2013

Undergraduate Education 2013

College of Engineering, Michigan Technological University

MICHIGAN TECHNOLOGICAL UNIVERSITY

College of **ENGINEERING**

Michigan Tech

2013 Undergraduate Engineering

Michigan Tech engineering students begin to contribute solutions to the world's increasingly complex problems both on and off campus, well before they graduate.

Letter from the Dean

Here at Michigan Tech, our innovative approach to engineering education actively involves students in hands-on learning opportunities, leadership, research, and entrepreneurship. Our courses are taught by many of the nation's most talented and dedicated faculty. Our students experience exciting educational opportunities in the field, in the lab, and around the globe.

In fact, through participation in a wide array of cutting-edge programs, our students begin to contribute solutions to the world's increasingly complex problems well before they graduate.

An engineer from Michigan Tech will make a difference and be highly sought after by industry. A few weeks ago, almost 300 companies braved a blizzard to meet the ambitious, motivated and talented students of Michigan Tech. Representatives conducted more than 2,000 student interviews. It was the largest Spring Career Fair Michigan Tech has ever had, beating last year's total by about fifty companies. Our Fall 2012 Career Fair attracted nearly 300 corporations to campus—the largest career fair per capita in the entire country. Michigan Tech graduates earn the 12th highest starting salaries in the nation among public universities, with an average starting salary of $56,000.

I invite you to visit or contact us if you would like to learn more about the College of Engineering at Michigan Tech. We look forward to hearing from you.

Sincerely,

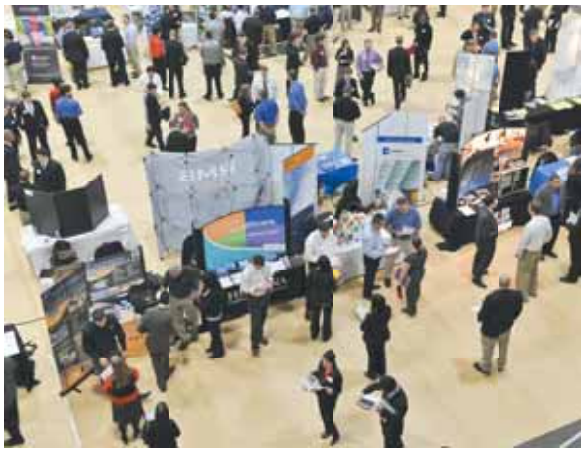
William M. Worek
Dean of Engineering
Dave House Professor
wworek@mtu.edu

Faculty

Full-time faculty: 160
Full professors: 49
Associate professors: 52
Assistant professors: 43
Lecturers: 16
Endowed Chairs and
Distinguished Professorships: 15

Job Placement of Graduates

- 98 percent of our students are employed within their field of study, enlist in the military or are enrolled in graduate school within six months of graduation.
- Each student averages seven interviews.
- 280 employers came to campus in Fall 2012 to recruit students.



Financial Aid

More than 91 percent of Michigan Tech students receive financial assistance—totaling more than $79 million per year—in the form of scholarships, grants, loans, and part-time student employment.

College of Engineering Enrollment

Undergraduate students	3,370
Graduate students	785
Total student enrollment	4,155
Overall total women	835
Women in undergraduate class	674
Women in graduate class	161
Overall total international students	659

Students by Department

	Undergraduate	Graduate
Biomedical Engineering	280	18
Chemical Engineering	434	59
Civil and Environmental Engineering	584	104
Electrical and Computer Engineering	569	213
Geological and Mining Engineering and Sciences	74	56
Materials Science and Engineering	92	31
Mechanical Engineering–Engineering Mechanics	1,123	288
Engineering Others*	214	16
Total	3,370	785
Grand Total	4,155	

*Engineering, General Engineering, Atmospheric Science, Computational Science and Engineering, Hybrid Electric Vehicle Engineering

Engineering Better Bikes for Wounded Vets

The Achilles Freedom Team, a non-profit organization, brings running programs and marathon opportunities to disabled veterans returning from Iraq and Afghanistan.

GM's Military Discount Program provides hand cycles to the Achilles Freedom team, but in the past they had design issues. Some designs proved unstable, on others the components broke down under the pressure of racing. What could GM do to help?

Terry Woychowski, a Michigan Tech alumnus, retired GM vice president and current member of the University's Board of Control, knew exactly where to turn. GM has long partnered with Michigan Tech, supporting research and educational programs, including Senior Design. The scope was bigger than the typical Senior Design team could handle in a single year, however. So, they developed a strategy, and the Huskies Helping Heroes project was born. GM agreed to support four Senior Design teams throughout 2012, and a fifth team emerged in September. Each team worked with a veteran on the Achilles Freedom Team to address his special needs and concerns.

Last fall, GM brought the teams to the Detroit Free Press/Talmer Bank Marathon to see first-hand the challenges the wounded veterans faced. With feedback from GM engineers on their initial designs, the Michigan Tech teams integrated the best ideas into the two prototypes that they proceeded to build. One cycle is called the Keweenaw Cruiser. The other is the Tomahawk. Both use high-strength steel alloys for durability, improved restraints for comfort and safety, and designs that make them more portable and less prone to damage. For example, a pivoting fork-to-frame attachment allows the front wheel assembly to fold into the seat during transport.

The Achilles Freedom team unveiled one of the prototypes at the Army-Navy football game. A team member rode one of the cycles onto the field on

TOP Students with athlete John Hayes at the Saturday tune-up before the Detroit Marathon. MIDDLE Perusing a new bike design. BOTTOM GM, Michigan Tech and the Achilles Freedom team unveil the new cycles at the 113th Army-Navy Game.

Achilles Freedom Team member Ben Maenza

national television, accompanied by Michigan Tech senior James Cook, GM Chairman and CEO Dan Akerson, and GM engineer Alexa Ellswood. Cook is a mechanical engineering major and member of one of five Senior Design teams that worked on the project. Another Michigan Tech student, Brett Jenkins, represented the teams at a pre-game press conference. “This is the most rewarding assignment I’ve ever worked on,” said Jenkins, a senior from Troy, Michigan. Cook of Lexington, Kentucky, agreed: “The athletes aren’t shy about sharing their opinions. That’s good, because all feedback is good feedback.”

Chevrolet engineers mentored the student teams. “I loved working with the students and seeing their energy and passion,” said Ellswood, one of those engineers. In addition, GM will build ten prototypes for use next year by the Achilles Freedom Team of Wounded Veterans in marathons across the country.

Huskies Helping Heroes Senior Design team members unveil a prototype hand cycle with Achilles Freedom athletes and GM executives.

The Enterprise Program at Michigan Tech: A Great Opportunity

Michigan Tech's Enterprise program caught the eye of the National Academy of Engineering. Enterprise is among twenty-nine programs showcased in a new National Academy of Engineering (NAE) report called *Infusing Real World Experiences into Engineering Education.* The report highlights programs considered "best practices" as models for schools seeking to incorporate hands-on, multidisciplinary problem solving into their curriculum. Seven of those—including Michigan Tech's Enterprise Program—are Capstone programs.

"The multidisciplinary Enterprise Program resulted directly from our belief that all students should have the opportunity to graduate with the confidence, skills, and abilities to start their own company and that topics such as leadership, entrepreneurship, communications, ethics, innovation, and globalization should not be limited to a few courses but integrated throughout the curriculum," said Enterprise Program Director Mary Raber. In the program, second through senior year students from engineering and nonengineering disciplines participate in teams of 15 to 70 or more that operate like real companies. Team members define problems, develop and design solutions, perform testing and analyses, make recommendations, manufacture parts, stay within budgets and schedules, and manage multiple projects.

As students advance through the program, they assume increasing levels of responsibility ranging from project leader to President and CEO of an entire Enterprise team. Real-time interaction with faculty advisors, industrial clients, and peers provides the students with valuable, immediate, and first-hand feedback about the effectiveness of their leadership skills. Enterprise teams are perpetual, and student experiences are long term, typically two-to-three years, with each student having the opportunity to participate in multiple projects.

According to Raber, Enterprise has yielded measurable impacts on retention and graduation, with three-year retention rates of 93-100 percent for Enterprise students versus 65-85 percent for non-Enterprise students. Graduation rates are similarly improved.

Enterprise has twenty-eight unique, student-driven, multidisciplinary teams, and over forty industry sponsors each year, many of whom support teams for multiple years and now contribute over $700,000 each year to sustain and expand the program. Areas of focus for Enterprise teams run the gamut—from communications to vehicle design and transportation. Whether an aspiring entrepreneur or a gaming guru, there's bound to be a team for any student—and if one doesn't exist to fit their interests, they can start an Enterprise! Check out all twenty-six teams online at www.mtu.edu/enterprise.

Being involved with the Enterprise program has not only helped ArcelorMittal with several unique "out of the box" ideas to improve our process capabilities, it has helped us attract some of the best and brightest students to our industry.

Joe Nowosad,
ArcelorMittal USA

A Sampling of Enterprise Teams— See Them All at www.mtu.edu/enterprise

Wireless Communication Enterprise (WCE)

WCE specializes in a variety of wireless, optical, renewable-energy, and biomedical technologies—from embedding pacemaker data onto Smartphones to designing an autonomous robot utilizing GPS technology. WCE works as an entrepreneurial think tank, generating ideas that yield useful results for industry and consumers alike.

Green Campus Enterprise

This team helps Michigan Tech reduce its carbon footprint. Projects include a study on wind power feasibility, reducing the electrical consumption of lighting, and a competition between residence halls to see who can save energy and recycle the most.

International Business Ventures (IBV)

IBV offers a unique opportunity for students to learn how to work cooperatively to develop and bring to market much-needed new products. Projects include an infant heart annunciator and a ventilation device, both low-cost and designed specifically for use in third-world countries where such medical equipment is in short supply.

BoardSport Technologies

The team produces new, streamlined skate, snow and wake boards each semester with a focus on refining designs, finding and working with lighter and stronger materials, and researching and incorporating environmentally friendly materials like recycled steel and bamboo.

Nanotech Innovations

Their motto: “Students creating the future one atom at a time.” The team researches, develops, and markets nanotechnology-related products and services, and shares its knowledge and experience with high school students and teachers along the way.

Velovations

Building a better bike is the common goal. The team collaborates with the bicycle industry to develop new products and services, from the beginning of the process—researching customer needs and identifying current problems—through the final stages of design, testing, marketing, and distribution.

Alternative Fuels Group (AFG)

AFG focuses on investigating and creating a variety of alternative energies—from solar vehicle propulsion and biodiesel-fueled street sweepers to methanol production from natural gas and more.

Enterprise Students Help to Winterize Homes

Baby, it's cold outside—but with help from a group of Michigan Tech students, low-income and fixed-income households in nearby communities aren't feeling the chill.

With support from Range Valley State Bank and the Ford College Community Challenge grant, members of Michigan Tech's Efficiency through Engineering and Construction Enterprise (ETEC) are working with local service agencies on an energy-saving initiative to winterize homes in this cold and snowy community.

Chelsea Smith, 21, a native of Manistique, is a fourth-year student earning a Bachelor of Science in Engineering degree customized to fit her interests in energy-efficient building design. Secretary of ETEC, her academic focus is energy conservation. She enjoys doing the kind of work that will define her career, for her goal is to do large-scale energy audits and reduce energy consumption in buildings. "This work," she says of the winterization project, "is relevant to my future job and an opportunity for leadership. And it feels good to help out people in the community and to give something back."

Michigan's Western Upper Peninsula gets 100–250 inches of snow per year.

Enterprise student Chelsea Smith helped insulate the home of Loren Kommes of South Range, Michigan

Loren Kommes, 75, of South Range, Michigan, is one benefactor. He worked as an electrician, and he and his wife live on Social Security. “We hit the bottom quite a few times,” he says of their budget. “We’re living on the edge.” His heating bill is $1,500 a year. He has oil heat supplemented by a pellet burner. “I think it’s going to help,” he says of the winterization. “It’s a lovely program.”

The effort blends campus and community efforts: members of the enterprise, local at-risk high school students, and volunteers from New Power Tour Inc., a local nonprofit, provide the labor to winterize one home each week.

The problem: a leaky house. The goal: a tighter house.

The students have the necessary equipment, including a blower door to measure air infiltration and a thermal-imaging camera to detect where heat leaks from the house. They also have the materials to seal and insulate water pipes, boilers, windows, doors and electrical outlets. The workers encounter temperatures as low as 37 degrees in the nooks and crannies of some homes. The problem: “a leaky house.” The goal: “tighter, more efficient house.” The students complete the job in an afternoon or two.

Another benefactor of the operation is Patty Monroe, of Chassell. Her monthly heating bill has been reduced from $200 to $130. “That’s huge,” says this woman who lives alone on disability. “I’m absolutely, unbelievably grateful. It’s like heaven.”

Jacob LaSarge Receives Air Force Research Award

Michigan Technological University's Jacob LaSarge has received the US Air Force Cadet Research Award, presented annually to one Air Force cadet in the nation, chosen by the Air Force chief scientist from nominees submitted by the nation's 145 AFROTC detachments.

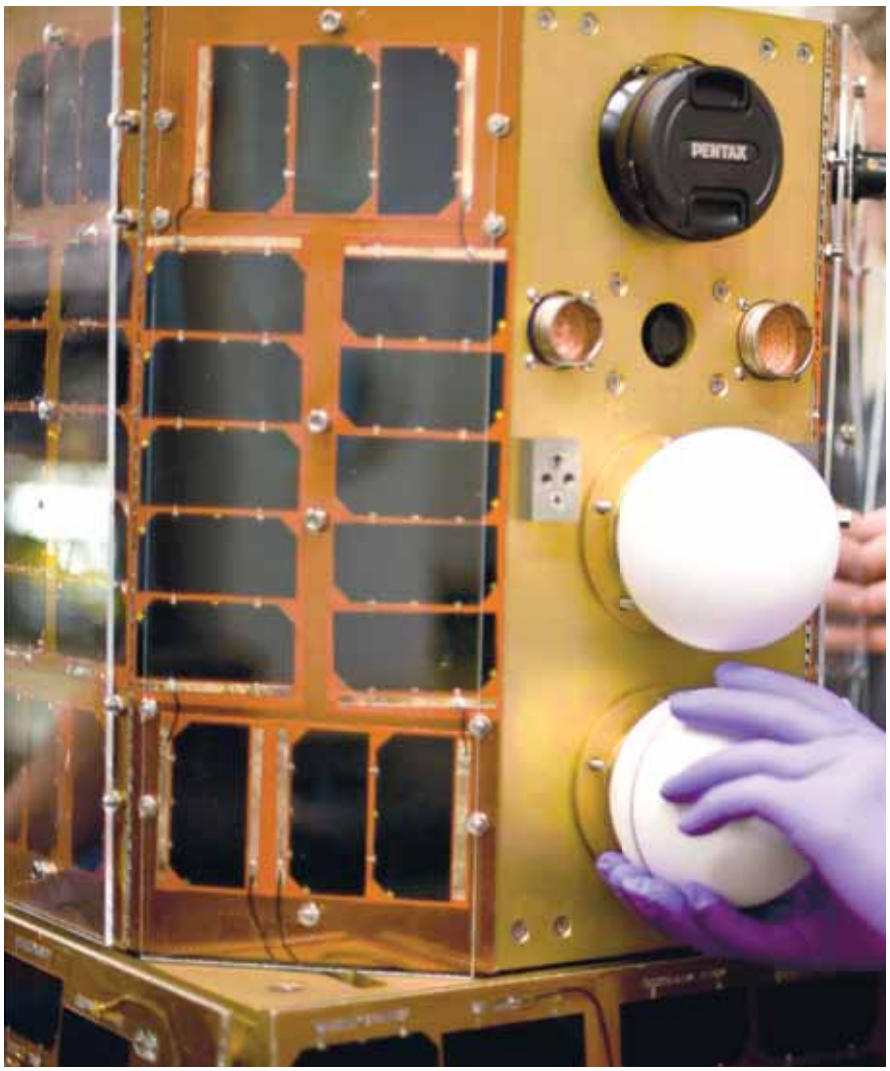
LaSarge, a mechanical engineering senior, was chosen for the leadership and technical ability he exhibited as project manager of the Oculus-ASR Nanosatellite effort. The project is under the umbrella of Michigan Tech's Aerospace Enterprise.

The all-student group has developed a prototype satellite as part of the Air Force Research Lab's University Nanosatellite 6 competition. In January 2011, the Michigan Tech group took first place in the competition, winning the right to get its nanosat "launch ready", with the ultimate aim of putting it into orbit.

"The outstanding leadership and technical expertise provided by Cadet LaSarge has advanced this project further than anyone had imagined," said Lt. Col. Michael Brothers, head of Aerospace Studies and commander of the Air Force ROTC program at Michigan Tech. "Jake is an outstanding student-leader and is truly deserving of this recognition."

LaSarge joined Michigan Tech's nanosat project in fall 2010 as part of the guidance, navigation, and controls section. After a semester, he took charge of the group, and in spring 2011 assumed leadership of the entire team when the project manager position became available.

Jake is responsible for over 70 undergraduates and a $200,000-plus budget for research and development. He skillfully motivates other college students (who don't get paid to work) in order to complete tasks and milestones, with the goals of being on time, under budget and efficient in transition.



Oculus–ASR will launch from Cape Canaveral in 2015, orbiting over the lower continental US at an altitude of 700 kilometers.

"Jake is responsible for over 70 undergraduates and a $200,000-plus budget for research and development," Michigan Tech's Aerospace Studies faculty wrote in nominating LaSarge for the award. "He skillfully motivates other college students (who don't get paid to work) in order to complete tasks and milestones, with the goals of being on time, under budget and efficient in transition."

Their nanosat, Oculus–ASR, was designed to help the AFRL improve "space situational awareness—detecting everything that's orbiting, from space junk to other nations' satellites," LaSarge explained. "The Oculus–ASR satellite, specifically, is for calibrating telescopes, which will make it easier for the Air Force to detect, identify, and classify space objects."

Though Oculus–ASR won't be shot into orbit from Cape Canaveral for another year or two (tentatively scheduled for August 2015), it has already yielded benefits. "I've certainly learned a lot," said LaSarge. And Brothers notes that the US Air Force has adopted several innovations developed by the Oculus team.

This fall, LaSarge will purse a Master's in Aerospace Engineering at the Air Force Institute of Technology. Any interest in becoming an astronaut? "It's on the to-do list," he says.

Society of Women Engineers

The SWE Region H Conference will take place at Michigan Tech in February 2014.

Two members of the Society of Women Engineers (SWE) section at Michigan Tech, Kaitlyn Bunker and Alicia Walby, have been elected to national and regional positions within the organization.

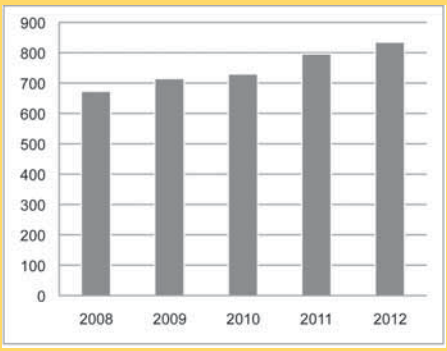
Bunker, an electrical engineering PhD student, is the collegiate director of SWE and sits on the board of directors for the Society. The collegiate director is the only student who sits on the board, and Bunker is responsible for giving the collegiate members a voice. “I am the first graduate student in the position in quite a while. I also come from a smaller, but really active section, so I bring a new perspective,” she said. “This is a great opportunity for me to give back to SWE because I’ve gained so much from being a part of it.”

As SWE collegiate director Bunker has traveled to SWE meetings and events in Chicago, Minneapolis, and Houston, with stops in Delaware and Washington, DC coming up this spring. She also visited Bangalore, India for a SWE symposium, “Women Engineers Leading Global Innovation,” with more than 100 participants from industry and academia. “About half were from the US and half from India,” says Bunker. “It was such a fantastic experience to meet women engineers from across the globe and realize how alike we all are.”

Bunker is involved in the development of SWE’s new strategic plan. “It’s been really exciting to be a part of writing the strategy that SWE will follow over the coming years.” She plans to attend SWE’s Capitol Hill day in March, where she will get an opportunity to meet with the US senators and representatives from Michigan to discuss the importance of diversity in engineering. Bunker is studying power engineering, specifically the connection of windpower to microgrids.

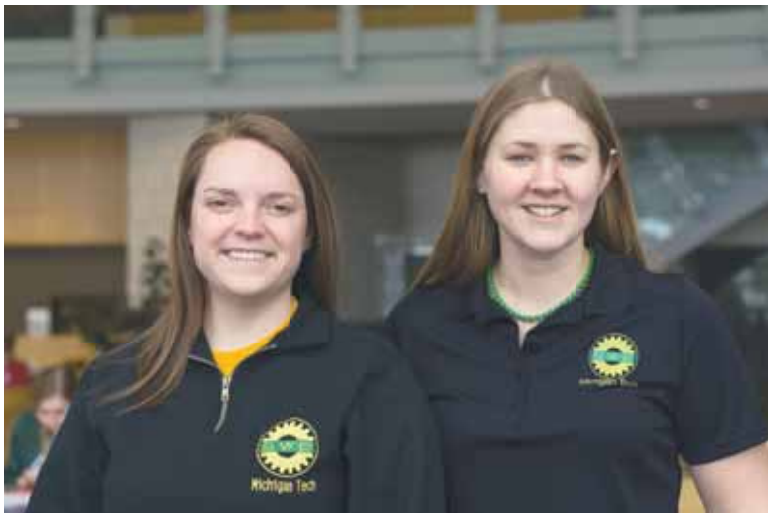
Big Mac, anyone? SWE students teach fourth graders about engineering, teamwork, and efficiency by creating a burger assembly line.

Enrollment On the Rise: More Women Study Engineering at Michigan Tech



leadership. She also works with sections that are not in good standing to help them get back on their feet.

Walby especially enjoys working with presidents of the collegiate SWE sections in Region H. “There are so many great female leaders, and it’s awesome to see what kinds of things they’re doing with their sections. It’s motivation for me to keep pushing them to make their sections even better.” Walby has accepted an offer from Pratt and Whitney as a Mechanical Design Engineer. She will be moving to Maine after graduation this year. But she plans to be back on campus for a visit: The SWE Region H Conference will take place at Michigan Tech in February 2014.



Kaitlyn Bunker (left) is new collegiate director of SWE. Alicia Walby (right) is regional college representative.

Engineers Without Borders at Michigan Tech

"It's important to educate a new generation of engineers to do humanitarian work—to put a heart and a face into engineering, instead of just profit and technology," says Catherine Leslie, a Michigan Tech civil engineering alumna and the president and executive director of Engineers Without Borders USA (EWB). "There's nothing wrong with profit, but it ought not drive everything. That's why we become engineers—to design and build and help people."

From a small program of ten students nine years ago to a burgeoning program of over eighty active members, Michigan Tech's chapter of Engineers Without Borders (EWB) is now one of the largest student chapters in the nation.

The team has built eco-latrines in Montero, Bolivia; septic systems and a toilet house in Santa Cruz, Bolivia; wells in La Fronterizo and La Libertad, Guatemala; and designed a a daycare center and hurricane shelter in La Ceiba, Honduras. The Guatemala project, in particular, has presented some daunting challenges.

The clean water project started in 2004, with EWB members traveling to La Fronterizo and La Libertad in 2006 on a feasibility trip. They looked at water sources—a river, wells, or a spring a few miles away in the forest. The spring and the river were discarded for various social and political reasons, and they began to develop a plan for a well in both communities.

In 2007, the team implemented a well in each community using a locally available pump. Though these wells functioned properly, they did not produce enough water for the communities. The team added another well in each community in 2009, and in the summer of 2010, they returned to Guatemala yet again to assess the condition of the wells. There had been a dramatic drop of the water table due to increasingly hot weather during their dry seasons. The wells in La Libertad were not functioning at all, and the wells in La Fronterizo were having problems. Both communities began to resort to other shallow wells in the area, which were found to be contaminated.

During their stay in the communities, the team was able to create temporary valves for the pumps in La Fronterizo. In La Libertad, they were able to dig one of the two wells deeper and place a smaller caisson in the well to keep the ground from collapsing.

Initiated
2004

Website
ewb.students.mtu.edu

Goals
Improve the quality of life, notably health, environment, and economics in partner communities; create better engineers

Students
First-year through doctorate, open to all majors on campus

Current projects
Guatemala, La Fronterizo and La Libertad
- Deep well project
- Clean cooking stoves

Bolivia, Montero and Santa Cruz
- Sanitation system with composting toilets

Michigan Tech's EWB chapter has more than 80 active members.

Since their trip, the EWB team has decided to rethink the project. It is now obvious that for the wells to be sustainable, they must reach far deeper than community workers can dig by hand—just a short distance after reaching the water table. Their current plan is to manually drill a 6-inch borehole capable of reaching depths of at least 30 feet. This will allow them to tap a more reliable source, deeper in the ground, with less chance of surface contamination. It will be much safer to construct than the previous hand-dug wells.

Michigan Tech's EWB team is currently searching for a plot of land on or near campus to create its first deep well this summer—a place nearby where they can practice and make their mistakes, as opposed to making them "in country" where something like forgetting a tool could set them days behind.

Family Engineering Inspires Students (and Mom and Dad)

Neil Hutzler, professor emeritus of civil and environmental engineering at Michigan Tech, has published broadly, advised numerous PhD students, and performed research for more than three decades. Now, he is using his expertise to provide playful and irresistibly fun engineering learning experiences to elementary age children and their families.

He's developed a Family Engineering program with Joan Chadde, K-12 education and outreach coordinator for Michigan Tech's Center for Science and Environmental Outreach, along with help from the Foundation for Family Science, the American Society for Engineering Education and the Boston Museum of Science.

Supported by the National Science Foundation (NSF), the program helps families work together to discover what engineering is, how to solve engineering problems and inspire some youngsters to pursue education and careers in engineering. Typically, families gather at community schools in the evenings to do hands-on engineering activities developed by the family engineering team.

The sessions involve a dozen activities, like "Are You an Engineer?" in which participants are asked if they played with Legos (mechanical), or created concoctions (chemical), "until everyone has raised their hand at least once," Hutzler says.

Other activities reveal nature's inspiration for modern engineering marvels: the burdock burr begat Velcro; the octopus, the suction cup; the kingfisher, bullet-train design, and more. Moms, dads, and kids build cantilevers with dominos, discover laminates' strength with note cards in an activity called "Glue is the Clue," and create towers of spaghetti and marshmallows that can withstand strong winds.

Members of Michigan Tech's NSBE chapter head to Detroit, to inspire younger students to explore engineering as a career option.



Mining for chocolate chips: Family Engineering prepares college students—and others—to lead fun learning experiences at local schools.

"We have them reverse-engineer a retractable ballpoint pen," Hutzler says. "First, they put it together alone and then they put it together using an assembly-line process, timing the difference between the two."

Parents are vitally important to students' attitudes towards—and success with—science, math, and the careers that come from studying them.

The sessions are held in the evening, and the local activities involve Michigan Tech students and have attracted as many as 200 schoolchildren. The first pilot programs last spring also were tested in North Carolina, Oregon and Detroit, some targeting underrepresented students.

A Family Engineering Activity Guide was published last year to spread the good word about engineering to parents and future engineers via a new network of trained volunteers. For more info, visit www.familyengineering.org.

Michigan Tech Students Reach Out

Tau Beta Pi

The Michigan Tech student chapter of Tau Beta Pi was the first in the nation to learn about Family Engineering. Twenty members of this national honors engineering society turned out on a snowy Monday evening in February to design rockets as part of the Family Engineering activity "Blast Off." Students then designed and tested their custom "Hot Chocolate Machine" using paper cups and a push pin, plus water and milk/chocolate powder. The students have since helped out with numerous Family Engineering Nights at local schools.

Society of Hispanic Professional Engineers (SHPE)

Students from the Society of Hispanic Professional Engineers chapter at Michigan Tech conducted a Family Engineering night in Grand Rapids, Michigan last fall. Families gathered at Harrison Park elementary school to experience what it's like working as a team on engineering challenge activities, such as how to create an assembly line to produce ballpoint pens in the least amount of time, how to design a light bulb with wires and batteries, and how to build a launcher to propel objects across the room.

National Society of Black Engineers (NSBE)

Members of Michigan Tech's chapter of the National Society of Black Engineers traveled to Detroit for an alternative spring break in order to reach out and give back to their hometown schools. The NSBE students visited six middle schools and one high school (an average of 320 students per school) to talk with students about going to college, introduce them to engineering, and engage them in an engineering activity. They conducted Family Engineering Night events at three schools.

Turning Trash Into Cash—and Saving Energy

Suppose that every time you polished off a jug of two percent milk, you would be stocking up on raw material to make anything from a cell phone case and golf tees to a toy castle and a garlic press.

Michigan Tech's Joshua Pearce and his research group, including undergraduates Meredith Mulder and Alexandra Glover, are working on making this a reality. Their main tool is open-source 3D printing called the RepRap, which Pearce uses to save thousands of dollars by making everything from his lab equipment to his safety razor.

Using free software designs downloaded from sites like Thingiverse, which now holds over 62,000 open-source designs, 3D printers make all manner of objects by laying down thin layers of plastic in a specific pattern. While high-end printers can cost many thousands of dollars, simpler open-source units run between $250 and $600—and can be used to make parts for other 3D printers, driving the cost down ever further.

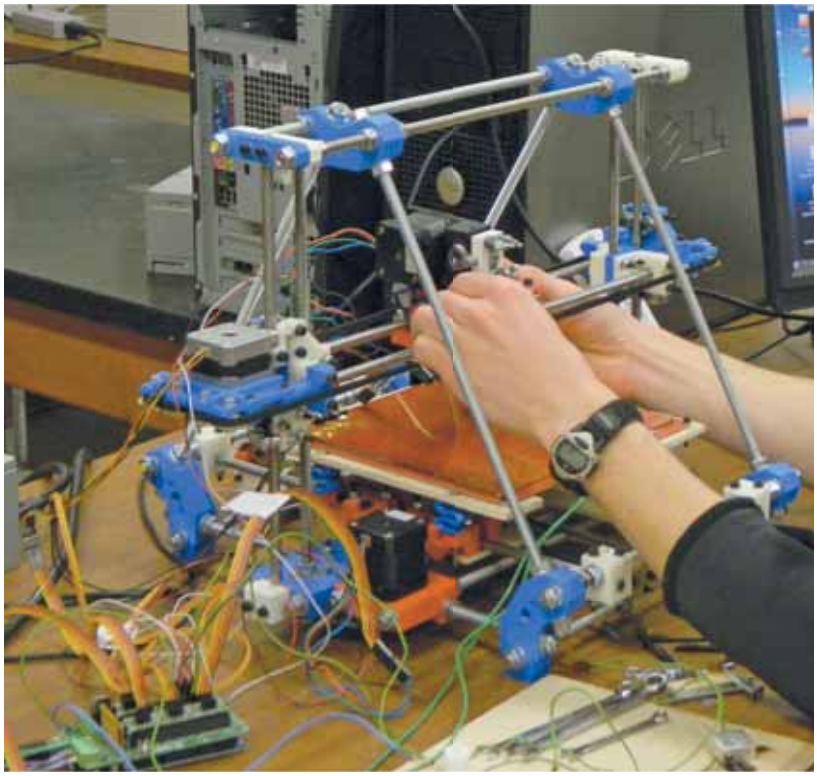
"One impediment to even more widespread use has been the cost of filament," says Pearce, an associate professor of materials science and engineering and electrical and computer engineering. Though vastly less expensive than most manufactured products, the plastic filament that 3D printers use isn't free.

Milk jugs, on the other hand, are a costly nuisance either to recycle or to bury in a landfill. But if you could turn them into plastic filament, you could solve the disposal problem and drive down the cost of 3D printing even more.

So Pearce and his research group decided to make their own recycling unit. They cut the labels off milk jugs, washed the plastic, and shredded it. Then they ran it through their homemade device—the RecycleBot—that melts and extrudes it into a long, spaghetti-like string of plastic. Their process is open-source and free for everyone to make and use at Thingiverse.com.

The process isn't perfect. Milk jugs are made of high-density polyethylene, or HDPE, which is not ideal for 3D printing. "HDPE

LEFT Joshua Pearce, Alexandra Glover, and Meredith Mulder
TOP A DremelFuge chuck, created using a 3D printer, turns a Dremel hand tool into a high-speed centrifuge.



RepRap 3D Open Source printer. Plans available at RepRap.org.

Milk jugs are a costly nuisance, either to recycle or to bury in a landfill. But if you could turn them into plastic filament, you could solve the disposal problem and drive down the cost of 3D printing even more.

is a little more challenging to print with," Pearce says. But the disadvantages are not overwhelming. His group made their own climate-controlled chamber using a dorm-room refrigerator and an off-the-shelf humidifier and yielded good results. With more experimentation, the results would be even better.

The group determined that making their own filament in an insulated RecycleBot used about 1/10th the energy needed to acquire commercial 3D filament. They also calculated that they used less energy than it would take to recycle milk jugs conventionally.

RecycleBots and 3D printers have all kinds of applications. "Three billion people live in rural areas that have lots of plastic junk," he says. "Imagine people living by a landfill in Brazil, recycling plastic and making useful products or even just 'fair trade filament' to sell. Twenty milk jugs gets you about 1 kilogram of plastic filament, which currently costs $30 to $50 online."

Mulder is a senior studying materials science and engineering with minors in polymer science and engineering, and Spanish. She is interested in studying the application of polymers, especially ways to use them for a sustainable future.

Glover is a junior. Her research focuses on designing, building, and testing an extruder for the RepRap open source 3D printer.

Michigan Tech's New Great Lakes Research Center

The work done here will be all encompassing and highly interdisciplinary, ranging from sustainability issues to the economy of the upper Great Lakes region.
Guy Meadows

THE GREAT LAKES represent almost 90 percent of the US surface freshwater, with nearly one-half of that in Lake Superior alone. Never before has the Great Lakes basin faced the magnitude of issues and stresses currently in operation—challenges that cut across all branches of engineering and science.

In the Great Lakes Research Center, Michigan Tech now has a state-of-the-art, integrated facility where engineers and scientists, students, technicians, policy makers and the general public can come together to not only share ideas, but to share laboratory space, advanced equipment and a common goal. "The work done here will be all encompassing and highly interdisciplinary, ranging from sustainability issues to the economy of the upper Great Lakes region," says Guy Meadows, director of Great Lakes initiatives.

The four-story center houses a complex of research laboratories, each tailored for a different topic that relates to the Great Lakes, among them invasive species, fish ecology, sediments, remote sensing, and atmospheric science. It also has offices for visiting scholars, a boathouse for the University's research vessels and environmental-monitoring buoy network, and a public area that includes conference facilities and space for K-12 education.

The center opened in August 2012, but its seeds were sown a decade earlier. "That's when Michigan Tech realized that water is the focus of many of the University's strengths, and the concept of the Great Lakes Research Center was born," says Meadows. "We also want partnerships throughout the Great Lakes basin, including US and Canadian government labs, industry, and other universities," says Meadows. "Our success depends on the desire of faculty, policy experts, and outside researchers to come together to do great work."

Visualization Studio Opens Doors

The array is powered by nine computers—one "master" and eight "slaves."

The Department of Electrical and Computer Engineering now has an Immersive Visualization Studio. This research and teaching space for students and faculty will transform the way Michigan Tech does business in three disciplines: electrical engineering, computer engineering, and computer science.

The facility is in a black room with sixteen computer monitors that act together to form one large display. The array is powered by nine computers—one "master" and eight "slaves." Each of the eight is capable of high-end graphics; in concert, they act like one large computer.

The bank of monitors displays high-resolution images and data far beyond what you would get with a single monitor. The facility can be used to analyze and visualize a tremendous amount of data—to study the fluid dynamics of Lake Superior, simulate volcanic eruptions, look at weather patterns, and much more. Cameras record body movement—a capability that will allow users to use the space as a virtual reality environment and control their own avatars on the display. This capability will also be attractive to researchers in the kinesiology and integrative physiology, and biomedical engineering departments.

The visualization facility is part of the Paul and Susan Williams Center for Computer Systems Research. Professor Saeid Nooshabadi, who has joint appointments in both Electrical and Computer Engineering and Computer Science, directs this computing center. He envisions interdisciplinary teams addressing new problems, sharing camaraderie and a purpose, and engaging in a "cross-pollination" of ideas.

An Adaptable Classroom

A NEW HIGH-TECH CLASSROOM on campus facilitates innovative teaching for improved learning.

The Fernstrum Family Adaptable Classroom in Room 402 in the R. L. Smith Mechanical Engineering–Engineering Mechanics Building has been outfitted with an impressive array of instructional gadgetry.

"The point is to let students stop taking notes and immerse themselves in the class," says Director of Audiovisual Services David Chard, who designed the classroom. To that end, nearly everything that happens there is recorded and saved on the web. After class, faculty can email a link to students so they can review the material. A video camera records the teacher, voice recorders capture the students' questions and comments, and two projectors display information from iPads or laptops on screens. They allow the instructor to write over the image on the screen, and they also project larger-than-life images of 3D objects to show the class in detail.

The audiovisual system turns on automatically at the beginning of class, so a professor can teach without thinking about the technology.

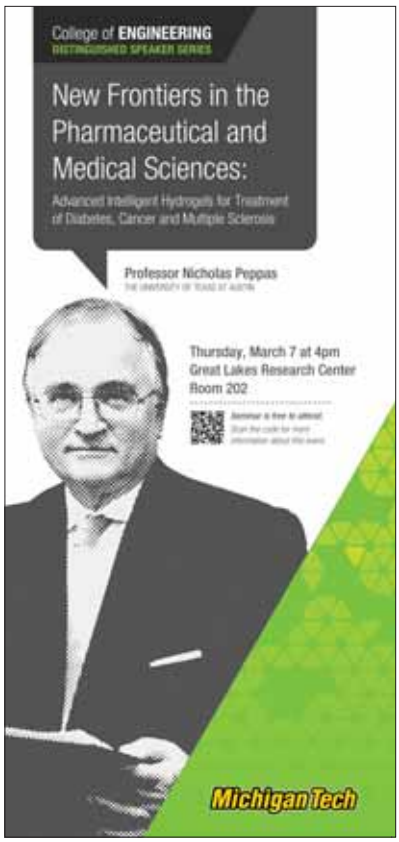
The class also features easels with removable white-boards along the walls and student desks on rollers, allowing them to form small discussion groups and easily display group work.

These bells and whistles, and those across the hall in Room 406, come to Michigan Tech courtesy of the families of Michigan Tech mechanical engineering alumnus Paul Fernstrum '65 and his sons, Sean '90 and Todd '92 (pictured above).

"We felt we could make the investment," Paul said. "It's paying it forward. I've been able to use the disciplines I learned at Michigan Tech throughout my whole life."

The point is to let students stop taking notes and immerse themselves in the class.

Distinguished Speakers Series



The College of Engineering is proud to announce its first Distinguished Speakers Series. Dean Bill Worek will host highly accomplished faculty from across the country each spring and fall semester.

Spring 2013 speakers

Professor Nicholas Peppas

The University of Texas at Austin, New Frontiers in the Pharmaceutical and Medical Sciences—Advanced Intelligent Hydrogels for Treatment of Diabetes, Cancer and Multiple Sclerosis

Dean Nadine Aubry

Northeastern University, Combining Fluid Dynamics and Electric Fields for Improved Microfluidic and Self-Assembly Devices

Professor Adrian Bejan

Duke University, Constructal Law of Design and Evolution in Nature.

For more information, visit www.mtu.edu/engineering/speakers.

Adrienne Minerick Wins ASEE Fahien Award

Associate Professor Adrienne R. Minerick is the winner of the 2011 Ray W. Fahien Award from the Chemical Engineering Division of the American Society for Engineering Education. The Fahien award was given to Minerick for her outstanding educational scholarship and teaching effectiveness. Of special note is her effort to involve underrepresented minorities in undergraduate research opportunities.

The award honors Raymond W. Fahien, who was editor of the archival journal, Chemical Engineering Education, from 1967 to 1995. It is based upon two equally weighted criteria: outstanding teaching effectiveness in the training of undergraduate and/or graduate students and educational scholarship through significant contributions to education in the field of chemical engineering.

The Fahien Award has been given by the society since 1997. Minerick is the fourth chemical engineering faculty member at Michigan Tech to receive this award. Previous award winners include Kirk Schulz (1997), David R. Shonnard (2003) and Jason Keith (2008).

Minerick received her BS in Chemical Engineering from Michigan Tech and her MS and PhD in Chemical Engineering from the University of Notre Dame. Minerick has won numerous awards for both teaching and research, including an NSF CAREER Award, the Michigan Tech Fredrick D. Williams Instructional Innovation Award, and is twice winner of the Thomas C. Evans Instructional Paper Award. Her research interests are in nonlinear electrokinetics in microdevices with applications in medical diagnostics.

Minerick and student Tayloria Adams in the Medical Micro-Device Engineering Research Lab

New Fellows

Zhi “Gerry” Tian, IEEE

Mike Neuman, IEEE

Sean Kirkpatrick, SPIE

Miguel Levy, OSA

Steve Kampe, ASM International

Fellows of Societies

IEEE
Mike Neuman, Zhi “Gerry” Tian, Dan Fuhrmann, Martha Sloan

ASME
Bill Worek, Bill Predebon, Mohan Rao, Amitabh Narain, John Johnson, Song-Ling (Jason) Yang

SAE
Jeff Naber, Mohan Rao, Bill Shapton

ASM International
Steve Kampe, Mark Plichta, Calvin White

AIChE
Dan Crowl

PCI
Tess Ahlborn

SPIE
Sean Kirkpatrick, Tim Schulz, Mike Roggeman

SME
S. Komar Kawatra

Optical Society of America
Mike Roggeman, Miguel Levy

ACM
Martha Sloan

SWE
Martha Sloan

BME
Mike Neuman

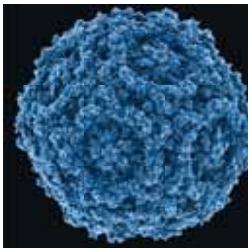
American Institute for Medical and Biological Engineering
Mike Neuman

Institute of Physics and Engineering in Medicine (UK)
Mike Neuman

GSA
Jacqueline Huntoon, Ted Bornhorst

AIMBE
Mike Neuman

Alpha Sigma Mu
Calvin White





Endowed Chairs and Distinguished Professorships—Awarded

College of Engineering

William M. Worek, Dave House Professor, College of Engineering

Department of Chemical Engineering

Daniel A. Crowl, Herbert H. Dow Professor for Chemical Process Safety

Ching-An Peng, James and Lorna Mack Endowed Chair in Bioengineering

David R. Shonnard, Richard and Bonnie Robbins Chair in Sustainable Materials

Department of Civil and Enviromental Engineering

William Leder, P.E., Roland A. Mariucci Distinguished Practitioner in Residence

Department of Electrical and Computer Engineering

Timothy Havens, William and Gloria Jackson Assistant Professor

Department of Materials Science and Engineering

Stephen L. Kampe, Franklin St. John Professor and Chair

Yun Hang Hu, Charles and Carroll McArthur Professor of Materials Science and Engineering

Department of Mechanical Engineering–Engineering Mechanics

Jeff Allen, John and Joan Calder Associate Professorship in Mechanical Engineering

Craig Friedrich, Richard & Bonnie Robbins Chair in Sustainable Design and Manufacturing

Lyon B. King, Ronald and Elaine Starr Professorship in Space Systems

Jeff Naber, Ronald and Elaine Starr Professorship in Energy Systems

Gordon Parker, John & Cathi Drake Professor of Mechanical Engineering

Rush Robinett, Richard and Elizabeth Henes Chair, Mechanical Engineering–Engineering Mechanics

Awards

NSF CAREER Awards

Aleksey Smirnov

Reading magnetic fingerprints from deep time

Greg Waite

Predicting volcanic earthquakes

Veronica Griffis

Forecasting flood risk

Fulbright Scholars

Jeremy Goldman

Bio-absorbable metal stents Technion-Israel Institute, Haifa, Israel

S. Komar Kawatra

Advanced sustainable iron and steelmaking, Tata Research Development & Design Centre, Pune, India

Gregory Odegard

Aging process of thermoplastic polymer materials, Norwegian University of Science and Technology, Trondheim, Norway

Awards

Jason Blough

SAE Faculty Advisor Award

Durdu Guney

ORAU Ralph E. Powe Award

John Johnson

SAE Franz F. Pischinger Powertrain Innovation Award

Scott Miers

SAE Ralph R. Teetor Educational Award

Gregory Odegard

SAE Ralph R. Teetor Educational Award

Mohan Rao

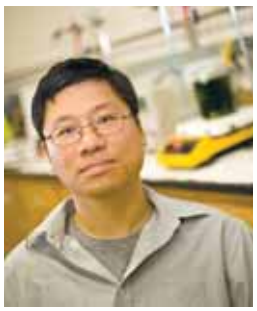
Institute of Noise Control Engineering Outstanding Educator Award

Tess Ahlborn

Woman of the Year WTS International, Michigan Chapter

Martha Sloan

Michigan Tech Distinguished Service Award



Keat Ghee Ong

Outstanding Young Investigator, Frontiers in Bioengineering Workshop

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