

2004

DEPARTMENT
OF
MECHANICAL
ENGINEERING
—
ENGINEERING
MECHANICS

ANNUAL REPORT

MichiganTech.

ANNUAL REPORT

A MESSAGE FROM THE CHAIR



For the past seven years it has been an extraordinary privilege for me to serve Michigan Tech as Chair of the Department of Mechanical Engineering-Engineering Mechanics. Reviewing each year's achievements of our students is both exciting and humbling: exciting because I witness the promise of outstanding education fulfilled, yet humbling because I know it is only possible with tremendous support from faculty, staff, alumni, and sponsors. Their collective commitment to excellence and innovation is the foundation of our research and academic success.

On behalf of the entire ME-EM Department, I am proud to issue our first annual report, which offers an overview of ME-EM progress and growth over the past two years, highlighting research from nanotechnology to space exploration. These ambitious projects illustrate the strong connection of the ME-EM Department with other world-class institutions and industrial partners. I have no doubt you will find many interesting topics in these pages, and I invite you to share with us your feedback and ideas. For every project begins with someone considering a problem, asking "What if..." and engaging our students and colleagues with a challenge. We look forward to hearing from you.

A handwritten signature in gold ink that reads "William W. Predebon".

William W. Predebon
Professor & Chair



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AN OVERVIEW OF THE ME-EM DEPARTMENT

Mechanical engineers play a crucial role in contemporary society. They incorporate a comprehensive understanding of physics, nature, and technological tools to propel innovation beyond the arc of today's horizon.

Our mission is to prepare students to be successful engineers by creating an energetic balance between education and research. This balance includes a challenging curriculum, a supportive relationship between students and faculty, and an environment that welcomes diversity.

Our vision is to maintain and improve our position as one of the leading undergraduate, graduate, and research departments in the nation—an excellent program that consistently equips students for work and research at the cutting edge. We will be recognized as a premier center of education and innovation by industry, government and academia nationwide.

EXECUTIVE COMMITTEE

Dr. Gordon G. Parker

Design and Dynamics Systems Area Director

Dr. Song-Lin (Jason) Yang

Energy Thermofluids Area Director

Dr. Michele H. Miller

Manufacturing & Industrial Area Director

Dr. Ibrahim Miskioglu

Solid Mechanics Area Director

Dr. Ghatu Subhash

Associate Chair and Director of the Graduate Studies

Dr. Harold E. Evensen

Associate Chair and Director of the Undergraduate Program

Dr. William W. Predebon

Department Chair



MISSION

Prepare engineering students for successful careers.

VISION

Be a department of choice nationally.

COMMENTS ON THE STRATEGIC PLAN

In the spring of 1998, the ME-EM Department established a number of ambitious goals as part of a comprehensive strategic plan to achieve our vision. I am pleased to report that we have reached several milestones from this plan ahead of schedule. This year, the *2005 U.S. News and World Report: America's Best Colleges and Graduate Schools*, ranked our graduate program 44th (top 30%) among 148 doctoral-granting mechanical engineering departments, achieving our goal to rank in the top 50 nationwide one year ahead of the strategic plan. Our undergraduate program is ranked 25th (top 16%) among the 148 doctoral granting mechanical engineering departments considered by the *2005 U.S. News and World Report*, entering the top 25 five years ahead of our plan's stated goal.

The ME-EM Department has consistently maintained a strong presence in the nation's mechanical engineering education; For 21 consecutive years the mechanical engineering program has been one of the top five U.S. mechanical engineering departments in number of BS ME degrees granted. Our innovative programs and high level of industry involvement continue to draw outstanding students from around the globe. Participation in Senior Design projects and the Engineering Enterprise Program, supported by industry, give students the technical and communication experience necessary to succeed in the 21st century workplace.

As our research expenditures (ranked 26th among all mechanical engineering departments nationwide by the National Science Foundation) have grown, we have expanded our graduate programs and are approaching our strategic goal to maintain a 4:1 ratio of undergraduate to graduate students. Through an effective balance of education and research, the ME-EM Department is achieving the goals that will make our vision a reality.

3 DEPARTMENT DATA ENROLLMENT & EXPENDITURE STATISTICS

ME-EM DEGREES GRANTED

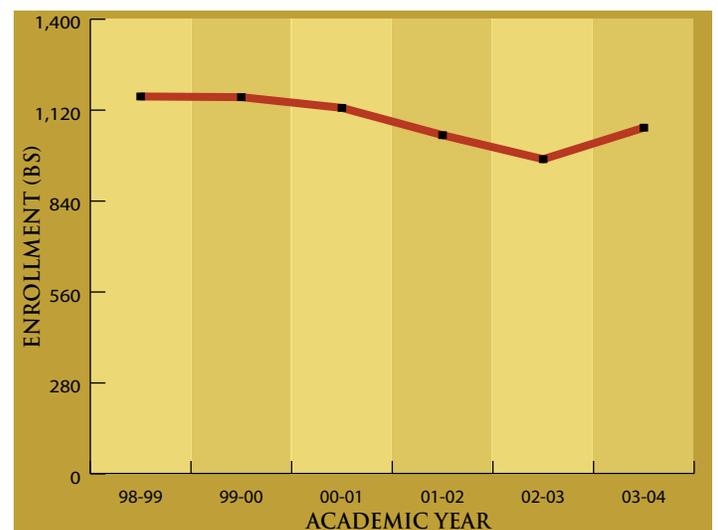
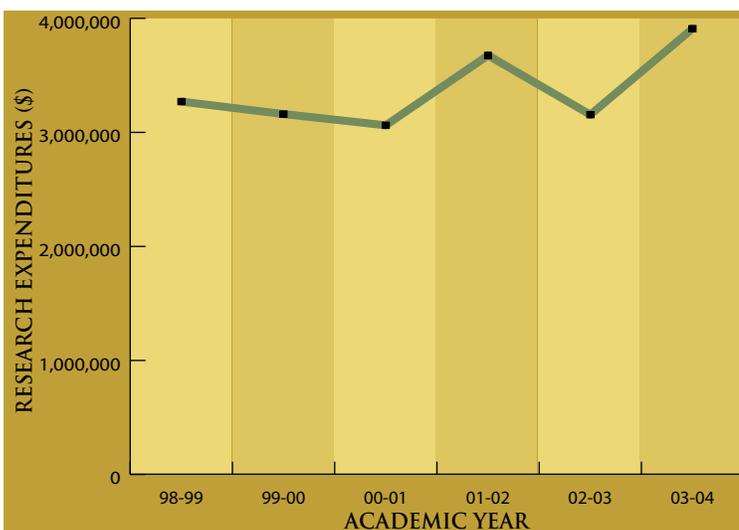
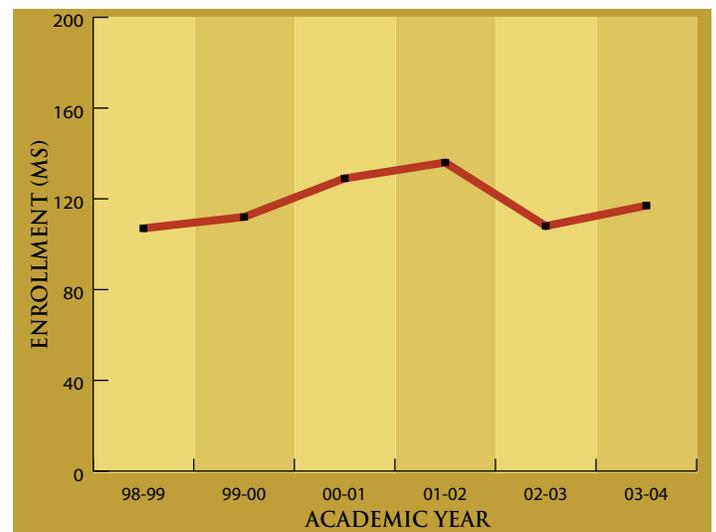
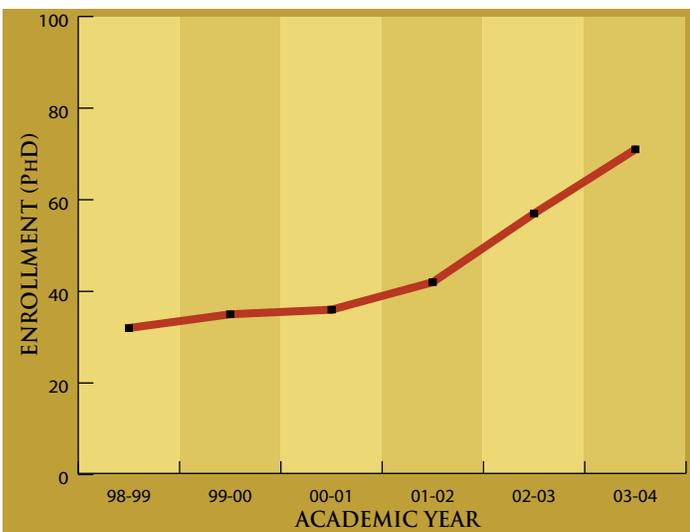
	BS	MS	PhD
1999-2000	254	20	9
2000-2001	237	31	2
2001-2002	238	37	3
2002-2003	219	45	6
2003-2004	215	41	10

Enrollment in the ME-EM Department's graduate program is increasing while we continue to maintain one of the largest undergraduate programs in the U.S. PhD enrollment has risen dramatically from thirty-two students in the 1998-1999 academic year to seventy-one

students in the 2003-2004 academic year. Enrollment in Masters programs has increased by more than thirty students in the past five years.

As our graduate programs have expanded, our undergraduate enrollment remains strong. In

addition, the department's research expenditures are growing. The enrollment and expenditures statistics shown here align with the goals stated in the ME-EM Department's strategic plan. We look forward to continued growth in the future as we work together to realize our vision.





The ME-EM Department is located in the R.L. Smith building.

FACULTY & STAFF

MECHANICS OF MENISCUS

TAMMY L. HAUT DONAHUE
ASSISTANT PROFESSOR



Tammy Haut Donahue is an engineer on a mission. Her destination: to understand the mechanics of osteoarthritis—the degeneration of cartilage in joints, particularly the human knee.

Haut Donahue loves her work, which connects her to the world. “Knee problems are extremely common and debilitating. This research affects thousands of people and could potentially improve their lives. It’s a very exciting field,” says Haut Donahue.

Her research is centered on preventing the disease rather than treating it. She is specifically examining how injury to the meniscus, a fibrous cartilage in the knee, may cause osteoarthritis. This approach is uncommon and she can count on one hand the number of scientists nationwide who focus on the role the meniscus plays in osteoarthritic knees.

The meniscus acts as a buffer in the knee joint and is susceptible to injury, especially in athletes. Older adults are also at high risk, and aging baby boomers represent millions of potential patients who would be affected by this research. Haut Donahue hypothesizes that if scientists can prevent degenerative

changes in the meniscus, they may be able to slow or halt the progression of osteoarthritis.

When walking or running the knee undergoes severe mechanical loading. The meniscus, which is a soft, crescent-shaped tissue, separates the contact areas of the knee joint. Dampening impact like a shock absorber, it has two functions: to distribute the mechanical load on the knee over the entire joint and to protect the cartilage that adheres to the end of each bone. The meniscus itself has no nerves and therefore produces no sensation. Without a meniscus, cartilage wears against cartilage. When the cartilage is worn away, bone wears on bone. Both are painful conditions. “This process of the cartilage wearing away is osteoarthritis,” Haut Donahue says.

Haut Donahue grew up in Lower Michigan where she attended Michigan State University and later moved on to

the University of California at Davis where she earned a Master’s Degree in Mechanical Engineering and a PhD in Biomedical Engineering. She accepted a position at Michigan Tech in 2001, after conducting a year of postdoctoral work at Penn State.

Her research encompasses two disciplines: measuring the mechanical processes of impact and wear while tracking the biological responses to those events. She explains that a mechanical load induces a biochemical reaction in the meniscus. “It’s a close relationship,” she explains. “So close that one relies on the other. That is, mechanical loading keeps the cells of the meniscus healthy. It’s the very nature of the tissue. We know if we take away loading, the tissue degrades.”

The aim of Haut Donahue’s research is to understand how the mechanical loading produces a biochemical response. “The tissue is constantly changing,” she says.

“...THE BIOCHEMICAL RESPONSE PRODUCES HEALTHY TISSUE THAT CAN WITHSTAND GREATER MECHANICAL LOADING.”



“You don’t just make it and it sits there. Everyday tissue is changing. It’s producing new matrix constantly. There’s a remodeling process in the meniscus, and it relies on the loading. We want to know how loading causes the cells to have a biochemical output. It’s a critical function to understand because the biochemical response produces healthy tissue, which can withstand greater mechanical loading. It’s a cycle.”

A damaged meniscus from either a sports injury or old age is treated by surgically removing the damaged tissue—a problematic practice that dates back to the 1940s. “We don’t advise this treatment, but surgeons often choose it because there aren’t many other options,” she says.

Through her research, Haut Donahue is pursuing an alternative approach to the removal of damaged tissue. “Rather than having a surgeon go in and take torn tissue out, we want to repair it. We want to take a biopsy, bring it to the lab, apply the right mechanical loading to it, and thereby grow new tissue from the ground up.” The process is called *tissue engineering*. “Hopefully, when this tissue is damaged, we can put in a sufficient replacement that behaves the same way as the normal tissue. The science isn’t there yet, though. In order to design the new tissue, we have to understand very clearly how the original tissue functions,” says Haut Donahue.

One approach that has not succeeded is synthetic prosthesis. Scientists have attempted to replace the meniscus with several synthetic materials such as metal, Dacron, and Gore-Tex. However, the geometry and material properties, the mechanics of the meniscus, are not something easily replicated with synthetic material.

Meniscus tissue is seventy percent water. “You’d never know it if you held it in your hand; it’s a solid structure,” Haut Donahue explains. The empirical understanding that mechanical loading allows the



meniscus to continually reinvent itself has led her to test three possibilities: compression, fluid flow, and combination. It is possible that compression of the cells alone could induce the redevelopment of new, healthy cells. Alternately, fluid flow resulting from compression, or a combination of compression and flow could be required. “We’re looking for the right signal,” she says.

The search has attracted a \$240,000, three-year grant from the Whitaker Foundation. Haut Donahue’s research team includes seven graduate students and four undergraduate students. Some of the work is theory; some computer modeling; and some of it uses animal models to investigate the process. It’s all groundbreaking work. “The rest of the United States,” she says, “studies what happens to bone and cartilage in the absence of meniscus. My goal is to protect the cartilage and interrupt osteoarthritis before it starts. Then you won’t have the arthritis problem in the first place,” she said.

There are thousands of researchers focused on bone and cartilage only, but very few others are working on the meniscus. The cells in the meniscus are one-fifth the diameter of a strand of human hair. “That makes it tough to measure the

“MY GOAL IS TO PROTECT THE CARTILAGE AND INTERRUPT OSTEOARTHRITIS BEFORE IT STARTS. THEN YOU WON’T HAVE THE ARTHRITIS PROBLEM IN THE FIRST PLACE.”

mechanical loading experienced by a single cell,” says Haut Donahue.

Her immediate goal is to understand how the meniscus works. In ten years, she hopes to accomplish tissue engineering or as she describes it, “Building a scaffold that will mimic your natural tissue.” With a lifetime goal to prevent osteoarthritis in the knee, Haut Donahue remains focused on her mission and developing her team. “I see tremendous possibilities for this research.”

7 FACULTY & STAFF IMPROVING THE FUTURE—ONE STEP AT A TIME

JOHN K. GERSHENSON
ASSOCIATE PROFESSOR



Since arriving at Michigan Tech in 2000, John Gershenson has been teaching and researching product and process design in the ME-EM Department. He views product and process design as extending from a technological need to producing a tool for that need, or a “widget,” as he calls it. Gershenson’s central focus is on achieving lean and agile methods of design and manufacturing, with an emphasis on function, efficiency, and cost reduction.

His contracts with industrial sponsors such as General Motors Corporation (GM) are an important part of his research. “While working within the walls of the university is a valuable experience, unless one can get out there and talk with industry, work with industry, and experience industry, your impact within the field is limited,” he said.

Gershenson is currently researching product modularity and architecture through a project sponsored by the National Science Foundation (NSF). This research will allow companies to quantify the relationship between product modularity and the cost of developing and manufacturing a product.

For example, suppose a company produces twenty-seven different refrigerator models. They could choose to manufacture twenty-seven unique fridges. Alternatively, they could modularize their design and production and rely on only three different door styles, three different volumes, and three colors to offer twenty-seven refrigerators. Modularity can lead to considerable savings across the entire life-cycle of a product from development to manufacturing. “When you modularize

your design you gain economies of scale,” summarizes Dr. Gershenson. Manufacturing, assembly, and service are all simpler and cost less.

His research is different from other projects in the field because it focuses on the connection between the level of a product’s modularity and the type of product architecture that would be most efficient for a company to use. Product architecture is the organization of product families within a company.

The relationship between modularity and efficiency in manufacturing and design has historically been murky. Gershenson’s work with the NSF is a comprehensive study that examines the entire life-cycle of a product. His research will allow companies to more clearly understand how modularity and product architecture affect efficiency so that they can make informed, quantitative decisions about their production processes.

Efficiency plays an important role in another of Gershenson’s research projects that is sponsored by GM. He is studying how to apply lean principles to engineering processes. The goal is to more efficiently

use resources such as employee time, capital costs, and machine availability to minimize waste in engineering. GM has already seen significant benefits from Gershenson’s research. They applied lean engineering principles to a manufacturing engineering process to reduce the process lead time by over ninety-six percent.

Gershenson is the director of Michigan Tech’s Life-cycle Engineering Lab. He supervises twelve students who range in experience from undergraduates to PhD



“FOR TWENTY-ONE YEARS
WE’VE BEEN AMONG THE
TOP FIVE PROGRAMS
IN THE COUNTRY. YOU
DON’T STAY IN THE
TOP FIVE IF YOU’RE
NOT PRODUCING TOP
QUALITY.”

candidates. Gershenson encourages the students to work as a team and consult with each other on their projects. The cooperative effort gives them a broad view of their work that is valued in both industry and academia. Students who have worked in the MTU's Life-cycle Engineering Lab have had very good job placement in leading organizations.

Gershenson, a 37-year-old New York native, earned his BA in Physics from Cornell University. He then moved on to Ohio State University to earn his MS in Mechanical Engineering and finally to the University of Idaho, where he earned his PhD in Mechanical Engineering. After completing his studies at the University of Idaho, he taught at both the University of Alabama and Utah State University before joining the Michigan Tech faculty.

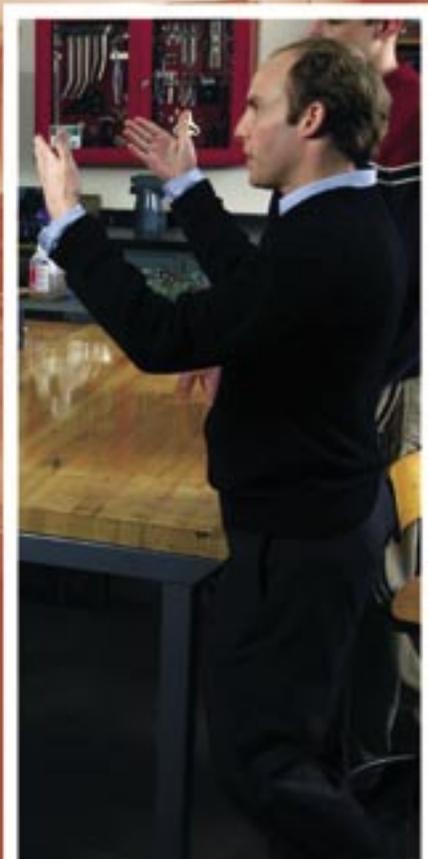
Geographically, MTU lies in the heart of Northern Michigan's Copper Country. Named for the great copper mining surge in the 1800s, the Copper Country is surrounded by Lake Superior and thousands of acres of great northwoods

that provide endless opportunities for the outdoor enthusiast. Gershenson enjoys activities like mountain biking and snowboarding. He says, "This place has everything to offer just outside my back door."

Gershenson enjoys the collaborative atmosphere among the University's faculty. "I've never had this opportunity before," he says. "This is why I came to MTU." He also enjoys contributing to one of the largest mechanical engineering programs in the country. "Statistics speak for themselves," he says. "For twenty-one years we've been among the top five programs in the country, in terms of undergraduate degrees awarded. You don't stay in the top five if you're not producing top quality."

Gershenson is committed to continuing Michigan Tech's tradition of excellence. He enjoys teaching and highly values the rich interaction with students as he supports their ongoing education and development. As part of the ME-EM faculty, Gershenson can actively pursue his passion to improve our future through efficient, less wasteful engineering and manufacturing.

Gershenson with Human-Powered Vehicle senior design students.



QUOTABLE QUOTES

"The (EPA) test needs to include more fundamental engineering," says John H. Johnson, an automotive expert who co-authored a 2002 National Academy of Sciences report on fuel-efficiency standards. "They haven't been updated to encompass hybrids." *Wired News*, May 2004

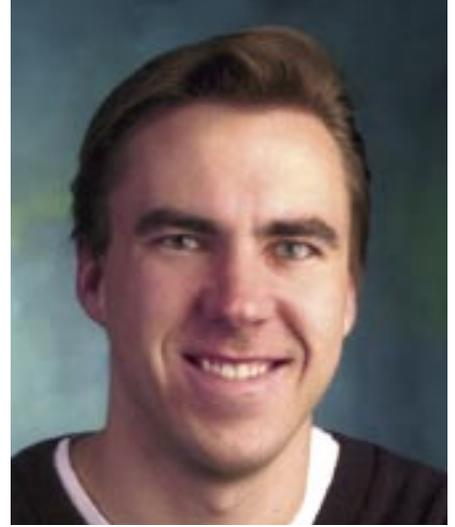
Carl Anderson, Professor of Mechanical Engineering at Michigan Tech and one of the founders of the Enterprise Program, said, "Fifteen to twenty years ago, I recall teaching mostly just engineering fundamentals at the chalkboard; students would graduate and come back three years later dressed in a suit and tie and understanding ethos that were only learned off-campus. Today, as a result of the Enterprise Program, I am seeing that metamorphosis of learning the business, communication, and commitment-to-project aspects of engineering that industry is seeking on campus." *AEI*, January 2004

William J. Endres, PhD, associate professor in the Department of Mechanical Engineering-Engineering Mechanics at Michigan Technological University, Houghton, Mich., has studied edge preparation for more than a dozen years. The effects of edge preparation are under-appreciated, he said, because "The control of edge prep has not been particularly good. It's hard to assess in any solid fashion the effect of a variable when you don't have good control of that variable in the first place." *Cutting Tool Engineering*, February 2004

Dr. Mohan D. Rao's paper, entitled "Recent applications of viscoelastic damping for noise control in automobiles and commercial airplanes, published in the *Journal of Sound and Vibration*, Vol. 262, No. 3, pages 457-474, 2003 was among the five most downloaded articles from the JSV web site in 2003.

FACULTY & STAFF ION THRUSTERS AND AEROSPACE

L. BRAD KING
ASSISTANT PROFESSOR



Assistant Professor L. Brad King, 32, leads a new aerospace education and research program at Michigan Tech. King describes the program, established in 2000, as "a bold move" into an emerging technology with a vast potential for growth. King's leadership in the aerospace program is focused in two main areas; He works with graduate students to develop large-scale ion thrusters and supports undergraduate education as the MTU Aerospace Enterprise advisor.

As Director of Michigan Tech's Ion Space Propulsion (ISP) Laboratory, King provides opportunities for graduate students to develop innovations in space propulsion systems through projects funded by NASA, the Air Force Office of Scientific Research, and the Department of Defense. An experimentalist by nature, he takes a hands-on approach with research and pushes results beyond pen and paper to realize practical solutions. "Whether it's cutting steel, welding, or soldering wires, the graduate research assistants put in the sweat and hard work involved with experiments," said King. His drive to connect experimental results with real-world solutions is contagious and motivates his team of seven doctoral candidates to prove the performance of high-power ion propulsion innovations.

After reaching space atop a rocket, many spacecraft still have demanding propulsion requirements. There is substantial industry interest in the high-power ion thrusters under development at the ISP lab: it could be used to transport large payloads, move scientific satellites to outer planets, or drive communications satellites from low to high orbits. The benefits of existing small-scale ion thrusters are that solar panels serve as the

root source of power, expelling ionized xenon propellant. This reduces the launch payload by eliminating the need to carry thruster fuel. "Our goal is to greatly increase the power of ion thrusters," says King.

King's current work is part of NASA's Project Prometheus, an effort to develop an ion thruster with 100 times the power of existing ion thrusters. In addition, the comprehensive goal for the project involves increasing thruster longevity by 10 times and doubling its efficiency. To illustrate its complexity, King describes the task in terms of an automobile, "Imagine taking a 200 horsepower car engine and redeveloping it for 20,000 horsepower, doubling its efficiency and designing it to run for 100 years or 1,000,000 miles without maintenance." Despite these challenges, King's team is demonstrating success in their portion of the project. They expect to develop and run a 20 kilowatt ion engine in a vacuum chamber within the next two years and plan to be testing a 50 kilowatt or higher version within 5 years. The 20 kilowatt model is anticipated to have 50% efficiency—producing 10 kilowatts of thrust and 10 kilowatts of waste heat.

The electrical power source for a thruster of this size would require 3 football fields of solar panel surface area. Such enormous size is simply not feasible. And when satellites reach to the outer planets, solar panels are almost useless. High-power ion thrusters will likely have small nuclear reactions to power their electromagnets.

Spacecraft that use ion propulsion systems rely on the fact that like charges repel each other. Within an ion thruster, neutral particles of an element are ionized, or converted into positively charged particles. These ions are then repelled from the likewise positive charge of the ion thruster and are pushed out the back of the spacecraft. The force of the particles moving out of the thruster propels the craft in the opposite direction.

King compares the concept of ion propulsion to a person standing on a skateboard and holding a garden hose. If the person sprays water off the back of the skateboard, he causes it to move in the opposite direction. The force produced by ions exiting the spacecraft is tiny; it would only be enough to move a couple of paperclips in Earth's atmosphere. Due to the absence of gravity and friction, however, the low thrust of ion propulsion systems is very effective in space.

Xenon is the element commonly used as the propellant in ion thrusters. Spacecraft propelled by Xenon are limited by cost and efficiency. King's research promises to lower costs and improve efficiency of ion propulsion systems by using Bismuth instead of Xenon. In addition to being cheaper than Xenon, Bismuth is also physically superior for use in ion thrusters. King invented and patented a

"KING COMPARES THE CONCEPT OF ION PROPULSION TO A PERSON STANDING ON A SKATEBOARD AND HOLDING A GARDEN HOSE."

means of channeling a portion of waste energy to melt, vaporize, and ionize the Bismuth propellant.

Ion thrusters must be thoroughly tested before they are launched—companies are unwilling to invest in novel aerospace technology without rigorous testing. Michigan Tech's ISP Lab has specially-designed vacuum chambers that permit the testing of full-scale ion thrusters—no other such facility exists in the world. King's work to develop Bismuth-powered ion propulsion systems will lead to substantial savings in high-power ion thruster development. When testing ion thrusters that use Xenon, the expelled Xenon must be constantly pumped out of the test chamber to maintain the vacuum. This costly pumping process is not as demanding when using Bismuth because this element—which is a solid metal that resembles lead—has a negligible affect on vacuum chambers.

King's research is shaping the future of ion propulsion systems and space travel. Replacing Xenon with Bismuth in ion thrusters will allow scientists to move bigger spacecraft farther into outer space. This technology could enable NASA to accelerate exploration of Mars, and any company using satellite technology would be able to keep their satellites in

orbit longer. With far lower launch costs, the ion thrusters are much smaller and lighter than conventional thrusters.

Partially due to his work on ion propulsion systems, King was one of only sixty faculty members recently selected from U.S. colleges and universities to receive a Presidential Early Career Award, the highest honor bestowed by the U.S. government on outstanding scientists and engineers at the beginning of their careers. The award is valued at over \$600,000. The National Research Council and NASA have also honored him, and he received three awards from the Johnson Space Center in Houston. He presented the Outstanding Paper in Electric Space Propulsion at the 1999 Joint Propulsion Conference in Los Angeles and he also received a National Science Foundation CAREER award, granting him at least \$400,000 for his research and teaching programs.

King is a native of Michigan's Upper Peninsula, where coping with the challenges of the northern climate helped to shape his tenacity and respect for practical solutions. He studied aerospace engineering at the University of Michigan, where he earned BS, MS, and PhD degrees. Following a stint with the National Institute of Standards and

Technology as a post-doctoral researcher, King joined Michigan Tech in 2000 to pioneer the institution's first-ever aerospace program. He feels fortunate to be living in Houghton and continuing his research in aerospace. "Professionally I am doing what I want to be doing and I am also living where I want to live," King says. "There are not many places you can do high-level scientific research and own a dog sled team."

He left Calumet, his hometown, after graduating from high school in 1989. "It's good to be back home," he says. "I spent ten years running around the country trying to find a place like the U.P., and it finally occurred to me, there is only one."

MICHIGAN SPACE GRANT CONSORTIUM AWARDS

The vision of the Michigan Space Grant Consortium is to foster awareness of, education in, and research on space-related science and technology in Michigan. Its mission is to create, develop, and promote programs that support its vision and reflect NASA strategic interests. The consortium also encourages cooperation between academia, industry, state, and local government in space-related science and technology in Michigan.

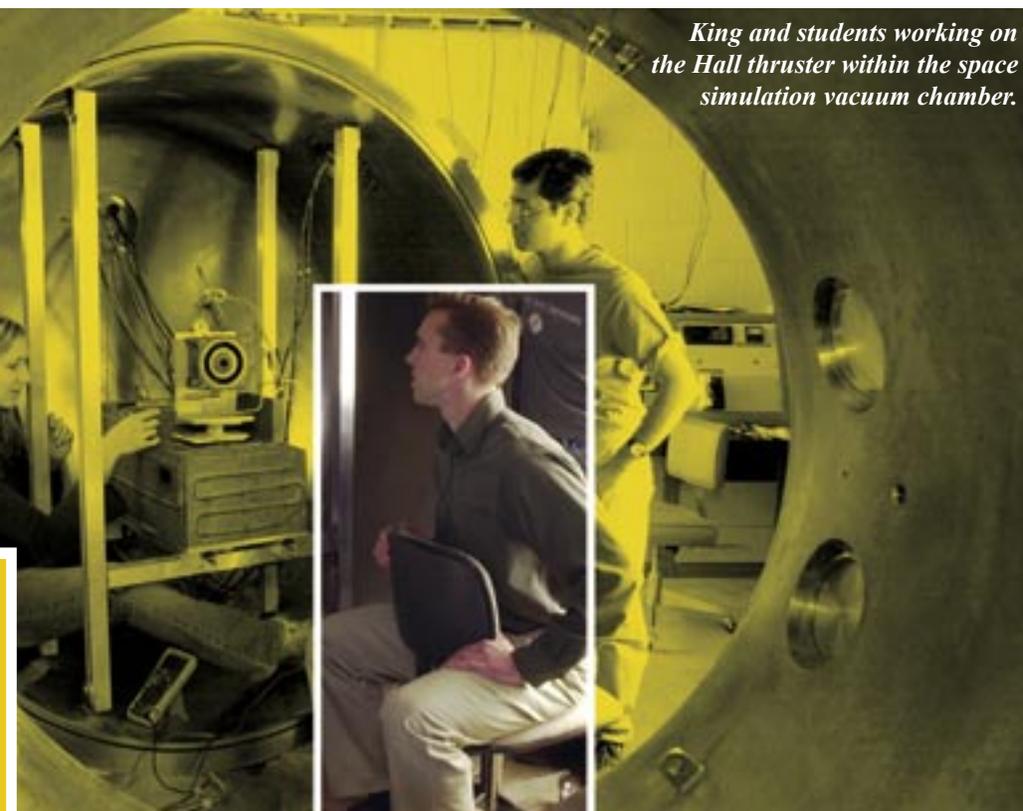
Four students in Michigan Tech's ME-EM Department were recognized with this award in 2003-2004.

David Dame
Junior

Lindsay Godin
Graduate Student

Jason Makela
Graduate Student

Dean Massey
Graduate Student



King and students working on the Hall thruster within the space simulation vacuum chamber.

FACULTY & STAFF

RESEARCHER HAS "WIGGLE" ROOM

GORDON G. PARKER
ASSOCIATE PROFESSOR



Scientific challenges are the sum and substance of Professor Gordon Parker's work. But while he's busy solving one problem, his mind is working overtime as he dreams up new problems to address. "It's wild and it's fun," Parker says of his work.

A native of the Detroit area, Parker earned a BS in Systems and Electrical Engineering from Oakland University. He then continued his education and earned a MS in Aerospace Engineering from the University of Michigan. Then, after a three-year stint with General Dynamics Space Systems in San Diego, Parker earned a PhD in Mechanical Engineering from SUNY at Buffalo, New York.

He also spent four years at the weapons research facility at Sandia National Laboratories in Albuquerque, New Mexico. During his first two years at the nuclear weapons facility, he worked on his dissertation research through a Department of Energy fellowship. After his PhD was complete, he continued one year as a postdoctoral fellow and one year as a senior member of the technical staff. Meanwhile, he also taught at the University of New Mexico. Parker joined the faculty of Michigan Tech's ME-EM Department in 1996.

Parker's main research focuses on control systems: getting a machine, system, or plant "to do what you want it to do." To illustrate control systems, he points out two that we use in everyday life: the cruise control system and hydraulic braking system used in modern automobiles. "Control systems are all over the place," he says. Much of his work involves eliminating what he calls "wiggles"—the not-so-technical term for vibrations and oscillations.

At Sandia, he worked on a variety of projects, including satellite control systems and robotic systems for cleaning up hazardous nuclear waste created during the Cold War. "Nobody wanted to be anywhere near this stuff," Parker says of the waste. Therefore, long robotic arms were used to remove material from underground, million gallon tanks, eliminating human contact altogether. However, there was the question of how to effectively stabilize the robotic arm, which tended to vibrate as it was swung around with a load on its end. Parker designed control systems that eliminated this "wobble."

Parker's solution impressed the right people and has led to more work to research for the Navy. Flashing forward to the weeks leading up to the Gulf War, U.S. armed forces scrambled to find a nation close to Iraq from which they could launch their attacks. However, these nations were uncooperative causing the U.S. to rapidly become frustrated in its efforts. To avoid such frustrations in the future, the U.S. Navy developed the Sea Basing initiative—which involves using offshore facilities as a staging area, as opposed to relying on other nations.

This is one component of the U.S. Navy's guiding vision called *Sea Power 21* and is comprised of three fundamental components: the Sea Shield, Sea Strike, and Sea Basing initiatives. One logistical scenario involves large ships outfitted with numerous cranes that pull material

off of a cargo ship, bring it over the deck, and deposit it on a smaller vessel (called a "lighter"), a roaming transport for men and material. "It's an offshore base with all the functionality of a land base," Parker says. "This is a big push, especially for

An example of the Sea Basing Initiative for the U.S. Navy.



expeditionary activities where the Navy is in a supportive position."

However, there are two problems with the setup. One is the same tendency that the robotic arms that were used to remove waste had demonstrated: the crane's payload oscillates when moved by the operator. The second problem is that even a mildly heavy sea can affect the crane. "Realistically one can do this only on a glassy sea," Parker notes of this particular operation. "We want to be able to do it in high seas when the ship is rolling and heaving."

Having already developed a system to handle the former problem, Parker set his sights on designing a system to offset the motion created by the waves. His control scheme is "a crane system that will cancel out the ship's motion." Parker's solution

has been successfully tested on land and during an at-sea demonstration last fall. Meanwhile, he continues to work with the Navy to further enhance the crane-ship system.

Parker also recently completed a project for the Air Force Office of Scientific Research on the Optimal Design of Smart Structures. Picture an airplane wing with flaps and spoilers. Now picture the wing with no moving parts—a structure that can be formed and deformed by actuators, hydraulic cylinders, and other more exotic methods internal to the wing. Rather than using rudders and flaps to control a plane's direction, a wing can be deformed and twisted to perform a particular function. "These are referred to as smart structures," says Parker. He continues, "Active structures may be a better term. You can actually morph wings on an aircraft—generate its maneuverability—without using control surfaces, like flaps. Instead you literally twist the wing. That's a big push, too, with NASA and the Air Force."

He is also involved with computer code that ties in with smart structures. This optimization code, a parallel genetic algorithm, can run on hundreds of computers simultaneously, integrate with off-shelf codes, and assist in producing "whatever kind of complex, smart structure one can imagine." But that's not enough for the restless Parker—there are three other areas of research that he would like to do more work in.

He wants to work with robotic systems in factories to solve that same vibration

and swinging problem present with the hazardous waste and crane-ship projects. "Mathematically, there are ways to move it properly to get high speed without the wiggle," he says. "It's fun, and it's cool-looking. To see it happening, one would say, 'no way.'"

Finally, he and a colleague, Professor L. Brad King, are joining forces with Professor Hanspeter Schaub at Virginia Tech University to develop new propulsion and control methods for formation-flying spacecraft. Parker explains, "Take two spheres, introduce an electric charge, and make them either attract or repel one another. A combination of natural gravitational forces can be used, along with charging the spacecraft, to maintain or change a certain formation. The application here is earth-imaging—spy satellites, for the most part. This allows a tight formation of spacecraft at geosynchronous orbit—the orbit where an object can remain fixed over part of the earth full time-- and do some extremely high-fidelity imaging. In a nutshell, one could have hemisphere imaging with a resolution of a meter. The exactness of the image is related to how well these spacecraft can remain in a certain location—and talking to each other—to form a large satellite dish. Basically, they're all taking pictures at the same time and communicating that to a central spacecraft that combines all the data into a composite image."

"It's cool," the enthusiastic Parker continues. "The control problems and the dynamics associated with it are huge, but it's fun." When asked whether he enjoys research or teaching more, he answers, "They're tied. They're both a lot of fun. What I don't like—I don't want to be in the position where I'm just managing graduate students. That's no fun. I like doing stuff—coding, testing, and technical work."

He sums up the support that he gets from the ME-EM Department in one word: "Fantastic."



"PARKER'S MAIN RESEARCH FOCUSES ON CONTROL SYSTEMS."

FACULTY & STAFF IMPACTING THE SCIENCE OF MECHANICS

GHATU SUBHASH
PROFESSOR & ASSOCIATE CHAIR



The research of Professor Ghatu Subhash quite literally sends waves through the field of mechanics. As part of his research to understand how materials behave as they are rapidly deformed, Subhash developed and patented a hardness testing system called the Dynamic Indentation Hardness Tester or DIHT. To determine how a material like titanium would behave during a severe impact, the DIHT system uses wave mechanics to strike a sample quickly, but without bouncing. “Think of it this way,” Subhash explains. “You want to impact something in a fraction of a second, and then take away the load. It’s like firing a bullet, making it kiss the target, and come back. It’s not an easy thing to do, but we have been able to develop the technology.” Titanium’s hardness while deforming quickly – the whole testing procedure is over in a matter of microseconds – is thus obtained by the table top-sized DIHT and can be used to predict how a titanium structure would hold up to a crash, an explosion, or other high speed event like surface grinding.

Subhash’s advanced research in mechanics produces core scientific understanding useful to many fields. “It’s not only applications such as a new tennis racquet or car bumper,” he points out, “Applications are everywhere.”

After completing undergraduate studies in India, Subhash carried out his graduate work

at the University of California, San Diego, where he majored in Applied Mechanics and minored in Materials Science. He conducted postdoctoral work at California Institute of Technology before coming to the ME-EM Department at Michigan Tech in 1993.

His research extends throughout the fields of materials, mechanics, manufacturing, and nanotechnology. Subhash is currently working on four projects, including a collaborative effort with the Norwegian firm Norsk-Hydro to hydro-form aluminum. Hydro-forming is a relatively new technology that uses water pressure to form multiple sections and shapes, eliminating the need to cut out sections, bolt parts together, weld attachments, and use other traditional machining techniques. The goal is to make complex shapes with close tolerances in one fell swoop. “It’s like blowing up an aluminum balloon inside of an intricate mold,” he

explains. “It reduces labor and the number of parts.”

He is also working with the auto industry on structural foam technology aimed at strengthening steel frame members. When a steel tube is filled with a gel and heated, it becomes structural foam, a composite structure able to withstand 5-10 times greater load. Subhash is testing its crash-worthiness to determine whether it can be used to increase the strength of a bumper or a car door or to protect a fuel tank. He is both researching its behavior and is developing guidelines for its use. “In order to make structural foam perform optimally, rather than just satisfactorily, we need to know how to design, use, and evaluate it,” he explains.

Subhash’s work also reverberates in the realm of metallic glass, a new material

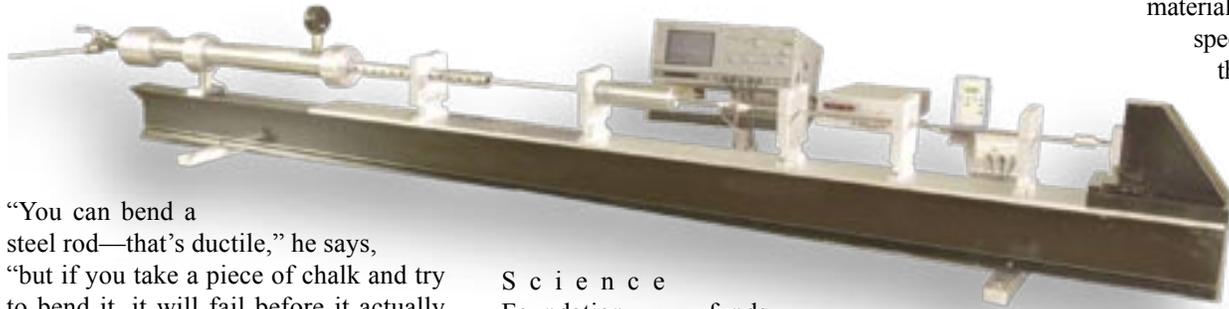
**“IT’S LIKE FIRING
A BULLET,
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COME BACK. IT’S
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THING TO DO,
BUT WE HAVE
BEEN ABLE TO
DEVELOP THE
TECHNOLOGY.”**



Subhash with the Dynamic Indentation Hardness Tester.

formed by rapidly cooling metal from its melting state to room temperature. The result is a material with both strength and ductility—two properties Subhash illustrates through a comparison of steel and chalk.

“IT’S AN EXCITING FUTURE. NO MATTER WHAT ANYBODY SAYS, WE’RE GOING IN THE DIRECTION OF NANOTECHNOLOGY.”



“You can bend a steel rod—that’s ductile,” he says, “but if you take a piece of chalk and try to bend it, it will fail before it actually bends—that’s brittle.” Typically with metals, the higher the strength, the lower the ductility. Metallic glasses have both strength and ductility. “Marrying the two,” he says, “will have tremendous benefits.”

“We know that materials behave differently under static and dynamic conditions,” he explains. The thrust of this research is to study the level of damage that an impact causes and that the material endures. The important thing is the rate of impact. “Think of Silly Putty,” Subhash says. “When you pull it slowly, it elongates. When you pull it fast, it snaps. So that’s what we’re trying to do here. We are trying to understand how metallic glasses behave when you apply rapidly increasing load.”

Nano-structured ceramics are yet another area of Subhash’s dynamic research. The nano-world is between the atomic world and the micron world. The micron level is one-tenth the diameter of a strand of human hair; the nano-level is 1,000 times smaller than that. Subhash is collaborating with Materials Modifications, Inc., in Virginia, to make nano-structured ceramics of various grain sizes. “Change the grain size, change the properties,” he says. The National

Science Foundation funds this work. Once again it’s a study of loading—how nano-structured ceramics behave under static and dynamic loads. His ultimate goal is to “figure out the properties of these ceramics and how to improve them.”

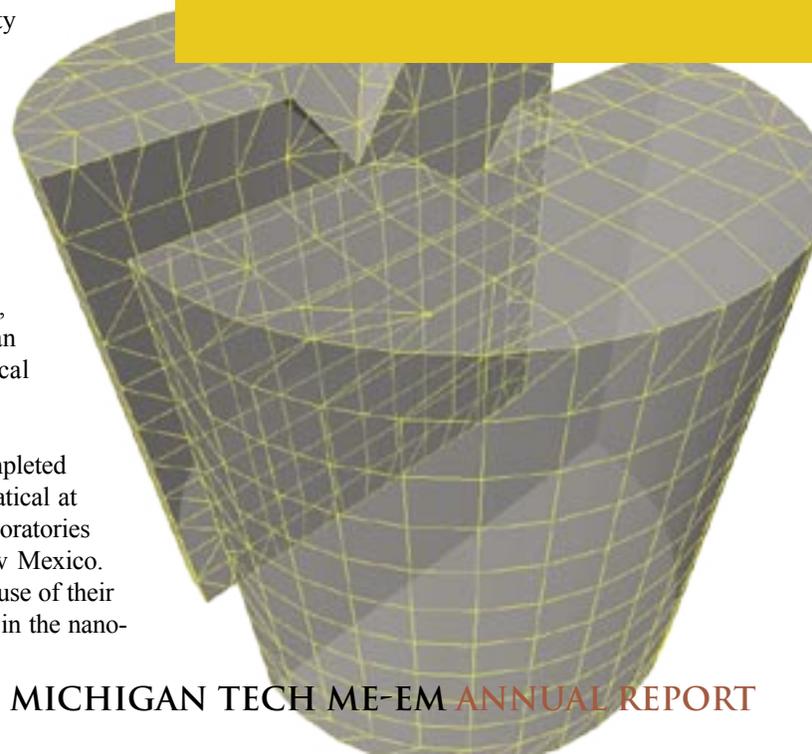
Based on his professional stature, Subhash was one of seven people in the nation invited recently to the U.S. Army Research Office to speak about the dynamic deformation and fracture of materials. He was also asked to help establish the direction of research for the next fifteen years. His list of other honors ranges from commendation letters from the Governor of Michigan and Michigan Tech’s distinguished teaching award in 1994 to awards from professional organizations such as the American Society of Engineering Educators, the Society of Automotive Engineers, the Michigan Association of Governing Boards of Higher Education, and the American Society of Mechanical Engineers.

Subhash recently completed an eight-month sabbatical at Sandia National Laboratories in Albuquerque, New Mexico. “I chose Sandia because of their outstanding research in the nano-

world,” he states, explaining that scientists at Sandia produce machines on the nano-level. The research crosses disciplinary lines and attracts physicists, biologists, engineers, and materials scientists. His specific project tested the reliability and wear of these machines. Subhash is enthusiastic about this scientific frontier. “It’s an exciting future. No matter what anybody says, we’re going in the direction of nanotechnology.”

He is pleased to be undertaking his research at Michigan Tech, where his team continues to make waves. “The department and the university support for my research is absolutely fantastic,” says Subhash. “I’m happy to be here. It’s a good place to continue, and a great place to grow.”

“I’M HAPPY TO BE HERE. IT’S A GOOD PLACE TO START, A GOOD PLACE TO CONTINUE, AND A GREAT PLACE TO GROW.”



15 FACULTY & STAFF A SUSTAINABLE FUTURE

JOHN W. SUTHERLAND
RICHARD W. AND ELIZABETH A. HENES CHAIR PROFESSOR



When Professor John Sutherland looks at a product, he sees not only the engineering effort that went into designing and manufacturing it, but also all the wastes created and resources consumed associated with the entire life-cycle of the product. Given the way that consumers and industry create waste and consume resources, he wonders whether future generations will be able to enjoy the same standard of living that we all currently enjoy. Sutherland is trying to do his part to ensure a sustainable future by working with industry to achieve an economically successful balance with nature.

"Environmental problems are complex and require careful study in order to be prevented," says Sutherland. To solve these problems, Sutherland focuses his efforts on improving the efficient use of resources and advocating the development of sustainable and renewable materials and energy sources. His work centers upon the evaluation of current industry products and their processes.

As Co-Director of Michigan Tech's Sustainable Futures Institute, Sutherland leads an interdisciplinary effort to create and disseminate new tools, methods, knowledge, and technologies that promote, enable and support environmental, economic, and societal sustainability principles.

Sutherland, a native of Illinois, has been a faculty member at Michigan Tech since 1991. Before coming to Houghton, he received a BS and an MS in Industrial

Engineering and a PhD in Mechanical Engineering from the University of Illinois at Urbana-Champaign. As a faculty member at MTU, he has won numerous awards for both his teaching and research, has worked as an investigator on grants totaling nearly \$15 million, and has mentored approximately sixty students to the completion of graduate degrees. His skills as a researcher combined with his interests in sustainable development are leading to the creation of viable solutions to environmental problems.

One such problem is the mist produced by machining operations in factories. This mist and other airborne particles can be harmful to employees. Sutherland, along with Mechanical Engineering Associate Professor Donna Michalek, is currently investigating alternatives to reduce pulmonary health risks posed by these harmful mists. By examining emissions from these manufacturing processes, he

"ENVIRONMENTAL PROBLEMS ARE COMPLEX AND REQUIRE CAREFUL STUDY IN ORDER TO BE PREVENTED."



Sutherland interacting with students.

FACULTY & STAFF AWARDING EXCELLENCE

and Michalek are able to recommend and help implement changes that lead to environmentally safe, "green" processes.

Sutherland is also working with Professors David Shonnard (Chemical Engineering) and James Mihelcic (Environmental Engineering) on the development of decision-making aids to reduce the environmental impact of manufacturing. This research is beginning to yield tremendous advantages to manufacturers in terms of their competitiveness, as well as producing demonstrable environmental benefits. "In our work with industry, we identify new, transforming ideas that are win-win in terms of competitiveness and the environment," notes Sutherland. Improvements in environmental performance are generally accompanied by improvements in production efficiency. As Sutherland says, "The status quo is rarely the optimal way to do business. We are helping manufacturers to improve both competitiveness and the environment."

Sutherland's research interests are driven by his "strategic concern" for the well-being of U.S. industry in the global market. He points out, "The U.S. lags behind many industrialized nations in designing green products and then manufactures them with environmentally benign processes. With wide-open spaces and abundant natural resources, we tend to be wasteful. Global competitors, faced with limited space and expensive energy, will innovate in response to these circumstances, leaving the U.S. to fall behind because we're not subjected to the same drivers in terms of sustainable development." This motivates Sutherland to help stimulate innovation and change attitudes in American industry.

Similar scenarios have plagued industry in the past. In the late 1800s, explains Sutherland, Frederick Winslow Taylor pioneered the concept of scientific management. Manufacturing companies that failed to adopt this new concept and its associated practices became uncompetitive and often went bankrupt. In the 1970s, Japanese industry gained leadership in terms of quality by adopting the principles of W. Edwards Deming. Again, because many U.S. companies did not adopt this new quality philosophy, they failed in the global marketplace.

FACULTY AWARDS

Dr. John E. Beard

Outstanding Faculty Advisor
National Science Foundation, 2003

Dr. Peck Cho

MTU Distinguished Service Award
Michigan Technological University,
2003

"I am legitimately concerned that this scenario is going to play out again, this time with a new set of competitors that practice a *green* philosophy."

To counteract this potentially damaging situation, Sutherland cites the need for cooperation among industries, government, and U.S. citizens to create a sustainable future for ourselves, achieving a balance between economic development, the environment, and society. He and his collaborators have received support from industry, government, and foundations. Their work towards a sustainable future has resulted in a \$3.6 million award through the National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) program. Industry support for the Sustainable Futures Institute ranges from money to materials and equipment. "Our industry partners recognize that a fully informed decision is a better one, with more opportunities for innovation. The key starting point is for forward-looking American companies to recognize that environmental responsibility will give them a competitive edge."

Dr. L. Brad King

Presidential Early Career Award for Scientists and Engineers
President's Office of Science and Technology Policy, 2004

CAREER Award

National Science Foundation, 2004

Dr. Kee S. Moon

P.K. McElroy Award for Best Paper
Reliability and Maintainability Symposium, 2004

Dr. Gordon G. Parker

SAE Ralph R. Teetor Education Award
Society of Automotive Engineers,
2003

Dr. Ghatu Subhash

Fellow of ASME
American Society of Mechanical Engineers, 2004

ASME Student Section Advisor Award

American Society of Mechanical Engineers, 2003

STAFF AWARD

Michael A. LaCourt

Engineer/Scientist
Employee Excellence Award
Michigan Tech, 2004

A MAN FOR MANY REASONS

GERALD P. DION
SUPERVISOR OF LABORATORIES



Gerald Dion has his fingers on the pulse of the ME-EM Department. “He’s the go-to guy when you need something,” says one co-worker. Dion is in charge of all the laboratories in the ME-EM building. This is a daunting task because the ME-EM has sixty labs (totaling over 50,000 sq. ft.)—in addition to computer labs, machine shops, the wood shop, and welding shop.

His work schedule keeps him busy. “The days go by quickly,” he says. “I’ve never had to say, ‘This is a long day.’” His duties include ensuring that all the labs, equipment, and related support facilities meet the needs of 40 faculty members,

“HE MAKES THIS BUILDING RUN.”

190 graduate students, and 40 senior design teams that are all conducting research. In addition, he orders all of the new equipment, updates existing systems and performs all maintenance. “He makes this building run,” a colleague says.

After earning an Associate’s Degree in Electrical Engineering Technology from Michigan Tech in 1971, he was hired a year later as an electronics technician and began his current position in 1974, three years after the ME-EM building opened. Over the years, the number of people he has served has grown and the services have become more sophisticated.

The changes Dion has encountered on the job are illustrated through one measure: the specific equipment needed to fulfill

the program’s needs. Years ago he started out with oscilloscopes and voltage meters. His responsibilities have advanced to computer systems, data acquisition, and facilities for research such as materials testing, manufacturing, fabrication, vibration, acoustics, fluids, robotics, and biomechanics.

A native of the Keweenaw, Dion, 57, is known locally for restoring classic cars, commenting that it was typical of kids in his day to tackle such labors. Now, he says, students are fascinated by computers. “When we have computer-related questions, we often turn to them for help.” However as advanced as students may be in computer skills, they often enter MTU weak in the practical applications of their studies. This is why Senior Design projects, emphasizing hands-on, high-quality engineering, are so necessary. (See related story on page 27.)

With no set schedule for his duties, Dion says, “Everything is on demand.” If there is one constant to his position, it’s the refrain: “I need this tomorrow.” This is, however, an observation, not a complaint, because he thrives on assisting others. “I’ll do anything,” he says, whether it be moving furniture, running to the hardware store, or serving on the department’s social committee. The most fulfilling part of his job is just helping, and, indeed, a co-worker describes Dion as, the benefactor of students, faculty, and other support people.

Dion especially enjoys showing newcomers on campus where to go and whom to see in order to get what they need. “Knowing the ropes,” he comments, “is one of the benefits of being around a

long time.” Dion has been at Michigan Tech for 32 years, though he feels like he just was a student himself. “Time



has flown by,” he says. Now Dion’s son, Jeremy, is following in his father’s footsteps as a student at Michigan Tech. He is studying mechanical engineering and also works as a research assistant and a student grader in the department.

Dion recently pondered retirement. The very mention of this distressed the department chair, William Predebon, who at the time summed up Dion’s worth. “We can fill the position, but we can’t replace the man.” Dion received an employee excellence award in 1996 and the BOB (Best of the Best) award in 2002 for his dedication to the ME-EM Department.



Dion and his son, Jeremy, a 3rd year ME student.

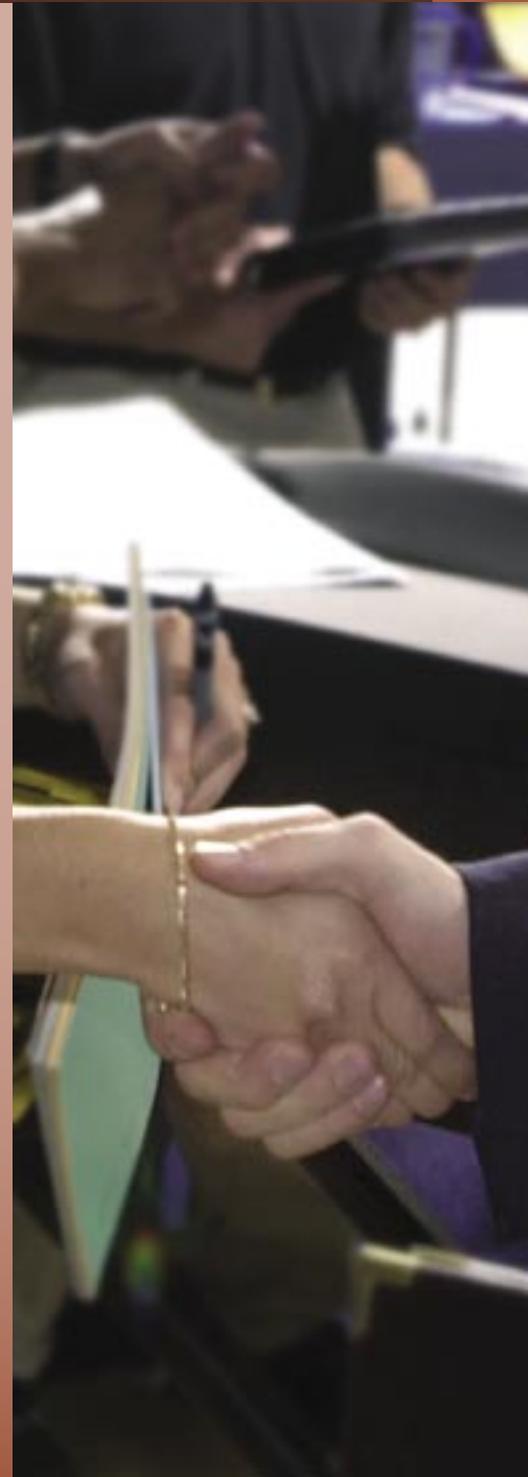
FACULTY & STAFF 18

MTU FACULTY TOP LIST OF AWARD RECIPIENTS

Of over 275 universities and colleges, Michigan Technological University is tied with West Virginia University for having the highest number of SAE’s Ralph R. Teetor Award recipients in 2004. The official list of Teetor Awards also shows that Michigan Tech educators have received twice as many Teetor Awards as the University of Michigan and thirty percent more than Kettering University (formerly GMI). The hands-on learning environment created by the ME-EM laboratories has directly contributed to Michigan Tech’s outstanding number of recipients.

The Teetor Award is one of more than sixty awards that have been developed by the Engineering Society for Advancing Mobility in Land, Sea, Air and Space (SAE) to recognize outstanding contributors to the profession. It specifically recognizes the nation’s top young engineering educators—those with more than three years and less than ten years of teaching experience. Recipients are chosen annually based on education, excellence in teaching, contributions to research, leadership in student activities and participation in engineering society activities.

The SAE Ralph R. Teetor Educational Fund was established to enable teachers and practicing engineers to exchange views and develop a better understanding of theory and the "real world" in the learning environment. Ralph R. Teetor believed that the success of our future society depends on the emphasis we place on teaching our youth. The ME-EM Department’s dedication to a balance of teaching, student involvement, and research has been nationally recognized by the SAE through the Ralph R. Teetor award.



BRINGING EXPERIENCE BACK TO CAMPUS

INDUSTRIAL ADVISORY COMMITTEE

To maintain a strong relationship with industry, Michigan Tech's ME-EM Department has established an Industrial Advisory Committee. Comprised of leaders in the field of mechanical engineering, the IAC helps the ME-EM Department achieve excellence in education. IAC members assist with curricular development, identifying research projects, safety programs, mock interviews for students, presenting seminars, liaisons with other industries, and sometimes serve as advocates for the department. "They help us on every front," says Dr. William Predebon, ME-EM Department Chair.

TOM CLARK
Caterpillar Incorporated

WILLIAM S. COOPER
Visteon Corporation

ROGER L. DEWITT
John Deere Power Systems

ALAN R. FRANK
Whirlpool Corporation

BRIAN S. HENRIKSEN
Navistar International Truck and Engine Corporation

MICHAEL V. HOFMAN
Ford Motor Company

PAUL W. JONES
American Axle and Manufacturing

DAVID M. KIMBALL
DaimlerChrysler Corporation
Plymouth Marketing Division

JOHN M. LEINONEN, P.E.
Exponent Failure Analysis Associates

BRENDA MOYER-KOCHAN
Dana Corporation

LEIGH OTTERLEI
3M Corporation

PETER P. SANDRETTO
DaimlerChrysler Corporation

JOHN F. SCHWEIKERT
General Motors Powertrain Group

ADIL SHAFI
Shafi Incorporated

FREDERIC C. SHERRIFF
Kraft Foods, Incorporated
Philip Morris Companies, Incorporated

SANDRA A. SKINNER
Ford Motor Company

MICHAEL SMABY
Kimberly-Clark Corporation

RICK SMITH
Denso International America,
Incorporated

MARTHA SULLIVAN
Texas Instruments Incorporated

TIMOTHY N. THOMAS
PARTsolutions LLC

CAMIEL E. THORREZ
C. Thorrez Industries

GEOFFREY R. WELLER
General Motors Corporation

JEFF ZAWISZA
Dow Chemical Company





Fall 2004 IAC Meeting. Members (from left to right): William Predebon (Dept. Chair), Geoffrey Weller, Timothy Thomas, Tom Clark, Alan Frank, Roger DeWitt, Michael Smaby, Peter Sandretto, Jeff Zawisza, Michael Hofman.

ME-EM INDUSTRIAL ADVISORY COMMITTEE

VISION Make MTU graduates the preferred candidates for industry hires.

MISSION STATEMENT Leverage the partnership between industry and MTU to recommend direction and implementation that results in improving the ME-EM Department in the areas of: Human & Material Resources, Research, Curriculum, Placement, and Fund Raising.

- STRATEGIC OBJECTIVES**
- I. Help MTU obtain, develop, and utilize best human and material resources to support curriculum and research mission.
 - II. Help MTU become a recognized leader in research having real-world relevancy and complement MTU's broader research goals.
 - III. Integrate academic and industrial perspectives to continuously improve the ME-EM curriculum to produce tomorrow's balanced and robust professional engineers to meet industrial needs.
 - IV. Advise ME-EM Department on the marketability of our students.
 - V. Actively assist the ME-EM Department in its fund-raising activities to obtain the best human and material resources to support the curriculum and research mission.

STUDENTS GRADUATE STUDENT RIDING TO SUCCESS

SCOTT MIERS
PHD CANDIDATE



Scott Miers has been involved in Michigan Tech's ME-EM Department for more than a decade. He received his BS degree in Mechanical Engineering in 1995, his MS degree in Engineering Mechanics in 2001, and is currently pursuing his PhD in Mechanical Engineering with a specialization in high-speed diesel spray identification. At this point in his career, Miers recognizes Michigan Tech's strength as an academic institution. As a senior in high school, however, Miers chose Michigan Tech for its snowy winters. Houghton, Michigan

has an average annual snowfall of over 200 inches and is a popular destination for winter sports lovers. Snowmobiling is Miers' favorite sport, and studying mechanical engineering at MTU has allowed him to pursue this passion both inside and outside of the classroom.

Since he was a child, Miers has enjoyed exploring the mechanics of dirt bikes, lawn mowers, snowmobiles, and just about anything with an engine. As an undergraduate in the ME-EM Department, Miers encountered an ideal environment

to prepare him for a professional career in the field of mechanical engineering. After receiving his Bachelor's degree Miers accepted a position in the snowmobile industry with FAST, Inc. in Eveleth, Minnesota.

Miers worked on product support and snowmobile design during his time at FAST, Inc. The company specializes in high performance, aftermarket products for snowmobiles. It was an exciting opportunity for Miers to work in the mechanical engineering industry in

Scott Miers 'field testing' in deep powder near the Michigan Tech campus.



STUDENT AWARDS

an area of special interest to him. With two years of workplace experience, Miers returned to MTU to enter the Master of Science program in Engineering Mechanics.

As a Master's student, Miers specialized in sandwich core compression reduction. He also participated in the SAE Clean Snowmobile Challenge and acted as Michigan Tech's Clean Snowmobile Team leader the first year. He spent many hours working with the team, writing reports, and traveling to competitions. Miers became a leader in the classroom as well. Through his teaching assistantship in the ME-EM Department, Miers discovered a passion for teaching.

Under the guidance of MTU faculty members—including Dr. David Sikarskie, Dr. John Ligon, Dr. Ibrahim Miskioglu, and Dr. Carl Anderson—Miers decided to combine his interest in internal combustion engines with his love of teaching by pursuing a PhD in Mechanical Engineering-Engineering Mechanics. For his research, Miers set up a high speed diesel engine laboratory to measure instantaneous piston temperatures and record fuel spray impingement—a challenging task, considering the limited previous research that exists. When fuel is injected into the cylinder of a diesel engine, it can move through the entire combustion chamber and contact the piston surface, resulting in detrimental effects on emissions and durability. Miers' research involved identifying and predicting when the fuel makes contact with the piston.

Miers' research was completed in cooperation with Infrared Telemetrics, Inc., a Michigan Tech spin-off company that is the worldwide technology leader in providing wireless data transfer from reciprocating and rotating components. IR Telemetrics provided technical advice and support through installation



Illustration of a telemetry transmitter installed on a connecting rod.

of wireless telemetry to record data within the engine in Miers' laboratory.

Graduating in December of 2004, Miers has accepted a post-doctoral position at Argonne National Laboratory in Chicago, IL. He plans to eventually pursue a faculty position at a university with an Engine research program where he would like to teach both undergraduate and graduate classes as well as continue his research. In Michigan Tech's ME-EM Department Miers has been able to explore life-long interests and discover new career opportunities.

Kiran Khadke

*NSF/ASME Student Travel Grant
National Science Foundation and
American Society of Mechanical
Engineers, 2004*

Andrew Barnard

*First place paper
Noise-Con Conference, 2004*

Jason Lalonde

*Second place paper
Noise-Con Conference, 2004*

Hao Li

*Best Poster Award
MTU Graduate Student Council Fall
Poster Session, 2003*

Ka Heng Liew & Egel Urip

*Software Release Award
NASA Glenn Research Center, 2004*

Scott Miers

*First Place, Sigma Xi awards
Sigma Xi*

Jamie Krull

*Fulbright Grant
United States Government, 2004
Second Place, Sigma Xi awards
Sigma Xi*

Jeffrey D. Schut

*SAE Long Term Member Sponsored
Scholarship
SAE Foundation*

Greg Ives, Joe Littlefield & Casey Carr

*MTU PACE Award
Partners for Advancement of
Collaborative Engineering Education/
GM 2004*

STUDENTS UNDERGRADUATES EXCEL IN ENGINEERING

DAN ADLER & JORGE AGUILA
UNDERGRADUATE RESEARCH ASSISTANTS



Dan Adler, a senior at Michigan Tech, is leading his classmates into the future. Adler decided to come to this university because of his interest in science and mathematics, but has found many more reasons to stay. Adler said, “Although the course work is demanding, there are a lot of opportunities to explore interests outside the classroom.” Michigan Tech has more than 250 student organizations that encourage students to get involved on campus.

As Student Assistant to the Office of Student Affairs, Adler has worked closely with these groups. He has also been active in the Undergraduate Student Government and served one year as President of the Student Body. Adler’s leadership on campus has prepared him to succeed in the professional world.

Adler is also an academic leader and has taken his coursework beyond lectures and exams to find practical solutions for industry problems. He is currently working on a senior design project to

develop a robotic cutting table that will control a plasma torch—technology that can be used to cut metals such as steel or aluminum with precision and accuracy. Adler is excited to apply his technical knowledge and skills. “Between senior design and all of the different enterprise programs, there are a lot of hands-on project opportunities at Michigan Tech,” he said.

After graduation, Adler will join Michigan Tech’s Sustainable Futures Institute to earn a Master’s Degree in Mechanical Engineering with a Certificate in Sustainability. His research will focus on finding ways to design products or processes that are more environmentally friendly and, at the same time, more cost effective. The ME-EM Department is helping Adler prepare to lead industry into a brighter future.



Jorge Aguila first came to Michigan Tech through the Michigan Colleges and Universities Partnership (MICUP), a program he joined while attending Grand Rapids Community College. As

a participant in MICUP, Aguila traveled to Michigan Tech’s campus to take a class and work as a research assistant in the ME-EM Department. According to Aguila, the engaging classes and helpful faculty and staff drew him back. After earning his associate’s degree in Sciences and Arts, Aguila decided to return to Michigan Tech to pursue a Bachelor’s degree in Mechanical Engineering.

Aguila has traveled a long way from home to study at Michigan Tech. Originally from Cuba, Aguila immigrated to the United States of America with his family at the age of 18 when his mother was granted a visa. He is looking forward to a career in the automotive industry—a field with very limited opportunities in Cuba. Aguila says that, although he has been interested in cars for a long time, his career choice was largely influenced by his father, a metallurgical engineer. “I always wanted to follow in his footsteps,” he said.

Jorge and his father share more than just an interest in engineering. Like Jorge, his father traveled to a foreign country to study. Aguila’s father studied the Russian language and earned bachelor’s and master’s degrees in metallurgy as a young man in the Soviet Union. Now, Jorge Aguila is following in his father’s footsteps, he works hard and studies in his second language—English.

In addition to being a full-time student, Aguila works as an undergraduate research assistant with ME-EM faculty member John Gershenson. His work with Gershenson focuses on modularity and reducing the steps involved with design, manufacturing, and assembly. He also works on computational fluid dynamics software with Mahesh Gupta, an Associate Professor in the ME-EM Department. At Michigan Tech Aguila is getting the education and experience he needs to become a successful Mechanical Engineer.

LAUNCHING AN EXCITING CAREER

As a student in Michigan Tech's Mechanical Engineering Department and a member of the Michigan Tech Huskies volleyball team, Emily Fossum has reached for success in the classroom and on the court. She chose Michigan Tech because she was interested in studying engineering and continuing her volleyball career. "Michigan Tech has a strong athletic department and also a strong science and math program," said Fossum. "It was the perfect match."

EMILY FOSSUM
PHD CANDIDATE

Although it was a challenge to balance her interests in athletics and academics, Fossum says she learned valuable lessons from the experience. "Playing volleyball as a full-time student taught me to stay focused and manage my time," she explains. Fossum used these skills to earn a dual degree in Mechanical Engineering and Business Administration from Michigan Tech.



A member of the research team for Michigan Tech's Ion Space Propulsion Lab, Fossum is currently pursuing a PhD in Mechanical Engineering-Engineering Mechanics with a concentration in Energy Thermofluids. Her graduate research focuses on electric propulsion for spacecraft. Fossum describes her work as a fusion of mechanical engineering, physics, and electrical engineering. She considers the opportunity to work with talented Michigan Tech faculty in a variety of fields a huge asset to her research. Fossum says, "The combination of many different disciplines gives me a broad view of my projects."

In the Ion Space Propulsion Lab, Fossum is studying how to increase the efficiency

of ion thrusters so that it will cost less for companies to launch and maintain spacecraft. She is working on innovations that could eventually allow bigger craft to travel deeper into space—making projects such as a manned mission to Mars possible. After earning her PhD from Michigan Tech, Fossum hopes to extend her research at a government laboratory or in commercial industry, with a postdoctoral assistantship. Then she would like to continue her career in aerospace engineering as faculty at a research institution. "I love the university environment," says Fossum. "There is an energy about universities that is all about learning and moving forward."

Pictured is a Hall thruster in operation running on xenon fuel. These are tested in MTU's Ion Space Propulsion Lab in a space simulation vacuum chamber which is able to achieve pressures of 10^{-6} Torr. The blue glow you see is from excited xenon ions that are accelerated from the thruster.

STUDENTS

ME-EM

SCHOLARSHIP

RECIPIENTS

Talented and committed students are the heart and soul of any university. Students often make their decision on which university to attend on the financial aid available. Our goal is to make sure that opportunities to recognize and reward excellence are available to qualified students for high academic merit, financial need, under-representation, and outstanding leadership. Below are the 2003-2004 academic year mechanical engineering undergraduate scholarship recipients.

Abdollahzadeh, Navid	Blecke, Jill C	Cummings, Jarrod M	Fry-Schallhorn, Lindsay D	Heering, Jason R
Ackerman, Heather A	Bobchik, Joseph P	Curmi, Tricia K	Fultz, Derek W	Heichelbech, Benjamin S
Adler, Daniel P	Boes, Steven T	Curry, Brian J	Gardner, Jacob J	Heins, Ryan D
Aguila, Jorge L	Bojanowski, Brenton E	Daavettila, Andrew R	Garlock, Kevin D	Hemenger, Alicia G
Ahlem, Eric D	Bosscher, Nathan L	Daavettila, David C	Garver, Scott W	Hempel, Elizabeth A
Aho, Heather N	Botero, Derek R	Dame, David M	Gay, Zackery B	Herman, Adam J
Allen, Tyler S	Bouman, Jeffery A	Davis, Gregory A	Gentry, Nathaniel J	Herman, Luke J
Alt, Matthew M	Bourgo, Kevin M	Dayton, Richard A	Gerbers, Bryant J	Hernandez, Joseph E
Altobelli, Matthew L	Bowron, Micah J	Dean, Catherine A	Gerondale, Adam P	Heubel, Eric V
Amlotte, Sarah M	Bracy, Cory L	Deaner, Justin M	Gibbs, Christopher A	Himes, Matthew D
Anderson, Beau L	Bradley, Brett B	Debo, Matthew	Gibbs, Timothy L	Hipsher, Jacob A
Anderson, Christian T	Bradley, Sarah M	Deffendall, Sean A	Gidcumb, David C	Hocking, Joel M
Anderson, Greg A	Brady, Jason A	Dehlin, William J	Gifford, Jonathon L	Holbrook, Matthew T
Anderson, Kelly S	Brandt, Colin M	Dehn, Lucas S	Gillespie, Jason E	Holland, Daniel P
Anderson, Matthew P	Bray, Farah J	DeLand, Seth B	Gillespie, Justin W	Holmes, Matthew A
Anderson, Nathan C	Breining, Elizabeth K	DesLaurier, Ryan E	Gilmer, Matthew C	Holt, Georgio M
Anton, Steven R	Brewster, Michael R	DeVormer, David D	Goffard, Gregory D	Honkala, Carl A
Arens, Gregory D	Brinks, Andrew J	Dewey, Timothy J	Golda, Fred N	Houlmont, Michael L
Aschinger, Michael J	Brouwers, Andrew J	DeWitt, Robert M	Gomez, Andre L	Hoyles, Andrew J
Atherton, Brandi M	Brown, Stephanie J	Deyo, Benjamin E	Gonzalez, Juan C	Huesman, Wade M
Auge, Jessica L	Bruce, Andrew D	Diemer, Joel M	Granstrom, Jonathan M	Huggard, Jacob D
Austin, Gregory T	Bryson, Peter A	Dion, Jeremy J	Grassmid, Kyle C	Hughbanks, Zachary J
Azarovitz, Daniel E	Buck, Steven J	Donaldson, Stephen M	Gray, Eric M	Huhtasaari, Kevin M
Babbitt, Darryl P	Buckingham, Scott A	Donovan, Luke R	Green, Jacob T	Iduma, Godwin C
Bagley, John T	Buono, Joseph R	Downer, Andrew M	Greenwald, Jonathan R	Igboanugo, Chukwuemeka P
Baldwin, Scott N	Burt, Fritz N	Duarte, Joseph A	Grumm, Dennis M	Inman, Kristopher S
Balfour, Juan J	Burwell, Alan C	Dubiel, Matthew J	Gulewich, Brian C	Isaacson, Christopher J
Barczak, Nicholas A	Caldwell, Ryan E	Duesing, Peter E	Guyton, Matthew R	Isaacson, David W
Barkley, Matthew D	Campbell, Alan W	Ehlers, Jonathan A	Haas, Thomas R	Jacobsen, Eric J
Bassindale, Joseph J	Canepa, Rachel E	Ehlers, Joseph R	Habashy, Mina N	Jager, Nicholas J
Baxter, Bryan J	Capello, Kyle J	Ehlert, Gregory J	Habegger, Adam D	Johnson, Adam S
Beatty, Jeremy T	Carl, Brian A	Ellis, Katrina M	Hadden, Cameron M	Johnson, Amanda J
Becker, Joshua R	Carlson, Melissa M	Enck, Carolyn M	Hagner, Charles A	Johnson, Christie L
Beckman, Justin L	Caudill, Cole J	Erickson, Brigham M	Hall, Bryon J	Johnson, David L
Bejcek, Brian C	Caverly, Jacob A	Essex, Ryan W	Hall, Christina J	Jones, Andrew P
Bekkala, Craig H	Ceterski, Kenneth N	Evans, Brent I	Hallesy, Susan A	Jordan, Kari L
Bekkala, Wesley H	Chamberlain, Matthew L	Evon, Matthew J	Halls, Corey M	Joseph, Elmo
Belknap, Ryan A	Chaphalkar, Nikhil S	Eziyi, Ifegwu L	Halonon, Levi J	Joseph, Eric D
Belling, David A	Christian, Kevin J	Faulkner, Andrew L	Halt, Thomas M	Jousma, Charles A
Bendick, Kathleen M	Christle, Keith R	Faussett, Thomas W	Hamilton, Daniel M	Jungnitsch, Russell P
Benes, Philip M	Cieslinski, Andrew J	Fecteau, Blake J	Hanes, David C	Kahl, Dirk L
Bengry, Matthew E	Cohrs, Angela S	Feenstra, Joel R	Hanna, David J	Kalafut, Calvin W
Benson, Michael S	Conner, Chris R	Fenton, Andrew C	Hannah, James M	Kalenauskas, Eric W
Berger, Joseph D	Cook, Eric R	Fields, Tom H	Hanson, Cody W	Kamppinen, Timothy W
Berry, Kevin J	Cook, Ryan B	Figliomeni, Jonathan M	Harjer, Jennifer L	Kangas, Greg A
Besonen, Thomas P	Coolich, Casey K	Fitzgerald, Edmund W	Harris, Kathryn L	Kangas, Scott R
Biery, Cameron J	Cox, John A	Folson, Stephen W	Hasslen, Eric J	Kanitz, Steven M
Billiu, Christopher S	Coyne, Jonathan C	Fors, Kelsey L	Hatch, Tenasia E	Karner, Steven J
Billmeier, Michael K	Crandell, Beau E	Fox, Ryan E	Hauch, Karen N	Kartes, Trevor J
Birkhold, Joseph O	Cross, Jason R	Francis, Ray A	Hawkins, Brett T	Kastamo, Adam P
Black, Eric C	Crouch, Molly S	Frantti, Neal V	Hawley, Justin R	Kaupilla, Carl J

Kayser, Mark R
 Kempeinen, Matthew P
 Kern, Shaughn
 Kevianne, Julian M
 Kiel, Haijo A
 Killeen, Matthew
 Kim, Hwa Y
 Kivisalu, Michael T
 Klein, Mark D
 Kloss, Jacob P
 Klug, Solomon C
 Kluskens, Laura J
 Kneeland, Philip D
 Knepfler, Carl M
 Knoebel, Ronald W
 Kolhagen, Benjamin J
 Koning, Laura A
 Kooiker, Seth C
 Kortenhoven, Keith A
 Korth, Hans G
 Koskey, Louis W
 Koski, Philip J
 Kostner, Timothy R
 Kostrzewski, Thomas J
 Kramer, James R
 Krcmarik, Andrew J
 Krieger, Brandon W
 Kroodsma, Nathan D
 LaBar, Ryan D
 Lacy, Adam J
 LaFountain, Andrew L
 Lange, Robert A
 LaPeer, Jeremy K
 Larson, Jonathan M
 Larusson, Birkir
 Lashore, Babatunde O
 Lass, Amber B
 Latsch, Joseph R
 Lauman, Jeffrey W
 Lautner, Andrew K
 Lechnyr, Joseph W
 Lee, Kevin M
 Lehmann, Erik W
 Lennon, Michael T
 Leonard, Cody M
 Leonard, Edgar J
 Lepinski, Joshua J
 Lepley, Brian K
 Lewis, Stephen J
 Liedke, Brent J
 Lievens, Charisse M
 Linfoord, Aaron M
 Little, Adrian M
 Littlepage, Steven M
 Lixey, George M
 Loisselle, Jacob A
 Longstreet, Aaron J
 Losiewicz, Eric P
 Loukus, Roy H
 Love, Richard W
 Loveland, Dustin P
 Lowe, Nicholas C
 Ludy, Andrew J
 Lyngstad, Kyle D
 Lyons, Trevor P
 MacDonald, Brad M
 MacNeill, Chelsey A
 Maloney, Christine A
 Manchik, Kari A
 Mann, Craig A
 Manninen, Paul J
 Manthei, Jesse P
 Marchlewicz, Derek S
 Marconnit, Aaron C
 Marks, Amanda K
 Marsh, Kyle J
 Martell, Peter A
 Martin, Benton C
 Martin, Jennifer L
 Martin, Michael A
 Martin, Nicholas T
 Mason, Blake J
 Mayville, Samantha A
 Mazure, Ryan J
 McCubbin, Nicholas E
 McCullough, William J
 McDonald, Mitchell A
 McElmurry, Scott M
 McHale, Brian C
 McLean, Patrick D
 McNally-Carolan, Christop
 Mendolla, Aaron C
 Merkel, Laura K
 Messenger, Aaron S
 Messenger, Jacob C
 Meyer, Edmond J
 Meyers, Amy L
 Miller, Christopher F
 Miller, Jessica S
 Miller, Samuel J
 Miller, Timothy J
 Mittag, Matthew D
 Mleziva, Brian T
 Monick, Kassie I
 Moore, Christopher L
 Moore, Christopher W
 Moore, Kevin M
 Moran, Jonathan W
 Morello, Andrew J
 Morgan, Dan C
 Morris, Daniel H
 Morris, Ryan L
 Morris, Sean M
 Morrison, Chad H
 Motz, Julie A
 Mullins, Bradley M
 Murtland, Frank C
 Nagy, William H
 Neece, Joshua A
 Nelson, Matthew T
 Newbury, Kyle J
 Niemela, Carrie S
 Noreen, Trenton B
 Norris, Jessica L
 Nyquist, Jason B
 O'Dell, Christi J
 Olearnick, Joshua D
 Olson, Christopher L
 Osborn, Matthew J
 Osborne, Jonathan J
 O'Sullivan, Christopher M
 Otis, Amanda M
 Ovist, Grant J
 Owen, Kristina M
 Pairolero, Nicholas T
 Palmer, Leann M
 Panczenko, Jason A
 Pantke, Andrew W
 Parenteau, Alan R
 Parker, Seth R
 Pasquali, Dean A
 Paul, Jeremiah D
 Pearson, Sarah J
 Pederson, Mark D
 Peplinski, Andrew J
 Peterson, Kyle I
 Pierce, Carl P
 Pipkorn, Casey J
 Piro, Anthony R
 Plott, Christopher A
 Plummer, Bradley R
 Pohlman, Benjamin N
 Pollum, Christopher A
 Polonowski, Christopher J
 Polzien, Stephen J
 Prenkert, Christopher J
 Pruehs, William N
 Pruetz, Jeffrey E
 Pullen, Kyle S
 Putnam, Douglas C
 Quade, Brekke E
 Quade, Rachel L
 Racklyeft, Adam C
 Rajala, Andrew M
 Rajnauth, Rodney J
 Rankin, Victoria L
 Rath, Stephen D
 Reedy, Tyler G
 Reeves, Timothy C
 Reinhardt, Timothy R
 Renn, Bryant C
 Reno, Tyler M
 Rhode, Joshua L
 Rhome, Brandon P
 Richards, Andrew W
 Rickli, Jeremy L
 Riedel, Christian T
 Riffe, Jessica A
 Riley, Timothy P
 Riutta, Benjamin J
 Robinson, John F
 Robinson, Rosalyn H
 Rochowiak, Dain S
 Rohr, Andrew P
 Ronning, Kiel E
 Rosalez, Javier
 Rose, Stephanie M
 Rosenberger, Amanda L
 Rosinski, Ryan D
 Rothe, Jillian J
 Rouse, Brandon T
 Ruth, Jessica A
 Rutterbush, Scott A
 Sams, Steven K
 Sarsen, Douglas C
 Scallon, Sean T
 Scarth, Caleb P
 Schechter, Ryan E
 Scheich, Chris L
 Scherwinski, Aaron D
 Schneider, Danielle M
 Schoo, Dusty J
 Schuster, Noah D
 Schut, Jeffrey D
 Scoggins, Brent A
 Scott, John H
 Sealander, Christopher J
 Sebastian, Christopher M
 Sebeck, Bryan J
 Sechler, William F
 Serbowicz, Thomas J
 Sesselmann, Kristen R
 Shah, Amit
 Shaner, Benjamin J
 Sherrington, Matthew R
 Shissler, Ryan P
 Sikkema, Brian J
 Simula, Nate T
 Skauge, Sandy M
 Smith, Nicholas J
 Smith, Richard G
 Smith, Zachariah P
 Snyder, Kevin H
 Soderlund, Justin J
 Soetaert, Michael J
 Soliz, Steven C
 Sommerfeldt, Nelson I
 Sorensen, Philip H
 Soule, Ian B
 Spalding, Stephen W
 Stanaway, Benjamin C
 Stanczuk, Grant A
 Stasa, Korinne M
 Steslicki, David M
 Stewart, Kyle B
 Stickels, Daniel W
 Stock, Jacob L
 Stone, Raymond T
 Strebel, Christopher J
 Streberger, Daniel S
 Strelcheck, Joseph R
 Strickland, Jessica A
 Sturgis, Brandon D
 Sturos, Chase P
 Sturtevant, William W
 Sturza, John D
 Sutton, David C
 Swanson, Tara E
 Swathell, Joshua J
 Talbot, Kiel E
 Tan, Alan W
 Taylor, Gustan J
 Taylor, Jeffrey D
 Thomas, Nathaniel R
 Thomasini, David M
 Thoms, Christopher G
 Thut, Ryan R
 Toohy, Charles W
 Toutant, Daniel P
 Traczyk, Timothy
 Trierweiler, Rebecca M
 Tuinstra, Kimberly A
 Turner, Travis D
 Ulstad, Melissa A
 Underwood, Chanty A
 VanAppledorn, Craig
 VandenBush, Matthew T
 Vanderhoof, Daniel E
 VanDrese, Glenn J
 VanHeusden, Elizabeth M
 Velthous, Evan R
 Verhey, Ian R
 Vettel, Drew M
 Viitala, Bryan J
 Vincenz, Jason M
 Vine, Cody J
 Volmering, Andrew D
 Voshol, David B
 Wackerle, Christopher K
 Walber, Chad M
 Walsh, Matthew W
 Walsworth, Jordan M
 Walter, Jon A
 Walton, Stephanie J
 Ward, Ryan L
 Warmack, Adam M
 Watkins, Steven G
 Webber, Janine L
 Weber, James C
 Wellnitz, Casey C
 Wells, Lee J
 Westrope, Benjamin E
 White, Keith B
 White, Raymond A
 Whitehead, James A
 Whitney, Evan M
 Wickman, Justin R
 Wieman, Kyle L
 Wilkie, Nathan E
 Wilkins, Matthew L
 Willett, Kelly L
 Winer, Evan T
 Wingard, David R
 Wirbel, Edwin L
 Woelmer, Lee N
 Wolk, Kimberly A
 Zajac, Michael R
 Zambon, Nathan D
 Zatzke, Kyle S
 Zeitz, Eric R
 Zettel, Tom A
 Zink, Brian S

MTU SENIOR DESIGN: REAL CHALLENGES, REAL RESULTS

One cornerstone of a Michigan Tech engineering education is undergraduate collaboration with industry. The ME-EM Department's Senior Design course involves small teams of students working for two semesters on real-world problems from industry. Corporate sponsors provide not only the technical challenge, but also mentoring and funding, while faculty function as advisors who guide the seniors.

One of the organizers of Senior Design is Associate Professor John Gershenson. He loves teaching, especially as part of MTU's Senior Design program. "Doing design is the only way to learn design," he says of this hands-on program. He

figures that, already in his young career, he has worked on such projects with 125 students at four universities. "The highest quality in senior design projects that I've seen have come out of MTU—more so than any other university," he declares. He calls the industry sponsors of Senior Design projects "customers."

According to Gershenson, the goal of each design project "is to deliver what the customer wants, when the customer wants." He adds that students respond

enthusiastically when they realize that their success equates, not to a final exam, but to customer satisfaction. The overall experience, he says, gives students a significant experience with the working world. "This is not their last class," he says of student participants. "It's their first job."

ME-EM students are involved in over thirty Senior Design projects each year. Sponsoring companies include some of the titans of American industry: Kimberly-Clark, International Paper, Caterpillar, General Motors, John Deere, Federal Mogul, Boise Paper Solutions, Ford Motor Company, Boise Cascade, and Polaris Industries.

One enthusiastic sponsor is Tom Kadlub, a Test Engineer with Polaris in Roseau, Minnesota. He works on all-terrain vehicles, overseeing a range of innovations including new vehicles, new

**"DOING DESIGN IS
THE ONLY WAY TO
LEARN DESIGN."**

MARKETABILITY:

"The graduates from the ME-EM Department are excellent engineers, highly motivated, and very practical."

ADVANTAGE TO INDUSTRY:

"You're only helping yourself by sponsoring one of these projects, because these are your future engineers. The more they understand how your company works—how to get things done—the better off you'll be when they start working for your company."

TEAMWORK:

"When people work together, the project gets done. It's a unique experience to work with four individuals who come from different backgrounds. Not everyone is like you and cooperation is very important. If you haven't done it before, your first job is going to be very difficult."

FORMULA FOR SUCCESS:

"You have to keep a very positive attitude because you run into problems with your project. Nothing is ever going to be just right or just perfect. You need to deal with these problems and obstacles. Really, those things are what benefit you the most. They help you to become a better engineer."



2004 Senior Design Exhibits.

components, and new materials. Polaris is sponsoring a Senior Design team of five mechanical engineering seniors and five seniors in electrical engineering. This team will design and build a snowmobile belt dynamometer.

The dynamometer is the second Senior Design project that he is coordinating.

“It was my first experience with MTU that sold me on a second one,” he says. Kadlub appreciates working with MTU’s faculty and students. “They have been very easy to get along with and are very dedicated.”

“THIS IS NOT THEIR LAST CLASS...IT’S THEIR FIRST JOB.”

INDUSTRY OPPORTUNITY: CHALLENGE:

“You get to be creative, you get to take initiative, you get to do design work, and you get quite a bit of freedom. It’s been a very good experience.”

“I’ve never worked harder than with senior design, or work with this wide of a scope.”

INDUSTRY PREPARATION FOR THE REAL WORLD:

“This is an opportunity to work with different people, and to play different roles, such as leadership roles and supportive roles. It is an opportunity to see what happens in the real world and to experience the real challenges out there in industry.”

INDUSTRY UNIQUENESS:

“I think the school has a good hands-on feel for design projects, as well as good contacts with industry. I know people at other schools, and their Senior Design projects are not as involved as Michigan Tech’s.”

A RACE TO THE STARS

AEROSPACE ENTERPRISE

The Aerospace Enterprise (AE) at Michigan Tech, founded by Assistant Professor L. Brad King, teams MTU undergraduates up with the Air Force and NASA to develop a nanosatellite. King praises the enterprise for getting students actively involved in the field early in their academic careers. “We have freshman turning nuts and bolts on spacecraft headed for orbit,” says King.

Students in AE are working to design a nanosatellite that can measure background electromagnetic noise in specific

wavebands. To model climate, scientists have long studied the presence of water in the air and on the Earth’s surface. They now plan to refine their understanding of this important process by studying the moisture found in the soil.

The original method of studying soil moisture was to measure the microwave radiation it produces using precise measuring devices. But with the advent of new wireless technologies—such as cell phones—this method can no longer be used. The frequencies of these modern

wireless technologies interfere with the measuring devices. The nanosatellite will help detect this electronic pollution in advance and enable scientists to measure soil moisture by pinpointing the microwave radiation that it gives off.

The project constraints alone represent a daunting challenge. All nanosatellites must meet NASA Space Shuttle payload safety requirements to eliminate any additional risk to shuttle and crew. However, King identifies an even bigger test for the students involved. “The greatest challenge of this project is for the students to learn to work on a multi-discipline project,” he explains. “For example, to develop a working spacecraft, you cannot consider your electrical systems in isolation—they affect the mechanical design and the software to control the satellite. As in real corporations, the enterprise program forces the students to understand and consider the concerns of ‘other’ engineering fields. In the end, it’s one satellite, not six disconnected aspects of a satellite.”



Furthermore, the schedule is demanding and the project does not wait for coursework. King says, "An electrical engineering student once came to me and said he had not yet taken the course where a particular type of circuit design was covered, so he could not develop the circuit. I told him that was no excuse—in a company you can't tell your boss, 'Sorry, I didn't take that class.'" Motivated by King's example, the student overcame the obstacle, found the resources, and figured it out. "Enterprise helps students adopt an energetic, can-do approach," concludes King.

Michigan Tech is one of ten universities from around the country participating in this high-stakes enterprise contest which will culminate in January 2005. NASA will then select the top team to spend two years finalizing their satellite before launching it into space. Along with the other nine universities involved, Michigan Tech received a \$125,000 grant from both NASA and the Air Force Office of Scientific Research.

Michigan Tech's team fared well at a hands-on workshop at the University of Colorado; Students were given a plastic container full of equipment and asked to design a payload for a stratospheric balloon. They won one of the competitions by constructing the lightest payload using only the supplied items. Opting for an unorthodox, but effective, innovative approach, Michigan Tech students won the contest by using the plastic from their parts bin to make very lightweight duplicates of the supplied metal parts. The MTU student team is up against universities that have up to 20 years' experience in competition. However, after the latest biannual project review from NASA, the MTU Aerospace Enterprise was considered to be one of the top two contenders.

The competition is exciting, but the real benefit is what King calls 'accidental learning'. "These students are focused on the goal—building a satellite and the numerous tasks such a goal demands. Buried in those challenging tasks, under the grime of cutting, soldering, and writing reports, are hidden many gems—engineering lessons that cannot be learned from a textbook."

MTU'S ENTERPRISE PROGRAM

Michigan Tech's Engineering Enterprise program provides a unique way for its students to work with industry to solve real-world problems. It is through this program that students stretch their engineering talents while gaining experience in conceptualizing, developing, producing, testing, and marketing a variety of products ranging from aerospace propulsion to Mini-Baja off-road vehicles.

Instead of being limited to textbook knowledge and laboratory exercises, students are pushed to use their acquired knowledge from school and apply it to real-world, industrial problems and situations.

Enterprises involve a large, interdisciplinary group of sophomores, juniors, and seniors who work together over the course of three years. The program also provides industry the

advantage of a "fresh" approach to engineering problems from a young, enthusiastic workforce; faculty an outlet for new techniques and theories; and students the opportunity to gain skills not only in engineering, but also in teamwork, communication, and problem solving.

Enterprises operate much like the everyday working world. "Our students don't feel like students," says Carl Anderson, Professor in the ME-EM. "They feel like engineers, and that's the magic of it."

Michigan Tech's Engineering Enterprise program is more highly developed than any other engineering educational program in the country. Says Mary Raber, who oversees the program; "Nobody does it like we do it."



ACADEMIC PROGRAMS

FROM THE INVENTIVE TO THE SWIFT

HUMAN-POWERED VEHICLE SENIOR DESIGN PROJECT

The Human-Powered Vehicle, one of Tech's ME-EM ongoing Senior Design projects, fared well in national competition. The MTU student team brought home the *Design and Innovation* award in April of 2004 for the third consecutive year.

The competition, sponsored by the American Society of Mechanical Engineers, is comprised of four separate events: a sixty kilometer endurance race, a two-hundred yard sprint, a utility race, which simulates realistic city driving, and a technical report (including design

and innovation), where the Tech team achieved a perfect score this past spring.

The competition challenges students to design, build, and race a vehicle solely powered by human means with no stored energy or power for locomotion—similar to a bicycle.

For the past three competitions, Tech's team set their sights on winning the *Design and Innovation* award. "That's where the engineering is," says Associate Professor John Gershenson, the team's faculty advisor.

In the 2003 competition, Tech students tried something new. The team decided against the traditional method of having the driver of the bobsled-sized vehicle face forward with their feet out in front—a method commonly used when

2004 Human-Powered Vehicle Senior Design Team.



driving ordinary automobiles. Instead, they decided to have the driver in a face-forward, prone position, or as they call it: "Brains in Front of Butts" (BIFOB).

The more common technique of feet forward has several disadvantages. For one, it requires the driver to either power the front wheel by foot, making steering difficult; or it requires steering with the rear wheels, which can be awkward. Even worse, it requires a long, inefficient transmission system extending from the front to the rear wheel. By going prone and facing forward, the feet are directly over the rear wheel and the hands are forward, directly over the steering wheel. This system, the BIFOB, is all part of what Gershenson calls an efficient "linear drive" system, a system pioneered at Michigan Tech.

"This is an engineered product from beginning to end," Gershenson says, "from concept to design to prototyping to testing to manufacturing. It's all from scratch," he adds—including the fairing and the frame, both of which the students made from a composite of carbon fiber, foam, and resin. "We designed and fabricated it ourselves. It was fantastic. By graduation, these students will have learned more about composites than nearly any other undergraduates in the country," Gershenson says.

MTU's team also refined a concept introduced in 2002—the capability of switching from two to three wheels and back again. Gershenson says, "We noticed that vehicles with three wheels were winning the utility race, and the

vehicles with two wheels were winning the sprint and endurance races. Nobody was getting the best of both worlds. So we wanted one vehicle to compete in all three races." A wrinkle that took the students a mere five minutes to iron out in one routine pit stop. "Everybody was watching us," Gershenson says. "They were enthralled with what we were doing. It was great."

However, the Michigan Tech team continues to innovate. When asked about how the team plans to improve the wheel-changing aspect, says Gershenson, "We have run that course. We started it and improved it. There's really no innovation left. To do it again, we'd be recreating the same thing." So, for 2005, they are going to shoot for speed—a combination of lightness, minimal drag, and an efficient drive train—where they haven't fared as well. "All that innovation has cost us some speed," points out Gershenson. The emphasis for 2005 will be on developing a more efficient linear drive, weight reduction, a design for a windowless vehicle with a vision system, and improving the fairing component alignments—all work that he explains involves rigorous engineering analysis.

However, Gershenson also stresses the other, non-engineering skills the team acquires through participation in this fun and unique event. Half the challenge is in managing a team of Michigan Tech's size, approximately twenty students. Additionally, they also learn about the process of going from idea to product; a process that will need to be honed for the upcoming competition. They plan to take less time for design and creativity to allow for more time for fabrication, testing, and analysis.

"FOR THE PAST THREE COMPETITIONS, TECH'S TEAM SET THEIR SIGHTS ON WINNING THE DESIGN AND INNOVATIONS AWARD."

STUDENT ADVISORY COMMITTEE

CHARTER

Charge:

(i) To advise the Chair and the faculty about special concerns of the students, and to provide feedback of student opinion on matters referred to the committee by the Chair.

(ii) To coordinate the calendar of activities of departmental honorary and professional society groups.

Composition:

One representative from each departmental, honorary and professional society. The Department Chair is the Chair of the committee.

Term:

1 year, renewable.

Current members:

David Dame

Aerospace Enterprise and Committee Chair

Joal Derbas

ASME Chair

Grace Eaton

Society of Women Engineers Rep.

Brigham Erickson

Challenge X Leader

Kiran Khadke

Graduate Student Council Rep.

Laura Koning

SAE President

Chad Morrison

Challenge X Leader

Akshay Patil

Graduate Student Council Rep.

Sandeep Pavnaskar

Graduate Student

Jordan Wadsworth

Freshmen Advisory Board Chair

Other representatives:

Pi Tau Sigma, Honorary Mechanical

Engineering Fraternity

Tau Beta Pi, Engineering Honor Society

American Society of Mechanical

Engineers

Harold Evensen

Director of Undergraduate Studies

William W. Predebon

ME-EM Department Chair

TEAM PLACES SECOND IN COMPETITION

CLEAN SNOWMOBILE CHALLENGE ENTERPRISE

Let it snow, let it snow, let it snow... That's the wish some folks are making for the upcoming winter season which will provide the ME-EM Department, in conjunction with Michigan Tech's Keweenaw Research Center, the opportunity to successfully host the 2005 Clean Snowmobile Challenge (CSC) for the third consecutive year.

The CSC, sponsored by the Society of Automotive Engineers, challenges student teams to re-engineer a stock snowmobile to reduce emissions, noise, and fuel consumption, while maintaining or even improving its

performance. Teams are also judged on sled performance and how exciting the sleds are to ride.

More than one-hundred and fifty students, most from the northern region of the country, will participate in the sixth annual upcoming competition. Seventeen collegiate teams will test their engineering designs against one another during this four-day event. Universities from Idaho, Maine, New York, Wyoming, Colorado, Minnesota, Michigan, Wisconsin, and Ontario are scheduled to compete. Tech will host this event for the third consecutive year. The first three challenges were held near Jackson, Wyoming.

In the 2004 competition, Michigan Tech placed second for the second year in a row in the overall challenge rankings. The team also earned both the Quietest Snowmobile and Best Performance awards, as well as the Blue Ribbon Coalition Award for Most Practical Solution. Bernhard Bettig, ME-EM Assistant Professor and Faculty Advisor for the competition, said of Tech's showing in 2004, "Excellent! This is the best we've ever done. I'm very happy with their performance and hopefully we'll do even better next year, since only four members of the team have graduated."

Other teams that participated in the 2004 competition were Idaho State University, the University of Idaho, Colorado State University, the University of Wyoming, Kettering University, Minnesota State University-Mankato, Clarkson University, the University of Waterloo (in Ontario), State University of New York at Buffalo, the University of Wisconsin-Madison, and the University of Wisconsin-Platteville.



*The 2003-04 Clean
Snowmobile team.*

ACADEMIC PROGRAMS STUDENTS SHINE AMONG ELITE COMPANY

ME-EM students excelled in the 2004 FutureTruck competition sponsored by the U.S. Department of Energy and Ford Motor Company.

Michigan Tech's team placed fourth in the event that saw fifteen teams from across North America retool a Ford Explorer for lower emissions and increased fuel economy—all without sacrificing performance, utility, safety, or affordability. Tech also finished third in both the Delphi Advanced Powertrain Controls and the Math Works modeling competition.

A hybrid four-cylinder gas-electric engine powered Tech's truck. The team shaved 300 pounds off the weight of the stock truck—making it fifty pounds lighter than the winning vehicle. "And we did it with steel," Nick Manor, a student on the team, proudly says. Because of strength, safety performance, and cost, steel is the material of choice for auto manufacturers.

"Our team did very well," says John Beard, ME-EM Associate Professor and the Team Advisor. Beard received the 2003 NSF Outstanding Faculty Advisor Award for his involvement with Michigan Tech's FutureTruck team.

Beard notes the team's ability to quickly solve problems under pressure. Halfway through the Fuel Economy competition,

FUTURETRUCK COMPETITION ENTERPRISE

Michigan Tech's truck overheated. Due to Houghton's cool climate, the team was unable to test their vehicle in high temperatures prior to the competition. Operating on a warm day, a key fan failed on the truck. The team worked together to make the necessary repairs, but the malfunction pushed the team from second to fourth place.

This was the final year of the FutureTruck competition, but Michigan Tech students will continue to participate in hands-on research and development with leading-edge automotive propulsion, fuels, materials, and emissions-control technologies through "Challenge X: Crossover to Sustainable Mobility." Michigan Tech is one of the seventeen universities selected nationwide to participate in this new competition developed by General Motors

Corporation, the U.S. Department of Energy, and other government and industry leaders.

Michigan Tech is always a strong contender in national automotive competitions. Other competing universities for the 2004 competition were the University of Wisconsin-Madison, Pennsylvania State University, Georgia Institute of Technology, Texas Tech, Virginia Tech, Cornell University, Ohio State University, the University of Idaho, the University of Alberta, the University of Tennessee, the University of Maryland, West Virginia University, Pennsylvania State University, and California Polytechnic State University.



*Members of the 2003-04
Future Truck team.*

EXPANDING ENGINEERING EDUCATION TO MICHIGAN AND BEYOND

DISTANCE LEARNING PROGRAM

Distance learning is quickly becoming an increasingly popular method of instruction nationwide; and Michigan Tech's ME-EM Department is no exception.

A study released July 21, 2003 by the U.S. Department of Education found that the number of students in distance learning courses doubled between 1997-1998 and 2000-2001. Michigan Tech is one of the few universities in the state of Michigan with a distance learning program in

BSE program in 1989 specifically for General Motors employees. The ME-EM Department started its PhD program in 1995, primarily for Ford Motor Company employees. The MS program was created in 1998, offering a global research MS ME degree in conjunction with the University of Bradford, England, and more recently, a coursework-only MS ME degree in partnership with Ford Motor Company. In 2000, it embarked on its design engineering certificate program, again targeting GM employees.

The distance learning programs are delivered either by video tape or are video-streamed via the internet. Cost-conscious community college students are able to stay at home to take their freshman and sophomore classes, and after completing the first two years, then can transfer to Michigan Tech's campus as well-prepared as resident students. Place-bound students are able to complete three years of schooling at the community college through distance learning and then transfer for their final year at MTU or complete their last two years through distance learning at the community college and earn an MTU degree.

"It's a great opportunity for a much larger market," says Mike Needham, Advisor and Coordinator of the ME-EM distance-learning program. "But more importantly, the state cannot grow its technology economy without expanding engineering education. Michigan Tech's leadership in distance learning reflects our commitment to statewide technology business development."



engineering. The ME-EM Department offers three degrees via distance learning—Bachelor's of Science in Engineering (Product Design Minor offered through the College of Engineering), MSME, and PhD—and one certificate in the field of design engineering.

Since its inception, the ME-EM Department's distance learning program has been customer-driven and primarily designed to meet corporate needs. Beginning in 2003, however, the program tapped into a new and larger audience—students at community colleges. The ME-EM Department is currently working in collaboration with Northwestern Michigan College in Traverse City with the ultimate goal of expanding the program to include all community colleges statewide.

The College of Engineering at Michigan Tech and the ME-EM Department implemented the ABET-accredited

The distance learning degree program has expanded far beyond the original programs created for GM and Ford employees. The ME-EM Department is now able to work with any person or organization to develop a distance learning program that will meet individual needs. Companies and organizations that have taken advantage of this opportunity to move beyond education's traditional geographical limitations include the US Army Tank Command, Harley Davidson, Visteon, and INA Bearing.

The ME-EM faculty has instructed over 400 undergraduate and certificate students and over 30 graduate students enrolled in distance-learning classes. These students completed over 2,200 total credit hours in the 2003-2004 academic year. In 2003, Michigan Tech was the largest distance learning provider to General Motors worldwide.

**"MICHIGAN TECH IS ONE OF
THE FEW UNIVERSITIES IN THE
STATE OF MICHIGAN WITH A
DISTANCE-LEARNING PROGRAM
IN ENGINEERING."**

ACADEMIC PROGRAMS UNDERGRADUATES FIND SUCCESS IN THE ME-EM DEPARTMENT

STUDENT SUCCESS CENTER

At the Lagina Family Student Success Center, the ME-EM Department is achieving its mission to prepare students for successful careers. The center integrates the Engineering Learning Center with the Academic Advising Offices, making it easier for undergraduate students to find the academic assistance they need. The Lagina Family Student Success Center provides students with a one-stop resource center.

Students can effectively plan their academic schedules and coordinate enrichment opportunities such as co-ops, internships, and study abroad at the Academic Advising Offices. The Engineering Learning Center is a place for students to get help with lecture material, problem solving, and preparing for exams. "The Student Success Center is a supportive environment where you can get help from people who actually know the answers," said fifth-year Mechanical Engineering Student Andy Richards. Richards came to the Engineering Learning Center for help as an underclassman and is now working there as a coach to help other students succeed in their classes.

Under the direction of ME-EM faculty member Dr. Peck Cho, the Lagina Family Student Success Center is expanding its services beyond academics. In addition to advising and coaching, the center provides guidance to help students succeed in campus life and career development. Undergraduates can meet with peer mentors to discuss issues beyond the classroom. They can also look at resumés of seniors in the department to find out about the many opportunities in Mechanical Engineering.

The Success Center has established a Freshman Advisory Board (FAB) to help the ME-EM Department continue to improve the program for incoming students. Members of the FAB interact

with their classmates outside of the lecture hall and participate in campus events such as Keweenaw Day, Winter Carnival, and Spring Fling. These students also have the opportunity to meet with successful Mechanical Engineers through activities with the Industry Advisory Committee. The Freshman Advisory Board is giving first year students the opportunity to become apprentices for senior design projects. "The whole idea of the Student Success Center is to provide students the opportunity to mingle with successful people," said Cho.

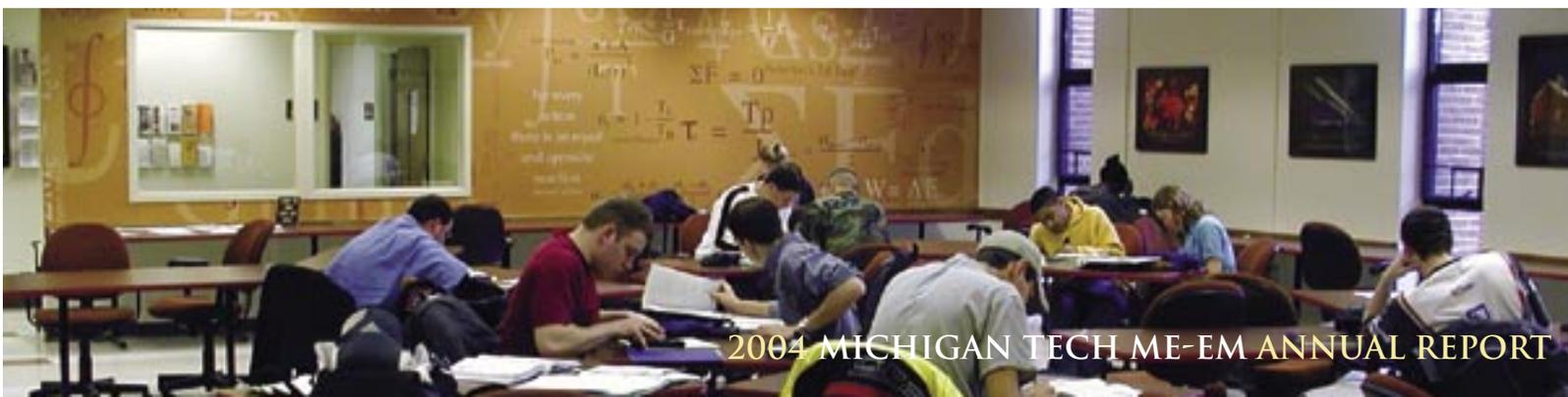
One wall of the Lagina Family Student Success Center is devoted to the Interactive Curriculum Board. This 3-D diagram visually demonstrates the flow of the curriculum from the freshman year to graduation. "It shows students in a very concrete way how the courses are connected to each other," Cho explained. The board helps students understand the relevance of each course to their degree—inspiring them to succeed throughout their academic careers.

The center is also working to make the faculty more accessible

to students. Members of the ME-EM faculty volunteer to hold office hours in the center where they may be easier to approach than they would be in their personal offices. Faculty can also coordinate evening help sessions in the center to provide extra instruction for difficult material.

By helping individual students develop successful academic careers and student lives, the Lagina Family Student Success Center is having a positive impact on the entire ME-EM Department. Cho hopes that one day the center will be truly student centered (student led and student operated). Rather than directly guiding them to success, he will work to provide an environment that allows them to develop into successful people. This, he believes, will truly ensure their success throughout their careers.

"THE STUDENT SUCCESS CENTER IS A SUPPORTIVE ENVIRONMENT WHERE YOU CAN GET HELP FROM PEOPLE WHO ACTUALLY KNOW THE ANSWERS."



ACADEMIC PROGRAMS

ME-EM INVESTS IN UNDERGRADUATE CURRICULUM & LABORATORIES

It is hard to make one of the best Engineering programs in the country better, but Michigan Tech's Mechanical Engineering-Engineering Mechanics Department is doing just that. The ME-EM Department has worked to reshape both its curriculum and laboratories to meet the emerging needs of industry. The improvements provide students the experience they need to pursue successful careers in today's job market.

The ME-EM Department decided that a change was necessary to stay ahead of technological advances within the field, so they wiped the slate clean and rebuilt the curriculum from the ground up. By reviewing the entire field of approaches to educating mechanical engineers, the faculty determined that manufacturing should be offered earlier in the curriculum and combined with design. Prior to the changes, the ME-EM Department focused primarily on design. While there was exposure to the manufacturing process, it was minimal and the students mostly observed, hardly ever physically participating in the manufacturing process.

Beginning in the sophomore year, the ME-EM program closely ties its design classes to its manufacturing classes and places a strong emphasis on manufacturing again during the junior year. Instead of being limited to a single, ten-week class, students are now offered one new fourteen-week course on manufacturing processes and their influence in design and two fourteen-week courses with an integrated exposure to manufacturing, analysis and design. The new curriculum gives students confidence in manufacturing, more opportunities for experimentation with senior design capstone projects, and the ability to obtain

jobs for which they would previously have been marginally qualified.

This extensive shift in the curriculum would not have been possible without a change in the undergraduate laboratories as well. In order to handle the new coursework and demands of a manufacturing and design-focused curriculum, the ME-EM undergraduate laboratories had to undergo major renovations. For instance, prior to the renovation, one manufacturing laboratory had exactly one lathe, one milling machine, and one material testing system. Since the improvements were made in 2000, it holds six lathes, six mills, and three material testing systems. Now, twelve students can simultaneously work and learn in an unprecedented, hands-on manner, instead of merely observing work being done on one machine.

"There is little doubt that our new curriculum is better for the students," says Dr. Michelle Miller, a ME-EM Associate Professor at Michigan Tech. "Where we previously cultivated a small interest in manufacturing from students, we now cultivate a passion. Students have shown a large interest in manufacturing and we have already seen the results from our senior design projects and from the jobs our recent graduates have obtained." She continues, "We couldn't ask for any more." Yet, the sophomore-level Integrated Design and Manufacturing Laboratory is only one of four ME-EM labs that have recently

been improved to better meet the needs of undergraduate students.

The junior-level Integrated Mechanical Engineering Laboratory challenges students with a comprehensive approach to product development and testing with state-of-the-art data acquisition equipment. Rather than focusing on a single topic, the more realistic approach of this laboratory puts several engineering concerns on the bench: performing tests in thermal systems, strength of materials, free- and forced-vibrations, and fatigue. The course culminates in a multi-system test scheme and requires students to characterize the operating behavior of a complex system, such as a washing machine.

The General Motors Energy Laboratory expands the challenge of understanding thermal-fluid behavior using new, state-of-the-art equipment. Each lab section includes multiple experimental set-ups to maximize students' hands on experiences. Offered in the junior year, the Energy Lab teaches students how to use modern data acquisition methods and processing techniques to investigate systems that are discussed in thermodynamics and fluid mechanics courses. This lab provides students with opportunities to use advanced software applications to process



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data recorded in their experiments. In addition, students gain valuable experience writing and formatting scientific reports in the Energy Lab.

As seniors, ME-EM students receive a hands-on introduction to feedback fundamentals, computer-aided control system design, and rapid-prototype control system testing in the Calder

ACADEMIC PROGRAMS

PRESIDENTIAL COUNCIL OF ALUMNAE

Systems and Control Laboratory. Because computer control has become ubiquitous in modern society, understanding the benefits and pitfalls of feedback control is important to prepare mechanical engineers to design complex systems. In the Calder Systems and Control Laboratory, students apply design strategies in conjunction with system modeling to create a controlled system. Software integrated into the laboratory experience allows simulated experimentation prior to hardware experimentation, enabling students to focus on advanced design implications rather than low-level programming issues. The ME-EM Department has redesigned its curriculum and laboratories to create a hands-on learning environment for undergraduate students.



Above: State-of-the-art data acquisition systems. Left: Multi-system testing of a washing machine. Below: Thermal-fluid testing stations in the Energy Lab.

IS HARD TO MAKE ONE
THE BEST ENGINEERING
GRAMS IN THE
NTRY BETTER, BUT THE
EM DEPARTMENT IS
NG JUST THAT."



The Michigan Technological University Presidential Council of Alumnae (PCA) consists of women recognized for achievements in education, industry, service, and support of the university. PCA members assist the University President by identifying activities and programs that will benefit Michigan Tech students, and work with the Department of Educational Opportunity, the Advancement area, and the various academic departments to implement their ideas. The 12 PCA members from the ME-EM Department are listed below.

Mary E. Barker

MS Mechanical Engineering, MTU, 1993; BS Mechanical Engineering, MTU, 1991; MS Biological Sciences, MTU, 1983

Diana D. Brehob

Ford Global Technologies, Inc.
BS Mechanical Engineering, MTU, 1978; MS Mechanical Engineering, University of California-Berkeley, 1982; PhD Mechanical Engineering, University of California-Berkeley, 1985

Nancy Cragel

Ford Motor Company
BS Mechanical Engineering, MTU, 1986

Mary Fran Fisher

Raytheon Technical Services Company
BS Mechanical Engineering, MTU, 1988; MS Business Administration, University of Connecticut, 1993

Kathy M. Grisdela

TRW, Inc.
BS Mechanical Engineering, MTU, 1984; MS Operations Management, Kettering University, 2004

Cynthia Hodges

Ford Motor Company, Large and Luxury Car Vehicle Center
BS Mechanical Engineering, MTU, 1987; MS Mechanical Engineering, MTU, 1990

Susan R. Jesse

Lockheed Martin
MS Mechanical Engineering, MTU, 1981

Tanya J. Klain

General Motors Corporation
BS Mechanical Engineering, MTU, 1990

Rose M. Koronkiewicz

SRI Quality Systems Registrar
BS Mechanical Engineering, MTU, 1981; MS Pastoral Studies, Loyola University - New Orleans, 1989; MBA University of Pittsburgh, 1996

Sandra Skinner

Ford Motor Company
BS Mechanical Engineering, MTU, 1978; MS Industrial Engineering, Wayne State University, 1988

Sheryl Ann Sorby

MTU Associate Dean of Engineering and Chair, Engineering Fundamentals Department
BS Civil Engineering, MTU, 1982; MS Engineering Mechanics, MTU, 1985; PhD Mechanical Engineering-Engineering Mechanics, MTU, 1991

Susan Trahan

Boston Scientific - SCIMED
BS Mechanical Engineering, MTU, 1987; MBA University of St. Thomas, 1994

ACADEMIC PROGRAMS GRADUATE SEMINAR SERIES 2003-04

The ME-EM Graduate Seminar Series is offered as an opportunity for graduate students and faculty to broaden their knowledge beyond their specific area of research and studies. The Seminar Series Committee, chaired by Associate Professor William J. Endres works diligently to provide a full agenda of speakers who are known nationally and internationally and represent academia, industry and government. The intention is to balance the topics across all areas of the department while also integrating a few speakers who traverse the traditional ME-EM boundaries into new and exciting areas.



SPEAKER	INSTITUTION OR ORGANIZATION	TITLE
Prof. L. Cate Brinson	Northwestern University	Why Nanoreinforced Polymers?: Mechanics Issues
Dr. Tia Benson Tolle	U.S. Air Force Research Laboratory	Composites in Advanced Air Force Weapons Systems
Dr. Frank Underdown	Keweenaw Nanoscience Center	Nanomanufacturing
Dr. Roger Myers	Aerojet	Electric Propulsion for Spacecraft: An Industry Perspective"
Dr. Mark Spalding	Dow Chemical	Problems in Single-Screw Extrusion
Prof. Jayathi Murthy	Purdue University	Modeling and Simulation of Sub-Micron Heat Conduction
Dr. Kwan Kwok	DARPA	Moletronics: Vision for the Future of Molecular Electronic Systems
Prof. Sridhar Kota	University of Michigan	Exploiting Elasticity in Engineering Design – Design Methods and Applications
Dr. Christian Hamm	Alfred Wegener Institut for Polar and Marine Research, Germany	Form and Function of Shells Surrounding Diatoms and other Unicellular Organisms
Dr. Jaime A. Camelio	University of Michigan	Dimensional Variation Analysis in Multi-Station Assembly Systems
Dr. Tim Roggenkamp	General Motors Corporation	Observations on Noise and Vibration Challenges in the Automotive Industry
Prof. Karthik Ramani	Purdue University	Similar Shape Search with a Hierarchical Shape Representation
Prof. Gordon G. Parker	Michigan Technological University	Challenges and Prospects of Coulomb Spacecraft Formations
Dr. Kenton R. Kaufman	Mayo Clinic	BIOENGINEERING: Challenges and Opportunities
Prof. Scott L. Post	Michigan Technological University	Characterizing Base and Fore-body Drag on a Blunt-Base Vehicle
Prof. Satyandra K. Gupta	University of Maryland	Automated Design of Multi-Stage Molds: A Step towards Cost Effective Manufacturing of Multi-Material Objects
Prof. David R. Shonnard	Michigan Technological University	Eco-efficiency Analysis of Chemical Products and Processes
Dr. J. Michael Fife	U.S. Air Force Research Laboratory	Electric Space Propulsion Development at the Air Force Research Laboratory
Dr. James M. Boileau	Ford Research and Advanced Engineering	The Effect of Solidification Time on the Mechanical Properties and Fatigue Behavior of a Cast 319 Aluminum Alloy
Prof. Hyungsuck Cho	Korea Advanced Institute of Science and Technology (KAIST)	Opto-Mechatronic Technology: The Fusion of Optical and Mechatronic Engineerings
Dr. Frank E. Goodwin	International Lead Zinc Research Organization	Production and Application of Advanced High Strength Galvanized Steels in Automotive Bodies and Structures
Prof. Patrick Kwon	Michigan State University	Enhancing the Nature of Tool Wear in Machining
Dr. Mohammad Kassemi	NASA Glenn Research Center	Fluid-Structural Dynamics of The Vestibular System during Ground-based and Microgravity Caloric Tests
Prof. David Rosen	Georgia Institute of Technology	Process Planning for Additive Manufacturing: Issues, Methods, and Challenges
Dr. Susan M. Ward	Ford Research and Advanced Engineering	Building Car Bodies in the 21st Century - Joining Dissimilar Materials
Dr. Eric Baumgartner	NASA's Jet Propulsion Laboratory	Driving Rovers on Mars: Challenges and Opportunities associated with Robotic Planetary Explorers
Prof. Victor Birman	University of Missouri - Rolla	Wrinkling in Sandwich Composite Structures subject to Multiaxial, Dynamic and Thermal Loads
Prof. Vijay Dhir	University of California - Los Angeles	Is the Prediction of a Nucleate Boiling Heat Transfer a Hopeless Task?

41 ALUMNI
2004 ACADEMY
INDUCTEES

ACADEMY OF
MECHANICAL ENGINEERING-
ENGINEERING MECHANICS

The Purpose of the Academy is to honor outstanding graduates of the Michigan Technological University Department of Mechanical Engineering-Engineering Mechanics. Selection into the Academy recognizes excellence and leadership in engineering and civic affairs.

This induction honors some of the most successful of the more than eleven-thousand ME-EM alumni of Michigan Tech. Portraits and a brief biography of Academy members are prominently displayed in the ME-EM building to serve as inspirational role models for future mechanical engineering and engineering mechanics students.



ERIC A. NIELSEN
'80 BSME

Eric A. Nielsen earned a BS Degree in Mechanical Engineering in 1980 at Michigan Tech and went on to earn an MBA in Finance & International

Business at the University of Chicago in 1988. After graduating from Michigan Tech he started as a consulting engineer with Hazard Engineering in Morton Grove, IL. From 1983 to 1994 he held engineering and management positions at Omron Electronics in Illinois, Conveyor Equipment Division in Mississippi, and FMC Corporation in Pennsylvania. In 1994 he joined Volvo Construction Equipment Parts in Eskilstuna, Sweden as Vice President of Business Control and Information Systems. From 1997 to 1998 he was Chief Financial Officer of WECO Metals in Illinois. In 1998 he became Chief Financial Officer and de facto CIO of Volvo Construction Equipment Korea, Ltd. In 2000 he assumed his current position of President and CEO of Volvo Excavators and Volvo Construction Equipment Korea, Ltd.

Eric's awards include the Gold Industry Medal from the Government of Korea, the Achievement Award from the Ministry of Industry & Resource for achieving \$300 million in exports, and the Safety Management Award from the Ministry of Labor and the Presidential Award for Manufacturing Based Technology. In 2002 he received the Gold Tower Award for meritorious service from Korean President Dae-Jung. He is an active volunteer for Habitat for Humanity, Korea. Since 1988 he has been a lecturer in the Graduate School of Management at the International Management Institute in Seoul, Korea.

While at Michigan Tech, Eric was active in ASME, Skydiving Club, Four Wheelers, and intramural sports. Eric has reestablished his connection to Michigan Tech through Volvo. In 2003, Eric recruited two Michigan Tech students

through his Engineering Internship Program. Last year, four Korean students from Michigan Tech participated and three of the four accepted permanent employment with Volvo. Eric and his wife Vicky have three children and live in Seoul, South Korea.



JAMES L. REUM
'53 BSME

James L. Reum graduated from Michigan Tech in 1953 with a BS in Mechanical Engineering and later earned an MBA from Xavier University in 1965 and his P.E. license from the State of Ohio in 1959. Jim started his career at General Electric (GE) in 1957 after serving in the United States Army Aviation Division as a company commander and as a pilot in Korea. He began as a process engineer at GE and later held various management positions including Director of Engine Maintenance at United Airlines in California, Executive Vice President of Engine Operations at Cooper Airomotive (now Avicell, Inc.) in Texas, and Executive Vice President and General Manager of Chromalloy, Gas Turbine Corporation in Oklahoma.

From 1986 to 1990 he was self-employed as a management and engineering consultant to companies in the aerospace industry. In 1990 he joined Jet Aviation Corporation, a subsidiary of HEICO, as Director of Research and Development. From 1991 to 1998, he served as President of LPI Industries Corporation, a subsidiary of HEICO and as President of Jet Avion Corporation from 1996 to

1998. He was Chief Operation Officer of HEICO from 1995 to 1999. Jim became Executive Vice President of HEICO Aerospace from 1993 until he retired from full-time service in 2001. In 2001, HEICO sales were \$171.3 million with 1,021 employees. In his "retirement" he works part-time for HEICO Aerospace Holding Corp.

While a student at Michigan Tech, Jim was a member of the varsity golf team and Sigma Rho fraternity. He was also a Cadet Captain in the Army ROTC. In 2001, Jim and Ann established the James and Ann Reum Endowed Scholarship at MTU to recognize undergraduate students majoring in mechanical engineering. Jim has been active in community and charitable groups such as the Chamber of Commerce and the United Appeal Fund. He and his wife Ann have grown children and live in Plantation, Florida.



DR. HUSSEIN ZBIB
'81 BSME, '83 MSME, '87
PHD ME-EM

Hussein M. Zbib earned a BS in Mechanical Engineering in 1981, an M.S. in Mechanical Engineering in 1983 and a PhD in Mechanical Engineering-Engineering Mechanics in 1987 all from Michigan Tech. In 1988 he was hired as an Assistant Professor in the School of Mechanical and Materials Engineering at Washington State University. He was promoted to Professor in 1998. Currently he is Interim Director and Professor of the School of Mechanical and Materials

Engineering at Washington State University (WSU) Pullman, WA. While at Michigan Tech he taught for seven years as a graduate student, Instructor and Visiting Assistant Professor. He is also the Director of the Computational Mechanics and Materials Laboratories at WSU.

In 2003 he received the 2003 Computational Mechanics Achievement Award from the Japanese Society of Mechanical Engineers for his distinguished achievements in the field of computational mechanics. He was named a fellow of ASME in 2001 which recognizes exceptional engineering achievement and contributions to the engineering profession. Other awards include the 1994 Research Excellence Award from the College of Engineering at WSU, the 1994 and 2000 Research Award from the School of Mechanical and Materials Engineering at WSU, two Japanese Fellowships, the NSF Research Initiation Award, and a NATO Fellowship.

He is very active professionally and serves on a number of national and international committees. He was selected as the Associate Editor of the ASME Journal of Engineering Materials and Technology in 1997. He is a member of the Advisory Board on the International Journal of Plasticity, Member of the Board of Review of Metallurgical and Materials Transactions, Member of the International Advisory Board: Materials Science Research International in Japan 2001, and Review Committee Member of the "Revue de Mecanique Appliquee et Theorie, Morocco Society of Mechanics Science." He is the chair of the joint ASME MD-AMD Committee on Constitutive Equations. His publication record includes six edited books and over 160 technical articles. He and his wife, Marcia, reside in Pullman, WA.

ACADEMY OF MECHANICAL ENGINEERING - ENGINEERING MECHANICS MEMBERS (GRADUATION YEAR)

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Carl E. Avers '62
Richard Bayer '44
Wilfred S. Bobier '43
John S. Cook '42
Charles D. Cretors '63
Charles D. Cronenworth '44
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Dean J. Driver '65
John L. Drake '64
Theodore R. Edwards '50
Edward J. Gaffney '51
Joseph A. Gemignani '53
John O. Hallquist '72
William F. Hartwick '48
Gerald L. Haycock '68
Ralph Hayden '33
Richard W. Henes '48
David C. Hill '65
Raymond W. Kauppila '61
K. Peter Knudsen '64
Martin G. Lagina '77
Charles L. Lamoreaux '56
Charles J. Laurila '59
Gary R. Lawrey '79
Craig C. Lazzari '42
Albert J. Maki '48
Paul A. Masini '69
Thomas G. McKie '47
Fred C. Mitchell '61
Robert E. Monica '50
Lawrence Mulholland '55
Merle C. Potter '58
Norman R. Pratt '42
Kamlakar Rajurkar '78
Jack G. Real '37
Daniel L. Rivard '59
Richard J. Robbins '56
Harold J. Schock, Jr. '74
Frederic C. Sherriff '64
James E. Sorenson '60
James B. Stone '40
Paul W. Swift '33
Camiel E. Thorrez '70
Robert W. Thresher '70
William A. Turunen '39
James G. Vorhes '47
Thomas K. Walker '62
Harold J. Wiens '63

DONATIONS

“BUILDING FOR THE FUTURE” PHASE I & “ENDOWING EXCELLENCE” CAMPAIGNS

The generosity of donors to our *Building for the Future* Campaign has been truly remarkable. Their contributions accelerate the development and expansion of education and research in the ME-EM Department, and their generosity serves as a reminder to all faculty, staff, and students of the important role that education and research play in society.

Phase I of the *Building for the Future* Campaign exceeded the goal of \$2.8 million by twenty nine percent, having raised \$3.6 million. Phase I was an investment in our undergraduate program. It focused on creating four required labs with state-of-the-art equipment and creating new learning environments including the student success center and a world-class senior design program and facilities.

Phase II of the *Building for the Future* Campaign is called *Endowing Excellence* with a goal of raising \$54 million by 2010. It is all about people—attracting, rewarding and retaining the best faculty, students, and staff. The focus is on endowed faculty chairs, endowed fellowships and scholarships, endowed department, and endowed student-enriching programs.

PHASE I - STAGES 1 & 2 CONTRIBUTIONS OF \$10,000 OR MORE

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Chad Fisher & Tricia Elston
Mary Frances Fisher
Shivan & Kurt Forster
Gustav H. Frangquist P.E.
Arthur & Marcy Gajewski
Gary & Rita Gay
Michael & Kristie Gerulski
Gene F. Gilligan
Kathy & Paul Gridela
Thomas & Kathleen Gunning
Jon & Suzanne Harry
Todd & Kerrie Haugh
Ron & Diane Hemming
Michael C. Herbert
Phillip E. Hill
John & Margaret Hilton
Cynthia Protas Hodges
Bruce & Mary Hoffenbecker
Thomas & Joanne Hofman
Marc & Janet Hotchkiss
Leif E. Hovin
Robert J. Hughes
Susan Ilax
Alice & Kevin Irwin
Kenneth Jackson
M.R. & Shirley Jacoby
John & Mary Jaye
Robert & M. Jean Besner Thresher
Patrick & Laura Johnson
Bernard A. Jorgensen
Todd & Becky Jozwiak
Michael L. Jurosek
John & Kristi Jajander
Roger A. Karl
Jeremy L. Karnowski
Michael & Joy Keagle
Donald & Terralynn Keski-HynnTimer
Timothy & Laura Kilbride
David & Marguerite Kimball
Dale & Delores Klawitter

Robert Napp & Dr. Mary Janet Kachmarski
 David Knauer & CDJKR Consulting
 Otto Koch
 Fred & Lou Anne Koerschner
 Stephen & Kris Kolpacke
 Kurt Korpela
 James E. Koski
 Arron Kowalczyk
 Steven J. Kuehl
 Roger W. Lange
 Mark & Patricia Lecznar
 John & Joan Leinonen
 Lowell & Peggy Lepisto
 Jurt Weshphal & Carol Lindsay-Weshphal
 Lynn & Nancy Lohman
 Patrick & Joanne Macaulay
 Cynthia MacDonald
 Robert & Tracey Marzonie
 Roy T. Mattson
 James & Linda Mattson
 James & Barb McKenna
 Charles H. Melcher
 Robert & Mary Melvin
 Michele Miller
 Ibrahim Miskioglu & Ayse Nur
 Michael J. Molenda
 Brenda M. Moyer
 Lawrence K. Mulholland
 Brian & Anne Naszradi
 Thomas C. Newhouse
 Michael O'Brien
 David & Susan O'Donnell
 William K. Ojala
 Mark & Julie Osborne
 Gary & Gail Oshnock
 Joseph & Wanda Osterman
 James W. Pakkala
 Timothy J. Palmer
 Sudhakar & Maneesha Pandit
 Joseph A. Panella
 Ying Pang
 Theodore & Catherine Pardike
 Charles R. Paterka
 Eszter & Tibor Pattantylus
 Bradley Patton
 Dr. Debabrata & Maitreyee Paul
 Steve & Barbara Penkevich
 Ahti & Dorothy Petaja
 James S. Peterman
 Christopher J. Petitpren
 Christopher J. Plude
 Brian M. Pospeck
 Norman & Ruth Pratt
 Peter T. Prouty
 James M. Quantrell
 Stanley C. Rajala
 Jan & Ellen Rankinen
 Albert Reif
 Ferdinand J. Remondino
 Douglas S. Ringwelski
 William Risteen
 Juan & Dorothy Rizza
 William P. Robinson
 Richard Routsala
 John & Catherine Rowe
 Ronald Rupert
 James A. Russell
 David M. Russler
 Gail L. Sanchez
 A. Michael Santoski
 Steven W. Sawby
 Alan J. Schmitt
 Howard & Patricia Schuman
 Ee Seng Sim & Loo-Yee Sim
 James M. Sima
 Alex & Mary Kay Simon
 Judy & Paul Smigowski
 Charles Smith
 Rob & Heather Springer
 Robert & Alicia Starbowski
 David & Colleen Stein

Jeffrey & Karen Stroven
 Dr. Narasipur & Pramila Suryanarayana
 Eric C. Suyham
 Steven Swartz & Annette Viges
 Chester & Elenora Taylor
 Tim & Lori Thomas
 Camiel E. & Ann Marie Thorrez
 Robert & Lori Turnbull
 Charles & Lois Van Karsen
 Daniel & Catherine Vandersluis
 Larry J. Vojtech
 James J. Vonk
 Victor & Michelle Vukorpa
 Don H. Wacker
 Julie & Michael Wank
 Neil Wasylewski & Qiong Sun
 Dorothy N. Watson
 Dr. Thomas W. & Synthia Webb
 Richard C. Weinert
 Keith W. Weishuhn
 Steven & Donna Wesoloski
 Wayne & JoAnne Wheelock
 Charles & Angela Whitmer
 Lcdr. Gary L. Wick
 Harold & Claudia Wiens
 Daune E. Williams
 Steven L. Williams
 Jennifer & Jason Wilson
 Robert & Elizabeth Wise
 Virginia M. Wishart
 Debra D. Wright
 Larry & Sue Yager
 Kevin Zajac
 Paula Feira Zenner
 Dr. Yi Zhao

**PHASE II
 CONTRIBUTIONS OF
 \$10,000 OR MORE**

John & Joan Calder
 Paul DeBaeke
 Paul & Sandra Fernstrum
 Douglas & Shelby Hamar
 Albert J. & Beatris Maki
 Lynn Peterson
 William & Mary Ann Predebon
 Forest & Coretta Randall
 James & Ann Reum
 William & Marian Scott
 Frederic & Wanda Sherriff

**ADDITIONAL PHASE II
 CONTRIBUTORS**

Frank E. & Leslee Agosti
 Jerry & Patricia Aho
 Duane & Karen Aho
 Dante & Ruth Balanga
 Kathleen Grisdela
 Charles & Marilyn Knauer
 Fred & Lou Anne Koerschner
 John Leinonen
 Paul Masini
 Peter T. Prouty
 Wallace & Helga Renn
 Dale & Sarah Roberto
 Peter & Anita Sandretto
 John Schweikert
 Earl & Sylvia Seppala
 Ron & Elaine Starr
 Dr. Narasipur Suryanarayana
 Robert W. Thresher
 Geoffrey & Terri Weller
 Virginia & James Wishart
 Paula & Mark Zenner

**MICHIGAN TECH
 ME-EM GRADUATE
 FELLOWS 2003-2004**

Alumni Fellowship

Ke Li
 Thomas Mayer
 Kenneth Gunter
 Zhen Zhang

Century II Henes Fellowship

Kenneth Gunter
 Xuefei Hu

Cummins Fellowship

Mohammed Hasan

DaimlerChrysler Fellowship

Andrew Barnard
 Melissa Marszalek

Ford Fellowship

Karl Haapala
 Vishesh Kumar

GAANN Fellowship

Christopher Henning
 Scott Miers
 David Horstman

NSF Teaching Fellowship

William Peers

NSF Fellowship

Rebecca Petteys

Thorton Endowed Fellowship

Fang Guo
 Sandeep Pavnaskar

Winnikow Fellowship

Brian Eggart
 Mehmet Inal
 Alexander Kieckhafer
 Sharizal Shaik Ahmedullah
 Jichao Sun
 Foo Chern Ting
 Xiaomin Wang

**Integrative Graduate Education
 and Research Traineeship**

Karl Haapala
 Margot Hutchins
 Julio Rivera

CONTRACTS & GRANTS

DESIGN & DYNAMIC SYSTEMS

The following contracts and grants were active in fiscal year 2004. Over twenty percent of ME-EM research is sponsored by industrial partners. This is a very high level of industry support and illustrates the high quality of engineering research at MTU.

SPONSOR	TITLE	PRINCIPAL INVESTIGATOR	TOTAL AWARD
GENERAL MOTORS CORPORATION	Creation of an MTU Demanufacturing Lab (Co-PI: Sutherland, John W.)	Bettig, Bernhard P.	\$10,000
AUTOLIV CORP.	AutoLiv NVH Short Course	Blough, Jason R.	\$6,500
AUTO LIV NORTH AMERICA	Various Sponsors: Steering Wheel Natural Frequency Testing (Co-PI: Parker, Gordon G.)	Blough, Jason R.	\$4,667
GENERAL MOTORS CORPORATION	Application of GM-GMS to Manufacturing Engineering	Gershenson, John K.	\$137,334
HARRY CROSS	Eccentric Propulsion Scooter (Senior Design)	Gershenson, John K.	\$17,250
NATIONAL SCIENCE FOUNDATION	Selection of Industrial Coatings Based on Environmental and Societal Impact Characteristics	Gershenson, John K.	\$627,515
NATIONAL SCIENCE FOUNDATION	Product Modularity-The Link Between Product Architecture and Product Life-Cycles/Costs	Gershenson, John K.	\$372,715
NATIONAL SCIENCE FOUNDATION	Research Experiences for Undergraduates in Product Modularity	Gershenson, John K.	\$12,000
NISSAN TECHNICAL CENTER	Thin Seat Back (Senior Design)	Gershenson, John K.	\$15,000
FORD MOTOR, INC.	2004 C3PNG PTO Support	Lumsdaine, Edward	\$397,633
FORD MOTOR, INC.	2004 Funding for a C3PNG Technical Administrator	Lumsdaine, Edward	\$137,026
FORD MOTOR, INC.	2003 Funding for a C3PNG Subject Matter Expert	Lumsdaine, Edward	\$89,155
FORD MOTOR, INC.	2003 C3PNG PTO Support	Lumsdaine, Edward	\$466,072
FORD MOTOR, INC.	2003 C3PNG Support	Lumsdaine, Edward	\$246,225
FORD MOTOR, INC.	Graduate Studies in Entrepreneurship	Lumsdaine, Edward	\$148,434
FORD MOTOR, INC.	2004 C3PNG Support	Lumsdaine, Edward	\$194,309
OFFICE OF NAVAL RESEARCH	High Capacity At-Sea Transfer of Materials, etc. (Co-PI: Blough, Jason R.)	Parker, Gordon G.	\$165,616
NATIONAL SCIENCE FOUNDATION	Graduate Research Fellowship	Parker, Gordon G.	\$87,800
BMT DESIGNERS &	System Identification of Hydrostatic Transmissions for Pendulation	Parker, Gordon G.	\$45,698
CATERPILLAR, INC.	Development and Application of Correlation Processes for Caterpillar's Machining Simulation Models	Parker, Gordon G.	\$29,855
NSWC CARDEROCK	Development of a Hydraulic Pump Internal State Measurement System	Parker, Gordon G.	\$97,910
JOHN DEERE CO.	Measurement of Acoustic Absorption of Crass Surfaces Using the In-Situ Method	Rao, Mohan D.	\$19,600
CATERPILLAR, INC.	CB-534D Vibratory Asphalt Compactor Cab Noise Reduction	Van Karsen, Charles D.	\$18,500
NATIONAL SCIENCE FOUNDATION EEC	Multi-Semester Interwoven Projects for Teaching Basic Core Stem Material Critical to solving Dynamic Systems Problems	Van Karsen, Charles D.	\$31,413
WHIRLPOOL CORP.	Field Test-Operational Parameters Data Collection System: Phase 1	Van Karsen, Charles D.	\$22,000
WHIRLPOOL CORP.	Sound and Vibration of a Prototype Dryer	Van Karsen, Charles D.	\$37,500
NATIONAL SCIENCE FOUNDATION	Senior Engineering Design Projects to Assist Disabled Persons (Co-PI: Nelson, David A., Beard, John E.)	Wright, Debra D.	\$16,089

CONTRACTS & GRANTS SOLID MECHANICS

SPONSOR	TITLE	PRINCIPAL INVESTIGATOR	TOTAL AWARD
OHIO UNIVERSITY	Science and Engineering of Carbon Foams	Gao, Xin-Lin	\$163,000
US DEPT OF DEFENSE- AIR FORCE-OSR	Modeling of Nanotube-Reinforced Polymer Composites	Gao, Xin-Lin	\$31,935
STRYKER	Tension and Compression Tests of Polyvinyl Alcohol Hydrogel for Meniscal Replacement	Haut Donahue, Tammy L.	\$26,700
TUTOGEN MEDICAL INCORPORATED	Mechanical Properties of Bone-Patellar Tendon-Bone Grafts	Haut Donahue, Tammy L.	\$17,600
WHITAKER FOUNDATION	Mechanotransduction in the Meniscus	Haut Donahue, Tammy L.	\$319,661
MI STATE GOVERNOR'S TASK FORCE COMMITTEE	An Experimental Study to Investigate Fracture Pattern Differences in the Pediatric Skull for Internationally Inflicted and Accidental Free Fall Impacts	Jayaraman, Gopal	\$125,000
DAIMLERCHRYSLER CORPORATION	Development of Mechanical Fastener Systems for Joining Glass-Fiber Reinforced Polyethylene Terephthalate (PET) Composite Components to Steel (Co-PI: Miskioglu, Ibrahim)	Ligon, John B.	\$123,333
USDA FOREST PRODUCTS LABORATORY	A Study to Examine the Use of Transverse Vibration Nondestructive Techniques to Determine Residual Stiffness and Strength of Timber Bridges (Co-PI: Evensen, Harold A., Van Karsen, Charles D.)	Ligon, John B.	\$184,806
HYDRO ALUMINUM/ SINTEF	Hydroforming of Aluminum Extrusions	Subhash, Ghatu	\$299,506
OAK RIDGE NATIONAL LABORATORY	Scratch Hardness Tester	Subhash, Ghatu	\$16,000
OAK RIDGE NATIONAL LABORATORY	Plasticity Limits for Structural Ceramics Under Instrumented Single-Grit Scratch Testing	Subhash, Ghatu	\$188,844
NATIONAL SCIENCE FOUNDATION	GOALI-Ultrafine Grained and Nanostructured Ceramics: Influence of Processing Grain Size and Strain Rate on Fracture Characteristics (Co-PI: Gao, Xin-Lin)	Subhash, Ghatu	\$405,044
NORSK-HYDRO	Internship at Norsk-Hydro in Norway for Adam Loukus	Subhash, Ghatu	\$16,000
SANDIA NATIONAL LABS	Sabbatical at Sandia National Laboratories	Subhash, Ghatu	\$62,000
US DEPT OF DEFENSE- ARMY	High Strain Rate Characterization of Bulk Amorphous Metals	Subhash, Ghatu	\$279,820

CONTRACTS & GRANTS

ENERGY

THERMOFLUIDS

SPONSOR	TITLE	PRINCIPAL INVESTIGATOR	TOTAL AWARD
US DEPT OF EDUCATION	GAANN: Fuel Efficient Hybrid Compatible Internal Combustion Engines	Anderson, Carl L.	\$163,980
US DEPT OF ENERGY	Direct Injection Compression Ignition Diesel GATE Program (Co-PI: Cho, Peck, Johnson, John H., Michalek, Donna J., Yang, Song-Lin)	Anderson, Carl L.	\$91,107
GENERAL MOTORS CORP.	Noise Measurements in an Automotive Torque Converter (Co-PI: Blough, Jason R, Evensen, Harold A.)	Anderson, Carl L.	\$403,240
GENERAL MOTORS CORP.	Experimental Determination of Turbine Blade Tip Loading	Anderson, Carl L.	\$86,378
GENERAL MOTORS CORP.	Experimental Determination of Turbine Blade Inlet Tip Loading (Co-PI: Blough, Jason R.)	Anderson, Carl L.	\$96,510
VISTEON	Electronically Controlled Powertrain Cooling (Co-PI: Anderson, Carl L., Yang, Song-Lin)	Arici, Oner	\$307,643
NATIONAL INSTITUTE OF INTERNATIONAL EDUCATION DEVELOPMENT	Short Term Professional Development Program for Korean Secondary Teachers of Science and Vocational Education	Cho, Peck	\$149,468
WHITAKER FOUNDATION	Modeling and Measuring the Effects of Microcracks on Fluid Flow in Bone (Participating Member: Michalek, Donna J.)	Donahue, Seth W.	\$239,496
JOHN DEERE CO.	The Modeling of a Continuously Regeneration Particulate Trap in a Heavy-Duty Diesel Engine w/Cooled Low Pressure EGR (Co-PI: Yang, Song-Lin)	Johnson, John H.	\$60,000
GENERAL MOTORS CORP.	Development of a Diesel Particulate Filter Simulation Code Using Matlab/Simulink (Co-PI: Yang, Song-Lin)	Johnson, John H.	\$108,084
CUMMINS ENGINE CO.	Grant Michigan Tech Fund	Johnson, John H.	\$40,000
UNIVERSITY OF WISCONSIN	Army Research Office Grant (Co-PI: Anderson, Carl L., Arici,Oner, Parker, Gordon G.)	Johnson, John H.	\$770,000
JOHN DEERE CO.	Gift Michigan Tech Fund	Johnson, John H.	\$10,000
GENERAL MOTORS CORP.	Software License Agreement (Co-PI: Yang, Song-Lin)	Johnson, John H.	\$50,000
UNIVERSITY OF WISCONSIN	Software License Agreement (Co-PI: Yang, Song-Lin)	Johnson, John H.	\$2,000
US DEPT OF ENERGY	Ignition Improvement of Lean Natural Gas Mixtures (Co-PI: Post, Scott L.)	Keith, Jason M.	\$200,890
US DEPT OF DEFENSE-AIR FORCE-OSR	A Vaporizing Liquid-MetalAnode for High-Power Hall Thrusters	King, L. Bradley	\$355,000
NASA JOHN H. GLENN RESEARCH CENTER	Optical Plasma Characterization for Next-Generation Ion Engines	King, L. Bradley	\$85,148
US DEPT OF DEFENSE-AIR FORCE-OSR	Nanosatellite Technology Demonstrator for Earth Remote Sensing	King, L. Bradley	\$125,000
US DEPT OF DEFENSE-AIR FORCE-OSR	Ground-Test Facility for High-Power Electric Thrusters Operating on Condensable Propellants	King, L. Bradley	\$185,000
NATIONAL SCIENCE FOUNDATION	CAREER: Election Fluid Dynamics in a Hall-effect Accelerator: Using Fundamental Research to Enhance Education and Technology	King, L. Bradley	\$756,090
MICHIGAN SPACE GRANT CONSORTIUM	High Power Vacuum Arc Thruster	King, L. Bradley	\$2,500
MICHIGAN SPACE GRANT CONSORTIUM	Procurement of an Inflatable Boom for a Nanosatellite	King, L. Bradley	\$5,000
MICHIGAN SPACE GRANT CONSORTIUM	Probe Studies of Bismuth Plasma as a Hall Thruster Diagnostic	King, L. Bradley	\$5,000
NATIONAL SCIENCE FOUNDATION	Investigation of a Kinematic Coagulation Mechanism to Improve Air Quality in Machining Environments (Co-PI: Sutherland, John W.)	Michalek, Donna J.	\$118,654

LIST CONTINUED ON BOTTOM OF OPPOSITE PAGE

CONTRACTS & GRANTS MANUFACTURING/ INDUSTRIAL

SPONSOR	TITLE	PRINCIPAL INVESTIGATOR	TOTAL AWARD
US DEPT OF DEFENSE-ARMY/DARPA	Research and Infrastructure Development Center for Nanomaterials Research	Friedrich, Craig R.	\$3,770,654
ANONYMOUS SPONSOR	Confidential	Gupta, Mahesh	\$90,019
NATIONAL SCIENCE FOUNDATION	GOALI: Optimum Design of Extrusion Dies Using the Estimated Elongational Viscosity of Polymers	Gupta, Mahesh	\$405,044
NATIONAL SCIENCE FOUNDATION	Small Business Innovative Research	Gupta, Mahesh	\$100,000
NATIONAL SCIENCE FOUNDATION	NUE: Undergraduate Exploration of Nano-Science, Application, and Societal Implications at Michigan Tech (Co-PI: Aifantis, Elisas C., Caneba, Gerard T., Miller, Michele H., Seely, Bruce E.)	Jaszczak, John A.	\$134,396
UES, INCORPORATED	Development of Ion Beam Techniques for Layer Splitting of Oxide Materials (Co-PI: Moon, Kee S., Moran, Peter, D.)	Levy, Miguel	\$370,000
KIMBERLY-CLARK CORPORATION	Data Dependent Systems Joint Engineering Project	Pandit, Sudhakar M.	\$90,720
MTU REF-IF	Nationally Visible Infrastructure: Industry-Directed Planning of Centers (Co-PI: Endres, William J., Gershenson, John K., Sutherland, John W.)	Predebon, William W.	\$15,000
MTU REF-IF	Nationally Visible Infrastructure: The MTU MERL (Co-PI: D'Souza, Roshan, Endres, William J., Friedrich, Craig R., Michalek, Donna J., Miller, Michele H., Sutherland, John W.)	Predebon, William W.	\$34,700
NATIONAL SCIENCE FOUNDATION	Defining a Curriculum for Service Sector Engineering(Co-PI: Bohmann, Leonard J., Frendewey, James O., Mattila, Kris G., Sutherland, John W.)	Sorby, Sheryl	\$99,976
NATIONAL SCIENCE FOUNDATION	IGERT: Achieving Environmental, Industrial, and Societal Sustainability via the Sustainable Futures Model (Co-PI:Gershenson, John K., Michalek, Donna J.)	Sutherland, John W.	\$6,519,794
BOSTON SCIENTIFIC CORPORATION	P2A2 Membership (Co-PI: Endres, William J., Gershenson, John K.)	Sutherland, John W.	\$60,000
UNIVERSITY OF MICHIGAN	An Engineering Research Center in Wireless Integrated Microsystems (Co-PI: Bergstrom, Paul L., Levy, Miguel, Friedrich, Craig R.)	Warrington, Robert O.	\$725,523
FORD MOTOR, INC.	Ford-MTU Off-Campus PhD Program: A Proposal for Advising Support Development of Hybrid Forming Dies for Super Plastic Forming in Aluminum Sheet	Weinmann, Klaus J.	\$53, 050

ENERGY THERMOFLUIDS CONTINUED

NATIONAL SCIENCE FOUNDATION	Research Experience for Undergraduates-Investigation of a Kinematic Coagulation (Co-PI: Sutherland, John W.)	Michalek, Donna J.	\$12,000
NATIONAL SCIENCE FOUNDATION	Prediction and Attainment Capability for Quasi-Steady Internal Condensing Flows: An Integrated Computational/Experimental Approach (Co-PI: Evensen, Harold A.)	Narain, Amitabh	\$349,975
R.W. FERNSTRUM & COMPANY	Investigation of Flow and Heat Exchange Capabilities for FERNCOOL Box Cooler Heat Exchangers (Co-PI: Arici, Oner)	Narain, Amitabh	\$69,138
NATIONAL SCIENCE FOUNDATION	Acquisition of High Speed Digital Imaging System for Multidisciplinary Research at MTU (Co-PI: Miskioglu, Ibrahim, Endres, William J.)	Post, Scott L.	\$214,230
CALIFORNIA SPACE GRANT FOUNDATION	CFD Analysis of Ground Research Vehicle	Post, Scott L.	\$7,500
NASA JOHN H. GLENN RESEARCH CENTER	Numerical Study of Low Emission Gas Turbine Combustor Concepts, Phase V	Yang, Song-Lin	\$107,763

GRADUATES MS & PHD GRADUATES AND ADVISORS 2003-2004

PHD IN MECHANICAL ENGINEERING- ENGINEERING MECHANICS

Gunter, Kenneth L (2004) Advisor: Sutherland, John W
Inventory and Value Management in Demanufacturing Facilities

Huang, Chengyi (2003) Advisor: Subhash, Ghatu
Mathematical Characterization of Road Surface Texture and its Relation to Laboratory Friction Measures

Imaninejad, Mehdi (2004) Advisor: Subhash, Ghatu
Experimental and Numerical Investigation of Tube Hydroforming of Aluminum Alloys

Kowalski, Darin I (2004) Advisor: Anderson, Carl L
Characterization and Prediction of Cavitation Induced Torque Converter Noise

Li, Ke (2004) Advisor: Gao, Xin-Lin
Micromechanical Modeling of Graphitic Carbon Foams

Li, Shengjian (2004) Advisor: Miskioglu, Ibrahim
Contact Problems in a Simple Strain Gradient Theory of Elasticity and Application to Nano-Indentation

Liang, Qiyu (2003) Advisor: Narain, Amitabh
Unsteady Computational Simulations and Code Development for a Study of Internal Film Condensation Flows' Stability, Noise Sensitivity, and Waviness

Liu, Qunli (2004) Advisor: Subhash, Ghatu
Mechanical Behaviour of Structural Polymeric Foams

Niu, Yuming (2004) Advisor: Gershenson, John K
Selection of Industrial Coatings Based on Environmental Impact Characteristics

Sarkar, Debabrata (2003) Advisor: Gupta, Mahesh
Parameter Estimation for Elongational Viscosity of Polymer Melts

Shen, Ge (2003) Advisor: Sutherland, John W
Modeling the Effect of Cutting Fluids in Peripheral Milling

Siow, Yeow-Khern (2003) Advisor: Yang, Song-Lin
A Reynolds-Stress Turbulence Model in the KIVA Code for Engine Simulation

Sun, Jichao (2004) Advisors: Michalek, Donna J & Sutherland, John W
Cutting Fluid Mist Formation and Behavior Mechanisms

Xue, Huanran (2003) Advisors: Sutherland, John W & Pandit, Sudhakar M
Application of Input-Output Modeling to the Environmental Characterization and Improvement of Manufacturing Processes

Zhan, Yumei (2003) Advisor: Friedrich, Craig R
Finite Element Analysis of Induced Damage due to Indentation and Scratching on Brittle Materials

MS IN MECHANICAL ENGINEERING

Bandyo, Raka (2004) Advisor: Subhash, Ghatu
An Investigation of the Scratch Susceptibility of Structural Ceramics

Barnard, Andrew R (2004) Advisor: Rao, Mohan D
Evaluation of Measurement Techniques to Determine the Acoustical Properties of Porous and Multi-Layered Acoustic Treatments

Birru, Krishna (2003) Advisor: Bettig, Bernhard P
Uncovering the Technical Issues Related to Dynamic Solver Selection in Advanced Engineering Environments

Boyapati, Shyammohan (2003) Advisor: Grimm, Thomas R
Influence of the Thickness of a Bracket on the Load Transmitted to the Fasteners in a Bracket and Flange Assembly Considering Preload in the Bolts

Butala, Nikhil V (2003) Advisor: Friedrich, Craig R
An Actuated Cochlear Prosthesis Insertion Tool

Chakraborty, Rajat (2003) Advisor: Haut Donahue, Tammy L
Material and Viscoelastic Properties of Bovine Meniscal Attachments

Chen, Wei (2003) Advisor: Parker, Gordon G
Optimal Sensor Design and Control of Piezoelectric Laminate Beams

Chiang, Wen-Po (2004) Advisor: Patankar, Ravindra P
Engine Speed Control Using Throttle-by-Wire

Chope, Nicholas D (2003) Advisor: Gershenson, John K
Development of Design Guidelines for the Climbing Hold Industry

Cook, Brent R (2003) Advisor: Evers, Lawrence W
Coursework Only

Curlee, John S (2004) Advisor: Nelson, David A
An Approach for Determining Localized Thermal Clothing Insulation for Use in an Element Based Thermoregulation and Human Comfort Code

Dayton, Wendell B (2003) Advisor: Rao, Mohan D
Effects of Environmental Factors on the Measurement of Sound Power with Applications to Snowmobiles

Dhaliwal, Amanjot S (2004) Advisors: Parker, Gordon G & Blough, Jason R
Active Structural Acoustic Control of Road Noise in a Passenger Vehicle

Dinkel, Jared L (2004) Advisor: Blough, Jason R
Algorithms for Autonomous Tandem Operation of a Dual M113 System

Eifler, Robert L (2003) Advisor: Haut Donahue, Tammy L
Oscillatory Fluid Flow Regulates Glycosaminoglycan Production via an Intercellular Calcium Pathway in Meniscal Cells

Flaska, Matthew L (2003) Advisor: Arici, Oner
Coursework Only

Frait, Steve A (2003) Advisor: Parker, Gordon G
Parameter Effects in Magnetic Speed Sensing Through an Interposed Rotating Element

Gan, Jing Voon (2004) Advisor: Parker, Gordon G
Actuator Characterization and Design Improvement

Haapala, Karl R (2003) Advisor: Sutherland, John W
A Model for Predicting Manufacturing Waste in Product Design and Process Planning

Hagemeyer, Catherine A (2003) Advisor: Gershenson, John K
The Classification and Applications of Problem Solving Quality Tools

Harvey, Kristin B (2004) Advisor: Donahue, Seth W
The Effects of Annual Periods of Hibernation on the Material Properties of Black Bear (*Ursus americanus*) Cortical Bone

Henning, Christopher A (2004) Co-Advisors: Post, Scott L & Keith, Jason M
Natural Gas Compression Ignition Engine with Pilot Injection of Dimethyl Ether (DME)

Hicks, Daniel A (2003) Advisor: Rao, Mohan D
A Comparison of Speech Intelligibility between the Callsign Acquisition Test and the Modified Rhyme Test

Holt, John G (2003) Advisor: Rao, Mohan D
The Use of Unique Time History Excitation in the Dynamic Characterization of Elastomers

Hong, Yong Kyu (2003) Advisor: Moon, Kee S
Microscale Fabrication and Motion Measurement of PZN-PT Film Actuators

Howell, James W (2003) Co-Advisors: Ligon, John B & Miskioglu, Ibrahim
Mechanical Fasteners for Thermoplastic Composite to Aluminum Joints Subjected to Dynamic Peel and Shear Loading

Jones, Robert A (2003) Advisor: Jayaraman, Gopal
An Experimental Study to Compare the Bike Air and Prototype Advance Helmet with Respect to Their Responses due to Oblique Impacts

Kantipudi, Vidyasagar (2004) Advisor: Gershenson, John K
Coursework Only

Kemppainen, Jeffrey S (2004) Advisor: Jayaraman, Gopal
A Finite Element Study of the Standard Auto-Bumper When Tested as per the Insurance Institute for Highway Safety Standards and Code of Federal Regulations

Kiilunen, Charles P (2003) Advisor: Bettig, Bernhard P
Coursework Only

Kiiskila, Jason C (2004) Advisor: Van Karsen, Charles D
Caterpillar CB-534D Vibratory Asphalt Compactor Cab Noise Reduction

Krull, Jaime A (2004) Advisor: Gershenson, John K
A Method to Identify Promising Materials - An Enabling Technology for Sustainable Development

Kukula, Lisa A (2004) Advisors: Michalek, Donna J & Sutherland, John W
An Experimental Investigation of Metal Working Fluid Mist Formation During the Wet Turning Process and Mist Reduction Using a Kinematic Coagulation System

Kulkarni, Chandan D (2003) Advisor: Friedrich, Craig R
Chip-level Fluid Connector for Microsystems

Labyak, David M (2003) Advisor: Jayaraman, Gopal
Interpretation of Head Injuries Due to Oblique Impact by Finite Element Analysis

Lee, Edward T (2003) Advisor: Van Karsen, Charles D
Noise Path Analysis of a Clothes Dryer

Lichtenberg, Glen S (2003) Advisor: Evers, Lawrence W
Quality Improvement of a Manual Transmission Input Shaft Radial Lip Sealing System: Failure Analysis, Design and Manufacturing Assessment

Luptowski, Brian J (2003) Advisors: Johnson, John H & Arici, Oner
Development and Evaluation of an All Electric Active Cooling System in a Heavy Duty Diesel Truck Using the Vehicle Engine Cooling System Simulation

Mayer, Thomas P (2004) Advisor: Patankar, Ravindra P
Control of Electric Power Steering

Mekkes, Joel T (2003) Advisor: Anderson, Carl L
Static Pressure Measurements on the Nose of a Torque Converter Stator During Cavitation

Miller, Kenneth J (2003) Advisor: Anderson, Carl L
Coursework Only

Morison, Angus M (2003) Advisor: Van Karsen, Charles D
Nondestructive Evaluation of Short Span Timber Bridges with Impact Generated FRFs

Muehlfeld, Christian M (2003) Advisor: Pandit, Sudhakar M
Data Dependent Systems Forecasting for Hybrid Electric Vehicle Control

Nadgouda, Amod S (2003) Advisor: Yang, S.L.; Co-Advisor: Johnson, John H
Calibration and Parametric Studies of a 1-D Filter Model to Predict the Performance Characteristics of Diesel Particulate Filters

Nanda, Satpreet (2003) Advisor: Yang, Song-Lin
I.C. Engine Flow Simulation Using KIVA Code and Modified Reynolds Stress Turbulence Model

Ng, Siong Kai (2003) Advisor: Parker, Gordon G
Robot Trajectory Design for High-Speed Flexible Payloads

Niu, Yuming (2004) Advisor: Gershenson, John K
Selection of Industrial Coating Based on Environmental Impact Characteristics

Ooi, Pey Hann (2003) Advisors: Vilmann, Carl R & Miskioglu, Ibrahim
Analysis of Post Yield Shear Distribution within Sandwich Beams and Panels

Peehal, Arvind K (2003) Advisor: Arici, Oner
Coursework Only

Peers, William J (2003) Co-Advisors: Wright, Deborah & Miskioglu, Ibrahim
Wear Characterization of Self-Reinforced Composite Poly (Methyl Methacrylate)

Petteys, Rebecca S (2003) Advisor: Parker, Gordon G
Modeling, Simulation and Adaptive Control of an Electromagnetic Bearing System

Plotkin, Charles W (2003) Advisor: Moon, Kee S
Continuously Variable Transmission Degradation Test for Customer Satisfaction Attributes

Pruse, Ronald L (2004) Advisor: Rao, Mohan D
Speech Intelligibility of the Callsign Acquisition Test (CAT) in Noise

Riemer, Rose F (2003) Advisor: Haut Donahue, Tammy L
A Validated, Subject-Specific Model for Predicting Tibiofemoral Knee Force Distribution from Intersegmental Forces

Ringshia, Aditya K (2003) Advisor: Anderson, Carl L
Calibration and Analysis of Strainon 310 mm Automotive Torque Converter Turbine Blades

Ryu, Thae Hwan (2004) Advisor: Yang, Song-Lin
Coursework Only

Saxon, Christine A (2004) Advisor: Ligon, John B
Coursework Only

Shende, Anand S (2003) Advisor: Johnson, John H
A Study of the Filtration and Particulate Matter Oxidation Characteristics of Two Catalyzed Wall-Flow Diesel Particulate Filters: Experimental and 1-D 2-Layer Model

Shetty, Mayur P (2004) Advisor: Endres, William J
The Effects of Dwell on Surface Finish -An Experimental Study

Shyamsunder, Sudeep (2004) Advisor: Friedrich, Craig R
An Electrokinetic Pumping System for a Cochlear Implant Insertion Tool

Singh, Nishant (2003) Co-Advisor: Parker, Gordon G; Thesis Advisor: Johnson, John H
Development of a Vehicle Engine Aftertreatment System Simulation (VEASS) Model with Application to the Study of a Controls Design Strategy for Active Regeneration

Spruit, Matthew J (2003) Advisor: Van Karsen, Charles D; Co-Advisor: Vilmann, Carl R
Modeling and Correlation Techniques for Development of Experimental and Analytical Modal Models of a Thin, Flexible Plate

Thalagavara, Abishek M (2003) Advisor: Johnson, John H
A Study of the Effects of Two Catalyzed Particulate Filters with Different Loadings of the Catalyst on Exhaust Emissions from a Heavy Duty Diesel Engine

Wang, Xiaomin (2004) Advisor: Narain, Amitabh
Direct Computational Simulations of Internal Condensing Flows and Effects of Normal Gravity, Zero Gravity, Shear and Surface Tension on Interfacial Waves and Heat Transfer Rates

Wegleitner, Joseph A (2004) Advisors: Coates, Samuel W & Evers, Lawrence W
Characterization of Exhaust Catalysts for Marine Spark Ignited Engine Applications

Wirkner, Donald G (2003) Advisor: Passerello, Chris E
Experimental and Finite Element Analysis of a Parking Brake Bracket Using Contact Elements

Zach, Kacey S (2004) Advisor: Van Karsen, Charles D
Application of a Viscoelastic Dynamic Absorber to a Front-Loading Washing Machine

CONGRESS LEADER AT ASME

Dr. Amitabh Narain, Associate Professor in Michigan Tech's ME-EM Department, is serving as the lead organizer and lead editor for the Symposium on Gas-liquid and Phase-change Flows at Macro- and Micro-scales at the 2005 International Mechanical Engineering Congress and Exposition during the ASME Winter Annual Meeting. The symposium will provide a platform for reporting the latest results within the field which increase understanding and predictive capabilities for annular or stratified gas liquid and phase-change flows at macro or micro-scales, flow regime maps, interfacial phenomena, and capillary flows. The Fluid Mechanics Committee of the Applied Mechanics Division, the K-8 Committee of the Heat Transfer Division, and the Multi-Phase Flow Committee of the Fluids Engineering Division of the ASME are sponsoring the symposium.

GRADUATES

BS GRADUATES

2003-2004

FALL 2003

BS ME GRADUATES

Matthew R Baker - Cum Laude
 Debashis Bardhan
 Chad A Bareither - Magna Cum Laude
 Brian D Bartley - Cum Laude
 Kevin M Boll - Cum Laude
 David J Bosscher - Magna Cum Laude
 Jacob D Bryson
 Brent J Burns - Cum Laude
 Joseph P Cannon - Cum Laude
 Casey S Carr - Cum Laude
 Pedro H de Freitas e Silva
 Charles J Denys - Cum Laude
 Cullen Z EngBlade
 Brian L Fiala
 Jason F Figas - Cum Laude
 Chad A Finkbeiner - Cum Laude
 Brian J Franck
 Benton R Gady - Cum Laude
 Heather L Gonyea
 William J Grevelding
 David M Gruza
 Scott P Heim - Cum Laude
 Jonathan C Hofstra - Cum Laude
 David M Houser
 Greg S Ives - Cum Laude
 Mindy M Jensen - Summa Cum Laude
 Jason A Jerz
 Kenneth B Keranen - Cum Laude
 Jeremy M King - Cum Laude
 Matthew D Klein
 Brandon J Kroll - Cum Laude
 Mary K Kuhar
 William R Lee - Magna Cum Laude
 Daniel P Leep
 Eldon S Leidich - Cum Laude
 Andrew S Manninen
 James R Mason
 Todd A Matelski - Magna Cum Laude
 Brian J Mooren
 Kristin E Parker - Cum Laude
 Robert J Pearson
 John M Pietila - Magna Cum Laude
 Edward B Pondelik

Brent J Pontius

Douglas A Prime - Cum Laude
 Jason J Rae
 Justin C Reichel
 Sharen N Ripley
 Benjamin F Schleis
 Lynn S Schreiber - Cum Laude
 Melissa S Shall - Summa Cum Laude
 Joseph A Stadel - Cum Laude
 Matthew A Sturos - Cum Laude
 Albert K Suckow - Summa Cum Laude
 Chee M Tang - Magna Cum Laude
 Thomas W Thompson
 Danielle L Toelle - Cum Laude
 Adam R Tufnell - Summa Cum Laude
 James H Whitmarsh - Cum Laude
 Raymond R Williams - Cum Laude
 Andrew J Zobro - Cum Laude

SPRING 2004

BS ME GRADUATES

Joseph C Aiello
 Anthony J Alecci
 James R Andrews
 Christopher M Anton - Cum Laude
 Casandra M Applin - Cum Laude
 Micah E Badenhop - Cum Laude
 Robert R Ball
 Leah M Balsis - Cum Laude
 Derek R Barnes - Cum Laude
 Brian D Barr - Cum Laude
 Christopher D Beaty
 Greg M Beauchamp - Cum Laude
 Jennifer L Beckley
 Craig S Biebel - Magna Cum Laude
 David J Blondheim - Summa Cum Laude
 Richard S Boss
 Nicholas C Bovid
 Stephen N Burns
 Jose F Cabrera
 Norma M Ceaser
 Colleen A Chapman - Cum Laude
 Sze K Cheah - Summa Cum Laude
 Dominick M Cianfaroni
 Antonio M Cittadino - Summa Cum Laude

Kevin D Cooper - Summa Cum Laude
 Raymond R Cramer
 Nicholas J Cristan - Cum Laude
 Joseph A D'Andrea
 Kristin L Day - Cum Laude
 Brian C Delrue - Cum Laude
 Bartholemew DeWard
 Robert H Dixon
 Jason E Dobberstein - Cum Laude
 Brett A Duiser - Summa Cum Laude
 Brandon J Dykstra - Cum Laude
 Sara K Dzirnis
 John S Ehlert - Magna Cum Laude
 Eron C Eno - Cum Laude
 Andrew K Even - Magna Cum Laude
 Michael A Falik - Cum Laude
 Nathan K Ferrier - Cum Laude
 Emily C Fossum - Magna Cum Laude
 John J Freiberg
 Elijah L Fry
 Craig V Fuller
 Adam C Gillis
 Michael P Gorski
 Nathan R Gries - Magna Cum Laude
 Andrew J Grose
 Timothy L Gumm - Cum Laude
 George R Haka
 Bryan K Hann
 Jason A Harsant - Cum Laude
 David K Haselhuhn - Summa Cum Laude
 Leanne M Hellerud
 Kahreem O Hogan
 Jacob L Howe - Magna Cum Laude
 Brian C Howson - Summa Cum Laude
 Robert J Imel - Cum Laude
 Brandon J Ittner
 Erik E Johnson
 Paul N Johnson
 David A Johnson - Summa Cum Laude
 Nicholas P Kammer
 Eric J Karr
 Nathan D Kemp
 Briar M Kerver - Cum Laude
 Justin D Keske - Summa Cum Laude
 Daniel P Klawitter - Magna Cum Laude
 Andrew J Koritnik - Cum Laude
 Ian J Kowalczyk - Cum Laude
 Adam B Kutschinski
 Phillip M Lariviere - Magna Cum Laude
 Randall N Wing Kit Lau
 Amanda C Lavoy - Cum Laude
 Kevin R Lee - Summa Cum Laude
 Joseph R Littlefield - Summa Cum Laude
 Luke S Luskin - Summa Cum Laude
 Scott M Lyman - Cum Laude
 Mark J Lysakowsky
 Jason M Makela - Cum Laude
 Dave Mathers - Cum Laude
 Elizabeth B Matlock - Cum Laude
 Daniel L Matthies - Cum Laude

GRADUATES

ORDER OF THE ENGINEER

Craig S McArthur - Cum Laude
 John A McConnachie
 Adam M McGilton
 Jeffrey A Mesko
 Christopher J Miller
 Jeremy R Mortl
 William C Navin - Cum Laude
 Eric J Nyhof
 Todd M Olson - Cum Laude
 Gregory T Onderlinde - Summa Cum Laude
 Todd D Pennala - Magna Cum Laude
 Jared T Peterson - Cum Laude
 Adam M Podleski - Magna Cum Laude
 Brian J Poirier
 Andrew J Poulos - Cum Laude
 Paul J Reed
 Nicolas R Reed - Cum Laude
 Robert J Rentmeester - Cum Laude
 Brian R Rivet - Cum Laude
 Darrell L Robinette - Summa Cum Laude
 Christopher A Rock - Summa Cum Laude
 Kevin M Romzek - Cum Laude
 Corrine N Ruether
 Steven M Ruspakka - Cum Laude
 Douglas W Salowitz - Magna Cum Laude
 Brett J Schalk - Cum Laude
 Brooke L Scharich
 Charles J H Severance - Summa Cum Laude
 Lucas D Smith - Cum Laude
 Joshua J Smith
 Raymond J Spruit - Cum Laude
 Aaron M Stanski - Cum Laude
 Andrew Stark - Cum Laude
 Mike E Steele - Cum Laude
 Lance B Steinmacher
 Adam J Stewart - Cum Laude
 Nicholas J Stibitz - Cum Laude
 Ira R Stoodly
 Michael J Svendsen - Magna Cum Laude
 Jennifer L Swanson - Cum Laude
 Adam E Sworski - Magna Cum Laude
 Robert K Taylor - Cum Laude
 John H Thompsen - Cum Laude
 Kerry A Trumble - Cum Laude
 William J Ulrich - Summa Cum Laude
 Michael E VanDonsel - Cum Laude
 Scott R Vissers - Cum Laude
 Andrew S Waisanen - Magna Cum Laude
 Jace C Walsh - Cum Laude
 Jason A Walter - Cum Laude
 Thomas C Wolk - Cum Laude
 Cheejartz I Yang
 Jason T Zebrowski
 Matthew P Zeisler

SUMMER 2004 BS ME GRADUATES

Theodore R Berger
 Angelo P Chialva - Summa Cum Laude
 Jason S Everson - Cum Laude

Graduating seniors in Michigan Tech's ME-EM Department gather for a banquet and public induction into the *Order of the Engineer*, a roster of engineers in the United States who have publicly accepted the *Obligation of the Engineer*. This formal statement recognizes an engineer's responsibilities to the public and to the profession.

At the ceremony, inductees receive a stainless steel ring to be worn on the little finger of their working hand as a symbol of commitment to the *Obligation of the Engineer*. Through participation in the *Order of the Engineer*, Michigan Tech graduates join engineers nationwide to recognize the primary purpose of engineering as service to the public.

Kevin A Ford
 Erin E Gore - Summa Cum Laude
 Brian M Lang
 Robert P Mank
 Daniel J Panik - Summa Cum Laude
 Matthew D Patterson
 Kristina C Peck
 Kipp B Rood
 Eugene J Sandona
 Sean A Tabacsko
 Sheng H Tseng
 Philip A Wiegand

All graduating seniors are invited to take the order. Each year, about 90% of graduates participate.

ORDER OF THE ENGINEER SPRING 2004

Dr. Diana D. Brehob, ME-EM Alumna
 – *Keynote address and Inductee*

Sandra Skinner, Ford Motor Company
 – *Inductee*

Jeff Zawisza, Dow Chemical Company
 – *Inductee*

FALL 2003

David J. Brule, Sr., CEO Boss
 Motorsports
 – *Keynote address and Inductee*

H. Michael Needham, ME-EM Distance
 Learning Advisor and Coordinator
 – *Inductee*

PUBLICATIONS

JOURNAL ARTICLES

2003-2004

- Li, S., **Altan, B.S.** and **Miskioglu, I.**, "Gradient Elasticity Solution to Line Loading of a Semi-infinite Elastic Solid," *Int. Journal of Solids and Structures*, Vol. 41, No. 13, pp. 3395-3410, 2004.
- Purcek, G., **Altan, B.S.**, **Miskioglu, I.** and Ooi, P.H., "Processing of eutectic Zn-5%Al Alloy by Equal-Channel Angular Pressing," *Journal of Materials Processing Technology*, Vol. 148, No. 3, pp. 279-287, 2004.
- **Altan, B.S.** and **Subhash, G.**, "A Nonlocal Formulation Based on a Novel Averaging Scheme Applicable To Nanostructured Materials," *Mechanics of Materials*, Vol. 35, pp. 281-294, 2003.
- **Altan, B.S.**, **Miskioglu, I.** and **Vilman, C.R.**, "Propagation of S-H Waves in Laminated Composites: A Gradient Elasticity Approach," *Journal of Vibration and Control*, Vol. 9, No. 11 pp. 1265-1284, 2003.
- Sweger, P., **Anderson, C.L.** and **Blough, J.**, "Measurements of Strain on 310 mm Converter Turbine Blade," *International Journal of Rotating Machinery*, Vol. 10, No. 1, pp. 55-63, 2004.
- **Anderson, C.L.**, Zeng, L., Sweger, P., **Narain, A.** and **Blough, J.**, "Experimental Investigation of Cavitation Signatures in an Automotive Torque Converter Using a Microwave Telemetry Technique," *International Journal of Rotating Machinery*, Vol. 9, No. 6, pp. 403-410, 2003.
- Bühler, M., **Bettig, B.** and **Parker, G.G.**, "Homogenization of Active Material Finite Element Cells," *Communications in Numerical Methods in Engineering*, Vol. 19, pp. 977-989, 2003.
- **Bettig, B.** and Shah, J., "Solution Selectors: A User-Oriented Answer to the Multiple Solution Problem in Constraint Solving", *ASME Journal of Mechanical Design*, Vol. 125, No. 3, pp. 443-451, 2003.
- Chen, W., **Bettig, B.**, Bühler, M. and **Parker, G.G.**, "Optimal Sensor Design and Control of Piezoelectric Laminate Beams", *IEEE Transactions on Control Systems Technology*, Vol. 12, No. 1, pp. 148-155, 2004.
- Bühler, M., **Bettig, B.**, **Parker, G.G.**, "Topology Optimization of Smart Structures using a Homogenization Approach," *Journal of Intelligent Materials Systems and Structures*, Vol. 15, No. 8, pp. 655-667, 2004.
- Singh, P. and **Bettig, B.**, "Port-Compatibility and Connectivity Based Assembly Design," *ASME Journal of Computers and Information Science in Engineering*, Vol. 4, No. 3, pp. 197-205, 2004.
- **Blough J.** and Brown D.L., "Development and Analysis of Time Variant Discrete Fourier Transform Order Tracking," *Mechanical Systems and Signal Processing*, Vol. 17, No. 6, pp. 1185-1199, 2003.
- Castelino, K., Sundararajan V., **D'Souza, R. M.**, Wright, P. K., "AMPS - An Automated Modular Process Planning System," *Journal of Computing and Information Science in Engineering*, Vol. 4, No. 3, pp. 235-241, 2004.
- Castelino, K., **D'Souza, R.M.**, Wright, P.K., "Tool Path Optimization for Minimization of Air-time During Machining," *Journal of Manufacturing Systems*, Vol. 22, No. 3, pp. 173-181, 2003.
- **D'Souza, R.M.**, Séquin, C.H. and Wright, P.K., "Automated Tool Sequence Selection for 3-Axis Machining of Free-Form Pockets," *Computer Aided Design*, Vol. 36, No. 7, pp. 595-605, 2004.
- **D'Souza, R.M.**, Wright, P.K. and Séquin, C.H., "Handling Tool Holder Collision in Optimal Tool Sequence Selection for 2.5-D Pocket Machining," *ASME Journal of Computing and Information Science in Engineering*, Vol. 2, No. 4, pp. 245-349, 2003.
- Kountanya, R. K. and **Endres, W. J.**, "Flank Wear of Edge-Radiused Cutting Tools under Ideal Straight-Edged Orthogonal Conditions," *ASME Journal Manufacturing Science and Engineering*, Vol. 126, No. 3, pp. 496-505, 2004.
- Corpus, W. T. and **Endres, W. J.**, "Added Stability Lobes for Machining Processes that Exhibit Periodic Time Variation: Part 1- An Analytical Solution," *Journal Manufacturing Science and Engineering*, Vol. 26, No. 3, pp. 467-474, 2004.
- Corpus, W. T. and **Endres, W. J.**, "Added Stability Lobes for Machining Processes that Exhibit Periodic Time Variation: Part 2- Experimental Validation," *Journal Manufacturing Science and Engineering*, Vol. 26, No. 3, pp. 475-480, 2004.
- Morison, A. M., **Evensen, H.A.**, **Ligon, J. B.** and VanKarsen, C. D. "Dynamic Response of Timber Bridges as a Tool to Measure Structural Integrity," *Experimental Techniques*, Vol. 27, pp. 25-28, 2003.
- **Friedrich, C.** and Kulkarni, V., "Effect of Springback on Micromilling Forces," *Microsystems Technology Journal*, Vol. 10, No. 6-7, pp. 472-477, 2004.
- Arcand, B., Butala, N. and **Friedrich, C.**, "Design and Modeling of an Active Positioning Device for a Perimodular Cochlear Electrode Array," *Microsystems*

- Technology Journal, Vol. 10, No. 6-7, pp. 478-483, 2004.
- **Gao, X.-L.** and Li, K., “A Shear-Lag Model for Carbon Nanotube-Reinforced Polymer Composites,” International Journal of Solids and Structures, Vol. 42, pp. 1649-1667, 2004.
 - Li, K., **Gao, X.-L.** and **Subhash, G.**, “Effects of Cell Shape and Cell Wall Thickness Variations on the Elastic Properties of Two-Dimensional Cellular Solids,” International Journal of Solids and Structures, Vol. 42, pp. 1777-1795, 2004.
 - **Gao, X.-L.**, “On the Complex Variable Displacement Method in Plane Isotropic Elasticity,” Mechanics Research Communications, Vol. 31, pp. 169-173, 2004.
 - **Gao, X.-L.** and Li, K., “Finite Deformation Continuum Model for Single-Walled Carbon Nanotubes,” International Journal of Solids and Structures, Vol. 40, pp. 7329-7337, 2003.
 - Li, H., Dowding, R.J., **Gao, X.-L.**, Kecskes, L.J. and **Subhash, G.**, “Negative Strain Rate Sensitivity and Compositional Dependence of Fracture Strength in Zr/Hf Based Bulk Metallic Glasses,” Scripta Materialia, Vol. 49, pp. 1087-1092, 2003.
 - **Gao, X.-L.**, “Elasto-Plastic Analysis of an Internally Pressurized Thick-Walled Cylinder Using a Strain Gradient Plasticity Theory,” International Journal of Solids and Structures, Vol. 40, pp. 6445-6455, 2003.
 - **Gao, X.-L.**, “Strain Gradient Plasticity Solution for an Internally Pressurized Thick-Walled Spherical Shell of an Elastic-Plastic Material,” Mechanics Research Communications, Vol. 30, pp. 411-420, 2003.
 - Li, K., **Gao, X.-L.** and Roy, A. K., “Micromechanics Model for Three-Dimensional Open-Cell Foams using a Tetrakaidecahedral Unit Cell and Castigliano’s Second Theorem,” Composites Science and Technology, Vol. 63, pp. 1769-1781, 2003.
 - **Gershenson, J.K.**, Prasad, G.J. and Zhang, Y., “Product Modularity: Measures and Methods,” Journal of Engineering Design, Vol. 15, No. 1, pp. 33-51, 2004.
 - Zhang, Y. and **Gershenson, J.K.**, “Questioning the Direct Relationship between Product Modularity and Retirement Cost,” Journal of Sustainable Product Design, Vol. 2, No. 3, pp. 55-70, 2004.
 - Zhang, Y. and **Gershenson, J.K.**, “An Initial Study of Direct Relationships between Life-cycle Modularity and Life-cycle Cost,” Journal of Concurrent Engineering Research and Applications, Vol. 11, No. 2, pp. 121-128, 2003.
 - **Gershenson, J.K.**, Prasad, G.J. and Zhang, Y., “Product Modularity: Definitions and Benefits,” Journal of Engineering Design, Vol. 14, No. 3, pp. 295-313, 2003.
 - Pavnaskar, S.J., **Gershenson, J.K.** and Jambekar, A.B., “A Classification Scheme for Lean Manufacturing Tools,” International Journal of Production Research, Vol. 41, No. 13, pp. 3075-3090, 2003.
 - Sun, Y. and **Gupta, M.**, “Effect of Elongational Viscosity on the Flow in a Flat Die,” International Polymer Processing Journal, Vol. 18, pp. 356-361, 2003.
 - **Haut Donahue, T.L.**, Donahue, H.J., Haut, T.R., Jacobs, C.R. and Yellowley, C.E., “Mechanosensitivity of Bone Cells to Oscillating Fluid Flow (OFF) Induced Shear Stress may be Modulated by Chemotransport,” Journal of Biomechanics, Vol. 36, pp. 1363-1371, 2003.
 - **Haut Donahue, T.L.**, Hull, M.L., Jacobs, C.R. and Rashid, M.M., “The Sensitivity of Tibio-Femoral Contact to Parameters Describing the Geometry of the Lateral and Medial Menisci,” Journal of Orthopaedic Research, Vol. 22, pp. 807-814, 2004.
 - Zhang, Z., **Johnson, J.H.** and **Yang, S.L.**, “Modeling and Numerical Simulation of Diesel Particulate Trap Performance During Loading and Regeneration,” SAE Journal of Fuels and Lubricants, pp. 471-483, 2003.
 - **King, L.B.** and Gallimore, A.D., “Ion Energy Diagnostics in an SPT-100 Plume from Thrust Axis to Backflow,” Journal of Propulsion and Power, Vol. 20, No. 2, pp. 228-242, 2004.
 - Mitchell, T.B., **King, L.B.**, Jensen, Itano, W.M., Bollinger, J.J., Kriesel, J.M., and Dubin, D.H.E., “Strongly Correlated Ion Plasma in Penning Traps,” Journal of Physics A, Vol. 36, No. 22, pp. 6117-6118, 2003.
 - **Michalek, D.J.**, Hii, W.W.-S., Sun, J., Ju, C., Yue, Y., Gunter, K.L. and **Sutherland, J.W.**, “Experimental and Analytical Efforts to Characterize Cutting Fluid Mist Formation and Behavior in Machining,” Applied Occupational and Environmental Hygiene, Vol. 18, No. 11, pp. 842-854, 2003.
 - Yue, Y., Gunter, K.L., **Michalek, D.J.**, Sun, J. and **Sutherland, J.W.**, “Character and Behavior of Mist Generated by Application of Cutting Fluid to a Rotating Cylindrical Workpiece, Part 1: Model Development,” ASME Journal of Manufacturing Science and Engineering, Vol. 126, No. 3, pp. 417-425, 2004.
 - Sun, J., Gunter, K.L., Ju, C., **Michalek, D.J.**, **Sutherland, J.W.** and Yue, Y., “Character and Behavior of Mist Generated by Application of Cutting Fluid to a Rotating Cylindrical Workpiece, Part 2: Experimental Validation,” ASME Journal of Manufacturing Science and Engineering, Vol. 126, No. 3, pp. 426-434, 2004.
 - Lee, H., Bifano, T.G. and **Miller, M.H.**, “CMOS Chip Planarization by Chemical Mechanical Polishing for a Vertically Stacked Metal MEMS Integration,” J Micromechanics and Microengineering, Vol. 14, No. 1, pp. 108-115, 2004.

In addition to the listed journal publications, ME-EM faculty attended 115 conferences, professional panels, and professional meetings during the 2003-2004 academic year. This involvement demonstrates the Department’s commitment to a high level of professional activity.

PUBLICATIONS

JOURNAL ARTICLES

2003-2004

(CONTINUED)

- Konell, J.P., King, J.A. and **Miskioglu, I.**, "Synergistic Effects of Carbon Fillers on Tensile and Impact Properties in Nylon 6,6 and Polycarbonate Based Resins," *Polymer Composites*, Vol. 25, No.2 pp. 172-185, 2004.
- Heiser, J.A., King, J.A., Konell, J.P., **Miskioglu, I.** and Sutter, L.W. "Tensile and Impact Properties of Carbon Filled Nylon 6,6 Based Resins," *Journal of Applied Polymer Science*, Vol. 91, No. 5, pp. 2881-2893, 2004.
- Konell, J.P., King, J.A. and **Miskioglu, I.**, "Tensile Modulus Modeling of Carbon Filled Nylon 6,6 and Polycarbonate Based Resins," *Journal of Applied Polymer Science*, Vol. 90, No. 6, pp. 1716-1728, 2003.
- **Moon, K.S.**, Levy, M., Hong, Y.K., Bakhru, H. and Bakhru, S., "Microscale Patterning of Mesoscopic PZN-PT Single Crystal Films by Crystal Ion Slicing and Laser-Induced Etching," *Ferroelectrics Letters*, Vol. 30, No. 3-4, pp. 47-57, 2003.
- Vanga, R.R., Levy, M., **Moon, K.S.**, and Hong, Y.K., "Single-Crystal Relaxor Ferroelectric Piezoactuators with Interdigitated Electrodes," *IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control*, Vol. 51, No. 12, pp. 1593-1599, 2004.
- **Narain, A.**, Liang, Q., Wang, X. and Yu, G., "Direct Computational Simulations for Internal Condensing Flows and Results on Attainability/ Stability of Steady Solutions, their Intrinsic Waviness, and their Noise-Sensitivity," *Journal of Applied Mechanics*, Vol. 71, pp. 69-88, 2004.
- Liang, Q., **Narain, A.** and Wang, X., "Effect of Gravity, Shear and Surface Tension in Internal Condensing Flows - Results from Direct Computational Simulations," *ASME Journal of Heat Transfer*, Vol. 126, No. 5, pp. 676-686, 2004.
- Wilson, D.G., **Parker, G.G.**, Robinett, R. D. and Starr, G.P., "Nonlinear Adaptive Control for Slewing Flexible Active Structures," *AIAA Journal of Guidance, Control, and Dynamics*, Vol. 27, No. 1, pp. 142-145, 2003.
- **Patankar, R.P.**, "Unified Risk Analysis of Fatigue Failure in Ductile Alloy Components During all Three Stages of Fatigue Crack Evolution Process," *Risk Analysis*, Vol. 23, No. 5, pp. 929-936, 2003.
- **Patankar, R.P.**, "Predicting Stochastic Behavior of Fatigue Crack Nucleation and Small Crack Growth in Ductile Alloys Based on Stochastic Behavior of Large Crack Growth," *International Journal of Materials and Product Technology*, Vol. 30, No. 1-3, pp. 21-30, 2004.
- Black, M. and **Rao, M.D.**, "Evaluation and Reduction of Steering Column Vibration of a Rear Wheel Sedan," *International Journal of Vehicle Noise and Vibration*, Vol. 1, Nos. 1 / 2, pp. 122-141, 2004.
- Hao, M. and **Rao, M.D.**, "Optimum Design of Multiple Constrained Layered Systems for Vibration Control," *AIAA Journal*, Vol. 42, No. 12, pp. 2448-2461, 2004.
- Spruit, M., **Rao, M.D.**, Holt, J., Boyer, L., Barnard, A. and Dayton, W., "Study of Noise Transmission from a Table Saw," *Sound and Vibration*, June, pp. 20-26, 2004.
- Wirkner, K.J., Gruenberg, S. and **Rao, M.D.**, "Dynamic Characterization of Automotive Exhaust Isolators," *Journal of Automobile Engineering*, Vol. 218, pp. 891-900, 2004.
- Liu, Q. and **Subhash, G.**, "A Phenomenological Constitutive Model for Polymer Foams Under Large Deformations," *Polymer Engineering and Science*, Vol. 44, pp. 463-473, 2004.
- **Subhash, G.** and Liu, Q., "Crushability Maps for Structural Polymeric Foams Under Uniaxial Loading in Rigid Confinement," *Experimental Mechanics*, Vol. 44, No. 3, pp. 289-294, 2004.
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LOOKING AHEAD TO 2005

As we reflect on our achievements in the past year, we continue to develop new projects and ideas that will shape the future of Michigan Tech's ME-EM Department. Look for the following features in the 2005 ME-EM Annual Report:

- The results of the 2005 SAE Clean Snowmobile Challenge hosted at MTU by the ME-EM Department and the Keweenaw Research Center
- A look at start-up companies and industry-supported student projects at the recently opened Advanced Technology Development Center (below), which is part of the State of Michigan SMARTZONE located near Michigan Tech
- An introduction to new faculty hires and a glimpse of their research and work at MTU
- Articles highlighting alumni accomplishments and news
- An update on the Department's national rankings

The 2005 ME-EM Annual Report will include a feature of the Advanced Technology Development Complex.



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Michigan Tech, founded in 1885, has gained world-wide recognition for innovative education and scholarship. Our graduate students receive intensive, advanced instruction and the opportunity to pursue wide-ranging research. Houghton lies in the heart of Upper Michigan's scenic Keweenaw Peninsula. The campus overlooks Portage Lake and is just a few miles from Lake Superior. The area's expansive waters and forests, including the University's 600-acre recreational forest adjoining campus, offer students unparalleled opportunity for outdoor recreation. Houghton is rated the safest college town in Michigan and the eighth-safest in the nation. It also has been named one of the nation's top-ten summer sports areas and one of the ten best places in the country to live. Houghton has a population of 7,400 residents. The University's more than 6,600 students from many states and foreign countries make the area a vibrant multicultural community.