Hall, the second building in the new state-of-the-art engineering complex (see p. 6)

FEBRUARY 2011
Launched new major in Electrical Science



APRIL 2010
Construction began on Preston M. Green Hall, the third building in the new state-of-the-art engineering complex (see p. 32)



OCTOBER 2010
McDonnell International Scholars Academy hosted International Symposium at Washington University on Global Energy Future



FEBRUARY 2011
Engineers Week included Alumni Achievement Awards (see p. 30)



APRIL 2011
FIRST Robotics World Championship held in St. Louis

SCHOOL OF ENGINEERING & APPLIED SCIENCE:
>> engineering.wustl.edu

BIOMEDICAL ENGINEERING:
>> bme.wustl.edu

COMPUTER SCIENCE & ENGINEERING:
>> cse.wustl.edu

ELECTRICAL & SYSTEMS ENGINEERING:
>> ese.wustl.edu

ENERGY, ENVIRONMENTAL & CHEMICAL ENGINEERING:
>> eece.wustl.edu

MECHANICAL ENGINEERING & MATERIALS SCIENCE:
>> mems.wustl.edu

HENRY EDWIN SEVER INSTITUTE:
>> sever.wustl.edu

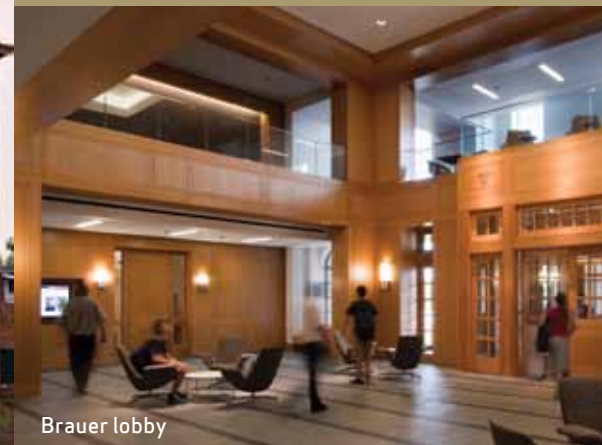
Stephen F. & Camilla T. Brauer Hall Dedicated



Photo by MATT MCFARLAND

BRAUER HALL RIBBON CUTTING & DEDICATION

From left, Melissa Holtmeyer, Pratim Biswas, John McDonnell, Blackford Brauer, Suzanne Snowden Brauer, Dean Ralph Quatrano, Stephen Brauer, Camilla Brauer, Chancellor Mark Wrighton, Rebecca Randolph Brauer, Stephen Brauer, Jr., David Kemper, Provost Edward Macias and Frank Yin



Brauer lobby



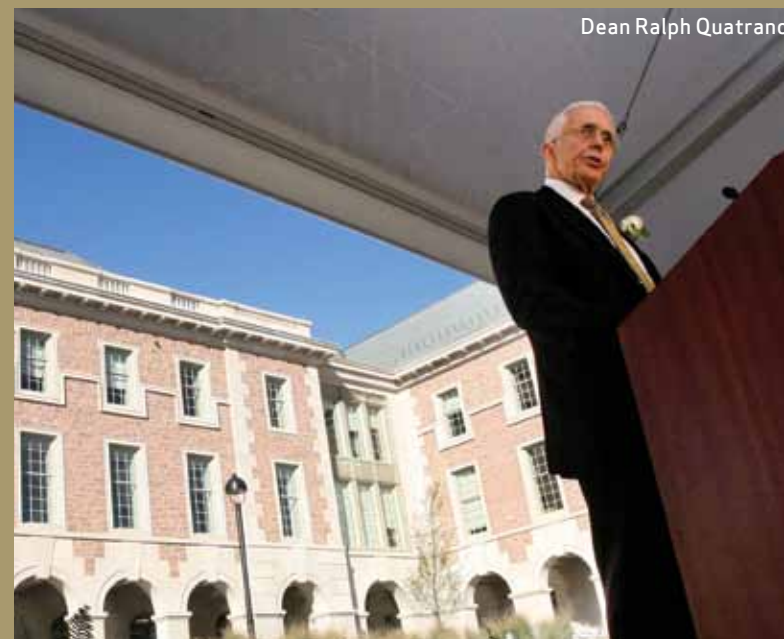
Collaboration meeting space



Distance learning classroom

“Brauer Hall is the hub for new ideas, a place for advancing innovative theories and the focal point for research, leading us toward a healthier, more sustainable and cleaner planet.”

— RALPH S. QUATRANO, PHD,
DEAN, SCHOOL OF ENGINEERING & APPLIED SCIENCE

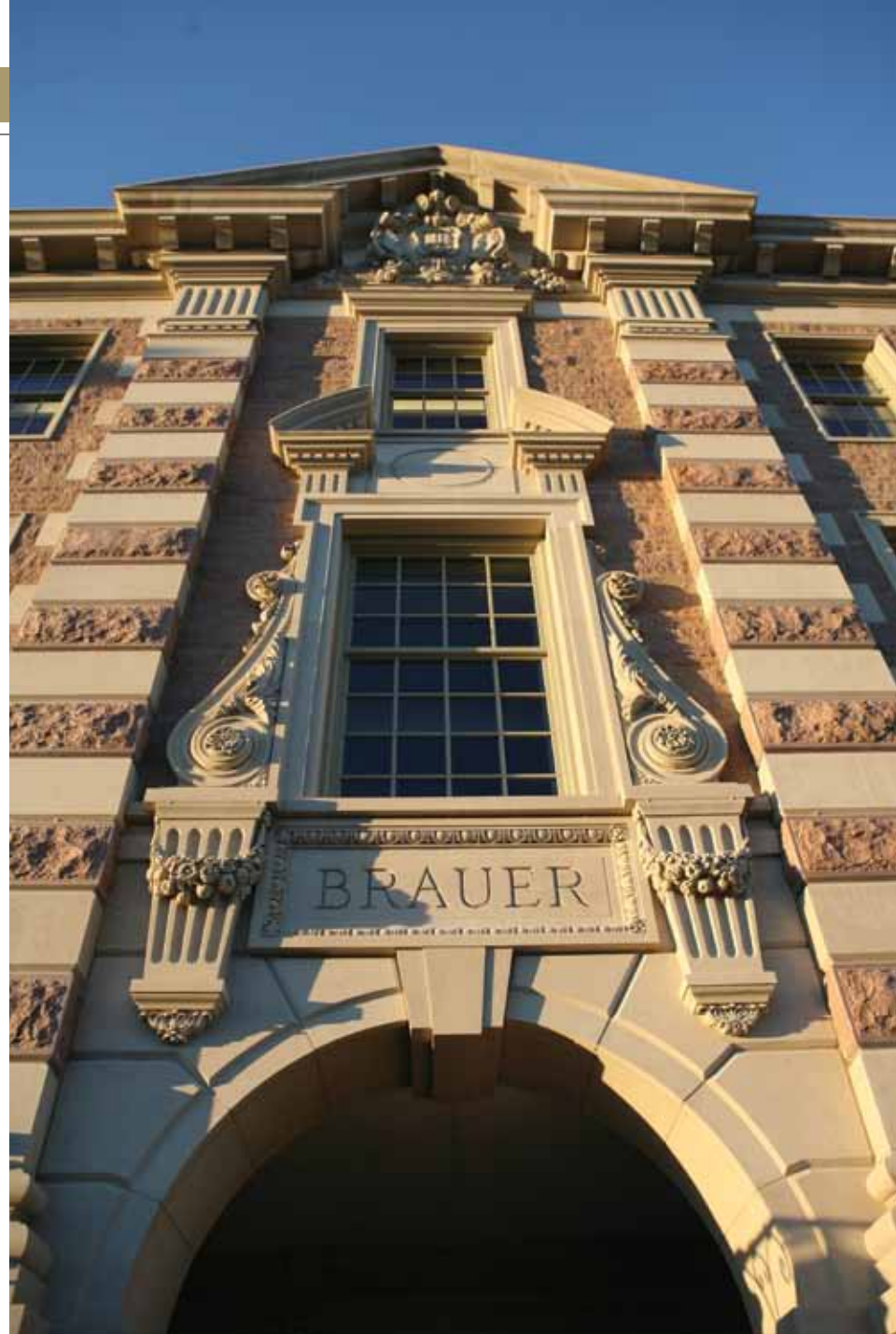


Dean Ralph Quatrano



Mrs. & Mr. Brauer

Photos by **GEOFF STORY**



Stephen F. & Camilla T. Brauer Hall, the second building in a new engineering complex at Washington University in St. Louis, was dedicated October 1, 2010.

The building, named in honor of Stephen F. and Camilla T. Brauer, is home to the Department of Energy, Environmental & Chemical Engineering (EECE) and includes space for the Department of Biomedical Engineering (BME) and the dean's office.

Participating in the ceremony were Stephen F. Brauer, chair of Washington University's Board of Trustees, and Camilla T. Brauer; John F. McDonnell, vice chair of the Board of Trustees; David W. Kemper, vice chair of the Board of Trustees; Chancellor Mark S. Wrighton; Ralph S. Quatrano, dean of the School of Engineering & Applied Science; and Melissa L. Holtmeyer, doctoral candidate in EECE and student representative to the Board of Trustees.

"Thanks to Steve and Kimmy Brauer and the other donors, the engineering faculty and students now have additional state-of-the-art facilities to pursue interdisciplinary research in collaboration with colleagues in the physical, biological and medical sciences," Quatrano said.

"So many of today's important research challenges and questions exist at the interfaces between engineering and other disciplines," Quatrano said. "Brauer Hall will enable us to attract and retain the best and brightest students and the most talented faculty, and it will provide them with the tools they need to do great work."



BRAUER HALL DEDICATION DINNER
From left, John P. Holdren, PhD, Assistant to the President for Science and Technology, Director of the White House Office of Science and Technology Policy, and Co-Chair of the President's Council of Advisors on Science and Technology, and Chancellor Mark Wrighton

The dedication was followed by a reception in Brauer Hall and a private dinner, where the keynote speaker was John P. Holdren, PhD, who was appointed by President Barack Obama as Assistant to the President for Science and Technology and Director of the White House Office of Science and Technology.

The dedication took place during a symposium on the future of global energy hosted by the McDonnell International Scholars Academy and its Global Energy and Environmental Partnership, a consortium of 25 international universities and Washington University that works collaboratively on energy, environmental and sustainability research initiatives. Among the delegates to the symposium were the presidents of the partnering universities in the academy.

Pratim Biswas, PhD, the Stifel & Quinette Jens Professor of Environmental Engineering Science, chair of the EECE department, and director of the McDonnell Academy Global Energy and Environmental Partnership, pointed out that energy and the environment are global challenges. "Brauer Hall will be a living laboratory for energy efficiency and environmental projects," Biswas said.

The 150,875-square-foot building is located at the northeast corner of the Danforth Campus. Construction began in October 2008 and was completed in April 2010. Faculty and staff moved in during the summer, and classes were held in the building for the first time in August.

Brauer Hall features state-of-the-art laboratories, including 21 wet laboratories, four dry laboratories and two teaching laboratories; a distance learning classroom that will allow researchers and students to hold real-time meetings via the Internet with their counterparts at partner institutions; instrumentation and imaging facilities; and electronically equipped collaboration points in the halls near the labs.

"One of the best parts of this building," Holtmeyer said during the dedication ceremony, "is the openness that you find everywhere. Interaction with other students and professors is a very important aspect of research."

"Here at Brauer Hall, that interaction is made easy. The collaboration areas in the halls are already frequently used for ad hoc gatherings and information discussions for those times when you just need someone else to bound some ideas off of."

"Students and visitors will be able to see for themselves the application of knowledge to green building activities. This building will serve as a beacon for energy efficiency and energy sustainability for years to come."

— PRATIM BISWAS
OCTOBER 2010

BUILDING BRAUER HALL Images courtesy of CLAYCO

>> **GROUND BREAKING 10.29.08**



>> **01.08.09**



>> **04.20.09**



>> **06.05.09**



>> **01.22.10**



>> **04.21.10**



Chancellor Mark Wrighton and Dean Ralph Quatrano presented Mr. and Mrs. Brauer with a small copy of their portrait, which is now displayed in the building's main lobby.



Stephen F. & Camilla T. Brauer

"Steve and Kimmy Brauer are two of St. Louis' and America's most distinguished citizens. They have been steadfast friends of Washington University for many years, and through their leadership, generosity, and service, they have left an indelible imprint both on the University and the School of Engineering & Applied Science."

— CHANCELLOR
MARK S. WRIGHTON

Mr. Brauer is the President of Hunter Engineering, the company founded by his late stepfather, Lee Hunter, who served on the University's Board of Trustees from 1982 until his death in 1986. Mr. Brauer joined Hunter Engineering in 1971, after serving three years in the U.S. Army Corps of Engineers. From 2001 to 2003, Mr. Brauer served as United States ambassador to Belgium, and since 1995, he has been a partner in the St. Louis Cardinals Baseball, L.P. He is currently a member of St. Louis Civic Progress, a director of Ameren Corporation, and a past president of the board of the Missouri Botanical Garden.

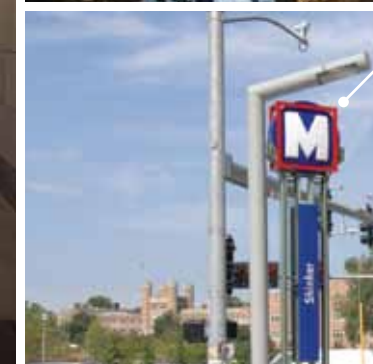
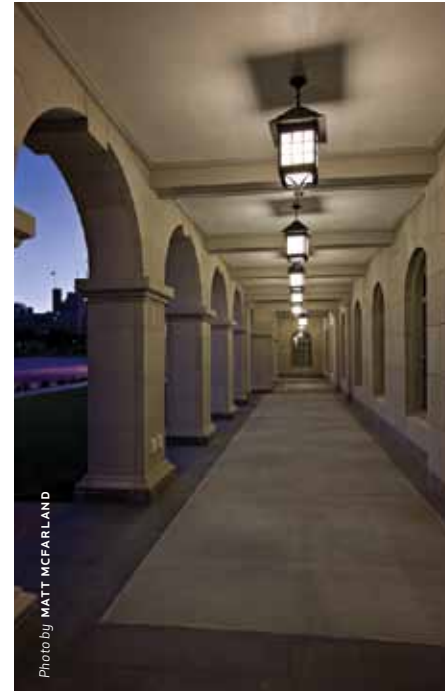
Mr. Brauer became involved with Washington University in 1987 when he joined the National Council of School of Engineering & Applied Science. He was elected to the University's Board of Trustees in 1991 and became chair on July 1, 2009.

Mrs. Brauer is a cultural and civic leader. She serves as vice chair of the United Way of Greater St. Louis and has chaired five Alexis de Tocqueville Society campaigns. She has served as a program chair for the Washington University William Greenleaf

Eliot Society and is a founding member of the Danforth Circle Committee. The National Society of Fund Raising Executives recognized Mrs. Brauer in 1996 as the top volunteer fundraiser in the United States.

With the naming gift for Stephen F. & Camilla T. Brauer Hall, the Brauers continue their long tradition of philanthropy at Washington University. In addition to providing significant support for scholarships in the School of Engineering & Applied Science and Olin Business School, they endowed the Stephen F. & Camilla T. Brauer Distinguished Professorship in Biomedical Engineering. The Brauers are long-standing members of the Eliot Society and are sustaining charter members of the Danforth Circle.

Mr. and Mrs. Brauer have three children, Blackford Fitzhugh Brauer, Rebecca Randolph Brauer, and Stephen Franklin Brauer, Jr., a daughter-in-law, Suzanne Snowden Brauer, and two granddaughters, Camilla O'Fallon Brauer and Caroline Snowden Brauer. Mr. Brauer's mother is Jane Brauer Hunter.



Recipient of a LEED Gold rating from the U.S. Green Building Council, Brauer Hall includes the following features:

9.8 kW Solar Panels: A portion of the building's power is generated using solar panels installed on the roof.

Wind Turbine: A portion of the building's power is generated by using a vertical-axis wind turbine located on the northeast corner of the roof.

Cistern: Rainwater from the building is stored in an underground cistern, which was an abandoned brick-lined sewer pipe located in front of the building. The water is used to irrigate native Missouri plants around the building.

High-Albedo Roof: Roofing not covered by solar panels or mechanical equipment has a highly reflective membrane to minimize heat gain.

Low-Flow Fixtures: Restroom fixtures use 20 percent less water than minimum standards set by the 1992 Energy Policy Act.

Adjacent to MetroLink Station: The building was constructed adjacent to MetroLink's light-rail station at Skinker Boulevard and Forest Park Parkway.

Low-Energy Lighting System: Energy for lighting is minimized through the use of occupancy sensors, dimmable ballasts, and control systems throughout the building.

Construction Waste Management: Nearly 84 percent of all construction waste generated was recycled.

Regional Materials Used in Construction: Materials gathered and processed regionally were used in the construction whenever possible. Recycled blue jeans were used as insulation throughout the building.

Mr. Brauer (left), Dean Emeritus James McKelvey (center), and Mrs. Brauer toured the building on October 30, 2009, to view construction, including insulation made of shredded blue jeans.

LEED: The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is a third-party certification program and the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings.

BOEING & WASHINGTON UNIVERSITY

Written by CANDACE O'CONNOR

ENGINEERING Synergy

An optically distorted windshield on an F/A-18 Super Hornet can cause ailments ranging from mild eye-strain to severe nausea in a pilot. Distortions can even impair the pilot's ability to land the airplane safely on a rolling, pitching U.S. Navy aircraft carrier — a challenging enough feat even on placid waters. So, in 2008, engineers from The Boeing Company, including WUSTL Engineering alumni Matt Thomas and Philip Freeman, teamed up with computer scientists Robert Pless, William Smart, Robert Glaubius, and Michael Dixon from Washington University's School of Engineering & Applied Science to find a solution: an automated assessment system that transformed windshield production, won a Boeing Special Invention Award, and resulted in a recently issued patent.

That's just one success story among many in the close, long-standing relationship between Boeing and Washington University in St. Louis. It's a partnership that dates back some 65 years through a series of chancellors and deans at the University and a changing corporate identity at Boeing, previously McDonnell Aircraft Corporation (1939-1967) and then the McDonnell Douglas Corporation (1967-1997). Today, Boeing employs about 65,000 people across its Defense, Space & Security unit, headquartered in St. Louis.

"Washington University's School of Engineering & Applied Science has long benefited from the presence of the aerospace industry in St. Louis," says Chancellor Mark S. Wrighton. "For decades, our leading engineering graduates have been employed by McDonnell Aircraft (MAC), McDonnell Douglas and now Boeing — the world's top aerospace company. Boeing continues to be an outstanding civic contributor to St. Louis and Washington University, and I consider Boeing as a leader among our most valued corporate partners."

Over time, this relationship has taken various forms. The company has been generous, with donations to the University totaling more than \$27 million to date. Beginning with the late James S. McDonnell, MAC founder, the McDonnell family has also been extraordinarily philanthropic, making gifts that benefit the Danforth Campus as well as the School of Medicine.

Further, Boeing and the University continue to collaborate in mutually beneficial ways. As they did in the windshield project, members of Washington University's faculty work with Boeing engineers on important research, while Boeing provides scholarships to engineering and business students. Increasing numbers of University students visit Boeing for Job Shadow Day, a new mentoring program, and for internships and undergraduate design teams. Without the other, neither Boeing nor Washington University would be the company or university that it is today.

It is by no mistake that the defense headquarters for the world's top aerospace engineering company and one of the world's leading engineering schools are both in St. Louis. The synergy that exists between Boeing and Washington University has resulted in mutual success.

Photo courtesy of BOEING



Photo courtesy of BOEING

>> Preparing Boeing's workforce for leadership roles in a global, technology-driven society:

1,200 current Boeing employees received degrees from Washington University's School of Engineering & Applied Science with another 200 Boeing employees currently pursuing a degree; more than 2,000 Boeing employees have taken one or more classes in the past 10 years through the engineering school's Center for the Application of Information Technology.

And there is every indication that this partnership will grow. Washington University has trained or is training a significant portion of Boeing's workforce. A recent Boeing survey showed that almost 1,900 employees have degrees or certificates from Washington University. Some 1,200 of them are engineering employees, with more new hires each year and more current employees in part-time degree programs.

"We work with some 150 universities around the country, and our relationship with Washington University is one of the best and most vibrant of all," says Dennis A. Muilenburg, president and chief executive officer of Boeing Defense, Space & Security, who recently joined the University Board of Trustees. "We are building on a strong foundation, and I would like to continue to have a great and growing partnership."

"I look at Washington University as an important institution for the St. Louis community, and for the world, in terms of making the world a better and more educated place."

— JOHN F. MCDONNELL

The History of the Boeing/Washington University Collaboration

In the late 1940s, James S. McDonnell got acquainted with Washington University's new chancellor, Arthur Holly Compton, winner of the 1927 Nobel Prize in Physics. The two struck up a friendship, and McDonnell developed an abiding interest in the University. From 1960-1966 he served as a trustee, chairing the board from 1963-1966.

He also began donating generously to the University through his private foundation, while his company began giving through its corporate foundation. Among their many benefactions were programs on the Danforth and medical campuses, including the McDonnell Center for Space Sciences, as well as numerous buildings. At the time of McDonnell's death in 1980, gifts from McDonnell and his family, as well as both foundations, totaled more than \$28 million.

"My father was always fascinated by all the cutting-edge science going on at Washington University," says McDonnell's son, John F.

McDonnell, himself a longtime member of the University's board who also served as its chairman. "He loved talking with the faculty members about what they were doing."

John McDonnell and his brother, James, have continued the family tradition of philanthropy with gifts including the James M. McKelvey Professorship. "I look at Washington University as an important institution for the St. Louis community, and for the world, in terms of making the world a better and more educated place," he says.

The Boeing-Washington University Relationship Today

Boeing and the University have recently looked for new ways to strengthen the partnership. The key contact from Boeing to the School of Engineering & Applied Science, Mike Gibbons, is eager to find opportunities for

cooperation. And on the Washington University Engineering side, both Ralph S. Quatrano, dean since 2010, and Nick Benassi, associate dean, are equally committed to forging new connections.

"Long before I became dean, I knew of our strong partnership and the rich history of our relationship," says Quatrano, also the Spencer T. Olin Professor. "It's certainly not a coincidence that St. Louis is home to a top engineering aerospace company and a top engineering school — this partnership has created opportunities for each to excel and to make a real difference to the world. Now we are working with an outstanding, enthusiastic team at Boeing to capitalize on the existing relationship and grow it to new levels."

"Synergy" is the word that Gibbons uses to describe the benefit of that relationship. Boeing provides opportunities for students and faculty to interact with aerospace engineers on real-world problems; in turn, the company often attracts talented employees through this process.

"What we want to do is foster the ongoing partnership between the University and Boeing so

that it spawns new activities of mutual interest," says Gibbons, F/A-18E/F Super Hornet program manager, who has a master's in mechanical engineering and an executive master's in business administration, both from Washington University, and who serves on the engineering school's National Council.

Recruiting Women & Minorities

Washington University and Boeing share a special interest in recruiting women and minority students to engineering. Kristin Robertson, then chief engineer for Boeing's St. Louis site, who spoke to a group of women engineering students at the University



2010 SCHOLARSHIP DINNER

Left: Boeing leaders with the 2010 Boeing Scholars in the School of Engineering & Applied Science.

Photo by GEOFF STORY



>> Enhancing the engineering curriculum and student experience:

Boeing is helping to enhance the engineering school's curriculum and students' experiences by sponsoring undergraduate student design projects, speaking to classes, mentoring students, hosting job shadow days, providing internship opportunities, and supporting scholarships.

In 2005, Boeing began offering scholarships to engineering and business students, including two Washington University/Boeing First Scholarships, awarded to high school seniors who have participated in the FIRST Robotics Competition. This year, 16 engineering students and 17 students at the John M. Olin School of Business have Boeing scholarships.

"By providing financial support through scholarships, The Boeing Company is focused on improving access for and retention of top students who are interested in science, technology, engineering and math," says Matt Daniels, regional manager of university relations for Boeing. "We build upon these investments with

last fall, believes strongly in mentoring young women. "It is important for women in industry to share lessons learned and help show the way," she says. "We can balance work and life, and we bring a diverse perspective."

Scholarships

For Tyler Gordon, a fifth-year mechanical engineering and materials science student in the BS/MS program, the scholarship support he has received from Boeing has made a giant difference in his life and career.

"Without the support of The Boeing Company, many students — myself included — would have a much more difficult time coming to Washington University," says Gordon. "It also allows us to focus on our education instead of needing to work full- or part-time jobs throughout the school year."

our Boeing Scholarship recipients by providing mentoring, job shadowing, and other experiential learning opportunities."

Job Shadow Day, Internships, Mentoring & Design

Two years ago, Boeing inaugurated a new program, Boeing-St. Louis Engineering Job Shadow Day, a one-day experience aimed at giving some 50 engineering students a preview of work life at Boeing. Last October, F/A-18 tooling design engineer Nirvana Deck hosted two of them, showing them the tools and software she uses and describing her work on an integrated product team. In the afternoon, they toured the F/A-18 production line, visited the flight simulation center and met senior executives.

BOEING-WASHINGTON
UNIVERSITY
ENGINEERING TEAM

Kory Mathews, Executive Focal and Vice President, F/A-18 & EA-18 Programs

Mike Gibbons, Engineering Focal and Program Manager, F/A-18E/F Super Hornet and member of the engineering school's National Council

K.K. Sankaran, Research Focal and Senior Technical Fellow, Boeing Research and Technology

Matt Daniels, Regional Manager, Boeing University Relations

Ralph Quatrano, Dean, School of Engineering & Applied Science

Nick Benassi, Associate Dean, School of Engineering & Applied Science

OTHER SENIOR
LEADERS AND KEY
CONTRIBUTORS TO
BOEING-WASHINGTON
UNIVERSITY
PARTNERSHIP

John McDonnell, Retired Chairman of the Board, McDonnell Douglas Corporation; member of the Boeing Board of Directors; Vice Chair of the WUSTL Board of Trustees and member of the engineering school's National Council

Dennis Muilenburg, President and Chief Executive Officer, Boeing Defense, Space & Security and member of the WUSTL Board of Trustees

Shephard Hill, President of Boeing International and member of the McDonnell International Scholars Academy Advisory Committee

Mark Wrighton, Chancellor, Washington University

Mahendra Gupta, Dean, Olin Business School

"Overall, the production tour was the highlight for them, but getting to fly in the simulators was tough to beat. They were also impressed that we work closely with other teams, such as manufacturing and design, in such a collaborative environment," she says.

Interested students may wish to move on to a Boeing internship, as Tyler Gordon did in summer 2010. At Boeing's Seattle facility, he did structural dynamics, vibration analysis and project management as part of an engineering team working on the F-22 program.

Other students may participate in a job mentoring program, inaugurated last September, which is off to a promising start. Ten University students were matched with 10 younger Boeing engineers and business professionals in a yearlong effort, led by Stuart Voboril, experimentation manager, Boeing's Virtual Warfare Center, to provide guidance for students as they prepare for their professional careers.



Above, Kristin Robertson, Director/General Manager, Chief Engineer - Global Strike at Boeing Defense, Space and Security, was a 2010 Engineers Scholarship Dinner special guest speaker.

Also launched last fall was a design collaboration, proposed by Kristin Robertson. Her office gathered ideas from Boeing teams and then chose one: creating a loop closure pneumatic simulation for performing engine control testing on the F-15 jet fighter. Selected students worked side by side with Boeing mentors on the project, which they completed successfully during the 2010 fall semester, and the students' work is being integrated into Boeing's Vehicle Integration Test Lab.

"I think this collaboration adds tremendous value to us from an innovation perspective, as students look at a project with different ideas," says Robertson. "It also gives students real-life experience in the kind of problems that a Boeing

engineer has to work through."

Boeing wants to expose younger students to engineering concepts, too. So the company has developed a K-12 outreach that includes the 3-year-old Boeing Engineering Challenge (BEC). This year, 150 St. Louis-area high school students are taking part: building model gliders with mentoring from Boeing engineers and design review from University faculty. At the end of this five-month process, they will take part in a flight competition, held at Washington University.

Research Collaborations

Much is happening in the research partnership. Last June, both sides signed a Proprietary Information Agreement that will open the door to new areas of collaboration, especially in materials and energy. As the world's largest manufacturer of solar cells, Boeing is also interested in CO₂ reduction and biofuels.

K.K. Sankaran, senior technical fellow in Boeing Research and Technology, is the contact from Boeing for research efforts at the University.

"Washington University is focusing on some key areas that are of interest to us as well in materials, chemical engineering, and energy and biomedical engineering," says Sankaran, who has taught graduate-level engineers at the University as an adjunct faculty member.

Several new joint research projects are currently being developed.

Altogether, says Gibbons, these various collaborations between Boeing and the University make both institutions stronger. "The work we do together heightens both of our performances," he says. "We feel as though we definitely perform better as a team than we do separately." And beyond the institutions, says Benassi, the partnership is creating a safer, better world. "The advanced technological discoveries and training that come as a result of our partnership are leading to innovative, new knowledge with global impact," he says. "No matter if it's creating airborne systems that can fly farther and longer in an environmentally responsible way, developing new and more efficient ways to integrate defense systems and networks that make us safer, or preparing current and future Boeing employees for global and leadership roles, our joint work is changing the world."



Photo courtesy of BOEING

Q: Why is higher education important to you?

A: I have children, 9 and 6, and they are already thinking about future careers; in fact, my son says that he wants to be an astronaut or an engineer. One of the key things I tell them is that higher education will enable them to make a difference in the world. At Boeing, we take pride in working on things that matter globally — that save people's lives or provide national security. Higher education is what develops the people and the talent that allow us to carry out that important mission. Our work also demands a sense of excellence, and I believe that higher education is a key contributor to that excellence.

Q: What did your own education mean to you?

A: I received my undergraduate degree from Iowa State University in aerospace engineering and then a master's degree in aeronautics and astronautics from the University of Washington. I had grown up on a farm in Iowa, and there wasn't a lot of aerospace business there. But I always had a keen interest in airplanes, and my educational background gave me the sense of what I could do. I didn't really know what the art of the possible was until I was in college. My education sparked my excitement about what I might do in my career, and it gave me a much more global view of what that meant.

Q: What would you say to teenagers today who want to be aeronautical engineers?

A: First of all, I would tell them what a great and worthy goal that is, because engineers can make a big difference in the world. I would say that it's a hard curriculum — so they should recognize that it will be challenging — but it's a way to have a positive impact on the world.

Q: Along with math and science, do engineers at Boeing need a broader range of courses?

A: Absolutely. To be a good engineer, you need to be a good communicator, and that includes verbal and writing skills — the ability to present ideas clearly. You have to be able to simplify the complex, and communicate it in such a way that people can understand it. And you need the skills to work as part of a multidisciplinary, diverse, and sometimes global team.

Q: Are other countries ahead of us in math and science training?

A: Yes, in many areas, and this is one of the biggest concerns we have in our business from a competitive and national strategy standpoint. Our pipeline of U.S. students in science and technology is woefully insufficient for our business needs; we see other countries graduating many more students. We need to build that pipeline earlier and diversify it, and I think a key part of that is getting kids interested

DENNIS
MUILENBURG

President and Chief Executive Officer, Boeing Defense, Space & Security and member of the WUSTL Board of Trustees

early and maintaining that interest through high school, then sustaining that momentum through college. That's where our university relationships come in — including all the things we do with Washington University.

Q: Could you comment on that relationship?

A: For decades, Boeing has enjoyed a wonderful relationship with Washington University. I'm a big fan of our "People First" strategy, which means that we invest in our people and in the communities where our employees live. Joining the University's Board of Trustees was a great way for me to do that and to build on our joint relationship. The McDonnell International Scholars Academy, now under way at the University, is also interesting to me, as our international portfolio is growing from about 15 to 25 percent of our business over the next five years.

Q: What do you see as the future of that relationship?

A: I am going to do my part to maintain the momentum, but there are many other Boeing employees engaged in that as well — as many as we have with any university. Our network of connections is exceptionally strong. We understand the University's mission and strategy, and the University understands ours; those missions mesh really well, resulting in a productive relationship.

Written by **BETSY ROGERS** Photos by **GEOFF STORY**

HEART OF THE ISSUE

An international leader in cardiac arrhythmia research, Professor Igor Efimov's work to create an implantable defibrillator could extend life for millions of patients with irregular heartbeats.

When Winston Churchill made his famous Iron Curtain Speech in 1946, his words reached around the globe. Their ripple effect encompassed countless people — including Igor Efimov, PhD, the Lucy & Stanley Lopata Distinguished Professor of Biomedical Engineering.

Efimov was not yet born, but in response to Churchill "Stalin immediately made two decisions that had a major impact on my personal life," he says. The first was to establish a network of high-technology centers to research and produce sophisticated armaments. "My hometown was one of them," Efimov explains. The city's factories produced spy satellites and plutonium for nuclear warheads.

"I grew up 100 yards from the satellite company," Efimov recalls. "I played right next to it. Many of my friends were the sons and daughters of engineers. With such a high concentration of scientists and engineers, we got a very good education."

Stalin's second decision established the Moscow Institute of Physics and Technology. This university, under the leadership of the brilliant physicist Peter Kapitsa, transformed Russian scientific education and remains Russia's pre-eminent technological institute. Efimov studied nuclear physics as an undergraduate, then turned to biophysics, doing computer modeling of heart arrhythmia at the Institute of Biophysics, Puschino near Moscow, where he completed his doctorate.

When he defended his dissertation, the Soviet Union had just collapsed, and suddenly it was possible for scientists to emigrate. He went to the University of Pittsburgh for a two-year postdoctoral fellowship and on to the Cleveland Clinic, long renowned for heart research and treatment. Then he moved to Case Western Reserve University, and in 2004 he came to Washington University.

From the time he began his graduate studies, Efimov has focused on electrical malfunctions of the heart, and in a world where 15 million patients suffer from cardiac arrhythmia, his work could make a dramatic difference.

Efimov is advancing two potentially powerful new therapies to treat patients with cardiac arrhythmia, in particular with atrial fibrillation. The first is a painless implantable defibrillator, now in testing, and the second is essentially a biological pacemaker that would use tissue engineering to replace the heart's own electrical generator.

This generator is the sinoatrial node, a tiny biological mechanism in the right atrium, where a biochemical reaction triggers an electrical impulse, which propagates through the heart and causes it to contract. "Every heartbeat you have from conception to death is preceded by an electrical impulse," Efimov observes. As long as this node does its job and the impulse propagates precisely, all is well. But a variety of factors — fibrosis, genetic predisposition, even infections — can cause changes in the heart muscle, disrupt the impulse and produce arrhythmia.

EFIMOV'S TEAM DEvised A REVOLUTIONARY, PAINLESS, IMPLANTABLE DEFIBRILLATOR.



"Arrhythmia," says Efimov, "kills about 400,000 people a year in the U.S." And that number is expected to grow as people live longer.

Among forms of arrhythmia, tachycardia or rapid heartbeat is the most dangerous. Ventricular fibrillation, or disorganized rapid contractions of the ventricles, is particularly deadly "because," Efimov explains, "basically there is no pump and the brain will be deprived of oxygen." Fibrillation in the atria is very common, afflicting up to 5 million patients in the United States alone. Though not lethal, it increases stroke risk and in some produces debilitating side effects.

Drug therapy has proven ineffective and even dangerous. In his dissertation research, Efimov used computer simulations to investigate drug efficacy and found, unexpectedly, "that some drugs which are routinely used in fact increase chances of arrhythmia; at the time," he adds, "it was not commonly accepted wisdom."

Ablation, in which an electrophysiologist cauterizes malfunctioning areas in the

heart, is effective — but the procedure can take a full day, and there are only some 500 electrophysiologists in the country, far too few to treat millions of patients.

An artificial, implantable defibrillator can work, but like external defibrillators used with ventricular fibrillation it produces a powerful electrical shock. "In ventricular fibrillation," Efimov points out, "the person passes out, so this extremely painful shock will not affect him. But in atrial fibrillation the patient is conscious, so even if you apply a relatively mild shock, it is still so painful" that patients refuse it.

Efimov's team has devised a revolutionary, painless, implantable defibrillator and expects to move to a feasibility study with human patients within a year. They've founded a company named CardiaLen to develop it, and have enlisted investors from St. Louis, Chicago and Minnesota.

"The potential market is gigantic," Efimov says. "Worldwide, there are probably 15 million patients. If we succeed, it could be an important contribution."

Ralph Quatrano, PhD, Dean of the School of Engineering & Applied Science, is enthusiastic about Efimov's work. "Igor is a very special faculty member," Quatrano notes, "who can couple strong research funded by peer review funding agencies with an excellent entrepreneurial sense that has led to a startup with a potential for commercialization. Very few faculty members can combine traits as effectively as Igor."

Efimov and his team are advancing on another front, to engineer tissue to produce a biological substitute for malfunctioning sinoatrial nodes. "It might be 20 or 30 years from now," he acknowledges. "The whole structure needs to be redone, a reconstruction of the whole sinus node and a bridge of tissue connecting to the atrium."

Efimov has a secondary appointment in radiology and in cell biology and physiology at the School of Medicine, and his lab melds students from both schools. The interdisciplinary approach is indispensable, he believes, and in fact he is leading a new university-wide PhD program in medical imaging for chemistry, biology, engineering and medical students. "This is a unique program; it doesn't exist anywhere else," he says.

Medical school colleagues prize his gifts. "Igor is great to work with," says Richard B. Schuessler,



From left: Igor, Maria, Tatiana and Andrew.

COURTESY PHOTO

exchanges and bringing world-renowned scientists to Russia to establish laboratories. "In Russia, I was given this education for free," he notes. "I'm most grateful to those professors. They really worked just for us. Science education is falling apart in Russia, but the students are still as talented. We want to help them."

CAREER HIGHLIGHTS

1986

MS in experimental nuclear physics from Moscow Institute of Physics and Technology, USSR

1992

PhD in Biophysics (Biophysics/Biomedical Engineering) from Moscow Institute of Physics and Technology, Moscow, Russia

1992-1994

Postdoctoral training in fast fluorescent imaging of cardiac bioelectricity, University of Pittsburgh, Pittsburgh, PA.

2008-2011

The Lucy & Stanley Lopata Distinguished Professor of Biomedical Engineering, Washington University; Professor of Cell Biology and Physiology

PhD, research professor of surgery and biomedical engineering and Cardiothoracic Surgery Research Laboratory director. "He is an incredibly creative scientist. He is very productive and has the ability to get things done."

Among the places where he gets things done is his homeland. He and several colleagues have established the Russian-Speaking Academic Science Association and are taking up the slack in funding-starved Russian science, sponsoring

Science runs in his family: his wife, Tatiana Efimova, PhD, is a molecular biologist and assistant professor of dermatology at the medical school. Daughter Maria is completing a premed program at the University. Then there's Andrew, 14. "He's the only one of us born in the United States," Efimov says. "That's good, because he wants to be president."

» engineering.wustl.edu/faculty/efimov

CROSSING THE DIVIDE

Written by RICK SKWIOT

Designing and building better sewage facilities for students at the Mekelle Blind School in Ethiopia; devising improved means for producing nutritional food for Haitian infants; and refurbishing needed medical equipment for the Lwala Community Health Center in Kenya: These forays represent just part of the efforts of Washington University undergraduate engineering students to cross geographic and disciplinary borders, address critical human needs and, in the process, perhaps change the perceptions and culture of engineering education.

Through their campus chapters of Engineers Without Borders (EWB) and Engineering World Health (EWH), students like Andrew Frangos are using engineering solutions to address critical social needs, both here and abroad. For his senior design project, which grew out of an EWB undertaking, Frangos, a systems engineering major, has been working with George Warren Brown School of Social Work's International Programs Director and associate professor Gautam Yadama, both here and in India, studying why cleaner-burning cook stoves supplied to villagers there are frequently discarded after a short time.

"One of the things that attracted me to Engineers Without Borders was the political thinking about designs," says Frangos. "A lot of times engineers pursue very challenging technical

questions without necessarily pursuing whether or not the technology will be successfully used. This particular project is real exciting because it's getting at that issue, figuring out how the technology you're designing is going to be used, so you can have a positive impact."

This broadened focus can be seen in the School of Engineering & Applied Science's classrooms as well, according to EWH chapter president Sam Fok, a senior studying biomedical engineering and electrical engineering. "These classes are starting to crop up, where there's more focus on real-world problems, global issues, sustainability and developing world technology. It's one thing to learn about energy systems, but entirely different to learn about it in the context of sustainability and how you will implement systems with renewable energy sources."



ENGINEERS WITHOUT BORDERS

At left, Jaime Cummings (seated) works with Meds & Food for Kids (MFK) staff in Haiti to develop equipment manuals and factory machine maintenance schedules. In 2009 and 2010, EWB/EWH members traveled to MFK's factory in Haiti and used technical writing skills to develop the maintenance schedules. Currently, EWB/EWH students are designing a new, smaller-scale solar peanut dryer and working to create charcoal out of waste peanut shells from the factory. MFK is a nonprofit corporation that produces a peanut-based food that is highly effective at curing malnutrition in children and was founded by Dr. Patricia Wolff, a professor of clinical pediatrics at Washington University School of Medicine.

COURTESY PHOTO

Fok is helping spearhead an EWH collaboration with the School of Medicine's Global Health Scholars in Internal Medicine program and BJC Healthcare to locate, refurbish and deliver medical equipment to hospitals and clinics in Bhutan, Eritrea, Honduras, India and Kenya. "There is a lot of old equipment here with a potential to do some good where it is more needed," says Fok. EWH plans first to provide reconditioned ultrasound equipment and a centrifuge to a rural Kenyan hospital.

that they're affecting and the lives that they can change with engineering."

She says encouragement for a more encompassing engineering curriculum also comes from the Association of Professional Engineers' accreditation evaluation, whose criteria include "if we're using real-world examples and real-world bases." Also, says Shepard, the Department of Energy, Environmental & Chemical Engineering "put worldwide applicability and sustainability among their primary goals."

"THIS GIVES THEM A REALLY GOOD OPPORTUNITY TO SEE THE PEOPLE THAT THEY'RE AFFECTING AND THE LIVES THAT THEY CAN CHANGE WITH ENGINEERING."

— ROBIN SHEPARD

Faculty advisor Robin Shepard, who teaches chemical engineering and has traveled with EWB students to Haiti for a project there, says that the more worldly and global approach to engineering education embodied in EWB and EWH is derived both from students and faculty.

"I have a new course this spring on sustainable technology for the global community. The primary reason I wanted to teach it was because of the students in Engineers Without Borders. I was inspired by them," says Shepard.

She, in turn, works to inspire her students to take a more "global" view of engineering.

"The experience with groups like Engineers Without Borders helps students see how engineering can function. It shows them they can make a difference. Engineers get the reputation of being sometimes not very social, which is not true, and also that they tend to think very much about their problems and not the people, which is sometimes true," says Shepard. "This gives them a really good opportunity to see the people

But it's the fieldwork — such as the Haiti project — that reveals engineering's human impact and helps bring the message home for students and instructors alike. "It's a life-changing experience," says Shepard. "You can't overstate it."

Those sorts of global experiences and opportunities appeal to today's students. EWB's work solidified Frangos' engineering career choice.

"Coming into Washington University, I wasn't sure if I would major in engineering," says Frangos. "It seemed very focused on the mathematics and not as much about people. But the Engineers Without Borders chapter president at the time spoke at our freshman convocation and said things that made me change my mind: In engineering, you have a high amount of social responsibility and an opportunity to make an impact through the work you do. That idea has kept me going through engineering and kept me involved with Engineers Without Borders."



Recent and current EWB & EWH projects include:

- » Successfully completing a wind-turbine renewable-energy education project for Patrick Henry School in downtown St. Louis, and a patient data-entry system for La Casa de Salud, a free clinic run by Saint Louis University.
- » Increasing incorporation of EWB/EWH projects into the Engineering curriculum. Fall 2010 classes with EWB/EWH projects included Mechanical Engineering Design and Build, Technical Writing and Service Learning, and Biomedical Engineering Design.
- » Establishing an EWH New Equipment Donation Project with the Washington University Internal Medicine Residency program, which will soon supply refurbished medical equipment to the Lwala Community Health Center in Kenya, and obtaining a \$3,500 grant from the Student Sustainability Fund.
- » Designing and installing latrines in a Kerala, India, school in conjunction with EWB-Gateway, the St. Louis-area professional engineering chapter, whose members will act as mentors.
- » Partnering with Meds & Food for Kids (MFK), based in Cap Haitien, Haiti, developing a small-scale peanut dryer and a charcoal maker. MFK manufactures and distributes a highly nutritious peanut-based food called "Medika Mamba," or peanut butter medicine, used with infants.
- » Implementing a new sewage system that accommodates desert conditions, for Ethiopia's Mekelle Blind School and surrounding community.
- » Helping to construct large water-distribution systems to aid marginalized community members in Honduras, in conjunction with the Washington University Water Brigades chapter of Global Water Brigades.
- » Working with the St. Louis Special School District to develop a new computer-mouse design for children with disabilities.
- » For the national EWH Design Competition, creating a low-cost, reliable device to detect the onset of Sudden Infant Death Syndrome.
- » Providing on-campus enrichment through the ongoing EWB Speakers Series and through a biodiesel workshop.

Architecture for Humanity founder Cameron Sinclair (left) visited campus as a part of the ongoing EWB Enrichment Speaker Series. Sinclair was a special guest in many classes outside of Engineering, including a sustainable design class in the School of Architecture, and shared his experience and vision for global, social conscious design.

» ewwashu.org

Mission:

Engineers Without Borders/Engineering World Health provides Washington University students with the opportunity to serve and learn from those who live in disadvantaged communities by means of improving their quality of life through implementation of environmentally and economically sustainable engineering projects, while developing internationally responsible engineering students.

Quit YOUR DAY JOB

Written by TONY FITZPATRICK Photos by GEOFF STORY

Anna Patterson, Director of Research for Google, Inc., and along with husband Tom Costello, developer of the avant garde search engine Cuil (“cool”), has some straightforward advice for would-be entrepreneurs: “There isn’t much of a downside to being brave: You learn a lot.”

Patterson’s long journey to researcher and entrepreneur involved stops at Northrop and Arthur Andersen in Chicago, the University of Illinois Urbana-Champaign, for her PhD, Stanford University (where she met and married Costello), and Google, twice, from 2004-2006, and presently since September 2010. It all began when the former Oakville, Mo., resident began her undergraduate studies in 1983 at Washington University on a Langsdorf Scholarship.

“I really liked the focus on undergraduate learning at Washington University,” she said. “I liked the size of the school. There wasn’t this rigid structure – you could take classes in other areas. I took a fashion design class, and I was definitely the only engineer there and the worst sewer in the class!”

“Being at a school that was very integrated, both socially and academically, with a student body from all over, helped me become more well rounded, which I think is very important in becoming an entrepreneur.”

Patterson, a current member of the School’s National Council, was president of EnCouncil and remembers various faculty fondly, including Will Gillette, Jerome Cox and Catalin Roman, and a Spanish literary group she joined where she “read nice classics in Spanish.”

It was in this milieu where she first witnessed the birth of entrepreneurial efforts in various computer science and electrical engineering projects.

“That was a benefit of being here (at Washington University),” she recalls. “The school was just small enough that you got to know everyone, and you would learn of beginning entrepreneurial efforts that led you to believe that product success was possible.”

Her interest in search mechanisms took root and then blossomed at Stanford University, which she joined in 1997 as a research scientist working under the tutelage of Caroline Talcott and John McCarthy, who was Costello’s adviser. She worked in the very mathematical field of logic, initially on a project in phenomenal data mining, where “if you had some base level correlations that you knew, then you could use data mining to find more correlations. Data mining was just becoming mainstream in academia then, and it led to my interest in search.”

She joined Google in 2004 after she built and sold Recall, a search engine that probed old websites.

“Google had a lot of folks that I knew from Stanford, and it had a graduate school sort of feel that I liked a lot,” Patterson said.

ANNA PATTERSON

Education

BS, computer science, electrical engineering, Washington University, 1987

PhD, computer science, University of Illinois Urbana-Champaign, 1998

Cuil,

the company Patterson co-founded, is Irish for knowledge or wisdom and is pronounced “cool.” Her husband, Tom Costello, is from Ireland, and Anna is an Irish citizen as well.

Businessweek

listed Cuil as one of the most successful U.S. startups of the year in 2008.

Google

had 3,000 employees when Patterson started working there in 2004. Today, the company has more than 20,000 employees.

Anna Patterson on campus outside Olin Library on November 18, 2010. That same day she addressed a packed crowd of 300 people for a morning alumni event.



Patterson visited campus to present "Quit your day job anyway: Insights from Silicon Valley" on November 18, 2010.

"There's market risk in doing something like Cuil, and that's what we took."

"You were expected to try hard projects and work on very intellectually interesting material. The philosophy was to do what you can, and if you fail, so you fail. So many good things can come of that. It brought to mind a favorite saying of one of my professors: 'If we knew what we were doing, it wouldn't be research.'"

She did a number of projects at Google, among them one on ads, another on Web ranking, but most notably the serving system called Teragoogole, which was aimed at serving a very large index. Previous large index approaches put the index entirely in memory, which required the purchase of many more machines.

"I came up with a hybrid approach, which used some disk and some memory, and disk is a thousand times cheaper than memory," she noted.

From 2001-2003, while Costello worked at Stanford University, Patterson stayed home with their family. Later, when Patterson started her first stint at Google (2004), their roles reversed when Costello stayed at home with the four children, and researched, networked and sought funding for the technology that would become Cuil — a search engine estimated three times faster than Google's and 10 times faster than Microsoft's.

Cuil (meaning "wisdom," an homage to the Irish folk hero Finn McCool, a favorite of Irish native Costello) launched to enormous fanfare on July 28, 2008.



Anna and Tom's children, from left, Caia, 9, Avania, 7, Ilaria, 4, and Sean, 10

COURTESY PHOTO

Backed by \$33 million in venture capital, Cuil's index spanned 20 billion Web pages and was available in eight languages. Novel features included contextual searches that were automatically categorized, rather than searches that ranked quantity and quality of links to websites. Results were presented visually in a sort of magazine style, rather than in a heap of Web links. Cuil's photographs were spread horizontally with sidebars that featured more information.

The advent of Cuil sparked an international media frenzy, which included articles in *Forbes* and *Businessweek*, with the latter citing Cuil as one of the most successful startups of 2008, based on money raised.

"We wanted to do interesting things with the user interface," she said. "One was to put a picture in instead of text for the snippet because

we thought that if we could somehow represent the page by a picture, it would help users find the page they wanted to click on more quickly. We thought that this would be a really good internationalization scheme and add to its mobility."

Cuil's intent was to give users a range of ideas. When a person searched, for instance, a musical group, there would be a link for the group, another part about albums, new and old, another on tours, yet another on personal life of the group members.

"We had young people just starting out at Cuil as well as four or five people who came out of retirement to do a startup," she says. "It was exciting, a big adventure for a great portion of the employees, and there was a lot to learn, and much perspective to gain, sort of like going to school again."

Patterson described Costello as more the project visionary, who devised most of the features and design of the system, and she as more the executor, who did external managing, including the negotiating with 18 companies worldwide across numerous time zones, as they sought to sell the intellectual property in 2010.

"There was interest, but we didn't get anything done before we ran out of money and closed operations in September 2010," she said. "There's market risk in doing something like Cuil, and that's what we took."

Patterson enthusiastically returned to Google in 2010. While in many working communities leaving a company to try something new would appear to be burning a bridge, she said it's not that way in Silicon Valley.

"As far as Silicon Valley is concerned, you keep your network, and as the network moves around, you might just move with it or toward it," she said.

She explains the rarefied Silicon Valley culture using two analogies.

"It's like a small town," she said. "If you work in a small-town diner, then go to work in another one, and then come back, people don't think that much of it. Small-town people get to know you, and you know lots of them."

"On the other hand, I also think of Silicon Valley as the tech entertainment industry. Similar to L.A., with a large number of people in films frequently changing studios or agents, for instance, Silicon Valley has tons of worldwide talent and places to go and people who want them."

On November 18, 2010, Patterson was back at Washington University to share entrepreneurial insights with 300 students and alumni. She told stories of starting three different companies, funded in three separate ways, and shared her candid takeaway advice: "The talk is about quitting your day job and going for it — something I strongly recommend," and "if you don't like drama, don't start a company. I'm willing to be quoted."

Alumni Achievement Awards 2011

SCHOOL OF ENGINEERING & APPLIED SCIENCE
HELD THE ALUMNI ACHIEVEMENT AWARDS
DINNER FEBRUARY 23

Photos by GEOFF STORY



YOUNG ALUMNI AWARD

Matthew Ettus



Ettus earned dual bachelor's degrees in electrical engineering and computer science at WUSTL in 1996 and went on to earn a master's degree in electrical and computer engineering from Carnegie Mellon University. He is the founder and president of Ettus Research LLC.

Ettus is a major contributor to the GNU Radio project, a free software development tool kit that provides the signal processing, runtime and processing blocks to implement software radios using readily available, low-cost external hardware and commodity processors.

His company sells a line of software-defined radio systems called the Universal Software Radio Peripheral family that can be used for a wide variety of communication systems. Customers have included more than 300 universities, dozens of research labs, nearly every branch of the U.S. government and military, and hundreds of companies, large and small.



ALUMNI ACHIEVEMENT AWARD

S. Massoud Amin

Amin earned master's and doctor of science degrees in systems science and mathematics from WUSTL in 1986 and 1990, respectively.

He is the Honeywell/H.W. Sweatt Chair in Technological Leadership at the University of Minnesota, where he also is director of the Technological Leadership Institute and professor of electrical and computer engineering.

Before joining the Minnesota faculty, Amin held positions at the Electric Power Research Institute (EPRI) in Palo Alto, Calif. In the aftermath of September 11, 2001, he was in charge of all infrastructure-security research and development and of grid operations and planning at EPRI. As a pioneer in smart grids and self-healing infrastructures, **Amin is considered the "father of the smart grid."**

Prior to joining EPRI, Amin worked at Washington University for 12 years as a senior fellow/lecturer (1985-1989), assistant professor (1990-1997), and associate professor (1997-1998) of Systems Science & Mathematics.



ALUMNI ACHIEVEMENT AWARD

Sanjai Kohli

Kohli earned a master's degree in systems science from WUSTL in 1981.

He is recognized worldwide as the architect of mass market global positioning (GPS) systems and helped develop the GPS systems now found in cars and mobile phones. In April 2010, he was named "Inventor of the Year" by the European Union for his contributions to GPS technology.

Kohli founded SiRF, a company that captured more than 70 percent of the GPS semiconductor and software market. He also created WirelessHome (a data communications company) and TrueSpan (a mobile video company), and is working on a company that will authenticate mobile transactions and ePayments.



ALUMNI ACHIEVEMENT AWARD

Frederick (Rick) J. Oertli

Oertli earned a bachelor's degree in electrical engineering from WUSTL in 1982 and his master's of business administration from the John M. Olin School of Business in 1992.

Oertli is chief executive officer of Guarantee Electric Co., founded in 1902 by a coalition of entrepreneurs who "guaranteed" to light the 1904 World's Fair. The company has grown into one of the largest and most respected national electrical contracting firms, with offices in four states.



DEAN'S AWARD

Jerome R. Cox, Jr.

Cox is the founding chair of Washington University's Department of Computer Science. **He is recognized worldwide as a leader in the application of advanced technology for introducing new treatments in biomedical engineering. He developed new computer methods for CT and PET scanners that revolutionized the diagnosis of cancer, cardiovascular disease and heart rhythm disturbances.**

With two colleagues, Cox founded Growth Networks, a company acquired by Cisco that produced an advanced networking chip set, and, in 2007, he started a new company, Blendics (Blended Integrated Circuit Systems), that provides system-on-chip design tools and services to companies that wish to develop complex, proprietary, low-power integrated circuits.



» View bios of past recipients: engineering.wustl.edu/alumni

going GREEN

PRESTON M. GREEN HALL

A groundbreaking ceremony for a new School of Engineering & Applied Science building on the Danforth Campus of Washington University in St. Louis was held April 30, 2010.

The building, named in honor of the late Preston M. Green, an alumnus and benefactor, will turn the corner at Skinker Boulevard and Forest Park Parkway, connecting on its western edge to the recently completed Stephen F. & Camilla T. Brauer Hall.

In 2006, Chancellor Mark S. Wrighton announced an \$8 million commitment from Green to support the School of Engineering & Applied Science and its Department of Electrical & Systems Engineering, which was named in Green's honor.

"It is a privilege to have the opportunity to honor our distinguished alumnus Preston M. Green," Chancellor Wrighton said at the groundbreaking.

Preston M. Green



WUSTL PHOTO

Born in 1915 and a native of St. Louis, Preston M. Green received his Bachelor of Science degree in electrical engineering from Washington University in 1936. After graduation,

Mr. Green worked in a local factory until he joined Southwest Steel Supply Co. in 1950 as vice president of purchasing and production. He became president in 1955 and chairman of the board in 1957. During his career at Southwest Steel, Mr. Green was responsible for adding a second manufacturing plant in Madison, Illinois, and growing his company into the leading processor of steel throughout the Midwest.

Mr. Green designed most of the equipment used by Southwest Steel, and was acknowledged for creating more efficient processing procedures. He was recognized nationally for his leadership and vision within the steel industry, including receiving the Steel Distributor of the Year award in 1986 from the Association of Steel Distributors.

In 1990, Mr. Green sold Southwest Steel to Hanwa American, a subsidiary of the Hanwa Corporation of Japan. Mr. Green died in 2003, but his legacy continues today through his many contributions, both professional and philanthropic. In 2006, Washington University Chancellor Mark S. Wrighton announced an \$8 million commitment from the late Preston Green to support the School of Engineering & Applied Science and the Department of Electrical & Systems Engineering.

Nancy Green, his widow, lives in St. Louis and serves on the advisory board for the Preston M. Green Charitable Foundation, which continues to support several charities within the St. Louis community. In 2010, the Preston M. Green Charitable Foundation committed an additional \$5 million to support construction of the Preston M. Green Hall.



Photo by GEOFF STORY

"The new building named for him will accelerate the pace of progress in our School of Engineering & Applied Science.

"The new spaces for research and education will be a lasting tribute to a longtime friend and benefactor," Wrighton said.

Participating in the ceremony were Wrighton; Salvatore P. Sutera, PhD; ; Ralph S. Quatrano, PhD; ; Justin Ruths, a doctoral candidate in the Preston M. Green Department of Electrical & Systems Engineering; Stephen F. Brauer, chairman of WUSTL's Board of Trustees; and Nancy Green.

"I wish Preston could be here today to see his dream become reality," Nancy Green said. "He was a strong believer in innovation and forward thinking. Preston would have been so very proud of the School of Engineering & Applied Science and the facilities that it is providing for its students."

Green Hall is the next phase of the new state-of-the-art complex of Engineering buildings at the northeast corner of the Danforth Campus.

When it is completed in summer 2011, the building will provide additional research facilities that are critical to the continued development of the school's strategic plan, including additional



"It (Green Hall) sends a clear signal to prospective students that Washington University is a place of constant growth and is committed to providing facilities and resources for world-class research and innovation."

— JUSTIN RUTHS, PHD CANDIDATE, APRIL 2010

"Preston M. Green Hall will provide the School of Engineering & Applied Science with state-of-the-art research and instructional facilities that will not only enhance our research efforts but will also be a strong, attractive force for recruiting and retaining the very best faculty and students," Quatrano said.

space for the Preston M. Green Department of Electrical & Systems Engineering.

Green Hall will also be home to the International Center for Advanced Renewable Energy and Sustainability (I-CARES).

Directed by Himadri Pakrasi, PhD, the George William and Irene Koechig Freiberg Professor of

GREEN HALL GROUND BREAKING CEREMONY

Right: Dean Ralph Quatrano, Nancy Green and Chancellor Mark Wrighton. Far right: Nancy Green leaves her signature on the building's cornerstone.

WUSTL PHOTOS



inside GREEN HALL

83,849 gross square feet

17 RESEARCH LABS

DESIGNED FOR LEED GOLD RATING

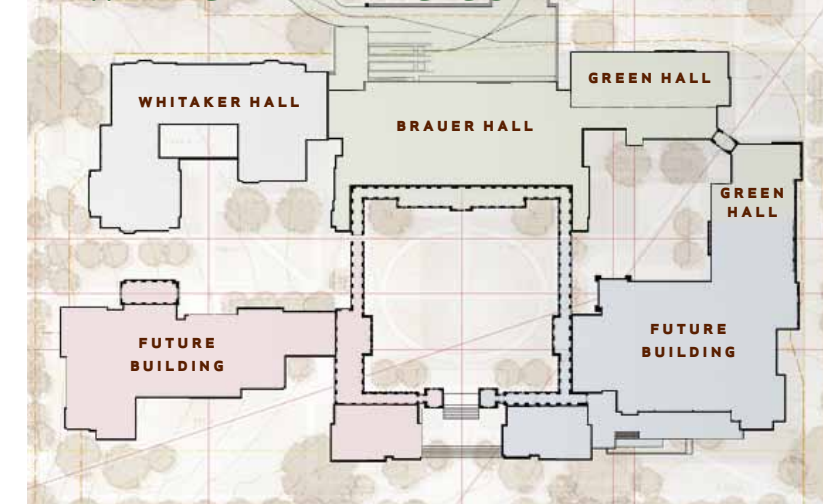
150 classroom seats

Home to the Preston M. Green Department of Electrical & Systems Engineering and the International Center for Advanced Renewable Energy and Sustainability (I-CARES)

87 STEPS TO THE METROLINK

96% of construction waste is recycled

NEW ENGINEERING COMPLEX



Biology in Arts & Sciences and professor of energy in the School of Engineering & Applied Science, I-CARES is a major initiative that encourages and coordinates university-wide and external collaborative research into biofuels and other alternative energy applications.

"Green Hall is a fitting name for a building that will be the permanent home of I-CARES," said Pakrasi. "And the building's location at the entrance of the Danforth Campus will make a powerful statement about the university's commitment to research and education in renewable energy and sustainability."

Green Hall will connect with Brauer Hall on all three levels of its west facade. It will present a seamless quality to those within the two structures to create an extraordinary physical presence on the northeast side of the Danforth Campus.

On the diagonal at the corner of the two wings of the building, there will be an impressive gateway similar to the one at the top of the steps leading to Brookings Hall.

The architectural firm RMJM, which also designed Brauer Hall, was chosen because it specializes in laboratory design and historic preservation. The construction firm is Clayco, also chosen to build Brauer Hall.

The new building will share the Collegiate Gothic style characteristic of the campus.

All of WUSTL's recent construction projects have been built with environmental sustainability in mind, and this building is also being designed according to LEED specifications for a Gold rating.

LEED, the acronym for Leadership in Energy and Environmental Design, is a nationally accepted rating system for the design, construction and operation of buildings that use its specifications for achieving environmental sustainability.

» View video from the groundbreaking ceremony: engineering.wustl.edu/greenhall

Engineering welcomes three new professors



MARK ANASTASIO

Professor Mark Anastasio, PhD, came to Washington University in January 2011 after his work as an associate professor in the Biomedical

Engineering Department at Illinois Institute of Technology.

Professor Anastasio's research interests include the development of biomedical imaging methods, image reconstruction, and inverse problems in imaging and theoretical image science.

His current research projects include the development of advanced X-ray, optical, and acoustical imaging systems that are based on wave physics and can provide important structural and physiological tissue information. These projects include photoacoustic and thermoacoustic imaging, X-ray phase-contrast imaging, optical and acoustical tomography and holography, and improvement of existing clinical imaging methods.



JOHN FORTNER

Assistant Professor John Fortner, PhD, joined the faculty at Washington University in fall 2010. Professor Fortner was previously an intelligence

community postdoctoral research fellow at Rice University and held previous postdoctoral positions at Georgia Tech and ETH-Zurich.

Professor Fortner's research is primarily focused on environmental implications and applications of advanced materials. He has extensively studied the environmental fate, reactivity and impacts of engineered carbon nanomaterials, including fullerenes and carbon nanotubes, in aqueous systems. In the areas of sensing, Professor Fortner is developing nanoscale iron-based materials for detecting low levels of heavy metals. In addition, he is developing and applying similar metal oxide materials for novel, high-efficient, water-treatment processes.



BRENT WILLIAMS

Assistant Professor Brent Williams, PhD, joined the faculty at Washington University in fall 2010. Previously, he served as a post-doctoral associate at the University of

Minnesota Particle Technology Laboratory and as a postdoctoral scientist at Aerodyne Research, Inc.

As a PhD student at the University of California-Berkeley, he developed novel organic aerosol measurement instrumentation, and deployed and operated this instrumentation in multiple large-scale international and domestic field campaigns. His work focused on issues ranging from urban and agricultural pollution to long-range transport of pollutants.

Professor Williams' research interests focus on the exploration of the composition, chemistry, and physical properties of Earth's atmosphere to determine the role of biogenic and anthropogenic gases and particles in Earth's climate system.

Roman named Dean at University of New Mexico School of Engineering



GRUIA-CATALIN ROMAN

Gruia-Catalin Roman, PhD, will become Dean of the School of Engineering at the University of New Mexico on July 1, 2011. Dr. Roman has been a member of the faculty at Washington University in St. Louis since 1976 and was named The Harold B. and Adelaide G. Welge Professor of Computer Science in 2004. He served as the chair of the Department of Computer Science & Engineering from 1997-2007 and again from 2008 to the present. Under his leadership, the department experienced a period of unprecedented growth and renewal.

Dr. Roman has a distinguished research career. He is recognized as a leader in the

software engineering field and a pioneer in the development of software technologies for mobile computing. As a citizen of the region, he was deeply involved with the Saint Louis Science Center and the information technology community. As a faculty member, he has been an innovative teacher, an advocate for diversity, and a key contributor to enhancing the quality of computer science graduate education. His advocacy for multidisciplinary research and studies enabled him to engage the university community in impactful conversations about the role of computing in the modern world.

Computer Science & Engineering professor named ACM fellow



RON CYTRON

Professor Ron Cytron, PhD, is one of the newest Association of Computing Machinery (ACM) fellows.

The ACM Fellows Program, initiated in 1993, celebrates the exceptional contributions of the leading members in the computing field. These individuals have helped to enlighten researchers, developers, practitioners and end users of information technology throughout the world.

Computer Science & Engineering professor earns NSF CAREER Award



CAITLIN KELLEHER

Assistant Professor Caitlin Kelleher, PhD, received a five-year, \$500,000 National Science Foundation (NSF) CAREER Award titled "Looking Glass: Leveraging mentor interactions to create personalized programming help for independent

learners." The project will enable researchers to build a virtual mentoring system using captured interactions between computer science domain experts and children with whom they are working.

Since 2005, Professor Kelleher is the ninth School of Engineering & Applied Science faculty member to receive a NSF CAREER Award.

David Peters receives AIAA's highest honor



DAVID PETERS

David Peters, PhD, the McDonnell Douglas Professor, received the Reed Aeronautics Award for 2011 from the American Institute of Aeronautics and Astronautics (AIAA).

The Reed Aeronautics Award is the highest award an individual can receive for achievements in the field of

aeronautical science and engineering. Peters received the award "for outstanding contributions to the advancement of rotary wing unsteady aerodynamic theory and applications to design."

Two professors named American Institute for Medical & Biological Engineering fellows



SHELLY SAKIYAMA-ELBERT



YOUNAN XIA

The American Institute for Medical & Biological Engineering (AIMBE) announced the election of new members to the College of Fellows. The newly elected fellows were nominated and approved by current fellows, consisting of over 900 engineers and scientists. Two of the 79 new members are professors in the Department of Biomedical Engineering.

Shelly Sakiyama-Elbert, PhD: For pioneering work on biomaterials for drug delivery and cell transplantation for the treatment of peripheral nerve and spinal cord injury.

Younan Xia, PhD, the James M. McKelvey Professor: For his seminal contributions to the design and controlled synthesis of nanostructured materials for various biomedical applications.

Chenyang Lu promoted to full professor



CHENYANG LU

Professor Chenyang Lu, PhD, was promoted to full professor in October 2010.

Professor Lu joined the faculty at Washington University in 2002. He is associate editor of ACM Transactions on Sensor Networks, Real-Time Systems, and the International Journal of Sensor Networks, and served as Guest Editor of the Special Issue on

Select Research Grants from FY10 & FY11

Pratim Biswas, PhD

\$206,443; 3 years

California Energy Commission

Title: "Advanced Water Treatment Technologies for Onsite Water Reuse"

Jianmin Cui, PhD

\$1,330,000; 4 years

National Institutes of Health

Title: "Subunits Interaction in the Function of BK Channels"

Guy Genin, PhD

\$300,000; 3 years

National Science Foundation

Title: "Mechano-Electric Regulation at the Plant Cell Periphery"

Raj Jain, PhD

\$199,968; 2 years

National Science Foundation

Title: "EAGER: Large-Scale Distributed Scientific Experiments on Shared Substrate"

Chenyang Lu, PhD

\$300,000; 3 years

National Science Foundation

Title: "CPS: Medium: Collaborative Research: Cyber-Physical Co-Design of Wireless Monitoring and Control for Civil Infrastructure"

Arye Nehorai, PhD

\$827,820; 4 years

National Science Foundation

Title: "Design and Implementation of Position-Encoded 3D Microarrays"

Shelly Sakiyama-Elbert, PhD

\$418,000; 2 years

National Institutes of Health
Title: "Axon-Targeted Microdevices for CNS Axon Transport Studies"

\$1,330,000; 4 years

National Institutes of Health
Title: "Fibrin Based Scaffolds for Spinal Cord Injury"

Bill Smart, PhD

\$487,209; 3 years

National Science Foundation
Title: "A Physical Vocabulary for Human-Robot Interaction"

Larry A. Taber, PhD

\$1,628,375; 5 years

National Institute of Neurological Disorders and Stroke
Title: "Mechanics of Early Brain and Eye Development"

Jay Turner, DSc

\$760,000; 5 years

Conoco Phillips
Title: "Roxana Air Quality Study"

Jonathan Turner, PhD

\$450,000; 3 years

National Science Foundation
Title: "Performance-Engineered Overlay Networks for Real-Time Distributed Applications"

Lihong Wang, PhD

\$568,249; 5 years

National Institutes of Health
Title: "Photoacoustic Endoscopy of Barretts Esophagus"

\$1,198,524; 1 year

National Institutes of Health National Center for Research Resources
Title: "Integrated Two-Photon/Confocal/Photoacoustic Microscopy"

Real-Time Wireless Sensor Networks of Real-Time Systems and the Special Section on Cyber-Physical Systems.

Rohit Pappu promoted to full professor



ROHIT PAPPU

Professor Rohit Pappu, PhD, was promoted to full professor in January 2011. He joined the faculty in 2001 and holds appointments in Molecular Biophysics and Biochemistry.

Professor Pappu's research interests are focused on quantitative studies of protein stability, biophysics of intrinsically disordered proteins, and the role of protein aggregation and amyloid formation in neurodegenerative and systemic diseases, including Huntington's and Alzheimer's diseases.

Yixin Chen promoted to associate professor



YIXIN CHEN

In July 2010, Yixin Chen was promoted to associate professor in the Department of Computer Science & Engineering. He joined the faculty at Washington University in 2005 and has a number of awards, including the

Microsoft Research New Faculty Fellowship and the Department of Energy Early Career Principal Investigator Award.

Professor Chen's research interests are in the general areas of nonlinear optimization, artificial intelligence, data warehousing and data mining. He is particularly interested in large-scale, constrained, nonlinear optimization in discrete, continuous and mixed-integer spaces.

Tao Ju promoted to associate professor

In July 2010, Tao Ju was promoted to associate professor in the Department of Computer Science & Engineering. Professor Ju joined the faculty at Washington University in 2005, served on the program committees of top conferences



TAO JU

in computer graphics, including ACM Siggraph Asia and Eurographics, and co-chaired Pacific Graphics in 2007. He was the invited speaker at the IEEE International Conference on Shape Modeling and Applications in 2008.

With a number of grant awards from NSF and NIH, Professor Ju's research interests lie in the field of computer graphics and applications in biomedical research. He is particularly interested in geometric modeling, mesh processing, visualization, and biomedical modeling.

Daniel Giammar earns Emerson Excellence in Teaching Award



DANIEL GIAMMAR

The Emerson Excellence in Teaching Awards program, sponsored by Emerson, annually recognizes teachers who are examples of excellence in the field of education in the St. Louis metropolitan area. Daniel Giammar, PhD, an associate professor in the Department of Energy, Environmental & Chemical Engineering, is a 2010 recipient of the annual award.

Yinjie Tang receives Ralph E. Powe Junior Faculty Achievement Award



YINJIE TANG

Yinjie Tang, PhD, assistant professor in the Department of Energy, Environmental & Chemical Engineering, received the Ralph E. Powe Junior Faculty Achievement Award from Chancellor Mark S. Wrighton.

The research grants awarded by Oak Ridge Associated Universities (ORAU) provide seed money for research by junior faculty at ORAU institutions. Assistant Professor Tang is among 32 recipients nationwide of this award in 2010-2011.



Photo by HALSKI STUDIO



WUSTL PHOTO



NSBE National Convention comes to St. Louis

The National Society of Black Engineers (NSBE) hosted its 37th Annual Convention March 23-27 at the America's Center Convention Complex in downtown St. Louis. The annual convention attracted more than 8,000 black engineers, and 250 corporate and government entities, including each of the arms of the military.

NSBE, with more than 35,700 members, is one of the largest student-governed organizations in the country. Founded in 1975, NSBE now includes more than 394 college, precollege, and technical professional/alumni chapters in the United States and abroad. NSBE's mission is "to increase the number of culturally responsible black engineers who excel academically, succeed professionally and positively impact the community."

» nsbe.wustl.edu

Clockwise from left: WUSTL NSBE students, Kickoff party in Whitaker Hall and high school students visit campus.



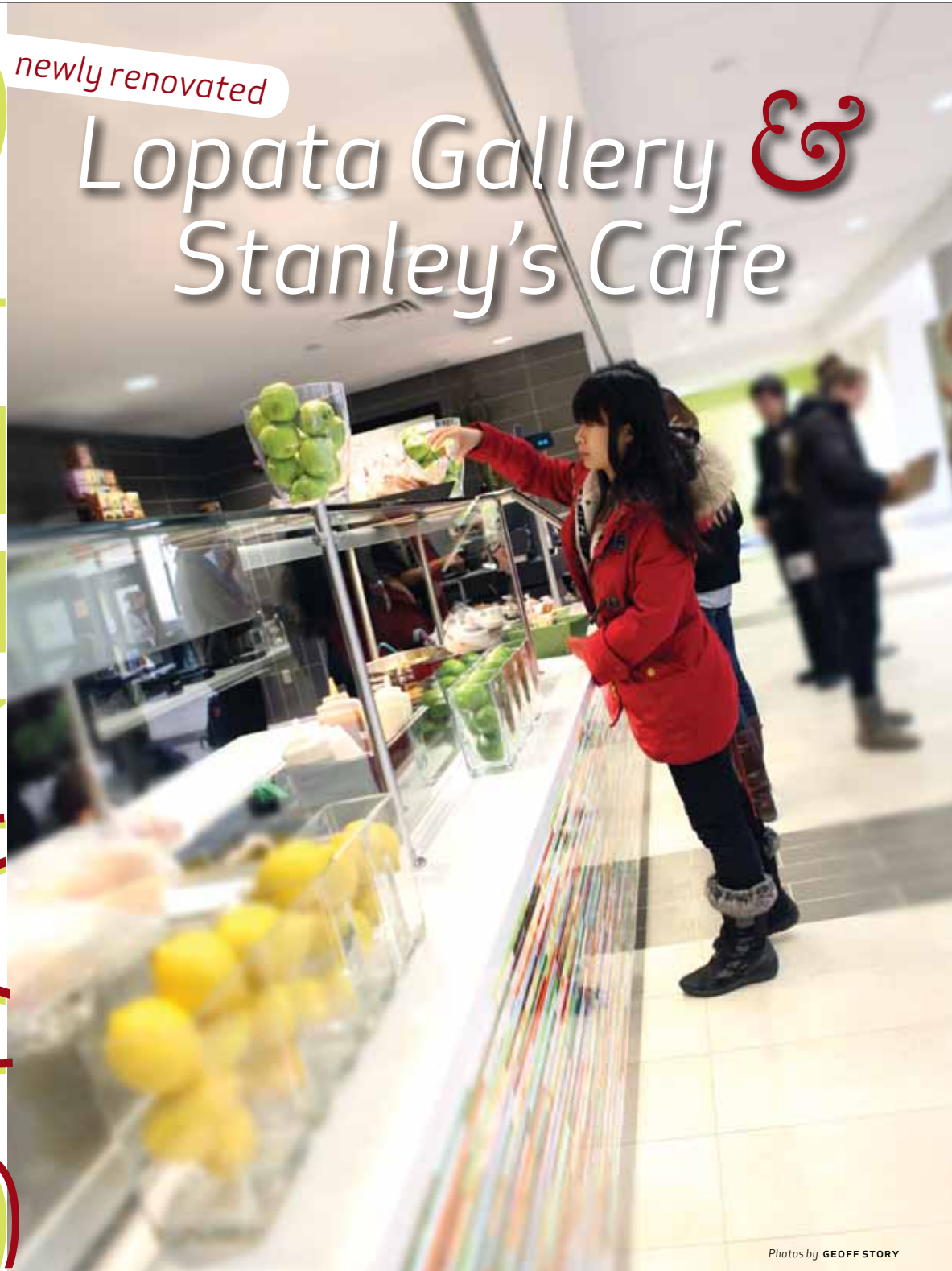
WASHINGTON UNIVERSITY NSBE CHAPTER ACTIVITIES

- » Biweekly mentoring sessions with middle and high school students
- » A Walk for Education, a day of college preparatory programming for local St. Louis families
- » Mentor/mentee program, study sessions before large exams and academic technology bowls
- » Annual campus career fair, company presentations and professional development workshops

STANLEY'S

newly renovated

Lopata Gallery & Stanley's Cafe



Photos by GEOFF STORY

The new Lopata Gallery opened February 14, 2011, and includes modern and expanded collaboration space and a new food and coffee service in the School of Engineering & Applied Science. **Stanley's Cafe** — located in Stanley & Lucy Lopata Hall — features table and lounge seating and computer stations. The new menu includes salads, sandwiches, wraps, soups, hot dogs, freshly baked goods, desserts and more.



“I think the new space is great. Engineering students finally have a place to meet, hang out, and eat together.”

— CATIE REYNOLDS, JUNIOR



WUSTL PHOTO

STANLEY & LUCY LOPATA

Stanley's is named for Stanley Lopata, a 1935 College of Arts & Sciences graduate and former trustee of the university. Founding Carboline Company in 1946, he built his coating and sealant company from a basement laboratory into a multimillion-dollar business with global reach before selling it to Sun Oil Refining and Marketing Company. In 1986, he started Lopata Research and Development. He died in 2000.

Lucy Lopata was born in Germany and attended school in Switzerland. For 60 years, she and her husband earned a reputation as two of the most generous and engaged people in the St. Louis area. Today, she continues

her work as a philanthropist and volunteer, directing her time and energy to many Jewish causes and to other cultural and educational organizations in the St. Louis community.

Evidence of the Lopatas' generosity and leadership may be found at Washington University through their support of two professorships in the School of Engineering & Applied Science and several scholarships across schools. In addition to Lopata Hall, the Lopata name can be found at Lopata Courtyard in Simon Hall, Lopata Plaza, and Lucy & Stanley Lopata House in The Village. In addition, The Lopata Classic, a men's basketball tournament, is held each fall.

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VERTIGO 2011
More than 1,300 students packed Lopata Gallery for Vertigo on April 2. The new LED dance floor, built by Institute of Electrical and Electronics Engineers (IEEE) students, included more than 1 billion colors and 32,000 lumens of LED lights. Working with the Olin Business School and the School of Law, IEEE is in the process of creating a company to market and rent the dance floor.

Photo by DEVON HILL



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