STUDENTS
Changing the World in Big and Small Ways
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Editing & Writing: Charles Creekmore  
Design: Mickey Boisvert, MBDesign  
Photography: Ben Barnhart of Ben Barnhart Photographs, Sarah Harvey

### STUDENTS

Changing the World in Big and Small Ways
STUDENT ACHIEVERS

Mechanical engineering student Stacia Marcelynas is a poster woman for every world beater at the College of Engineering. She has a prestigious position lined up after graduation in the highly selective Edison Engineering Development Program at GE Aviation in Lynn, Massachusetts. Marcelynas will be designing jet engines there and getting her master’s degree. She was one of 25 undergrads nationwide to receive a Society of Automotive Engineers (SAE) Leadership Development Award for 2008. She’s president of the UMass Amherst chapter of the SAE, and treasurer of Pi Tau Sigma, the mechanical engineering honor society. And she has also completed two internships for the Raytheon Company.

But some of her most memorable moments in college came during the 2007 and 2008 SAE Supermileage Vehicle Competition, where Marcelynas was the driver for a sleek UMass Amherst vehicle named “Homewrecker.” This June, her vehicle finished eighth in the national competition by getting 683 miles per gallon, despite tornado warnings and torrential rain that at one point forced her car off the track and into the high grass. Marcelynas was picked as the Homewrecker driver because she has one skill that can’t be learned.

“Stacia is the only one on the team small enough to fit into the vehicle,” says Professor David Schmidt, the faculty advisor for the supermileage team from the Department of Mechanical and Industrial Engineering (MIE).

In some ways last year’s 2007 SAE event was just as memorable for Marcelynas. As she was navigating Homewrecker around the three-quarter-mile oval, she felt a loud clunk against the wafer-thin firewall located right behind her crash helmet. Her heart nearly screeched to a stop. Then Homewrecker actually did. That sickening clank meant her crankshaft had broken.

Her pit crew swung into action and had a new crankshaft and engine installed within half-an-hour. But Homewrecker would finish out of the money that year, although the other UMass Amherst entry, Hellraiser,
finished third out of 32 teams by ticking off a cool 1,125 mpg. This year, in preparation for the 2008 competition, Marcelynas and her Homewrecker teammates were determined to do better. The team designed a flawless crankshaft. Marcelynas helped replace the flimsy balsawood and carbon-fiber chassis with a much sturdier, ultra-light, aluminum chassis. And her teammates installed new wheels which revolutionized the coasting ability of Homewrecker. Voila!

Stacia Marcelynas is only one example of many undergraduate and graduate students at the College of Engineering who are changing the world in big and small ways.

**Goldwater Scholar**

Chemical engineering senior Dawn Eriksen was not only awarded a prestigious Goldwater Scholarship, established by Congress in 1986 to provide a pipeline of high-quality scientists, mathematicians, and engineers, but also a National Science Foundation Graduate Research Fellowship, which she’ll use at the University of Illinois, Urbana County.

**Scholar-Athlete of the Year**

Electrical engineering senior Jason Small was named as the UMass Amherst Male Winter Sport Scholar-Athlete of the Year. Small finished first overall in the northeast regional college skiing championships and second in the college nationals, and he has accepted a job at Millitech, Inc. in Northampton, Massachusetts, doing radar component design.

**Singled Out by Governor**

Mechanical engineering senior Jonathan Labaki was one member of the team that worked on an energy audit singled out by Massachusetts Governor Deval Patrick as a paragon of his clean-energy strategy. “The Industrial Assessment Center at UMass Amherst conducted a full energy audit of Crane Paper,” said Governor Patrick. “The company has decided to implement all but one of the efficiency measures recommended. Here’s the punch line: That implementation will save them $600,000 a year. That’s $600,000 a year.” The punch line for Labaki is a job lined up as a mechanical design engineer at Westinghouse Nuclear in Windsor, Connecticut.

**TIC Winner**

Perhaps the most high-profile showcase for our students is the annual UMass Amherst Technology Innovation Challenge (TIC), a competition for the best entrepreneurial technology business plan produced by students, recent alumni, and faculty advisors on campus. Starting this year, the TIC will simply be called the Innovation Challenge. This spring Brian Mullen, a mechanical engineering doctoral student, won the $50,000 TIC grand prize. Mullen is founder of Therapeutic Systems, a concept business that will market a novel “deep-pressure vest,” developed in MIE, that improves the quality of life for people with mental illness, especially autism, by providing a “portable hug.”

**Emergency Beacon**

The $15,000 second-prize winner at the TIC was MIE undergraduate Brycen Spencer, who designed an invention that will literally save your life if you’re a motorcyclist, bicyclist, skier, snowboarder, kayaker, rock climber, horseback rider, or ATV enthusiast. Spencer’s concept-stage company is marketing an “emergency beacon” that can be used in any safety helmet. It automatically dials 911 when you have an accident, even if you’re out cold. The beacon also alerts emergency crews to your exact location. Spencer and his beacon have been covered by newspapers and radio/TV stations around the world.

“Some people have such good ideas,” said The Times of London about Spencer, “that you hope they make a fortune.”
Here’s a lifesaver for older drivers. Heather Rothenberg, a doctoral candidate in the Transportation Engineering Program in the Department of Civil and Environmental Engineering (CEE), is developing a computer model that will systematically identify older drivers who are at high risk for potentially severe accidents. Rothenberg is working on a scientific approach that can identify high-risk older drivers, based on their previous driving histories, and suggest productive policies and licensing procedures to improve safety for these drivers.

“Ideally, we would like our model to be a tool for licensing agencies such as the registry of motor vehicles,” says Rothenberg. “It should be something they can put data into each year and get a list of higher risk drivers. Then they can use that information in any way they decide is useful, whether it’s to encourage reeducation for high-risk drivers, or change licensing policies, or whatever they think would be most effective.”

Another part of the project is surveying older-driver licensing policies in other states and some of the legislative efforts that have succeeded or failed there.

“One of the things we’re looking at,” says Rothenberg, “is what kind of legislative changes need to be made to existing Massachusetts policy to enable the Commonwealth to implement what has worked in other places.”

Most states have language that mandates certain restrictions for older drivers. In some states, for instance, older drivers have to take road tests, some states have a shorter renewal cycle for the licenses of older drivers, and some have additional vision tests. Massachusetts state law currently mandates that state licensing procedures cannot discriminate against older drivers in any way.

“The development of licensing practices specifically aimed at improving older-driver safety requires careful thought to ensure the methods are effective in identifying high-risk older drivers,” says Rothenberg, “and to ensure the rights of older drivers are protected throughout the process.”

Besides being a doctoral student, Rothenberg is the Project Coordinator and Lead Analyst in the UMass Traffic Safety Research Program (UMassSAFE). UMassSAFE is a multidisciplinary highway safety research organization within the UMass Transportation Center whose purpose is to reduce the frequency and severity of crashes through extensive work in crash-related data collection and analysis. On June 4, Rothenberg also received the Ann B. Hershfang Graduate Scholarship during the Women’s Transportation Seminar-Boston Annual Awards, attended by Governor Deval Patrick.

Her research is being supported in part by $180,000 from the Massachusetts Executive Office of Transportation and Public Works, and $100,000 from the New England University Transportation Center housed at MIT.
Two chemical engineering sophomores are working on a new method to boost production of the world’s bestselling chemotherapy drug, Taxol, and perhaps save a multitude of yew trees (from which Taxol is derived) in the bargain. For the next three years, Amit Shavit and Nik Finneran will be working on a new technique designed to squeeze as much Taxol as possible out of yew cells that metabolize this life-saving drug.

Shavit and Finneran work with incubated flasks of media solution containing thousands of yew-cell clumps, called aggregates, that produce Taxol.

“We’re trying to find out ways to maximize the production of this drug,” explains Shavit. “We think that the cells in the middle of each aggregate will produce more Taxol because they have a different sort of metabolism than the cells on the outside, due to the cells inside getting fewer nutrients. Getting fewer nutrients might stunt the cell growth, but it will also kick up their metabolism so they’ll make more Taxol.”

“Because the cells in the middle of these aggregates don’t have access to nutrients, they go into a state of no-growth,” adds Finneran. “But they’re not dead. And so to survive and keep functioning, they start producing more Taxol.”

The basis of their research is proving that these inside cells produce more Taxol, and then determining how to process the right-sized aggregate clumps to metabolize the highest amount of Taxol.

Taxol, the patent name for this drug sold by Bristol-Myers Squibb, was first extracted in the 1960s from the bark and leaves of the yew tree (Taxus brevifolia), considered by ancient Druids as their emblem for immortality and known as “the tree of life.” Yew trees produce the Taxol chemical as a defense mechanism against insects and other invaders.

Taxol has proven so effective since being licensed by the Food and Drug Administration (FDA) in the 1980s that new methods of supply will be the key to meeting increasing demand for this wondrous drug. The Taxol explosion (generating more than $2 billion in revenue per year) and its demands are taxing the limited lumber resource, with millions of yews debarked or cut down to meet the demand.

“Taxol is really expensive and the supply of yew trees limited,” notes Shavit. “You can’t keep cutting down trees to keep up with the rate of production of this drug.”

The drug has been approved by the FDA to treat breast, ovarian, and lung cancers, as well as an AIDS-related cancer known as Kaposi’s sarcoma.
On Friday, May 9, visitors to the College of Engineering met the latest crop of talented students from the Electrical and Computer Engineering Department (ECE) and their brilliant projects. Imagine inventions ranging from a Smart Mechanical Guide Dog to something called a BrainMobile that allows people to operate machines with thought waves. In that context, the 18th annual ECE Senior Design Project Day was a sort of brainstorm. It was a public review of 15 senior projects, in which students displayed their inventions, explained them to visitors, and demonstrated their genius.

Take the BrainMobile, which allows users to control a device with their thoughts. The key to the BrainMobile is electroencephalography, or the measurement of brain waves using electrodes attached to somebody’s scalp. The BrainMobile team chose a remote-controlled toy tank as a stand-in for its ultimate target, a wheelchair. Users have EEG electrodes secured to their scalps, then they control the tank by thinking good thoughts that correspond to different maneuvers. The BrainMobile faculty advisor is Dr. Ramgopal Mettu, and the team is made up of Alexander De Geofroy, Tong Huang, Michael Todd, and Duy Truong.

The Smart Mechanical Guide Dog is the brain child of Yi Chen, Steven Hochstadt, Hoi-Sun Tong, and John Ying, with faculty advisor Dr. Dennis Goeckel offering advice for this robotic K-9. The Guide Dog is designed to be a robust, cost-effective approach to enhancing the everyday lives of the visually impaired. The problem is that only a small percentage of visually impaired people are able to afford guide dogs. One answer is this mechanical seeing-eye dog that is able to navigate by wirelessly downloading various routes through a given location.

Another catchy senior project is called Wireless Drumsticks, a new musical instrument that mimics the drumming motion of a conventional drum set and generates sounds wirelessly through a computer. When the drumsticks are beaten against a particular surface, impact data are measured and sent to a computer, where this information is interpreted and converted to a synthesizer signal. The faculty mentor for this project is Dr. Marinos Vouvakis, and the team members are Adam Daniell, Seth Jackson, Eric Rebeiz, and Eldad Tamman.

Inventions such as these serve as capstone projects for seniors in ECE. “The design project is as close as we can get to duplicating what these students will be doing in their professional lives,” says ECE Department Head Dr. Christopher Hollot.
Industrial engineering undergraduate Ashley Lewis is doing research on solar energy that could go a long way toward shaping our country’s energy policy related to climate change. Lewis is creating a computer model that will show how much funding the government ought to invest in solar energy, taking into consideration such uncertainties as the future damage caused by climate change and future breakthroughs or failures in solar technology.

“My senior thesis is on climate change economics,” says Lewis. “The motivation behind this particular project is to investigate how uncertainty will affect the country’s optimal investment in solar R&D.”

Lewis is part of a research team headed by Dr. Erin Baker, MIE, who is doing research designed to influence the government’s future investments in energy technologies. Baker is studying the seven most promising alternative energy sources to determine which combination of these technologies represents the best portfolio for reaching our national emission goals. The seven are solar, nuclear, carbon capture and sequestration, bio-electricity, batteries, biofuels, and wind and solar grid integration.

“Our research is aimed at maximizing the social benefit of energy technologies by minimizing the cost of R&D investment, the cost of emissions reduction, and the damage from climate change,” says Baker. “Our modeling should determine which R&D portfolio will do all this the best.”

The research being done by Baker and Lewis introduces a key variable that policy makers have largely ignored in the past: the role of uncertainty in decision making. In this case, we are uncertain about the amount of future damage from climate change, as well as the future failures and breakthroughs in energy technologies. Meanwhile, Lewis is working on the prototype model for the first of those seven technologies, solar energy. She’s creating her prototype by adapting a pre-existing Integrated Assessment Model to her specific project. Called DICE (Deterministic Integrated Climate Economy Model), it combines the economics of climate change with the science of climate change.

“DICE is a common model used in numerous climate change economic analyses,” explains Lewis. “But I will be reprogramming the DICE model by feeding in a new description of technical change that includes the key factor of uncertainty.”

Her reprogrammed version can analyze the relationship between the country’s investment in solar energy, the cost of solar energy per kilowatt hour, and the corresponding effects of solar energy on curbing greenhouse emissions. Baker will take the prototype model developed by Lewis and apply it to each of the six remaining technologies in her study.
Stephen Malkin, a distinguished professor in MIE, has been elected to the National Academy of Engineering, among the highest professional distinctions afforded to any engineer. The academy cited Dr. Malkin “for pioneering research in and the implementation of grinding-system simulation and optimization.” Dr. Malkin’s research activities have been related to grinding and abrasive processes. An author of more than 200 technical articles and a book – *Grinding Technology: Theory and Applications of Machining with Abrasives* – he is internationally recognized as a leading researcher in his field. He has been an invited lecturer and keynote speaker at more than 65 industrial companies, professional associations, and universities in North America, Europe, Asia, and South America. He has worked as a consultant for more than 35 industrial companies.

George Huber of the Chemical Engineering Department (ChE) spent the year juggling a three-ring circus of extraordinary accomplishments. First, he was named the Armstrong Professional Development Professor. Then he chaired a national workshop in Washington entitled “Breaking the Chemical and Engineering Barriers to Lignocellulosic Biofuels” that was attended by 71 top scientists in the field. One outcome from that workshop was the production and distribution of a so-called “roadmap” publication that was designed to provide the nation with a clear-cut blueprint for making sustainable fuels an economic reality. Then, to top off his momentous year, Dr. Huber received a coveted CAREER Award of $400,000 from the National Science Foundation to study his revolutionary new method for producing environmentally friendly “green gasoline.”

The College of Engineering has really boosted its number of minority graduate students through the National GEM Consortium. GEM is a network of organizations and institutions that promotes the participation of underrepresented groups in postgraduate science and engineering education and the technical work force. In the last year alone, the College of Engineering recruited five GEM Fellows, three of whom are female. Meanwhile, last October Lieselle Trinidad, MIE, was honored as the GEM Fellow of the Year. Besides Trinidad, our current GEMs are: Ibis Benito, ECE; Kyle Morrison, ECE; Esuasi Segbefia, ECE; Tamara Sobers, ECE (starting in the fall of 2008); and John Altidor, CS (starting in the fall of 2008).

**Gut Reaction**

Lianhong Sun of ChE has received a $400,000 grant from the National Science Foundation Faculty Early Career Development (CAREER) Program. Dr. Sun’s research reconfigures the *E. coli* bacterium, better known for causing distress in the human gut, so that it can act as a tiny protein factory for making such drugs as insulin, human growth hormone, and antibiotics. “Once we implement our new system inside *E. coli,*” says Sun, “the production of protein will be self-sufficient and automatic.”
Meteor expert Joseph Goldstein of MIE was the recipient of the Peter Duncumb Award for excellence in microanalysis given by the Microbeam Analysis Society at its annualMicroscopy and Microanalysis meeting. This award is the highest one granted by the society, and Dr. Goldstein was the second recipient. “I am very pleased to receive this award,” says Dr. Goldstein. “Peter Duncumb played a very important role in my research career. This award is a capstone for a long career in the electron microscopy field.”

As part of the 100th Anniversary Celebration Dinner and Awards Ceremony for the Graduate School on April 9, Dr. Dev Gupta ‘77 was honored with the Centennial Award. As the citation notes: “He has brought distinction to the Department of Electrical and Computer Engineering, the college, the graduate school, and the university through his reputation as an expert in broadband and network access infrastructure technology. His company, NewLANS, is working on the development of high speed wireless data transmission.”

Ekundayo (Dayo) Shittu, a Ph.D. candidate in Industrial Engineering and Operations Research, has been selected for the 2008 Young Scientists Summer Program at the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria. This is a three-month research program for some 50 advanced students whose interests correspond with IIASA's ongoing research. While at IIASA, Shittu will work on climate change technology policy analysis. Shittu had previously won a $10,000 Eugene M. Isenberg Award.

Dr. David Reckhow is part of a team of researchers from CEE currently studying the drinking water supply in areas across southern New England to determine if it contains measurable amounts of pharmaceuticals that treatment plants have failed to remove. The work is part of a $150,000 research project funded by the American Waterworks Association Research Foundation, the Massachusetts Department of Environmental Protection, and participating public water utilities. The Waters Corporation also donated a $350,000 piece of equipment to this effort.
Turning Salmonella into Tiny Terminators

Neil Forbes of ChE has received a grant of more than $1 million to work on groundbreaking research into killing cancer tumors with salmonella bacteria. His technique turns salmonella into tiny Terminator robots that can use their own flagella to venture deep into parts of tumors that conventional chemotherapy can’t reach. Once in place, the bacteria then manufacture drugs that trigger cancer cells to kill themselves. “It sounds like science fiction, doesn’t it?” says Dr. Forbes. “But salmonella bacteria, in effect, are each little robots that can swim wherever they want. They have propellers in the form of flagella, they have sensors so they can tell where they’re going, and they’re also little chemical factories. So what we’re doing as engineers is controlling where they go, what chemical we want them to make, and when they make it.”

Brack Gives Back with Postdoc

Robert B. Brack, a 1960 graduate in civil engineering, has committed $100,000 to support a postdoctoral fellowship at his alma mater. The Robert Barker Brack Postdoctoral Fellowship will fund a postdoc within the Structural Engineering and Mechanics Group of CEE.

Transportation Student of the Year

Kevin Moriarit, who earned his master’s degree from CEE in 2007, received the UMass Transportation Center Outstanding Student of the Year Award. Moriarit has worked for Vanessa Hangen Brustlin, Inc. in its Vienna, Virginia, office since August of 2007 doing a variety of projects, including signal timing plans for Fairfax County, parking and traffic studies, and safety work.

Brown Receives Chancellor’s Citation

Gregory W. Brown, the Director of Recruitment and Transfer Programs at the College of Engineering, was one of 11 UMass Amherst staff members honored with Chancellor’s Citations. The annual Chancellor’s Citation Award recognizes employees who have demonstrated exemplary and outstanding service to the university in one or more of the following ways: original contributions; attainment of high-priority objectives; service beyond the call of duty; significant improvements in productivity and/or operational savings.
Shaping Energy Policy

Erin Baker of MIE has received a $430,000 grant from the National Science Foundation Faculty Early Career Development (CAREER) Program. The research that Dr. Baker will continue with her CAREER grant is designed to influence the government’s future investments in the most cost-effective energy technologies for carrying out our nation’s climate-change policies.

Hyers Wins Teetor Award

The Society of Automotive Engineers (SAE) named Dr. Robert Hyers of MIE as the 2008 recipient of the Ralph R. Teetor Educational Award, which is focused on exceptional younger engineering educators. “The current decade places greater expectations upon the colleges and universities of the world to educate individuals who must successfully meet the challenges that face society,” says the SAE about the award, established in 1953. “The purpose of the Teetor Award is to recognize and honor those younger educators who are successfully preparing engineers for this task.”

Elevated to IEEE Fellow

Dr. Aura Ganz of ECE has been elevated to the honorary title of Institute of Electrical and Electronics Engineers Fellow. In her citation, the IEEE noted that Dr. Ganz was receiving this high honor “for contributions to architectures, algorithms, and protocols for high speed communications networks.”

Career Moves

The College of Engineering Career Center serves engineering students by offering career counseling, resume and cover letter review, mock interviews, and career fair preparation advice. This year the center, under new director Cheryl Brooks, posted over 250 different jobs on our newly designed electronic job board, and hosted 90 companies at our Engineering Career Fair. As one result, more than 75 different companies hired our students for full-time positions. The Career Center also hosted 13 companies in afternoon or evening information sessions. These events offer students the opportunity to hear in detail what the companies do. Companies who participated in information sessions this year included: Rohm and Haas, ExxonMobil, General Electric, Department of Energy, Westinghouse, Abbott Labs, CISCO, Sun Microsystems, MassHighways, Momentive Performance, Jeld-wen, and the Shaw Group. The center also ran plant tours at BOSE and Abbott Labs.
Sanghi Rings NASDAQ Opening Bell

On March 19, alumnus Steve Sanghi (center, standing directly behind NASDAQ sign), Chairman and CEO of Microchip Technology Incorporated, presided over the opening bell of the NASDAQ Stock Market in New York City to celebrate the company’s 15-year listing anniversary. Sanghi earned his M.S. in the ECE here in 1978. Two of his invited guests at the honorary bell-ringing ceremony were Theodore Djaferis (second from left), our Associate Dean for Academic Affairs, and Paula Sakey (fourth from left), Director of Development. Both Dr. Djaferis and Ms. Sakey are alumni of UMass Amherst.

Playing the Field

A team of researchers from ChE, led by Dr. Dimitrios Maroudas, has predicted that a strong electric field used on an electrically conducting stressed solid, such as a metal, can inhibit catastrophic, stress-induced, crack-like surface instabilities. This innovation could have far-reaching effects in the function and reliability of complex structures in aircraft, micro-machines, medical transplants, military equipment, semiconductor devices, and metallic lines interconnecting semiconductor devices in integrated circuits. The team described its study in an article published in the January 25 edition of Physical Review Letters, the leading journal in the physical sciences community.
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University of Massachusetts Amherst College of Engineering Annual Report 2008

FUNDING SOURCES [$22.6m]
RESEARCH EXPENDITURES FY08

- State and Local 19%
- Industry 15%
- Other 10%

REVENUE SOURCES FY08 [$41.2M]
- Federal/State Grants 41%
- State/GOF/RTF 40%
- Other 19%

EXPENDITURES FY08 [$41.2M]
- Salaries 51%
- Equipment/Leases 5%
- Admin/Travel/Postage 5%
- Scholarships 1%
- Subcontracts 8%
- Supplies/Maintenance 6%
- Overhead 9%
- Student Support 15%

FY08 College Numbers
- Faculty 94
- Undergraduate Enrollment 1209
- Graduate Enrollment 376
- B.S. Degrees Granted 228
- M.S. Degrees Granted 101
- Ph.D. Degrees Granted 38

FY08 Research Expenditures by Department
- ChE 2,746,263
- CE 5,301,639
- ECE 9,887,243
- MIE 4,465,365
- DEAN 226,186
A six-person team from the UMass Amherst chapter of Engineers Without Borders took a trip to the Brazilian Amazon that will lead to a cheap, sustainable way to collect clean water and dispose of wastewater for some 1,400 people living in a rural preserve for rubber tappers. The team leader was Marina Pereira (pictured, right, with laptop computer), a graduate student in environmental engineering and a native of Brazil. Marc Santos (pictured on the back cover with a Brazilian child), an undergraduate in mechanical engineering, was also on the six-person team.
The best and the brightest in our student body are changing the world with good ideas and high ideals. We sincerely hope they are rewarded by making a fortune, paid out in whatever currency they prefer, whether that be in abundance, satisfaction, achievement, fame, or simply by making the world a better place.