IOWA STATE UNIVERSITY
College of Engineering

DIMENSIONS

Department of Mechanical Engineering

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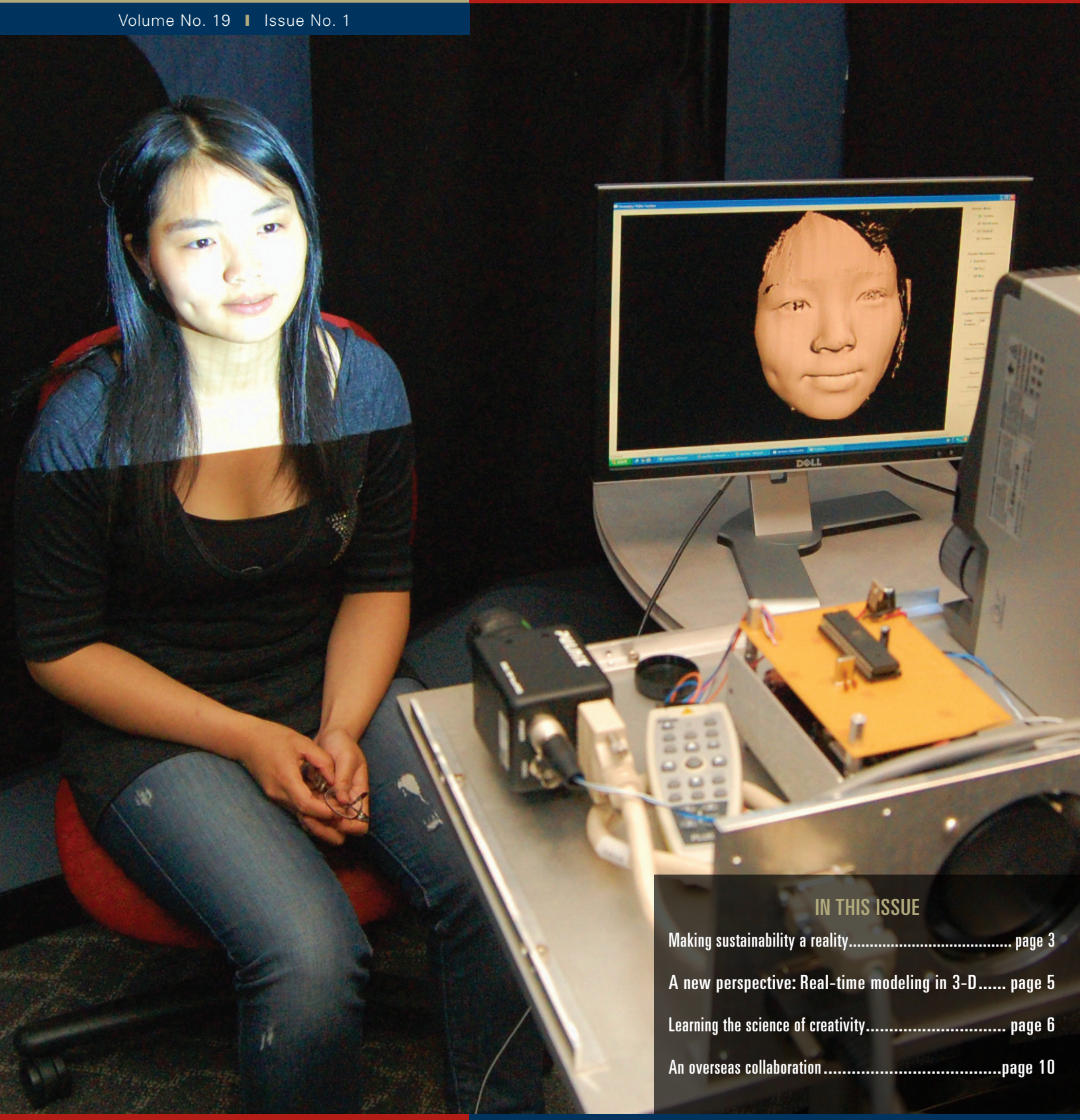

IN THIS ISSUE

Message from the Chair

We just completed another successful academic year, and more than 220 graduates are beginning careers as mechanical engineers. Many of our students work on projects during their tenure at Iowa State that have direct impact on people's lives and livelihoods; they include promoting energy conservation and sustainability on campus, researching ways to help astronauts grow food in space, and building solar fruit dehydrators in rural Belize.

Many student projects start in our classes, and we are constantly working to increase the value of our curriculum. Our course in computer-aided design now offers students a more hands-on approach using our rapid prototyping machinery, and students experience the more creative side of engineering in ME 432—Creativity and Imagination in Engineering Design.

Our world-class faculty continue to be recognized for their achievements, and our early career faculty are making a mark for themselves at Iowa State and beyond, including Assistant Professor **Song Zhang**, who uses a 3-D shape measurement system that he developed to advance technology in a variety of disciplines from the medical profession to entertainment.

We are expanding our graduate program and increasing the department's connections overseas as we are now working with Hochschule Mannheim—University of Applied Sciences to recruit future PhD students.

We have enjoyed receiving memories from our alumni, and even Emeritus Professor **George Serovy** has taken some time to share some of his memories with us. Please continue to send your thoughts and memories to mealumni@iastate.edu.

Ted Heindel

Changes in ME

A lot has changed in 50 years in the Department of Mechanical Engineering. Take a look at some highlights from 1960 compared to today:

1960	2010
• Chair: **Henry Black** • Location: Mechanical Engineering Building • Curriculum: Divided into 3 quarters • Faculty: 2 professors, 6 associate professors, 5 assistant professors, 10 instructors • 473 undergraduate students enrolled • Undergraduate study: Foundation ME courses include metallurgy, machine design, fundamental thermodynamics and heat, and applied thermodynamics • Graduate study: MS in mechanical engineering • Slide rules, drafting, and lettering class	• Interim Chair: **Ted Heindel** • Location: Henry M. Black Engineering Building • Curriculum: Divided into 2 semesters • Faculty: 2 distinguished professors, 1 emeritus distinguished professor, 1 emeritus university professor, 9 professors, 21 emeritus professors, 11 associate professors, 2 emeritus associate professors, 4 adjunct associate professors, 10 assistant professors, 2 senior lecturers, 4 lecturers • More than 1,100 undergraduate students enrolled • Undergraduate study: Foundation ME courses include mechanics, dynamics, thermofluids, materials, manufacturing, and design • Graduate study: MS and PhD in mechanical engineering, MEng in mechanical engineering (a coursework-only program) • Calculators with wireless Internet access, 3-D computer modeling

On the cover

Ying Xu, *junior in mechanical engineering, works with Assistant Professor* ***Song Zhang*** *in the 3-D Machine Vision Laboratory.*

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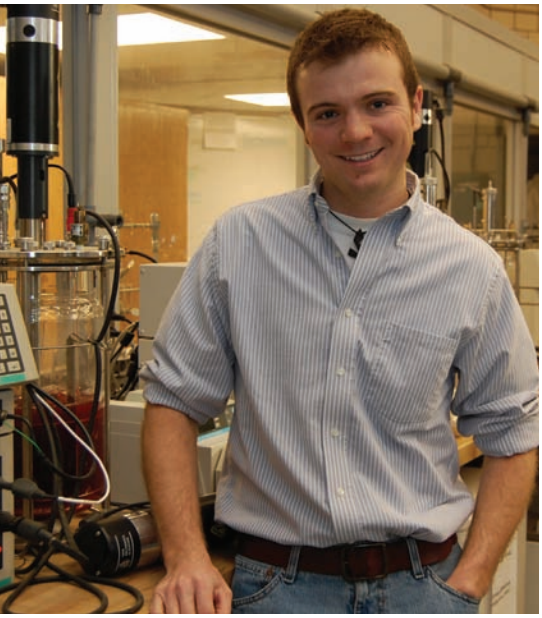
Making sustainability a reality

When he started the Engineering Leadership Program, **Wade Nasheim** didn't realize his leadership-learning project would result in being a panelist at Iowa State's Second Annual Symposium on Sustainability. Nasheim, a senior in ME with sights set on graduation next fall, says it all just sort of fell into place.

The leadership project requires students to complete work that addresses an issue or challenge faced by a group or community. As a result of the work, students must investigate and make a sustainable contribution to an area of interest while further developing their leadership skills.



Wade Nasheim worked on a leadership project that encouraged people to be more conservative with energy consumption on campus.

"I was thinking about how to bring my interest in alternative methods of energy into my project," he explains. He talked about his plans with **Jonathan Wickert**, who was ME department chair at the time and is now the College of Engineering's dean.

"He just happened to have something on his plate that had goals similar to those I was hoping to accomplish, and he wanted student involvement to make the project team a more diverse group."

Wickert's project was no small task. The team he was forming was charged with analyzing the Black Engineering Building and determining how to best spend an interest-free loan available through Iowa State's Live Green Revolving Loan Fund. To qualify for the loan, projects must promote energy conservation and sustainability and provide a return on investment. Recipients then use their energy savings to repay the loan fund, which helps fuel more energy conservation projects across campus.

From heating and cooling equipment to lighting to water consumption, the group closely examined everything in the building. They even individually counted the building's 1,687 light fixtures because the number of fixtures and ballasts varies for each area of the building. And if you've ever been in the building, you know that the group also had to deal with an infrastructure that is nothing short of complex.

"I did some heating and ventilation analysis with Dr. **(Greg) Maxwell**, who works with the Industrial Assessment Center," Nasheim says. "We quickly realized the building is such a dynamic thing that as soon as you start changing one component it's going to affect all these other components. Making any adjustments would require a lot of design work, which would get expensive in a hurry."

The group also turned to those with previous experience for ideas, reviewing case studies from Harvard's Green Campus Initiative.

After a thorough investigation and keeping in mind that the loan requires a substantial return on investment and a short payback period, the group came up with a plan: replace current light fixtures and lamps with more energy-efficient varieties, install occupancy sensors in rooms and offices as well as timers in hallways, and offer power strips for easy on-off operation of multiple energy consumers.

The team also decided to launch a behavioral campaign to help raise awareness of energy consumption and encourage people to make changes. As part of the campaign, the group will host two buildingwide seminars and install electric meters that display the building's real-time and historical electrical usage. The meters will be located in high-traffic areas in the building, and readings will also be available on the college's website.

All the planning and success landed Nasheim on a symposium panel with **Gary Mirka**, chair of industrial and manufacturing systems engineering; **Jim Alleman**, chair of civil, construction, and environmental engineering; and **Ted Heindel**, interim chair of mechanical engineering, to discuss how to incorporate energy-efficient ideas into buildings with those interested in doing similar projects across campus.

The panelists were just one part of a two-day event that also featured keynote speaker Leith Sharp, founding director of Harvard University's Green Campus Initiative, and presentations from Student Leadership in Sustainability, the University Live Green Teams, and the Solar Decathlon Team, among others.

Fueled by a rewarding experience, Nasheim is already using this knowledge in other projects on campus. Working with Engineers for a Sustainable World (ESW), he joined a project to identify ways to decrease the environmental impact of Iowa State's library and make the building more sustainable.

"The library recruited the help of ESW because its members have a technical understanding of how all these pieces of equipment work and they can do a financial, cost, and consumption analysis," Nasheim explains. "The main objective of the project is to provide quantifiable data that demonstrates the impact these improvements can have, and we're working to provide them with the information they need."

Something Nasheim hopes people across campus will realize is that if these little efforts are done by groups everywhere, they can start making a truly significant impact on the environment. "One of the most critical things that everyone can do is just being aware of his or her consumption," he says. "Then we can each do as much as we can to limit that and really see a difference."

Getting hands on with CAD

Students in the ME computer-aided design (CAD) course got to see their on-screen designs take true form this semester.

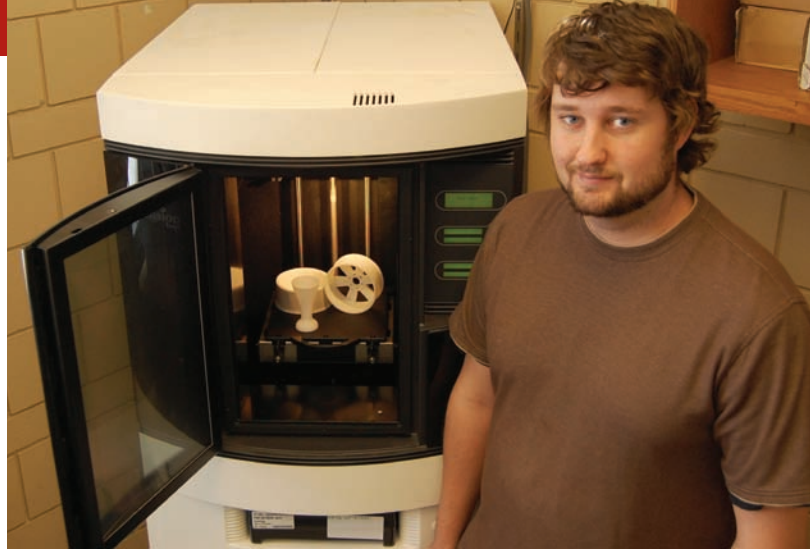
After creating models of custom car wheels using a CAD modeling software program, each group of students loaded their designs into the department's rapid prototyping machine. From there, the machine heated and melted acrylonitrile butadiene styrene plastic bit by bit to develop a scaled-down prototype of the design.

Within the course, senior lecturer **Emmanuel Agba** aims to emphasize the entire engineering process—moving from design to analysis, then to prototyping and manufacturing—all while keeping optimization in mind.

To achieve this goal, he has integrated more hands-on experiences like the rapid prototype component into the course. "Once students gain a deeper understanding of the process, they can then learn how to use software and other computational tools to do more sophisticated work," Agba says.

In addition to creating prototypes, another part of this hands-on approach requires students to develop a computer program that performs calculations based on values a user inputs into the program from a common database. "Entering data once and using it several times down the product development stream significantly improves the overall efficiency of a project," says Agba.

Students, such as recent ME graduate **Jordan Lee**, appreciate the opportunity and challenges Agba's approach offers. Having completed an internship where he created designs with CAD programs, Lee says the ability to analyze one's own work and virtually assess feasibility is important.



Jordan Lee appreciated the practical application that was integrated into a CAD course he recently took.

"In some cases, engineers design a product and then hand it off to the machine shop, where communication issues and inaccurate dimensions can lead to all sorts of problems," Lee explains. "I've found that if I can do the analysis myself before I pass the design to the next person, a lot less rework is involved."

During the spring semester, Lee completed an independent study in CAD with Agba. He designed a product for the Department of Mechanical Engineering to give to guests, creating a 3-D print of it on the rapid prototype machine and eventually casting the end product.

"These practical applications really help students realize what they will be doing once they are done with school," says Lee. "It's great that the department is taking this approach with these classes."

Graduate student honors and awards

Michelle Buehler
Spring 2010 Seward, Ratcliffe, and Galloway Foundation Mechanical Engineering Fellow

Le Chen
Spring 2010 Miller Fellowship

Rachel Dudley
Spring 2010 Miller Fellowship

Shuangyan Lei
Spring 2010 Miller Fellowship

Minhua Long
Spring 2010 Miller Fellowship

Xiao Ma
Fall 2009 Teaching Excellence Award

Sergiy Markutsya
Spring 2010 Teaching Excellence Award

Tyrone Moore
Alliance of Graduate Education for the Professoriate Fellow

Jing Ren
Spring 2010 Seward, Ratcliffe, and Galloway Foundation Mechanical Engineering Fellow

Victor Roa-Baerga
Spring 2010 Seward, Ratcliffe, and Galloway Foundation Mechanical Engineering Fellow

Jinjuan She
Spring 2010 Seward, Ratcliffe, and Galloway Foundation Mechanical Engineering Fellow

Melissa Wickham
Spring 2010 Seward, Ratcliffe, and Galloway Foundation Mechanical Engineering Fellow

Ying Wu
Fall 2009 Research Excellence Award

Excellence of Graduate Research Awards
Eight graduate students received awards during the Excellence of Graduate Research Conference this spring. The conference was divided into two concurrent sessions and was supported by the ME design and manufacturing innovation and biological and nanoscale sciences research programs.

Session 1

- **Hamed Attariani**, 1st Place ($400), "Continuum Simulations of the Formation of Hollow Nano-Sphere"
- **Nathan Johnson**, 2nd Place ($200), "Sustainable Systems Engineering in Product Design for the Developing World"
- **Chris Tourek**, 3rd Place ($100), "An Alternative Method to Determining Optical Lever Sensitivity in Atomic Force Microscopy without Tip-Sample Contact"
- **Yufeng Wu**, 3rd Place ($100), "Effects of Mechanical Alloying on Al6061-CNT Composite by Semi-Solid Powder Processing"

Session 2

- **Sergiy Markutsya**, 1st Place ($400), "Coarse-Graining Approach to Infer Mesoscale Interaction Potentials for Aggregating Systems"
- **Kamran Samani**, 2nd Place ($200), "Phase Field Modeling of Melting of Aluminum Nanoparticles"
- **Hari Kodali**, 3rd Place ($100), "A Computational Framework for Accelerated Performance Characterization of Organic Solar Cells"
- **Lin Liu**, 3rd Place ($100), "Fabrication of Solid Oxide Fuel Cell Anode Electrode by Spray Pyrolysis"

A new perspective: Real-time modeling in 3-D

Song Zhang works with a student to measure the shape of a statue in 3-D.

Assistant Professor **Song Zhang** has a number of motivations driving his work with a high-resolution, real-time 3-D shape measurement system. One that generates a lot of excitement for him is advancing medical science through projects like a current study to model a beating heart.

"When you are working on studying something like heart disease, it would be beneficial to immobilize the organ," he explains. "Obviously you can't do that with someone who is living, but this technology can create real-time imaging that allows researchers to evaluate and understand what phenomena are taking place in a whole new way."

Another benefit of using this specific technology would be in the case where a patient has a condition that requires seeing a specialist in a different state. Zhang says 3-D images can be transferred electronically and integrated into a remote robotic surgical system, allowing doctors to study the condition and plan a surgery if necessary.

So how does the technology work? The system uses structured light, which projects a known pattern of light onto an object. Deformations in the light pattern on the object can be used to calculate the object's dimensions. In Zhang's system, the light pattern is created by a modified digital-light processing projector, the kind often used to project computer or video images, which can quickly illuminate an object with changing fringe patterns.

A black-and-white digital video camera acquires images of the object, and a specially built controller synchronizes the projector and the camera. The camera also takes 2-D photos of the object, which are then mapped onto the 3-D models to add texture.

Zhang has developed an algorithm that derives the maximum possible amount of information from an object using a minimum number of fringe patterns. Coupled with an advanced graphics processing unit, the system can process up to 30 frames per second at a resolution of 640 x 480.

While he has many scientific projects in the works, Zhang says the entertainment industry continues to be interested in the technology. Radiohead used the system in its music video "House of Cards," and Zhang was recently contacted by U2 to project images from the system while performing "Even Better Than the Real Thing" during the Glastonbury music festival that will take place on June 25 in England (this U2 performance has since been cancelled).

"The more I work with the 3-D system, the more applications I find in areas I never imagined when I first started working on the technology," Zhang says. "We have some ideas to integrate the technology into robots that are really starting to take shape that include harvesting crops and searching for survivors of a natural disaster. The real-time images derived from this technology can make a significant difference in our everyday lives."

Parts of this story were contributed by Robert Mills, IPRT, and appeared in the Virtual Reality Application Center's fall 2009 VRTech *newsletter.*

Department selected to host NSF REU site

Starting this summer, the Department of Mechanical Engineering will be hosting a three-year Research Experiences for Undergraduates (REU) program focused on the area of microscale sensing actuation and imaging (MoSAIc). This is the first REU site within the ME department.

Associate Professors **Sriram Sundararajan** and **Pranav Shrotriya** assembled the National Science Foundation proposal and were recently notified of the award. "We are looking forward to offering this program and working with the students," says Sundararajan. "It will help enhance the visibility of the department, the college, and the university, while also introducing students to the innovative research taking place on our campus."

The program launched with a diverse cohort of eleven outstanding undergraduate students and will expand in future years to an intended pool of twelve students. In addition to leveraging the ME graduate program's recruiting base in the Midwest, Sundararajan and Shrotriya have begun working with various programs at the college and university including the Summer Program for Enhancing Engineering Development, the Program for Women in Science and Engineering, and the Graduate College to help recruit students to the program.

The MoSAIc REU will provide participants with a 10-week research experience, allowing them to pursue fundamental investigations related to design and manufacturing of microscale sensors, actuators, and smart materials as well as development of state-of-the-art imaging and diagnostic systems. Eleven ME faculty will be mentors for the program, and examples of the types of materials students will be working with include flexible linkages, magnetorestrictive materials, solar cell architectures, nanomechanical sensors for biological agents, switchable surface assemblies, and high spatiotemporal resolution 4-D imaging sensors.

Additionally, the research experience will be complemented by cohort experiences including a suite of short courses, professional development opportunities, and extracurricular activities. There will also be a workshop on ethical issues pertaining to engineering research. As a result of their REU experience, students will become relatively independent in their research abilities and will have gained lifelong learning skills that will impact their contributions to society.

Learning the science of creativity

With the goal to push students outside of their comfort zone, **Erin MacDonald**, an assistant professor of mechanical engineering with a courtesy appointment in art and design and the Michael and Denise Mack 2050 Challenge Scholar, used the class ME 432—Creativity and Imagination in Engineering Design to introduce different perspectives on creativity, including what it has done for products and how students can build it within themselves.

"When you are trying to be creative, you want to suspend the instinct that engineers have of being analytical and immediately judgmental of an idea," MacDonald says. "There's this idea of letting go that's the most challenging thing for the students to learn and for me to teach them."

To get students to access their creativity, MacDonald had them complete eight different units that ranged from reading scientific and motivational articles to a semester-long Rube Goldberg project.

One class project called Chindogu got students thinking about innovation. Chindogu is a Japanese art of engineering solutions to everyday problems and has sometimes been described as "unuseless" because the designs solve a problem, but they aren't necessarily practical. For example, one ME student designed the "Brib," which was a bib for ribs. "It was a paper plate attached to strings made of floss, so you can floss your teeth after eating the ribs," MacDonald explains. "The students came up with some great projects, and it seemed to get some energy flowing in the class."

Amanda Newendorp, senior in mechanical engineering, said one of her favorite projects was creating a Rube Goldberg machine. For the project, students used a series of complex devices to complete a simple task in an indirect way. As part of the assignment, they had to incorporate a transfer of energy and the entire process had to last a certain period of time.

Amanda Newendorp (left) looks on as her teammates work on their Rube Goldberg machine.

Newendorp's team built a machine with a tropical theme that resulted in a drink garnished with a lime. The design featured a volcano, a five-foot palm tree, and actual coconuts. "A marble traveled down a track and landed on a button, which started a robot that drove away to trigger other steps," she explains. "Eventually a crank mechanism went up the tree, causing water to come out of a coconut into a glass, and finally a guillotine chopped a lime into the drink."

The open-ended side of engineering that was found throughout the class was a breath of fresh air to Newendorp, who is also working on a minor in design studies from the College of Design. "It was fun to focus on the creative process to come up with new ideas," she says. "I now have new tools so I don't have to just fall back on standard practices. I'm really looking forward to continuing to connect my engineering and design background."

ME student working on Soybeans in Space project

Swenson

For nearly two years **Tyler Swenson**, a senior in mechanical engineering, has been working on a project that could someday help astronauts grow food while completing a space mission.

He first came across the opportunity as a freshman when he applied for a NASA scholarship and has twice received the $7,000 award from the Iowa Space Grant Consortium.

Swenson is part of a research team through an independent study course with **Amy Kaleita**, associate professor of agricultural and biosystems engineering, and the Program for Spaceborne and Earthbound System Sustainability. The group includes two other undergraduate students: **Brandon Wilson**, formerly a junior in agronomy, and **Rebecca Meerdink**, a freshman in environmental science.

They are researching the effects of using intercanopy LED lighting to grow soybeans. "Our hypothesis is that the extra LED lights used will produce a high enough yield that the increased power consumption can be neglected," Swenson explains. "We are hoping that NASA astronauts can use a method like this to grow food in space."

By growing their own food, astronauts would maximize their limited interior space and be able to extend the length of their missions. After spending a great deal of time conducting literature reviews and gathering adequate background information, the group is now working on the experimental side of the project. Within a month, they expect to be able to take yield measurements.

Swenson jumped at the opportunity to learn something beyond his normal class work, and this scholarship offered a way for him to do just that. "I have learned many skills that come with working in a team, and I think the experience has prepared me for when this will come up again in the real world," he says.

Research briefs

Brown part of $78 million national effort to develop advanced biofuels

Two teams of Iowa State University researchers will receive a total of $8 million over three years from a $78 million U.S. Department of Energy program to research and develop advanced biofuels. **Robert C. Brown**, Anson Marston Distinguished Professor in Engineering, the Gary and Donna Hoover Chair in Mechanical Engineering, and the Iowa Farm Bureau director of the Bioeconomy Institute, is leading one of the teams. Brown's group, which is part of the National Advanced Biofuels Consortium, will conduct a $2.7 million study of the thermochemical and catalytic conversion of biomass to fuels. **Brent Shanks**, CBE professor and director of the Center for Biorenewable Chemicals based at Iowa State, is a member of the team.

Levitas receives Lifetime Achievement Award

Valery Levitas, Schafer 2050 Challenge Professor, recently received the Lifetime Achievement Award from the World Congress of Arts, Sciences and Communications in recognition of a lifetime of contributions to science, engineering, and education.

BodyViz success continues

Two ME faculty and a pediatric surgeon in Des Moines are continuing to see success with their start-up company, BodyViz. The company boasts a software technology, accessible with a personal computer, that gives an accurate, 3-D view inside a medical patient's body.

James Oliver, professor and director of the CyberInnovation Institute, and **Eliot Winer**, associate professor and associate director of the Virtual Reality Applications Center, developed the technology that converts flat images from medical scans into 3-D images, which can then be manipulated with an Xbox game controller. Thom Lobe, a pediatric surgeon based at Blank Children's Hospital in Des Moines, helped the engineers design a tool doctors could use.

The technology gave contestants of NBC's *The Biggest Loser Couples* a close look inside their bodies, showing their MRI scans in 3-D.

Morrow discusses future of the U.S. fuel tax

Ross Morrow, assistant professor of mechanical engineering and economics, was lead author on a recent report cited in *The New York Times* Dot Earth blog. The report, released by Harvard's Belfer Center for Science and International Affairs where Morrow was formerly a research fellow, analyzes transportation energy policy options including increased fuel taxes. Morrow also discussed the topic in an interview with Bloomberg Television.

The bottom lines of the report are as follows:

- Harder Than it Looks. Reducing oil consumption and carbon emissions from transportation is a much greater challenge than conventional wisdom assumes. It will require substantially higher fuel prices, ideally in combination with more stringent regulation.
- Higher Gasoline Prices Essential. Reducing carbon dioxide (CO_2) emissions from the transportation sector 14% below 2005 levels by 2020 may require gas prices greater than $7/gallon by 2020.
- Tax Credits Expensive. While relying on subsidies for electric or hybrid vehicles is politically seductive, it is extremely expensive and an ineffective way to significantly reduce greenhouse gas emissions in the near term.
- Climate and Economy Not a Zero Sum Game. Aggressive climate-change policy need not bring the economy to a halt. Even under high-fuels-tax, high-carbon price scenarios, losses in annual GDP, relative to business as usual, are less than 1%, and the economy is still projected to grow at 2.1–3.7% per year assuming a portion of the revenues collected are recycled to taxpayers.

Two with ME ties earn NSF Graduate Research Fellowship awards

Jason Boggess, BSME'10, and **Nordica MacCarty**, BSME'00, are among the ten students who are currently attending or previously graduated from Iowa State to receive the 2010 National Science Foundation (NSF) Graduate Research Fellowship award.

Each year NSF awards these fellowships to recognize and support outstanding graduate students in science, technology, engineering, and mathematics disciplines. These students will receive three years of financial support including a $30,000 annual stipend, a $10,500 cost-of-education allowance, a $1,000 one-time international travel allowance, and TeraGrid Supercomputer access.

Boggess

Boggess is planning to pursue a graduate degree at the Massachusetts Institute of Technology or Stanford in the fall. He looks forward to building on his undergraduate research experiences to discover new ways of approaching challenges. His current research interests are in 3-D visualization and advanced rendering techniques along with robotics, but he's also open to new projects and interests.

MacCarty

MacCarty has been volunteering and working for the nonprofit Aprovecho Research Center in Oregon for the past six years, developing and sharing appropriate technology-based cooking stoves across the world. She will continue to focus on appropriate technology, alternative energy, and international development while she pursues her PhD remotely at Iowa State.

PhD student **Joseph Miller** received an NSF Graduate Research Fellowship last year and is currently studying under Assistant Professor **Terry Meyer**.

Pletcher receives ASME award

Professor Emeritus **Dick Pletcher** received the American Society of Mechanical Engineers (ASME) Heat Transfer Memorial Award on November 17, 2009. The award was presented during the International Mechanical Engineering Congress and Exposition and is bestowed on individuals who have made outstanding contributions to the field of heat transfer through teaching, research, practice, and design, or a combination of such activities.

Pletcher received the Heat Transfer Memorial Award in the area of science of heat transfer for "seminal contributions to the field of heat transfer, particularly developments in computational heat transfer when that technology was in its infancy; and for contributions to the development of computational approaches for separated flows with heat transfer, viscous-inviscid interaction methods, and large-eddy simulation through research, education, and archival literature."

Meyer receives SAOT Young Researcher Award in Advanced Optical Technologies

The Erlangen Graduate School in Advanced Optical Technologies (SAOT) has honored **Terry Meyer,** assistant professor of mechanical engineering, with the 2010 Young Researcher Award. The award is granted annually to an outstanding young scientist in the field of optics and photonics, and Meyer is being recognized for his work in developing new laser imaging techniques for reacting flows.

Meyer was honored during a ceremony on May 31, 2010, at the Friedrich-Alexander-University Erlangen-Nuremberg in Erlangen, Germany.

The award is compensated with 100,000 euros, which can be used for collaborative visits to Erlangen over a four-year period. Meyer will go to Germany for a month during the summer of 2010 as a visiting professor to collaborate with researchers at SAOT. Additionally, the funding supports a graduate student to travel with Meyer.

"As professionals, we are always learning from our colleagues at other institutions," Meyer says. "When a group like SAOT brings scientists together who are working distantly but in parallel efforts, new ideas are formed through that close interaction."

SAOT provides interdisciplinary research and an education program of excellence in a broad international network. The group was established at the University of Erlangen-Nuremberg in November 2006 within the framework of the Excellence Initiative of the German Federal and State Governments to Promote Science and Research at German Universities. The experts at SAOT focus on innovations and leadership in optics and optical technologies at the interfaces between physics, engineering, and medicine.

ME students work in Belize on school feeding project

Students in EWB helped engineer solar fruit dehydrators in Belize.

If all goes well with an Iowa State Engineers Without Borders (EWB) project, dried fruit may soon become a resource that helps fund books and supplies for students in rural Belize.

Over spring break, eight EWB members visited the country to implement their prototype design of a solar fruit dehydrator. In addition, they worked on several secondary projects including constructing a town sign, implementing two cook stove designs, providing a hygiene program to villagers that emphasized the importance of hand washing, and assessing soil quality to determine the feasibility of a school garden. The visit was a follow-up to an initial site visit that took place this past summer during which EWB members met with people to assess the community's needs.

The project originally aimed to provide healthier snack options in the school system and has now led to a potential income opportunity. "Schools are given a biannual ration of dried fruit for snacks that is typically gone within a few weeks," says **Tom Cooper**, a senior in mechanical engineering and EWB member who attended the trip. "With a fruit dryer on-site, students have access to nutritious snacks and schools could sell any fruit surplus to help pay for educational supplies."

The solar fruit dehydrator is made from wood, a resource that is easily found in Belize, and the initial prototype is a simple design that combines a sheet of plywood, some 2x4s, screws to hold it all together, and a polycarbonate material like Plexiglas.

"The whole idea is to keep the project sustainable," Cooper says. "We want to make sure people in the community are able to build it, understand how it operates, and know how to repair it and keep it clean."

The group also helped create a welcome sign for the village.

Before leaving, students constructed two dehydrators and were able to test one in the Department of Horticulture's greenhouses. But the real test took place when they started working on it in the community.

"The materials on-site were a little different from what is available in the U.S.," explains **Laura Jarboe**, assistant professor of chemical and biological engineering and EWB faculty adviser. "Belize is known for its excellent hardwood, which ended up being much harder than what was used in Iowa, and sizes of the materials were less standard. But the students adapted their design and were able to construct two working solar fruit dryers."

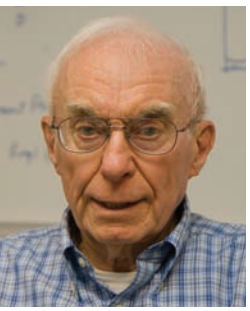
Another prominent challenge for the group was ensuring the community understood what EWB was trying to accomplish and that villagers were vested in the work being done. To help increase confidence in their efforts, the students held several discussions with families throughout the community and spoke with community leaders.

And the community response was favorable.

"Students and staff were excited about their dryers and eager to give them a try, and the Rotary Club in Orange Walk was also interested in the dryers and building more units," Jarboe says. "We will keep in contact with them to receive updates on changes and improvements we may need to make, and then we'll go back to evaluate the projects, implement any necessary changes, and possibly expand the program."

For Cooper, working on the project was also a welcome opening to a new culture. "The people of Belize were kind, hospitable, and unbelievably accepting and excited about our ideas to help their communities," he says. "We experienced challenges with communication and cultural tendencies but that provided us with a new perspective to approach life with. The entire trip was so wonderful it's hard to describe."

Taking a look back



Serovy

At the age of 83, emeritus professor and ME alum **George Serovy** has a great deal of life and professional experience under his belt. From serving in the navy to working at the National Advisory Committee for Aeronautics, becoming a professor at Iowa State, and being actively involved in the American Society of Mechanical Engineers (ASME), his journey has taken him across the world and always brought him back to where it began—the city of Ames and Iowa State University.

Serovy started at Iowa State in 1943 to become an engineer. He didn't initially think mechanical engineering would be the best fit for him, but he later found out that it was right where he belonged. His educational pursuit was interrupted by service in the U.S. Navy in Illinois, Ohio, and Missouri. After he was discharged, he came back to school to finish what he started.

When he returned to Iowa State in 1946, **Henry M. Black** was department head and he was, according to Serovy, already establishing his esteemed reputation as someone who was always looking out for others. "I stayed in touch with Black long after I finished my bachelor's degree," he says. "He was always a fine man and someone to look up to.

Fresh out of school, Serovy took a job with the National Advisory Committee for Aeronautics (NACA), what we know as NASA today, during the summer of 1948. When he arrived at the flight propulsion lab in Cleveland, Ohio, he was floored by the new technology. He started working in the fundamental compressor research section and began learning more about axial-flow compressors. Throughout his career at NACA, Serovy published 15 to 20 technical reports that proved beneficial once he decided to pursue his PhD.

He came back to Iowa State and received his master's and doctoral degrees and started teaching right away. "I had a wonderful mentor in **H. J. Stoever**," Serovy says. "We were teaching juniors who were studying thermodynamics for the first time and Stoever, even though he was never designated boss of the course, always provided guidance and insight on the assignments we were to teach. We called it the Stoever system and it never failed."

As Serovy continued his successful career as a professor, he was also busy building his research interests. Through his connections at NACA, the U.S. Air Force, and the North Atlantic Treaty Organization, he was able to secure several research contracts, which were just starting to occur more frequently on campuses. And when he began getting more involved with ASME, he was offered the opportunity to present his paper "Recent Progress in the Design of Axial-Flow Compressors in the United States" in Switzerland.

The paper is still recognized today, and the experience was hard for Serovy to put into words. "The paper went over really well," he says. "But beyond that, my family and I had a great time visiting a place I never thought I'd see."

He got involved on several committees for ASME's gas turbine division (which is now the International Gas Turbine Institute) and eventually worked his way up to chairman. During his tenure, the division organized technical meetings with product exhibits that highlighted cutting-edge technology. Serovy also got to visit China to deliver a series of lectures and to spend two sabbatical years in research laboratories in France and Switzerland.

When comparing his time with the university today, Serovy says he wishes the department was able to reinstate smaller class sizes. "We didn't have the same budget issues to deal with back then," he says. "That allowed us to focus on teaching students in a different environment using a different set of standards. I'd like to see the engineering education system redirected, and Iowa State would be a good place to start."

Serovy retired in 1991 as an Anson Marston Distinguished Professor in Engineering. He and his wife, Joy, live in Ames, and he says, "I had a terrific time at Iowa State, and I still get to come around here and tease you and talk about what's going on in the department. Like all things in my life, I've been really lucky and still am."

Department gains from industry advice

Members from the department's Industrial Advisory Council met during Veishea this spring.

Each semester, the department invites members of the Mechanical Engineering Industrial Advisory Council (ME IAC) to campus to discuss what's going on in the profession and get input for the future direction of the department. ME IAC members come from a variety of companies and provide an outside perspective as the department develops strategic initiatives to build its research and academic programs. The group also serves as an advocate in representing the department's needs to the college, university administration, and alumni.

Craig Connell, BSME'79 and director of Black & Veatch's corporate project management office, has been involved with the council for six years. He says one of the biggest benefits of having the ME IAC in place is the balance it helps bring to the department that would otherwise be missing.

"Ultimately, we are the consumers of the product of the department, and our views either validate the status quo or provide an impetus for change," he explains. "We are strong advocates for curriculum review to make sure courses are still relevant for the changing world, and we look for ways for the department to increase diversity of the student and faculty populations because with greater diversity comes growth and success."

Typically during meetings, the council hears updates from faculty and staff on strategic goals, as well as students like those in the department's capstone design class. They also take time to discuss topics like the department's outreach effort, budget constraints, and fundraising activities.

"We share industry needs based on our work experience and look for ways to support the department's initiatives," says **Mike Hilby**, BSME'79 and global manager for John Deere's tractor platform engineering operations. Hilby is a strong supporter of the department's Women in Mechanical Engineering program and also coordinates job shadowing opportunities and project work for students.

Both agree that being involved in the ME IAC is rewarding for them personally, and that it has other advantages like getting their company's name in front of potential employees and reconnecting with their alma mater. "We bring the same values we live everyday in our industry to the department, like commitment to improve, integrity, innovation, and a focus on quality for the customer," says Hilby. "It's a matter of ensuring the department is aligned with the future direction of mechanical engineering to prepare students to do their best once they graduate."

An overseas collaboration

Matthias Veltman came to Iowa State for his PhD after graduating from Hochschule Mannheim–University of Applied Sciences.

The ME graduate program office is constantly seeking quality PhD candidates to help contribute to research and add to the prestige of the department. Recently, this pursuit took several representatives from Iowa State's College of Engineering to Hochschule Mannheim–University of Applied Sciences. The group is working out details for a program that will help students graduating from the university in Germany transition to Iowa State to earn a PhD.

During spring break, a group from Iowa State's College of Engineering visited Mannheim to learn more about the university's degree programs, which include both bachelor's and master's degrees and require students to complete an internship before graduation. The university also works closely with industry partners such as John Deere and Mercedes Benz and focuses on applied research with a global outlook.

Ted Heindel, interim ME department chair, and **Sriram Sundararajan**, ME associate chair for graduate study and research, were joined by **Balaji Narasimhan**, COE associate dean for research and graduate studies; **Nancy Knight**, COE graduate enrollment management director; and **Monica Lamm**, CBE assistant professor, on the trip.

"In Mannheim, students get hands-on training and do a lot of practical coursework," says Sundararajan. "Because of their foundation, they have potential to add a lot of value to the experimental research taking place in the department."

The ME department has had two students come to Iowa State for PhDs from the University of Applied Sciences—**Matthias Veltman** is a research assistant in the Internal Combustion Engines Laboratory and **Norman Keller** works in the Experimental Multiphase Flow Laboratory. Through their research contributions and accomplishments in the classroom, both demonstrate how successful the program could be.

While working on his bachelor's degree at the University of Applied Sciences, Veltman completed his final thesis with John Deere in Mannheim. He continued working with John Deere during his master's program and was accepted into an exchange program that led him to John Deere Power Systems in Waterloo during the summer of 2006.

Once in Iowa, he spent a year taking classes at Iowa State that he was able to transfer back to Mannheim. While on campus, he met **Song-Charng Kong**, William and Virginia Binger Assistant Professor of Mechanical Engineering, who offered him a position as a PhD student. Veltman returned to Iowa State in January 2008 and has been a staple in the Internal Combustion Engines Laboratory studying ways to improve the efficiency and emissions of combustion engines, including diesel engines.

According to Veltman, one of the greatest benefits of this type of program is that it would provide a global perspective. "When you start working with people from a variety of backgrounds, you learn new ways to approach challenges," he says. "Everyone has different resources available to them, and when you add those different ideas to solve a complex problem, you find a new and efficient way that you wouldn't have come up with otherwise."

Both Veltman and Sundararajan agree such a program will be mutually beneficial for both institutions involved partially because of the similar research that is taking place on each of the campuses, including the areas of turbo systems and internal combustion engines, virtual reality, and tribology.

"This is a great opportunity to collaborate with researchers overseas," says Sundararajan. "At the same time, it provides us with a pool of excellent students to recruit to our program."

Veltman adds, "With this program, students get international experience, which is useful in a world that's getting smaller and smaller through globalization."

While the ME department is hoping to have an official agreement in place sometime next academic year, representatives continue to look at students at the University of Applied Sciences as prospective students. "We've had success with two students so far," Sundararajan says. "I'm looking forward to seeing it continue in the future."

Sundararajan identified as emerging leader

Sriram Sundararajan, associate professor and director of graduate education, is among the 22 Iowa State faculty and P&S staff members who have been selected for the second annual Emerging Leaders Academy (ELA).

ELA is a leadership development program for faculty and staff established by the Office of the Executive Vice President and Provost. It aims to enhance the leadership abilities of employees currently serving in leadership roles or those who aspire to such positions in the future.

The 2010 ELA class participates in monthly leadership sessions. Throughout the year, the participants' learning experiences will focus on leadership research, theory, and practice; an in-depth look at Iowa State's past, present, and future strengths and challenges; and a semester-long mentoring experience with a current Iowa State leader.

Ted Heindel, interim department chair and Art and Priscilla Bergles Professor in Thermal Science, graduated from the inaugural ELA class, which wrapped up this past December.

ME memories

We received several notes from alumni who wanted to share their memories of the department. What do you remember most about your time at Iowa State in the mechanical engineering department? Send your memories to mealumni@iastate.edu. Be sure to include what you are up to now, your degree earned, and your year of graduation. We look forward to hearing from you!

Don Clausing, BSME'52, talks about his work in the Steam Laboratory.

I was at Iowa State from 1948–1952, and we took one-quarter courses in machine shop, foundry, and welding. The photographs in the previous issue of *Dimensions* are long before my time. We did cast something in the foundry, but it was not manhole covers.

In the Steam Lab, there was an old Corliss steam engine, circa 1875, that ran around 60 rpm. We had a three-hour lab in which we tested the engine, took the P-V diagram, etc. The engine was worn, and the valve mechanism did not function reliably so my job was to sit in the middle of the steam and help the valve mechanism. When it tried to throw, I helped it along with a push—it was human-assisted mechanical effort instead of mechanically-assisted human effort. Needless to say, I was very glad when the three hours came to an end!

Roger W. Haines, BSME'53, looks back on his unique connection with the ME department.

In the early 1920s, when I was still in grade school, my father was an instructor teaching Sheet Metal and Pipe Fitting in the mezzanine area of the Steam and Gas Lab building. He was a Master Mechanic and an excellent teacher who enjoyed his work immensely, which I learned for myself when he taught me his trade. Occasionally he brought a student home with him to dinner—one of those students was **Henry Black**.

Skip a few decades to 1950…

For a while I was a sheet metal worker and later a design draftsman, working with engineers designing new products in the heating, ventilating, and air conditioning field. I got married and had three children, and with my wife Wilma's encouragement, I enrolled at ISC as an ME student. Guess what? Henry Black was ME department head!

Henry remembered me and helped in many ways, not the least of which was encouragement. I took the sheet metal and pipe fitting course by exam (my father had taught the present instructor), as well as the drafting course (my ten years of practical experience paid off). During my time at school, I had a lot [of] drive, being older and a family man, and my wife and I had two more children.

My freshman English courses also proved helpful later in my career when I was writing two engineering handbooks. The first book I wrote sold more than 40,000 copies and was printed in four languages. By attending VEISHEA every year, and visiting most of the shop buildings in the engineering area as a child, I learned the concept of the various trades involved in ME and began an affinity for ISC early on, and now I have great memories of my years at Iowa State.

John M. Hobbs, BSME'42, reflects on how his coursework prepared him for a successful career with General Electric.

Before enrolling in Ames in 1938, I had completed a four year machinist apprentice course at General Electric in Schenectady. With this background, I was offered an instructor job in the Machine Shop. I taught for a few years and pursued the mechanical engineering curriculum as a student. It was a great experience, and I received great coaching from faculty.

Upon graduation, I was offered a job at General Electric to design and produce surveillance equipment to detect and destroy German submarines in the Atlantic Ocean, which was the first application using airborne radar for detecting surfaced submarines at night as they were recharging propulsion batteries. The excellent Iowa State engineering courses such as dynamics, statics, metallurgy, and hydraulics, along with math and my previous apprentice training provided the tools to accomplish my first engineering job.

After WWII, I constructed an in-board odometer for a guided missile that could be controlled in flight to achieve targets with extreme accuracy. The odometer registered position in three dimensions and provided remote control radio signals to identify and then destroy an assigned target. I later participated in an assignment to provide a nuclear steam supply system that generated electrical power for a commercial utility—Commonwealth Edison's Dresden 1 plant went on line in 1962.

I retired from General Electric after having 49 years of exciting, technical assignments, and Iowa State provided much of the foundation for accepting each challenge.

Tom Richers, BSME'84, shares memories of professors who made a lasting impression.

My favorite professor was **Al Joensen** who taught me thermodynamics. He called my name almost every day in class to participate in the discussion, and boy did I have to be ready! He gave me that 'look' when I did not quite get the correct answer, and I always had to have my assignments complete! It helped me to become a much better student.

As my adviser, Professor **Ted Okiishi** set the bar very high for my grades. I remember that my first year of school was not a stellar one for good grades and that my best grade was my math class. When I had to visit him (only one time), he referenced my grades and made a suggestion that I should find a different major (math). What a motivator—my study habits improved dramatically and so did my grades in mechanical engineering!

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