

# SYSTEMS

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## At the cutting-edge of rapid manufacturing



**P**roducing machined parts is an industry task often associated with mass production operations. Turning out large quantities, however, may not always be the desired goal, according to IMSE Assistant Professor Matt Frank, especially for clients wanting single, one-of-a-kind parts or prototypes, quickly and on demand.

Ad hoc manufacturing of this type often surfaces in the military, elaborates Frank. "If a part in a 40-year-old tank is disabled, and the original contractor is unavailable to replace it, the military has very few options," he explains. "It can do one of two things—stockpile thousands of these parts, which may ultimately never see use, or wait for the desired part to be shipped in." Another example involves prototyping functional parts when manufacturers wish to create a "first" part in order to test its capability.

"We're investigating how to advance the capabilities of a single machine to rapidly manufacture these parts at an on-site facility, such as an aircraft hangar. All we would need to do is stockpile the appropriate raw material and use information available through a computer database to fabricate the required part as the need arises." The 'machine' that Frank refers to is a computer numerical controlled (CNC) milling machine that uses 2D or 3D digital information to create physical objects from blocks of raw material.

Current rapid prototyping (RP) techniques (the process of creating physical models from computer-aided design [CAD] files) fall short when it comes to the types of materials they use and the accuracy with which they can create parts. Stereolithography uses only UV curable photopolymers, and some 3D-printing processes are starch and plaster powder based, explains Frank. In particular,



### Engineering a better kitchen

For a growing number of elderly Americans, fixing a meal in a traditional kitchen involves physically stressful movements in reaching, stretching, and bending while using cabinets and appliances. An important reason why older people decide to move into assisted living facilities is because they are unable to cook in their own kitchens, according to IMSE Professor Pat Patterson, an expert in rehabilitation engineering and developing products for the disabled.

Now, thanks to a \$488,575 Department of Health and Human Services Administration grant on aging, Patterson and a group of IE students are designing and building a Universal Design Kitchen (UDK) that meets the physical needs of the elderly. The multidisciplinary project involves the efforts of Mary Years, faculty member from ISU's College of Family and Consumer Sciences, and Andy Bice, an industrial specialist at ISU's Center for Industrial Research and Service.

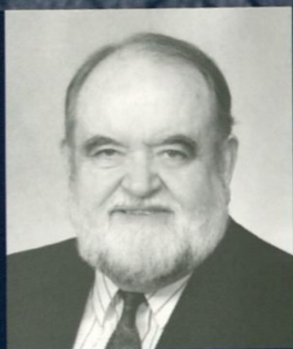
The modified kitchen features flexible and reconfigurable cabinets and shelves that can be adjusted for special uses. Last fall, 40 volunteers tested the units and provided feedback that led to the

continued on page 5

continued on page 2



## Francois receives Marston Medal



*IMSE congratulates Francis B. Francois for being honored with the 2003 Marston Medal, the College of Engineering's highest alumni honor!*

Francois earned a degree in general engineering from Iowa State in 1956. He began his career specializing in patent and trademark law. In 1980, he was named executive director of the American Association of State Highway and Transportation Officials, a position he held for 19 years. A member of the National Academy of Engineering, Francois spent much of his professional life developing and implementing public policy.

Francois served in elected office for 18 years in Prince George's County, Maryland, and maintained a private practice in intellectual property protection for nearly two decades. Now retired, Francois lives in Bowie, Maryland.

### **Kitchen design** (continued from page 1)

fabrication of an initial prototype by Bertch Cabinet Manufacturing, an Iowa company. Ultimately, the goal is to make these units available for general use in retail hardware stores, says Patterson.

A recent Housing and Urban Development assessment states that the assisted devices and home modifications market for the elderly will become increasingly important over the next 30 years with over-65-aged adults constituting more than 20 percent of the U.S. population. The UDK approach targets this trend as America's elderly opt to stay home longer, with the hopes of postponing costs associated with assisted living quarters.

## Walkup lectures bring experts

The 2003–2004 Joseph K. Walkup Distinguished Lectures featured a series of four seminars by prominent IE academicians and researchers from across the country and led to a stimulating exchange of ideas in the department.

Richard A. Wysk, Leonhard Chair in Engineering and Professor of Industrial Engineering from Penn State University, presented a brief overview of using computer simulation software to control a manufacturing system and its impact on changing manufacturing environments. Barry L. Nelson, James N. and Margie M. Krebs Professor in the Department of Industrial Engineering and Management Sciences at Northwestern University, Evanston, Illinois, discussed computer simulation experimental design, analysis, and applications in manufacturing and services.

Product offerings, pricing, and manufacturing decision making were topics explored by Candace Yano, Professor of Industrial Engineering and Operations at the University of California, Berkeley. Yano introduced her research ideas and findings in this interface between manufacturing and marketing. The final lecture, delivered by W. Monroe Keyserling, Professor of Industrial and Operations Engineering and Occupational Health at the University of Michigan, focused on industrial ergonomics. Keyserling discussed the relationship between low back pain, disability, and workers' compensation.

The lecture series was established last year in honor of Joseph K. Walkup, who was instrumental in creating the industrial engineering department in 1942 and served as department chair for the next 31 years.



Wysk



Nelson



Yano



Keyserling

## Site visits yield valuable insights

Observing IE students at work on internship and co-op sites, IMSE Professor and Department Chair Pat Patterson says he's struck by one undeniable reality: "I'm constantly amazed at how much responsibility our students have to shoulder. In many instances, they take on multiple projects."

Patterson visits approximately 50 students each year in Iowa, adjacent states, and across the country. Watching students interact in a professional setting provides a whole new perspective on classroom dynamics, says Patterson. "Students often voice ideas like 'I wish I had learned this concept in class' or companies express the need for students to be equipped with a certain set of skills before they come to the job."

Site visits function as an important matrix for gauging student preparedness, as well as industry expectations, according to Patterson. "There's no denying the double-edged benefit here. Students know that we're paying attention beyond the classroom, and, more importantly, I get to make sure firsthand they're engaged in

engineering-related work," he says. On another level, Patterson welcomes the opportunity to keep connected with companies and be mindful of their needs.

While working on a large project with Lennox Industries in Marshalltown, Iowa, IE sophomore Morgan Gottschalk found a chance to take on responsibility and experience firsthand the value of faculty involvement. "The primary purpose of an internship is to help students shape their goals and career objectives," observes Gottschalk, who is convinced that students require just as much guidance, if not more, on internships than in class. "Site visits by faculty also help students remain connected to the department," she adds.

According to Patterson, experiencing real-world engineering practice is critical, but making sure that students are engaged in the right types of engineering-related activity is equally important to their educational success. And, he adds, "it's good to hear companies express satisfaction with how well our students perform."

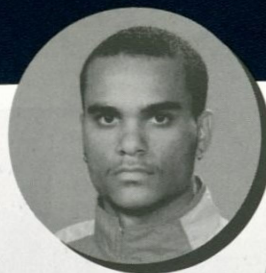




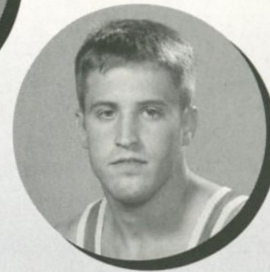
Johannes Egbers



Neil Hines



Daniel Zelik



Zach Roberson



Lindsey Chapman

## Going the extra mile

During the past few years, several IE student athletes have flexed their intellect as well as their bodies for Iowa State. The department would like to recognize their dedication and team spirit and highlight some of their achievements:

**Johannes Egbers** (junior) from Clinton, Iowa—Offensive lineman for the ISU football team; 2001 Big 12 Commissioner's Honor Roll; 2002 ISU Scholar-Athlete Award.

**Neil Hines** (freshman) from Mores Bluff, Nebraska—ISU Freshman of the Year; finished 4th in the decathlon at the 2004 Tom Botts Invitational, 6th in the 2004 Big 12 Championship.

**Daniel Zelik** (junior) from Pittsburgh, Pennsylvania—Hurdler, missed 2003–2004 season while interning with NASA; best time in the 110-meter high hurdles in 2004.

**Zach Roberson** (senior) from Overland Park, Kansas—2004 NCAA 133-pound wrestling champion; 106 career wins, which is tied for 23rd on ISU's all-time career win list; runner up Big 12 Champion; voted Art Kraft Champion of Champions for exemplary qualities for an athlete; 2003–2004 ISU Student Athlete of the Year.

**Lindsey Chapman** (senior) from Bowling Green, Ohio—Team setter for ISU Women's Volleyball; named to Academic All Big 12 First Team; finished ISU career with 1,307 assists, which is 7th on ISU's all time career assist list.

### Not Pictured

**Molly McNertney** (senior) from Ames, Iowa—ISU women's softball team walk-on; earned a scholarship and was named captain her senior year; had knee surgery, but came back and played this spring semester.

**Matthew Rolling** (senior) from Dubuque, Iowa—ISU Cheer Squad

**Phil Hummel** (senior) from Crete, Illinois—Played Club Hockey at Iowa State

## Picking up where he left off

### Alum resumes career after service in Iraq

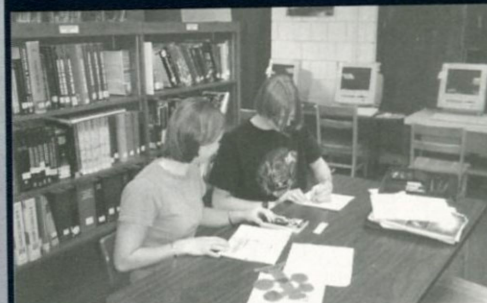
At the beginning of the Iraq War in 2003, Scott Pauley (IE'91) flew a KC-135 all weather refueling aircraft in the area. He had flown missions over No Fly Zones before the war, but this was his first call to combat.



The months leading up to the war were stressful, recalls Pauley. "It was tough going from a real corporate job and establishing a career to all of a sudden leaving for an undetermined amount of time." After six weeks of action, Pauley returned home safely to family and a career at GE Healthcare Systems. Scott was also honorably discharged from the Air Force after successfully completing several years of active duty assignments.

Today, as an operations production leader for GE's wireless medical telemetry products, Pauley oversees manufacturing requirements for new products and maintaining product quality. He continues to serve part time in the Milwaukee Air National Guard in Wisconsin, where he currently lives with his wife, Martha, a 1991 ISU English graduate.

## Shine with IIE!



IE students involved in the Institute of Industrial Engineers (IIE) don't just stay on campus. They fan themselves out into the community. In a recent venture, IE students formed SHINE (Students Helping Individuals Navigate to Excellence) and initiated weekly volunteer math and science tutoring for 7<sup>th</sup> and 8<sup>th</sup> graders in the Ames Middle School. IE students not only helped young adults excel, but they also served as excellent role models for middle schoolers as they began planning their future.

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# Meet IMSE's global engineers

*"Through travel I  
first became aware of  
the outside world;  
it was through travel  
that I found my own  
introspective way  
into becoming  
a part of it."  
-Eudora Welty*

Nine weeks at Brunel University, near London, England, last spring semester had Mike Rodgers, IE senior from Oskaloosa, seeing the world through other people's eyes. "I've shed some of my American ideas of the way things should be," he observes candidly. "Now, when I enter an unfamiliar environment, I don't go with any assumptions," an attitude, he adds, that has prepared him well "for the differences out there."

Rodgers, who took IE courses and an international marketing class at Brunel, found his academic experience in another environment uniquely inspiring. "The instructor gave us a long list

of textbooks to consult, which meant I had to approach the material from a totally different perspective than I was used to," recalls Rodgers. As for adjusting to a different culture, Rodgers says he learned to develop a new mindset: "In the beginning I was looking for the familiar

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that that was the  
wrong approach."**

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IE sophomore Spencer Geisler, currently taking Spanish courses at a university in Cáceres, Spain, is impressed with how the native population is passionately focused on family and friends. A trip to Grenada, at the base of the Sierra Nevada Mountains, introduced him to the country's natural treasures and diverse population. "My time here has really helped shape my view of the world," observes Geisler.

JoHannah Tripp-Rieks knows a thing or two about exotic locales. She visited eight European countries while taking courses at Brunel. Her favorite spots included Sardinia, where "the people are extremely nice," and Croatia, for its spectacular scenery. Tripp-Rieks, an IE sophomore, also made good friends with members of a visiting Indian cricket team, who were "extremely hospitable and a lot of fun," she recalls.

In addition to semester exchange programs, IMSE Associate Professor Frank Peters has established a 6-week summer program at Brunel geared towards IE student academic needs. Collaborating



Mike Rodgers (left) hangs out with friends at Brunel University.



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2006-2007



IE student JoHannah Tripp-Rieks spends time with a cricket team from India (far left).

IMSE Associate Professor Frank Peters toured with students in the city of Bath, England. They visited the Abbey (left) and the famous Roman baths (below right).

Students visit the Rolls Royce assembly plant in Derby, England (bottom right).



with Scott Chumbley, a faculty member in ISU's materials science and engineering department, the Brunel summer session offers courses in materials sciences and women's studies.



offering students a firsthand glimpse of different production and managerial styles. In addition to Peters and Jackman, IMSE faculty members Doug Gemmill and Sarah Ryan have also accompanied students to Brunel.

Faculty encouragement, combined with student scholarships and travel support available through companies like John Deere and the Schneider Electric Company, makes international travel a very real possibility for IE students, yielding practical and beneficial returns.

Fachhochschule Mannheim, in Mannheim, Germany, is yet another university where IE students can steep themselves in another culture while gaining course credits. Program coordinator and IMSE Professor John Jackman notes that besides immersing themselves in the culture, students learn how engineering and business come together in a global economy. Germany and England are major players in a rapidly expanding European Union economy, says Jackman, and it's highly desirable that students develop an awareness of "the culture of engineering" in an international context.

Both programs include organized tours of industry sites—such as Rolls Royce, Perkin Engines, Sauer-Danfoss, and Caterpillar—



IMSE alumni (left to right) Bob Day (Gen Engr'49), Don Bice (Gen Engr'49 ), Matt Frank, Dick Bauerle (Gen Engr'53), and Jim Jacobson (Gen Engr'54) visit Frank's lab during Alumni Days.

**Rapid manufacturing** (continued from page 1)

few processes create parts in metal, and those available often are limited in material properties and accuracy.

CNC machines, on the other hand, accept a broad range of materials—from plastic to aluminum to steel, making it "a very enabling technology and the most logical one to consider for rapid processes," states Frank. Moreover, a CNC milling machine can create parts with a higher degree of accuracy and usability. It is from this perspective that Frank is looking to understand some of the factors that effectively prohibit CNC machining from being called an RP process. One consideration is that RP requires minimal human intervention compared to CNC's labor-intensive processes that require skilled operators to plan, design, and execute complex steps for positioning and orienting raw material.

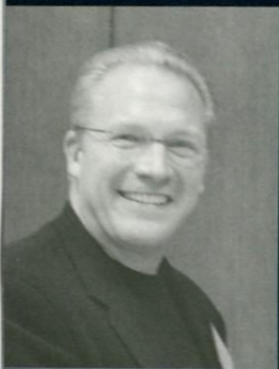
Last fall semester, Frank set up a new lab for researching rapid prototyping and manufacturing techniques and also developed an experimental course on this topic. At the Institute of Industrial Engineers national conference held recently in Houston, Texas, a technical paper titled, "Visibility from a Slice File for Rapid CNC Machining," written by Frank and co-authored by Penn State colleagues Rick Wysk and Sanjay Joshi, won the best paper award in the manufacturing and design division.

The work on rapid CNC machining is being conducted in collaboration with the machine tool and CAD/CAM industries, as well as the U.S. Army, and involves graduate student participation.



## Industry exec shares on-the-job experience

IMSE's executive-in-residence program was held April 22-23, 2004. The featured guest, Roy King, is retired chairman, CEO, and president of Mecator Software, Inc., which was recently acquired by Ascential Software. King worked with IE students and faculty on a range of issues in enterprise computing and software solutions.



Prior to joining Mecator in 2001, King was the CEO and president of Immediant Corporation, a Thayer Venture Capital company. In a distinguished professional career spanning over two

decades, King held several managerial and consulting positions at IBM Global Services, Booz Allen Hamilton, KPMG Peat Marwick, Theodore Barry & Associates, AT&T Long Lines, The Trane Company, and Deere & Company. He received his bachelor's degree in 1976 from Iowa State and his M.B.A. from Harvard Graduate School of Business Administration in 1982.

Since its inception in 1997, IMSE's executive-in-residence program has given students opportunities to engage in one-on-one conversations with visiting executives, who help reinforce faculty instruction and provide a broad view of real-world engineering practices. In return, visiting executives get a chance to educate future engineers and contribute to department efforts to teach and develop courses strong on industrial relevance.

## Student paper recognized at IIE regional



*IE senior Scott Post presents the paper at the IIE competition.*

IE students Teresa Hicks and Scott Post placed second in the Institute of Industrial Engineers (IIE) regional technical paper competition held in March at the University of Wisconsin in Madison. The students received a cash award and recognition at the Awards Banquet. The team also included IE students Matt Marek and Casey Waechter.

The technical paper was based on a Fall 2003 IE quality course project with Pella Corporation of Story City and involved a quantitative analysis that students conducted on the company's existing stop-inline process. The paper offered solutions and recommendations for long-term quality improvements.

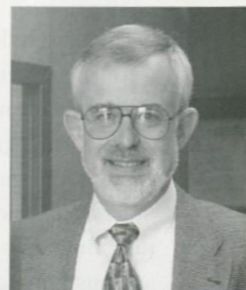
Each year, the IIE encourages students to write and present technical papers, which are judged for depth and originality as well as excellence in written and oral presentation. The regional level includes universities in the upper Midwest.

## PIE Award to Herrmann

The 2004 Joseph K. Walkup Prominence in Industrial Engineering Award was presented to Rudolf J. Herrmann (BSIE'73 and a 1975 M.B.A. graduate from Harvard Business School). Herrmann was cited for his extensive service to Iowa State and wide range of civic causes. He served on industry advisory committees for both IMSE and the College of Engineering for a number of years and also contributed his service to the ISU Foundation. He is chairman of the Goodwill Industries in Tulsa and on the Nature Conservancy Board, Oklahoma Chapter.

Herrmann's contributions to the IE profession include serving as foundation director of the Institute of Industrial Engineers and serving as vice president at large for its board of trustees. He began his career with Fisher Controls Company in 1975 as a sales engineer. Four years later he became president of Command Hydraulics, Inc. During the past decade, Herrmann was president as well as CEO of Dover Resources, Inc., a company that has more than doubled its size under his leadership.

Currently retired from industry, Herrmann works pro bono for Oklahoma State University's engineering and technology management program. The Walkup Award, instituted in 2002, recognizes department alumni who have demonstrated exemplary service to their profession and the community at large.



## Teaching excellence

IMSE Associate Professor Frank Peters presents IE graduate student Roy Stevenson with the Iowa State University Teaching Excellence Award. Stevenson was cited for his exceptional teaching and mentoring skills.



# IMSE faculty/staff honors and awards

- **Carolina Cruz-Neira**—Named Computer Graphics Pioneer for her contribution to the field of computer graphics
- **Doug Gemmill**—Received 3rd Annual R1ed Award, presented by a consortium of 34 American research universities recognizing work in the field of distance education
- **John Jackman**—Outstanding IE Professor, Engineering Student Council
- **Siggi Olafsson**—Promoted to Associate Professor
- **Frank Peters**—All-Greek Academic Recognition, "Outstanding Faculty Member," E-Week "Professor of the Semester"



Siggi Olafsson



**Left:** Donna Cerka, IMSE secretary, is recognized for 25 years of service in industrial engineering by ISU President Geoffroy.

**Below:** The department welcomes Devna Popejoy-Sheriff, undergraduate academic advisor who joined the IMSE staff in Fall 2003. In addition to academic advising and counseling, Popejoy-Sheriff teaches an IE orientation course and coordinates the department's learning community.



**Right:** Roger Berger presents IE senior Lori Finkenbinder with the 2004 Berger-David Prize for academic excellence.



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## IMSE Scholarship Recipients

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## Where are IE alums now?

Leslie Potter is teaching in IMSE—Where are the rest of you? Share updated information with Lynn Franco (contact information at right). Listed below are IE alums who are currently serving on the IMSE Industry Advisory Council. We thank them for their support.

**Eric Ervin (BSIE'95)** has been a director of engineering services at JB Hunt Transport, Inc., in Lowell, Arkansas, since 2002. He is currently working on his M.B.A. at the University of Arkansas, Fayetteville, where he lives with wife, Karen (also an ISU alum), son, Cameron, and daughter, Elizabeth.

**Wayne Flory (BSIE'87)** is a senior director of operations technology and services at Rockwell Collins, Inc., Cedar Rapids, Iowa. He leads Rockwell's advanced manufacturing technology implementation group.

**Sue (Tuttle) Osier (MSIE'83)** is a plant manager for Harris Corporation, a manufacturer and worldwide supplier of radio and TV transmitters in Quincy, Illinois, where she has worked for 21 years. Osier's family includes her husband, Joe, who is a school principal and a 1975 ISU grad, and two sons, Geoff, an aerospace engineering grad student at Purdue, and Kyle, a mechanical engineering freshman at Iowa State.

**Arvin Pleima (BSIE'83)** has worked for Pella Corporation, Pella, Iowa, since 1984 and is currently director of its supply chain division.



Leslie (Baker) Potter (second from left) and friends.



"Blues Brothers"—1989 IE Banquet.

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