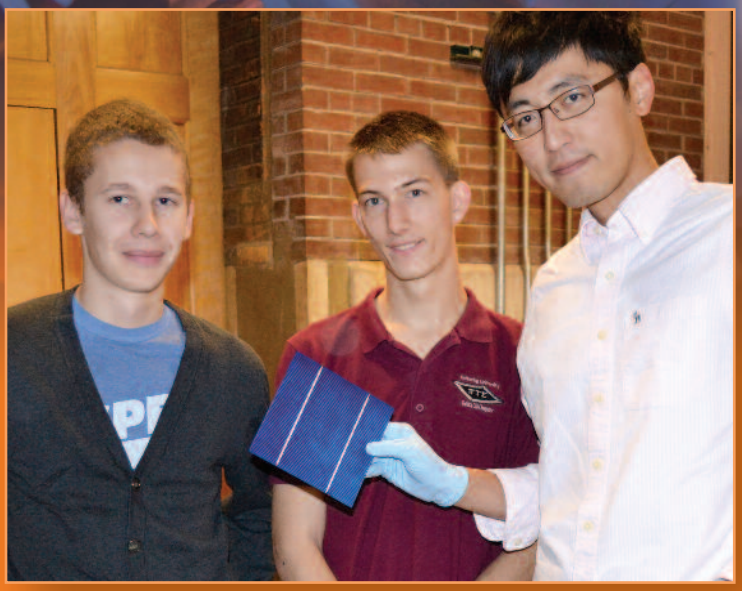
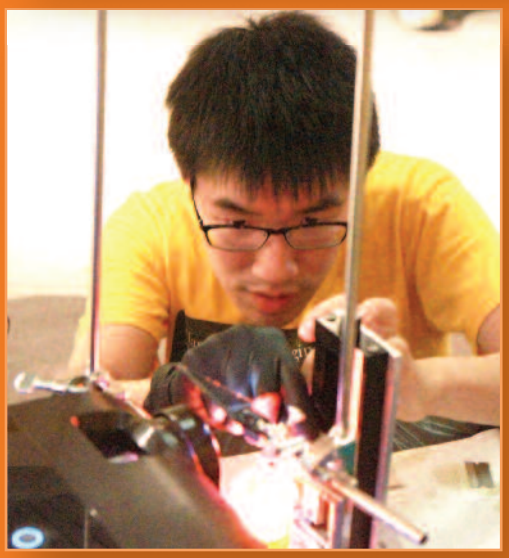
ENGINEERING AT ILLINOIS

Spring 2014

Mechanical

SCIENCE AND ENGINEERING





Moving the World Forward

Contents

Mechanical Science and Engineering

Department Head
Placid Ferreira

Director of Advancement
Bob Coverdill

Editor
Bill Bowman
wbowman@illinois.edu

Writers
Lyanne Alfaro
Bill Bowman
Julia Cation
Kim Gudeman
Betsy Innes
Rick Kubetz
Betsy Powers
Meredith Staub

Designer
Pat Mayer

Cover photos: Lyanne Alfaro, Betsy Innes, Joe Muskin, Meredith Staub

From the Department Head

As we head into the Spring 2014 semester in the Department of Mechanical Science and Engineering, our students, faculty, and alumni continue to make us proud with their incredible achievements. We are pleased to share many of these with you in the pages of this magazine.

For the 2013-14 academic year, our incoming freshmen had a mean composite ACT score of 32.2, the highest in recent history. And when the undecided engineering students have committed to their majors, this year's class may end up being our largest ever as well.

Our new graduate students are equally impressive. With the 2013-14 incoming class the largest on record, we have surpassed the 400-student mark for total grad students, up more than 30 from a year ago. These new students also have the highest GPA and test scores of any class for which we have data.

In August 2013, we welcomed three extremely accomplished new faculty members to the department: **Leonardo Chamorro**, **Tonghun Lee**, and **Sameh Tawfick**. Beyond impressive research credentials, their dedication to education ensures our students will benefit greatly from their instruction and guidance.

From the Air Conditioning and Refrigeration Center, which celebrated its 25th anniversary in 2013, to the International Institute for Carbon-Neutral Energy Research, MechSE faculty members are leaving a large and very integrated footprint in the energy field. And a new Department of Energy center will soon be underway at Illinois, with several MechSE faculty members helping to lead its efforts. The pages that follow highlight the involvement of our faculty, students, and alumni in this crucial industry.

The entrepreneurial spirit has also been a consistent theme among our alumni, and we have provided listings of some of their great companies. In particular, I think you will enjoy the story of Microlution, a company launched by three MechSE grad students that is now seeing great success in Chicago. We are creating a valuable network of partners within our MechSE family, and I encourage other alumni entrepreneurs to inform us about your companies.

On the topic of start-ups, we recently unearthed some fascinating information about the beginnings of our department. In fact, we discovered that 143 years ago, the name of our department was Mechanical Science and Engineering. After many decades and several name changes, we have returned to the very same name, even though we were unaware of its historical significance. I think you will enjoy reading the sidebar on this page, which excerpts word-for-word information published about the department from the 1870-71 academic year.

Thanks to all of you for your continued collaboration and support. We hope you enjoy reading this magazine and that you have a wonderful 2014.

With best regards,

Placid Ferreira
Department Head
Tungchao Julia Lu Professor

Looking Back

Mechanical Science and Engineering: 143 years ago

The following is excerpted from the Mechanical Science and Engineering section of the University's Board of Trustees 1870-71 Annual Report.

The studies of this Department are intended to qualify young men for the designing, constructions or superintendence of all kinds of machinery. It will embrace a thorough course of instruction in the principles of mechanical philosophy, of mechanical devices and the parts of machines, of pattern making, finishing and mechanical proportion, and of mechanical designing and drawing.

A very important element of mechanical training, too often overlooked, is that of shop practice. Many of the schools of mechanical engineering have met with but partial success from the neglect of this important element of instruction. Here practical instruction goes hand-in-hand with the study of theory, not for the purpose of teaching mere mechanic art, which can be learned in any of the thousand shops of the country; but to give a practical character and value to the instruction and to teach more effectually the work of the mechanical engineer.

Mechanical Science and Engineering Curriculum from 1870-71

First Year, First Term: Drawing.
First Year, Second Term: Descriptive Geometry.

Second Year, First Term: Designing and Drawing.
Second Year, Second Term: Shades, Shadows and Perspective. Practical Mechanics.
Second Year, Third Term: Practical Mechanics continued.

Third Year, First Term: Cinematics or Comparison of Motion. Principles of Mechanism.
Third Year, Second Term: Analytical Mechanics. Physics.
Third Year, Third Term: Analytical Mechanics continued. Descriptive Astronomy. Physics continued.

Fourth Year, First Term: Hydraulics, Pneumatics and Thermodynamics. Strength of Materials.
Fourth Year, Second Term: Prime Movers. Drawings (Complete Drawings of Machinery).
Fourth Year, Third Term: Mill Work and Machinery. Drawing (Designing of Machinery, Drawings, and Estimates).

Advancing powerful new **ideas in energy**

Whether we put it to use in our cars, our houses, or our places of business, having energy is paramount to our society. As fossil fuels become more expensive, and further evidence of their negative effect on the environment appears, the importance of energy efficiency has increased dramatically. Capturing energy from the world around us has always been an engineering pursuit, and today it is no different; faculty members throughout the MechSE department are putting their diverse skills to use finding alternative energy methods, improving conventional energy methods, and studying in-depth the processes by which we use the energy we collect. Those profiled here include **Joseph Bentsman**, **Leonardo Chamorro**, **Elif Ertekin**, **Predrag Hrnjak**, **Anthony Jacobi**, **Harley Johnson**, **Tonghun Lee**, **Moshe Matalon**, **Sanjiv Sinha**, and **Petros Sofronis.**

Behavior of materials at extreme temperatures relevant to hydrogen energy

In 2010, the International Institute for Carbon-Neutral Energy Research (I²CNER) was established after nearly five years of research collaboration between Kyushu University in Japan and the University of Illinois at Urbana-Champaign. I²CNER's purpose is to conduct fundamental research to advance science and technology, which will contribute to a sustainable, environmentally friendly society. The main institute at Kyushu and the satellite at Illinois are both directed by MechSE professor **Petros Sofronis**, whose own research focuses on the behavior of materials in adverse chemo-mechanical environments. In I²CNER, he applies this research by exploring ideal materials for hydrogen transport in a hydrogen economy.

Hydrogen is an ideal and sustainable energy carrier for a hydrogen-powered society. When used in a fuel cell to produce electricity, the by-product is water vapor. However, for the realization of the hydrogen economy, many pressing issues still exist, such as how to produce, store, transport, and dispense hydrogen safely. Sofronis, along with the entire I²CNER research team, is conducting fundamental research to address these logistical questions. For example, since common materials are rapidly degraded and cracked when exposed to hydrogen, I²CNER's hydrogen materials compatibility research team aims to improve the structure and properties of existing materials or come up with new material microstructures to find those that are resistant enough to store or transport hydrogen long-term.

"We try to develop tough materials, as tough as we can make them, better than the materials we have today," Sofronis said. "We start by focusing on materials that we know. We have to first understand the existing materials such as austenitic and ferritic steels, and we find out which ones are the best candidates that can operate safely and reliably. And then we try to understand how and why the best candidates are degraded by hydrogen. Once we understand that, we try to modify these materials. At a later stage, since we will know how these materials respond and how they are degraded by hydrogen, we can come up with new alloys."

I²CNER is now in its third year of operation and is progressing rapidly toward becoming what Sofronis calls a "world class institute." Recently, I²CNER established a thematic research cluster on energy analysis in order to identify the roadblocks to achieving a carbon-neutral energy society, which exist due to the constraints of both primary energy availability and resources, by measuring CO_2 emissions, efficiency, and cost. Once the roadblocks have been identified, the primary goal of this research group is to establish a roadmap toward a sustainable and low-carbon society over mid- and long-term scenarios by continuously assessing the relevance of the institute's research activities. This roadmap, which helps I²CNER achieve its vision, is made up of technologically feasible pathways to a carbon-neutral society, which are identified through quantitative analysis. Within this roadmap, there may be multiple pathways that will each require various research-and-development (R&D) strategies. Further, each of these R&D strategies may involve different technologies to be developed. However, I²CNER will focus on the central issues of important technology targets.

"By having carried out this analysis, we usually identify the roadblocks in the research that need to be addressed for a specific pathway in order to make it more efficient, perhaps to the point that it can be adopted relative to another pathway," Sofronis said. "In other words, this helps set milestones and targets for our research. Of course, although this research is focused on basic science, it is also mission-driven. It is not just curiosity—it is research that serves the taxpayer. That's our purpose."

Study of boundary layer crucial in flow-related energy methods

Energy can be generated from a multitude of sources, and it can also come from motion in the form of kinetic energy: the energy from moving air can be extracted using wind turbines, and the energy from moving water can be extracted using turbines in rivers or oceans.

Assistant Professor **Leonardo P. Chamorro** studies turbulence and boundary layer flows—two subjects very relevant to wind energy and hydrokinetic energy (extracting energy from moving water). The boundary layer of any fluid flow is the portion of the flow that feels the effect of the surface it is flowing against. In the atmosphere, for example, the wind feels drag as it moves against the stationary ground. This drag stops having an effect on the wind flow at some higher point in the atmosphere, which defines the limit of the boundary layer. This layer exists in other flows as well, including those of river currents and ocean tides. The complexities of this layer have a great effect on turbines operating within it, and understanding these complexities is part of the drive behind this area of Chamorro's work.

The first energy application of his studies is in wind energy. Large wind turbines average about 100 meters high; they operate where turbulent boundary layer effects are significant. Chamorro and his group, the Renewable Energy and Turbulent Environment Group (RE-TE-G), are studying how to reduce the undue stress exerted on turbines by turbulence in the boundary layer, so as to make them more efficient and reliable.

"I do experiments in the field with various topologies," Chamorro said. "I have 16 turbines of 3.2 meter rotor diameter. This is bridging what we use in wind tunnel experiments, which are very small, and the actual turbines you would find on a wind farm, which are 80 to 100 meters tall. Then I measure flow turbulence, scalars, and turbine quantities to characterize what's happening, and then I study how this flow turbulence affects the turbines' performance."

Chamorro's group is also addressing environmental questions, such as wind farms' effect on pollinators. As many wind turbines are installed on farmland, ensuring that they won't adversely affect the pollination of the crops is crucial.

"Bees are critical for our crops, and we know that bees are affected by turbulence," Chamorro said. "To better understand how turbulence and its structure across scales modulate the behavior of the bees, we are setting the infrastructure to track individual bees with various cameras both in a standard environment and

cont. page 7

Alumni in Energy: KR Sridhar

KR Sridhar (PhDME '90) is the founder and CEO of Bloom Energy, with a mission to "make clean, reliable energy affordable for everyone on earth." In 2010, Bloom Energy launched a new fuel cell called a Bloom Box that would be both energy-efficient and environmentally friendly, and able to generate electricity near where it is needed. Companies such as eBay, Google, FedEx, Wal-Mart, and the Coca-Cola Company use large Bloom Boxes to power manufacturing facilities and large office buildings. eBay's CEO reported to "60 Minutes" that their first five Bloom Boxes saved the company $200,000 on electricity in one year. In 2013, eBay announced that Bloom Energy would be powering its massive new data center in Salt Lake City.

Alumni in Energy: Jay Paidipati

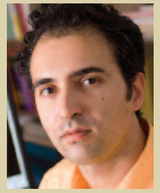
Jay Paidipati (BSME '02) is an associate director in the Emerging Technologies & Renewables group in the Energy Practice of Navigant Consulting, Inc. Navigant offers business consulting services in a multitude of industries, including construction, energy, financial services, and health care. Paidipati's work focuses on renewable energy technologies, markets, resource assessments, and policy. Prior to joining Navigant, Paidipati was involved in the photovoltaics industry.

ExxonMobil representatives **Darnell Smith** (BSECE '02) and **Amber Massingill** (BSChemE '02) pledged $14,000 in unrestricted support for the MechSE Department in September 2013. They met with MechSE staff, as well as undergraduate students **Taylor Oltman** and **Mike Bastanipour** (in blue), at Engineering Hall to communicate the donation news. The giant energy corporation, which alternates between the first and second spot on the Fortune 500 list, is a top employer of MechSE graduates.

MechSE faculty play major role in new DoE center


Jonathan Freund


Harley Johnson


Carlos Pantano-Rubino


Nick Glumac

The U of I will receive $16 million to fund a new center that will leverage extreme-scale computing to predict how plasmas could be used to control combustion. The research may pave the way for cleaner-burning combustors and more reliable and higher performance jet engines.

Named the Center for Exascale Simulation of Plasma-Coupled Combustion (XPACC), it will be funded for five years by the Office of Advanced Simulation and Computing of the National Nuclear Security Administration (NNSA), part of the U.S. Department of Energy. The center, one of three Multidisciplinary Simulation Centers funded through NNSA's Predictive Science Academic Alliance Program II, comprises of researchers from Illinois and the Ohio State University.

Professor **Jonathan Freund** of MechSE is co-leading the center with Computer Science professor **William Gropp**, the principal investigator on the cooperative agreement and director of Illinois' Parallel Computing Institute, which administers the new center. Freund will orchestrate the predictive physics modeling and simulations, including the supporting experiments.

"Plasmas offer a little-explored means of tuning combustion to meet engineering objectives of performance or efficiency," Freund said. "Harnessing the power forthcoming computer architectures, as is planned within this center, will enable truly predictive simulations that can advance this technology."

Other MechSE faculty—**Harley Johnson**, **Carlos Pantano-Rubino**, and **Nick Glumac**—are also heavily involved in the center.

"This would be a whole new mode of managing combustion," Gropp said. "We aim to make breakthroughs in this emerging field at the basic science level that ultimately lead to a greener world."

In a normal combustion event, many steps occur between the spark and the firing of an engine. Control of the intermediary steps is not possible with current technology. However, plasma—a gas that is transformed into a new state of matter when its atoms are ionized—has properties that enable intervention at intermediary steps. Plasma can create the same chemical species that occur during normal combustions and also can produce heat during the different phases, making the chemical process happen faster.

By using plasmas as a control mechanism, researchers believe they can manage the chemical process, thereby boosting performance or reducing emissions of greenhouse gases into the environment. Plasmas could also help stabilize flames for hypersonic, high-speed jet engines, in which air passes through so fast that the flame can be extinguished.

But understanding just how to manage plasma is a difficult problem, requiring three-dimensional, fluid computer simulations that can cover many space and time scales. To make reliable predictions, researchers need scalable computational resources to model and analyze the physics components, which range from flow turbulence to electrodynamics.

"You have to be able to understand what's happening at the atomic scale all the way up to the bulk flow in the plasma, which you can measure with a ruler," Gropp said. "We can't do this as one big computation, so we have to create new techniques that will help us stitch everything together."

The efforts will include the development of new technologies for heterogeneous petascale and exascale systems. Computer scientists and engineers will create better tools for managing efficient data structures, mitigate the irregularities that come with both extreme-scale computing and the fluid nature of the chemical processes, develop novel computational and programming tools for mapping hardware architectures, and design simulation models specifically for turbulence, combustion, plasma dynamics, and the electro-chemical properties of surfaces.

Established by Congress in 2000, NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science. NNSA maintains and enhances the safety, security, reliability, and performance of the U.S. nuclear weapons stockpile without nuclear testing; works to reduce global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the U.S. and abroad.

Alumni in Energy: Steve Vavrik

Steve Vavrik (BSME '90, MSME '91) is the executive vice president of business development at Apex Wind Energy. In this role, he directs efforts in power marketing, origination, and acquisitions for Apex's wind and solar projects. Previously he has worked in management positions at CleanPath Ventures LLC, a solar project investment firm; SunPower Corporation, a solar panel manufacturer; First Wind (formerly UPC Wind Management), a wind energy company; and energy companies PPM Energy and Dynegy. "While all projects are challenging, renewable energy projects help create a positive legacy for future generations," Vavrik said.

in a wind farm environment. Then we will study how their trajectories and behaviors change with the flow turbulence generated by a wind farm."

Hydrokinetic energy as a form of alternative energy is slowly gaining traction. It is slightly newer and less developed than other methods, such as wind energy or solar energy, but it is the perfect application for Chamorro's study of turbulent boundary layer flows.

"Hydrokinetic is like a little brother of wind energy," Chamorro said. "A special case, but it uses the same principles. If you put a turbine in a fast-flowing river, the electricity is produced from the kinetic energy of the current."

This concept can be used anywhere there is moving water, including tidal motion in the ocean and wave motions on the surface. And because the current is affected by the drag it feels from the bottom and banks of the body of water, the complexities of boundary layer flow apply to the study of hydrokinetic turbines. In an ME 470 senior design project, Chamorro is overseeing a group of students whose project is to build a hydrokinetic device. But in his own research, his current goal is also focused on the environmental safety of hydrokinetic energy.

"Even if it is clean energy, we don't know how it can alter the dynamics of the ecosystem and the topology of the surrounding area," Chamorro said. "Are the fish going to be killed? What about the nutrient distributions in the river bottom or ocean bottom? What are the effects of the enhanced mixing in the water? We don't know yet, but these are very important questions besides the technological aspect of the problem."

Materials may hold secret to solar cell progress

The first photovoltaic cell, more commonly known as a "solar cell," was engineered in 1883. Despite being 130 years old, solar cell technology is still in a very young stage of its development, far behind most other forms of energy production.

"Solar cells have existed in some form or other for more than a hundred years now," MechSE assistant professor **Elif Ertekin** said. "But they still haven't been optimized; their performance is still not as good as it could be. So we're trying to determine what we have to do at the materials level to manufacture devices that are better at converting sunlight to electricity."

Ertekin's research is in computational modeling and materials design, with interests that include thermoelectrics and photocatalysts as well as photovoltaics. Although her work is entirely computational, she works closely with the experimentalists who synthesize the materials and measure their properties.

"It's a pretty exciting time for computational work," Ertekin said. "Systems that our group can model on a computer can now be grown almost exactly—down to the atomic scale—in a laboratory."

With the average efficiency of a conventional solar cell, it takes one to two years to generate the same amount of energy needed to make the silicon the cell is made of. In order to compete with other forms of energy production, the efficiency needs to be increased significantly. One potential way to do this is to "hyperdope" the silicon with impurities. Hyperdoping is giving the silicon impurities at concentrations several orders of magnitude higher than the solid solubility limit. This process creates what is called "black silicon," a material Ertekin and her group are studying that would be capable of absorbing sunlight in the low-energy portion of the solar spectrum, and is a good model system to explore how to make silicon a better absorber of sunlight.

There are also other factors to consider, such as manufacturing costs. In order to augment the efficiency and decrease the costs, Ertekin and her group are looking at alternatives to the bulk silicon that most modern solar cells use as the active layer.

"We want a low-cost material that is still good at converting sunlight to electricity even when it's been manufactured at low

cont. page 9

MechSE student talks batteries on the BBC

In June 2013, MechSE grad student **James Pikul** was a guest on the United Kingdom's BBC radio. Host **James Hazell** interviewed Pikul on the microbatteries being developed within the research group of MechSE professor **William P. King**.

Pikul's work concentrates on the most powerful microbatteries ever created.

"We're really pushing into an area in the energy storage design space that is not currently available with technologies today," Pikul said. "It's not a progressive improvement over previous technologies; it breaks the normal paradigms of energy sources."

For more information on these breakthroughs from King's research group, please see MechSE's Fall 2013 magazine or mechse.illinois.edu.

ACRC celebrates 25 years at Illinois

In 2013, the Air Conditioning and Refrigeration Center (ACRC) marked the 25th year it has called the MechSE department home. The ACRC, a cooperative research center founded by the NSF, promotes collaboration between industry and university research in advanced air conditioning and refrigeration systems. It seeks to develop more energy-efficient equipment and to provide a forum for industry to share pre-competitive research and results. The center is co-directed by MechSE professors **Predrag Hrnjak** and **Anthony Jacobi**, who both research heat transfer and energy systems. They have been involved with the center for more than 20 years and have served as directors 11 years.

"In the United States, this is the only NSF-funded center in this area," Jacobi said. "There are a handful of related efforts at other universities, but they are much smaller. ACRC dominates the area in the U.S."

The center began in 1989, co-founded by **Clark Bullard** and **Roy Crawford**, who were professor and assistant professor, respectively, in the MIE Department (predecessor to MechSE) at the time. The need for such a center arose after international agreements began limiting certain refrigerants that had been proven to damage the ozone layer. Research was desperately needed to find alternative technologies for the refrigeration industry, and the ACRC was the answer, bringing university researchers and refrigeration/air conditioning companies together to make progress in the field. By the mid-1990s the ACRC had grown to involve 30 member companies, which each contributed to a pooled research fund. The companies would then vote on research projects the faculty proposed, and the projects selected for funding were supported by this pool of common resources. The center operates the same way today.

"We are trying to do pre-competitive research in the ACRC," Hrnjak said. "That means, whatever we do, this could be useful for all of our members, who are competitive groups from certain parts of industry. I think that is pretty unique, to have people from competitive companies sitting together at the same table discussing what will be funded and listening to students who are presenting their research, and giving them input."

The center is very well-integrated into the department. Faculty members can interact with companies if it is in the interest of their research to do so, or they can pull away for a time to do their own research apart from the center. Students, too, can move back and forth doing research through the ACRC, and independently in the department.

"That is one of the beauties of the ACRC," Jacobi said. "Students and faculty move around freely. We feel like we are fully integrated into the department. I think that lack of separation is a huge strength—one that helped us to grow. The ACRC has become a little technical community all its own in this industry; it has developed a culture of exploration and trust, allowing faculty to go down a lot of unexplored paths."

MechSE research professor **Predrag Hrnjak** manages more than 25 graduate students and many labs in Mechanical Engineering Laboratory as part of his work for the Air Conditioning and Refrigeration Center (ACRC).

The center has seen great success since its founding. Countless papers have been published through its research, and the students that participate in it fare well after graduation.

"We've seen our students graduate and go to academic positions and become our competitors, which is good," Jacobi said. "We've seen our students go to our sponsoring companies and become our bosses, which is good. We've seen our students graduate and then become the leaders of big government activities, where they go in and make big changes and suddenly rise to the top. To me, it is probably as rewarding as the research itself to watch our young people go out there and hit a home run."

The center has also become more focused on energy efficiency. As efficiency standards for refrigeration and air conditioning systems rise, the industry has a vested interest in keeping ahead of those standards with technology.

"The industry is pushing very hard in increasing energy efficiency," Hrnjak said. "How is the industry going in that direction? By improving the components, improving the systems, and improving buildings. We hope that we are contributing to that effort."

The ACRC is making powerful strides in research for the refrigeration and air conditioning industry, bringing industry leaders together to make meaningful change. Hrnjak and Jacobi speak with pride of the difference the center has made in the field throughout its years.

"I think a lot of the time, the results of the center just quietly show up in the marketplace," Jacobi said. "Then we see it and say, 'Oh, we know where that came from!' I think that's good. That's the way we want to be involved."

Quantum dots could help solar cells reach new levels of efficiency

One of the most important components of the solar cell is the material used to convert sunlight into electricity, which is usually a semiconductor. Defects in this material from manufacturing processes can reduce its efficiency, and in alternative energy forms such as solar power, efficiency is crucial. Professor **Harley Johnson** and his research group study how these defects can impact the properties of the material and decrease its efficiency in a solar cell—as well as how to make beneficial "defects" of their own with quantum dots.

temperatures, even if it's not electronic-grade pure," Ertekin said. "So the key is to figure out what it takes for a material to be defect-tolerant."

Researchers around the world have taken interest in thin-film semiconducting materials, creating what are known as "thin film solar cells." The amount of material required to make these cells is significantly less than that of bulk silicon solar cells, although their efficiencies still lag behind silicon by several percentage points. The two most popular thin film materials are cadmium telluride (CdTE) and copper indium gallium selenide (CIGS). CdTE is currently the most cost-effective, while CIGS has the highest efficiency of the thin-film materials. Ertekin and her group are focusing on another thin-film material: copper zinc tin sulfide (CZTS). Because it is made from earth-abundant elements, CZTS offers a significant advantage over many thin-film candidates; the raw material for CZTS is about five times cheaper than that of CIGS.

Most importantly, efficiencies with CZTS are already up to about 12%. The best semiconductor solar cells are about 27-29% efficient out of a laboratory, and 21-23% efficient off a manufacturing line or industrial process. Thin film modules can range from 10% to a little under 20%. Compared to these efficiencies, 12% for a CZTS cell doesn't seem entirely impressive—but considering the age of the technology relative to that of other solar cell materials, it's actually quite surprising.

"It's a very early-stage material," Ertekin said. "The research community has only been working on CZTS for a handful of years. The fact that it's as high as 12% so early in the game makes you think there's still a lot of room for improvement in this particular material.

"And I think that as photovoltaic technology continues to improve, as it gets more convenient and more reliable, we'll see more and more adoption here in this country. It's an exciting time for the field right now."

Alumni in Energy: Clay Nesler

Clay Nesler (BSME '82, MSME '83) is the vice president for global energy and sustainability of Johnson Controls, Inc., a company whose products and services focus on improving energy and operational efficiencies of buildings, batteries, electronics, and more. In this role, he is responsible for energy and sustainability strategy, policy, marketing, education, innovation, operations, and international NGO relationships. He also serves on the company's global environmental sustainability council and several other boards and groups committed to sustainability, including the Task Force of National Energy Policy and the World Environment Center. "Most people believe that sustainability costs extra and that you are trading off financial returns for environmental or social benefits," Nesler said in an interview with *The Atlantic*. "In the area of energy efficiency, it is clear that you can achieve all three of the 'triple bottom line' returns from a single investment."

HV/TMS Center proposed to NSF

MechSE professors **Iwona Jasiuk** and **Martin Ostoja-Starzewski** are proposing a National Science Foundation-supported Industry/University Cooperative Research Center called the Center for Novel High Voltage/Temperature Materials and Structures (HV/TMS), along with researchers from the University of Denver and Michigan Technological University.

The center's primary aim is to find the best structures, materials, and methods for replacing the nation's system of electrical power lines as well as for improving the electrical cables in aircraft.

"The demands for electricity are increasing by businesses and consumers alike, and the current power lines are becoming inadequate to meet these demands," Jasiuk said. "There is an urgent need to transport more electrical power more efficiently."

A key to creating a new center that will have significant impact on the power industry is having the right corporate partners involved.

"We have already attracted several major companies to join us in this effort," Ostoja-Starzewski said. "These include Southwire, Boeing, and BP. We're talking with more companies from various states and other countries, in the power industry, aerospace, automotive, electronics, and petroleum sectors. Strong connections and technical similarities exist between the power industry's high-voltage electrical and the aerospace industry's avionics materials and structures."

Besides the member companies from industry, federal laboratories are also likely to join in this NSF-funded approach to creating the HV/TMS Center.

Member companies from industry will join universities, federal laboratories, and the NSF in a four-pronged approach to creating the HV/TMS Center. Interested companies, faculty, and students may contact Iwona Jasiuk at **ijasiuk@illinois.edu** or Martin Ostoja-Starzewski at **martinos@illinois.edu** for more information.

Silicon is the most popular semiconductor material for consumer-grade solar cells. Because it comprises such a large portion of the solar market, even small changes in efficiency can mean drastic differences in industry prices. Using a novel infrared optical method developed by his collaborator **Gavin Horn**, Johnson is defining exactly how stress and defects alter the properties of a silicon wafer.

"We're interested in understanding it at a level that is not being considered currently," Johnson said. "And the way we're doing it is to use a new inspection technique that lets us see the stress and the defects inside the material using an infrared optical method. We're really excited about it because we think it could teach us a lot of basic science, but also some very applied concepts that could be used by industry to make more efficient solar cells."

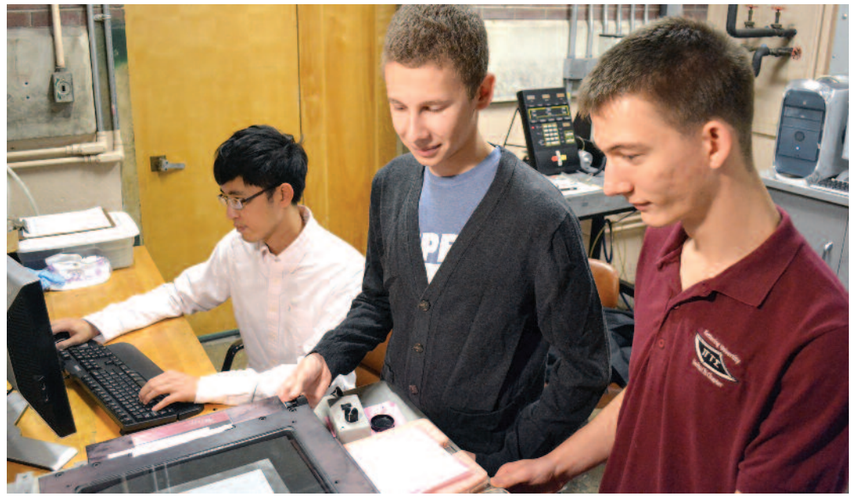
Another way Johnson and his group, including graduate students **Purnima Ghale**, **Tung-Wei Lin**, **Brian McGuigan**, and undergraduate **Logan Rowe**, and undergraduate **Alex Kaczkowski**, are trying to improve solar cell efficiency is by engineering new semiconductor materials: gallium arsenide embedded with indium arsenide nanoparticles, called quantum dots. The band gap energy for silicon is well-suited to the solar spectrum, which is what makes it an ideal semiconductor material for a solar cell. Gallium arsenide has a larger band gap that is matched differently to the solar spectrum. Embedding it with nanoparticles of indium arsenide gives it "states" in the bandgap, which allows it to absorb the energy of sunlight more efficiently. Theoretical estimates say that cells created with this strategy could have efficiencies upward of 60%, while current commercial silicon solar cells only have efficiencies around 20%.

There are still issues to be solved. In a solar cell, the absorption of light separates electrons from the material, and then the solar cell must get the electrons moving in a current in order to translate the absorbed energy into electricity. While the quantum dots allow for the cell to absorb more of the solar radiation, the electrons scatter off the quantum dots and make it difficult for the cell to produce electricity. On top of this, gallium arsenide and indium arsenide are more expensive than silicon, and manufacturing a solar cell with nanoparticles has a high cost.

"This kind of cell would be more suited to things like space applications, where the efficiency alone is really important," Johnson said.

Besides applications in industry and manufacturing where efficiency is more of a concern than cost, Johnson believes that research in quantum dot solar cells is important in the search for higher efficiencies in solar energy.

"I think the hope here is really that we'll learn a lot about the fundamental properties of how the more complex solar cell architecture works," Johnson said. "These materials likely will not be the future of solar energy. But we might learn enough from studying them that we can make a breakthrough and transition to some other material that we haven't yet discovered."



Grad student **Tung-Wei Lin** analyzes data on the computer, while undergrad student **Alex Kaczkowski** and grad student **Logan Rowe** investigate a silicon wafer in Professor **Harley Johnson**'s lab.

MechSE professor studying optimized biofuels for combustion in current engines

Biofuels have existed for almost as long as cars; Henry Ford in the early 1900s planned to fuel his first cars with ethanol, and some very early diesel engines ran on peanut oil. Gasoline and diesel are also "biofuels" of a sort, as they come from decomposed plant and animal matter—but while they come from ancient biomatter, the biofuels being studied today by Associate Professor **Tonghun Lee** and scientists around the world come from more recent plant life.

Today's biofuels come from plants that typically have a high fat or oil content. These plants then undergo a process called hydroreforming, which separates them into large hydrocarbons that can then be broken up into smaller pieces depending on what fuel is needed—hydrocarbons in jet fuels have between 7 and 14 carbon atoms, while diesel fuels can have up to 20. The process of refining a biofuel gets more complicated when there are multiple shapes the molecule can take, as chemical structure can influence the performance of a fuel. This makes the processing of a biofuel a crucial step in making them "drop-in fuels," or fuels that will be compatible with current engines.

Lee's research specializes in combustion, with a focus on laser and optical diagnostics. These laser and optical diagnostics help him quantify what occurs in the combustion of these biofuels, which gives insight into how exactly different processing methods affect the performance of the biofuel.

"Until biofuels become mainstream, nobody is going to build a new engine for biofuels," Lee said. "We need to make these fuels work in our engines. So we want to provide information about how to process these fuels so that they can become drop-in fuels, and give them design guidelines for an optimized biofuel. "

The two main properties that Lee is studying in biofuels are ignition and low-temperature chemistry. Each biofuel can have a different ignition delay, which is the 1-50 milliseconds before ignition when the molecules disintegrate and prepare to burn. This delay dramatically influences engine control. Also important is the performance of the fuel at low temperatures.

"So when it's really hot, high-temperature combustion, all fuels behave kind of the same way," Lee said. "When it's cold combustion, fuels behave very differently. So we want to make sure that the fuel performs adequately in terms of the ignition but also in terms of the low-temperature combustion."

As one of his main projects, Lee is helping the U.S. Navy and Air Force reach their goal of having a biofuel fleet by 2016 and using 50% biofuel in all of their fleets by 2020. Although petroleum-derived fuels are the most widely used fuels, the U.S. generates very little of the petroleum it uses. A desire to ease the country's dependence on fuel it cannot produce, as well as to use fuels that have less of an impact on the environment, has sparked interest in biofuels created from organic matter.

"It's driven by the military because the military does not care too much about how much the fuel costs," Lee said. "The military is concerned

cont. page 13

Alumni in Energy: Dirk Andreas

Dirk Andreas (BSME '82) is the managing director of in4m LLC, a company that provides new project development and acquisition services to companies and clients in the energy sector. He has been deeply involved with the energy industry for more than 20 years, working in management for companies such as Indeck Energy Services, NRG Energy, Florida Power & Light Company, Iberdrola Renewable Inc., and Enerkem Inc.

Illinois hosts I²CNER's Catalytic Concepts for Energy Symposium

The I²CNER Catalytic Concepts for Energy Symposium was held at the University of Illinois in September 2013. The symposium featured a diverse group of national and international researchers specializing in catalysis issues. The topics covered included proton, oxygen, nitrate, and carbon dioxide reduction; non-platinum metal electrodes for catalysis; alloys and composite materials for catalysis; mass spectrometry; and electrochemical methods.

Not only did the Catalytic Concepts for Energy Symposium introduce I²CNER as a stakeholder in the field of catalysis to some of the experts in the field and vice versa, it also allowed all participants a unique opportunity to interface and explore possible new research directions. In particular, the I²CNER hosts have reported that they used this event like a think tank to brainstorm about I²CNER's present and future research efforts on catalysis. I²CNER Director and MechSE professor **Petros Sofronis** stated that the event was "an overall success."

In light of the success of the symposium, the organizers are planning to carry on the tradition by hosting a subsequent symposium on catalysis issues at the Kyushu University campus in Japan.

In the keynote lecture, Professor **Fraser Armstrong**, University of Oxford, emphasized the importance of biomimetic concepts for catalysis issues. The invited speakers included Dr. **Vojislav Stamenkovic**, Argonne National Laboratory; Professor **Naotoshi Nakashima**, Kyushu University; Professor **Aleksandar Staykov**, Kyushu University; Professor **Tom Jaramillo**, Stanford University; Dr. **Etsuko Fujita**, Brookhaven National Laboratory; Professor **Dan Scherson**, Case Western Reserve University; Professor **Sharon Hammes-Schiffer**, Illinois; and Professor **Takahiro Matsumoto**, Kyushu University. The symposium was attended by many Illinois faculty and students, most notably, the Dean of the College of Engineering, Professor **Andreas Cangellaris**, who gave remarks before the start of the afternoon session.

The symposium was sponsored by the I²CNER Satellite and organized by Professor **Tom Rauchfuss**, Chemistry/I²CNER Satellite Faculty; Professor **Paul Kenis**, Chemical and Biomolecular Engineering/I²CNER Satellite Faculty; and Professor **Andy Gewirth**, Chemistry/I²CNER Principal Investigator.

Solar house returns to Urbana

The Element House was transported on three trucks from Chicago to Urbana in August 2013.

After six years "on tour," the university's Element House returned home in August 2013. Built in 2007 to compete in the U.S. Department of Energy's Solar Decathlon competition, the totally solar-powered house has been on display at the Chicago Center for Green Technology for the past five years, where several thousand visitors toured the house when it was featured during a Green Tech conference in 2007. Its new home will be located at the Energy Biosciences Institute (EBI) Research Farm just south of the U of I campus.

"This new facility is an ideal location to accommodate the Element House," explained **Robert Coverdill**, MechSE's director of advancement and outreach. "The intention of the Solar Decathlon team was always to return the Element House to a suitable location on campus where the building could be used for ongoing education and research in renewable (clean) energy, and where it could be viewed by visitors, especially local K-12 school groups."

The Element House was designed and built by a collaborative team of architecture, engineering, and industrial design students to compete in the competition, held in Washington, D.C. on the National Mall. After two years in planning and development, the university's first Solar Decathlon entry finished 9th overall in 2007.

Illinois is the only school to be invited to each of the past three Solar Decathlon international events hosted in the U.S., earning 2nd place honors in 2009, and 7th place overall in 2011.

"Because the 2013 Solar Decathlon team is participating in China, there have been fewer local project opportunities to engage the very large Solar Decathlon RSO (registered student organization)," Coverdill noted. "We see the Element House as providing just such an opportunity."

It will likely take two semesters to fully refurbish and update the house, with a "grand reopening" possible at the end of the Spring 2014 semester.

Since opening in 2007, the EBI Research Farm has welcomed more than 2,000 visitors, ranging from top executives from BP and Under Secretaries of Agriculture and Energy, federal program managers, and EPA staff, to various environmental non-governmental organizations, managers of venture capital firms, high school and university students, plus farmers, equipment manufacturers, and land-owners from across the U.S. and around the globe.

"This is the largest experimental farm in the U.S., dealing with second generation sustainable bioenergy crops, and supports a wide range of rural bioenergy projects and assessments of environmental services," said EBI Farm manager **Tim Mies**. "Combining the Element House with the Energy Farm will increase the visibility of both. While the houses may provide accommodation for short-term research visitors, this location will also provide a one-stop site to see a collection of diverse interdisciplinary research activities addressing the challenges of climate change."

about energy independence and increase of warfighting capabilities. Once the technology is mature in that sector, it will trickle down."

Biofuels are not widely used in the commercial sector today because of their high costs and lower efficiencies compared to petroleum fuels. But Lee has faith that this will change.

"Biofuels are expensive right now," Lee said, "but you have to keep in mind that we are still in the preliminary experimental phase. Whether we like it or not, biofuels may take over—it may not completely take over petroleum, but it will become a huge portion of our infrastructure. It is ripe for innovation."

Alumni in Energy: Jigar Shah

Jigar Shah (BSME '96) founded SunEdison, a solar energy company, in 2003. Under Shah's influence, SunEdison became the largest producer of solar services in the U.S. by 2009 and was sold for $200 million just six years after being founded. Shah served as the first CEO of the Carbon War Room, a global organization created to help combat climate change through entrepreneurial and market-driven solutions, and now serves on the board. He is CEO of Jigar Shah Consulting and a partner at Inerjys, a fund that invests in clean energy.

Understanding combustion leads to more efficient engines

Combustion is one of the most common ways of extracting energy from a substance or material. The invention of the internal combustion engine enabled mass transportation in the Industrial Revolution and is still very widely used in everyday life in planes, trains, cars, furnaces, and gas ovens and stoves. MechSE professor **Moshe Matalon** is answering essential questions about the nature of combustion, to make it easier and more efficient to utilize its energy.

"The objective is a fundamental understanding of combustion processes," Matalon said. "And understanding is crucial to anything. If you want to improve things, if you want to design things, you need to understand."

Combustion is a very complex process to model. It involves fluid mechanics when the fuel is a gas or a liquid, but becomes more complicated when a liquid fuel is evaporated and the combination of liquid and gas becomes a multiphase flow. The chemistry of the process is also quite involved, as the reaction can involve hundreds of compounds that react to each other differently. In addition, the release of heat from the reaction can change the state of the evaporated fuel and make the flow even more difficult to model.

"It's all very coupled, and mathematically very complex," Matalon said. "Even if you use all the equations that we believe we know more or less sufficiently accurately, we have to put them into a computer because you cannot really solve them with all of their complexities in any reasonable way. So you need to adopt some simplifications and approximations in different aspects of the problem."

This field of study doesn't limit itself to specific applications; it can be applied to everything that requires a stable flame, including most forms of traditional energy manufacturing, which may use such a flame as a pilot.

One major problem with keeping a flame stable is how to deal with "turbulence" from the motion of moving parts or moving air. Almost all practical applications of combustion operate under turbulent conditions of some kind. Matalon and his group have researched how quickly a turbulent flame propagates—a property crucial to determine the mean fuel consumption rate of a combustion system. This information could be incredibly helpful for optimizing internal combustion engines and improving current models of similar systems.

"If you want to improve your engine," Matalon said, "if you want to be able to predict what your engine will do, you cannot just do it by brute force experiment. That is how engines have been developed in the last 100 years, by trial and error. You try, you improve. But in recent years, there has been more emphasis on increasing our computational ability, and it has shown us how important it is to have a fundamental understanding of these complex systems. It invariably helps the design and the improvement of the machines."

Harvesting waste heat could be new source of clean energy

About two-thirds of all the energy we use—in computers, in cars, in making products such as steel—is lost as heat. That energy does not do anything useful, and yet we are paying for it all the same. Assistant Professor **Sanjiv Sinha**, with the help of collaborators across campus, is making breakthroughs in finding efficient and cost-effective ways to reclaim some of that lost energy.

For Sinha and his group, the answer lies in thermoelectric materials: those in which a temperature difference creates an electric potential (or vice versa). Thermoelectric energy conversion has been studied since the early 1800s, but it was only effective at very high temperatures, and the materials were too expensive. If it could be done with a cheap, abundant material that could be altered to be more effective at thermoelectric energy conversion, the implications for energy production would be powerful.

Sinha specializes in the study of electro-thermal transport: how electrical current and heat are carried through a material. These characteristics are very important in a thermoelectric material, especially when the goal is to make the electric conductivity high and the thermal conductivity low, but there are no cheap and abundant materials with these characteristics. They decided to find a material that they could change the characteristics of in order for it to meet the necessary standards.

"Just before our work began," Sinha said, "a discovery was made that if silicon was structured as a nanowire, the thermoelectric energy conversion efficiency gets a significant boost. So our project here involved using silicon nanowires in a scalable fashion, trying to engineer it to be able to boost energy conversion efficiency, and to understand the physics of transport inside this structure."

This effort took interdisciplinary cooperation between faculty members and departmental affiliates from three College of Engineering departments: Professors **John Rogers** and **David Cahill**, from Materials Science and Engineering; Associate Professor **Xiuling Li**, from Electrical and Computer Engineering; and Sinha and Professor **Placid Ferreira** from MechSE, in addition to approximately 20 students across the three departments.

Waste heat doesn't just come from polluting sources of energy—thermoelectric energy conversion can be used with *all* types of energy production, including alternative sources such as solar power and biofuels.

"It's going to be there for the vast majority of energy solutions that are being talked about," Sinha said. "It's nature's garbage. No matter what energy portfolio you create, there will be significant advantage to be able to get waste heat and convert it at low cost."

Equinox House a home for net-zero energy and healthy living

Professor Emeritus **Ty Newell** said it is a good sign that his wife, **Deb**, continues to reside in the Equinox House, a "test bed" for net-zero energy consumption and improved air quality living.

"It is a healthy, comfortable environment. My wife would leave the house for many reasons, but especially if she isn't comfortable," Newell laughed.

"It took me a few years to research here, to study and learn and test and analyze, but it's like all the stars have aligned now: the cost, the efficiency, the technologies, they are all here right now just waiting for people to figure out how to put the pieces together to this puzzle in an economically efficient manner."

Today, the home's main source of power is the sun. And instead of using aquifers, the Equinox House relies on the rainwater collectors on the roof to accumulate water.

"We were the first house in Illinois to get that permission to use rainwater in a house," Newell said. "After almost three years of collecting rainwater, it's never run dry, even with the drought last summer, and it works very well. We are restricted to use that for toilets at present, but that is half of the water consumption in a house."

Newell reported that the house has never had a utility bill except for a monthly customer service fee.

With the completion of the Equinox House, Newell also hoped to promote the importance of fresh air, a quality that many homes lacked in the past.

"Homes were just very leaky. Now that we are building more efficient homes, sealing them up better and better, we need to ensure that there is fresh air coming in," Newell said. "It impacts your health, your well-being."

To address the issue of stagnant air, the Equinox House uses a Conditioning Energy Recovery Ventilator (CERV), to consistently provide the home with fresh air, as well as moderate temperature and humidity levels.

The CERV regularly monitors indoor air quality and checks the weather outside. If the system finds that the air quality inside the house needs improvement, it will deposit fresh air in living areas and rooms while removing exhaust air from "wetter" spaces in the house.

"Unlike opening a window, the air going into this is filtered, so you are not bringing in those asthma triggers, pollen and dust, and those other things that typically are difficult," Newell said.

Similarly, if the system finds that the temperature inside is higher than desirable, it will send fresh air through cooling coils and into the house. If the temperature is too cold inside, it will send fresh air through heating coils and into the living space.

"Instead of a simple heat exchanger, we use a heat pump to exchange energy from outside to the inside," Newell said. "The CERV's conditioning box has a heat pump and the top half are the cooling coils and the bottom half are heating coils."

The Newells had wanted to live in a solar-energy powered house for 40 years. Newell and his son, **Ben Newell** (BSME '02, MBA '08), designed the Equinox House in 2009 and completed its construction in 2010. Even the tools used during construction were powered by the home's solar PV system.

More robust controls can limit wasted energy in power plants

The U.S. electrical power grid is one of the largest machines in the world. It is made up of 3,200 utilities, whose companies sell $400 billion worth of electricity a year. Efficiency in the power plants that generate this electricity is very important to reduce waste and keep prices from rising.

Professor **Joseph Bentsman**, whose research interests lie in the control of nonlinear and distributed parameter systems as well as network control, has been working with the Electric Power Research Institute to increase the performance robustness of its power plant control systems. A system with poor performance robustness is very sensitive to changes in the plant's core parameters, which can lead to excessive waste and pollutants.

"The control system performs less well if the parameters change, and this deficiency can only be marginally affected through tuning," Bentsman said. "This is a pervasive plant operation maintenance problem. If something changes, someone has to show up and tune the system. Something changes again, someone again has to come in and tune. Tuning is a very difficult thing, and this creates a maintenance nightmare."

Bentsman found two solutions to this problem: introducing iterative, self-tuning control, where the control clusters of the power plant would tune themselves in response to changes in core parameters; and "robustification" of the clusters, correcting the structural deficiencies of the existing clusters by inserting additional control elements. Tests on a simple model showed that the "robustification" method can improve the performance by up to three times. Replacing the existing clusters with an iterative, self-tuning control could improve it by up to 30 times. However, the "robustification" method is much more preferable to the power plants, because self-tuning control clusters would require replacing the existing ones with a system that operators may not be able to understand.

"In many manufacturing industries, the operator wants to be the ultimate control authority on the process if something goes wrong," Bentsman said. "In order to do that, the operator has to have a grasp of what the controller does. An operator would have no insight into what's going on with an advanced feedback control design. And as a result, industry has not been accepting it very well."

So to make something that will still improve the robustness and efficiency of existing clusters, without blinding the operators to the processes going on inside, Bentsman took controller elements from a full-order advanced control design and placed them on top of the clusters.

The system has performed well on simple models. The next step is to test it on a high-fidelity simulator of a power plant's control system, before it is actually implemented in a power plant. Once integrated, Bentsman said, it should improve the efficiency of the plant and reduce waste.

More research being done

Many other members of MechSE's faculty are significantly improving our understanding of conventional energy, as well as finding new and alternative ways to obtain it. Professor **Chia-Fon Lee** studies automotive combustion, particularly as it relates to engine performance and emissions. He is conducting research on alternative fuels as well as an engine that can run off of low-temperature combustion to reduce emissions. Professor **Shiv Kapoor** is finding new ways to make manufacturing methods and processes more energy-efficient, and Shao Lee Soo Professor **Scott Stewart** and Professor **Nick Glumac** study energetic materials for use in high energy density energy storage applications. Professor **William P. King** directed a research group including graduate student **James Pikul** (see sidebar on page 7) that created the most powerful micro-battery ever documented. **Huseyin Sehitoglu** is working on next-generation nuclear reactor materials: ones that can withstand much higher temperatures and enable more efficient reactions. MechSE faculty members are making big differences in the world of energy and energy applications, and these differences are fulfilling the ideal goal of engineering: helping to make the world a better place.

Alumni in Energy: Greg Haas

Greg Haas (BSME '87, MSME '89) is the manager of research, integrated oil, and gas at Hart Energy, a leading provider of news, data, and analysis for the global energy industry. In 2012, Haas was the lead author on a research report titled "Refining Unconventional Oil—Unconventional Resources Invigorate Mature Industry," which analyzed and projected crude fundamentals for the next five years. He has worked with Exxon, the Electric Power Research Institute, and with pipeline and power consulting firms.

Alumni in Energy: Donald Langley

Donald C. Langley (BSME '73) is the senior vice president and chief technology officer of The Babcock & Wilcox Company (B&W), where he oversees research and development projects such as those related to clean coal technology development. B&W provides services such as engineering, manufacturing, and facilities management to energy companies all over the world, including nuclear and renewable energy producers. Langley has been with B&W since 1973.

‘Car guy’ Bhole drives home eco concepts at Cusp Conference

In September 2013, the sixth annual Cusp Conference—a gathering of designers, artists, professors, and other innovators who share unique, potentially world-changing design ideas—was held in the main auditorium at Chicago’s Museum of Contemporary Art. Among these highly accomplished professionals was MechSE graduate student **Sanat Bhole** (BSME ’13), who presented to the audience his experiences working on efficient vehicle technologies and the importance of student-led design.

Cusp organizers say it is “a conference about the design of everything.” The 2013 presenters ranged from the designer of NASA’s Johnson Space Center and the inventor of an electric cargo scooter, to the creator of a new model of MBA programs called The Leap Year Project and the founder of The Noun Project, which seeks to create a series of icons that would actually become a rudimentary worldwide language. Bhole was honored when he received the invitation to join such a high-aspiring group.

A self-described car enthusiast, Bhole is the former president and co-founder of the Illini EcoConcept team. The student group formed in Fall 2011 with the goal of designing a fuel-efficient vehicle that was also practical—incorporating elements of real vehicles such as turn signals, headlights, and tail lights. Bhole and his teammates designed their first vehicle, named “The Chief,” for the 2012 Shell Eco-marathon Competition, a series of contests that challenge teams from around the world to design, build, and test exceedingly energy-efficient vehicles.

Bhole described to the Cusp crowd how he and his EcoConcept team decided early on that they were interested in exceeding the requirements of the competition, to push themselves even further into innovative territory. They wanted their vehicle to travel at least 30 miles per hour, have a fuel efficiency of 100 miles per gallon, and offer a comfortable ride for the driver and passenger.

MechSE grad student Sanat Bhole presents at the Cusp Conference in September 2013.

Of course, with great expectations come great challenges. As the team strived to incorporate novel technologies that weren’t currently being considered at the university or among the other design teams, they came across several major speed bumps. With limited resources, their approach to designing a simple but functional chassis resulted in the extensive use of aluminum honeycomb, which was easy to fabricate but proved to be too heavy and lacking in structural rigidity and reliability.

“If you go to our shop at the university, you can still see bits and pieces (of the aluminum) that fell off after we came back from the competition,” Bhole said.

For the 2013-14 car, the Illini EcoConcept team was even more driven to make a lighter, stronger, and more efficient vehicle, learning from its mistakes the first time around. Inspired by the carbon fiber technology used by innovative car companies like Ferrari, Lamborghini, and Porsche, the team figured out how to use a large carbon fiber nomex honeycomb panel, cut it into pieces, and configure it “like a giant, car-shaped, 3D puzzle” that was 26 pounds lighter and considerably stronger than their previous vehicle. They also reduced the aerodynamic drag by almost 36 percent and improved the coefficient of drag to .29, comparable to the aerodynamically efficient Toyota Prius.

For the 2014 competition, Bhole said the car’s major advancements will be the use of a new, lighter, and more efficient fuel cell and a focus on improving the efficiency rather than the practicality of the vehicle.

Bhole concluded his presentation to the Cusp Conference audience by reiterating that student-led design is vital because it “engages students, inspires innovation, and develops outgoing students into outstanding professionals.”

He currently works as a student researcher for the Army Corps of Engineers and as a graduate research assistant for Professor **John Rogers**, while working toward his M.S. in mechanical engineering.

A movement performance interacting with real-time sound synthesis is presented during an engineering class (TAM 456 Experimental Stress Analysis). The methods for analyzing the movement were the focus of the discussion.

Dance mechanics educates dancers and engineers

What does modern dance have to do with mechanical engineering? Ask **Bruno Azeredo**, a MechSE graduate student and co-organizer of an educational initiative titled “Visualization and Quantification of Dance Mechanics for Alternate Approaches to STEM Education.”

Driven by the question, “Can dance be a platform for an engineering classroom?” Azeredo and MechSE professor **Armand Beaudoin** embarked on a journey to develop new undergraduate course materials that use “contact improvisation,” a form of modern dance, to teach basic principles of mechanics. Together, they applied for the Focal Point Program—a seed grant from the Graduate College to initiate interdisciplinary collaborations within the university.

“Students come to class and see professional dancers in the act of moving, jumping, spinning, and colliding. They are essentially learning concepts such as inertia, conservation of energy, linear and angular momentum,” Azeredo said. “The reason I decided to ‘put my hands in the dough’ (a Brazilian phrase meaning ‘to get deeply involved’) is that it’s fun, it’s creative, and it has important implications for my future teaching goals.”

After receiving the grant, new collaborators joined their efforts, and what Azeredo refers to as “originally a garage project” began to take the shape of a cross-disciplinary research endeavor between MechSE, the Beckman Illinois Simulator (ISL), and the Dance Department. In March 2013, Azeredo, Beaudoin, and ME junior **James Lakowski** analyzed movement data from two modern dancers that was later compiled into two experimental classes serving the following courses: Experimental Stress Analysis (TAM 456) and Contact Improvisation for Actors, Musicians, and Dancers (DANC 461).

Fellowships are an important way for MechSE to attract top graduate students who have achieved success at Illinois or at other top institutions throughout the world. Listed below are MechSE’s fellowship recipients for 2013–14. We congratulate these students and would like to express our thanks to the alumni and friends who made these honors possible.

MechSE Endowed Fellowships

Eugene and Lina Abraham Fellowship
Jonathan Bunyan
Luis Fernandez
Ali Hamed
Yichu Jin
Houpei Li
Kyle Mackay
Eric Mayhew
Raqeeb Thameem

Pat and Bette Calabrese Fellowship
Jeffrey Shen

Wen Lung Chow Fellowship in Mechanical Engineering
Timothy Smith

George A. Costello Memorial Fellowship
Ian McNamara
Randi Potekin

Thomas J. and Virginia Fisher Dolan Fellowship
Sushilkumar Koundinyan

C.J. Gauthier Mechanical Science and Engineering Fellowship
Yinai Fan
Herschel Pangborn
Joshua Schiller

George B. Grim Fellowship
Hamidreza Jafarnejadsani

Richard Kritzer Fellowship
Chenchao Shou

Henry Langhaar Fellowship
Amanda Jones

Louis J. Larson Fellowship
Zhao Wang

MechSE Alumni & Friends Fellowship
Pratik Mayur Parekh

MechSE Alumni Teaching Fellowship
Raymond Essick
Farzan Kazemifar

MechSE Excellence Fellowship
Kartik Marwah
Lihan Xu
Matthew Fitzgerald

Robert E. Miller Fellowship
Patricia Weisensee

James E. Peters Fellowship
Sicong Wu

Shao Lee Soo Fellowship
Sicong Wu

H.C. Ting Fellowship
Michael Johnston
James Pikul

Stoyke Fellowship
Nan Li
Christopher Peterson
Matthew Poss
John Sanders
Jonathan Schuh
John Seo
Brian Williams
Yan Wu

William and Virginia Waterman Fellowship
Shengji Yang

W. Grafton and Lillian B. Wilkins Fellowship
Li Lu
Jiange Xiao
Kaihao Zhang
Wentao Zhang

College of Engineering Fellowships

SURGE Fellowship
Amanda Jones
Hector Lopez-Hernandez
Miquela Trujillo

Roy J. Carver Fellowship in Engineering
Rebecca Corman

Graduate College Fellowships

Illinois Distinguished Fellowships
Anna Oldani

Corporate-Sponsored Fellowships

ExxonMobil Fellowship
Zhao Wang

Sargent and Lundy Fellowship
Justin Koeln

National Fellowships

Department of Energy Fellowship
James Pikul
Matthew Rosenberger

NSF’s Integrative Graduate and Research Traineeship (IGERT)
Yung Fan
Rishi Singh

NSF (National Science Foundation) Fellowship
Bruno Azeredo
Stephen Hammack
Elizabeth Jones
Justin Koeln
Brian McGuigan
Anna Oldani
Harpreet Sangha
Matthew Williams

National GEM Consortium Fellowship
Lindsey Gonzalez
Charles Orozco
Mario Valdez

International Fellowships

Fulbright Fellowship
Muhammad Zaman

Science, Mathematics, and Research for Transformation (SMART) Fellowship
Sushilkumar Koundinyan

American Society of Mechanical Engineers (ASME)

To help situate freshmen, ASME hosted a Freshman Conference geared toward helping new students understand the MechSE flowchart of classes and learn more about future classes. The conference closed with a design competition in which students were challenged to build a mechanism to launch a marshmallow as far as possible. For the 2013 homecoming parade, the ASME Special Projects Committee built a "300" movie-themed float in anticipation for Illinois' game against the Michigan State Spartans. Five board members attended the International Mechanical Engineering Congress and Exposition in San Diego in November 2013 to learn about new technologies related to mechanical engineering.
asme.mechse.illinois.edu

Eco-Illini

In Fall 2013, the Eco-Illini car was no longer suffering from the drivetrain and electrical reliability issues that cropped up in Spring 2013. Eco-Illini's new car accommodates a larger-diameter wheel to help reduce rolling resistance and drag. Designed to be lighter than in the past, the new model features a spoked sprocket and a wheel that is 40% larger while increasing drag forces only by about 15%. Work on the vehicle's engine has also begun. Eco-Illini's goal with the new engine is to reduce fuel consumption by adding variable ignition timing and fuel injection while also increasing the compression ratio and reducing displacement. The society continues to dyno-test and tune the engine using the EFI control computer.
ecoillini.edu

Illini EcoConcept

As the society continues to participate in student-led design, the team decided to build a more compact, one-person vehicle this year to cut material usage and costs as well as drop overall weight from the car. This year's vehicle will also include a new fuel cell with a more efficient direct-drive power train package, which will limit mechanical losses found in more traditional drive systems that utilize chains, sprockets, and differentials. In September 2013, former president of Illini EcoConcept **Sanat Bhole** gave a lecture in Chicago (see page 16). "I feel that student-led design certainly is beneficial for students," Bhole said. "If industry doesn't support these types of endeavors, who knows how many innovators and inventions we might miss out on in the future?"
illiniecoconcept.com

Summer 2013 success!
The Formula SAE team was the top U.S. finisher at the 2013 Formula North competition, bringing home third place overall.

Formula SAE

In May 2013, the Formula SAE team finished third overall and was the top U.S. team at the Formula North competition in Barrie, Ontario, Canada. At the Missouri State and Technology Autocross in September 2013, Formula SAE's car had the fastest time and took first place in the competition. The team returned home with a set of Hoosier tires as its prize. In May 2014, the society plans to attend the Formula SAE Michigan competition. FSAE also hopes to compete at Formula Student Germany in Hockenheimring during Summer 2014. The contest requires teams to build a single-seat formula racecar to compete against teams from across the globe. The team with the best overall construction, performance, and financial and sales planning takes first place. Experts from auto, motorsport, and supplied industries will judge the teams' cars and plans.
illinimotorsports.net

The i-Robotics team displays its entry from a Jerry Sanders Design Competition. This robot won the consolation round.

Illini Formula Electric

After taking a break from competing during the 2012-13 school year, Illini Formula Electric (IFE) is back to building and racing cars. With a record number of people on the team—more than 200!—it plans to partake in two competitions during 2013-14. Currently, the society is halfway done with its first competing car. Once achieving a rolling chassis in October 2013, the team began working on designing the car's electrical systems. As an outreach activity, IFE will attend Mahomet Science Day taking place at several schools in Mahomet, Illinois, and talk about the science behind electric race cars. The society also hopes to work with the Aerospace Engineering Department to attend Space Day.
illiniformulaelectric.com

iRobotics

iRobotics began designing its robots early in Fall 2013. Two years after its founding, the society engages in three competitions throughout the school year: Jerry Sanders, VEX, and ComBots. With three Jerry Sanders teams, the society keeps busy while building the 3 x 3 x 3-foot robots, which must weigh no more than 150 pounds. For the VEX competition, the society designs one large and one small robot. The first minute of the VEX contest restricts the robots to completing only autonomous tasks. In the second minute, drivers can take control of the robots, which are scored based on the number of tasks completed in the two minutes. The VEX competition is in April 2014 at the Anaheim Convention Center in California. iRobotics also has two ComBot teams, which build robots that are judged based on aggressiveness and damage caused when they come face-to-face with other robots in 10-second face-offs. The ComBots competition will take place in April 2014 in San Mateo, California. In September 2013, iRobotics initiated outreach activities that included a series of workshops for local students and mentors competing in the annual FIRST LEGO® League (FLL) competition as well as STEM-related engineering activities at local middle schools.
irobotics.tk

Pi Tau Sigma (PTS)

In Fall 2013, PTS members helped to host Engineering Family Night at a local elementary school. About 50 families attended the event and took part in any of seven activities set up in different rooms, including mining for chocolate and balancing dominos. The society also continues its weekly outreach visits to Booker T. Washington, a local middle school, to lead an after-school club featuring hands-on projects focused on math, science, and engineering principles. With these activities, the society hopes to introduce students to STEM fields at an early age. In Spring 2014, Texas A&M will host the PTS National Convention. Illinois's chapter will send at least five members to attend and connect with other chapters. As PTS nears its 100-year anniversary, the society begins to make plans for a celebration in Spring 2015. PTS got its start at Illinois, and the Illinois chapter will send invitations to more than 150 chapters across the nation to attend the national conference here in Urbana, including an annual awards ceremony, panel for company representatives, social events for networking, and more.
pitausigma.mechse.illinois.edu

Pi Tau Sigma demonstrated sand casting as well as many other exhibits at the 2013 Open House for prospective students and MechSE freshmen and their parents.

Society for Experimental Mechanics (SEM)

SEM kicked off 2013-14 with three times as many members as in previous years and numerous projects to begin designing. The society has two teams working on their own T-shirt cannon for a university-wide competition, tentatively scheduled for Homecoming 2014.
mechse.illinois.edu/undergraduate/mechse-student-life

Scholarships

Scholarships are an important way for MechSE to attract top undergraduate students from Illinois and around the world. Listed below are MechSE's scholarship recipients for 2013-14. We congratulate these students and would like to express our thanks to the alumni and friends who made these honors possible.

MechSE Endowed Scholarships

James W. Ashbrook Scholarship
Julia Huynh

A. Richard Ayers Scholarship
Angela P. Davis

James and Loretta Bayne Scholarship
Bruno Abdelnour
Anne Goering
Michael Martin

Paul A. and Edna M. Beckemeyer Scholarship
Nicha Viraporn

Thomas J. Breen and Gail Schaller Breen Scholarship
Athrey Nadhan

Donald E. Carlson Scholarship
John Meyering
Matthew Piper

Bei Tse and May Chao Scholarship
Justin Hunter
Karen Lipa

Phillip A. Dethloff Scholarship
Cassidy Warning
Scott Zacek

Guy Richard Collins Engineering Scholarship
Timothy Chen
Vincent Hughes
Alec Mori
Adam Rosenbaum
Daniel Tisza

Patrick B. and Janet A. Flanagan Scholarship
Jerome Orzech

A. G. Friederich Memorial Scholarship
Alex Kahn

C. J. Gauthier Mechanical Science and Engineering Scholarship
Taylor Tucker

Margaret L. Gongaware Scholarship
Anthony Bruno
Quinton Ford
Nikhil Kapur
Scott Kramer
Jennifer Lin
Alessia Serafino
Eric Wright

Al Hallene/Pella Corporation Engineering Scholarship
Alexander Gruebele

Roger and Sandra Heath Scholarship
Brett Glasner

Ralph J. Henneman Scholarship
Jacob Avery
Christopher Johnson
Zachary Renwick

Miles and Louise Hinsley Scholarship
Jeffrey Smith
Alex Studnicka
Jason Troutner

Illinois ME Scholarship
Jessica Simpson

Erle E. Johnson Scholarship
Emily Weerakkody

Karl W. Kolb and Arden M. Kolb-DeBolt Scholarship
Gideon Horberg
Kevin Kibler
Daniel Wong

Arthur W. Lindstrom Scholarship
Alexander Castaneda
Hye Min Choi
Kaleb Collier
Michael Hafeman
Thomas McGrath
Patrick Slade
Logan Wan
Samuel Zschack

John H. and Billie Jean Marsh Scholarship
Prashant Guha

Robert E. Miller Scholarship
Kendall Rak

Mark E. Prasse Memorial Scholarship
Marc Deetjen

Ben Jay Rosenthal Scholarship
Adam Flanders
Alex Wu

Sam Sachs Memorial Scholarship
Robert Born
Chee Haw Chan
Nathan Dostart
Jill Godman
Carl Handley
Michael Hutchinson
Rohan Karmarkar
Jarrod Martis

Kent F. and Carol Ann Schien Engineering Scholarship
Charles Tierney

Fred B. Seely Scholarship
Drake Hislop

Mark A. Shannon Scholarship
Jerome Sacherer

George M. and Ruth N. Sinclair Scholarship
William Iverson

Sittner Scholarship
Claire Peters
Allison Rymut

Earl and Althea Smith Scholarship
Grant Hallan

Soo Family Scholarship
Alexandra Klieger

Morris Stern Scholarship
Da Yae Frail

Wilbert F. Stoecker Scholarship
Sonja Brankovic

Ray L. and Edna P. Sweigert Memorial Fund
Kyle Johnson

Charles E. Taylor Scholarship
Jessica Simon

Thomas-Lain Scholarship
Sonja Brankovic
Jill Godman
Anne Goering
Nikhil Kapur
Jason Troutner
Eric Wright

James R. Tucker Scholarship
Mason Blake
Joanna Bober

Raymond and Birute Viskanta Scholarship
Michael Hubner

Eleanor and Eugene Wesselman Scholarship
Jonathon Ervin
Kathryn Neville

Steven Kyoon Yun Memorial Scholarship
Sanjit Dutta
Eric Staniszewski

MechSE Annual Scholarships

William L. Fourney Scholarship
Matthew Piper

MechSE Alumni Scholarship
Jacob Haseltine
Emily Weerakkody

MechSE Outstanding Scholarship
Kevin Brenner
Nicholas Fazzini
Bryan Hoffman
Justin McDonough
Dante Reese
Donald Witt

MechSE Corporate Scholarships

Anheuser-Busch Foundation Scholarship
Monica Ngo

Caterpillar Scholarship
Ryan Ruddell
Alejandro Scholcoff
Albert Xiao

Citgo Scholarship
Matthew Tabrizi

Conoco Phillips Scholarship
Soorya Todatry

ExxonMobil Scholarship
Bobby Baer
Elizabeth Bertness
Gail Butler
Christopher Marry
Maggie Naden
Eric Staniszewski

Hendrick House Scholarship
Dante Reese
Adam Vega

Norfolk Southern Scholarship
Heyuan Huang
Matthew Jackson
Michael Lynch

Kaiser Aluminum Scholarship
Oluwami Dosunmu-Ogunbi
Ana Fleming
Luis Jaime
McKenzie Lavalle
Mario Martinez
Christopher Sanders
Paula Stocco
Adam Vega
Nathan Zimmerer

Parker Hannifin Scholarship
Scott Schilling

Shell Oil Company Scholarship
Andrew Kim

University Endowed Scholarships

James J. and M. Joan Stukel Scholarship
Thomas McGrath
Joshua Schiller

Alumni Notes

Jason Ballou (BSME '06, MSME '06) recently moved from designing frames for medium wheel loaders at Caterpillar in Aurora, Illinois, to working in powertrain manufacturing quality at Chrysler LLC's headquarters in Auburn Hills, Michigan. His team conducts assessments of the quality systems at all engine and transmission manufacturing facilities in the United States and Mexico. The team also provides launch support for new products like the 9-speed transmission for the 2014 Jeep Cherokee. Jason regularly visits Illinois as an engineering recruiter and an Illinois Leadership Center facilitator to promote Chrysler and attract talented candidates. Jason and his wife, Sara, had their first child, Jack, in October.

Stan Chang (BSME '12) is a program manager in Windows devices and networking for Microsoft Corporation. Stan recently finished his work on shipping Windows 8.1. His current team focuses on wireless mobility for the Windows OS and is responsible for developing new features for Wireless LAN (WiFi) connectivity. He is excited for the launch of the devices that he worked on this past year, including the Surface 2, Nokia Lumia 2520 (Nokia's first tablet), and a host of Intel Haswell and Baytrail tablets. He is appreciative of his engineering degree from Illinois, which has prepared him to take on the challenges in the fast-paced electronics/software industry.

Thomas J. Donovan (BSME '82) is a partner in the Chicago office of Barnes & Thornburg LLP. He is a member of the firm's management committee and chair of the intellectual property department. He is also an adjunct faculty member at Chicago-Kent College of Law, his law school alma mater. Tom has been recognized since 2006 as an "Illinois Super Lawyer" in surveys conducted by *Law & Politics* and featured in *Chicago Magazine*. He has also been recognized as a Leading Lawyer in Illinois by the Leading Lawyers Network, and by The Best Lawyers in America® 2012 and 2013 for his work in patent law. He serves as the vice president of MechSE's alumni board.

Eric Gobst (BSME '12) is a Consulting Analyst with Accenture and currently serves as a consignment specialist for hospitals. Eric works in non-profit hospitals throughout the country to help them upgrade their current supply chain systems, specifically with high-dollar items. These improvements translate into savings for patients, which lead to more affordable procedures and lower healthcare costs to the general public.

Daniel Martin (BSME '11), a Champaign native and research specialist with the University of Illinois Fire Service Institute (IFSI), received a scholarship in July 2013 from "Erasmus Mundus" to study engineering at three prominent European engineering schools, Ghent University in Belgium, Lund University in Sweden, and Edinburgh University in Scotland. Daniel's studies will focus on fire safety engineering. He is expected to live in Europe for two years and will receive an international master's of science in fire safety engineering in June 2015.

Patrick McAuliffe (BSME '87) works for Robert Bosch Tool Corporation as the director of manufacturing engineering for Skil Power Tools North America in Mount Prospect, Illinois. After graduation, Pat worked at LECO Corporation designing and developing analytical instrumentation. He received his M.S. in mechanical engineering from Southern Illinois University at Carbondale in 1996 and subsequently returned to LECO as a senior engineer and project leader. In 2001, he joined Bosch's power tool division as a senior engineer. Pat became director of engineering for the North American accessories division of Bosch and transferred to Switzerland from 2010 until July 2013 to serve as director of engineering for Bosch's global accessories division. He also serves on MechSE's alumni board.

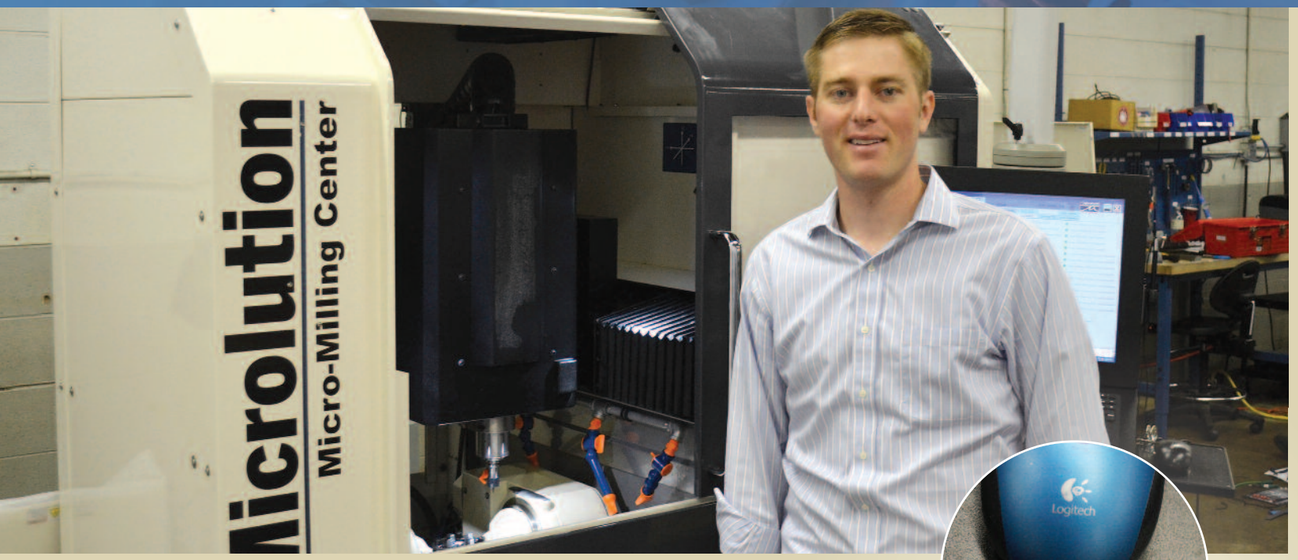
Madison Whitt (BSME '13) returned to campus to speak at MechSE's Scholarship and Fellowship Banquet in October 2013. She is a mechanical contact engineer for ExxonMobil at its Joliet, Illinois, refinery. She has been able to apply the technical skills she acquired though her studies in the field by implementing new piping systems, designing clamps and strong backs, and designing repair packages. Madison's experience in the Technology & Management Minor Program at Illinois prepared her to make direct connections between business and engineering teams. Madison was a member of the ExxonMobil UIUC Recruitment Team and volunteered at the Engineering Expo in September. She has also volunteered with Secrets in Science through ExxonMobil, a program in which engineers visit local elementary and middle schools and perform science experiments with students to show what it means to be an engineer.

We'd like to hear from you!

If you have news you'd like to share with us and your fellow alums, please contact Betsy Powers at epowers2@illinois.edu. Thanks!

Launched in MechSE, Microlution
now rewarding alums' efforts in Chicago

"Eventually we got to the point where we graduated and said, 'Okay, we're going to do this thing full-time.'"
- Andrew Honegger



Microlution co-founder Andrew Honegger stands by one of the company's standard machine offerings.

"It all started at Illinois in grad school," said **Andrew Honegger** (BSME '03, MSME '05).

More specifically, it started in the research group of Professor **Shiv Kapoor** and the late Professor **Richard DeVor**. The "it" is Microlution, which is now a 24-employee company that designs and manufactures specialty machines that create tiny, high-precision parts on Chicago's northwest side.

As they worked toward their master's degrees, Honegger and **Andy Phillip** (MSME '05) noticed a growing need for extremely small machining parts and that manufacturers were not addressing this space in the market. They decided to focus their work in this territory, not knowing exactly where it would lead.

"My first task was to build a small three-axis machine about the size of my laptop to make parts smaller than an inch in size," Honegger said. "So that was kind of the first focus of what I did; I learned about what it would take to make such a machine. I had never designed a machine like that in my life. Andy was doing something similar, except his machine was a five-axis machine."

The more they worked, the more promise the machines showed. In 2004, they were able to display the machines among other emerging technologies at the International Manufacturing Technology Show (IMTS) at McCormick Place in Chicago.

"We had people come by from places that were cool-sounding to us, like the jet propulsion laboratory, NASA, electronics companies, big-name companies we had heard of, and people would come by and say, 'This is really different than what's out there, and I can really see where this could be useful to me. Have you ever thought of selling it commercially?'" Honegger said. "And at that point we really hadn't thought too much about selling it commercially, but it doesn't take too many people asking that question to start thinking about that."

After IMTS, Honegger and Phillip worked extensively on the business plan for the company that would become Microlution.

"The resources at the Technology Entrepreneur Center, and especially Dr. **Brian Lilly**, helped us a great deal as we developed our business plan," Phillip said.

They also participated in a number of business plan competitions.

"The judges at these competitions are real angel investors and venture capital guys, they don't pull any punches," Phillip said. "You find out right away if they think your idea is any good or not!"

Armed with thoughts of a higher-potential endeavor than they had originally envisioned, they were still not ready to enter the market. Graduation was approaching, but unlike most of their peers, Honegger and Phillip weren't thinking about employment prospects or a possible Ph.D. route—they were focused on the progress they were seeing and determining whether or not they really had a sustainable business on their hands.

Microlution's machines can create parts so small they are dwarfed by a computer mouse.

"Eventually, it got to the point in our grad school that we should have been looking for jobs—and Andy and I just weren't looking for jobs," Honegger said. "We just kept going down this route, and eventually we got to the point where we graduated and said, 'Okay, we're going to do this thing full-time.'"

Located in Chicago after graduation, the small start-up did not have a finished machine yet and had very little money. As they worked on building that first machine, their workspace consisted of a walk-in closet in Honegger's northside apartment.

"It was big enough for one person to work in there at a time—two people couldn't fit. My wife didn't like it because it was a walk-in closet right off the living room," Honegger said. "And I don't think our landlord liked it either, because we had an air compressor in the basement."

But while they lacked office space and funds, they had the technology. Just as important, they had a business plan, honed through many revisions at Illinois through classes, faculty guidance, and business plan competitions.

And like in so many success stories, it was just a matter of time before all of the hard work paid off with some good fortune.

"In 2006, we got hooked into a network of investors in mainly the Peoria area, just through complete happenstance," Honegger said. "A guy I went to school with and his dad were coming back to Peoria from the Big Ten Tournament in Indianapolis, and they passed through Champaign. They just happened to pick up the *News-Gazette* to see what was going on, and in there was a picture of us because we won the Cozad New Venture Competition," an annual contest run by the Technology Entrepreneur Center at Illinois.

"And he says, 'Hey, I know that guy...'"

Before they knew it, Honegger and Phillip were presenting to new groups of investors and struck an agreement with the right one. This allowed them to launch the business in earnest, and one of their first moves was to hire **Onik Bhattacharyya** (BSIE '03, MSME '05). He actually had been part of the Microlution team from the start, working with Honegger and Phillip in grad school and spotting early on the potential in the technology. He wanted to be the one handling the sales.

"Onik is a really unique blend of talents," Honegger said. "I mean, he's obviously technical with a master's degree in mechanical engineering, but he has the personality of a sales person. When we first started, we certainly didn't have the money to pay him or ourselves. So we had to put the sales arrangement on hold until later."

With the original three united and some funds to utilize, Microlution began to take shape quickly. Like most start-ups, the profits did not come right away, but they came quicker than they do for most.

"We've been self-sufficient and profitable now for several years and we've grown every year," Honegger said. "Even in the economic downturn in 2008 and 2009, which was especially bad for our industry, we grew some."

After working out of their first real office for several years, they moved to a new, larger space in the summer of 2013. Roughly half of the 24 employees work on the engineering and manufacturing side, headed by Honegger. The others are sales and front-office workers, working with Phillip and Bhattacharyya.

Microlution now builds four milling products and one turning product. The smallest one is a three-axis machine, which they say is the one really spawned out of their work at Illinois. A larger milling machine has five axes, but it is still on the very small end of what is available in the market. The turning machine is Microlution's newest offering and provides a powerful manufacturing capability for many small biomedical parts. These machines can be customized for customers with very specific needs, and often those customer needs are what lead to new breakthroughs in the company's capabilities.

Kathryn Svoboda became the fifth MechSE alum at Microlution in 2011.

Two other machining products use lasers to perform the cutting process, spawned by one recent customer who needed laser-cutting capability. Even though the Microlution team had no previous experience with laser technology, they had worked with similar functionality. With hard work and sharp minds, they filled in the gaps in their knowledge and produced a machine with lasers that cut with incredible precision. And now they can offer this technology on two new products to other potential customers.

With a growing business now in place, Microlution stands as a real success story. And while they now employ two other MechSE alumni—**Kyle Stacy** (MSME '08) and **Kathryn Svoboda** (BSME '11)—so far they have resisted painting the walls orange and blue. But the early days at Illinois were when the company's roots were planted and the founders showed the dedication and perseverance it takes to keep their dream afloat.

"There are a lot of horror stories that we have about starting the company, and there were a number of times when Andy and myself had a rented U-Haul truck with the entire possessions of the company in the back of it," Honegger said. "You have to kind of assess your strengths and weaknesses, and be really critical of your weaknesses, and really try to figure out a way to fill in those gaps. The sooner you find that out and try to address it, the better."

Alumni in Memoriam

1937
John J. Roche, 01/25/2013

1940
Anton L. Sidak, 05/09/2013

1941
Robert H. Collier, 05/25/2013
Arthur R. Segal, 01/12/2013

1942
Jack I. Duboff, 09/01/2012

1943
Albert E. Benoist, 10/09/2012
Carl Ellisman, 05/26/2013
Elmer J. Renner, 11/27/2012
Omar M. Sidebottom, 07/08/2012

1944
Carl F. Brown, Jr., 12/23/2012

1945
Joseph F. Lyden, Jr., 03/04/2013

1946
Richard W. Bailey, 08/03/2012
James D. Lenardson, 03/12/2013
Jared Williams Davis, Jr., 12/17/2012

1947
Warren E. Henricks, 06/30/2013

1948
James L. Harp, Jr., 11/13/2012
James C. Holland, 11/22/2012
Arthur A. Leshin, 05/01/2013
Larry R. Moore, 09/09/2012
Robert Eugene Uhrig, 06/12/2013

1949
Royce E. Beckett, 07/10/2012
Almon Joseph Frost, 12/29/2012
George William Guirl, Jr., 11/28/2012
Chester Max Peterson, 10/05/2012

1950
Fred Abdula, 10/12/2012
William Francis Barbour, 10/31/2012
Forest Eugene Block, 02/07/2013
William Edward Dearlove, 09/19/2012
John D. Dwyer, 08/08/2012
Gene E. Hayward, 09/17/2012
Bernard Fred Kalvelage, 08/29/2012
Arthur G. Kozacka, 06/03/2013
Robert J. Lankston, 06/13/2013
Robert H. Mitchell, 09/09/2012
Elmer Narcisi, 05/15/2013

1951
Wallace J. Beck, 01/14/2013
Roger T. Henry, 12/08/2012

1953
Frederick G. Bauling, 09/09/2012
John F. Loos, 01/10/2013
Loren Nils Montgomery, 08/15/2012
Wayne R. Nixon, 06/05/2013

1954
William E. Dirkes, 06/22/2013

1955
Harvey B. Karpiel, 09/01/2012
Richard J. Teutsch, 06/01/2013

1956
Donald Wayne Hagemann, 01/18/2013

1957
Gilbert L. Burns, 11/27/2012
Cyril L. Rich, Jr., 06/21/2013

1958
Joseph James Castronovo, 12/12/2012
Dennis Dobrinich, 10/17/2012
John E. Hannon, 01/07/2013
Frank W. Heckler, Jr., 06/06/2013
Carroll Eugene Peters, 11/01/2012

1959
Glen Lee Bellows, 08/28/2012
Jimmie Glen Hangartner, 09/28/2012
Charles O. Lewis, 05/17/2013
Gunther G. Wackerman, 10/03/2012
Robert Earl Woods, 07/20/2012

1960
Gerald J. Moyar, 07/05/2012
David A. Thomas, 03/10/2013

1961
John Victor Larson, 01/24/2013

1962
Robert B. Gaither, 08/18/2012
Bruce H. Mauritzson, 10/31/2012

1963
Charles A. Bouc, 09/12/2012
Ronald J. Placek, 12/21/2012

1964
George Earl Sliter, 11/06/2012

1965
Ronald L. Barsema, 10/09/2012
Walter Eugene Rowden, 10/04/2012

1966
Steven M. Blomgren, 03/15/2013
Victor Michael Parker, 06/03/2013

1967
Jay B. Troy, 10/21/2012

1968
Melvin R. Partridge, 08/27/2012

1970
Michael Healy Pleck, 06/15/2013

1973
Mark C. Peterson, 02/15/2013
Michael A. Swim, 02/20/2013

1974
Dennis A. Schwertman, 12/13/2012
Don LeRoy Thompson, 06/10/2013

1976
Frederick G. Carlson, Jr., 09/24/2012

1984
David J. Butkus, 08/11/2012
David Scott Troeger, 06/06/2013

1985
Jeffrey Allen Moorehouse, 05/12/2013

1990
Ingrid Krucke McConkey, 12/07/2012

1992
Gregory T. Balls, 01/29/2013

2004
Christopher L. Sanger, 02/25/2013

From the **MechSE Alumni Board**

It is with great excitement and enthusiasm that I write to you as the new president of the MechSE Alumni Board of Directors, serving the 2013 to 2015 term. I encourage everyone—whether you are actively engaged in department and university alumni activities, just reconnecting with the department through this magazine, or a student on your way to becoming a future member of our alumni—to take a moment to reflect on the impact your education from the department has had (or will have) on your life.

Unquestionably, there are as many unique stories of our impact on the world as there are alumni. However, we all share the experience of years spent learning and growing in Urbana-Champaign with faculty and friends in the department. We would like to hear the stories from your Illinois legacy and potentially share them in a future magazine. Whether you just graduated, are now retired, or fall somewhere in between, we encourage you to engage with the department as a valued member of the MechSE family.

For those not familiar, the MechSE Alumni Board serves as a representative group of MechSE alumni that have a vested interest in the advancement of the department. The purpose of the board is to connect with fellow alumni like you and find ways to support the department and the university. This year we are working to launch a number of exciting endeavors. Among them, keep an eye open for more alumni stories on the pages of future magazines, the introduction of an early career alumni department award, and increased alumni presence on department social media.

We are resurging to two annual board meetings, held in the spring and fall, from the single meeting we have been holding the last several years. This will greatly help us to support additional initiatives, which we will be sharing soon. At our Fall 2013 meeting, **Thomas Donovan** (BSME '82) of Barnes & Thornburg LLP was named the new vice president of the board. He brings tremendous energy and ideas. Having settled in Chicago, he also has a local Illinois presence. I wish to thank and acknowledge Professor **Joseph Powers** (BSME '83, MSME '85, PhDME '88) of the University of Notre Dame for his outstanding service as the outgoing president of the board.

We also receive tremendous department support through MechSE's director of advancement and outreach, **Robert Coverdill** (BSME '83, MSME '85), and its coordinator of student and alumni relations, **Betsy Powers** (BACOM '10). If you are looking to connect with the department or the board, I urge you to reach out to them. As we work to give back in support of the department, its students, and alumni, we are always open to your ideas and help. Let us know your thoughts.

Being an alumnus of both Mechanical Engineering and Theoretical & Applied Mechanics at the University of Illinois means a lot to me—it has contributed to everything I have done personally and professionally. To me, serving on the Alumni Board is just one small way I can give back. Join me in sharing your own alumni story and in giving back to the department and university!

Sincerely,

Eric N. Brown

Eric N. Brown
President, MechSE Alumni Board of Directors

The MechSE Alumni Board held its Fall 2013 meeting at the Illini Center in downtown Chicago.

About Eric Brown

After receiving his Ph.D., **Eric Brown** (BSME '98, MSTAM '01, PhD-TAM '03) headed to Los Alamos National Laboratory for a postdoctoral fellowship, which transitioned into a research staff position. He went on to serve as technical advisor in the office of the U.S. Secretary of Defense on a range of applied science and engineering topics. Now back at Los Alamos, he leads an experimental physics group in international programs of research ranging from gamma ray astronomy and dark matter detection to fluid dynamics to national security missions.

"The breadth and depth of the education I received at the University of Illinois has enabled me to constantly tackle new professional challenges, while relationships I developed at Illinois continue to serve me every day," Brown said. "Along the way, I married my college sweetheart and we have three beautiful children who get new Illini gear every time I am back on campus."

Donors

July 1, 2012 – June 30, 2013

The spirit of philanthropy, so much a part of the American heritage, empowers our quest for excellence. Again and again, with pride and gratitude, we write or speak these words: "It was made possible through the generosity of alumni and friends." You have helped make Mechanical Science and Engineering at Illinois what it is today, and your philanthropy is what will make our future so bright.

$25,000 and above

Friends
Hermia G. Soo

1960s
William and Virginia Waterman Estate

1980s
Sidney Lu

$10,000–$24,999

Friends
James W. Phillips

1960s
Fritz E. and Helga E. Dohse
William L. Fourney
Donald R. Sittner

1980s
Kent F. and Carol Ann Schien

$5,000–$9,999

Friends
David D. Soo and Sheila J. Chapman

1950s
A. Duane and Carol L. Tonelli

1960s
Emerson W. and Martha L. Lacey

1980s
Hugh A. and Lisa L. Abrams
Mark L. and Ruth Karasek

$2,000–$4,999

Friends
Elizabeth J. Chato
Norman R. and Sallie H. Miller
John A. Rogers and Lisa Dhar
Shirley A. Soo and Matthew Gorman
Albert Vartanian
Scott A. Wozny
Stan Zitello

1950s
Ralph A. Andersen Estate
Wen L. and Rhoda Y. Chow
Charles A. Gautschy, Jr. and Jo Gautschy
Robert Earl Miller
John J. and Gladys M. Nowicki

1960s
Robert Roy Awe
Stephen W. Blakely
Richard and Marilee Davies
Jack Bailey and Cheryl Wassmundt Esmond
William R. and Susan C. Winn

1970s
Lon R. Ballard
Michael R. and Kathleen M. Mitchell
Paul R. and Christine T. Predick
Norman R. and Kathleen M. Warpinski

1980s
Susan Brasmer
John R. Ewan
Ronald C. Schneider
Kendall A. and Susan A. Warren

1990s
Katherine S. Lin
Sarah J. Schultz

2000s
Jonathan D. Chappell

$1,000–$1,999

Friends
Andrew George Alleyne
Thomas A. DeTemple
Stuart D. and Sandy Foltz
Phyllis W. Hallene
Michael Moore
Don K. Schopfer
David Storch
John D. Stuart
James K. and Karen G. Trigger
Surya P. Vanka

1940s
John T. Fisher
Charles A. Sweningsen

1950s
Gerald E. McGinnis
Lester D. and Joyce A. Moore
George R. Powers
Ellis A. Schmidt
William H. Smith, Jr.

1960s
G. Thomas and Joan D. Castino
Donald H. Frenzl
Phillip W. Thiessen

1970s
Walter L. Earley
Jan Paul Favero
Richard E. Furkert
James C. Hickman
Stephen and J. Donna Plesh

1980s
Robert L. and Angela M. Bayne
Edwin S. Chim
Kathryn N. and Grant Frost
Clay G. Nesler

2000s
Paul A. Kawka

$1–$999

Friends
Adelaide H. Aime and David G. Cahill
Narayana R. Aluru
Martha R. Atwater
Joseph Bentsman and Osanna Shahbazyan
Mark and Marie E. Bergmann
Gerry and Suzanne Blue
Randall D. Buss
Jerry A. Carden and Timothy W. Temple
Julia T.Y. Chen
Harris Chien
Tzu-Suan Chu
Ki-Sup and Hyunim Chung
Orlando Coronell and Jeanne Luh
Debra G. Coy
Harry Dankowicz
Charlotte S. DeMaris
Mamadou Samba Diallo
William A. Dick and Katrina Cheney
Lisa C. Duffin
Geir E. Dullerud and Carolyn L. Beck
Melvin Echols
Jonathan L. Ehlmann
John H. and Beatrice Y. Fung
Carlos and Nelia A. Garner
Scott A. Gold
Anna M. Greene
John B. Henel and Julie C. Smith
Polly Hillis
John Houck
Roger L. and Amanda L. Houser
Naira Hovakimyan
Roger and Jenny W. Howe
Chuanpu Hu
Calvin and Margaret Hunt
Robert I. Hurwich
Charles D. Janota
Chaman N. Kashkari
Michael C. Keblusek
Stacy L. Keller
Chang-Jin Kim
Dorothy M. Korst
Peter K. Korst
Richard H. Korst
Dimitrios C. Kyritsis
Bonnie B. Langhaar
Robert and Mary L. LaRose
Annette Lee
Zhong Li and Qingmei Chen
Yukweng Michael and Ying Yuh June Lin
Eric and Marie L. Loth
R. Scott and Laurie A. MacAdam
T. Wayne and Vicki Mayes
Lori C. Melchi
Glennys A. Mensing
Lesley Millar
Gordon R. and Bonnie S. Montgomery
Allanah K. Nagy
Richard and Arline Nechtow
Elizabeth Ann Voss Neilson
Robert L. and Jane Peddicord
Nathaniel and Dorothy A. Penrose
Maynard A. and Mona C. Plamondon
Earl and Marcia Prasse
Janice L. Rideg
Paul Ronney
Massoud Rostam-Abadi
Robert C. and Joanne Ryan
Juan Pablo Salas and Fatima T. Husain
Robert J. and Barbara R. Salata
Mark A. and Whitney Nicolle Scifres
Sue A. Shannon
Wei T. Shieh
Milo and Rosemary Sieve
Arthur J. Skelton
Barbara A. Smith
E. Jean Smith
Tammy S. Smith
Vern Snoeyink
Donald R. and Celia G. Snyder
Lydia M. Soo
Jim and Michelle D. Stapleton
Warren Stober
Nancy K. Stoner
Brian G. and Sandra L. Thomas
Molly Mangan and Timothy W. Tracy
Sandra Trowbridge
Tim and Elizabeth L. Ulfig
Jeffrey F. Voelz
Anna V. Walker
Theodore and Leah Godsey Walker
Steven J. and Kathy Wallcave
Edward J. and Kathleen Wallin
Glen A. Watford
Judith Watford
James E. Wheeler and Judy M. Wheeler
John K. and Judy L. Wierschem
Paul and Patti E. Wilkins
Tom J. and Carole Ann Wilson
Margaret K. Wolf
Yan Wu and Zhiqiang Ma
Randy Y.N. Yang
Joanna W. Yeh
Yisheng Zhang
Likun Zhu
Charles F. Zukoski and Barbara J. Morgan

1940s
Lester H. Beck
Robert J. Hartman
Frank William Houck
Roger Oehmke
Wayne A. Ring
Robert M. and Jean C. Sanford
Jacob E. Staab

1950s
Naim Z. and Beverly J. Azer
Herbert S. Bistritz
E. J. Blunt
Edward J. and L. Priscilla Brown
David Lee and Barbara Sue Carlson
Leonard J. Carlson
Kenneth R. Carroll
James O. and Joretta A. Chambers
Frank J. and Rosemary Citek
Donald C. Dowdall
Antanas V. Dundzila
Marvin W. and Barbara A. Ehlers
Calvin C. Frantz
Thomas C. Goad
Gerald J. Gresh
John H. and Mariana D. Grimson
Emmanuel F. Guyon
Gerald L. Jenkins
James T. and Kimi C. Johnson
Frederick D. Ju
Joseph F. and Patricia A. Kennell
William G. and Eleanor L. Kilker
Fred N. and Joyce A. Krull
John W. Kurzrock
William H. Lahrman
Brace H. Lambert
Eugene W. Lewis
Harvey W. Liberman
Gustav R. Lofgren
Kenneth R. Lohbauer
William C. Mohr
Ronald J. Peterlin
Karl S. Pister
Joseph A. and Rosemary A. Plamondon
Robert N. and Joyce E. Quade
Robert H. Rollins II
Charles T. and Mary Goodman Schmidt
Veto J. Straznickas
Albert Barry Taylor, Jr. and Juanita R. Taylor
Charles J. and Sondra S. Travers
Clair C. Trefz
Franklin A. and Linda S. Vassallo
Philip V. and Barbara A. Voorhees
Norman E. Wandke
Philip S. Webber

1960s
A. L. and Sandra T. Addy
David R. and Bonita K. Anderson
Thomas J. and Belle Bander
E. C. Blomeyer
Melferd A. and Janet R. Bose
Eugene F. Brown
John R. and Judith P. Calhoun
Larry E. and Jo Ellen Campbell
Frank J. Cihak
O. William and Karen J. Clausen
William Carl and Claire Ann Cleff
Robert A. Colombo
Ronald Lee Devaisher
John E. Devereux
Walter P. Dieckmann
Archie M. and Judy F. Doering
John A. and Linda Dystrup
Phillip H. Fisher
Kenneth M. Geach
Joseph Harry Golant
Raymond J. Golik
Ronald J. Haky
James L. Hill
Michael P. Hills
Bradley B. Horton
H. Karl Ihrig, Jr. and Janice S. Ihrig
Mikio and Vickie Ann Ishimaru
Lawrence C. Joiner
Michael E. Kent
Ronald H. Krasnitz
Gerald J. Krupp
Harold J. and Jerilyn Liberman
James R. Lobitz
Robert J. and Peggy L. Malnar
Arlan G. Martin
Waldo D. Martin
Jerry N. Mason
Norman J. McCormick
Victor J. Melville and Margaret L. Sellers
Sonia K. Metropole
Robert J. and Susan S. Nikolai
Wallace W. and Julia F. Noll
Donald W. Pacer
Garrett J. and Barbara E. Pardekooper
Linn A. and Sharon L. Peterson
Henry J. Petroski
Donald J. Render
Larry Ivan Ross
David E. and Sonia B. Russell
Martin H. Sadd
Mostafa A. and Naoko Shirazi
Bruce T. Stafford
Karl K. Stevens
Byron W. Stutzman
Benedict C. Sun
Richard B. Thomson
Patrick S. and Vivian M. Tsuji
Frank R. Vigneron
William M. Weakley
Roy L. Williams
Eugene E. Zavrel
George F. Zehner, Jr.

1970s
Donald W. and Paula J. Anderson
Raymond M. Anderson
Steven K. Anderson
James C. Baird
Allen R. Baker
Ronald L. Beldon
Timothy R. Bennington
Jason C. Bramhall V and Patricia L. Bramhall
David M. Connor
Marlin D. and Ida E. Crown
John F. Curtis
James J. and Cindy DeWulf
Alan S. Duncanson
Robert H. Felker
William D. and Claudia H. Fischer
Kevin M. Flannery
John S. Ford
N. Allen Gammon
Glenn R. Gehrke
Andrew J. Goettsch
Alten F. Grandt, Jr. and Barbara R. Grandt
Alan M. Hallene, Jr.
Ira C. Hanan
Michael E. and Catherine P. Heidenreich
Mehrdad Hojati
Min-Nan and Pi-Yu Huang
Floyd D. Jennings
Leonard K. Johnson
James C. Keiler
D. Brad and Theresa M. Keleher
William J. Keppel
Mark A. and Mark A. Kopec
James R. LaHood
Walter E. Lohmann, Jr.
Jeffrey M. Makulec
Borys J. Melnyk
Larry B. and Deborah L. Morgan
Wilford D. and Kathleen P. Morris
Roger E. Mott
Wayne K. Murphy
David L. Ostrodka
John W. Parker
Terrence R. Phelan
James C. Rice
Richard L. Shell
Mark A. Snowden
Michael S. and Colleen Thornton
Stephen K. Tung
Gary S. Walgenbach
George N. Walton
Lawrence M. Ziemba

1980s
James A. Ang
William P. Bahnfleth
Blake E. and Jane T. Bastien
Thomas P. Brand
Jeffrey R. Brassel
John J. and Joann B. Brown
Jane E. Buckthal
Harold W. Buddenbohm
Liming Chang
Carl S. and Joann Chow
Robert E. and Celeste M. Coverdill
James P. Creaser
Mark A. Curley
John L. Ditter and Christine Elizondo
Thomas J. Donovan
Michael E. Erickson
Craig S. Espevik
Ahmad Fakheri
Daniel J. Foreman
Joel S. Freeman and Sharon B. Smaller
Joseph G. Gaidos
Michael W. Gillman
Bobbie J. Gilman
Dean M. Gleason
Mark S. Goodin
Charles L. Gustafson
Mark E. Hink
Michael R. Kapolnek
David D. Kiefer and Courtney R. Tobin
Craig A. and Elizabeth M. Kroeger
David L. Lewis
Kun-Ho Li
Thomas G. Limbrunner
John N. and Renee W. Lubbe
Thomas R. Lyons, Jr.
Patrick M. McAuliffe
Thomas D. McGowan
Brian K. McMillin
Robert J. and Karen L. Messersmith
Daniel L. Morrow
Paul C. Niemann
Robert L. and Susan M. Norwood
Paul D. Olsen
Alan R. and Christina Parkinson
Laura L. Pauley
John J. Pausche
Thomas R. Perzentka, Jr.
Michael J. Pinnella
Joseph M. Powers
George L. Pritchett
Craig R. and Sarah Ann Bush-Randolph
Jay S. Rawot
Craig T. Reali
Donald A. Rice
Lonnie Sharpe, Jr.
Russell D. Skocypec
Corbett T. Smith
Timothy A. and Mary J. Staber
David W. Stengel
Goran Predrag Stojkovich
Jamie S. Sturtewagen
Michael T. Sullivan
John A. Swanson
Dale A. and Kimberly H. Sylvan
Michael S. and Dawn M. Szatkowski
Daniel M. Tarkoff
Daniel A. and Linda L. Tortorelli
Eric J. Tuegel
Steven A. and Debra J. Tyler
Steven A. Velinsky
Albert J. Wavering III and Gail A. Wavering
John S. Wilson, Jr.
Paul R. Wyness
Jamal S. Yagoobi

1990s
Douglas N. Anderson
David J. and Alice M. Bjork
James N. Brouillette
Joel P. Busker
William E. and Amber J. Chapman
Brad and Davon Taylor Cook
William J. Fortino II
Dean S. Ganschow
Martha A. Grover
Garrick W. Herbst
Bryant Ho
Michael J. Kempiak
Thomas G. Leone
Greg M. Levine
Li Li
Ravi K. Madabhushi
Bernard S. Mania
Brian David Mansfield
William L. Martz
Thomas W. Megli
Clifford E. Miller
Fady M. and Joumana A. Najjar
Michael C. Newman
Peter Kevin Parker
Ronald Lee Phelps
John G. Plumpe
Keith G. Rackers
Joseph L. Savio
David M. and Leora Ornstein Siegel
Daniel E. Solarz
Kevin M. Stone
Joshua P. Styron
Patrick Ulysse
Daniel J. Weinacht
Anson Wong and Shuk Ying Lau
David K. and Carolyn E. Zerkle

2000s
Adam Andriano
Michael E. Bange
Timothy A. and Raeanne J. Bazyn
Mary E. Beckmann
Vladimir P. Cabildo
Matthew T. Carter
Ramesh Chandrasekharan
Zhiqun Deng and Ying Yu
Stephen J. and Joycelyn R. Dieter
Christopher J. Fisichella
William M. Gray II
Benjamin R. Eyring-Green
Crystal C. Gwynn
Emad W. Jassim and Fatima Ahmed
Xiaoai Jiang
Michael C. Keir
Thaddeus J. Kiedaisch
Jamie Kimberley
O. Sung Kwon
Min Li
David M. Maas
Christopher Jordan Marks
Benjamin E. Newell
Nicholas J. Ploplys
Shaurya and Ruchika S. Prakash
Jeffrey J. Rizzo
Jacob J. Ruden and Tawny Reyes
Christopher M. Schuman
Viral R. Shah
Natalie A. Stevens
Andrew Stubbs
Dipan P. Surati
Russell J. Thacher
Marina L. Tharayil
Christopher D. Tomkins
Mark P. and Kassandra Towle
Satya N. Varadhan
Jeffrey and Susan Veazie
Kevin Edward Verzal
Robert L. Vlach
Michael J. Wilson

2010s
Henry Africano
Nicholas C. Browning
Xiangyu Dai
Prashant Jayaraman
Ki Sung Lee and Jungmin Kwon
Douglas A. Litteken
Patrick T. Lynch
Matthew J. Morse
Mauro Rodriguez
Michael D. Simon

MechSE Featured **Entrepreneurs**

MechSE graduates head out into the world prepared to succeed, and many of them do so through entrepreneurship. We are proud to feature several of these business pioneers here, helping to build the incredible contacts available to our graduates through the MechSE alumni network.

We want to continue building this network of MechSE start-ups, so if you have started your own business, we want to hear from you. Please contact us and tell us about your company: **MechSE-Advancement@illinois.edu.**

Three Sigma Manufacturing, Inc. engineered and manufactured the reduction gear boxes in the Bud Select twin turbine boat that was powered by two 2,800 horse power Lycoming T55 gas turbines and routinely exceeded 200 miles per hour. The company has supplied precision machined components to the marine industry since 1989.

Allomet Corporation
Richard Toth (BSME '63, MBA '67)
www.allomet.net
Producer/seller of "EternAloy"

Bloom Energy
KR Sridhar (MSNE '84, PhDME '90)
www.bloomenergy.com
World-renowned manufacturer of fuel cells for portable energy production

Bump
Adam Booher (BSEM '11)
www.madebybump.org
"OpenSocket" prosthetic-arm nonprofit organization

Daily Equipment Company
Emmerson Daily (BSME '71)
www.dailyeq.com
Material handling and distribution

Fox Valley Forge NEW
David Day (BSME '52)
www.foxvalleyforge.com
What started out as a retirement project for Day in 1994 became a successful blacksmith shop in Appleton, Wisconsin. Creating custom-made porch railings, garden decoration, and many other crafted pieces, Day described his work as "a beautiful blend of heat transfer, metallurgy, forming and welding, which make up the body of mechanical engineering."

Innoventor
Kent Schien (BSME '81)
www.innoventor.net
Entrepreneurial design-build engineering firm

Intelliwheels
Scott Daigle (BSME '09, MSME '11)
www.intelliwheels.net
Producer/seller of "Easy Push" wheelchairs

Inventables
Zachary M. Kaplan (BSME '01)
www.inventables.com
The designer's hardware store / online sales

JCC Energy-Solutions, LLC
Jack C. Ciesa (BSME '71)
jccesolutions@yahoo.com
Energy efficiency for industrial manufacturers

J.L. Meece Engineering, Inc.
Jerry L. Meece (BSME '67)
www.jlmeece-eng.com
Engineering consulting in manufacturing

Microlution NEW
Andrew Honegger (BSME '03, MSME '05), **Andy Phillip** (MSME '05), **Onik Bhattacharyya** (BSIE '03, MSME '05)
www.microlution-inc.com
Machines for manufacturing small parts (see page 22)

Newell Instruments NEW
Ben Newell (BSME '02, MBA '08)
www.newellinstruments.com
Green energy systems and solutions. Originally revolving around customized electronic concentration sensors, Newell Instruments' expertise now spans energy conversion, air conditioning, refrigeration, heat transfer, fluid mechanics, controls and instrumentation, solar energy, and building technology.

Oso Technologies
Michael Clemenson (MSME '12), **Eduardo Torrealba** (MSME '13)
www.myplantlink.com
Smart technology producer for gardening, taking the watering of plants to a new level of ease and accuracy

Prairiefire Consulting, Inc. NEW
Drew Coverdill (BSME '08, MSME '10), **Michael Lopez** (BSME '91)
www.pfcae.com
Prairiefire Consulting is an engineering consulting company that analyzes system sensitivities and simulates manufacturing of products to make the design insensitive to variation. It incorporates variation from sources including manufacturing, the environment, time, and the user, quantitatively predicting quality, performance, and fit-up to validate products before production.

Servabo
Tim Deppen (BSME '09, MSME '09, PhDME '13), **Nishana Ismail** (MSME '13)
www.servabosafe.com
"AllAlert" personal protection device, designed to connect to and utilize smart phones to make distress calls

Three Sigma Manufacturing, Inc. NEW
Ken Frankel (BSME '77)
www.threesigma.net
Three Sigma's 18,000-square-foot facilty in Kent, Washington, houses a variety of machinery including CNC mills, CNC lathes, CNC grinder, wire EDM, gundrills, and inertia welding. Its high-end CAD/CAM capability (Pro/Engineer) allows its technicians to efficiently model and generate CNC cutter paths.

Vulcan Spring & Manufacturing Company
Alexander Rankin V (BSME '57)
www.vulcanspring.com
A leading spring manufacturer providing flat steel springs, retractable display security tethers, retail cable tethers, and counterbalances

Z BioScience NEW
Gary Holmes (BSIE '66, MSME '67)
www.z-bioscience.com
Founded by Holmes, a MechSE distinguished alumnus (1990), Z BioScience is a biotechnology company based on the application of microorganisms as a mechanism to eliminate pathogenic bacteria without creating antibiotic and antibacterial resistant "superbugs." The range of applications for this technology spans across human, agricultural, commercial, and industrial markets.

NEW companies are new to this magazine, not necessarily to the marketplace!

New Faculty

Leonardo P. Chamorro

Assistant Professor Leonardo P. Chamorro joined MechSE in August 2013. For the Fall 2013 semester, Chamorro taught the Theoretical and Applied Mechanics course TAM 538: Turbulence. He also advised a group of students in the senior design class (ME 470) who built a hydrokinetic device, and the independent study class ME 597, which focuses on mathematical analysis of vortex-induced vibration in complex setups.

Chamorro received his B.S. in civil engineering from the University of Chile, and his M.S. and Ph.D. from the University of Minnesota, where he then worked as a research associate in the St. Anthony Falls Laboratory. There he helped found the lab's renewable energy program.

His research specializes in fluid dynamics, particularly turbulence and boundary layer flow phenomena. Please see page 5 of this magazine, in the energy research section, for more details on Chamorro's research.

Tonghun Lee

Another new face in the MechSE department is that of Associate Professor Tonghun Lee. He was previously an associate professor at Michigan State University in its Mechanical Engineering Department. His research is in combustion, with a specific focus on laser and optical diagnostics, and with two main applications: propulsion and energy.

Lee received his bachelor's degree in mechanical engineering in 2000 from Yonsei University in Seoul, South Korea. He then moved to the United States, where he completed his master's degree (2002) and Ph.D. (2006) in mechanical engineering at Stanford University. He says he had two main reasons for coming to Illinois.

"A lot of it was the prestige of the engineering college here," Lee said. "And there are a lot of colleagues in my field that I can interact with. Those are the main reasons I came to Illinois."

Please see page 10 of this magazine, in the energy research section, for more details on Lee's research.

Sameh Tawfick

Assistant Professor Sameh Tawfick brings to MechSE his research program in scalable nanomanufacturing, a field that bridges the gap between manufacturing research and nanomaterial science.

"There's been a myriad of recent discoveries of new types of nanomaterials and individual nanostructures with outstanding electrical and mechanical properties," Tawfick said. "We as mechanical engineers work on bringing those lab-scale materials to large-scale production and applications."

The central issue with trying to apply nanomaterials to large-scale applications is that the properties of individual nanostructures don't always match the properties of millions of them in bulk. Tawfick's research seeks a fundamental understanding of how these properties scale from miniscule structures—with diameters that can be 1,000 times smaller than that of a human hair—to integrated computer chips, batteries, or the wings of an airplane. He and his group also invent new processes to use nano-sized building blocks in large production systems.

Tawfick received his bachelor's and master's degrees in mechanical engineering from Cairo University in Egypt. Between receiving those degrees, he worked in Basel, Switzerland, as a design engineer for pharmaceutical equipment. He then came to the United States to earn his Ph.D. in mechanical engineering from the University of Michigan before becoming a postdoctoral associate at the Massachusetts Institute of Technology (MIT).

For his Ph.D. research, Tawfick developed a process to manufacture multifunctional carbon nanotube surfaces and fibers using capillary forces. Capillary forces act on the surfaces of liquids and are what enable certain insects to walk on the surfaces of ponds and lakes.

"These forces are not as weak as we tend to think; and they can perform manufacturing work," Tawfick said. "At the nanoscale they have two advantages: their magnitude can deform solids, and their direction can be locally self-controlled. This means that those liquid molecules can be programmed to do a specific mechanical job at very small scales. By simply submerging a large surface having millions of sparse nanotubes in a liquid, and drying it under controlled conditions, capillary forces can organize the nanostructures into more robustly integrated assemblies with enhanced bulk properties."

Tawfick is also part of the MechSE team implementing a new competition in ME 370, known among the students as "the dart project," where students design and build a mechanism to throw darts at a dart board. In parallel, he is developing a new 400-level nanomanufacturing class, which he intends to offer next year. The class will cover the fundamental principles and challenges of scalable nanotechnologies, including self-assembly, electro-hydrodynamic jetting, nano-molding, and imprinting.

"I learn by making," he said, "so I am planning for this class to have hands-on activities."

Part of what drew Tawfick to Illinois, he said, was available resources for micro- and nano-research, and above all the pioneering faculty in these fields.

"I think the labs at Illinois are unmatched," Tawfick said. "Their organizational structure also makes them accessible, especially to young faculty. Collaborations on research and education are integrated into the environment here.

"And my family and I feel that we are truly welcome."

In Memoriam

Wen Lung Chow, former professor of mechanical engineering, died September 20, 2013. He was 89. A professor at Illinois from 1955 to 1988, Chow was also an alumnus of the department, having received his MSME degree in 1950 and PhDME degree in 1953. The late Dr. Helmut Korst was Chow's faculty advisor. Despite economic and political uncertainty, Chow courageously left China to pursue education in the United States, inspiring and enabling relatives to follow his path. In his 50-year academic career at the University of Illinois and Florida Atlantic University, he developed novel analytical and numerical methods to address complex fluid and gas dynamics problems, delivered practical and valuable solutions to the aerospace industry (including the U.S. Space Shuttle program), and passed along lessons learned to interested colleagues and students of all ages.

Frederick A. Leckie, MechSE professor emeritus and former department head of Theoretical and Applied Mechanics, died June 14, 2013 in New York. He was 84. A member of the TAM Department from 1978 to 1988, Leckie served as department head for four years beginning in 1984. During his first six years at Illinois, he held a joint professor position split between TAM and Mechanical and Industrial Engineering. In February 1988, he left Illinois to become head of the mechanical engineering department at the University of California at Santa Barbara. Leckie was born in Dundee, Scotland, and obtained his bachelor's degree from St. Andrews. In 1954, he came to the United States and received an M.S. in civil engineering in 1955 and a Ph.D. in engineering mechanics in 1957, both from Stanford University. He then served as a lecturer at Cambridge for nearly 10 years. In 1968, his book on engineering plasticity was published by Cambridge Press, and Leckie left Cambridge to become professor of engineering at Leicester University, where he stayed for ten years before coming to Illinois.

Myunghoon Seong, post-doctoral scholar in MechSE, passed away on July 30, 2013. Born in 1977 and raised in Seoul, South Korea, he received a B.S. degree with honors in mechanical and aerospace engineering from Seoul National University (SNU) in 1999, and an M.S. degree in mechanical engineering from Stanford University in 2001. Seong served as a naval officer at the Republic of Korea Naval Academy from 2002 to 2005. He returned to the United States and earned his Ph.D. degree in mechanical engineering from the University of California at Los Angeles in 2009 for his research on thin film valves based on micro-electro-mechanical systems (MEMs). He joined MechSE in 2009 and worked with multiple faculty members in the department. Seong notably contributed to the development of silicon-based thermoelectric heat engines for waste heat recovery. An expert in semiconductor micro-fabrication, he performed key measurements on the thermoelectric properties of silicon nanostructures. Seong is survived by his wife, Eun, and four children, as well as his parents and siblings.

Faculty News

Narayana Aluru is the director of the new Computational Science and Engineering program at Illinois, through which undergraduate students within the College of Engineering and other selected departments can earn a Certificate in Computational Science and Engineering as part of their regular coursework.

Kenneth Christensen has been named a Fellow of the American Physical Society. This honor is bestowed to no more than one half of one percent of the society's membership.

Harry Dankowicz co-authored the book *Recipes for Continuation*, which was published in May 2013 and is meant to be used in tandem with the *Computational Continuation Core* (*COCO*) program. He teamed up on both the book and program with Dr. **Frank Schilder** from the Technical University of Denmark.

Randy Ewoldt received National Science Foundation funding for "BRIGE: Hagfish Defense Gel and the Rheology Zoo," which will establish his Rheology Zoo project. The Zoo will be a venue for part of a six-week summer program to help incoming students transition to college, including a large number of students from underrepresented groups. Ewoldt also received ASME's Pi Tau Sigma Gold Medal for outstanding achievement within 10 years after graduation.

Placid Ferreira has been named the first **Tungchao Julia Lu** Professor in Mechanical Science and Engineering. MechSE alumnus **Sidney Lu** established the professorship as part of a $5 million gift in honor of his mother, the professorship's namesake. Mrs. Lu was college educated during a time in which that was a rarity for women throughout much of Asia. An ardent supporter of education, she sent her children abroad for college, and all three graduated from the University of Illinois. The MechSE Named Faculty Appointments Committee made the unanimous recommendation that Ferreira be appointed as the Tungchao Julia Lu Professor, stating, "Placid is an outstanding scholar and a leader in the nano-manufacturing area." The investiture ceremony will take place in Spring 2014.

Jonathan Freund is co-leading the new Center for Exascale Simulation of Plasma-Coupled Combustion, funded by the National Nuclear Security Administration, which is part of the Department of Energy (see page 6).

John Georgiadis was interviewed by *National Geographic*, which published the interview in September 2013. The topic was the functionality of gas masks, which emerged as an area of national interest in the wake of alleged chemical weapons attacks in Syria.

Professors **Anthony Jacobi** and **Pega Hrnjak** welcomed 30 member companies to the fall Industrial Advisory Board Meeting of the NSF-founded Air Conditioning and Refrigeration Center (ACRC). The ACRC is celebrating its 25th anniversary (see page 8), and these two faculty are the center's co-directors. Also participating in the fall meeting was the founding director, Professor **Clark Bullard.**

Seok Kim was interviewed by *Nanowerk*, which spotlighted his recent work with the tile of "Microfabrication inspired by LEGO."

William P. King published a paper on pyroelectric electron emission that became the No. 1 download on Applied Physics Letters for a period of several months in 2013. Other contributors to the paper were **Patrick C. Fletcher**, formerly of King's research group, as well as **Vengadesh Kumara R. Mangalam** and **Lane W. Martin** from Materials Science and Engineering. King also received ASME's Pi Tau Sigma Gustus L. Larson Memorial Award for outstanding achievement 10 to 20 years after graduation.

SungWoo Nam was awarded a research grant from the U.S. Air Force (AFOSR/AOARD). This grant supports research at the convergence of nano, bio, and information technology (NBIT). A total of eight projects were funded to advance the NBIT research related to the U.S. Air Force, all at top U.S. universities. Among these, Nam was the only junior faculty member selected for this funding.

Martin Ostoja-Starzewski received funding for his proposal Fractal Patterns in Fracture and Damage Phenomena from the NCSA/IACAT Fellows program, along with MechSE adjunct assistant professor **Seid Koric.** He was appointed Associate in the Center for Advanced Study for 2013-14. Ostoja-Starzewski also was interviewed and published in *International Innovation.* The interview was titled "Interpreting Patterns in Materials" and his article was titled "The Inner Workings of Fractal Materials."

Petros Sofronis has been named MechSE's next **James W. Bayne** Professor. The professorship's namesake, Professor James W. Bayne, instructed, inspired, and led students of mechanical and industrial engineering for more than 50 years. Alumnus **Alexander Rankin V** (BSME '57) and his wife, **Joanne**, established the Bayne Professorship in 2000. Sofronis is also in the process of organizing the "Mechanics of Energy Storage" symposium at the 17th U.S. National Congress on Theoretical & Applied Mechanics and the "Multiscale Approaches to Hydrogen-assisted Degradation of Materials" symposium at the 2014 Minerals, Metals & Materials Society (TMS) Annual Meeting.

Daniel Tortorelli has been named MechSE's first **George B. Grim** Professor. The professorship's namesake, George Grim, attended Illinois and received a BSME degree in 1940 and an ME degree in 1952. After graduating, he joined Caterpillar and spent 39 years with them conducting engine research. The George B. Grim Professorship was created in accordance with his wishes.

G-BAM Camp proves **girls make awesome mechanical engineers**

According to MechSE associate professor Matthew West, "I've talked to some of our undergraduates, and you hear them say, 'Engineering's not like what I really thought it was. I somehow wound up here, and actually it's really cool now that I'm here.' I always think, 'Oh, if only we could have told them beforehand that it's going to be this fun.'"

During the first-ever G-BAM (Girls Building Awesome Machines) G.A.M.E.S. camp held in July 2013, West got his wish. He and Assistant Professor Elif Ertekin, who together co-directed the camp, and numerous other MechSE faculty, graduate students, and undergrads got to show 16 high school girls how much creativity there is—and how much fun can be had—in mechanical engineering.

Since the overall theme of the camp was energy, the main overarching project for the camp was designing and building wind turbines, which culminated in an end-of-the-week competition to see whose wind turbine produced the most power. The girls worked on the projects every day over the course of the week.

The goal of G-BAM planners was to equip the girls to address difficult problems and figure out how to solve them by offering a balance between guided options, while leaving some room for design creativity and flexibility.

After learning how to use CAD to design their wind turbines, the girls then participated in a variety of activities introducing them to manufacturing technologies using machinery available in Mechanical Engineering Laboratory. For example, they experienced rapid prototyping, 3D printing, sandcasting (which involves casting liquid aluminum in sand molds), injection molding, thermal imaging, and other techniques, and then chose one of these technologies to manufacture their turbine blades.

Above: G-BAM camper displays the prototype she and her team designed for the wind turbine project.

Top Right: Assistant Professor Elif Ertekin (left) lends a hand to a couple of campers during a hands-on project where the girls designed and constructed solar ovens.

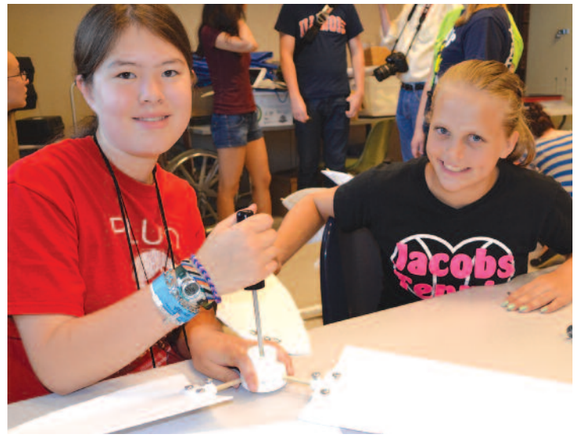
Bottom Right: A team of campers from a joint session of G-BAM and GLAM G.A.M.E.S. camps assemble their solar oven.

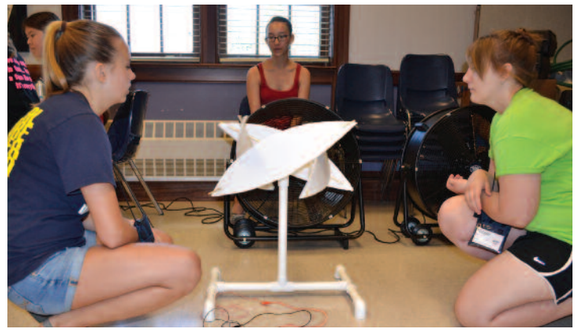
"Part of the whole design aspect was to expose them to manufacturing technologies and then give them the freedom to decide what they want to make their blades out of," West said.

The campers also made nano particles, experienced the clean room laboratory, and learned about advanced microscopy using the Scanning Electron Microscope. During a field trip to John Deere, Caterpillar, and Bump at the Research Park, they learned about many of the tasks engineers undertake in industry. While at Caterpillar, the campers participated in a hands-on project designing a fan for use in a cooling assembly for large equipment. Fans were tested based on air flow and stability, while remaining below a temperature threshold.

Another energy-related project campers tackled was to design and assemble solar thermal ovens. The project required the girls to investigate design aspects to, for example, figure out what kind of reflector shape and area is optimal for focusing the energy of the sun to a point. The goal? To boil water.

"So we were hoping for a sunny day," Ertekin said, prompted by the previous day's heavy storm.





Top: Two G-BAM campers construct their wind turbine.

Bottom: One team of campers tests their wind turbine design in front of a huge fan.

According to West, these solar ovens are the type of devices used for cooking in third-world countries to reduce pollution from wood fires.

Both Ertekin and West agreed that, in addition to exposing the campers to fun engineering projects, there were several messages that they were delivering. First: this isn't your father's (or your mother's) mechanical engineering anymore.

"The traditional picture of a mechanical engineer from 30 years ago is very different from today's mechanical engineers and what we do," Ertekin said. "So we're trying to expose everybody to some of these non-traditional things they may not have thought of as being a part of a mechanical engineering career."

Their second message was that if the girls want to choose a career where what they do really matters and can truly help society, they should consider mechanical engineering.

West explained to them that mechanical engineering is about much more than just cars and engines.

"If you want to save the world," he said, "mechanical engineers, surprisingly enough, have something to contribute to improving people's lives."

Keeping this in mind, the camp included what West called a "health impact strand."

For example, the girls participated in a prosthetics laboratory designed by graduate student **Laurie Rustom**. This project was spun out of Bump, a non-profit involved in the design of prosthetics for deployment in developing countries. Designed to be manufactured locally in developing countries, the prosthetics are robust and use readily available materials. In addition to the lab on campus, the girls visited Bump to see the operation for themselves.

West and Ertekin agreed that while it is great to be politically active and to care about things of importance, in order to have an impact, someone has to design and then actually build something.

"There's a huge, huge role for mechanical engineers to really drive a lot of these," Ertekin said. "Not just as academics, but we as a society, historically haven't done a good job of explaining to the public in general what it is that engineers do. It is, at the end of the day, instilling a value in society for engineering, for research, for the societal benefits of these things. It's up to us, and we need to do a better job of it."

Overall, the biggest message G-BAM planners hoped to get across was this: engineering is a great career for women. Ertekin and West said that, for the 16 girls who attended, at least, they hoped to change the mindset that engineers should be men.

"Some of these ideas are kind of subconsciously instilled in people's minds," Ertekin said. "And I think early, continual, persistent exposure is the key to eliminating that."

To help combat this flawed perception, the G-BAM camp exposed the girls to a really good group of role models. It involved a huge group of female graduate students, undergraduates, and faculty.

"Not only do the camp participants get to see female role models featured through this activity," Ertekin said, "but our female undergraduate and graduate students get to see how they can play a role in outreach and in inspiring young students as well."

Corporate and Foundation Donors

July 1, 2012 – June 30, 2013

Our strong partnerships with corporations, foundations, and professional organizations have created an important source of support for MechSE. Grants and gifts provide scholarships and fellowships, restricted or unrestricted support, facility improvements, and student project support. Such gifts include matching gift funds made in connection with donations from employees, typically alumni. We are proud to acknowledge the organizations here, which have supported MechSE programs over the past year.

A. O. Smith Corporation
AAR Corporation
ABB AB
Advanced Diamond Technologies
Alliant Energy Foundation, Inc.
Alliant Techsystems Community Investment Foundation
Ameren
American Chemistry Council
American Society for Engineering Education, Inc.
American Society of Heating Refrigerating and Air-Conditioning Engineers, Inc.
American Society of Mechanical Engineers
Anasys Instruments Corporation
Antaean Solutions LLC
AO Foundation Research Fund
Arcelik AS
ArcelorMittal Global R&D-East Chicago
ASO/CEII/AWCM Continuing Education Institute of Illinois
Babcock & Wilcox Company B&W PAC Match Program
Behr GmbH & Co. KG
Bitzer Scroll, Inc.
Boeing Company
Brazeway
Carrier Commercial Refrigeration
Caterpillar, Inc.
Chevron Corporation
Chicago Association for Research and Education in Science
Cisco Systems Foundation
CITGO Petroleum Corporation
CNH America, LLC
Continental Automotive Systems, Inc.
Crowe Horwath LLP
Cummins, Inc.
Daikin Air-Conditioning & Environmental Lab, Ltd.
Danfoss A/S Refrigeration and Air Conditioning
Delphi Thermal Systems
Deslauriers Inc.
Devonshire South VI Home Owners Association
Ducato Gardens, LLC
Eaton Electric Holdings, LLC
Eclipse, Inc.
ElectroMotive
Eli Lilly and Company Foundation
Exelon
Exelon Generation Company, LLC
ExxonMobil Corporation
ExxonMobil Foundation
Fidelity Charitable Gift Fund
Ford Motor Company
Fuji Electric Company, Ltd.
Gartner Group
GE Foundation
GE Global Research
Greater Wilmington Tennis Association
Grumman/Butkus Associates
Hallene Family Foundation
Halliburton Foundation, Inc.
Harley-Davidson Foundation, Inc.
Hewlett-Packard
Hillphoenix
Honeywell International
Honeywell Turbo Charging
Hydro Aluminum AS ACC Sunndal
IBM Matching Grants Program
Illinois Tool Works Foundation
Intelliwheels, Inc.
International Business Machines Corporation
ITW Construction Products
ITW Deltar Fuel Systems
Jarden Consumer Solutions
John Deere Foundation
Johnson Controls
Johnson Controls Foundation
JustGive
KBR
Kysor/Warren
Kyushu University
LG Electronics, Inc.
Liberman Construction Company
Lockheed Martin Foundation
Lombardo, Spradley & Klein
Lyondell Chemical Company
Magnesita Refractories Company
Maxeta Technologies, Inc.
Mexichem UK Limited
Microsoft
Midtronics, Inc.
Mitsubishi Electric Corporation
Modine Manufacturing Company
Monsanto Fund
Mori Seiki U.S.A., Inc.
Motorola Solutions Foundation
Navistar, Inc.
Nippon Steel Corporation
Norfolk Southern Foundation
Nucor Steel Decatur, LLC
Owens-Illinois Fund
P&G Company
Pacific Dental Care
Panasonic Corporation
Parametric Technology Corporation
Parker-Hannifin Corporation
Paslode, A Division of ITW
Phillips 66
Pittsburgh Foundation
Porifera Inc.
Postech Academy Industry Corporation
Precision Castparts Corporation
Preferred Meeting Management, Inc.
Procter & Gamble Fund
Quaker Manufacturing, LLC
Raytheon Company
Robert Bosch, LLC
Saint Francis Medical Center
Samsung Electronics Company, Ltd.
Sanhua Holding Group Company, Ltd.
Sargent & Lundy LLC
Scientia Microfluidics
Severstal Dearborn LLC
Shanghai Hitachi Electrical Appliance Company, Ltd.
Shell Oil Company
Space Exploration Technologies Corporation
Sport Dimensions, Inc.
SSAB Iowa, Inc.
Tata Steel Ijmuiden BV
United States Binational Science Foundation
United Technologies Corporation
University of Minnesota Office of Sponsored Projects
University of Pennsylvania
Vehicle Design Labs, Inc.
Whirlpool
Xerox Foundation
Xylem, Inc. (Fluid Handling, LLC)

Bolded listings = $25,000+ donors

Many of our corporate partners participate in MechSE's "Corporate After Hours," which allows students to meet company representatives in a casual atmosphere.

Interested in attending the next Corporate After Hours?
Contact Betsy Powers at **epowers2@illinois.edu.**

Message from the Advancement Office: The Impact of Giving

Dear Alumni and Friends:
Last year when I started in this position, I was aware of the term "giving" as it relates to higher education, but I did not fully understand just how important it is. Indeed, it is vital to everything we do and for which our department stands.

I have found this spirit of giving runs exceptionally deep in the MechSE family. From our alumni and friends to our current students and faculty, there is an amazing amount of time, effort, and support given for the benefit of others and the advancement of engineering education.

- In 2013, our alumni board doubled their ongoing time commitment by adding an annual fall meeting. Several board members live hundreds of miles away from Illinois, and we greatly appreciate the effort and expense they undertake to come share their thoughts and advice with us, not to mention their work on additional tasks between meetings. And from lecturing at ME 390 seminar classes to arranging company visits, internships, and interviews, many other alumni continually go out of their way to create opportunities for our students.

- Our outreach coordinator, **Joe Muskin**, is often joined by MechSE students eager to volunteer their time to educate the next generation of students and spur their interest in both engineering and Illinois. And without being prompted, many additional MechSE students—either with their student societies or on their own—make selfless efforts to share what they are learning in MechSE with children and the community. How they find time for this among their classes, labs, projects, and social lives never ceases to amaze me.

- As detailed on pages 32 and 33, MechSE held its first annual summer camp for girls—called G-BAM (Girls Building Awesome Machines!)—in July 2013. Faculty, students, alumni, and corporate friends came together to create an incredible experience for the 16 bright and motivated high schoolers who visited MechSE for a week they will never forget. I love the thought that one (or more!) of these campers could one day have an impact on the world based on an engineering career this camp inspired.

With outreach being a part of my job, these efforts are near and dear to my heart. The "circle of life" in MechSE starts with young students just being introduced to engineering and reaches its pinnacle with our current students who spend countless hours on their studies, in labs, and volunteering. It continues with our alumni, who have reached a point in their lives when time is typically scarce but resources have increased.

In the challenging economic times being experienced at the state and university level, we rely on the gifts from the MechSE family more than ever. From scholarships to student projects, our continued success depends greatly on the generosity of those who have benefited from their education in our department. Whether it is for $5 or $500, every single gift has an impact on our students, their activities, and their opportunities for success. Our web page for this is **www.mechse.illinois.edu/giving**, or you can always reach me directly at the email address or phone number below.

Best wishes to you and your loved ones, with thoughts of peace for the new year.

Robert E. Coverdill
Director of Advancement and Outreach Activities
coverdil@illinois.edu, 217-333-4109

Giving a gift to MechSE online is simple and secure. Just go to **mechse.illinois.edu/giving**. If you have a smart phone, you can access this page by scanning the accompanying QR code.

QR code reader app must be used to scan this code.

Keep in touch

Keep up to date with the MechSE Department! Just go to **mechse.illinois.edu/contact** to sign up with your current contact information or email us at **MechSE-Advancement@illinois.edu**. If you have a smart phone, you can access this page by scanning the accompanying QR code.

Attention, entrepreneurs!

MechSE wants to hear from all of our alumni who have started their own businesses. Please contact Bob Coverdill at **MechSE-Advancement@illinois.edu**, and provide a short description of your company. We will share this information in a future publication.

Join our social networks—just go to mechse.illinois.edu!

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Department of Mechanical Science and Engineering
1206 W. Green Street
Urbana, IL 61801-2906

RETURN SERVICE REQUESTED

Non-Profit Org.
U.S. Postage
Paid
Permit No. 453
Champaign, IL

Meeting space and more

MechSE's new Grad Lounge opened in September 2013 on the lower level of the Mechanical Engineering Building. The lounge serves as a place for graduate students to meet, relax, and study. It features a kitchenette, comfortable furniture, and an adjoining conference room equipped with a projector and screen. Here, members of GraMS (Graduate MechSE Students) mingle in the lounge before a night out in Campustown.