Wisconsin engineer. Volume 97, No. 4 October 1993

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

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

Vol. 97, No. 4

October 1993

wisconsin engineer

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

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

Michigan State University will hold its **SIXTH ANNUAL MINORITIES IN COMMUNICATION ARTS AND SCIENCES MID-WEST CONFERENCE** on October 21-22, 1993 at its main campus in East Lansing.

The conference is an excellent combination job fair, series of workshops, and career development activities. It brings together recruiters in the field of communication, students, professionals and academicians. The conference provides an outstanding opportunity for students and others to polish career building skills and compete for jobs and internships. Recruiters represent well known corporations, regional firms, and graduate schools. Interviews are one on one and private.

Pre-registration is $10. A check of money order, Michigan State University payable, can be sent to Dr. Lawrence N. Redd, 290 Communication Arts Building, Michigan State University, East Lansing, Michigan. For additional information, please call (517) 355-3410 or fax 336-1244.

The conference is sponsored be the College of Communication Arts and Sciences.

wisconsin engineer

Published by the Students of the University of Wisconsin–Madison, October 1993

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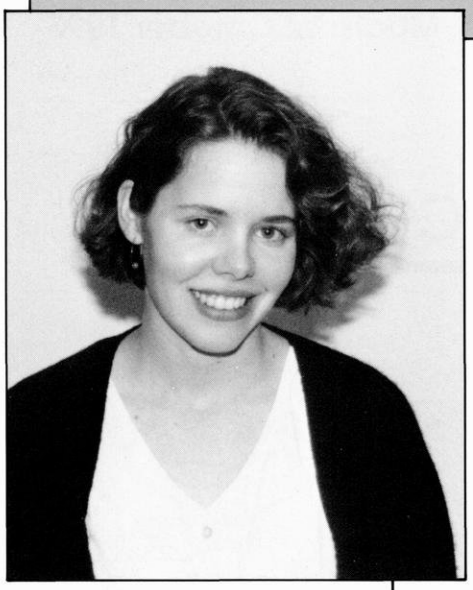
The **wisconsin engineer** magazine, a charter member of the Engineering College Magazines Associated, is published by and for engineering students at UW-Madison. Philosophies and opinions expressed in this magazine do not necessarily reflect those of the College of Engineering. All interested students 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.

Technology and the Environment



Mariah Steele
Wisconsin Engineer Co-Editor

The nineties have been notorious for the popularization of the PC movement. It is impossible to exist on a college campus with out being literally bombarded nearly every day with arguments about political correctness. As a literature major, I have engaged in countless discussions, some rather heated, about the pros and cons of being "PC." Environmentalism has unfortunately become characterized by many as simply a part of the PC movement. I say unfortunately because as scary as political correctness is, ignoring the issues it addresses is even scarier. Few would disagree that labelling a cause "PC" tends to trivialize it. Even fewer would disagree that at this point, the environment is a "PC" issue that is too important to ignore.

My roommate and I were discussing this editorial when she pointed out something I found interesting, but had never really thought about. She is what I would call a serious environmentalist, with very strong feelings about the movement's purpose and goals. She was lamenting the fact that it looks like technology is ultimately going to save the environment. My initial reaction was "Wow, that is weird — it just seems too much like a contradiction in terms." But after thinking about it for a while, it made sense, and for some reason that I could not figure out, I was reassured, which I have never felt before when talking about the environment.

Technology brings out a strange reaction in me. I prefer to shy away from it, claiming fear and ignorance. Yet I find it fascinating and oddly appealing, and in many ways it has made my life so much easier that there is a certain comfort in knowing I can count on technology. When it comes to searching for ways to protect the environment, I am similarly comforted by technology, probably because I consider this such a massive problem that I do not understand, and technology could be the massive solution that I do not understand either.

But technology can still be frightening, particularly when its applications are not carefully thought out, or when it is allowed to get out of hand. A devastating example of an instance when environmental technology did more harm than good is the case of the Green Revolution. Scientists developed strains of seeds that could produce three or four times what regular seeds of the same type could. The seeds were sent to countries where people were consistently undernourished and very poor. The problem was that the seeds were not very hearty so crops could not withstand harsh weather conditions such as extreme heat and drought or wetness that many of these countries experience. The crops were not resistant to pests, and needed fertilizers to grow successfully. Poor people were forced to purchase expensive, dangerous, often petroleum-based pesticides and fertilizers to make these high output crops produce. In spite of its very worthy intentions, the Green Revolution was more harmful than helpful.

If I were truly PC, I would argue that to save the environment we need a "back to nature approach." To some extent, I think this is true. People are not going to be interested in saving the rapidly diminishing environment until they have learned to appreciate it. They are not going to learn to appreciate it by sitting around college campuses waxing politically correct. However, college campuses are one of the few places we can learn about the technology that may ultimately save our environment, and are even better places to make sure such technology will do more good than harm.

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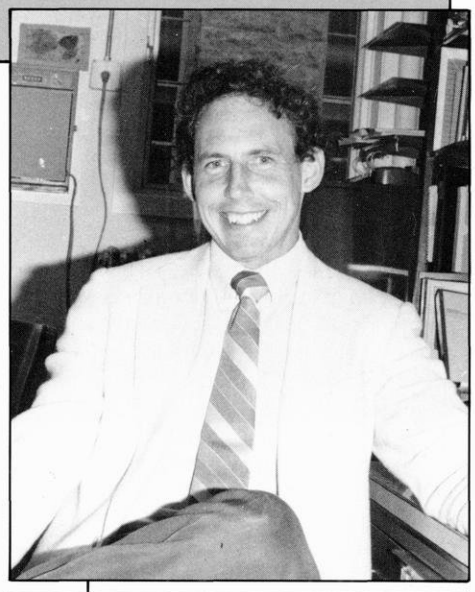
she was doing at Madison. Each was genuinely determined to get the most, not the least, from an undergraduate engineering degree by obtaining a first-rate education, part of which was the experience of working on the magazine.

That characteristic put them into the category of students whom I like best and respect the most: the kind who are NOT happy to get less than they pay for.

Dean's Corner

An Education or a Degree?



Don Woolston
Associate Dean
Pre-Engineering Office

Dichotomies: win or loss, one or zero, present or absent, right or wrong.

Lots of things besides the insides of computers can be understood in terms of variables that have only two possible values. The more I work with college students, the more I think I can separate all of them according to just one dichotomous variable.

I'm not talking about male vs. female, smart vs. dull, poor vs. rich or introverted vs. extroverted. I certainly am not talking about successful vs. unsuccessful, since I don't claim to be nearly smart enough to know what constitutes success in engineering school, let alone in life in general.

I think what it is that divides engineering students right down the middle is whether they know what they are doing here or not.

Now that I have said that, please do not stop reading. Otherwise you'll think that I am talking about whether a student knows what he or she is going to major in, and what he or she will do for a job in a few years.

Nothing could be further from my mind. I spend a lot of time talking to students who are brave enough to come into my office and admit that they are not sure about a major, or about whether they will really like working as an engineer. Other students come into my office and want to talk only about a certain major. My point is that it is not necessarily the students in the second group who know why they are here. Many times it is the students in the first group who have a clearer vision of purpose.

You see, when I talk about students knowing what they are doing here, I am talking about much more than whether they have picked a major. I am talking about whether they have figured out that their purpose here is to get an education; that is, to grow into the role of a competent, mature professional.

Too many students fall into the other group. They think they are here to get a degree;

that is, they think you pick a curriculum; you sign up for classes for nine or ten semesters; you cross off all the courses you've taken, always taking the easiest possible options; and pretty soon you graduate with a ticket to success in your hand. Along the way, you worry about your GPA enough to get by, and maybe about joining a student group or two so that you can have something to put on your resume.

If you think getting an education and getting a degree are the same thing, then think again. I'd like to give that advice to the Wisconsin legislator who recently managed to make the front page by advocating a three-year bachelors degree. As past students of mine know, I like to start each semester by passing on an interesting saying that I got from my colleague Dr. Jay Samuel: "Higher education is the only place where the customer is happy to get less than he or she paid for." How true that is. Yet, it is only true for some students, in fact, exactly those who are confused enough to think that they are here to earn a degree rather than to receive an education. Those that are concerned about becoming competent professionals look at each course and each lecture as an opportunity to be explored, not as a burden to be carried only as far as absolutely necessary.

Nowhere does that difference in attitude show more than during Engineering Expo, which was recently held in record-setting fashion. Those students who think they are here to earn a degree were nowhere to be seen. Those that are here to get an education were proudly taking part and, in the process, learning something while contributing to the general good of the college. In some cases, I am sure that education came at the expense of somewhat lower grades on recent exams, but that is just one of those tradeoffs in life.

Another good illustration of that difference came recently when I had the pleasure of travelling with four engineering students and my colleague Dr. Ryn Etter to the national Engineering College Magazine Associated convention in Lawrence, Kansas. Of the four students, two were firmly decided on a major, one was committed but still exploring options, and the fourth was profoundly undecided on a major. None, however, was in the least confused about what he or

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Toxic Sludge or Free Fertilizer?

The Land Application Controversy

SETTING:
The first golden rays of the morning sun illuminate the rolling Wisconsin countryside. A crisp springtime breeze blows as an old farmer and his son quietly walk the country road beside their barren farmland. A cloud of dust rises in the distance.

"Here they come," mutters the old man.
"Who is it?" asks his puzzled son.
"The fertilizer trucks."
"From the local feed store?"
"Nope. From the city. They belong to the *sewage treatment* plant!"

Granted, a farmer and his son waiting to apply municipal sludge to farmland may not be fit for an "Escape to Wisconsin" ad. Still, this scene is very appealing to local engineers challenged with the problem of sludge management and disposal. Thus, our story begins . . .

FLASHBACK:
From 1942-1974 the Madison Municipal Sewerage District (MMSD) stored sludge in lagoons at the Nine Springs Wastewater Treatment Plant. After receiving permission from the regional administrator of the Environmental Protection Agency (EPA) in 1974, the MMSD began applying sludge to agricultural land. The sludge supplied all the necessary nitrogen for crop growth, saving farmers about $50 per acre in fertilizer costs. This also helped alleviate Madison's sludge disposal problem.

CONFLICT:
In 1982 forty-year-old sludge from one lagoon was found to be contaminated with polychlorinated biphenyls (PCBs). PCBs are potentially toxic organic molecules with varying numbers of chlorine atoms attached to a double-ring carbon "skeleton." Now outlawed in the U.S., PCBs were previously used as semiconducting liquids in capacitors, inks, carbonless carbon paper and transformers.

The disposal of PCBs found in sludge at concentrations greater than 50 parts per million falls under the Toxic Substances Control Act. Professor P. Mac Berthouex of the Civil and Environmental Engineering Department explains: "Under the Toxic Chemical Substance Act it was classified as a material that you couldn't do anything with unless you had special permission."

Now outlawed in the U.S., PCBs were previously used as semiconducting liquids in capacitors, inks, carbonless carbon paper and transformers.

The MMSD appealed to the EPA to allow application of the PCB-contaminated sludge to area farmland. The EPA refused on grounds that not enough was known of the persistence of PCBs or the mechanism by which they were absorbed into the environment. The EPA feared that PCBs would be taken up by crops and passed into the food chain.

THE QUEST:
Berthouex outlines the MMSD's task at this point: "The engineering job is to figure out how to reduce the risk. You can do it two ways . . . . One way is to prevent people from being exposed . . . . The other way is to reduce the concentration of the chemical to a level where exposure doesn't do any harm or poses a risk that society can tolerate."

The MMSD decided to sponsor (without federal funding) a five-year study with UW-Madison. This study determined the degradation rates, plant uptake, soil leaching and runoff of PCBs from sludge applied to farmland. These results support land application as an environmentally sound answer to the sludge disposal problem.

ENTER THE MAIN CHARACTERS:
Begun in 1985, the MMSD-sponsored

Photo courtesy of Professor Art Peterson

Workers from the Madison Municipal Sewage District transfer PCB-contaminated sludge to a UW-Madison tanker truck. Land application of sludge provides essential nutrients to farmland and helps to alleviate Madison's sludge disposal problem.

study was developed by Professor Art Peterson of the UW-Madison Soil Science Department and David Taylor of the MMSD. The project involved the subsurface injection of Madison sludge into farmland at UW-Madison's West Madison Agricultural Research Station. The soil of this two acre site is similar to that of local farmland which had received Madison sludge.

RISING ACTION:
Peterson and others broke down the site into three rectangles, subdividing each into ten 1200 square foot (60 foot by 20 foot) plots. They held two plots from each rectangle as control plots. To avoid possible contamination from adjacent plots, the researchers chose to use the inner 400 square feet of each plot, taking 24 random samples from each plot.

Photo courtesy of Professor Art Peterson

Workers at the West Madison Agricultural Research Station plot out farmland for application of PCB-contaminated sludge. Researchers measured degradation rates, plant uptake, soil leaching and runoff of PCBs from the sludge.

Every spring 5000 gallon tanker trucks hauled sludge from the lagoons to the research site. Sludge was applied one time or annually to each plot according to Peterson's original design. Workers injected the sludge eight to ten inches below the soil surface and disked the land to ensure thorough mixing of the PCBs. Next they planted field corn without the use of pesticides or herbicides. These chemicals could not be used since they would likely interfere with research results.

Over the next five years, Peterson and co-workers collected 1400 surface soil samples. In addition, they collected four-foot deep soil samples each fall to assess the effect of leaching on the soil. Peterson describes the tight controls over the project: "Even when we were taking the soil samples we had to wear plastic gloves over our hands so that [we] didn't contaminate it with [our] hands."

Peterson then employed the technique of capillary column gas chromatography to analyze the PCB concentration in the surface soil, corn stover (whole plant minus the cob) and grain. First, samples were liquefied and purified. Next, they were injected into a capillary column. Then, the samples were passed through the column and separated into distinct bands of individual congeners. Electron-capture detectors measured the composition of the samples. Finally, computers recorded and analyzed the data.

The negative publicity towards PCBs was the result of one study done years ago on laboratory rats.

The Madison researchers had to employ a very complex analysis to ensure accurate interpretation of the data. Any congeners that were similar to each other were recorded as similar peaks on the gas chromatograph. This proved to be especially true for congeners present in extremely low concentrations. Despite the difficulty involved, 79 distinct PCB congeners were detected from the sludge.

CLIMAX:
The results of the analyses were taken to Berthouex. He and consultant Robert Gan began statistical interpretation and modeling of the data.

According to Berthouex, "The rate of disappearance can be modelled as a simple first-order decay . . . just like radioactive decay." This means that the PCB concentration in the soil decreases exponentially with time. The study found that the rate constant (which determines the "speed" of the degradation) is independent of the initial concentration, application rate and frequency of application (once or annually) of PCBs in the soil.

The half life of the PCBs, the amount of time it takes for the concentration to decrease by one-half, varied from five months to four years. The average was 19 months. PCBs with fewer than four chlorines had the shortest half-lives, which is good news since they comprise more than three-fourths of the total concentration. PCBs with more than five chlorines generally had very long half-lives or did not decrease noticeably. In all, 43 congeners disappeared.

There are four possible causes for the disappearance of the PCBs: volatilization (passing off as a gas), leaching through the soil, crop uptake and biodegradation. Volatilization was ruled out since previous studies show that volatilization is responsible for less than two percent of PCB loss. Leaching was rejected since PCB levels at 24 to 36 inches were almost as low as background levels in the soil. In fact, the PCBs appeared to be repelled from water.

This left only crop uptake and biodegradation as possible causes for PCB disappearance. The data from the study clearly

showed that crop uptake did not account for any significant disappearance of PCBs. Biodegradation by microorganisms had to be the mechanism. Eighty-five percent of the biodegradable congeners degraded while only six percent of non-biodegradable congeners were reduced. Thus, PCBs were broken into safer chemicals with no harm to the environment. Most importantly, PCBs were not absorbed by the corn, so they could not be passed on through the food chain.

Furthermore, PCBs may not be as dangerous as was once thought. Berthouex criticizes, "For years the popular press would never report a PCB, they would always report it with some emotional adjective like 'deadly' PCBs or 'toxic' PCBs."

The negative publicity towards PCBs was the result of one study done years ago on laboratory rats. After being subjected to massive, lifelong doses of some PCBs, the rats developed cancer. A more recent study done in Germany suggests that PCBs do not pose a great health risk. In fact, the 26 July 1991 issue of *Science* quotes the EPA in the 30 January 1991 *Federal Register* : "There is inadequate evidence of carcinogenicity of PCBs in humans." Still, Berthouex does not expect PCBs to be reintroduced into the U.S. Other chemicals have been developed which have replaced PCBs in industry.

MORAL OF THE STORY:
The Madison sludge project can be hailed a resounding success. Not only was a model developed for the degradation rates of the PCBs, but an environmentally sound mechanism for their disappearance was introduced. Analysis showed that crop uptake was not a factor in PCB disappearance, so the food chain is not endangered by land application of PCB-contaminated sludge. The UW-Madison study supports land application as an effective and economical management approach for treating PCB-contaminated sludge.

VISIONS FOR THE FUTURE:
PCBs are the only chemical substances in sludge that are restricted based on their concentrations, rather than the actual amount applied to the soil. New regulations need to be established that limit total PCB application over time. With the data from this study and Berthouex's first-order model, it will be easier to calculate these safe limits.

The results of the Madison sludge project will undoubtedly be used in determining future EPA sludge application policy. However, the fate of future sludge work ultimately rests with the EPA. Their decision affects not only farmers receiving the sludge, but also the many people in the Madison area that unconsciously use its sewage system every day.

Heightened environmental awareness calls us to reuse our precious resources. By simply recycling sludge, we convert it from a persistent burden to a valuable resource.

. . . So father and son proudly survey their land as two large vehicles rumble down the country road. The man's confident smile and the boy's shining eyes reveal their high hopes for this year's crop. Side by side, they contemplate the hard work to be done. Neither really seems to mind. The son is happy to help out the family. The father is content knowing he is supporting the family while preserving the environment for future generations.

AUTHOR

Jason Och is a sophomore pre-engineer praying for divine help in selecting his major. This fall, he hopes to buy a hot pink Volkswagon bus and go cruisin' to Graceland or maybe Woodstock.

Green Bay Study Successfully Explores PCB Contamination

Professors Anders Andren and Dave Armstrong of the UW-Madison Water Science and Engineering Laboratory recently completed participation in the $12 million Green Bay Mass Balance Study (GBMBS). They determined the mass of about 100 PCB congeners in Green Bay sediment as a function of their location and depth.

UW-Madison's involvement in this project was largely due to its Sea Grant project. Directed by Anders, this administrative program has funded research on the Great Lakes for more than 20 years.

Building on Sea Grant's work, the GBMBS determined the source, distribution and quantities of PCB contaminants in Green Bay sediment. Six federal agencies, the Michigan and Wisconsin Departments of Natural Resources, four UW campuses and nine other universities participated in the project. They obtained rather surprising results.

From analyses of more than 1000 sediment samples, the researchers discovered that the bay contains 8500 kilograms of PCBs, 2000 kilograms in the first three centimeters of sediment. The PCBs were concentrated in the southeastern region of the bay. This led researchers to conclude that the Fox River, entering at the bay's southernmost end, was the principal source of contamination. In fact, 95 percent of the bay's PCBs came from the Fox.

An estimated 40,000-55,000 kilograms of PCBs still remain in the riverbed of the Fox. If left alone, the PCBs will continue to contaminate Green Bay for another 20-40 years.

Using data from the GBMBS, the Green Bay region is developing a remedial action plan to outline the cost and feasibility of various PCB clean-up and removal techniques.

– Written by Jason Och

Ryn Etter Adds a Flare to Technical Writing

A quick glance at Ryn Etter's desk reveals that she is not a run-of-the-mill professor. It actually takes more than just a glance to realize that there *is* a desk under the piles of papers, books and magazines in the corner of her office. More revealing, though, are the postcards, pictures, and thoughts that are taped up above her desk. Pictures of *The Far Side*, Aretha Franklin, howling wolves, and "The Advantages of Being a Woman Artist" cover most of the space over her desk. Of all the things Ryn has in her collage, the one thought she feels is especially important is "Happiness is a spiritual necessity." "I think this is an important idea that many people don't realize"

"Happiness is a spiritual necessity."

she says.

While Ryn doesn't necessarily teach "happiness" in her classes, she does apply her unique or, as she puts it, "slightly skewed" views to her teaching.

"I believe in the power of the written word. Not many people do anymore." Ryn has made the study of the written word a big part of her life, and her B.S. in Journalism, M.A. and Ph.D. in English from the University of Iowa (a veritable Mecca for English academics) make her more than qualified to talk about the written word.

In her eighteen years of teaching — she began as a teaching assistant at the University of Iowa in 1976 and has been teaching at the University of Wisconsin Madison since 1989 — Ryn has taught a lot of people a lot of different things, such as American literature, narrative literature, women's studies, news writing and reporting, composition and technical writing. Teaching technical writing is a new direction for Ryn, and she says her writing has changed since she first started teaching courses in technical writing. "Technical writing has sharpened my focus on the audience. It's made me extra conscious that not only is there me and the paper, but there's another person, the audience, in the equation too." She finds that this focus on audience works well with her background in journalism.

Another change for Ryn is her attitude towards technology. Working for the College of Engineering has increased her fascination with technology, but has also reinforced her wariness of relying on it too much. "Gizmos won't make you a good writer. There is a definite danger in substituting technology for understanding." So how does one become a better writer? "Read a lot and write a lot. That plus good DNA can make you a great writer," she laughs. "Seriously, reading is an important part of becoming a good writer." Ryn would like to start a class on "Critical Technical Reading" as an Engineering Professional Development course. "I've found that the people who write well, in any field, are the ones who were encouraged at some time in their lives to read."

In addition to her work in Engineering Professional Development, Ryn also works on outreach seminars for professional engineers. These seminars generally run for two days, and are meant as a sort of tutorial for writing skills.

I asked Ryn how people react to her less than conventional appearance at the seminars she does for businesses. "Their first reaction is 'God I hope she's just bringing in the overhead projector!' Then they realize that I'm actually one of their instructors for the next two days." While Ryn may not have a typical professional appearance (cowboy boots and jeans are her "power suit"), she has strong feelings about what "professional" means. "Professional is defined in many different ways. I see the ultimate professional as someone who gives people information that's good. That's what I try to do in the seminars I do."

Ryn uses this same approach with her audience of students: "The best way I can help people learn how to write is by giving them an opportunity to hear their own voice. Basically, I try to do minimal damage in my classes." ■

AUTHOR

Joy Grapentine is an English major involved in the TCC program.

W. Edward Deming: A Man of Quality

"Ninety-five percent of the quality problems are in the process," states W. Edwards Deming impatiently. The 92-year-old statistician has been voicing his quality philosophy throughout Japan since the 1950s. But it took until the early 1980s for American companies to awaken from their long slumber of poor management. Using statistical procedures, Deming has changed companies' attitudes and incomes.

In front of a filled lecture hall of American managers, Deming presents his theory of quality management. The crowd of managers did not come to be praised; rather, they came to learn from the Guru of Quality, Deming. A stern man of precision, Deming's frustration with American management has grown through the years. From the podium he proclaims sarcastically, "We should never export American management to a friendly country." The crowd of intense listeners chuckles in response. Although Deming was originally from the western United States, his impressive quality improvement theories were first implemented in Japan rather than in America.

After being rejected by many American universities and companies, who were thriving in post-World War II prosperity, Deming found the Japanese highly interested in his contemporary ideas about quality. Japan, suffering economic strife after the war, began to implement Deming's ideas on Statistical Process Control and Total Quality Management. In the 1950s, the Japanese economy flourished as a result of Deming's ideas. At the start of the decade, the Japanese established the most prestigious award found in business in Deming's honor–the Deming Prize. Yet, Deming's success remained only in Japan. America was still sound asleep.

Deming's new ideas sparked a revolution in Japan's businesses. As an example, Professor Donald S. Ermer, a statistical process control expert at the University of Wisconsin-Madison, states, "According to Deming, you should make more use of the people involved in the process." The Japanese began incorporating Deming's ideas with quality circles. Over time, variations of these quality circles have become extremely effective in industry. Quality circles consist of people involved in the improvement of various stages of a process. Meetings and discussions among these workers, representing all levels in a company, provide necessary feedback for upper management. Quality circles require training, another of Deming's strict quality rules.

"Create constancy of purpose for improvement of product and service," reads Deming's first point. The basis of Deming's plan relies on this first point, continually improving to meet the needs of the customer and employees. "Deming talked about continuous improvement in all processes," clarifies Ermer. "Quality improvement has to be in all departments, not just in the quality management department," he says. Deming's philosophy emphasizes eliminating common practices and ideals used in many industries today, such as instilling employee fear, providing monetary rewards and touting corporate slogans. Although Deming primarily concentrates on attitudes and ideals, he relies on specific tools and techniques to assist individual clients. Statistical Process Control is one of these tools.

After being rejected by many American universities and companies who were thriving in post-World War II prosperity, Deming found the Japanese highly interested in his innovative ideas about quality.

A control chart, a technique found in SPC, is used to measure random samples of a product at certain time intervals. To understand its implementation, consider an example, Pontiac's Engine Plant Number 18 which had a problem with machining a hole in a camshaft gear. The hole diameter of a randomly picked camshaft gear was measured every hour and values collected over time were plotted on a control chart. Control charts are used to find any trends or noticeable variations. The variation can be accounted for by one of two causes, special or common. "Special causes are not bad," explains Ermer. "All the other causes are common caused variability. They are in the system and can be fixed. Common causes account for 85 percent of the variability," he says. Changes which developed on the control charts were associated with common cause variability. Employees were able to determine when to adjust the machine by following trends on the control chart.

America's alarm was finally sounded in 1980 by an NBC documentary on Deming. Soon after, American companies began to call on Deming for scholarly advice. Although America had finally recognized *Dr. Deming* , he would not pamper America's managers. Managers from Ford, GM, AT&T and others learned that it was Deming's way and none other. Some of Deming's clients were left to fend for themselves after he abandoned them because of their lack of obedience. Since Deming has been recognized in America, companies have seen

results in quality and productivity that surprise even the Japanese.

In 1981, Deming began working with Pontiac; within a year simple changes had been made which yielded impressive results. Using Deming's statistical methods, Pontiac had found that most of its defective connecting-rod bolts were supplied by a single source. That supplier was dropped. The number of defective connecting-rod bolts decreased substantially.

Another example involved the machining of a Pontiac camshaft gear mentioned previously. In 1981, 38 engines had been removed from the line due to loose camshaft gears. By obtaining statistical measurements each hour and plotting them on a control chart, the machining tool could be adjusted to meet the gear specifications. In 1982, only six engines needed to be removed. Deming's ideas for better quality affected the training of the production workers as well. Pontiac's workers were given a four week course in quality and statistical methods. In only a year Pontiac was able to improve its productivity by 27 percent. Deming's methods paid off.

The Zytec Corporation, a power supply manufacturer, is yet another success story of a company that implemented Deming's methods. Zytec employs Deming's 14 points in every aspect of its company. For example, when a company wants to buy Zytec's power supplies, the two companies become partners. "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." Although Deming's ideas are a drastic change from older managing techniques, they have proven successful.

Deming is still evolving his 14 points as a guide to industry throughout the world. He has given a new goal to today's industry: continue to improve by using quality. With Deming's philosophy, everyone is a winner. Deming has challenged today's industry to learn to use the knowledge obtained to improve our society. According to Deming, a basic knowledge of all parts of a process is a key factor in achieving success. Said best by Deming himself,"Hard work and best efforts, put forth without guidance of profound knowledge, leads to ruin in the world that we are in today. There is no substitute for knowledge."

AUTHOR

To the relief of the *WIEngineer* staff, general manager Jim Webb will be taking a leave of absence for a co-op at 3M this fall.

TQM in the COE

A new revolution of quality is spreading from industry to education. A new concept of quality has affected the education of students at the University of Wisconsin-Madison – Total Quality Management. According to Sandra Courter, a member of the Engineering Professional Development Department, TQM is "a system which promotes continuous improvement in any process." Courter, director of the Technical Communication Certificate program, uses TQM ideals to provide her students with opportunities to improve their technical communications skills.

Frequent course evaluations are used to meet the needs of students. For example, Courter asked students in EPD 275, Technical Presentations, if they benefitted from preparing, delivering and video taping presentations outside of class. "I thought that it was technically more trouble than it was worth," states Courter, "but when I asked the students, they said they really liked it." The frequent evaluations directly affect the students presently enrolled in the course as well as those in future classes. The strategy of using these evaluations incorporates the Plan, Do, Check, Act technique.

Sandra Courter, TCC program director uses Deming's principles in her classes.

The PDCA cycle outlines four steps for implementing a process. First, students plan their presentations. Once they have finished planning, the students *do* their presentations. Having done their presentations, students *check* themselves by viewing their own video tapes and by using reviews from fellow classmates. The final step involves changing the methods for future presentations or *acting* on evaluations. The PDCA cycle is a method which constantly improves any process.

Along with TQM, Courter also applies some of Deming's theory to the TCC program. "All of Deming's 14 points apply to education," declares Courter. Deming's first point, constancy of purpose, dictates the importance of teachers helping students "maximize their own potential as communicators through continuous improvement." Through the variety of courses and faculty, the TCC program allows students to improve their skills through learning and doing. According to Deming's theory, quality is used to continually improve a process. Using TQM, Courter is improving the TCC program for students, teachers and students' future employers.

— Written by Jim Webb

Engineering Expo...

Green slime. Concrete canoes. Glowing plasma. Voice-driven model cars. Recycled Bucky magnets. Robotic welding.

What do all of these seemingly unrelated objects have to do with each other? These are only six of the over 90 project topics that were on display at the UW-Madison College of Engineering Exposition of 1993 on April 16, 17 and 18. Engineering EXPO is a three-day event in which students in the College of Engineering and members of industry spend hours displaying exhibits that demonstrate engineering technology, new products and fascinating research.

But what's the reward for spending so much time on such a huge project? CASH! The EXPO committee awards a total of $7100 cash for winning projects in five different categories: Individual Exhibits, Graduate Student Exhibits, Small Group Exhibits, Student Organization Exhibits and People's Choice.

In all the categories, monetary rewards are distributed as follows: First place $700, Second place $450, Third place $250 and Three Honorable Mentions $100 each. An award of $150 is given for the best theme related exhibit and another $150 award is presented for the best overall project.

Exhibits and exhibitors are judged on a variety of criteria including presentation (oral and visual), comprehensibility to non-engineers, application of engineering principles, creativity, challenging the senses and overall appearance.

Each category is assigned four judges, except the Student Organization Category, which has two sets of four judges because of its size. Two of the judges for each category are engineers from industry and the third is from the UW system. To test an exhibitors ability to communicate with the non-engineer, the fourth judge for every category does not have an engineering background. Tom Weisen, EXPO Committee Co-Chair states, "I thought it was a great success mainly because of the student exhibits.

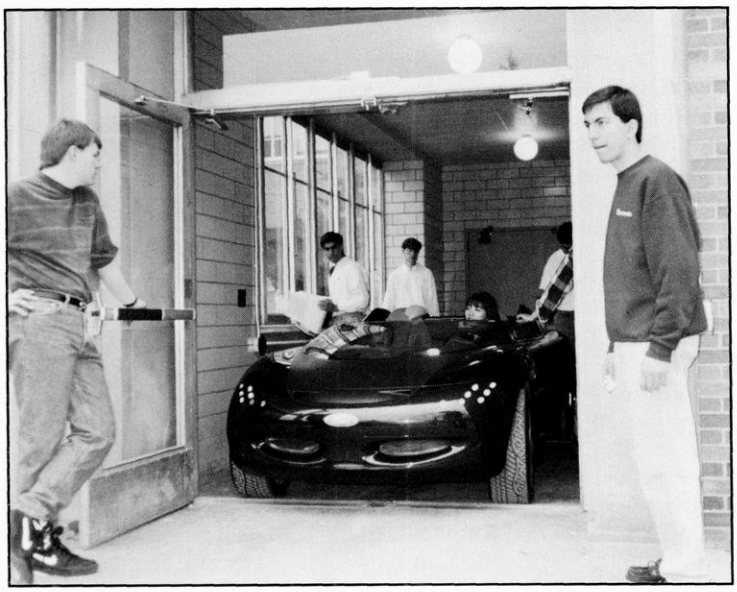
"There was a lot of thought and effort put forth on all the projects"

There was a lot of thought and effort put forth on all the projects." But it takes more than just the exhibits, judges and awards to bring about such a success. The nine-member EXPO Committee commissioned more than 150 student volunteers to help sell tickets and concessions and assist with parking. In total, the 1993 Engineering EXPO was attended by almost 19,000 members of the viewing public.

Because it is only presented biennially, it won't be until 1995 that students will get to demonstrate their vast engineering knowledge and viewers get to come and see the green slime and glowing plasma of the next Engineering EXPO. ■

AUTHOR

Julie Hromadka is a second year student in chemical engineering. She is also a very active member in SWE.



When EXPO was finished, volunteers helped to remove a display car from the Engineering Building.

Photo courtesy of the EXPO committee

...and the winner is...

Student Exhibits: Individual Awards

First Place	Virtual Reality Simulations Adisak L. Pochanayon
Second Place	Robot Compact Disc Changer Scott Hasse
Third Place	CD Juke Box John Hare
Honorable Mention	Robotic Welding Andrew Loron
Honorable Mention	Neural - Networks Denis Goddard
Honorable Mention	Feel the Bass Francis Doreian

Small Group Exhibit Awards

First Place	Logrolling Simulator
Second Place	Engineering Campus Walkthru
Third Place	Recycling-Stick With It
Honorable Mention	Hybrid Rocket Engine
Honorable Mention	Wings!
Honorable Mention	Applied Superconductivity

People's Choice Awards

Best Overall Project	Hybrid Rocket Engine
Best Theme Related Project	AIChEese Challenge

Graduate Student Exhibit Awards

First Place	XDRUMS Todd Brennan
Second Place	Audible Plasma Screen Mark Erickson

Student Organization Exhibit Awards

First Place	Virtual NASCAR Reality Kappa Eta Kappa
Second Place	Formula Car SAE
Third Place	The AIChEese Challenge AIChE
Honorable Mention	Sensor Response Car Tau Bet Pi
Honorable Mention	Transparent Display SHPE
Honorable Mention	IEEE's Invisible Maze IEEE

Pre-Engineers Party On!

Attention Pre-Engineers! Keep your eyes open for flyers promoting the *Pre-Engineers' Bash* , an event coordinated each semester by Polygon Engineering Council. This semester's *Bash* should feature the usual FREE PIZZA as well as opportunities to talk with representatives from various engineering student organizations. Get involved early and start building that all-important resume. The *Bash* traditionally takes place during the first week of classes.

Engineering Briefs

by Mike Waters

Anarchy Rules in University Student Government

After months of bickering over whether or not to disband the Wisconsin Student Association (WSA), the university student government, the WSA Senate voted on April 15 to dissolve the organization and make room for a new student government. In the meantime, however, there will be no student government. The April 15 vote called for disbandment of the WSA by July 1, with the exception of the WSA *Studentprint* Office. The Senate decision to disband was the result of months of debate prompted by last fall's referendum which asked students whether or not they wanted the WSA to disband. Students who participated in the referendum voted in favor of disbandment by almost a two-to-one margin. The disbandment resolution also formed a Board of Trustees which will oversee the trust of the organization until a new student government is formed. On April 29, the WSA Senate created guidelines for the re-establishment of a student government. The guidelines state that any UW student or student group may submit a constitution for a new student government to the Board of Trustees. The Trustees will then formulate a referendum question to be printed on petitions. The student or group that submitted the constitution must then get 4000 student signatures in order for the Board of Trustees to hold a referendum to vote on a new constitution.

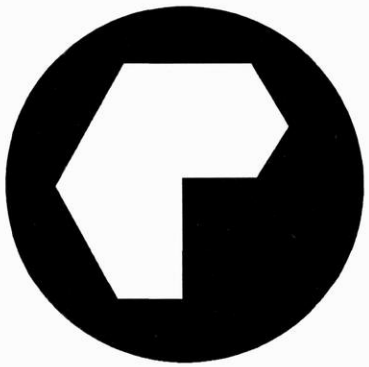
Get Connected at Career Connection

Need a summer or permanent job? Well, don't miss this fall's *Career Connection* . Coordinated by Polygon Engineering Council, *Career Connection* provides a prime opportunity for engineering students to get their feet in the door to employment. This annual, two-day event in mid-September draws representatives from over 70 companies from across the nation. *Career Connection* is traditionally held at Union South. Watch for posters publicizing the specific dates of this event. (Students looking for employment should also stop by the Engineering Career Services office in Engineering Hall.)

Polygon Elects New Officers

At the final Polygon Engineering Council spring meeting, engineering student organization representatives elected nine new Polygon officers: *President* –Melissa Kumlien, *Vice Presidents* –Linda Kensler and Mohsin Khan, *Treasurer* –Tom Wiesen, *Banquet Chair* –Bernie Menachery, *Pre-Engineering Chair* –Jenifer Brunette, *Publicity Co-Chairs* –Matt Kavan and Debbie Zastrow, and *Scholastic Chair* – Brian Bartels. The **wisconsin engineer** wishes each of the new officers good luck in the upcoming year. Also, many thanks to this year's Polygon executive board for all of their hard work.

POLYGON



ENGINEERING COUNCIL

Nukes Win Blood Drive...Again

The results of the Polygon Engineering Council spring blood drive are in! Once again, students in the Nuclear Engineering and Engineering Physics (NEEP) Department won the competition with the highest percentage of donors. A bit surprisingly, however, NEEP students also donated the most pints despite the small size of the department. The blood drive fell short of its goal of 50 pints with only 44 donations. Individuals wishing to donate blood may stop by Youngblood in Union South. Polygon will organize another blood drive sometime in the middle of the fall semester.

Environmental Remote Sensing

Since the dawn of the atomic age, people have become more critical of the technology that engineers introduce to the world. Technology is expected to improve our quality of life without harming to world we live in. To do this, we need to understand the effects that technology has on our environment. We all know about the hole in the ozone layer and the possibility of global warming, but how are these problems detected? Remote sensing of the environment provides a practical way to monitor our world and to identify problems in the way we manage the Earth's resources.

Numerous departments at UW-Madison are involved in remote sensing education and research. Civil and Environmental Engineering makes up the core of the program, while the Institute for Environmental Studies offers a strong curriculum in Environmental Monitoring. Forestry, Geography, Soil Science, Botany, Computer Science and many other departments are also involved, making the study of environmental remote sensing available to a wide range of students.

THE TECHNOLOGY

Remote sensing, or sensing from a distance is accomplished through airborne or satellite monitoring of the Earth. The satellite weather maps on the evening news are one common application of remote sensing. In a remote sensing system energy covering a broad range of the electromagnetic spectrum is recorded. This ranges from ultraviolet light and visible light to radio waves. The energy is captured on photographic film from aerial monitoring or in a digital image from a satellite. The photo or image is then interpreted and analyzed resulting in information about our environment (see figure 1).

Remote sensing provides a challenge for those who enjoy the latest in technological advances and are concerned about the welfare of our environment.

Airphoto interpretation, or the identifying objects on an aerial photograph, is a widespread method of remote sensing. Aerial photography provides the only means of capturing a relatively small area of land in a high degree of detail. Once the area is captured on film, the photo is usually scanned into a computer which changes it to a digital image. It can then be analyzed both by the human eye and with computer methods just as a digital image from a satellite can. Although aerial photography provides a highly detailed record of the land, it is impractical for many applications because it is often inconvenient to get flights off, and if data needs to be collected on a regular basis, many flights are required. Also only energy in or near the visible part of the spectrum can be recorded on photographic film, again limiting the use of airphoto interpretation.

If the high resolution that an aerial photo provides is not required, remote sensing from space is the most practical and complete method of acquiring data about our environment. By using satellites to monitor the Earth, it is possible to look at every part of the Earth approximately once every 16 days. To date, five U.S. Landsat satellites and a SPOT satellite put up by France have been used to collect images. The first three Landsat satellites used a multispectral scanner (MSS) to look at four broad areas of the spectrum(green, red, and two near infrared bands). They had 80 meter resolution as compared to 30 meters accomplished by Landsat-4 and 5 which in addition use a Thematic Mapper (TM). The Thematic Mapper looks at seven narrow areas of the spectrum(blue, green, red, and four infrared bands). Figures 2 through 4 show the differences between an aerial photograph and images from the MSS on Landsat-3, and

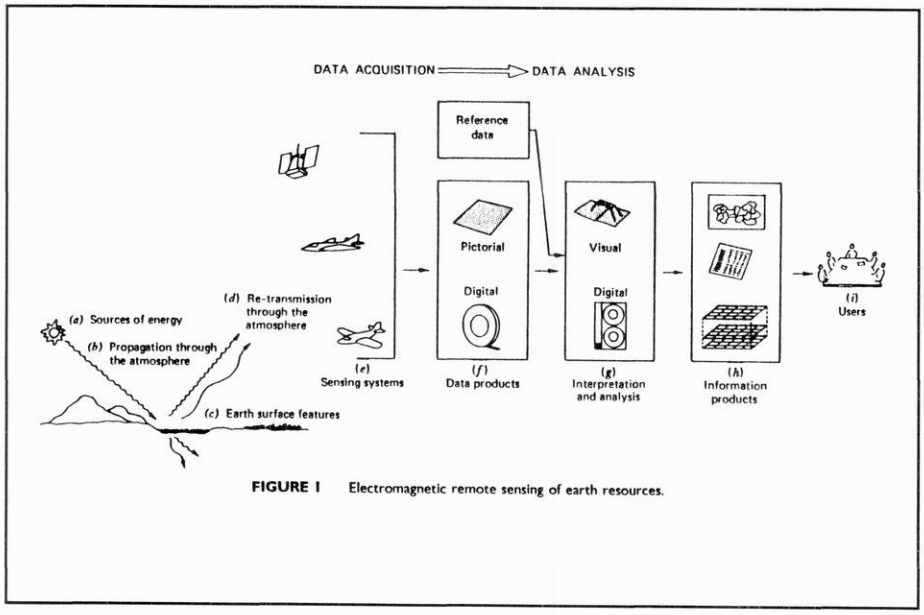


FIGURE 1 Electromagnetic remote sensing of earth resources.

the TM on Landsat-4. The French SPOT satellite provides the best resolution to date. By providing 10 meter resolution for black and white images and 20 meter resolution for color images the satellite began a new era in remote sensing.

Initially, operation of the Landsat satellites was controlled by the government. In 1983, President Reagan commercialized the satellites, putting the responsibility on private companies for their further development. This resulted in more specialized applications of remote sensing and an increase in the cost of obtaining satellite images. A SPOT image is about 4000 dollars for a 150 mile by 150 mile area. In the near future, regulation will transfer back to the government, resulting in data being provided at the cost of reproducing it.

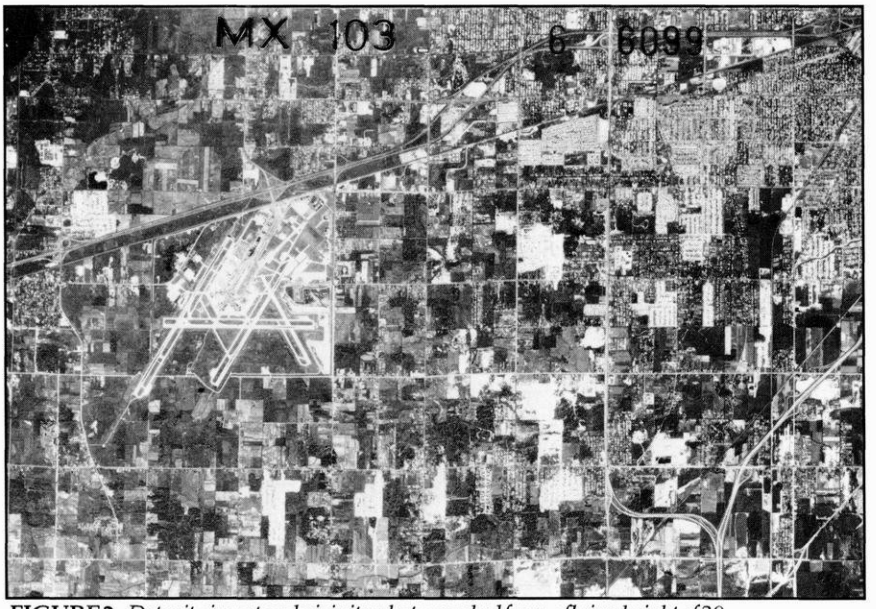


FIGURE2. *Detroit airport and vicinity photographed from a flying height of 20 kilometers*

DIGITAL IMAGE PROCESSING

Obtaining remote sensing data is a much simpler than using the data to solve environmental problems. Once an image has been recorded by a satellite or an aerial photo has been scanned into a computer, the first step in applying this information is called digital image processing. Professor Frank Scarpace from the Environmental Studies and Civil and Environmental Engineering departments develops computer algorithms to do just this. He works with two types of algorithms, those that classify, or group the objects in an image, and those that enhance an image.

According to Scarpace, two approaches are taken in classifying land cover; supervised classification and unsupervised classification. With supervised classification, an image is first displayed on a computer screen. Each object on the ground reflects different wavelengths of light and therefore appears as a unique color in the image. Someone then classifies the image by assigning the different groups of colors to the objects they represent. For example, a Shortleaf pine tree appears olive green to yellow green on an image while an American beech tree appears orange yellow. Once colors are related to their corresponding objects, a computer can be trained to repeat the process. With unsupervised classification, the computer first narrows down the number of different colors in the image, which makes it easier for someone to classify the image. Once an image is classified, the location of resources on the ground is known and can be used to manage the land in many different ways.

Image enhancement is another integral part of digital image processing. Since satellites record images line by line, if one sensor is not calibrated properly the image ends up with a set of evenly spaced horizontal lines on it. Scarpace's algorithms use Fourier analysis to remake the lost part of the image, thereby removing the lines. Other methods of image enhancement are used to make it easier to differentiate between objects in an image.

An introduction to digital image processing can be found in CEE 303 taught this fall by Scarpace. Students in the class examine and use his algorithms to do classifications of aerial photos and satellite images.

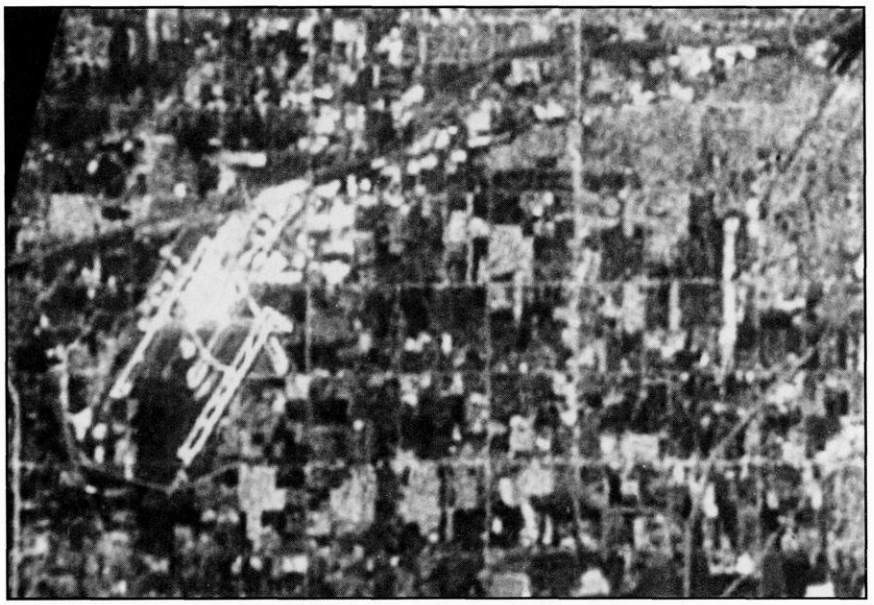


FIGURE3. *Detroit airport and vicinity imaged by Landsat-3 multispectral scanner (MSS) from a height of 900 kilometers.*

THE ENVIRONMENTAL REMOTE SENSING CENTER

Much of the research done in remote sensing at the UW is conducted in association with state and local government agencies. Many of these research projects are coordinated through the Environmental Remote Sensing Center

(ERSC) which provides a focus for remote sensing research at UW-Madison. Tom Lillesand, director of the ERSC and Professor of Environmental Studies, Forestry, and Civil and Environmental Engineering explains that even though the Center is not part of the Engineering School, it provides many opportunities for engineers. According to Lillesand, the ERSC conducts "high risk" research and development. It then transfers this technology through demonstrations and pilot projects to different agencies and industries. Many students who do research for the ERSC introduce their skills to companies they eventually work for. In turn, people from different state agencies and industries give lectures at the University to identify what the real world needs from remote sensing.

Linking all the different disciplines together is the key to applying remote sensing on a larger scale.

The question of whether global warming is occurring was recently researched by Professor Lillesand and Randy Wynne a graduate student in Environmental Studies. They monitored the duration of lake ice on 45 lakes and reservoirs in Wisconsin using data from the AVHRR satellite. They found that long term trends in the lake ice duration correspond with climate changes around the world. Records of lake ice formation and break up for Lake Mendota have been kept for 135 years allowing Lillesand and Wynne to relate long term trends in lake ice to long term trends in the climate. Their results, which suggest a general warming trend could be a breakthrough in the on going debate.

Another project coordinated through the ERSC was proposed by the Department of Natural Resources. It involves satellite land cover mapping of Wisconsin on a regular basis. According to Lillesand, "It is a fundamental thing to know the use of the land and how to manage it." Information obtained from land cover mapping can be used to support environmental legislation, and can help with forest management and land use planning. It can also be used to attract business to the state by identifying and locating the many natural resources that Wisconsin has to offer.

EDUCATION IN REMOTE SENSING

Undergraduate students at UW-Madison have the opportunity to take classes in remote sensing starting their junior year. This spring, the Department of Civil and Environmental Engineering began offering 14 one-credit modular courses taught in five-week portions. This allows students to design their own program to satisfy their interests in remote sensing. Graduate study can be done either through the Department of Civil and Environmental Engineering or the Institute for Environmental Studies (IES).

IES offers an Environmental Monitoring Program which draws faculty from a wide range of departments. Ralph Kiefer, a professor of Civil and Environmental Engineering and Environmental Studies, is the Chair of the program. Kiefer likes to see students come into the program looking for a way to apply remote sensing to their own field. He feels that engineers have a head start with the technical aspects of the Environmental Monitoring Program. Those with non-engineering backgrounds are better able to apply the technology.

According to Kiefer, the most popular sequence of courses to prepare students for graduate study in remote sensing is CEE 301, 302, 303. CEE 301 is an Introduction to Aerial Photographic Systems, 302 looks at Electro-optical and Microwave Remote Sensing Systems, and 303 is an Introduction to Remote Sensing Digital Image Processing. All three classes are crosslisted with Forestry and IES and are taught by Kiefer in the spring.

Corresponding with-world wide environmental concerns, the emphasis today in remote sensing education takes on a more global vision. Linking all the different disciplines together is the key to applying remote sensing on a larger scale. Kiefer feels that "global databases are needed so that people in different disciplines don't have to separately do the research, they can just go to the database."

Remote sensing education at UW-Madison offers many exciting opportunities for students from a vast range of disciplines. It provides a challenge for those who enjoy the latest in technological advances and are concerned about the welfare of our environment. ■

AUTHOR

Jesse Wolff is an ME-4. He spent the summer hanging out and enjoying Madison.

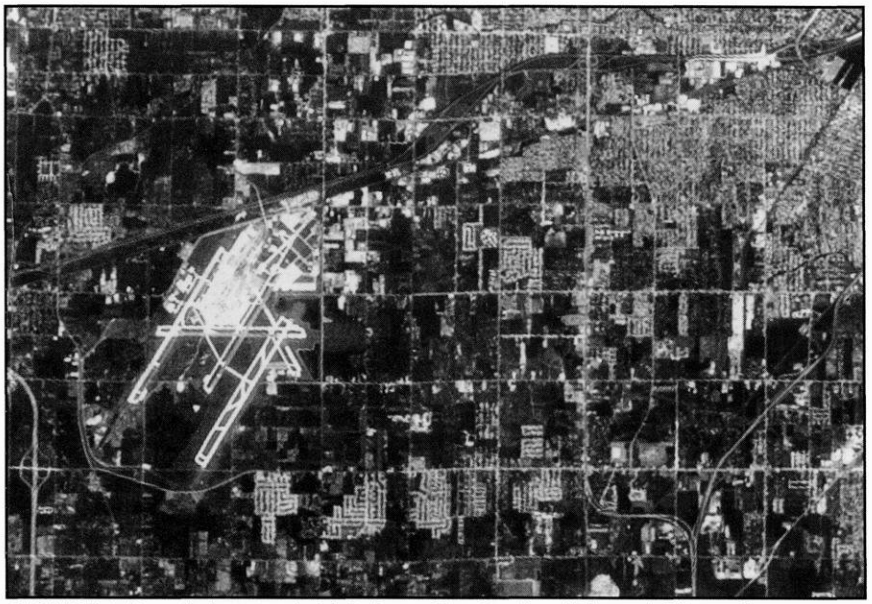


FIGURE 4. *Detroit airport and vicinity imaged by a Landsat-4 Thematic Mapper from a height of 700 kilometers.*

NEW Graduate Program In Air Quality

Since the adoption of the Federal Clean Air Act in 1990, the field of environmental engineering and technologies has grown exponentially. In response to this growth, the UW-Madison will offer a graduate program in Air Resource Management this fall. The program will fall under the broad umbrella of the Land Resources Graduate Program of the Institute for Environmental Studies (IES). Currently the Land Resources program also covers the Water Management program. Both the water and air programs hope to have their own classification in the next few years.

The program was devised by a nine member faculty committee, headed by Erhard Joeres, a professor in Civil and Environmental Engineering (CEE) and IES. Joeres stated that the program was created with several factors in mind. "We worked hard with both the government and the business community to find out what kind of training they wanted professionals to have. This program was designed in part to fit their needs." The demand for new employees with specialized training in air resources is tremendous . According to Joeres, the Wisconsin Department of Natural Resources Bureau of Air Management is expected to double its size, from 150 to 300 employees in the next two years. In addition, private industries will also need trained professionals to deal with the implications of the new law.

Employers needs were not the only factors considered when this program was created. "The Clean Air Act is going to have a profound effect on our lives," said Joeres. "Air pollution is one of our biggest problems because it is hard to measure and hard to control. We need skilled people to help deal with the problem." This was the other main factor discussed by the committee, according to Joeres.

The Air Resources Management program itself is designed to cover many disciplines. Courses range from control technology and atmospheric sciences to policy and economics. The program consists of 36 credits, including a six credit thesis. There are 21 core requirements including Atmospheric Science I (AOS 321), Air Pollution Effects, Measurements and Control (ME 466/CEE 423), Modeling the Earth System(AOS 601/IES 400), and Air Resources Policy, Institutions, and Regulation which has no course number as of yet, because it was created for this curriculum. Of the nine remaining electives, participants must take either a policy or an economics course to fulfill humanities requirements. This curriculum was constructed to meet the stated goal of the program which reads: "The Air Resources Management curriculum in IES is designed to meet the critical need for professionals competent in air resources issues spanning air system behavior, multimedia issues, regulations, analysis, planning, design and control."

Professor Joeres is proud of the development of this program. He feels that it follows in the Wisconsin tradition of progressive environmental ideas. "Many people don't know that the Federal Clean Air Act was based in large part on the 1985 Wisconsin legislation (Wisconsin Clean Air Act). That bill was designed to cut sulfur emission in half by the year 1993, and we have more then met that goal." Joeres feels that with the success of the past to build on, the new program can go a long way towards reducing air pollution. ■

We worked hard with both the government and business community to find out what kind of training they wanted professionals to have. This program was designed in part to fit their needs.
-Professor Erhard Joeres

HELP WANTED: Air Quality Engineer

AUTHOR

By the time you read this, Dan will have graduated and will be working in the field of Technical Communications (he hopes). He has a B.S. in English and is out to dispell the myth that English majors have no future. He may also be engaged.

Hey, Who Turned Out The Lights?

Uninterruptable Power Systems

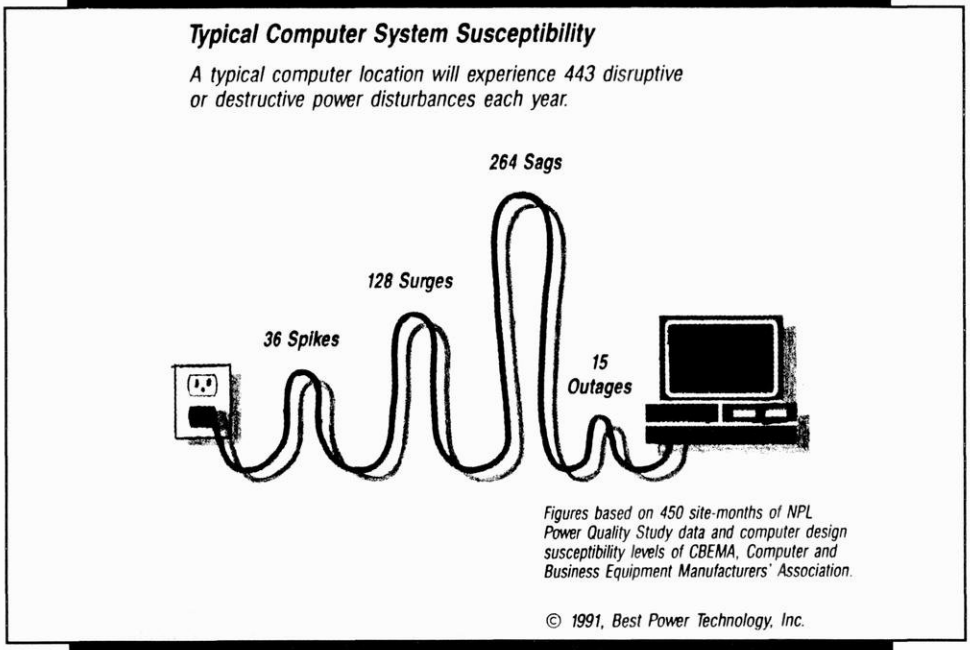


Figure 1. ***Typical Computer System Susceptiblity:*** *A typical computer location will experience 443 disruptive or destructive power disturbances each year.*

It's midnight on a dreary Sunday night. You, a dedicated engineering student, sit face to face with a PC at the Computer Aided Engineering Center. You stare intently at the screen. The last thing you can remember is having breakfast sometime this morning. The rest of the day has blur of computer screens, graphs, and data for the lab report that has been looming over your head for days. You are comforted by the thought that it will soon be over, and the report that you are so close to finishing will be in the hands of your professor in less than 24 hours. You smile at the thought of completion when suddenly-your screen goes blank! This cannot be! Around you about fifteen faces suddenly bear the same distressed expression. What is happening? A crowd forms at the CAE consultant's desk. The frazzled young man can tell you only that the system's power is down, and when it will be back is anybody's guess! How can this happen? What do you do?

Is this horrible scenario just an a nightmare from a stressed out engineering mind, or is it a possible reality? As many students know, this is not a figment of the imagination. Rather, downed computer systems often result from powerline disturbances which threaten all sensitive electronic equipment every day.

It is estimated that power disturbances throughout the United States cost over 12 million dollars a year. When a manufacturing plant experiences a power problem, thousands of dollars in production are lost for every hour of downtime.

So how is a business to know what causes these huge losses, and how likely is their equipment to be hit? Until recently the causes and frequency of power failures were a mystery. But in 1990 the world's largest power quality study was initiated by National Power Laboratory, a division of Best Power Technology. National Power Laboratory was established in 1988 by Best Power Technology, Inc. of Necedah, WI to research power conditioning and protection products, and to monitor their performance.

In March of 1990 NPL began a five year study on power disturbances throughout the United States. Although power problems which affect sensitive electronic equipment are random in nature, the probability of a certain type of disturbance occurring can be evaluated through statistical sampling methods. NPL is using this strategy to conduct a

Any operation dependent on computers...needs to have a system of protection against power disturbances

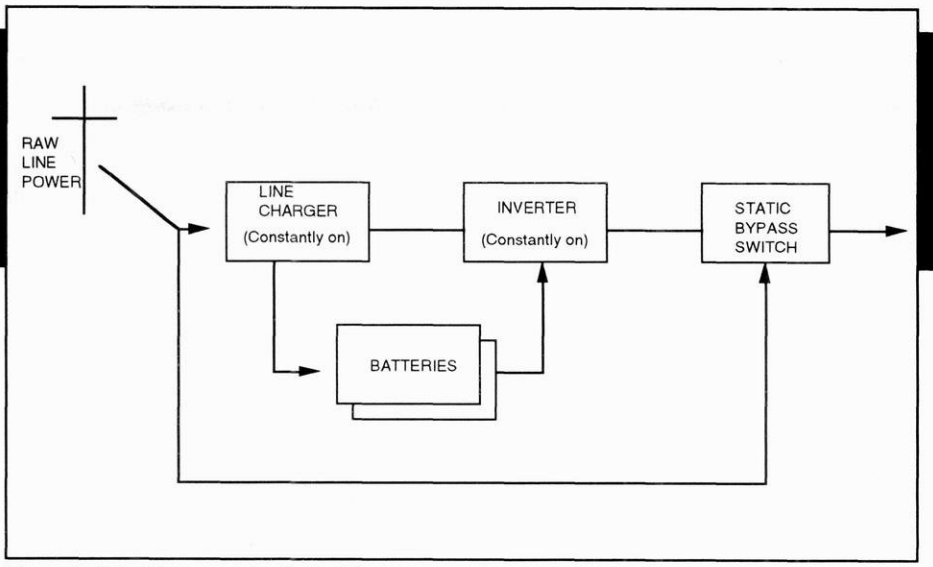


Figure 2. A double conversion design UPS converts einput AC power to DC and back to AC for input.

study of power disturbances at over 80 randomly selected sites throughout the U.S. and Canada. The study monitors a variety of locations, such as residential houses and huge industrial plants. At these locations single phase 120 volt AC power is continuously monitored for up to 12 months. The voltage and duration of every disturbance is recorded, as well as the date and time of occurrence. Graphic plots indicate the type of power problem at hand.

Typical sensitive electronic equipment faces four main categories of power problems. **Spikes** are high magnitude split second jumps in voltage often caused by lightning, or when large electrical loads are switched on and off. If the impulse of voltage is high enough, it can actually blow holes in delicate microchip traces, causing permanent hardware damage. **Surges** are overvoltages that last longer than a regular 1/60 second cycle. They are caused by the the same factors as spikes. Surges that last a long time or occur frequently can cause damage to computer hardware. Undervoltages that last for many cycles are known as **sags**. Sags are caused by lightning, undersized power systems, and ground faults. They can cause computers to lock up, and also slow the disk drive speed. **Power outages** can be prolonged undervoltages or extended periods of zero voltage conditions. Such blackouts cause any system to crash, often resulting in permanent damage to hardware. The current findings of the National Power Laboratory's power quality study have shown that a typical computer is susceptible to 443 disruptive or destructive power disturbances per year. (See Figure 1)

Clearly these results indicate that any operation dependent on computers or other sensitive electronic equipment needs to have a system of protection against power disturbances. To insure that valuable time and money is not lost, equipment must be provided with power conditioning, which removes small disturbances, lightening protection, and alternative backup power. That's where Best Power Technology comes in. Best, the founding company of NPL, is the world's largest manufacturer of the standard technology for dealing with power disturbances: the uninterruptable power system, or UPS.

Uninterruptable power systems work on the concept of continuous power. When a machine loses AC input power, a UPS prevents a fatal break in output power. This is different from the older technology of standby power systems which break output power when transferring from line input power to their own stored battery power. A UPS contains a charger, which converts AC power coming in from a utility into DC power, making it suitable for storage. This energy is stored in batteries. During an outage the batteries provide their stored power to an invertor, which converts it from DC back to AC and feeds the power to the electronic equipment being protected by the UPS. (See figure 2)

It is estimated that power disturbances throughout the United States cost over 12 million dollars a year

The concept of uninterruptable power systems originated in the 1960s. Researchers at that time were working with arrangements of inverters attached to batteries which in turn connect to chargers that provide AC power when utility sources turn off. In 1974 an engineer working for Brown-Boveri corporation termed one such system "double conversion", indicating that it converts AC power into DC power, some of which is stored while the rest is converted back into AC power to be used by the protected load. The UPS operates on the double conversion principle. The double conversion UPS was the the first design which could provide continuous power to sensitive machinery such as computers. Today UPS's provide power protection to nearly all varieties of computer operated systems of all ranges of complexity. Best Power Technology, Inc. manufactures UPS products for five levels of power protection. The most powerful UPS's are intended for mini-computers and LAN File Servers, while the lowest level of protection guards printers, modems and copy machines against surges and noise.

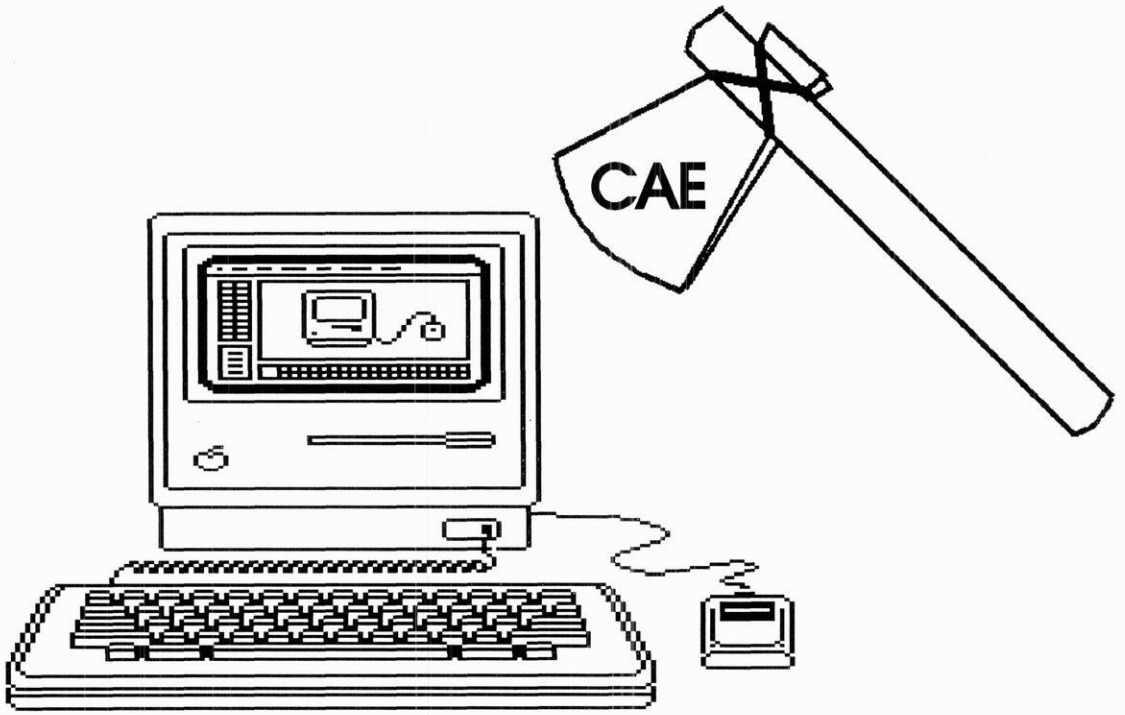
Today, thanks to UPS technology and the research of National Powers Laboratory, many electronic systems are provided with protection against the variety of power disturbances. So the next time a hard working soul is slaving for hours at a computer terminal, we can hope that lightning does not strike, and if it does, there could always be a UPS waiting to save the day. ■

AUTHOR

Liz Zilist is an ME-4. She spent the summer interning at Amoco in Chicago.

Macs.....the Axe?

CAE Officials Ponder Changing Computers as the Computer Market Changes



In early April, engineering students were alarmed by news that Apple Macintosh computers would be removed immediately from the Computer-Aided Engineering (CAE) labs. Fortunately for engineering students, the news was not true. However, the fate of Macintosh computers in CAE is still uncertain.

The flyers were posted by Polygon Engineering Council out of fear that students would not have an opportunity to give input into the decision-making process. This fear arose when a student consultant at CAE was told that no student input would be solicited on the decision to phase-out Macs. The consultant then passed this news on to Polygon. However, according to CAE officials, Polygon did not contact CAE to verify the rumors before posting the flyers.

While CAE officials admit that a phase-out of Macintosh computers is being considered, no decision has been made as to the future of Macs in CAE. CAE Director Mike Redmond stated that even if such a decision is made in the near future, the phase-out will not happen until the summer of 1994 at the earliest and probably not until the summer of 1995. However, if Macs are eliminated from CAE, once the phase-out begins, it is likely that all Macs will be removed at once. If the administration decides not to eliminate Macs, the current Macs will be replaced with new Macs.

...if computer prices continue to fall, 70% of students may own computers in the near future

It is uncertain whether the same number of computers will be bought to replace the Macs that may be removed. While CAE officials hope to keep the current computer lab space occupied with computers, budgetary constraints may not allow this. Also, CAE officials stated that as computers continue to become more affordable, they expect more students will own their own computers, reducing the number of machines needed in CAE labs. According to the latest survey of incoming freshmen, approximately 30% own a computer. CAE Associate Director Art Wittmann speculates that if computer prices continue to fall, 70% of students may own computers in

the near future. Wittmann bases this estimate on a comparison to the sales of calculators in the 1970s. Calculators were initially quite expensive, but prices declined as technology increased, making them more affordable.

Wittmann outlined several reasons for the proposed phase-out of Macs. First and foremost, Wittmann cited Apple's place within the market. Apple holds about 15% of the personal computer market. Despite having a user interface that has been clearly superior to its competitors, Apple's market-share percentage has not increased over the past several years. Wittmann attributes this to the relatively high cost of Apple hardware compared to competitors' hardware. Wittmann also sees a trend in the development of more user-friendly operating systems by companies such as Microsoft. These systems will be able to run on commodity (cheaper) hardware, thus threatening Apple's interface edge. Commodity hardware, primarily Intel-based hardware, has a 75% market share. Therefore, software companies are eager to meet the needs of an already large and growing market. This is likely to mean better software and a greater variety of software for this majority platform.

Despite having a user interface that has been clearly superior to its competitors, Apple's market-share percentage has not increased over the past several years.

CAE could also gain from the discontinuation of Macs. By eliminating one type of computer, the network would be easier to manage, hardware easier to maintain, and staff easier to train. This translates into a more stable system (i.e. fewer network crashes and printing problems) and a staff that is better able to handle users' questions and problems. In addition, the money used to buy software for this specific type of computer could be used to provide more services to CAE users, such as better engineering applications.

Wittmann cites several reasons why Macs have been targeted as the platform to eliminate. First, few engineering applications are unique to Macs, whereas there are unique applications on HP and Sun workstations and IBM PCs. Second, Macs are difficult to support in a network. CAE is recognized nationally for its ability to run such a complex, multi-platform network. Third, because Macs are used primarily for document-processing, as student ownership of computers continues to increase, more document-processing will be done away from CAE. Thus, CAE can put more emphasis on engineering applications.

In the future, CAE would like to have portable laptop computers for students to use. These portable computers could be equipped with wireless transmitters which would allow students to access the CAE network from any room with a receiver. This would enable students to take class notes directly onto the computer. This might also enable professors to better integrate computer applications into their curricula by having them available in the classroom rather than having to reserve a CAE lab to conduct a class in.

CAE officials say that there is no campus-wide movement to phase-out Macs in computer labs, so students who have spent considerable time learning how to use Macs would still be able to find them on other parts of campus if they are taken out of CAE. However, since the College of Engineering is often the leader on campus in changing technology, a campus-wide phase-out of Macs is certainly a future possibility. ■

By eliminating one type of computer, the network would be easier to manage, hardware easier to maintain, and staff easier to train.

AUTHOR

Mike Waters is a senior in mechanical engineering. Mike spent last summer on his second co-op term at 3M.

ECMA 93

The crew from the Wisconsin Engineer *poses for a picture after the awards banquet at the Kansas University student union.*

Neither snow nor Don Woolston's jokes stopped the *Wisconsin Engineer* crew from getting to Lawrence, Kansas, to attend the 1993 Engineering College Magazines Associated conference. Each year, a magazine from ECMA sponsors a convention. This year the Kansas Engineer hosted the convention where representitives from 12 college engineering magazines gathered. The convention gives magazine staff a chance to find new ideas to bring back to their magazines. The theme this year was "Decoding the Technical Dialect."

Although the first 150 miles took us four hours, but we arrived only an hour behind schedule. The kind faces of the award winning *Kansas Engineer* staff greeted us when we arrived at the Quality Inn/Karaoke bar. Thus began the weekend of intense communication in workshops, assemblies and social events.

After brief formalities with magazine members from across the country, we headed to the hot spot of Kansas, Caleco pizza. A lively bar, Caleco pizza sported the signatures of all who felt the need to write on its walls. Both Liz Zilist, *Wisconsin Engineer* Editor, and Jenny Wondergem, Production Editor, were provoking stimulating conversations about the production of engineering magazines with representatives from Ohio State and University of Colorado. Jason Och, *Wisconsin Engineer* writer, was heard discussing Jimmy Hendrix lyrics with anyone he could find. Don Woolston and Ryn Etter entertained themselves at the pin-ball machine. Before we knew it, it was midnight and time to head back to the Quality Inn.

On the way to our rooms, Jason and I decided to sing some tunes at the Karaoke bar. To the amusement of the remaining bar customers, we sang a few memorable tunes, including Rhine-Stone Cowboy and an Elvis hit or two. Although we had many cheers (we could not quite tell if they were cheers to get us off the stage), we decided to head for bed.

The next morning, we awoke and managed to make our way to breakfast, slightly behind schedule. Apparently the majority of the conference participants had similar morning schedules. After a hardy breakfast we headed to the Kansas University Campus by double decker bus.

A Washington Post photographer started the day's events with a talk on his work in the journalism field. His discussion focused on the importance of initiative with-in any discipline. He explained that his best work has resulted from assignments that he created for himself. As an example, he showed slides of his work documenting the war in Yugoslavia, where he went because of personal curiosity rather than an assignment. This powerful display of initiative through the medium of photography lingered in our minds as we proceeded to various workshops.

Throughout the morning, conference participants chose three workshops to attend. Programs ranged from design techniques and managing workshops to critiques of your school's magazine. The four of us each went to different workshops, trying to get the most out of our registration fees. Jenny was able to get radical new ideas from the design workshop. Liz found the critique to be a helpful guide for analyzing both the layout and writing aspects of the magazine. Jason went to the technical writing seminar, to learn some strategies of writing for a technical magazine. Jenny and I went to the printing workshop which gave advice on what to look for in a good printer. Overall, we were able to broaden our knowledge of

the technical writing world.

The next event, assembly committees, took place in the afternoon. The *Wisconsin Engineer* , was in charge of the Awards and Membership Committee. Here we decided what awards to add to the present awards and what membership requirements should be. After long deliberation and much awaited anticipation, we came up with a "Most Improved Magazine Award" and clarified unclear membership requirements. The meeting adjourned after two hours of decision making.

By now, dinner time was approaching quickly, it was time for the four of us to find a restaurant. We decided to go to Buffalo Bob's, an interesting barbecue joint. We all were ready to eat huge servings of fries and barbecued chicken except for Jason, who wanted a Mc Donald's Happy Meal. After stuffing our faces, we headed to a local brew pub, where most of the conference members were congregating. The rest of the evening was a blur.

The next morning began with the long and painful process of a general assembly, at which each committee had to give motions for the constitution. Four hours later, the constitution was finally amended and we adjourned. After short naps, we headed to a Cajun restaurant for lunch where we had some *hot* food. It took some time but my tongue finally recovered from the cajun spices and I was able to speak in time for the awards banquet.

Photo by Jennifer Wondergem

General Manager Jim Webb and writer Jason Och establish a reputation for Wisconsin as the Karaoke masters.

The banquet was held in the student union. While we ate we listened to an engineering journalist who spoke about communication. A captivating speaker spoke of the need for engineers to learn how to communicate on the job. When he was finished, awards were given. The *Wisconsin Engineer* picked up third place for most entertaining article and an honorable mention for best layout. The banquet was a grand finish to a successful conference.

We left Lawrence bright and early the next morning. The car was silent. We discovered that a full weekend of constant communication can wear out even the most talkative bunch. Eventually we made it back to Madison to find the homework we had forgotten about over the weekend. ■

– *Written by Jim Webb*

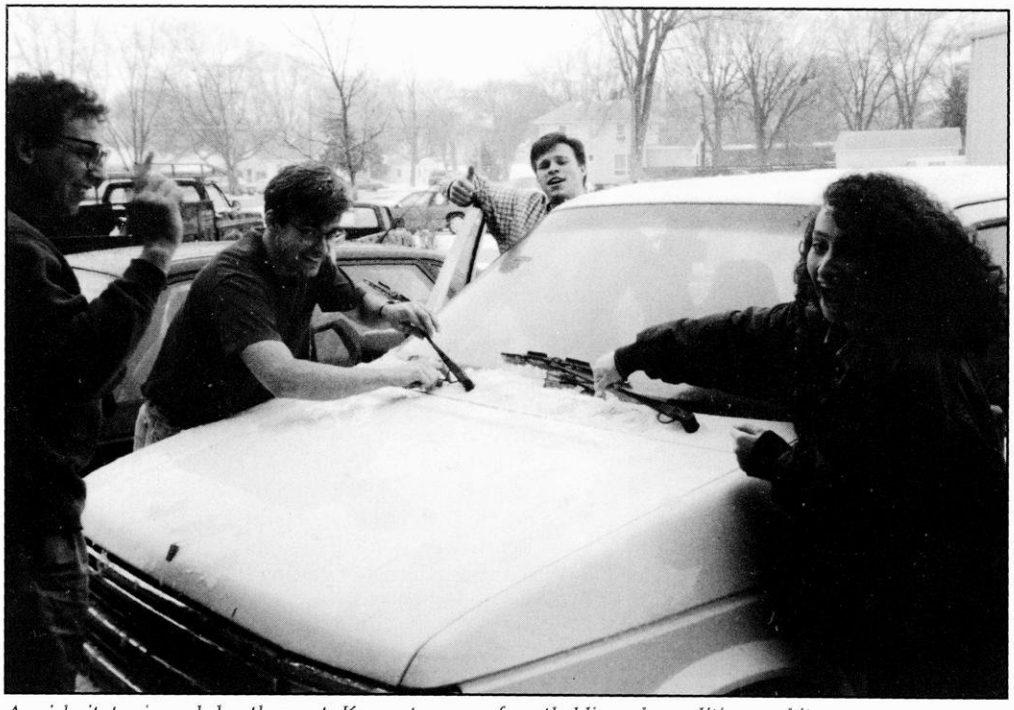


Photo by Jennifer Wondergem

A quick pit stop is needed on the way to Kansas to recover from the blizzardy conditions we hit travelling through Wisconsin. Don Woolston gives us tips on the finer points of scraping a car.

What is *ECMA?*

The organizing force behind the annual *Wisconsin Engineer* road trip is the 70-year old Engineering College Magazines Associated, a non-profit organization devoted to supporting engineering-student produced magazines like the *Wisconsin Engineer* .

The organization started in 1912 because of an advertising executive who saw the revenue potential in the 10 or 12 engineering magazines that existed at the time. He brought the student leaders together to standardize their format and publication schedules so that in return he could collect commissions on advertisements placed in the magazines. He also instituted an annual convention with workshops and awards. The *Wisconsin Engineer* is a charter member of ECMA, making it perhaps the oldest student organization on campus. Even though that advertising agency is no longer involved, the tradition of the ECMA convention continues.

Photo by Jennifer Wondergem

Don Woolston, as a part of his duties as ECMA chairman, heads the general assembly at the ECMA convention at Kansas University.

The ECMA organization reached its peak in success in the 1960s and 1970s. Over 40 magazines belonged, including even the UW-Platteville *Geode* . During that era, recruitment ads from large national corporations like General Electric and Bechtel filled the magazines, and revenue from the ads made both the magazines and ECMA as a whole extremely prosperous. At one time, the *Wisconsin Engineer* had a reserve of over $10,000, in spite of the common practice of paying to fly as many as 18 students and faculty to each national convention.

The bubble burst in the 1980s. National advertisers found the mushrooming number of professionally produced periodicals such as *Graduating Engineer* , *U.S. Black Engineer* , and *Hispanic Engineer* to be a more attractive investment. The ad agency that started ECMA went out of business, leaving ECMA without a reliable funding source.

But none of these problems has reduced the effectiveness of the annual ECMA conventions. Each year, one of the 20 or so active schools bids to hold the convention, each trying to outdo the previous year's event in terms of prestigious speakers, elaborate workshops on publishing, and outrageous social events. From year to year, each magazine strives for a coveted ECMA award, especially that for Best All Around Magazine. The *Wisconsin Engineer* last had that distinction in 1990; in the last two years, the magazine has placed in the top five, but has not overcome stiff competition from the likes of the *California Engineer* , with a circulation of over 9000, and the *Minnesota Technolog* , which boasts a paid staff.

However, none of the schools competes with Wisconsin in terms of getting the most out of trips. to the annual ECMA convention. ■

– Written by Associate Dean Don Woolston

Society Spotlight:

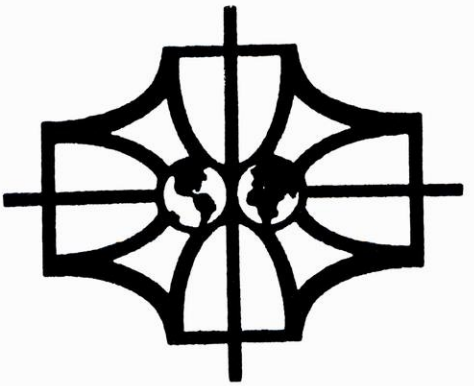
Society of Hispanic Professional Engineers

Coming to the fishbowl of UW-Madison, with its large campus and variety of students can be intimidating for anyone. When you cannot speak your native language and no one listens to the same music you do, you can really feel like a fish out of water. One engineering group is working to help some students feel more at home in Madison. The Society of Hispanic Professional Engineers has helped 40 engineers make friends with whom they can speak Spanish and have fun while wading through the mire of homework and classes.

SHPE offers a unique environment for students of color, especially Latinos, who may feel that they are alone in their classes
-David Pena

"SHPE offers a unique environment for students of color, especially Latinos, who may feel that they are alone in their classes, as they often are," says David Pena, a member of SHPE. The group tries to help Latinos feel more comfortable in Madison by providing a support network for them on academic, social and personal levels.

Some society members are international students from Hispanic countries, and some are from the United States. Although they have very diverse backgrounds, being able to "meet other Latino students [who share the same] language and music... is a comforting feeling" for Pena.



Rudy Chavez, former president and founder of SHPE, also emphasized the support function of the group. The older members often give advice to younger students about classes, professors, and job and intern searches. They are glad to be able to speak to someone in Spanish. "There's a lot of mutual support," he said.

Chavez began SHPE in the fall of 1991 with the aid of Vilma Linares, an administrator in Engineering Mechanics. They recognized that Latino students needed an organization of their own. Linares eventually became the society's academic advisor. Since then she has been helping students who are intimidated because of lingual or cultural barriers to talk to their professors.

Members of SHPE have the opportunity to visit industries, participate in conventions and get hands-on experience at EXPO. Last year they were invited to visit Kraft General Foods in Glenview, IL by a member of the Chicago professional SHPE chapter. "We had good attendance and everybody was very impressed," says Chavez. The group also attended the national SHPE conference in Chicago where they met industry leaders and other Hispanic professionals. Both Chavez and Pena thought EXPO was a great success for SHPE last spring. "It really joined the group together," Chavez commented. Pena agreed and added that there was something for everyone to do. The freshmen were especially glad to be able to help with the project and get practical experience. Their hard work paid off in an Honorable Mention at EXPO.

SHPE is not only an organization that helps students of color in academic areas, but also provides a forum for socializing and meeting new friends. "I feel we have a strong base now with lots of ideas and a fresh membership with a willingness to work," said Chavez confidently. ■

AUTHOR

Alyssa Hunt is a junior in mechanical engineering. This summer, Alyssa to worked like a dog, ate ice cream every day and walked barefoot through the fountain on library mall at every opportunity.

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With the football season upon us, some unusual sights abound right in the backyard of the Engineering Campus.

- Which foot goes forward first?
- Come on girls - let's see some more leg!
- The new band mittens cause quite a stir.
- Schmeel, Scmozl, Haas and Pepper Corporated...
- Good thing this isn't our day job!
- U - Rah Rah Wisconsin!