Wisconsin engineer. Volume 98, No. 2 March 1994

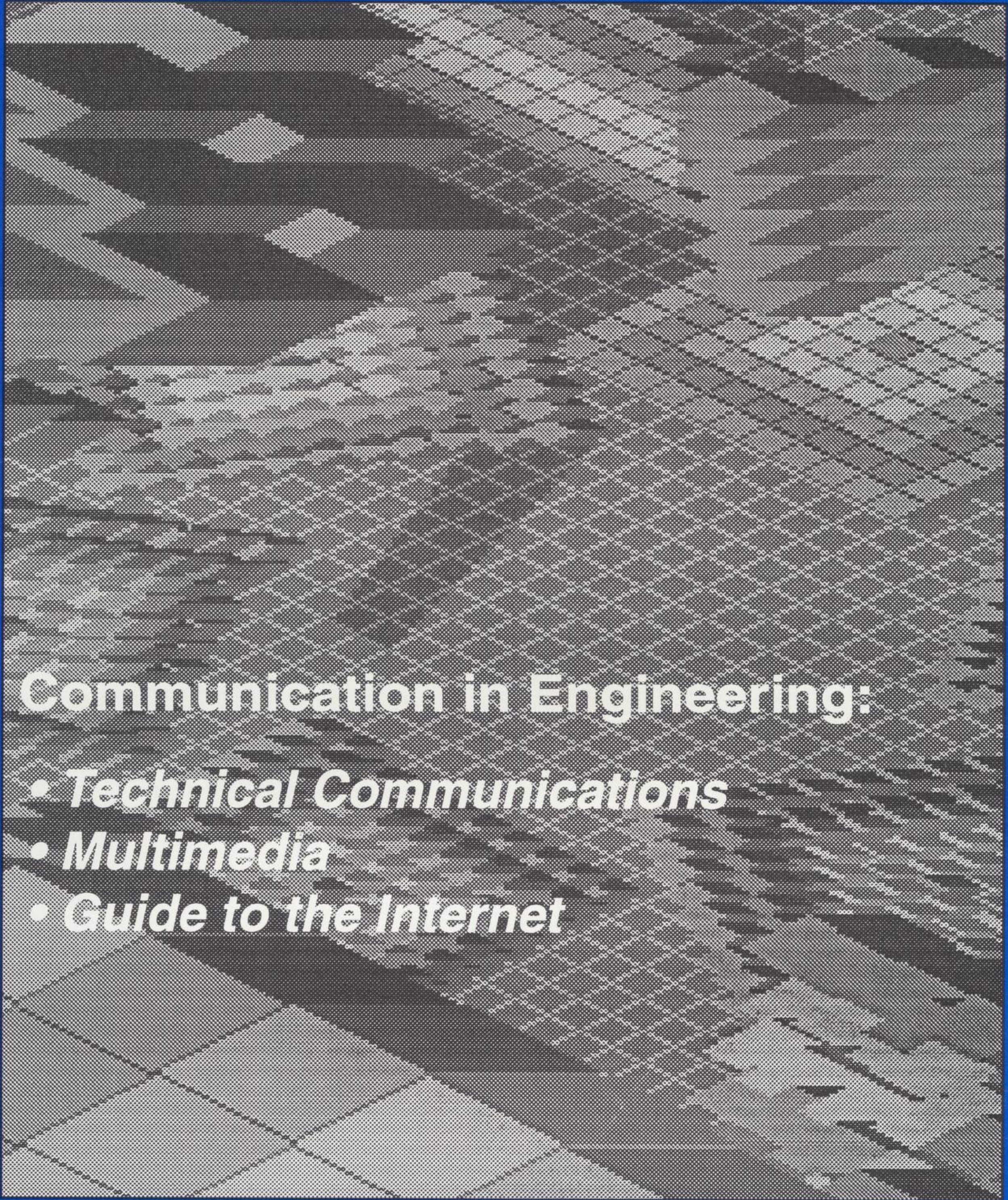
Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

https://digital.library.wisc.edu/1711.dl/7P3DBZ6M5SIJV8I

Volume 98, No. 2

March 1994

wisconsin engineer



Communication in Engineering:

- *Technical Communications*
- *Multimedia*
- *Guide to the Internet*

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

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

Correction

Three errors in the October, 1993 edition have been brought to our attention. Line 12 of column three of the article *W. Edward Deming: A Man of Quality* should read " . . . SPC, is used to measure **rational** samples . . . ", rather than " . . . SPC, is used to measure random samples . . .". Also in column three, Ermer's quote "Special causes are not bad," should read "Special causes are **very bad**," because they lead to poor product quality and process productivity. Finally, on page nine, column two, the quote "From ground zero, Zytec has their people and your people design the product together," states Ermer, "and after that Zytec takes you to their sales department and gives you access to all records of Zytec's sales," should read "From ground zero, Zytec has their people and your people design the product together," states Ermer, "and after that Zytec takes you to their **accounting** department and **shares their costs of your product design with you**." We regret these errors and apologize to Professor Ermer and our readers. The Wisconsin Engineer staff thanks Dr. Ermer for pointing out these mistakes.

wisconsin engineer

Published by the Students of the University of Wisconsin–Madison, March 1994

Editors
Mariah Steele
Svetlana Zilist

Production Editor
Jennifer Wondergem

General Manager
Jim Webb

Business Manager
Pete Johnson

Advertising Manager
Craig Drugge

Circulation Manager
Alyssa Hunt

Writers
Caitlin Howell, Alyssa Hunt
William Keller, Lisa Mlinarcik
Jason Och, Leslie Shalabi
Mariah Steele, Sarah Stevenson
Tony Wolfram

Production
Howard Chen, Suzanne Clark
Chi Duong, Eric Gentz
Roman Tivyan

Cover
The cover is a graphic taken off of the Internet.

Table of Contents

Board of Directors: Michael Corradini, Gerald Duchon, David Malkus, Evelyn Malkus, Richard Moll, Tom Murray, Kenneth Potter, Thatcher Root, Karen Walsh.
Faculty Adviser: Ryn Etter.
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. All interested students have an equal opportunity to contribute to this publication.
Publisher's Representative: CASS Communications, 1800 Sherman Ave., Evanston, IL 60201-3715. Phone (312) 475-8800.
Publisher: Community Publications, McFarland, WI.
ECMA Chairperson: Donald C. Woolston, 1527 University Ave., Madison, WI 53706.
Correspondence: Wisconsin Engineer Magazine, Mechanical Engineering Building, 1513 University Ave., Madison, WI 53706. Phone (608) 262-3494. The **wisconsin** engineer is published four times yearly in November, January, March and August by the Wisconsin Engineering Journal Association. Subscription is $10 per year.

Editorial

Where the Women Aren't

Mariah Steele
Wisconsin Engineer Co-Editor

A recent issue of *Scientific American* ran an article called "A Lab of Her Own" (by Marguerite Holloway, November, 1993). The subject of the article is one that comes up frequently in women's studies classes and feminist circles in general. Until recently, however, it has not been a regularly addressed subject in science and engineering departments on college campuses, or in industries that hire scientists and engineers, or even in the grade schools and high schools that should be creating, fostering and encouraging young children's interests in science. The subject I am referring to is women in science. Or, more accurately, the startling lack of women in science and science-related fields.

Holloway's story is disturbing. She cites statistics that are almost unbelievable: 16 percent of employed engineers and scientists in the United States are women; female scientists frequently earn salaries that are approximately 25 percent lower than those paid to men in the same positions; women scientists are twice as likely as men to be unemployed and are rarely promoted to high positions. The bad news continues as Holloway notes that while Nobel Prizes have been awarded to over 300 male scientists, only nine women have received the same award. Finally, I must quote the passage that provoked this editorial: "[women make up] 1 percent of working environmental scientists, 2 percent of mechanical engineers, 3 percent of electrical engineers, 4 percent of medical school department directors, 5 percent of physics Ph.D.'s, 6 percent of close to 300 tenured professors in the country's top 10 mathematics departments, and so on." As these extraordinarily low numbers show, something is very wrong.

Look around your classes, your departments, at your professors. How many female students are in your science, math, and engineering courses? How many female professors do you have? Have you ever thought about why the male-female ratio is so out of proportion in these areas? Have you thought about what it might take to even this gross imbalance out?

It is an undeniable fact that historically, women have been denied many things and repressed in many ways. That women should have been excluded from academic and intellectual areas such as science and engineering then should come as no real surprise. That women are still absent from these fields should. As this issue gradually gains more and more attention from academic and industrial institutions, people are beginning to look for some answers to the obvious question "What is it that prevents women from being interested in or keeps women out of science?" The answers have ranged from the ridiculous to the oppressive, and more often than not have blamed women for their plight. What concerns me is not who or what is responsible for keeping women out of engineering and science, but what we as a society can do to bring more women into science and related fields and how we can keep them there.

Many people, men and women alike, have suggested ways to make science more appealing to women. Some of these suggestions have met with controversy, and a number are borne of the belief that there are fundamental differences between women and men that cause them to approach scientific topics differently. I would argue that while there may be some truth to this idea, what would be most beneficial to the scientific community as a whole and particularly to women scientists, is a change in the very exclusive climate that surrounds science. Numerous studies have shown that even young children are affected by this climate in grade schools where teachers encourage boys to to excel at science and math. This is when girls begin to lose interest in these topics. As girls grow up, they see few female role models in science and related fields, and the competition gets stiffer. In many ways, the situation begins to seem hopeless. After all,

continued on page 15

Dean's Corner

Your Personal Balance Sheet

Another semester is behind you and you are just a little bit closer to the reality of taking part in a globally competitive professional environment. Once in a while it is useful to make a personal inventory of those factors which make up your intellectual/professional balance sheet. This will provide you with a useful self assessment exercise.

Balance sheets consist of assets and liabilities. I would like to share with you at least one view of how to develop such a balance sheet. In the Asset column, we can include items such as:

- The quality of your education
- Documented performance
- Good written expression
- Good oral presenter
- Team work experience
- Demonstrated interest in participation
- Collegial personality
- High ethical standards (honesty and integrity)
- Vision of the future
- Industry experience

In the Liability column, I would include:

- Less than average performance
- An inflated ego
- Inconsistent behavior/performance
- Communication problems both written and oral
- High academic performance with no other participation
- Lack of a professional plan or vision of the future
- Poor personal hygiene and appearance
- Willingness to accept less than your greatest effort
- Unfamiliar with faculty and fellow stu dents
- No professional work experience dur ing your college career

If you reorder these elements in a set of questions to ask yourself you will find that the answers that you give will logically fall in either the asset or liability columns. Some of the answers lie in data you can collect. For example, look at grade points, progress toward graduation, honors, etc. Assess how you spend a day, did you work on an organization committee, participate in one of the national competition teams, or join an important organization that will provide you recognition and new experiences? You can obtain some valuable feedback from your friends. Some of these questions might best be asked of others. Do not be afraid of the answers. You need to know how others see you. You can usually assess how well others understand you and how you are received by your peers, by employers, and by faculty and staff. Your goal should be to make the assessment process a part of your daily life, always assessing outcomes to see if the experience can be placed in the asset or the liability column.

Collecting data and assessing the situation is only the first step in improving your success rate and level of personal satisfaction. Planning how you want your personal balance sheet to look and establishing the gap between where you are and where you want to be sets the stage for improvement. Next you need to establish the action items. Develop a plan of action to move items from the liabilities column to the asset column. Build on your strengths and focus on improving your weaknesses. The bottom line is that your intellectual/professional "net worth" is determined by your assets minus your liabilities.

You do not need to seek improvement in your net worth alone. One of the most important aspects of your educational opportunity is that there are many of us who care and want to help you prepare for the future. But you must seek the advice and assistance which will provide you with information about options and opportunities. In addition to your peers, you can consult faculty and the many staff in organizations that have been created to assist you. Consult the publication "Getting Around" to find a list of the many people that are available to help.

continued on page 15

Dean John G. Bollinger
College of Engineering

Levelling With Lovell

Professor Ed Lovell, Chair of Engineering Mechanics Department, Tells All

Nestled down one wing in that maze of a building called Engineering is the office of Professor Edward Lovell, chair of the Engineering Mechanics Department. Sitting in his blue high-back chair, behind a putty-colored, paper-covered desk, the fit and distinguished Lovell tells us of his position as departmental chair, his career in general and his life beyond.

Prof. Lovell came to the University of Wisconsin-Madison in 1968. He had just finished a 14 month post doc position at NASA-Langley, NASA's research lab in Virginia. He said he took that position, where he did research on the effects of vibrations on cylindrical shell structures, because "I was green and needed to learn something in a research setting." He had just earned his Ph.d. in the area of structural analysis from the University of Michigan in 1967.

Lovell took over the position of chair in July 1992, replacing Prof. Philip Kessel. Lovell said he can break down his job into several components: administrative, teaching & research, and committee work, which takes up a lot of his time.

Lovell enjoys getting involved with students in the department. Along with Professor Ron Thompson, Lovell teaches the senior design course in the Engineering Mechanics Department. "Teaching this class is the best way for me to get to know students, " Lovell says. He uses this knowledge to help students by writing recommendation letters, recruiting them for graduate school here at the UW or offering suggestions for other graduate schools.

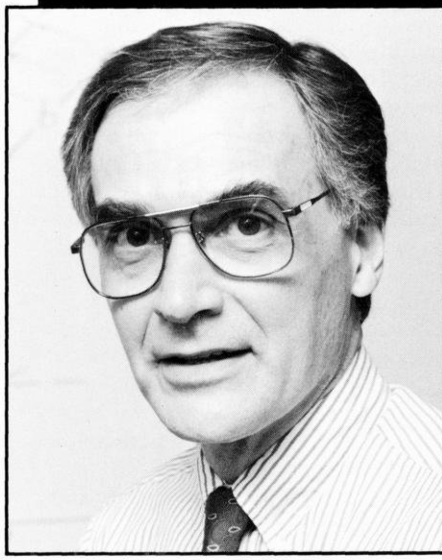
Lovell, like most professors at UW Madison, has pursued a wide variety of research projects. His research interests lie in the area of structural mechanics which include stress analysis and vibration work.

One major research project in which he has participated over the last decade is the Fusion Technology Institute, part of the Nuclear Engineering department. This consortium is working on developing a new energy source through nuclear fusion. His particular role in the Institute involves research on stress analysis of the nuclear reactors themselves.

Lovell has worked on other multidisciplinary projects such as the manufacturing of micromotors. He was part of a team of professors that included faculty from Material Science, Electrical and Chemical engineering departments. The micromotors, some only as wide as three human hairs, were the smallest ever to be made out of metal. Others had been made but only out of silicon. Gears and motors this small would have applications, mainly in the medical world, Lovell says. They could be used in cell manipulation, microsurgery and the dispensation of drugs and other medical treatments.

Lovell is also a member of several campus committees which illustrate some of his wide-reaching interests. He is a member of the Rec Sports Board, the advisory board that governs the activities of the Natatorium, SERF, Shell and other athletic facilities on campus. He also takes part in the Campus Planning Committee. This group makes decisions about major campus changes, such as the construction of new buildings or additions to and renovations of any major structure on campus. In fact, the construction of Engineering and Grainger Halls were approved by this committee.

And to top of his involvement in campus committees, Lovell is an avid racquetball player, and is the faculty advisor for the UW Racquetball Club. He was



the Wisconsin State Racquetball champ in his age category in 1991, and he plays regularly several hours a week.

Finally, Lovell offers some advice to students in the College of Engineering. "Make sure and get involved, especially with student organizations and events like Engineering EXPO," he says. "If you just sit back, you're missing out." He adds "These groups aren't just social, they provide a professional link that you can't get from faculty."

AUTHOR

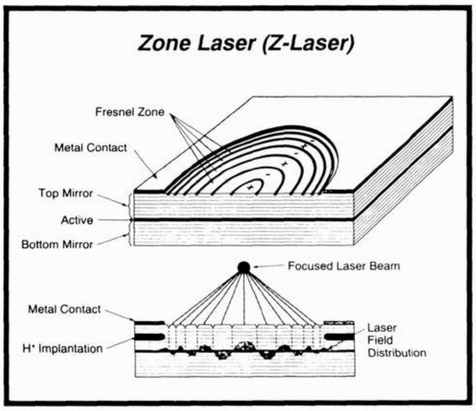
Leslie Shalabi is a senior Journalism and Anthropology student who has been working in the college of Engineering for the last three years. She will graduate in May and hopes to find a job in journalism. And she's darn good at making wine glasses sing.

The World's First Z-Laser

The world's first Z-laser is in the making. No, they have not figured out the laser transporter beam thing on Star Trek, but scientists at AT&T Bell Laboratories *have* made the first self focusing laser. Zone lasers (Z-lasers) are unlike conventional lasers because they do not require a lens to focus their light on a specific point.

The significance of the Z-laser is in its implications for telecommunications, computers and consumer electronics. By eliminating the lens, Z-lasers may make the construction of fiber optics and optical interconnections less complex.

"They [Z-lasers] may have applications in future systems that couple lasers to optical fiber for information transmissions," says Niloy Dutta, head of Bell Labs Optoelectronic Device Research Department. "They may also be used in future optical interconnections on a single chip, between chips, or between circuit boards in a computer; or in future optical recording / storage systems," notes Dutta.



Z-lasers are unique because they emit light vertically from their surface rather than horizontally as conventional edge-emitting lasers do. They are made of layers of indium-gallium-arsenide, gallium arsenide and aluminum gallium arsenide. The light emitted from Z-lasers tends to come together at a point because of the way the lasers are designed and processed. This is not possible with other lasers.

Z-lasers are unique because they emit light vertically from their surface unlike conventional edge-emitting lasers

Z-lasers are constructed by using molecular beam epitaxy (MBE). With this technique, various materials as thin as a single atom are deposited on top of one another to form thin films. These films are the basis for many semi-conductors.

Daryoosh Vakshoori, the inventor of Z-lasers, says that Z-lasers will be helpful for systems which require attaching lasers to fibers, such as fiber optics and optical interconnects.

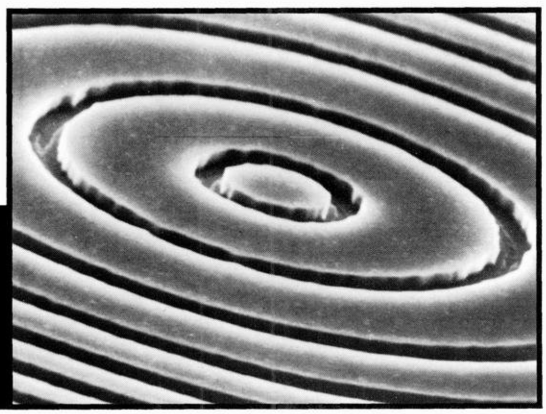
Fiber optic systems use lasers as a light source. They transmit information such as telephone conversations and computer language by encoding it in the ones and zeroes of digital data, with the light source turns on or off to represent a one or zero. The light which is transmitted by the laser travels along a clear plastic or glass rod. The Z-laser will enable the laser generator to be put directly next to the opening of the fiber optic cable, bypassing the complex process of focusing the lens. Fiber optic systems are used in telecommunications and in computer networks.

Lasers have been used experimentally to link computer chips. They have also been used to optically connect circuit boards in a process is called optical interconnection. For example, information could be transmitted from lasers on one circuit board to detectors on another spaced about an inch away.

"For these applications and others requiring coupling to fibers, a laser source with a converging output would be preferable to any laser in commercial use today," says Vakhshoori. ■

AUTHOR

Lisa Mlinarcik is studying journalism and sociology. This is her second semester writing for the Wisconsin Engineer.



Zone lasers, the world's first self-focusing lasers are a new class of experimental vertical-cavity lasers invented at AT&T Bell Laboratories. They emit light upward from their surface rather than horizontally as do conventional lasers, and the Z-lasers need no lenses to focus their light at a predetermined point. They may have future applications in fiber-optic systems, free-space interconnections on chips and circuit boards, and optical recording/storage systems.

Cooking up Structures at the Atomic-Scale CAFE

Recipe for Making Atomic-Scale Structures:

Obtain the following:

- Slab of silicon (3mm x 12mm)
- Variable voltage source
- Scanning-tunneling microscope (STM) connected to ultra-high
- Vacuum pump

Instructions:

Place silicon in room-temperature STM. Connect voltage source to STM tip and evacuate to less than one-trillionth atmospheric pressure. Bring tip of STM close to silicon surface and increase tip voltage to -3.5 volts. Remove unwanted atoms, forming a trench around desired structure. Serve structure hot or cold!

Yield:

1 structure approx. 5 atoms long x 2 atoms wide with atomically-straight edges.

Note:

This recipe produces a structure that remains stable after several hours, so it is ideal for many electrical applications.

Imagine . . . pocket-size computers one billion times more powerful than today's supercomputers; microscopic machines able to enter the blood stream and destroy all known diseases; atomic-scale manufacturing processes that create no waste at all. These are only a few of the possible consequences of the "nanotechnology revolution."

Don't throw away your personal computer, yet, however. Much research remains to be done on the fabrication techniques and physical properties of nanostructures — the atomic-scale components that make nanotechnology possible. Dr. Craig Salling, Staff Scientist at the University of Wisconsin-Madison's Materials Science and Engineering Department, is "breaking new ground" with his work on silicon-based nanostructures.

"My area of research is . . . to start answering some questions that are relevant to the future of integrated circuits," explains Salling. "Namely, how small of a wire or transistor can you make? Can you make useful devices that are only a few atoms big?"

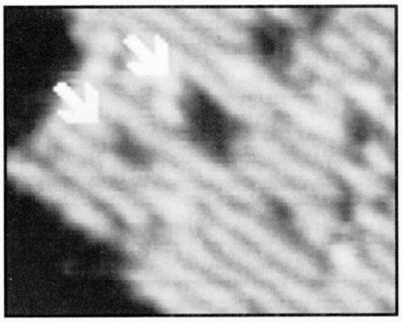
Salling has successfully created the world's first room-temperature silicon nanostructures with atomically-straight edges

To answer these questions, Salling has developed a "recipe" for making atomic-scale structures. He bases his recipe on two critical developments by other researchers. In 1990, a scientist at IBM assembled the first nanostructures by positioning individual atoms with a scanning-tunneling microscope at temperatures below 4 K (-269 °C.). These structures became unstable when heated, however, so they could only be used when cooled with expensive cooling systems. Other researchers then developed a technique for making room-temperature nanostructures out of sulfur atoms. Because sulfur is an insulator, these structures could not be used to make electronic devices. By instead using silicon wafers cut from a silicon crystal in a particular direction, Salling has successfully created the world's first room-temperature silicon nanostructures with atomically-straight edges.

At the atomic scale, the way one cuts a crystal affects what shapes can be produced on its surface. The atoms in a silicon crystal bond into a tetrahedral or "pyramid-shaped" structure. When that crystal is cut along a certain plane, the newly-exposed surface atoms are left free to bond with each other. This bonding pulls the atoms together into pairs called dimers. Since the crystal structure repeats itself, long dimer rows form on the surface. The atomic separation across adjacent rows is twice the separation between atoms in the same row. Due to its straightness and greater spacing across dimer rows, silicon with this surface structure, known as Si(001), is ideal for making atomic-scale wires.

Salling is the first person to fabricate nanostructures out of Si(001). He employs a method known as lithography in which he creates a structure by removing unwanted material from an initially uniform surface. The process for removing the unwanted material is called chemically-assisted field evaporation (CAFE).

Now that Salling has fine-tuned his recipe, he has begun looking at the ability of electrons to flow down nanostructures. He hopes this work may lead to the development of atomic-scale switches and transistors, the fundamental components of nanocircuits



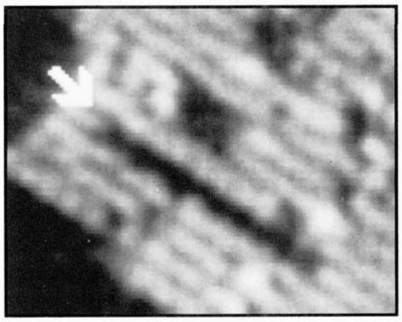
Photos courtesy of Dr. Craig Salling

The arrows indicate pits fabricated using threshold voltages at s=1.5Å (larger pit) and s=1.1 ±0.3Å (smaller pit).

CAFE is a method of inducing the evaporation of surface molecules by placing them in the presence of an electric field. First, Salling moves the STM tip close to the silicon sample. He then increases the voltage between the tip and surface. Because the separation between the tip and sample atoms is almost as small as that between bonded atoms, the dimers directly underneath the tip begin to chemically bond with the atoms from the tip. The tip-dimer bond and the electric field between the tip and dimer weaken the surface-dimer bond. The thermal energy of the dimers is then sufficient to break them free from the surface. The evaporated dimers accelerate to the STM tip, leaving a "hole" in the silicon surface. When Salling moves the STM tip along a row, the dimers in that row are closer to the STM tip than dimers in adjacent rows. Therefore, the STM is most likely to remove dimers only from the row which Salling chooses. This enables Salling to dig straight trenches, isolating structures with atomically-straight edges.

> **We are now on the verge of perhaps the greatest technological revolution in history, one that will dwarf the microelectronics revolution of the '70's and '80's... Indeed, technology in the "nanoelectronics age" will be limited only by the human imagination**

So far, Salling has been able to pick up as few as two dimers (four atoms) at a time. He expects to soon remove single dimers by using even smaller tip-sample separations. However, as Salling removes silicon from the surface, silicon dimers build up on the STM tip. For very small separations, the STM frequently deposits this "junk" from the tip to the surface.



A trench one dimer wide that was fabricated by repeatedly removing atoms from an individual dimer row, starting at the lower right end of the smaller pit.

Structure after forming another single-dimer-wide trench starting from the bottom row of the larger pit.

In order to clean the tip, Salling moves the tip away from the nanostructure fabrication site and switches the tip polarity from negative to positive. Since silicon tends to transfer from the positive electrode to the negative electrode, the silicon atoms jump to the (negative) surface. The unwanted dimers form what Salling calls "a silicon compost pile" on the surface. Salling may then move the STM tip back to the fabrication site and continue the lithographic process. Salling is currently able to dig trenches approximately 400 Angstroms (4×10^{-7} m) long without having to clean the tip.

Occasionally, Salling has to sharpen the STM tip so that the electrical interaction between the tip and sample remains localized. Salling refers to his sharpening process as "atomic-scale taffy pulling." He moves the tip close enough to the surface that it bonds to the silicon. Pulling on the tip, Salling stretches the tip into a "pointy" shape. The bonds eventually break, and a sharpened tip remains.

Now that Salling has fine-tuned his recipe, he has begun looking at the ability of electrons to flow down nanostructures. He hopes this work may lead to the development of atomic-scale switches and transistors, the fundamental components of nanocircuits. Salling also plans to develop techniques for computer-controlled tip cleaning. Such automation would greatly speed up the nanostructure manufacturing process.

We are now on the verge of perhaps the greatest technological revolution in history, one that will dwarf the microelectronics revolution of the '70's and '80's. Yet, before this great transition can take place, engineers face the challenge of mass-producing nanostructures. Although this is an enormous task, the possible benefits to society are almost limitless. Once engineers perfect these manufacturing methods, inexpensive nanoelectronic devices will become available to perform tasks for virtually every conceivable application. Indeed, technology in the "nanoelectronics age" will be limited only by the human imagination.

Island one that is dimer wide and 5 dimers long, isolated by a moat one atomic layer deep.

The Science behind the STM

The scanning-tunneling microscope relies on a quantum-mechanical effect known as "tunneling" to produce images of the atomic surface it scans. According to quantum mechanics, an electron spinning around an atom is not a particle in

continued on page 9

Touching the Future: Engineering Outreach Programs

How many mornings have you asked yourself, while lying in bed, cozy and warm, with your head sunk deep into the pillow and the rest of your body buried under piles of covers "Wouldn't it be great if I didn't have to go to school today?" A smile probably crossed your face as you pushed the snooze button one more time, the cold snowbanks in your mind melting into a sunny, sandy beach. For some UW-Madison students, going to school does not involve plowing through four feet of Wisconsin snow while trekking to Engineering Hall. In fact, some students have never seen snow. Sounds pretty good, doesn't it? For 120 Engineering Outreach participants, it is the best deal around.

For some UW-Madison students, going to school does not involve plowing through four feet of Wisconsin snow while trekking to Engineering Hall.

The Engineering Outreach Program is unique to the College of Engineering. The program enables engineers across the country to take classes from some of the best educators available without having to quit their jobs or move to Wisconsin. Engineers in industry need to stay on top of the innovative technology taught at UW-Madison in order to complete company projects and keep climbing the

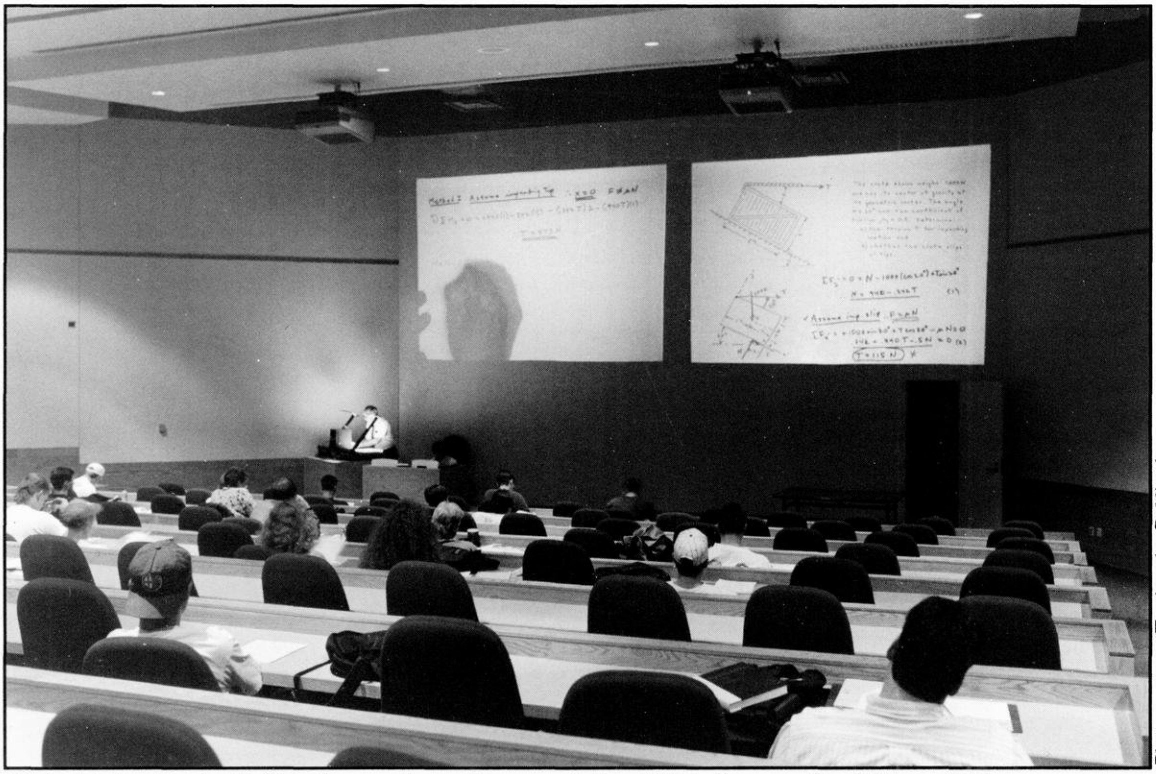


Photo courtesy of Engineering Publications

Students in Engineering Hall take the same class as off-campus Badgers 5,000 miles away. How is this possible? With lights, action, a camera and the help of the Engineering Outreach Program.

corporate ladder. Some engineers hope to go to graduate school in Wisconsin, but need to fulfill course requirements before they will be accepted. Others simply want to enrich their knowledge and need the strict deadlines of school to help them to get the work done. Whether these professionals have undergraduate or doctorate degrees, they must apply to the university like every other student. After being accepted, they contact Engineering Outreach for help in selecting courses, arranging financial aid or for assistance with just about anything else they need to straighten out. "I am their legs and their eyes on the campus," says Engineering Outreach program assistant Helene Demont, describing her place in the chain.

They do phenomenal and outstanding work, usually these students don't get anything below an AB
–Helene Demont

Students choose from 24 classes each semester in Electrical, Mechanical, Material Science and Nuclear Engineering. The classes are regular lectures given to students on-campus and broadcast via satellite to companies or institutions where the students are. Sometimes, videotaped versions of lectures are sent to students in the mail.

Off-campus Badgers may not be here in Madison but they are certainly not excluded from the rigors of schoolwork. "They have many commitments on their time. Most of these people work long days at their jobs and don't get a chance to sit down and watch the class until 10:00 at night," acknowledges Demont. She says students must watch classes and complete the same homework assignments and take the same exams as on-campus students. Homework is due to the lecturing professor or TA by fax, mail or e-mail within the same time frame as regular students' assignments. "They do phenomenal and outstanding work," explains Demont, "Usually these students don't get anything below an AB." And they do not get out of exams, either. Efforts are made to find a proctor in the student's area but occasionally the student must come to Madison to take an exam.

Not only does Engineering Outreach coordinate classes in the four engineering disciplines, it also assists the 45 students enrolled in the Technical Japanese Program. Engineers who are interested in learning this very valuable language for today's marketplace can learn about Japanese language, culture and customs and through "correspondence": watching lectures on a video screen and submitting homework and exams.

The Engineering Outreach Program also contributes classes to the National Technological University (NTU), an institution that has no classrooms. NTU collects videotaped classes from 40 of the country's best engineering schools and broadcasts them via satellite. NTU boasts that over the course of one year, they broadcast more live TV than NBC, ABC and CBS combined! Because of Wisconsin's particularly qualified and innovative instructors, UW-Madison classes are an integral part of NTU's course offerings.

Students working towards graduate degrees need approximately five years to complete the program. So far five have earned master's degrees through the outreach program and nearly twenty more are anticipating that milestone. "We are so proud of them. They work very, very hard for this," says Demont with a smile.

The Engineering Outreach Program office has seen many changes since its inception. Demont calls it a "continuously growing program," pointing out that in the 1982-1983 school year, only two courses were offered to 20 enrolled students. Today, those figures have exploded to include 25 classes and 118 students. Demont is confident that as communication technology progresses, Engineering Outreach will similarly progress right along with it. ■

AUTHOR

Alyssa Hunt is a senior Journalism major who will be relieving her parents of a major financial committment come May. She aspires to become a Cheeto delivery truck driver and holds the county record for balancing silverware on her nose.

Nanostructures continued from page 7

the classical sense. It is actually a "wave function" whose position can only be described in terms of its probability of being in a certain location in space and time. The electron has a potential energy "barrier" which holds the electron in place.

As the STM's tip gets within about five Angstroms (5×10^{-10} m or two atomic diameters) of the silicon surface, the tip's electron wave functions begin to overlap those of the surface. Due to this overlapping, the electrons have a finite probability of tunneling through the energy barrier to the tip of the STM. The tunneling current, which varies exponentially with the tip-sample separation, can then be measured. A feedback loop adjusts the position of the tip to keep current constant. The tip then follows the surface producing a "map" of the surface.

Salling describes the tunneling effect: "It is analogous to a sled coming down a hill that doesn't have enough speed to go over the next hill. . . .You'd expect the sled to go part of the way up the second hill and just slide back down. But in quantum mechanics there is a finite probability for the sled to go right through the hill." ■

AUTHOR

Jason Och, a junior in Electrical Engineering, is currently enjoying the "amber waves of grain" in Iowa as he co-ops for Rockwell International. He explains that he is "secretly on assignment from the CIA to explore the disco/funk revivalist movement that has grown so powerful in world politics today."

The Challenge of Technology and Culture: The Technical Japanese Program

科学技術日本語

LEARN TECHNICAL JAPANESE!!!

The Technical Japanese Program is located in the office of Dr. James Davis. The decorated office sets the mood for the type of learning a student in this program will encounter. From the books in Japanese lining the shelves to the Japanese pictures and items on the wall, the office invites students to challenge and better themselves by learning to speak and read Japanese.

Importance of Technical Japanese Knowledge

Engineers and business people are just recently realizing the importance of learning Technical Japanese. It is necessary for United States manufacturers to adequately compete within the world market, where Japan is a leading competitor in fields such as electronics and computer technology. Much of the literature surrounding these types of products is only available in Japanese. English-speaking engineers must be able to read this literature to keep up with the vast advances that occur in Japanese technology. Many people in the business world, however, run into problems with the high level of comprehension they need to reach to make their Japanese useful, while others lack the time necessary to learn Japanese.

Japanese is a very complicated language. Sufficient mastery of the language must be achieved for it to be useful. Since such a large amount of technical information presently comes out of Japan, it is not enough for engineers to just be able to translate the literature; they must also be able to skim articles quickly and select those that would be useful to fully translate. The language used in these articles is especially difficult because Technical Japanese is not used in the daily conversational language. Students must therefore learn the written and spoken Japanese mixed with technical and cultural studies to *fully* understand the language. This large amount of knowledge requires an equally large amount of class work, studying and time. Since people in the work force do not have a lot of time to take off from work to learn a language, this can be a difficult or even impossible task. The Engineering Professional Development (EPD) department attempts to overcome some of these difficulties by offering a wide variety of program options including new satellite technology that brings the classroom to the students in any computer adaptable off-campus site.

Japanese Studies

The Basic Technical Japanese program is the most specific program offered by the department. It focuses on the technical Japanese language with very limited conversational and cultural requirements. This program is recommended for professionals and higher level students with no experience in Japanese who need basic Japanese knowledge to read and translate technical literature. The courses include learning Japanese script, technical grammar, vocabulary and translating techniques applied to recent scientific literature. The Basic option consists of three courses taken over a one year period.

For professionals with less time available, the Summer Translation Seminar can be a less time-consuming way to learn the technical Japanese they need in industry. This program is an eight week directed study where students choose a piece of literature in their field of study and independently translate it . Class meetings with this program are centered around questions and problems students encounter while translating. The Seminar option is appropriate for those who have already had some exposure to basic Japanese.

The Certificate in Japanese Studies program combines learning the Japanese language with cultural studies and engineering. The main goal of this program is to teach engineering students to speak and read conversational Japanese, read and translate technical Japanese and gain an understanding of the Japanese culture. The program takes a minimum of one calendar year to finish and consists of 27 or 30 credits, depending on the plan chosen by the student. The program has 18 credits of required course work: 12 credits of general language classes and 6 credits of technical language classes. The remaining 9 or 12 credits are to be chosen from a list of classes that teach the students about the Japanese culture.

Advanced Technical Japanese is a one semester class for people who have completed at least one year of technical Japanese and want to focus on more current information in rapidly changing fields like robotics and telecommunications. This course can be taken several times because the literature studied changes every semester. This course is a way that engineers and business people can keep up with the enormous amount of literature presently coming out of Japan.

These programs are available to both students and professionals through the EPD department. Satellite technology has made it possible for professionals to attend without leaving work. The fully interactive system combines audio conferences with graphics output into any computer that is connected to telephone lines. This increased flexibility makes learning Japanese much easier for people around the country and around the world.

Studying in Japan

Students who want to continue their Japanese overseas can take part in one of several work-study programs. In addition to the usual study abroad approach, the engineering department has two specialized programs, the EAGLE Japan program and the Engineering Leadership program, in which engineering students can study or work in Japan on a paid scholarship. These programs can give students a chance to use their Japanese in a corporate or university atmosphere while traveling overseas and learning about Japanese culture.

The EAGLE Japan program is an eight week summer study in one of three cities in Japan that combines classroom work with corporate visits to give students work experience and an intensive study of the language and culture. The program chooses students from Madison and 14 other universities around the United States based on applications and date of graduation. Students are required to have finished their undergraduate degrees in engineering or an engineering related field with one year of required Japanese language studies before they can participate in this program. The EAGLE program completely covers the cost of travel to and from Japan, room and board and instruction in Japan. Each participant pays $1500 for the American intensive course that prepares students before departure to Japan.

The Engineering Leadership Program is a five year program that includes 3-4 years of engineering and Japanese class work in Madison, and then a study in Japan at a university in Kyoto, Tokyo, or Hokkaido. Thomas Chapman, director of this program, says most students study in Madison until January of their senior year, then go to Japan to intern at a Japanese company before their studies begin in March. Corporate sponsors pay for the students to travel to Japan and employ them as interns, offering them an incredible opportunity to gain experience and business contacts for future employment. Chapman says the majority of the alumni from this program get jobs with international companies that work with or in Japan.

Photo courtesy of Denise Lattos

Denise Lattos, an electrical engineering student at UW-Madison, spent a summer conducting research at the Tokyo Institute of Technology.

Experience in Japan

Denise Lattos, who recently returned from a summer in Japan, is the only woman to go to Japan through the Leadership program. GE Medical Systems sponsored her while she studied at the Tokyo Institute of Technology for three months. She was part of an electrical engineering research team that was studying artificial odor sensing (teaching a computer to smell). Weekly seminars in which American students gave talks on their research and laboratory time took up the bulk of Lattos' time. Each student had to give a talk once a month, all in Japanese, and discuss the books and background materials they were reading. Lattos also took a large number of factory tours in Tokyo and saw various portions of the corporate sector.

The most positive thing Lattos has to say about the program is its flexibility. She was given her choice of location and research topics, and was able to live in a dorm for foreign students only. Although she did not like Tokyo as much as the smaller towns and villages she visited, Lattos did appreciate the camaraderie she found in the dorms and enjoyed meeting people from all over the world. She feels other students can benefit from this program by learning to live and interact in this unique culture.

Lattos says she learned a lot about herself in Japan and feels her experiences were most affected by the vast cultural differences. She realized that group peer pressure plays a major role in Japanese society; there is an *expectation* that everyone conforms and follows the group's activities. This attitude leads to a more controlled, less violent society that easily adapts to change. She found that to be a problem in that the group atmosphere also suppresses individualism. Lattos also felt a different sense of respect after studying in Japan. She now has more respect for the educational facilities we have here and for the American habits and traditions that are so different from Japanese culture. She notes, "You begin to question things," like challenging authority, an action considered taboo in Japan. The role women play in Japanese society was also difficult for Lattos. She observes, "They're considered second class citizens," which is a tough thing to overcome for an American woman working towards a successful career in engineering. ■

AUTHOR

Sarah Stephenson is a fifth year senior studying Environmental Engineering and Technical Communications. She enjoys outdoors activities, especially running, camping, skiing, adn SCUBA diving. She recently returned from Australia, where she did a 6-week field study in rainforest ecology.

Engineering Week in the Making

Polygon, the engineering student government, is off to another exciting start. Plans for next semester's Engineering Week have been progressing well. The theme will be Dilbert Days, in honor of the Scott Adams comic strip character. E-week will be held February 20-26, and all student groups are invited to participate.

Engineering Briefs

by Sue Leisses, Alyssa Hunt and Willie Keller

Mechanical Engineering Offers New Course

Beginning in fall, 1994, a new computer since course will be available for engineering students. Problems Solving Using Computers (CS 310) introduces engineering undergraduates to base programming skills and simple numerical method. As more students emerge from high school with basic (or advanced) computer skills, the need for introductory courses wanes. CS 310 is designed to combine the most important topics in CS 302 and CS312. The latter courses are currently required for a Mechanical Engineering major; the new course will replace that requirement. Problem Solving Using Computers was originally requested by the Mechanical Engineering Department as part of a plan to streamline the number of credits needed for a Mechanical Engineering major.

Areas covered in the new course include introduction to computer and analytical skills, elementary Fortran and C programming and instruction on spreadsheets, symbolic manipulation and software packages. The main objectives of the course are to introduce the use of algorithms, and to instruct students about using these tools to solve engineering-related problems.

The course, designed by Professor John Strickwerda, is worth three credits. Prerequisites include a basic knowledge of Fortran, C, or Pascal and Math 222.

New CAE 'Puters!

CAE purchased 13 new Pentium computers last semester for you engineers who are ready for the big leagues. Currently, 300+ level courses are using them for Auto CAD labs but everyone has access to them in 346 ME when there are no classes in the room. The Pentiums are much faster than MS-DOS and feature a window environment.

The CAE is also excited about the new Model Advanced Facility (MAF) in room 187 CAE. High end, powerful work stations have been set up and a scanner and color printer are expected to join the stations sometime second semester. Not only is new hardware being added, but the CAE also got a hold of some speedy software. Condor software will be installed on Unix computers to help you get your homework finished in a jiffy. Todd Tannenbaum is your man if you need specific information about these big-time 'puters. He knows drive sizes and other useful stuff. Give him a call at 262-3118.

Have you heard? The CAE has made the Unix workstations in room 356 and 352 ME open to everyone when classes are not using them. Take a walk on the wild side and check out these HP Risk Stations.

New Polygon Officers Elected

New elections have been held for spring positions. The vice-president for Career Connections is Melissa Kumlien. The new secretary is Jennifer Hirshey. The Spring Banquet Chair is Eric Ellison. The Publicity Director is Stephanie Mucker. The Pre-Engineering Relations Director is Deanna Schmidt.

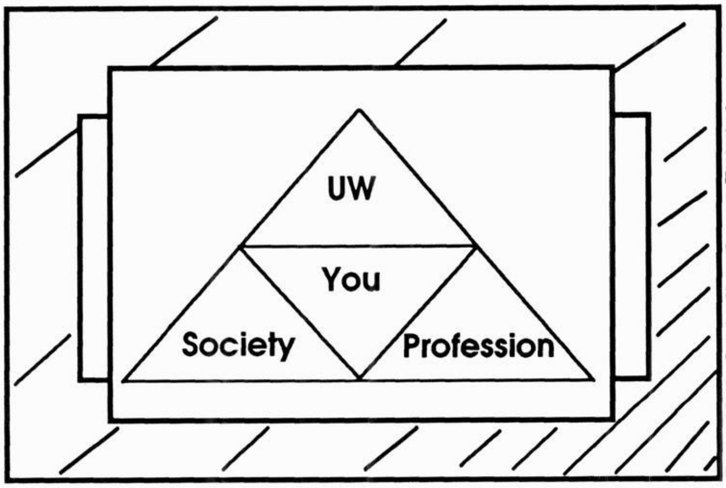
Polygon Activities

Other Polygon activities include a Fall Luncheon for graduating seniors, the Fall blood drive, a survey for Teaching Assistants (possibly including a new system of training and feedback), and an announcement of a creativity contest to be held in February, 1995 with $10,000 in prizes.

NGINEERING BRIEFS ENGINEERING BRIEFS ENGINEERING BRIEFS

Technical Communication Internships:

Experiencing the Future



Design idea by Sandra Shaw Courter, Technical Communication Certificate Director

This design explains the relations between the intern, the university and the public.

Almost all of us would like to know what our futures holds. Though few of us are fortune tellers, there are other ways of peeking into what lies ahead. Internships provide excellent opportunities for students to explore potential careers.

The Technical Communication Internship (TCI), offered through the Department of Engineering Professional Development, allows students to gain insight about possible careers in engineering and technical writing professions.

As part of the Technical Communication Certificate (TCC), the internship requires students to work part-time, usually five hours per week, for one semester on a communication project for a local company sponsor.

In addition to gaining valuable field experience, the students participating in the TCI program also meet every other week to discuss work-related topics. Some topics they discuss include ethics in the workplace, how to deliver effective presentations and how to work under deadline pressures. Bonnie Schmidt, coordinator for the TCI program, said that the meetings also act as a support group for the interns in which they can share their work experiences with each other.

Engineering students are not the only students involved in the technical communication certificate and internship programs. "A variety of students with majors such as English or journalism also participate in the programs," says Schmidt. "We can pair students with sponsors who need either general writers or writers who have extensive technical backgrounds."

To ensure that all interns have some technical background before the internship begins, the TCC curriculum requires all students to take courses in computer science, mathematics or statistics, and management, business or economics.

During the internship, students work on technical communication projects that vary depending upon the sponsor company.

Past interns have written operator and maintenance manuals for Ohmeda, a manufacturer of anesthetic equipment in Madison, written software documentation for various software companies, and written newsletters for sponsors including UW-Madison Physical Sciences Laboratory in Stoughton.

Schmidt explains that students who write operator and maintenance manuals for companies like Ohmeda are often engineering majors with well developed technical backgrounds because they write for an audience that understands technical terminology. On the other hand, students majoring in journalism or English often write materials such as newsletters to inform the public about the sponsor and its projects. Schmidt adds that even when students write for a general audience, they still must be able to interpret some technological goals of the company and produce information that the public can understand.

Russell Hall, a 1986 graduate from the journalism school, returned to complete the Technical Communications Certificate and interned last spring with the USDA Forest Products Laboratory . Although his main interest is writing software documentation, Hall wrote press releases, technical summaries and a pro-

In a world of uncertainty about career options, an internship can provide a glimpse into the future – and a career in technical communication

posal for an annual report during his internship. "Overall, the internship is a great program," he says. Giving credit to Schmidt for the success of the program, Hall notes, "Bonnie is very organized and does a good job finding sponsors for everyone who is interested." Since students can repeat the internship for additional credit, Hall hopes to intern again this year with a sponsor that can provide him with professional experience in writing software documentation.

Mariah Steele, an English major, is currently an intern at Meriter Hospitals in Madison. As part of a hospital study, Steele conducts interviews with patients and distributes staff questionnaires concerning noise levels within the hospital. The internship program interested Steele because, "Frankly, the career options in English are limited. The internship is an opportunity to expand those options." Steele also said that in addition to learning about technical communication, the internship, "Is a good lesson in working with many people who have different priorities...it has given me a good view of what it's like to try to coordinate a bunch of different schedules."

The internships benefit both the students and the sponsors. "The companies are delighted to get students who are interested in communicating clearly, which is very important in a technical world," explains Schmidt. "Through the internships, the companies get skilled assistance and the students get professional guidance and instruction."

In a world of uncertainty about career options, an internship can provide a glimpse into the future—and lead to a career in technical communication. ■

Photo courtesy of Bonnie Schmidt

Russell Hall will be interning at a software documentation company.

AUTHOR

Wendy Shimshak is a junior majoring in journalism and aspires to be a Pulitzer Prize winning journalist!

Editorial continued from page 2

how do you change a male-dominated institution that has its roots deeply embedded in history? And how do you answer this question, which women have been wondering about for years?

It is, I think, an easier task than many suspect. Education, as a first step towards awareness which is the first step toward change can be fairly simple. I learned from Marguerite Holloway just how few women there are in science and related fields, and I hope a few people learned this from me. As more programs and organizations are developed to encourage women to acquire and keep interests in science, and more people learn about and accept what women have to offer science and related fields, the climate change I mentioned above will naturally happen. But we must keep working to increase awareness, and we must keep educating. Especially our little girls.

Dean's Corner continued from page 3

I receive many questions about the job market. Employment statistics do not tell the entire story. Regardless of the employment environment, people with greater intellectual/professional net worth find jobs sooner, receive higher salaries, have more options to select from. The items I have outlined on the balance sheet are typical of issues which are asked by employers in reviewing candidates for employment. It is essential to start assessing your net worth as soon as possible. If you wait until you fill out your resume and start interviewing to carry out the assessment, it will be too late to implement meaningful improvements.

MULTIMEDIA

Computers as Part of Our Daily Lives

Imagine yourself returning home from class and saying, "Computer, let's finish that Physics problem we were working on!"

After your computer turns itself on and accesses the homework you did not finish yesterday, it asks you, "Would you like to see problem three, where we left off last night?"

After you respond with a quick "Yes," the computer monitor displays problem three from your physics text, a graph charting your progress in class, and a message from your Teaching Assistant — all before you even sit down.

After listening to the computer read the problem out loud, you respond, "Computer, please bring up whichever reference materials at the Engineering Library best explain the term vector. Oh, I'd also like to send a video message to my Physics TA to explain the fluctuations in my four dimensional graph."

Not only does current technology allow for this scenario to be reality, but the price of adding these features to your personal computer is decreasing every year.

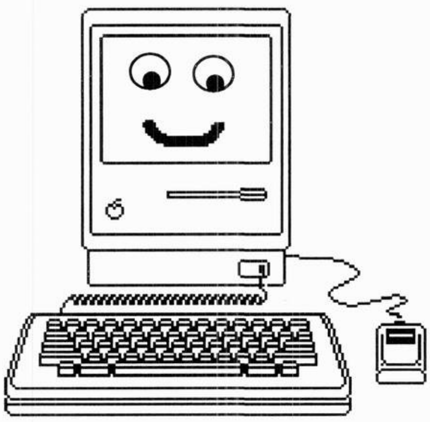
In an attempt to keep up with breakneck advancements in computer technology, the College of Engineering is offering a new course to help students develop their skills in technical communication and presentations techniques.

Engineering Professional Development 690, officially called "Special Topics in Technical Communication," offers students the chance to experiment with new software and computers that integrate video, text, graphics, telecommunications, voice commands and graphical user interfaces. The ability to manipulate these different sources of media through the computer is called multimedia.

Gisela Kutzbach and Paul Ross teach the three credit course, which covers multimedia topics such as on-line presentations, interactive instructions and procedures, usability testing and screen design.

The class will allow students to focus on subjects that they are particularly interested in. Students can work at their own pace using a variety of materials including computer based tutorials and projects. Most of the course work will be done in the new EPD multimedia computer lab, which is equipped with $60,000 worth of IBM hardware.

The new course was created when



In the future, your personal computer could become your best study buddy.

the College of Engineering, in conjunction with the School of Business and the Office of Quality, earned a five year, one million dollar Partnership Award from IBM. The award focused on improving education through quality management techniques.

Under the terms of the grant, EPD faculty and students will develop and produce communication modules on graphics, presentations, and other technical communication topics. These modules include written material, videos, and interactive computer applications. In addition, EPD faculty will help students learn to use the new multimedia computers and to develop usability testing procedures.

A particular issue addressed in EPD 690 is the inherent problems of trying to communicate information about computers through oversized and seldom-read manuals. Fortunately, some brave writers have ventured into the world of electronic communication, and are trying to bypass paper and the written word altogether.

What began as a few help screens on a computer has become a stream of multimedia help systems. Most major software packages now include instructions that you can view on the monitor in the form of a help window that appears on top of the current screen you're working on (called context-sensitive help). Some packages even include video tutorials.

Students can expect the skills and experience which they acquire in this class to be applicable to many different occupations and fields of study. Ross sees a growing need for these kinds of abilities in industry and education. The free-form nature of EPD 690 will teach students to use multimedia to become well-rounded problem solvers, a quality that is needed in the field of technical communication.

The once slow growth of multimedia is now emerging into a tidal wave of information available at your fingertips. Classes such as EPD 690 keep university students on the cutting edge of multimedia usage. The future holds even greater promises of computers that respond to voice commands and interact with us to access information and help solve many of our problems.

AUTHOR

Tony Wolfram is back with the Wisconsin Engineer while working for a degree in Industrial Engineering. This will be his second degree from UW - Madison. Tony worked with the Wisconsin Engineer in what we call "the old days" of Don Woolston, Amy Damrow, and the rest of the gang.

Co-Combustion:

Meeting New Needs with Old Fuels

Picture if you will: A future which meets our environmental needs. A future in which foreign dependence on oil is reduced tremendously. A future where longer-lived power plants are a reality.

Co-combustion, the process of burning two fuels simultaneously, could lead to such a future because it offers many advantages over conventional power generation. Dr. Alex Green, Director of the Clean Combustion Technology Laboratory at the University of Florida, Gainesville, is advocating further research into the area of co-combustion technology. "There is a considerable need to develop technologies for retrofitting boilers and furnaces for firing alternative fuels or co-firing two or more domestically available fuels," he notes.

Co-combustion can be a substitute for burning oil in these processes, thereby greatly reducing our country's need for oil

There are three basic fuel combinations that facilitate co-combustion. The options are firing coal with refuse-derived fuel in municipal utility plants, firing natural gas in coal-fired boilers and firing biomass with coal. Biomass encompasses any combination of wood, wood waste, agricultural waste, municipal solid waste, sewage sludge and cellulosic industrial waste.

Co-combustion works by burning two fuels in the same burner at the same time, where one fuel burns at a higher temperature than the other. This hotter environment forces complete combustion, which eliminates many of the toxic byproducts created when the burning is incomplete. For example, the higher burning temperature of natural gas forces coal to burn more completely, thus reducing harmful emissions of dangerous gases such as sulfur dioxide (SO_2) and nitrogen oxide (NO_x). These emissions are much greater in an ordinary coal-fired power plant.

The relative abundance of coal, biomass, and natural gas compared to oil in the United States is one key to the co-combustion idea. The United States produces thirty-two percent more coal than it uses and has found significant reserves of natural gas. Currently, thirty percent of the oil imported by the United States is used for industrial purposes. Co-combustion can be a substitute for burning oil in these processes, thereby greatly reducing our country's need for oil. Since over fifty percent of the oil used in the United States is imported, a reduction in this amount would be a tremendous financial asset. Furthermore, most estimates say that the world's oil supply will run out during the middle of the next century. Using co-combustion as an alternative for oil prepares us for this grim possibility.

The co-combustion philosophy fits well into the current economic situation. The shortage of capital funds has and will continue to restrict the amount of new machinery industries purchase. Conversion to co-combustion would extend the life of many current boiler systems, as well as improve performance and help reduce the environmental problems caused by conventional fossil fuel power plants. This would also help decrease the need to replace many base load power generation plants in the next twenty years as they wear out or become inefficient.

Green warns, "Co-combustion technology is still in the early stages of development and to a large extent its specifics are dictated by the available fuels. With the continued low price of oil and natural gas, there is little direct economic incentive to replace oil by co-combustion technology. Thus, in addition to public policy driven by national interests, technology advancements will also have a major influence upon future energy policy."

Co-combustion is not perfect. Many details and fine points still need to be developed and worked out. Full-scale use of this technology will probably not be available until early in the next decade. However, if funding improves and government and industry express greater interest in co-combustion, such problems could be solved before the end of this decade.

Co-combustion alone can make a big difference in future energy policy, but more

Thus, in addition to public policy driven by national interests, technology advancements will also have a major influence upon future energy policy
-Dr. Alex Green

needs to be done. Increasing conservation and efficiency should also help ease the energy crunch. Other options include the increasing the use of nuclear, solar, wind, geothermal and hydrothermal energy. Both short and long range research in many of these areas should be continued and expanded by the Federal Government. The United States will not be able to import oil from foreign sources forever, and a bit of foresight could reduce many problems in the future.

1992 Overview of Energy Consumption and Production

	Oil	Coal	Gas	Nclr.	Hydro
Consumption					
quads	33.4	18.9	20.3	6.6	2.8
%	41.5	22.9	24.6	8.0	3.4
Produced					
quads	15.2	21.6	20.6	6.6	2.5

Our use of oil greatly exceeds our production, creating a need for importing foreign oil. Our use of coal and natural gas is very close to our production levels.

AUTHOR

Willie Keller is a third year Nuclear Engineer. He keeps busy by playing college bowl and operating UW's nuclear reactor.

International Engineering Programs:

A Gateway to Adventure

The tenth floor of the Engineering Research Buildings is always buzzing with activity. People from every corner of the world float in and out of the friendly offices, discussing future plans and sharing stories about past experiences. Faculty, graduate and undergraduate students pass through the doors, stepping into a plethora of opportunities for travel and learning. The ERB's tenth floor is home to International Engineering Programs (IEP), a department within the College of Engineering that is the gateway to an adventure in another country, culture and language.

IEP is a resource center for engineers who want to gain an international perspective first hand. The office helps to arrange learning experiences at leading universities and corporations around the world. Students and faculty have travelled all over the world, studying and teaching at renowned institutions and working for top industries.

Many find that they think about the world in a new way after mastering a new language, understanding foreign customs and acclimating themselves to lifestyles that are very different from the American way of life. Four UW students traveled to Japan last summer to study Japanese language through a program called EAGLE. The EAGLE intensive language program prepares students for industrial internships in Japan. EAGLE participant Joe Skidmore says he is glad he immersed himself in another culture. "The thing that I noticed the most was how my perception of what is 'normal' was challenged so quickly when we arrived. Initially I thought 'Wow, that's weird' when I encountered something that was different in Japan. But before I left, I had gotten used to seeing things that I had never considered being different in another country. I got used to seeing only Japanese-made cars on the street, people whose hair was all the same color on the sidewalks, and bikes on the left side of the road. There are some things that I still think are strange, but now I see them as just another way to do things." Skidmore jokes that learning new skills abroad can be fun back in the States. "I can eat corn on the cob with chopsticks now!" he laughs.

Last year Paul LeMahieu, an ECE major, travelled to France through two separate IEP programs. He worked at an industrial summer internship in Rouen, a city perched on the banks of the Seine in northern France. He also studied for a year at Ecole Centrale-Paris, an engineering school just outside of Paris. While abroad, LeMahieu attended the International Student Festivals in Trondheim, an international student convention that gathers in Norway every other year to promote understanding of other cultures and views. He met people from all backgrounds and nationalities in the seminars and then toured Europe and India for a

Photo courtesy of Laura Skibba

Laura Skibba, an IE, participated in the 1993 Nancy Summer Program in France. Nancy has beautiful business districts and sidewalk cafés snuggled into the shadow of the city's Arc de Triomphe.

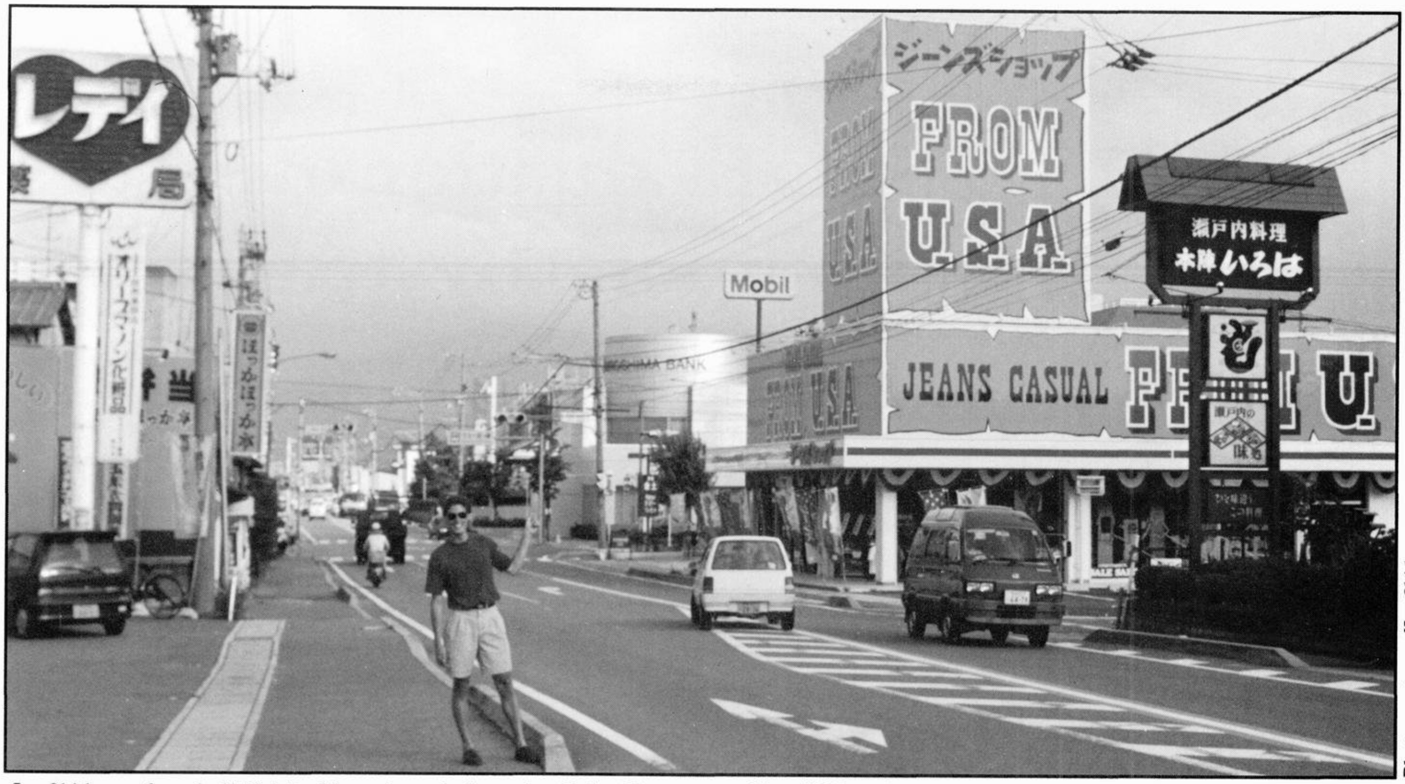


Photo courtesy of Joe Skidmore

Joe Skidmore found a little bit of Americana in Japan last July. He was one of four UW engineers to take part in a Japanese language program offered by International Engineering Programs.

month afterwards. "I did the classic Eurrail thing after school and then flew to India for a month. It takes a while to get used to things," LeMahieu confides. A year later, his voice still rings with excitement when he recalls his time overseas.

One opportunity that is unique to UW-Madison is the UW/Japan Leadership Program. Students are selected and sponsored by international companies such as Kodak, GE Medical Systems, Emerson Electric, Johnson Controls and Xerox. They take courses in Japanese language and culture along with their engineering curriculum at UW-Madison. During the participants' senior year, they take classes at a Japanese university and may opt for an internship at a Japanese company.

Professor Thomas W. Chapman, Associate Dean of International Engineering Programs and a chemical engineering professor, says experiences abroad are invaluable for engineers. "Today we see many of our alumni getting involved in international activities, either on assignment abroad or collaborating with foreign associates in multinational ventures, and we expect this trend to continue. Therefore, developing cultural awareness and foreign language ability, flexibility and communication skills is critical to future professional success," says Chapman.

This school year engineering students are studying in Germany, France, England, Israel, Mexico and Japan. A unique aspect of IEP's approach to international experiences is that every program is individualized for each students interests, time constraints, graduation requirements, skills and budget. One woman planned to take engineering classes in Israel for a semester, then spend time touring Europe with a friend on her way back home. Students in Japan experience both university life and industrial internships, as well a a chance to travel in Asia.

IEP assists international students and faculty coming to UW-Madison for a semester or longer through the College's exchange agreements. Every year engineers from well-known engineering schools in Germany, Mexico, Japan and Taiwan, to name only a few, rely on IEP to help with housing arrangements, academic and financial concerns and as a friendly place to stop for a reassuring smile.

IEP is also responsible for coordinating the London Summer Lab for chemical engineering students. To fulfill department requirements chemical engineers must take a laboratory-intensive class, offered during summer sessions, before they can graduate. Many years ago, a professor dreamed up the concept of pairing an international experience with this lab requirement. This idea became a program known as the London Lab where chemical engineering majors join students from six other American universities at University College London for a 5-week lab class. Planned excursions take participants to landmarks such as Buckingham Palace, St. Paul's Cathedral, Roman ruins, into a coal mine and through industrial chemical plants. Between classes, excursions and industrial visits, students find many chances to enjoy quality beverages in the small, quaint pubs that appear on nearly every corner.

IEP can make a travel experience rewarding beyond belief, and will help create almost any study or work program imaginable. If you would like to expand your horizons and career opportunities, walk to the end of the hall on the ERB's tenth floor and step through the gateway to adventure. ■

-Written by Alyssa Hunt

Caldwell Leads Evaluation of State's New Computer System

Assistant Professor of Industrial Engineering Barrett S. Caldwell is leading UW-Madison's evaluation of the sociotechnical impact of the Kids Information Data System (KIDS). KIDS is a statewide computer network which, once implemented in October 1995, will be used to help enforce child support payments.

According to a 1993 informational paper by the Legislative Fiscal Bureau, one responsibility of the state Bureau of Child Support is "developing and maintaining a statewide automated child support data system." KIDS is designed to meet this goal. By cross referencing information about child support offenders with information kept by the Department of Motor Vehicles, the Department of Revenue and other government agencies, enforcement of child support payments can be made much more effective.

The Bureau of Child Support 'flags' names of parents who owe child support. These flags will be relayed to computer systems at other participating government agencies. Should a delinquent parent's name come up, perhaps when he or she is trying to renew a driver's license or receive a tax return, the agency can refuse to complete the transaction. For example, the tax refunds of parents owing child support may be directed towards their debt.

The challenge that KIDS presents is to integrate a brand new computer system into the administration of Wisconsin's county governments. According to Caldwell, "The elegant solution is the seamless integration of technology into peoples' work lives, to improve quality and amount of work they do."

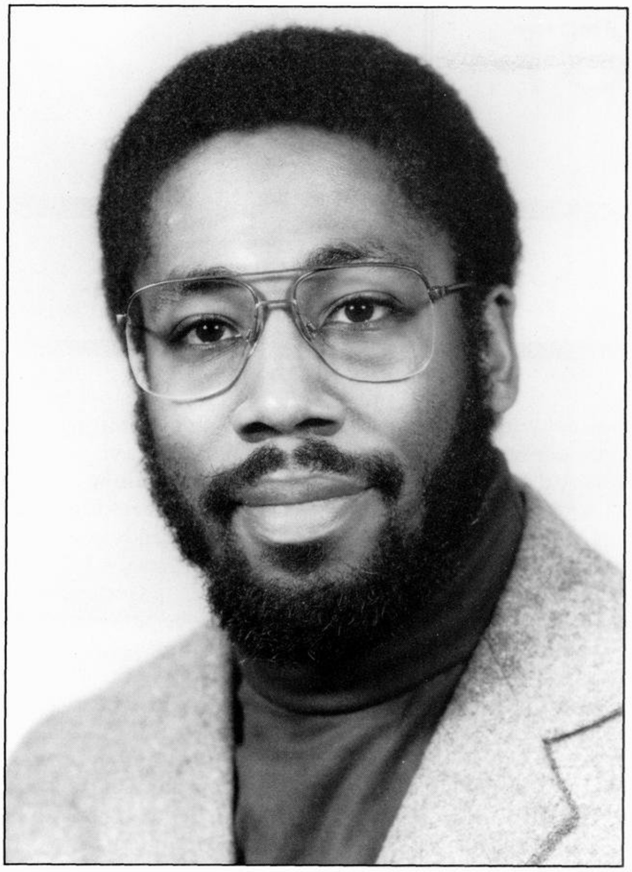
UW-Madison and Caldwell's goal, is to smooth the implementation of the KIDS system. They hope to achieve this by evaluating ergonomics and attitudes towards computers in different county offices of various sizes, and using their findings as a guideline for suggestions on how to make the transitions easier on employees.

The elegant solution, is the seemless integration of technology into peoples' work lives, to improve quality and amount of work they do
-Barrett Caldwell

Ergonomics is the study of the effects of space and movement on work efficiency. It is easy to overlook the influence that office design has on efficiency. "Just the physical placement of the aspects of the workstation have effects in and of themselves," noted Caldwell. He explained that work can be made more efficient by combining useful work with movement and a well designed work station. Too much of any activity, especially one which demands that the worker sit in one place, causes fatigue and a decrease over time in the amount of work an employee can achieve. Sitting and typing at a computer terminal, for example, can cause wrist fatigue and eye strain. A worker can be more effective for longer periods of time by alternating typing with an activity that involves some movement, such as filing. Workstation design can be improved by locating frequently used items where they are easiest for a worker to reach.

Caldwell and the students working with him will also evaluate overall office flow, which involves studying how job tasks are currently divided and how the KIDS program will change the distribution of certain tasks. Some paperwork will be eliminated, and new tasks that demand interaction with computers will be created. These jobs may consume very different amounts of time and thought from their predecessors, and in order to keep these amounts balanced, the same people may divide the tasks differently.

The anxiety that comes with the new computer system will also be a major focus of the study. "More computerization breeds fear of loss of jobs," commented Caldwell. "Deskilling of jobs is a concern." He explained that workers wonder, 'Will I lose my job? Will my coworkers lose their jobs? Will the computer be doing everything for me?'



Assistant Professor Barrett S. Caldwell is heading UW-Madisons sociotechnical study of the effects of a new computer system.

Caldwell further explained that many of the offices being evaluated have little or no automation, and those that do have computer systems will be upgrading from systems manufactured in the 1970's or 1980's.

According to Caldwell, another concern of workers is that human errors are more likely to get caught. Workers may feel that the state is looking over their shoulder because if they make a mistake, it is recorded on the computer system. Therefore, it is easier to trace it back to its source. Caldwell said dealing with these attitudes is a major issue because the success of the system depends heavily on the cooperation of the government employees, who have the power to help the system run smoothly or slowly and shakily.

Since Caldwell is the only faculty member involved in the KIDS evaluation project, two or three graduate students and three undergraduates are being enlisted to help with the project. The undergraduate students work through the UW-Madison Technical Communications Department to write up reports about the evaluations. These reports are considered to be one of the most important parts of the evaluations because they will be used as a reference for improvement by the state and counties. "The success of these reports will drive the way the project is perceived because that's what people see," stressed Caldwell.

The major reason why I'm doing this is to help county level staffs improve their transitions and minimize the problem. Part of my research approach is to do things that help people
-Barrett Caldwell

This feedback from the evaluation makes this project more than pure research. It fits in with Caldwell's overall goal, which is to use engineering to help people. "There have been a couple of confusions. One is the idea that the University doesn't do research that benefits the people in the state. That concept bothers me. Sometimes we don't do a good job explaining what we do. The major reason why I'm doing this is to help county level staff improve their transitions and minimize the problem. Part of my research approach is to do things that help people."

And so, the source of this project is traced back to a concern for people. Caldwell and the students working with him are helping solve problems outside the scope of UW-Madison with a refreshing approach to engineering.

AUTHOR

Caitin Howell is a Sophomore majoring in Electrical Engineering. When she's not writing she is looking for someone to play the guitar with, or reading a good book.

The Internet: Plugging Into a

If you have access to a computer, you may have access to an information source of incredible speed and power. If you can get access to the Internet, you will have access to a fantastic computer network whose fingers reach all over the world. Across the Internet you can have instantaneous communication, almost infinite information, and resources to fulfill your intellect and amusement. If you are interested in what goes on within the Internet, read on.

What is the Internet?

The Internet can be described as the world's largest computer network. The computers on the Internet share resources by communicating through a circulatory system of special high-speed and regular phone lines. The Internet owes it's incredible size to the fact that it is actually the merging of many smaller networks.

Before there was the Internet, the U.S. Defense Department developed ARPAnet. ARPAnet was a computer network designed to convey information over long distances. The designers of ARPAnet were trying to create a network that would successfully deliver information even in case of a partial network failure. To insure delivery of information, the developers of ARPAnet developed a reliable protocol, a standardized method that computers use to communicate. ARPAnet created Internet protocol. Inherent in Internet Protocol was an addressing system. This system insured that no matter how far the information was separated from it's source, it would not lose track of it's destination.

ARPAnet formed the base of the Internet as other organizations connected to ARPAnet to take advantage of a reliable protocol.

When local area networks became popular about ten years ago, the Internet became more accessible and more complicated. Local area networks (LAN's) are short range computer networks that share file servers and other resources, like printers. A server is a computer that stores programs, information, or other files that users connect to to use these files. Universities, government agencies, and other organizations that used local area networks connected their networks to the Internet. These smaller networks connected the Internet to a wealth of information and resources.

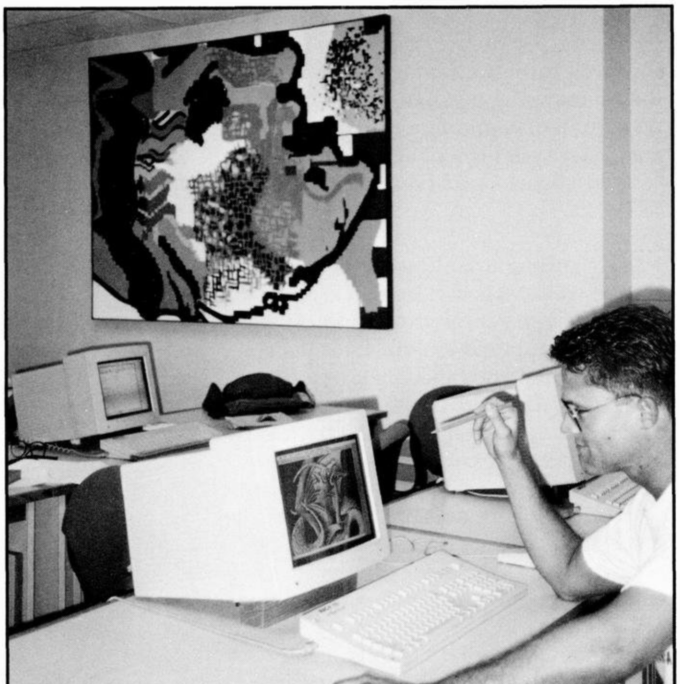
Why should you care about the Internet?

The Internet has a lot to offer. Information is its most abundant commodity. This includes news stories, instructional guides, and information on more topics than many libraries have available. The Internet provides a forum for discussion of news and topics of general interest, Usenet. The Internet also offers the power of communication. The Internet is a means of electronic mail as well as live-time conversation. It also offers computer files. These are not limited to technical subjects. They include graphics, text files, and programs. There are computer virus vaccines, educational programs, and even games available.

This article is intended as an Internet launch pad. The most difficult thing about using the Internet is getting started. As you become involved in the Internet, you will find that there are many helpful resources within the Internet to guide your use.

Getting access

You may be able to get a direct link to Internet through a local area network at your school or business. If you must forge your own connection, there are a few different levels of access available. Dedicated Internet access is the fastest, most complete, and most expensive access available. Usually it is used only by large corporations and organizations. SLIP(Serial Line Internet Protocol) and PPP(Point to Point Protocol) are less expensive options for Internet access. SLIP



A student accesses computer graphics over the Internet in CAE.

World of Resources

and PPP are similar levels of access, but PPP is slightly newer and faster. Unlike dedicated access, which consumes a full-time phone line, SLIP and PPP occupy the phone line at the user's convenience. SLIP and PPP give the user direct access to the Internet.

Finally, there is dial-up access. Dial-up access requires the user to get an account on a computer that has dedicated access. Then, over the phone line, the user uses a modem to 'dial-up' and connect to the account. This type of access is the least expensive, but it has a drawback. Unlike SLIP and PPP, with which the user's computer is a part of the Internet, the user works through an account. The organization that owns the computer providing the user's account may restrict the user's access as it sees fit.

In Wisconsin, WiscNet is a provider of all of these types of access, dedicated, and limited SLIP, PPP, and dial-up access. The WiscNet Office is located at 1210 Dayton Street, Madison, WI 53706. It can also be reached by phone or electronic mail at 608-262-8874 or dorl@macc.wisc.edu, respectively.

Basic Internet Services

Communications: email and other options

Internet is the world's most far-reaching electronic mail carrier. Electronic mail, or email, is analogous to conventional mail. Written messages are sent between Internet users. Individual email programs vary between computers, even between different UNIX machines, so for instructions it is best to consult the provider of the Internet connection or a manual for the software being used.

Email users have email addresses of the form *user's name@place name*. The user's name will be a login name, an alias given to the user by the organization that owns the mail server. The place refers to the name and location of the mail server. Most UW-Madison students have an email address something like *cthowell@students.wisc.edu*. 'Cthowell' is a login name based on the student's name. Some login names are randomly assigned, or contain letters and digits. 'Students' is the name of the email server. 'Wisc' means that it is a part of the University of Wisconsin. 'Edu,' which ends email addresses at most American universities, means that it is a part of an educational institution.

Some servers on the Internet also support 'talk,' a program analogous to a phone conversation. One user rings another user on the Internet. If the receiver of the call is logged into a computer, that user can accept the call. Then, the users engage in a real-time written conversation. There is another chat forum which is analogous to a telephone party-line Internet Relay Chat, or IRC is a live time discussion forum, which allows many users to communicate at the same time. Because it consumes a large amount of resources, Internet Relay Chat is not very widely used.

Logging in: Telnet

In order to use Internet's resources, the user has to establish a connection with a computer or server that has those resources. Telnet is a widely used method of making this connection.

Telnet is another Internet communications protocol. This protocol establishes an almost instantaneous link between your terminal and a remote machine, "as if your keyboard is connected directly to that remote computer," according to Ed Krol in his manual, the Whole Internet User's Guide and Catalog.

To Telnet to another machine where the user has an account, the user would type:

telnet *machine name*
(or)
telnet
open *machine name*

At this point, the user might be prompted for a login name and a password. The user would have previously received the login name and password from the organization that gave the user the account on the remote computer.

In the second example, when the user types 'telnet', the program first goes into Telnet command mode. On most UNIX systems, the command line prompt will become 'telnet>'. If the user types a question mark at this prompt, a list of Telnet commands will appear on the screen, including 'open' and 'quit', which quits command mode. This question mark feature is a built-in help feature of many programs used on the Internet.

Telnet provides a flexible means for the Internet to offer access to many services, including bulletin board systems, Internet Relay Chat, and library databases.

Sifting through the archives: ftp

The files available on the Internet cover an ever-increasing range of topics and run on a widening scope of operating systems. Internet file archive sites warehouse programs that run on DOS, Amiga, Macintosh, NeXTSTEP, and UNIX machines. Some graphics and text files come in formats that are usable by almost all operating systems, like the 'gif' graphics format and ASCII text files. However, the fascinating part of the archives is the files contained in them. Not only are there vivid digitized pictures and text files containing recipes and guitar chords, but playable samples of music, adventure games, and entertaining educational programs. One method of retrieving these files these is ftp, which stands for file transfer protocol. File transfer protocol is the name of a set of communication standards as well as specific software used on some computers. Most local area network servers on the Internet only give access to a user with an account on the server. To give people without accounts access to the archived files, anonymous ftp was created. With anonymous ftp, a Madison Internet user can access files on servers in California, Missouri, Finland, or Japan (or anywhere else that there is an anonymous ftp server, for that matter) without having accounts on those servers.

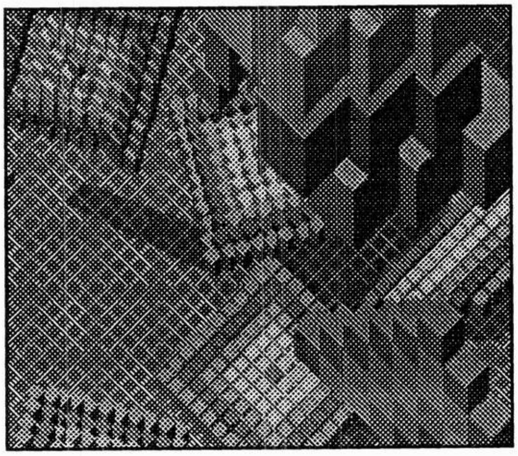
Performing anonymous ftp in the UNIX environment is fairly simple. To open a connection to an ftp server, the user types 'ftp *name or address of site*'. *The* remote server will prompt for a login name. The user types 'anonymous.' Then the remote server will prompt for a password. Here, the user types her or his email address. At many ftp sites, the email addresses are recorded for statistical purposes, to improve service for the users.

Once connected to the ftp site, the user can enter the public access file directory, usually named 'pub' and peruse the files. The change directory and list directory commands, 'cd' and 'ls', are the same as they are in the user's non-ftp UNIX environment. Before transferring any files, the user types the command 'binary' to insure that the transfer is made in binary mode. If the user skips this command, the files may be transferred in either binary or ASCII mode. ASCII mode generally simplifies binary files during the transfer and corrupts them, rendering them unusable. When the user locates a desirable file, she types 'get *file*' where 'file' is the name of a specific file. This command sends a copy of the file to the user's account on their local machine.

A problem presents itself when a user is faced with such vast file resources: How does the user find a specific file or kind of file, when it might be in any archive server in the world? The most commonly used tool to find archive files is Archie. Several servers on the Internet run Archie, which is a huge computer database program of descriptions of the files stored at ftp sites. One of the easiest ways to use Archie is through the Internet Gopher.

The Easy Way: Gopher

One of the methods of accessing the resources available through the Internet is by using the Internet Gopher. The Internet Gopher is a user-friendly program used to access other programs and resources. By typing 'gopher' at the command line prompt, the user activates a menu of resources. Most telnet resources and some ftp resources are organized under Gopher's menu format. Gopher is an easy way to use databases like Archie and phone books and to read daily news stories. Because it is menu-driven, Gopher is largely self-explanatory once the program is activated.



Intelligent Conversation: Usenet

Usenet is the Internet's forum for news and discussion. Formally, *Zen and the Art of Internet* defines Usenet as "the set of machines that exchange articles tagged with one or more universally recognized labels, called Newsgroups."

Newsgroups are the different subject headings of topics discussed on Usenet. Users read and write articles within the Newsgroups. Different Newsgroups are located on different machines throughout the world; there is no single machine that stores all the articles in all the Newsgroups.

There are several thousand Newsgroups on the Usenet, discussing a wide variety of topics. UW-Madison's Internet connection subscribes to everything from alt.activism, which debates politics and political activism, to alt.guitar.tab, which discusses guitar and guitar tablature music, to a whole slew of sports discussion Newsgroups and Newsgroups discussing television and computer technologies.

The are prefixed according to type. prefixed with 'rec', for example, are for discussion that falls under the topic of recreation. The 'alt' in 'alt.activism' indicates, according to Krol, 'alternative ways of looking at things.' Actually, 'alt' and a few other types of are not officially part of Usenet, but that is not usually obvious or important from the user's standpoint.

Usenet is also a sort of society. It has its own etiquette and sense of humor. Experienced Usenet users recommend spending some time reading the Newsgroups and getting a feel for the norms of the society before posting. For more information about the proper way to behave on the Usenet, users can also read the postings in the Newsgroup 'news.announce.newusers.' Larry Nathanson, one experienced user of Usenet, advises that "The most important thing to realize is that the Internet is as much a culture as anything else. It has a different sense of what is good, and what is taboo. So long as you read a group for a while before posting to it, you'll do fine." The Usenet is one of the least censored news and discussion forums in the world today. A few users post to offend, and some sincerely want to express radically different ideas concerning sex, drugs and politics. Jeremiah Blatz, another experienced Usenet user recommends, "Keep an open mind and you can get lots out of the net. If you close up and don't read a Newsgroup because a couple of things on it offended you, you may as well just go home." Free expression is an integral part of the spirit of Usenet.

The UNIX command for reading Usenet Newsgroups is 'rn' or 'nn.' Like telnet, at the Newsgroup prompt, the user can type a question mark for a list of helpful commands.

Taking off into the Internet

The Internet is an environment that encourages self-instruction. Most programs and services have some sort of built in help feature. If an Internet feature described in this article is unclear, it is usually best to try it out. Other users are an excellent source of help. Bill Morton, another Usenet user, suggests that new users "Get a guru. A person to guide you. There are lots of files containing 'guides' to the Internet but they are not as handy as a real life guide." The books used as sources for this article are extremely useful guides, as well. Most of these sources were recommended by Internet users. Good luck taming the Internet frontier, and don't let it intimidate or discourage you. The Internet exists to present you with new possibilities, not impossibilities. There is a place in the Internet for everyone. ■

AUTHOR

Caitlin Howell is a second year student in Electrical and Computer Engineering. She enjoys skiing and is learning how to snowboard.