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wisconsin engineer

SEPTEMBER 2007 VOLUME 111, NUMBER 4

EXPANDING THE ENGINEERING EMPIRE

Construction results p. 12

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wisconsin engineer

Published by the Students of the University of Wisconsin-Madison VOLUME 111, NUMBER 4 SEPTEMBER 2007

COVER STORY

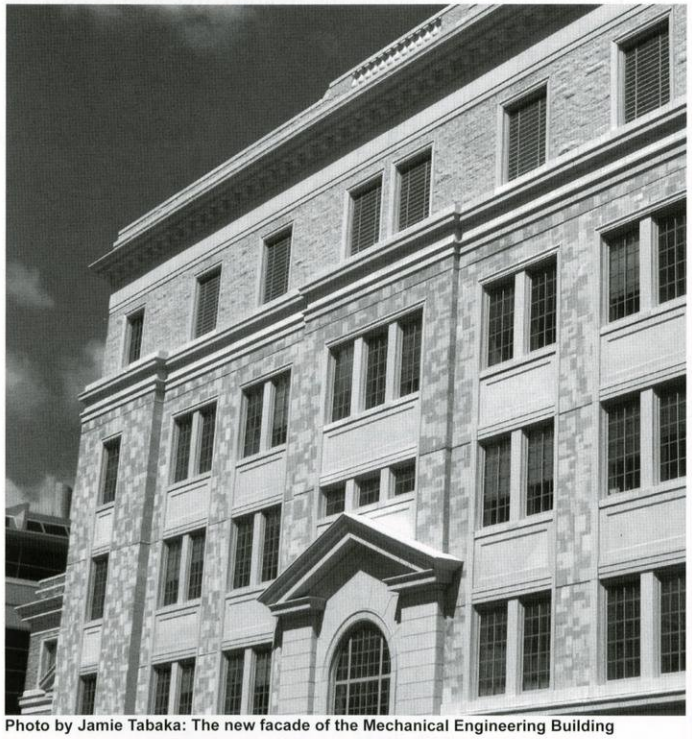

Photo by Jamie Tabaka: The new facade of the Mechanical Engineering Building

FEATURES

COMMENTARY

www.wisconsinengineer.com wiscengr@cae.wisc.edu (608)262-3494 1550 Engineering Drive, Madison, WI 53706

Nicole Rybeck
Writing Editor

Moving forward, not away

I wasn't quite sure what to expect of this summer. A lot of things were different. For starters, many of my friends were interning out of state or even moving away to prepare for grad school. Additionally, I was beginning a disappearing act involving a three week backpacking excursion through Europe, an eight-month co-op and a semester of study abroad in Finland. It was hard for me to even imagine the Madison that I would be returning to.

The backpacking was an adventure in itself—hopping on the wrong trains in France, witnessing political rallies in Spain, stumbling through broken Italian—the list goes on. I had only been to Europe once before and it was for a week-long vacation over spring break with my family way back when I was a freshman in high school. This time it was just me, one other engineering student and two backpacks full of warm-weather clothes. Maybe someone should have reminded me that this wasn't some beachside vacation. I ended up wearing my Marmot jacket a whole lot more than I wore that swimsuit I had so deliberately packed.

I felt so lost from the instant we arrived in Rome. Maybe it was the fact that I speak but one word of Italian—if you count "gelato." Or it could it have been the fact that I had been warned by my family about the pickpockets, my guy friends about the Italian men and my girl friends about the ridiculous amount of carbs I would be consuming. I wouldn't want to eat an *entire* plate of spaghetti…let alone three.

It was painfully obvious that I had no clue what I was in for. Despite the warnings from the hotelier, the weather websites I had visited before departure and my travel companion, I couldn't quite grasp the concept of what "enough water" is to be drinking during the blazing Roman heat. I blacked out from heat stroke at the Roman Forum a mere 24 hours after arrival in the historic city. Maybe this is where the stereotype of clueless Americans comes from?

By day two, I was still a little unnerved by the complexity of just making it through a single day in a city where the language and culture was completely beyond my comfort zone.

This is the day I had a big realization.

In walking through the Vatican, we ran into a girl I was friends with in the dorms and a pack of biomedical engineers from UW-Madison. The next day, walking down the street near the train station in Rome, we ran into a girl I knew from the Institute of Industrial Engineers who was living in Italy for a chunk of her summer.

What I realized is this—you can get lost in whatever city you want, move anywhere your heart desires, and no matter where you go, you always have a piece of Madison with you. Of course, "Madison" will change because while you're away from the physical 85 or so square miles that encompasses the city, you will change, too.

However, you can rest assured that the spirit of Madison—and a Badger or two—are never far from reach. We

Nicole Rybeck

COLLEGE OF ENGINEERING
UNIVERSITY OF WISCONSIN-MADISON

THE UNIVERSITY of WISCONSIN MADISON

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Professor Profile: *Susan Hellstrom*

Saying goodbye to Madison

By Marshall Stringfield

We've all seen it. You walk into a professor's office and wonder how any work could possibly be accomplished in that room due to an enormous jungle of paper and disarray. Upon walking into Susan's office, I was immediately struck by its neat and tidy appearance. In fact, her only flaw seems to be drinking too much coffee.

However, there is something else that really makes her special: her passion for people.

"Susan is an excellent teacher, but her willingness to develop a personal relationship with each of her students is what truly makes her stand apart," Kevin Jayne, writing editor at Wisconsin Engineer, says.

Susan Hellstrom became a member of the academic staff in the engineering professional development (EPD) department in 1998. She quickly became involved with Wisconsin Engineer magazine, serving as co-advisor with Steve Zwickel for one year and then becoming the full-time advisor in fall 2000. Since then, students have benefited immensely from her impact.

Photo by Nurhuda Adam and Muhamad Asyraf Yahaya

Wisconsin Engineer staff members celebrate another successful year at Susan's final meeting. From left: Jamie Tabaka, Marty Grasse, Susan Hellstrom, Kevin Jayne, Heidi Mielke, Kari Jordan, Steve Koralesky and Jonah Paul.

"I would describe Susan Hellstrom as a mentor, coach, instructor, counselor, friend and my mother away from home," Phil Mauermann, advertising manager, says.

"[Susan] became a mentor and a friend. She offered advice when I asked for it and a listening ear when she knew I needed it," Karen Mandl, former editor-in-chief, says.

"Susan cares deeply about her students. We were lucky to have an adviser who is so generous with her time, and the students in her classes benefited from that same generosity," Kyle Oliver, former writing editor, says.

As you might have guessed, Hellstrom's other joy is journalism. Since graduating in that field from Ohio State University, she has been a technical writer, a movie reviewer, a staff writer for the Associated Press and a copy editor for the Capital Times. She loves magazines, especially Bon Appetit and National Geographic Traveler. And, although she enjoys all the classes she teaches, Wisconsin Engineer is one of her favorites and is a natural fit.

"It combines my love for journalism and my love of working with students. It also makes a big difference," Hellstrom adds with a smile, "that all the students want to be there."

"[Wisconsin Engineer] brings engineering and science to life for our readers, gives our engineering students [on staff] a chance to

showcase their communication skills and serves as an unofficial historical record of the College of Engineering and university," Hellstrom says.

Sadly, Hellstrom is saying goodbye to UW-Madison.

Susan and her husband Eric, who has been a professor of materials science and engineering at UW-Madison since 1985, have decided to move to Tallahassee, Florida, the new home of the Applied Superconductivity Center, with which Eric has been working for the past 20 years. While their two children, Sonja and Brett, attend college elsewhere, Eric and Susan will both be teaching at Florida State University. Eric will be a member of the mechanical engineering faculty and will also be affiliated with the National High Magnetic Field Laboratory, while Susan will have a split appointment, teaching in the English department and working on publications for the College of Arts and Sciences.

Hellstrom says, "I will miss you engineers."

Wisconsin Engineer is a completely student-run publication, so Hellstrom's job is primarily training and support. She provides steady guidance for a magazine staff that is always changing as students graduate.

One specific challenge arose after the 9/11 catastrophe. At the time, the magazine relied on pizza sales and advertisements from job recruiters for funding. With the resulting job market fallout, there was a corresponding loss in recruiting and advertisements fell significantly. The magazine faced a financial crisis and fell severely in debt to its publisher. Despite the scary situation, Hellstrom is proud of the turnaround.

"You get students trained, they do a great job and then they graduate. It's really like working with temporary employees all of the time. It's fun getting to meet new people, but it is challenging."

-Susan Hellstrom

"I used to lie awake at night…but the students rose to the challenge," Hellstrom says. They drastically cut spending and increased fundraising with more pizza sales and the addition of Per Mar security fundraising for Kohl Center and Camp Randall events.

Since then, Hellstrom has been a part of many positive achievements for the magazine. Wisconsin Engineer has been very successful at Engineering College Magazine Associated (including winning "Best All-Around Magazine") and working towards the digital archiving of back-issues through the university library system.

Hellstrom is definitely an involved faculty member, serving on the University Library Committee and various other committees within the EPD department. She has also been asked to speak about communication issues at numerous events outside the classroom.

Despite her success and experience, Susan has a goal to never micromanage people and always lets the students make their own decisions.

"[Students] are completely capable, and it's the only way to learn," Hellstrom says.

When asked about the best part of the magazine, her answer is simple.

"Definitely the people. Of course there's the journalism angle, but it really is the people, and I've been blessed to work with some absolutely wonderful students."

And no doubt, UW-Madison and the members of Wisconsin Engineer will miss a teacher, advisor, mentor and friend. WE

Author bio: Marshall Stringfield is a fifth-year senior graduating in December with a B.S. in industrial and systems engineering and a certificate in technical communications.

Photo by Nurhuda Adam and Muhamad Asyraf Yahaya

Hellstrom greets her students at her last meeting for Wisconsin Engineer.

A NEW SPIN ON HURRICANES

Courtesy of http://www1.ncdc.noaa.gov

UW-Madison researchers explore a correlation between global warming and hurricanes

By Anshu Khanna

In 1998, the wrath of Hurricane Mitch claimed between 11,000 and 18,000 lives in Latin America and Florida. Hurricane Wilma, the most intense Atlantic hurricane in history, inflicted $21 billion worth of damage in Florida, Mexico, and Cuba in 2005.

Just a few months before Wilma, Hurricane Katrina—one of the deadliest hurricanes in the history of the United States—left at least 1,800 victims and $81.2 billion of damage in its wake. The carnage and devastation left by recent high-intensity storms has sparked a new level of concern in how these natural disasters develop, as a better understanding of the contributing factors might help prevent Katrina-scale tragedies in the future.

This concern, coupled with the increasing intensity and frequency with which storms occur, has led to further research on their causes. Based on a theory of correlation initially proposed by Kerry Emanuel, atmospheric scientist at the Massachusetts Institute of Technology, in 2005, a group of scientists at UW-Madison and the National Climatic Data Center have found evidence that one of the causes of intensifying storms might be the climate changes caused by global warming. The research has determined that global warming, by way of increasing sea-surface temperatures, contributes to stronger storms in the Atlantic Ocean.

James Kossin, an atmospheric research scientist in the Cooperative Institute for Meteorological Satellite Studies at UW-Madison, has helped lead the research group's quest to confirm this correlation between temperature and storm occurrence. According to Kossin, hurricanes need temperatures of approximately 26.5 degrees Celsius (81 degrees Fahrenheit) at the water's surface in order to form. His group's findings indicate that the Atlantic Ocean's surface temperature near the Caribbean Sea is about equal to this threshold temperature. The effect of global warming pushes it just over the temperature and into the type of conditions that could produce the massive storms that the area has experienced.

Kossin believes that the cause of the increasingly intense hurricanes in the Atlantic Ocean can be traced back to human-related causes.

Kossin's research focuses on the Atlantic Ocean due to restrictions in data. Equipment used to identify and track hurricanes has changed drastically in the last 50 years and being able to translate this data has been a difficult task.

"The science behind the data is clear. But the data collecting, in itself, has not been," Kossin says. The team has worked on smoothing out the data collected from the Atlantic Ocean basin since 1983 when equipment became advanced enough to provide reasonable data they can utilize today. The fact that the focus is on one particular area is significant, since it means that none of the effects of sea-surface temperature that the team has found apply to the rest of the world—not for now, at least.

Another important factor to consider is that increases in sea-surface temperature are not the sole determinants in creating the hurricanes that have ravaged the United States and Latin America. Often, hurricanes are "basin-dependent," meaning they occur because of patterns in the Earth's composition. Also, vertical wind sheer, caused by the east-west trade winds, is critical to these storms since the pressure created by their interaction with sea-surface temperatures begins the process of creating a hurricane.

Overall, as Kossin says, the effects of these storms "have a lot of variability—inter-annual variability, and very, very long cycles—and there are those who certainly believe such a cycle is taking place" in the Atlantic Ocean, as well as across the rest of the world. The issue of whether or not hurricanes can be traced back to global warming is hotly debated and many argue that they are mostly caused by natural weather-cycle patterns. However, in the end, Kossin believes that the cause of the increasingly intense hurricanes in the Atlantic Ocean can be traced back to human-related causes; the same ones that have made global warming such a pressing issue in recent years. WE

Author bio: Anshu is a senior studying industrial and systems engineering. This is his first article for Wisconsin Engineer.

Photo by Ross Kaplan

James Kossin and his team have determined that global warming is linked to stronger storms in the Atlantic Ocean.

~~Diamonds~~

Tin and Barium titanate composites are a girl's best friend

By Adam Anders

A diamond is forever. Sure, a diamond may be the strongest material on the earth, but a group of scientists at UW-Madison have taken away its crown as the stiffest material around.

Stiffness is a property of a material that characterizes its resistance to deformation. Roderic Lakes, UW-Madison professor of engineering physics and mechanical engineering, published a paper in 2001 outlining the theory behind creating a material with extreme stiffness. The idea was to create an ultra-stiff composite by combining two materials—one with positive stiffness and one with negative stiffness. A material with positive stiffness pushes back in a direction opposing an applied force (think of a spring). Conversely, a material with negative stiffness doesn't push back at all; instead, it increases the deformation in the direction of the applied force.

Although it would intuitively seem that combining these two materials would create a composite with minimal stiffness, it actually breaks the limits and creates a very stiff material.

"It's like putting anti-sugar into espresso and getting something sweeter than sugar," Professor Lakes says.

Previous attempts to create stiff composites used materials with only positive stiffness. For several years, a diverse team of engineers has been working to create a composite of tin and barium titanate that would exhibit extreme stiffness. There have been many technical challenges in physically creating the composite since the constituents must be combined very uniformly to make use of the phase transformation that the barium titanate undergoes.

Tim Jaglinski, a former UW-Madison Ph.D. student in materials science, has been credited with finally creating the composite in the lab. Currently, researchers are testing the only sample of this material ever created.

The composite's extraordinary stiffness is derived from the technique used to combine the tin and barium titanate. Small amounts of barium titanate, a molecule which undergoes a solid phase transformation when it is heated or cooled, are suspended in a tin matrix. As the barium titanate attempts to exhibit its phase changing qualities within the tin, potential energy is stored within the composite. This potential energy counters the effects of pressure on the composite and is responsible for the composite's exceptional resistance to pressure.

One of the challenges for the team of engineers in preparing the composite for commercial use is the narrow temperature range at which the material displays this extreme stiffness. The composite has been shown to be stiffer than diamond within a 3 degree Fahrenheit range and stronger than steel within a 10 degree Fahrenheit range. However, recent theoretical experiments conducted by Walter Drugan, UW-Madison professor of engineering physics, have shown that it may be possible to extend the temperature range far beyond this.

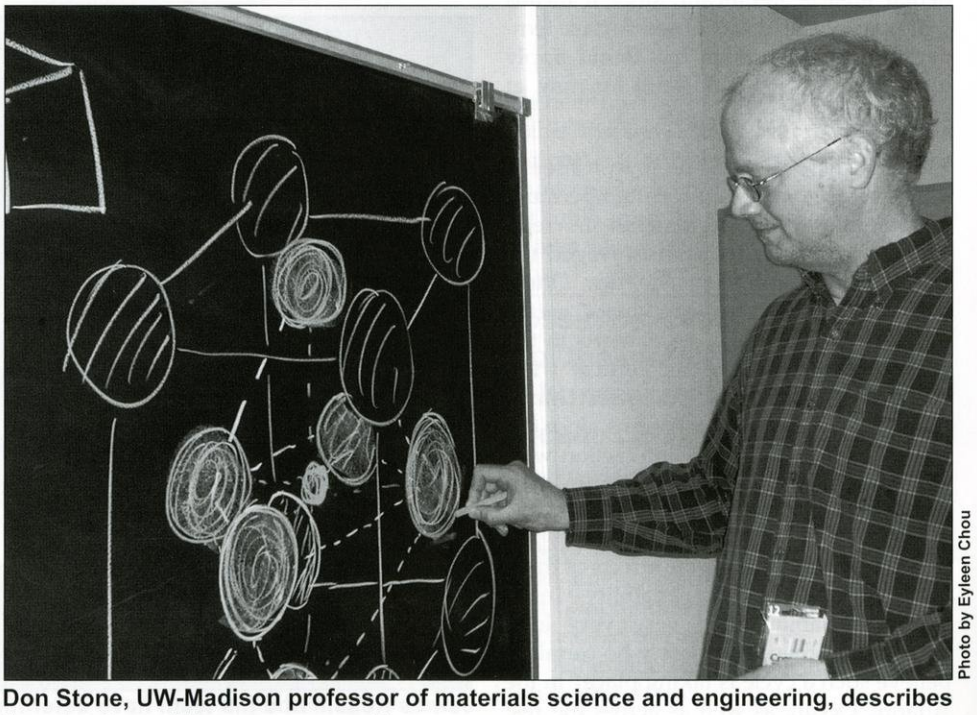

Photo by Eyleen Chou

Don Stone, UW-Madison professor of materials science and engineering, describes the structure of the new composite.

Although the material is stiff, there is no reason to suspect it will be as strong as a diamond, and therefore it is unable to replace diamond cutting tools. However, there may be useful applications for such a material in structures, airplanes, hard drive platters and robotic arms where increased stiffness could lead to more efficient designs. For instance, bridges could be built using less material if it was stiffer than diamond or even steel.

"You wouldn't build a bridge with diamonds," Drugan says.

In addition to being stiff, the new composite has a high phase angle resulting in high damping effects.

"It's like putting anti-sugar into espresso and getting something sweeter than sugar."

-Roderic Lakes

Professor Lakes demonstrated a metallic ringing sound by tapping on the platters of a dissected hard drive to demonstrate characteristics of a material with a low phase angle. This ringing is due to vibrations within the material, which reduce the accuracy of the drive's reading head, thereby reducing the maximum possible data density. The new composite could be used to create a hard drive with less vibration, capable of a higher data density.

This new composite has a promising future in industry, but for now it is relegated to a lab on campus while the synthesizing process and temperature characteristics are improved.

Even though your next piece of jewelry may not be tin and barium titanate composite, the material may find its way into your next computer hard drive. We

Author bio: Adam Anders is a junior majoring in electrical engineering and physics.

ALUMNI NEWSLETTER

Dear past and present Wisconsin Engineer staffers, advisors and readers,

This issue we have decided to include a short newsletter to update you on what's new with the magazine.

As we return to UW-Madison campus for another school year, we are excited to announce that Wisconsin Engineer is doing great. We are sad to see our faculty advisor since 1999, Susan Hellstrom, move on to another opportunity. Taking her place is Steve Zwickel, who advised the magazine before Susan. We are looking forward to working with him.

We are happy to report that Wisconsin Engineer is financially stable and would like to thank our advertisers for working with us. We have been able to enhance the value we provide by increasing the number of pages. This allows us to include two additional articles and run a larger portion of the magazine in color. We also received a grant from the Kemper Knapp Bequest that enabled us to expand our distribution and increase our visibility.

This past spring, we received a generous grant from UW-Madison's Department of Information Technology (DoIT) that allowed us to purchase equipment to begin a podcast. The podcast is an internet-released audio and video broadcast that can be found on our website at www.wisconsinengineer.com. We are excited that the podcast will enable us to reach our readers through another medium.

With these additions and changes, we hope to continue to increase the quality of our publication and to bring relevant science and engineering news to Wisconsin.

Most of all, we are glad to be attending this great university. UW-Madison is a special place, and we're all privileged to be here.

Thanks for reading. We

Marty Grasse
Writing Editor

We commit, we control, we conserve

By Jaynie Sammons

Between global warming awareness, Al Gore's award-winning documentary and the ever-present dilemma of oil consumption, Americans are constantly being reminded about the importance of conserving our natural resources. So it should come as no surprise that UW-Madison has decided to jump on the bandwagon and make major efforts toward energy conservation on campus.

Although the university has worked to reduce energy consumption in the past, the "We Conserve" campaign sets more specific goals for the future of the campus. The campaign aims to not only reduce campus-wide energy consumption 20 percent by the year 2010, but more importantly, it looks to educate students about conservation tactics.

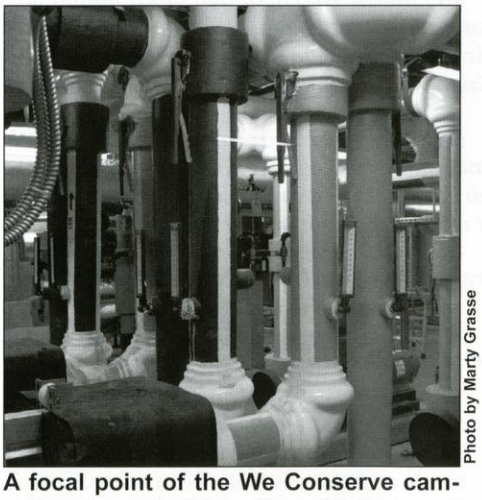

Photo by Marty Grasse

A focal point of the We Conserve campaign is optimizing the efficiency of HVAC equipment in all campus buildings.

Faramarz Vakili, the program's director, says that instilling the spirit of conservation is the number one goal of We Conserve.

Vakili had been working toward energy conservation for five years prior to suggesting the We Conserve campaign.

"We needed a goal. For me, 20 percent was a very aggressive goal," Vakili says.

Since starting in April 2006, the program has made a name for itself across campus. Signs bearing witty slogans such as "Heroes Needed" and "Conversation about Conservation" can be seen posted on several buildings. At the We Conserve website, supporters can pledge to do their part in the fight against energy waste. To date, over 600 people have agreed to consciously make efforts toward reducing consumption. Vakili hopes these supporters will spread the word about We Conserve and work to get others involved.

To some, the 20 percent decrease may seem like an easily-obtainable goal for a campus the size of UW-Madison; however, with so many students and faculty requiring a constant supply of energy, this may not be the case.

"Even if we turned off all the lights on campus and all the computers, we still would not even be close to saving 20 percent," Vakili says.

Vakili believes the project's progression has been on target with his expectations. We Conserve is an "exponential project" in that once initial milestones are reached the progress will have a snowball effect. The program has been concentrating on educating students on how they can make future improvements. The program is currently in the planning stage, pinpointing the most significant sources of energy consumption and deciding on the next move. On the engineering campus alone, there are approximately $1.5 million in possible savings.

Vakili says that the project is not based on linear progression and that there are no specific day-to-day goals.

UW-Madison initiates life-long energy conservation tactics.

"There are four legs to the table: efficient systems, informed people, realistic expectations and responsible actions," Vakili says.

One of the biggest sources of controversy in regards to this campaign is that UW-Madison's energy suppliers use entirely non-renewable generation methods. Most of the energy being used is produced at UW-Madison's Charter Street Plant, a coal-burning facility.

Many environmentalists have expressed concern over UW-Madison's contribution to air pollution through the continued use of coal power. However, Vakili says the switch to a campus powered by all renewable sources is easier said than done.

"The buildings on this campus were not made overnight, therefore they can not be replaced overnight…the bottleneck is not money," Vakili says.

Vakili admires the passion and determination of those that argue against the use of coal power, but says passion is not enough. In order to eliminate the use of coal, UW-Madison would need to undo 150 years of technological decisions. The entire energy infrastructure would need to be replaced to keep UW-Madison running at the same standards. The choice to switch to renewable energy sources is not simply a monetary issue; it is also an issue of time and space.

"The mission of the university is more important. We cannot compromise the university," Vakili says, describing why immediately switching to other energy sources such as water, wind or light is not as easy as flipping a switch.

For those of us living in a perpetual bubble of classes, tests, student organizations and Badger sports, monitoring our energy consumption may not be number one on our priority list. However, Vakili promises that becoming energy-conscious has long-term benefits everyone can appreciate. Going "green" is meant to be a lifestyle decision and is a process that will occur over time. It means replacing light sources with more efficient bulbs, taking advantage of public transportation and turning down the thermostat. Though the goals of We Conserve are far-reaching, they are attainable if everyone adopts the proper mindset. We

Author bio: Jaynie Sammons is a senior in industrial and systems engineering. She is also working toward a technical communications certificate.

For additional information visit www.conserve.wisc.edu

Photo by Andy Hardy

Faramarz Vakili stresses campus conservation through the We Conserve campaign.

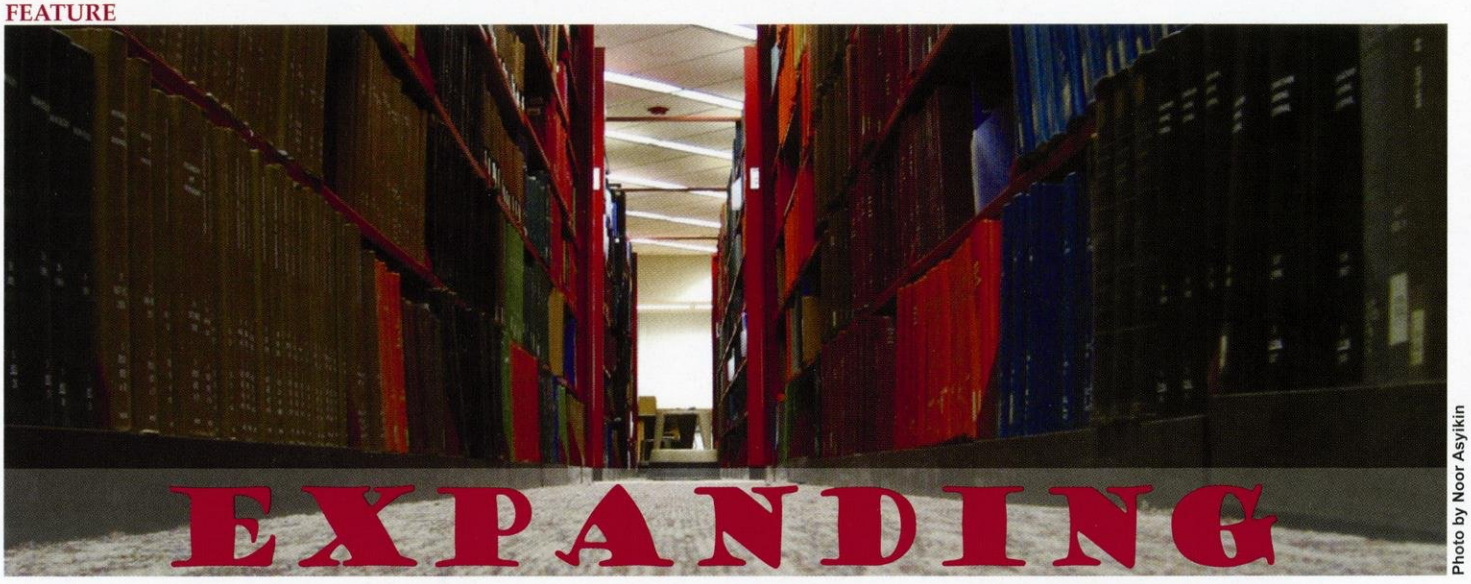

Photo by Noor Asyikin

EXPANDING THE ENGINEERING EMPIRE

By Victoria Yakovleva

Believe it or not, during the early 1900's, the Education Building that is nestled on Bascom Hill once housed engineering students.

By the end of World War I, the College of Engineering was startled by a massive influx of students. Freshman enrollment doubled from 1916 to 1920, and the college administration realized that packing their students into overcrowded laboratories would not suffice. In response, they built a 20,000-square-foot, heavy-duty machine shop, nicknamed "Sawtooth," on the north end of Camp Randall along University Avenue. This was the first mark of engineering territory.

Yet the shop building was not enough. The building on Bascom Hill was still overflowing with engineering students, who now had to walk across campus to get to their shop classes.

Dean Turneaure, the engineering dean at the time, devised a solution. He appointed a construction committee to plan the design of the new engineering building on the Camp Randall site. Just as the Spanish empire expanded into the western hemisphere in the 18th century, the engineering department expanded to the western side of campus.

The new engineering building was three stories high, 81,000 square feet and formed a U-shape around the sawtooth shop. Needless to say, as of the 1931 fall semester, engineering faculty and students had more breathing room.

That was then; this is now.

"Mechanical engineering has changed a lot in the last 75 years. It has become much more science-based, research-intensive and extremely high-tech," Paul Peercy, dean of the College of Engineering, says.

To support the advancing field of engineering, Peercy wanted a building that would be "state-of-the-art, but easily reconfigured as needs change with time—a building that would be flexible and usable for the next 50 or 75 years."

To meet this need, renovations to what is now known as the Mechanical Engineering Building included a new electrical and data infrastructure to support the several modern research laboratories, classrooms

Photo by Mohd Helmi Bin Hasan Adli

The newly renovated interior of the Mechanical Engineering Building provides students with an open, inviting place to do schoolwork.

and lecture halls that the building now contains. Also, a new elevator was added that will make the building more accessible for disabled students and faculty. Finally, a new central heating, ventilating and air conditioning system to replace the multiple substandard mechanical systems that once served the building was installed.

"The total construction project more than doubles the square footage of the building," Peercy says.

As immense as this building project was, the Mechanical Engineering Building wasn't the only site of recent development in the engineering empire.

From new facilities available for better in-classroom learning to new study spaces available for out-of-classroom learning, the engineering campus continues to expand.

"When I came here as dean, I did some analyses and I found that about half the students that enter college saying they want a degree in engineering actually get a degree in engineering," Peercy says.

Photo by Mohd Helmi Bin Hasan Adli

Within the Student Learning Center, located in Engineering Hall, students are able to socialize and study in a relaxed environment.

The number one reason the other half doesn't earn a degree in engineering is because, as Peercy says, they have difficulty in math and science their first year.

To assist the success of students in the College of Engineering, Peercy had a vision for a "welcoming, open and easily reconfigured" space where students can work in groups or individually and obtain the assistance they need.

As of the 2007 spring semester, Engineering Hall received the 4,500-square-foot renovation Peercy envisioned: the Student Learning Center. This center encompasses a student information area, seminar rooms, a group tutoring area, a group study area, individual study areas, informal space and an internet café.

"I'm hoping it will let [engineering students] see it's okay to study," Peercy says.

One way in which the Student Learning Center has especially assisted engineering students is the addition of the Supplementary Instruction (SI) room.

The SI program, an outside-the-classroom academic support program to supplement lectures and discussions, was previously situated on the 4th floor of Wendt Library. During the busy hours—that is, after 4 p.m.—Wendt Library became very noisy, posing a problem for students trying to study.

"We have always hoped we [would] have an enclosed area for us... and that [has] happened now," Jia-Ling Lin, director of the program, says.

The new SI room is completely enclosed by glass. This allows people outside the room to view the learning that's going on inside (perhaps motivating them to join the SI program in the future), yet prevents outside noise from interfering with the learning inside the room.

"I go to the SI room twice a week and have found it very helpful. It's really nice to have an enclosed area to review material with others in my class," Amy Lenz, a first-year engineering student at UW-Madison, says.

Right next door to Engineering Hall, Wendt Library also saw changes this past semester.

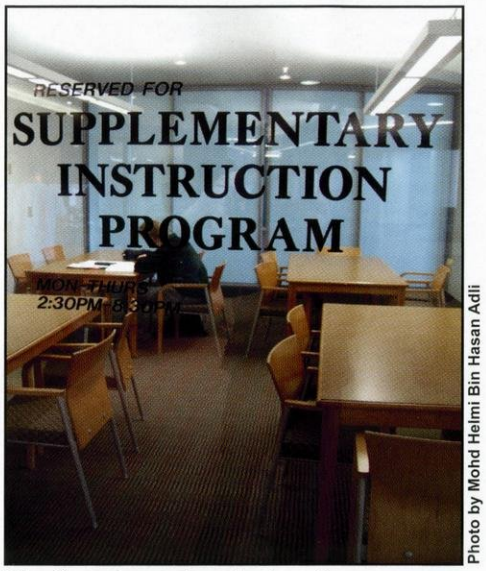

Photo by Mohd Helmi Bin Hasan Adli

The Supplementary Instruction room, an enclosure within the Student Learning Center, allows students to learn from their peers.

The alcove next to the front entrance of Wendt turned into an informal study area, equipped with comfy seating, painted walls and softer lighting.

"We're really trying to give [engineering students] a more relaxed space," Deborah Helman, director of Wendt Library, says.

On top of the alcove, the carpeting—unchanged since the building's opening in 1976—has finally been replaced.

"We're looking for ways to upgrade the overall appearance of Wendt and make it more welcoming. We're also looking for ways to facilitate group work and balance that with individual study space," Helman says.

This just goes to show how much the engineering community is coming together to improve the education of engineering students at UW-Madison. From new facilities available for better in-classroom learning to new study spaces available for out-of-classroom learning, the engineering campus continues to expand.

Since the beginning of the 20th century, the College of Engineering has gone from a single building on Bascom Hill to an expansive empire north of Camp Randall. The message is clear: engineering is a field that is rapidly advancing and UW-Madison doesn't dare lag behind. WE

Author bio: Victoria is a sophomore at UW-Madison who hopes to major in biomedical engineering. This is her fourth article for Wisconsin Engineer.

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Volume 11 — Number 3

The WISCONSIN ENGINEER

Published Four Times a Year by the University of Wisconsin Engineering Journal Association

MADISON, WIS. — APRIL, 1907

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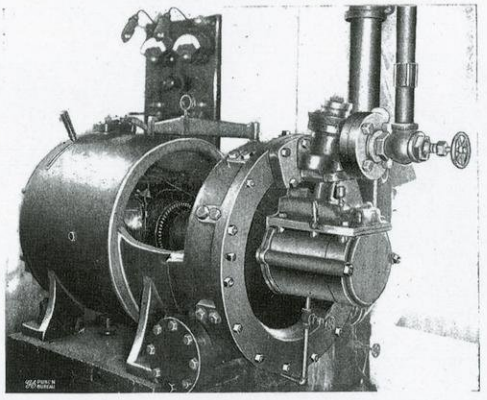
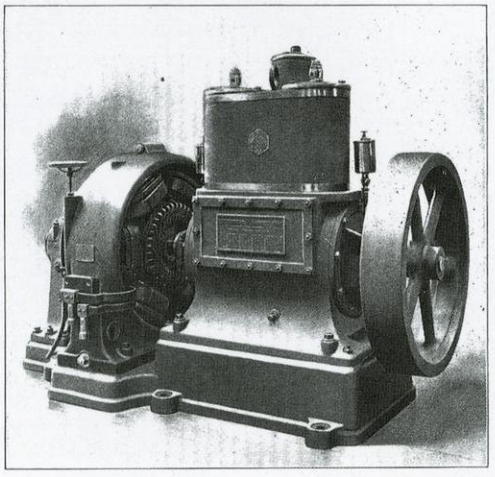


25-K. W. Curtis Turbine-Generator.



Westinghouse Engine and Generator Lighting Set.

THE WISCONSIN ENGINEER

VOL. XI — APRIL, 1907 — NO. 3

VIBRATIONS IN PASSENGER TRAINS FROM HIGH SPEED ELECTRIC LIGHTING ENGINES.*

F. W. HUELS, '03.

Presented before the Western Society of Engineers, December 19, 1906.

The vibrations in passenger trains caused by the reciprocating action of the high speed engine of the electric generating sets constitutes one of the principal objections to their use. These engines produce vibrations that are sometimes of considerable magnitude, owing to lack of perfect balance of the reciprocating parts. The vibrations are transmitted back into the train, since the whole train is elastic. Thus a source of annoyance to the passengers is created which railways would be glad to get rid of, and steam turbines are now replacing reciprocating engines in the train lighting field because they have the advantage of no vibration.

It is interesting and of some importance to know something about the magnitude and character of these vibrations. So far as is known to the writer, no attempt has been made, heretofore, to make measurements of them. In the following pages the results of tests of this kind are presented.

Method of Locating Generating Sets as Adopted by Various Roads.

In Plate 1 is shown the method of locating the generating set as adopted by the Chicago, Milwaukee and St. Paul Railway Company. Here the engine is placed crosswise in the

*Reprint from *Journal of Western Society of Engineers*, April, '07.

baggage car and as close to the locomotive as possible. This location is at a point about three feet ahead of the forward king bolt. It is claimed that in this way the piping between the locomotive and the lighting engine is reduced to a minimum length, thereby reducing the condensation of steam in the pipe to a minimum.

The Chicago and Northwestern Railway and the Northern Pacific Railway adopt the arrangement shown in Plate 2. Here the generator is placed so that the shaft is parallel to the length of the car and at a point over the rear king bolt. The Chicago and Northwestern Railway uses this system because the front part of the car is the express compartment, and the door leading into it is kept locked. By placing the set in the rear of the car, the electrician can attend to it without disturbing the expressman. In this arrangement the distance between the locomotive and generator is as much as fifty feet, which produces a considerable amount of condensation in the steam pipe.

Further, it has been claimed that the vibrations could be felt farther back in the train when the latter arrangement is employed because the "vibration center" is farther back in the train. The experiments on vibrations described in this paper seem to bear out this point, as will be observed by making an examination of Plate 9.

Vibration Indicators and Seismographs.

For measuring vibrations of this kind, instruments known as "seismographs" or "seismometers" are used. This name was originally given to instruments constructed to measure the movement of the ground during earthquakes. Webster's dictionary gives these definitions:

> "Seismometer: An instrument for measuring the direction, duration, and forces of earthquakes and like concussions."
>
> "Seismograph: An apparatus for registering the shocks and undulatory motions of earthquakes."

A 'Virgin' spaceflight

Commercial space travel will become a reality in 2009 when Virgin Galactic spacecraft, SpaceShipTwo, carries its first passengers to space and back.

Photo by Peter Penegor

By Natalie Forster

It is said that history repeats itself. If the history of commercial air travel is any indication, vacations in space will soon be as regular as international flights.

After Charles Lindbergh flew the Spirit of St. Louis nonstop from New York City to Paris in 1927, the commercial air travel industry boomed. His 33.5 hour flight transformed skeptics into believers, proving that long distance flights were possible. The feat earned him the $25,000 Orteig Prize, offered to the first person to fly the route. Seventy-seven years later in October of 2004, SpaceShipOne (developed by Burt Rutan's company, Scaled Composites) was the first non-government reusable manned spacecraft to travel repeatedly into space (twice within two weeks), winning the Ansari X-Prize of $10 million and pioneering commercial space travel. Will history repeat itself?

Photo by Peter Penegor

SpaceShipOne, connected to the bottom of its transport vehicle, the White Knight, at the 2005 EAA AirVenture airshow in Oshkosh, WI.

Billionaire entrepreneur Sir Richard Branson jumped at the opportunity to lead the commercial space travel industry. A division of Branson's Virgin Group—which includes Virgin Mobile, Virgin Records, three Virgin airlines and now Virgin Galactic—partnered with Scaled Composites to build a fleet of five SpaceShipTwos, the first of which will be named VSS Enterprise (yes, the name deliberately honors Star Trek's Starship Enterprise).

Seven thousand people worldwide have already indicated their willingness (and wealth) to buy a ticket for a 2.5 hour suborbital spaceflight that promises three to six minutes of weightlessness and a stunning

(continued on page 19)

A 'Virgin' spaceflight

(continued from page 16)

view of Earth. Among those pre-booked for the adventure are Star Trek's William Shatner, theoretical physicist Stephen Hawking and electrician Alan Watts, a London man who exchanged 2 million frequent flyer miles earned on Virgin Atlantic airlines for the roughly 200 mile round trip to space. Branson himself plans on taking the first flight, slated for 2009, along with a few members of his family.

This thrill ride isn't cheap. If you're not a member of Branson's immediate family or a seasoned traveler with 2 million frequent flyer miles, the only way to get a seat is to fork over $200,000, which amounts to about $1,300 per minute off the ground. Branson's ultimate goal is to price the tickets more affordably once he recoups most of the venture's initial cost.

Millions of dollars are going into the development of SpaceShipTwo, which will be designed to carry a maximum of nine passengers 84 to 87 miles above the earth's surface—a few miles past the border of what's considered "space." Although SpaceShipTwo is designed to be sub-orbital (meaning it comes straight back down without orbiting the earth), an orbiting commercial spacecraft may not be too far off.

Seven thousand people worldwide have already indicated their willingness (and wealth) to buy a ticket for a 2.5 hour sub-orbital spaceflight that promises three to six minutes of weightlessness and a stunning view of Earth.

"To go into orbit you just have to go faster—give it more of a boost," Gil Emmert, UW-Madison professor of engineering physics, says. Emmert worked on rocket engines and fuel cells for the Apollo missions.

There are, however, additional challenges involved in designing an orbital vehicle. According to Daniel Kammer, a UW-Madison professor of engineering mechanics and astronautics, the higher speed required for orbit necessitates a heat shield—a component prone to failure. Also, orbital spacecrafts must have the means to sustain human life in space: including equipment to provide oxygen, food, water and protection from radiation.

Photo by Peter Penegor

Today, SpaceShipOne hangs in the Smithsonian next to Lindbergh's Spirit of St. Louis—two aircraft that paved the way for commercial travel.

Reaching the outer limits of Earth's atmosphere requires a lot of power and a lot of rocket fuel as it is, but SpaceShipOne (and SpaceShipTwo) require less fuel by launching from mid-air. Instead of launching vertically from the ground, like NASA's space shuttle, a separate aircraft carries SpaceShipOne to an altitude of about 46,000 feet and then drops it. During its freefall, SpaceShipOne's relatively small rockets kick in and push it into space. This method requires less fuel because drag decreases at higher altitudes as the atmosphere thins. Another advantage is that if the rockets fail, the spacecraft can proceed with a normal landing.

"You reduce the drag, and that's probably the biggest benefit of [an air launch]," Emmert says.

Branson doesn't plan on stopping at sub-orbital spaceflights. He tells the press that he hopes to one day offer orbital spaceflights (aboard a SpaceShipThree), trips to the moon and to build a hotel in space. Maybe his head is in the clouds, or in space for that matter, but seemingly impossible things have happened before. Eighty years ago, intercontinental air flights were just a dream reserved for daredevil pilots.

"You can never say, 'They'll never do this, and they'll never do that,' because things have a way of evolving. People find ways to do it. Especially if there's money to be made, they'll find a way," Kammer says.

When asked whether he'd accept a free ticket on SpaceShipTwo, Kammer replied, "I'd love to go into space…Yeah, I'd go in a second."

Today, SpaceShipOne hangs in the Smithsonian next to Lindbergh's Spirit of St. Louis—two aircraft that paved the way for commercial travel. If Lindbergh's legacy is any indication, it won't be long before space becomes a regular vacation destination. WE

Author bio: Natalie Forster graduated in May with a degree in mechanical engineering. This is her fourth and final article with Wisconsin Engineer.

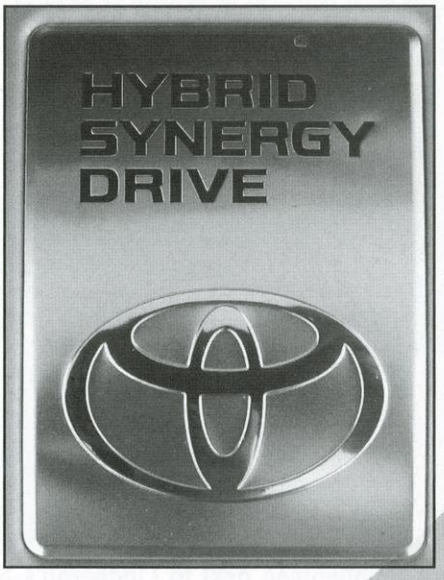


Photo by Franz Stadtmueller

Hybrid Help

Hybrid vehicles offer improved fuel economy

By Ryan Denissen

It's a hot summer day and your friends, clad in beach attire, wait impatiently in the car as you fill up with gas. As you watch the display roll past 10, 20 and then 30 dollars you chuckle to yourself, pondering how great it would be if the university gave out scholarships during the summer for trips to the beach. Until the university determines that swimming and laying in the sun have substantial academic benefit, students and all who tire from watching their gas tanks devour their paychecks may want to consider the hybrid alternative.

A hybrid can be any vehicle that combines two power sources, but today's consumer hybrid vehicles are primarily gasoline-electric. These hybrid cars typically achieve 30 miles per gallon (mpg) to 40 mpg on the highway, far better than the 20 mpg to 30 mpg rating for most conventional vehicles.

Because hybrid vehicles use less gasoline, they are far more environmentally friendly than conventional cars. Gasoline combustion produces carbon dioxide, a greenhouse gas. Because hybrids are easy on the environment, purchasing one will also line your pockets with a little more green come early April.

"What few people will tell you is they get a pretty generous tax credit for purchasing a hybrid," Nick Rudolph, of Stark Chevrolet in Stoughton, says.

Conventional cars must be designed with larger engines capable of creating the necessary horsepower and torque for situations such as highway merging, when considerable acceleration is necessary. Heavy, large-displacement engines and cylinders require a great deal of energy to operate. These heavy components drive down gas mileage, and since typical highway driving requires only a fraction of the engine's total horsepower capacity, its full power capabilities are used only when passing other vehicles or peeling out of beachside parking lots. Hybrid vehicles, on the other hand, can be designed with smaller and more efficient engines. When the car requires an additional boost during acceleration, a battery-powered electric motor kicks in.

Hybrid cars differ from their strictly electric counterparts because they generate their own electricity and never need to be charged with an outside power source. Hybrids use regenerative braking, which converts the heat from friction in the brakes into

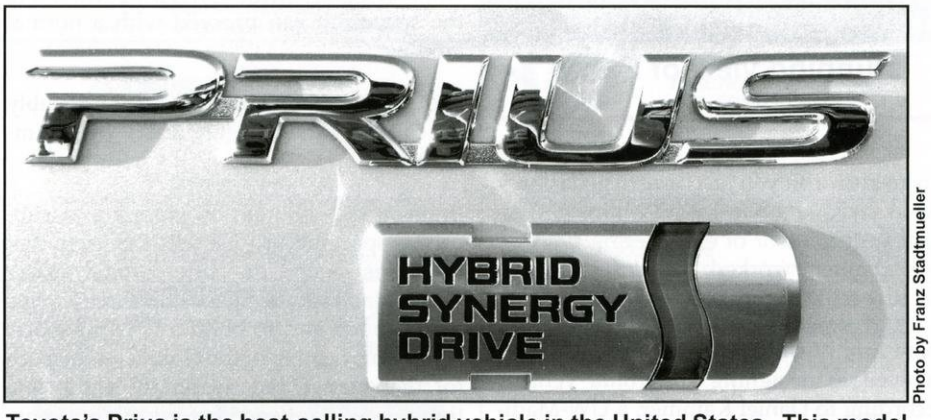


Photo by Franz Stadtmueller

Toyota's Prius is the best-selling hybrid vehicle in the United States. This model is rated at 60 mpg city and 51 mpg highway.

electrical energy that charges the hybrid's batteries.

Gasoline engines are efficient at high speeds, so hybrids favor their gas engines when cruising on the highway. However, during city driving the hybrid primarily uses its electric motor.

These technological advancements come at a price, though.

"Toyota hybrids typically cost $3,000 to $4,000 more than the equivalent conventional model—most will recoup this money in five years. If you drive a lot in the city you will get [your money] back in half that time," Jeff Seamans, of John Lancaster Toyota, says.

Another hidden expense associated with hybrid vehicles is the possibility of high maintenance costs down the road. Hybrid vehicles have not been on the market very long, making it difficult to predict the cost of future repairs such as battery replacement.

"What few people will tell you is they get a pretty generous tax credit for purchasing a hybrid."

-Nick Rudolph

"What are these hybrids going to cost to maintain five years from now?" Rudolph says.

Toyota, General Motors, Daimler Chrysler, Hyundai, Ford and Audi will all be releasing new hybrid models in 2008.

Toyota plans to release its third generation hybrid Prius. The current model is the most fuel efficient hybrid on the market, earning an Environmental Protection Agency estimate of 60 mpg on the highway. The new design includes lighter lithium-ion batteries and a new Synergy Drive powertrain system that will be both half the weight and cost of the current Prius. Toyota's line of hybrids also includes the Camry and Highlander; Seamans expects continued expansion and improvement in the future.

General Motors continues to implement hybrid technology into its high volume, high fuel consumption vehicles. General Motors, Daimler Chrysler and BMW have teamed up to develop a two-mode hybrid system.

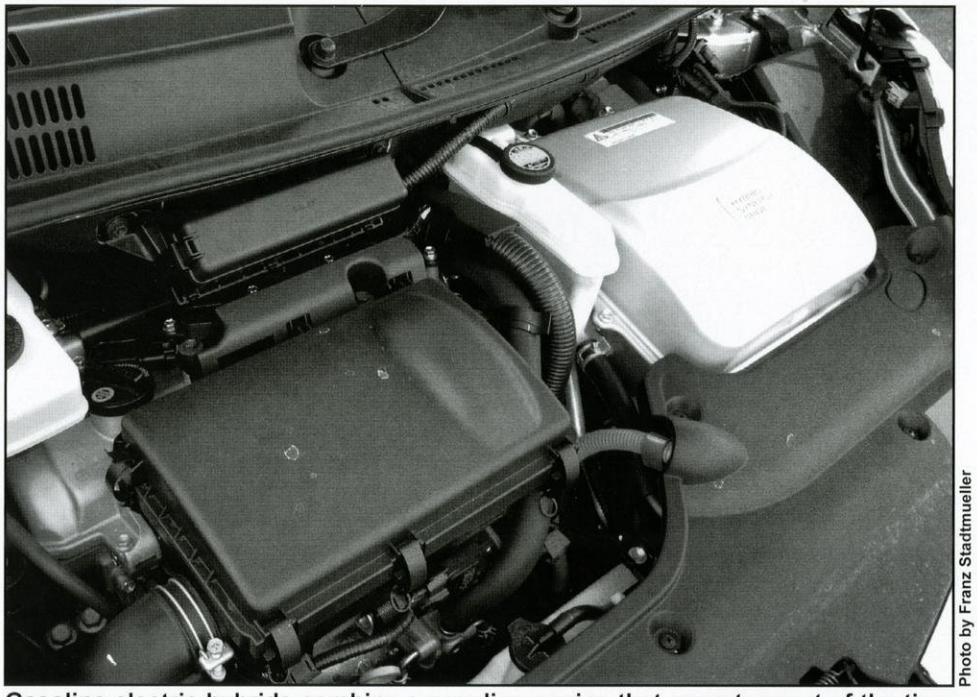


Photo by Franz Stadtmueller

Gasoline-electric hybrids combine a gasoline engine that operates part of the time with a battery-powered electric motor.

This system uses two electric motors and a dual-mode transmission. In other words, the vehicle has both city and highway modes. Each mode uses the electric motor and gas engine differently to provide optimal gas mileage.

"These vehicles employ active fuel management; they can shut off four of the eight cylinders to improve gas mileage," Rudolph says.

With this two-mode system, consumers can expect an increase in fuel economy—maybe even as high as 25 percent. This hybrid system will be used in the 2008 Chevy Tahoe and GMC Yukon and is also expected to be available in the Cadillac Escalade, Chevy Silverado and GMC Sierra models.

"[In the future,] I think you will see diesel hybrids being brought in. [Diesels] use a smaller motor and still get the same horsepower and torque," Rudolph says.

The next time you find yourself lost at a car dealership, it may be helpful to think back to those hot summer days at the gas station. Shouldn't you be spending your money at the final destination, not getting there? WE

Author bio: Ryan Denissen is a senior majoring in mechanical engineering.

Engineering goes global

Engineering students take their studies overseas

By Lynn Singletary

Globalization is becoming increasingly important for all careers, including engineering. Being aware of global issues and other cultures lays the groundwork for all new learning experiences. There is no better way to experience other cultures and broaden one's world view than to travel. According to Francis Bacon, "Travel, in the younger sort, is a part of education; in the elder, a part of experience."

While UW-Madison is a renowned university in a beautiful city, there is only so much a classroom education can offer students who want to experience the world outside of Wisconsin. UW-Madison, however, does offer study abroad opportunities on five—soon to be six with the inclusion of a program in South Africa—of the seven continents. The choices of travel destinations are nearly endless, including Ecuador, Australia, Japan, Denmark and many more.

"You can't expect everybody to speak English, but try not to go where you're comfortable, study abroad is about experiencing new things. Be flexible and take advantage of the opportunities you have. Challenge yourself to go to a place you would probably never see otherwise," Talia Esser who studied abroad in Budapest, Hungary, says.

Photo by Jamie Tabaka

The study abroad program offers opportunities to explore engineering in other cultures.

Typically, students choose to study abroad during their junior or senior years at UW-Madison and most stay abroad for just one semester.

"I'd say close to 75 of our approximately 100 annual study abroad students choose a semester long program, though some—particularly when studying another language—students do opt for a year long program because that language proficiency can come during that time," Marianne Bird Bear, international engineering office advisor, says.

"If you ask an employer if they would rather hire a student who graduated in four years or someone who can be flexible, adaptable and open to other points of view, I am confident they would choose the latter."

-Kate Theirren

The biggest piece of advice any student or advisor would give to a prospective study abroad student is to plan ahead. UW-Madison has partnerships with many universities around the world, so transferring credits is often an easy process, but not all courses match up. It is important that students talk with an advisor before traveling

to ensure that requirements are met without too much delay in graduation date.

Graduation date, as many students who have studied abroad urge, is not something to get caught up on. The life lessons a study abroad experience provides make a slightly later graduation date worthwhile. There is no better place to learn flexibility and acceptance of new ways of thinking than studying abroad.

"If you ask an employer if they would rather hire a student who graduated in four years or someone who can be flexible, adaptable and open to other points of view, I am confident they would choose the latter," Kate Theirren, who studied in Lyon, France, says.

This experience doesn't have to cost an arm and a leg, either. Tuition is comparable to that of UW-Madison. The biggest difference in price is the cost of living, which varies greatly depending on the country of study. In Copenhagen, Denmark for example, the cost of living is much higher than in Budapest, Hungary. The fees generally amount only to a few hundred dollars more than staying in Madison, and many need-based scholarships are available.

Many students travel around the region while abroad, providing an invaluable pathway for cultural discovery. Students often travel in small groups during school breaks or on weekends. It is away from the campus at local hangouts—not tourist sites—where one gets the best feel for the lifestyle in a particular place.

Photo by Ahmad Juhari, Azyyati Hamizan and Farah Jamil

Marrianne Bird Bear, international engineering office advisor, discusses the study abroad program with a student.

"Make it your trip. Don't simply follow the crowd. When else will this opportunity arise?" Dibya Phuyal, who studied in New Zealand, says.

"If I had one suggestion for those who intend to study abroad in the future, it's this: Meet as many people as you can from all over and visit them. Nothing compares to a typical night on the town in Berlin or celebrating Queen's Day with 10 million Dutch folk. Being a study abroad student, you can often get stuck in you own little world," Joe Hippensteel, who studied in Spain, says.

"Travel to the extent that your resources permit. You will inevitably return to UW-Madison after a term or year abroad with an understanding of yourself and other cultures that will give you something unique to bring to any situation in which you find yourself," Theirren says.

It is difficult to find a student who had a negative experience abroad. Not only is it an amazing social opportunity to meet friends and potential future colleagues from around the world, it is a great educational opportunity to see the way engineers work abroad. More and more, engineering is becoming a global trade, and the additional experience gained from interacting with people from other cultures will strengthen any student's résumé.

"Stepping out of your cultural boundaries, and the US, not only allows you to experience another culture first-hand but also helps you to understand your own culture and identity as an American more than you ever could if you never left," Theirren says. WE

Author bio: Lynn Singletary is a sophomore majoring in civil engineering.

JUST ONE MORE

The finest in eclectic humor

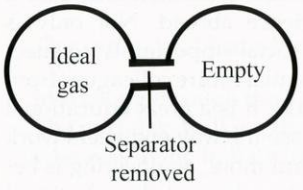
By Kari Jordan and Phil Mauermann

Are you an engineer?

Are you an engineer because you are getting a degree, or have a degree... or is there something more to being an engineer? Take this quiz a) for enlightenment b) for amusement c) to battle boredom d) because we said so

This image is a good example of....

a) Friction
b) Kepler's Laws
c) Entropy
d) Chaos Theory



Which of the following is NOT a characteristic of a professional engineer

a) Specialized knowledge
b) Responsibility to the public
c) Self-regulation
d) High salary

What are the true dimensions of a 2x4? (not including length)

What is an ideal gas?

What is one kilowatt in units of horsepower?

How many licks does it take to get to the center of a Tootsie Pop?

What is a lemniscate?

a) A group of lemmings
b) The infinity symbol
c) An object that can only be described in five dimensions
d) All of the above

Su-dork-u

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