IOWA STATE UNIVERSITY
COLLEGE OF ENGINEERING
ME UPDATE
Spring 2006 Newsletter Volume 15 Issue 2

Alum wins ASME's highest honor

As **Donald Zwiep** completed his master's degree at Iowa State in 1951, his advisor, **Henry Black**, asked him if he'd thought about teaching. "I said, 'Oh, I might be interested in it for a year,'" Zwiep recalls. As it turns out, this emeritus professor and ME department head from Worcester Polytechnic Institute (WPI) has spent more than 50 years making significant contributions in engineering education.

His distinguished academic career, along with his dedication to the ME profession and involvement in the American Society of Mechanical Engineers (ASME), earned Zwiep the highest award ASME bestows on individuals—Honorary Membership—in 2004. The prestigious award recognizes distinguished service that contributes significantly to the attainment of the goals of the engineering profession.

Zwiep, who joined ASME in 1947 while an undergraduate at Iowa State, has held many local, regional, and national positions with the society. Serving as president in 1979–80, ASME's centennial year, he visited his counterparts all over the world. His travels included England, China, Indonesia, and the Philippines. He also initiated some of the first agreements of cooperation between ASME and foreign mechanical engineering professional societies.

Zwiep retired from WPI in 1990 after 31 years as professor and head of ME and two years as acting provost and vice president of academic affairs. His dedication to engineering education has continued, however. He's worked with international student projects in London and at the Technical University in Delft and also with projects at NASA's Goddard Space Flight Center and Johnson Space Center.

Donald Zwiep, center, with Warren DeVries and Judy Vance at the ASME awards ceremony.

Through his role as chairman of the board of trustees of the James F. Lincoln Arc Welding Foundation in Cleveland, Ohio, Zwiep has stayed connected with engineering education from high school through post-college. The foundation publishes educational texts and conducts awards programs for participants from high-school age through professional engineers to recognize technical expertise.

Zwiep, who now resides in Orange City, Iowa, is a strong promoter of ME as a field of study for today's students. "I see it as a wonderful equivalent of a liberal studies program in the age of technology," he says. "Mechanical is the most basic and broadest of all engineering fields. It gives students a high degree of freedom to work into their area of specific interest, and it gives them the opportunity to change fields, which is so prevalent today, along the way."

VEISHEA 2006

Gregg R. Swiss, an ME freshman, tells Bernard and Brittany Roy, visitors from Marshalltown, about the human powered vehicle team that is one of the many ASME student chapter activities.

ME department and industry form a winning team

When Ford Motor Company needed help designing more efficient engines, program managers knew where to turn. **Song-Charng Kong**, ME assistant professor who joined the Iowa State faculty last fall, had worked with the company previously and had a solid reputation developing computational models for engine simulations.

Partnerships between industry and faculty benefit both sides, according to ME Associate Professor **Mark Bryden**, who worked in industry for 14 years prior to coming to Iowa State in 1998. "Industry support gives faculty the opportunity to apply and expand our expertise to solve particular problems or challenges," says Bryden. "These partnerships also provide support for graduate students who are hired to assist with the

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INSIDE THIS ISSUE:

Everything's the same—Only it's not

For as long as he can remember, **Lee Harris** wanted to be an engineer. That's what he wrote down in 1992 when his teacher asked the class of first-graders, "What do you want to be when you grow up?" While Harris may not have known exactly what it meant to be an engineer at the time, he did know he liked all things mechanical.

Over the next 12 years, Harris' interest in engineering evolved. He spent hours working on cars and trucks with his dad and decided he could see himself as an automotive engineer. Growing up just five miles south of Ames, Harris chose Iowa State to pursue his engineering degree.

Harris' first year as an ME major went fast. A member of the ME learning community, he took classes, studied, and participated in group projects. He spent last summer working in the garden department at Lowe's and rebuilding the motor on his pick-up. After a backpacking trip to the Black Hills and the Badlands, he was ready for his sophomore year.

On September 12, 2005, just three weeks into fall semester, however, Harris' life changed dramatically. Returning to Ames from his parents' home in Kelley, Iowa, he lost control of his motorcycle as he rounded a curve. "I hit some sand or something and went into the ditch," he recalls. "I tried to crawl up to the road, but I couldn't move."

At Des Moines' Iowa Methodist Medical Center, doctors found that Harris had shattered two vertebrae near the top of his spinal column and irreparably damaged his spinal cord. They told Harris what he already knew—he was paralyzed from the chest down. With many torn ligaments in his back and neck, he was put in a brace that extended from his neck to his waist so the ligaments could heal. And physical therapy was started.

The first session was disheartening. "They sat me up, my blood pressure dropped, and I passed out," Harris explains. "The session lasted 10 seconds." But, day by day, he worked hard to regain his independence. It meant learning how to get his body out of bed, into the wheelchair, onto the toilet, into the car—the list was long. Harris, though, was optimistic and determined; he registered for spring semester classes.

Two months after the accident, Harris left the Younker Rehabilitation Center at Methodist and went home to his parents. He had mixed feelings. "At the hospital you know things aren't normal," he explains. "Then you go home and everything's the same as it was before—only it's not."

In spite of the challenges, Harris hasn't allowed the injury to put his life on hold. After just a month at his parents', he moved back to his Ames apartment. His roommate, **Greg Vetterick**, had checked it out to make sure Harris could maneuver his wheelchair through the doorways and around the bathroom. Vetterick, a friend since kindergarten, has helped in other ways too. "Greg doesn't see the wheelchair," Harris observes. "He gives me as hard of a time as he ever did."

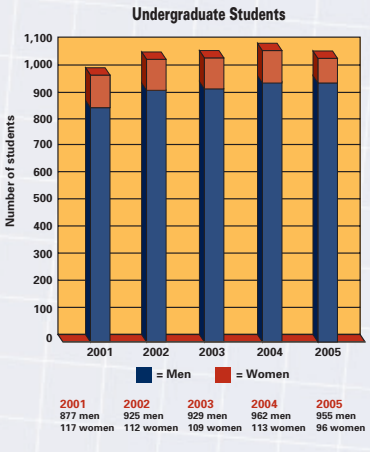
It's now eight months since the accident, and Harris has amazed everyone with his progress. With the purchase of a four-wheel-drive pick-up that he had outfitted with hand controls, he can drive himself wherever he needs to go. He's taking eight credits this semester and works 20 to 25 hours a week at Lowe's.

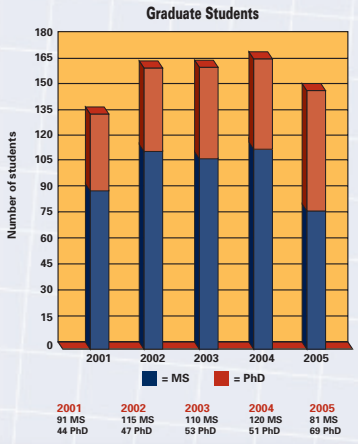
While Harris definitely plans to complete his ME degree, he's got another goal to achieve first. "The doctors here say there's nothing more they can do for me; that I'm going to be in this chair forever," he says. "But I'm 20 years old, and forever is too long."

With help from his parents, Harris is taking a proactive approach. He's researched some surgeries that could help him regain feeling in his legs. Recently he sent in his application to be considered for a surgery that's performed in Portugal. The procedure transplants stem cells from the olfactory bulb in the patient's nose into the damaged area of the spinal cord.

Since the surgery is considered experimental, insurance won't cover the costs. Harris is already looking at how to raise the $100,000 he'll need for surgery and rehab. He has launched a Web site www.myspace.com/wheelchair_warrior, and he's using the National Transplant Assistance Fund to help manage the fundraising. Harris knows he has a tough road ahead, but he won't give up on his goals to walk again or to be an engineer.

Enrollment Fall 2005





Student, club focus on quality of life

Michael Snodgrass isn't your typical ME student. At age 26, he'd been working in customer service for a couple of years when his employer was bought out, and he had to figure out what to do next. His decision—change careers.

"I wanted to be able to do something to help improve people's lives," Snodgrass explains, "and I wanted my skills to be useful anywhere in the world." He chose mechanical engineering as the career that would help him achieve those goals.

Now a senior at Iowa State, Snodgrass is well on his way to acquiring the engineering knowledge and skills he needs. In addition, he's gaining an in-depth perspective on global development work and experience building partnerships thanks to his involvement with the Iowa State chapter of Engineers for a Sustainable World (ESW).

ESW is dedicated to reducing poverty and promoting sustainable engineering and technology in developing countries. Two teams from Iowa State's ESW chapter won $10,000 grants in 2005 from the Environmental Protection Agency's People, Prosperity, and the Planet Program to find sustainable answers to specific environmental problems.

One team is developing a renewable energy system model with the goal of helping a Brazilian university power its campus entirely with renewable energy by 2010. The study includes investigation of the local economic factors that will be affected by this system. The second team is developing a simple and small-scale sustainable system to disinfect water for consumption in Uganda. The teams will present their projects to judges in May with the winners receiving additional funds to move their projects forward.

Snodgrass, who is the ESW chapter president, oversees the work being done by the chapter and facilitates partnerships with other groups both on and off campus. "ESW is fairly small with 66 members, but we work with a variety of organizations so that we can succeed in our goals," he says. "This has been a great experience for me. I've learned a lot about partnering, and I've gotten a much bigger view of what's going on in our college and in the world. ESW has the mentality of what I want to do as an engineer."

Students take projects from design to production

From morning to night, the Raymond A. Engel Manufacturing Laboratory in 1051 and 1095 Black Engineering Building buzzes with activity. The lab is equipped to give students hands-on experience taking a project all the way from design to production. Established 20 years ago, the lab is named in honor of **Ray Engel**, a 1929 engineering graduate. Engel, who passed away in 1986, and his wife, **Kathryn**, who received an Iowa State Honorary Alumna Award in 2005, provided significant support for the lab.

Students in ME 324, Manufacturing Engineering, are the primary users of the lab, according to **Pal Molian**, ME professor and curriculum development committee chair for 324. "They conduct a six-week project that covers the three basic areas of mechanical engineering: design, manufacture, and testing," he says." **Larry Couture** serves as lab coordinator, ensuring that the equipment works properly and that the students understand proper use.

Equipment, acquired through Engel endowment funds and NSF's major instrumentation grant program, includes computer-numerical-control (CNC) machine tools such as a lathe and mill, injection molding unit, coordinate measuring machine, robot and conveyer, and computer-aided design and manufacturing (CAD/CAM) software and hardware packages. Future plans call for acquiring highly precise, automated machine tools such as an electric discharge machine, water-jet, and tensile tester. "Our goal," says Molian, "is to enable continued excellence in the integration of design and manufacturing in engineering education."

For **Katie Fendrick**, a junior from Omaha, Nebraska, designing and fabricating an actual product meant putting principles she had learned in the classroom into action. "We designed a coaster using a CAD program, created a metal mold using the CNC machine, and formed the plastic part using injection molding," she says. "One thing I realized while researching the project is not long ago we were doing all this manually and now we have extremely accurate programs and machines that can create almost anything imaginable."

Jared Bartel and Katie Fendrick designed and fabricated a coaster using the equipment in the Engle lab.

In addition to ME 324, the lab is used for a variety of projects and classes requiring design and fabrication activities. These include such things as senior design projects, light boxes for the mechanical systems design class, parts for the Iowa State solar car, and graphite nozzles for model rockets used in aerospace engineering.

Winning team...continued from page 1

John Deere engineers and managers along with Iowa State researchers participate in the annual Deere Day hosted by VRAC to highlight current projects funded by the company.

work as they pursue their degrees, and it helps students get to know companies that may hire them in the future."

For industry, the relatively low cost of university research enables companies to improve their products and processes and, ultimately, their competitiveness. "When companies work with university faculty, they don't have the start-up costs involved in establishing a research area," explains Bryden. "They select professors who already have expertise in the area and the equipment they need to conduct research in a particular area."

Working with Deere

ME's relationship with the John Deere Company is a prime example of successful collaborative efforts. Kong, for example, is working with Deere to develop technology to reduce emissions on diesel engines. A number of other ME faculty—**Mark Bryden**, **Atul Kelkar**, **Greg Luecke**, **Jim Oliver**, **Judy Vance**, and **Eliot Winer**—are directing one or more projects funded by Deere through Iowa State's Virtual Reality Applications Center (VRAC).

"Companies today often don't have big research and development budgets," says Jim Oliver, ME professor and VRAC director. "With our facilities and expertise, manufacturers like Deere can find out if their idea is feasible without a big investment. They come to us with a concept, and we develop the idea and demonstrate it in VR. Deere can show their vendors exactly what they want to manufacture. It helps Deere maintain its leadership as a product development innovator."

Diversity of projects, sponsors

Kong's project with Ford has the specific goal of developing a computational method that will speed up engine combustion simulations without compromising accuracy. To achieve this goal, Kong's method must change the size of the cells in the computational grid whenever and wherever necessary during the computer simulation. The new method will be implemented into Ford's in-house computer code for engine simulations.

J. Adin Mann III, associate professor, and **Michael Olsen**, assistant professor, have done several projects coupling noise and fluid mechanics studies to help understand the sources of noise generation and develop design tools to aid engineers in coming up with more efficient and quieter designs. A recent project with Eaton Corporation involved automotive superchargers. Used on high-end cars, superchargers increase horsepower by forcing more air into the cylinders. "It's definitely an engineering challenge to keep the noise level down while achieving high performance," says Mann.

Mann has developed a very simplified model based on data Eaton provided that is reasonably accurate at predicting pulsations related to noise and performance. "This model enables the design engineer to try different things and quickly evaluate them," Mann explains. "Once they get a design close to their objectives, they'll move to more complex and time-consuming computational models to continue their work."

Olsen, meanwhile is using particle image velocimetry (PIV), a non-intrusive velocity measurement technique, to help identify and understand the physical phenomena that affect the sound pressure pulses generated at the inlet and outlet. In addition to providing a physical description of the flow, the PIV data also allow researchers to quantify various aspects of the turbulent inflow. In turn, these turbulence data can be used to develop, fine-tune, and verify computational fluid dynamics (CFD) models of the supercharger flow. Eventually, CFD may provide engineers with a design tool to accurately predict the performance of superchargers without the need to build prototypes for testing and modification, resulting in a streamlined design process.

In a project started with Procter and Gamble in 2002, **Judy Vance**, ME professor and chair, focused on ways to design manufacturing equipment. The research team developed software and algorithms to enable designers to examine their equipment and interact with the products in a virtual environment. "They can make adjustments to improve the equipment and the assembly line before anything is actually installed," Vance explains. Procter and Gamble has built several VR caves and is using the software and algorithms to continue the work on site.

Robert C. Brown, ME professor and director of Iowa State University's Office of Biorenewable Programs, has been studying biomass gasification, a process that turns organic material into a flammable gas, for over a decade. **Jared Smeenk**, MSME'95, worked with Brown first as a graduate student and then as an

associate scientist developing biomass conversion technologies. They've built many different systems and have experimented with processing a variety of materials, such as switchgrass, cornstalks, and manure, to gain an understanding of their conversion characteristics and energy value.

"We've learned how to design these systems to work well and produce a high-quality combustible gas that can be used in a variety of commercial applications," Smeenk explains. Smeenk recently joined Frontline BioEnergy LLC, an Ames start-up company that develops biomass gasification technologies to replace nonrenewable resources. Brown's work will continue with this company as they seek to bring this important technology to the marketplace.

In Iowa State classrooms

Collaborations between industry and ME extend into the classroom as well. **Max Gassman**, an ME lecturer who has taught machine design for 30 years, likes his classes to work on projects from manufacturers like John Deere and Vermeer. "It's more fun for the students to tackle real problems from industry and then visit the plants to see what they've worked on," he explains.

Max Gassman, left, and David Brownmiller show the pre-production unit of the electric shredder they're building.

Four years ago, Gassman initiated a class discussion on development of a shredder to grind up branches, leaves, and other yard waste. "Our idea was to design and build a machine that was lighter weight than traditional shredders and powered by a small electric motor so it would be quieter and have no engine exhaust," Gassman says. Currently a senior ME student, **David Brownmiller**, is designing a pre-production unit. Gassman has just received word that the U.S. Patent Office will issue a patent on the machine and work will now begin on building the pre-production unit.

Another ME class, Technology, Globalization, and Culture, is funded through grants from Deere & Company and Cargill, Inc. **Jim Bernard**, Anson Marston Distinguished Professor of Engineering, and **Mark Rectanus**, professor of German studies in the Department of World Languages and Cultures, co-teach the class.

Now in its second year, the course is a cross-disciplinary examination of the impact of globalization on companies and countries. The class features guest lecturers from business, industry, cultural institutions, and academia who confront the challenges of globalization in both theory and practice. Lecturers have included executives from corporations such as Caterpillar, CTARCo, Deere & Company, HON, Kemin Industries, and Rockwell Collins. Taught on campus, the class is also targeted to professionals working out in the field through Engineering Distance Education (EDE).

Beyond campus

Last July, another kind of partnership was initiated. The technical education division of 3M hosted a 90-minute live Webcast featuring ME Professor **Pal Molian** on nanomanufacturing technology and applications of nanomaterials and devices. Directed at audiences with interest in microelectronics, photonics, medical devices, and energy-related products, Molian provided an overview of the unique properties of nanoscale objects and the widespread potential for nanotechnology to improve products and manufacturing processes.

"This was the first time we've broadcast this kind of seminar outside of the company," says **Chris Jacobs**, 3M technical education specialist and 1983 alumna of Iowa State's industrial engineering program. "It's an opportunity to build connections between industry and the university."

Over 60 3M engineers around the world viewed the seminar that was simultaneously offered to the Iowa State community. "This was an unprecedented opportunity for us," says **Paul Jewell**, EDE program coordinator. "Not only did we contribute to a topic of very high interest, but they provided a live stream back to Iowa State, and we have it as an archived Webcast for future use." EDE and 3M are exploring future collaborations.

Professors leave their mark...continued from page 6

With the help of undergraduate and graduate students, Colver has designed and built a test chamber with five combustion cells. The chamber goes inside an A-frame, sent from NASA, which is equipped with instrumentation.

Once Colver adapts his chamber for the A-frame, it will be sent to the Glenn facility, and testing will begin. The entire apparatus will be dropped eight stories and experience 2.2 seconds of near zero gravity during which computers and a camera will record exactly what happens as the powders ignite.

"I want to see how well EPS works in microgravity and how that compares to our computer predictions. We think we'll be able to expand the flammability test range in microgravity, and now we'll find out," Colver says.

Professors leave their mark on ME

When **Shyam Bahadur** arrived in Ames in 1970, he had just completed his PhD at the University of Michigan. He wasn't new to academic life; he had taught for nine years in his native India and held a good university position there. Bahadur, however, wanted to further his academic qualifications and engage in research, so he came to the United States in 1967.

Now Bahadur, who was given the title University Professor in 2000 in recognition of the significant impact he's had at Iowa State, officially retires May 15. Reflecting back on his career, he says his fascination for learning and his great respect for people in academic life and research caused him to choose academia. "I love teaching, and I wanted to give young people the benefit of my experience and help them advance in life," Bahadur explains. He also wanted to continue to grow in his own knowledge and contribute to the advancement of the engineering field.

In his first year at Iowa State, Bahadur secured a National Science Foundation (NSF) grant for research in the emerging field of tribology, the science of friction, wear, and lubrication. He expanded the field even more when he initiated the study of structures and properties of polymers and polymer composites.

Bahadur had continuous research activity funded by NSF, other government agencies, and industry throughout his career. His significant contributions are known worldwide through his publications, presentations at conferences, and lectures. He chaired a number of international conferences and symposia and edited many conference proceedings. He is a Fellow of the American Society of Mechanical Engineers and the American Society of Testing and Materials.

As a mentor for many graduate students, Bahadur set high standards for their research leading to MS and PhD degrees. "I emphasized quality and not quantity," Bahadur says. "I demanded my students' theses should match or exceed the quality of theses produced anywhere in the world."

Bahadur has a reputation as a tough professor in the classroom as well. His courses have been rigorous with high expectations. "A lot has changed over the last 36 years," Bahadur observes. "One reason I went on phased retirement was to write a textbook. But now, a fair percentage of students depend solely on the course material put on the Web and don't even read the textbook. So I question the practicality."

While Bahadur may not write a textbook, he looks forward to devoting time to the many activities that he didn't have time for as a faculty member. These include reading, learning about the things that interest him, some writing, and a favorite pastime—stock market analysis.

Early in his 28-year tenure at Iowa State, Professor **Jerry Colver** became known to some as Mr. Wizard. Colleagues regularly saw him with a device of one kind or another in hand, and he'd eagerly explain how it worked.

Colver's passion for understanding the inner workings of mechanisms hasn't diminished since his December retirement. Now however, he has the time to delve into the mechanics of all sorts of things—cars, tractors, watches, and refrigerators. "There's not much I don't have apart right now," he admits.

While Colver enjoys the hobbies he can do in retirement, he's also busy writing articles and doing research. In fact, the music room at his home in rural Roland, Iowa, is currently the construction site for an apparatus designed for a microgravity combustion experiment funded by NASA Glenn Research Center.

That's not a surprise to those who know him. As a new professor, Colver set a goal to teach at least one new course every two years or audit an outside course. He taught 30 different graduate and undergraduate courses at Iowa State and at Rensselaer Polytechnic Institute (RPI) where he was a faculty member from 1970 to 1977. Colver is also an accomplished researcher with over 90 publications, and he's lectured worldwide on topics related to powder combustion, fluidization, and electrostatic effects in powders.

The apparatus in Colver's music room uses a unique technique to study powders that he first worked on at RPI and has continued to perfect ever since. "Our electric particle suspension (EPS) technique enables us to study and identify the fundamental characteristics that lead to the explosion hazards of powders," Colver explains. "Many substances, for example, aluminum, flour, and coal, become highly combustible in powder form because they react with oxygen. NASA, as well as industry, needs reliable flammability testing so that powders can be safely used in processing and space environments."

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Alum stays connected to Iowa State

Larry Pithan, senior vice president, KJWW Engineering Consultants, likes being connected to his alma mater. When the native of Lost Nation, Iowa, arrived on the Iowa State campus in fall of 1969, his goal was simple—become an engineer. The Department of Mechanical Engineering provided the people, tools, and environment that enabled him to achieve his goal.

Pithan made the most of his education. His strong credentials, combined with a good job market for engineers in 1973, led to interviews all over the country. He went to work for KJWW in Rock Island, Illinois. "When I was hired as a design engineer, I was the 12th employee," Pithan recalls. "Now we're at 270 and have five offices throughout the Midwest."

KJWW, ranked among the top 20 engineering firms in the U.S., provides comprehensive structural, mechanical, electrical, and technology services. It has received two International ASHRAE awards—the highest HVAC engineering awards in the world.

During Pithan's 33 years with the firm, he has progressed from project manager to department manager for the mechanical engineering department at Rock Island to mechanical manager for the entire firm. Most recently, he moved out of engineering and into financial management of the company.

In the years since he graduated, Pithan has developed a strong relationship with Iowa State by making contributions to the Black-Hilstrom Fund. "I received a good education," he explains, "and I feel it's important to give something back."

In recent years, Pithan and his wife, Pamela, have focused their contributions in specific program areas. "In the consulting business, we need engineers who can not only design a device but know what it takes to build it," he says. "That's when you find out what some of the problems are and can figure out solutions."

To ensure students can get that kind of hands-on experience, the Pithans have provided support for the senior design class, which, in previous years, has developed assistive devices for disabled children. Students are currently working on designs for more efficient wood-burning stoves for use in third-world countries.

Pithan's connection to the department got even stronger last fall when he accepted an appointment to the Industrial Advisory Board (IAB). "This is a real honor for me," he says. "The IAB is an excellent way for the university to get feedback from industry about what we're looking for as we recruit engineers. KJWW is a major employer of Iowa State engineering graduates, with 43 currently on staff."

For more information on the many ways, you can support the Department of Mechanical Engineering, please contact Jodi Reinhart at 515 294-1431 or Sallie-Grace Tate, senior director of development, at 515 294-0934, or use the form below.

Your support makes a difference

Generous gifts from ISU ME alums, industry, and others enable our department to continue our tradition of academic excellence. Your contributions are used for

- Scholarships and fellowships
- Start-up funds to attract top-notch new faculty
- Seed money for development of new projects
- Laboratory equipment

In 1980, **Henry Black**, department head from 1946 to 1972, joined with **Hollis "Pete" Hilstrom**, ME'34, to invite alumni to contribute to the Black-Hilstrom Mechanical Engineering Development Fund. Since then, the endowment has grown to more than $2 million with gifts from more than 475 alumni.

Please use this form to contribute or call us at (515) 294-1423 to learn about other ways you can support ISU ME.

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National Science Foundation grants awarded

Pranav Shrotriya, an ME assistant professor since 2003, has received a prestigious National Science Foundation Faculty Early Career Development Program grant. He will receive $400,000 over four years for his project, "High Resolution Interferometry-Based Surface Stress Sensors for Chemical and Biological Species Detection."

"The goal is to build a working model of a miniaturized sensor that is able to detect the presence of substances that pose a threat to health, national security, or the environment," Shrotriya says. "If you can coat a surface with a particular compound that only reacts to something harmful such as explosives or a bacteria, then, if that substance is present, molecules will be absorbed causing deformation of the surface." Shrotriya is modifying an optical technique he first developed as a postdoc at Brown University to detect and measure the deformation differences between a reference surface and a sensor surface. He's also developing computational simulations to try to understand how the molecular rearrangement happens.

ME Assistant Professor **Michael Olsen** leads an interdisciplinary Iowa State team that has received a National Science Foundation Major Research Instrumentation grant for $325,350. Researchers nationwide compete for these prestigious grants. Co-principal investigators are **Rodney Fox**, **James Hill**, and **Dennis Vigil**, chemical and biological engineering; and **Fred Haan**, **Hui Hu**, and **Partha Sarkar**, aerospace engineering.

The instrumentation acquired is a high-speed particle image velocimetry (PIV) system that will be used to perform single- and multi-phase fluid dynamics research. PIV is a flow measurement technique for measuring instantaneous velocity fields. The high-speed PIV system provides the capability to obtain time-resolved velocity field data for turbulent and/or unsteady flows. These data will give researchers much more detailed information that will lead to major breakthroughs in the understanding and modeling of many research areas in fluid dynamics, including turbulent mixing, chemically reacting flows, microscale fluid flows, multi-phase flows, acoustics, and wind engineering.

ME Update is published twice a year by the Department of Mechanical Engineering at Iowa State University and is prepared by Engineering Communications and Marketing. Please send comments to:
ME Department, ISU, 2025 Black Engineering, Ames, IA, 50011-2161. Phone: 515 294-1423; Fax: 515 294-3261; E-mail: isume@iastate.edu; Web site: www.me.iastate.edu

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