Purdue's Windmill Men

Breaking ground with smart parts

PURDUE **MECHANICAL**

ENGINEERING IMPACT

FALL 2009

John 13
Bringing healthcare to market

Bike Across America
A student's two-wheeled adventure

Energy Saver
Through innovative design

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From Dan's Desk

Purdue is a land-grant university, and the mission of these institutions as set forth in the Morrill Act of 1862 was to "teach such branches of learning as are related to agriculture and the mechanic arts" as a response to the Industrial Revolution and changing social class. Today, we are in the midst of another revolution, a global economic one, and engineering is every bit as important in this revolution as it was nearly 150 years ago.

Engineering has fueled the prosperity of the United States since its founding, and the continued discovery of new knowledge is critical to maintaining a growing and prosperous economy in Indiana and the nation. Purdue's School of Mechanical Engineering continues to make substantial contributions to sustaining and growing that prosperity.

In addition to the economic impact made by the 350-400 world-class engineering graduates per year, our school also generates economic development in even more direct ways. Innovations by faculty and students in our labs have resulted in 27 currently active licenses and options, up from nine just five years ago. Many of these are being commercialized in the Purdue Research Park, spawning new jobs in alternative energy, assistive and Internet technologies, and food safety to name a few. School participation is extremely broad, with about 70 percent of our disclosures involving student inventors, and about 70 percent of our faculty involved in one or more inventions.

I hope you will go to our Web site at engineering.purdue.edu/ME and look at some of our faculty and students' recent contributions to economic development. I think you will be impressed with the range and potential impact of the research.

Finally, I must say I am sincerely grateful for the outstanding financial support we have received from the alumni and business communities that make it possible for us to be a world-renowned center for mechanical engineering research and education. We are working very hard to earn your continued loyalty.

Dan

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

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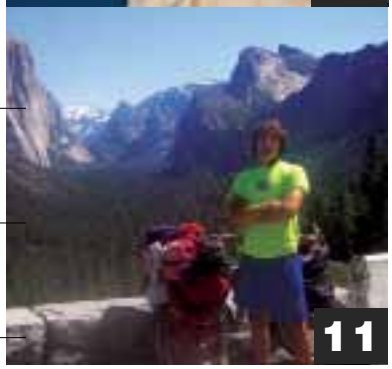

PURDUE UNIVERSITY
COLLEGE OF ENGINEERING

School of Mechanical Engineering

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Associate Heads....**James D. Jones, Anil K. Bajaj**
Assistant Head....**Keith H. Hawks**
Directors of Development....**John Sanderson, Laura Edwards**
Development Secretary....**Cynthia Dalton**
Director, Marketing and Communications....**Rwitti Roy**
Editor....**William Meiners**
Graphic Designer....**Kari Burns**
Contributing Writers....**Dan Howell, Linda Thomas-Terhune, Gina Vozenilek**
Copy Editor....**Dan Howell**

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Mechanical Engineering Impact
Attn: Cynthia Dalton
Purdue University
585 Purdue Mall
West Lafayette, IN 47907-2088
(765) 494-7320

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High Marks

News on a few of our award-winning faculty

Purdue mechanical engineering faculty and students continued to make a splash in 2009. The following represents a few of the many who have published, been honored, and won competitions. Congratulations to all.

Doug Adams, professor of mechanical engineering, was the recipient of the Society of Experimental Mechanics D. J. DeMichele Award, presented at the 27th International Modal Analysis Conference in February in Orlando, Florida. The commendation is for service and support in promoting science and educational aspects of modal analysis technology. Adams is now listed among a distinguished group of international leaders in the field of modal analysis.

Suresh Garimella, the R. Eugene and Susie E. Goodson Professor of Mechanical Engineering, along with graduate students Niru Kumari and Vaibhav Bahadur, had a paper selected by the *Journal of Micromechanics and Microengineering* to be among those showcased in its "Highlights of 2008." Articles chosen for this designation best represented the high quality and breadth of the contributions published in the journal over the past year.

Tim Fisher, professor of mechanical engineering, was selected to be among the latest group of University Faculty Scholars from the College of Engineering (CoE). Associate and full professors who have been tenured within the last five years receive this distinction in recognition of their scholarship. They are nominated through their academic areas, selected by a committee of CoE named and distinguished professors, and approved by the provost. They also receive additional funding to support their research. The program was created in 1998.

Charles Krousgrill, professor of mechanical engineering and the academic director for Engineering Professional Education, was the 2009 recipient of the Class of 1922 Helping Students Learn Award. Recognized for his innovative work entitled "For the Implementation and Evaluation of HigherEd 2.0 to Enable Asynchronous Student Interaction and Peer Support," Krousgrill was honored at the University Honors Convocation in April.

Isaam Mudawar, professor of mechanical engineering, and graduate students Robert Nacke and Brittany Northcutt, received a Rolls-Royce Milestone Award for their design of a new air-to-fuel heat exchanger for high Mach turbine engines. The researchers were honored by Rolls-Royce North American Technologies Inc.'s Liberty Works in February. The Purdue project is part of the university's Rolls-Royce University Technology Center in High Mach Propulsion.

Jeffrey Rhoads, assistant professor of mechanical engineering, received a CAREER Award from the National Science Foundation. His project, "Exploiting Collective Behaviors in Coupled Micro- and Nanosystems," involves studying the unique properties of large arrays of micro- and nano-mechanical resonators for use as filters for electrical signals, ultra-sensitive mass and force detectors, and mechanical electrometers and magnetometers.

Purdue student team wins solar-car division at 'Eco-Marathon'

A team of Purdue students won the solar-car category of an international competition for ultra fuel-efficient vehicles, achieving the equivalent of 4,913 miles per gallon, the most ever recorded at the event.

Purdue Solar Racing, an extracurricular club of students from disciplines ranging from engineering to business administration, received a $2,500 prize. It was the second consecutive year Purdue's team won the solar category in the Shell Eco-Marathon Americas, held in April in California.

The Purdue car, called Pulsar, cost about $75,000 to build last year and another $11,000 this year to modify. Major sponsors of the project are Lockheed Martin Corp. and Exelon Corp.

"The most important aspect of this project is its multidisciplinary nature. It's real engineering in that sense," says Galen King, professor of mechanical engineering and an advisor to the group. "It has included students all the way from electrical engineering to liberal arts. In other words, people from outside the geek arena."

Project teams ranged from groups focusing on the carbon-fiber body, braking and suspension systems, as well as critical business, marketing, and fundraising functions. More than 50 students, mostly undergraduates, participate in the project.

"It provides better experience than you can get in the classroom, in the sense that you can see the project go from conception to an actual finished product," says Ted Pesyna, a junior in mechanical engineering and this year's Purdue Solar Racing president.

Ted Pesyna, a junior in mechanical engineering, sits in Pulsar, a solar car.

Most of the car's body is covered with panels containing photovoltaic cells, which convert sunlight to electricity to power a motor. The three-wheel vehicle weighs 170 pounds and has a top speed of 25 mph. Cars in the contest drove 10.5 miles on a racetrack in Fontana, California.

A mathematical calculation is used to convert the car's electricity consumption to miles per gallon of gasoline. Last year's Pulsar achieved 2,861.8 miles per gallon at the competition.

The students plan to enter the 2010 Eco-Marathon, but in a more challenging, "urban concept" category, which requires that cars be street-legal. ■ **Emil Venere**

The Power of *WIND*

Engineers work to increase the role of wind in the nation's energy portfolio

By Gina Vozenilek

Photos by Andy Hancock

Wind Engineers: (from left) Doug Adams, professor of mechanical engineering, Sanford Fleeter, the McAllister Distinguished Professor of Mechanical Engineering, Brandon Ennis (MSME '09) and Jonathan White (PhD '09) at the Benton County Wind Farm in Fowler, Indiana.

Twenty years from now, the nation will be deriving 20 percent of its national electrical supply from wind energy. That's not a lot of hot air; it's a goal established by a report from the U.S. Department of Energy that looks to wind as a major component in the evolution of a greener, more sustainable energy portfolio. Bringing technology up to speed with this need for workable wind power is a tall order, but it is achievable, according to Douglas Adams, professor of mechanical engineering. "Whenever we try to take a technology and rapidly advance it, that's a challenge," he says, "but that's what makes wind power so interesting. It's one of engineering's 'grand' challenges."

continued on next page >

Why Wind?

The benefits of tapping the power of the wind are numerous. Approximately 40 percent of total U.S. CO_2 emissions come from power generation facilities. Since substantial amounts of coal and natural gas fuels would be displaced by a 20 percent wind scenario, CO_2 emissions in 2030 could be reduced by 825 million metric tons. Wind power saves water, too, by not using any of it in the generation of power. Unlike the water-thirsty processes of fossil-fuel and nuclear energy generation, generating 20 percent of U.S. electricity from wind would reduce water consumption in the electric sector in 2030 by 17 percent.

And then there is the economic impact. The US Department of Energy report entitled *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply* finds that, during the decade preceding 2030, the U.S. wind industry could:

- support roughly 500,000 jobs in the U.S., with an annual average of more than 150,000 workers directly employed by the wind industry.
- support more than 100,000 jobs in associated industries (accounting, law, steel work, and electrical manufacturing)
- support more than 200,000 jobs through economic expansion based on local spending.
- increase annual property tax revenues to more than $1.5 billion by 2030.
- increase annual payments to rural landowners to more than $600 million in 2030.

Read more about the report and wind power at: http://www.20percentwind.org/default.aspx.

Adams' colleague Sanford Fleeter, the McAllister Distinguished Professor of Mechanical Engineering, is an expert in gas turbine engines. He became interested in wind power not just because he thought he could "really make a contribution" to the rapidly advancing science, but also because he recognized its commercial potential.

"When I looked at wind power, I saw a growing business," Fleeter says. "With energy costs going up, wind power is not only a green alternative."

But it also makes sense economically, since it is not subject to supply-and-demand fluctuations of the marketplace. Fleeter notes that "when you put in a wind farm, you know what the power from that farm will cost in 20 years."

Fleeter estimates that as he was entering the wind power arena about five years ago, 1,500 people attended the Windpower Conference and Exhibition. Two years ago, that number was up to 7,000. This year, 15,000 attendees and 1,200 exhibitors gathered for the meeting in the Windy City. A paper Adams co-authored with his graduate student Jonathan White was presented at the Chicago meeting, where "unbelievable attendance" excited Adams and his colleagues. It seems the winds of change are indeed blowing in energy innovation.

Better understanding, better design

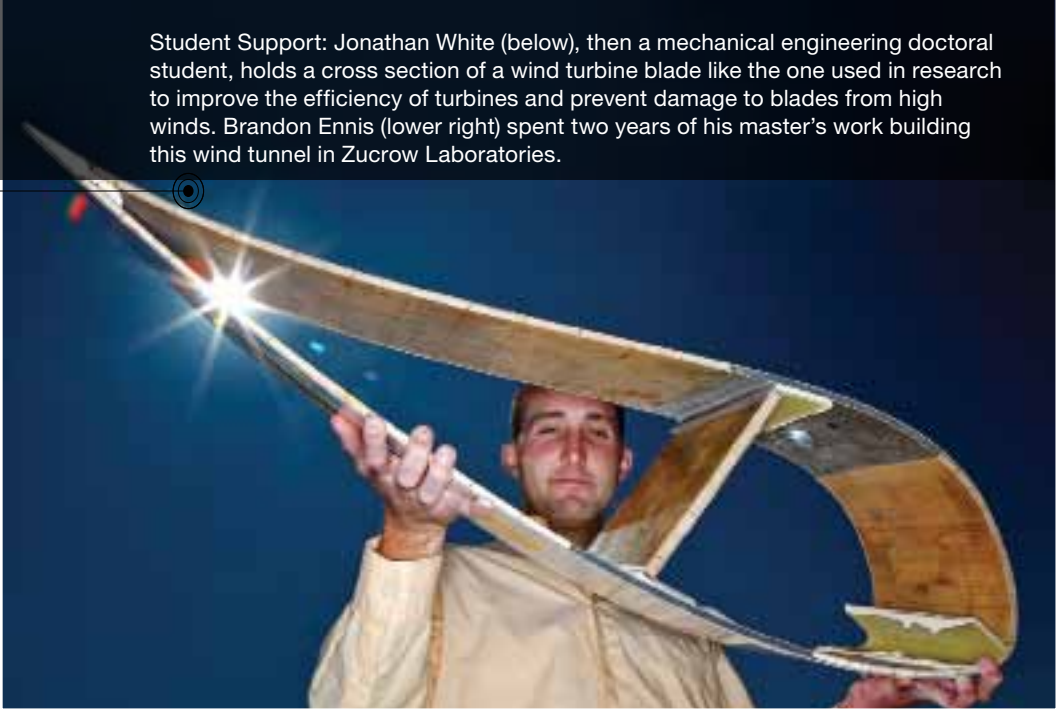
Right now wind provides about 2 percent of the national energy supply. Adams admits there is risk in rushing to ramp up wind power capacity. "We've got a functioning technology," he says, "but how do we get to 20 percent? Not by installing turbines that sometimes suffer reliability setbacks in the variable wind corridor of the American Midwest."

To achieve the ambitious goal of 20 percent wind power by 2030, engineers like Adams and Fleeter are analyzing the things that can go wrong and figuring out a way to predict and manage problems with the wind turbines and all their various parts.

What can go wrong? Adams, who hates to see a wind farm with its towers at a standstill has a list of potential problems for engineers to study and design around. That list includes a leak in the hydraulic seal of the pitch actuator, structural failure of the blade itself, which could arise from rare but catastrophic cracks in the blade, failed bearings in the drive train, shafts that become misaligned, which in turn can have a negative effect on the gear box, whose meshing gears can either lose energy or crack, damaged dampers, a faulty generator—even hail and lightning present a threat. These turbine assemblies are sometimes 200 feet off the ground, and Adams notes that when a turbine "goes down" it can take several thousand dollars to rent a crane and make the repairs, not to mention the loss in productivity.

Fleeter has constructed a model wind turbine facility at Purdue to study fatigue failure and other issues that arise from the dynamics of the turbine. He quantifies the interactions between the tower and the rotor in a wind tunnel. Because the rotors have three blades that are revolving past a columnar tower, they create a three-beat impulse that affects operational reliability. These vibrations, plus phenomena like acoustic noise from the blade tips, are factors that need to be accounted for. "We're trying to understand and monitor these vibrations, and hopefully become

Student Support: Jonathan White (below), then a mechanical engineering doctoral student, holds a cross section of a wind turbine blade like the one used in research to improve the efficiency of turbines and prevent damage to blades from high winds. Brandon Ennis (lower right) spent two years of his master's work building this wind tunnel in Zucrow Laboratories.



able to control them," he says.

Adams wants the turbines to be able to "speak" for themselves, so to speak. "We need enough intelligence on board to manage the turbine's reliability," he says.

So Adams is working with Sandia National Laboratories to design "smarter" turbines that can quantify both static (centripetal) and dynamic (fluctuating wind) loads on the blades. They use a capacitive accelerometer to measure acceleration directly related to force, something earlier sensors have not been able to do.

"The aim is to operate the generator and the turbine in the most efficient way, but this is difficult because wind speeds fluctuate," Adams explains. "You want to be able to control the generator or the pitch of the blades to optimize energy capture by reducing forces on the components in the wind turbine during excessively high winds and increase the loads during low winds. In addition to improving efficiency, this should help improve reliability."

Deciding where to build a wind farm is a big decision for a developer. The first step after a potential site has been identified is to erect an anenometer tower to collect wind data for one year before going ahead with construction. These calculations often overestimate the potential wind power generation at a site, says Fleeter, because they do not accurately account for the turbines that stand in the "wake" of other turbines. Fleeter is working to quantify the effects of this interaction of the turbines with the "atmospheric boundary layer" of the wind as it moves through the farm. Identifying and understanding subtle factors like these will help developers move forward on construction with a greater degree of confidence.

The next wave in wind

Fleeter sees a great interest in wind power among his students at Purdue. In the fall 2008, he offered a senior/graduate course in wind energy, expecting six students. Three times that many signed up. He and his students also became involved in a senior design project: a self-starting vertical wind turbine. "In the space of one semester the students designed, built, and ran it. It worked," says Fleeter proudly. "I thought it was pretty amazing." Several of those students have gone on to work for wind turbine companies.

Fleeter also worked with an Engineering Projects in Community Service (EPICS) group to do a feasibility study to put a small wind turbine on Purdue's campus, with incoming students wanting to continue this EPICS project and actually get one installed. "There are definitely opportunities for engineers in wind power," Fleeter says.

Adams is equally optimistic about wind power as a promising professional field. "Boilermakers will be in leadership roles in the green economy," he says, "and wind energy stands to offer plenty of jobs." From manufacturing to wind farm management to retrofitting existing wind farms with new technologies to quality control and beyond, the new wind power industry will make rewarding careers for many engineers. "And we're not working on the fringe, with obscure technologies that will take decades to work," says Adams. "The core technology is very feasible in the near term." ■

Special thanks to Mr. Dale J. Budreau for allowing our our team to photograph the windmills on his land.

America's Need for Innovation

An engineering call to creativity and imagination

Tom and Sandra Malott with Purdue President France Córdova

Since graduating as a Purdue ME in 1962, I have witnessed the world "flatten" from both economic and cultural perspectives. Our nation now faces a far more challenging playing field than my generation did. Some even argue that America has lost its economic advantage. During the "good times," (1945 through the 1970s) many leaders got "a little fat, dumb, and happy," selling most anything they made. There was a euphoric feeling that Americans could do no wrong.

A wake-up call came in the 1970s with the first oil crisis. Consumers discovered that Japanese cars were not only economical, but also had quality plus innovative features. Global economic forces further increased through transportation, the Internet, television, and the American university system that attracts the best and brightest students from around the world. This helps build a more prosperous world, but the impact on the U.S. economy has been life-changing for many.

For the U.S. to regain its growth, we have to return to "Yankee ingenuity" or, in other words, win at innovating. Money flows to what customers perceive as value but even more so to "I gotta have one." Apple's iPhone is a great example. It has many features designed with "gotta have" esthetics. Even though it sells for twice as much as other smart phones, customers around the world stand in line to buy new releases. This is innovation!

Apple changed the game on its competitors. The only way for our country to regain its wealth is through innovation to society. Universities must graduate engineers ready to enter the workforce skilled in developing innovative solutions that change the global playing field.

Purdue has earned a reputation for graduating engineers who contribute greatly to economic growth through leadership in design, development, research, business management, education, the Armed Forces, and the space program. Our school fosters the innovative spirit. Beyond these design process principles, students learn creativity, teamwork, multidisciplinary engineering, prototype fabrication, and communication skills.

Globalization means that the competition for Purdue ME includes international universities. Because of this, we need to become more engaged with our school and its faculty by helping stimulate ideas and programs that will keep Purdue ME recognized globally as a premier institution. If we are not willing to step up to the plate to face these growing global challenges, we are at grave risk of allowing U.S. engineering to lose its leadership position to other countries. If this happens, it would be the proverbial "stake in the heart" of our future economic growth.

For these reasons my wife Sandra and I have funded two endowments for Mechanical Engineering. The first, a global initiative, gives students a true international engineering and cultural experience. This led to the establishment of the Global Engineering Alliance for Research and Education (GEARE). Through GEARE and other associated programs, the Purdue ME students' participation rate in international programs is four times that of other U.S. engineering schools, and is growing at a rate seven times faster. My wife and I could not be happier with the success the faculty has brought to this program.

However, learning to function in a global economy alone will not drive economic dominance. Inventive improvisation has led to most of the advances we have seen, created opportunities for personal advancement, and spurred American prosperity.

We feel so strongly about the need for our students to have innovative skills that our second endowment is aimed at fostering innovation through ME's design courses by having the teams' products judged for originality and inventiveness (a market), and by providing financial rewards to those teams with the most innovative concepts (economic reward).

After reading the article (next page) focusing on the most recent Innovative Awards Competition, I think you will agree that the Purdue ME legacy is in good hands. I also ask you to help our school further improve our leadership position in this changing world, by passing on ideas to the faculty and by giving whatever financial support your circumstances allow. ■ **Tom Malott (BSME 1962, HDR 2002)**

Real Engineering

Senior design teams display creativity, ingenuity in competition

"We need to get back to making stuff, based on real engineering." - Thomas Friedman

At Purdue, mechanical engineering students have long been taking Friedman's words to heart. In a late spring competition, a team that created a unique, working prosthetic leg—and showed off a very mobile 12-year-old boy to prove it—captured the school's top 2009 Innovation Award.

A seven-judge panel of experts chose Leg Up Design after eight teams made presentations in May. Teams advancing to the Innovation Awards were selected by mechanical engineering faculty from a field of 31 teams in "ME 463," the senior design class. Winning teams received cash prizes funded by the Thomas J. and Sandra H. Malott Fund for Innovation in Mechanical Engineering.

"I am proud of how the projects showed our students' ability to develop innovative solutions, which is a critical attribute for mechanical engineers of the 21st century," says Dan Hirleman, the William E. and Florence E. Perry Head of the school.

The winning team consisted of Brian Schoolcraft, Christie DeWert, Tommy Thigpen, David Armbrust, and Dan Gorsky. "It was totally worth it," says Schoolcraft, the team leader. "We put in a ton of time. The vision of seeing him wear it gave us extra motivation."

The boy's right leg, which was deformed at birth, led to amputation of his foot. By age 12, his right knee was four inches higher than the left, creating a hindrance to a typical prosthetic solution. Leg Up created an innovative solution to resolve the problem. Kevin Hagemeier, a professional prothetist from Indianapolis, worked with the team in

Judges and winning design team from the 2009 Innovation Awards

evaluation and casting, plus guidance in design and alignment. "The excitement came when the students started understanding the equipment and product," Hagemeier says. "That allowed them to work on the project with minimal assistance."

The team's task and solution are documented under "News" on our Web site: engineering.purdue.edu/ME.

"From doing the project, I learned more about manufacturing, carbon fiber, and 3-D design," DeWert says.

The team is donating its $1,500 prize to help cover the future expenses for the boy's next prosthetic device in a couple of years. The other top prize-winning projects and teams were: Second place ($1,200) – A wheelchair attachment that turns a standard chair into a powered one. It is relatively easy to attach and remove and is far less expensive than powered chairs currently on the market. Third place ($800) – Go Water, a barrel for use in developing countries that lies on its side and is pulled while devices being activated by each rotation filter the water inside. Fourth place ($400) – Windworks kite-board power generator flies a kite to generate electricity competing with today's wind turbines. ■ **Dan Howell**

Winning teams received cash prizes funded by the Thomas J. and Sandra H. Malott Fund for Innovation in Mechanical Engineering. Thomas Malott served as president and CEO of Siemens Energy & Automation. A member of the Purdue Foundation Board, he received the President's Council Pinnacle Award in 2008. He was recognized as an Outstanding Mechanical Engineer and a Distinguished Engineering Alumnus in 1991.

Pumping up the Economy

Innovative hydraulic drive systems save energy, cost


Vincent Walter

Monika Ivantysynova with Jonathan Baker (MSME '09) at the Maha Research Center

Imagine a huge excavator and its mighty engine moving tons of dirt. Now imagine filling its fuel tank. With the rising cost of diesel fuel, it's become a big concern for both operators and manufacturers. This is where Purdue researcher Monika Ivantysynova is making impact.

Ivantysynova, the Maha Fluid Power Systems Professor, with joint appointments in mechanical engineering and agricultural and biological engineering, is investigating advanced energy-saving hydraulic drive systems. Her work with displacement-controlled actuation has both environmental and economic implications, traditionally resulting in fuel savings around 25 percent. Ivantysynova's research team, however, achieved an astounding 55 percent savings in laboratory testing of hydraulic actuators involving heavy equipment such as excavators. Little wonder she's attracting international attention.

Ivantysynova's work at the Maha Fluid Power Research Center has drawn interest from companies such as Komatsu in Japan and domestic manufacturers like Caterpillar, John Deere, and Bobcat. And the energy-efficient equipment would surely captivate their customers—heavy equipment owners and operators.

Much of the research falls under the umbrella of Purdue's Engineering Research Center (ERC) for Compact and Efficient Fluid Power (directed by Ivantysynova), which was funded by a five-year, $21 million grant from the National Science Foundation in May 2006. Several ERC inventions are in the patent-application phase, a startup company is in the works, along with much inquiry about licensing.

In her research on displacement-controlled actuators, Ivantysynova's team built a test rig to simulate a trench-digging cycle. The displacement-controlled excavator consumed 39 percent less total energy than the traditional load-sensing excavator. The efficiency improvement was almost entirely due to the elimination of valve-metering losses rather than energy recovery.

"It's a breakthrough," Ivantysynova says. "If this technology comes to market, people will recognize the importance of having efficient pumps and motors."

Ivantysynova is also investigating energy savings that come from a novel approach to lubricating gap construction. The lubricating gap between the cylinder block and valve plate of swash plate type axial piston machines is a major contributor to total machine losses, whether under partial- or maximum-load operating conditions. Ivantysynova applied a micro-structured waved surface to one of the sliding surfaces of the cylinder block-valve plate interface and significantly reduced power loss at partial load conditions in the interface. Measurements of a pump running with the prototype valve plate showed an increase in total pump efficiency of up to 10 percent.

Ivantysynova also hopes to see her work in energy efficiency and fuel savings passed on to average consumers through fuel-efficient hydraulic hybrid vehicles, a lighter and more compact alternative to electric hybrids that power cars such as the Toyota Prius. Her dream is to have Purdue become a major world center for such vehicles.

Hydraulic pumps help reduce energy loss and lower emissions by allowing freedom in engine management. The envisioned power-split drive represents a class of Continuously Variable Transmission (CVT) that combines the convenience of CVT with high overall transmission efficiency. In its hybrid configuration, a high-pressure accumulator captures the braking energy that is regenerated to aid the engine power during the next propulsion event. Electric hybrids cannot store brake energy. The technology could be used on both small and large scales to power passenger vehicles, along with military vehicles and semis.

Ivantysynova's groundbreaking research has set Maha Laboratories apart from other such facilities in the world. "We are definitely the leading fluid hydraulics laboratory in the United States. Purdue has the largest laboratory," she says. ■ **Linda Thomas Terhune**

Almost Free, Hardly Easy

A mechanical engineering undergrad reflects on his cross-country bicycle trip


Vincent Walter

Hornyak, back on campus

Tom Hornyak spent his 21st birthday in a very atypical way for a college student. On January 23, 2008, the then junior in mechanical engineering left his parents' home in Naples, Florida, to begin a 3,700-mile bicycle ride to San Francisco. Inspired by the Dierks Bentley song "Free and Easy I Go Down the Road," Hornyak strapped some 200 pounds of gear (a second-hand tent, sleeping bag, some clothes, and light tools) to a borrowed bicycle and headed west.

Feeling a "little stressed and depressed" from the challenges of a difficult major, Hornyak had taken a break from school after the fall semester. "I worked at UPS, a bicycle store, and even did a little hair modeling," he says. "But I really wanted to get out and explore."

With admittedly zero experience for such a biking adventure, Hornyak pedaled north through Florida, turned left at the panhandle, and then cruised coasts through Alabama, Mississippi, and Louisiana. He then made his way—"averaging about 60 to 70 miles a day"—through U.S. highways in Texas, New Mexico, Arizona, and California on a three-month tour of America. "I did a few century rides," he says, but was mostly committed to traveling on Bentley's "free and easy" advice.

The owner of Big Mama's Bicycle Shop (where he worked) had insisted that Hornyak borrow a good bike—a Surely Long Haul Trucker Bike. He stopped by visitor centers along the way for free maps. When he came across other colleges, he got a guest account and updated his blog, where he detailed the trip. He made friends of many strangers along the way, and spent an occasional night not under the stars by finding a free couch through a site called couchsurfing.com. And the whole trip cost him only $700.

Much depends on the wind, weather, and rain when you're spending three months on a bike, Hornyak says. "There were a couple of stretches where people lent me rides," he says, including a drive through the Mojave Desert, which would have taken him 14 days on two wheels.

For Hornyak, the best part of the adventure came with the people he met along the way. He met folks from all types of cultures, including Cajun and Native American. He says he tried to keep "himself presentable" most of the time, and felt like people were generally helpful and interested in what he was doing.

He arrived in northern California, the last of eight states, in April, having survived a few wipeouts, about a dozen flat tires, many off-the-road camping experiences, and the aforementioned trials of wind and rain. After exploring San Francisco (mostly by foot), Hornyak bought a plane ticket back to Purdue. His battery recharged, he signed up for summer classes and is now happily back on his scholastic course with a lot of stories to tell. ■ **William Meiners**

To read more about Tom Hornyak's trip visit: crazyguyonabike.com/doc/tomontour

Engineering Bloodlines

Mann Institute director helps speed healthcare products to the marketplace


John Underwood

John Hertig with Eric Nauman (right) and Darryl Dickerson (left)

John C. Hertig (BSME '74) is the thirteenth John Hertig in a family tree dating back to Switzerland and the 1600s. All first-born sons, each John—in 13 of 13 cases—became either an architect or an engineer. And while this particular Hertig would take his mechanical engineering degree and have several startup entrepreneurial successes in the medical device industry, a happy coincidence brought him back to his alma mater two years ago.

As the executive director of the Alfred Mann Institute for Biomedical Development at Purdue (AMIPurdue), Hertig is now helping to bring products from the labs to the forefront of the healthcare industry. "Our mission is to support the commercialization of life science technologies created at Purdue that help mankind," he says. "We feel these technologies that are emerging from the discovery stage have the potential to make a significant contribution toward improving healthcare."

The Alfred Mann Institute for Biomedical Development at Purdue was established in 2007 through a $100 million endowment from the California-based Alfred E. Mann Foundation for Biomedical Engineering. The institute works closely with Purdue's Office of Technology Commercialization, part of the Purdue Research Foundation.

For Hertig, who started in engineering research and development at DuPont, and went on to build and sell companies such companies as Medsource Technologies and Enpath Medical, the opportunity at AMIPurdue allowed him to get back closer to the labs and the cutting-edge work he loves. "The best part is I don't have to be raising money all the time," he says.

The goal of AMIPurdue is to get products to the marketplace, and do it faster. "AMIPurdue funds faculty projects in the early stages of development," Hertig says. "The purpose of this seed funding is to provide additional support to faculty working on high-potential projects in life sciences for which we believe we can provide enabling resources to facilitate rapid commercialization."

Of particular interest to Hertig and the institute is the work of Eric Nauman, associate professor of mechanical engineering and biomedical engineering. Working closely with Darryl Dickerson, who recently earned his biomedical engineering PhD, Nauman is creating tissue scaffold technology to improve damaged ligament and tendon reattachment to bone structures and provide a cartilage repair between bone interfaces for diseases such as osteoarthritis, which affects over 20 million Americans alone. The goal of the development effort is to improve the healing and long-term health of tissue interfaces while eliminating the secondary wound recovery from procedures, some of which require harvested tissue from the patient.

For an old research and development lab rat like Hertig, the close working relationship with talented researchers like Nauman and Dickerson is very special. "We work with incredibly smart people who appreciate our combining healthcare marketplace knowledge and business experience with their passion for technology innovation."

While as many as 60 projects may be of interest each year, AMIPurdue typically supports between five and 10 technologies at a time. The Purdue-based Alfred Mann Institute is the third in the world created by the efforts of the Mann Foundation. The first institute became fully operational in 2000 at the University of Southern California. The second was established in October 2006 at the Technion-Israel Institute of Technology in Haifa, Israel.

The economy may be affecting all businesses, but Hertig notes "people still get sick," so turning patents into marketplace realities becomes a very important part of the AMIPurdue process. And between his close proximity to the labs and the researchers and his dealings with the business world, Hertig is busy, but extremely happy with his Purdue homecoming.

Interestingly, his oldest son, another John Hertig, started in engineering at Purdue but ended up switching majors and getting his PharmD instead. Nevertheless, his youngest son, a "chip off the old block," says his father, is pursuing his BSME. ■ **William Meiners**

Class Notes

1940s

Gerry DeHoff (BSME '41) retired as a senior power engineer from Lockwood Greene/Ch2M-Hill in Atlanta, Georgia. He is a life member of the American Society of Mechanical Engineers.

Robert Singer (BSME '49) is co-author of the *History of Minneapolis-Moline and White Motor Corporation*—an in-depth look of the company from its inception in the early 20th century up to its 1980 bankruptcy.

1950s

Robert Lyon (BSME '50) is a retired program manager from the Naval Surface Weapons Center in the Department of Defense. He holds six patents, and was the Naval Weapons field maintenance manager for fleet ballistic missile submarine emergency communications system.

Kenneth Rice (BSME '52) retired from Garlock Bearings and is currently living in Downers Grove, Illinois.

Paul Eubanks (BSME '53) has been a substitute public school teacher for the 14 years for grades K-12. He serves as trustee with Northern Moraine Wastewater Reclamation District. He also served three terms in McHenry and Lake counties as a 1st Lt. U.S. Army Ordnance in the 1950s.

Fenton Bagley (BSME '56) is a partner at Fenton Bagley in Holman, New Mexico. He served as a crew leader on building projects including the Continental Divide Trail, where he designed and built a kitchen trailer for use on the trail projects.

Nathan "Nate" Krupp (BSME '57) is partially retired, but still active as an instructor with the Christian Leadership University, a consultant for House Churches, and writing and editing books on various aspects of Christianity.

Gordon Vail (BSME '57) retired from Lockheed Martin ORD Systems and is living in Belvidere, New Jersey.

1960s

Andrew Ceperley (BSME '65) retired after 35 years at DuPont Chemicals. He has since worked as a facilitator for the West Virginia Department of Environmental Protection Brownfields.

1970s

Bruce McIntosh (BSME '70) is director of information technology at Graco, Inc. in Minneapolis, Minnesota.

1980s

Hal Strait (BSME '83) is the president of S & G Ventures, LLC in Perrysburg, Ohio.

1990s

Joe Frabotta (MSME '91) is chief engineer at Current Model Engineering in Fort Valley, Georgia.

Douglas Anderson (MSME '97) is manager for PRTM Management Consultants in Newport Beach, California.

Marc Yap (BSME '97) is the group product manager at Spine, Osteomed in Addison, Texas.

2000s

Ben Furnish (BSME '00) is a product manager with linear automation products at Parker Hannifin in Irwin, Pennsylvania.

Christopher Tarte (BSME '00) is working for Peterbilt Motors Co. in Denton, Texas.

David Shaffer (BSME '01 MSE '07) is working as a mechanical design engineer for Defense North America, Rolls-Royce in Plainfield, Indiana.

Stephane Poussou (MSME '04 PhD '08) is a senior research engineer for Air Products and Chemicals Inc. in Allentown, Pennsylvania.

Rameshjit Tarlochan (BSME '98 MSME '01 PhD '07) is a senior lecturer for the Department of Mechanical Engineering in Puchong, Malaysia. He is also a chartered engineer with the UK Council of Engineers and professional engineer with the Board of Engineers in Malaysia.

What's new with you?

Please help us keep up with your achievements and career successes by e-mailing mealumni@purdue.edu. Include your contact information, degree(s) and year(s) earned, and the news—civic achievement, board memberships, professional honors, or career activities. We reserve the right to edit for length and content. Alumni News will be published in future issues of ME Impact, which you can also find online.


photo courtesy of nasa.gov

Space Candidate

Alumnus chosen for astronaut training


Scott Tingle (MSME '88)

A Purdue mechanical engineering alumnus is one of nine astronaut candidates selected by NASA this year out of more than 3,500 applicants, the space agency announced. Scott Tingle (MSME '88) of Hollywood, Maryland, began training in August at NASA's Johnson Space Center in Houston. The training takes about two years to complete, says NASA spokesperson Nicole Cloutier-Lemasters.

The 43-year-old Tingle specialized in fluid mechanics and propulsion while working toward his master's degree at Purdue. He is a commander in the U.S. Navy and will become the 23rd Purdue graduate to become an astronaut if he completes the training.

Tingle has accumulated more than 3,100 flight hours in 48 types of aircraft, including combat missions in Iraq and Afghanistan. His decorations include a Meritorious Service Medal, three Air Medals, six Navy Commendation Medals to include a Combat V, four Navy Achievement Medals, and various unit commendations. ■ **Emil Venere**

Cooling Research

Energy-saving method checks refrigerant level in air conditioners

Purdue mechanical engineers have developed a technique that saves energy and servicing costs by indicating when air conditioners are low on refrigerant, preventing the units from working overtime.

The new "virtual refrigerant charge sensor" is particularly practical for automotive air conditioners, which tend to leak refrigerant more than other types of units, and also for household central air conditioning units, says James Braun, professor of mechanical engineering.

Maintaining the proper "charge," or amount of refrigerant in a system, saves energy because air conditioners low on refrigerant must operate longer to achieve the same degree of cooling as properly charged units.

"Not only does the energy efficiency go down, but you also reduce the lifetime of the unit because it has to work harder, causing parts to wear out faster," Braun says.

Mechanical engineering graduate student Woohyun Kim, at right, and James Braun, professor of mechanical engineering

"It's also very time consuming and costly to have a technician check the refrigerant and charge it up to specification. To accurately learn how much charge is in the system, you have to remove all of the refrigerant and weigh it, a procedure that requires a vacuum pump and is quite time-consuming."

The new alternative works by using sensors to monitor the temperature of refrigerant at various points along the tubing in an air-conditioning unit. The technique is easy to use because the sensors are simply attached to the outside of the tubing, Braun says. ■ **Emil Venere**

Photos by Andy Hancock

Race Day

Two seniors reflect on their final Grand Prix

Inverse Collision: Brink's car 32 gets entangled with car 23.

For 52 years now, the Purdue Grand Prix has been a rite of spring on the West Lafayette campus. This past spring the event that's been called "The Greatest Spectacle in College Racing" took place on a new track, as the old one is now under construction to make room for the renovation and expansion of Mackey Arena. Sharper corners on the new track took the top speeds down from 60 to 50 miles per hour, but the crowd thrilled as the tiny karts buzzed their way through the race on a sunny April Saturday.

Among the competitors was a driver named Parker. Parker Brink, a mechanical engineering senior, on the brink of his May graduation, was part of the racing team sponsored by the American Society of Mechanical Engineers.

Qualifying and lining up near the back of the pack, Brink said before the engines started that he just wanted to stay in the 160-lap race. "Anyone who can do that has a chance to win," he said.

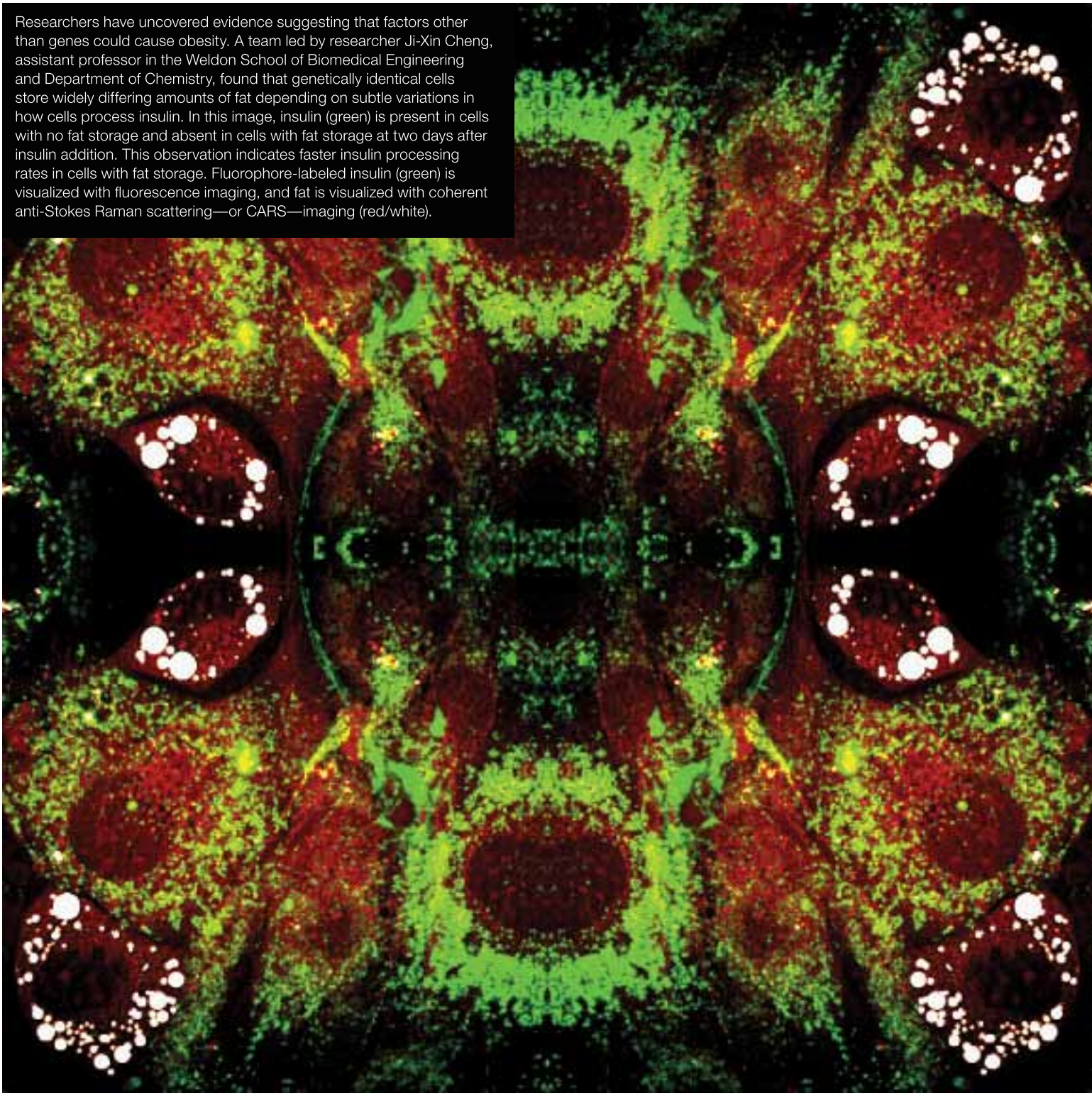
A collision around lap 20 made the glass of milk in victory lane a long shot, as Brink's number 32 ride became entangled with another kart. "It took them a while to get the karts apart and get Parker sent back out," says crew chief Zach Marvel, a mechanical engineering senior who plans on graduating in December 2009.

Marvel's job was to make the kart as fast as possible for Brink, who eventually finished in 13th place. Roommates since their freshman year, Marvel and Brink share a passion for racing and cars. Marvel says he has a 1981 Camaro at home that he has long tooled around with, but imagines that his racing days are behind him now. Brink, however, who has accepted a job with Major Tool and Machine in Indianapolis, hopes that racing stays a part of his life. With sponsorships in hand, he would like to race in some of the kart series around Indianapolis. ■ **William Meiners**

Final Puzzle

Congratulations to **Phillip T. Ross (BSME '61, MSME '62)** for solving the "Oscillating Beans" puzzle from our last issue. If you'd like to know the answer, contact Cynthia Dalton at cdalton@purdue.edu. Due to space constraints, we are discontinuing the puzzle.

aperture



Researchers have uncovered evidence suggesting that factors other than genes could cause obesity. A team led by researcher Ji-Xin Cheng, assistant professor in the Weldon School of Biomedical Engineering and Department of Chemistry, found that genetically identical cells store widely differing amounts of fat depending on subtle variations in how cells process insulin. In this image, insulin (green) is present in cells with no fat storage and absent in cells with fat storage at two days after insulin addition. This observation indicates faster insulin processing rates in cells with fat storage. Fluorophore-labeled insulin (green) is visualized with fluorescence imaging, and fat is visualized with coherent anti-Stokes Raman scattering—or CARS—imaging (red/white).