

MEDC Pledges Funds to Project to Create Safer, More Efficient Tools

Mahmut Eksioglu and John Cherng have just received a \$74,796 pledge for one year of funding from the Michigan Economic Development Corporation (MEDC) Emerging Technology Challenge Fund. It is being matched by the Research Excellence and Economic Development Fund (REEDF) and by Churchill Aerospace, who will partner with Eksioglu and Cherng to design and develop ergonomic rivet tools. The total amount of money allocated to the project is approximately \$150,000.

"Work-related musculoskeletal disorders are costing billions of dollars each year to U.S. industry," says Eksioglu, assistant professor of industrial and manufacturing systems engineering. "These disorders diminish the quality of life of affected people, their families, and society in general. Numerous studies show that workers who use ill-designed tools are at higher risk. Tools designed according to ergonomic principles not only reduce the occurrence of these disorders but also improve the productivity and quality of the work being performed."

Foreign rivet tool manufacturers in Japan and Europe, using ergonomic principles, have introduced a new generation of rivet tools with much less vibration, threatening domestic rivet tool manufacturers' market share. Eksioglu and Cherng, professor of mechanical engineering, will work closely with Churchill Aerospace, a Michigan-based company, to optimize the ergonomic design of Churchill's rivet tools and to produce prototypes. The ultimate goal

of this project is to commercialize a set of ergonomically sound tools for the purpose of workers' health and safety as well as to improve the productivity and quality of the product.

This is not the college's first project with Churchill Aerospace. In 1990, U.S. Industrial Tool and Supply Company (now Churchill Aerospace) gave Cherng a grant of \$10,000. "The grant went toward investigating the frequency characteristics of rivet tools," says Cherng. His team developed an innovative measuring procedure to accurately capture dynamic transient impulsive signals generated by rivet tools.

From 1992 to 1994, Cherng's team used a REEDF grant of \$35,000 to optimize the design of the rivet



Mahmut Eksioglu and John Cherng in the Acoustics and Vibration Measurement Laboratory's anechoic chamber

tools by applying vibration isolation and damping techniques. "We developed a set of ergonomically designed tools," he says, "but we didn't have the time and funding to do the handle design. This new MEDC funding will give us the chance to finish the handle design and construct and test prototypes and bring them to market."

MEDC was formed in 1999 through an alliance between the State of Michigan and local communities. Its focus is business retention and expansion within the state.

For more information on this project, contact Mahmut Eksioglu at 313-593-0326 or meksio@umich.edu.

"The Inside Story"

The Institute for Advanced Vehicle Systems (IAVS), part of the College of Engineering and Computer Science (CECS) at the University of Michigan-Dearborn, has teamed with the College for Creative Studies (CCS) in Detroit to design the interior of a low-mass vehicle (LMV). "This vehicle, the first focused project undertaken by IAVS, needs to have an interior that is compatible with the exterior that was designed at CCS," says Roger Shulze, director of IAVS.

The low-mass vehicle is being designed to compete with vehicles such as the Toyota Echo and the Ford Focus but with 30% less mass. In addition, the LMV will match features, space, and performance and be price competitive with vehicles in that segment. It is intended to be profitable in low volumes by means of low piece cost and low manufacturing investment.

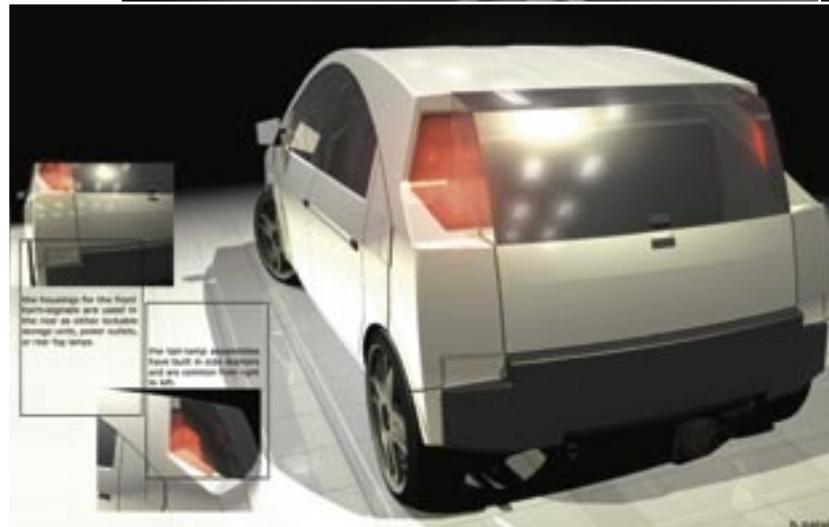
The exterior of the low-mass vehicle was designed during a student competition at CCS in the summer of 2000. A panel of industry experts judged the designs and chose one created by Herain Patel, then a CCS student and now a designer in the automotive industry. Patel's design was selected because, in the opinion of the judges, it had the highest potential of achieving the stringent weight, cost, and investment objectives without sacrificing occupant comfort. For example, the LMV body was designed with 14 body panels and 3 glass panels compared to 32 body panels and 8 glass panels for similar vehicles in this class.

The wheelbase of the low-mass vehicle is approximately 10 inches longer than the Toyota to maximize the occupant space and for easier entry-exit through the common doors. "A longer wheelbase directly translates into increased rear legroom and allows the possibility of a rear sliding-reclining seatback," says Patel.

With the rear seat in its forward position, the car can accommodate two extra rear-facing passengers. The rear overhang is comparable to the Toyota Yaris hatchback. Luggage space would be equivalent to the Toyota Echo through the elimination of the rear spare tire.

The LMV interior design project began in the fall of 2002 and is being completed in two phases. The first phase required each student in the CCS senior interior design class to create an interior design for the low-mass vehicle. In addition to the obvious requirement of being aesthetically pleasing, especially to young buyers, the designs needed to pay special attention to weight, cost, and investment. Designs also had to conform to engineering standards.

In December, a design by student Jeff Bonner was chosen by a panel of industry experts to be the official low-mass vehicle interior design. For



- Translucent body of the low-mass vehicle (LMV)
- LMV rear view (left)
- Picture of the LMV interior seen through the driver's window (above)

his efforts, Bonner was designated a Prechter Fellow for New Manufacturing for the winter 2003 semester.

During the second phase, Bonner will refine his

design and make it conform to engineering standards. The product will be a mathematically accurate rendering and a quarter-scale model of the interior design. Bonner will work closely with Vivek Bhise, professor of industrial and manufacturing systems engineering (IMSE) at CECS, and Huzefa Mamoola, this year's Prechter Fellow and a CECS graduate student.

"It is no coincidence that Jeff Bonner and Huzefa Mamoola, both Prechter Fellows, will be working together on the second phase of the interior design project," says Subrata Sengupta, dean of CECS. "Our goal with the Prechter Fellowships is not only to produce engineers and designers who are technically astute in their specialized fields, but who are also well-rounded. We select high-caliber students for the fellowships and help them focus not just on the technical nuts and bolts of their own fields of expertise but on an entire systems approach."

"The most important goal of the interior design project is to help CECS and CCS faculty and students learn how to work together for the integration of vehicle interior and exterior styling and engineering," says Shulze.

Jeff Bonner's interior design achieves great mass reduction by eliminating the cosmetic components of the typical interior. The remaining elements are aesthetic as well as functional.

The interior uses aluminum tubing extensively as well as Spandex-Lycra fabric and urethane foam. The dash is made of a center console and three transverse aluminum tubes. The top two tubes function as airtight HVAC channels, and the third houses electrical and airbag components. Fabric is stretched across the top tubes for a horizontal surface and hangs below to create a hammock-like compartment for storage.

The seats are made with an aluminum tube structure and urethane cushions that are covered with a Spandex-Lycra fabric. These materials eliminate the typical moldings, springs, and stampings in common seating. Both front and rear seats can be flipped and folded-flat to provide a flexible environment.

The door panels demonstrate efficiency from symmetry. The front door can be used on the opposite rear door. The door handles also act as

"The Inside Story"

Continued from page 3

map-lights and allow for safe egress in the dark.

"My design is a simple solution to the problem of weight reduction," says Bonner. "It is affordable and flexible and aimed at youth and emerging markets. Most of all, it's honest. There are no simulated leathers or painted covers. What you see is there for a purpose."

Addressing ergonomics, Bonner, Mamoola, and Bhise will ensure that the seats, dashboard controls, and foot pedals are created with the user in mind. For example, they will test reach and range of vision to make sure the vehicle meets safety and comfort goals.

The collaboration among otherwise separate disciplines doesn't stop with the teaming up of interior design and ergonomics. Other projects under the IAVS umbrella that directly affect the low-mass vehicle design include structural analysis and material selection, suspension design and vehicle dynamics, optimizing the body shape for aerodynamics, and mass customization.

Ghassan Kridli, assistant professor of IMSE at CECS, and his team are conducting structural design and material selection studies for two basic body configurations—space frame and unibody. "The objective of our project is to design the body structure for the low-mass vehicle, select materials, and perform structural analysis on the design," says Kridli. "We're in the last phase; we have designed the structure two ways—as a space frame and as a unibody. We have selected different steel and aluminum alloys, and now we're looking at crashworthiness."

In concert with Kridli's study, a project is well under way by Charu Chandra, assistant professor in the same department, focusing on supply chain economics related to the choice of body configurations. Studying under Chandra was Claus Narr, the recent recipient of the Prechter Fellowship. Narr was a visiting student from Aachen University in Germany and completed his studies at CECS in June 2002. His research resulted in a model and method for simulation-based order management and structuring of production networks.

These and other studies will lead to the best "systems" choice for the LMV body structure design.

What's next for IAVS and CCS?

With the success of the joint design and engineering efforts of UM-Dearborn and CCS, the schools are investigating the possibility of creating a more formal ergonomics and interior design class that might be offered at both schools. "Who knows; if we are successful, we would love to share our techniques with other educational institutions as well as industry," says Dean Sengupta.

"The Inside Story" is excerpted from an article written by Roger Shulze, director, IAVS, for an upcoming issue of Interior Motives magazine.

For more information on the low-mass vehicle and other IAVS projects, contact Roger Shulze at 313-593-6431 or rshulze@umich.edu.

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CEEP ADVISORY BOARD PROFILE

David Donegan

David Donegan is a car guy. Cars drew him into engineering, initially as an amateur mechanic and eventually as a materials engineer at Chrysler and ArvinMeritor. "I've always been a car person," says Donegan. "As I grew up, I would buy cars and modify them. At one point, I raced them, too." Donegan raced his souped-up cars on a quarter-mile drag strip and actually won one trophy. "But," he adds, "I was a better mechanic than I was a race car driver."

Putting ideas of a racing career aside, Donegan got a bachelor's degree in materials engineering from Wayne State University in his hometown of Detroit. He pursued graduate studies in business administration at Wayne before deciding that he wanted to go in a more technical direction.

After getting his degree, Donegan went to work at Chrysler Corporation as a materials engineer. "I worked mostly in manufacturing the first seven or so years," he says, "at an axle manufacturing plant, a foundry, and a forging facility. Then I spent the next seven years in research and development before moving on to ArvinMeritor in 1981."

Today, Donegan is chief engineer responsible for corporate engineering laboratories and computer-aided design services at ArvinMeritor. His work puts him in charge of materials engineering, mechanical bench and field testing, vehicle proving grounds, and worldwide coordination and support of computer-aided design and computer-aided engineering procedures.

"I'm fortunate that I'm involved with the beginning and the end of a project," continues Donegan. "We collaborate with designers at the initiation of a project, we work together on modeling and simulations of components, and then we test them when they're completed. Things rarely work the way we thought they would, which is where simulation and modeling comes into play, both on the computer and on the lathe."



David Donegan, ArvinMeritor chief engineer and CEEP Advisory Board member

Donegan had his first substantial contact with the University of Michigan-Dearborn through mechanical engineering classes he took at ArvinMeritor through UM-Dearborn's on-site program. "The UM-Dearborn courses were offered at ArvinMeritor," says Donegan, "which is an outstanding way to get an education. When you take classes at your workplace, you know all your classmates and have direct interaction with the professor right on the industrial site. It's very 'real world.' I think it benefits both the students and the teacher. Plus, the professor had to drive through the snow, not me."

Donegan immediately spotted the value of combining education with industry, a conviction that has only grown over time and that led him to accept a position on the college's Center for Engineering Education and Practice (CEEP) Advisory Board five years ago. "I looked at it as an opportunity to get involved with engineering education," he says. "I thought we could generate a lot of significant interchange between students,

professors, and practicing engineers to the mutual benefit of all."

"I strongly believe in the work CEEP does," Donegan continues, "especially Technology Day, which has grown tremendously in the past five years." During Tech Day, students, professors, and practicing engineers present projects they've worked on together throughout the year. "It provides a very effective interchange among all parties," says Donegan. "As a result, Tech Day has grown into an exceptionally effective showcase for the college's talents and a formal process for industrial collaboration."

Donegan and his wife live in West Bloomfield Township, where he enjoys tennis, photography, and woodworking. "I enjoy working with wood," he says, "primarily because it's easier than trying to work with metal in your home workshop." For years he has also photographed landscapes and, of course, cars. Now, he says, "I mostly take pictures of my grandkids."

New Ford Labs Will Benefit Students, Faculty, and Industry

Continued from page 1

for audio systems," says John Cherng, professor of mechanical engineering. Cherng was responsible for the redesign work on the lab and oversees the facility's operations and activities.

Carole Mei, assistant professor of mechanical engineering, manages the activities of the newly upgraded instrumentation lab, which is now equipped with four B&K Pulse Stations. The equipment was purchased and installed in June 2002 and will enhance students' and faculty members' ability to perform digital signal processing, sound intensity analysis, order tracking, and material absorption coefficient testing.

"This new advanced equipment significantly improves the quality of our lab courses," says Cherng. "The labs provide students with the most up-to-date technology in the fields of digital signal processing, structural dynamic analysis, acoustical measurements, and sound quality analysis. In addition, it provides the tools for faculty to conduct more in-depth research projects that require accurate and advanced measurement facilities."

Roman Krygier, group vice president at Ford Motor Company and a member of the College of Engineering and Computer Science Visiting Committee, has supported the upgrades to the labs throughout the past several years and worked within his company to arrange funding for the project. Krygier recently toured the new labs with Subrata Sengupta, dean of the college.

"Mr. Krygier has been an exceptional sponsor and champion of the College of Engineering and Computer Science," says Dean Sengupta. "His efforts have made it possible for the school to provide top-notch facilities and programs to large numbers of undergraduate and graduate students and to dozens of faculty members. The results of his support will be seen for many years to come."

Shen Blazes Trail with NSF CAREER Award

John Shen, assistant professor in the electrical and computer engineering department, has received the prestigious 2003 National Science Foundation (NSF) CAREER Award. This is the first time a faculty member at University of Michigan-Dearborn has been recognized with this award.

The Faculty Early Career Development (CAREER) Program was established in 1995 to help top-performing scientists and engineers early in their careers to simultaneously develop their contributions and commitment to research and to education.

Says NSF director Rita Colwell, "We recognize these faculty members, new in their careers, as most likely to become the academic leaders of the 21st century."

Shen received his Ph.D. in electrical engineering from Rensselaer Polytechnic Institute in 1994. After working as an engineer at Motorola, he came to UM-Dearborn in 1999. His research in the College of Engineering and Computer Science has included the development of semiconductor transient voltage suppressors for automotive systems, the development of novel power devices for automotive ignition driver applications, and the study of power module reliability in electric vehicles. He has also developed a low-voltage, high-speed power device for next-generation power supplies in PC motherboards.

The CAREER Award is not Shen's first involvement with NSF. In 2002, NSF awarded him \$101,200 to set up an automotive electromagnetic compatibility laboratory for research and teaching, which he recently completed. A three-year, \$55,000 CEEP grant awarded in 2000 to work on automotive power semiconductor devices provided the seed money necessary for Shen to lay the groundwork

for the NSF proposal. He has also received grants from GW Semiconductor, ON Semiconductor, and PowerOn Technologies, in addition to various university grants.

"I'm especially excited about the research we'll be doing with this NSF CAREER Award," says Shen. During the lifetime of the NSF award, Shen will partner with Third Dimension Semiconductor, a high-tech start-up company in Silicon Valley, to fabricate what he calls "super junction power devices."

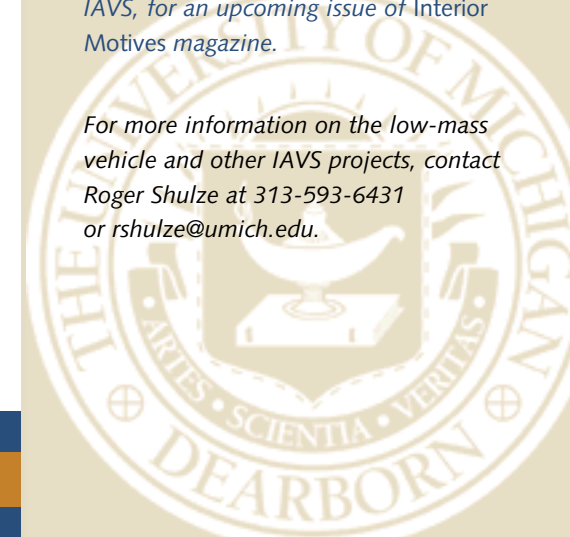
"Super junction power devices can improve the power-handling capability of conventional silicon power devices by orders of magnitude," says Shen. "This is important because although advances in power semiconductor technology in the past two decades have led to the rapid proliferation of power electronics into tele-communications, computers, consumer, transportation, and industrial applications, the performance of state-of-the-art power semiconductor devices is quickly approaching the theoretical limits of

silicon."

The project is slated to begin in July and will include participation by undergraduate and graduate students, which is required by CAREER's stated priority of effectively integrating research with education. The award, for the amount of \$400,000, runs through the year 2008.



John Shen, assistant professor of electrical and computer engineering





the Catalyst

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The Catalyst is published for the alumni and friends of the University of Michigan-Dearborn College of Engineering and Computer Science. Send correspondence to the Editor, The Catalyst, 4901 Evergreen Road, Dearborn, MI 48128-1491.

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William Grosky, Chair
Phone: 313-583-6424
e-mail: wgrosky@umich.edu

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Phone: 313-593-5528
e-mail: mals@umich.edu

Department of Industrial and Manufacturing Systems Engineering
Swatantra Kachhal, Chair
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e-mail: clchow@umich.edu

Centers of Excellence

Center for Engineering Education and Practice
Robert Hildebrand, Director
Phone: 313-593-0941
e-mail: rhildeb@umich.edu

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Roger Shulze, Director
Phone: 313-583-6431
e-mail: rshulze@umich.edu

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Competition Puts Technical Skills to Test: UM-D Mini Baja Team Finishes in Top 10

When most people make a trip to Orlando, Florida, they might plan to relax in the sun, spend time by the pool, or visit Disney World. But the members of the University of Michigan-Dearborn Mini Baja team are not your typical travelers. Team members Jessie Crozier, Chris Howes, Robert Hyden, James Perrin, and Jim Szymusiak made the journey to Orlando to compete in the 2003 SAE (Society of Automotive Engineers) Mini Baja East Competition, the first of three regional Mini Baja events in the U.S. The goal: to produce a winning off-road vehicle.



UM-D's car #26 in the Mini Baja East events

After ending last year's campaign with two top-ten finishes and one first-place overall award the team looked to this event as a new challenge. "The East competition gave our team a chance to do some design work and try out new ideas that were not possible in the other competitions," says team captain Perrin. With the successes of the past two racing seasons behind them, the team entered the race with high expectations and hopes of finishing in the top-ten.

The race was held April 4-6 on the campus of the University of Central Florida in northern Orlando. The competition was divided into three days consisting of numerous activities. Days one and two were spent in static judging and individual events such as top speed, sled pull, or mud bog. The scores for these events were then combined and published, setting the stage for the final four-hour endurance race on Sunday. After the first two days of competition, the Mini Baja team was poised for success. "I think we were all pleased with our standings going into Sunday's race," says Szymusiak. "The car was

running well and we worked together as a team to ensure that everything was ready for the big race."

As dawn broke on Sunday's endurance race, the team made one final check of the car and their equipment. For this race, the car had to do more than maneuver quickly on dirt; it had to float, too. To race at the East competition, cars must be able to navigate an open body of water as well as overcome the usual off-road obstacles. "Bringing water into the equation adds a whole new dimension to the race," says Hyden. "You are now forced to design a car that can race and win on two different fronts." The race began with about 50 cars entering the water simultaneously. After successfully navigating the water portion of the course, it was off into the woods for some of the most treacherous and rugged racing conditions many Mini Baja teams had ever

seen. "The course was designed to push your car and its driver to the limit," says Howes.

When the dust cleared and the water receded, the UM-D team emerged from the four-hour race in one piece and in seventh place. Their #26 car was one of only a handful to still be running when the checkered flag went down. "We were excited to see our car finish the race in one piece and under its own power," says Crozier.

With the racing over and the points totaled up, the UM-D Mini Baja team was awarded with tenth place overall, leaving the group well positioned for the rest of the 2003 Mini Baja campaign. "I am very happy with the way our car and team performed. For our first time at the East competition, I couldn't ask for much more," says Perrin.

General Motors Offers New Support to CECS

Continued from page 1

"This grant recognizes all of the relationships that we have with GM—in research, teaching, and recruitment—and formalizes them."

"With our academic partners, we're interested in not just recruiting from them but developing a relationship. UM-Dearborn has, for a long time, been a provider of a significant number of engineers for GM. We find the talent they bring to be extremely valuable," says Dean Guard, executive technical assistant at GM. Guard is a former CEEP Advisory Board member and GM's relations team coordinator for the university.

CEEP works to incorporate engineering practice, design, innovation, and concepts of manufacturing technology at all levels of engineering education by integrating the teaching environment with practice. To accomplish its mission, CEEP uses funding from companies such as GM to stimulate faculty and student interaction with practicing engineers from industry and government laboratories. This new funding will support the continued activities within CEEP, including joint faculty-industry research projects, some of which may include GM engineers and CECS faculty.

Another area that will benefit from the new GM funding is the college's senior design program. Over the next several years, this grant will provide for a number of senior-level students to purchase materials, supplies, or equipment to conduct their projects. Senior design projects help students learn new techniques and skills, gain valuable experience, and become better prepared for employment in industry.

"We want to get more involved in supporting senior design projects," says GM's Guard. "We're always looking for ways to help students gain real-life experience in applying engineering knowledge. We consider the senior projects to be a big deal, because while they provide students with real-world problem exposure, they also provide GM with potential solutions to our problems. And when students get excited about helping us work on our problems, they develop an interest in coming to work for us after graduation. It's a win-win deal."

The college's minority and women student scholarship program, which is also being partially funded with the GM grant, has the objective of increasing the number of minority and women students graduating with degrees in engineering. "The engineering profession is very open to participation by all," says Dean Sengupta. "It's important to reflect the diverse nature of the marketplace in our graduates, and GM's generous support helps us further that goal." GM's funding will augment similar scholarship funding that is already being received from Ford Motor Company, DaimlerChrysler Corporation, DTE Energy and others.

"We're interested in supporting scholarships specifically aimed at minorities and women because GM recognizes the value of a truly diverse workforce," adds Guard. "We feel it makes us a better company. Obviously, UM-Dearborn is providing the kind of industry-based academic training we're looking for. The question for us isn't why would we support UM-Dearborn; it's why would we do anything else? We would be missing an opportunity if we didn't."

For more information on VLT2, contact Armen Zakarian at 313-593-5244 or zakarian@umich.edu.

the Catalyst

News from the College of Engineering and Computer Science



CEEP
Center for Engineering Education and Practice

IAVS
Institute for Advanced Vehicle Systems

CLAMP
Center for Lightweight Automotive Materials and Processing



Welcome Friends

This has been a challenging year for faculty members engaged in industrial research. The fallout from the events of 9/11 and the subsequent continued downturn in the economic climate have resulted in a significant drop in opportunities to secure industrial funded research. The struggling economy has also greatly reduced opportunities for faculty members to find summer internships or sabbaticals in industry.

Despite the poor conditions, faculty members associated with the Center for Engineering Education and Practice (CEEP), the Research Excellence and Economic Development Fund, and the Institute for Advanced Vehicle Systems have had some very significant successes during the past year.

We were all very pleased to learn of the National Science Foundation CAREER Award that was granted to John Shen, assistant professor of electrical and computer engineering (ECE), the first CAREER Award ever received by a CECS faculty member.

It was also a great boost to the college and its faculty when the Michigan Economic Development Council pledged funds from its Emerging Technology Challenge Fund to John Cherng, professor of mechanical engineering (ME), and Mahmut Eksioglu, assistant professor of industrial and manufacturing systems engineering (IMSE). This also represents the first award of its kind to the college.

John Shen and Ghassan Kridli, assistant professor of IMSE, were each awarded a highly competitive grant from Ford Motor Company's University Research Program (URP). UM-Dearborn was the only university worldwide to have two faculty members receive URP grants this year.

In March, Armen Zakarian, assistant professor of IMSE, was designated a Computerworld Laureate for his VLT2 web course delivery software and is now a finalist for a prestigious 21st Century Achievement Award in the education and academic category.

We were also grateful to hear that two of our IMSE faculty members, Associate Professor Ali Kamrani and Assistant Professor Armen Zakarian, were selected for DaimlerChrysler's Advanced Manufacturing Engineering Summer Intern Professors Program.

Another high point for the school was its annual Technology Day, which was held on June 4, 2003. This event is hosted by CEEP and showcases the joint academic-industry research of the college's faculty members in a free-roaming poster format.

Many of the achievements I've mentioned are highlighted in this issue of the Catalyst.

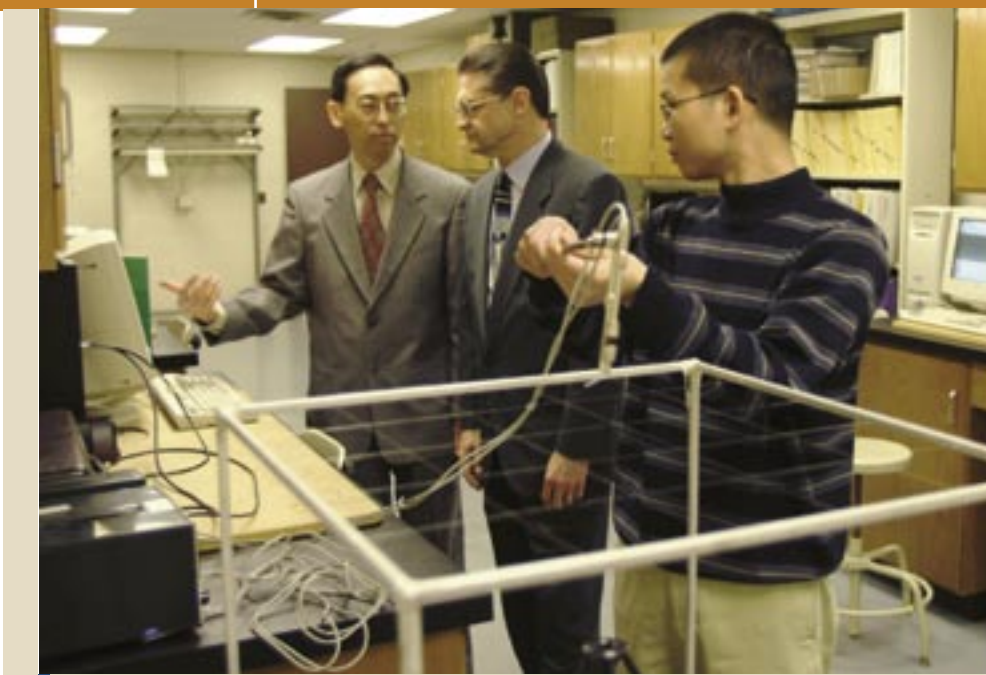
Robert W. Hildebrand

Robert Hildebrand
Director, CEEP

New Ford Labs Will Benefit Students, Faculty, and Industry

With generous new funding from the Ford Motor Company and the Ford Motor Company Fund, the College of Engineering and Computer Science has greatly improved two important laboratories that are used for teaching, research, and joint college-industry projects.

Upgrades to the labs were made possible through funds received as part of Ford's current five-year, \$2-million pledge of support to the college. In addition to its outstanding support of the laboratory improvement project, Ford's multi-year grant is also making it possible for the college to offer a larger number of scholarships to minority and women undergraduate students and to continue expanding the Center for Engineering Education and Practice (CEEP), which Ford helped to establish more than a decade ago.



John Chen, professor of mechanical engineering; Roman Krygier, group vice president of global manufacturing and quality, Ford Motor Company; and visiting scholar Yi Liao

General Motors Offers New Support to CECS

A new pledge of support from General Motors Corporation to the College of Engineering and Computer Science will strengthen an effective relationship that has been built over the last few decades. The school may receive up to \$79,000 over the next three years to support several mutually beneficial initiatives. Funding from GM will assist the Center for Engineering Education and Practice (CEEP), senior student design projects, and scholarships for minority and women engineering students. The company has already presented the college with a check for \$39,000 for the 2003 academic year.

"The College of Engineering and Computer Science is an outstanding school. It does an

excellent job of meeting the needs of engineering students who work, and strikes a good balance between practical knowledge and theory," says David VanderVeen, GM's executive director of vehicle engineering, quality, reliability, and durability. VanderVeen is also GM's representative on the CECS Visiting Committee. "These funds will help support three initiatives that are important to both the university and GM."

Along with this pledge, General Motors identifies CECS as a strategically important partner of the company. "We're very pleased," says Subrata Sengupta, dean of the college.

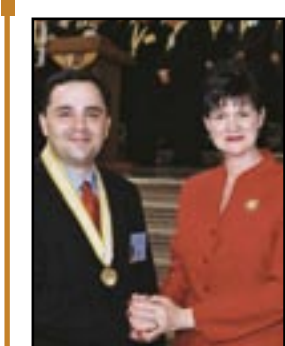


Dean Guard, GM's relations team coordinator; Thomas Stephens, group vice president of GM powertrain; and David VanderVeen, GM's executive director of vehicle engineering, quality, reliability, and durability

The Catalyst provides news and information about the innovative projects being developed through the UM-Dearborn College of Engineering and Computer Science Centers of Excellence: Center for Engineering Education and Practice (CEEP), Institute for Advanced Vehicle Systems (IAVS), and Center for Lightweight Automotive Materials and Processing (CLAMP).



Shen Blazes Trail with NSF CAREER Award



Computerworld Honors SBC-Funded Project