GOING GLOBAL
Students Work and Learn Abroad to Engineer 21st-Century Careers
Today, engineering education is facing a new challenge: global competency is emerging as an imperative for engineering professionals. I think we've reached the point where there are two classes of engineers, regional and global. There was a time when one could graduate from Purdue and work in the Midwest with collocated teams of Big 10 engineers on products that would be distributed regionally, in middle America. Today, that's not the case for most of our students. Most of those who choose industry as a career path work for global firms with global teams on global product platforms. Purdue ME needs to provide each and every one of our students the opportunity to enter the workforce well along their pathway to being a global engineer and a global citizen.

So how do we achieve that? I am confident that global competency skills can be woven into our curriculum just as seamlessly as professional skills, ultimately making our students' technical skills even stronger. This immersion can be accomplished in several ways, ranging from using international case studies in class to developing a strong study/intern abroad program. As you will learn in this issue (see page 4), Purdue’s Global Engineering Alliance for Research and Education (GEARE) program is at the forefront of international engineering education—and it’s just one of many ways that the Purdue School of Mechanical Engineering is taking a proactive yet steady approach to incorporating global engineering into our students’ curriculum and educational opportunities.

I encourage you to reflect on how you can partner with us in this effort. Are you an engineer working internationally? Our undergraduates could benefit from sharing from a firsthand source about the relevance of global competency to an engineering career. Your alma mater is leading the way in strengthening our students’ technical, professional, and global skills. Please join us in meeting the challenges of this exciting frontier of engineering education!

E. Dan Hirleman
William E. and Florence E. Perry Head School of Mechanical Engineering
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Mechanical Engineering Impact
Attn: Cynthia Dalton
Purdue University
585 Purdue Mall
West Lafayette, IN 47906-2088
peimpact@purdue.edu
765-494-7320

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New Technology Accurately Identifies E. coli for Food Safety

Researchers have shown that a new low-cost system to quickly identify bacteria by analyzing scattered laser light can accurately distinguish between different strains of E. coli, a potentially valuable way to screen the food supply. The technique, which stems from technology developed for such ME applications as fuel spray characterization and particle-contamination detection and prevention processes in semiconductor manufacturing, works by passing a laser beam through bacterial colonies growing on a nutrient medium. "The technique promises to have future applications in medicine and homeland security, identifying dangerous organisms far more quickly and at much lower cost than conventional technologies," says E. Dan Hirleman, a professor and William E. and Florence E. Perry Head of Purdue’s School of Mechanical Engineering.

Laser light passing through and around the colony is redirected by the bacteria and produces a scattering pattern. This light-scatter pattern is recorded and analyzed to identify the types of bacteria growing in colonies.

“We have learned that slight genetic differences between strains of E. coli create subtle differences in the micro- and macrostructure of the respective colonies,” Hirleman says. “Our scattering instrument, in effect, amplifies these slight differences to produce remarkably different scattering phenomena.”

The light-scattering project was initiated by Hirleman, working with Arun K. Bhunia, a professor of food microbiology in the Department of Food Science, and other researchers, including J. Paul Robinson, a professor in the Weldon School of Biomedical Engineering.

Hirleman has specialized in research to develop new types of sensors that work by analyzing light scattering off objects for applications such as detecting impurities on silicon wafers in computer chip manufacturing and measuring the size and speed of burning fuel droplets in jet engines.

A major motivation for the bacteria-detection research is to reduce the time it takes to identify harmful organisms in food processing. The industry generally collects food samples or swabs, places them first in a nutrient broth and then on a plate coated with solid nutrient to allow the bacterial growth to reach detectable levels. E. coli bacterial cultures take about 18 to 24 hours to grow. Then, subsequent biochemical analyses and other time-consuming and expensive techniques, such as polymerase chain reaction, take four to seven days to complete the bacteria identification. The light-scattering method works immediately after the colony is grown. — Emil Venere

ME Head Honored for Global Approach to Engineering

E. Dan Hirleman, the William E. and Florence E. Perry Head of the School of Mechanical Engineering and interim director of Purdue’s Global Engineering Program, received the 2006 Achievement Award from the International Network for Engineering Education and Research. The organization gives only two to three awards annually to engineering educators from around the world.

Among other achievements, Hirleman was recognized for his vision and role in developing Purdue’s GEARE (Global Engineering Alliance for Research and Education) program (see page 4). He was also recognized for his leadership in international organizations, including the Organizing Committee for the Colloquia on International Engineering Education and the International Congress on Optical Particle Sizing. In addition, he was recognized for co-chairing the first conference on engineering education jointly sponsored by the American Society of Mechanical Engineers and its Chinese counterpart, the Chinese Mechanical Engineering Society. — Cynthia Sequin
Now Is the Time to Act

Our School of Mechanical Engineering has always been the cornerstone of Purdue. From its founding as the first School of Engineering in 1882 to the leadership roles our students and alumni have played in so many venues over the past 125 years, Purdue has looked to ME for inspiration.

The $1.5 billion Campaign for Purdue is no exception. The school took on a leadership role to raise a full 10 percent of that total, or $150 million in gifts between June 30, 2000, and June 30, 2007. This is the largest goal of any school, of any college outside of engineering, and of any other unit at Purdue—bar none. While most of our sister schools and colleges have met their goals (as has Purdue as a whole), we in ME still haven’t completely done our part this time around.

We are about $10 million short of our $150 million goal, and with more than 17,000 living alumni, I know our school can make it!

Maybe you have been thinking about making a gift but would like to talk with someone about ways to go about it. You may have made a gift early in the campaign and are in a position to make an additional gift now. If you want to help us reach the goal, now is the time to act.

The time-sensitive IRA rollover provision (see gray box at upper right) has been used by many alumni to make gifts, and now would be a good time to ask your financial advisor if it could work for you. Although a gift of cash or securities now would be wonderful, you can also help us without transferring funds immediately. You can make a pledge to be paid over a number of years. You can notify us if you have named the School of Mechanical Engineering as a beneficiary in your will or to receive the remainder of an income-producing gift such as a trust or charitable gift annuity. By knowing your wishes, we can work together to ensure your gift has the impact you desire—and it helps us meet our campaign goal.

We will use your gift as you direct. If you received a scholarship or fellowship when you were a student, you might want to help a current or future student. Possibly you want to help improve the learning environment by contributing to the new Herrick Laboratories or the Gatewood Wing of the Mechanical Engineering Building. You can help to recruit and retain the best faculty by endowing a professorship. We also need unrestricted gifts to meet the various needs of the school like purchasing and maintaining equipment, and funding student organizations. We can work with you on a naming opportunity to honor family members, friends, and/or those who were a positive influence on your life.

Thanks to all who have given so generously to help us keep the School of Mechanical Engineering at the cutting edge and to put us within reach of our goal.

Dan

E. Dan Hirleman
William E. and Florence E. Perry Head School of Mechanical Engineering

Pension Protection Act Creates Unique Gift Opportunity

The Pension Protection Act has made it possible for individuals age 70 1/2 and older to donate up to $100,000 a year directly from an Individual Retirement Account (IRA) or Roth IRA to Purdue University. This gift can be made through the end of 2007, and while it cannot be counted as a charitable contribution deduction for federal income tax purposes, it does provide the equivalent of a 100 percent federal income tax charitable contribution deduction.

Gifts of this type reduce the amount that must be taken into taxable income as an IRA minimum required distribution.

For more information, contact Purdue’s Planned Giving Office at (800) 677-8780 or plangift@purdue.edu.

To talk with someone about making a gift to the School of Mechanical Engineering, please contact one of us:

Dan Hirleman
Perry Head of ME
hirleman@purdue.edu
765-494-5688

John Sanderson
Director of Development
sanderjd@purdue.edu
765-494-9769

Alicia Pilon
Director of Development
apilon@purdue.edu
765-494-5629
In the workplace, an office door can be telling. Is it open? Is it closed? What does that signify about the person occupying the office? And how does that person (let’s say it’s your boss) care to interact with you? If you and said boss share the same cultural background, chances are that your take on the situation is going to be a lot more accurate than if you’re from different backgrounds.

Cultural differences can be subtle, but they can profoundly affect an international company’s success. Some 44 percent of U.S. multinational companies report failed expatriate assignments in the Asia-Pacific region, and 63 percent report expatriate failures in Europe. E. T. Hall’s book *The Hidden Dimension* cites the example of a U.S. subsidiary firm located in Germany. The American managers kept their doors open; the German managers kept theirs closed. “The open doors,” Hall writes, “were making the Germans feel exposed and gave the whole operation an unusually relaxed and unbusinesslike air. Closed doors, on the other hand, gave the Americans the feeling there was a conspiratorial air about the place and that they were being left out.”

Students participating in Purdue’s Global Engineering Alliance for Research and Education (GEARE) report just such experiences. Junior Paul Imel, who’s currently interning in Germany with Pratt & Whitney Canada’s European center for customer service, makes this...
observation: “[Germans] seem to prefer [things] to be detailed and have systematic steps toward a definitive goal. Not that they need things spelled out for them—they just seem to prefer more organization. People here are also extremely focused on their work while on the clock” (see college side, “Students Abroad: A Virtual Roundtable,” page 18).

That kind of cultural discovery lies at the heart of the GEARE program. And the real goal is not just to bridge the cultural divide but to use the complementary strengths of each culture to develop better problem definitions and better global solutions to engineering problems.

Launched in the School of Mechanical Engineering in 2003, GEARE supplements the education of engineering students so that they’re prepared to function immediately, on graduation, in the global workplace. “In today’s global economy,” says E. Dan Hirleman, the William E. and Florence E. Perry Head of Mechanical Engineering, “we have an obligation to give our students a competitive advantage by providing them with the experience of studying and working with engineers from other countries.”

Face to face, shoulder to shoulder

The study-abroad concept has existed in the United States since the 1920s, more closely associated with the liberal arts than with engineering. The context for engineering education, however, has changed dramatically over the past few decades. Citing concern about America’s economic competitiveness, the National Academy of Engineering declared in its report Educating the Engineer of 2020 that “U.S. engineers must become global engineers.”

What Hirleman and his founding team—ME professor Eckhard Groll; Jerry Matthews, the director of ME’s Office for Industrial Experience; and communications specialist Dianne Atkinson—have created through GEARE is singular in integrating international-team design, study abroad, and an overseas internship into a comprehensive, 24-month program.

At no additional cost beyond their usual Purdue tuition and fees, and with no time added to the typical engineering student’s four-year plan of study, GEARE students participate in:

- an orientation program, which includes instruction in language and culture,
- one paid domestic internship,
- one subsequent international paid internship at the same company,
- one semester of study abroad with fully transferable engineering course credits, and
- a two-semester design team project (one semester at the home university, one abroad) with design teams that include students from international partner universities (see page 7).

Those international partner universities include Germany’s Universität Karlsruhe, China’s Shanghai Jiao Tong University, the Indian Institute of Technology Bombay (Mumbai), and, as of 2006, Mexico’s Monterrey Institute of Technology and Higher Studies (the Tecnológico de Monterrey).

That means that a Purdue GEARE student learns by working face to face, and shoulder to shoulder, with students from Europe, Asia, or Latin America. Indeed, says Hirleman, “the face-to-face engineering project experience in cultural-immersion situations is what differentiates GEARE and provides Purdue students with a competitive advantage [over other American students].”

‘Something’s happened in their lives’

In the U.S., the number of engineering students participating in study abroad is minuscule: only 2.9 percent of all U.S. engineering students took part in formal education abroad in 2004-05 (measured as percentage of same-year degrees awarded). In contrast, 17.5 percent of all U.S. business and management students participated in study-abroad programs the same year.

From the perspective of Tom Malott (BSME ’62), retired president and CEO of Siemens Energy and Automation, the problem is acute. A native of Attica, Indiana, who grew up in South Bend, he notes that a Midwestern upbringing doesn’t
fully prepare students for today’s global business environment.

“Our kids are at a disadvantage because they often don’t learn the languages and aren’t exposed to the cultures of people they ultimately could be working with on complex projects,” says Malott, who with his wife, Sandra, provided an endowment fund now worth over $800,000 to help support the GEARE program. “I learned this the hard way. I think I was 32 years old before I even crossed the ocean.” (Compare that experience with that of ME faculty member Groll, who was born in Germany: “For German engineering students, international experience is a must. It’s not a matter of if but where.”)

Before the introduction of GEARE and some short-term programs, less than 1 percent of ME students at Purdue had had a global experience related to the engineering profession. In more recent years, nearly 16 percent of Purdue’s graduating mechanical engineering students have had overseas courses or internships.

Building on that success, GEARE has expanded to include students from other engineering disciplines, including chemical, civil, electrical and computer, and aeronautics and astronautics. In addition, a graduate version of the program has been established with Germany (and funded for three years by the German government) whereby Purdue and Karlsruhe master’s students are paired to work on research projects. Current projects include surgical robots, HVAC systems for office buildings, space-shuttle panels, and rapid-fired combustion engines.

Recognizing GEARE’s success and promise, the College of Engineering awarded the program its Team Excellence Award in 2004, and GEARE has become the flagship component of Purdue’s growing Global Engineering Program (see college side, “Engineering in 360°,” page 12). The program is attracting global attention—and formed the basis for Purdue’s receipt of the 2006 Achievement Award from the International Network for Engineering Education and Research.

“GEARE tends to attract the upper cut of students,” says ME’s Matthews, the industrial-experiences director. He handles GEARE’s administrative details and comes to know the Purdue participants well, from the beginning of the application process through the end of the students’ experience. As for students’ personal growth over the two-year experience, “It’s really amazing,” he says. “They are much more confident and mature in the way they handle themselves. You can tell that something’s happened in their lives that’s made a world of difference.”

**Opening minds**

John Wall, vice president and chief technical officer of Cummins Inc. (see “In My View,” page 12), can see that difference in Purdue’s graduating engineers.

“Cummins always recruits top academic talent,” he says, “but the GEARE students are even more. They are risk takers who challenge their comfort zone by seeking global experiences, they adapt readily to new environments, and they know what it takes to work in teams of international engineers.”

Francisco Montalvo, a mechanical engineering junior who’s interning at Siemens in Berlin, has learned that flexibility is key: “[In Germany], I’ve found that, as likely in every other country, there are different kinds of people and different kinds of situations. The cultural barriers and different ways of thinking that often cause great issues in business, especially at a global level, force us to keep our minds open and use our past experiences to find solutions where all parties can be satisfied.”

An open mind may be the GEARE graduate’s hallmark. “One of the subtleties of working across cultures,” says ME professor George Chiu, who’s led Purdue students to Shanghai (see “Up Close: Faculty,” page 8), “is that we think our way is the most optimized way. Other people, though, may be operating on a different set of assumptions. GEARE leaves students with that thought. There may be no solution to this problem, but they’ve experienced it firsthand. That’s a very valuable experience, and our students need immersion in order to see it.”

Dan Hirleman: “In today’s global economy, we have an obligation to give our students a competitive advantage.”
Global Design Team Projects: A Gallery

The GEARE experience culminates in the global design team project. Working alongside teammates from another culture, students discover new ways to solve problems and new ways of seeing the world. Project planning takes place during the Purdue students’ study-abroad semester. Fabrication and testing happen when the student teams are at Purdue (as well as in Shanghai for the GEARE China students). Here, a look at some results.

The Personal Carousel

The University of Karlsruhe & Purdue
2003-04

This portable amusement-park ride seats up to four people and is powered by electric motors. It consists of a 12-foot-long steel-beam assembly that has two seats at each end. Each pair of seats is mounted on a single platform, and the two platforms spin as the entire assembly revolves while tilting up and down, seesaw-like, every 11 seconds. The design stemmed from an idea to create portable rides that people could rent for birthday parties and other special occasions.

The Autonomous Vehicle

The University of Karlsruhe & Purdue
2004-05

More than 120 graduating Purdue seniors from civil, computer, electrical, and mechanical engineering designed this computer-controlled, GPS-equipped, dune-buggy-style car to compete in a DARPA Grand Challenge event that placed unmanned vehicles in the Mojave Desert to navigate a 175-mile, obstacle-filled course. GEARE students from Purdue, as well as nine GEARE students from Germany, built the suspension.

The Wall-Climbing Robot

Shanghai Jiao Tong University & Purdue
2005-06

Wall-climbing robots are used for window washing on high-rises, for inspecting nuclear reactors, for climbing piping in chemical processing plants, and for a host of other applications. The challenge here: to investigate the weight-and-performance trade-off in designing a robot that can climb up a steel wall. Constraints: limit the size to 25 cm x 25 cm x 25 cm, use less than 10 watts of power, and spend less than $300. Two teams (10 students) produced entries judged on (1) a race up a 1-meter wall with no load, (2) a race up a 1-meter wall with a 100-gram load, and (3) maximum payload capacity.
George Chiu and Bin Yao.

East Meets West, Comfortably

These two professors move easily between East Asian and American culture (and time zones) to pursue their educational and research initiatives.

George Chiu takes a piece of paper and writes these Chinese characters:

師長

The first character means teacher. The second character means elders. "In traditional Chinese culture," he says, "teachers receive the same respect, if not more, as the elders in the family."

That respect, or deference, is a distinguishing characteristic of East Asian culture. Whereas American students are encouraged to ask questions in class and to make public presentations about their work, East Asian students are traditionally more passive in comparison, focusing on academics, particularly exams.

Chiu, a mechanical engineering professor at Purdue and native of Taiwan, first came to the States in the mid-1970s, spending his sixth- and seventh-grade years in Virginia. Returning to his home country, he graduated from the National Taiwan University but decided on the U.S. (Berkeley) for graduate school, joining Purdue’s faculty in 1996. Thanks to those cross-cultural experiences, Chiu is steeped in American as well as Taiwanese culture—and was ideally suited to teach both American and Chinese undergraduates taking courses at Shanghai Jiao Tong University (SJTU) through Purdue’s GEARE program in 2005.

GEARE (the Global Engineering Alliance for Research and Education) originated in the School of Mechanical Engineering and has expanded to include students in aeronautics and astronautics, chemical, civil, and electrical and computer engineering. The program offers both a domestic and an international corporate internship, one semester of study abroad, and a two-semester co-located global design team project.

"I went with a group of five American students to Shanghai," Chiu says. "Our students can take courses there in English." Working with SJTU faculty, Chiu, a mechatronics expert, led a three-credit-hour class in which undergraduate students designed wall-climbing robots. (He also taught a digital controls course to Chinese graduate students.) In the design class, two teams of five students each—each team a blend of American and Chinese students—competed to see whose robot performed better.

"It’s interesting," says Chiu. "All the students are very similar in the gut. They’re in their early 20s, with the same drive and curiosity. They all want to learn from each other and to explore."

Colleague Bin Yao, who works one door down from Chiu on the School of Mechanical Engineering’s third floor, also benefits Purdue and his discipline through his East Asia ties. Yao grew up in China and, after earning his bachelor’s degree at the Beijing University of Aeronautics and Astronautics, moved to Singapore for his master’s. By 1990 he had joined Hong Kong Polytechnic as a research assistant and began to think of getting his PhD in the United States. Like Chiu, he wound up at Berkeley and joined Purdue’s mechanical engineering faculty on graduation. "It was exhilarating to be outside of my home country and learn new things," Yao says of his international experiences.

Yao’s bicultural background has enabled his research collaborations, focused on electrohydraulic controls, to thrive. In 2005 he was named a Kuang-piu Lecture Professor by China’s Zhejiang University for his work with the institution’s State Key Laboratory of Fluid Power Transmission and Control, one of the world’s foremost research centers on the subject. In addition, he is a participant in a joint training agreement with Zhejiang University as an advisor to Chinese doctoral students joining Purdue as visiting scholars (any resulting scientific work is shared by the two universities), and he is a guest professor of Shenzhen Graduate School in China’s Harbin Institute of Technology.

Whether in the East or the West, both Chiu and Yao are able cultural interpreters. "It may be an overgeneralization, but the American culture tends to says, ‘I want,’” says Chiu. "The East Asian culture tends to says, ‘I should.’" He adds that Americans living in the East have to learn the art of handling uncertainty. For his part, Yao notes: "I’ve been through two cultures, and I can show Chinese students how things are done here in the States.”

■ Lisa Hunt Tally
Located on Puerto Rico’s western coast, the village of Humatas de Añasco is lush, dense, and green—not rainforest habitat, strictly speaking, but close to it. Yet this community of 750, which sees rain every day, has had trouble securing a reliable supply of water. It’s at the end of the supply line, and problems upstream can mean no water for the village’s 186 households for weeks at a time.

Last fall, the University of Puerto Rico at Mayaguez’s University Institute for Community Development set out to assist Humatas in developing a water system that the townspeople could control independently of the central system. Luisa Seijo-Maldonado, director of the institute (which is affiliated with Engineering Projects in Community Service, or EPICS, the service-learning program that originated at Purdue), worked with Efrain O’Neill-Carrillo, a UPRM professor of electrical and computer engineering, and Dan Hitleman, head of Purdue’s School of Mechanical Engineering, to assemble and help the team. That team included Purdue mechanical engineering seniors and roommates Dustin Armer and Greg Mattes. The pair wound up on what would become the biggest technological and cultural adventure of their academic careers.

Knowing their heart for community service—Armer had been a camp counselor for kids with life-threatening illnesses, Mattes had volunteered with Big Brothers/Big Sisters—ME staff member Tarri Brickler had connected them with the Puerto Rico opportunity. Civil engineering students Matt Carroll and Josh Messmer participated as well, and Larry Nies, a civil engineering professor, and Bryan Hubbard, the industrial relations director for the School of Civil Engineering, offered technical support.

“We made our first trip over Labor Day,” says Armer. The goal: to understand and define the problem, meet the rest of the team, and visit the community.

“The residents of Humatas didn’t speak a lick of English,” says Mattes, who himself speaks a bit of Spanish. (For his part, Armer says, “I never spoke Spanish in my life.”) The Puerto Rican professors and some of their students spoke English—and welcomed their guests with warmth and hospitality, including lots of tips on where to eat and which beaches to visit.

The cross-cultural team spent a semester designing a water-delivery system consisting of a well (already in place), a pump, a concrete tank, and pipes for connecting system components and distributing the water to the community. “We needed to look at how changing the design variables of the system—like the pipe diameter, the pipe material, and the tank designs—affect cost and functionality,” says Mattes, “so we created a computer model to integrate the technical analysis for each of the project’s subsystems.”

In addition, Armer and Mattes worked specifically on the pump and tank, participating in biweekly teleconferences from Purdue after returning to Indiana and each earning a technical elective credit in the process. Some information was difficult to pin down, particularly because of the long distance, they say. They determined that community water usage amounted to 37,800 gallons a day, but they had difficulty locating the specifications of the existing well.

“Our biggest problem, though,” says Armer, “was to identify the supplier of the tank, get the correct specifications for that, and pick the piping in order to maximize the flow rate.”

Together the team came up with a couple of water-delivery options to present to the community and its leader, Don José. The Purdue group made a second trip to Puerto Rico to finalize recommendations with the rest of the team and join in the presentation.

“The community has already raised $15,000 for piping for this project,” says Armer. The EPICS team’s options range from $31,000 to $73,000 for capital costs. “When you see Don José encouraging everyone to come together to raise money, it’s pretty cool to watch that firsthand.”

Whichever option the citizens of Humatas choose, they’re moving in the right direction, says Armer. As for himself and Mattes, they moved on to another cross-cultural project for their final semester: designing simple solar ovens, as alternatives to wood fires, for use in Tanzania.

Lisa Hunt Tally
Stephanie Faber likes nothing better than rebuilding British sports cars, shaking things up by moving every few years, and bicycling in remote corners of the world. So when Purdue’s College of Engineering offered her the chance, as an undergraduate student, to combine those interests with work and study in Shanghai, she jumped at the opportunity.

Faber (BSME 2006) went to China with Purdue’s GEARE program. GEARE—the Global Engineering Alliance for Research and Education—offers engineering students the opportunity to combine overseas internships with study. It consists of a domestic internship, followed by an international internship with the same company, a semester of study abroad, and a two-semester design team project with students from the international partner university. With GEARE programs also available at the time in Germany and India, Faber opted for the program with China’s Shanghai Jiao Tong University. She was one of five Purdue students in the group.

Faber moved often as a child, sometimes living overseas when her father’s mechanical engineering projects took him there. As a result, travel doesn’t scare her—in fact, it thrills her. “I get the itch if I stay in one place too long,” says Faber, who is now a product development engineer in the crankcase ventilation division of Cummins Filtration. “I chose China, because I thought it would be exciting to experience something so different from our culture and would be great from a career perspective.”

Faber’s GEARE program began the summer after her sophomore year with a three-month internship in Tennessee at Cummins Filtration, then known as Fleetguard. She returned to Purdue for the fall semester, then flew to China over the winter break and began an eight-month stay in Shanghai. She had taken two semesters of Mandarin but says she felt illiterate when she first arrived, unable to make sense of street signs or ask for a bread roll at a food stand. She says the experience helped her realize the importance of communication.

For the first two months, she lived in university housing for international students, sharing a room with a student from France. Chinese rules, she explains, prohibit foreign students from entering Chinese student residences and vice versa. Her dorm-mates included students from around the world—Africa, Asia, Europe.

During the day, Faber worked in a paid internship in the engineering group at Shanghai Fleetguard, where she was introduced to the Chinese work culture. “It’s different,” she says. “There’s a lot less individual accountability. You have to get approval on everything. It was frustrating at first to learn how many hoops I had to jump through to get things done, but by the end I learned how to work effectively within the system.”

In her free time, Faber and two Purdue classmates traveled far and wide—from tropical Kunming to the snowy Himalaya region, sometimes by train, sometimes by plane,
sometimes by bicycle or on foot. She opted not to travel in tour groups, as most Chinese do, but instead set off on her own with a backpack.

When summer came around, the GEARE students moved to the countryside outside of Shanghai for three months and took classes such as heat transfer and global design. They then returned to the city and completed their internships. During this time, they also worked in blended teams of five Purdue and Chinese students each, designing a small wall-climbing robot.

“The whole experience helped me understand how important communication is and how important it is to be patient. I work with people in China in my job now, and I understand where they’re coming from. It’s been very valuable for me to understand that work culture,” she says.

In addition to the cultural experience, Faber also benefited from the GEARE program internship, which led to her current job with Cummins Filtration in Wisconsin. She’s recently been appointed project engineer on a team that includes engineers from Cummins China, Cummins UK, and Cummins USA to develop a new filtration product that will be manufactured in China, sold locally, and then transferred globally.

For a woman with wanderlust whose finest childhood memories are of rebuilding cars with her father and grandfather, including an MGB for her, she’s in the right place. She’s not building MGs, but she is working on light-duty and heavy-duty diesel engines—and assuming a level of responsibility that’s rare for someone just over six months past graduation.

“I’m exactly where I want to be,” says Faber, whose GEARE experience placed her on the fast track. “Cummins has a lot of opportunities for me to go abroad, and I hope to do so in the near future.” — Linda Thomas Terhune
My first encounter with globalization was to endure the personal humiliation reserved for 12-year-old big brothers forced to accompany their little sisters on that Disneyland ride, "It’s a Small World," while cute little dolls in international costumes danced and sang their sappy theme song over and over. Little did I know how true that theme would be for me.

As I am writing this article, I am outside the U.S. and have spent more time in India than in Indiana in 2007. Over the past four years, I have spent about 10 percent of my time in India, another 10 percent in China, and made shorter excursions to Europe and other parts of Asia. It is fascinating, exciting, and a necessary part of my work. And mine is not a unique story. Globalization is a macroeconomic trend, but it is also personal for many people, and it will become more personal for more people in the future.

While many associate globalization with modern call centers in India, it runs far deeper than that, and it is not new. Cummins’ story in India is indicative. At about the same time my sister and I were emerging from the Small World tunnel, Cummins was opening its first operations in India. Thirty years later, Cummins India engineering had evolved to have global impact. When we designed a new family of 45- and 60-liter industrial engines, the chief engineer resided in India and led "virtually co-located" teams of engineers in India, the U.S., and the U.K. Forty years later, I took our engineering leaders to India to benchmark other companies’ technical operations. Our visit to GE’s Technology Center in Bangalore, where more than 3,000 engineers and scientists were engaged in projects supporting GE operations worldwide, completely transformed our vision of what Cummins could do in India. We established Cummins Research and Technology, India in 2003. It is our first technical center with no physical laboratories—it is totally devoted to “analysis-led design,” with its engineers functionally integrated into engineering teams all over the world and applying high-level analysis in structural mechanics, computational fluid dynamics, combustion, and design.

Cummins’ experience in China parallels our story in India. Today, our newest international technical center is in Wuhan, China. Over these 40 years, our engineering operations have evolved from a collection of international technical centers, located in many countries but focused mainly on local products, to a truly global technical organization that works seamlessly across international boundaries.

We have learned a few lessons along the way. The main lesson is about the importance of effective personal communication. The primary enabler for globalization today is cheap, high-bandwidth internet access. But file swapping is not a substitute for real communication. Engineering is a social exercise. Successful engineering is based on teamwork and on effective communication within and across disciplines.

One of the major challenges for companies and individuals to work effectively in a global workplace is to establish fundamental cultural understanding as a foundation for effective personal communication. To really understand another culture, you have to go there, meet the people, and learn about their history, culture, and customs firsthand. It is fascinating. And it is necessary. Speaking in a common language may create the illusion of communication, but if the individuals don’t really understand the context of the other, they won’t always "get it.”

We have also learned about the power of diversity in creative problem solving. An engineering team with members having diverse backgrounds and life experiences has a much better chance of coming up with a truly innovative solution to a tough engineering problem.

Purdue engineers need to prepare themselves to operate effectively in this global engineering environment. It’s not too late. And nobody has to drive to Disneyland to get started. Purdue already has the best undergraduate global engineering program I know of—the Global Engineering Alliance for Research and Education (GEARE), which got its start in the School of Mechanical Engineering. There are other opportunities for international study and work too numerous to mention. Our students just need to get started. It is a small world, after all!

John Wall
Distinguished Engineering Alumni

Honored at a February 23 ceremony, these four ME graduates—an entrepreneur, an operations expert, a university president, and a government official—joined six other Purdue Engineering alumni as the 2007 recipients of the Distinguished Engineering Alumni Award. Just 438 Purdue alumni have held this title.

Allen H. Alley
BSME ’76
Chairman, Pixelworks Inc.
Deputy Chief of Staff, Governor’s Office, State of Oregon
Honored for his pioneering technical and executive vision, and for his contributions as an entrepreneur to the nation’s economic growth.

Marcia P. Alstott
BSME ’79
Vice President, Operations
Sun Microsystems Inc.
Honored for her outstanding contributions in manufacturing, engineering management, and business development in high-tech industry.

Robert A. Altenkirch
BSME ’70, PhD ’75
President
New Jersey Institute of Technology
Honored for his exceptional contributions as an educator, researcher, and university administrator.

John H. Hager
BSME ’58
Assistant Secretary, Office of Special Education and Rehabilitative Services
U.S. Department of Education
Honored for his outstanding contributions as an industry, government, and community leader.

Outstanding Mechanical Engineers

Seven ME alumni received the 2006 Outstanding Mechanical Engineer (OME) Award on October 26, 2006. Of nearly 24,000 Purdue ME alumni, only 195 (including this year’s recipients) have received the OME award.

James J. Allen
PhD ’81
Distinguished Member of the Technical Staff
MEMS Device Technologies
Sandia National Laboratories

John H. Atwood
BSME ’51
Retired Chairman, CEO, and President
Atwood Oceanics Inc.

Patricia J. Bishop
MSME ’72, PhD ’76
Vice Provost and Dean of Graduate Studies
University of Central Florida

J. Douglas Field
BSME ’87
Chief Technology Officer
Segway LLC

Roger B. Gatewood
BSME ’68
President
Westbay City Homes LLC

John H. Hager
BSME ’58
Assistant Secretary, Office of Special Education and Rehabilitative Services
U.S. Department of Education
Honored for his outstanding contributions as an industry, government, and community leader.

Robert A. Altenkirch
BSME ’70, PhD ’75
President
New Jersey Institute of Technology
Honored for his exceptional contributions as an educator, researcher, and university administrator.

John E. Grimmer
BSME ’52
Founder and Chairman Emeritus
Grimmer Industries Inc.

Patricia J. Bishop
MSME ’72, PhD ’76
Vice Provost and Dean of Graduate Studies
University of Central Florida

J. Douglas Field
BSME ’87
Chief Technology Officer
Segway LLC

Roger B. Gatewood
BSME ’68
President
Westbay City Homes LLC

John E. Grimmer
BSME ’52
Founder and Chairman Emeritus
Grimmer Industries Inc.

Michael S. Kelly
BSME ’78, MSME ’83
Vice President of Operations
X PRIZE Cup and X PRIZE Foundation
**Fastball Puzzle**

Solve this puzzler and e-mail your solution to Cynthia Dalton at cdalton@purdue.edu. Readers supplying correct answers will be named in the Winter 2007-08 issue of *Mechanical Engineering Impact*.

During the seventh inning, National League Cy Young Winner Randy Johnson throws his “killer fastball” and hits a 5.5-oz dove. The ball and the dove stick together after the impact. Taking the point on the ground directly under the collision as the origin, the dove moves in the xz plane, and its motion is given by 
\[ z = \frac{3}{4}(x+1)^2 + \frac{5}{4}. \]

At the point of collision, the speed of the dove is 10 mph, and the speed of the ball is 95 mph in the positive y direction. Neglecting air friction, where do the ball and dove land? Assume the ball weighs 0.328 lb.

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**Class Notes**

**Peter N. Baker** (BSME ’53), retired pediatrician and active in retirement; rode his recumbent tricycle around Lake Michigan 1,100 miles in 38 days. Planting trees in Wisconsin and performs a one-person play and sings in the Oshkosh Chorus.

**Ray Barney** (BSME ’52), semiretired, member of board of directors of nonprofit development housing for low-income families, volunteers as a math tutor at elementary school. Member of the American Legion, B.P.O.E., Moose, political activist, part-time employee of consulting engineering firm.

**Charles E. Bassett** (BSME ’38), retired captain of Pan Am World Airways. Pilot for the U.S. Air Corps and U.S. Navy during World War II.

**Donald Bixby** (BSME ’56) retired in 1996 from U.S. government (DOD, SBA). Received his MBA from Northeastern Illinois in 1987 and served as president of the local Rotary Club 1988-89.

**Thomas J. Chiplis** (BSME 55) recently retired as president of Rotz Engineers Consultants. *Engineering Impact* is a great publication!

**Richard A. Colberg** (BSME ’65) retired in December 2006 from Robson Forensic Incorporated. [Editor’s note: Dick and his wife Nancy Willcox joined us last October for our 2006 Outstanding Mechanical Engineer Awards Banquet, and Dick guest-lectured for ME 290.]

**Curtis N. Crane** (BSME ’98), currently completing a six-year residency in urology to become a physician.

**Brian S. Davis** (BSME ’98) recently moved from Brookfield, Wisconsin, to Reedsburg, Wisconsin, and is employed as supplier quality engineer for Product Services Group.
James Esler (BSME ’01), currently an engineer with ESG Engineering in Tempe, Arizona. He and his wife, Margaret, an attorney, live with their dog Sammy in Phoenix.

Nathan Krupp (BSME ’57), founder of Preparing the Way Publishers. He and his wife, Joanne, have spent their adult lives since 1961 in Christian missionary work around the world. Has written approximately 30 books, some of which have been translated into other languages and used around the world.

Peter E. Rentz (BSME ’55) retired eight years ago as principal engineer from Northrup Grumman Corporation and loves solving puzzles in Tau Beta Pi’s Bent.

E. John Roschke (MSME ’53, PhD ’58) retired from Jet Propulsion Laboratory (JPL) after 10 years. While employed engaged in applied research, propulsion, bioengineering, solar energy systems development, and space station subsystems as well as spacecraft thermal design and development.


William A. SerVaas (BSME ’46), expert civil forensic engineer, testified as an expert witness in north, central, and southern Indiana federal courts and many Indiana state courts. Beginning to write a book using his 40 years of forensic files.

Robert T. Tutobene (BSME ’55) retired from Aerospace, General Dynamics/Convair Division. Enjoying retirement, playing tennis, reading, and traveling the world.

Ashwin Varadarajan (BSME 2006) is currently working as an associate engineer for Micro Technology in Manassas, Virginia. Current member of ASME.

Coming Up: Fall 2007

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This image of Earth’s city lights was created with data from the Defense Meteorological Satellite program Operational Linescan System, which NASA uses to map urbanization. The brightest spots are the most urbanized but not necessarily the most populated. (Compare Western Europe to China and India, for example.) See “Prime Numbers” on page 10 (college side) for a numerical quick look at our world.