IOWA STATE UNIVERSITY
College of Engineering

DIMENSIONS

Department of Mechanical Engineering

SPRING 2008 | Issue Number 16

IN THIS ISSUE

Message from the Chair

As VEISHEA and spring commencement pass us by, this issue of *Dimensions* describes some of the initiatives that are underway in the department, including new faces among the faculty and staff; innovations in our undergraduate curriculum; achievements of our students, faculty, and alumni; and a newly endowed faculty position. Our national impact on the mechanical engineering profession was highlighted this year when we were ranked among the top 10 programs in terms of BSME degrees awarded.

You may have heard that Iowa State celebrated its 150th anniversary this past year. Like the university, our department also has a rich educational heritage. Did you know that Iowa State's first diploma, awarded in 1872, was granted to **Edgar Stanton** in the field of mechanical engineering? "Stanty" went on to become a faculty member and chair of the mathematics department, and he served four times as acting university president. His heart was indeed in his work, and he and his family contributed 36 bells to the central campus's carillon. Look for an article on Edgar Stanton and his family in a future edition of *Dimensions*.

Also in this newsletter, you will see our inaugural section on alumni news. Please stay in touch and keep us up to date on what is new with you.

Jonathan Wickert

ME ranks ninth in undergraduate degrees awarded

The Department of Mechanical Engineering ranks ninth in the nation based on the number of undergraduate degrees that were awarded in the 2005–06 academic year, the most recent for which national data are available. The American Society for Engineering Education compiled the ranking.

"Our undergraduate program makes a significant national impact and it has done so for over 100 years, so it is nice to receive this distinction," says **Jonathan Wickert**, ME department chair and Larry and Pam Pithan Professor of Mechanical Engineering. "Our faculty and staff are very dedicated and committed to the quality of our undergraduate program, and this ranking is testament to their hard work. We are very proud of the accomplishments of our students and alumni as well. Every day, literally, I'm impressed by the innovation and creativity of the ME department's community."

Data were collected from 276 schools that have ME programs. With 207 ME degrees awarded, Iowa State is the only Big 12 university to be ranked in the top 10.

1. Purdue University, 277 (tie)
1. Virginia Tech, 277 (tie)
3. Georgia Institute of Technology, 273
4. Pennsylvania State University, 261
5. Kettering University, 257
6. University of Michigan, 223
7. Michigan Technological University, 222
8. California Poly. State University, SLO, 209
9. **Iowa State University, 207**
10. University of Illinois, Urbana-Champaign, 205

On the Cover

From left, graduate students Nathan Franka and Joshua Drake and Professor Ted Heindel discuss bubble plumes as they rise through a large liquid column in the Experimental Multiphase Flow Laboratory in Black Engineering.

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Published twice a year by the Department of Mechanical Engineering, College of Engineering, 2025 Black Engineering, Iowa State University, Ames, IA 50011-2161; www.me.iastate.edu; jlstrawn@iastate.edu

Prepared by Engineering Communications and Marketing, College of Engineering ECM 08259

Hoovers create endowed chair in ME

Gary Hoover, a 1961 ME graduate, and his wife, **Donna**, have pledged more than $1.5 million to create the first endowed chair in the Department of Mechanical Engineering.

A native of Coon Rapids, Iowa, Gary Hoover worked at Westinghouse for 20 years. In 1987 he moved to Omaha, Nebraska, where he co-founded a company, Tenaska, Inc., to design, develop, construct, and operate large-scale power plants. He retired in 1995 as vice president of Tenaska.

The Hoovers, who now live in Scottsdale, Arizona, returned to campus this spring when Donna Hoover received Iowa State's Honorary Alumni Award. It is the highest honor given by the university through the Alumni Association to individuals who have made significant contributions to Iowa State's welfare, reputation, prestige, and pursuit of excellence.

"It means a lot to us to be able to give back to Iowa State so we can help the students who will be our future leaders," say the Hoovers, who are long-time supporters of the university. "We know the College of Engineering will use this newly created position to make an impact in the lives of many."

Endowed chairs are the most esteemed positions in academia, according to **Mark J. Kushner**, dean of the College of Engineering. "They are awarded only to the top tier of faculty, and when this position is filled, he or she will command considerable prestige within the university and the larger professional field of mechanical engineering," Kushner says. "Endowed positions not only bring honor to the chairholder, they also help attract the most talented students and provide an educational experience that transcends the classroom."

In addition to the $1.5-million commitment required to create this faculty position, the Hoovers are funding the chair on an annual basis until the endowment is fully funded. This gifting method enables the department to fill the position more quickly.

"This extraordinary gift will extend far beyond our ability to recruit and retain outstanding faculty," says **Jonathan Wickert**, ME department chair and Larry and Pam Pithan Professor of Mechanical Engineering. "Because of the Hoovers' tremendous dedication to Iowa State, for many generations to come our students will benefit by being able to work with and learn from world-class researchers, educators, and academic leaders."

This commitment from Donna and Gary Hoover is part of Campaign Iowa State: With Pride and Purpose, the university's $800-million fundraising effort that was publicly launched in October 2007.

Women in Mechanical Engineering group formed

The ME department has created a new organization this year called Women in Mechanical Engineering. With 70 female undergraduates currently in the department, the primary goal is to explain the rewards and excitement of a career in mechanical engineering in order to better retain and recruit women to the field. The group sponsors monthly events with a focus on providing networking and professional development opportunities both among students and with alumni.

"We plan activities to bring these students together so they can bond and form friendships," says **Janelle Miranda**, program assistant and coordinator for the group. "We also bring in alumni to share their perspectives on what it is like to be female in the ME field and to talk about what they wish they had known as students."

The department has partnered with the National Academy of Engineering on a new program to improve the participation of women and traditionally underrepresented minorities in studying mechanical engineering.

Plans are already underway for next fall when Women in Mechanical Engineering will start off the year with a "welcome to campus" picnic.

Women in MECHANICAL ENGINEERING
Making a Difference in the World

Solving the mysteries of nanowires and nanotubes

Measuring the thermophysical properties of nanowires and nanotubes is a challenging task. They are extremely small: 1,000 times smaller, in fact, than a strand of human hair. Researchers, however, are eager to learn all they can about them because their size and unique properties make them a promising component in the next generation of electronic devices, materials of super mechanical strength, and optical and chemical sensors.

Xinwei Wang, the ME department's newest associate professor, is focused on solving some of the mysteries of nanoscale materials. He has already developed unique techniques using lasers to thermally excite the material and then measuring the electrical resistance change. With that data, he can determine what the thermal properties are inside, and that will lead to a better understanding of thermal transport in nanomaterials as well as the physics behind the phenomenon. His measurement capabilities cover the entire spectrum of nanowires and nanotubes: dielectric, metallic, and semiconductive.

Those thermal properties are very important in the design of new electronic devices. "Electric current creates very high temperatures very quickly," Wang explains. "The materials used to fabricate an electronic device can help control the temperature so the device will not overheat. If we can predict the performance of different materials, designers will know which materials will work best in their products."

Currently, most of the activity is conducted at universities, but Wang expects industry to begin developing widespread applications within the next five years. Companies will then turn to Wang to measure the properties of the materials they are considering using to help them determine which materials will work best in their products.

Wang, who taught ME 536, Advanced Heat Transfer, spring semester, came to Ames in November from the University of Nebraska, Lincoln, where he had been an ME faculty member since 2001. The move to Iowa State is an exciting one, Wang says, because the breadth of areas within the ME department provides the opportunity for a variety of collaborations. The move also allows both Wang and his wife, who has joined Iowa State's information technology staff, to live close to their jobs. Previously, they lived in Omaha, and Wang commuted to Lincoln.

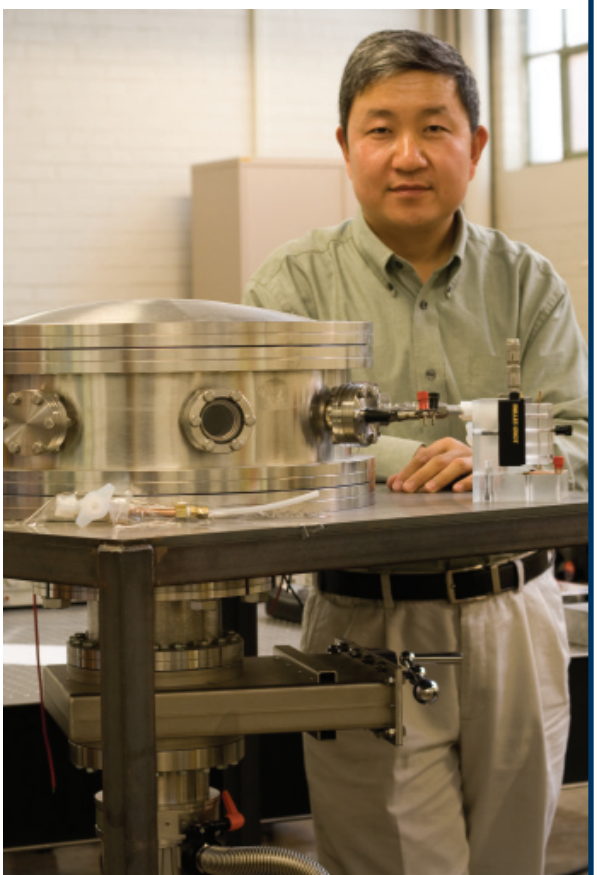
A native of Shandong Province in eastern China, Wang earned his BS and MS in ME at the University of Science and Technology of China. He came to the United States in 1996 to work on his PhD at Purdue University.

In addition to his work with nanoscale materials, Wang is collaborating with researchers at the University of Nebraska to explore the use of thermal measurements as medical and dental diagnostic tools. Specifically, he is investigating the use of laser-assisted thermal wave imaging to assist doctors in detecting skin cancer and dentists in locating a problem in a patient's tooth.

The premise in skin imaging is that healthy skin has a normal thermal conductivity and response curve to a thermal impulse, while a problem under the skin would result in an abnormal thermal response curve. Using a sensor to measure the temperature response of the skin, the researchers will be able to tell if it is healthy or if there is a problem.

The dental imaging project is aimed at finding cracks that are so tiny an x-ray or ultrasound cannot detect them. "Using a laser, we can measure the temperature in all parts of the tooth," Wang explains. "How much the temperature goes up or down will indicate precisely where the crack is."

Wang and his collaborators are still in the early stages of these research areas, but Wang says the early results look very promising, and he and his collaborators are in the process of writing grant proposals.



Faculty/staff honors and awards

K. Mark Bryden, associate professor, U.S. patent (Creating Realtime Data-Driven Music Using Context Sensitive Grammars and Fractal Algorithms)

Nate Jensen, systems support specialist, College of Engineering Staff Exceptional Performance Award

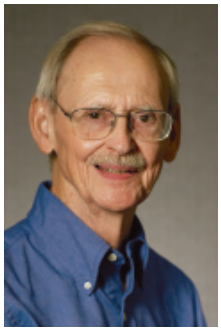
Song-Charng Kong, assistant professor, SAE International's 2008 Ralph R. Teetor Educational Award

Palaniappa A. Molian, professor, U.S. patent (Ultra-Hard Low Friction Coating Based on AlMgB14 for Reduced Wear of MEMS and Other Tribological Components and Systems); Iowa State University 25-Year Club

Ted Okiishi, professor emeritus of mechanical engineering, American Society of Mechanical Engineers 2008 R. Tom Sawyer Award

Michael Pate, professor, Iowa State University 25-Year Club

CFD pioneer Richard Pletcher retires



When ME Professor **Richard Pletcher** arrived on the Iowa State campus as an assistant professor in 1967, the only computer on campus was the mainframe in the basement of the computer science building, now named Atanasoff Hall. He had to cart boxes of computer punch cards across campus to solve fluid mechanics equations. It was a rather low-key beginning for a man who would become one of the pioneers of a newly emerging field—computational fluid dynamics (CFD)—and who would help establish Iowa State as a leader in this field.

Pletcher, who retired in May at the age of 73, had begun his computational work as a graduate student at Cornell University. Although his adviser at the time suggested he concentrate on experimental work, the ability to solve problems numerically intrigued him.

With his PhD completed, Pletcher considered some university offers, but turned to industry to start his career. He spent two years in the propulsion section of United Aircraft Research Laboratories (now called United Technologies) in Connecticut developing algorithms for solving flow problems. In 1967, Pletcher, who grew up in Indiana and earned his BS at Purdue University, returned to the Midwest to accept an appointment at Iowa State.

While teaching a variety of courses ranging from ME 330, Thermodynamics I, to ME 536, Advanced Heat Transfer, Pletcher continued his efforts in CFD. Promoted to associate professor in just three years, he won his first National Science Foundation (NSF) grant in 1970 to study finite-difference analysis of turbulent boundary layer flows.

Soon after coming to Iowa State, Pletcher discovered that **Dale Anderson** and **John Tannehill**, faculty members in the aerospace engineering and engineering mechanics department, shared his interest in CFD. The three collaborated on research, developed coursework in their respective departments, and wrote *Computational Fluid Mechanics and Heat Transfer*, the first comprehensive CFD textbook. They also wrote a proposal for the establishment of a NASA-sponsored CFD Center of Excellence on the Iowa State campus. The CFD center officially opened in 1984.

"Winning that grant was one of the most satisfying accomplishments for me," says Pletcher. "Stanford and MIT also won awards for centers, so it really put us on the national scene in CFD work."

During his 40-year career, Pletcher won many research grants from governmental agencies such as NSF, NASA, and the Air Force Office of Scientific Research. He was major or co-major professor for 30 PhD and 15 MS students and taught hundreds of graduate and undergraduate students.

As for his future plans, Pletcher will have more time to spend with his family at his cabin in Minnesota, but he will also continue working with Anderson and Tannehill on a third edition of their textbook.

"The power of the computer has changed the field immensely," he says, "and that means revisions for the textbook. In the 1990s, there was a lot of buzz about supercomputers, but today we have desktop computers that are as fast as those supercomputers were. A calculation that would take a whole year to do 10 years ago can now be done overnight. It is amazing."

"Dick's retirement is a bittersweet occasion for all of us since he will be deeply missed. He has had a lasting national influence on mechanical engineering, and for many, Dick personifies the field of CFD," said Jonathan Wickert, ME department chair, at Pletcher's retirement reception.

New staff members join ME

Amy Carver joined ME in February as a program assistant for graduate education, focusing on growing the quality and impact of the MS and PhD programs. Carver received her BS in marketing from Iowa State in 2001 and her MBA from the University of Phoenix in 2007. She previously worked for the University of Phoenix in Korea, recruiting students for the MA education and MBA business programs.

Janelle Miranda leads the day-to-day operations of the undergraduate ME program. Her responsibilities include mentoring programs, recruiting, and planning networking opportunities as part of the Women in Mechanical Engineering Program. Miranda earned her BS in child and family services from Iowa State in 2006 and will begin work on her MEd in higher education with an emphasis in student services this fall. She worked for Kaplan Test Preparation before joining the ME staff in January.

Kevin Osgerby started as an academic adviser for the department in February, providing guidance for undergraduate students and helping coordinate the Mechanical Engineering Learning Community. He is an Iowa State alumnus, earning his BS in construction engineering in 1981 and his MA in teaching secondary school science in 2005. Osgerby is a licensed civil engineer and was previously an undergraduate adviser for undeclared students in engineering.

Jessi Strawn creates communication materials covering everything from ME alumni news to departmental activities as a communications specialist. Strawn, an Iowa State alumna, received her BS in technical communication in 2006 and will receive her MA in rhetoric, composition, and professional communication in December. Before joining the ME staff in April, she was a corporate communications specialist with SHAZAM in West Des Moines.

Johna Wolfe assists students as an academic adviser, providing help and direction as they make their way through the ME program. Wolfe, who joined the department in September, is also a co-coordinator for the Mechanical Engineering Learning Community and co-adviser for the Iowa State Society of Women Engineers. She received her BS and MA in history from Iowa State and is currently pursuing an MEd in higher education with an emphasis in student affairs. Before returning to higher education in 2005, Wolfe worked in the financial services industry.

ME and Camp Courageous collaborate to build a train

This spring, ME seniors helped to design and build a train. The project represented a perfect combination of engineering and community service.

When finished, the train—a one-third-scale locomotive, caboose, and passenger cars—will be a featured attraction at Camp Courageous of Iowa, a respite care and recreational facility for children and adults with disabilities. The year-round camp, located near Monticello, hosts around 5,000 campers a year.

The project began when **Tom** and **Nan Riley**, long-time camp supporters, donated their miniature replica of a Chicago Northwestern engine and caboose to the camp. To use the train to transport campers, however, the camp needed help designing new rail cars. "Our number-one concern," says **Charlie Becker**, camp director, "was that the cars be designed to make them very accessible for campers in wheelchairs."

Camp Courageous came to the ME department for design assistance. The project presented some unique challenges. "We usually work with industry," explains **Jim Heise**, ME design projects coordinator. "Our students develop a design and build a prototype that demonstrates the design will work. The design then goes back to the company, which has its own engineers who review the designs."

In this case though, the client was a human service agency. "It meant we would be designing something—the passenger cars—that will interface directly with the public," Heise explains. "It's not something we would ordinarily do, but this was a one-of-a-kind opportunity for our students to gain great experience working on a large-scale project and to serve the community." Camp Courageous hired a professional engineer to review the designs, so the department accepted the project.

In September, 14 students in ME 415, Mechanical Systems Design, with **Rejeev Madhavan Nair** as the instructor, began developing the design for the rail passenger cars. Student teams were assigned to four specific areas: the wheel truck, the carriage or flat-bed frame, seating and safety aspects, and the body and canopy.

Each team went through a detailed process to determine the best design and materials for their assigned area. The teams presented periodic reports to Heise, Madhavan Nair, and Becker, who offered comments and asked questions for the students to consider. In December, the teams presented their final reports, including drawings and specifications, documentation, maintenance procedures, and safety considerations. The reports were given to Pella Supply in Pella, Iowa, which will build the cars.

ME senior **Kurtis Stockdale**, who helped design the carriage last fall, continued with the project as an independent study spring semester. He worked on a fail-safe brake system and also served as contact person to answer questions that might come up at Pella Supply.

Stockdale says he enjoyed the hands-on work the project provided. "We got to see the practical aspects of the theory we have learned in our other classes," he says. "It was a good experience also because our professors didn't tell us what to do. We had to think about how to approach the problem and come to our own conclusions on what would work best."

This spring, the project was expanded to include the locomotive. Two student teams worked to upgrade the drive and braking systems. "Right now, the train has just enough horsepower to pull two cars on level ground," Heise says. "An engineer at Sauer Danfoss helped the students specify the hydrostatic drive components that were needed. I hope to have some students work on it this summer to replace the two-cylinder gas engine with a three-cylinder diesel engine. That will make it pull more like a real train."

Becker is very pleased with the project's progress. "This has been a great experience for Camp Courageous," he says. "The students have taken real ownership and have played a crucial role in helping us get the train ready for the camp. In a few months, they can come over and watch the campers ride on it and see their enjoyment for themselves."

More information about Camp Courageous and the train project is at **www.campcourageous.org**.

ME students check out the locomotive donated to Camp Courageous.

Seniors tackle real-world design projects

Engineering is all about creativity and putting science into practice, so it makes perfect sense for ME students to show they can accomplish just that in the capstone course, ME415, Mechanical Systems Design.

"When they take 415, they've had all of their coursework, which has given them the knowledge and analysis skills they need," says **Jim Heise**, ME's design projects coordinator. "Now they have to show they can put science into practice. That means students must come up with a concept, model it using math, prove their math is correct, turn the concept into a real object, and then test and confirm that their design works."

As design projects coordinator, Heise works with companies to bring in projects with real time lines that the company will act on in some way when the class is done. Spring projects were with AgriDrain Corporation, Adair, Iowa; Altec Industries, St. Joseph, Missouri; Do-it Corporation, Denver, Iowa; Snap-on Tools Corporation, Kenosha, Wisconsin, and Algona, Iowa; and Fleenor Manufacturing, Pella, Iowa.

This summer, Heise plans to develop a new capstone design Web site to promote industry involvement with the senior design classes. For more information, contact **jheise@iastate.edu.**

Iowa State team selected for solar decathlon competition

ME faculty and students are key members of the Iowa State team selected to compete in the Department of Energy's (DOE) fourth Solar Decathlon to be held in Washington, D.C., in the fall of 2009. Each team receives $100,000 from the DOE over two years to support the research goal of reducing the cost of solar-powered homes and advancing solar technology.

Twenty teams from Canada, Germany, Spain, and the United States were selected to design and build innovative, entirely solar-powered, attractive 800-square-foot homes from scratch that they will display as part of a Solar Village on the National Mall in the fall of 2009. An estimated 120,000 people visited the Solar Village built for the 2007 competition.

The decathlon gets its name from the 10 areas of competition: architecture, engineering, market viability, communications, comfort, appliances, hot water, lighting, energy balance, and entertainment. Each entry must produce enough electricity and hot water to perform all the functions of a typical home.

ME professors **Ron Nelson** and **Mike Pate**, who is also director of the Center for Building Energy Research, are co-PIs on the project. **Ulrike Passe**, assistant professor of architecture, is heading the campuswide effort. More than 100 students and faculty from 11 departments in five colleges are involved.

David Gustafson, ME senior and president of the Solar Decathlon Team, became interested in the project when Passe talked to a class he was taking on alternative energy systems about how much energy could be saved with solar homes. "A large part of energy consumption comes from heating and cooling our homes," Gustafson says. "If we incorporate passive systems that use natural sources of heat and air flow, we can save on energy costs. Our goal is to develop a design that will educate people by demonstrating how these systems work. It also has to have broad market appeal."

Iowa State's 800-square-foot "Interlock House" will use three primary system features: a photovoltaic array (solar cells) to produce electricity, the structure's envelope and thermal mass to capture and store energy, and water-based radiant heat and cooling vents to balance overall energy flows.

The house will also be designed to fit, or interlock, into an existing neighborhood, according to **Tim Lentz**, an ME graduate student and project research assistant. "The idea is for the house to fit into the green space between current developments. It is a way to limit urban sprawl and save on resources by connecting to existing infrastructures," he explains.

Continued on page 8

Tim Lentz (left), ME graduate student, and David Gustafson, ME senior, discuss one of the models designed for the Solar Decathlon.

Scott Kraus, a senior from Jesup, Iowa, works on a human-powered battery charger.

Class is a work in progress

ME students in the introductory design course, ME 270, are presented a challenge: design, build, and test a human-powered battery charger. Inspired by the One Laptop Per Child (OLPC) program, an international movement to provide laptops for children in developing countries, the students' assignment is to develop a device that, with one minute of charging time, can power a laptop for 10 minutes.

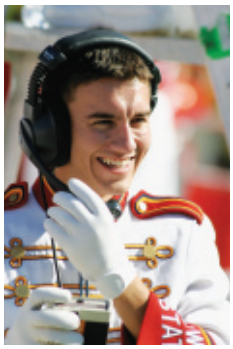
This is a complex task for students who are just beginning their ME core courses, but the class lets students experience what engineers do on the job, according to **Jim Heise**, ME design projects coordinator.

ME 270 itself has been a work in progress. It began as an experimental course in 1999 with the purpose of teaching students what ME is about. The students worked on a variety of projects during the semester.

The first semester-long projects involved designing and building devices such as a tricycle for a physically disabled child. In 2003, Professor **Jim Oliver** added a business angle. Students were asked to propose an appropriate technology for an emerging economy and compete for a U.S. government grant.

The OLPC project was started in 2006. Oliver suggested the charger after hearing about OLPC on the radio and learning that the original hand-crank power system was being replaced. Oliver and Heise, along with Professor **Adin Mann**, developed the current course curriculum.

Strike up the band



Autumn is the busiest time of year for ME senior **Eric Almeida**, and it is not just his ME classes and Air Force ROTC activities that keep him occupied. This native of Papillion, Nebraska, also spends countless hours from mid-August until the end of Iowa State's football season as a drum major for the varsity marching band. Almeida and two other drum majors conduct the 300-member band through rehearsals and game-day performances. The role requires dedication, enthusiasm, and the ability to bring out the best in all of the band members as they perform for thousands of football fans each Saturday afternoon.

Getting a reaction from the crowd is the best part of the job, according to Almeida, who finished his second season as drum major last fall. "Whether it's a halftime show they loved or hearing them yell to one of the cheers we play, it's a great feeling," he says. "Last fall we traveled to Kansas where the fans booed us when we came onto the field but gave us a standing ovation when we went off. That was very special."

For his ME studies, Almeida is interested in nuclear science. He hopes to complete requirements for a nuclear engineering minor by the time he graduates in May 2009. This summer Almeida is participating in the Research Internships in Science and Engineering Program, sponsored by the German Academic Exchange Service. He will be living in Darmstadt, Germany, and working with a German graduate student on a project on mass transfer in Opalinus clay.

In mid-August, Almeida will be back on the marching band practice field to once again lead the Iowa State marching band.

ME grad serves as college student marshal

When the fall 2007 College of Engineering graduates walked to the stage at Hilton Coliseum to receive their diplomas on December 15, ME's **Samantha Hanson** led the way. Each of Iowa State's colleges selects a graduating senior, who stands out as a role model, to serve as a student marshal.

A native of Hudson, Iowa, Hanson got involved in several organizations her first year and by her senior year had assumed major leadership roles. As resource management co-chair for the 2007 Engineers Week, she managed a $400,000 budget and coordinated the schedules of 80 student ambassadors to work at the career fair. She also headed a 23-member committee in charge of facilities and equipment for the 2007 Iowa State Dance Marathon.

To augment her engineering studies, Hanson interned three summers at John Deere in Waterloo. She was a member of the structural analysis group this past summer and got to see the test parts of an axle she had designed when she worked with the drive train group. Previously, she interned with the reliability group and developed a method for documenting verification and validation activities. That method is now being implemented to train new engineers in the department.

Samantha Hanson with her parents, Leonard and Maureen Hanson.

With her degree completed, Hanson returned to John Deere in January to begin her full-time career in the CFD analysis group. "CFD is a new area for me, so I know I have a lot of learning ahead of me," she says, "but I am very excited to be here."

Solar decathlon competition
Continued from page 7

The Iowa State team has been working since January to come up with the best possible design and materials for the house.

"It is a great learning experience to see how people from different disciplines approach the project," says Lentz. "We started with the students creating models that were aesthetically pleasing, but then we looked at the models from other perspectives. As an engineer, I was able to make suggestions about things like the right angle for the solar panels and how to prevent the panels from shading each other. The final design has to have everything working together."

Another important aspect of the project is fundraising. The proposal estimated that the project, including in-kind donations, will cost around $750,000. University units including the Iowa State Office of the Executive Vice President and Provost, the Institute for Physical Research and Technology, the Center for Building Energy Research, and the Colleges of Design and Engineering, as well as the Iowa Energy Center and the U.S. DOE's Ames Laboratory, are supporting the project. The team also seeks corporate sponsors.

"We have already had companies express interest in donating materials," Gustafson says. "The enthusiasm is awesome. It shows that this project is really raising awareness of what can be done with solar power, and, when we take it to Washington, D.C., it will be a way to showcase the strengths of Iowa State and Iowa."

For more information about the Interlock House, visit **www.solard.iastate.edu/.**

Intern helps set the stage for Cirque du Soleil

Combine an interest in the performing arts with hydraulics and what do you get?

For ME senior **Rachael Waggoner**, it was an internship with KÀ, a Cirque du Soleil production at the MGM Grand in Las Vegas. Waggoner, who has a minor in theater design, says that in spring 2007 she became the first engineering intern at Cirque du Soleil. "The application questions were geared toward theater interns," she says, "but I made it clear I wanted an engineering experience."

And that is exactly what she got. One of Waggoner's responsibilities was to operate the Sand Cliff Deck, one of seven moving platforms that make up the unique KÀ stage.

A vertical Gantry crane supports and controls the 25x50-foot-deck, which weighs 80,000 pounds. The crane is a giant mechanical arm attached to four 75-foot-long hydraulic cylinders. It can lift the deck 74 feet up, rotate it a complete 360 degrees, and tilt it from flat to 110 degrees.

Waggoner developed her unusual combination of interests while growing up near Dubuque, Iowa. Throughout high school and until she turned 21, she had been a member of the Blue Stars Drum and Bugle Corps out of LaCrosse, Wisconsin. She performed with the team as it competed across the United States and Canada in the Drum Corps International summer tour.

Her dad, who is a mechanical engineer at John Deere's Dubuque plant, helped inspire her interest in engineering. "I read an article about hydraulics in one of his technical journals," she explains, "and it really interested me." About the same time, Waggoner heard about Cirque du Soleil in her high school French class. Learning about the moveable performance platforms helped her see a way she could combine her two interests.

As an intern at Cirque du Soleil, Waggoner participated in the many behind-the-scenes activities required to keep the show going twice a day, five days a week. She got a first-hand look at the extensive safety precautions required for the complex KÀ set.

"It isn't just a matter of getting the stage set up and working properly," Waggoner says. "It requires constant assessment to insure the integrity of all of the various parts."

Following her May 2009 graduation, Waggoner will pursue a career as a design engineer. With new shows opening regularly, Cirque du Soleil, she says, has the kind of opportunities she seeks.

Don't be afraid to wear pink

Janice Marquardt has accomplished a lot during her six years at Iowa State. She earned her BS with a double major in mechanical engineering and communication studies in 2007, and in August she will have another degree, an MS in mechanical engineering.

When Marquardt arrived at Iowa State in 2002 to begin her studies in the male-dominated ME field, she wanted to blend in with the guys. "I just wanted to fit in," she says, "and that meant hiding my feminine side."

She soon decided, however, that her perspective on how to solve problems was a valuable addition to her classes and to the engineering profession. "Women often have a different way to approach problems," she says. "It's not a bad perspective, just different from what men might have. That diversity leads to better conclusions and better solutions, and we can make the world a better place."

Marquardt has reached out to other female engineering students throughout her college career. She joined the Iowa State section of the Society of Women Engineers (SWE) her freshman year and has served in a number of leadership roles including president. Marquardt points out that SWE is not just for females, but also for anyone who wants to support women in the field. Her husband, Ryan, for example, is a member. He graduated in May with an MS in sustainable agriculture.

This spring, Marquardt continued her involvement with students. In addition to her research assistantship, she was a quarter-time adviser, working with 60 first-year students.

The new networking group, Women in Mechanical Engineering (see article on page 3), also provided her the opportunity to share this advice with students. "First, find a mentor. The person can be older or younger, it doesn't matter, but it should be someone you admire and who you can interact with; and second, don't be afraid to wear pink. When I started in ME, I wanted so badly to not be THE girl in the class, but it's okay to be THE girl. Don't be afraid to be feminine."

Marquardt, who has an internship with Vermeer Corporation in Pella, Iowa, this summer, will pursue a career in machinery after her August graduation.

Alumnus designs improved nuclear power plants

Larry Fennern's career with General Electric (GE) has taken him around the world.

He didn't really plan it that way, but as an expert in nuclear power plant development, he traveled to where plants were being built. For the last 25 years, that has meant Asia and Europe.

Today, however, the United States is experiencing a nuclear renaissance of sorts. Planning is underway for 30 or more new nuclear power plants. Fennern, a composite systems manager with GE Hitachi Nuclear Energy, developed the design configuration for GE's ESBWR nuclear plant, which will be among the first to go online in about eight years.

The nuclear revival is good news for the industry and for the environment, according to Fennern. "With carbon-free emissions, nuclear power can reduce greenhouse gases while helping to solve the world's energy needs," he says. "One nuclear power plant in a concentrated space can easily provide the electrical needs for a city like Des Moines."

Fennern, who grew up in farm country between Garrison and Vinton, Iowa, earned his MS and PhD in nuclear engineering at Iowa State. Following his graduation in 1974, Fennern went to work for GE. Another Iowa State nuclear engineering alumnus, **Steven Specker** (BSEngS'67, MSNucE'68, PhDNucE'70), who later became president of GE's Nuclear Energy business, hired Fennern to perform reactor physics evaluations for the nuclear fuel and core.

His career soon evolved from reactor physics to modeling the operations of the entire plant. His role was to determine the effects of an abnormal occurrence on the plant's operation and to look at factors that add to a plant's stability.

In the mid-1980s, Fennern moved into reactor design where he worked on advanced boiling water reactors (ABWR). With the U.S. nuclear power industry at a standstill in terms of new plants, most of the support for the ABWR came from Japan, according to Fennern. It provided him great exposure to other cultures and the international market.

After the ABWR, Fennern began work on a new design called the ESBWR. "Nuclear reactors currently operating in the U.S. and most of the world use active safety systems, meaning motors drive pumps to add coolant to the reactor during emergencies and diesel generators back up the normal power supply for the pump motors," he explains.

"The ESBWR uses passive safety systems that rely on gravity and natural ways of removing heat through convection and conduction," Fennern says. "The gravity-driven cooling system, for example, has large bodies of water located above the reactor. In the case of a power outage during an emergency, a battery-driven power system will open the valves, allowing water to flow into the reactor."

The new safety systems not only add a layer of diversity and defense-in-depth that will prevent or minimize problems, but they also reduce the number of large pumps and motors needed. As a result, Fennern observes, the ESBWR requires less maintenance and is more economical than previous designs.

In recognition of his work on the ESBWR, Fennern received the 2007 GE Energy Edison Award. Named after Thomas Edison, one of GE's founders and one of history's most prolific innovators, the Edison Awards are presented to individuals across all GE businesses on the basis of their recent technical achievements that have made a significant impact on the current and future vitality of their business. As part of the award, Fennern received a $25,000 grant to fund research at the university of his choice. He directed the grant to Iowa State's Department of Mechanical Engineering.

Naval career focuses on nuclear power

One recent ME alum with an avid interest in nuclear power is **Leia Guccione**. The December 2004 graduate and commissioned officer in the U.S. Navy recently began a two-year assignment onboard the nuclear-powered aircraft carrier USS Ronald Reagan (CVN-76). In her role as division officer and propulsion plant watch officer, she is the head operator of one of two nuclear reactors that power the ship, which has the capacity to carry 80 aircraft and 5,500 crewmembers.

A ROTC scholarship brought Guccione to Iowa State from Pennsylvania to major in political science. She added mechanical engineering as a second major when a naval science course on ship engineering systems inspired her interest in energy and power systems.

Guccione's naval career began with her assignment on the USS Pearl Harbor (LSD-52). She spent 20 months with the ship, including a seven-month deployment to the western Pacific and the Persian Gulf where the Pearl Harbor was the lead ship in the Pakistan earthquake relief effort.

In 2006, Guccione entered the Naval Nuclear Power School in Charleston, South Carolina. The intensive program included six months of classroom work and six months operating a reactor.

Guccione is excited about the increasing interest in nuclear power. "People are recognizing that it's not just transportation fuels we have to replace, but also the natural gas and coal we use to power our homes. The bulk of all dangerous emissions is from power that is generated by coal," she explains. "Nuclear power is the only feasible option to replace coal, oil, and gas in the capacity we need in order to improve our country's independence and protect the environment."

While Guccione is uncertain how long she will serve in the Navy beyond her assignment on the Ronald Reagan, she eventually wants to use her political science and technical background to be involved in policy-making roles at the national level.

Alumni notes

George Barnes, BSME'04, works in high precision manufacturing engineering at CDM Optics, Inc., in Boulder, Colorado. An avid mountaineer, Barnes has climbed all 59 of Colorado's mountains 14,000 feet or taller. Pictures of his expeditions are at www.gb4mfg.com/mtn/Win-Sun-Jup_070207.html.

James H. Norman, BSME'55, was elevated to the grade of fellow at the American Society of Heating, Refrigerating, and Air-Conditioning Engineers 2008 winter meeting. Norman, who retired as ASHRAE's manager of technical services, lives in Atlanta, Georgia. His grandfather, **Roy A. Norman**, who graduated in ME in 1903, was a professor in the department from 1907 until his death in 1944.

Joshua Breon, BSME'04 and MSME'05, has been named senior engineer of dynamic systems at Sikorsky Aircraft Corporation in Stratford, Connecticut. "I have had the opportunity to learn from the best engineers at Sikorsky, and I use the knowledge I have gained to teach or mentor many other engineers of a large range of experience. I am currently working on the S-76D and CH-53K helicopter blades. It is very exciting and challenging work."

Srikanth Padmanabhan, PhDME'91, was named vice president and general manager, Cummins Emission Solutions in Columbus, Indiana, in January. During his 17 years with Cummins, Padmanabhan has served in leadership positions in England, Mexico, and Tennessee. This summer he plans to come to Ames to visit his nephew, who is an MS student in aerospace engineering.

Nick Mohr, BSME'02, finished medical school at the University of Iowa in 2006 and is now starting his last year of residency in emergency medicine at Indiana University. He is currently interviewing for fellowships in critical care.

Megan Mohrfeld Parsons, BSME'04, is a development engineer with Burns & McDonnell in Kansas City. She is currently working with utility companies to develop coal-fired power plants with advanced environmental controls and is heavily focused on how to implement CO2 capture. She got married April 12, 2008.

Iowa State memories

After reading last fall's edition of *Dimensions*, two ME alumni wrote back and shared memories from their Iowa State days. Portions of their letters follow.

Roger W. Haines, BSME'53, PE (retired)
"My memories of ISC go back a long way, to 1924. My father, **William Haines**, better known as Bill, taught from about 1923 to 1928 in the engineering 'shops.' As an Iowa farm boy, his formal education ceased at the end of grade 8. He was master mechanic and a good man. . . . All engineering students were required to take several 'practical' shop courses so they would better understand the methods and processes . . . **Henry Black** was one of his students . . . "

Twenty-five years later, Haines, then 33 and a design draftsman by trade, brought his wife and three children to Ames so he could return to school to become an engineer. They had two more children while they were here.

" . . . Henry Black was now department chair. He remembered me and my father and gave me a great deal of help and encouragement . . . By carrying over 20 hours per quarter and getting extra credit for various things I graduated in June of 1953. I was highly motivated! I went directly into the consulting field as a mechanical engineer, designing HVAC systems. . . .

Frank Fordyce Silver, BSME'39
"The cover photo of the water tower brought back a long ago experience to my mind. Spring time—1938—VEISHEA approaching and I was a junior. I got a phone call from a fellow ME who was quite active in student activities. 'Frank, I hear you and **Warren Sargent** like to climb tall towers, chimneys, etc., right?' 'Yeah, I do.' 'Well,' he said, 'we want to install a lighted ME sign on the water tower, and we can't find anyone who will climb the tower.' I agreed to do it. . . . It was quite a success. At the time, I was also a pretty good half miler on the track team and caught some serious flack from the coach for such a foolish stunt."

Share your memories of Iowa State ME

Alumni notes is a new feature in *Dimensions*. It is an opportunity for alumni to be recognized for career developments or other accomplishments of merit. Please submit your noteworthy update with your name, type of degree, and year of graduation to mealumni@iastate.edu. We look forward to hearing from you.

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