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WISCONSIN ENGINEER

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WISCONSIN ENGINEER

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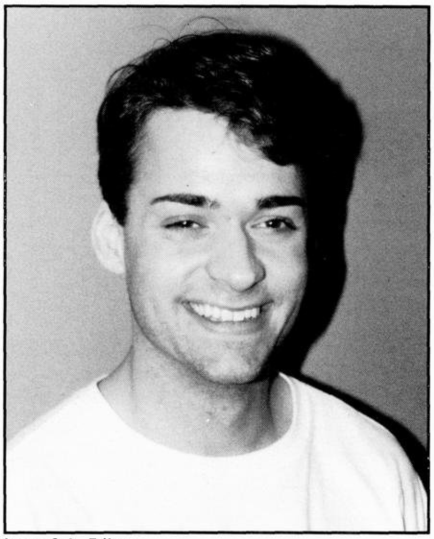


Jason Och, Editor

Editorial

The "Smart" Side

...Or So

When I think of engineering students, I picture hard working problem solvers who, should they have the luxury of a few minutes of free time, would probably spend it "surfin' the Net" at CAE. Then when I focus on non-engineers, in particular liberal arts types, I envision young idealists arguing philosophy over a cup of espresso at a State Street coffee shop. When I first came to Madison, I believed I would end up one of those idealists. Gradually, however, I discovered that idealism didn't pay well and philosophy brought more questions than answers. So I made the "smart" decision; I became an engineer.

Now, looking back on many semesters as an engineer, I ask myself if engineers and non-engineers are really that different. Are the stereotypes valid? Is it true that two different cultures have developed on campus, the "smart" and the "art"?

- *Libraries*: Take Helen C. versus Wendt. The former was ranked in the '80s as one of the top ten non-alcoholic pick-up joints in the nation. Wendt, on the other hand, certainly has to be one of the top ten places on campus to take a nap — or at least "pick up" a good book on electromagnetic wave theory or thermodynamics.

- *The SERF vs. the Shell*: It may not be entirely accurate to label the SERF as "artsy" and the Shell as "technical," but at the very least there are a lot more members of the Greek system at the SERF. Whenever I go to the SERF I figure I will run into someone I saw at the bars the night before, whereas at the Shell I am always afraid I will run into one of my professors — *in better shape than I am..*

- *Ratio of women to men*: Much like a bad house party. As one female engineer put it, "I walk in the classroom and a sea of [male] heads turn and stare at me."

- *Clothing*: It's '70s retro vs. '80s leftovers. Or better yet, Urban Outfitters vs. young urban professionals.

- *Student unions*: Memorial Union offers the Rathskeller, the Terrace and Memorial Concert Series. Union South offers Einstein's, a view of Wendt Library, and bowling. Hmm...

Clearly there are many differences between the engineering and non-engineering parts of the University. Nevertheless, there are many similarities. Every student, engineering or otherwise, has tests to cram for, homework to complete, and partying to do. Each individual has his or her own ideals and philosophies. And every person brings to Madison unique talents and aspirations. I know my college experience is richer now because of my interaction with people of different backgrounds and interests. I hope I have had the same effect on those people as well.

vs. The "Art" Side

They Say

Carolyn Curley, Editor

When first beginning at this university, my primary focus was to earn an English degree, with hopes of teaching it on the collegiate level someday. During this time, I indulged myself with literature classes as well as writing courses. One day in my Expository writing class there was talk of a program that taught students how to write and communicate in a clear and concise manner. I later learned that it was called the Technical Communications Certificate (TCC) program and was being offered by the College Engineering. At that time I was concerned about finding a job with just an English degree and thought that this certificate would distinguish me from all the rest of the "artsy" type English majors, when applying for a job. That following Fall semester I began taking (Engineering Professional Development) EPD 397 and EPD 201 as part of my courses.

Over the past two years I have toggled back and forth between the two distinctly different areas of this university. I have become involved with *Wisconsin Engineer* as well as volunteering for EXPO '95. In Fall of 1994 I began a program in Elementary Education, while still majoring in English. So suffice it to say I have received a well-rounded educational experience at this university. In addition, I have noticed many differences between the Engineering and Letters and Sciences Colleges including the surrounding areas, classes, and students. I have also developed a strong sense of how separated these two areas can be.

One day while eating lunch at the McDonald's near the computer aided engineering lab (CAE), with a friend from my Elementary Education classes, the topic of EXPO came up. Actually, she said in a blaring voice "So what in the world is EXPO anyway, and where does it take place Milwaukee?" As I looked at the people immediately sitting around us, I noticed the shocked expressions on their faces and I slowly began to sink into my chair.

Well, the lack of awareness of the Education major is shared with a few Engineering students. I have encountered discussions more than once, when an Engineering student has had no clue what the Humanities building was or where it is. I understand that perhaps taking a class in that building is unlikely for the engineering student, but not knowing that it exists at all is riveting. For all who still do not know, Humanities is the building where music can be heard throughout the hallways and where elaborate paintings and sculptures are created.

Throughout my education here I have taken courses in literature, ceramics (**not** ceramic engineering), French, Spanish and Technical Writing and currently Education. The big thing that I have noticed through experience and word of mouth is homework. Sometimes I will have three to four papers due each week for one of my classes. Writing paper after paper takes time, thought and creativity, whereas the Engineers are assigned grueling calculations and long lab nights at the CAE, and may only have few papers to write throughout four years of college.

Another distinction within the classes are the majority of gender differences. When taking an EPD class I was usually one of two girls in a class of twenty-five men. On the other hand in my Education classes, consisting of twenty-five students, every single one is a girl. I often receive requests from fellow classmates to keep an eye out for some available bachelor Engineer.

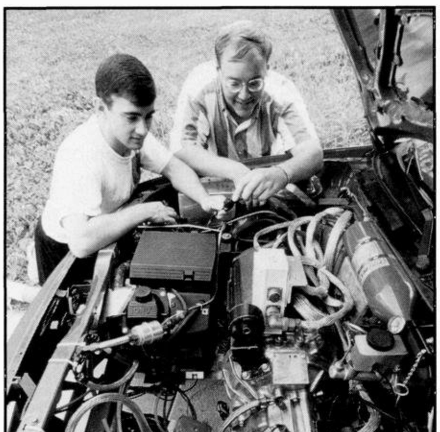
A lot of these harmless differences are just the way things are on this campus due to different areas of study and location. I really feel that there is no "smart" side of campus and no "art" side of campus. So hopefully both sides can just have awareness of each others strengths and weaknesses, as opposed to disrespecting them.

Jump-Starting the Electric Vechicle Industry

California's zero-emission mandate sparks nationwide debate over electric vehicle feasibility

City planners and engineers across the U.S. have searched for decades for the "ideal" form of transportation, one that offers convenience and affordability without harming the environment. In theory, electric vehicles (EVs) fit the bill. Yet EV performance falls far short of cars powered by internal combustion engines. The reason? Pound for pound, conventional batteries supply only one-hundredth to one-twentieth the energy of gasoline.

Recently, several states adopted mandates requiring auto makers to produce pollution-free vehicles. Since batteries are the limiting factor in EV production, much research is underway to develop better batteries. Engineers are also working on new charging techniques to optimize battery and charge storage capability. If these technologies can be implemented on a large enough scale, EVs, or at least their hybrids, may soon become commonplace on American roads.



Source: Engineering Publications

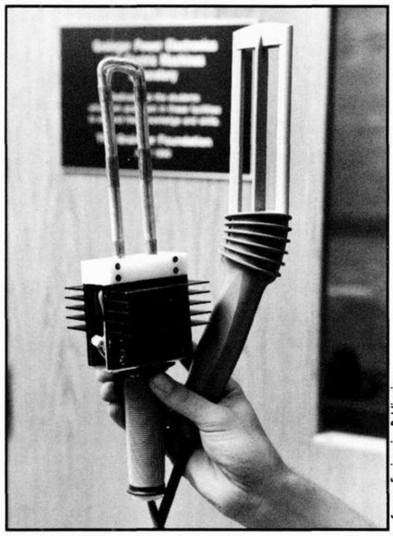
Two members of the UW's Hybrid Electric Vehicle Project inspect the automobile's gasoline-and battery-powered engines.

Battery and Electric Vehicle History

Even though batteries and EVs have received much media attention lately, each has been around for a long time. Remnants of the oldest known electrical element date back to 250 B.C. Producing a terminal voltage of approximately 0.5 volts, this rudimentary battery consisted of copper and iron electrodes immersed in a weak organic acid. In 1800 Alessandro Volta developed the first battery, a stack of cells known as a "pile." The first modern battery, with lead electrodes in sulfuric acid, appeared in 1854, while the first practical rechargeable cell emerged in 1859.

Surprisingly, electric vehicles have been around longer than those powered by internal combustion engines. At the end of the nineteenth century, Americans drove more than 15,000 EVs. However, the gasoline-powered vehicle, with its superior performance, quickly stole the automobile market.

During the twentieth century, as more cars have appeared on American roads, more automobile-related problems have affected society. In 1973 a major fuel crisis shocked the entire economy, reminding the nation of its strong dependence on fossil fuels. Meanwhile, smog in cities such as Los Angeles grew to nearly intolerable levels.



Source: Engineering Publications

Developed by UW researchers, these hand-held magnetically coupled chargers provide a safe means of recharging electric cars.

America clearly could not depend on gasoline-powered vehicles forever.

Paving the Way for EVs

Consumers and legislators alike have recognized the need for alternative, environmentally friendly energy sources. In an effort to promote pollution-free vehicles, the California Air Resources Board (CARB) recently passed a zero-emission mandate requiring that two percent of all 1998 model cars and light trucks sold by companies producing 150,000 or more vehicles annually must be battery powered. By 2003 that number rises to ten percent. Maine and New York have passed similar laws, while other New England states are considering putting such laws into effect.

These regulations could have a great

impact on the auto industry, particularly on the Big Three auto makers. Any manufacturer not meeting states' regulations would be prohibited from selling cars in those states. To meet the 1998 California guidelines, GM alone must sell roughly 5500 EVs, twice the number of Corvettes it sells annually in that state.

COMPARISON OF BATTERY TYPES FOR ELECTRIC VEHICLE USE

Battery Type	Availability	EPA City/ Hwy Miles [1]	Recharge Time [2]
Lead-acid	Now	70/90	8-12 hrs.
Nickel-iron	Now	100/129	4-5 hrs.
Nickel-cadmium	Now	110/135	6-8 hrs.
Nickel-metal hydride	Imminent	160/205	1 hr. w/smart charger
Sodium-sulfur	Around 2001	200/257	6-8 hrs.
Zinc-air	Around 2001	235/300	4-8 hrs.
Lithium-polymer	After 2001	280/360	Not available
Lithium-aluminum/ iron-disulfide	After 2001	300/385	Minutes

Source: Popular Science

[1] Includes benefits of regenerative braking, which contributes about 15-20 percent of city driving range and about 5-10 percent of highway driving range.

[2] Home-charging times are affected by the type of electrical service and connectors installed in the residence. "Smart" chargers also reduce charge times.

Auto industry experts assert that these laws have been passed prematurely. They point out that current battery technology drastically limits EV performance, especially compared to gas-powered cars, and new experimental batteries are costly and unavailable for production on a large scale. Despite strong lobbying efforts against zero-emission laws, auto makers have been forced to prepare for the 1998 mandate. They, in conjunction with battery makers and the federal government, are pouring millions of dollars into development and reassessment of battery technology.

The Inadequacy of Conventional Batteries

No single battery type is best for EV use. Conventional automobiles use 12-volt lead-acid batteries, which are relatively inexpensive and easy to manufacture. These batteries consist of six cells producing two volts each as lead terminals react with sulfuric acid to form lead sulfate and water. The batteries have several drawbacks, including high weight and environmental toxicity.

The high weight of the materials in standard lead-acid batteries prevents them from storing large amounts of charge per pound of battery. This low energy density renders standard lead-acid batteries impractical for EV use. According to Herman Wiegman, research assistant for the Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) and Electrical Group leader for the UW Hybrid Electric Vehicle (HEV) project, standard lead-acid batteries have only one-hundredth the energy density of gasoline. The 800 pounds of lead-acid batteries powering Wisconsin's HEV store the energy equivalent of only eight pounds of gasoline. "Driving an EV is like starting the day on one gallon of gasoline," Wiegman notes.

New Battery Technology

Other types of batteries offer much better performance than lead-acid technology. Nickel-cadmium (Ni-Cad) batteries, often used to power portable devices such as TVs and electric shavers, offer long life and high charging rates. Despite these attributes, Ni-Cad cells are several times more ex-

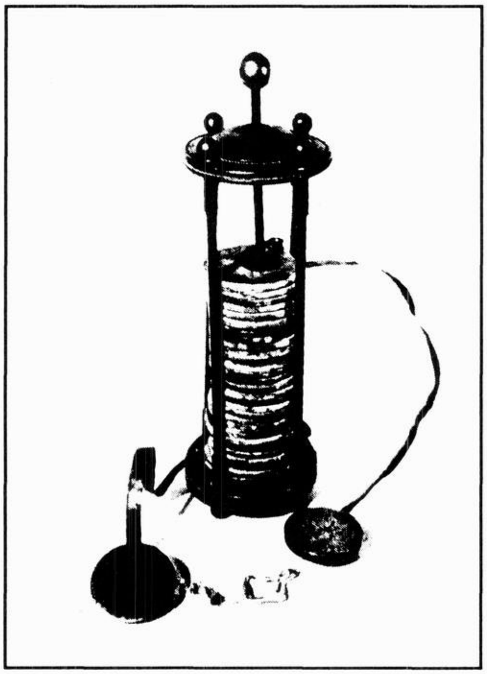
Advanced Charging Methods

Modern battery charging systems are extremely complex. "We have to use high-technology electronics, monitoring systems, even computer-controlled chargers to get the best life and the best energy in and out of these batteries," says Wiegman.

In a lead-acid battery, parasitic reactions occur which cause sulfation, the crystallization of lead-sulfate deposits formed on a battery's electrodes. These unwanted reactions decrease battery performance. "It's something like getting dirt on your windshield," Wiegman explains. "If you don't wash it off, you won't be able to see after awhile." The crystallization takes place especially when the battery is low on charge. Several techniques have been developed which actually remove sulfation while charging the battery.

One charging technique, known as Podrazhansky's method, involves periodically reversing the direction of charge flow to remove sulfation. First, a forward charge is applied for approximately one second. Then for one-hundredth of a second the charge is reversed. The retreating charges break up the sulfation, allowing the crystals to dissolve in the sulfuric acid. Finally, the battery is allowed to rest for another hundredth of a second. Podrazhansky's method has several advantages over standard charging, including less heat loss, faster charging and better treatment of the battery. These combined effects make Podrazhansky's method an attractive solution to the charging problem.

Resonant charging is another advanced technique for energizing and cleaning lead-acid batteries. A periodic voltage pulse, a one-volt high-frequency signal applied on top of the battery pack voltage, shakes crystallizations loose from the electrodes. Wiegman offers an analogy: "This is kind of like playing musical pied piper. The sulfation is of a certain molecular size and weight, and the chemical reaction has a certain time constant, so you [apply a voltage pulse] just right and make the sulfation dance." Resonant techniques, along with Podrazhansky's method, will almost surely be employed in future elecpensive than lead-acid, and they tend to spontaneously discharge over a period of several months. Furthermore, Ni-Cad batteries suffer from a "memory effect." They tend to "remember" their charging levels, only allowing operation between the most recent charge and discharge levels. Therefore, Ni-Cad cells must be fully discharged before charging them again. Ni-Cad batteries, while outperforming lead-acid, do not meet specifications for EV use.


Source: Modern Batteries

In 1800 Alessandro Volta created this "pile" of cells--the world's first electrochemical battery.

Researchers are investigating other less established battery technologies for possible application in EVs. GM plans to use nickel-metal hydride batteries in its pilot EV. Bellcore, meanwhile, has developed a thin-film plastic rechargeable battery, based on lithium-ion technology, that offers the same energy storage as lead-acid batteries, at one-third the weight. The Bellcore battery loses only five percent of its initial charge in the first month, compared to 20 percent for Ni-Cad and 60 percent for nickel-metal hydride. The thin-film battery also offers flexibility in EV design. Thin sheets of batteries could be hidden throughout a car in the doors, roof and floor. Yet nickel-metal hydride and thin-film plastic technologies, along with several other battery types (see chart), are still in the developmental stage.

Industry experts question whether or not auto makers will be able to quickly produce these high-tech batteries on a large enough scale to make them affordable. The cheapest batteries available for EVs cost roughly $3,000. Even standard lead-acid powered EVs are expensive. Converted Geo Prisms, after federal and state tax credits, cost $26,000 and have a range of only 40 - 70 miles. Conventional Prisms, on the other hand, can go 350 miles at a sticker price of $14,000. Even if inexpensive EVs are available, their drivers still face the inconvenience of long charging times.

Battery Charging: Techniques and Safety Concerns

A recharging infrastructure, consisting of safe and convenient EV "gas stations," must be in place before 1998. To be practical, the standard pit-stop should take ten minutes or less. Traditional battery charging techniques, however, take as long as twelve hours to fully charge a lead-acid battery. In comparison, when a gasoline pump fills a 12-15 gallon tank in a few minutes, it delivers to a car an equivalent power flow of 30 megawatts, the rate of energy consumption of 300,000 100-watt light bulbs. To safely and quickly force such large amounts of energy into potentially explosive batteries is a challenge that engineers now face.

Existing charging techniques prove inadequate for EVs. "Right now," Wiegman states, "a standard charger is a very heavy device. ... And the charger is not too kind to the battery because it (the charger) is so simple. So your battery life, the number of cycles you get out of a battery, is usually low, typically 300 - 500."

Consumers should remain aware that no vehicle--battery powered or otherwise--is entirely pollution-free

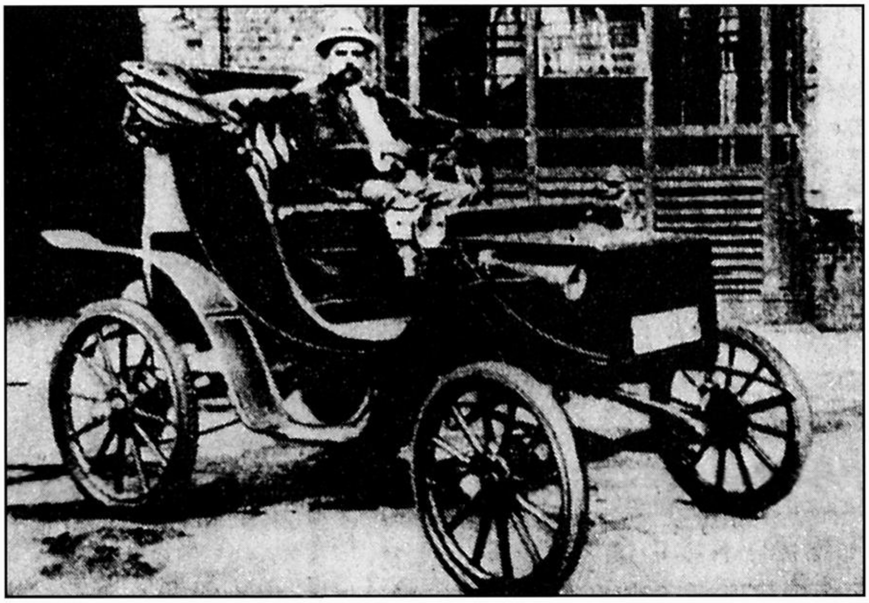
While that lifetime is fine for regular automotive starter batteries, it is pathetically short for an EV. "If you charge your battery every day, that comes out to about a year-and-a-half battery life," says Wiegman. It is highly unlikely that consumers will be willing to spend $3,000 every one-and-a-half years for a new battery pack. Other charging techniques must be utilized for EVs to become commercially viable (see sidebar).

As fuel pumps have been standardized to deliver gasoline to a tank, so must EV charging stations have common charging "nozzles" to transport electricity safely to a battery pack. Researchers at the UW Electrical and Computer Engineering department have developed a hand-held paddle that magnetically couples to an EV to deliver current to the vehicle. Despite being less efficient than direct ("hard-wired") chargers, magnetically coupled chargers offer greater safety. They isolate the vehicle from the utility grid, preventing electrical shock. Given that an EV battery pack can store the explosive potential of eight sticks of dynamite, safe charge delivery systems, such as UW's paddle charger, are essential to EV success.

Are EVs the Answer to the Zero-Emission Problem?

Presently it is uncertain whether or not practical EVs will be available for the 1998 California deadline. "We've got an electric car that we can sell," Cliff Vaughn, Vice President of GM North American Truck Platforms, said recently at a speech to the College of Engineering. "We just don't think anybody is going to buy it."

Wiegman and others suggest that HEVs, vehicles powered by batteries and gasoline, are the next logical step in vehicle technology, at least until battery energy densities and charging times improve. HEVs have low emissions because their computer-monitored engines only run at their most efficient loading point. Conventional gasoline engines emit high levels of pollutants during idle and acceleration, and due to the sporadic nature of human drivers, these engines seldom run at their most efficient load. HEVs, however, do not meet the zero-emission guidelines set by CARB. Proponents of HEV technology argue that states like California should consider revising their laws to allow for ultra-low emission vehicles like the HEV. The debate presumably will intensify as the 1998 deadline approaches.



Source: Battery Technology Handbook

The first electric battery-powered car, the "Runabout," in 1890.

"We've got an electric car that we can sell," Cliff Vaughn, Vice President of GM North American Truck Platforms, said recently at a speech to the College of Engineering. "We just don't think anybody is going to buy it."

The Future of Zero-Emission Vehicles

Many issues have been raised questioning the legislative push to get EVs on American roads. Cost, safety and convenience will ultimately decide the success or failure of these vehicles. Auto makers and the federal government are investing millions of research dollars to develop low-maintenance batteries with high energy densities. Research also continues on charging techniques and charge delivery systems. Should these technologies progress rapidly enough to meet California's 1998 zero-emission mandate, consumers throughout the country will soon begin to enjoy the quiet efficiency of electric vehicles. Until then, hybrid electric vehicles are an attractive alternative.

Consumers should remain aware, however, that no vehicle — battery-powered or otherwise — is entirely pollution-free. EVs draw their energy from the nation's power grid, which primarily uses fossil and nuclear fuels. Furthermore, as EVs age, their batteries must be disposed of. Thus, the problem of developing environmentally friendly forms of transportation is a complex one, and promises to keep automotive engineers busy for quite some time.

AUTHOR BIO:

Jason Och is a senior in Electrical and Computer Engineering. He looks forward to the day when he can buy a zero-emission Harley.

SPECIAL THANKS to Carolyn Curley, R.J. Elsing and Jon Furniss for their help in editing the April issue of Wisconsin Engineer.

Plastic Recycling
A Global Concern

The recycling of plastic is a major concern for many industries in the United States. As the applications for plastic continue to grow, so does the amount of recycling that must be done. New questions about collection, reuse and storage are brought up every day, and agencies, both governmental and private, are constantly attempting to find new and better solutions to these problems. But what about outside the U.S.? Little is mentioned as to the growth of plastic in the foreign market and even less about their recycling ideas and methods. Is the difficulty of recycling a problem that is solely kept within our borders, or do foreign countries face a similar situation? How successful are they?

The idea behind Cuplink is that the polystyrene cups are collected and then granulated at a workshop and incorporated into potting soil for large landscaping projects

Australia: Cheers!
In Australia, Plastics & Chemicals Industries of Melbourne has recently coordinated a recycling program for the apparently large amount of rigid and foam polystyrene cups the nation produces. The program, called Cuplink, began last year and has the support of ten plastics, packaging and cleaning firms. The idea behind the program is that the cups are collected and then granulated at a workshop and incorporated into potting soil for large landscaping projects. Though some questions were raised about the safety of putting plastic in soil, nursery officials have reported, "The polystyrene helps plant growth, controls weeds and makes the mix lighter and cheaper to transport." The reuse of polystyrene helps save money and the environment. The program has enjoyed some initial success, and Cuplink officials hope for even better results in the coming year.

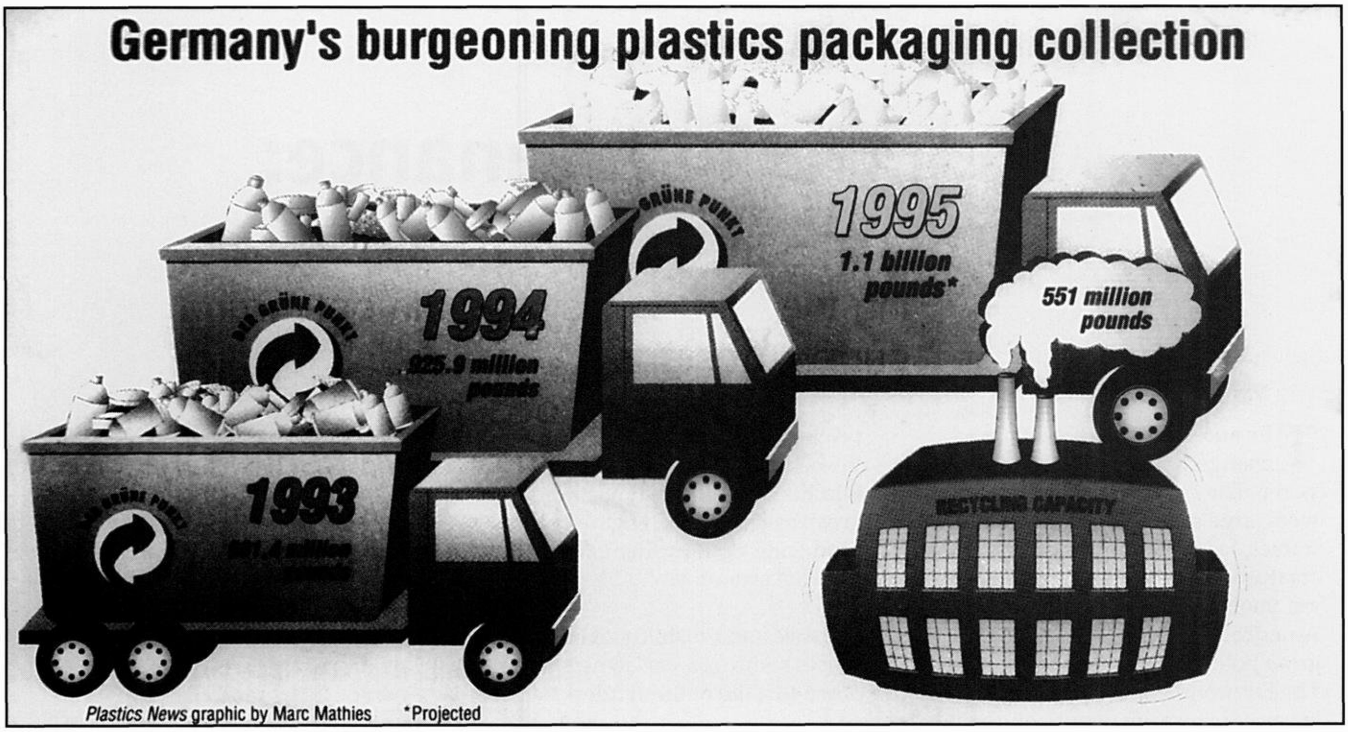
Canada: Getting the Run-Around
Canada's recycling problems seem to be rooted in the government. The country's two national packaging reduction and recycling proposals are threatened by government cutbacks and squabbles.

The National Packaging Protocol (NAPP), started in 1990 with the goal of reducing packaging waste by 50 percent by the year 2000, will lack federal leadership this year because of drastic cutbacks in the Solid Waste Management division of the federal ministry Environment Canada. Larry Dworkin, spokesman for the Packaging Association of Canada (PAC), said packaging firms fear lack of federal leadership in NAPP could lead to a checkerboard of conflicting provincial regulations. PAC President Alan Robinson adds, "This will seriously impact our operating costs and our competitive situation."

NAPP exceeded its first target of reducing packaging waste in 1992 by 20 percent relative to 1988. In 1992, the initiative landfilled 4.6 million tons of packaging, approximately 21 percent less than in 1988. By 1996, NAPP targets diversion of 35 percent of packaging waste from landfills.

The Germans are flooding the market with the plastics they can't use, but are mandated to collect

The country's other recycling proposal is the Canadian Industry Packaging Stewardship Initiative (CIPSI), introduced last summer. Under CIPSI, Canadian industry proposes to boost its funding for curbside collection and recycling of post-consumer packaging. Funding would be directed to help municipalities develop markets and recycling programs. Long-term funding levels would be based on formulas for efficient recycling, and inefficient municipalities would pick up some of the recycling costs. Provinces are balking at CIPSI partly because it does not include newsprint and other wood fiber recyclables. They feel the proposal would only make administrative sense if it went beyond packaging materials. Furthermore, provinces do not want to pay for recycling out of their tax base. Currently, CIPSI's progress is at various stages of government and industry consultation.



Germany's Green Dot recycling program, mandating the recovery of 64 percent of post-consumer plastics packing, has flooded the European plastics market.

Germany: Plastic Invasion
Germany's major concern is that a great deal of the plastic packaging they collect, at a cost of $1.33 per pound, is never recycled. While other nations watch and consider copying Germany's model, German consumers and industry ask the question, How long can the nation support a plan to collect far more plastic than the market can handle?

Statistically, Europeans are more enthusiastic recyclers than their American counterparts, and Germany is Europe's most aggressive recycler. This summer, Germany's recycling program, Green Dot, started enforcing a new rule mandating the recovery of 64 percent of post-consumer plastics packaging. Up from a previous level of nine percent recycling, Green Dot's recycling efforts are expected to bring in more than 1.1 billion pounds of plastic. However, Germany only has the capacity to recycle 551 million pounds of plastic. Therefore some 60 percent of German plastic must be recycled abroad. This onrush of export plastic has caused neighboring countries to legislate defensively. France's recycling laws, for example, are designed to keep German plastics from flooding its domestic market. And the European Parliament, the body that loosely oversees industrial goals for the entire continent, has set a 45 percent collection limit for domestic plastic packaging.

David Perchard, a London-based plastics consultant who has published a book on this subject, says,"The Germans are flooding the market with the plastics they can't use, but are mandated to collect. France, Ireland and other countries are having to adopt similar laws to Germany or be overwhelmed with German plastic. The Green Dot [German recycling program] is a political success, but a disaster for recycling and the environment."

Another shortcoming of the Green Dot program is that despite its domestic political popularity, the actual amount recycled under the German system is not significantly greater than that in the United States. According to J. Winston Porter, president of the Waste Policy Center in Sterling Va., "The United States now has a 23.5 percent recycling rate — at one-third to one-fourth the cost of Germany's recycling program."

He feels the problem is that Germany is "trying to make all recyclables equal," but costs vary widely and the need to recycle everything in equal percentages is a false economy.

It is estimated that Germans pay more than a dollar per pound to recycle plastics, while the American cost is in the range of 7.5 to 12.5 cents per pound. It has also been estimated that a German family pays approximately $125 per year to subsidize the system.

Though aggressive and idealistic, the program probably will not be implemented in the U.S. anytime soon. Early figures show that it would add $9 billion annually to the cost of American solid waste management.

Japan: A Bumper Crop
Japanese auto repair shops annually replace nearly two million plastic bumpers, twice the rate of a decade ago. With plastic bumpers currently installed on 70 percent of new cars and trucks in Japan, auto makers are facing

see PLASTIC on page 15

Vehicle Maintenance: It's Still Important

The automobile industry has changed much in the last 30 to 40 years. The cars of the '50s and '60s were large steel structures with heavy frames, large engines and very few creature comforts. As more and more automobiles appeared on the roads of America, they were soon singled out as gross polluters of the air we breathe. The Environmental Protection Agency began forcing auto manufacturers to take measures to reduce vehicle emissions. Large scale enforcement of emissions laws started in 1975. The oil shortage of the '70s caused additional concern for fuel economy. Unfortunately, the automobile industry was not prepared to adapt to these limitations.

Improvements in technology were needed to meet the demands of the EPA and those of the consumer. A device called an electronic control module (ECM) varies from one car to another but usually includes control of the fuel and ignition systems. Technology of the early '80s consisted of computer adjustable carburetors and a variety of "tack-on" devices meant to compensate for the side-effects of non-optimum engine operation. The limited technology in use by these cars resulted in rather poor performance. The biggest problem was in the mechanical deficiency of the fuel metering device, the carburetor. This is a dirty device that does a less-than-perfect job of regulating fuel for many operating conditions.

The introduction of electronically controlled fuel injection systems has rescued the automobile from the certain death that would have resulted from consumer dissatisfaction. Easy starting, increased power, and improved fuel economy are just a few of the benefits seen from electronic fuel injection. Engineers have been allowed greater flexibility in engine design, producing even further gains in power and fuel economy.

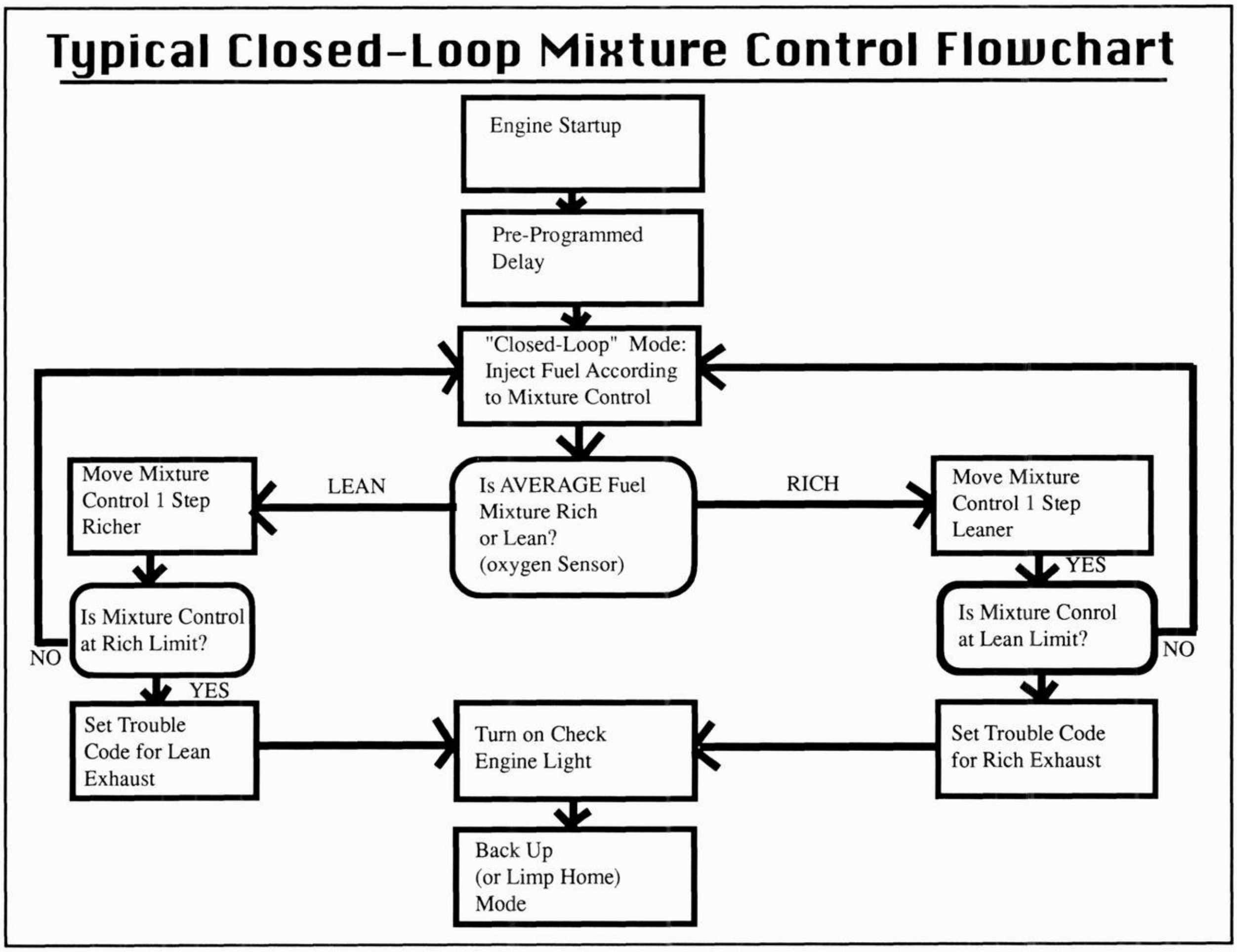
The ease and reliability of fuel injection causes some new car owners to settle down to a life of thoughtless vehicle maintenance. Usually oil changes and pit-stops at the local gas station seem to be the only needed upkeep. Then one day if the car begins to run terribly or the Check Engine light comes on, the consumer panics. Car repairs are more costly than in the past because the equipment needed to test and diagnose today's automobile is more complicated. In fact, almost all adjustments to the fuel and ignition systems have been eliminated. These systems are almost completely controlled by one or more computers built into the car. Unfortunately, these computer controlled systems can be confused by a poorly maintained engine.

The ease and reliability of fuel injection causes some new car owners to settle down to a life of thoughtless vehicle maintenance

A modern engine has a variety of sensors that are unique to the particular make, model, and engine combustion of the vehicle. All engine control systems use a simple device called an oxygen sensor to determine the condition of engine operation. The internal combustion engine running on gasoline requires 14.7 parts of air to every one part of fuel vapor. This mixture provides the best compromise of emissions and driveability. The catalytic converter, located in the vehicle's exhaust system, provides a voltage of approximately 0.4 volts when the engine is operating with the correct air-fuel mixture. If not, the computer compensates itself and hopefully returns to optimum operation.

Due to the self-compensating feature of the computer, engine running condition can degrade to unbelievably poor levels before a sudden and complete "failure" of the system occurs. The computer can recognize a problem in some instances, and when it does, it no longer compensates and operates in a pre-programmed backup mode. Then the Check Engine light comes on and vehicle performance seems to hit the basement. Is this better than the "old" engines? In comparison, many of the pre-'80s engines would not have even started with such poor engine maintenance. People would have noticed serious driveability problems and poor fuel economy long before problems are even perceptible in current engines. On the other hand, there are a few instances where a small imperfection can cause serious running trouble and/or damage in a current engine.

An example of a small imperfection is a



defective spark plug. In an older pre-computer V-8 engine, a single bad spark plug barely would be noticeable. It may cause a slightly rough idle but would seem OK on the highway with a slight reduction in power. This situation would be much worse in a modern engine. That one bad spark plug would let an entire unburned cycle of air and fuel pass through to the oxygen sensor. The oxygen sensor would sense an increased oxygen content which the engine computer would interpret as lean condition. The ECM would compensate by increasing fuel delivery to *all* of the cylinders and the cycle would continue again. The ECM may or may not detect a problem and keep running happily at the adjusted conditions. The catalytic converter would work hard trying to burn the excess fuel being injected into the engine but would soon overheat. At some point the converter may become so hot that it actually melts or breaks apart inside and becomes plugged. This may even stop the engine from running! The end result is a ruined catalytic converter, a "poisoned" oxygen sensor, and possibly a towing bill. This is, of course, in addition to the sizable bill the service garage charges for testing to find the cause of the trouble.

Engine maintenance is still an important part of vehicle ownership. The miracles of technology have given us impressive automobiles that perform well under a variety of situations. But these cars still need to be maintained at scheduled intervals as specified by the manufacturer. Failure to comply with these scheduled pit-stops can transform your high performance vehicle into a stumbling lump of plastic and steel.

by Nick Thompson

Note: This article was submitted as an assignment for ECE 350 - Professional Expression.

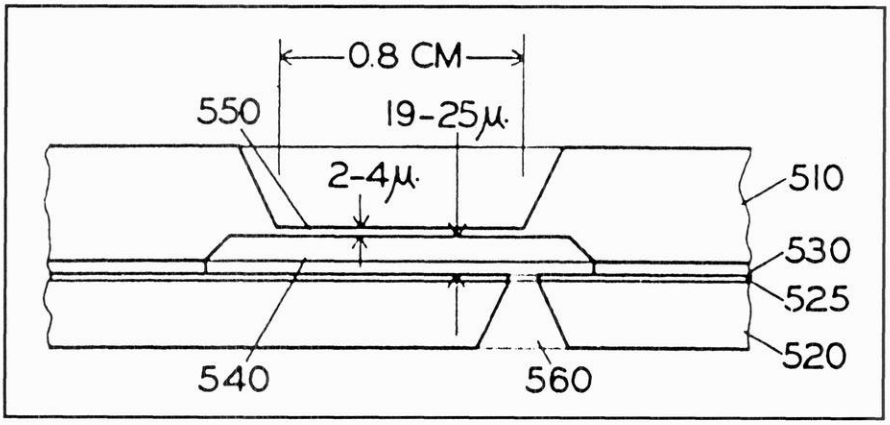
Is Your Patent Pending?

Have you ever had a good idea that you thought could be patented and make money one day? Do you know how to find more information about patent technology? Wendt Library should be your first step.

Wendt Library is a full depository library for utility, design and plant patents. A utility patent is given to a person who invents or discovers some new and useful process, machine, or composition of matter, while design patents are ornamental designs used on an article of manufacture. The library contains a complete set of utility patents dating from 1921 to 1960 on the fourth floor, and the third floor contains all the up-to-date patents on microfilm and microfiche.

Wendt Library contains a complete set of utility patents dating from 1921 to 1960 on the fourth floor, and the third floor contains all the up-to-date patents on microfilm and microfiche

With the patent office issuing thousands of patents every week, the amount of patent material available to research is enormous. To make the task seem less daunting, the librarians on the third floor of Wendt Library can help.



Patent drawings are an important part of the patent application. This drawing, taken from a patent by Professor Henry Guckel, ECE, shows a silicon membrane which is only a few microns thick.

Amy Kindschi, a technical reports and patent librarian, admits searching for patents can be a long and complicated process. "Most people are hoping they won't find their ideas in the patent books," Kindschi admits.

So how does one go about looking up their ideas? The classification system for patents does not work through subject headings or key word searches. Each invention is classified by description.

The information in a patent can be utilized in many different ways. People are often interested in the patents a certain company holds, especially if a competing company wants to know what a specific company or researcher is doing. Since patents are often referred to in journal articles, a better understanding of the technical information can be inferred from reading the patent itself. Some inventors working on a patent may want to reference other related patents.

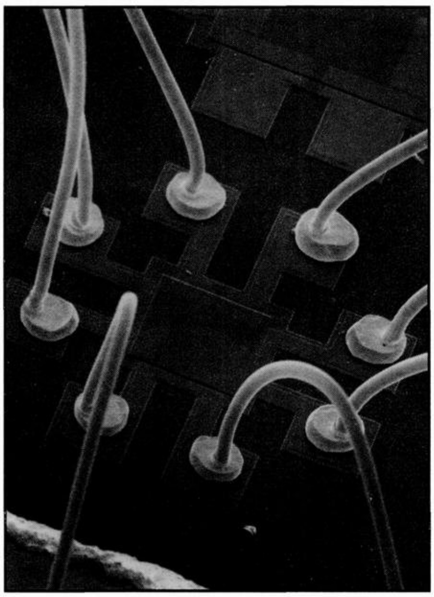
If your idea has not already been patented, filling out a patent application is your next step. However, Kindschi warns that although patent applications are available at the library, she highly recommends seeing a patent attorney instead of filling out the applications alone.

This route can cost a fair amount of money and a lot of time and effort. Are there any other alternatives?

The Wisconsin Alumni Research Foundation (WARF), located at the far west end of campus, provides all UW-Madison faculty and students the chance to commercialize research findings. Its goal, as a non-profit organization, is to support research and to manage patents the University's faculty has discovered. By using the patent licensing royalties of the faculty, WARF has channeled over $300 million back to the University for funding future research.

John Hardiman, a legal associate at WARF, believes there are three major requirements for a technology to be patented: utility, novelty and obscurity. "Most of the technologies the UW works on (in research) are in an embryonic state, and it is a long process to develop and market the patents."

What patented inventions have brought the most money to WARF and the University? In 1924, Professor Harry Steenbock discovered that by irradiating Vitamin D, he could prevent rickets in animals and people. Since Steenbock knew his discovery could bring huge financial benefits to the University, he created WARF to not only protect his discovery but the discoveries of future researchers. Other innovations that have brought large patent royalties to WARF include an anticoagulant, a fungicide and an organ preservation solution.



Their wires one-third the width of a human hair, these polysilicon pressure transducers were patented by Professor Henry Guckel.

What happens to the royalties WARF brings in from licensing the technology? The inventor receives 20 percent, the department where the researcher works receives 15 percent, and the remainder goes back to the University as part of a grant. A research committee under the graduate school dean then considers the allocation of grant funds to projects like research and building construction. Last year, WARF was able to grant over $18 million.

The Wisconsin Alumni Research Foundation, located at the far west end of campus, provides all UW-Madison faculty and students the chance to commercialize research findings

The advantages for faculty and students in using WARF to patent technology are significant. Hardiman admits, "Scientists are probably not interested in marketing their ideas since it's not their forte." Furthermore, WARF is able to handle the legal aspects of patents, including possible lawsuits. Licensing the scientific achievements and technology of the faculty and students since 1925, WARF has helped the UW become a world-renowned research university.

Henry Guckel, professor of Electrical Engineering at the UW, thinks WARF does "a magnificent and very professional job in dealing with my patent proposals." In the 1980s, Guckel worked on a patent for a polysilicon pressure transducer, which at the size of a few microns thick, has been used in an automatic sensing system in anti-lock brakes. Today, Guckel is working on patenting technology in the field of micromechanics. Basically, this technology uses electromagnetic forces to drive gears that are only a few human hairs wide. These kinds of devices could be used to study the minute effects of friction or vibration on materials.

Patents are a great device to make the ideas of students and faculty known to the world. Kindschi says,"Even if you're never going to patent anything, (patents) are still a wonderful source of information about many things." The technology developed in the past and hopefully the research being conducted today at the UW will make the world better for us all.

Author Bio:
Jeremy Marwil, a senior in Chemical Engineering, enjoys astronomy as a hobby.

A Movie Without an Actor

How They Finished The Crow after Actor Brandon Lee Died

In March 1993, disaster struck the set of the Miramax/Dimension film *The Crow*. In an accidental prop mishap, 28-year-old actor Brandon Lee, son of kung-fu legend Bruce Lee, was shot and killed. The tragedy was heightened by the fact that the shooting occurred just before he had the opportunity to finish perhaps his greatest acting achievement.

Using unprecedented electronic imaging technology, Dream Quest Images gave the movie makers the ability to shoot the movie without using a body double.

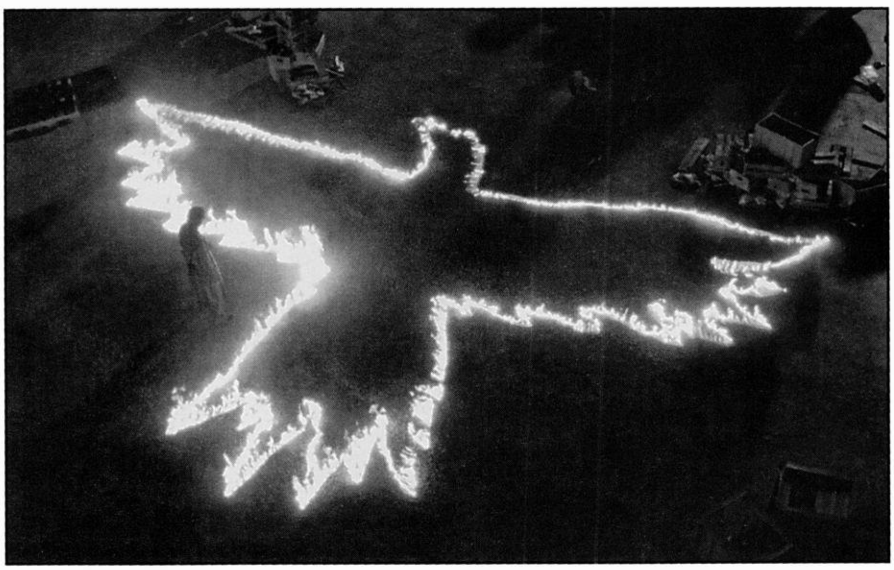
With the film close to completion, director Alex Proyas and the producers were not about to give up on it. The movie was put on hold for two months as Proyas and company planned how best to complete the picture. Meanwhile, screenwriter David J. Schow completed rewrites. Although a majority of Lee's filming had been completed, there were some scenes that required his presence.

Based on the popular underground comic book of the same name by James O'Barr, *The Crow* was billed as a dark, urban fantasy for the '90s. As the story goes, the hero, Eric Draven, played by Lee, is a guitar player who, along with his fiancee, is killed by inner city thugs. Armed with superhuman strength and vision, and guarded by a black crow (a spirit that goes between the worlds of the living and the dead), Eric returns from the dead one year later to seek his revenge on those who murdered him.

Footage that was crucial to the storyline for explaining how Draven becomes empowered and why he is brought back had not been shot. Not wanting to rely on the traditional body double and wanting to include facial shots, the producers faced a unique problem. Additional footage of Lee without make-up would be required and amazing technology would have to be used.

Enter Dream Quest Images, a Simi Valley, California-based motion picture, television and commercial special effects company. Headed by Mark M. Galvin, a team of electronic imaging (EI) technicians were asked to devise digital solutions to finish the film.

Using unprecedented EI technology, the team gave the movie makers the ability to shoot the rest of the film without using a body double. They digitally lifted Lee's image out of a previously shot scene and put him in a new scene. This effect had never been tried before. In one scene, they wanted Lee looking into a cracked mirror. First, they found some footage of him standing in a rainy alley. Thinking the footage had the correct look and feel for their scene, EI experts made a cookie-



In The Crow, Eric Draven, played by actor Brandon Lee, shows his superhuman powers by creating a burning image of a crow.

cutter image of Lee by tracing around the shape of his body and each strand of hair. Then they blacked out the background of the rainy alley. Next, a computer altered Lee's face. In the final composite, they combined Lee's body with the image of his face in the mirror. The effect was so convincing that audiences could not suspect that Lee had never been there.

Dream Quest created this film in a unique environment. According to Galvin, typically visual effects are created in a very controlled environment. "When you're working with miniature photography or a blue screen (a common way of isolating an object and putting it into an environment that does not exist or that is not full size), you shoot those elements separately and very controlled. The camera would be locked down or you would have a pin-registered, steady camera." In this case Dream Quest was working in a very uncontrolled environment. Elements were shot by a live action camera, either hand-held or on a dolly. There was no way of knowing how far the camera crew had moved. It made for painstaking work and slow progress.

For 15 weeks Dream Quest worked on the set of *The Crow* . An average scene ran one to two weeks and had a two- or three-person crew. A total of 52 special effects shots were done with about seven Brandon shots. The additional work added $100,000 to the film's budget but allowed for much greater freedom.

Dream Quest's accomplishments in this film were a movie making first. Other film makers are adopting Dream Quest's techniques in the production of future films. Perhaps the greatest compliment that could be offered was not that this was an amazing feat, but that few audiences knew what had been done and fewer still could see it. Thanks to EI technology Brandon Lee could finish his movie.

Sources:

Gentry, "Digital Body Double," *Photo Electronic Imaging* , Vol. 37 No. 7.

Author Bio:

Not known for his wit, Jon Furniss has trouble thinking of something clever to say in this space.

PLASTIC from page 9

a potential environmental crisis.

Unfortunately, plastic bumpers, unlike steel, cannot be repaired after minor traffic accidents. This means they must be scrapped, and until the beginning of the decade they invariably found their way to landfills or as fuel for waste-to-energy incinerators. They were commonly made of reaction injection-molded polyurethane and were not easy to recycle. But a recent shift away from this material to polypropylene has facilitated efforts. Since 1991 most of Japan's big car makers have established bumper collection and recycling programs in major metropolitan areas.

In 1991 Nissan became the first Japanese auto manufacturer to initiate a bumper recycling program. A trial program was set up west of Tokyo, specifically in the areas around its Zama, Oppama and Murayama plants. Then in January 1993, Fuji Heavy Industries Ltd., the maker of Subaru, joined the recycling effort. The companies presently recycle some 4,400 bumpers collected each month from 98 sale outlets, yet they estimate it will take at least five years before a nationwide collection structure will be in place.

After collection, bumpers are cut and shipped to NP Plastic Chemical Co. Ltd., where they are pulverized and mixed with virgin polypropylene. The resulting material is used in air ducts, trunk finishers, rear bumper parts, footrests and pallets. In late 1992, Nissan Motor Manufacturing (UK) Ltd. began using the recycled material for eight components in the Micra. Each car has 21 ounces of recycled material. Though a seemingly small amount, this is one of the highest levels among European models.

In August 1991, Honda began a recycling program similar to that of Nissan. Using polypropylene bumpers, Honda currently has 2,200 of its 2,300 dealerships involved in this program. They collect approximately 10,000 bumpers each month. The bumpers are shipped to two different plastic suppliers, where the material is pulverized and recycled.

Toyota was the last of the big companies to begin a program. In December 1991, they inaugurated their program at 26 sales branches and six dealerships in western Tokyo. The program has since expanded and currently sees a collection rate of 3,000 units per month.

A major problem for all the companies is the removal of paint from plastic components. While Nissan is researching a procedure to dissolve the paint, Toyota is working on a process to neutralize the paint without removing it. With recycling always in mind, auto makers are also attempting to develop easily detachable bumpers. Honda currently is in the forefront of this technology, but all the Japanese car makers are headed in this direction.

Look to the Future

Clearly the United States is not alone in its battle with recycling. People around the world will continue to use plastics, and it may be many years before all plastic is recycled. But the international plastic problem will most likely be solved through combined consumer, industrial and governmental efforts. Then the world will be a cleaner and better place in which to live.

Sources:

King, "German overflow floods Europe," Plastics News, March 20, 1995.

Schreffler, "Japanese pursue bumper recycling programs," Plastics News, March 20, 1995.

Plastics Technology, January 1995.

Author Bio:

Jon Furniss is studying to be a Mechanical Engineer, but he is not really sure why.

Counseling and Advising Resources: Help Available for COE Students

The College of Engineering has many academic advising resources available, particularly for freshmen. Pre-engineers can turn to either of two academic advisors designated specifically for EGRs: Don Woolston or Bonnie Schmidt. In addition to advising, Woolston and Schmidt remain in close touch with students by lecturing within the Engineering Professional Development department.

These two knowledgeable, experienced advisors aid pre-engineering students in a variety of ways. The advisors' main role is to help students with course selection. Sometimes they also help students decide which department they really want to be in. Other times the advisors may recognize that a student may not succeed in engineering.


Source: Shaun Burke

Susan Piacenza (right), assistant director of Engineering Career Services, gives some friendly advice to an engineering students.

The counseling services are free and confidential, along with the other advising resources in the COE

Woolston notes that in cases such as these the advising staff is "not advocating engineering so much as trying to help students."

Woolston observes that during the fall semester he deals mainly with students who are doing well and come to him to make sure that they are on the right track. Second semester he finds that more of the students are in trouble and "come in to find out how to save themselves." Woolston and Schmidt also help students with financial troubles apply for a short-term, interest-free loan.

Schmidt enthusiastically admits that she is "here for the students." Often she is called upon to diagnose the cause of an academic problem. Occasionally she helps students decide whether engineering is really for them. Sometimes the problem is time management and study skills, other times the student is referred to the Math Lab or GUTS tutorials. Schmidt also encourages students to "get involved in student organizations," since other students often serve as excellent advisors. Woolston warns, "Students go around and ask a question until they hear what they want to hear, which can be dangerous."

Not all the problems a student faces are academic. Occasionally there are more serious issues to deal with. Often personal problems such as relationships gone sour, drugs, or depression are the cause of academic problems. For cases such as these, the academic advisors will refer the student to Linda Schilling, the official College of Engineering counselor. The COE is the only college within the University to have its own counselor. Having worked with both engineering and non-engineering students in her career, Schilling says that often engineers are "analytical types who are not used to talking with people about their problems." Schilling sees students on a regular basis in order to get them through a crisis. Others she meets with on a biweekly basis if needed. If she cannot help them, she will find someone who can. The counseling services are free and confidential, along with the other advising resources in the COE.

Engineering Career Services offers students information and advice on employment opportunities and the interviewing process. "ECS has expanded and improved its services dramatically over the years under the guidance of Sandra Arnn, ECS director," says Susan Piacenza, ECS assistant director. "Our staff counsels students on career choices, teaches them to develop lifelong job search skills, and advises students making job offer decisions."

From a two typewriter operation nine years ago, the ECS staff now offers a fully computerized resume and interview scheduling program to engineering students. The office is also a resource for students searching for information on nearly every aspect of gaining an internship, co-op or career. From writing a resume to deciding which job offer to accept, the ECS has useful information in the form of handouts, books and videos. Workshops on resume writing and interviewing skills are held on a regular basis. In addition to keeping updated information on employers, the ECS annually brings about 400 companies to the engineering campus to recruit students.

Source: Shaun Burke

Assistant Dean of Academic Affairs Don Woolston (right) counsels a pre-engineering student on course selection.

The ECS office also offers a special career orientation class for juniors and seniors every spring to help them develop lifelong job search skills. In the career orientation class, students learn how to write resumes and approach interviews. Alumni and experienced engineers are brought in to the class to expose students to different work areas within engineering. Other guests share with students what it is like to go through the interview process.

There are many resources available to students from the time they enter the College of Engineering. Freshman should become familiar with Don Woolston and Bonnie Schmidt, their pre-engineering advisors. Linda Schilling, the official College of Engineering counselor, can help students with more personal matters. Students already accepted into the College of Engineering should get to know their faculty advisor, and make sure and visit the Engineering Career Services office.

Author Bio:

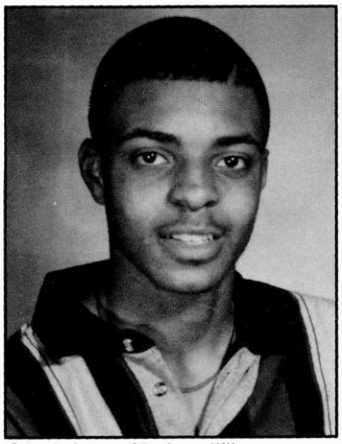
R.J. Elsing graduated last May and especially would like to thank Don Woolston and Susan Piacenza for all their invaluable advice during his time as a student.

Excelling in Engineering

School is a place where learning and growing begin for many people early in their lives. For some a primary education is used as a foundation to gain more advanced knowledge. For one particular high school student, success in academics has always been of important significance, and will continue to be in the future.

Deshaun Hill is a recent graduate from one of the top high schools in Wisconsin, Rufus King in Milwaukee, and was ranked number one in his class. He has won three medals from science fairs, which dealt with the construction of truss bridges and strengthening agents. He has always been highly interested in science and mathematics, which led him into the study of engineering. He gained confidence in engineering when he won a silver medal from the National 1993 African American Academic, Cultural, Technological, and Scientific Olympics (ACT-SO), for competing in the Physics/General category. Hill defines engineering as "the science by which the properties of matter and sources of energy are made useful to man in structures, machines, and products." During his sophomore year, he was encouraged by one of his teachers to research the *Effect of Portland Cement Replacement By Class F and C Fly Ash on Ultimate Compressive Strength*. This led into a major project that he worked on through his senior year of high school. At Engineering EXPO '95 Hill brought his exhibit showing the application, data, process, and results of this experimental project. His experiment showed that fly ash cement can be used as a rational replacement to Portland cement in concrete and have considerable effects on the environment as well.

Concrete is used in sidewalks, roads, buildings and bricks. For many years Portland cement has been used as



School picture of Deshaun Hill

a main material to construct these items made of concrete. Portland cement is composed of "ground, mixed and kiln heated limestone or chalk with clay or slate (and gypsum added in the final stages.)" Then this mixture is added to water to form a gel that hardens. Hill pursued the theory that this pure Portland concrete could be replaced by another concrete mixture that was composed of Portland cement and Class C or F fly ash.

Fly ash is the "by-product of the combustion of pulverized coal in thermal power plants." In these power plants a dust collection system removes the ash particles from the combustion gases before they are released into the atmosphere. This fly ash has the potential for pozzolanic activity, (a siliceous or aluminous material which in itself possesses little or no cementious value, but can chemically react with calcium hydroxide to form compounds containing cementious properties) which can be harmful to the atmosphere. The Class C fly ash is a more fine spherical ash than the Class F fly ash. It usually contains more calcium and less carbon than the Class F ash. Hill wanted to determine which of the two concrete mixtures and ash mixtures would be best to use and why.

Hill followed strict procedures so that the experiment would be standardized and controlled. In addition, Hill executed several of his experimental procedures at the Marquette University concrete lab in Milwaukee. He first combined various amounts of fly ash (10, 20, 30, 40, and 50 percent replacement) with Portland cement for different batches of mixtures. Next, he put the concrete mixture into a standard cylinder. After the various mixtures

During his sophmore year, Hill was encouraged by his teachers to research the effect of Portland cement when replaced with Class F and C Fly ash.

were placed into their cylinders and capped, they were prepared to be cured. The capped cylinders were placed into a curing tank filled with water at a temperature of 72 degrees Fahrenheit, for periods of 3, 7, and 14 days.
After the filled cylinders were cured, their compressive strengths were measured. Hill defines compressive strength as "the measure maximum resistance of a concrete to axial loading." This measurement is usually expressed in pounds per square inch (PSI). A printed read out was generated after each of the cylinders were tested. The stress capability in PSI was calculated by dividing the total force by the surface area in contact with the cylinder. Hill compared the results of each of the strengths of the mixtures from the cylinders and concluded that the Class C fly ash was the best of the concrete mixtures.

Class C fly ash has several advantages when being used as an element for making concrete. Since the Class C fly ash is a result of a modern and thorough dust collection system, the ash particles are more refined and as a result easier to work with, then the Class F fly ash, when mixed with the Portland cement. In addition, the Class C fly ash concrete hardened quicker than the Class F fly ash concrete, due to the higher calcium-oxide and lime content. It was found that the compressive strength of the concrete with fly ash increased as the curing time matured. In addition, the permeability was decreased because the concrete containing fly ash required less water than the concrete containing only Portland cement.

The environmental advantages of using the fly ash as a resource, opposed to burying it in landfills, are innumerable.

Using fly ash replacement in concrete lowers cement costs, reduces heat of hydration, decreases permeability, improves workability, and acquires required levels of strength in concrete after 90 days. In addition, the environmental advantages of using the fly ash as a resource, as opposed to burying it in landfills, are innumerable. This presents a valuable incentive for the use of fly ash in concrete.

Deshaun Hill plans to attend "one of the top universities in the United States in order to get the most knowledgeable education and the best background in the field of engineering." Recently, he was awarded a scholarship from Harley Davidson. Hill is very proud of his achievements and is very thankful to his mother, friends and special teachers especially William Weber and William Jones, for giving him the motivation and encouragement that led to his success that he has today. Undoubtedly, his current academic achievements are just a glimpse of future successes in engineering.

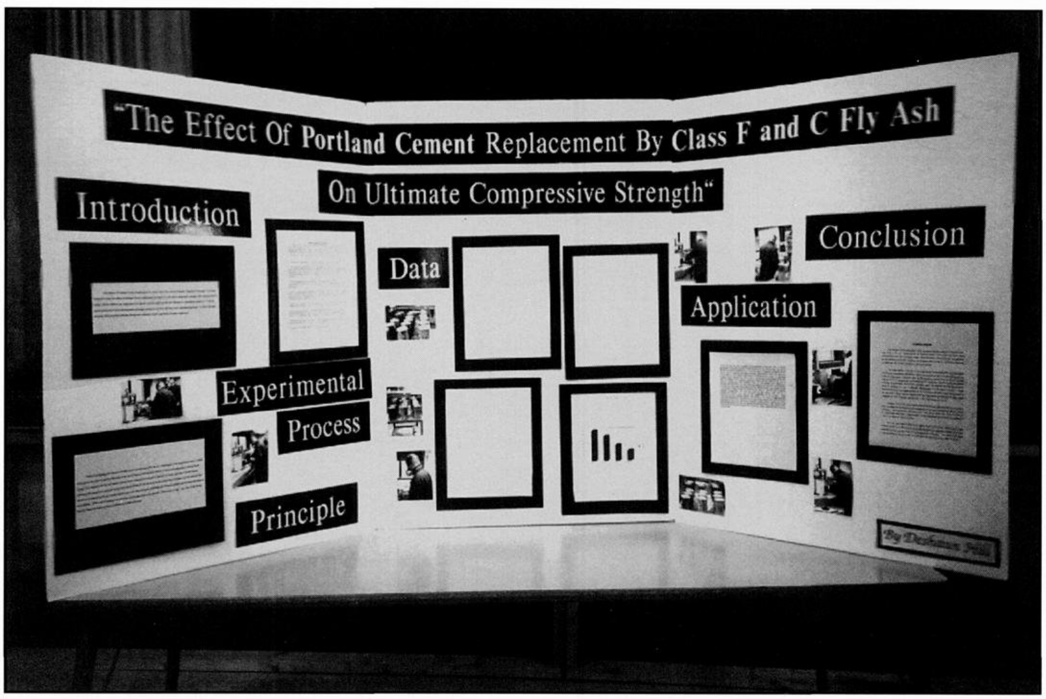


Photo taken by Carolyn Curley.

Rufus King High School student Deshaun Hill exhibits his research on Portland cement at EXPO '95.

Author Bio:
Carolyn Curley is a senior majoring in Elementary Education and English. She enjoys recreational activites, for example, two summers ago she went sailing on Lake Michigan. Unfortunately, after tipping over into the chilly, deep waters Carolyn had to be rescued by the U.S. Coastguard. So this past summer she chose to sign up for Hoofer Sailing Club lessons!

Not Pulp Fiction...Pulp Production!

Have you ever wondered when and where paper was invented or how it is being produced today? Paper production has developed over the centuries into a very complex process.

Paper was invented in China in 101 A.D. by a man named Ts'ai Lun. Before this breakthrough the Chinese had written on silk scrolls, using brushes made of camel hair. Since Lun's paper was much less expensive and more abundant than its predecessor, it quickly became the preferred medium.

Lun produced paper in the following manner. First, he would soak and beat the inner bark of trees such as bamboo and mulberry into pulp. Then he would spread the pulp on cloth to form and dry. After a period of drying, he replaced the cloth with a network of hairs and threads on which the pulp would continue draining. The paper was coarse and long-fibered but worked well for the type of ink the Chinese used.

Paper arrived in Europe after 1000 A.D. Spain and Italy created the first European papermills betweeen the eleventh and fourteenth century. William Rittenhouse introduced paper to America in 1690. Along with the aid of his son, he established the first paper mill in Pennsylvania, which today is considered the cradle of the papermaking industry in North America.

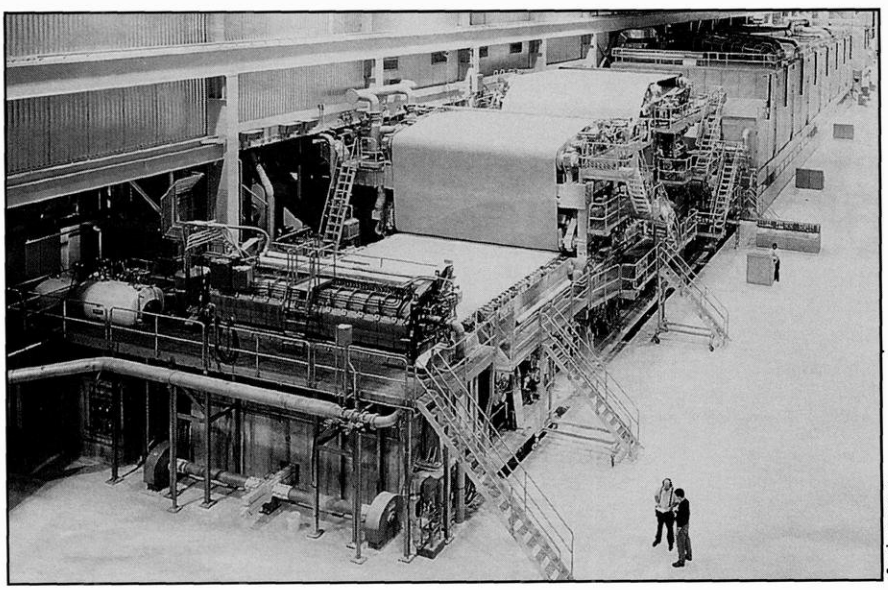
Paper making has been refined much since then. First, logs arrive at a mill. Then bark is removed from the logs, and they are thrown into a chipper, where they are condensed into small workable chips. Next, the wood chips are cooked in sulfite to dissolve the natural glue in the wood. The resulting pulp, called the chemical pulp, is refined by a series of washings and screenings. Dirt, knots and coarse fibers are extracted from the pulp. To produce white paper, the pulp is bleached, and a final washing removes excess bleach.

In order to make paper as strong as possible, pulp is fibrillated. This process makes the pulp fibers shorter, increasing their ability to interlock. The pulp is then immersed and drained at a high speed onto a fine mesh net, forming a sheet of interweaving fibers. The sheet is run through press rolls and dryers to remove unwanted moisture. If the paper is to be coated, it will go through a series of coaters and dryers. Next, pigments and dyes are added to produce the desired tint. The paper then goes through a final smoothing. Finally, the paper is wound and cut for packaging and shipping to distributors.

Over the centuries many countries have refined the production of paper. Research continues on developing improved ways of making paper. The Wisconsin paper industry offers many exciting and challenging opportunities to UW engineers.

Author Bio:

Todd Wilson is a sophomore in Mechanical Engineering. He also plays soccer for the men's varsity team.

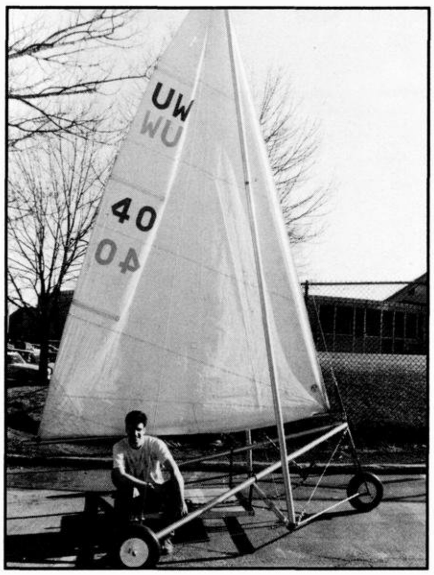


source: The Paper Age

New #7 Voith paper machine at Appleton Papers, Combined Locks, WI., produces 150,000 tpy of carbonless and thermal copy papers.

The 1995 Schoofs Prize for Creativity Contest

Judging for the 1995 Schoofs Prize for Creativity was held on February 23 - 24, during this year's Engineers' Week. Every year the University of Wisconsin Technology Enterprise Cooperative (UW-TEC), an industrial entrepreneur outreach organization, runs the Schoofs Prize for Creativity contest. The purpose of the contest is for students to develop their original ideas into patentable devices, designs, compositions-of-matter, and processes, and to learn how to protect them through the patent system. The contest is open to all University of Wisconsin College of Engineering undergraduates. All contestants are required to attend four seminars on inventions and patents, prepare a written disclosure describing the original idea in patent-like form, and give an oral presentation to the panel of judges. The contestants' ideas are judged on creativity, novelty, probability of commercial success, patentability, and technical and market innovation. The contest is sponsored by Richard Schoofs, president of Schoofs Incorporated and an alumnus of the UW College of Engineering.



Tom Swetish won the 1995 Schoofs Prize for Creativity with his collapsible land yacht/iceboat.

Tom Swetish, a senior in Mechanical Engineering, won the $10,000 first prize in the 1995 Schoofs Prize for Creativity. Swetish's winning device was a collapsible land yacht/iceboat. A land yacht/iceboat is a sailboat that sails on land or ice and consists of a sail attached to a passenger bed that sits on either wheels or blades. Swetish designed this wind-powered recreational vehicle so that one person can disassemble it in about 15 minutes without tools, and so that it can be transported on the roof rack of a car. According to Swetish, "The innovation of my invention is that it is much lighter, more maneuverable, easier to transport, and cheaper to manufacture and purchase than land yachts and iceboats that are currently on the market. It can also be used with wheels as a land yacht or with blades as an iceboat, making it usable any time of the year."

The purpose of the contest is for students to develop their original ideas into patentable devices, designs, compositions-of-matter, and processes, and to learn how to protect them through the patent system

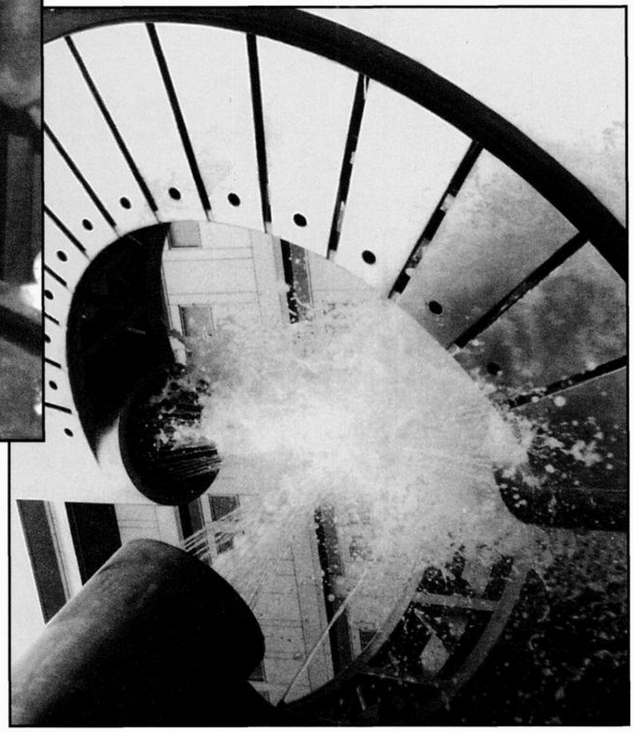
Swetish came up with his idea for the land yacht/iceboat in high school and has been refining and improving it since. He is currently considering marketing his idea or selling it to other entrepreneurs and manufacturers. Swetish found the competition for the Schoofs Prize to be enjoyable and educational. He commented, "So much of engineering stifles creativity and innovation. The Schoofs contest is a unique opportunity to develop and show your creativity."

Chris Hamilton and Martin Radue were the $7,000 second-prize winners. Their rotary valve system makes possible the continuous and independent adjustment of the opening and closing relationship between the valve and the piston. The openings in the rotating cylindrical valve align with fixed passages in the engine cylinder head, allowing gas exchange between the cylinder and the atmosphere. Electric motors, controlled by a programmable microcontroller, drive the valves. Hamilton and Radue's design provides maximum efficiency and flexibility of valve timing and engine control.

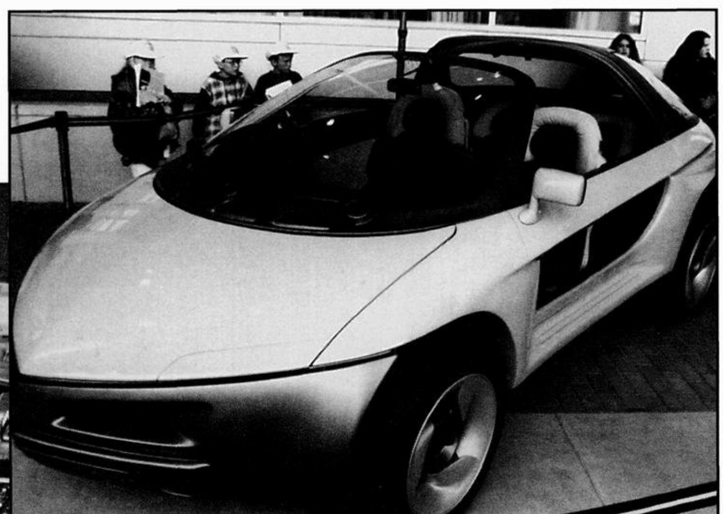
John Zahn won the $4,000 third prize with his swimming pool heater deck. The design allows pool water to be pumped through special deck boards where the water cools the deck, and the sun heats the water. This design will heat a pool quickly and efficiently.

AUTHOR BIO

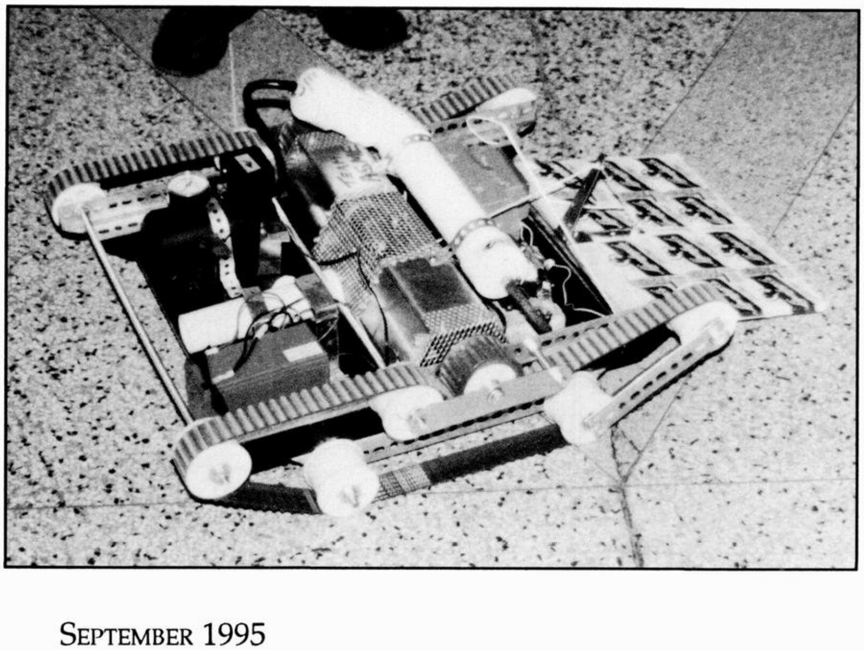
Matthew Vokoun is a sophomore in Chemical Engineering pursuing his Technical Communication Certificate.



Memories from Expo '95



Join the Wisconsin Engineer and win a feathered headdress!



Offer not valid anywhere . Join the Wisconsin Engineer anyway. If you join the layout staff, we'll give you the robot (just kidding).

Just ONE More

EGR's Isle

(Sung to the theme of "Gilligan's Island")

Now sit right back and hear a tale,
A tale of a pre-engineer,
Who packed his bags for U-Madtown
To start his college career.

The EGR had a steady physics hand,
His vectors straight and true.
Loans and grants had paid the way
For a four-year college tour ...
A four-year college tour.

(CRASH!)

The classes started getting rough,
He studied to no avail.
If not for the guidance of the counselors,
The student soon would fail ...
The student soon would fail.

He then found a tutor who
Would help him for a price
With calculus,
Thermo too.
Kinematics — day or night!
At the C-A-E,
With lab write-ups and diagrams,
Even prep for finals.

Now this is the tale of our engineer,
He's been here for a long, long time.
He'll have to make the best of things
Before he works full-time.

The professors and the TAs too
Have done their very best
To cram a whole semester's work
In one final test.

No books! No calculators!
No cheat sheets, too!
Not a single luxury.
Without a laptop PC,
As primitive as can be ...
As primitive as can be.

So join us here each semester, my friend.
You're sure to get a smile:
'Cuz L&S students have it great,
But the jobs are at EGR's Isle!

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