Wisconsin engineer. Volume 103, Number 3 April 1999

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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APRIL 1999
VOLUME 103, NUMBER 3

WISCONSIN ENGINEER

LASERS!

nside this issue:

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The College of Engineering
University of Wisconsin-Madison

WISCONSIN ENGINEER

Published by the Students of the University of Wisconsin-Madison

VOLUME 103, NUMBER 3

APRIL 1999

TABLE OF CONTENTS

FEATURES

On the Cover:

Meredith Porembski (left) and Emily Reichert, both graduate students in the UW Chemistry department, adjust an optic on their Nd:YAG pumped dye laser.

-Photo by Victor Chen

DEPARTMENTS

TO CONTACT THE *WISCONSIN ENGINEER:* 1513 University Avenue Madison, WI 53706 wiscengr@cae.wisc.edu http://www.cae.wisc.edu/~wiscengr 608-262-3494

Slackers Unite!!!

Senioritis. That's what I'm suffering from, and not because the AARP mistakenly invited me to join them last week. I'm suffering because I'm 23 and about to graduate. Basically this means I've got job prospects to follow up on, a wedding to plan, and laundry to do. Oh yeah. And three more essay tests to pass, six more papers to write, and hundreds of more steps to climb before I get my diploma. Sheesh.

This is the second time in my life when I've caught Senioritis. Most of us caught it for the first time when we were high school seniors. The difference between back then and now though, is that back then we didn't know what being burned out REALLY meant.

Technically, I shouldn't be sick with it now because this time around, I actually love my classes. With most of my requirements out of the way, I was free this semester to take pretty much whatever I wanted. And it's been nice voluntarily going to lecture, laughing at the professors' jokes, not feeling like (or being treated like) a complete idiot freshman anymore. Now I never get lost going to class, I know where all the computer labs are, and I can find my way around MadCat well enough to round up some decent research when asked.

But I *am* sick, and it's all attitude, baby: I want to throw up when I look at my homework, and I get chills when I think of studying for finals. The 40K+ salary virus is just too strong now, wiggling its dizzying green dollar signs around in my head, chanting, "This time next year you'll be..."

Wait a second. This time next year I'll be...in an office. A cubicle, probably. I'll be in a cubicle stuck beside the same coworkers every day—no more alternating Monday-Wednesday-Friday and Tuesday-Thursday faces. No more summer internships in big cities. No more road trips over break. No more student discounts with my I.D. Shoot—I bet I'll even be wearing pantyhose this time next year. Eeeeew...

You probably think I'm about to tell you to slow down and enjoy college while you can, while you don't have to wear ties and pantyhose, right? Nah...time passes at the same rate no matter how you spend it, objectively. But as I sit here, grudgingly starting the fifth-to-last paper of my college career, and starting to feel ill, I can't help but have conflicting feelings about what to do with my time...

"Give it a whirl for old time's sake" one dollar bill whispers. "Screw it—your boss won't care whether or not you know the difference between Modernity and Modernism!" another teases. Then my mother's voice pops up from behind the dollar bills, undoubtedly from the nervous center of guilt: "You might not *have* a boss *or* a salary if you don't get your degree because you flunked a core course!"

Tough call for all of us, huh?

You know, there is one option we are all overlooking. If ALL UW seniors slacked off, what could they do? Not graduate all of us? I don't *think* so. I mean, sure, they'd love to have another semester's worth of our tuition money, but they don't have room for all of us if we stay through next fall. And not that I would dare to underestimate our administrators, but it would have to be pretty complicated to decide who to hold back and who to sneak across the commencement line if we *all* had slacked off. I don't see how they could worry about that and Y2K at the same time. I say we rush them while they're got their hands full. Senioritizens unite!!

What? Shut up and start my paper you say? Fine. See you at the Kohl Center then. If you survived the Senioritis virus, that is.

Genevieve Warden

The *Wisconsin Engineer* magazine, a charter member of the Engineering College Magazines Associated, is published by and for engineering students at UW-Madison. Philosophies and opinions expressed in this magazine do not necessarily reflect those of the College of Engineering and its management. All interested students have an equal opportunity to contribute to this publication.
Faculty Advisor: Steve Zwickel **Publisher:** Community Publications, McFarland, WI.
Correspondence: *Wisconsin Engineer* Magazine, Mechanical Engineering Building, 1513 University Ave., Madison, WI 53706. Phone (608) 262-3494.
E-mail: wiscengr@cae.wisc.edu, **Web address**: http://www.cae.wisc.edu/~wiscengr
The *Wisconsin Engineer* is published four times yearly in September, November, February, and April by the Wisconsin Engineering Journal Association. Subscription is $15 for one year and $25 for two years.

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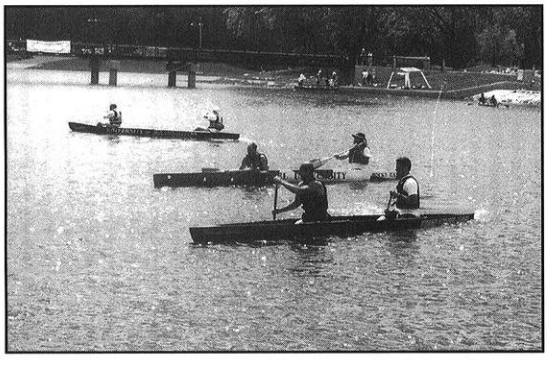

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Friday April 30, 1999
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Last year, both teams from Wisconsin made it to the National Competition. For more information, see the ASCE display at the Engineering Expo, April 16-18, 1999 on the UW Madison Engineering Campus.

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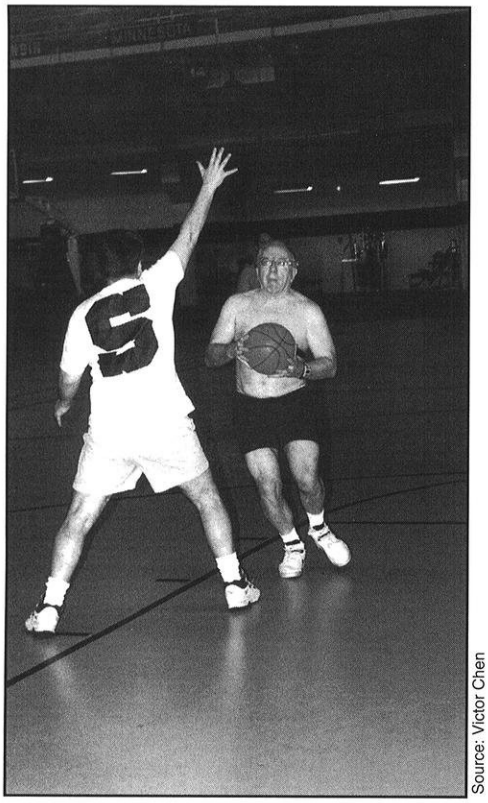
Or visit our web page: http://www/cae.wisc.edu/~glrc99/

Professor Charles Hill:

Master of Chemical Reactor Kinetics and the No Look Pass

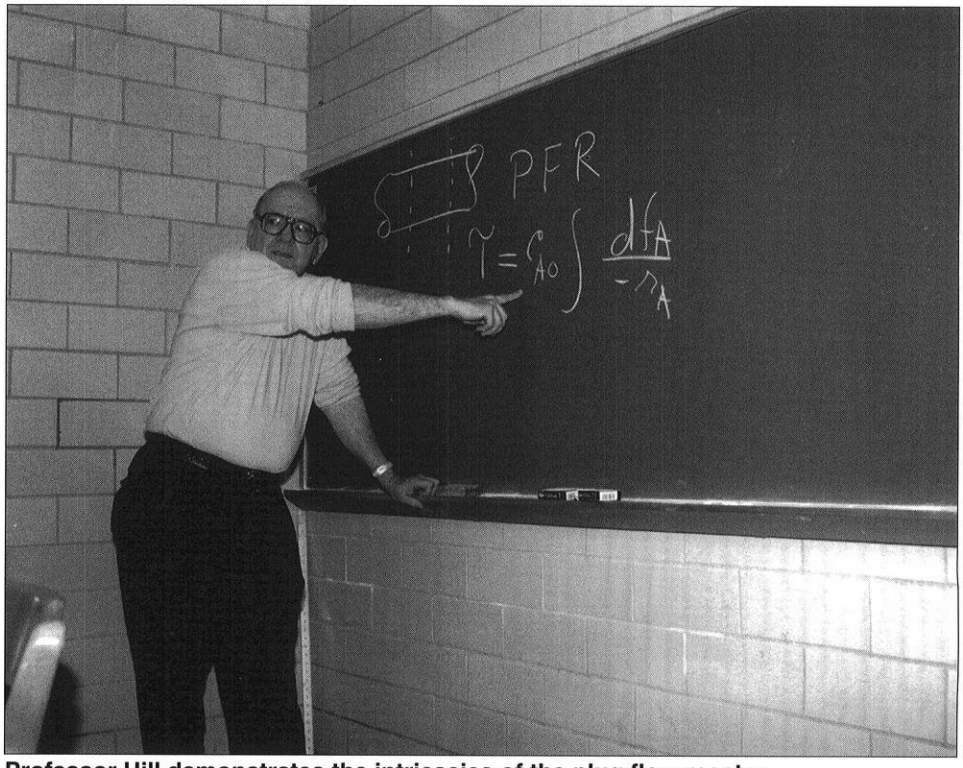
By Dan Pierpont

Your shot just missed its mark. Banking hard off the rim, the ball is rebounded by the other team and passed up to the point guard. The guard casually takes it down the court, makes a couple of moves, wheels and deals, and finally dishes the ball to a wide open man under the basket for an easy lay-up. As you contemplate how you were schooled by this point guard, you realize it is Professor Charles Hill, who has been teaching chemical engineering since before you were born. It is not often you can lace up and hit the court with a man who has three degrees from the Massachusetts Institute of Technology (MIT).



Source: Victor Chen

You won't catch Professor Hill stopping on his way to the hoop, but he doesn't hesitate to stop and help his students off the court..



Source: Victor Chen

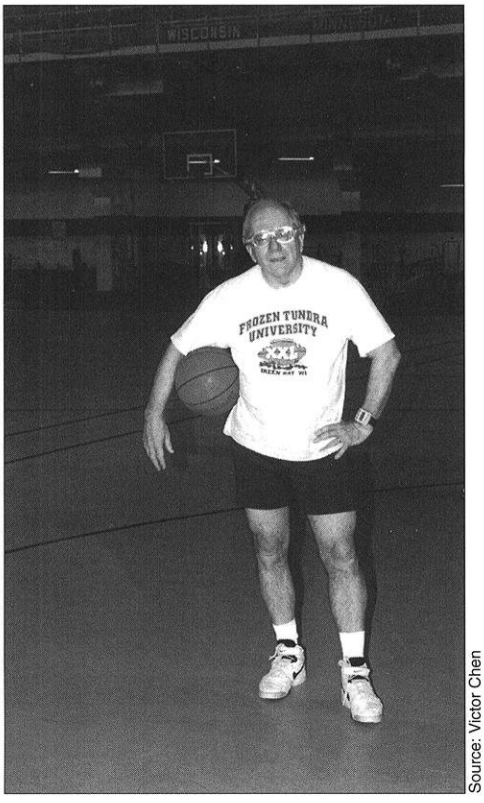
Professor Hill demonstrates the intricacies of the plug flow reactor.

More commonly known by his students for teaching *Chemical Kinetics* (ChE 430), Professor Hill loves to run the court. Between regular exercising at the Sports Medicine Clinic and playing the highly touted B-Ball games with the grad students and other professors at the Shell, Professor Hill stays very active. In the past, he has played intramural softball for the Chemical Engineering Department and he coached his daughter's softball team for eight years. Professor Hill is also an avid hockey fan and has season tickets for UW-Madison hockey.

Chemical Engineering graduates often recall "Kinetics"(ChE 430) with Professor Hill as their favorite class. When asked about why students like kinetics so much, he said, "You just wouldn't be a chemical engineer if you didn't like kinetics." One UW-Madison senior said, "Even though Chem. Engr. 430 is extremely challenging, it is exciting when Professor Hill is teaching."

As anyone who has taken a course with Professor Hill knows, the class will not be a walk in the park, especially with his style of using the Socratic dialog for teaching. Socratic dialog is a form of lecturing in which the teacher often asks questions of the students. As much as it may be uncomfortable when one has no clue what the answer is, it is the best way to learn because it forces one to think. Students like Professor Hill because they learn a lot in his class, and the material is interesting because Professor Hill bases many of his examples and problems on articles from the literature. His text for the course is currently in its 24th year of printing.

On four occasions Professor Hill has taught the section of Summer Unit Operations Labratory(ChE 424) offered at the University College London (UCL). Students and faculty from UW-Madison and several other U.S universities utilize the UCL facilities to



Source: Victor Chen

conduct labratory experiments in the heart of London for a five week period. One of these weeks is devoted to a tour of industrial and historical sites in western England and Whales. The highlight of the course is a midieval banquet at Caldicott castle. As for the labratory reports, many students have indicated they have never seen so much red ink in their lives!

Professor Hill has accrued a long list of awards and honors over the years, and when asked which professional accomplishment he is most proud of, he cited his 17 teaching awards - an amazing number considering that he teaches one of the most difficult engineering classes at UW-Madison.

Unlike many professors, Professor Hill keeps his office door open whenever he is there. When asked if it is a distraction to have his door open, especially since his room is next to an exit in Engineering Hall, he said, "...it can be a little distracting, but I like to leave my door open for accessibility. I want students to feel that I am open to their questions."

What many of us don't know about Dr. Hill is that he served as a First Lieutenant and Captain at the U.S. Army Nuclear Defense Laboratory in the mid 60's. His studies in radioactive waste disposal later served as a basis in his work with Dr. Clyde Amundson of Food Science on the applications of membrane separation techniques in the dairy industry.

Dr. Hill is involved in numerous research projects which range from his work with immobilized enzymes to incorporate conjugated linoleic acid in food products, to research on new technology for bleaching wood pulp at the Forest Products Laboratory, to work on photocatalysts that may have large environmental implications. It is easy to see why he is often busy. However, even though Dr. Hill is extremely involved with his research, he still takes the time to work with his students. He is not the type to stand over students and rigidly dictate what they should do, but lets them work for themselves and use him as a resource.

Professor Hill is modest when talking about his many research projects and teaching accomplishments. When asked to explain his greatest accomplishment, Dr. Hill exclaimed that "...raising three daughters that can support themselves and stand on their own feet is what I am most proud of." His oldest daughter, Betsi (Elizabeth) is a vice-president of Alliance Capital Management Corporation, working on analysis of fixed income securities. Deborah is a group leader at a major advertising company, where she works in media placement. Professor Hill's youngest daughter, Cynthia, teaches math and computer science at Eagle School here in Madison.

Author Bio: Dan Pierpont is a super senior in Chemical Engineering who finally plans to graduate. ON WISCONSIN!

Source: Victor Chen

With his door always open, Professor Hill is always an available resource for his students.

Engineering and the New Millennium

Relive the exciting journey from the days of brut force catapults to those of high-tech gadgets once thought impossible.

By Mark Takala

With the dawn of a new millennium upon us and an abundance of mind-boggling technological advancements, there is no better time than now to take a look back into engineering history. The surprising steps taken in engineering in recent years lead people to entertain the thought, "Where do we go from here?" How all this madness started is often forgotten.

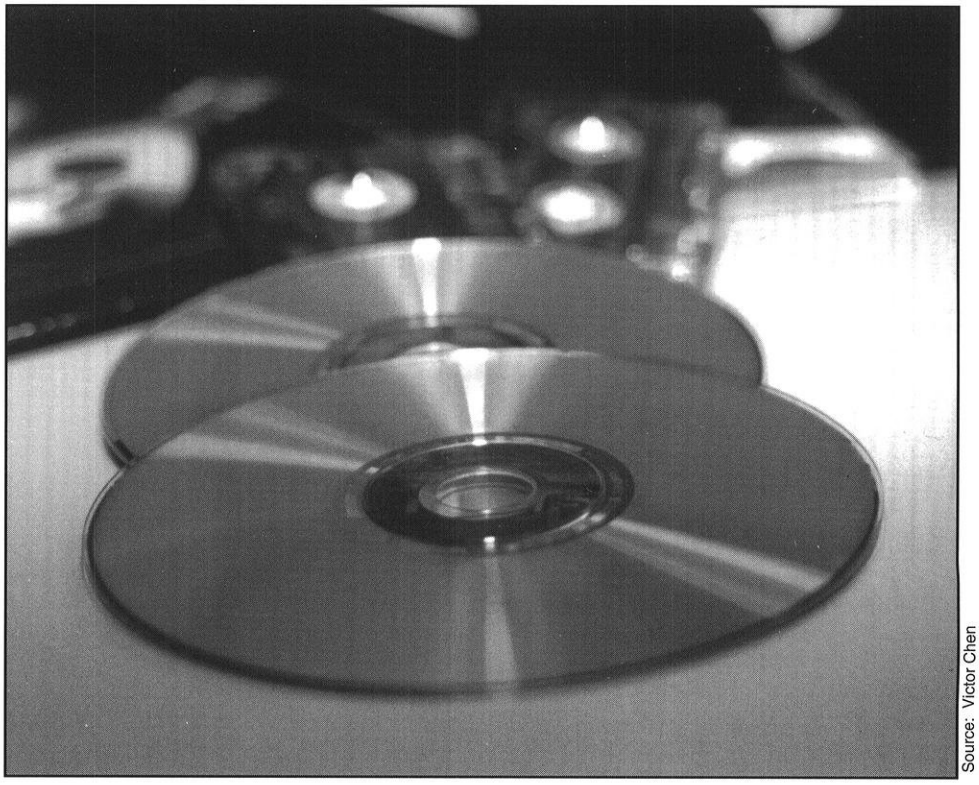
The current Webster's definition of the word "engineering" is "the profession in which a knowledge of the mathematical and natural sciences, gained by study, experience, and practice, is applied to the efficient use of the materials and forces of nature." Here at UW-Madison, we have plenty of fields of engineering, but they have not always been in existence. Most of them, in fact, came into effect after the turn of the century.

18th Century

Engineering began in the mid-18th century with the invention of forts, bridges, docks, catapults and roads. During this time, most engineering was done in the purely physical and building sense. At the time it was called "Military Engineering," as most, if not all, of the work was done for military purposes. Few universities have Military Engineering programs anymore, as the name was changed to civil engineering by the end of the 18th century. This name change more accurately reflect the nature of the activity as it progressed from being purely military to being more civilian-oriented.

"I always like to break out my old record player and listen to the unbroken sound. CDs just don't capture the essence of the music like records do"

By the end of the 18th, century people had started to perform tasks which utilized scientific knowledge for their own good. For the first time in recorded history, people were engineering goods on a large scale for non-military purposes (such as crude clothes washing devices), instead of products that were only for the greater good of a country (i.e. the building of forts and roads).



Source: Victor Chen

With compact discs so popular, are cassette tapes and LP's a thing of the past?

19th Century

In the 19th century, the use of machinery gradually gained popularity as its ramifications became recognized among the general population. Machines were able to undertake never-before-thought-possible deeds, such as the printing and distribution of texts (before that point everything had to be hand-written). As the development and use of machinery became commonplace, a new type of engineering surfaced called mechanical engineering. Engineers from around the globe focused on the development of new and innovative machines. The printing press, just one mechanized warrior of the era, completely revolutionized the world as we know it. From its invention, the scope of the engineering field broadened at mystifying proportions. The technical advances of the nineteenth- and twentieth-centuries acted much like a row of dominos being toppled: machines begot the power of electricity, which dynamically influenced technology and engineering.

Our forerunners accomplished daunting tasks for the good of mankind. Without Edison, for example, we would be nowhere today. Aeronautical, chemical, and electrical and electronics engineering (the most diverse engineering fields today) are all products of prior advancements. The engineers of tomorrow hold the keys to unlock the doors to further technological freedom.

20th Century

Two of the most profound advancements in the engineering field during this century have been the advent of the fiber-optic cable and the development of analog and digital systems. The copper cable, predecessor to the fiber-optic, posed many problems because it had a relatively small carrying capacity, and was highly susceptible to interference. The fiber optic cable circumvents both of these problems by being both light in weight and inexpensive. This newfound ability to transfer massive amounts of data opens many new possibilities in the realm of technological communications. As a consequence of this new cable technology, telephone systems operate on a much more cost-effective basis. The transcontinental phone call, which before was thought to be something you would only see in the movies, is now an everyday occurrence.

During the 18th century, most engineering was done in the purely building and physical sense...most, if not all of the work was done for military purposes

Although some systems, such as cellular phones, still use analog, because computers use digital, analog is generally considered a fast fading technology. Data in analog systems comes in a continuous flow, and may not be accessed at any place, any time.

Compare a cassette tape to a compact disc. On the cassette tape, you would have to rewind and fast-forward to find the song you want. On the compact disc, you can simply and immediately access the song. Bring this technology into computerized systems, and you drastically improve runtime and reliability. The only fallback is that in digital media, the data is split into thousands of small parts, whereas with the analog, it is one continuous flow.

In essence, a CD to a very trained and highly sensitive ear, much more sensitive than that of a human, would sound very choppy. However, even this ear would not be able to detect skips in an analog-based data. For computers, it is a commonly known fact that digital is better. However, some audiophiles have argued that CDs, while being easier to use and handle than tapes and records, sacrifice some sound.

Matt Allen, UW-Madison freshman, said: "I always like to break out my old record player and listen to the unbroken sound. CDs just don't capture the essence of the music like records do." Although Allen's views are not shared by everyone, he has a point.

Microminiaturization

Today, microminiaturization is the newest fad in technology. Everything from the personal computer to the cellular phone is getting smaller. The future of miniaturization could lead to watchface-sized computers, thumbnail-sized telephones and disease-fighting microchips implanted under the skin—who knows, maybe a UW-Madison student will be the one to realize these dreams.

Author Bio: Mark Takala is a freshman engineer who loves to watch "The Simpsons."

The Information Era: Spatial Information Technology

By Sandeep Menon

Have you ever thought about how much information there is in the world? Information permeates our society. It's everywhere. In libraries and offices all around the world there are books, reports and diskettes—you name it—collecting layers of dust.

Source: Leo Chen

Information Overload! With so many forms of information in the world, it's no question why numerous efforts are being made to organize information.

Imagine the ultimate computer: a single database that digitally represents all of the data in the world. In order to view this digital model, you must put on a head-mounted display—much like one you would wear if you were playing a virtual reality game. Once secured, you would see the Earth in front of you, as it would appear from space. With your data glove you could point at and zoom in to any place you would like to visit. As you zoom in, the resolution would increase to the point where you could see continents, then regions, then countries, cities, and finally individual trees and houses. In this virtual world, every object you see would have a specific geographic location and information about that object linked to it. Using the system's voice recognition capabilities you could request information on land cover, distribution of plant and animal species, real-time weather, roads, political boundaries, population or any other type of data which could be associated with an object.

This scenario probably sounds like science fiction, right? However, in a speech he gave last year at the Los Angeles Science Museum, Vice President Al Gore said that building a "Digital Earth" is such an immense project in scope that it would be unrealistic to think that one organization or government could undertake the project alone. "It would require the grassroots efforts of hundreds of thousands of individuals, companies, university researchers and government organizations [it has the potential to be a] collaboratory—a laboratory without walls for research scientists seeking to understand the complex interaction between humanity and our environment."

The conceptual idea behind "Digital Earth" is part of a scientific discipline known as Spatial Information Technology or Geographic Information Systems (GIS). GIS is a relatively new technological innovation that is allowing us to capture, store, process, and display an unprecedented amount of information. A GIS is based on the concept of topology or how objects are interconnected in the real world. Simply speaking, a GIS stores information by assigning it to its specific entity or geographic location, making the management and retrieval of that information a much easier task.

The usefulness of this type of database can be illustrated best by comparing the human brain to computer. Humans have a very low bit rate, but a very high resolution. Humans have trouble remembering more than seven pieces of data in their short-term memory. However, if this information is arranged in a recognizable pattern, such as a human face, we can remember millions of bits of information.

The point is, if we can arrange data in a logical manner, one in which is familiar to us, we can manage and process all of that information overflowing our file cabinets in a much easier way. The type of data is not important, rather the way that the data is conveyed to the user is the major factor in its ultimate usefulness.

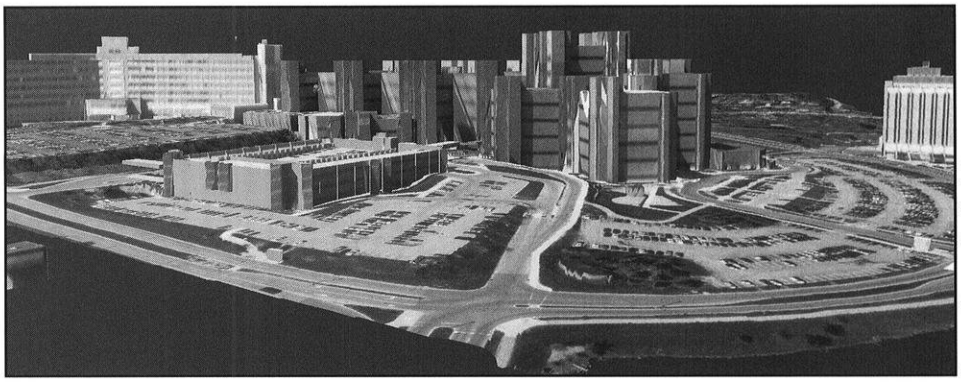
Throughout all disciplines, graphical aids are used to promote the understanding of information. From line graphs and bar charts to scale models and virtual reality, we all like to be able to picture things so we can increase our understanding of them.

Because of its ability to store information and present it in an easy and logical way, GIS technology is being used by many disciplines to solve diverse problems

Because of its ability to store information and present it in an easy and logical way, GIS technology is being used by many disciplines to solve diverse problems. For example, one application which is used throughout the country is 911 routing. The emergency dispatch system is connected to the police department's phone line. When an emergency call comes in, the caller's

phone number automatically appears on the screen. This phone number is then matched with a phone number in the database, which in turn is matched with a specific geographic location that shows up on the screen in front of the dispatcher.

Each ambulance carries a device that sends the current coordinates of its location to the dispatch center. When the location of the emergency is found, the dispatcher can get the locations of all the ambulances stationed around the city. When the ambulance closest to the emergency is determined, the GIS displays the fastest route to the scene of the emergency by using an algorithm which factors in the distance, volume of traffic, road construction, and current weather conditions. Currently, 911 routing is just one of many applications for which GIS is being used. Many companies and government organizations are now using GIS to solve problems ranging from engineering, routing, business/marketing, environmental and demographics.



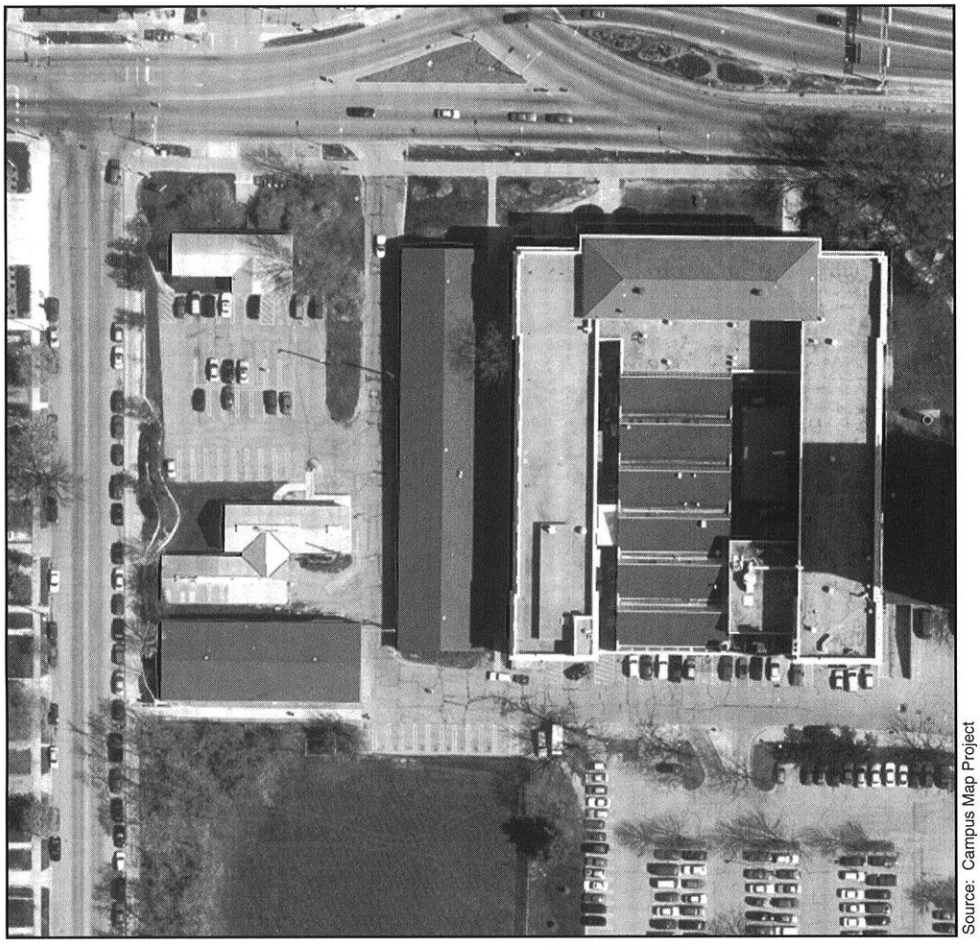
Source: Campus Map Project

This image of the UW Hospital was created by the GIS of the UW Civil & Environmental Department. The image was generated solely by a computer's analysis of aerial photos. Pictures like these are being used to develop an online map of the entire campus.

At the university level, UW-Madison has four major GIS facilities: The School of Engineering's Geo-Spatial Information Engineering Laboratory in the Civil and Environmental Engineering Department, the School of Agricultural and Life Sciences' Land Information and Computer Graphics Facility (LICGF), the Institute for Environmental Studies' Environmental Remote Sensing Center (ERSC), and the School of Letters and Science's Geography Microcomputer Laboratory in the Geography Department. These facilities are not only being used for research and the development/implementation of GIS technologies, but also for classroom instruction and public outreach.

Today we are living in the Information Era. GIS is one of America's fastest growing industries, and it is gaining widespread use in diverse contexts. From professional service industries such as computer, software, Internet, telecommunications, and system integration sectors, to universities around the world, we are learning new and more efficient ways to manage information. Who knows—one day, not too far off, we might just have a "Digital Earth."

Author Bio: Sandeep Menon is a senior whose area of specialization is in Geographic Information Systems.



Source: Campus Map Project

An overview image of the future Engineering Centers Building. But what's unique about this photo? It's a planimetric view of the site created by the Campus Map Project, meaning that the image was corrected so that every pixel of the picture is set as if you were looking straight down.

UW-Madison Has Another Winning Team

By Kristin Shuda

Case, John Deere, and Caterpillar struggle with the challenge of building a tractor that can pull more weight everyday. Likewise, some students on the UW-Madison campus have taken this same challenge into their own hands. Who are they? They are the Quarter Scale Tractor Pulling Team, and they are not your average team – they are a winning team! After only one year of the competition's existence, the UW-Madison team has proven to the rest of the competition that they are strides ahead. In last year's competition, hosted in East Moline, Illinois, the team took first-place in the overall competition, the 800lb pull, appearance, team presentation, manufacturability, serviceability, craftsmanship, design and written design report.

Made up of agricultural and mechanical engineers, the team's members range in rank from freshman to senior, and all belong to the American Society of Agricultural Engineers (ASAE). Anyone with a little motivation and dedication is welcome and encouraged to join. The group got started about three years ago when graduate students Kelly Wehner and Neil Detra proposed the idea of starting a Quarter Scale Tractor Pull Competition between different universities and colleges. That year they rounded up a team and competed locally with a modified Cub Cadet garden tractor. The next year Wehner and Detra presented their idea at the ASAE annual meeting and received the support they needed to develop their dream into a reality. They surprised everyone the same year by successfully organizing the first annual, 1998 Quarter Scale Tractor Competition in East Moline. Seventeen different schools competed with the help of corporate sponsorship.

Once Wehner and Detra's idea received the support they needed from ASAE, the UW-Madison team was ready to get started on a new tractor. They began a new design in the fall of 1997. Although there were many rules and restrictions to follow, such as you can not touch the engine, you must have bumper bars, and limitations on weight and horsepower, the team still came up with numerous ideas on paper. But the question of whether the idea would work always remained in the back of their minds. Everything they designed was drawn up on Pro-Engineer, a 3-D computer drawing program, and conceptualized, before it could be developed. In fact, they had the entire tractor completed on Pro-Engineer before they even began constructing the first part. And for every part, they had a drawing to make it to scale and fit the right parameters. Besides the engine, brakes, drive line, fire extinguisher, and a few other parts, the team built the entire tractor.

Once their ideas on paper, there was something else the team needed to get their tractor built – TIME! The team spent many hours at the computer lab developing the drawings, but the time commitment did not end there—the tractor still needed to be constructed. The machining of the parts began after the first of the year and continued up until the time the team left for competition. They had five months to make their ideas into a reality. Every Thursday night and all day Saturday from 6 a.m. to midnight during the spring semester, the group met in the Agricultural Engineering Research Laboratory (located across from the Lakeshore Dorms) to machine parts and get their tractor in working condition.

Source: Ben Mahalko

East Moline, Illinois. Brian Hitt, last year's team leader and most experienced driver, drove the tractor for all competition pulls.

May quickly approached, and it was time for the team to head to East Moline for the first-annual competition. Once there, they discovered that 17 other schools had completely different ideas of what a tractor should be capable of doing or even look like. Immediately ideas were exchanged and new ideas for the next competition were already in their midst. Before they even began competing, the teams exchanged ideas for the competition.

The first day of the competition was dedicated to practice pulls. And it is a good thing that it was only practice because many of the teams had many failures. But if it meant staying up most of the night, like the Tennessee and Texas A&M teams did, they were willing to do it. After all the work they had already put into it, they could not give up. Every team made it to the starting line the next day, but the winners were obvious. Go Badgers! And winners they were, taking home first place trophies in nearly every event.

So what lies ahead for the UW-Madison team? The challenge of another competition. This coming May, East Moline will be hosting the second-annual, 1999 ASAE Quarter Scale Tractor Pull Competition. The only differences will be a few more rules and the size of the competition and corporate support. Thirty-one different schools, with some schools entering two tractors, will be competing this year. Corporate support has doubled as well.

The Badger team has already begun constructing a new and improved tractor. The new design utilizes a couple aspects from last year's winning machine, but still has a completely new design with many new parts. Ben Mahalko, the design leader for the UW-Madison team and a senior in Mechanical Engineering, explains why it is so important to have a new design: "It is essential for us to have a completely new design concept for the 1999 machine because all of the other schools have taken ideas from our previous tractor and are using them in this year's competition. In order for us to win, we need to give a performance that will greatly impress the judges and other teams again this year. We are the school that all the other teams will be judging themselves against, which makes the competition all the more fun and challenging."

Anyone with a little motivation and dedication is welome and encouraged to join

Jon Wuest, the fabrication team leader and a senior in Agricultural Engineering, had this to say about the competition: "At last year's competition we set a standard for future pulls. This year everybody is out to get us – making it harder for us to be as successful as last year's team. Hopefully, this new team and tractor design will allow us to set yet another standard." The team had nearly all of their drawings completed on Pro-Engineer before January and is currently working on building the parts and fitting them together. This year's tractor will incorporate nearly 200 parts. Good luck Badgers in the upcoming competition!

If you are interested in becoming a member of the UW-Madison Quarter Scale Tractor Pull Team, or are interested in cheering them on at their competition in East Moline, Illinois in May, you can contact Team Leaders Jon Wuest (jmwuest@students.wisc.edu) and Ben Mahalko (mahalko@cae.wisc.edu). Also check out their web page at http://bse.wisc.edu/students/ASAE/pulling.html

Author Bio: Kristin Shuda is a senior in Industrial Engineering. She would like to thank Jon Wuest and Ben Mahalko for all the information and pictures.

February issue clarifications...

For the article "Engineering Mall: A Walkway Through History," two of the photo captions were marked incorrectly. The building shown as the former home to ChE was actually called 600 N. Park and was located across Observatory Drive from Science Hall. It was replaced by The Helen C. White Library which is still there, as is Science Hall. Also, the picture showing construction of Engineering Hall depicts the construction of Johnson Hall on Bascom Hill which was the second engineering building after Science Hall. The name was later changed to The Education Building, as it is still called, after the present Engineering Hall was built.

We apologize for these errors and are sorry for any confusion they may have caused.

LASERS: Bringing Light to Life

By Jackie Polzin

When you think of lasers, a certain image probably comes to mind: a laser pointer darting around a crowded lecture hall, carefully aimed by a jokester in the back row. This timely diversion interrupts the ebb and flow of nodding heads, and there are more smiling faces than usual as the lecture hall clears. While this is one way to apply laser technology, there are more uses for lasers than most people could even dream up.

Did you ever wonder how your DiscMan works or marvel at the shiny-metallic disc that produces a higher-quality sound than anything that came before it? Lasers are the answer. A laser beam in your compact disc player focuses on the rotating disc and recovers information by detecting variations in the light reflected off the disc. Since the player doesn't come in physical contact with the disc, the quality of the sound is really remarkable and will not degrade over time or with repeated use. Who would have ever guessed that the only thing separating Yanni from the Grateful Dead was the bounce of a light wave?

Who would have ever guessed that the only thing separating Yanni from the Grateful Dead was the bounce of a light ray

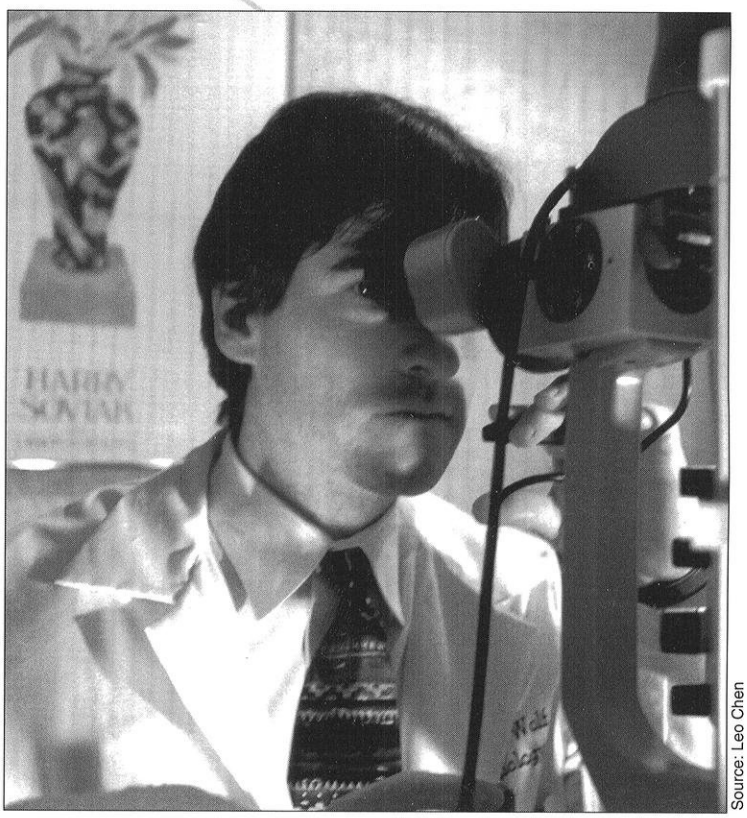
Laser printers are another item that uses this technology. The printer's processor controls a laser, which it moves over a light-sensitive drum. A copy is produced more effectively this way and efficiently than by previous printing machines.

Grocery store scanners also use lasers to accomplish a task more efficiently. A laser beam passes over the barcode on your package of Oreos, and a computer interprets the varying reflected light patterns to determine what the item is. The same technology applies to the ID scanners that leave you "waiting for the beep" in order to enter the computer lab at the library.

Since the first laser was built in 1960, the general population hasn't taken a very active interest in the science behind lasers. Given the complexity of laser technology, this is certainly understandable. Lasers are high-powered sources of light that can be focused and directed to a higher degree than normal light sources. A laser consists of energized atoms in an amplifying medium. The medium has a mirror on either end. Light waves are introduced to this medium and cause the atoms to give off energy in the form of more light waves. These waves intensify in energy as they are bounced between the two mirrors. Some of the light waves are allowed to escape the laser system as a beam of laser light. There are countless ways in which lasers contribute to our daily lives and many potential uses for lasers in the near future.

Historically, laser technology has been a source of mixed emotions. Buck Rogers' infamous death-ray laser gun gave a negative reputation to the technology, which actually has a wide range of uses for high-energy light. This farcical weapon was merely an image of destruction; in reality, harnessing lasers for destructive purposes has not been carried out on any large scale. However, lasers have been utilized for military use. The citing and targeting capabilities that lasers allow proved a vital advantage to the U.S. peacekeeping efforts in the Cold War era. Sheer numbers, in terms of manpower, have historically dictated outcome of wars. Lasers have played an important role in reversing this trend. The tight reins held on the Soviet Union during this period wouldn't have had nearly the muscle behind them that laser-enhanced defense provided. In this sense, the laser has truly served as a "ray of life" in contrast to the death-ray of Buck Rogers.

Here at the UW-Madison, Professor J. Lawler has taken a very active interest in future prospects of lasers. Lawler is the head of a research project in the UW Physics Depart-



Source: Leo Chen

Laser eye surgery requires a doctor who is extremely skilled.....

ment. that will benefit the entire realm of science. He leads the Wisconsin Atomic Transition Probability Program, which develops and applies laser techniques to make the field of spectroscopy more quantitative. Basic spectroscopy is the study of interactions between light and matter. It transcends many other fields, including astronomy, physics, chemistry and engineering. Lawler's insights into the history of lasers stand testament to the profound impact they have already had in their limited existence. Lasers have been received with mixed feelings, as their function in the modern world is not widely understood. However, Lawler finds solace in envisioning lasers as the rays of life they have proved to be, over the death-rays they were feared to become.

The world of medicine has also made incredible breakthroughs with the use of lasers. Perhaps the most widely known medical application is the use of lasers in retinal surgery. The carefully directed heat energy provided by the laser fuses detached retinas back into place. Both the energy of the laser and the amount of time the beam is applied are controlled to protect surrounding tissues from being affected by the beam. The heat generated by a laser is a concern in surgical applications, but short pulses of exposure safeguard against heat damage in the surrounding area.

Also, corrective eye surgery has become a reality through the use of lasers. This surgery involves the actual reshaping of the cornea by exposing the corneal tissues to a laser beam. The extreme energy levels reached in the process take the tissue from its present phase as existent tissue, by-passing the liquid and gas phases, directly to the plasma phase where it vaporizes. The process can be likened to shaving off the unnecessary tissue. A cornea can be shaped to correct both near and far-sightedness, eliminating the need for glasses or contact lenses.

Lawler finds solace in envisioning lasers as the rays of life they have proved to be, over the death-rays they were feared to become

Lasers are also useful in the removal of "port-wine" stain birthmarks. The mass of blood vessels lying just under the surface of the skin are responsible for the deep red birthmark. These vessels are destroyed as they absorb the laser beam, and the discoloration disappears. The same technology has been applied to afflicted souls bearing the namesake of their "ex" just under the surface of their skin, although tattoo removal is not yet a common practice.

Treatment of emphysema involves using a laser to heat-shrink the blisters that cover large portions of a sufferer's lungs. The laser also seals up leaks caused by the open sores. Using lasers to unclog obstructed arteries is a recent medical development. An optical fiber is threaded through a clogged vessel. A laser beam is then transmitted through the fiber. The beam destroys blockages in the vessels, and circulation is restored. The optical fibers used in this case form an integral relationship with lasers that have led to groundbreaking technology in the field of telecommunications.

The most revolutionary realm of laser science has proved to be telecommunications. The production of ever-improving optic fibers allows laser beams to be transmitted in nanoseconds over vast distances, transferring quantities of information at unheard of speeds. Our ability to communicate on an international level has exploded with the development of the World Wide Web. Before the combination of high-tech fiber optics and lasers, such a complex system simply was not possible. There are few strangers to the popular phrase "You've got mail!" and rightly so. Long-range, split-second communication has never been easier. Imagine the possibilities—the interaction of people half a world apart is limited only by the click of mouse.

Technology is on a rampage and there's no telling where lasers will send us next. Whether it's to the De-Tattoo parlor on the corner, or to technological heights yet unimaginable, it is certain that lasers will continue to bring light to life.

Author Bio: Jackie Polzin is a sophomore struggling through Chemical Engineering, who's bound to be around UW-Madison a good long time.

Sorce: Leo Chen

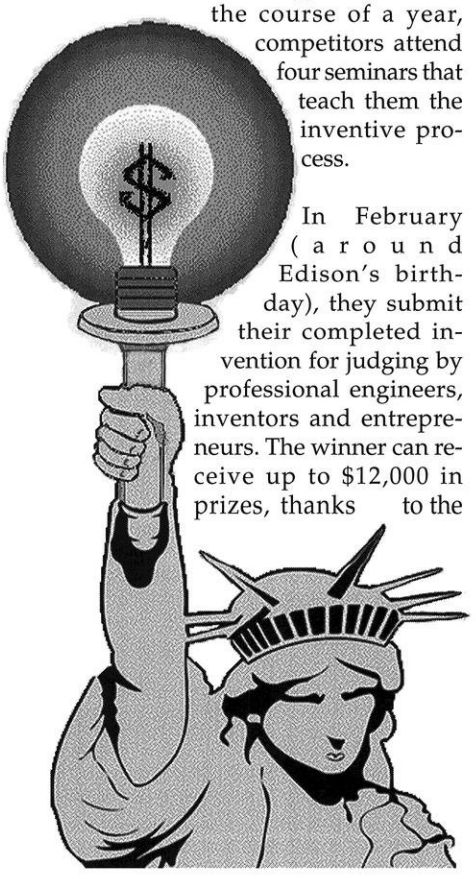
.....and a patient who wants the most advanced treatment. These photos were taken at Davis Duehr Dean in Madison.

Saving Us All: Inventors Encouraged by Schoofs Prize and UW-TEC

By Mike Hsu

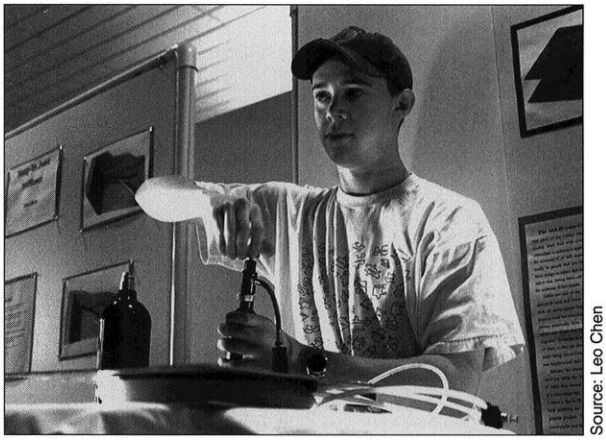
These people do miraculous things. They save our time, our money, and our precious resources. They toil in relative obscurity, pouring their mental and financial faculties into their work. They look at the world as filled with possibility and potential. They strive to improve lives, advance humanity, further the bounds of applied knowledge, and find some practical use for those clunky, fat heels on fashionable shoes these days. But can they save our souls?

Inventors, modern-day martyrs, live and work among us on the UW-Madison campus. The spirit of the sainted Thomas Edison has not only survived, it has thrived thanks to opportunities like "Brainstorm: The Schoofs Prize for Creativity" and the related Aschenbrenner Best Prototype Prize. Over the course of a year, competitors attend four seminars that teach them the inventive process.



In February (around Edison's birthday), they submit their completed invention for judging by professional engineers, inventors and entrepreneurs. The winner can receive up to $12,000 in prizes, thanks to the sponsorship of Richard Schoofs, chairman of Schoofs Inc. and an UW-Madison engineering alumnus. Hopefully, these students will use this tidy sum to continue their crusade for technological evolution, life-enhancing innovations as well as apartment rent payment.

"Participants in the Schoofs competition demonstrate that engineering students are thinking beyond themselves and helping other people," said Margaret Tongue, student services coordinator for the Engineering Learning Center. Inventors are fairly altruistic people. They spend their time thinking about others' problems (or maybe their own) and work to solve them in a more efficient manner.



Source: Leo Chen

Eric Wobig makes some last minute adjustments to "Air Lift", his pneumatic wheelchair lift.

"All it takes is a little business savvy. It's better than starting on the ground floor of some giant corporation complex."
-Eric Wobig, senior, on the inventing process

Take, for example, senior mechanical engineering major Eric Wobig, who won the whopping $12,000 prize last year. His father, a grade school teacher, had a student whose wheelchair would not fit under any desk or table. Wobig wondered why pneumatic desk chairs were adjustable but wheelchairs were not.

Meanwhile, David Overbo, also a senior in Mechanical Engineering, was playing with his PDA (a handheld computer) when he wondered how could interface it with a normal computer.

"I began to think about how information is stored and how people carry digital information," said Overbo. He found that the current technology is the Smart Card, a disk that stores a limited amount of information and requires a separate device to read its data. This presented a challenge to Overbo.

Speaking of challenges, junior Dorene Kent, a chemical engineering major, took up a problem that faces millions of women around the world—where can a fashionable woman keep her keys and personal items if she does not want to carry a clumsy purse to formal dances? This cult of creators is constantly searching for answers to such questions.

"I have a lot of faith in the expression, 'Necessity is the mother of invention,'"said John Bollinger, Dean of the College of Engineering. "Prolific inventors are always in search of necessities, defining the problem, and then saying, 'Is there a better way?'"

Wobig, Overbo and Kent have found better ways. Wobig, after devising a set of criteria based on interviews with handicapped people, created a lightweight, stable and highly adaptable "air lift." His final product is an accordion-like platform that can be placed under the wheelchair cushion and pumped up, like an airbag, to various heights.

Wobig estimated that "in no time at all" a quarter-million AirLifts would be used in homes. "It's not an entirely new idea," he said, "but I'm doing it for under $300 and it's probably better than what's out there."

Overbo found a similar comparative advantage with his invention, dubbed "Pocket Memory." His credit card sized device stores 25 times as much information as Smart Cards, and can be read by any computer simply by inserting it into its adapter. He compares it to an 8mm tape adapter, a VHS tape shell in which an 8mm tape can be inserted and played in a regular VCR. His "Pocket Memory" adapter is a floppy disk in which a credit card-sized implement can be inserted.

Kent, seeing that big shoe heels are "becoming more in style," found an ingenious use for the potential space under such shoes. She hollowed out the thick heels and thus created a storage compartment which can supplement the purse at formal dances. While prom-goers may soon think of her as a saint, I don't think Kent is trying to find ways to save "soles." Instead, inventors throughout history have found ways to save money, save time, and waste time (in the case of such wonderful diversions like television and Furbys).

The many hours competitors spend working on the Schoofs Prize inventions are definitely not wasted.

"The only way you can learn the inventive process is to do it," explained Overbo. "The great benefit of the Schoofs Prize is that it forces you to go through the process." Along the way, participants enjoy many unforeseen perks.

"Even if I don't win, I still have a cool pair of shoes," said Kent, "It's actually something I would actually use! And when I look back on the seminars I attended, I realized that I learned a lot too. For example, learning how to do patent applications will really help me in my co-op with 3M and my eventual job there. Now I have already been through the process."

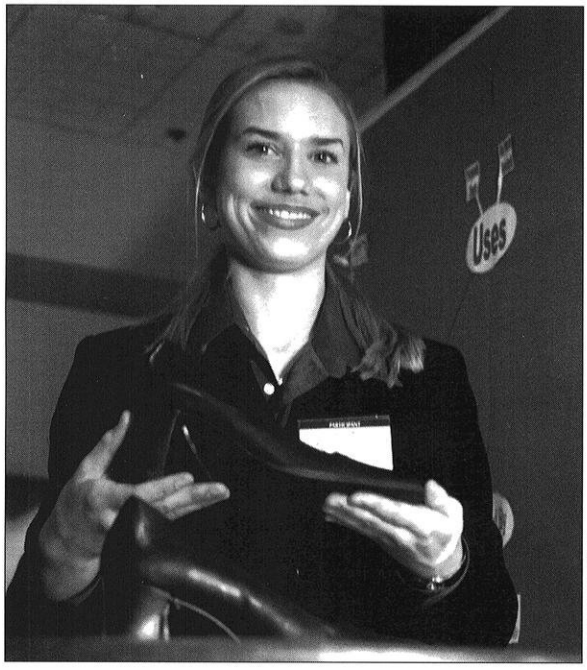
The process involves a lot of dedication, persistence, and dare I say it, saintly patience. Kent originally wanted to create a steering wheel that could be heated in the winter. She found that it had already been done. She then thought about making a microphone-like device that sends a radio signal to police in case of emergency. But then she learned that even the cheapest cell phones already perform that function. Finally, inspired in part by ***Mission: Impossible*** and ***Inspector Gadget***, she decided on her shoe idea. But her problems were only beginning.

"As I actually started to work, I ran into some unforeseen issues," Kent explained. "For example, there are different ways to put a door on the shoe heel compartment. I had to go back and think that through."

An inventor's next step is to build prototypes and redesign certain models. Then he or she seeks out legal assistance from lawyers and begins the long and expensive procedure of patent application.

In the real world, there is only a slight chance the invention will bring in a load of cash. "The inventive process takes a long time from start to finish," said Overbo. "What the Schoofs Prize does is it rewards you right away for coming up with and developing an idea, without having to take the process to the very end—selling the invention to a company."

This year, the top Schoofs Prize for Creativity of $10,000 went to Mete Kural, a first-year electrical engineering major, for his "Solar Photovotaic System Using



Source: Leo Chen

Dorene Kent shows off her creation - high heels with a compartment for small items.

SCHOOFS continued on pg 17

FULL RESULTS OF SCHOOFS COMPETITION

Schoofs Prize for Creativity:

1st Place ($10,000)
Mete Kural: "Solar Photovotaic System Using a Spectrum-Splitting Concentrator"

2nd Place ($7,000)
Jake Myre: "Snap-In Joist Stiffener"

3rd Place ($4,000)
Eric Wobig: "Air Lift"

4th Place ($1,000)
Dorene Kent: "Hollow Shoe Heel that Holds Personal Items"

4th Place ($1,000)
Eric Burgardt and Jeff Schwai: "Safety Range"

Aschenbrenner Prototype Prizes (2 prizes of $2,500 each):

Brian Gill, Wesley Gill and Nate Sellin: "Process of Hand Sanitation"

Eric Wobig: "Air Lift"

BRAINSTORM
The Schoof's Prize for Creativity

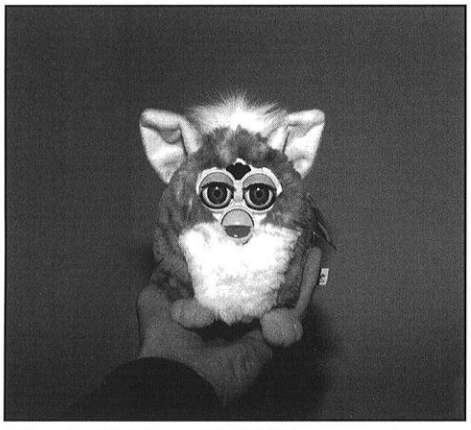
The Fabulous Furby Fad

By Nicole Waite

The scene: Christmas morning, suburban America. Jane, an eight-year-old girl, opens her first present and excitedly abandons the rest when she hears, "Me Too-Loo-Kah! Kah may-may u-tye!" What is this – a foreign language? Actually, yes—it's Furbish, and it's the first thing millions of children heard on Christmas morning when they turned on their new Furby.

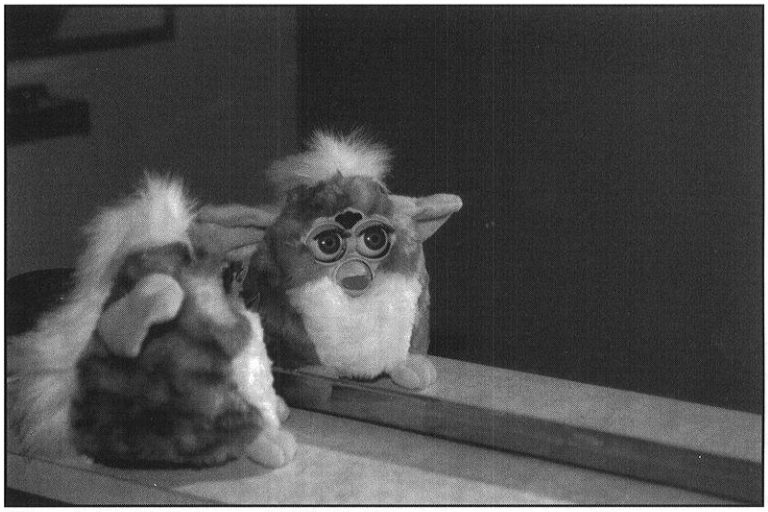
As any distraught mother who finally found a Furby for her son or daughter will tell you, Furbys, much like the Tickle Me Elmo of Christmas '97, became the Christmas '98 obsession of little kids everywhere. Once they went through the somewhat complicated starting process, holding their Furbys upside down and depressing their tongue switches, children heard them say their name (Toh-Loo-Kah is a typical one) and "I love you" in their native tongue. But children weren't left in the dark to guess what their Furbys were saying—they come complete with English-to-Furbish, Furbish-to-English dictionary, instructions, and more.

What's so wonderful about Furby? He isn't just another plaything. Furby is a little creature, about 8" tall, who comes in a variety of fur, mohawk, stomach and eye colors, and even color schemes, such as the tuxedo Furby (black with a white stomach). Auctioneers of Furbys claim that some colors are more rare than others, but Tiger Electronics, the maker of Furby, says that all colors are made in similar amounts.



Source: Zach Lewis

"You talkin' to me?" While a head-on confrontation with a stuffed creature may seem odd, a Furby can greatly benefit by you talking to it. Listen closely you might learn something.



Source: Zach Lewis

"Here's lookin' at you, kid." Furbies can even spend hours talking to themselves and learning new vocabulary.

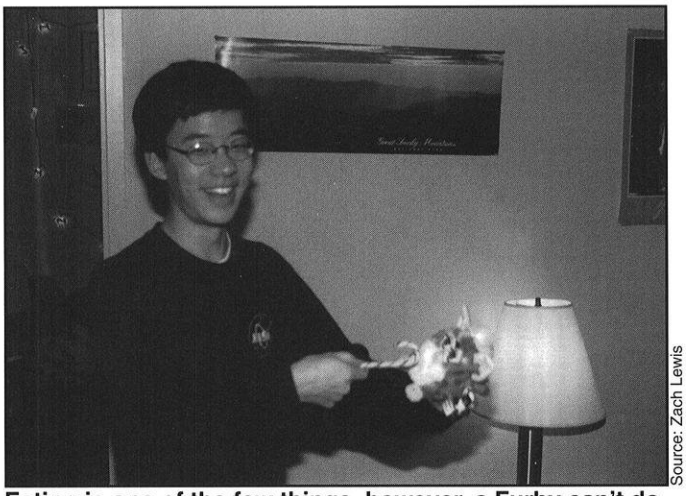
Furby isn't only pretty to look at; he actually plays with his owner. Instead of just laughing and talking when children tickle him, Furby responds to stimuli in a variety of ways. Furby has five interactive sensors: front and rear touch sensors, a light sensor, a sound sensor, and a movement sensor. By activating these sensors, children can "teach" Toh-Loo-Kah to sing a song, speak English, or do a dance. Perhaps the most amazing thing Furby can do is communicate with other Furbys: they catch cold from each other, sing to each other, and learn from each other. Furbys communicate by using infrared signals and sensors in their foreheads.

One Furby can detect another's fit of hysteria and will join in the fun! How much would you expect to pay for an electronic marvel like this? Eighty-five dollars, like the interactive Microsoft Barney doll? Fifty? All this can be yours—for only $30-$35!

Kids aren't the only ones interested in the technological marvel that is Furby. Adults are out buying Furby for themselves, but not all of them are happy with the result. As with any popular fad, there are some who don't like Furby. One site, entitled, "Stomp Furby," gives visitors the choice to stomp Furby or save Furby. When I visited the site, the stompers were winning, two to one. The owners of the "Furby Autopsy" website at http://www.phobe.com/furby, "did what any bereaved Furby owner would do" when their Furby malfunctioned – "cut him up and took pictures." They show detailed pictures of his motor and workings, saying, "we find him much more amusing dead than he was alive." At the "Hack Furby" website, http://www.homestead.com/hackfurby/, the technically inclined can figure out the programming of Furby's chips.

But Furby's legal problems didn't stop with the National Security Agency

As you may have heard, Furby has been having some problems with the government. In January, in a warning to employees, the National Security Agency said, "Personally-owned photographic, video and audio recording equipment are prohibited items. This includes toys, such as 'Furbys,' with built-in recorders that repeat the audio with



Source: Zach Lewis

Eating is one of the few things, however, a Furby can't do.

synthesized sound to mimic the original signal." This is rather unneccesary, since the only English Furby can "learn" is what's already been programmed into his chips. In fact, Furby "grows" in stages, using more and more of the vocabulary he was programmed with at each stage. But Furby's legal problems didn't stop with the NSA.

Tiger Toys was sued by Warner Brothers who produced the movie *Gremlins*, because they think Furby looks too much like the mogwi, Gizmo, from *Gremlins*. The two companies settled out of court, and Furby is NOT undergoing any major design changes as a result of the suit. Some people don't like Furby... but many do. There are 145 Furby websites in the Furby Webring alone, plus countless others written by everyone from ten year-old girls to professional businessmen. There are several websites dedicated to what computer geeks refer to as "Easter eggs," the techno-speak term for an "unprogrammed" input that makes Furby do something he isn't supposed to do. Easter eggs don't just happen, though; they must be programmed in. Software programmers often do this – you have probably tried the Microsoft Word Easter eggs, which often come up with an insult to Bill Gates when a certain sentence is checked with the thesaurus function. Furby designer Dave Hampton, who lives in the Tahoe National Forest in California with his family, says he didn't program any Easter eggs into Furby's chips, but websites such as http://www.netwebsites.com/furby/easter.htm claim that he did. For example, if you feed him three times, and then rub his back, he will burp eight times in a row!

That's right, burp – just one of the many things Furby can do *besides* talk. He can cry, sing, burp, fart, hiccup and eat – not to mention capture the attention of the nation and the world at Christmas. Has Furby had his fifteen minutes of fame? Only time will tell how long will the Furby fad last.

Author Bio: Nicole "Twiggy" Waite is a sophomore in Chemical Engineering. She does not own a Furby, but after this article, she wants one as badly as your eight-year-old sister.

SCHOOFS (continued)

a Spectrum-Splitting Concentrator." Junior mechanical engineering major Jake Myre took second place with his "Snap-In Joist Stiffener," and Wobig was third with his "Air Lift" design. Aschenbrenner prizes for best prototype went to Wobig and the team of Brian Gill, Wesley Gill and Nate Sellin for their fool-proof "Process of Hand Sanitation," a series of sensors that records when an employee does not wash his or her hands.

Kent, who won the fourth place $1,000 prize, took full advantage of the all-important business aspect of invention. "It's a good experience to think about the marketing side, the technical side, and then worry about putting everything together," she said.

For independent minds like Eric Wobig, inventions will have to put food on the inventor's table. Wobig plans to make invention his life work. "All it takes are good ideas and a little business savvy," he said confidently. "It's better than starting on the ground floor of some giant corporation complex."

But inventors need somewhere to start, and the UW-TEC (Technology Enterprise Cooperative) provides a springboard for ideas into the creative marketplace. The UW-TEC is a

Source: Leo Chen

David Overbo believes his digital storage system can work for you!

campus-wide program that encourages hands-on experience in applying technology to the business world.

"It was created to promote the development of creative ideas by student and faculty," said Dean Bollinger, who played an integral role in launching the organization. "And it all started with seminars where participants learned about venture capitalists and all the intricacies of entrepreneurship." Presently, the Schoofs Prize, Aschenbrenner Prize, and Tec Prize (awarded for technology-based business plans) fall under the UW-TEC umbrella. Of course, the opportunities afforded by UW-TEC are open to all UW-Madison students, faculty, and staff. This year, the Schoofs Prize was opened to all undergraduates at Madison. "We wanted to give the engineering students a little competition," explained Bollinger.

Just like all tireless inventive minds, Dean Bollinger is thinking about how to improve the inventive atmosphere on campus—even during his sabbatical next year. "The next level is to create an academic plan," said Bollinger, smiling. "I'll work on that when I'm done being Dean." He will work to create some new courses that teach the elements of creativity, the process of invention and the ways to find those critical necessities in life. "The best invention in the world is the one that people would least want to be without," said Bollinger. "There must be a perception of necessity."

One thing is certain—we will always need inventors. Bless their creative souls.

Author Bio: Mike Hsu is a freshman applying for the Journalism school who can barely use a screwdriver, but considers writing to be "linguistical engineering."

News From COE Organzations

American Society of Mechanical Engineers

The UW-Madison chapter of The American Society of Mechanical Engineers is one of the most active chapters in the nation. The fact that we have won the Allied Signal award three out of the last four years represents our remarkable accomplishments. Winning the Allied Signal award entails the avid participation in contests, fundraising, conferences, meetings, social events and professional development that our chapter displays. Our "work hard, play hard" motto makes us both a fun and distinguished organization.

First, ASME offers great academic support for its members. ASME provides extraordinary ways to get to know your professors better. This is achieved through Pizza with Professors and by having professors come as speakers at our biweekly meetings. Schedule advising sessions are held before registration to help students choose their classes wisely. Furthermore, we also have an extensive exam file that can be used to prepare for upcoming tests. Secondly, a major objective of ASME is professional development. ASME has members of industry also speak at our general meetings. ASME holds resume workshops and releases a resume book to companies at career connections. The industrial relations committee plans plant tours at least once a month so members can get a feel for what an engineer actually does outside of college. As well as individual development, we also enjoy improving the community around us. We participate in blood drives, Habitat through Humanity, and Christmas 4 Kids just to name a few. Our outreach committee also organizes such programs as High School Day on Campus to inform high school students about the field of mechanical engineering.

On the lighter side, ASME holds various social events and provides a fantastic way to meet new people in the College of Engineering. This all starts with our general meetings where free pizza and soda are always served. The beginning and end of every year is marked by a cookout while socials at local bars are held throughout the year. During the football season our tailgates are unbeatable! Highlights of our tailgates include hot tubs, pig roasts, and WMAD 92.1FM broadcasting live. Finally, there are the conferences that we attend in the spring and fall. These conferences are not only a great way to learn more about ASME or engineering in general, but are also a fun way to interact with fellow members throughout the nation. Our impeccable reputation can only be accomplished through the hard work and dedication of not only our officers but also our members at large. ASME is a wonderful way to get involved, meet new people, develop leadership skills, and have a lot of fun.

Instituite of Industrial Engineers

The elections for UW-IIE leadership positions will be held in April. All IEs, of all ages, are encouraged to run for a leadership position. Below, you will find a brief description of the seven positions available. Also see the IIE website for further information.

If you are interested in running for a position on the 1999-2000 UW-IIE board of directors, or if you know someone who might make a good director, please contact UW-IIE at iie@cae.wisc.edu. Include your name and the position(s) you are interested in.

President: general organization and coordination of the chapter. Vice President: organize chapter meetings and membership, maintain industry contacts.

Financial: seek out and manage the funding for the chapter.
Education: work with the department to make the learning experience more useful, develop ways to share information regarding academics and opportunities with students.
Outreach: promote engineering and IE to the public, especially high school students.
Social: organize social events to increase familiarity between students.
Communications: advertise the events of the chapter to students, faculty, and department.

Institiute of Electrical and Electronic Engineers

What is IEEE?
The Institute of Electrical and Electronics Engineers (IEEE) is a group of more than 300,000 professionals and students from more than 150 countries. IEEE was founded in 1884 and is the largest professional association in the world. It is the best source of Electro-technology publications in the world. At the local level, we have more then 200 members! We have at least one plant tour a semester and chapter meetings once a month. During the meetings, we have companies or distinguished speakers present for our group. We also have social activities such as a barbecue and volleyball.

Benefits of IEEE?
All IEEE members receive a personal subscription to the IEEE Spectrum magazine. With this, IEEE members gain an edge with the best technical information on electrical and computer engineering in the world. This is a monthly magazine that even UW-Madison professors have written for. IEEE is a great opportunity to network with other students and industry. It is an organization to become involved in if you want to contribute your own personal talents and skills.

So, GET INVOLVED!!!!

Applications are available at the meetings and are posted on our bulletin board next to the ECE mailboxes. If you can't make a meeting and want an application, email IEEE@cae.wisc.edu and we will make sure you get one. When you receive your application, please fill out the last page and attach your check or credit card number with the application. Student membership rates for 1999 are only $19. Place the application in the
IEEE mailbox. It is located with the ECE professor and T.A. mailboxes in Engineering Hall. To get to the mailbox, walk into the doors of Engineering Hall with the statue of the student next to them. Walk straight until you reach the Edison invention. Here you will take a right. The mailboxes will be on your left side. We are in the lower middle area of the mailboxes.

IEEE Itinerary for the rest of the spring semester:

Friday, April 9th
4:00 - 5:00 PM 1800 Engineering Hall
IEEE Chapter Meeting
Lama Nachman from Intel will present the new IA-64 architecture.

Tuesday, April 20th
6:00 - 7:00 PM 1800 Engineering Hall
IEEE Chapter Meeting
Josh from Northstar will give a presentation about investing for the future and present important financial information.

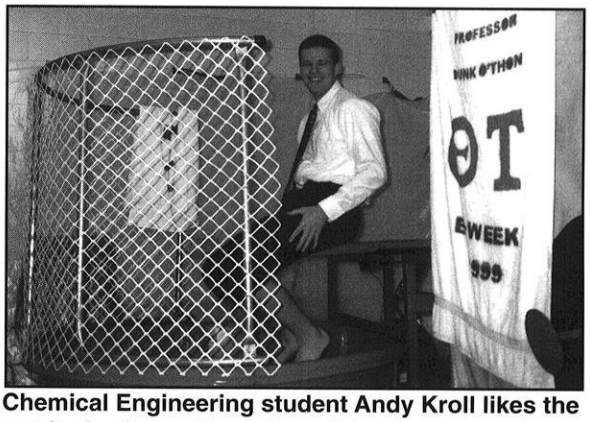
Friday, April 23rd 11:00 AM - 2:00 PM
In front of Engineering Hall
IEEE Grill-Out
IEEE will serve burgers and brats to everyone and IEEE members will receive a discount.

If you have any questions or comments, please email IEEE@cae.wisc.edu.

Theta Tau

When I saw a chance to get revenge on that prof who broke my GPA!

Theta Tau fraternity will be hosting The Dunk Tank II exhibit for Expo '99. The exhibit will include an actual dunk tank and a display showing the mechanics of how a dunk tank works. Expo visitors will be able to soak their favorite local celebrities throughout the weekend for a small charge. All profits from this event will go toward helping area high schools attend future Engineering Expos.



Chemical Engineering student Andy Kroll likes the wet look when going into an interview.

Theta Tau is a co-ed engineering fraternity consisting of 26 active members. They first brought a dunk tank to campus during Engineering Week 1999. Among the dunkees were: Dr. Samuel and Professor Osswald of the Mechanical Engineering department, and Professor Shakashiri of the Chemistry department. Several campus student leaders were also kind enough to give their time and bodies to the event, including Andrew Kroll, Scott McKenzie and Colin Hickey. Proceeds from this event were donated to the dunkees' charity of choice.

Look for the Theta Tau Dunk Tank this Engineering Expo '99 for a chance to warm up your pitching arm and help raise money for area high schools. Oh, and maybe even get *your* revenge!

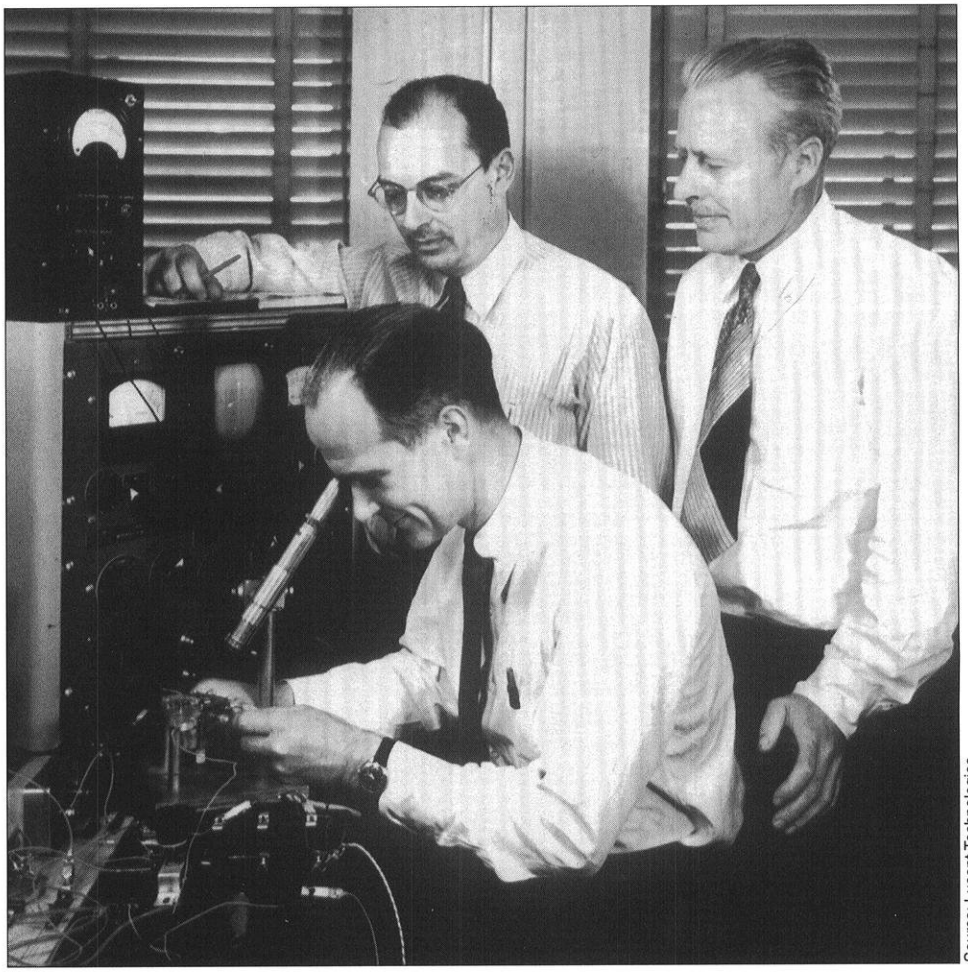
John Bardeen: A Brilliant Man and a Brilliant Career

By Nate Sellin

What do a computer, a stereo, a digital camera and a CD player have in common? They all rely on transistors to work properly. In fact, almost any product that plugs into the wall or uses batteries has transistors inside of it. Transistors have ushered in the information age and are perhaps the greatest invention of the 20th century. But none of this would have been possible if it hadn't been for the work of a UW-Madison graduate, John Bardeen.

In addition to co-inventing the transistor, Bardeen is the only person ever to win two Nobel Prizes for Physics. John Bardeen was born in Madison, Wisconsin on May 23, 1908. John was a very smart child. He skipped from the third grade to go directly to seventh grade. He attended the University of Wisconsin's high school, which existed in Madison until his junior year. He then switched to a public high school, because of its better laboratory facilities, and graduated two years later at age 15.

Upon graduation from high school, Bardeen enrolled at UW-Madison. He studied electrical engineering and graduated in 1928 with a BS. He also received an MS in electrical engineering in 1929. While attending UW-Madison, John Bardeen did more than just homework. He was a member of Tau Beta Pi, an engineering honor society. He was also on both the varsity swimming and water polo teams.



Source: Lucent Technologies

William Shockley (sitting), John Bardeen (left), and Walter Brattain were the three co-inventors of the transistor. The trio went on to win the Nobel Prize in 1956 for their discovery.

After leaving Madison, Bardeen took a job as a geophysicist at Gulf Research and Development Corporation in Pittsburgh. He worked there from 1930 to 1933. While there, Bardeen developed an electromagnetic process for oil prospecting. The idea was so novel that Gulf Research did not initially patent it because it did not want rival companies learning about it from the patent disclosure. It was finally made public more than 30 years after Bardeen invented it.
Bardeen eventually returned to school and got his Ph.D. in mathematical physics from Princeton in 1936. He spent some time as an assistant professor of physics at the University of Minnesota. After World War II started, he left Minnesota to work at the Naval Ordnance Laboratory. Following the war, Bardeen returned to private industry to work in a solid-state physics group at Bell Telephone Laboratories (now Lucent Technologies).

It was at Bell Labs where Bardeen, along with Walter Brattain and William Shockley, discovered the transistor effect. They demonstrated the first working transistor in December, 1947. It was used as an audio amplifier. Bardeen was instrumental in understanding the transistor effect and creating a working device. While at Bell Labs, Bardeen devised many of the terms now used in transistor electronics, such as emitter, base and collector currents. Bardeen shared the 1956 Nobel Prize in physics with Brattain and Shockley for their work on the transistor.

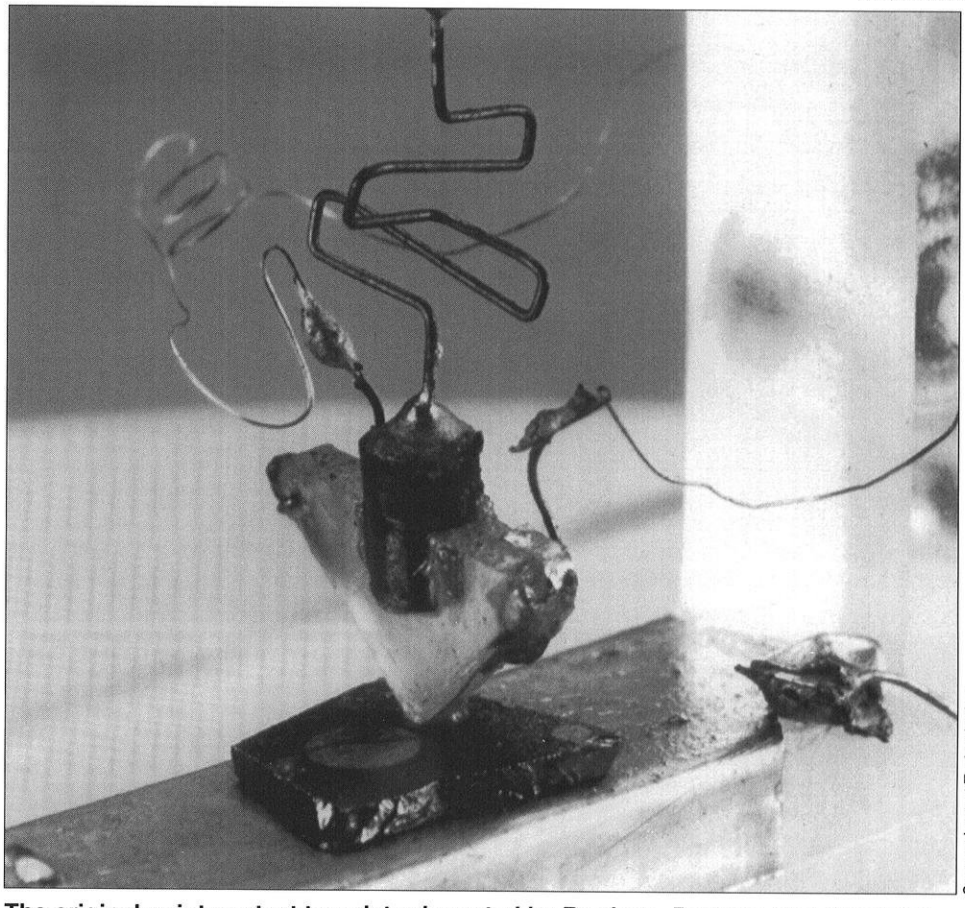
John Bardeen eventually left Bell Labs and became a professor of electrical engineering

and physics at the University of Illinois in 1951. He continued his successful research career when he co-developed the microscopic theory of superconductivity. Superconductors are materials in which the resistance is virtually zero below a certain critical temperature. In 1957, Bardeen, Bob Schrieffer and Leon Cooper published the theory. The three went on to share the 1972 Nobel Prize in Physics for their work.

While at Illinois, Bardeen also served as a consultant to Xerox Corporation. He was a member of Xerox's board of directors during the 1960's and 1970's. In addition to everything else, Bardeen was a member of the White House Science Council. Bardeen continued his research at the University of Illinois until his death on January 30, 1991.

It's true, John Bardeen did much more than just invent the transistor. But out of all his contributions, the transistor had the biggest influence on our everyday lives. It allowed computers to shrink from the size of buildings to the size of your watch, and it enabled other technological advances in almost every field imaginable. In a Jan 31, 1991 *New York Times* article, Bardeen was quoted as saying, "I knew the transistor was important, but I never foresaw the revolution in electronics it would bring." Not bad for a humble UW-Madison graduate.

Author Bio: Nate Sellin is a senior in electrical and computer engineering.

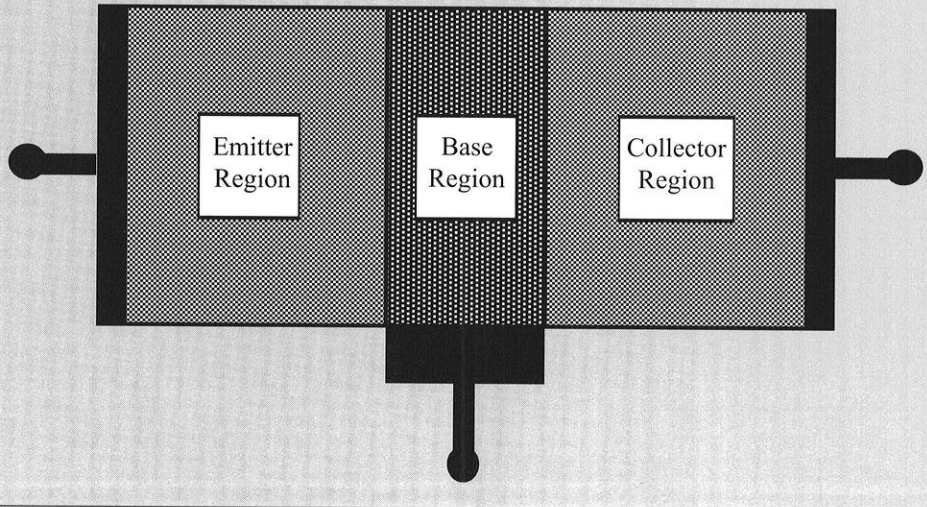


Source: Lucent Technologies

The original point contact transistor invented by Bardeen, Brattain, and Shockley in 1947.

How a transistor works:

A transistor is a three terminal circuit element. A transistor operates by controlling the voltage between two of the terminals, thus effecting the current in the third terminal. There are two common types of transistors: Bipolar Junction Transistors (BJTs) and Field Effect Transistors (FETs). The transistor invented by John Bardeen was similar to a BJT. A BJT has three terminals called the emitter (E), the base (B) and the collector (C). A BJT has three modes of operation saturation, active and cutoff. In saturation the transistor acts like a switch that is turned on. In active mode, the BJT acts as an amplifier. The transistor behaves like a switch that is turned off when it is in the cutoff mode. The following diagram shows a simple outline of a BJT's structure.

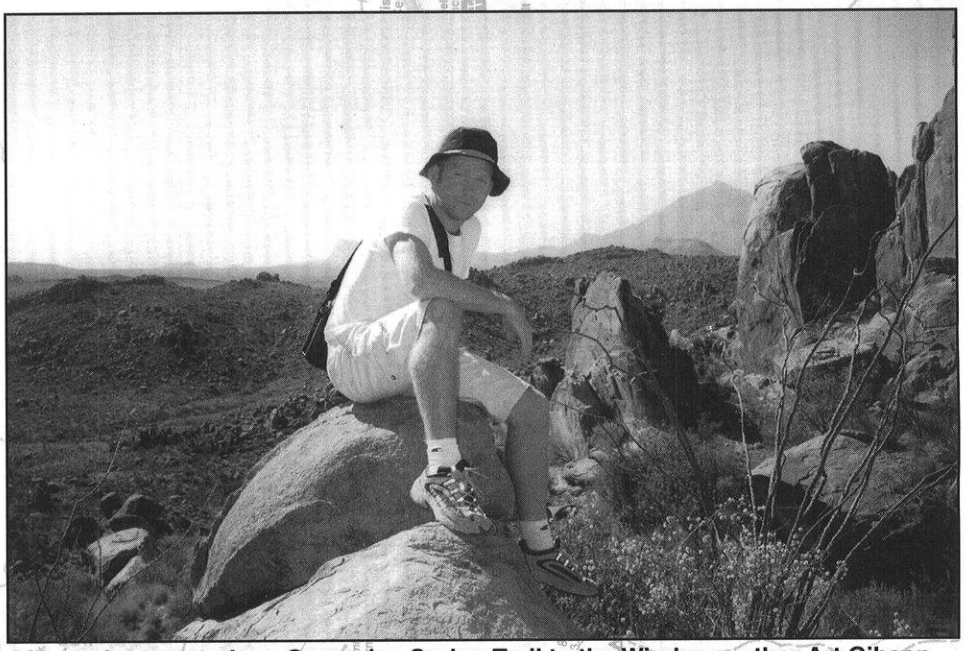


Camp for Credit

By Art Gibson and Jennifer Schultz

Looking at rocks for a week may not be your idea of a great spring break. But for the 16 Geology and Geological Engineering students, one TA, and our fearless leader, Professor Phil Brown, the rocky expanses of Big Bend National Park reaffirm why we love our major.

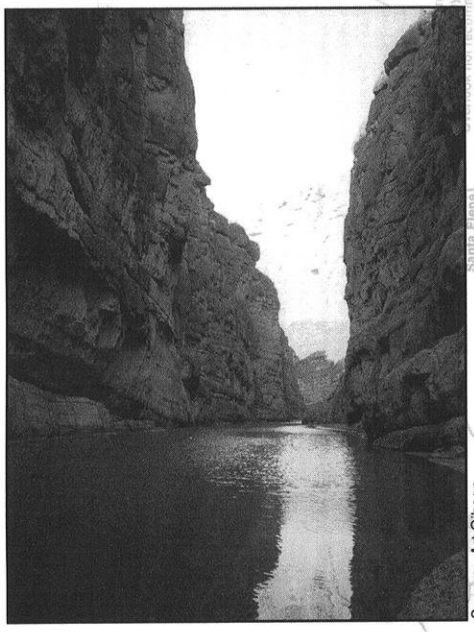
Big Bend National Park in southwest Texas was the spring break destination for *Topics in Geology* (GEO 376). Previous trips for GEO 376 were to southern New Mexico and the Smoky Mountains. Selection of the destination is based on conditions for camping. Yes, that's right—we camped for credit. The following is a narrative of our adventure.



Source: Art Gibson

After a vigorous trek up Grapevine Spring Trail to the Window, author Art Gibson pauses to reflect on the beauty of the surroundings.

Friday, March 5, 1999:
At 2:45 p.m., Jen Schultz, senior in Geological Engineering, finally arrived to make our group complete. The trailer was loaded, and we were whisked away in the geology vans, Pangea and Dolomite II. Within an hour, the snow began to fall. It eventually turned to rain.



Source: Art Gibson

Santa Elana Canyon, more than meets the eye.

Saturday, March 6, 1999:
Saturday began with a bang, literally. At 12:06 a.m., over the CB, the driver of Pangea informs those of us in Dolomite that they had a flat tire. After 20 minutes, we fixed the tire and were back on the road.

Around 9 a.m., we stumbled into a Denny's near El Paso, Texas. The checkout man asked us our destination. When we said we were headed to Big Bend National Park, his response was (please insert southern accent), "That's unforgivin' country."

About 9:30 p.m., we pulled into our campsite on the west side of Big Bend along the Rio Grande. We all commented on the warm temperature as we set up camp. Stepping out of the vans was like being reborn. We no longer had to wade through snow or worry about gloves, jackets or long sleeve shirts. It was dark, it was quiet, but it was far from cold. We joyfully set up camp for our first night beneath the never-ending Texas sky. Orion, Cassiopeia, the Big and Little Dipper and the Seven Sisters were glimmering brighter then anyone could imagine.

Sunday, March 7, 1999:
We filled our day with short hikes to see the geology of the area. Santa Elena Canyon and the tuff flows stick out in our memory as high points of the day. Hiking through the desert in 92 degree heat wilted even the strongest of our crew. The first thought on everyone's mind was, "I should have brought more water." We began to believe that the man from Denny's was correct by calling this "unforgivin' country."

Back at the camp, most of us went swimming in the Rio Grande. A group of geology students from Illinois State thought we were crazy for swimming such a dirty river. Later that evening, we became aquatinted with the true occupants of the campsite – the javelinas. In case you don't what a javelina is (we didn't either), they are basically wild pigs. Ten to twenty of these crazy little animals (harmless unless provoked) walked right through our campsite every night and early morning acting as if we had no right to be there.

Monday, March 8, 1999:
We began with a hike to see the window on the Grapevine Trail. We drove to Panther Junction, Park Headquarters, and saw the first sign of running water in two days. The hot springs were our next destination. Our plan was to soak a little and then take show-

ers. Well, let's just say, we had a chance to soak in the hot springs. The water reaches temperatures just above 100° F. The hot springs pour into an old foundation located right on the edge of the Rio Grande. Some of us even took our chances and crossed the river to say we had been to Mexico. Water wasn't available for showers. A few tried to wash in the Rio Grande, but that was a wasted effort.

Tuesday, March 9, 1999:
Today was a day of driving and short geological stops. We checked out a basalt dike intrusion in limestone. The rest of the day was spent exploring Closed Canyon, one of the narrowest large canyons we have seen.

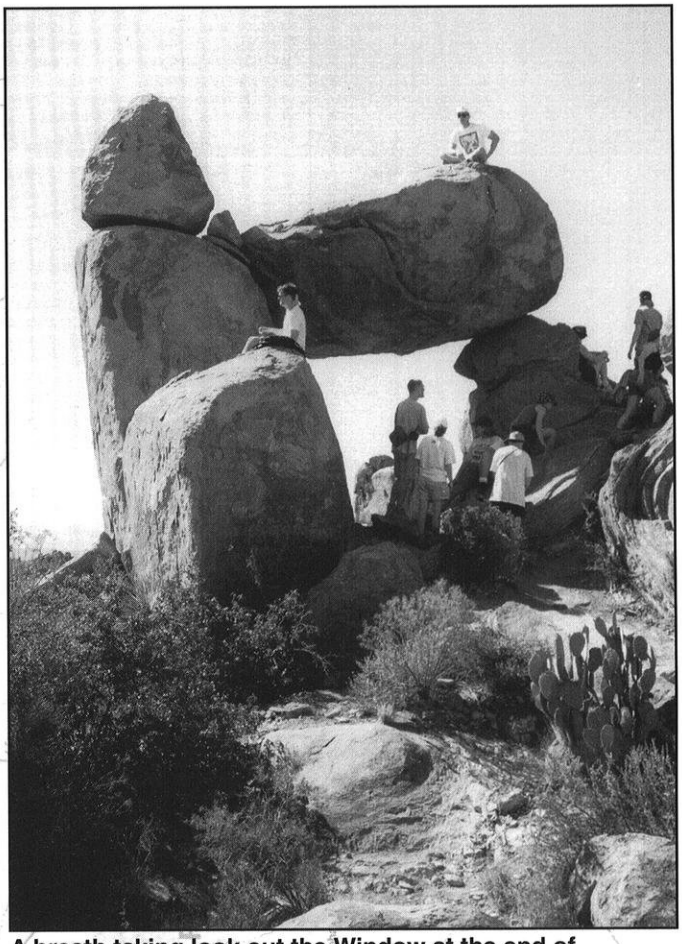
We finally found a grocery store and restocked our essentials, including cerveza of course. We moved to a new campsite, supposedly part of the movie set used for *Lonesome Dove.*

Wednesday, March 10, 1999:
Sometimes it takes more than an off-road vehicle to see geology. Taking this to heart, we saw geology from rafts and canoes floating down the Rio Grande. Along each side of the river were towering cliffs of igneous rock. It was a leisurely day that was often interrupted by Professor Brown cannon-balling off rock formations with the goal of soaking the rafters.

Our return to the campsite was not a pretty picture. We obviously made friends with some of the pigs, who had finished off all of the food we were going to eat for dinner. Oops! So we cleaned up the best we could (since none of us had showered since Madison), and headed for the town of Lajitas to eat at the only restaurant within 50 miles.

Thursday, March 11, 1999:
With yesterday's upper body workout from rowing, we decided our's legs needed a workout today. At noon, we began our trek up Emory Peak, the second highest peak in Texas. Total mileage was 14, and the elevation change was around 2000 feet. Our sunburned bodies were grateful that it was a bit overcast for the hike. Pictures from the top of Emory Peak were a little hazy, but a picture truly could not capture the awe-inspiring views of canyons, cliffs and wide-open spaces.

Friday, March 12, 1999:
With no place to camp that night in Big Bend, we started our drive back to Wisconsin with intentions of camping in Oklahoma. Well, when it rains, it pours and pours. All night the storm raged on, so we drove on and on and on.



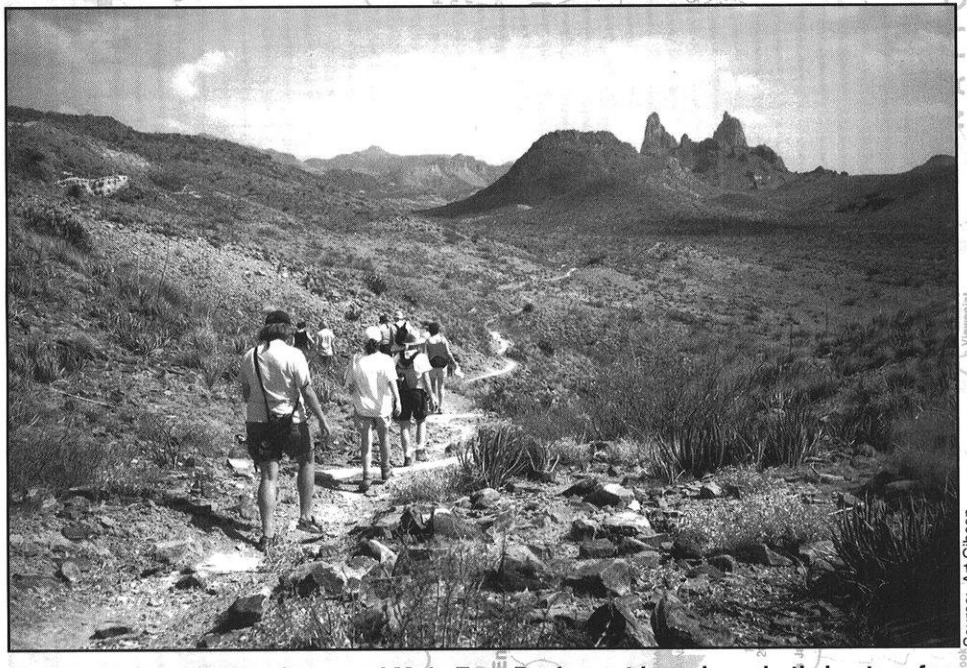
Source: Art Gibson

A breath taking look out the Window at the end of Grapvine Spring Trail.

Saturday, March 13, 1999:
At 4:10 p.m., Pangea and Dolomite II rolled in to the parking lot behind Weeks Hall. The weary 18 of us finally headed to our respective homes for long overdue showers.

Spring break 1999 wasn't a typical experience for us. We got a little dirty, saw a lot of cool rocks, canyons and mountains and were able to get actual credit towards our degree. Some may not see a week of camping, hiking and exploration as the best thing to do for spring break. All we can say is, "We wouldn't trade it for the world!"

Author Bios: Art Gibson and Jen Schultz – survivors of Big Bend, geological engineering students, Advertising manager and Editor-in-Chief.



Source: Art Gibson

The geology group heads toward Mule Ears Peaks, not knowing what's in store for them.

Just One More

Understanding Engineers

Understanding Engineers - Take One
A pastor, a doctor and an engineer were waiting one morning for a particularly slow group of golfers. The engineer fumed, "What's with these guys? We must have been waiting for 15minutes!" The doctor chimed in, "I don't know, but I've never seen such ineptitude!" The pastor said, "Hey, here comes the greens keeper. Let's have a word with him." "Hi George. Say, what's with that group ahead of us? They're rather slow, aren't they?" The greens keeper replied, "Oh, yes, that's a group of blind fire fighters. They lost their sight saving our clubhouse from a fire last year, so we always let them play for free anytime." The group was silent for a moment. The pastor said,"That's so sad. I think I will say a special prayer for them tonight." The doctor said,"Good idea. And I'm going to contact my ophthalmologist buddy and see if there's anything he can do for them." The engineer said, "Why can't these guys play at night?"

Understanding Engineers - Take Two
There was an engineer who had an exceptional gift for fixing all things mechanical. After serving his company loyally for over 30 years, he happily retired. Several years later, the company contacted him regarding a seemingly impossible problem they were having with one of their multimillion-dollar machines. They had tried everything and everyone else to get the machine to work, but to no avail. In desperation, they called on the retired engineer who had solved so many of their problems in the past. The engineer reluctantly took the challenge. He spent a day studying the huge machine. At the end of the day, he marked a small "x" in chalk on a particular component of the machine and stated, "This is where your problem is." The part was replaced and the machine worked perfectly again. The company received a bill for $50,000 from the engineer for his service. They demanded an itemized accounting of his charges. The engineer responded briefly: One chalk mark, $1. Knowing where to put it, $49,999. It was paid in full and the engineer retired again in peace.

Understanding Engineers - Take Three
What is the difference between mechanical engineers and civil engineers? Mechanical engineers build weapons, civil engineers build targets.

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

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

Understanding Engineers - Take Six
An architect, an artist and an engineer were discussing whether it was better to spend time with the wife or a mistress. The architect said he enjoyed time with his wife, building a solid foundation for an enduring relationship. The artist said he enjoyed time with his mistress because of the passion and mystery he found there. The engineer said, "I like both. If you have a wife and a mistress, they will each assume you are spending time with the other woman, and you can go to the lab and get some work done."

- source unknown

Essay Contest Reminder...

Who Would You Name as the Person of the Century?

To celebrate the ending of the 20th Century, the *Wisconsin Engineer* magazine is having an essay contest to decide who has been the most influential person of this century. Three essays will be selected and published in the November 1999 issue of the *Wisconsin Engineer* magazine. The following awards will be given: first place, $250; second place, $100; and third place, $50.

All you need to do to enter is the following:

- Write an essay of 500 words or less explaining who your choice is and why you feel that way. Back up all claims with facts or logic.
- Email your entry by May 1, 1999, to wiscengr@cae.wisc.edu, including your full name, address, phone number and/or email address where you can be reached in October 1999.

Any UW-Madison student enrolled during the Spring 1999 semester can enter, except for current staff of the *Wisconsin Engineer* magazine Don't worry if you are graduating. Please enter, but make sure we have a way to reach you in October in case you win.

1999 is a year for reflection. People make history. Who do you think has been the biggest history maker of the 1900s? Think about it, and get busy writing.

Jennifer Schultz
Editor-in-Chief

At the IRS we solve problems 24 hours a day.

You've told us—when you run into a tax question, you want the answer *now.*

So we're expanding our hotline hours. Phone toll-free 24 hours a day, seven days a week to speak to an IRS expert.

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The Internal Revenue Service *Working to put service first*

The ***Wisconsin Engineer*** is published by and for the students of the University of Wisconsin - Madison. It is distributed throughout the Engineering Campus as well as several other buildings throughout the university. Our goal is to reach as many students and faculty as possible. This magazine is also mailed to our subscribers and to every high school in the state. The *Wisconsin Engineer* covers news and events, organizations, faculty, students, and much more. In 1997 and '98, the *Wisconsin Engineer* was named **Best All-Around Magazine** by the Engineering College Magazines Associated, an organization that provides communication and resources among similar engineering college magazines.

Entering our **104**th year, we are currently seeking members for our **advertising, writing, web development, and business** staff. If you have bright ideas, want to get the gears in your head moving, or are looking for the missing piece in your student life, the *Wisconsin Engineer* might just be the thing for you. Individuals with or without experience, and students in all fields are welcome. Please contact the *Wisconsin Engineer* by email at **wiscengr@cae.wisc.edu** or by phone at **262-3494**. People can contribute to the magazine as either a volunteer or as a student in Engineering Professional Development. EPD 690 is a one credit course that meets on alternate Wednesday nights every semester. Please don't hesitate to register for next semester, contact us, or even stop by our general staff meetings. Our next meetings are on April 14, and April 28 in Mechanical Engineering Room 318 at 7 pm.

As always, we welcome all individuals to join our other departments, including production, circulation, photography, and history.

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Wisconsin Engineer Magazine
Mechanical Engineering Building
1513 University Avenue
Madison, WI 53706

Nonprofit Organization
U.S. Postage
PAID
Madison, WI
Permit No. 658

Frank & Meeilei Chen
1820 W. Glendale Ave.
Appleton, WI 54914-2472