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Published by the students of the University of Wisconsin-Madison VOLUME 116, NUMBER 2 FEBRUARY 2012

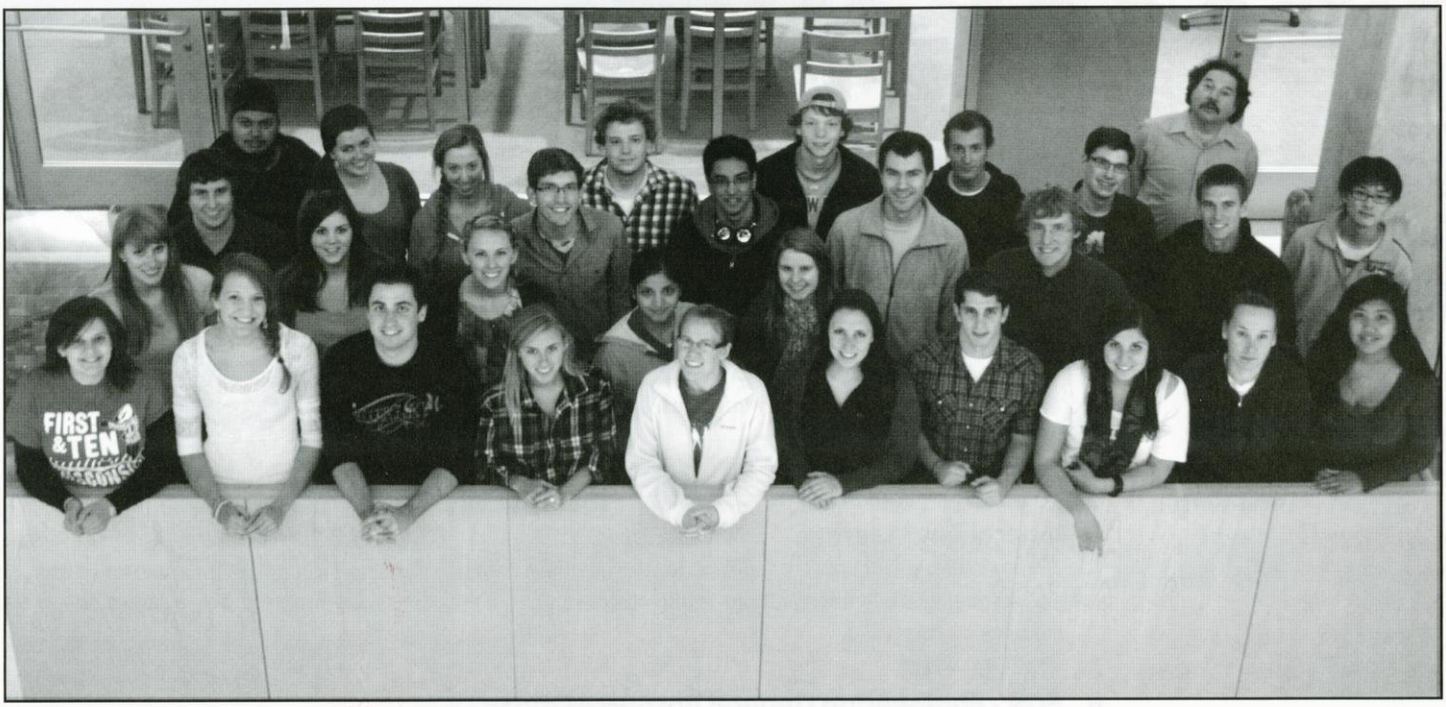
Feature

General

Cover photo by Joe Powell

Commentary

Wisconsin Engineer Staff



COLLEGE OF ENGINEERING
UNIVERSITY OF WISCONSIN-MADISON

THE UNIVERSITY of WISCONSIN MADISON

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Where will *you* go?

By: Christina Wallhausser
http://www.union.wisc.edu/wud/altbreaks-about.htm

"You have brains in your head. You have feet in your shoes. You can steer yourself any direction you choose. You're on your own. And you know what you know. And YOU are the one who'll decide where to go..." –Dr. Suess

People always say that getting a higher education can really "take you places". They talk about these places as if they were completely unattainable unless you go to college. They sound magical and fun, yet completely unknown. Upon receiving my acceptance to UW-Madison about 3 years ago I was so anxious to start "going places", as they would say. Little did I know, these places were not just my future after college, but also physical places throughout the world. Thanks to the UW, I have justified traveling to seven states within the U.S. (5 never travelled before), and now I am about to jump on a plane for 20 hours to begin my study abroad journey in Australia. I feel extremely lucky to go to an amazing school that literally takes me places.

About a year ago, on December 5th 2011, I was one of the lucky ones that bought two tickets to the 2011 Rose Bowl Game in the very brief twenty minutes they were available. On December 31st I boarded a plane to fly to Los Angeles. It was my first time ever going to California. I celebrated New Year's Eve with other friends from UW-Madison who also found themselves in California and the next day we travelled to Pasadena. At the stadium, it was almost as if we were at Camp Randall. Everywhere I turned there was a sea of red. I was even casually bumping into fellow students that I hadn't seen since exam time. I mean, seriously, I was 2,000 miles from campus and I was bumping into fellow students. And we all had that in common; we were all able to travel 2,000 miles for the same reason from the same university.

After a disappointing loss in 2011, it seemed only fair to have a second go at it in 2012. I once again logged into the system an hour early and waited for 9:00 pm to purchase yet another set of Rose Bowl tickets. This trip however was going to be different as our plans began December 26th at approximately 5:00 am in a Wisconsin decorated mini-van. This was when I began my second Rose Bowl journey thanks to UW-Madison and 15 hours later we ended up in Wyoming, again my first time. Then we travelled to Utah and Nevada (both new to me) and continued on to California. After the game we spent time in Oklahoma and Missouri, specifically St. Louis, where we toured the Anheuser-Busch brewery (you really should go if you ever get the chance). Although this journey was again greeted by a disappointing loss in Pasadena, the trip was an amazing experience. By the way, our country is HUGE!

This February I depart on yet another journey, maybe the most exciting journey of my life, which again has become possible because of UW-Madison. Of the 50 study abroad programs offered just within the college of engineering at UW-Madison, I settled on the University of Queensland in Australia where I will continue my coursework for the next five months. Prior to arriving in Australia I will be travelling to Fiji to hopefully squeeze in a week of relaxation before my "rigorous" semester abroad begins.

When I take a step back at look at my college career so far at UW-Madison, I can't help but think 'Wow, this school has really hooked me up'. UW-Madison has given me so many reasons to spread my wings and explore our country, and now, the world. I feel so lucky to have such amazing opportunities that have opened me up to different people and cultures and have provided me with a humbled mentality that I can bring back to campus. Moreover, I think about the places I will go after I graduate because of UW-Madison, whether it is through a job or volunteering or continued education; the possibilities are almost overwhelming. Every student that goes through UW-Madison will be presented with a lot of unique opportunities to explore and learn and try new things, and every student on campus should take advantage of those opportunities as often as possible. If you are curious about my adventures in Australia you can check out my blog at: *http://agingerinaustralia.blogspot.com/*
Looking for an adventure of your own at UW-Madison? Check out the alternative breaks for this year's spring break. Trips include destinations such as Michigan, Florida, Connecticut, South Dakota, or North Carolina.

SO to the Badger Herald...

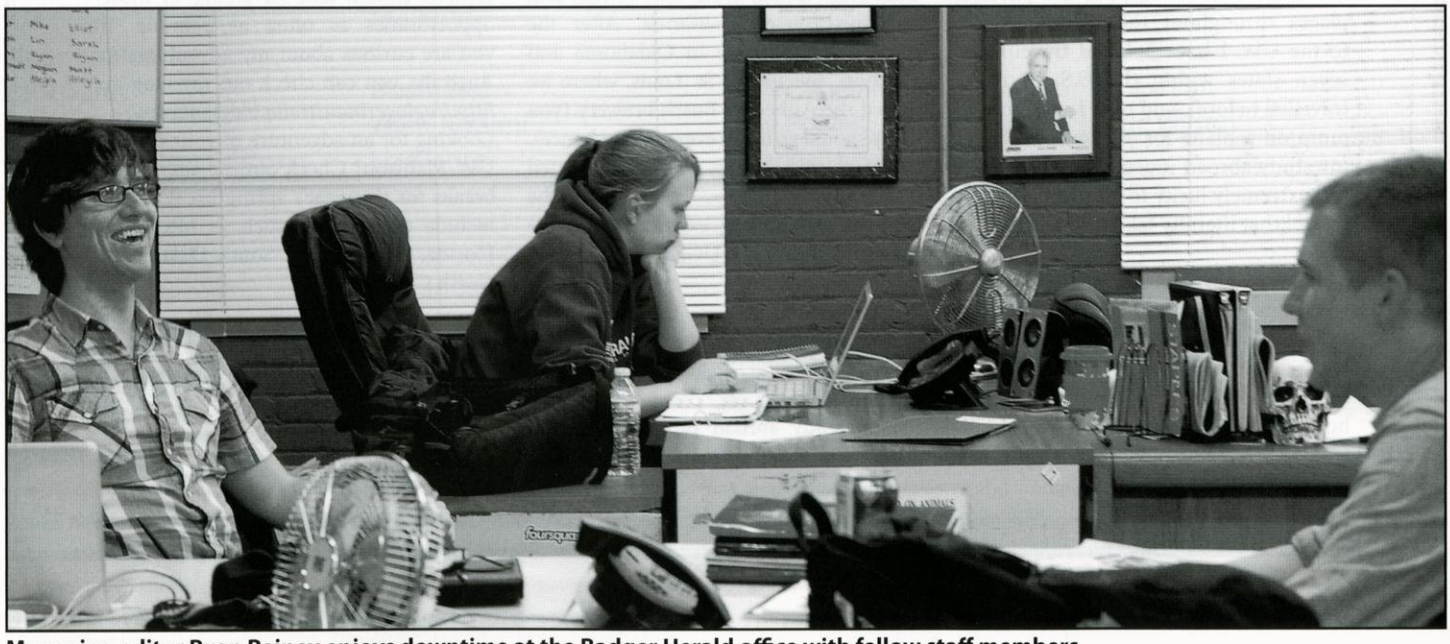
Forty-one years ago, in the midst of anti-war riots, four students with a few typewriters and desks established a weekly student newspaper. They called it an experiment. Today the experiment has become the largest and most award-winning fully independent student daily newspaper in Wisconsin, the Badger Herald.

Its offices, located at 326 West Gorham Street, bustle with about 150 staff members throughout the day. Most are full-time students and many put in 40 hour work weeks .

For every issue, the process of publication is a nearly continuous cycle, and the offices are occupied at all hours of the day. Around 100 writers and reporters scout out the biggest news stories for the next day's edition, and story assignments go out before noon. The advertising and business departments operate during regular business hours beginning at 7:00 a.m. Each department has a meeting at 4:00 p.m. to rank stories and create an agenda for the design department. Once complete news stories come in, they are triple checked, first by department head, then copy editor, then the editor in charge that day (editor in chief, editor at large or managing editor). The same three levels check the work again after content is organized and placed on the page. On an average night people are hard at work on the issue until the deadline at 2:00 a.m. For special occasions, such as an all-night session of the legislature, work continues until 4:00 a.m. After that time at night, the printer would refuse to accept the paper. The web department usually works between midnight and 6 a.m. to minimize site interruption . Just like the engineering campus , there's someone there around the clock, hard at work.

As we at Wisconsin Engineer Magazine know, practicing communication doesn't mean majoring in it. The Badger Herald is not just for communication or journalism majors. Many in the editorial department are, but many are pursuing double majors showing a range of other interests. The Badger Herald does not discriminate based on academic experience. The office's proud example is their design director, an engineering major! Whatever the major, all students can benefit from experience with a successful college newspaper. As the Editor-in-chief, Signe Brewster said, "It offers a set of experiences that you won't find in a classroom, and many employers recognize that because they once worked for a student newspaper as well."

The Badger Herald has met its share of challenges to its continuity. The paper has had to defend its decision to publish several highly controversial political cartoons and advertisements. The reprinting of a Danish cartoon depicting the Islamic prophet Mohammed sparked forums and debates on campus. Similarly in 2001 the Herald



Managing editor Ryan Rainey enjoys downtime at the Badger Herald office with fellow staff members.

A group of Badger Herald staff members meet to discuss story ideas.

published an advertisement by controversial conservative writer David Horowitz, resulting in protests and demands for an apology. Instead the Herald reiterated its commitment to First Amendment rights and received national recognition for its stance.

The Badger Herald also connects students across campus beyond the daily news in a unique way. Printed every Wednesday and available online every day, the Shout Outs give everyone a place to share random thoughts with the world. Whether profound or mundane, approving or angry, saluting the hottie in the library or denouncing the jerk in lecture, everyone loves reading the ShoutOuts. "There is a ShoutOut controller. I can't tell you who it is, but it is a single person behind that," says Brewster. "They have arguably the most important role on campus." Like the students in the role of Bucky at sporting events, the ShoutOut controller is never identified but always adored by fans across campus.

"As student journalists we are free to try different things because we are learning and we are not bound by the tradition of a professional paper"

- Signe Brewster

The Badger Herald is not just a piece of enduring history on campus. It moves at the pace of the campus, always renewing its ideas and refreshing its image. "As student journalists we are free to try different things because we are learning and we are not bound by the tradition of a professional paper," said Brewster. "That's something that we really try to respect here. We are constantly innovating." The Badger Herald does more than bring news to students, it brings students together to discuss, debate, banter, chat, tease, argue, and engage in real conversations about today's issues. What we have here is communication. WE

Article by: Lori Bierman
Photography by: Adam Dircz
Design by: Elizabeth Jurgens

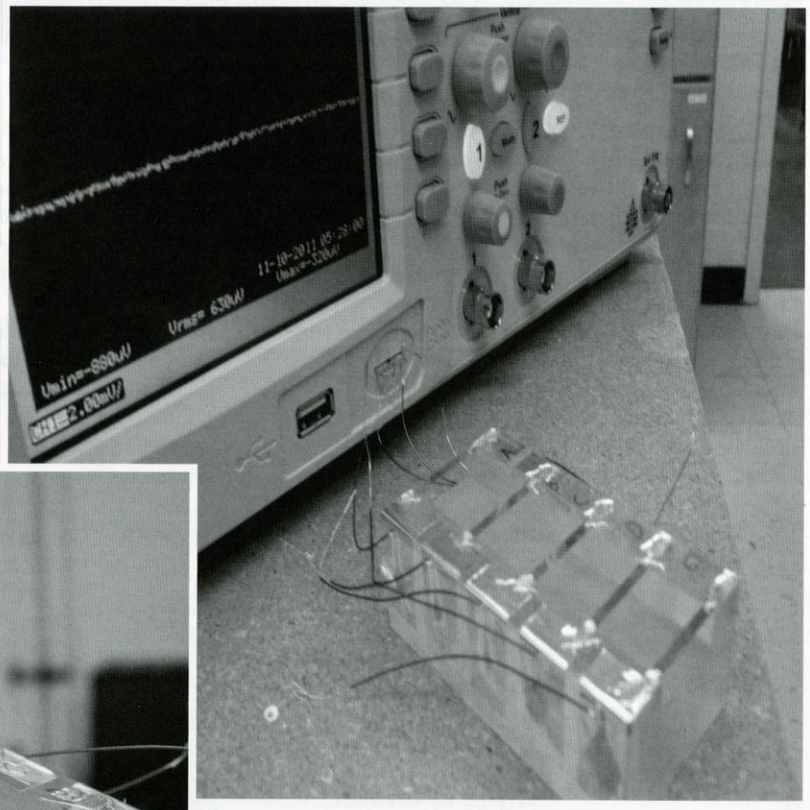
Gasp for Energy!

using piezoelectricity to recharge your batteries

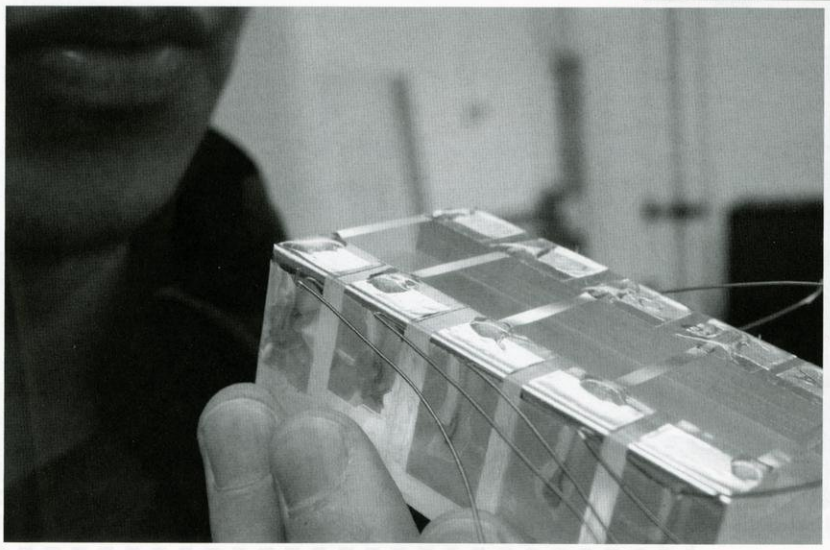
How would you feel if you no longer had to plug in your cell phone to recharge it? What about if you or someone you know could avoid an invasive surgery that was necessary to replace the batteries in their pacemaker? Imagine if you could produce the power necessary to operate these everyday electronics simply by breathing. The average person takes approximately 21,600 breaths per day, which is potentially enough to drive self-powered biomedical devices. By utilizing something called the piezoelectric effect, researchers at UW-Madison are working on a method that harnesses low velocity air flow to produce the power to do just that.

Piezoelectricity is not a common term but it is used in many common devices such as lighters, loudspeakers and ultrasound machines. A piezoelectric material is one which produces an electric charge in response to a mechanical force, such as pressure. If these materials are scaled down to nano-size, even forces as small as the vibrations from a heartbeat will trigger an electric response. Consider a few other sources of vibrations: acoustic waves, foot traffic, and air flow. Vibration forces are the most abundant and attainable mechanical energy source within our environment. Professor Xudong Wang's Nanoscience and Nanotechnology Group at UW-Madison is using piezoelectric material to harness the power from vibrations, in particular vibrations from air flow, in order to generate usable energy. Jian Shi, who is a graduate student in material science and engineering at UW-Madison, has been in charge of much of the simulations and calculations involved with this research. A former member of the group, postdoctoral researcher Chengliang Sun, was the key in suggesting the specific material used for this research.

The ideas behind this new technology were shaped from Professor Wang's research that he completed at Georgia Tech, in which he



The oscilloscope measures the vibration mvagnitudes.



Graduate student Jian Shi demonstrates how low velocity air flow vibrates the PVDF material.

What is PVDF?

The piezoelectric material that is being utilized for this research is polyvinylidene fluoride (PVDF). This is a material compatible in the body that exhibits better properties than the more commonly used piezoelectric materials. To be able to create enough vibration from an average respiration speed of about two meters per second, this material must be less than fifteen micrometers thick. In comparison, the average thickness of a strand of hair is 80 micrometers thick! The thinner the material, the more efficient it will be at converting mechanical energy into power. One experiment that the group successfully demonstrated was powering a stop watch by r unning a small fan that produced air flow around 3.5 meters per second across the PVDF microbelts. This illustrates that the group's method of harnessing low velocity air flow generates enough power for it be integrated into implantable biomedical devices.

determined various sources for mechanical energy generation. Wang is now a professor at UW-Madison who specializes in nanotechnology and piezoelectric materials. He teaches an undergraduate course in ceramic materials and also graduate level courses in nanotechnology for Master's and Pre-Dissertator's research and thesis. His motivation to succeed comes from his personal interest in the field. Wang says, "I have always had the personality of doing things the best. It's really an intrinsic thing, I think it's fun to make things work." His theory on success certainly proves true based on the numerous awards he has received throughout his career; some of which include the Ross Coffin Purdy Award from the American Ceramic Society, the Young Innovators Under 35 Award by Technology Review Magazine, the DARPA Young Faculty Award, and the KAUST Research Fellow award. Looking to the future, Wang hopes he can use his expertise to solve a more critical problem, such as solar energy harvesting.

The future in harvesting energy via piezoelectric material is shaping out to be an extremely important and competitive field for scientists and engineers. Researchers at Stanford University are working on harnessing muscular contractions of the heart to power pacemakers. This technology will incorporate a nanogenerator to not only produce power, but also to store it for emergency use. Similarly, researchers at Princeton University are working on a piezoelectric material that can be embedded into rubber shoes and will generate power using the vibrations from walking or running to charge personal electronics. Other energy harvesting technologies that are competing against these piezoelectric materials to become 'the next big renewable/alternative energy source' include solar and thermal energy, nanotechnology and even chemical energy.

One of the challenges in developing this renewable energy is incorporating a way to store the produced power efficiently. Each individual breath only creates up to a micro-watt of energy, which is not enough to power any electronic device alone (a mobile phone simply on standby consumes approximately 42 micro-watts per hour). Power output would increase with time if a method for accumulating all of the generated energy was introduced; thus to maximize the productivity of this technology, it is essential to design a storage system within the applied devices. This stored energy is what may power the piezoelectric devices in the near future until further development has succeeded in efficiently harvesting larger amounts of generated power.

Another challenge that must be overcome before this technology is integrated into nanoelectronics includes the fabrication of the piezoelectric materials. Optimizing the size is difficult because micrometer-sized products with the highest power output possible are needed. Currently, Wang's team is using an ion-etching process to thin the PVDF material from 100 to 23 micrometers. Developing a method to accomplish the thinning task is difficult because the piezoelectric properties of the material must be preserved throughout the process. Quantifying the mechanical to electric energy conversion is also a difficult task. The primary goal with this technology is to improve power density along with energy conversion efficiency while providing the thinnest product possible.

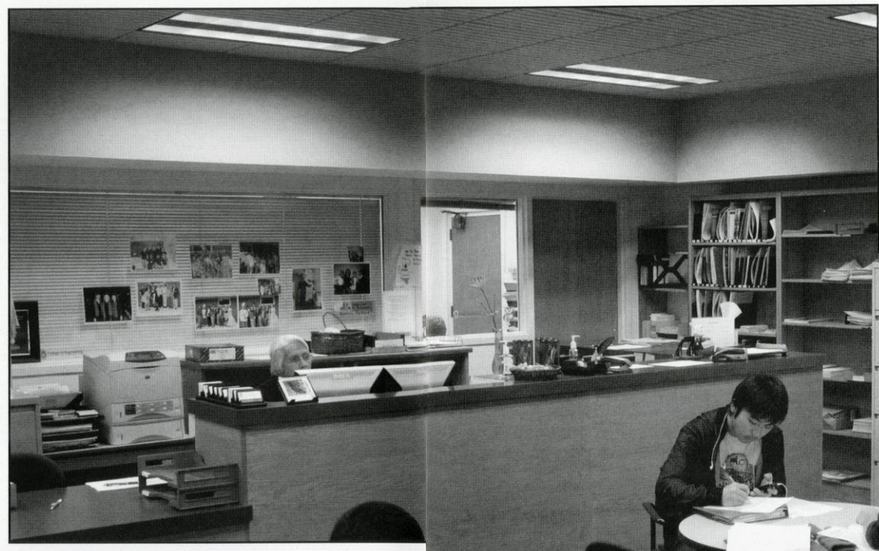
There will be high demand for this nanotechnology in the biomedical field because of its small-scale capacity and also because PVDF is a biocompatible material. One goal for this method of electric production is to be able to power devices that must be implanted in the body. Particular devices that may utilize this self-powered technology include pacemakers, defibrillators, ventricular assist devices, muscle and neurological stimulators, drug pumps and monitoring devices such as those to regulate blood-glucose levels. This renewable energy source will provide a much longer lifetime for these devices, deterring the need for surgical battery replacements.

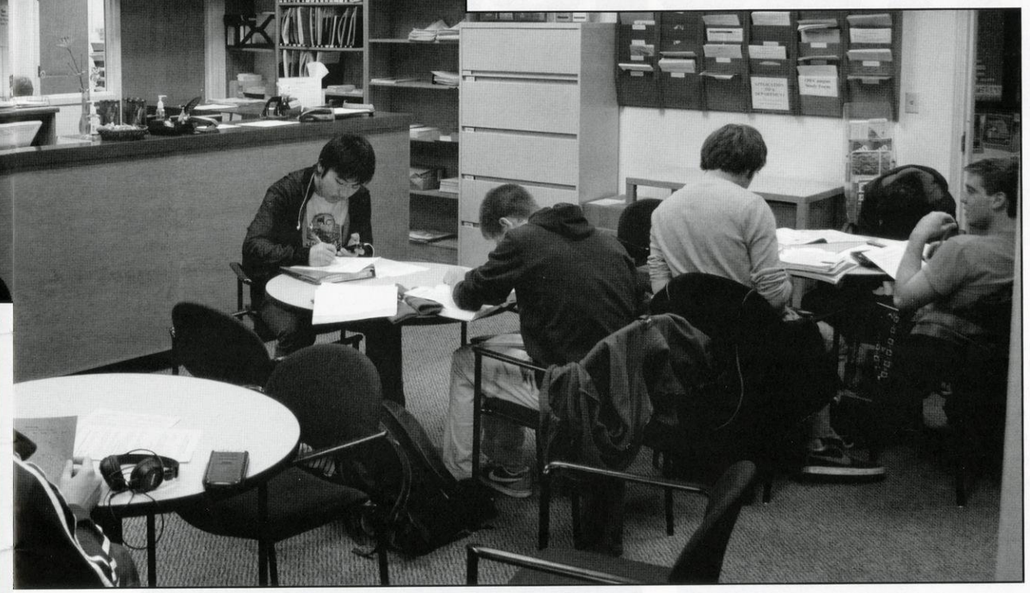
Researchers at UW-Madison are on the forefront of this technology, and considering the endless possibilities with it, someday instead of just recharging your body when you're asleep you could also be recharging your cell phone or a biomedical device. WE

Article by: Austin Kaiser
Photography by: Joe Powell
Design by: Max Burton

EGR

Advising for first and second year engineering students





The EGR office full of current students utilizing its many resources including drop in advising and tutoring.

If you are an engineer you have likely stepped inside the Engineering General Resource (EGR) office. Still remember your EGR advisor? Don't let the large engineering pool or the fact that each advisor can have upwards of 400 students to advise fool you: chances are they remember you too!

The EGR office is made up of 5 full time advisors: Eman Zaki, Tanya Cutsforth, Beth Dawson, Heather Mialik, and Bonnie Schmidt. Each advisor is assigned certain engineering departments. Tanya Cutsforth, who I spoke with, is the advisor for intended electrical and computer engineers.

Michelle Bay describes her experience with the EGR advisors as "a positive, very personal experience." Like most students, Michelle typically visits her advisor once or twice a semester to take advantage of what the advisor has to offer.

Most students typically see their advisor once a semester: when they schedule their classes. As a result, advisors are busiest right before class sign up. Outside of the busy scheduling period, most advisors' calendars are free – making it a much more ideal time to visit.

According to Tanya Cutsforth, these academic visits usually unfold in two ways: Curriculum guides and/or referrals. Advisors will initially go over everything from your DARS report, future classes, and, then refer you to potential tutors or support you may need.

Advisors are a great resource; they can connect you to information about studying abroad, certificates, changing majors, and more. Tanya herself says that "we all know a lot of advisors on campus." Whether it means providing a connection to another advisor, the EGR advisors want to "make sure people understand the resources available to them," says Tanya. Advisors are brimming with information from where to find great study groups and general preparation strategies to what the scoop is behind certain professors.

This year, the EGR advisors provided first year students with a new resource, Group Advising Days. Over the course of two days they provided information sessions where Tanya says "students came in to hear course choices for the spring, experienced a resource fair, received cross college advising, and got to speak with many other departments." She describes this resource as a "one stop shop" to help students become better informed. A majority of engineering freshman attended and the event was deemed a success. Another Group Advising Day is being planned for next fall.

Advisors admit that sometimes it's hard to break through to students. First year students often are hesitant to take full advantage of advisors and support programs. Tanya says "it's tough to know right away" when and where to get help in classes such as Calc 222 or EMA 201 (Statics). Most incoming students do not receive tutoring in high school and aren't comfortable with asking for help. My freshman year my advisor recommended that I enroll in the math department's Supplemental Instruction program –and as a result I saw an increase of two letter grades!

Most of the EGR advisors have been in students' shoes. Take Tanya for example, when she was a freshman at UW-Madison, she was failing Calculus 221. She felt the disappointment, frustration, and confusion most students feel. She decided to go in to talk to her advisor who helped calm her down and assisted in switching her classes. Like the rest of the staff in the EGR office, Tanya wants to "help students avoid some of the missteps."

Most importantly, advisors advise because they love it. Yes, academic advising is an important aspect of their job, but EGR advisors go beyond that daily. Tanya says "we really make sure to be accessible when they [students] need it."

As an EGR student, there was one month that I had to take an excused absence due to health related issues and family events. My EGR advisor was there for me; not only did my advisor make it a point to advise me every step of the way – she checked up on me with a personal phone call while I was gone to ask me how I was doing.

Whether you are still an EGR student yourself or have been accepted into your program, our friendly EGR advisors provide the resources to a better life here on campus. Why not give the EGR office a call to schedule an appointment with your advisor? After all, the EGR advisors want to share their experiences with students. As Tanya puts it " "the people who had the biggest influences on me as a student were my advisors and I want to pay it forward." WE

Article by: Rachel Feil
Photography by: Chris Ross
Design by: Evan Owens

The Future of **Nuclear** Energy

It has been nearly a year since the Fukushima-Daiichi nuclear power plant experienced catastrophe, after a massive earthquake devastated Japan and left nearly 16,000 people dead and another 80,000 homeless. The earthquake and the following tsunami caused critical damage at the Fukushima plant that led to multiple reactor core meltdowns and emission of radioactive material into the surrounding area. Consequent expenses of the 20-kilometer evacuation, stabilization of the facility, and waste treatment will cost billions of dollars. Additionally, the event has raised worldwide concerns about the safety and future role of nuclear power in a global environment dependent on energy.

The decommissioned Fukushima plant, first commissioned in 1971, was one of the 25 largest nuclear power plants in the world. It consisted of six light-water boiling reactors, and it was capable of producing over 4,500MW of electricity. Located on the eastern seaboard 250 kilometers from Tokyo, the facility was designed to withstand a magnitude 8.2 earthquake which would produce a five meter tsunami. It was grossly ill prepared to withstand the magnitude 9.0 earthquake and 15 meter tsunami it was faced with.

"The disaster at Fukushima released over 10 times more radioactive material than did the Three Mile Island accident in Harrisburg, Pennsylvania in 1979."

In order to understand how control was lost, it is necessary to understand the chain of events that led to the cessation of nuclear core cooling and, ultimately, meltdown. The seismic activity initially triggered an automatic shutdown of the reactors, and the nuclear chain reaction was stopped while cooling systems removed decay heat. However, the tremor resulted in loss of offsite electricity supply, which necessitated the use of diesel generators to power the emergency cooling pumps. An hour later, the plant, designed to withstand waves around 5 meters tall, was impacted by a 14-meter wall of water that left all motion-operated pumps inoperable. Reactor operators attempted to use emergency battery power to keep the cores from overheating while additional batteries were dispatched, but they only arrived six hours after the tsunami struck due to hazardous transit conditions. Cooling problems persisted, and the facility experienced meltdown in three reactors, which led to several large hydrogen gas explosions.

A general emergency was declared, and 200,000 people were evacuated. The disaster at Fukushima released over 10 times more radioactive material than did the Three Mile Island accident in Harrisburg, Pennsylvania in 1979 and about 1/10th of the radioactive material of the Chernobyl disaster in 1986. No loss of life has been attributed to the Fukushima accident, but a small number of workers were reported to have experienced radiation exposure of six times the allowable limit. The estimate of latent cancers is relatively low at 100 out of tens of millions when compared to Chernobyl, which saw about 50 early fatalities and thousands of attributed cases of cancer.

It is curious just how the disaster was able to unfold in the first place. The Fukushima facility was shown to be highly under-equipped to withstand such a large, once-in-a-thousand-years natural disaster. But officials were aware that tsunamis of larger magnitude had occurred in the past—specifically, a larger earthquake in 869AD. This has raised

concerns, not only in Japan, but also worldwide about the resilience to natural disasters and readiness of governments to respond in the case of an emergency. While Japan and the United States' philosophy for handling natural disasters is similar, the U.S. has more advanced safety measures and robust surrounding civil infrastructures. For this reason, Professor Michael Corradini, a professor of nuclear engineering at UW-Madison, believes that such a disaster "would never have happened in the United States."

There are many lessons to be learned from the Fukushima disaster. The Tokyo Electric Power Company (TECPO) did not sufficiently prepare for large-scale nuclear accidents. The facility's on-site emergency electricity sources were lost quickly, and a plan for dealing with prolonged power failure was not instituted. Improvements are necessary to severe accident management, as well as regulation and oversight. More rigorous personnel training, drilling, and exercise must also be called upon.

In response, the United States has made attempts to strengthen its existing nuclear program. U.S. nuclear power plants are prepared for the maximum credible disasters that pose a threat— floods, earthquakes, tornadoes, aircraft impact, etc. Industry preparation such as training is aimed to exceed the Nuclear Regulatory Commission's (NRC) requirements. U.S. industry has a long tradition of continuous learning, and a substantial amount of safety updates were put into action over a decade ago after the 9/11 terrorist attacks. In the short term, the U.S. is taking action to verify plants' capability to respond to natural disasters and loss of off-site power as well as emergency response equipment.

Support for nuclear power took a blow after the Fukushima disaster. A CBS News Poll in March of this year showed that American's approval of the United State's building new nuclear facilities dropped from 57% to 43%. Attitudes vary along regional, partisan, and gender lines. While the numbers may reflect a highly reactionary response to the disaster in Japan, they demonstrate just how fragile citizens' attitudes toward nuclear energy are in the United States even three decades removed from its last major disaster.

The United States' plan to mitigate public fears of nuclear energy is to demonstrate by example. Enhanced safety regulations put in place over the past decade and increased awareness and sensitivity provoked by the Fukushima disaster will greatly reduce the risk of a catastrophic event at one of the United States' 104 nuclear power plants—two of which are located in eastern Wisconsin.

Despite public fears that surround nuclear energy, it is a technology unlikely to diminish. While there are tremendous financial hurdles that must be overcome to develop new facilities, nuclear power currently provides about 20% of the United State's energy needs. The clean and, in the case of the United States, increasingly safe alternative to waning fossil fuels is likely to remain a prominent player in supplying global energy demands. WE

Article by: Matt Treske
Photography by: Sara Karraker
Design by: Max Burton

Signs in the Mechanical Engineering building light up to notify occupants if radiation is leaked from the research reactor.

A small charter school in Milwaukee uses a rigorous science and engineering curriculum to close the achievement gap

Carmen High School of Science & Technology

Chris Sover, a UW-Madison alum, Teach for America corps member and biology teacher at Carmen works with students on DNA translation during the three week winter *intersession*.

Where are we going to get the next generation of scientists and engineers? That's a question Dr. Patricia Hoben was first asked when she entered a career in public policy after completing a doctorate degree in biophysics and biochemistry at Yale.

To find her answer, "You have to look at the population." says Hoben. According to the U.S. Census Bureau, the Hispanic-origin population contributed over 50% of the nation's total population growth from 2000 to 2010, making them the fastest growing population in the U.S. Dr. Hoben, who was familiar with this type of research, set off to find and groom the future scientists and engineers of the United States—and she decided to start in Milwaukee.

"We knew when we were going to open in the south side that there was a very fast growing population here and not enough schools to serve them," says Hoben who opened Carmen High School of Science and Technology in 2007. Not having enough schools is not the only struggle many families on the south side face. With the average annual income for a family of four in the neighborhood being $24,000, there is limited access to resources many of us take advantage of.

There is an overwhelming amount of research from various public and private institutions that defines an achievement gap between low-income children and their peers from more affluent backgrounds. Low-income and minority students do not perform as well in math and reading on standardized tests by statistically significant margins. When Dr. Hoben started the project to make quality education that emphasizes science and engineering, available to the fastest growing population in the United States, she came in direct confrontation with the achievement gap.

Among the plethora of issues that high schools in urban settings face when trying to provide quality education, an overreaching pattern is "kids that have been, what I call socially promoted," says Hoben. "When even though they failed everything in 7th grade, they got allowed to go to 8th grade and then they failed everything in 8th grade and got allowed to go to 9th grade." When developing a curriculum with the goal of preparing these students for college, the problem of "social promotion" makes the jobs of high school teachers and administrators incredibly difficult.

Students that have been socially promoted or passed junior high with mostly Ds have never been held to standards that forced them to actually master the curriculum. Dr. Hoben explains that the key to preparing students for college is to change that culture of low expectations. "We are going to hold the bar here and say you can't pass until you meet the criteria," says Hoben, "and we have to do something to support kids if we are going to have that kind of a standard."

Many of the students arrive at Carmen with extremely below average standardized test scores that prove they really lack most of the basic skills that a high school curriculum is supposed to build off of. Dr. Hoben and her team designed several mechanisms to be able to give kids the opportunity to get up to a C level work. The first intervention measure is an after school program that students are assigned to by their teachers if they are not meeting the standards in class. "You have a smaller group instruction and the teacher knows what it is that group of kids isn't doing well on. The idea is that if you fail a test, after two weeks of going to after school program, you are allowed to retake the test," says Hoben. For students that go to the mandatory after school program but are still not able to raise their grade to a C, intercession programs are available in between semesters and in the summer. "You have the opportunity to take 3, 2 hour classes a day, so 30 additional hours, where we review the key, core things. Basically, it's like an extended semester."

Mr. Sover created recognition programs like the 'Bio Baller' in the spirit of competition to motivate students to work hard.

Students who are not able to bring their grade up in a course through any of these mechanisms will be forced to take it again. "We don't ever ask people to leave. We want people to finish here, if it takes them 5 or 6 years. We want them to stay here and finish, it's an investment on both sides, that's how we look at it. They can't keep graduating kids that are not ready to take college level courses. And so that was one thing that was behind our thinking—how can we structure a program that won't let kids leave unless they are ready to do college level work?"

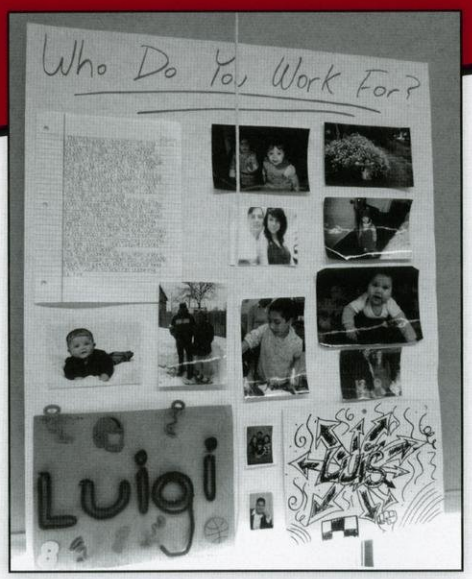
And when Dr. Hoben says "ready" for college level work, she means it. After learning that about half of UWM students that came from Milwaukee Public Schools were taking remedial classes in their first year, she was bothered. "When you look at the income levels in Milwaukee, these are children that come from impoverished homes and scraping together tuition is huge. To have to take remedial classes, up to 28 credits, that don't even apply to the college degree is just absurd." says Hoben.

Dr. Hoben and her team immersed themselves in research on college readiness. "The ACT is an achievement test that has a lot of research behind it," says Hoben. "What they showed is that students that get a certain score on the reading, have a 75% chance of getting a C or higher and a 50% chance of getting a B or higher on their college level biology class. There is real predictive value to that." So Dr. Hoben and her team went and looked at what it is these successful schools were doing that linked to higher performance on those exams and found that a common denominator was something called a "common core curriculum--4 years each of English, science, math, and history," says Hoben.

When developing Carmen's curriculum, Dr. Hoben drew from research by ACT on college readiness and her personal educational experiences. "I spent the last 25 years of my career outside of the research lab but still using my science in many different capacities. That's really why I thought an emphasis on science and engineering isn't just for the purposes of breeding more scientists and engineers, but to make everybody better thinkers and problem solvers and have the analytical mind of a scientist."

Carmen not only sets the bar high for its students, but for its staff as well. Six of the teachers at Carmen are current or former Teach for America corps members. "I feel that young people that are selected by Teach for America (TFA) are from schools that offer some of the most rigorous college curriculum and that these young candidates generally are among the highest performers," says Hoben, "If you have that knowledge, then you are comfortable enough in your subject area and you like it enough to have things in place that will help you be a good teacher."

Chris Sover, a second year TFA corps member and biology teacher at Carmen says that one of the biggest challenges when working with his students is getting them motivated to perform well. His classroom is decorated with multiple posters and pieces submitted by students that support a theme of



Posters like this one, found in Mr. Sover's biology classroom remind the students 'who they work for' to help keep them motivated to continue to perform well.

motivation through many mechanisms. "I post their class averages and they kind of compete against each other. So they can see that they are improving and getting closer to closing the achievement gap," says Sover. In the spirit of recognition as a reward for high performance, Sover dedicated a space in his classroom for different ranks of "Bio Baller"-ness. For those who attain "Bio Baller" status, they get a synchronized shout-out from the entire class—"Ballaa!" A third motivational mechanism Mr. Sover uses in his classroom is asking his students to remind themselves who they work for. "They understand that they are getting an education to improve their future and that's the reason a lot of their parents came here."

Low skills and motivation are problems that Carmen's teachers and administrators can deal with directly and in the classroom. "85% of our kids use Spanish as the primary language in the home," says Hoben, "so if you are going to want to engage parents in the whole process, you are going to have to have services that address the fact that they are not native English speakers."

Other facets of the achievement gap issue do not necessarily have solutions that can be solved through the hard work of a group of individuals but rather lie in resources that are out of reach. "85% of our kids use Spanish as the primary language in the home," says Hoben. "So if you are going to want to engage parents in the whole process, you are going have to have services that address the fact that they are not native English speakers." According to a Carmen brochure, 65% of the students at Carmen are first generation high school graduates and 95% are first generation college enrollees. It was certainly a great achievement then, when 100% of the class of 2011, the first graduating class at Carmen, were accepted to 4 year colleges.

93% are currently attending college. "The reason of course the other ones aren't is strictly financial. There is a limit to what we can do there," says Hoben. To help address this issue, Dr. Hoben and her team developed another mechanism that makes their charter school unique—an internship program. "Our kids work one day a week and the sponsorship fees we collect for the interns goes into a scholarship fund. For every semester you intern you could get scholarship. Last year it was $600 a semester," says Hoben. Not only does the internship program provide financial support, but it acts as an enriching out-of-classroom learning experience. "At the internship they go out and get life skills. They need to be able to see what professional cultures are and what the opportunities are out there. To take first generations and put them right into college, it's a culture shock," says Hoben.

Carmen's recognition of the difficulty this culture shock can create for the students' success in college led them to implement a Deputy College Transition Coordinator position. "You have to be a pretty independent person to be able to figure out how to navigate the college system. So we really micromanage that process those first few years of college," says Hoben. "We are trying to create a support system so first generations can not only get their college paid for but be successful." WE

Article and Photography by: Melody Pierson
Design by: Tom Bernath

Liberal Engineering

Gym may take your breath, but it doesn't give you breadth…

Liberal Arts and Engineers: a fiercer on-campus rivalry is hard to find. Of all the graduation requirements imposed on engineering majors, some of the most obscure fall into this category. Two courses from the same department, one intermediate or higher level course, ethnic studies, social sciences… why so many restrictions? The goal of these requisites is to open up students to new schools of thought, and to hopefully help them find new areas of interest. While this is a noble intent, the methods used seem to fall short, as is so often the case in the education world.

Many students here at UW-Madison have no problem with the idea of breadth requirements to ensure graduates are well-rounded. This does raise an issue with some, however. If engineers are required to take liberal studies electives to be well-rounded, why aren't liberal arts majors required to take intermediate math or science courses? Fair is fair, after all. And just think what it would do for the curve if an art history major took statics! It should be equally important that non-technical majors have an appreciation for how the world works as it is for technical majors to have an appreciation for how society works.

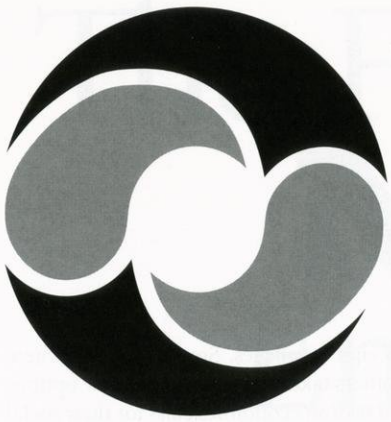
Another area some students have problems with, as mentioned above, are the number of restrictions forced upon. Often times this leads to students digging through the undergraduate catalog in search of that "magic class" that will hopefully fill more than one of these requirements. So, instead of actually taking courses that may be of interest, the outcome is an almost cookie-cutter line-up of classes that are taken merely out of necessity. Many of these courses are taken purely because of ease, such as Scary Monsters or Music Appreciation, lovingly known by those who take it as "Clap for Credit". The end result; instead of helping to broaden horizons, these requirements often become the equivalent of degree busywork.

For a majority of students, the most difficult of these requirements to fill is ethnic studies. Many classes that seem like they would fill this requirement actually don't; Asian Literature for example. Many of which do cater to a very specific interest group. Most students end up relying on friends' advice for what course to take, but this doesn't always work out for the best. So what are some of the most popular courses taken for ethnic studies by engineers? Anthropology 104 is a definite crowd pleaser, but be ready to read! Most find the material interesting but the work load can be a pain. If that doesn't sound like your cup of tea, then Sociology 134 is a good choice for those who don't want too much of a time commitment. Unfortunately these classes can vary quite a lot from semester to semester as different teachers will have very different styles and motives.

Luckily, there are a few useful courses that one can sneak in to fulfill at least some of their breadth requirements. Many use this as an opportunity to further their exploration of foreign languages. Some continue where they left off in high school, while others take advantage of the new options offered at UW-Madison. Many also take an economics class for their social sciences requirement which can be very valuable both now and after graduation. Additionally, if you are interested in earning your Technical Communication Certificate, there are several courses that will qualify as TCC electives and also help with liberal arts for your primary degree.

In the end it comes down to this; Just like the rest of your classes there will be some you enjoy and some you don't; some you think are pointless and others that seem invaluable. While the multitude of restrictions definitely put a hamper on which courses you can take, you should still be able to squeeze in a few that you actually want to. For the rest, try to find a course that at least somewhat caters to your interests. The experience will be more enjoyable, more educational, and most likely the material will be easier for you to understand and relate to. While you're there don't forget to branch out and meet some new people! WE

Article by: Nathan Rogers
Photography and Design by: Dani Dewitt



openMAMA

wall street software goes open source

Wall Street and the New York Stock Exchange are known for many things: relentless capitalism, greed, scandal, wealth, etc. Perhaps the only thing that the NYSE is not known for is sharing, yet sharing is exactly what Wall Street is doing with some of its software.

NYSE Technologies is the information technology division of NYSE-Euronext, the corporation that manages the New York Stock Exchange, along with a number of other exchanges around the world. Since the mid-90s, NYSE Technologies has licensed an application programming interface (API) to banks and investment funds called MAMA. MAMA stands for Middleware Agnostic Messaging API and it allows financial outfits to retrieve information from a centralized platform that streams data from over two-hundred markets worldwide.

"Data rates are growing, the number of sources are growing, the innovation is that data is growing; it is changing [and getting] a lot more complex, constantly."

- Brian Boherty

The purpose of MAMA, and other software like it, is to act as a tool that organizations on Wall Street can use to decide how to trade capital. The amount of data required to make those decisions is truly daunting. Every day approximately $153 billion of stock is traded amongst organizations at the New York Stock Exchange alone. This huge sum of money is the net worth of approximately three billion shares of stock from over 3600 listed companies that are traded every day. Needless to say, nobody could filter and make decisions based on all of that data at once. As Brian Boherty, the managing director of NYSE Technologies says, "data rates are growing, the number of sources are growing, the innovation is that data is growing; it is changing [and getting] a lot more complex, constantly." So programs like MAMA allow organizations to retrieve only the data that is important to them at a given time. For example, an organization might be interested only in stock traded within a particular industry, or by a small group of companies, or even by just one particular company. Organizations then use even more software to filter and organize this data in a way that makes it usable.

On October 31st, NYSE Technologies released the source code for MAMA under the GNU Lesser General Public License, making the software open source. The software, now called openMAMA, is hosted by the Linux Foundation. The significance of this decision is that the source code for MAMA can now be shared by the capital markets community, which includes vendors, small financial operations, financial start-ups and even competitors to NYSE Technologies.

There are several objectives behind the decision to move MAMA to an open source distribution structure. First and foremost, NYSE Technologies is a commercial entity and part of the reason why it decided to open source one of its key technologies is that it sees the potential to derive revenue from openMAMA. For example, NYSE Technologies sells a number of other software packages that are designed to work alongside openMAMA. By opening up the source code for MAMA to the public, NYSE Technologies hopes to see rapid growth in the adoption of the technology. Thus, NYSE

What is an API?

>> An application programming interface (API) is a particular set of rules that computers can use to communicate. An API allows different applications to understand each other. For example, an API allows users to copy and paste text from Microsoft Word to Notepad.

Technologies hopes that the market for their other software will expand. Additionally, NYSE Technologies seeks to position itself at the center of the open source financial software market, building customer loyalty and credibility in the process.

There are other, less self-centered reasons to open source MAMA though. For example, like all technology, the scale and complexity of the software used on Wall Street is constantly increasing; in fact the rate at which these technologies are becoming more complex is accelerating. Many of NYSE Technologies' clients were unable to keep up with the rapid pace of technological advancement on their own. , so NYSE Technologies took the innovative approach of turning over their software to the community. Consumers of openMAMA can develop their own feed handlers for filtering and interpreting market data, which enables downstream users, and the capital markets community as a whole, to more rapidly adapt to changing technology.

"Within this community, financial outfits, funds, banks, traders and vendors can operate without the fear of being locked into a particular set of technologies."

Another important problem solved by openMAMA is called vendor lock-in. Currently, various software tools for the financial services industry are distributed by vendors. Software vendors are simply business organizations that develop and sell software, either for mass-markets or niche applications. One of the primary ways that vendors differentiate themselves from their competition is to develop proprietary software, which they guard, sometimes fairly fiercely, against development by any third party, including their clients. For example, there are many vendors that sell software that works with MAMA. However, the problem that businesses face when they purchase software from vendors is that they can become dependent on one particular vendor to satisfy their technological needs. This is an issue because the costs associated with switching from one vendor to another are extremely high. So, when a company chooses a software vendor, they are stuck with that vendor for the foreseeable future and they can face problems if the vendor they choose falls behind other vendors in terms of the quality, performance and cost of their software.

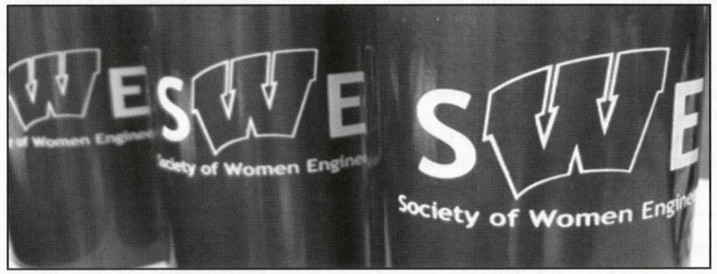
OpenMama solves this problem by creating a capital markets community based on a common, freely-available platform. Within this community, financial outfits, funds, banks, traders and vendors can operate without the fear of being locked into a particular set of technologies. In fact, aside from its economic objectives, the creation of this collaborative community was one of NYSE Technologies' major goals in its initiative to create openMAMA. According to Brian Boherty, "what really [NYSE Technologies] wanted to do here was to create an environment and an ecosystem in the capital markets community where the innovation is shared with everyone."

In its current form, openMAMA is only compatible with Linux systems and not all of the source code for MAMA has been released; however, NYSE Technologies promises that, within the coming months, the entirety of the MAMA code will be available as an open source financial messaging API. Additionally, openMAMA will be made available for use on any computing platform. By May, 2013, openMAMA is scheduled to be fully open sourced on (in order of implementation) C, C++, Win32, .NET and Solaris. As openMAMA becomes increasingly available, it may well be the future of software in the capital markets industry not only because it will help existing companies become more profitable and efficient, but also because it will allow new companies to enter the market more easily. WE

Article by: Scott Hatfield
Design by: Evan Owens

What is Source Code?

>> Source code is text that computer programmers write using the format and syntax of a particular programming language. Source code is converted to binary (ones and zeros) when a computer runs it, but because binary makes little sense to humans, source code makes it easier for humans to read code.



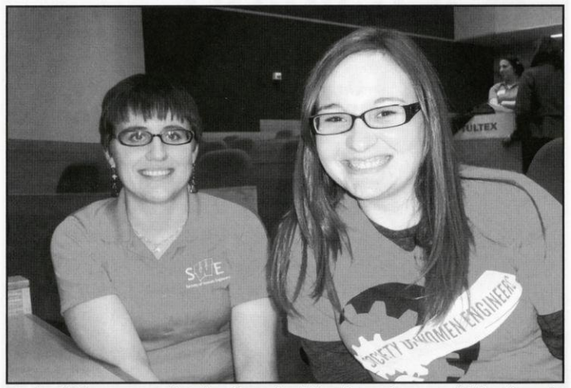
SWE Region H Conference

University of Wisconsin-Madison Hosts the 2012 Region H Conference

The Society of Women Engineers (SWE) is an engineering student organization on campus that promotes the involvement of women in fields of science, technology, engineering, and math - but you have heard all of that before. What you might not have known is that SWE is a national organization with both professional and collegiate sections, all split into regions and each of which hosts a regional conference every year. And this year… the University of Wisconsin-Madison takes center stage!

This February 17th – 19th, the UW-Madison chapter of SWE is hosting the annual Region H conference, a massive event that requires extensive planning. Region H is the largest of the SWE regions, with about 2,800 members, 45 university sections, and 13 professional sections. It includes Wisconsin, Minnesota, Illinois, Indiana, Michigan, Iowa, North Dakota and South Dakota. Being one of the largest regions, the Regional Conference tends to get a large number of attendees, typically 700 to 800. With such a large number of guests anticipated to the Madison area, what better place to host a conference than the Concourse Hotel?

The hotel is essentially booked for the weekend, save 11 single rooms, and it is ready and waiting for the Region H Conference Events. When attendees check in on Friday night, they have the choice of going out and exploring Madison or sticking around for some relaxed networking, otherwise known as fun. The next morning, guests will have breakfast with a keynote speaker, and then attend their choice of five sessions catered toward professional development, personal development, networking, section building, and much more. Conference attendees can also choose to tour the Wisconsin Institute for Discovery, Babcock Dairy, Epic Systems (a medical health records company based in Verona), or Capitol Brewery. As if this were not enough to fill one's day, attendees may also pass out their résumés at the career fair that the conference will be hosting. Once the day is over, the guests will have dinner with another keynote speaker, and wrap up the night with social events. Sunday morning, exhausted and exhilarated by the previous days goings-on, the attendees can grab a complimentary breakfast, check out, and return home, satisfied that they have networked, learned, and enjoyed a weekend with new friends.



Becky Kriger, a senior in Chemical Engineering, and Kim Pagel, a junior in Consturction Management and Engineering, are the Regional comittee co-chairs.

"Since school has started, we have planned and coordinated 40 sessions, four tours, the online registration system, figured out food, got all of the entertainment, and have made a game plan for acquiring volunteers."

-Becky Kriger

The conference may seem fairly straightforward – a standard networking experience, you might think; that is until you are in charge of planning one. Becky Kriger, a senior in Chemical Engineering and full time SWE member, and Kim Pagel, a junior in Construction Management and Engineering and also a full time "SWEster," are the Regional Committee co-chairs, and they pretty much run the show. Thankfully, the dynamics of the duo could not be more ideal. "We being co-chairs could not have gone any better, it's the perfect combination," says Pagel. Kriger agrees, "Kim and I are just made to be together." It is a good thing too – the UW-Madison chapter of SWE added 14 new officers to their team this year in order to plan the conference, and Kriger and Pagel manage them all. These additional positions include: a finance chair, corporate relations chairs, sessions planner, career fair planner, tours chair, website manager, registration chair, hotel liaison, entertainment chair, and volunteer coordinator. All of whom have been working together since last spring to work on the conference. Most of the summer was spent planning ahead and asking companies to be sponsors, but things really kicked in during the fall semester. According to Kriger, "Since school has started, we have planned and coordinated 40 sessions, four tours, the online registration system, figured out food, got all of the entertainment, and have made a game plan for acquiring volunteers."

And that was by the beginning of November. To their relief, all that is lef are the logistics of the conference such as which room should hold each session and where the signs should be placed. "I'm really proud of what our committee has done so far," she beams, "because we have gotten a lot done."

Sophie Weinsheim, a member of the regional committee, is updating the SWE website: *http://swe.slc.engr.wisc.edu/* at the SWE office on campus.

The planning was not all smooth sailing, however. During the summer, no committee members were in the same place, so keeping in communication was a struggle. Kriger and Pagel coordinated video calls, phone meetings, and a meeting once a month in person to try to keep on track. There are certain things that simply cannot be planned nine months in advance, so staying ahead of the game really helped the committee to accomplish everything they needed in the time cram they had.

All in all, being co-chairs for one of the largest region conferences really pushed Kriger and Pagel to their fullest potential. They acquired a variety of skills, including how to write professional emails, being able to talk to companies, talking to large groups versus small groups, how to manage people without micromanaging them, leading without giving orders, recognizing when to step in and when to let others take leadership roles – "It's not like they work for us…." ays Kriger, it is more of a "do what you need to do so that there will be a career fair at the conference." The pair has gotten better at presentations, holding meetings, marketing, and time management. Pagel explains, "It's amazing what you don't have to do every day, as opposed to what needs to get done." Finally, there comes fundraising. According to the two, "The biggest hurdle in fundraising is to know who to contact."

Still, Pagel and Kriger are satisfied with their accomplishments and what they have ahead of them. They look at the experience as a way to grow, learn, and contribute to the UW-Madison chapter of SWE. Also, Kriger comments, "One thing I've heard many times – if you can plan a conference, planning a wedding will be way easier."

So what about after the conference? The pair does not know just yet – "Nothing matters until the conference is over." – But one thing is certain, they will definitely be better equipped for the future. WE

Article by: Sophie Weinsheim
Phtography and Design by: Marita Thou

Mackenzie Bower, also a SWEster, is working on a project for one of her design classes.

WINTER WONDERLAND

It is that time of year again when streets are barren and layered clothing is paramount if you dare to brave the frigid air. In the past few years, snow has had an impressive showing on campus, resulting in two snow days in the last two years. For some, the white fluff brings with it the opportunity of adventure and excitement. For others, it is nothing more than a nuisance. So let me ask all of you; snow – yay or nay?

For all those who said 'nay', I bet you're going to have a lot of fun once you find out how much can be done in this season. And those who said 'yay', there might be some winter activities you haven't experienced yet.

Now when someone says snow, the first thing that pops into your head might be a snowman or maybe snowball fights. That is the kind of tradition that snow brings with it. Winters are incomplete without snowmen and snowball fights, but winters in Madison last for ages and you really can't do this all the time. There is indeed much more that you can do with snow – skiing, snowboarding, ice-skating, sledding, ice fishing, polar plunges - the list goes on and on.

"When life gives you lemons, you make lemonade; when Wisconsin gives you snow, you go snowboarding", Christa Wille says, a senior in biomedical engineering. Christa has been snowboarding for four years and was the director of the Alpine Ski team during her junior and senior year, and assistant director for two years before that. Even though she cannot race now because she is out of eligibility, she still plans to continue snowboarding. It's important to find some time to relax and according to Wille, the rush you get snowboarding or skiing is something you can't get anywhere. Dan Fourness, president of Hoofers club shares a similar opinion and says, "being outdoors is an excellent break for both the body and mind and at the same time it gives you a chance to go a little away from the campus and have fun. Being able to do it and enjoy it gives you a sense of pride to be able to teach yourself to do something." According to Matt Walker and Katie Kratcha, the directors of the Nordic Team, "all the fear that you might have converts to adrenaline once you really start skiing, it's like a challenge – something that you've got to accomplish."

"When life gives you lemons, you make lemonade; when Wisconsin gives you snow, you go snowboarding!"

A snowboarder displaying his skills at Hoofers Rail Jam. Warning: Do not try these stunts until you are a pro.

All of these people have been skiing or snowboarding since they were young. But will it be the same for a beginner – someone who has never done any such thing before? Well, anything new that you do, or something that you need to learn from scratch is never a piece of cake. That initial effort and courage needed to face your fears is always required, but in the end, when you really start any such sport, it is ultimately worth it. In addition, Hoofers offers ski and snowboard lessons to assist beginners. These sports give you a reason to brave the winter – rather than waste your time loathing it.

Wille believes that learning to ski is easier than learning to snowboard, but it's harder to become a more technical skier than a technical snowboarder. Skis have hard boots attached to the skis, so even small movements affect your motion, any manipulation or fine tuning of movements can have a large effect. Hence, learning to ski might be easy, but understanding the technicalities and then implementing them can be a challenge. On the other hand, snowboarders wear soft boots; small movements can be 'absorbed' by the boots. In fact the maximum potential that a snowboarder can have depends on the maximum potential of their board.

If you are the type of person who is not interested in the adrenaline rush from skiing and snowboarding, you need not worry. To start with, you can certainly go ice-skating. First timers will indeed slip and fall, but practice makes perfect! There is a rink at the Shell where you can rent equipment with your student ID and skate during open ice hours!

If even that does not get you out in the cold, this will – sledding. It's as simple as climbing up a hill and slipping down as if it were a slide. It may sound childish, but that's half the fun! Most common here on campus is 'tray sledding'. In simple words, grab a tray from any cafeteria, sit on it or squeeze yourself in, and allow someone to push you down the hill – weeee! No skill required, no technique necessary; just go out and do it! Race with your friends or make some obstacles down the hill - do whatever you can imagine. Climb up Observatory Hill and then off you go.

A game of ice hockey about to begin on Lake Mendota.

Now for those interested in extreme sports– did all of the above lack enough madness for you? Here's what you could do – polar plunge. All you need to do is find a frozen lake (Mendota, Monona, Wingra – pick the one you like), cut out a hole somewhere near and then go and sit in a steam room. Confused? Here's the deal – after spending some time in the steam room, run towards the hole and jump inside. And yes, I mean jump inside the freezing water! No matter how insane it may sound, this can supposedly have a very relaxing effect and it makes you really calm and peaceful – all the things that a student needs to seriously lower their stress levels, just make sure to use caution for this one!

To top it all, a snowball fight - rather a snow war! The first thing you need is a lot of snow, so check the weather forecast before planning this one. Once that's done, let the battle begin. In the past few years, an enormous battle on Bascom Hill has taken place, where people living north of Bascom Hill were one team and those on the South East side were another team. They battled to reach the top of Bascom Hill and conquer it; trust me, it is way more exciting to do than read about. Don't forget your cafeteria for this one too as snowballs are sometimes slingshot across the battlefield, and you'll need a shield!

There is also a winter festival that takes place here with all kinds of events like making ice sculptures and ski and snowboard races, even snowshoeing. It usually happens in the month of January with all these events spread all around Madison.

There really is too much to do as you have read. On a really important note, any of your new, bizarre or crazy ideas are welcome. Please write to us at wiscengr@cae.wisc.edu about anything you plan to do with the snow and we'll try to get your idea out in the public. All those who haven't tried a winter activity, please do because after all of the fun you'll be pouting about only having four months of snow. WE

Article by: Yaman Sangar
Photography by: Nick Lepak
Design by: Akhilesh Dakinedi

Just one more

The finest in eclectic humor

Understanding Engineers...

To the optimist,the glass is half-full. To the pessimist,the glass is half-empty. To the engineer, the glass is twice as big as it needs to be.

Two engineering students were biking across a university campus when one said, "Where did you get such a great bike?" The second engineer replied, "Well, I was walking along yesterday, minding my own business, when a beautiful woman rode up on this bike, threw it to the ground, took off all her clothes and said, "Take what you want." The first engineer nodded approvingly and said, "Good choice: The clothes probably wouldn't have fit you anyway."

A priest, a doctor, and an engineer were waiting one morning for a particularly slow group of golfers. The engineer fumed, "What's with those guys? We must have been waiting for fifteen minutes!" The doctor chimed in, "I don't know, but I've never seen such inept golf!" The priest said, "Here comes the greens-keeper. Let's have a word with him." He said, "Hello? George, What's wrong with that group ahead of us? They're rather slow, aren't they?" The greens-keeper replied, "Oh, yes. That's a group of blind firemen. They lost their sight saving our clubhouse from a fire last year, so we always let them play for free anytime." The group fell silent for a moment. The priest said, "That's so sad. I think I will say a special prayer for them tonight." The doctor said, "Good idea. I'm going to contact my ophthalmologist colleague and see if there's anything she can do for them." The engineer said, "Why can't they play at night?"

The graduate with a science degree asks, "Why does it work?" The graduate with an engineering degree asks, "How does it work?" The graduate with an accounting degree asks, "How much will it cost?" The graduate with an arts degree asks, "Do you want fries with that?"

Normal people believe that if it ain't broke, don't fix it. Engineers believe that if it ain't broke, it doesn't have enough features yet.

Three engineering students were gathered together discussing who must have designed the human body. One said, "It was a mechanical engineer. Just look at all the joints." Another said, "No, it was an electrical engineer. The nervous system has many thousands of electrical connections." The last one said, "No, actually it had to have been a civil engineer. Who else would run a toxic waste pipeline through a recreational area?"

An engineer was crossing a road one day, when a frog called out to him and said, "If you kiss me, I'll turn into a beautiful princess." He bent over, picked up the frog, and put it in his pocket. The frog spoke up again and said, "If you kiss me, I'll turn back into a beautiful princess and stay with you for one week." The engineer took the frog out of his pocket, smiled at it and returned it to the pocket. The frog then cried out, "If you kiss me and turn me back into a princess, I'll stay with you for one week and do anything you want." Again, the engineer took the frog out, smiled at it and put it back into his pocket. Finally, the frog asked, "What is the matter? I've told you I'm a beautiful princess and that I'll stay with you for one week and do anything you want. Why won't you kiss me?" The engineer said, "Look, I'm an engineer. I don't have time for a girlfriend, but a talking frog - now that's cool!

What is the difference between mechanical engineers and civil engineers? Mechanical engineers build weapons. Civil engineers build targets.

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