IOWA STATE UNIVERSITY
College of Engineering

DIMENSIONS

Department of Mechanical Engineering

Volume No. 20 | Issue No. 1

Message from the Chair

We are starting Fall 2011 off with another record enrollment of nearly 1,350 undergraduate students in our program. We are proud of the high quality of students, faculty, staff, and alumni. Our students continue to showcase their achievements such as Chloe Dedic receiving one the nation's most prestigious awards for undergraduates in STEM fields, the 2011 Goldwater Scholarship. Professor Terry Meyer received an NSF CAREER Award, and Academic Advisor Johna Wolfe was given the ISU Award for Early Achievement in Advising. Alum Scott Bowman received the Professional Achievement Citation in Engineering from the Iowa State University Alumni Association. You will find many of the achievements of our students, faculty, staff, and alumni in the following pages.

Four new faculty members joined the department this fall and we are happy to have Associate Professor Daniel Attinger, Assistant Professors Nastaran Hashemi and Reza Montazami, and lecturer David Asjes as part of our team. We will be searching for up to six additional faculty to join our department in the coming year.

In addition to our goals of hiring new faculty, we will continue to provide our students with the best possible education in mechanical engineering. Our students continue to impress us with their accomplishments in, and outside, the classroom.

Please continue to reach out and let us know what you are doing with your degree, or what you remember from your time as a student on campus. You are a valued member of our ME family and we would enjoy your shared correspondence sent to *mealumni@iastate.edu.*

Selected ME Points of Pride

- Student numbers reach an all-time high of nearly 1,350 undergraduate students and almost 200 graduate students in Fall 2011.
- More than 800 students per year use the facilities in the Boyd Laboratory and the Caterpillar Mechatronics Laboratory.
- Robert Brown's research team received a $20 million, five-year NSF grant, and Robert was named one of the Top 100 People in Bioenergy by *Biofuels Digest* in Fall 2010.
- Terry Meyer received a 2011 NSF Career Award as well as a 2010 Young Researcher Award in Advanced Optical Technologies and Guest Professorship from the SAOT Graduate School of Friedrich-Alexander University in Erlangen-Nuremburg, Germany.
- Abhijit Chandra received a 2011 College of Engineering David R. Boylan Eminent Faculty Research Award.
- Judy Vance became the Joseph and Elizabeth Anderlik Professor in Engineering.
- Johna Wolfe received the ISU Award for Early Achievement in Academic Advising.
- Jessica Van Winkle was elected to the ISU Professional & Scientific Council in Spring 2011.
- Undergraduate student Chloe Dedic received a 2011 Goldwater Scholarship, considered the nation's most prestigious award for undergraduates in STEM disciplines.
- Graduate student Andrew Friend founded Renovo Fuel Technologies.

On the cover

The ISU Lunabotics Team traveled to the Kennedy Space Center for the NASA Lunabotics International Competition. Story on page 11.

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Diagnostics at the heart of clean energy technologies

Understanding the details of non-equilibrium gas-phase chemistry in novel combustion and plasma systems is important for meeting current and future challenges in clean energy technologies.

Terry Meyer, the William and Virginia Binger Assistant Professor in Mechanical Engineering, is planning to study these details with a new laser diagnostic tool that has the potential to extract key information under reacting conditions that would otherwise be inaccessible with conventional measurement techniques.

His work will be supported by a $400,000 National Science Foundation (NSF) CAREER award for a project titled "Ultrafast Time/Frequency Domain Coherent Anti-Stokes Raman Spectroscopy for Combustion and Plasma Systems."

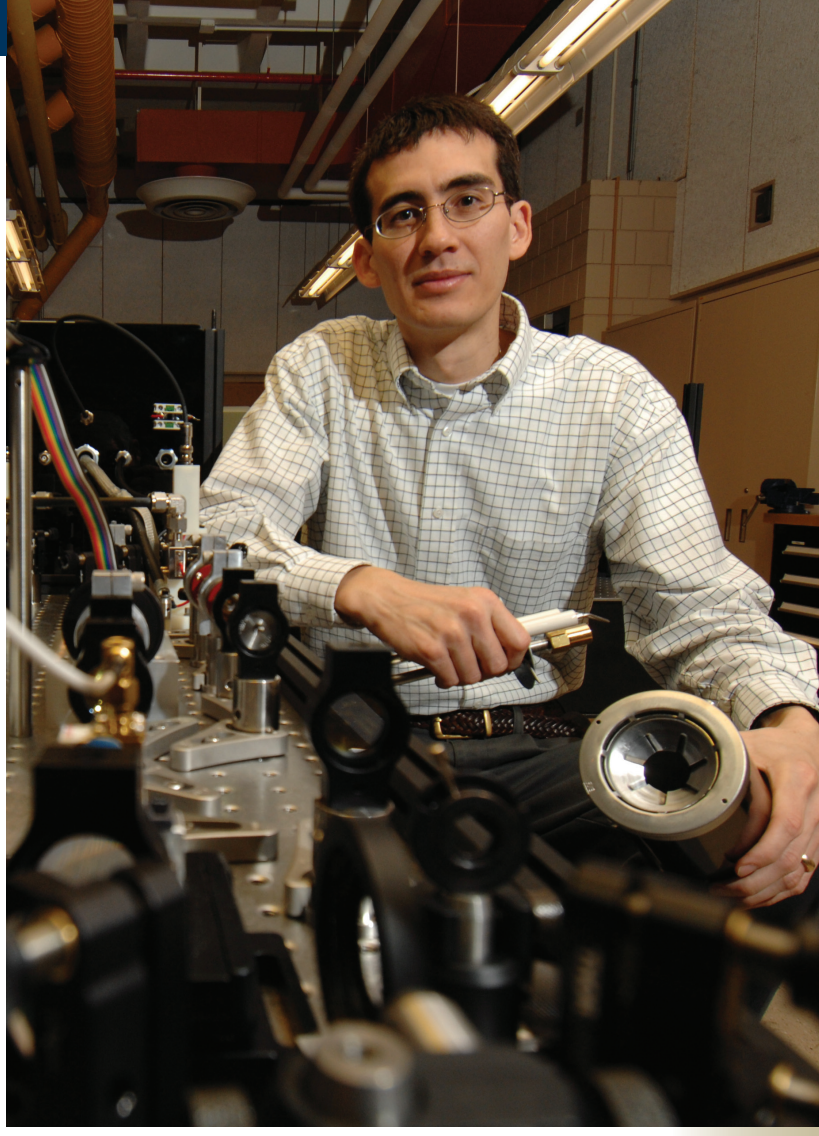
Applications of this work to clean energy technologies are wide ranging, including the study of high-pressure coal and biomass gasification, catalytic upgrading of biofuels, emissions reduction during combustion of alternative fuels, and plasma synthesis of nanomaterials and silicon alloys for solar energy conversion.

To begin the study of non-equilibrium gas-phase chemistry, Meyer will develop and use a new laser diagnostic approach known as ultrafast time/frequency domain coherent anti-Stokes Raman spectroscopy. This approach will enable him to characterize temperature- and pressure-dependent energy transfer processes at more extreme conditions and at a faster rate than previous spectroscopic approaches.

"Our first step is to study the photophysics of the laser-based measurement approach and how femtosecond laser pulses interact with the gas phase," Meyer explained. "From there, we can track the chemistry involved in various non-equilibrium processes and develop more complex models to help us predict the performance of certain technologies."

Meyer is particularly interested in improving the efficiency of biomass conversion and combustion devices for clean and efficient use of renewable sources of energy.

"High-temperature chemically reacting processes, typical of combustion and plasma systems, are critical for converting otherwise useless materials into alternative fuels or energy conversion devices," he said. "Understanding how this takes place is at the heart of both my research and educational objectives."



Meyer, the new William and Virginia Binger Assistant Professor in Mechanical Engineering, received a $400,000 NSF CAREER award.

In addition to this research, Meyer will develop outreach efforts to build interest in engineering among K-12 students as well as underrepresented and minority students. Meyer sponsors a number of undergraduate research assistants and this summer will take part in the Research Experience for Teachers program, where middle school and high school teachers will participate in projects in Meyer's lab.

His graduate students will also continue to create material for "Engineering at the Speed of Light," a program they developed and piloted for high school students to learn through engaging exercises how light is used in engineering.

"One aspect of this work that I really enjoy is the opportunity to mentor graduate students and prepare them to be leaders in research or academia," Meyer said. "They are learning how to get others excited about engineering while making advancements to the field of clean energy through their work in the laboratory."

Contributed by ECR

Enhancing multiphase microfluidic transport phenomena

Born in the village of Ardon, Switzerland, a country smaller than Iowa, **Daniel Attinger**'s future began to take shape without him even realizing it. He took an early interest in his dad's job as a motorcycle mechanic, and his enthusiasm for understanding the intricate details of mechanical work continued to grow throughout his teens, when he would spend hours tuning the engine of his moped. He recalls a defining moment from those years that guided him to his true passion that he is exploring today: "In high school I distinctly remember my geography teacher explaining a coming energy crisis to our class. That's when I decided that by becoming a mechanical engineer, I could help the world use energy more efficiently."

Attinger has joined the ME faculty, and is eager to continue his surface coating research.

He set this vision in motion when he attended two of the most honorable Swiss engineering schools, École polytechnique fédérale de Lausanne (EPFL) for his undergraduate studies and Eidgenössische Technische Hochschule Zürich (ETHZ) for his doctoral studies, both in mechanical engineering. At ETHZ, he got involved in his current specialty, microfluidics, and his PhD thesis described the impact, spreading, and freezing of miniscule drops of solder that can be printed on an electronic circuit board.

"My advisor showed me a simulation of the impact of these drops on a solid surface, and I found this deformation to be a very beautiful process, changing from a spherical to doughnut-shape" explains Attinger. "It was the first time I saw something so aesthetically appealing in mechanical engineering, which is why I chose it for my thesis." The techniques he learned during his thesis research allowed him to pursue further research and gave him the tools to work on future energy efficient projects.

After completing his PhD, Attinger began designing devices to handle very small quantities of medical liquids for a Swiss startup company called Seyonic. It was here that he began to see the practical applications of the manipulation of liquids and learned the techniques needed for microfabrication, which would focus future research he would work on at Columbia University.

In 2002, he moved to the United States where he was an assistant professor for the State University of New York at Stony Brook for three years before becoming assistant professor at Columbia in 2005. He remained there for about six years before recently accepting an offer from Iowa State University to join the ME department as an associate professor, where he plans to take the next step in applying his mechanical engineering expertise to improve energy efficiency.

His current research has been concentrated on understanding, controlling, and enhancing multiphase microfluidic transport phenomena. "My Columbia group and I have, for instance, demonstrated that appropriately micro-functionalized interfaces can enhance pool boiling heat transfer or guide the self-assembly of nanoparticles," says Attinger.

This discovery led him to explore how to develop a technique to systematically coat surfaces with micro and nanoparticles using self-assembly processes that occur during the drying of thin films or drops. It's a process he is based on the staining phenomenon that occurs when a drop of coffee dries to a sheet of paper, and it could be used for further applications, such as making cost competitive solar cells.

"I am currently assembling a team to implement these micro and nano-structured surfaces into energy systems to make for instance more efficient heat exchangers, or brighter lighting appliances" he says. "If I can contribute to reducing our consumption of fossil fuels for energy, I would be very pleased."

Although Attinger is most excited for his surface coating research, he is also involved a project related to forensic sciences to assist the criminal justice system. By studying the formation of bloodstains and developing 3D measuring techniques for these stains, his research will help reconstruct crime scenes.

These two research activities will progress nicely given the resources Attinger has access to at Iowa State. "I am fortunate Ames has both a virtual reality center and hosts the Midwest Forensic center because it will be very helpful in my upcoming project," he explains. Additional resources will come with the graduate student and post-doctorates he plans to hire.

Always eager to try new research venues, Attinger sees himself as an experimentalist. "With my lab members, graduate or undergraduate students, we start with basic tasks and keep increasing the challenges and difficulties until we reach the boundaries of current scientific and engineering knowledge," he says. The last two Ph.D. students who graduated in Attinger's lab gained faculty positions in research universities immediately following graduation.

Attinger is also enthused to begin his new teaching job. "I have always liked to teach partly because I like to be on stage," admits Attinger. "When teaching, I try to keep things simple and illustrate my lectures with real life examples."

He will continue his spirited and ambitious teaching style at Iowa State, hoping to make a difference. He also plans to make it a priority to get know each of his colleagues and form strong relationships with them. Additionally, he wants to boost his involvement in the American Society of Mechanical Engineers and American Physical Society by organizing several international conferences, during which time he looks forward to helping his colleagues expose and exchange their ideas.

The coming challenges in his new role are a welcome opportunity. "Being a faculty member in engineering is truly a wonderful job since you are free to choose the challenges you want to attack," says Attinger. "And the challenges of the 21st century, whether it's pollution, soil erosion, desertification, or energy efficiency, require contributions from mechanical engineers that I am excited to explore."

Contributed by ECR

University Awards

Michael Kessler, Associate Professor of Materials Science and Engineering and Courtesy Associate Professor in Mechanical Engineering, was selected as a 2011 recipient of the ISU Award for Early Achievement in Research. This award recognizes faculty members who have demonstrated outstanding accomplishments in research and/or creative activity unusually early in his or her professional career.

National Science Foundation Director and ME alum **Subra Suresh** received an ISU Distinguished Alumni Award. The award is the highest honor given to alumni by Iowa State University through the ISU Alumni Association. This award honors ISU alumni who are nationally and/or internationally recognized for preeminent contributions to their professions or life's work.

Johna Wolfe, Academic Advisor in Mechanical Engineering, was selected as a 2011 recipient of the ISU Award for Early Achievement in Academic Advising. The award recognizes ISU faculty or staff who have demonstrated outstanding performance in advising undergraduate students early in their professional careers.

Right: ISU President Gregory Geoffroy presents Johna with her University Award for Early Achievement in Academic Advising.

College of Engineering Awards

Scott Bowman received the Professional Achievement Citation in Engineering Award. This award recognizes the outstanding achievement by an alumnus of the College in the professional practice of engineering. Scott is known in the profession for his creativity at KJWW Engineering Consultants, and is a member of the ME Industry Advisory Council.

ME Professor **Abhijit Chandra** received the D. R. Boylan Eminent Faculty Research Award, which recognizes faculty of national and international acclaim for their dedication to academic excellence through research and exemplary contributions to understanding in their field of specialization. Abhijit is recognized for his research activity and scholarship in the area of the mechanics of manufacturing processes.

Amy Carver received the College of Engineering Dean's Staff Excellence Award for her outstanding work as graduate programs assistant in the ME Department. Amy has been instrumental in: developing new recruitment initiatives; deployment of professional master's degree and enhancing the graduate student experience through development of orientation programs, social activities and improved systematic communications.

Right: College of Engineering Dean Jonathan Wickert presents Amy with the College of Engineering Dean's Staff Excellence Award.

ME alumni receive honors

McKean wins Outstanding Young Engineer Award

ME alumnus Andrew McKean was recognized as the 2010 recipient of the SAE International/AEM Outstanding Young Engineer Award at the SAE 2010 Commercial Vehicle Engineering Congress and Exhibition.

Andrew works as a structural analyst for the John Deere Construction & Forestry Division, Dubuque Works. The award recognizes an outstanding young engineer in the off-highway or powerplant industry. Prior to joining Deere, McKean worked as a research assistant in the Virtual Reality Applications Center at Iowa State University. McKean holds bachelor and master's degrees in mechanical engineering from Iowa State University.

Prosise named Iowa STATEment Maker

ME alumnus Jodi Prosise (BSME'03), has been named an Iowa STATEment Maker. The honor recognizes the early personal and professional accomplishments and contributions to society of Iowa State University's young alumni (graduates under 32 years of age).

25 Year Club honorees

The 25 Year Club honors the loyal service of ISU faculty and staff. **Greg Maxwell**, associate professor, and **Jim Dautremont**, lab mechanical technologist, became members in 2011 after serving the university for 25 years.

Jessica Van Winkle elected to Professional & Scientific Council

Jessica Van Winkle, ME academic adviser, was elected to the ISU Professional & Scientific Council as an Academic & Research representative. The P&S Council is a representative body elected by, and responsible to, Professional & Scientific employees at Iowa State. The council studies issues affecting the P&S employee base, presents proposals to the ISU Administration, arranges open forums, and coordinates the P&S awards.

Hashemi is new William March Scholar

Hashemi

Growing up in Tehran, Iran, **Nastaran Hashemi** attended Farzanegan School, a group of schools created to educate talented young students. Administered by the National Organization for Development of Exceptional Talents, the schools challenge middle school and high school students with college-level study of academic subjects. Her strong educational background and interest in hard sciences eventually led her to Iowa State, where she is a new assistant professor of mechanical engineering.

As a young student at Farzanegan, Hashemi became interested in physics and began working on projects such as studying the general theory of relativity and black holes through reading books such as "A Brief History of Time" by Stephen Hawking to enrich her education. While participating on a telescope-building project with the Society of Young Researchers, her interests took a sudden shift that would guide her through her college career and beyond. "Following the telescope project, I became really interested in building equipment and realized that mechanical engineering would give me the opportunity to do just that," says Hashemi.

She then attended Tehran Polytechnic, where she received a BS in mechanical engineering in 1999. Following graduation, she worked in industry for three years and then moved to the United States to pursue her PhD in mechanical engineering at Virginia Tech, which she received in 2008. At Virginia Tech, she developed numerical techniques specifically tailored for discontinuous, nonlinear, and hysteretic dynamical systems to study the dynamics of tapping mode Atomic Force Microscope with capillary force interactions. Hashemi also served as a teaching assistant for various classes and was appointed as a visiting assistant professor following graduation. She was honored with a variety of awards that include the Hampton Roads Spring Scholarship from the Society of Women Engineers in 2007; the East Asia and Pacific Summer Institute Fellowship from National Science Foundation in 2007, which involved a summer study abroad experience in east Asia; and an American Society for Engineering Education Postdoctoral Fellowship in 2009.

From there, Hashemi took a position at the Naval Research Lab in Washington, D.C., where she got involved in a project that would fuel her current research aspirations. "My past and current research has been focused on developing Lab-on-a-chip devices based on microfluidic technology and portable biomedical devices such as microflow cytometers and biosensors," Hashemi explains.

At the Naval Research Lab, Hashemi developed a microflow cytometer to detect and analyze phytoplankton. Phytoplankton's fast response to changes in nutrient levels and environmental pollutions makes them a reliable dynamic indicator of such changes. The data from the biosensors helps researchers monitor environmental changes and develop an understanding of how these changes can have destructive affects on the marine microorganisms . The project took Hashemi about a year and half to develop, and she considers the research to be the most exciting she has conducted yet. "The first time I got results from my microflow cytometer and was able to detect different microorganism species was very exciting," Hashemi says. "With it, we can discriminate between different populations of phytoplankton, and as a result identify what pollutant is present at a specific region of the ocean."

At Iowa State, Hashemi hopes to get a lab set up and attract motivated students to work with her. "In research, I am really hoping to expand my expertise in the area of portable biosensors, specifically for monitoring the environment on a larger scale and point-of-care application" she says.

In terms of teaching, she expects her experience at Virginia Tech to help her considerably. Knowing that teaching a new class will offer some challenges, she has been focusing on perfecting her approach. "I know I will have some students who have a strong understanding and some that will need more attention," says Hashemi. "I am going to focus on reaching both of those groups of students." She says she will do this by providing extra curriculum material if needed and offering supplemental office hours.

Hashemi will hold the title of William March Scholar in Mechanical Engineering. With plans to make a difference in environmental sensing and her students alike, she looks forward to the new opportunities Iowa State has to offer her.

Contributed by ECR

Left to right: ISU President Gregory Geoffroy, Elizabeth Anderlik, Judy Vance, Dean Jonathan Wickert

Vance receives Anderlik Medallion

On September 9, 2011, **Judy Vance** received a medallion to commemorate her position as the Joseph and Elizabeth Anderlik Professor in Engineering during a ceremony that included remarks from President Gregory Geoffroy and Dean Jonathan Wickert.

Vance received her bachelor's, master's, and doctoral degrees from Iowa State, all in mechanical engineering. She spent several years working in industry before returning to Iowa State to pursue her graduate education. She then joined the Iowa State mechanical engineering faculty, and has held several leadership roles within the department, across campus, and at a national level for the American Society of Mechanical Engineers and the National Science Foundation.

Montazami furthers research of smart materials and structures

Working as an engineer was a somewhat unexpected career path for **Reza Montazami** after he graduated from Virginia Tech with a bachelor's degree in physics and astronomy. Part way through his undergraduate studies, he began working on polymeric functional thin films for energy harvesting applications. He then became interested in applied science and started looking for applications that combined his prospective degree and his work with thin films. Given his background in physics and knowledge of materials, the best fit was in materials science and engineering, a field that would eventually lead him to innovative research in smart materials and an assistant professorship in mechanical engineering at Iowa State.

As a student, Montazami was honored with several awards and fellowships, including two National Science Foundation fellowships during his undergraduate study and a fellowship from the American Society for Engineering Education for his graduate studies. After completing his undergraduate degree, Montazami earned his master's and doctoral degrees from Virginia Tech, both in materials science and engineering. As part of his dissertation project, he worked on developing smart structures based on ionic electroactive polymers for nature-inspired soft microrobotics. He conducted his initial research in collaboration with researchers from four universities, the US Army Research Laboratory, and the US Naval Research Laboratory, and continued his work as a research associate at Virginia Tech. During this time, he significantly contributed to the field of smart materials by developing a new generation of polymer based soft actuators and sensors, with applications in microrobotics and biomedical devices.

At Iowa State, Montazami is setting up a laboratory to resume his research on design, fabrication, and characterization of smart materials and structures, and is beginning to explore new applications in biomedical devices and soft microrobotics. The electromechanical actuators involved in his work have high flexibility, strain, and energy density similar to biological muscle fibers. He explains that when these actuators are subjected to an electrical field, they generate a mechanical response comparable to that of fibers in a biological muscle. This creates a smart structure that could have biomedical and military applications, including replacing damaged muscle or tissue with artificial materials that are capable of simultaneously actuating and sensing.

With the success he has seen up to this point, he expects his research to take a step in a different direction soon. "I would like to move towards creating smart biomaterials for biomedical devices," Montazami says. He adds that there is a need for both biocompatible and biodegradable smart materials to create devices that would be implanted in a bioenvironment and operate without triggering a reaction in the host.

Several other devices share a similar structural design with ionic electroactive polymer actuators and sensors, offering additional possibilities for Montazami to explore. For example, a functional thin film similar to that used in actuators can also be used in fuel cells. "High porosity and large surface area makes this thin films ideal for fuel cell applications," he says. Montazami is looking to generate renewable energy using devices based on similar functional thin films.

Montazami

As he gets settled into his new position, he is looking to hire students for his laboratory, and additionally, he is working on putting together a multidisciplinary research program. "For now, learning more about my peers and identifying possible collaboration opportunities are my main objectives," he says.

He adds that he is also busy bringing an interactive approach to teaching students. "Rather than having presentation-like lectures, I would like to keep my class interactive, making sure all students are involved and understand every step," he says.

During the fall semester, he will be teaching ME 160, Mechanical Engineering Problem Solving with Computer Applications. He hopes that his past teaching assistant positions at Virginia Tech along with several courses he had in pedagogy and various teaching workshops he attended will heighten his teaching skills.

Contributed by ECR

From the Navy to the classroom

After 25 years in the Navy, retired naval flight officer and adjunct assistant professor of naval science **David Asjes** is preparing to begin a new career. The insights he picked up through his honorable service to the country will inform his latest mission: helping mechanical engineering students at Iowa State learn about dynamic systems and controls.

Asjes started his career in the Navy, but has now joined the ME department as a lecturer.

Life in the Navy

His naval career began in 1985 after graduating with a BS in engineering from the U.S. Naval Academy. From there, he went to Navy flight school where he learned to fly in the back of carrier-based F-14 jets. He later attended the US Naval Test Pilot school and finished at the top of his class. While an officer in the Navy, Asjes also received his MS in aeronautical engineering from the Naval Postgraduate School in 1992 and his MA in national security from Naval War College in 1998. He is also a graduate of the Navy Fighter Weapons School TOPGUN Adversary course.

Three years after receiving his bachelor's degree, Asjes was assigned to serve on an aircraft carrier for six months. Between 1988 and 1997, he served three, six-month carrier deployments.

A shore-based deployment took him to Kosovo, where he had one of the most memorable experiences of his career. At the time, Asjes was conducting a study to see if it would be acceptable to remove NATO protective forces from some of the Serbian Orthodox shrines. The work offered the opportunity to sit down with the top assistant to the patriarch of the Serbian Orthodox church and listen as the assistant talked passionately about the icons, religious temples of their lives, and relics in their sanctuaries.

"It's hard to describe how enriching that experience was, but it was typical of many of the unforgettable experiences I've had over the years serving in the Navy," Asjes explains. For his contributions in Kosovo, he received a Meritorious Service Medal.

Asjes's extraordinary service to the Navy continued, and he was later deployed to Iraq in 2007, where he spent eight months managing air support for special operations. Upon his arrival, the Iraqi War troop surge was reaching its peak. While special operations teams were busy locating and capturing important figures, Asjes was in the field searching for innovative ways to improve how air support was allocated and how to more efficiently integrate it into combat. Successful in his operations, he was awarded the prestigious Bronze Star.

Asjes says his deployments were stretching experiences due to the demanding workload, but he adds they also offered him important, lifelong lessons in the variety of cultures around the world.

Switching gears

Before his honorable services in Iraq, Asjes began to switch gears in his career and pursue an educational-based track. After receiving an offer to become executive officer for the Naval Reserve Officers' Training Corps (NROTC) at Iowa State, he moved from Nevada to Ames, Iowa. It was here that he eventually decided he wanted to seek a PhD in mechanical engineering. In 2006, Asjes began his course work for his PhD while carrying on his usual duties with the NROTC.

As a part of NROTC, Asjes was in charge administering the department, teaching a history course to freshmen and an introductory leadership course to sophomores.

In August of 2010, he decided that after 25 years in the Navy it was finally time to retire. "There is a lot I love and miss about the Navy," Asjes explains. "As interesting and enjoyable as those assignment were, it was time for me to step out of my comfort zone and pursue a different direction."

Joining the College of Engineering

Asjes is living anything but the "retired life." Hoping to finish his doctoral degree soon, he will begin teaching a mechanical engineering course this fall on dynamic systems and controls, ME 421.

He is confident the lessons he learned in the Navy will complement his teaching style, saying deployment taught him a lot about how to approach new and unfamiliar situations. "It's all about being able to step into a situation with unknown requirements, figure out what they are, and then quickly adjust yourself accordingly," explains Asjes, also noting the importance of recognizing every student is unique.

Although excited about the opportunity to teach, more than anything he hopes he can become a mentor. "I'd like to think I can offer personal examples and perspective to prepare students with knowledge about working in the engineering industry," Asjes says.

Asjes noted that his first priority will be his students, but he is also focused on finishing his PhD so he can move on to other activities. "Once my doctorate is out of the way, I would like to pursue doing things with the local Navy League to help the community learn more about the Navy," says Asjes.

Contributed by ECR

Heindel named ASME Fellow

Heindel

The American Society of Mechanical Engineers has named ME Interim Department Chair and Bergles Professor of Thermal Science **Ted Heindel** as a 2011 Fellow. The ASME Board of Governors bestows the fellowship grade to worthy candidates to recognize their outstanding engineering achievements. Ted is receiving this honor for his accomplishments in advancing the field of complex multiphase flow systems, particularly with respect to novel x-ray imaging methods and applications to biorenewable technologies, and in serving the profession in leadership roles.

Bernard Retires

Bernard

Jim Bernard, an Anson Marston Distinguished Professor of Engineering, retired after 27 years of remarkable service as an ISU faculty member.

Bernard joined the mechanical engineering faculty in 1983 as department chair and served in various roles in the Engineering college, including interim director of ISU's computing center, director of the Virtual Reality Applications Center and interim dean of the college.

NSF invests $20 million in Iowa's renewable energy and energy efficiency research

The National Science Foundation has awarded a $20 million, five-year grant to build Iowa's research capacity in renewable energy and energy efficiency.

The Iowa Power Fund, a state program supporting energy innovation and independence, has also granted the project $2 million to pay for research equipment.

The core of the research project will be conducted at Iowa's three public universities - Iowa State University, the University of Iowa and the University of Northern Iowa. The program also includes partnerships with the state's community colleges, private colleges, school districts, government agencies and industries.

Iowa State's **Robert C. Brown** - an Anson Marston Distinguished Professor in Engineering, the Gary and Donna Hoover Chair in Mechanical Engineering, and the Iowa Farm Bureau Director of Iowa State's Bioeconomy Institute - will lead the program. Co-leaders are P. Barry Butler, executive vice president and provost at the University of Iowa; Kevin Nordmeyer, the director of the Iowa Energy Center in Ames; and Chitra Rajan, associate vice president for research at Iowa State.

"This $20 million grant is the latest example of Iowa's public universities working to build an exciting future for the entire state," said Craig Lang, president of the Iowa Board of Regents. "By developing Iowa's capacity to harness alternative renewable energy sources, our universities are promoting economic development for Iowa and enhancing the quality of life for its citizens."

The research program's vision is to establish Iowa as a leader in the worldwide transition from fossil fuels to renewable energy sources. The program will be built on four major platforms:

The **bioenergy platform** will investigate the challenges of sustainably producing large quantities of biomass (such as corn stalks) and using thermochemical processes to quickly heat the biomass to produce liquid or gas products suitable for generating electric power or upgrading to transportation fuels. Brown will also lead this platform.

The **wind energy platform** will use advanced engineering principles - including fluid dynamics, machine design and control theory - to improve the reliability of wind turbines. Research initiatives include establishing an outdoor laboratory to collect wind speed and turbulence data, studying the reliability of turbine blades and improving the designs of turbine drivetrains. Butler will lead this platform.

The **energy utilization platform** will study building energy science and how human behavior influences energy conservation decisions. The platform recognizes the role that the social sciences will play in understanding how people change their energy habits so renewable energy sources can replace fossil fuels. Nordmeyer will lead this platform.

The **energy policy platform** will explore ways for engineers and economists to collaborate and advise lawmakers on renewable energy and energy efficiency issues. The platform will establish an Energy, Economics, and Engineering (E^3) program to train engineering and economics faculty to work together on energy issues. Bruce Babcock, professor of economics and director of the Center for Agricultural and Rural Development at Iowa State, will lead this platform.

The project will also create a statewide Future Leaders in Advancing Renewable Energy (FLARE) Institute designed to develop the careers of junior faculty in renewable energy fields and broaden the participation of women, under-represented minorities and first-generation college students in science, technology, engineering and math (STEM) fields. The goal is to help the state create a workforce that can meet the needs of Iowa's emerging green economy. Rajan will lead the institute.

And, the grant supports:
- Hiring five new faculty members to improve energy research at Regent universities
- Improving Iowa's information technologies for energy studies
- engaging Iowans in energy issues
- transferring campus energy inventions to private companies.

"This project is a unique opportunity for collaboration among all three Regent universities, Iowa's community and private colleges, K-12 schools, state agencies and regional businesses," said Iowa State's Brown, the research program's leader. "I look forward to working with colleagues across the state who are interested in helping build research capacity in renewable energy and energy efficiency in Iowa."

The $20 million grant is part of the National Science Foundation's (NSF) Experimental Program to Stimulate Competitive Research. The program - known as EPSCoR - is targeted at states and regions that have not won as much research and development funding as other areas. The grants are designed to improve the research capacity of eligible states or regions, making them nationally competitive for future grants.

Contributed by News Service

ME graduate student launches new company

A mechanical engineering graduate student is bringing the Latin word renovo to life on Iowa State's campus. Translated to English, renovo means to repair or restore, and it's the underlying concept of **Andrew Friend**'s company Renovo Fuel Technologies.

The company is based on Friend's thesis research in renewable fuel. "We are hoping to market an energy product for use in the coal industry that would allow coal power plants to burn renewable fuel in their boilers," Friend says. "I chose the name renovo because I think of my process as renewing or remaking coal combustion."

Consulting with Friend on his research efforts and the start of his company are **Robert Brown**, Anson Marston Distinguished Professor of Engineering, Gary and Donna Hoover Chair in Mechanical Engineering, Iowa Farm Bureau director of the Bioeconomy Institute, director of the Center for Sustainable Environmental Technologies, and professor of mechanical engineering, chemical and biological engineering, and agricultural and biosystems engineering; and President of Breen Energy Solutions Bernard Breen. As Friend worked out his idea, Brown and Breen gave him insight into the renewable fuels and coal industry and offered their guidance and support along the way. Also working with Friend on product development was R. Christopher Williams, professor of civil, construction, and environmental engineering.

"The renewable boiler fuel developed during my thesis research proved to work so well that I figured starting a company was inevitable," says Friend. He started Renovo Fuel Technologies to enter in the John Pappajohn Iowa Business Plan Competition in April. Unfortunately, his proposal was not accepted for the final stages of the competition, but that didn't hinder Friend from pressing on with the launch of his new company.

Friend's confidence in the acceptance of his technology comes from the energy generation structure of the United States. Currently, the U.S. Energy Information Administration identifies coal as the leading form of electricity, supplying about 45 percent of United States power generation. "Coal will remain the most reliable form of baseline electricity generation for the foreseeable future," says Friend. "With that in mind, power plants should be looking at ways to burn renewable fuel in their boilers to reduce harmful emissions." The harmful emissions Friend mentions include a large amount of pollutants like carbon dioxide (CO2), sulfur dioxide (SO2), heavy metals such as mercury, and acidic gases such as hydrogen chloride.

Preliminary experiments of using alternative fuels in coal boilers have not been very successful. Attempts to burn a mixture of wood chips and coal was found to be ineffective because wood has low bulk and energy density, which requires large amounts of wood fuel to be brought to the power plants and increases fuel transportation costs. Additionally, alkali metals found in wood can cause fouling and slagging issues in the boilers.

Other biomass sources, such as corn stover and switchgrass, offer advantages over wood because they have high energy density, but they can't currently be co-fired in coal boilers because of high alkali content. Friend devised a way around this problem. "With my technology, we can use almost any kind of biomass because we remove the alkali metal during production of our renewable boiler fuel." he explains.

The process to create Friend's biorenewable boiler fuel, which comes in the form of pellets, grew from Iowa State's research into improving fast pyrolysis technology and took many months of fine-tuning. Friend breaks his improved method down into two basic steps. The first step utilizes fast pyrolysis technology by putting biomass such as wood or corn stover into a reactor at very high temperatures (500 C) in the absence of oxygen to prevent burning, which results in three products: biochar, bio-oil, and a gas. Next, the bio-oil is mixed with coal, placed into a mold, and compressed to form a pellet. The pellets consist of up to 35 percent bio-oil and have the same energy density as coal. Friend sees them as a substitute for coal because they can be crushed or pulverized, meaning that they can be handled with existing coal infrastructure.

While bio-oil plays a large role in the production of the renewable fuel, the co-product of fast pyrolysis, biochar, can be placed into soils, having a positive impact on the environment. Friend explains that biochar acts as a fertilizer because of the carbon, nitrogen and alkali metals found in the material. The biochar can also be used for carbon storage because it remains in the soil for thousands of years, reducing the levels of CO2 in the atmosphere.

Friend says the direction of his company will not be to create the bio-oil or make the pellets directly but rather to manage the technology. "We hope to be a consulting engineering firm that leverages our patents by providing engineering services, such as designing a facility for manufacturing the pellets, but not necessarily operating the manufactory," explains Friend.

Human Powered Vehicle Team performed well

The ASME Human Powered Vehicle student team did very well at a May 2011 regional competition. The team placed second in the 2.5-hour-long unrestricted speed endurance race, and fourth in the men's sprint, fifth in women's spring, and fourth in utility out of 10 total teams. This was the first year for the ISU team to construct a single rider vehicle, so these accomplishments are even more impressive. The team was also up against other school teams that had considerably larger budgets for building the vehicles.

The Human Powered Vehicle Team members Nick Miller, ME senior, Jon Fleming, CCEE grad student, Austin Hilton, ME senior, Ian Moore, ME senior, Mark Saul, ME junior, and Ana Williams, ChemE senior, pose with their creation.

"We are hoping to market an energy product for use in the coal industry that would allow coal power plants to burn renewable fuel in their boilers," Friend says.

The research behind Renovo Fuel Technologies was motivated by the increasing regulations associated with the renewable portfolio standard (RPS). Each state has its own RPS that requires a certain amount of renewable electricity be burned or sold. Iowa's requirement is that MidAmerican Energy and Alliant Energy generate a combined total of 105 megawatts of renewable energy. Since 1997, Iowa has met this standard, but as the demand for electricity increases, Iowa's RPS may be redefined to encourage the development of renewable energy.

The U.S. Environmental Protection Agency (EPA) is also considering regulations for CO2 emissions, which could make Friend's technology more valuable. "If the EPA enacts CO2 regulations, power plants will begin scrambling for ways to reduce their CO2 emissions. Burning my pellets is one way they could do this, and they would be burning renewable energy to meet RPS at the same time," explains Friend. In this scenario, using the proposed biorenewable pellets would also save power plants money because they wouldn't have to add expensive retrofits to remove carbon from their emissions. The pellets can also be used to meet the new EPA standards for the reduction of nitrogen oxides, heavy metals, sulfur, and acidic gases.

With all the advantages of his product, Friend expects a successful future for his company. After he graduates this fall with his master's degree, he plans on beginning test burn demonstrations that will allow the coal industry to see the effectiveness of the product. Although it is not official, he says the power plant at Iowa State seems interested in being a test site, and adds that it will take time to integrate the pellets into industry. "It will be two to five years before my product is used on a large scale because of the lack of fast pyrolysis infrastructure necessary to produce the bio-oil for the pellets," Friend says.

Friend has presented his product to a few companies and is currently applying for grants such as the Small Business Innovation Research grant. His thesis for graduate school is based on perfecting his product, and he hopes to test a variety of different compositions to find the perfect pellet. "It will be interesting to see the advancements made to my product, but as for the near future, I will continue to stay focused on getting my company's name out there," says Friend.

Contributed by ECR

Friend says the direction of his company will not be to create the bio-oil or make the pellets directly but rather to manage the technology.

Lunabotics Team competed at Kennedy Space Center

The ISU Lunabotics Team competed at the Kennedy Space Center May 23 to May 28. The ISU team went up against 45 national and international teams. There was a mechanical failure during the ISU team's only competition run, so the team did not place. They did, however, successfully complete a demonstration run and NASA engineers were impressed with the maneuverability of their rover.

Fourteen of the team's members and team advisor Jim Heise attended: Left to right, Front row: Jim Heise, Lunabotics Adviser; Zach Laws, ME senior; "CY"; Katie Goebel, ME junior; Micayla Haugen, ME senior; Back row: Kurtis Ferguson, ME senior; Sonia Jose, ME senior; Ben McNeil, ME senior; Andrew Klein, IE junior; Ricardo Canahui, ME sophomore; Chris Walck, ME graduate; Dan Kluesner, ME senior; Kyle White, AerE junior; Ryan McCleish, ME senior; Rick Hanton, CprE senior; and Mark Wiemer, ME senior.

Morgan received ASME conference award

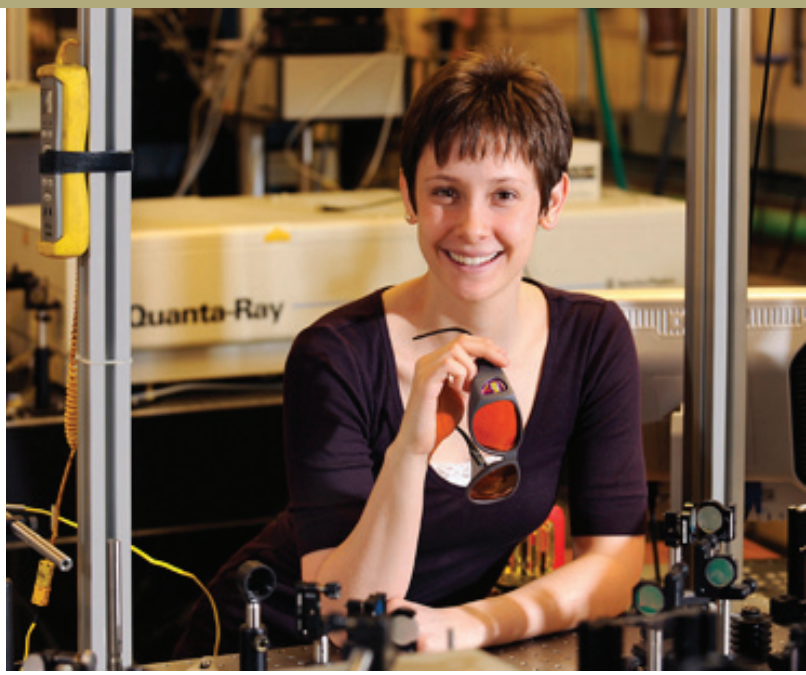
Tim Morgan, at the time a concurrent BSME/MBA student, won the ASME Fluids Engineering Division 2010 Young Engineering Paper Contest with his paper titled "X-ray Particle Tracking of Dense Particle Motion in a Vibration-Excited Granular Bed." He presented the paper at the 2010 International Mechanical Engineering Congress and Exposition in Vancouver, BC, November 12-18, 2010. The award was based on his written paper and conference presentation.

Working in the Experimental Multiphase Flow Laboratory under **Ted Heindel**, Bergles Professor of Thermal Science, Morgan completed the paper as part of his honors research project. His overall focus was on granular convection, or what is sometimes referred to as the Brazil nut effect. This phenomenon happens when the largest particles in a mixture of objects of different sizes end up on the top of the surface.

"During my freshman year at Iowa State, Dr. Heindel suggested I look into the Brazil nut effect but at the time the x-ray acquisition and analysis software wasn't sophisticated enough to produce data that satisfied my curiosity," Morgan said. "Over the past few years, the software on the system has improved to the point where more conclusive data could be obtained, so when I had the opportunity to reexamine the Brazil nut phenomenon for my honors research project, I jumped at the chance."

Morgan completed his master's degree in December 2010, and is continuing his studies at Iowa State as a PhD student in the Experimental Multiphase Flow Laboratory, working in x-ray flow visualization and, with the help of **Judy Vance** as co-advisor, extending the analysis into virtual reality.

"I am most excited about doing things that have never done before," Morgan said. "We are able to do research we didn't think was possible just a few years ago, and I expect that during my PhD work the progress will continue, if not accelerate. When you do something that you know few, if any, other people in the world have ever done, it is an adrenaline rush."



Chloe Dedic was one of 275 selected from a national field of 1,095 students to receive the Goldwater Scholarship.

Dedic named a 2011 Goldwater Scholar

ME student **Chloe Dedic** was named a 2011 Goldwater Scholar in the nation's premier undergraduate scholarship award in mathematics, natural sciences and engineering.

The 275 Goldwater Scholars were selected on the basis of academic merit from a field of 1,095 students who were nominated by the faculties of colleges and universities nationwide. The one and two-year scholarships will cover the cost of tuition, fees, books and room and board up to a maximum of $7,500 per year.

Chloe Dedic, who was first in her 2008 graduating class at Mason City High School, has been involved in undergraduate research experiences at Iowa State since her freshman year. As part of the First-year Honors Mentor Program, she worked with laser diagnostic techniques to analyze combustion systems in the Mechanical Engineering Department's Multiphase Reacting Flow Laboratory. She has continued as a researcher there, working on the laser diagnostic technique called CARS (Hybrid femtosecond/picosecond coherent anti-Stokes Raman scattering). The technique is used to better understand complex combustion reactions and can help adapt existing combustion infrastructure for biomass-derived fuels.

"My favorite part of conducting research is the idea that there is no answer key," said Dedic, who works on the system alignment, data collection and analysis, and co-authored a research conference publication.

"Because you may be only one of several people in the world researching a specific topic, no one yet knows the answer and there is rarely one correct answer. Although this can be frustrating at times, it's extremely rewarding when you do discover a possible solution, or even when you begin to understand what is happening and why," she said.

Dedic also is involved in a wide variety of campus activities. She is in the ISU Wind Ensemble, a member of the Water Polo Club and Engineers Without Borders. She has been a Women in Science and Engineering learning community peer mentor, an Ames Middle School mentor and a lector at her church.

A member of ISU's Honors Program and Tau Beta Pi Engineering Honor Society, Dedic has won several competitive scholarships and competitions. Next spring, she will begin the concurrent Master's/Bachelor's program at Iowa State and plans to pursue her Ph.D. and an academic career.

"I'm extremely interested in the research and development of new scientific processes," Dedic said.

"Chloe is admirably a complete student, excelling in academics, research, service and interpersonal skills," said **Terry Meyer**, the William and Virginia Binger Assistant Professor in Mechanical Engineering. "Add her energy and enthusiasm, and I have no doubt that Chloe will be successful in any engineering or scientific endeavor she chooses to pursue."

Contributed by News Service

ME student awarded United Nations fellowship for work with rural technology

Last winter, Colton Kennedy, a junior in mechanical engineering, traveled to India to implement a proposal he submitted for the Laura W. Bush Traveling Fellowship. The fellowship provided funding for a student-developed proposal to work abroad while fulfilling the mandate of the United Nations Education, Science, and Cultural Organization (UNESCO).

While in India, Colton worked with multiple not-for-profit organizations in the development of appropriate rural technologies and communication materials. He shared his experience with other college students interested in these technologies through the creation of non-profit organization and a project website.

Former First Lady Laura Bush presented Kennedy the award at the United Nations Building in New York City on September 8, 2010. He was one of only three students nationwide to receive the award.

Recipients for the fellowship are selected based on the originality and feasibility of a project proposal, the quality of their essay, and their dedication to connecting with other nations and cultures while promoting democracy throughout the world.

Kennedy's project, titled "Technology Granted Freedom (TGF)," allowed him to develop Appropriate Rural Technology (ART) in India while informing engineering and technical university students of design constraints, key issues, and impediments with the development of this sort of technology. ART, as Kennedy explained, is "technology which is both culturally-relevant and sustainable for its area of application, in regards to environmental, social, and economic context. The ultimate goal of TGF is to improve the quality of life for those rural and impoverished peoples around the world deprived of technology appropriate for their location and condition."

Another goal of the project was to facilitate the sharing of information and experience with this type of technology. "The goal of the project was to develop a networking infrastructure between students and professionals," Kennedy said. Kennedy secured the assistance of the Institute for Rural Research and Development in Dehli, India. He also worked with the Appropriate Rural Technology Institute located in Pune, India.

Additional funding for the project was provided by Kennedy's internship. "Through remarkable generosity, my friends at Pegasus-Global have offered funding to 'make it happen,' through the Patricia D. Galloway and Kris R. Nielsen Foundation," he said.

While working at his summer internship at Pegasus Global Holdings, Inc., Kennedy was encouraged to develop and finalize his proposal. "While working at Pegasus, I developed a close friendship with the President, CEO, and COO. These three individuals greatly encouraged my proposal. It was the CEO, Dr. Patricia Galloway, who introduced me to the award and helped me make the contacts necessary to develop the proposal."

Kennedy also had support from Iowa State Executive Vice President and Provost Elizabeth Hoffman, College of Engineering Dean Jonathan Wickert, and Ramesh Kanwar, chair of the agricultural and biosystems engineering department. "Without these individuals, and the connections they supplied, I never would have been able to develop a successful proposal," said Kennedy.

In pursuit of these ambitious goals, Kennedy worked with other like-minded students at Iowa State. "I hope to create something that involves a variety of individuals and has the ability to continue after I have left," said Kennedy. In particular, Kennedy worked with Brian Castro, a sophomore in Global Resource Systems. "I am lucky to share this experience with a friend like [Castro]. He has become a valuable asset to the project, and I am very grateful that we have students like him on our campus," said Kennedy.

After the travel abroad experience, Kennedy submitted a report describing his experiences and analyzed the success of the objectives which he outlined in his project proposal.

Contributed by ECR

Anthelion showed its speed and raced to fourth in Formula Sun Grand Prix

Anthelion finally proved it's a quick and reliable solar race car.

On the third and final day of this year's Formula Sun Grand Prix for student-designed and student-built solar cars, Team PrISUm raced for another 156 laps around a nearly one-mile section of the Indianapolis Motor Speedway's road course.

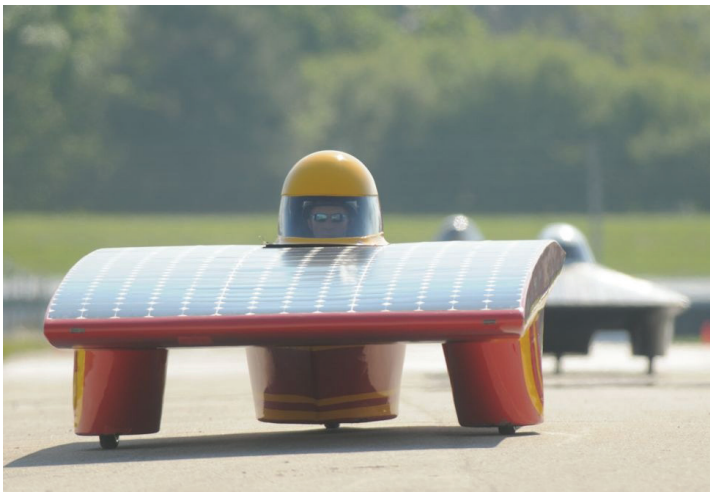
That was good enough to maintain the team's hold on fourth for the grand prix. Anthelion (the $250,000 car is named for the rare halo that can appear opposite the sun) completed a total of 403 laps. The University of Minnesota won the competition with 569 laps.

"We're real happy with the way our car has been performing," said Evan Stumpges, a team leader and a senior in mechanical engineering from Pauma Valley, Calif. "It has been nice to drive Anthelion to its potential."

The solar car suffered chronic electrical problems during the summer 2010 1,100-mile, cross-country American Solar Challenge. But, when the electronics worked, the car could race at the speed limit.

The students of Team PrISUm worked over the past school year to troubleshoot and revise Anthelion's electrical systems and test the car's performance. The Indy competition was the car's last chance to race; the team is currently designing and building a new car for next summer's cross-country race.

And - except for a crack in the frame that cost the team four hours of race time - Anthelion went out a racer.



"We're pretty happy with it now," said Stumpges. "I wish it was where it is now when we ran the big race in summer 2010."

Contributed by News Service

Kopytko receives national scholarship

Kathy Kopytko, junior in mechanical engineering, was named the Engineering Scholar for the Richard R. Gorecki Scholarship Program from the Polish Falcons of America.

This national scholarship program was established in 1999 in honor of Druh Gorecki, a longtime member of Nest 79 in Southgate, MI. The scholarship honors Falcon members who demonstrate the highest academic standards and leadership qualities.

Kathy is a member of Nest 42 of the Polish Falcons of America in Chicago Heights, Illinois, and has volunteered her time for various youth leadership development programs, theatrical productions and her parish.

Kathy is involved with the Society of Women Engineers (SWE) on campus, and as a SWE outreach co-director, she helps organize Girls Learning and Experiencing Engineering (GLEE) Days. GLEE Days invite local elementary, middle school and high school girls interested in engineering to campus.

Kathy chose mechanical engineering due to the broad range of opportunities it presents and her fascination with machine design. "Mechanical engineering is the broadest engineering major, yet it still feels like a tight knit community," she said.

She plans to continue her education with a graduate degree in biomedical engineering and work on prosthetics and the bionic arm.

ME senior wins Tau Beta Pi scholarship

Carl Kirpes, senior in mechanical and industrial engineering and member of Tau Beta Pi, has received a Campbell Scholarship from Tau Beta Pi. The national-level scholarships are awarded on the competitive criteria of high scholarship, campus leadership and service, and promise of future contributions to the engineering profession. The Campbell Scholarship is named for sponsors Ruth M. and Cleveland L. Campbell, P.E., IA A '47.

ISU Baja SAE Team Results

The ISU Formula SAE Team competed in the Formula SAE International Off-Road Racing Series competition at Michigan International Speedway in Peoria, IL. The team started well in the race, and, despite a few mechanical problems, the team managed to finish 59th overall out of 97 teams. They ranked 9th in the sales presentation and 18th in design presentation.

Mechanical engineering students make up a large part of the team. ME students on the team include: TJ Beavers, senior; Adam Carlson, sophomore; Kyle Dickinson, senior; Will Higgins, freshman; Steve Krug, freshman; Shail Patel, junior; Derek Peters, sophomore; Kevin Riley, sophomore; Derek Roberg, junior; Greg Tri, senior; Dallas VanWyk, sophomore; James Whisler, senior; Ryan Wiest, junior.

Faas finds her fit at MIT

Iowa State alumna **Daniela Faas** has had an enthralling journey that began with a move from Germany to the US as a teen, beginning what she calls her own version of the "American Dream." That dream has included excellent education and research opportunities that have taken her places she never envisioned, and ultimately landed her a position at one of the most prestigious institutions in the United States: The Massachusetts Institute of Technology (MIT).

Far from home

As a high school student in the city of Ludwigshafen, Germany, Faas and her parents decided that a year of schooling in the US would be beneficial to her education in order to prepare her for the Abitur, Germany's final exams that enable students to attend German universities. Faas' acceptance to Worcester Academy in Massachusetts launched the beginning of her educational pursuit in the US.

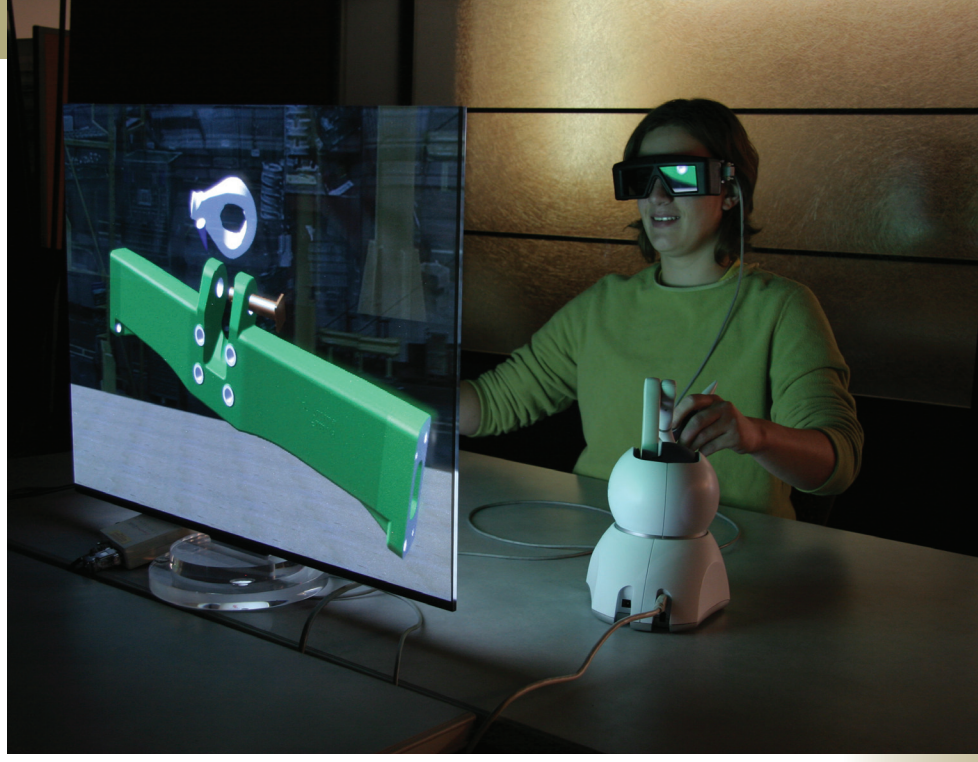
Upon arriving at Worcester, Faas found the cultural differences were hardly noticeable, saying the most difficult thing for her was learning the language. Ambitious to interact with her surroundings, she chose not to bring an English-German dictionary, hoping it would force her to learn from her classmates. "The language barrier in science and math was challenging in the first few weeks, but as soon as I asked my classmates and teachers to explain the concepts, I quickly picked up the material," says Faas.

She also had to adapt to living independently at a young age, as she lived in a dormitory by herself at Worcester. "The change from always having my parents around to being by myself in a foreign country was definitely a learning curve for me," Faas explains.

Despite the novelty of her situation, Faas managed to do well in school, making strong impressions along the way. She was offered a scholarship from Worcester to stay and finish her high school education there. Once she accepted the offer, she knew the US was going to be the place she'd call home for years to come since German colleges do not accept American high school diplomas.

In June 2000, Faas graduated from Worcester and moved to Pennsylvania to attend Bucknell University in the fall. It was there that she received a double degree in mechanical engineering and international relations in 2005. Following her undergraduate studies, she completed her master's in mechanical engineering in August 2006 also at Bucknell University.

Always searching for new and challenging opportunities, Faas began considering places to pursue a PhD. Her main focus was finding somewhere that offered her a variety of resources and would give her invaluable experience. After assessing schools against her criteria, she moved again, this time to Iowa State.



Irreplaceable experience

Faas received a doctoral degree in mechanical engineering and human-computer interaction from Iowa State in May 2010. As she reflected on her time here, she says she the opportunity to conduct important research and gain notable insight and experience in teaching provided her with much more than a degree.

Beneficial to her interests in design, Iowa State is a leader in virtual reality research and home to the Virtual Reality Applications Center (VRAC), where Faas completed research in computer-aided design (CAD) models.

Her dissertation, "A Hybrid Method of Haptic Feedback to Support Virtual Product Assembly," involved many hours of research in the virtual reality labs. The project combined her knowledge of CAD with haptics, which are the application of devices, such as joysticks, that allow a user to feel feedback through his or her hands.

"The key research challenge was to allow users to assemble complex, low clearance CAD parts as they exist digitally without the need to create expensive physical prototypes," explains Faas. "To do this, we had to develop the data structure and logic needed to switch between collision detection and constraint recognition while maintaining a haptic refresh rate of 1,000 hertz."

The results of her research were used in an engineering framework for assembly simulation, training, and maintenance. Faas says that seeing her research applied in the industry makes her very grateful for the tools she had available to her. "VRAC is truly unlike any other lab in the world. The support and passion for virtual reality is unrivaled there, and I am thankful for the learning opportunities I was presented with," explains Faas.

While conducting research, she also gained experience as an instructor. Fully responsible for course development and all aspects of instruction, Faas taught Engineering Graphics and Introductory Design (ENGR 170). Her class, which consisted of an average of 38 students, incorporated a robotic design activity inspired by a course at MIT. "I took a lot away from my experience teaching ENGR 170, but mainly it helped me find my own teaching style that I still use today," Faas says.

Unprecedented opportunities

Taking with her an established philosophy for teaching and considerable experience in research, Faas began a position as a postdoctoral associate in mechanical engineering at MIT, where her main focus is on teaching. She has been a lab instructor for Measurement and Instrumentation (2.671), but her most exciting appointment has been teaching MIT's infamous course Design and Manufacturing I (2.007), the course Faas used as a resource for the Iowa State class she proudly developed. 2.007 is known for its robotic design project and attracts large numbers of people for a final competition that occasionally airs on national TV.

"I took a lot away from my experience teaching ENGR 170, but mainly it helped me find my own teaching style that I still use today," Faas says.

Faas was assigned to teach two sections of the course with 16 students in each section and is responsible for the inventory of the design materials found in approximately 180 boxes given to students for their projects. At the end of the course, a final competition for all the sections is held. Faas had eight students competing this last spring semester. "The competition itself is very exciting," explains Faas. "The stands are packed, and it is quite a production to make it all happen."

This year's final competition consisted of each finalist maneuvering his or her robot through a scaled-down version of MIT's campus to complete a variety of tasks in the fastest time. The tasks were inspired by pranks of MIT's past, including moving rival Caltech's cannon, inflating a balloon on Harvard's football field, and placing a police car on the Great Dome.

Faas is excited that she will be teaching 2.007 again this coming spring semester and that she also will be continuing to conduct research at MIT. She is investigating presence and immersive tendencies during early stage design at MIT's International Design Center (IDC), which is the research portion of The Singapore University of Technology and Design (SUTD). SUTD is a new university established in collaboration with MIT, offering Faas the opportunity to take part in new, unique endeavors.

Although content with her work at MIT, Faas says she is looking for a permanent faculty position, and hopes to teach engineering design at a smaller university. While it is unknown where the next part of her journey will take her, Faas does know that the experiences she had in the US have prepared her to handle just about anything that would come her way. "There is a lot to be said for the learning and research opportunities I have had," she says. "They were rewarding, and they will allow me to follow my plans to help others in their own journeys."

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