



# Top of the World

Catching *UP* with Purdue's  
Oscar connection



PURDUE MECHANICAL

# ENGINEERING IMPACT

FALL 2010



## Symphony and Solar Racing

One King's passions

## Artists in Training

ME's talented  
students

## Engineering Acoustics

Perspective on  
sound business



## On My Mind

Welcome to Mechanical Engineering Impact. It's our tenth issue if you're counting, my first. I joined the Purdue's School of Mechanical Engineering as a faculty member in January 1981. Since 2001, I've been the associate head for graduate studies. I worked closely with Dan Hirleman during his tenure, and it is an honor to serve as interim head of the school while a search is conducted for his successor.

Dan served as the head for more than 10 years and by the time you read this he will have assumed his post as dean of engineering at the University of California, Merced. Under Dan's leadership, the school's research, curriculum, and engagement programs continued significant progress. Some of the highlights and accomplishments include:

- Developing of the school's strategic plan.
- Starting the Global Engineering Alliance for Research and Education — a comprehensive study and intern abroad program for engineering students.
- Creating 5-year BS/MBA, 5-year BS/MS, and direct-to-PhD degree tracks.
- Initiating an Innovation Awards Competition, highlighting student design projects and encouraging discovery with delivery.
- Growing the faculty from 51 to 64.
- Raising \$142 million in the Campaign for Purdue, which included the funds for the Roger B. Gatewood Wing of the Mechanical Engineering Building and Phase I of the new Ray W. Herrick Laboratories, the first and second LEED Certified buildings on Purdue's campus, respectively.
- Establishing and serving as founding director of GlobalHub— the world's first virtual organization dedicated to global engineering education and research.
- Receiving the Hon. George E. Brown, Jr. Award for International Scientific Cooperation, 2008, U.S. Civilian Research & Development Foundation.

These highlights are but a few of his many contributions to the school. All were accomplished with outstanding support from our alumni, friends, and business and industry partners, as well as the mechanical engineering faculty. Initiatives in these key areas also directly align with the current College of Engineering's Strategic Plan, "Extraordinary People, Global Impact."

As interim head, my goals are to continue implementation of many of these distinguished programs, maintain or improve the school's national ranking, encourage excellence in our world renowned academic and research programs and further the many study abroad and international research collaboration initiatives.

I thank you for your continued support of the school and interest in its activities.

**Anil Bajaj**

Interim Head and Alpha P. Jamison Professor of Mechanical Engineering



### Bajaj's Bio

**PhD, University of Minnesota, 1981**

**MTech. in Mechanical Engineering, Indian Institute of Technology, 1976**

**B. Tech. in Mechanical Engineering, Indian Institute of Technology, 1973**

*Bajaj is an ASME Fellow, A B. Tech – Institute Silver Medal Recipient and a founding member of the Vibration Institute of India. His research interests are in the areas of modeling of nonlinear systems; structural dynamics and localization; flow-induced vibrations; mechanical systems with impact; modeling and dynamics of seat-occupant systems; design of nonlinear resonant MEMS; and bifurcations and chaos.*

## Tell Us What You Think

Share your Purdue memories, react to a story, or let us know your thoughts about a particular issue. Write to us at [peimpact@purdue.edu](mailto:peimpact@purdue.edu). In doing so, you grant us permission to publish all or part of your letter in an upcoming issue. We reserve the right to edit letters for length and/or clarity.

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- Photographers ..... **Glenn Chang, Andrew Hancock, Orie Shafer, Mark Simons, Vincent Walter**
- Copy Editor ..... **Dan Howell**

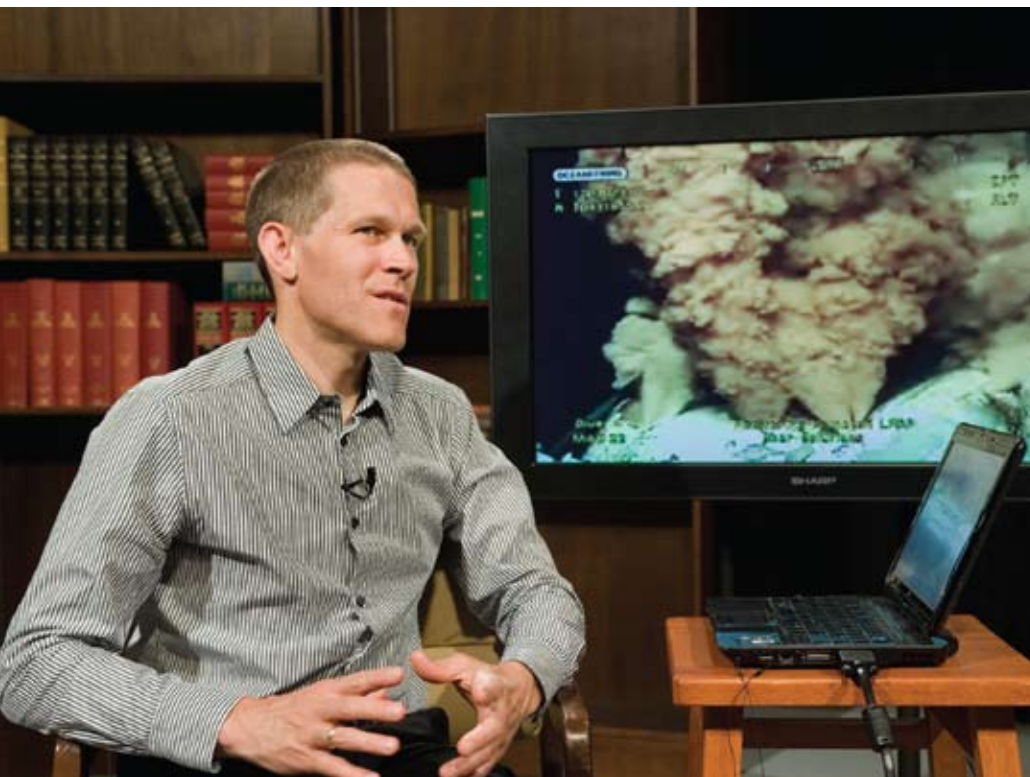
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**Mechanical Engineering Impact**  
**Office of Marketing and Media**  
**Purdue University**  
**507 Harrison St.**  
**West Lafayette IN 47907-2025**  
**E-mail: [peimpact@purdue.edu](mailto:peimpact@purdue.edu)**



## Newsmakers and World Shakers

ME researchers and students hard at work on the cutting edge



### ME professor finds limelight in oil spill estimates

When Steven Wereley, professor of mechanical engineering, helped spill the truth about the BP oil spill off the coast of Louisiana, a perfect media storm dropped right into his life.

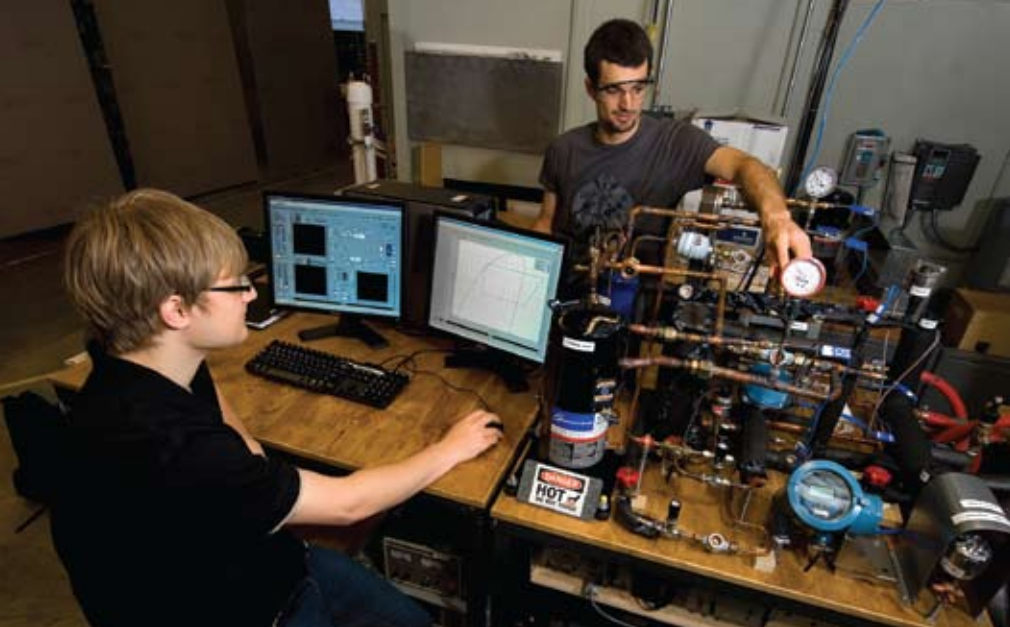
Had National Public Radio not called to ask him to analyze video footage of the gushing crude, Wereley may have lived out the rest of his career quietly researching fluid mechanics on microscopic scales. Instead things ballooned into super-scale proportions. Invitations to Washington, D.C., for a congressional hearing and to be part of an expert task force soon followed, as did his appearance in some 15,000 media outlets.

A team of scientists and engineers, including Wereley, released figures in late May showing that at least 12,000 to 19,000 barrels of oil were still flowing daily into the Gulf of Mexico in the aftermath of an April 20 oil rig explosion. That meant the BP PLC oil spill off the coast of Louisiana had already surpassed the Exxon Valdez as the worst in U.S. history, according to the U.S. Geological Survey.

**Flow Analyst:** Purdue mechanical engineering professor Steven Wereley analyzes a video clip of the oil well leak in the Gulf of Mexico. (Photo by Mark Simons)

*For these and other stories from the Purdue News Service, visit our homepage at [www.engineering.purdue.edu/ME](http://www.engineering.purdue.edu/ME).*

■ Phillip Fiorini and Emil Venere



**Heat Sensors:** Frederick Welck, at left, an intern from Institut für Technische Chemie in Clausthal-Zellerfeld, Germany, and mechanical engineering doctoral student Christian Bach work with an experimental setup for testing valves as part of research led by Purdue to develop more efficient heat pumps. (Photo by Mark Simons)

## New system to reduce heating costs in cold climates

A new type of heat pump being developed at Purdue could allow residents in cold climates to cut their heating bills in half. The research, funded by the U.S. Department of Energy, builds on previous work that began about five years ago at Purdue's Ray W. Herrick Laboratories, says James Braun, professor of mechanical engineering.

Heat pumps provide heating in winter and cooling in summer but are not efficient in extreme cold climates, such as Minneapolis winters.

"With this technology we can maintain the efficiency of the heat pump even when it gets pretty cold outside," says Eckhard Groll, professor of mechanical engineering, who is working on the project with Braun and W. Travis Horton, assistant professor of civil engineering.

The innovation aims to improve efficiency in general but is especially practical for boosting performance in cold climates. The new heat pumps might be half as expensive to operate as heating technologies now used in cold regions where natural gas is unavailable and residents rely on electric heaters and liquid propane.

## Hirleman named dean of UC Merced School of Engineering

In late June, the University of California, Merced named Daniel Hirleman, the William E. and Florence E. Perry Head and Professor of Mechanical Engineering at Purdue, the dean of its School of Engineering.

"We extend our thanks to Dan for all that he has done for mechanical engineering, the College of Engineering, Global Engineering Programs, and Purdue, and we congratulate him on this next major step in his career," says Leah Jamieson, the John A. Edwardson Dean of Engineering.

## Purdue students create wood-based vehicle to aid African nations

Purdue students designed and built a multipurpose vehicle made primarily from wood and traveled to Africa to help officials there set up a manufacturing facility for the trucks, which could help to transport everything from produce to people.

The Basic Utility Vehicle, or BUV, is produced from raw materials readily and affordably available in Africa and is designed specifically to meet the needs of villagers. The students traveled to Cameroon, Africa, in May to aid in setting up a manufacturing facility in a northern village near a forest.

The BUV's body and much of the frame are built of pine, but the design can easily be adapted to African hardwoods like mahogany or eucalyptus. It could be used for many purposes — such as hauling crops, water, building materials, students or the infirm — in areas where no other transportation exists, says Kyle Bazar (BSME '10).

The students won an innovation award for the vehicle during an April competition sponsored by the Indianapolis-based Institute for Affordable Transportation, which is promoting the use of BUVs to help people in poor regions of the world.

**Mechanical Woodworkers:** Mechanical engineering students Erik Cowans and Mackenzie McNamara (BSME '10) sit in the uncovered cab of a new multipurpose vehicle designed and built by Purdue students, as John Lumkes, assistant professor of agricultural and biological engineering, stands by the bed. (Photo by Mark Simons)



# UPWARD

## *Mobility*



**Animated Engineer:** Bob Peterson (MSME '86), here at Pixar Studios, was the lead writer and co-director of "Up," a 2009 Oscar winner.

### **ME alum credits rise in Pixar ranks to arts and engineering background**

by William Meiners

**F**rom the infancy of computer-aided design (CAD) to the pinnacle of Hollywood moviemaking, Bob Peterson has, along the way, successfully merged engineering know-how with good old-fashioned storytelling. And he has an Oscar to show for it.

Peterson (MSME '86) was the lead writer and co-director of "Up," which earned him a nomination for Best Screenplay and won Best Animated Feature honors on Hollywood's biggest night in 2009. For Peterson, the Oscar was the culmination of 16 years at Pixar Animation Studios (though he has no plans to rest on that particular laurel). At Pixar, Peterson says, he's run the gamut from directing commercials, to working in animation on "Toy Story," to supervising the story



*"He's a great writer, great actor, great artist, great draftsman, and a great director. I can't help but think that Bob's background in engineering has helped him settle easily into the filmmaking process of computer graphics and animation, which contain many technical components. He has an understanding of the other side of the building so to speak."*

— JONAS RIVERA,  
PRODUCER FOR "UP"



on “Monsters, Inc.,” and finally to writing the screenplays for “Finding Nemo” and “Up.” He’s also lent his voice to such notable characters as Roz in “Monsters, Inc.,” Mr. Ray in “Finding Nemo,” and Dug the dog in “Up.”

It’s the dream job for a kid who grew up loving Disney movies and Looney Tunes cartoons. “I was able to apply my vocation, which was engineering, to my avocation, which was drawing cartoons,” says Peterson. “I’ve told students, ‘If we could all combine what we do in our off hours with what we do at work, we’d all be happy people.’”

## CAD Lad

Peterson’s big break didn’t come being discovered in a Hollywood drugstore. In fact, he’ll tell you that the opportunity to cut his teeth in Purdue’s cutting-edge CAD lab helped pave his way to Pixar. As an undergraduate at Ohio Northern University, Peterson took a course taught by a Purdue graduate, Michael Rider, that showed him a confluence of art and science in the new field of computer graphics. Rider (PhD ’80) also was instrumental in getting him into grad school at Purdue.

In the CAD lab, Peterson tailored his research to his artistic vision. He was looking to design a 3-D modeling environment that would better fit the needs of a sketch artist. His graduate thesis focused on a modeling package with “lots of sketching and curves,” he says, “and building objects in the way that a designer might normally do with paper and pencil. The hopes were that this would lead to more of a rapid prototyping of objects.”

The timing was right, too. “I got to go to a conference called SIGGRAPH and learn about computer graphics,” he says. “It was an exciting time because it was a new industry. I was lucky to come along when I did as it was being

invented. And Purdue’s CAD lab was an exciting mix of grad students with different interests — interests encouraged by our great faculty advisors.”

Dave Anderson, professor of mechanical engineering, recalls hiring Peterson as one of eight or nine research assistants in the CAD lab, which took off in 1980 with a \$3 million grant from Control Data Corp. Projects ranged from finite elements analysis to intelligent design systems that would recognize shapes and interpret them according to need to systems very much in between. In all, more than 50 graduate research assistants (about half master’s students and half PhDs) were funded in the CAD lab from 1980 through 1995, Anderson says.

“The nice thing was that we weren’t solving a small problem for a company,” Anderson says. “We were literally trying to develop the next generation of ideas for systems that Control Data would sell to the manufacturing world.”

The experimental freedom served several students well. Two received Presidential Young Investigator Awards as they left the CAD lab for university teaching jobs. Anderson says the master’s and PhD students were a close-knit group, several of whom he’s kept in touch over the years. Anderson still has a drawing where Peterson, a working cartoonist, characterized the whole CAD Lab bunch.

The experience also helped Anderson achieve the teaching ideal — to see his students soar beyond him. “It’s exciting for me to see very talented students succeed,” he says. “They helped me in my career because of their ingenuity and creativity. And I, vicariously, enjoy their successes.”

## Loco Motives

As Peterson explored the new world of computer animation, he began developing his voice through a daily comic strip in the *Purdue Exponent* from 1984 through 1986. The strip’s title, “Loco Motives,” Peterson says, was a double entendre of Purdue’s Boilermaker train heritage and the crazy life of college students.

Populated by characters reacting to the politics and social climate of Purdue in the mid-1980s, the strip now seems like a time capsule to Peterson. “When I look back and read those cartoon strips now, they read like a history of what went on during that era of Purdue,” he says.

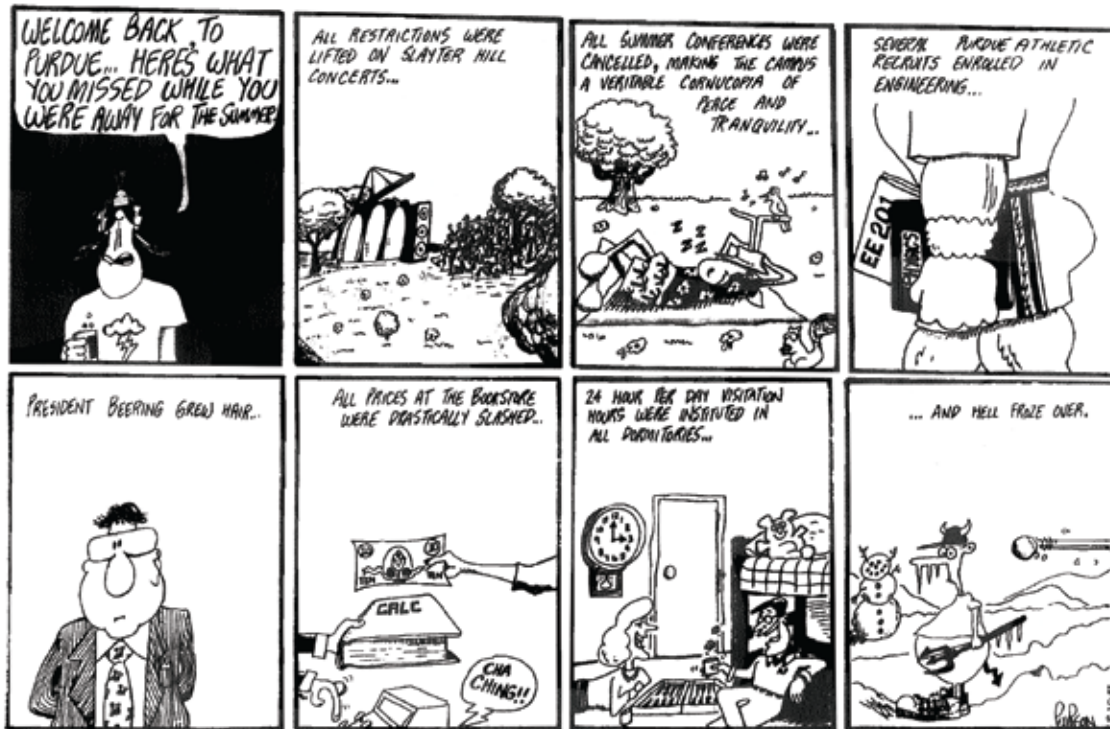
And the mid-’80s were rife for campus satire. “There was a football game where people started lighting toilet paper on fire,” Peterson recalls, “and Bobby Knight’s chair-throwing incident when a Purdue basketball player was taking a foul shot. It ended up being like an editorial cartoon. President Steven Beering even became one of my characters.

“It was wonderful to have a chance to fail,” says Peterson, whose childhood hero was “Peanuts” creator Charles Schulz. “I got to try a lot of different things and see what worked and what didn’t. I got instant feedback every day. Charlie Chaplin had the wonderful opportunity to fail and experiment with his comedy in Vaudeville with a live audience — approving or disapproving — long before he made his first movies. In the same way, I got to practice each day, and the feedback helped me define my voice, which I use in story and script decisions today.”



## LOCO MOTIVES

by BOB PETERSON



Back-to-School Special: Peterson's *Exponent* campus comic strip from Aug. 26, 1985.

Peterson spends most of his days now writing on a laptop, thinking about story beats, about the dialogue of characters. But he is perhaps proudest of an opening montage from “Up”, where nearly the entire lives of two characters (eventual husband and wife) pass on the screen without dialogue.

“There’s not a word said, but you follow the entire life of Carl and his wife together,” says Peterson. “At Pixar we strive to never talk down to kids or up to adults. We simply create a story that makes us, as people, laugh or get emotional. We’re just following our own muses. We’re adults, but we’ve really cultivated our childlike sides.”

And even though now he’s part of what the Pixar team calls the creative brain trust, guiding scripts and reviewing films in progress, Peterson’s job in the director’s chair keeps him in constant contact with the technical side of animation creation: modeling, lighting and research for topics that support animation, such as organic-object creations like clouds, animal fur, and water.

## Engineering Creativity

The creative clout Peterson has earned at Pixar and within the animation world has made him a spokesman for the industry. He’s been invited back to Ohio Northern University and he’ll be part of Purdue’s Old Masters program in November, where his message continues to be about combining vocations with avocations.

“I knew engineering was a great springboard into a lot of different professions. At one point I was thinking of designing toys for Mattel,” says Peterson, who believes engineering, on any front, is a very creative endeavor. “It’s taking science and applying it in creative ways. And whether that specifically means artistic creativity or creative problem solving, there’s always some creative component in engineering.”


By connecting the artistic and engineering sides, Peterson has become what Pixar colleagues like Jonas Rivera liken to a five-tool player in baseball. “Bob is one of the jewels of the studio,” says Rivera, producer of “Up.” “He’s a great writer, great actor, great artist, great draftsman, and a

great director. I can’t help but think that Bob’s background in engineering has helped him settle easily into the filmmaking process of computer graphics and animation, which contain many technical components. He has an understanding of the other side of the building so to speak.”

He’s funny, too. “One of the funniest guys I’ve ever known,” Rivera contends, “effortlessly funny. I used to look forward to all the story meetings, or even the budget meetings, because Bob would just make them cool. He’s good natured and smart.”

So maybe nice guys do get to finish first once in awhile, and even get to take their wives to the red carpet at the Oscars, which Peterson describes as surreal. “To stand among the actors and filmmakers that inspired you to be in film,” he says, “you just wonder how you got there. It was all very magical.”

Perhaps reminiscent of the Disney movie magic Peterson enjoyed in his youth. Maybe magic sprung from hard work, good timing, and a desperate desire to create something better for the world. Maybe something almost — but not quite — beyond an engineer’s wildest dreams. ■



**Music Man:** As part of a performance, here with the Lafayette Symphony Orchestra, or practicing alone (inset), Professor Galen King uses music to soothe his soul.

## Zen and the Art of Engineering

For Galen King, the line between the arts and engineering isn't blurred — it's nonexistent

Galen King, professor of mechanical engineering, would like you to leave your stereotypes at the door. The ones that say engineers predominantly use the left hemisphere of their brains while artists dwell almost exclusively on the right side. The ones that insist that if you're hardwired to calculate limits and wield differential equations, then you're precluded from creative pursuits like painting, drawing, writing, or playing an instrument.

Instead, King offers a simple yet powerful message: We're all human, and it's in our very nature to create. And the energy that goes into composing a symphony or painting a portrait isn't so different from what it takes to design a suspension bridge, an earthquake-resistant skyscraper, or a solar panel array.

"I think there's very little creative difference in the flavor of doing things with the performing or visual arts and the design process involved in engineering," King says. "Both are driven by very human needs, driven by aesthetics, driven by the desire of the individual to create something that's pleasing to themselves and others.

"In both cases, there's a great deal of expertise needed to master the technique. But when you get to the point that you have mastered the technique, the difference between it being music and just a bunch of notes you're playing is the spark of divine that comes from inside the performer. The same is true on the engineering side. Anyone can apply a set of rules, a set of equations, but the difference between it being aesthetically elegant and simply functional is based on that same spark. The only difference lies in the tools you have to work with."

Since his childhood, King has found his creative outlet in music. Although he currently spends most of his time playing the bassoon and contrabassoon — through various



engagements with the Lafayette Symphony Orchestra and the Lafayette Citizens Band — he's dabbled throughout his life with everything from cello and saxophone to a self-built harpsichord.

He explains his fascination with the bassoon from an engineering standpoint. "I like the bassoon the best because it's the most primitive of instruments," he says. "And there's the aspect that you have to make your own reeds. So there's actual engineering involved in making the device sound the way you want it to sound. It's really quite fascinating to first build and then use this very complex double reed."

Even though music was his first love, King admits that engineering is a more consistent way to pay the bills. "I consider music more of an avocation than a vocation," he says. "But it's incredibly important for my mental health. I've always had the gift of math and science. I used to joke in college that I'd enroll in extra math and chemistry courses to raise my GPA, but it's the music that keeps me balanced and enables me to be a better engineer, a better professor, a better person, really."

King also takes pride in his advisory role with Purdue's Solar Racing Team. The team's most recent accolades — to add to a long list — are first place in the solar power category and the People's Choice Award in the Shell Eco-marathon Americas, held in Houston in March. The team's car, the Pulsar, achieved the equivalent of 4,548 miles per gallon.

"I'm very serious about my role as advisor," King says. "The students do it all — they're an incredibly bright and talented group, and they don't much need my help. I advise.

"We're all sculptors. We use different tools, different chisels. But fundamentally, we're all humanistic. We're all trying to contribute something to this world. When it comes down to it, we're all very much the same." ■ Patrick Kelly

## My Engineering Muse

**Room with a View:**  
Rendering of the  
auditorium at the Grand  
Rapids Art Museum.

### ME alum combines acoustical ear with engineering expertise

Before my time at Purdue, I was the quintessential high school choir geek. Solo and ensemble competitions, theater performances, and choir concerts were always on the calendar. The only problem: I was also pretty good at math; I had the whole left-brain/right-brain thing going on. So as high school ended and college neared, I pursued a degree that would allow me to use both my math and art skills — acoustical consulting.

While completing my undergraduate studies in mechanical engineering, I began interning at a small acoustical consulting firm in Grand Rapids, Michigan. The job was great. We used high-tech noise meters and sophisticated software to measure acoustics in buildings, which satisfied my left-brain math fix, and we worked closely with architects (many of whom consider themselves artists at heart) to design acoustical improvements and finishes that fit a space's aesthetic, which fulfilled my right-brain needs.

When you're a left/right-brained person, you need balance: math and art, schedule and flexibility. To me, the balance was found in acoustical

consulting. That meant Purdue University was the right place for me. I completed my master's in mechanical engineering acoustics from Purdue in 1991 and have been working in the field ever since. In 2001, I returned to Grand Rapids and bought the company I interned at and renamed it Acoustics By Design. Now we are one of the largest acoustical consulting firms in the Midwest, offering acoustical engineering and audiovisual design services for everything from auditoriums and schools to hospitals and churches. And in each project, I get to do what I love.

A good example of this would be the Grand Rapids Art Museum, the world's first LEED Gold Certified art museum. Achieving the LEED Gold level of certification means it's designed with state-of-the-art energy efficiency and environmental awareness. Low water use, natural day-lighting, and optimized acoustics give the building longevity and sustainability.

Acoustics By Design provided acoustical engineering and audiovisual systems design for the galleries and the auditorium. We worked closely with Design Plus, the Grand Rapids Art Museum, and wHY Architecture out of

Los Angeles to seamlessly integrate the acoustical materials into the restrained minimalistic architecture. The museum has a lot of concrete and reflective surfaces, so it was full of acoustical challenges. One of the solutions was a European product called BASWaphon, which looks like drywall, but is really a sound-absorbing material.

Another challenge was the auditorium, which was designed to host everything from live music and film festivals to banquets and presentations. Our audiovisual designers developed a technical system that was flexible enough for the multiple uses, yet user-friendly enough for the museum staff to operate with ease.

As an independent acoustical consulting firm, our job is to represent the needs of the client throughout the entire project, ensuring that when everything is said and done, they end up with a fantastic sounding and looking space. And by all accounts, the Grand Rapids Art Museum is just that.

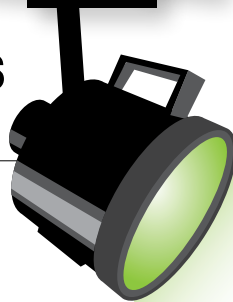
■ **Kenric Van Wyk**  
(MSME '91), president  
of Acoustics By Design





## Among Us

How creativity and technical know-how coexist within mechanical engineering students



Just making your way through a fluid dynamics test could define you as a mechanical engineering student. Though such Purdue students come with a variety of identifying characteristics. They pursue research in diverse fields from the traditional (motors, gears, and such) to the near fantastical (mechanical animals, space travel, and so forth). But among them also are the actors, craftsmen, and musicians who bring art into the world — in addition to their engineering ambitions. To follow: an actress, a jewelry maker, and a couple of drummers from Purdue’s “All-American” Marching Band. All of them are mechanical engineering students connecting the arts with engineering.

### Being Beneatha

Early in 2010, Ashley McElroy, now a junior in mechanical engineering, stood beneath Civic Theater spotlights in front of an intimate crowd in downtown Lafayette. She projected her voice in a way she never imagined she could, delivering long diatribes about what it means to be a young black woman in America (circa 1950), her desires to attend medical school, and who to choose between a pair of male suitors. After nearly 15 years of performing as a musician — usually within the confines of an orchestra pit — McElroy made her acting debut in the role of Beneatha in the Civic production of “A Raisin in the Sun.”



**Student Actress:** Ashley McElroy in the classroom and on stage. (Above photo by Vincent Walter)



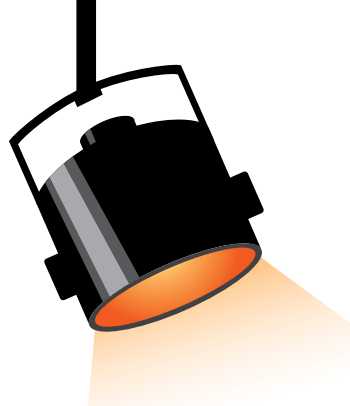
“When my family came to see it, they said I was playing myself,” says McElroy with a laugh, referring to the academic drive, strong opinions, and the sometimes changing mind she shares with the character she played.

Since grade school, music captured much of McElroy’s attention. Growing up in Bloomington, Illinois, she played the cello in various symphonies, including the Chicago Youth Symphony. Oddly enough, two of her choices for college came down to West Lafayette and Bloomington, Indiana — to be a musical Hoosier or a Boilermaker engineer. The sheer practicality of engineering won out.

“But music will always be a part of my life,” McElroy says. “I will always be teaching someone else, or just playing.”

Though a bit nerve-racking, acting could be in the cards again, as well. Soft-spoken by nature, McElroy says the thespian experience proved to be a confidence booster. “You really have to put yourself on the line when you’re out on stage,” she says.

As mechanical engineering studies lead her toward a possible career in energy and sustainability, McElroy knows the same dedication and passion to the arts can lead her through the classroom challenges. And when it comes to presenting a senior design project, her performing skills once again may take center stage.



## Jewelry Mechanics

As someone who sculpted in bronze castings throughout his high school days back in Oregon, Matt Prowant (BSME '10) was looking for a new artistic outlet to supplement his mechanical engineering studies. "I wanted to learn a similar, but new, trade," he says.

His solution: three years of classes in jewelry making in the metal studios of Yue-Kong Pao Hall. There, he spent much of his free time applying a torch to creations that would become a collection of various rings, necklaces, and mechanical "bracelets. But the artist to engineer leap (and the balance of the two) wasn't as difficult as one might suspect.

"The two disciplines actually tie together a decent amount," says Prowant, who began a job at the Department of Energy in June. "I was able to help some of the other students design certain clasps and latches. I also used engineering and problem-solving methods to design jewelry."

One such problem-solver came when it was time to present initial ideas for pieces to one of his teachers. When she was unable to visualize his intentions for a particular design, Prowant used AutoCad to show a design in three dimensions that could not be easily explained, or even represented in a simple sketch.

With his new nine-to-five routine, Prowant focuses on ultrasonic emissions for the Department of Energy in Richland, Washington. He's specifically analyzing and improving current technology used for measuring weld-line cracks for better and safer operation of reactor water pipes. But he has no plans to leave the kiln and his artistic ambitions behind him.

For Prowant, who also plans on revisiting bronze sculptures in an old friend's barn back in Oregon, the hands-on stress reliever with direct ties to the mechanical arts will always complement his engineering mind.

## Precision Timing

Back in the day, Purdue students had to choose between ROTC and the marching band. The fife-or-rifle option ensured an extracurricular activity that would add to already busy schedules. These days, many engineering students just attend to the task at hand — the challenging coursework. A surprising number of engineering students, however, balance their studies with roles in Purdue's "All-American" Marching Band. And this fall, eight mechanical engineering students took to the football field on the drum line.



**Handyman:** Matt Prowant at work in a design lab of Pao Hall of Visual and Performing Arts. (Photo by Mark Simons)

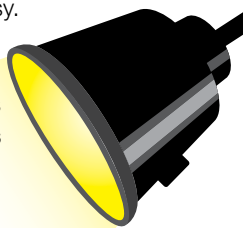
For two of those drummers, both leaders within the band, the hands-on nature of mechanical engineering relates well to the musicianship of drumming. "It might have to do with keeping things in motion," says Brian Leathers, a senior from Granger, Indiana, who is the tenor drum segment and the overall drum line section leader. "Percussion is also that main pulse behind the music. You can liken it to mechanical engineering as the engine that powers the music."

Like the engine composed of many moving parts working together, all four sections of the drum line (snare drums, tenor drums, bass drums, and cymbals) have to coordinate precisely to produce the best sound and cleanest rhythms, Leathers says.

Kevin Tsai, a junior from Naperville, Illinois, and the assistant leader for the snare drum section, says math could be the link between music and mechanical engineering. "The approach, especially for the snare drum," he says, "is very precise and mathematical. You may have to play something exactly twice as fast, so that timing becomes important."

Even Tsai's interest in sound engineering and acoustics echoes with his drumming passion. And while engineering may pay the bills, music will remain more than a hobby throughout his life. He played in a touring, professional drum corps last summer and says he learns more about music anytime he teaches someone else.

As far as timing when it comes to balancing marching band demands with mechanical engineering studies, both these drummers will tell you they are more focused when busy. "It forces you to manage your time better, which is helpful later on," says Leathers, who hopes to keep his percussion outlets open with his professional sights set on turbine or airplane engines. ■ **William Meiners**



**ME Drummers:** Mechanical engineering students (left to right) Brian Leathers, Blaine Kubit, Kevin Tsai, and Adam Pierce help keep the beat as part of Purdue's "All-American" Marching Band.

## Woodworker

ME alum turns artistic passion into full-time profession

If you live in Lafayette, Indiana, and both of your parents attended Purdue, your Boilermaker blood runs deep. That's the case with Dan Bollock (BSME '87), who grew up an avid Purdue football and basketball fan.

When he enrolled at the University himself, mechanical engineering was an ideal match for his skills. "Being strong in math and science in school, engineering seemed like a good fit. I liked the challenge of problem solving," he says.

It also started him on the path toward becoming an accomplished woodworker and artist.

Bollock worked for Wabash National after graduating from Purdue, designing semi trailers. As his 14 years with the company progressed, he found the work less challenging than he desired. Seeking the flexibility to explore his creativity, Bollock took up woodworking on the side. Then when the semi-trailer industry hit a downturn and he lost his engineering position, he decided, "I'm going to design and make furniture myself."

He saw a connection between engineering and woodworking. "Engineering is a lot of geometry and math. It's problem solving, which is what I do now a lot. You have to have methodology to solve problems visually, being able to see pieces and how they should fit together."

A self-employed artist, he draws furniture plans, makes the pieces and puts them in stores. The resulting direct sales represent half of his work; the other half he attributes to commissioned work. For the past five years, Bollock has displayed his pieces at the Artists' Own art co-op in Lafayette.

Recently Bollock's education and artistry joined forces when two of his art pieces were added to Purdue Engineering's Neil Armstrong Hall. Dean Leah Jamieson had contacted Artists' Own, seeking original artwork to display in the hall, and Bollock sketched two wall sculptures ultimately selected — one added to the dean's personal office and the other displayed in the office's large conference room. And across campus, visitors to Purdue's Hicks Undergraduate Library will find high-end cabinets he created that display letters and paraphernalia from Purdue astronauts.

Rich in detail, Bollock's additional artwork includes boxes, bowls and kitchenware. To create his pieces, he primarily uses Indiana lumber, often from trees he felled. "I'm a one-man show, really," he says.

At home, however, his team includes his wife, Sarah, and two young daughters, Maggie, 4, and Abby, 2.

**Backyard Builder:**  
Dan Bollock shapes a leg for one of his chairs.



Photo by Glenn Chang



Photo by Orie Shafer

## Picture This

*Photography provides creative outlet for this ME grad*

Alan Brockman (BSME '01, MSME '08) sees a connection between engineering and photography. For one, both require a substantial amount of spatial reasoning skills. Both also entail fitting together the pieces of a large technical puzzle. When taking photographs, for example, he must control the lighting, camera settings, poses and various photography equipment.

Yet it's the differences between the two professions that add a welcomed variety to Brockman's life. "I like photography because it's different than engineering. It's an aesthetic creative outlet," he says. "This allows me to explore a different part of me."

The owner of Brockman Photography, he spends much of his time photographing people. This includes taking portfolio pictures for models, producing promotional shots for musical bands, as well as taking portraits for such individuals as race car driver Martin Plowman. Shots Brockman took of the Firestone Indy Lights racer are used by Plowman's management team to position the driver for sponsorships and to build his public identity. "I'm helping to market these people through image," Brockman notes.

The engineer/photographer currently lives in Ann Arbor, Michigan, and works in nearby Grass Lake, developing emission control equipment for diesel locomotives. To explore more of Brockman's photographic talents, visit [www.alanbrockman.com](http://www.alanbrockman.com).

### ■ Matt Schnepf

**Vintage Design:** Jessica Snell, a 2006 Purdue graduate from consumer sciences and retailing, who created the Rockin' B Clothing fashion line.



**Speed Racer:** Martin Plowman, a professional race car driver in the Indy Lights circuit.



**Visual Thinker:** Self-portrait of the photographer, Alan Brockman.

*"I like photography because it's different than engineering. It's an aesthetic creative outlet."*

— ALAN BROCKMAN  
(BSME '01, MSME '08)



## Facts and Friction

The newly named Cummins Professor of Mechanical Engineering gets creative

From camshafts to pistons to ball bearings, something is always rubbing something else — often the wrong way. Farshid Sadeghi, recently named Cummins Professor of Mechanical Engineering, faces friction on a daily basis as the director of the Mechanical Engineering Tribology Laboratory (METL), and it sparks his creativity.

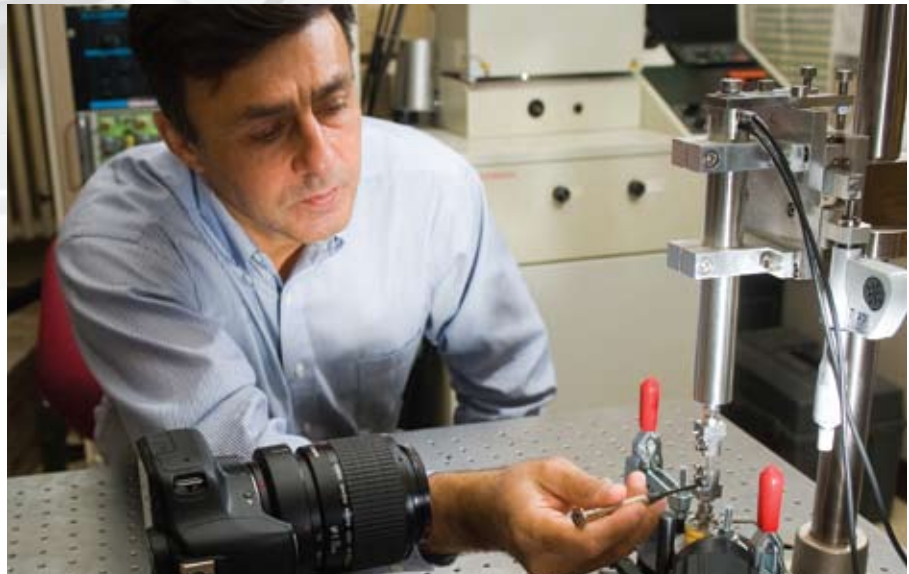
“One of the issues we are working on is to try and measure friction,” Sadeghi says. “It’s a very difficult parameter to determine.”

Sadeghi brings an innovative approach to traditional tribology through his work with micro-electrical-mechanical sensors (MEMS). Sadeghi uses remote MEM sensors to measure temperature — the byproduct of friction. Where there is friction, there is heat.

This indirect method for quantifying friction is especially interesting to manufacturers of bearings, who want to analyze the ball-cage temperature and impact forces. Sadeghi and his METL researchers are able to learn about bearing performance by measuring how hot the cage gets. Because they can’t attach wires to the cage, they have developed a wireless sensor.

“The cage is significantly higher in temperature than the surroundings,” Sadeghi says, corroborating the analytical work carried out by industry researchers. His inventive and elegant approach has caught the attention of governmental and aeronautical groups at the Department of Defense, the Naval Air Systems Command, Raytheon, and Rolls-Royce, and this summer he presented his findings at meetings in Germany and the Netherlands.

MEMS sensors have been proposed to be used on satellites as well, where two bearings support a “flywheel” that stabilizes the satellite’s orbit. When the



**Camera Ready:** Professor Farshid Sadeghi tweaks the instruments in his MEMS research. (Photo by Mark Simons)

bearings go bad, the satellite wobbles out of orbit. The MEMS sensors can detect temperature changes indicative of trouble before the bearings fail. With this warning, a second “backup” flywheel, also referred to as an attitude control wheel, can be brought online, and the vulnerable one can be disabled gradually.

Soon Marine helicopters will be equipped with MEMS sensors in their tail rotors. The shaft of the rotor is supported by a number of bearings that are replaced on a routine maintenance schedule, whether they need replacing or not. This represents a significant cost — tens of millions of dollars per year according to Sadeghi. He has developed a test procedure to predict bearing failure, where again, a temperature increase signals an anomaly.

“Hopefully this technology will provide the details they require to replace bearings on a need rather than a time basis,” Sadeghi says.

Beyond the MEMS sensors, Sadeghi is also excited about new research in the realm of rolling contact fatigue, a factor always considered with any kind of rotating machinery. He has begun to look at materials’ microstructure — the “topology” of materials’ grains.

“If fatigue occurs on the microscopic level, why not look at the micron-level geometry and see what is happening?” Sadeghi asks. “Is there any correlation between that level and the rolling contact fatigue?”

The answer seems to be yes. “One of the amazing things is that the results we have obtained are in such close agreement with experimental results by other parties,” Sadeghi says.

Sadeghi says he is most excited about the interdisciplinary nature of tribology. Not restricted to just one area of mechanical engineering, tribology offers overlaps with disciplines like fluid and solid mechanics, heat transfer, and material science. “Together we build ideas, develop them, and try to make significant impacts.”

■ **Gina Vozenilek**



**Hawks' Eye:** Keith Hawks, professor and assistant head of mechanical engineering, before the rising wing of the Mechanical Engineering Building. (Photo by Andrew Hancock)

## A Dream Becomes Reality

Gatewood Wing on schedule to open in 2011

When Keith Hawks (BSME '64, MSME '66, PhD '69) was a Purdue mechanical engineering student 50 years ago, administrators dreamed of adding a wing to the school's building. Now, a doctoral degree and long tenure on the engineering faculty later, he is preparing to retire. And as he does so, the School of Mechanical Engineering will at long last get its wing.

The Roger B. Gatewood Wing, now under construction, is slated to open for classes in the fall of 2011. Hawks, assistant school head, has been on board with the project since its inception in 1999 when he became chair of the planning committee. In that role, he drove the project from the initial academic program statement of need through the design phase with the architect and on to details including a personal touch in the atrium area. He has seen the project move from dream to reality as excavation gave way to a steel-beam skeleton and by this fall had risen to its full height.

"If you go back to the original plan for the campus in the 1920s or 30s," Hawks says, "you can see there were plans for a final wing for the ME building. Over the years, we have helped alleviate space needs by adding Zucrow and Herrick Laboratories, and Kepner on the east side of Lafayette. Those have taken the pressure off, but we are limited by space."

At 50,000 square feet, the new three-story wing — the first

LEED-certified Purdue building constructed to environmental standards set by the U.S. Green Building Council — will almost double the school's space. It will hold offices for faculty and graduate students, as well as much needed design and fabrication space for student projects and a biomechanics laboratory. Senior projects are now shoehorned in wherever there is space; they are built in hallways or tested at the football stadium. The new facility will include a 120-seat classroom and a large project instruction room. An abundance of flat screen panels will allow the use of cameras to record what is happening in one space and project it to another room or over the Internet.

Hawks, a history buff, is especially pleased that the new wing will contain a special element relating to the school's historic ties with the railroad industry. Metal spacers in the floor along the south wall of the atrium will outline a railroad track. A time capsule containing objects related to the school's history will also find a home in the new wing, sealed into a wall by the entrance during the building dedication in 2011.

"When I first came to Purdue as a student, I heard older faculty planning the wing," Hawks says. "I've been involved in the planning for so long now that I feel like it's mine. It's exciting." ■ **Linda Thomas Terhune**

# I AM A MAKER.

I THINK WORK SHOULD BE ABOUT MAKING THINGS WORK.  
BETTER. FASTER. SMALLER. SMARTER. SO I BUILD BRIDGES  
BETWEEN WHAT'S KNOWN AND WHAT'S NOT. I TINKER. I TOIL.  
I WRITE POETICALLY IN AN ABUNDANCE OF LANGUAGES  
(INCLUDING CODE). I HACK. I DISSECT. I HAVE AN INSATIABLE  
DESIRE TO UN-COMPLICATE THE COMPLICATED. I AM  
EASILY INSPIRED. I BELIEVE THAT JUST BECAUSE IT HASN'T  
BEEN THOUGHT OF DOESN'T MEAN IT WON'T BE. POTENTIAL IS  
MY THRILL RIDE. IMAGINATION IS MY MOST-USED TOOL.  
I AM A MAKER. AND I AM WHAT MOVES THE WORLD FORWARD.

**WE ARE PURDUE.**

**MAKERS,  
ALL.**