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wisconsin engineer

APRIL 2009 VOLUME 113, NUMBER 3

Airless Tire

p. 10

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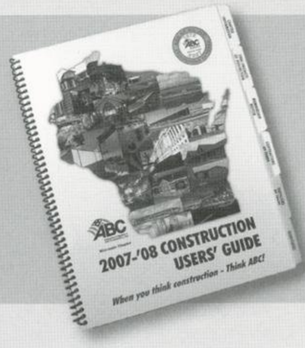

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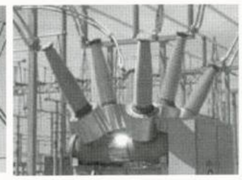

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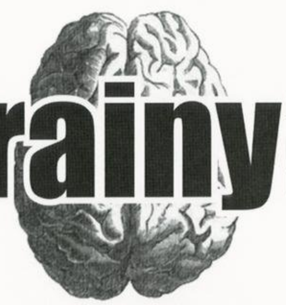

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Saving the planet one toaster at a time!

By Carrie Boecher

Like many idealistic undergraduate students, I came to UW-Madison with the vague but admirable goal of saving the world. Wisely realizing that I probably wouldn't be able to save all of the world, I decided to focus on just saving the environment.

Early on, it was clear that this would be no simple task. In freshman environmental studies classes, I watched with distress as pie charts and bar graphs flashed before my eyes, detailing the ecological horrors we were bringing upon ourselves. There's no more room for garbage! The land in sinking from groundwater depletion! We're going to run out of oil in less than 100 years! Florida is drowning!

The statistics were terrifying and motivating. Something had to be done, and I had to be to one to do it.

My first step towards saving the planet was to pick up an environmental engineering major. Not only did this degree allow me to keep with my engineering studies (as if I had just suffered through calculus two for nothing), it had the word "environmental" in the title—automatic earth-saving points.

After that, I started to unplug my toaster, and I replaced my light bulbs with compact fluorescents. Next, I dusted off the old Schwinn and learned to navigate the streets of Madison by bicycle. I also splurged on reusable shopping bags from Trader Joe's and an aluminum water bottle from Whole Foods. I even tried becoming a vegetarian, but failed on the second day when my roommate pointed out that the sausage on the pizza I was eating was, in fact, a pork product.

But time has worn on, and despite my best efforts, Earth continues to roar towards destruction at hyper speed. Every time I flip on the news there's either a new Nevada-sized chunk breaking off the Arctic Ice Shelf or a family of whooping cranes being displaced by suburban land development in Texas. Watching these bulletins, I've slowly realized that even if everyone did care, and even if everyone reused their shopping bags and changed their light bulbs, it still wouldn't be enough to save the planet.

So what would be enough? What would we have to do to save the planet?

This past fall, I listened to a lecture on the importance of liquid biofuels for both national security and the environment. When asked about those who criticized the use of ethanol, the lecturer laughed and said, "Do you know how those people suggest we save the environment? They suggest we cut down the population and start from scratch. To them, it's the only way."

The audience chuckled a bit; I'm almost positive no one in that auditorium was ready to sacrifice himself for the Arctic Ice Shelf. But theoretically, I thought, that is just about the only way we completely can fix this mess. How do we expect to purify our air and earth and water if we keep consuming ever-waning resources and producing disposable junk?

Realistically, however, very few of us are willing to give up our hot showers, microwavable meals and insulated homes. The aforementioned ethanol opponents might be correct when they we have to start from scratch. But let's be real. That's simply not going to happen.

This, I've realized, is where engineering comes in. It turns out that my first step towards saving the planet—picking up that environmental engineering degree—was also the most important. Engineers tend to be realistic people; we understand the feasibility (or lack thereof) of any given idea. Destroying the current infrastructure and eliminating a large fraction of the human population? Not very feasible. Using science and technology to improve on our current practices? Definitely feasible.

Obviously, engineering isn't quite synonymous with saving the earth. As a friend once joked of my major, "Isn't environmental engineering an oxymoron?" He's kind of right; development, by nature, takes its toll on the planet. Sustainable engineering, then, becomes a compromise—a compromise between the needs of the present and the fate of the future. It's the textbook definition of sustainability, and like never before we have the need—and the knowledge—to make it happen. WE

Caroline Bump

COLLEGE OF ENGINEERING
UNIVERSITY OF WISCONSIN-MADISON

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Professor Regina Murphy:

Breathing new life into chemical engineering

By Neal O'Meara

In many ways, the human body operates like a chemical processing plant. However, troubleshooting such a chemical reactor requires an approach other than turning dials in a control room. That is why Regina Murphy, professor of chemical engineering at UW-Madison, has been working hard to uncover the chemical basis of neurodegenerative diseases.

Growing up in Cambridge, Massachusetts, Murphy never would have guessed she would become a professor of chemical engineering. "In high school I was much more interested in English," Murphy says. Swayed by her high school chemistry teacher and friends, however, Murphy applied to her hometown university, the Massachusetts Institute of Technology (MIT). Murphy entered college undecided on a major. But it was a chemical engineering elective class her first year that struck her interest.

At a recent Clorox co-op information session, when a group of ten chemical engineering students were asked which class was their favorite, the first five responses were CBE 250.

With a BS in chemical engineering from MIT, Murphy moved to California to work at a Chevron oil refinery, where she says she spent her days "climbing through distillation columns and worrying about hydrogen balances." After five years at the refinery, Murphy came back to MIT to earn her PhD in chemical engineering.

When Murphy finished graduate school, she felt the call of academia and applied for professorships at several universities. "I had no intention of coming to Wisconsin, but I decided I would come and interview anyway—for practice," Murphy says. When she arrived, however, she was attracted to UW-Madison's diverse and quality chemical engineering faculty. She was also pleasantly surprised by the city which she thought was "neat."

A few years after Murphy began teaching at UW-Madison, the chemical engineering department decided to restructure its introductory courses. At the time, the first course in the curriculum was CBE 210: Chemical Engineering Calculations. Murphy says she thought that was a boring title. She thought back to the influential chemical engineering course she took as a freshman at MIT. Instead of teaching first year students just how to calculate mass and heat flows on existing processes, she wanted to teach students why and how new processes are developed. The mass and energy balance calculations were to be incorporated into this new framework. The new course, CBE 250, was given the more elegant title of her MIT course: Process Synthesis.

CBE 250 has proven to be a great success. Murphy says that, in designing the course, she "wanted students to know how to read flow charts and know about equipment—what [chemical engineering] is all about." The book she subsequently wrote for the course is being used in introductory classes at universities with well-known chemical engineering programs such as the California Institute of Technology, the University of Minnesota and Cornell University. It

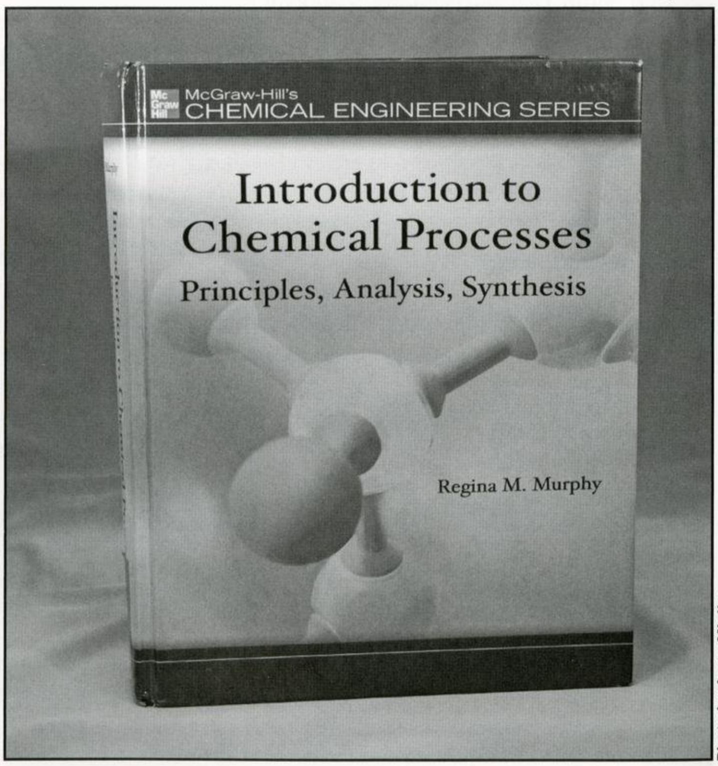

Photo by Anna Mielke

To support future chemical engineers, Professor Murphy donates proceeds from her text book to the American Institute of Chemical Engineering.

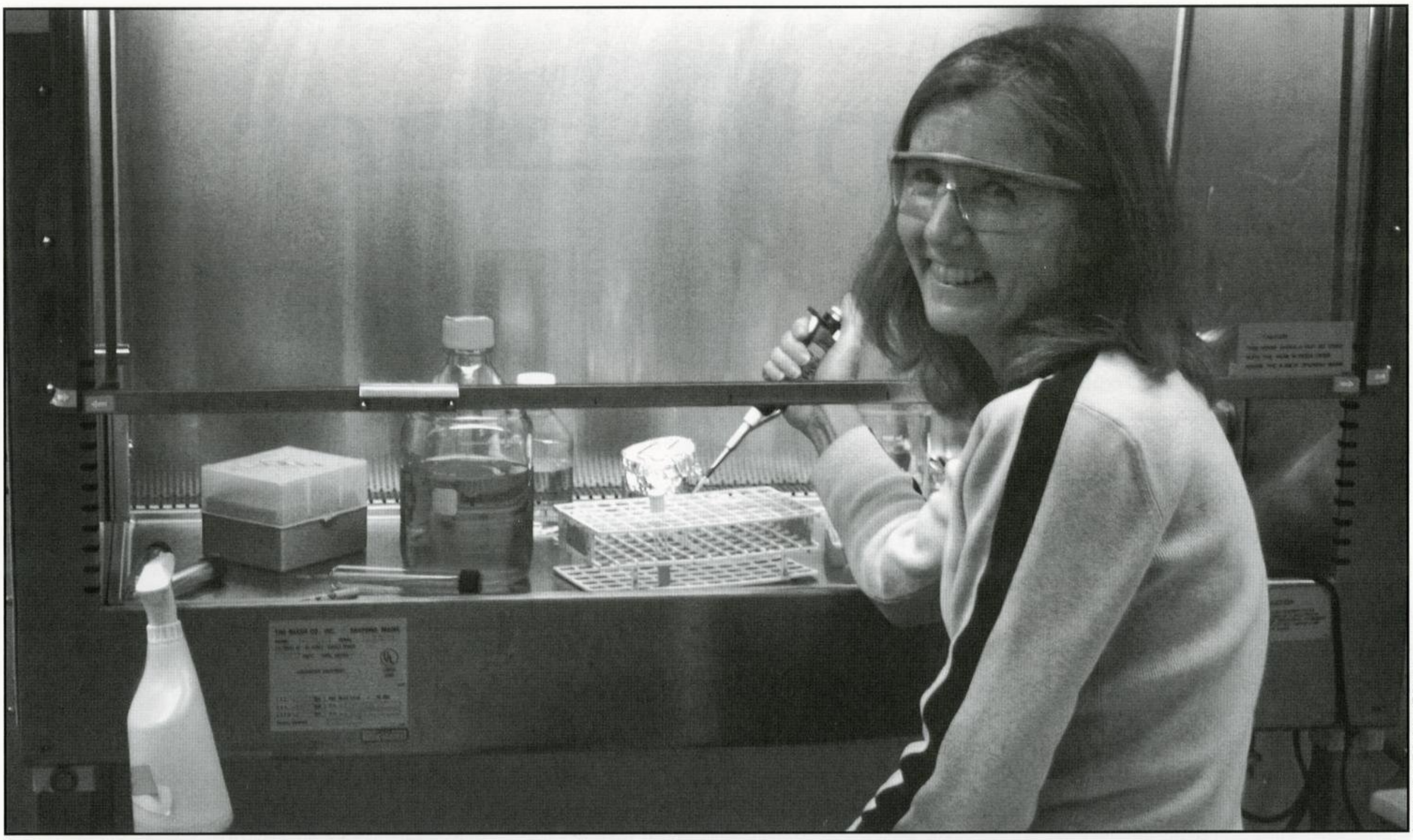

Photo by Rickey Dixon

Professor Regina Murphy works under a bio-safety hood, in order to keep materials sterile during her research.

has also been translated into Spanish and Korean. Students find the information in the course very useful for their co-ops and internships. At a recent Clorox co-op information session, ten chemical engineering students were asked which class was their favorite, and the first five responses were CBE 250.

Murphy's research for the past several years has been focused on trying to figure out the roots of haywire chemical reactions that may cause neurodegenerative diseases such as Alzheimer's and Parkinson's. The chemical reactions of interest are those of protein aggregation. It is believed aggregated (clumped) proteins can sometimes attack cell membranes, killing the cell tissue. Murphy says, "We are making some real progress in figuring out why these proteins aggregate and what the mechanism is."

Through a collaboration with Jeff Johnson in the UW-Madison department of pharmacy, Murphy's team has hypothesized that a certain protein, called transthyretin, may help protect against the damaging β-amyloid aggregates (toxic kinetic intermediates). Recent tests indicate that a specific amino acid mutation in transthyretin has an effect on its ability to protect tissues. This mutation may be age-related and further analysis may explain why certain people develop neurodegenerative diseases at an older age. "I'm really excited about the potential for discovering why this protein is protective and whether or not [we] can manipulate that somehow," Murphy says.

In her free time, Murphy enjoys spending time with her two teenage children, playing sports and running. She is training to run the Madison half marathon this spring. WE

Author bio: Neal O'Meara is a junior studying chemical engineering. This is his first semester with the magazine.

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Camp Badger

Exploring Engineering

By Ben Weight

Think back to middle school in early June. As the school year was coming to a close, what were you looking forward to during the summer? Was it a family vacation? Long days spent at the pool?

For each of the past ten years, 152 rising eighth grade students have looked forward to attending UW-Madison's Camp Badger. Camp Badger, launched in 1998, is a week-long camp designed to allow young students to "survey many types of engineering fields and begin to see the study of science and math as a path that can lead to great careers," according to the camp's website. "[We're] striving [for the students] to see how math and science is applied to engineering fields," Katie Thousand, the camp's coordinator, says.

Sponsored by the college of engineering, the department of engineering professional development, the Office of Diversity Affairs and Placon, Inc, the camp has thus far hosted over 1,500 students. Students entering the eighth grade from any Wisconsin school, public or private, are eligible to apply. These students are encouraged to have determination, creativity, problem solving and time management skills, and they should be able to get along well with others in a team environment.

The camp was conceptualized by Phil O'Leary, the program director, "to give underprivileged kids a chance to be introduced to engineering," Thousand says. Campers include students from all backgrounds and areas of the state. These campers are given the option to

Photo courtesy of Camp Badger

At Camp Badger, attendees get hands-on experience with science through activities such as building telescopes.

"I really enjoyed getting to work with the students and was always amazed at how interested they were in what we were doing and how much they were able to grasp—even when I was talking about plasmas and nuclear fusion."

-Becca Gilsdorf (day and night counselor, '07 and '08)

"It was a good time getting to know the individual kids and really talking to them. Every kid comes from a different background, which is different from our own, so you learn about different lifestyles."

-Katie Thousand (day counselor, '07 and '08)

"Even though being a camp counselor was technically a 'job,' I couldn't imagine having more fun on a daily basis.... We made spaghetti bridges, dropped eggs from several stories up, shot bottle rockets, made telescopes, walked through construction sites, learned how a bowling alley works, went rock climbing, and saw many, many other interesting exhibitions. How could you not have fun?"

-Chelsea Sabo (day and night counselor, '07 and '08)

Children, such as these eighth-graders, attend Camp Badger to learn more about pursuing an engineering education.

attend one of five week-long camps in June or July.

Campers are mentored and led by UW-Madison engineering students. They participate in an average of 12 hours of activities per day. Activities on campus may involve developing telescopes and visiting the UW-Madison telescope in the Washburn Observatory, or getting an inside look at the UW-Madison experimental cars. However, one of the favorite activities year after year has been "materials testing, being able to freeze and break stuff," Thousand says.

Apart from the activities, campers are also taken around the Madison area to study engineering in real world settings. Students are allowed to inspect the cockpit of an F-16 at the local airbase, tour the Kohl Center and visit Boulders, a local rock climbing gym. These trips show the campers now math and science can be fun, like learning about the center of mass of a climber as he or she scales a rock wall.

In addition, "[The students] get an early look at campus living," Thousand says. The campers stay in the residential halls and eat at the campus cafeterias while attending the camp. In 2007, campers were even given a tour of the Lucky housing building. These students are thus able to tour UW-Madison about four years before their classmates. As a result there have been a number of previous Camp Badger campers who decided to attend UW-Madison upon high school graduation.

The success of Camp Badger continues to grow. "Last year we received about 300 applications," Thousand says. With numbers continuing to rise and Camp Badger not able to grow much larger due to staffing hurdles and safety, too many students interested in this unique opportunity are being left out, creating a need for more of these camps around the state. In fact, O'Leary has plans for "writing up a process on how to run the camp and take it to other UW schools and around the country."

Camp Badger has given the young, bright minds of Wisconsin "a leg up" when it comes to deciding if math and science is the path for them. The camp opens the minds of its attendees to exploration and discovery of science and themselves. As Thousand says, "We're just trying to show them that math and science can be fun." we

Author bio: Ben is a sophomore majoring in electrical engineering. This is his first semester with the magazine.

From the *Wisconsin Engineer* vaults: flashbacks to 25, 50, 75, & 100 years ago

1909

SOME RECENT ADVANCES IN MECHANICAL ENGINEERING–In the field of Mechanical Engineering probably the most striking development has been that of the larger prime movers, notably the steam turbine and the internal combustion engine. The question is frequently asked, "Will not some one form of prime mover drive out of existence the other forms of engine?" Experience does not point, so far, to the probability of any one or two types of prime mover taking the place of or supplanting all the others. The steam turbine has not driven out the reciprocating steam engine; it has taken its place for certain uses, and the reciprocating engine will probably not regain the position it formerly occupied. However, the inherent qualities of the reciprocating engine are such that it is likely to remain superior to the steam turbine for certain special uses. In the same way the gas engine, while it has taken the place of the steam engine in special cases and will probably retain what it has won for a long time to come, is not so well adapted to the driving of alternating current generators in central stations, and for running many classes of machinery as is the steam turbine. The question as to the probability of the hydraulic turbines driving out of use all forms of heat engines may be answered in a somewhat different way: If falling water were available within practicable distance of all places where power is desired, it is probable that it would, in connection with electric apparatus, supplant heat engines for nearly all stationary power purposes, but the fact that water power is not thus universally available assures the continuance of extensive use of heat engines for power development. —Carl C. Thomas, Prof. of Steam Engineering

1934

UW-MINING CLUB—At the last meeting of the Mining Club members chose for their representatives to Polygon, Gilbert Nieman, ch'36, and Albert Gallistel, min'35. To replace their former treasurer, John Gillete who has left school, Laurence J. Mattek, min'34 was elected.

IMPRESSIONS—A century of progress - unprecedented, unheralded by even the most imaginative individual, undreamt of by the wildest dreamer, inconceivable a century ago, unbelievable as viewed in retrospect today - yet as purely a matter of fact today as the radical changes it brought about. These are but a few of the general impressions one carries away after having made a trip through the World's Fair and several of the largest industrial plants in the country. Since this is the first extended picture one has of the scope of modern industry, it is rather difficult to realize it all. in retrospect the whole thing seems like a dream. For amid the tranquil life of college it is difficult to imagine great ingots of iron being handled as though they were so much butter, or floors and floors of complex telephone apparatus capable of almost anything but thinking. This report is an attempt to give a very sketchy resume of the impressions a trip through the World's Fair, the Illinois Steel Co., the State-Line Power Plant in Chicago, The Illinois Bell Telephone Co., and the Hawthorne Works of the Western Electric Co., made in the mind of an embryo engineer. —Ernst Krause

1959

NEW PLASMA ARC TORCH—A radically new method for fabricating shapes and applying coating that will withstand temperatures above 5000° was recently announced. The process, which harnesses the highest controlled temperatures ever used in industry, up to 30,000° F, makes possible the fast and accurate mass production of ultra-hard materials that have been virtually unworkable by any conventional means in the past.

The key to the method is the Plasma Arc Torch (product of the Linde Company, Division of Union Carbide Corporation), a small device less than two inches in diameter that can melt the toughest materials known to man without being itself consumed by the intense heat it generates.

In addition to experimental rocket and missile parts of pure tungsten or tungsten-coated graphite, the new torch has already been used to produce high density tungsten crucibles for metallurgical purposes, special parts for nuclear work, sensitive electrical contacts, and electronic components and x-ray targets of superior density. —Jim Mueller

1984

MEET ME FOR LUNCH: TAKE A TOUR OF WISCONSIN'S ZANIEST DINING HOTSPOT—UNION SOUTH—The word is out, and by gosh, it sure is about time. The talk all over campus this semester has change drastically from the tedious Rathskeller-rif-raf of "TGIF-TGIF-TGIF" to something we can all sink our teeth into. "Eat lunch at Union South," echoes down State Street. "Eat lunch at Union South" is whispered in Helen C. "Eat lunch at Union South," is even pained on the side of Rennebohm's. That's right folks, Union South is where it's at and this is one engineer who kind of likes it.

It's the place where I don't have to worry whether my scarf matches my socks, or if my teeth are white. No one cares if my politics are in order or if my sweatshirt is ripped just right. Flannel is the fashion here. Gloomy frowns are in too, and so is any politician who promises to create enough government contracts so that we all get jobs. But we're not here to jabber: let's eat. —Greg Gorski

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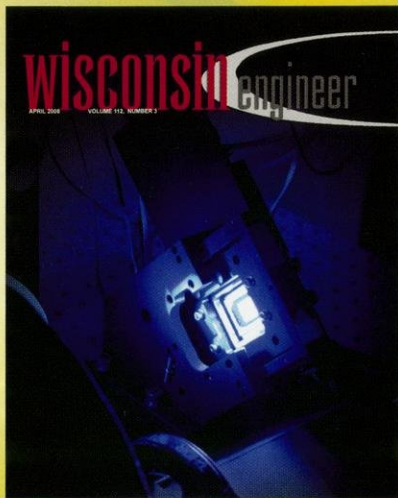

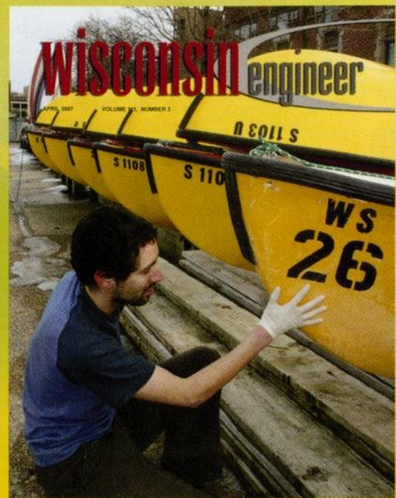

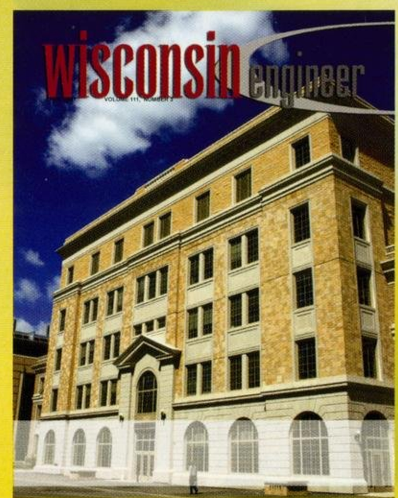

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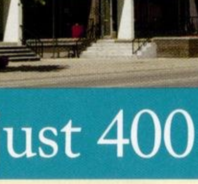


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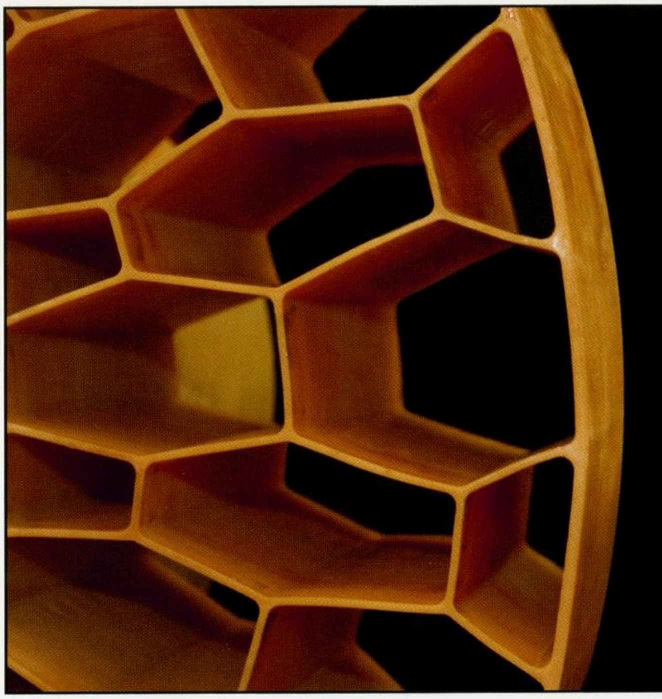


Reinventing the wheel: the airless tire

Photo by Emily Sorensen

By Melody Pierson and Anthony Lai

As the automotive industry continues its inevitable transition towards efficiency, the wheel is not typically among the first candidates discussed for innovation. From the spoke-adorned wooden wheel to the familiar air-filled, or pneumatic tire of today, the timeline of the wheel hardly shows dramatic structural improvement. This lack of adaptation, however comes with large costs on many different fronts, including the loss of lives on the battlefield.

Aware of this fact, the U.S. Department of Defense is now employing the expertise of Wausau-based Resilient Technologies in collaboration with the UW-Madison Polymer Engineering Center (PEC) as part of a four-year $18 million project. The team's task is to research and develop an airless, non-pneumatic tire that is suitable for use on heavy-grade military vehicles, such as the Humvee. The idea is that this tire will be able to continue to run reliably even after sustaining heavy damage from enemy fire or roadside bombs. "The current Humvee uses a run-flat insert which is supposed to go 30 miles per hour for 30 miles," Edward Hall, vice president of Resilient Technologies, says. "And you're also not going to be within 30 miles of some place safe to change your tire. So we're looking at any type of continuous mobility to get them out of harm's way."

Resilient Technologies began their work with PEC through the engineering professional development (EPD) department at UW-Madison. "They needed to have somebody that understood materials, who understood design … they wanted to sort of work in partnership with the university, so they got in contact with EPD," Tim Osswald, professor and lead researcher of PEC, says. Osswald had already conducted some training at Resilient and taught courses there on polymers and rubber materials. Thus, he was acquainted with the faults of pneumatic tires and the prospects of polymers in tire design. The problem with pneumatic tires is their susceptibility to puncture and the rapid decline in stability with a decrease in air pressure.

Photo by Emily Sorensen

Professor Tim Osswald peers through the computer-optimized, honeycomb structure, which can be reconfigured for a variety of applications.

Photo courtesy of Resilient Technologies, LLC

The design of the non-pneumatic tire enables military vehicles to easily maneuver through rough terrain.

Flat tires render the vehicle stationary and, most importantly, an easy target. Osswald and Resilient sought to conceive an alternative means of maintaining the functional structure of a pneumatic tire without the weaknesses evident in military applications. The team also needed a way of augmenting the tire so that the desirable properties of the pneumatic counterpart were maintained, such as consistency in ride performance across varying terrain.

"When it comes to blowing stuff up, we're going to let the military take care of that."

-Edward Hall

With these criteria in mind, PEC and Resilient set off and researched exhaustively for two years, putting their various designs through a battery of tests and analyses. Their efforts yielded a novel rubber polymer-based structure reinforced by an array of hexagonal shapes, more commonly referred to as "honeycomb" structures. "We had a couple of brainstorming sessions together with Resilient where we kind of jointly came up with the idea of using these honeycomb structures," Osswald says.

In testing the honeycomb against other shapes, such as a mesh of diamonds, the honeycomb ranked superlatively to the other designs. To test the designs, researchers applied damage to the tire and examined its quality before, during and after the damage. Most of the damage done to the tires, however, was minimal. "When it comes to ballistics testing we run minimal ballistics … with 5 mm rounds" Hall says. "When it comes to blowing stuff up, we're going to let the military take care of that."

In addition to their aesthetic appearance, these honeycomb wheels are already providing tangible - and potentially lifesaving, benefits; in fact, a number of Humvees in Iraq are currently fitted with a trial run of the tire.

Another interesting aspect of the wheel is its potential in the consumer market. "From an engineering standpoint there are all kinds of vehicles like tractors and heavy equipment that would really benefit from these types of tires because they are not pneumatic," Osswald says. Unlike pneumatic tires, the polymer material composition and shape of the honeycomb inside the airless tire may vary to ensure consistent performance for various applications. "We have different polymers for different applications. With a pneumatic tire you change the air pressure depending on what you want to do. …What we use is different material," Hall says.

The innovations associated with the latest revision of the wheel may help diminish the negative connotations associated with "reinventing the wheel" by reducing the number of lives lost in current and future military engagements. WE

Author bio: Anthony is a senior majoring in computer engineering and political science. This is his first semester with the magazine. Melody is a sophomore majoring in nuclear engineering with a certificate in biology in engineering. This is her second semester with the magazine.

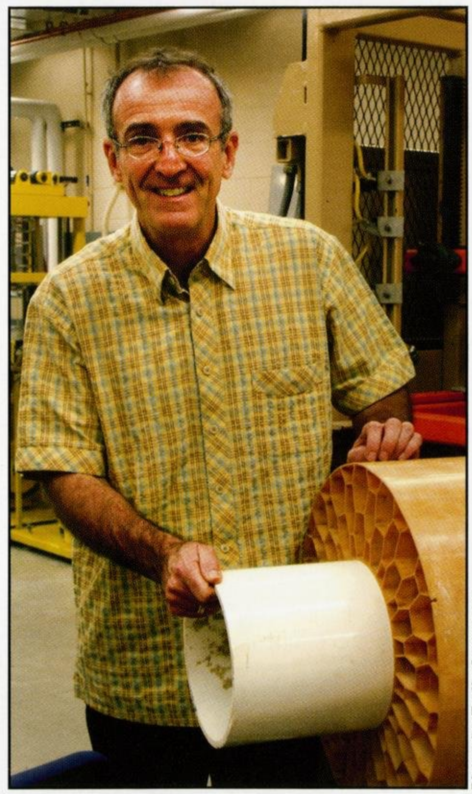


Photo by Emily Sorensen

Professor Tim Osswald, lead researcher of the Polymer Engineering Center, displays his prototype of the airless tire.

COE 2010: Leading the way in engineering education

By Amanda Feest and Mark Cigich

For the last few years, the members of the College of Engineering (CoE) 2010 task force have been agents of change, putting UW-Madison at the forefront of the engineering education revolution.

"The demands to educate our students and reach our students and the expectations of the skills they have when they walk out the doors have increased," Steven Cramer, the CoE associate dean of academic affairs, says. To meet these changing demands, the task force has identified three major forces that shape the future of engineering education: technology acceleration and the fusion of disciplines, global competition that transforms the educational landscape and shifts in funding for sustaining public higher education. Having a global perspective of where engineering education is headed, Cramer says that "we were ahead of the game" when the program started, and he hopes that the innovative programs in place will pull the CoE even further.

Implementing a culture of change, the task force looks to fund courses and programs that "make sure that [the CoE prepares] students for the world that they are entering, not the world that I entered," Paul Peercy, the dean of the CoE, says. The task force emphasizes that funded programs should generally revolve around interdisciplinary teamwork, innovative approaches to learning core material and developing a multicultural aptitude in students. "One of the obstacles we face is that degrees tend to be very disciplinary ... and of course the challenge faculty face is to ensure that students have the technical depth and disciplinary excellence they need [which] can't be compromised," Cramer says.

"It's very hard to emulate [chaos] in the classroom."

-Giri Venkataramanan

"[Students need] some interdisciplinary breadth so [they know] the languages of the other engineering disciplines [and] can work together with a team of engineers," Peercy says.

One such program focuses on the interdisciplinary teamwork aspect of engineering, putting students from a variety of engineering backgrounds on a team project that solves real world problems faced by Engineers Without Borders. "It's very hard to emulate [chaos] in the classroom," Giri Venkataramanan, associate professor of electrical and computer engineer-

Faculty members involved with the initiative have paved the road for UW students to become agents of change in the globalized work environment.

Photo by Rachel Dau-Schmidt

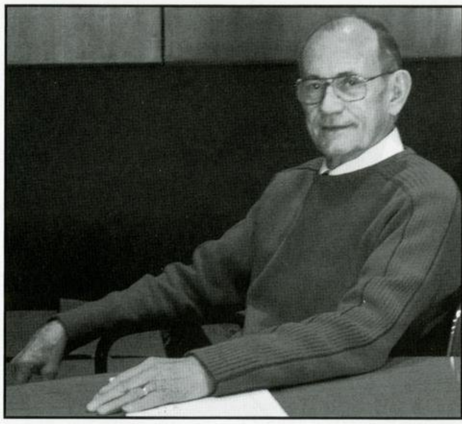


Photo by Rachel Dau-Schmidt

Dean Paul Peercy, one of the seven task force members, strives to improve the education of Wisconsin engineers.

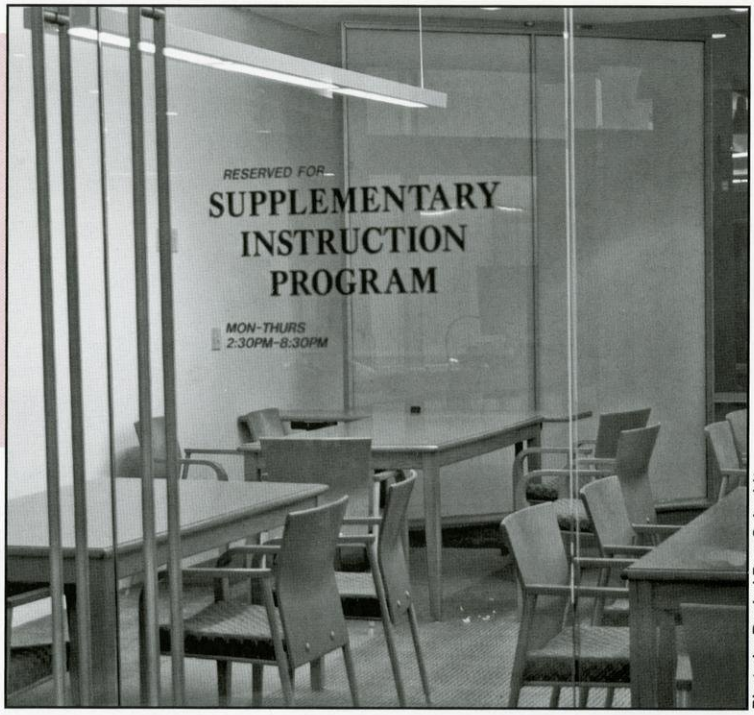


Photo by Rachel Dau-Schmidt

The supplementary instruction room is one of the many improvements the 2010 initiative has brought to the COE.

ing, says, referring to the chaos that he and his students experience while working in the field. Venkataramanan is the faculty overseer of an EPD 690 special topics class on international engineering, which received funding from the task force. "There has to be some sort of a field experience that [involves] chaos that you need to get exposed to and be able make decisions and walk on the fly [which] builds on the analytical skills learned in the classroom," Venkataramanan says.

Trying to incorporate innovative learning strategies into introductory science and engineering courses, the initiative is funding a new course, Inter-Engineering 150. Dr. Jia-Ling Lin, coordinator for the academic support services in Engineering General Resources, created this course to incorporate an online lecture component into the supplemental instruction (SI) program. Introducing this new learning format allows students, mostly freshmen, to dictate the pace of their learning. Delivering information online allows students to rewind lectures and focus on the concepts they don't understand, a luxury that is not available in traditional engineering lecture formats.

Photo by Rachel Dau-Schmidt

Wendy Crone, an active task force member, is currently working on a grant given to her by the initiative.

The goal of this new course, as part of the SI program, is to increase retention of engineering students. Students sometimes become discouraged by the engineering gateway courses, such as statics, dynamics and introductory physics. The SI course "helps students who are struggling with their learning … [it is] a building block for the future engineers," Lin says. By participating in a supplemental instruction program, students are more likely to receive better grades in the class and stay in the college of engineering. Since the implementation of this program, the retention of freshman in the college of engineering has increased, which signifies great success for the COE 2010 task force.

Industry has also responded positively to the changes made in the past several years. Peercy says, "Last year, each career day we had, we set a new record for the number of companies on this campus to recruit. That's pretty good feedback."

UW–Madison is not the only university scurrying to implement programs addressing the evolving needs of industry. "We were certainly one of the leading schools [in engineering education] a couple of years ago," Wendy Crone, associate professor of engineering physics, says. Crone has been involved in a number of the task force's round table discussions and also received a grant from the group. "I'd like to see more faculty engaged, more faculty involved, and I think with that we'll have fresh ideas and new insights," Crone says.

"There have been a lot of schools talking about creating a curriculum for the engineer of the future. Wisconsin is one of the schools that is actually doing things," Crone says. WE

Author bios: Amanda Feest is a senior in biomedical engineering. This is her first semester writing for the magazine. Mark Cigich is a junior in industrial engineering. This is also his first semester writing for the magazine.

New Union, New Experiences, New Memories.

Fences surrounding Union South force pedestrians to find new walking routes.

By Roxanne Wienkes

The corner of Johnson Street and Randall Avenue is a convenient location for students, faculty and staff to get a bite to eat or cup of coffee during the day. However, Union South's dining experience did not appeal to the campus community. Located closely to a student residential community, Union South was a great location for after class activities; but its bowling alley, game room and concert venue were not hot spots of campus night life. To improve on these shortcomings, the construction of a new union is underway and hopefully, with an eco-conscious and functional design, this new union will add to the UW-Madison college experience.

To the Union Council, the administrative board of campus unions, the old Union South did not meet the demands of a growing campus. The lines at the grills were long during lunch, student organizations did not have adequate meeting or storage space and the building's atmosphere lacked vitality. In 2005, plans were drawn up for a renovation of the facilities and, due to the extent of the needed remodeling, the most sensible idea turned out to be demolition and reconstruction. "We did not want to tear down the building, but [demolition] proved to be the most sustainable option out there and the best option for the future," Paul Broadhead, assistant director for the Wisconsin Union, says.

> **"We did not want to tear down the building, but [demolition] proved to be the most sustainable option out there and the best option for the future."**
>
> **-Paul Broadhead**

Union South first opened in 1971. The fact that the building did not even last 40 years has put pressure on the university to design and construct a building that is going to last longer. "Timeless and enduring" is the phrase Broadhead suggests for the new union. "We are trying to make it so that when we go forward we can adapt the building to the use that it's needed for; that's the most sustainable thing you can do."

Sustainability and energy efficiency were at the top of the list of demands students had for the new union. Along with keeping the design functional and adaptable, there are many other features that the union's design team is implementing to make sure the facility is built to be energy efficient. The American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) sets standards for energy use in the building. "Our current energy modeling puts us about 40 percent better than ASHRAE [standards]," Broadhead says. "There will be energy recovery ventilation in the H-VAC systems, variable speed fume hoods and recovery systems on the refrigerator," Josh Clements, chair of UW-Madison's Emerging Green Builders, says.

Gold certification from the U.S Green Building Council's Leadership in Energy and Environmental Design (LEED) is

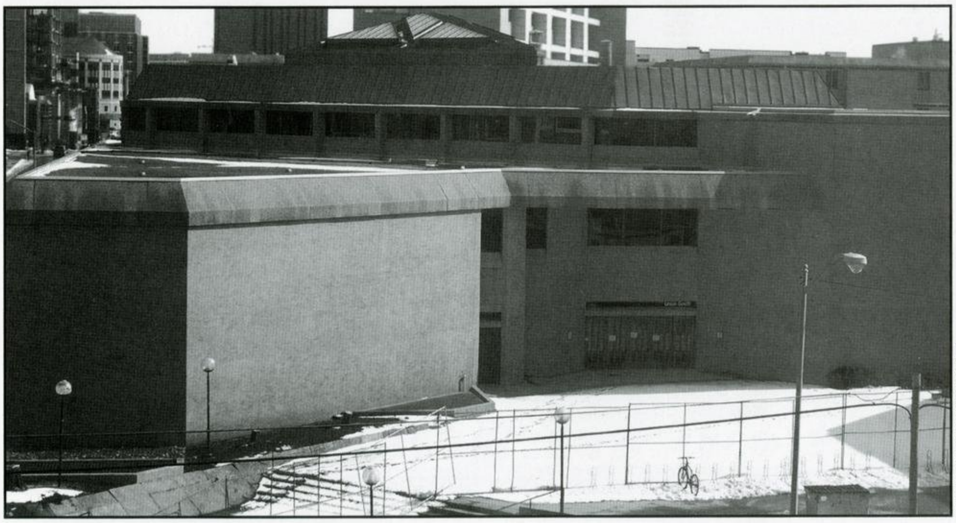


Photo by Dustin Walsh

When the building is complete in the spring of 2011, this area will house the theater, one at the many new attractions of the upcoming union.

also being sought, with silver certification being the minimum goal. "With a multipurpose building, LEED certification is difficult," Broadhead says. "The building serves different purposes every day, but we are aiming for gold."

"We are trying to create a sense of place within Union South ... that is where memories start happening."

-Mark Guthier

The university is also working with the Madison Environmental Group to make sure the highest possible amount of material is salvaged and recycled from the demolition. It is currently projected that 88 percent of the building will be reused in some way. Other eco-friendly attributes include vegetation planted on the roof and wiring for future use of solar powered photovoltaic (PV) cells. "PV is not budgeted for at this time," Clements says. "It's a high price tag item."

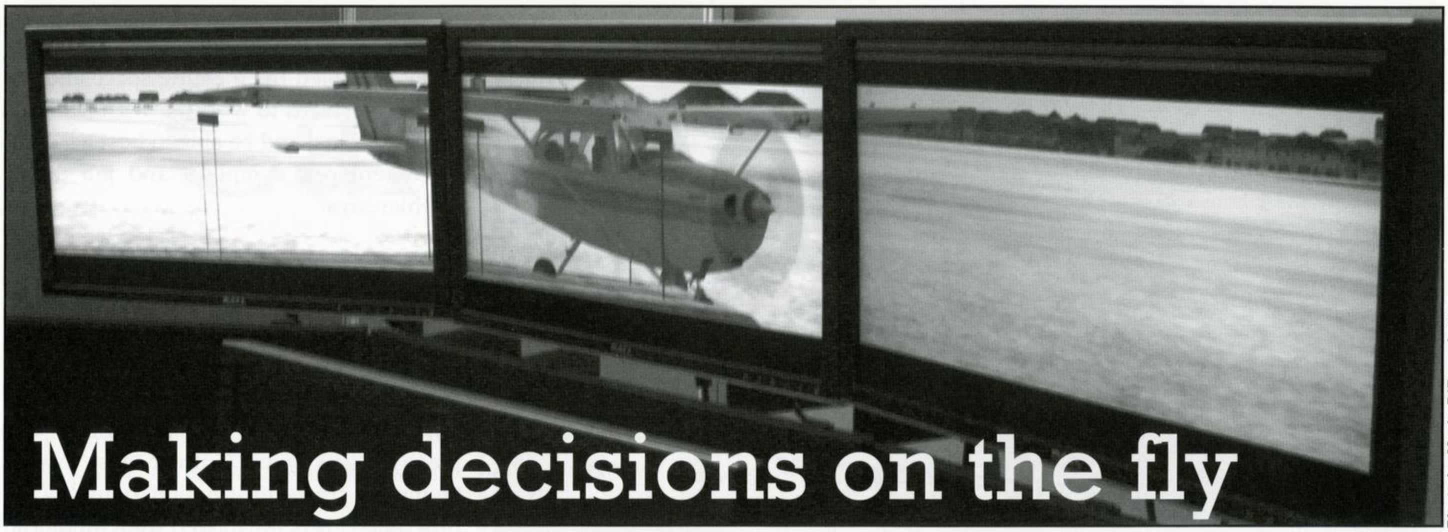
The plans for the new union have taken shape primarily based on surveys and student input. "We have sifted through suggestions and hope the best have risen to the top," Mark Guthier, director of the Wisconsin Union, says. "We feel really good about the level of input and feedback we have received from the students, faculty and staff on campus." It will be important to not only pay attention to what students want now, but to also think about what students will want in the future. For the building to be successful and sustainable, it will have to be able to adapt with the desires of the students. Guthier says, "We are trying to do the best with the current thinking we all have."

The new facility should bring a new atmosphere to the area of campus. "There are two exterior spaces we are excited about," Broadhead says. On the south side of the building will be an amphitheater focusing on a small outdoor stage, while the space between the computer science building and the new union will be tagged a pedestrian area. The hope is to bring a feel like that of Library Mall to the site. "We could do things like street festivals out there ... we think there is a lot of vibrancy out there, a lot of opportunity," Broadhead says. "The engineers want to have some fun too."

An important feature of the new union will be the 13,000-square-foot Badger Hall which will have enough space to host large events such as career fairs and conferences. The design also includes technologically up-to-date conference and meeting rooms. "We have almost doubled the meeting space and are looking forward to working with [campus organizations] and be able to host academic conferences, symposia and job fairs," Guthier says.

The new union will also include bowling lanes, a climbing wall, billiards and a television lounge on the lower floor. A variety of food options will be available, including pizza, Babcock ice-cream, grilled foods, flatbreads and Asian cuisine. To draw people to the new union, Guthier says, "We are trying to create destination points." The film theater is being moved from Memorial Union to the new union, and there will be 190 parking stalls underground. There will also be an art gallery, a coffee shop and a wine bar and pub near the performance stage. The idea of the new union is not to recreate Memorial Union, but to give it its own identity on campus. "We are trying to create a sense of place within Union South ...that is where memories start happening," Guthier says.

Author bio: Roxanne is a junior studying environmental engineering. This is her fifth semester with the magazine.



Making decisions on the fly

Photo by Mario DiBenedetto

"Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return."
-Leonardo Da Vinci

By Matt Stauffer

The prospect of breaking free from the terrestrial clutch of gravity and ascending to the sky has driven many great inventors to push the limits of aviation design. As a result, aircraft have come a long way from the fanciful designs of Da Vinci.

It takes a mere 30 hours to obtain the minimum general aviation pilot certificate. The requirements include training on takeoffs, landings, basic aeronautic maneuvering, as well as taking a standardized test. There is debate over whether this training is sufficient to ensure pilots are fit to fly, but any attempts to increase the requirements for flight training are often met with considerable resistance from the Aircraft Owners and Pilots Association (AOPA).

Doug Wiegmann, professor of industrial systems engineering at UW-Madison, and has developed a flight simulator to understand how general aviation pilots make decisions while flying. General aviation is classified as non-commercial, non-revenue generating flights, encompassing recreational and private pilots. Statistically, this area of aviation tends to be the most accident-prone. Thus, the simulator is being used to assess how effective the current training methods are and how they may be modified to make recreational aviation safer.

Photo by Mario DiBenedetto

Professor Doug Wiegmann plots a course for pilots to use in the stimulator on a traditional flight chart.

"We are working on understanding how pilots make decisions in dynamic situations that involve uncertainty..."

-Prof. Doug Wiegmann

"We are working on understanding how pilots make decisions in dynamic situations that involve uncertainty about what the correct course of action should be. Particularly, in our lab we are looking at dynamic decision-making related to changes in weather conditions and how pilots respond in-flight to those dynamic changes," Wiegmann says. The goal is for pilots to be able to assess how the weather is changing and effectively decide if such a change might jeopardize their safety.

"Most of the fatal accidents that occur tend to involve adverse weather conditions," Wiegmann says. This has led him to focus the initial stage of his research with the flight simulator on dynamic weather systems. To study the decision-making process, test pilots are set to fly a designated course and are given all of the information that would normally be available to them upon take off. Once the simulation has started, the weather patterns in the simulator change. The pilots must rely on visual cues to assess the situation and decide whether to adjust their course of action or continue on the flight path as planned.

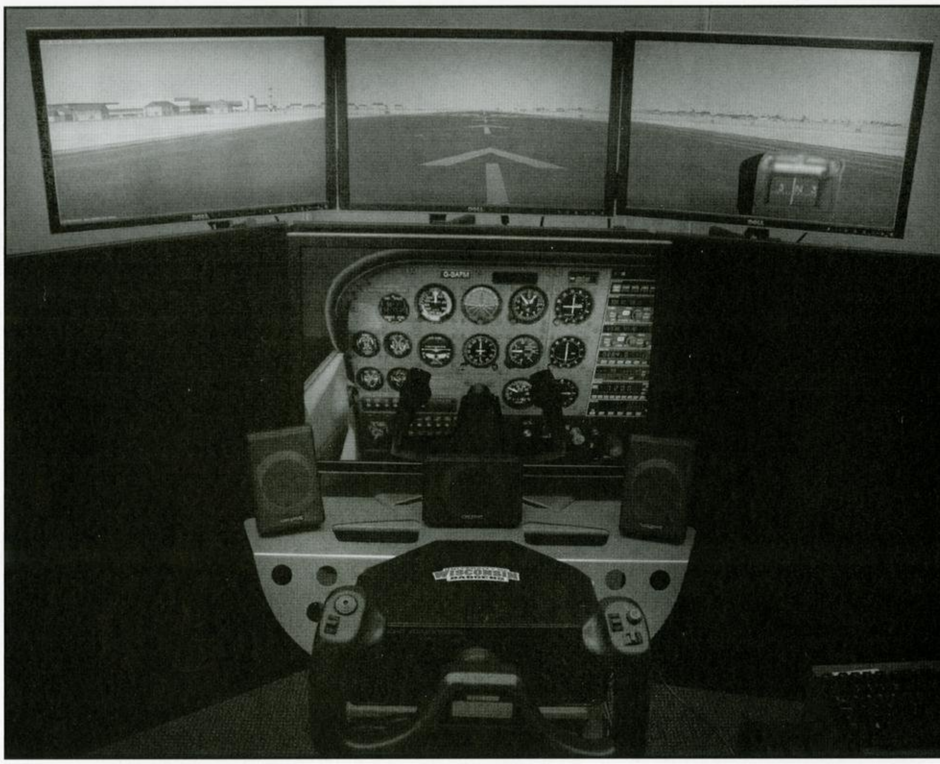


Photo by Mario DiBenedetto

The flight simulator used in Professor Wiegmann's study dons a three-screen, panoramic view that has all of the instrumentation of a modern light aircraft.

In general aviation, early warning indicators about changing and inclement weather are often limited to simple visual assessments made by the pilot and other pilots' chatter on the radio. Weather changes are often gradual and pilots can find themselves long distances from their origin and destination while the weather is changing. Recreational pilots rely heavily on simply "looking up ahead and thinking, 'how far away is that cloud?' and 'how high is it?' … But, generally, people are not that good at estimating cloud ceiling and visibility," Wiegmann says.

"There is some technology that is becoming more and more available; obviously they have GPS for navigation … some aircraft come installed with weather hazard displays … if you link that with your GPS you can see where you are at relative to the weather," Wiegmann says. There are some drawbacks, however, to additional electronic displays in the cockpit. Specifically, these systems can cause pilots to fly in a more "heads-down" position, which takes away from visual scanning of the surroundings. "There is some evidence that is coming out of our laboratory that shows pilots who have these displays are more likely to push the envelope because they have more information and so they think, 'I've got this technology, it's going to help me figure out how to do this or it's going to keep me out of trouble,' when it may not."

"The goal is to … study how pilots make decisions, but to also create scenarios that are used to train pilots on the ground, which is safer than in the air," Wiegmann says. His team plans to come up with different scenario-based programs that help train pilots to make better decisions. These simulations, which are similar to those used in commercial aviation, can then be used to test whether pilots have learned to deal with hazardous situations as they have been trained. The simulator can also be used to test new technology, such as a new weather hazard display. Analysis of simulations could highlight the benefits or expose any unforeseen hazards of the new equipment in the simulated setting. WE

Author bio: To my faithful readership: if you have picked up the magazine over the past half-decade you know me better than some of my relatives.

Photo by Mario DiBenedetto

The cockpit of a private light aircraft looks almost identical to the simulator designed for Professor Wiegmann's pilot decision-making study.

RAISING THE BAR for job-seeking engineers

By Lindsay Taylor and Matt Stauffer

The fickle economy is making it evermore challenging for recent college graduates to launch their careers.

What does this mean for engineering students at UW-Madison? It means engineers must break out of their comfort zone (think: nose down in a thermodynamics book) and explore professional development opportunities, such as public speaking, to set themselves apart from their peers.

Luckily for UW-Madison students, the college of engineering (COE) is home to the department of engineering professional development (EPD). The goal of EPD is to bridge technical engineering skills and global communications strategies. EPD offers a technical communication certificate (TCC) for students who seek to develop their technical speaking, writing and presentation skills.

The TCC is a 24-credit program with courses in technical writing, graphic design, international engineering strategies, social and ethical impacts of engineering and more. TCC students can also venture off the engineering campus and take communication courses in departments such as journalism, philosophy and psychology. All TCC students have the opportunity to work in a paid or volunteer communications internship, which gives them a hands-on experience to develop their communication skills.

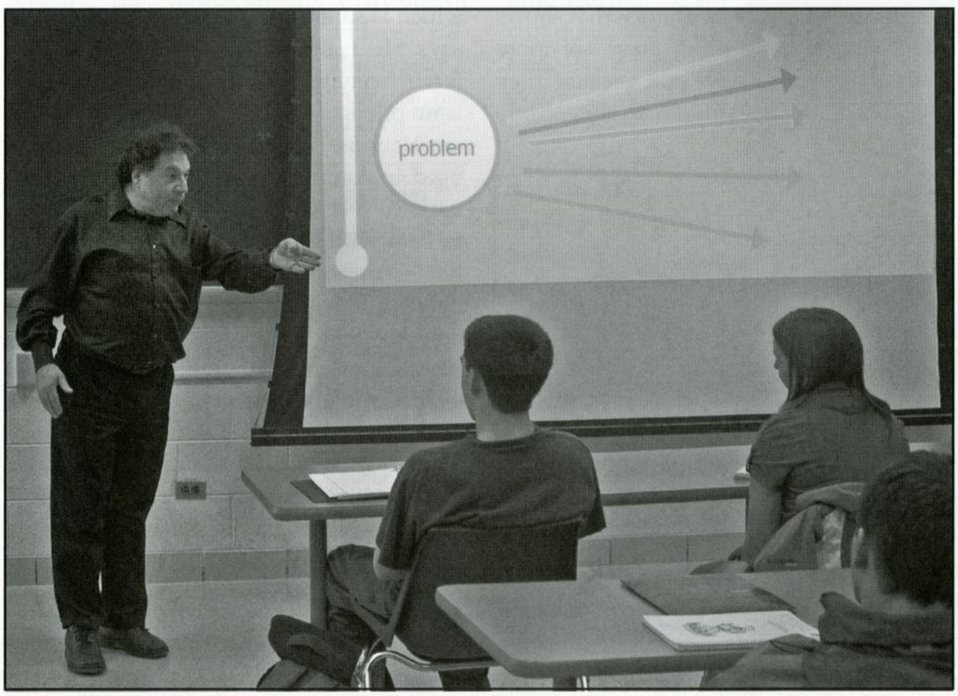


Photo by Alex Marconnet

Steven Zwickel, a faculty member of the department of engineering professional development, teaching EPD 397, a TCC course.

TCC alumni say that their certificate in technical communication from UW-Madison has helped them considerably in their job searches and professions.

"As I was interviewing for jobs prior to graduation, having the technical communications certificate on my résumé was an immediate attention-getter and something that I was always asked about in interviews," David Krahn, lead business analyst at Northwestern Mutual, says. Serving as the liaison between technical and business resources, "it is not an exaggeration to say that communication skills are the most important skill of a good business analyst," Krahn says.

For Sheldon Wolfe, a UW-Madison COE and TCC grad, beginning the TCC program served as a helpful diversion from his other engineering studies.

"I was terrified to speak in public and was a mediocre writer. I knew I had to do something to improve these skills," Wolfe says. "I will not lie, there were days I questioned my decision. Looking back, however, I am very pleased with my decision, and I now realize those days probably resulted from me being taken out of my comfort zone." After graduating with an electrical engineering degree, Wolfe went to law school and is now a partner at Michael Best & Friedrich LLP in Madison.

"The engineering school starts a student down the path of developing the student's

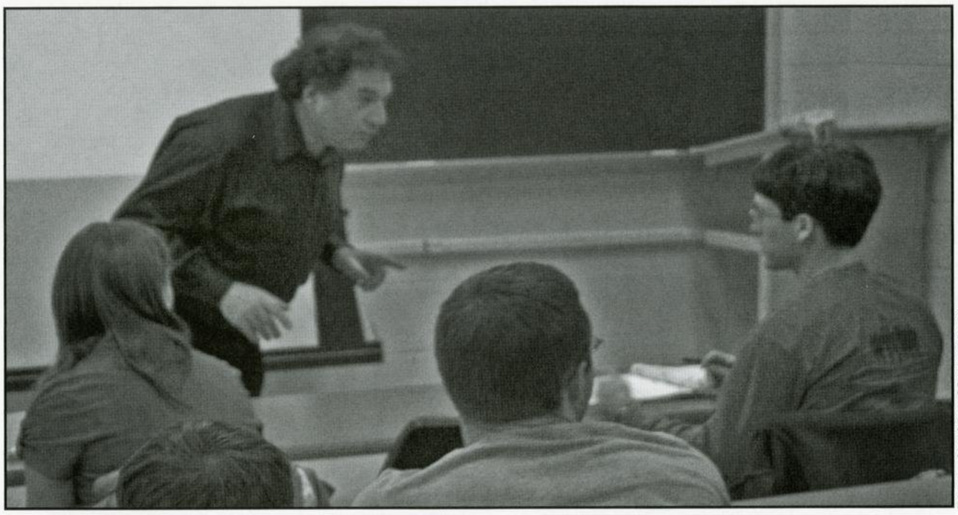


Photo by Alex Marconnet

TCC courses allow students to closely interact with their professors.

engineering skills; similarly, the TCC Program starts the student down the path of developing the student's communication skills," Wolfe says, noting the important duality between his engineering degree and the technical communications certificate.

"communication skills are the most important skill of a good business analyst"

-David Krahn

"Good engineering skills are essential to an engineer. However, an engineer still needs to promote his/her idea, product or solution to others. Whether the 'customer' is the engineer's colleague, the engineer's boss, upper management or an actual customer, communication skills are an essential aspect for promoting the engineer's solution," Wolfe says.

Besides being able to promote and sell concepts, engineers must know how to effectively communicate on a day-to-day basis. Between memos, e-mails and phone calls, engineers with colleagues and customers. Skills developed through the TCC can aid using engineers with these basic, but integral, modes of communication.

In addition to classes on campus, the TCC also offers a unique summer study abroad program in Hangzhou, China. During this two-and-a-half month program, students take EPD 397 (technical communications) and ME 361 (thermodynamics). This two and a half month program includes EPD 397 technical communication and ME 361 thermodynamics, allowing them to complete course work while exploring another country and receiving cultural exposure.

Students are pressured now more than ever to become as marketable as possible. Not only will technical skills and problem-solving abilities be important requirements for a job, but the ability to write, present and communicate that information effectively is increasingly critical for job seekers. The TCC helps engineering students develop crucial communication skills necessary in the highly competitive global job market.

Not even the best new technology will make it off the work bench if the engineer who designed it is unable to communicate the value of the product to investors and consumers. The TCC enables UW-Madison students to sell their ideas and increase their cultural awareness, allowing them to be more sensitive with global clients as they venture into the work force. WE

Author Bio: This team of writers represents the diversity embodied in the engineering professional development program at UW-Madison. Both authors are TCC students; Matt is pursuing a degree in materials science engineering and Lindsay is pursing degrees in Spanish and English.

Examples of strong communication skills, as suggested by David Krahn, a TCC grad and lead business analyst at Northwestern Mutual:

- Skills to communicate with someone with a technical background, like an engineer or a programmer, then translating that conversation to someone with a business focus, like a marketer or salesperson
- Skills to take a complex topic and explain it to someone with no prior knowledge of the topic in a way that is understandable
- Skills to produce a variety of documentation such as narratives, diagrams, graphs, tables, and process flows in a clear, concise and complete manner

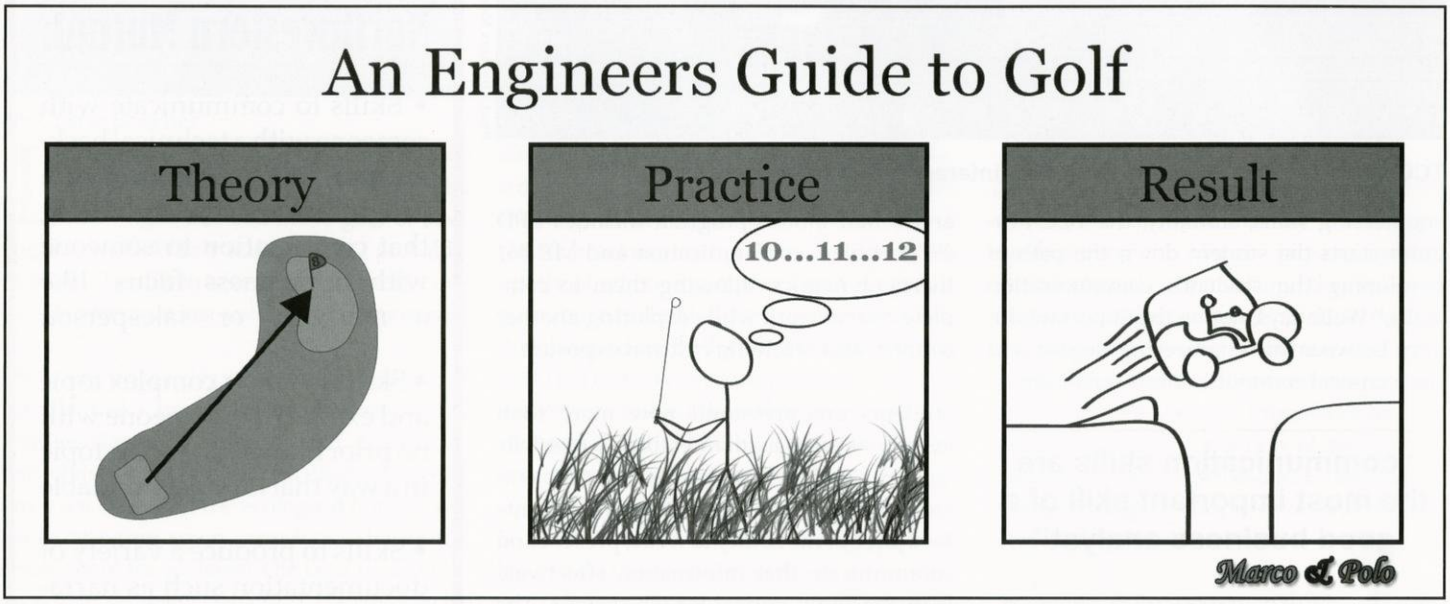
Links

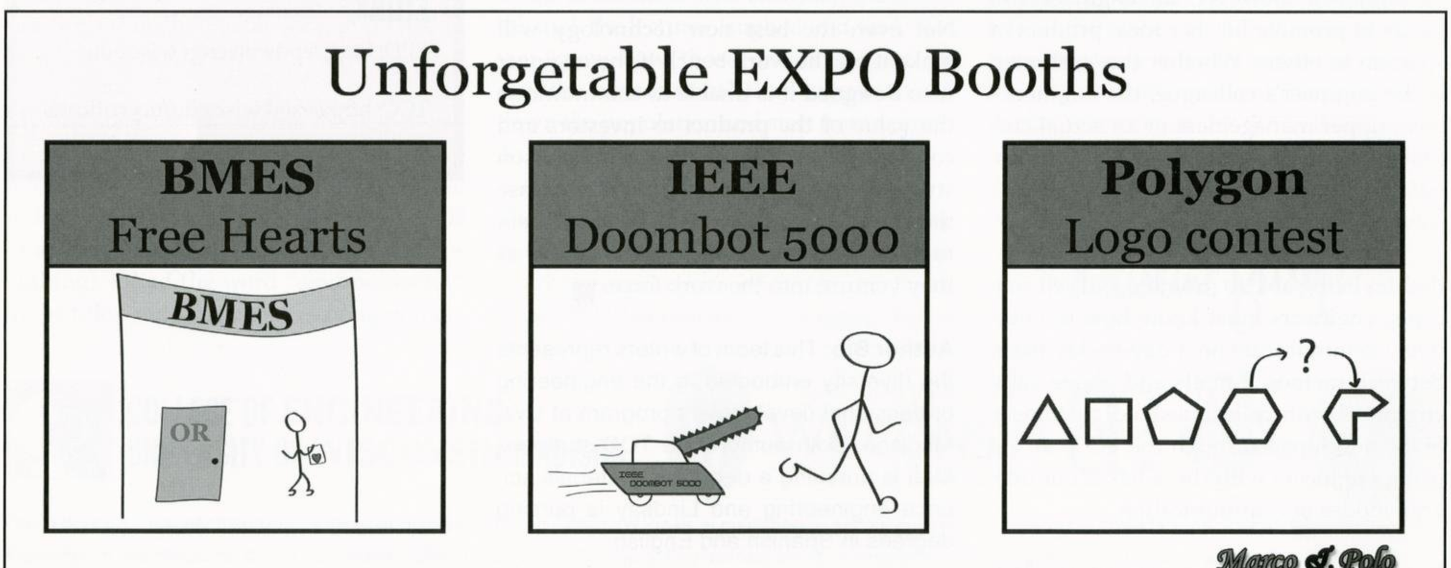
EPD: http://epdweb.engr.wisc.edu/

TCC: http://exed.wisc.edu/tlcertificate/

Just one more

The finest in eclectic humor





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