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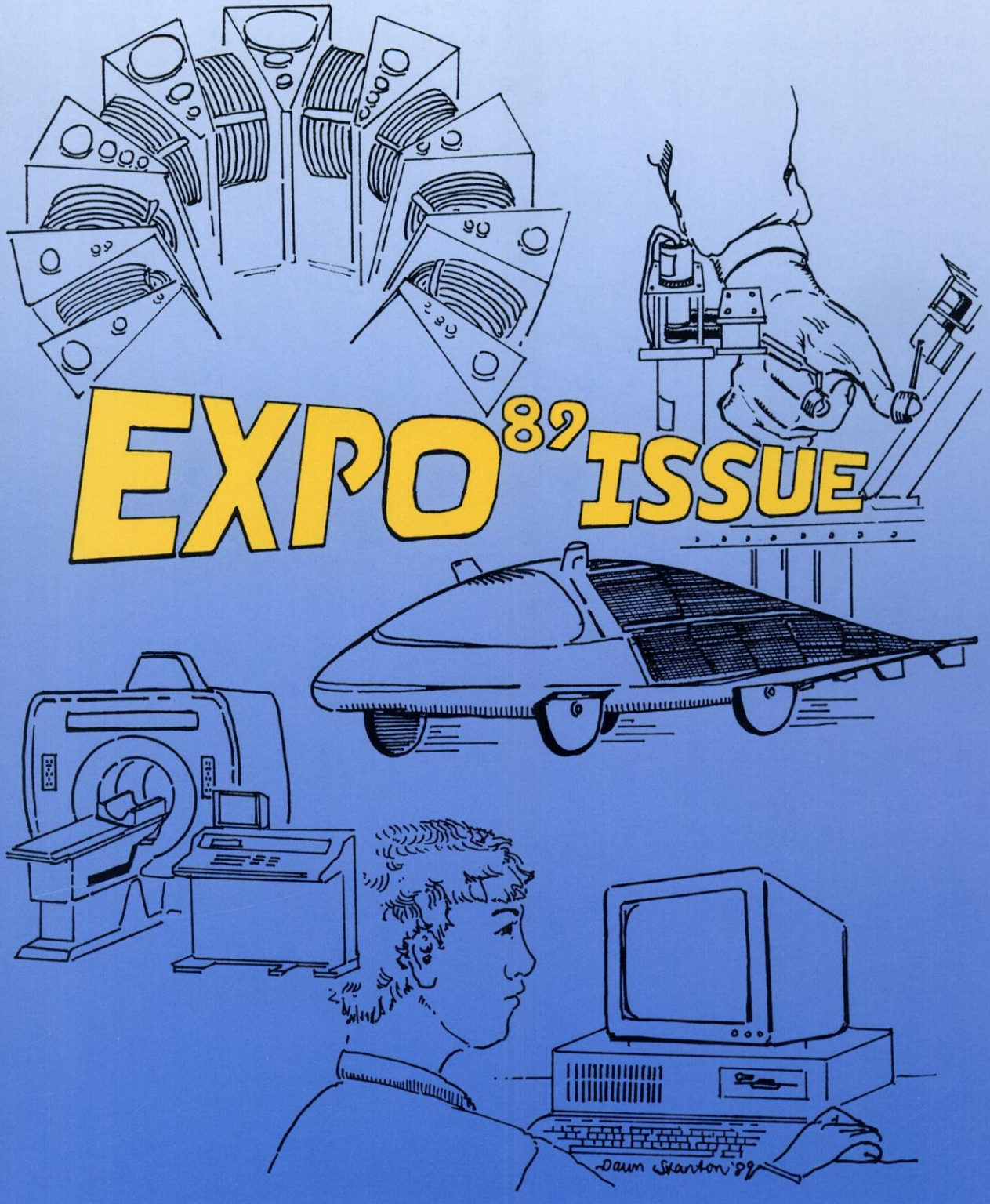
wisconsin engineer



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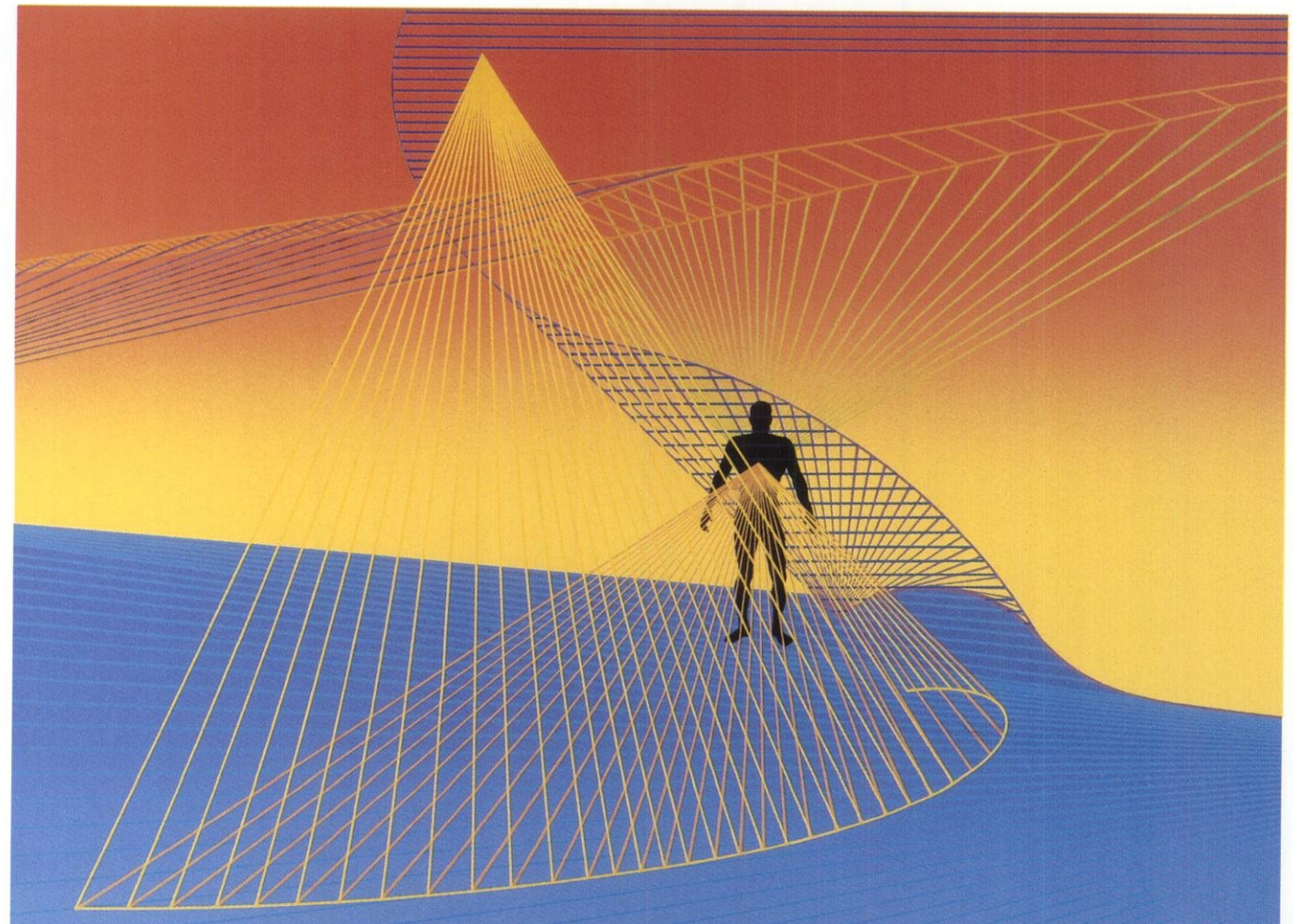

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wisconsin engineer

PUBLISHED BY THE STUDENTS OF THE UNIVERSITY OF WISCONSIN-MADISON, MARCH 1989

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The *wisconsin engineer* magazine, a charter member of the Engineering College Magazines Association, 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.
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EDITORIAL

FOUR OR FIVE OR ?

Come on people. Remove the mask and face reality. Since only a small percentage of students walk out or the door with a bachelors degree after eight semesters, change the schedule to fit the times. In other words, lay out the courses realistically for completion in nine or ten semesters.

The most recent statistics I could find at the Pre - Engineering office were for the graduating engineering class of 1986. Only 1% graduated in six semesters, 17% in 7-8 semesters and 82% took 9 or more semesters. Of that 82%, 67% graduated in 9-10 semesters.

At first, I thought of calling the engineering schedule a five year degree program. However, history showed me why this will not work.
In 1960, Ohio State changed the engineering degree program from four to five years. At the time, this appeared to be a very logical idea. However, Ohio State changed back to a four year program in 1969. The five year program was a dismal failure.

According to Dean James Marshall at Ohio State, they tried to change from a BSME to a "Bachelors of Mechanical Engineering." They also increased number of credits by 20% bringing the grand total to 150 credits, as though the students did not already have a full schedule.

Originally the program was recognized as a great idea and other schools such as the University of Massachusetts soon followed suit. However, industry did not recognize the program. Companies did not go out of the way to hire five - year graduates and they did not offer them higher salaries.

When the program at Ohio State was discontinued in 1969, they tried a one year, "Advanced Professional Degree," which was a one - year, post-baccalaureate, non-masters degree. This was unpopular as well.

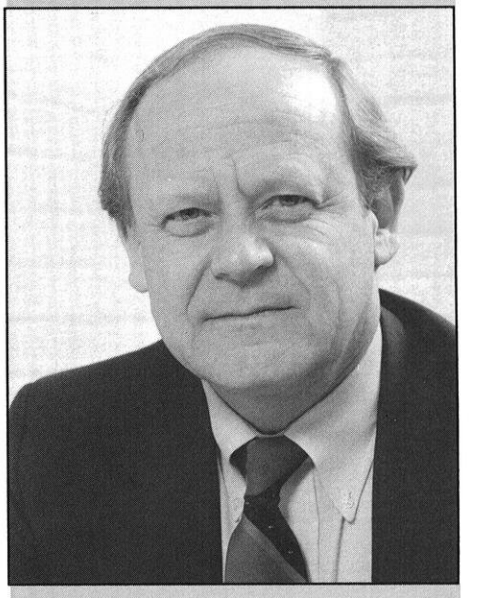
In Madison, most Letters and Sciences majors can receive a bachelors degree with 120 credits. In the engineering departments, a student can squeak out a degree with only 132 credits in several of the programs.

The typical engineering degree is scheduled for four years. As a writer for the University of Massachusetts points out in the April 1966 Parents Report, "The work is arranged so that it can be accomplished in four years, but many feel there is additional value if the work is done at a more leisurely pace..."

The engineering departments should re-evaluate the current four year schedule and make recommendations for a five year schedule. They can keep the four year schedules but should strongly recommend the five year program in literature presented to the students, their parents, scholarship donors and other interested parties. In this manner, the students will have a better idea of what is a more reasonable schedule to follow and all others concerned will understand why eight semesters is only an illusion for most students. ■

by Peter Holmi
Co-Editor

Dean's Corner



Any person practicing or offering to practice professional engineering in Wisconsin must be registered unless, according to Wisconsin Statutes, that individual is exempt. All states have similar laws. Generally speaking, persons engaged in the manufacture of a product or as a representative of material or equipment suppliers, do not need to be registered.

The purpose of registration is to protect the public health, safety and welfare. It also establishes a means of identification for those who have met certain professional standards and who agree to conduct their affairs by certain rules of professional conduct.

Engineering practice is regulated by state boards which set minimum standards of competence and conduct for those who become registered as professional engineers, (P.E.'s). There are over 340,000 registered engineers practicing in the United States.

Even though your present anticipated employment status may not require registration, you should consider beginning the registration process during your senior year for the following reasons:

1. A job promotion or future employer may require registration.
2. If you decide to become an engineering consultant, you will need to be registered.
3. If you are asked to give testimony in a trial, the P.E. registration lends credence to your testimony.
4. As a student, your course material is still fresh in your mind, so you will never be more prepared to take the eight-hour, multiple-choice test of competence in basic engineering knowledge, which is the first step in the registration process.

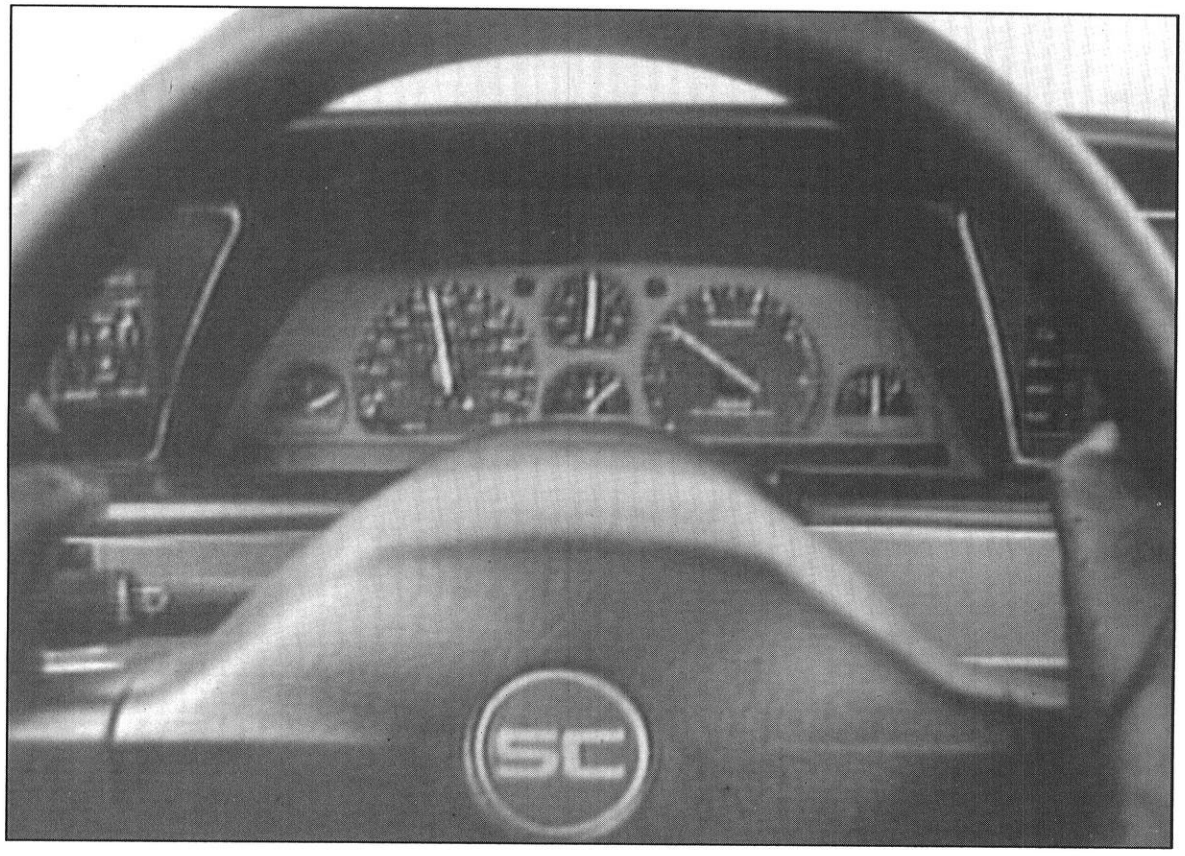
The number of University of Wisconsin-Madison, engineering graduating seniors, that take the second step (the first step is to graduate from an ABET accredited engineering program) in the registration process is very low. In the past, little emphasis has been placed on the importance of P.E. registration by the College of Engineering faculty. Dean Bollinger is trying to change the attitude of the faculty so that registration will be encouraged. As a first step the Dean has offered to support the student chapter of the Wisconsin Society of Professional Engineers (WSPE) in their efforts to conduct information sessions regarding the registration process. The WSPE Student Chapter also plans to conduct review sessions, and arrangements are being made to schedule Union South as an examination site.

If you want more information regarding the registration process, please contact my office, as I am the faculty advisor for the WSPE student chapter. I am located in Room 266 Mechanical Engineering Building. The members of the WSPE student chapter, Dean Bollinger and I invite you to become a member of the WSPE student chapter. This is an opportunity for you to become a member of a professional organization, affiliated with both the Wisconsin Society of Professional Engineers (WSPE) and the National Society of Professional Engineers (NSPE) and to receive WSPE and NSPE publications. WSPE student members also have excellent opportunities to learn leadership and organizational skills.

Earning an engineering degree is an important accomplishment. Getting a P.E. and joining a professional organization will provide personal satisfaction, professional prestige and practical assets which may prove to be of great value in your career. ■

William W. Wuerger
Associate Dean of Operations,
College of Engineering

MARK ANOTHER "A" IN THE BOOK FOR FORD



Ford Motor Company has entered yet another car into its growing showcase of high quality cars that not only offer visual appeal but performance that a sports car driver can enjoy.

At Ford's campus presentation January 26, they showed just how well the new Thunderbird and its fraternal mate, the Mercury Cougar are designed for comfort, ride, handling and performance.

Motor Trend magazine liked the car so much, they gave it their "Car of the Year" award.

The T-Bird underwent a complete redesign for 1989. An enormous nine inches was added to the distance between the front and rear wheels (the wheelbase) while the car's overall length was decreased by three inches. The hood was lowered and the car's width was increased. The suspension became fully independent sporting four wheel disc brakes. Finally, rear wheel drive was retained providing the ideal balance between performance and handling dynamics that true sports car drivers prefer.

The increased wheelbase, which changed the entire character of the car, required a very strong platform. Increased amounts of adhesives and "best in class" structural and joint integrity accomplish this need. In addition, extensive ribbing was used to stiffen the longer, wider floorpans along with plastic braces to provide additional rigidity to the quarter panels and fenders. Structural adhesives were added to the weld joints to increase damping and strength.

To decrease cabin noise and structural vibration, a special foam is injected into structural cavities which expands to

fill the entire cavity. This eliminates the transfer of airborne noise into the passenger compartment and adds damping to the structural surfaces helping to minimize structural vibration and noise. The final result is a significant decrease in noise of 4 dB.

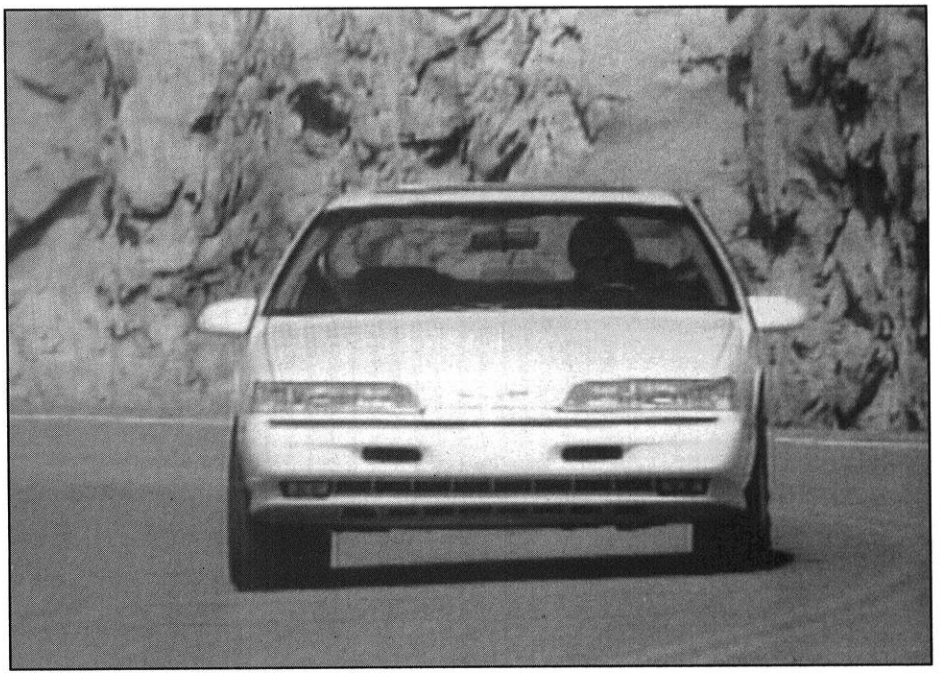
Structural foam is used to increase part rigidity. For example, the rear cross member is 30% more rigid when the foam has expanded and hardened. The increased rigidity assists in providing better performance dynamics.

The base T-Bird and Cougar come with standard 15 inch tires and wheels. The Super Coupe and XR-7 feature wider performance tires mounted on aluminum wheels.

A redesigned rear suspension allows the rear wheels to actually steer under side loads or when going over large bumps. A special link lets the rear wheel adjustment change during side loading, preventing trailing throttle oversteer and providing neutral handling.

Both the front and rear suspensions work together to reduce body roll by 30% compared to the 1988 base model cars, helping to eliminate the feeling of being on two wheels in high speed corning.

Except for the base T-Bird, the cars feature a new speed sensitive variable-assist rack-and-pinion steering system. Higher assist is provided at lower speeds to aid in maneuvers such as parking. As speeds increase, the power assist diminishes to provide a uniform road "feel".

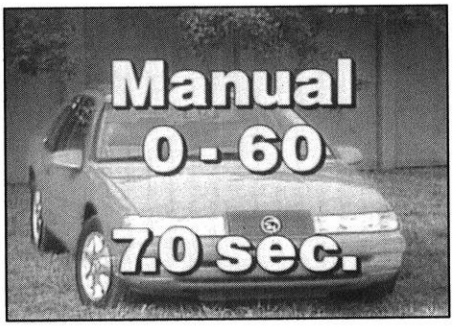


The brake system has been improved for fade resistance, stopping consistency, lining life, noise, and pedal modulation and effort. Large rotors with an additional four and one half inches of area in conjunction with improved lining compounds are used to improve high-speed braking.

Standard power is provided by a 3.8 liter naturally aspirated V-6 engine and a four speed automatic transmission.

Of course, these changes provide for a nice car that performs well. However, the real excitement begins with the Super Coupe and XR-7.

The cars feature a new automatic adjustable suspension system which uses a control module to monitor signals from speed, brake pressure, and steering sensors as well as acceleration signals from the electronic engine control. With this information in memory, the shock absorber damping is automatically adjusted. The driver can adjust the system manually for a firm ride under all driving conditions.

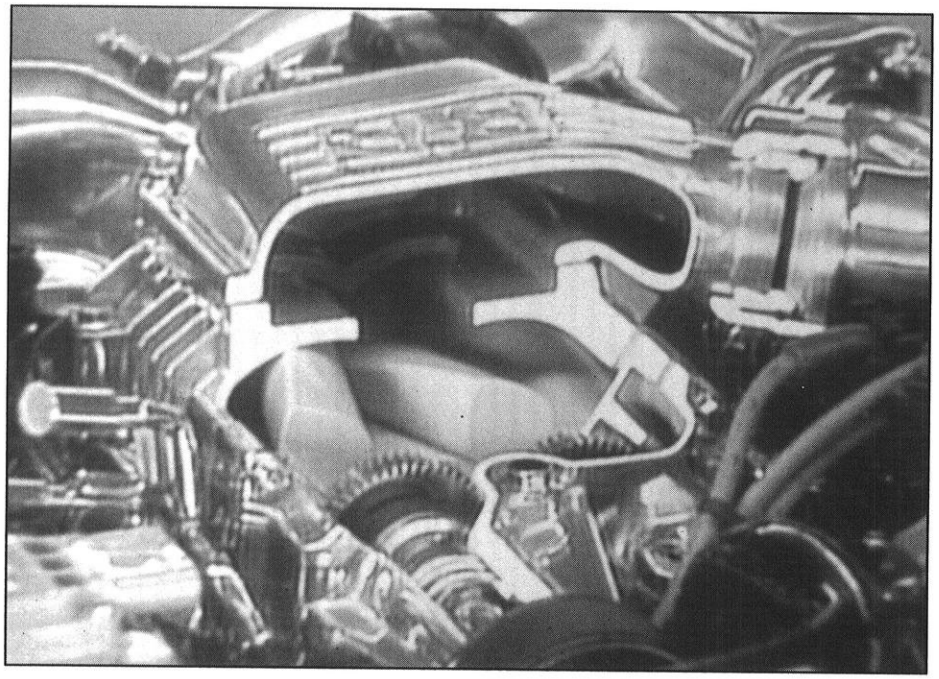


The automatic mode adjusts the shocks' damping for a smooth ride or for firm control when extra handling control is required. This occurs in the following conditions:

- The supercharger is producing 8 or more pounds of boost.
- Wide open throttle.
- Speeds in excess of 90 miles per hour.
- Hard braking.
- A steering maneuver that produces 0.3 G's or more of lateral force.

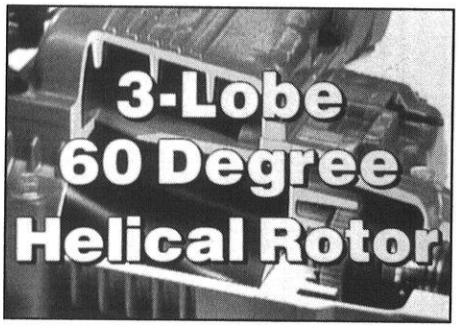
Stopping abilities have improved with the 4-wheel disc brakes featuring an anti-lock system with two sensors in the rear and one in the front.

Under the hood, the Super Coupe and XR-7 feature a new supercharged 3.8 liter V-6. The supercharged V-6 generates a motivating 210 horsepower at 4000



rpm and 315 foot pounds of torque at 2600 rpm. This is a marked improvement over last years 190 horsepower, 240 foot pounds of torque offered in the Turbo Coupe, and the XR-7's V-8 with 155 horsepower and 265 foot pounds of torque. The supercharger offers complete absence of turbo lag and strong bottom end (low engine rpm) performance.

The supercharged engine sports several changes to accommodate the excellent performance. The engine features a knock sensor to control spark advance.



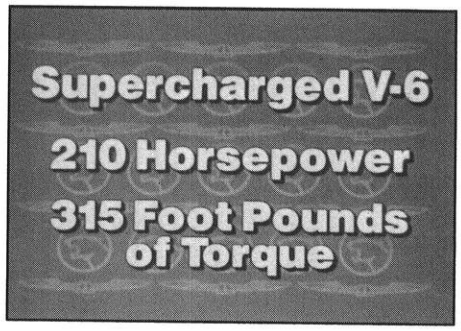
Special heat treated aluminum heads, increased cylinder head deck thickness, and reinforced bosses accommodate the increased pressures from the supercharger. A forged steel crankshaft now replaces the ductile iron model. Hypereutectic aluminum pistons are made from a heat-resistant silicon alloy that provides greater dimensional stability. A higher lift camshaft is used in conjunction with roller tappets.

The supercharger used on the Super Coupe and XR-7 is a roots-type positive displacement pump. The supercharger is an engine-driven pump which uses two counter rotating rotors to trap air within the supercharger body and force it under pressure through the intake manifold and into the combustion chambers. The supercharger features two three lobe, 60 degree helical rotors. The supercharger draws only 0.5 horsepower at 55 mph, develops 12 inches of boost at 4000 rpm and draws a maximum of 60 horsepower at 5000 rpm.

The supercharged engine also features an air-to-air intercooler. This reduces the supercharged air temperature up to 150 °F depending on ambient conditions. In addition, the increased air density increase power output for a given boost pressure.

All this finally translates into improved numbers. According to Ford, the gas mileage is 17 mpg for city driving and 23 mpg for highway driving. Motor Trend magazine testing shows that the Super Coupe pulls 0.84 G's on the skid pad while the XR-7 pulls slightly less at 0.83 G's and the Super Coupe/XR-7 stops in about 133 ft from 60 mph. Ford claims acceleration from 0 - 60 mph in 7.0 seconds for the Super Coupe featuring the manual transmission and from 0 - 60 in 7.5 seconds for the automatic.

According to an article recently printed in the Wall Street Journal, several problems have come up. Production difficulties with the cast iron crankshaft required for the Super Coupe necessitated a change to a forged steel model which has delayed production. Further, a mysterious rattle which turned out to be a bolt halted dealer shipments. Finally, the car is 800 pounds overweight and $800 over the production cost target, which cuts into profit margins.



Even with the few problems, demand has been very strong with over 32,000 orders waiting to be filled as of February 7. Hopefully, Ford will meet this demand by the time this magazine is available. ■

by Peter Holmi

Thanks to the extremely helpful people at Ford Motor Company, especialy Carl Ciracci and John Huston, for providing the information for this article and for an excellent presentation on the Engineering Campus.

All photos from Associates Creative, courtesy of Ford Motor Company.

Edison Day Celebration Looks to the Past

On February 10, the Department of Electrical and Computer Engineering showcased its annual Edison Day Celebration, in recognition of Thomas Edison's birthday. The event, which was hosted by ECE chairman Leon Shohet, consisted of the start-up of the Edison Dynamo Generator and a subsequent presentation by Ronald Kline, a Cornell University Professor.

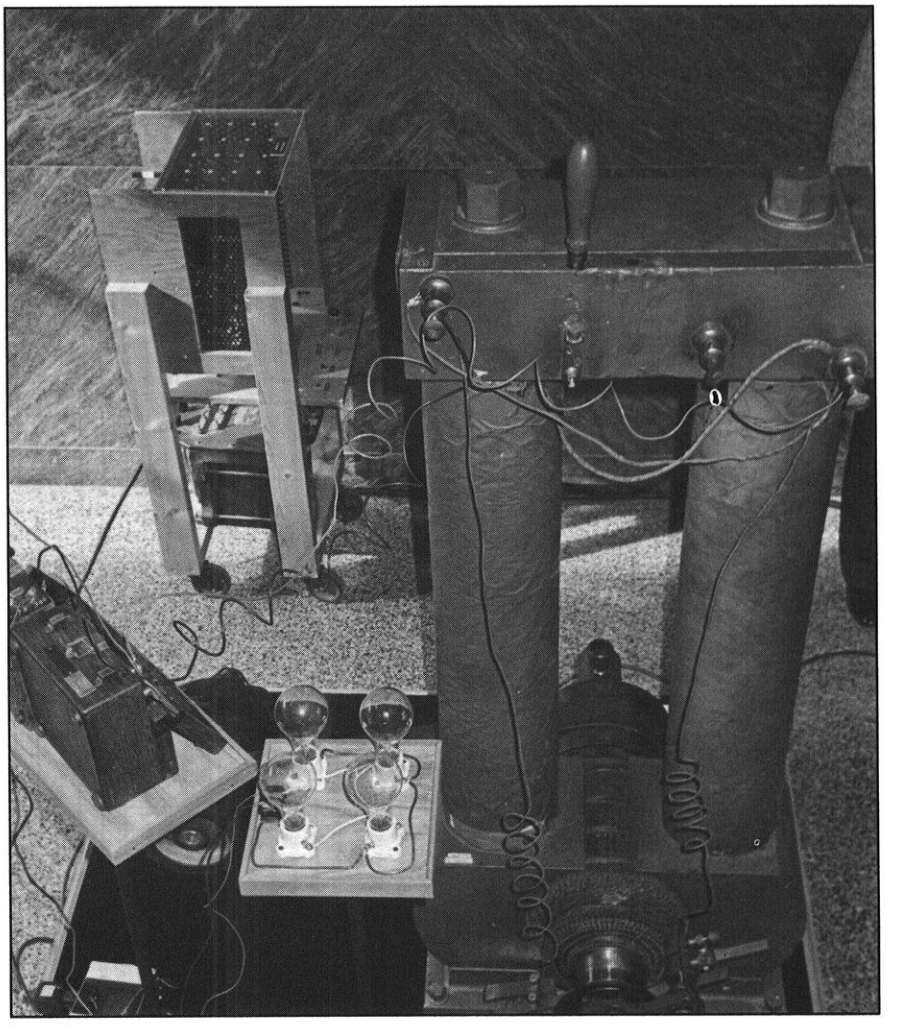
Edison's Dynamo Generator has been on display in the ECE lobby for about a year. The generator was the property of the ECE department from 1893 until 1955. Since 1955, however, it has been the property of the State Historical Society, and it is currently on loan to the ECE department.

In principle, Edison's generator was similar to others that existed at the time. The huge field magnets, however, were a unique development. The magnets are each 54 inches high and weigh 1100 pounds. The wrought iron cores of these magnets are 36 inches long and 6 inches in diameter. These cores are wound with three layers of cotton covered wire. In this "Long-Waisted Mary Ann", Edison was able to dramatically improve efficiency over other generators of his day. Earlier generators had an internal resistance equal to that of the load resistance. Thus, only about half of the energy produced by the generator was useful. Edison was able to reduce the internal resistance to about 10% of the total resistance, and greatly improved efficiency.

Needless to say, Edison must have done something right, because a group of about 75 people gathered to see Edison's ancient generator power a modern day personal computer. The demonstration was a success, as appropriately enough a program ran that played the song "You Light Up My Life."

Ronald Kline's presentation entitled "Edison-Steinmetz: electrical wizards in a corporate age" contrasted the lives and careers of Edison and Charles P. Steinmetz, a somewhat lesser known electrical "wizard."

Dr. Ronald Kline of Cornell University, left, and J. Leon Shohet, chairman of ECE dept., right, stand with the Edison generator.



The Edison generator is enclosed in a glass case in the Electrical Engineering lobby.

Steinmetz, though very well recognized and respected in his day, did not achieve the long lasting fame and popularity that Edison still maintains. Klein's explanation for this is that Steinmetz never became an "idol of consumption", but rather he was only an "idol of production." That is, Steinmetz was well respected for what he did, but he didn't have the same mystique or mythology surrounding his life that Edison had.

This is the same reason that so many scientists and engineers are not revered today, as opposed to movie and rock stars.

Kline gave an excellent example of this theory, when he compared the popularity of Steven Jobs (founder of Apple Computers) to that of many other equally important engineers that the public has never heard of. Jobs has become an idol of consumption.

The Edison Day Celebration showcased the past, but also gave some interesting insight on the present. That is, if you want to be famous, science and engineering are probably not the best careers to enter. If you do want to be famous, learn how to play the guitar—fast.

by Don Korjenek

HELP WANTED:

GEOLOGICAL ENGINEERS

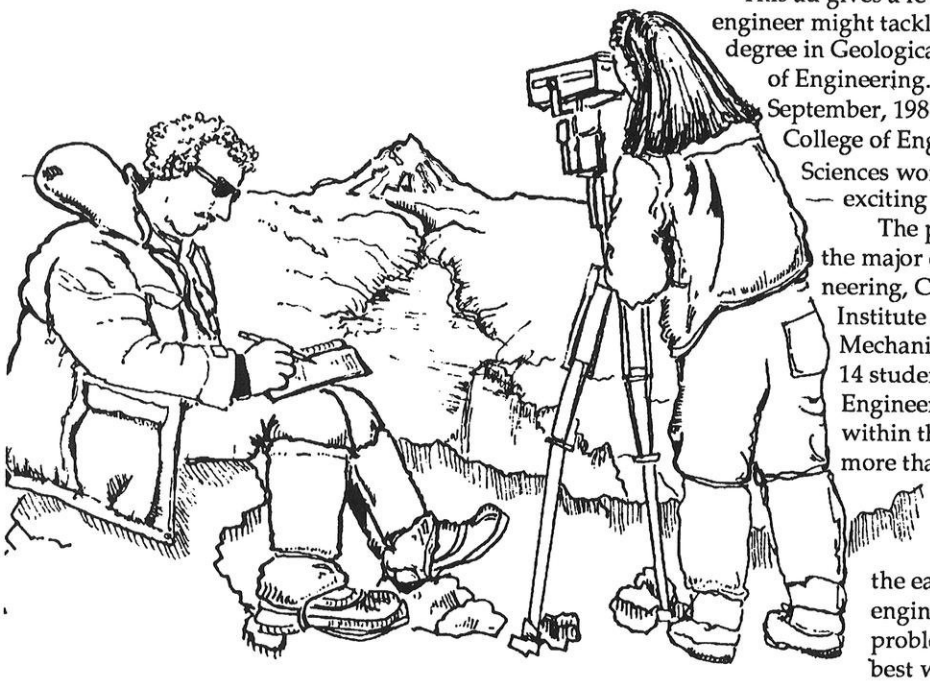
call for more information.

HELP WANTED:

Bright, talented engineers to design large dams and foundations, underground radioactive waste repositories, and the foundations of offshore drilling platforms.

HELP WANTED:

Mechanical engineer with four years experience in one of the



Geological engineers measure changes in shape of the crater of a volcano.

This ad gives a few examples of the projects a geological engineer might tackle after receiving a Bachelor of Science degree in Geological Engineering, a new program to the College of Engineering. In this interdisciplinary program, started in September, 1987, faculty from four departments in the College of Engineering and College of Letters and Sciences work together in developing and operating an exciting course of study.

The program has about 15 faculty members from the major departments of Materials Science and Engineering, Civil and Environmental Engineering/ Institute of Environmental Studies, Engineering Mechanics and Geology and Geophysics. Currently, 14 students are enrolled in the program. Geological Engineering Professor Rodolfo de la Cruz hopes that within the next two years the students will number more than 50.

In broad terms, geological engineering combines the two disciplines of geology and engineering. While geologists study the earth's origins, composition, and evolution, engineers apply scientific principles to technical problems. The geological engineer helps find the best way to use the earth's resources in the design and construction of structures while at the same time protecting the environment.

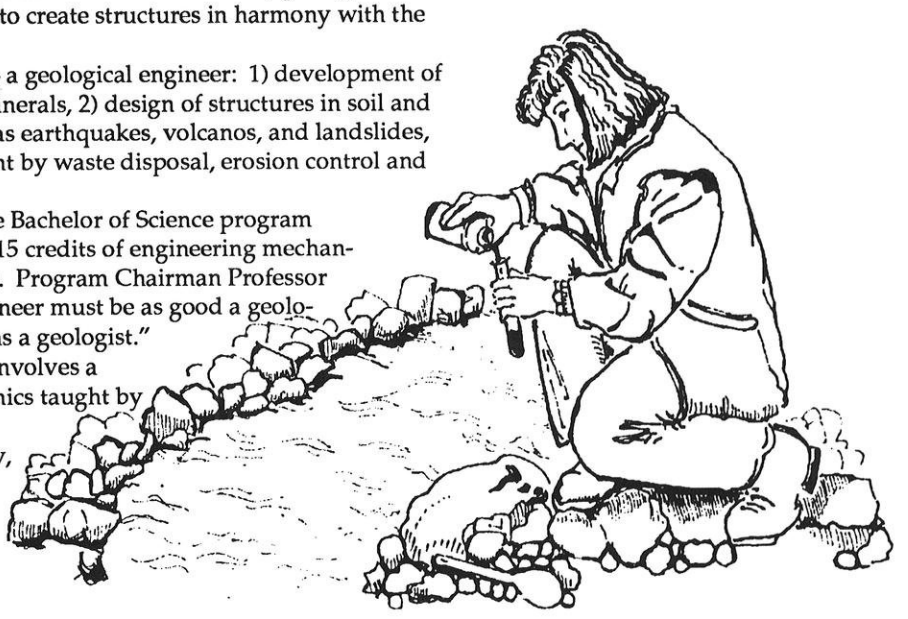
"Engineers and builders used to not consider the environment when building a structure," says de la Cruz. "But anytime you disturb the earth's crust, geological engineers become important. Now we want to create structures in harmony with the environment," he adds.

There are four major areas of interest to a geological engineer: 1) development of geologic resources like water, energy, and minerals, 2) design of structures in soil and rock, 3) mitigation of geologic hazards such as earthquakes, volcanos, and landslides, and 4) protection of man and the environment by waste disposal, erosion control and maintenance of ground water quality.

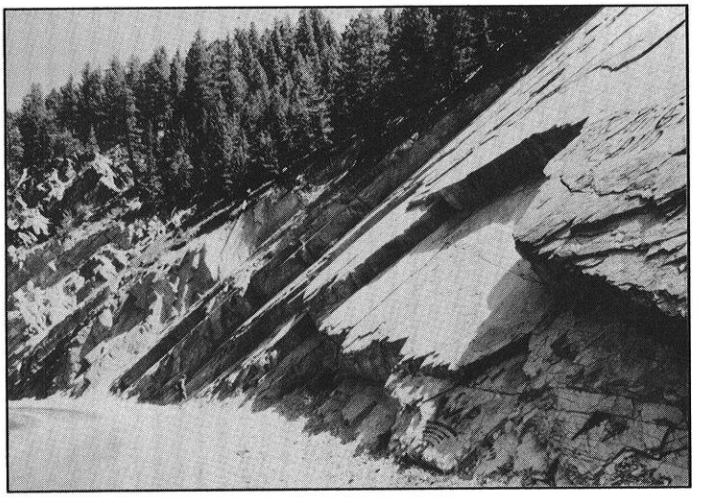
The major blocks of course work for the Bachelor of Science program include 24 credits of geological engineering, 15 credits of engineering mechanics, and 30 credits of geology and geophysics. Program Chairman Professor Bezalel Haimson states, "The geological engineer must be as good a geologist as an engineer and as good an engineer as a geologist."

The engineering side of the education involves a thorough knowledge of rock and soil mechanics taught by Materials Science and Engineering and Civil and Environmental Engineering, respectively, with Engineering Mechanics providing a basic background in mechanics.

"The program is a great opportunity for students to get personal attention inside and outside of class," says Haimson. He also mentioned that scholarships averaging $500 are available to the students doing well in the program based on achievement

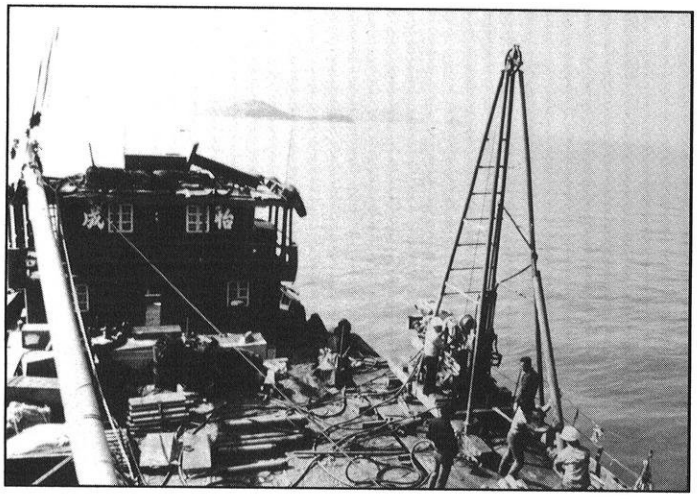


Water quality is just one of the major elements of the elements that must be protected.



Sandstone bedding surfaces exposed on Montana road. This is a typical problem for geological engineers.

Clearing site in front of 150 foot high, 75 degree angle rock slope for building construction



Site investigation program on Victoria Harbor, Hong Kong Sea Bed

Poor service protection and drainage system lead to erosion and embankment failure on East West Highway in northern Malasia

and need. This year three scholarships were awarded.

The Geological Engineering program is one of 19 programs in the country. It began after several faculty members from the four involved departments got together over a period of two years and investigated the need for such a program in Wisconsin.

They found that this campus had a great resource of faculty spread out over the college. The idea of an interdisciplinary program was a practical and economical way to combine the departments allowing faculty to complete primary tasks in their own departments and still be involved in the new program.

"The geological engineering field gives engineers the opportunity to work outside and be involved in projects that affect our lives through the environment," says Haimson. This career can be very flexible; it allows engineers to work in the field, as high-tech system analysts, or designers. If this field and job opportunities sound interesting to you apply now to Geological Engineering Professor Haimson in Room 252, Materials Science and Engineering. ■

by Barbara Angermann

Photography by Lok Sing Cheung, graduate student, Rock Mechanics. Original artwork by Dawn Stanton.

Dare to Discover

APRIL 7-9, 1989

Expo is here once again, to highlight technology and engineering, and to open the doors of the UW College of Engineering. The theme chosen for this year is "Dare to Discover" Expo '89. The exposition is a non-profit event that is entirely student organized and run.

Over the past 48 years, the UW Engineering Exposition has developed into one of the College of Engineering's finest and most enjoyable traditions. Although the founding of the College preceded the Exposition by more than eighty years, the history of Expo spans the most dramatic period of changes in both the school and the profession of engineering. The history of Expo gives a glimpse of the growth of the College of Engineering and also provides a fascinating perspective of the impact that rapidly advancing technology has made on modern society.

The roots of the UW Engineering Expo can be traced to the early 1930's and an annual feud between UW Law and Engineering students. While newspaper headlines of the day were filled with rumors of an impending war abroad, a different type of conflict was stirring at the University of Wisconsin.

Every March, UW Engineering and Law students prepared to rekindle their dispute over the true vocation of **Saint Patrick**; the engineers vehemently asserting that Patrick had been a fellow "slide-rule pusher," the lawyers laying claim to Pat as one of their own. Each group would hold a parade up State Street in their patron saint's honor. From the mid 1920's, these parades had clashed good-naturedly, but year after year the bickering became more spirited until it burst into a riot on St. Patrick's Day, 1938.

As a result, the Engineering faculty desperately sought a means of diverting the students' efforts into a more constructive enterprise. The result was the Engineering Expo - a new keystone to the St. Patrick's Day day celebrations and successor to the traditional, yet unpredictable, parade.

The Expo 89 Executive Committee: From left to right: Jeff Bondi- Advanced Promotions and Personnel, Ann Redsten- High School Public Relations, Mark Richter- Special Exhibits, Mary Schultz- General Co-Chair, Bill Taranowski - Publicity, Heidi Schmidt- Building and Exhibits, Mike Solomon- General Co-Chair, Mark Enerson- Student Exhibits, Troy Stucke- Industrial Exhibits

A HIGHLIGHT OF THE YEARS:

1940: The first Expo. It featured about 40 student and 30 industrial exhibits. Admission was set at 25 cents and the April issue of *Wisconsin Engineer* magazine served as the complimentary program booklet.

1942-1952: WWII put a temporary hold on the Expo.

1953: Expo was resumed on a triennial basis.

1956: The Expo began to broaden its purpose under the leadership of a young mechanical engineering student named John Bollinger, who worked at developing four basic objectives for Expo. First, to bring industry to the University and expose the engineering students to practicing engineers. Second, to open the College's doors to the public in an effort to illustrate the role of engineering in their lives. Third, to offer young people a chance to see the College of Engineering and to learn more about engineering as a profession. Lastly, to provide financial support to student organizations throughout the College. (John Bollinger has been Dean of the College of Engineering since 1981.)

1969: Expo reflected the concern of young Americans with the social problems of that era. The Expo program booklet became a showcase for anti- establishment rhetoric. Conspicuously absent from the Expo were the traditional exhibits by Army, Navy and Air Force.

1971: Expo and the College of Engineering worked to recognize the increasing role of women in engineering. This was the last Expo to feature the traditional "Expo Queen and her Court", a carry over from the Saint Patrick Day celebrations of old. This year also marked the first time that a woman served on the Expo Executive Committee.

1970's: The U.S. was deep in recession and Expo reflected these hard times as only six industries were able to exhibit. In contrast, the Expo featured a record number of student exhibits.

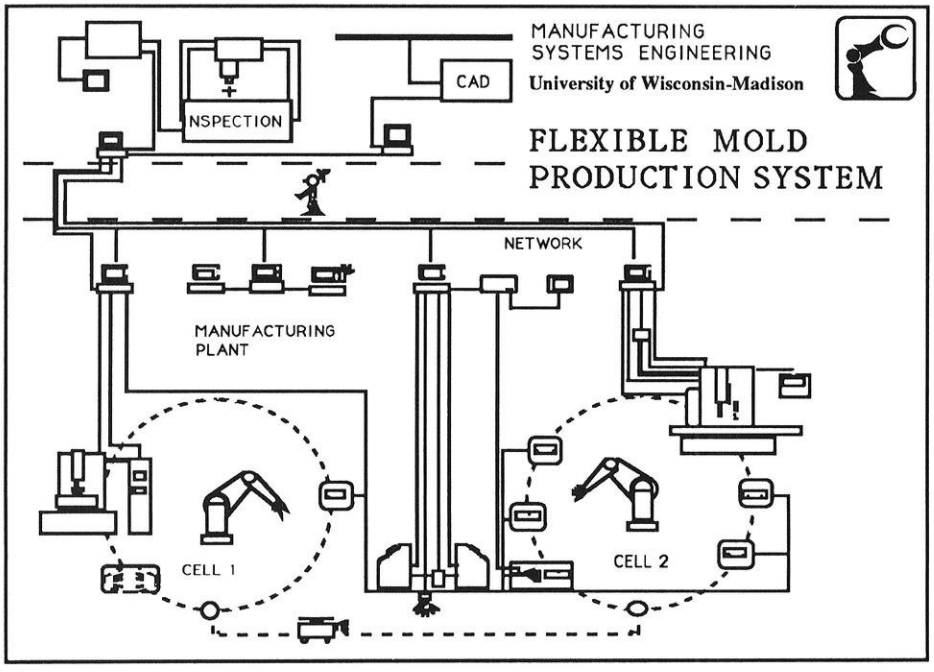
1980's: The economy had improved and the Expo continued to display fascinating technological advancements in today's modern society.

1985: The Expo executive committee began using a computer to aid their organization and planning. This set a precedent that Expo '89 was to continue and expand upon.

THE "LIGHTS OUT" UNMANNED AUTOMATED FACTORY

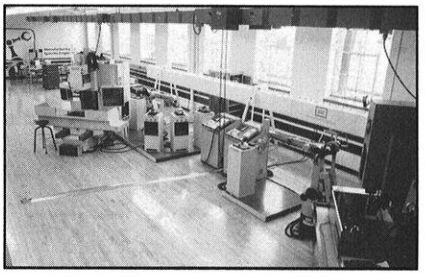
Does this sort of dialogue between parts, machines, and material handling devices in an unmanned flexible manufacturing system seem rather ridiculous, or is there some sense in it?

Part#241:	"Anyone out there free to machine my 50 mm x 250 mm top surface to a tolerance of ±0.05 mm with a 1.6 μm surface finish?"
M/C Center #16:	"Yeah Sure - I'm free."
M/C Center #3:	"So am I."
Surface Grind #1:	"Me too - I can give you a better surface finish - 0.4 μm."
M/C Center #8:	"I can't! My main bearings just seized - Fred should be here in the morning to fix me - meantime, I'll flush my tanks."
Part #241:	"Thanks, I'll take you M/C #3 - please reserve; you're nearest and remove metal faster - I don't need that good a finish.
S/G #1	- I'm on my way M/C #3." "Calling all transporters - who can get me to M/C #3 - now!?"
Robot #8:	"I can get you to the high speed pallet movers."
Pallet Mover #19:	"Sorry, I'm busy now - should be free in 5.39 seconds."
Pallet Mover #15:	"I'm close by and free - with you in 0.83 seconds."
Part #241:	"Thanks guys! - go ahead Robot #8 and P/M #15"
M/C Center #3:	"Hi, part #241, have a good trip? I'll try and get you finished quick - it gets pretty rough in here when Fred turns those light on!"



The Manufacturing Systems Graduate students are proving that there is indeed a great deal of sense in it. In fact, recent research by the MSE group indicates that a *Part-driven* heterarchical control system such as this, has many advantages over the traditional hierarchical approach with centralized cell controllers. These advantages include increased fault tolerance, reduction in system complexity, reduction in system software development and debugging time, and greater flexibility.

See the system in operation at EXPO'89, and judge for yourself! This approach is being applied to the manufacture of molds and dies for the volume production of precision plastic parts. A comprehensive system is being imple-

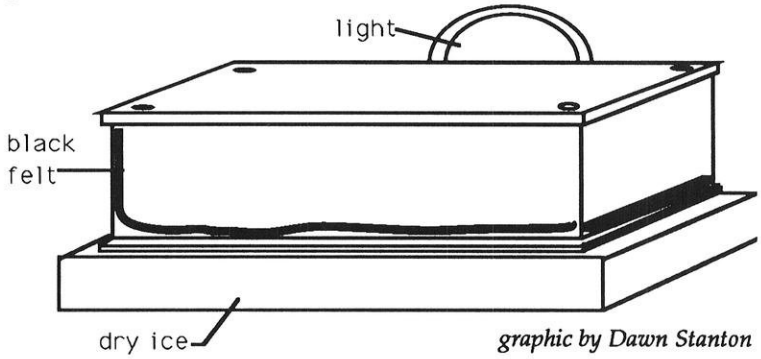


mented in the main MSE Laboratory showing for the first time, it is believed, integration from design through to finished product of injection molded components.

Some 15 graduate students, of multidisciplinary background, covering individual aspects such as vision inspection, integrated CMM inspection, mold cavity finishing by CNC grinding, integration of Electrical Discharge Machining, and the development of a flexible high speed transport device, are working as a team to design, build and implement this advanced Flexible Manufacturing System.

The system will be manufacturing plastic key rings, designed specially for EXPO and will feature an automated light show with running commentary.

The Cloud Chamber



graphic by Dawn Stanton

An old favorite will be back this year: The American Nuclear Society's cloud chamber. Felt soaked with ethyl alcohol lines the interior sides of the plexiglass box, which sits on blocks of dry ice to keep the alchohol vapor inside cooled to supersaturation. As spectators gaze through the chamber's transparent top, tiny "clouds" appear and vanish inside, seemingly for no reason at all. What's the secret? The alcohol vapor becomes visible when it condenses around ions produced by energetic charged particles, such as alpha particles, beta particles, and protons, that pass through the walls of the chamber. These charged particles are caused by the natural background radiation emitted by soil, rocks, and even the bricks of buildings.

by Lisa Peschel

The Sunraycer: GM Looks to the Future

GM Sunraycer – The General Motors Solar-powered car which won the 1,950-mile World Solar Challenge race in Australia in November, 1987, and led the Pasadena Tournament of Roses Parade on January 1, 1988 as "Pace Car of the Future," will be visiting auto shows, technology and engineering conferences, university and high school campuses across the country this year. Molly K. Brennan, Chevrolet assistant product engineering manager, and one of six Sunraycer drivers in the Australian race, is shown in the insert.

At Expo '89, General Motors and Hughes Aircraft will display the GM Sunraycer, a completely solar powered vehicle that won the World Solar Challenge Race across Australia. The Sunraycer won the 1950 mile race by a two and one half day, 620 mile margin, averaging 41.6 mph. Batteries, charged by a solar array and a regenerating braking system, allow the Sunraycer to travel at a constant speed even under cloudy conditions. In short runs using power from the batteries and the array, the vehicle can reach 70 mph speeds.

The car is an excellent example of today's engineering technology. It contains the latest advances in aerodynamic design, lightweight materials, electric motors, high efficiency batteries, and solar power. The welded aluminum frame, for example, weighs only 15 lbs, but supports 577 lbs. The Sunraycer has a drag coefficient of Cd=0.13, the lowest ever recorded for a land vehicle.

General Motors, pleased with the results of the competition, is currently sponsoring another solar powered vehicle race, GM Sunraycer USA, from Florida to Detroit on July 8, 1990. The competition, aimed at college students, is open to every educational institution submitting a proposal prior to March 1, 1989. It will be interesting to see how college students fare in this typically corporation-dominated field, and to see what new developments surface in the next generation of solar vehicles.

by Chris Lindell
Photo courtesy of General Motors

Engineering Gone Mad

The pressure mounts as you face the last problem on your microelectronic circuits exam. Looking up at the clock, you have five minutes left. You lower your pencil and the lead tip splinters, fragments pierce the person in front of you. Panic? No. You simply walk to the front of the room and sharpen it, right? Yet for members of Theta Tau, this scenario is nothing less than a nightmare. Theta Tau Expo participants will say that the simple solution may not always be the best, or at least the most interesting. Their display, a Rube Goldberg Machine, will consist of an intricate and often times off-the-wall contraption that sharpens a pencil through the oddest of technical means.

Rube Goldberg, a cartoonist, earned his fame by depicting seemingly simple tasks through complicated means. From placing a stamp on a letter to cheating on an exam, Goldberg drew comical procedures utilizing clapping seals, bowling balls, and various other oddities to achieve his task. Engineering students here and across the nation have taken this a step further, introducing technology to the Rube Goldberg concept. A contest emerged.

In 1949, the Engineering Gone Mad competition heated up at the UW. Participants were to perform such things as extinguishing a cigarette, opening a Coke bottle, frying an egg, or putting toothpaste on a toothbrush. The competition continues today, whereas recent winners have even seen the likes of an appearance on *Late Night with David Letterman* as well as the *Tonight Show*.

Theta Tau will be participating in this year's national competition held at Purdue University on March 18. The entries, from various universities, will be judged on intrigue, creativity and effectiveness. The machines will be required to sharpen a pencil within the time constraint of five minutes utilizing up to 25 steps in the process. Theta Tau participant, Alex Petniunas, anticipates great success on the national level, "I don't see why we shouldn't blow the doors off the competition. I mean, we are Wisconsin engineers. Seriously, I do think we will do well, and perhaps we can bring some enthusiasm for Rube Goldberg back with us. I'm anxious to get a contest started here on campus next spring. I'm certain that a lot of people will enjoy participating."

Theta Tau will be displaying its competition machine at Expo this year. Utilizing a VandeGraaff machine, electromagnets, levers, pulleys, Smurf dolls, toy cars, and Jeep dash boards, the result will be interesting.

by Deniz Ayaz

The Automated Railroad

Kappa Eta Kappa's entry in the 1989 Engineering Expo is an automated railroad system.

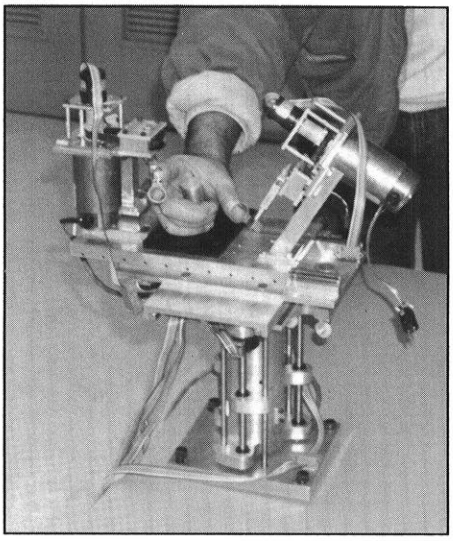
The professional electrical engineering fraternity's display consists of an HO-scale model railroad mounted on an 8' x 16' plywood platform. The fraternity is building its own microprocessor based system to drive multiple trains on the platform and direct them to perform various tasks. The platform will be set up as a series of miniature cities. By typing commands into a computer terminal, the user will be able to send a train to a particular city and direct it to execute a loading or dumping task.

An 8088 microprocessor, similar to that found in IBM-PC's, will be directing the trains via control switches located on the tracks. Sensing of the trains' positions will be achieved through a feedback network of hall effect transistors reacting to a change in magnetic field and working interactively with the microprocessor.

The purpose of the project is to demonstrate a control system. The fraternity has received various parts for its project from company donations including transistors, resistors, diodes, voltage regulators, and triacs. The total estimated cost of the project is $600.

by Nancy Hromadka

TECHNOLOGY AND TELEROBOTICS



Maher Abdelghani operates the Master hand.

Pi Tau Sigma and the Wisconsin Center for Space Automation and Robotics (WCSAR) have teamed up to display a telerobotic hand system at Expo '89. The purpose of the system is to allow an operator to guide a mechanical hand through identical movements of his own hand. To do this, the mechanical slave hand is connected by a computer to a glove-like master hand which fits over the operator's hand . Sensors in the master hand detect any motion of the operator's hand, and send a signal through the computer to the slave hand. Motors in the slave hand then reproduce the exact movements of the master hand.

Because the master and slave hands are not connected mechanically, the slave hand can be operated from a distance. This allows a slave hand to be operated in a hostile environment while the operator is far removed from any danger. Typical "hostile" environments today include nuclear and chemical plants, and space.

Pi Tau Sigma and WCSAR hope to have two complete systems operating at Expo '89. For the sake of simplicity, they will use a gripper, a simple device for clamping, rather than the three-fingered hand that the space industry is developing. They assembled the master and slave hands from an existing but non-operational system, and made minor improvements to their operation. Additionally, they will write all of the software necessary to complete the computer feedback loop. To show a possible application of the system, they will display the telerobotic hand inside a life-size model of the space shuttle's cabin.

story and photo by Christopher Lindell

HEALTH AND AGRICULTURE

The health and agriculture Expo projects headed by Geoff Schmitz of the American Society of Agricultural Engineers will focus on a variety of engineering problems faced by farmers and the farmstead.

Agricultural Tractor Development—Team leader: Tom Loher

An outdoor display will consist of representative tractors dating from an early steam engine tractor to a present day agricultural prime mover. The exhibit will look at the evolution of the "haphazard product" into the fine "engineering product" of today. Vehicles are selected to exhibit significant development in design, safety, construction, and materials.

Mechanical Farm Hazards and Safety—Team leader: Pat Pritzel

To be exhibited is an "historical" diagnosis of the nature and frequency of farm hazards from early to present day equipment. Tracing the solution of such hazards will involve an analysis of the problem with an approach more scientific than that of yesteryear.

Dairy Computer Identification / Ration System—Team leader: Laura Leihman

One exhibit will be an interactive demonstration of the use of computer identification tags to individualize dairy animals and give specific ration and animal information. Each tagged cow would receive any extra attention to special needs such as medication, whereas cows have traditionally beentreated more or less as an unevenly represented herd.

Chocolate Enrobing Process—Team leaders: Dwayne Klein, Paul Geiser

This delightful idea involves a machine demonstrating the principles in the operation of the chocolate enrobing process for condiments. The small scale machine can prepare treats for the sweet tooth, such as chocolate covered pretzels and raisins. Free samples will be available for all.

Farmstead Safety—Team leader: Todd England

An informative display will analyze farm hazards, health, and practice. Health problems (and possible solutions) to be focused on are respiratory ailments, pesticide exposure, and mechanical hazards.

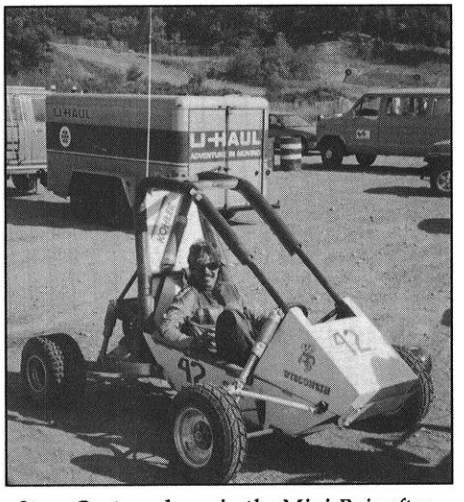
By Winnie Teng

THE SAE PERFORMANCE VEHICLES

The Formula SAE

Two of the SAE Student Branch's primary goals are to develop the engineering skills of its members and to keep them informed on recent developments in the automotive industry. The former is achieved through the SAE Student Design Competitions. The national SAE organization holds four design competitions each year. These are for off road,racing, and high efficiency vehicles, as well as radio controlled aircraft. Each of the competitions are entered by 30 - 40 colleges and universities from the U.S. and Canada. Currently, SAE is involved in the Formula SAE and the Mini-Baja competitions. The students are responsible for all phases of design, construction, and development.

Both vehicles were built by students in independent studies. The vehicles took about one year to make, from the design to the finished vehicle. The formula car cost about $4,000 to build and the Mini-Baja cost about $1500. Mechanical Engineering Professor Velinsky is in charge of the Formula car and Mechanical Engineering Professor Fronczak is in charge of the Mini-Baja.



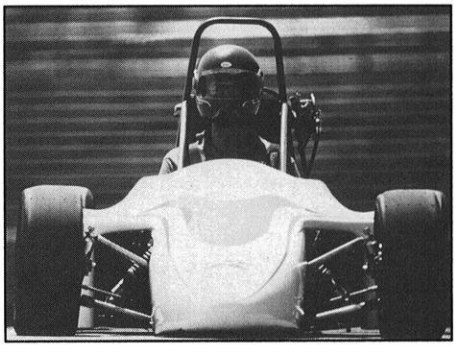
Steve Curtes relaxes in the Mini-Baja after the two hour endurance event.

The Formula SAE is a single seat, open wheeled race car intended for the weekend racer interested in autocross. It is very similar to a small Indy car. It must be inexpensive, reliable, easy to maintain, and above all, competitive. The cars are judged on design, cost, handling, acceleration, fuel economy, braking, and endurance with a two hour event on an autocross track. According to Loren Yearous, driving the formula car is "like riding a motorcycle three inches off the ground." This is probably due to the Kawasaki motorcycle engine providing the motivating force for a car that weights only 700 pounds.

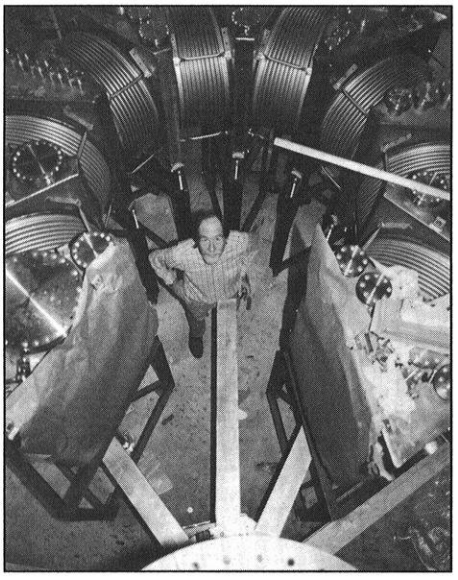
The Mini-Baja competition is for single seat off-road vehicles. This is a multi-purpose vehicle which should be suitable for both recreation and light utility work. They are tested for acceleration, braking, top speed, towing capacity, hill climbing ability, handling, and finally a two hour endurance event. Briggs and Straton donates eight horsepower engines for use in the Mini-Baja competition. Last year's endurance event was held at the Aztalan motocross track, which proved to be very challenging.

SAE also informs its members about new technology in the automotive industry. One area which has received a lot of attention lately is active suspension. This type of suspension reacts to the road surface to move the wheel up and down over bumps in order to reduce the motion of the body. SAE will be displaying a working model of this exciting new technology at EXPO '89.

by Peter Holmi
photos courtesy of SAE



The Phaedrus-T Tokamak and The Phaedrus-B Tandem Mirror

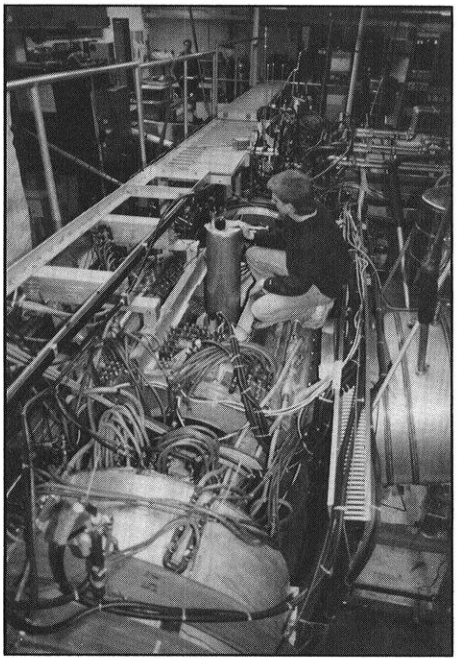


The Phaedrus-T Tokamak

The Phaedrus-T tokamak is currently nearing completion. It will have a plasma major radius of about 92 centimeters and a minor radius of 25 centimeters with BT about 1T. It will share the staff, control room, computer and some diagnostics with Phaedrus-B. Phaedrus-T will be devoted to studies of ICRF and will have several megawatts available.

Phaedrus-B is one of the largest university fusion experiments in the world. The Phaedrus Tandem Mirror device and experimental program were designed to investigate the use of ion cyclotron range of frequencies (ICRF) to increase end cell ion temperature and density, in order to improve stability and fueling. The Phaedrus program has demonstrated that ICRF has many other effects on a plasma. The ICRF can provide low frequency stability to a simple mirror plasma by providing a time average "ponderomotive" force, and can also affect equilibrium and transport. It can produce electric potentials which plug axial ion losses and radial electric fields which result in plasma rotation and radial transport changes. Phaedrus was the first tandem mirror to operate using only ICRF, without the need for neutral beams.

by Lisa Peschel



The Phaedrus-B Tandem Mirror

Trains That Can Fly?

One project that is certain to lift a few eyebrows at the Engineering Exposition this year is the Mag Lev Train, which integrates the relatively new world of high temperature superconductors and transportation to give an exciting machine with many possible applications. With the advent of superconductors which work at relatively high temperatures, Mag Lev (Magnetically Levitated) Trains are being looked at more and more seriously today as a clean and efficient mode of transportation.

Though the cost of keeping thousands of miles of superconducting track at 90 Kelvin far outweighs the benefit of the train right now, this project is nevertheless a glimpse into the future. As scientists and engineers around the world race to "build a better mouse trap", as it were, the critical temperature for superconductors continues to rise. And it is only a matter of time before the cost/benefit ratio is tilted undeniably towards the benefit side, and the trains will begin to roll. The students behind this project are giving the Expo goers a look at what will be.

The students propose to utilize an YBa2Cu3O7 (123) superconductor to levitate a train containing a permanent magnet in its belly. The tracks will be constructed so that the superconductor would be close to, if not in intimate contact with, liquid nitrogen which would be the cooling agent. According to the student proposal, the train will be powered by a small ducted prop, or similar air propulsion system, which in turn will be powered by solar cells mounted on top of the train. Because air resistance will be the only significant frictional force that the train's propulsion system will have to overcome, this low power system will be more than enough to drive the train.

The cost of 123 superconductor, however, has forced these students to try something new and very interesting. Tom Kelly, one of the students working on the project, has proposed that it may be possible to mix the 123 powder with an epoxy to form a superconducting composite. This will cut the cost of the track and will also be the first time the composite will have been used. The students are evaluating his proposal and are excited about its possibilities for application.

The students who worked on the project include Tom Kelly, Paul Bartelt, Brad Kokal, Jeff Irvine, Mark Kaphfhammer, Brian Hetzel, Howard Beumler, Bryce Brandstatter, James Foley, Kari Johnson, John Kelly, and Beth Milfred.

by Tobias George

The Centrifugal Atomizer

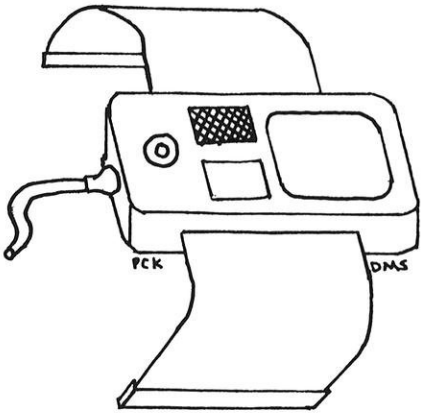
Bryce Brandstatter and Jim Foley have put together a Demonstration on Powder Metallurgy for exhibit at the Engineering Exposition this spring. They plan to set up a Centrifugal Atomizer, used in industry as an aid in the metal atomization process, to turn molten copper into powdered copper. Then, by showing what is made from powdered metals, they hope to convey the usefulness of such a device.

The Centrifugal Atomizer works as the powderization agent in the exhibit. A heated crucible is placed above a rotating disc; in the bottom of the crucible is a hole through which molten copper flows. When the copper contacts the disc it is thrown free and the individual droplets are cooled in the air. The droplets are extremely small and therefore cool relatively rapidly, at the rate of approximately 10,000 Kelvins per second. Once this process is completed the copper can be turned into whatever is desired. The critical aspect of the entire exhibit is the RPM of the disc; it has to be approximately 20,000 RPM or the atomizer will not work.

"This exhibit integrates a rapid solidification Centrifugal Atomizer, reactive sintering and finished products," say its authors in their report. The project also demonstrates an actual metal atomization process used by industry, as well as adressing what is new in powder metallurgy.

by Tobias George

The Dick Tracy Super-Sleuth Watch



Super-sleuth Dick Tracy depended upon a video walky-talky to communicate with partners in the war against crime. The comic book hero wore this two-way audio/visual system on his wrist, like a watch.

The fabricated video walky-talky will enter the world of reality when three students unveil their Dick Tracy Two-way Wrist TV at the biannual Engineering Expo. Piet Kreunen, Eric Van Rens and Andrew Kalnajs recruited Marquip, an industrial machine manufacturer, to aid in funding the project.

The cost of parts for such a gadget is surprisingly low in this advanced technological era, according to Kreunen, a senior majoring in Mechanical Engineering. Public access to reasonably priced video cameras and minitelevisions is quite high.

The inventors used components from a Fisher-Price video camera (about $100), a miniature television and a conventional radio. Mini-televisions usually sell for about $150 and go for as low as $30, Kalnajs, a senior majoring in Economics, said.

Kreunen pointed also to the evolved minuteness of video screens and transmitter components as key to the composition of the Two-way Wrist TV.

"The marriage of the visual and audio components is so simple," Kreunen said, emphasizing the feasibility of the Wrist TV. Kalnajs added that about five years ago, Seiko developed and marketed a wrist television, or a one-way wrist television.

The visual aspect of the Wrist TV works like conventional television. A mini, wide angle camera net to the screen "reads", for example, Dick's image line by horizontal line. The camera systematically transforms these spaghetti strips of light data into electrical impulses and sends them via wire to a walkman-sized combination transmitter/receiver on Dick's belt. Dick's transceiver sends the electrical signals to his partner's transceiver where the electrical impulses are converted back into light data.

An electron gun paints the light and dark information on his partner's screen in the same order it received them, creating a image of Dick. The process is continuous, so Dick's image moves on his partner's screen when Dick moves.

The audio variable of the Wrist TV works "in parallel" with the visual system. A microphone next to the screen picks up audio data that is transmitted to the other transceiver where it is converted back to audio data, just like a radio receives sound from its respective station.

The group chose the Wrist TV as an EXPO project because they wanted to pick something novel and interesting to the public, according to Van Rens, junior in Mechanical Engineering.

To display and demonstrate their invention, the students will have a model of Dick Tracy wear one Wrist TV while one of the inventors wears the other.

"People will be able to look at Dick's Two-way Wrist TV and see one of us," Kreunen said. So look for Dick Tracy at the Expo and have a chat with Piet, Andrew or Eric on the first Two-way Wrist TV this side of reality.

by Rebecca Cors,
Guest Writer, Journalism Student

Computers in Industrial Engineering

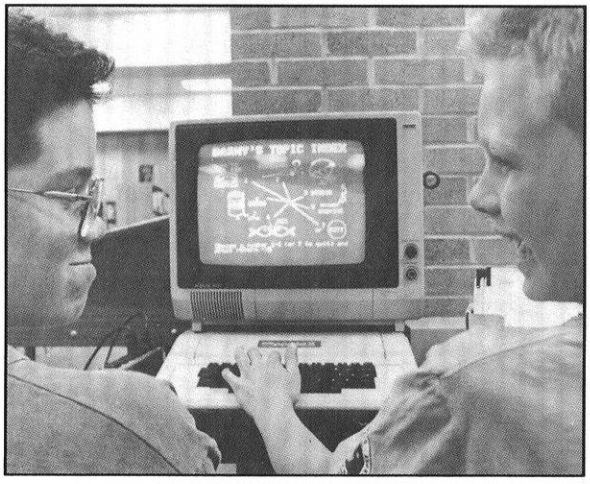
Alpha Pi Mu, Industrial Engineering Honor Society, along with the Institute of Industrial Engineers (IIE), will be presenting their exhibit on some of the many uses of computers in the IE field. Initially, coordinator of the IE Expo project, Bryan Timm, found that it was hard to represent the field of Industrial Engineering for an Expo project. The field is fairly broad, yet most of the areas are not "visual." However, one common link between all the fields of IE is the involvement of computers: whether they are being designed to be used easily by the handicapped, or they are running a simulation package.

An interesting project was the result of Timm's efforts. This year's Expo exhibit will consist of two displays of specializations within the IE field: one illustrating Facilities Planning (Manufacturing Systems) and another, Human Systems.

Facilities planning involves many things, from designing the layout of an entire office or factory, to the precise analysis of material flow through a facility for better productivity. This year's Expo exhibit will attempt to display the steps an Industrial Engineer would take in designing a facility. Expo project participants decided to show the workings of a tennis racket factory. Tennis rackets were chosen because an administrator within the IE department likes the game of tennis.

This display will consist of various computer terminals implementing BLOCPLAN, StarCell, and tentatively General Purpose Simulation System (GPSS), three computer packages used by Industrial Engineers during the Facilities Planning process.

BLOCPLAN is in a sense, set up like a "game." The user inputs the various departments/areas needed within the facility, the size, and interdepartmental relationships between them. These relationships are determined under two criteria. The first deals with the product flow between departments, while the second takes into account how close the departments should be to each other. This answers the following questions: Will the fumes from the factory be too close to the cafeteria? Is the noise level too loud for the office area within close proximity of a room with heavy machinery? The output of BLOCPLAN is a block layout of the facility with a score on how well the interdepartmental relationships are met.



Elementary students enjoying BARN

StarCell complements BLOCPLAN, by focusing on a particular department within the layout. It animates the flow through the department, whether it's a product being produced in a factory or paper flow through an office. StarCell also analyzes such things as the size of buffers between machines and what would happen in the event of a machine breakdown.

GPSS, a basic simulation system currently being used by Engineering students, may also be used to portray the various effects of flow through a particular department. Overall, the use of BLOCPLAN, StarCell and GPSS should present an interesting visual approach to Facilities Planning of the production of tennis rackets.

The Human Systems part of the display will show the Body Awareness Resource Network (BARN) on several terminals where people will be free to test it out. BARN is a computer system aimed at teenagers to address basic puberty issues. Through role playing, situation analysis, and decision making techniques, the user is encouraged to make responsible and logical decisions on such things as alcohol and other drugs, body management, human sexuality, smoking, and stress management. These issues may be sensitive to discuss, but teenagers are encouraged to try out BARN for tactful and informative answers to not so simple questions. A seven minute film will be set up explaining BARN.

Industrial Engineering represents a diverse and interesting field. From Facilities Planning to Human Systems, Expo coordinators within the IE department have worked hard to assure that this year's Expo exhibit will be as interesting and diverse as the field itself.

by Deniz Ayaz
photos courtesy of BARN, Alpha Pi Mu, and IIE

Source: Information concerning BARN was provided by "BARN: The Body Awareness Resource Network, Final Report". BARN is a computer system designed with input from David Gustafson, Professor of Industrial Engineering, Kris Bosworth, Center of Health Systems and Analysis, Betty Chewning, School of Pharmacy, Robert Hawkins, School of Journalism and Mass Communications, and Trisha Day, UW-Extension.

GE Medical Systems

As the leader in the development and introduction of high technology diagnostic imaging systems, GE Medical Systems' products are enhancing the quality of health care around the world. Headed by Nan L. Sheppard, Milwaukee-based GE Medical Systems will be bringing to Expo1989 a few of their representative products.

Magnetic Resonance: MR MAX

The MR MAX is the newest product line for GE and represents the state-of-the-art in diagnostic imaging technology. Using a strong magnetic field (1.5 Tesla) and radio frequency signals, GE's magnetic resonance scanner creates images of the body, head, spine, and extremities. The exhibit will perform demonstrations on image quality and applications, displaying sophisticated features such as high resolution RF coils, a high performance self-shielded GE magnet, an ergonomic design, and cost-effectiveness.

Mobile X-Ray System: AMX-4

This ruggedly reliable mobile radiography system features microprocessor control of all major system functions including the generator, drive mode, service diagnostics, and battery recharge. The AMX-4 mobile x-ray unit provides more versatility and comparable radiographic results to stationary systems.

ADVANTX ™

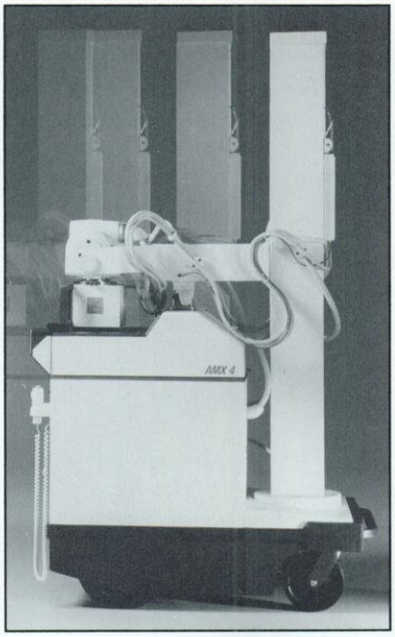
The new computer-based network architecture, Plexus™ , is the centerpiece of ADVANTX, the first software-controlled system for angiography, fluoroscopy, and radiography. In addition to giving improved image quality, efficiency, and reliability, the ADVANTX systems allows for access to important new applications and equipment only with software-controlled digital network technology.

by Winnie Teng
photo courtesy of GE Medical Systems

The Concrete Canoe

The American Society of Civil Engineers (ASCE) student section's project entry for this year's Engineering Expo is serving a two-fold purpose. Not only will their project, a concrete canoe, be displayed at Expo, but it will also compete in the annual concrete canoe race this April in Peoria, Illinois.
The unusual idea originated in 1971 at the University of Illinois at Urbana-Champaign when Professor Clyde Kesler suggested to students in his Civil Engineering- Properties & Behavior of Concrete class that they might try to build a concrete canoe. The students latched on to his idea and constructed a 360 lb. canoe that actually floated in water. When word of this project spread to Purdue University in Indiana, students there decided to build their own canoe and challenged the University of Illinois to a concrete canoe race, the first one ever.

From these beginnings, the concrete canoe competition spread across the United States, becoming an annual event sponsored by the ASCE. As the popularity grew, a similar idea also spread to countries throughout the world.



The mobile AMX -4 unit delivers radiographic results comparable to stationary units.

The concrete canoe races became popular here at UW-Madison as well, and for several years students participated regularly, won awards, and hosted races of their own. Unfortunately, in recent years interest has dwindled and no ingenius concrete canoe designs have come out of UW-Madison.

However, Kurt Apfelbeck, president of the ASCE student section in Madison, said that his group is currently trying to rekindle some of that old enthusiasm by creating their own concrete canoe for the spring regionals competition.

ASCE has already constructed a fiberglass form from a woodstrip racing canoe. Their next steps involve lining the structure with hardware cloth, reinforcing it with aluminum conduit and metal rebars, and coating the structure with portland hydraulic cement.

The group's plan is to have their vessel weigh from 150-180 lbs., and be approximately 17 ft. long by 3 ft. wide. The sides will be about 1/4 in. thick, and the bottom slightly thicker for added strength to support the weight of two passengers.

To comply with the rules of the competition, their concrete canoe must be able to float while full of water and only contain floatation material within the first two feet of both the bow and stern. It must contain no seats or steering devices of any kind, except for the paddles, and it must have been built within nine months prior to the race.

Judging for the competition is in four areas, with race results accounting for 20% of the score, performance for 30%, design/construction presentation for 40%, and sportsmanship accounting for 10%. Trophies and monetary awards go to the winners who are then eligible to participate in the National Competition in Oregon in June.

Although the group has little hope of funding a trip to Oregon, it is looking forward to the regionals race in April and will be ready for a trial run with their completed canoe at Expo.

by Nancy Hromadka

At IBM, outstanding people don't stand still.

So you always thought IBMers were a bunch of blue striped suits with buttoned down minds. Nothing could be further from the truth.

They're movers and shakers. Energetic, ambitious and smart. People who know where they're going and get there fast. People with ideas who choose IBM because they know their ideas will be heard and put into action.

That's right. The winds of change are sweeping the vast corporate infrastructure of IBM. Today's IBM is a leaner, more streamlined operation that reacts more quickly. . . takes more risks . . . is closer to the customer. . . and encourages IBMers to speak up, challenge old ways of thinking and initiate new ideas.

This is not a company that rests on its past successes. We're sharing our blueprint for the future with both our staff and competitors. We're expanding with the marketplace. . .and even developing products that easily hook up with systems outside the IBM environment.

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Alisa B. Eaker
Manager, Software Design/Development
Research Triangle Park, North Carolina

After all, we're the worldwide leader in communications. And with us communication begins right here. Where individuality is prized. Diversity applauded. And management is open-minded, progressive and responsive.

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Ana Cruz Gonzalez
Marketing Representative
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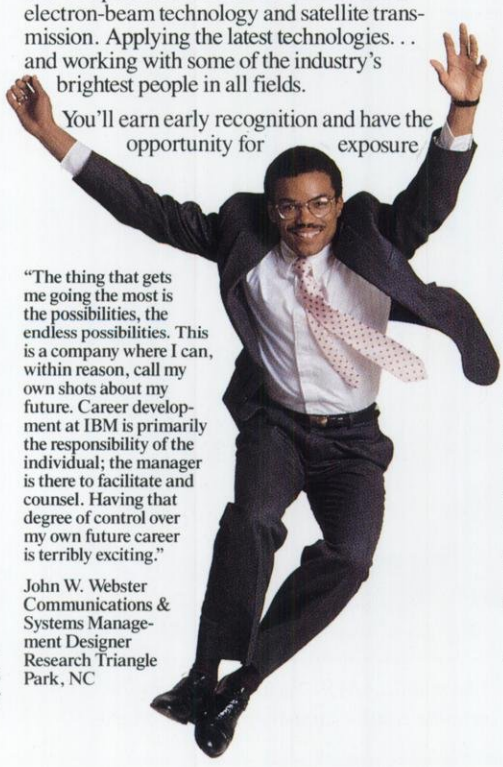
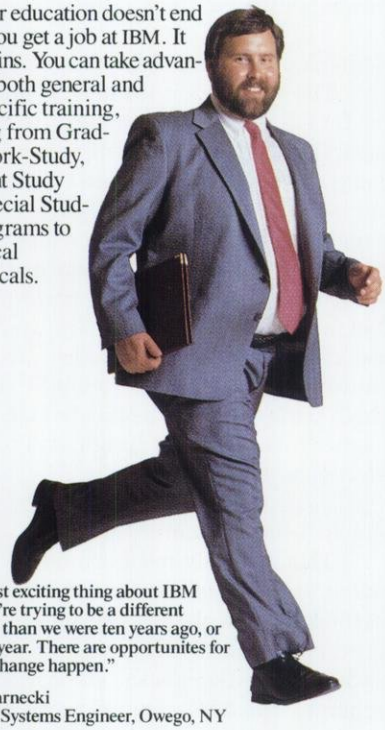
You'll earn early recognition and have the opportunity for exposure to multiple projects. IBMers have the option to move from one area to another . . .to relocate to a variety of sites. . . and to follow a career track along purely technical lines or into management. All the while moving up just as fast and as far as your talent will take you because we're a company that promotes from within.



"The thing that gets me going the most is the possibilities, the endless possibilities. This is a company where I can, within reason, call my own shots about my future. Career development at IBM is primarily the responsibility of the individual; the manager is there to facilitate and counsel. Having that degree of control over my own future career is terribly exciting."

John W. Webster
Communications & Systems Management Designer
Research Triangle Park, NC

Your education doesn't end when you get a job at IBM. It just begins. You can take advantage of both general and job-specific training, ranging from Graduate Work-Study, Resident Study and Special Studies Programs to Technical Sabbaticals.



"The most exciting thing about IBM is that we're trying to be a different company than we were ten years ago, or even last year. There are opportunites for making change happen."

Steve Czarnecki
Advisory Systems Engineer, Owego, NY

And there's more. IBM encourages its family of professionals to exceed their own expectations. At all levels, IBMers may receive recognition and financial awards for outstanding contributions, innovation and technical achievement.

Never has there been a more exciting time to join IBM in development, programming, research, manufacturing or marketing. If you want to experience that sense of accomplishment and self-fulfillment that sparks new ideas and keeps you growing, step into IBM. You and your career will never stand still.

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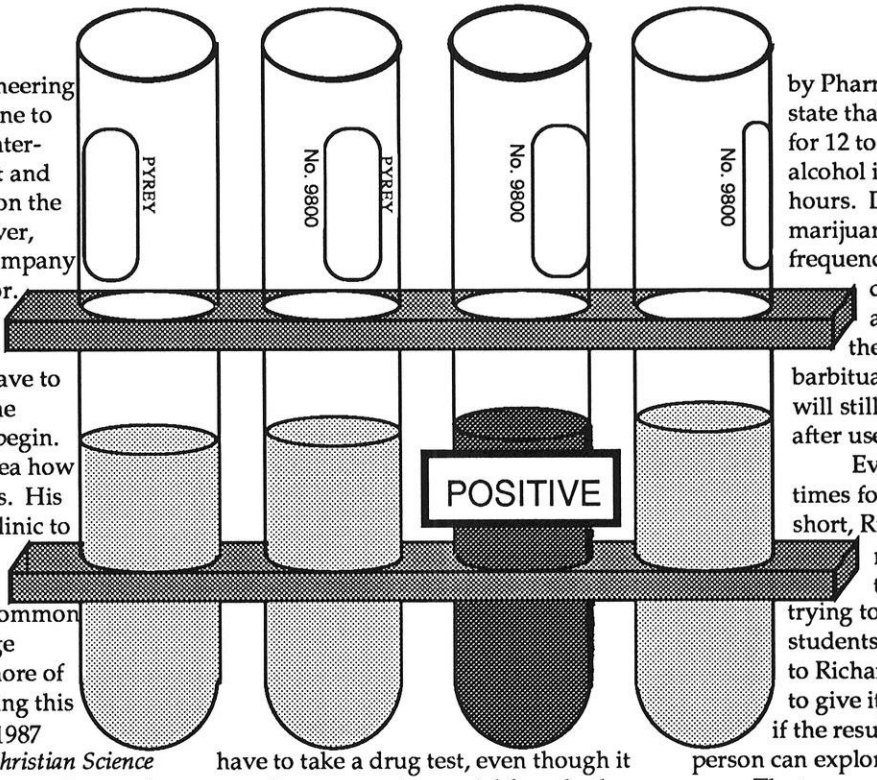
JOB HUNTING AND DRUG TESTING?



A graduating engineering student was on an airplane to Georgia for his second interview. Dressed in his suit and tie he was ready to take on the corporate world. However, before he saw his first company executive he saw a doctor. They told him during the first interview on campus that he would have to take a drug test before the second interview could begin. At the time he had no idea how literal that statement was. His very first stop was to a clinic to be tested for drug use.

This scenario is becoming increasingly common for the graduating college student and more and more of these students are flunking this critical final exam. In a 1987 study, reported by the *Christian Science Monitor* as the most wide-ranging on the subject ever done, University of Maryland researchers found 49 percent of the top United States firms test at least some job applicants for drugs. The study also found two thirds of these firms reject an applicant whose test is certified as positive.

According to Assistant Director of the Career Planning and Placement Office Helen Richardson, the main reason employers give drug tests is for safety. The Employee Assistance Society of North America estimates annual productivity losses at $30.8 billion from alcohol and $8.3 billion from other drug use. So the chances are good, that at some point in the hunt for a job the graduate will have to take a drug test, even though it remains very controversial from both a medical and a legal standpoint.

As the use of drug testing by the government and private corporations has increased dramatically in the past six years, so has the number of tests and the number of laboratories that do the testing. While it is possible to test blood, urine, saliva, breath, hair and brain waves for drugs, the most widely used method is urinalysis. This, according to Dr. Jim Thornbery, a pathologist at Meriter Hospital Labs, is because drugs are easier to detect in urine for a longer period of time.

The amount of time a drug is detectable in the urine is dependent on a number of variables. However, estimates by PharmChem Laboratories state that cocaine is detectable for 12 to 72 hours after use, and alcohol is detectable for 12 to 24 hours. Detection time for marijuana varies depending on frequency of use from 2 to 7 days for the casual user and up to 30 days for the chronic user. Most barbituates and amphetamines will still be found 2 to 4 days after use.

Even though detection times for most drugs are very short, Richardson said it has not been her experience that employees are trying to spring the tests on students. However, according to Richardson, "Employers want to give it as early as possible so if the results are unfavorable the person can explore other options."

The two main types of tests are EMIT and GC/MS. The EMIT is inexpensive and used primarily as a screening test. It can only show the absence or presence of a drug in the urine and a separate test must be done for each drug. For example, an EMIT test that finds marijuana will not detect the presence of cocaine. These tests usually have a minimum level of sensitivity. Samples that contain an amount of the drug below this level are reported as negative. Syva Corporation, which markets the EMIT test, claims that it is at least 96 percent accurate.

GC/MS tests are used to confirm the results of the less expensive EMIT tests. GC/MS tests are very sensitive and

can identify more than one drug. They are reported to be about 99 percent accurate; however, they require highly trained personnel and expensive equipment.

The National Foundation for the Study of Equal Employment Policy found that GC/MS tests are rapidly becoming the confirmation method of choice. Dr. Thornbery said, "When you run both a screening test and a confirmatory test, and have a good chain of custody of the specimen all the way through the process, the results are very good." The problem is that not all companies do confirmatory testing and not all laboratories are of the same quality.

A State of Wisconsin Information Bulletin concurs with Dr. Thornbery's analysis. It stated that "laboratory quality (or lack of quality) contributes more to accuracy problems than the limitations of the tests themselves." A study conducted by the Centers of Disease Control titled, "Crisis in Drug Testing," shows the validity of this statement.

Even when labs knew that samples had been submitted by the CDC, a government regulatory agency, to test their proficiency, they still were not able to be 100 percent accurate. In fact, one lab identified eight percent of the clean samples as containing drugs. When the labs didn't know the specimens had come from the CDC the results were worse. One laboratory identified 66 percent of negative amphetamine samples as containing the drug. While the rate of correct response was 90 percent or higher for most drugs, many labs failed to reach 80 percent on at least one drug class. These are sobering numbers considering some companies don't do confirmatory tests before terminating applicants.

The tests may also suffer from what is called "cross reactivity." Certain over-the-counter drugs can create positive test results. According to an article in *Psychology Today*, anti-inflammatory agents containing ibuprofen, such as Advil and Nuprin, mimic marijuana. Also Contac, Sudafed and certain diet pills can register as amphetamines on the tests. It is even suggested that poppy seeds, which contain small traces of morphine, and some herbal teas contain traces of cocaine can cause positive test results. However, the NFSEEP points out that this is only a problem with the EMIT tests.

According to Dr. Thornbery, Meriter will not do any job-related testing unless they do both the screening and confirmatory tests and they will not release any results to the company until both tests are positive.

Attempts to get around the test are often futile. "Drinking vinegar won't make any difference," Dr. Thornbery warns. In fact he says, "Some ways of trying to get around the test can actually make it easier to detect drug use." Buying powdered urine was once thought of as a way to beat the tests, but now a number of labs place blue dye in the water to discourage this act. A good lab with experienced personnel will also check the color and temperature of the specimen to make sure that it is the subject's. Dr. Thornbery said they check very carefully for adulteration of the

TYPES OF DRUG SCREENING

Test	What's Involved
Urinalysis (EMIT)	Enzyme Multiplied Immunoassay Test is the most commonly used urinalysis. Detects the presence of chemical metabolites by mixing urine with a special solution. If positive, a distinct reaction occurs.
Urinalysis	Usually used as an alternative method to confirm a positive EMIT result. Urine is placed on a chemically treated paper that shows the presence of individual drugs in a distinct pattern and color.
Blood	Chemical breakdown of a blood specimen to detect drugs. Costly and relatively complicated and thus not widely used.
Saliva	The active ingredient in marijuana, THC, can be detected in saliva two to eight hours after consumption.
Breath	Person exhales into machine known as breathalyzer, which measures percent of alcohol in blood.
Hair	Drug use over a period of weeks or months can be profiled by tests conducted on hair. Test uses radiation to determine specific drugs and when they were consumed.
Brain Waves	By monitoring the brain's electrical charges, a test known as the Veritas 100 is purported to be able to show current impairment due to a number of drugs.

Source: The Bureau of National Affairs, "Alcohol & Drugs in the Workplace," 1986.

specimen and reject any suspicious samples for retesting.

Graduates will find very little protection from drug testing in the law. The Fourth Amendment of the U.S. Constitution protects citizens from "unreasonable searches and seizures" by the government. The key word in this statement is "unreasonable." According to Wisconsin Assistant Attorney General Bruce Olson, "Almost every court that has discussed the matter, has decided that the collecting of urine is a search and seizure within the Fourth Amendment." However, a number of courts and former president Ronald Reagan issued an "Executive Order for a Drug Free Federal Workplace," calling for the testing of federal employees in sensitive positions. Last November, the U.S. Department of Transportation issued an order for the testing of 4 million transportation workers, ranging from truck drivers to commercial airline pilots. This is the first time the government has moved its drug testing programs into private industry.

Reasonableness is usually determined by "balancing the government's interest against the rights of the person who is searched," Olson said. He added that is very subjective and depends on the individual circumstances and the weight given to each by the court.

In an opinion issued in September 1987, Wisconsin Attorney General Donald Hanaway determined that "a pre-employment drug testing program most likely would be upheld by the courts in situations where public safety and security create a strong governmental interest and where the circumstances of collection are least intrusive."

Currently, challenges to these programs are being fought in courts all across the country. The U.S. Supreme Court will hear two cases this term that should help to determine the constitutionality of drug testing where the government is involved.

The resolution of these cases, however, will have no effect on the rights of private companies to test for drugs, because the Fourth Amendment only protects against government searches and seizures. Therefore, "absent any state legislative restriction a private employer can make drug testing a condition of employment, just like he can decide to hire only people who like auto racing," lawyer Jim Doyle said.

For example, CUNA Mutual Insurance Company will not hire any one who smokes and will terminate the employment of anyone who is found smoking. So until the state passes a drug testing law, companies will be free to do what they want as long as they don't discriminate against race, sex, religion, or handicap.

In 1987 Representative Peggy Rosenzweig introduced a bill that would not have forbidden drug testing, but would have regulated it to better protect employees' rights. The bill stated that employers could only use state licensed laboratories and the results of an initial positive test would have to be confirmed. It also would have allowed the person tested to have the sample retested at his or her own expense. And finally, the person would have to be given an opportunity to explain the results. The bill, however, was vetoed by Governor Thompson.

While the Governor stated that the bill contained several important provisions, such as those insuring test accuracy and consistency, he felt the bill had some serious flaws.

According to Rep. Rosenzweig's aide Kathy Herbek, the Governor's legal council is looking into the matter and trying to come up with a solution that will be acceptable to the Governor. She also said they will wait for the legal council's findings and then reintroduce a similar bill.

Until the state passes some kind of statute, employees will remain at the mercy of the particular company's drug testing program. In the meantime Richardson said that the Placement Office has pamphlets about drug testing that are available to recruits and offers some advice for the prospective employee. First, ask the company if there will be a drug test and why. Second, report thoroughly any prescription drugs or medication taken before the test. Be sure to find out what type of laboratory is doing the testing and know the company's policy on retesting. And finally, be sure to ask for reasons for employment rejection so you don't become the victim of an inaccurate test.

Richardson extends one final bit of advice, "We need students to be vocal, so we can get their concerns back to the companies. This is one place where students' opinions can make a difference, if only in how the tests are conducted." ■■

by Anthony Ueber,
Guest Writer, Journalism

HOW LONG DRUGS STAY IN THE URINE

Drug	Approximate Retention Time*
Alcohol	4-12 hours
Amphetamines	2 days
Barbituates	1 day (short-acting) 2-3 weeks (long-acting)
Cocaine	2-4 days
Darvon	6-48 hours
Marijuana	5 days (moderate smoker: 4 times/week) 10 days (heavy smoker: daily) 20+ days (chronic smoker)
Methadone	3 days
Methaqualone	2 weeks
Opiates	2-4 days
Valium	1-5 days

*Approximations are due to variables such as drug metabolism and half-life, person's physical condition, fluid intake, and method and frequency of use.

Source: TASC of Maricopa County, Inc.

ENGINEERING BRIEFS

College of Engineering Plans Major Building Addition

A combination of state and college funds will allow the UW-Madison College of Engineering to construct a major addition to the Engineering Building located at 1415 Johnson Drive. According to Connie Brachman, an assistant to the dean of the college, the four-story, 65,000 sq. ft. addition will feature a series of high-tech "technology-transfer" auditoriums, the largest of which will seat 300. The Madison architecture firm of Bowen, Williamson and Zimmer is collaborating with Berners and Schober of Green Bay on plans for the addition, which is to be completed by the spring of 1992. In addition to the auditoriums, it will house engineering administration offices as well as the Electrical and Chemical Engineering departments.

College of Engineering to Sponsor Summer Forum

For the second time in four years, the College of Engineering will be sponsoring the annual University Summer Forum. This summer the forum topic is "Energy in the 21st Century." In 1986, the College sponsored a forum on the Strategic Defense Initiative.

The 1989 Summer Forum is being coordinated by a College of Engineering committee led by Professors Max Carbon (Chairman of Nuclear Engineering) and George Maxwell (Associate Dean, Pre-

Additional Engineering Opportunities

The twenty-first century is rapidly approaching; however, the Additional Engineering Opportunities society is here today. A.E.O. is a professional society for engineers interested in technical sales, marketing, and continued education in business or law. The society was founded at the University of Wisconsin-Madison this semester, Spring 1989 by Steve Young. In addition, a national charter is currently being written by Kimberly Fish. It is hoped that A.E.O. will be a prominent national organization by January 1990.

The founding chapter has regularly scheduled meetings and technical and interpersonal seminars. Guest speakers from various disciplines will also be featured. A programming and networking program has been created to inform students of job opportunities, plan field trips, and to promote interaction with other student organizations and companies. In addition, a membership drive is underway. We anticipate having the largest student organization on the engineering campus before Fall 1989. T-shirts will be sold in March and April.

A.E.O. is actively seeking student, company, and community support. If you are eager to participate or have any questions, please contact Steve Young at (608)233-2456 or Kimberly Fish at (608)251-5215. Remember — A.E.O. is in search of people interested in additional opportunites; A.E.O. is "in search of excellence."

Application Deadline for Pre-Engineers

All students who have an EGR classification and think they may meet requirements for admission to a degree-granting department (such as Mechanical or Industrial Engineering) need to apply for transfer as soon as possible.

To be accepted by a degree-granting department at the end of Spring semester, an EGR student must have 17 credits in calculus, chemistry, physics, statics, computer science or statistics; must have a GPA of at least 2.5 in these math and science courses; and must have at least a 2.0 GPA in all other courses.

Students who believe that they will meet these criteria after the end of the current semester should apply now by stopping by Room 22 General Engineering and picking up a form.

Engineering). The forum sessions will be held Tuesday nights during summer session at 7:30 pm in the Historical Society Auditorium. Scheduled speakers include Dr. Chauncey Starr, President Emeritus of the Electric Power Research Institute, and Dr. Donna R. Fitzpatrick, Acting Secretary of the US Department of Energy.

Students who wish to enroll in a one-credit summer-session class associated with the forum may register for General Engineering 690 (Special Topics in General Engineering). The course has no prerequisites.

wisconsin engineer

EXPO 89 Dare to Discover
April 7-9, 1989

Professor Y. Austin Chang Wins Prestigious Metallurgy Award

Y. Austin Chang, the Wisconsin Distinguished Professor of Metallurgical Engineering and Chairman of the Material Science and Engineering Department, recently received one of the highest honors available to metallurgy researchers. The Metallurgy Society (TMS) conferred upon him the Hume-Rothery Award for his career-long research in metals, especially their thermodynamics and oxidation. According to Professor Reid Cooper of the MSAE Department, only about 20 metallurgists world-wide are recipients of the award; among them are several Nobel laureates.

Professor Chang received the award at the 1989 TMS Annual Meeting and Exhibition held February 25 through March 1 in Las Vegas, Nevada.

Say What?

Do you have something newsy for the Wisconsin Engineer magazine— something brief for our Briefs? We would like to hear from engineering departments, offices and student groups. If you want something publicized, drop a note in our mailbox in the ME lobby or call us at 262-3494.

Society of Women Engineers to Host High Schoolers Interested in Engineering

The University of Wisconsin-Madison chapter of the Society of Women Engineers (SWE) is planning an EXPO-weekend event designed to increase the number of females in Engineering at UW-Madison. SWE President Christine A. Schey and Treasurer Ming Ligh are working with the Pre-Engineering Office to invite every female student admitted to the College of Engineering for Fall 1989 to visit EXPO April 7. SWE members will host these graduating high school seniors at a Union South lunch, and will accompany the prospective engineers through the EXPO exhibits.

Any female who is graduating from high school and is interested in engineering can make arrangements to attend the SWE-EXPO event by calling the SWE office at 262-3387.

EXPO Needs Student Volunteers!

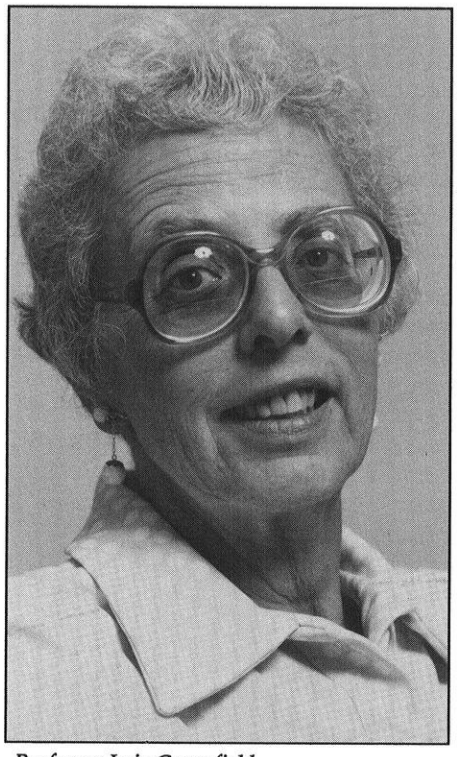
Students who would be willing to help out during the EXPO weekend are being recruited by the EXPO Executive Committee. Volunteers are needed to help set up and take down exhibits; work at concession stands; sell and take tickets; and monitor routes. These jobs are fun, but are vital to the success of the engineering open house. Don't be shy—volunteer to be a part of EXPO by calling 262-5137 or by stopping at the EXPO office (Room 113 T-21, on the corner of Breese Terrace and University Avenue). Ask for Jeff Bondi.

A Tribute to Professor Greenfield

The other day as I walked down the General Engineering corridor, I noticed a commotion in room 24, the office of Professor Lois Greenfield. As I neared, I saw boxes and garbage cans scattered about the room. A crumpled ball of paper nearly hit me on its trajectory to the garbage can. Lois commented that she was trying to fill three garbage cans a day before her retirement.

If you are wondering about the significance of this tale, try to imagine sorting through more than thirty years of hard work. In 1956 there were 18 women enrolled in the College of Engineering. It was this year Lois Greenfield began her career at the University of Wisconsin-Madison. She was a pioneer woman on the engineering campus and a mentor for all students.

Lois brought with her a great deal of experience and education. Originally from Chicago, Lois received both a Bachelor of Science and a Master of Science in Psychology from the University of Chicago. She also received a PhD in Educational Psychology from the University of California. During her college years, Lois was enrolled in engineering at the University of Minnesota. At one time, she was employed as a junior engineer. This combination of engineering and educational psychology has made Lois a great asset to the College of Engineering.



Professor Lois Greenfield

Lois started her career at Madison in the Research and Guidance Laboratory for Superior Students. This was a program funded by both the engineering and education departments. In1958 Lois became an Assistant Professor in the Engineering Experiment Station. Lois then moved to General Engineering after receiving tenure there in 1973. General Engineering is where one can locate Lois today.

In General Engineering, one can find Lois teaching or advising. Over the years, her advising has not been limited to freshmen engineering students, but also to high school educators in efforts to promote engineering. Lois has taught a variety of classes including drafting, technical writing, and freshmen orientation. Her contributions of thirty plus years span a variety of areas in education and counseling.

Beyond her General Engineering duties, Lois has served on many committees concerning several areas of interest. She has held several offices in the American Society for Engineering Education, and has been an active member in other professional societies . Lois has a long list of Committee memberships in the College of Engineering and in the Madison Campus. Being one of the few women on the engineering campus, Lois fell into roles dealing with women's issues. She was the faculty advisor for both the Women in Engineering Student Committee and the Society of Women Engineers Student Chapter. All of these activities have enhanced Lois' contributions to the College of Engineering.

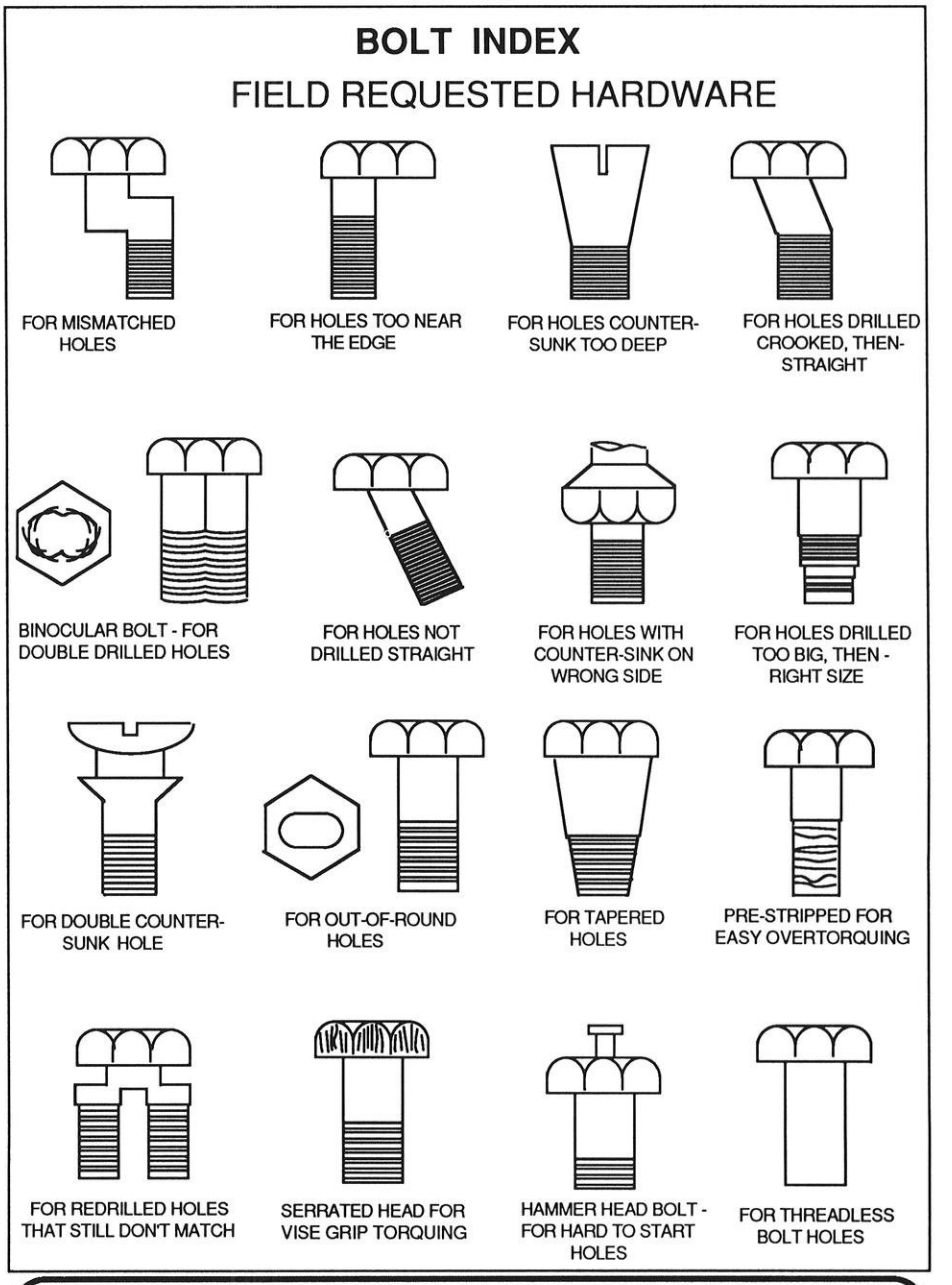
In a college where the enrollment of women has increased from less than one percent in the 1960's to 13.3 percent in 1989, programs to support women are vital. Being one of the female faculty

members, Lois naturally was involved in the development of these programs. She has developed several programs which are aimed at presenting engineering as a career option for high school girls. The contributions include programs with counselors, high school science and math teachers, and female students. *Expanding Your Horizons* is a conference for young women interested in non-traditional careers. At the suggestion of mothers and counselors who brought young women to this conference, *Retooling Strategies for the Future: Scientific, Technical and Math Related Careers* was developed. This is a conference for adult women who wish to make a career change or enter or reenter the job market. As an advisor to SWE, Lois has assisted in the society's many projects. All of these programs have helped to increase and retain the female enrollment in the College of Engineering.

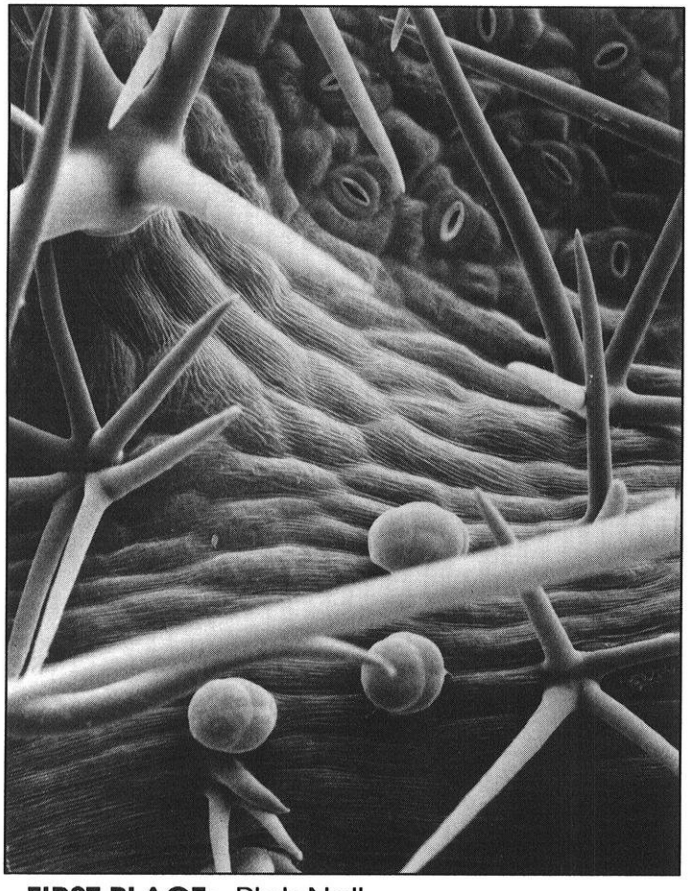
Not only has Lois been involved in helping women students, but also male students. Over the years, Lois has added a personal touch to the College of Engineering. She has enriched students lives by her genuine concern for their education and well being. Through her work at Summer Orientation and Registration, she has simplified the adjustment of incoming freshmen to college. Her teaching and advising has reached many pre-engineering students over the years. Her committee work has helped improve the education at the University of Wisconsin-Madison, as well as the engineering curriculum nation wide. She is also a definite support to all women in engineering. Her continual involvement with students, counselors, and faculty members has had a large impact in General Engineering.

At the end of February, Lois retired as a professor at the College of Engineering. The roles she has filled will be spread out to several faculty members. However, Lois will still be working part-time as a freshmen advisor. This means Lois has a little more time to clean out all of those file cabinets. ■

By Kathryn Anderson
Guest Writer, ECE 350



ZOOM IN ON PHOTO CONTEST RESULTS



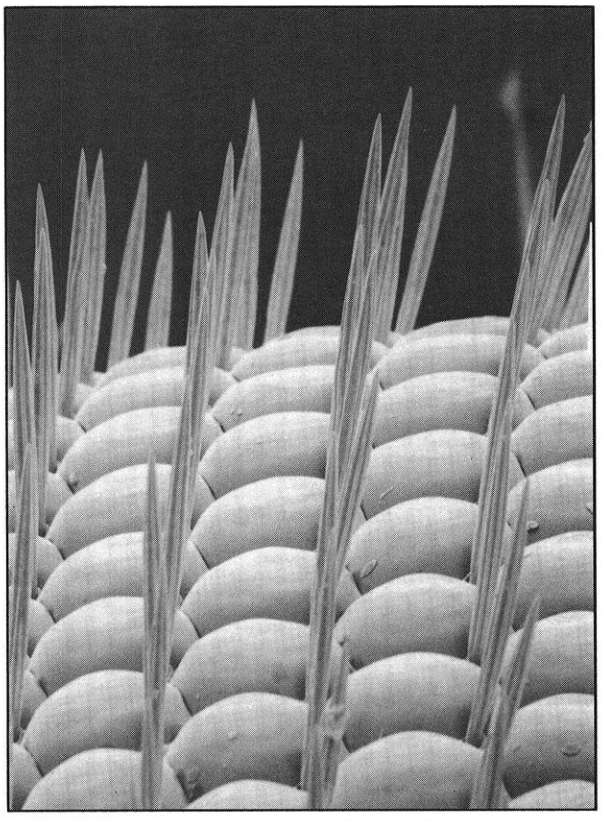
FIRST PLACE: Rick Noll - Hairs on a Coleus leaf

The College of Engineering recently sponsored a photo contest for all engineering students, faculty, and staff.

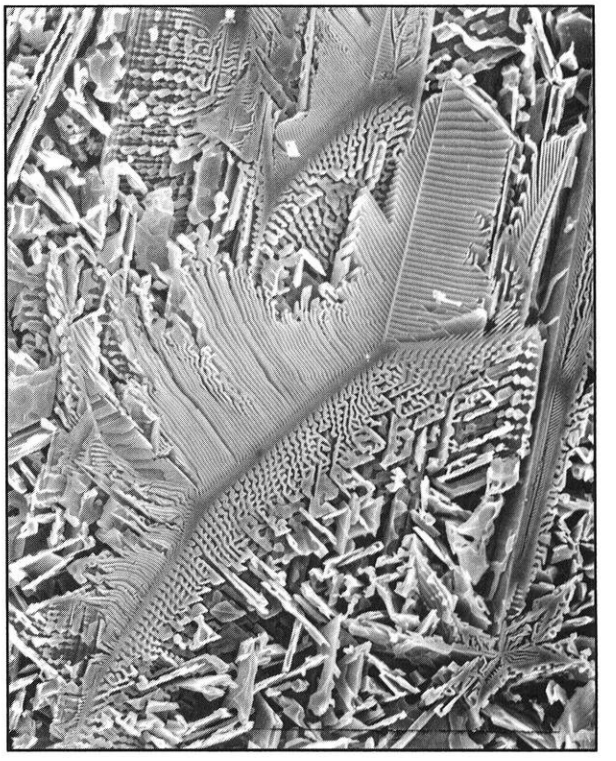
Photographs could represent microscopic views of engineered objects or engineering materials, computer generated images, or novel views of every day objects. Visual and artistic impact played a major role in the selection criterion.

The first place winner received $300 and the second place winner received $200 in black and white and color categories.

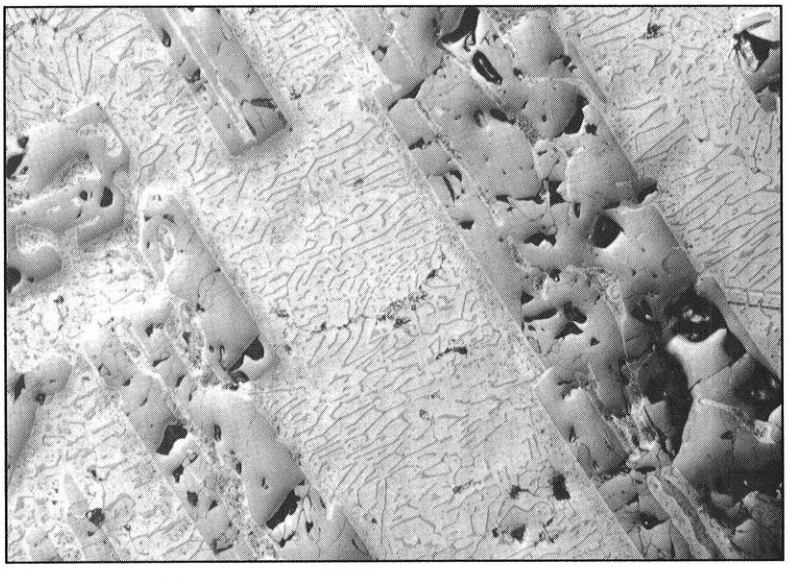
The photos will be on display in the second floor lobby of Mechanical Engineering during EXPO 89.



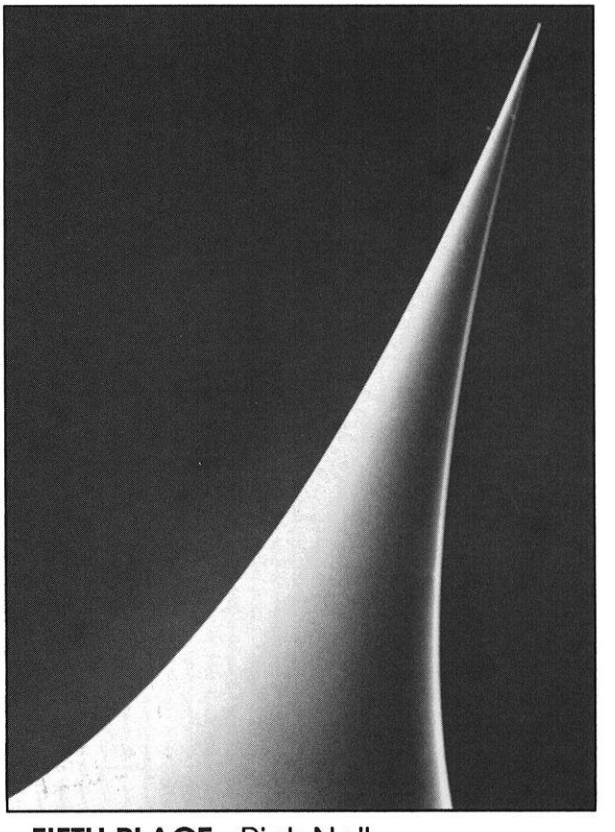
SECOND PLACE: Rick Noll -
Eyeball hairs of insect eye



THIRD PLACE: Rick Noll - Silicon
feather formations in SiAl alloy



FOURTH PLACE: Jim Foley -
Aluminum-23 Weight Percent Yttrium



FIFTH PLACE: Rick Noll -
Tungsten field emmission tip

HAPPY BIRTHDAY, COLLEGE OF ENGINEERING!

The College of Engineering is celebrating its 100th birthday this year, and in honor of this century of excellence in engineering, several special events have been scheduled for throughout the year. The theme for the Centennial is "Reaching for the Future".

The 1989 Engineering EXPO committee is compiling a centennial display highlighting important points in the college's history with old photos, articles, and exhibits reliving the past 100 years in engineering at UW-Madison.

During the spring semester, the college is sponsoring a weekly seminar series focusing on the social implications of technology in an increasingly global society entitled, "Technology and Society." Five such seminars have already taken place and focused on such topics as superconductivity, computers, defense technology, biotechnology, and manufacturing. Upcoming seminars will include guests such as Lyle Schwartz, director of the Institute for Materials Science and Engineering with the National Institute for Standards and Technology; Brewster Shaw, a NASA astronaut and graduate of UW-Madison's College of Engineering; Richard Mullen, Professor of Electrical and Computer Engineering from the University of California-Berkeley; and John Hancock, a consultant from Kansas City, Missouri.

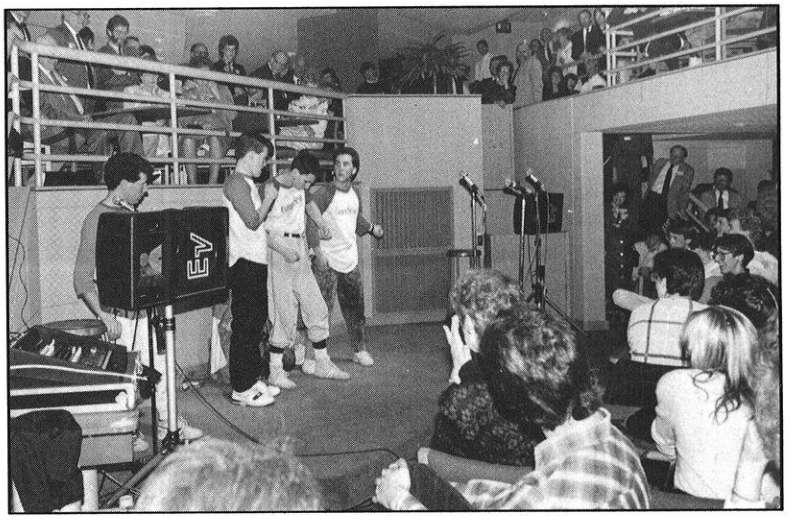
All seminars are held at Union South on Monday nights through the semester from 7:00-8:00 pm and are open to the public. A fall lecture series discussing "Ethics in Engineering, Business, and Government" is also being planned. Students may sign up for a one credit class which requires attendance at the seminars and a brief position paper on six of the presentations.

To celebrate the Centennial in style, a gala birthday party with a buffet dinner, dancing, games, exhibits, and entertainment was held in Union South for faculty, students, staff, and friends at the end of February. Also, a party in honor of Emeritus Professor, Ben Elliott's 100th birthday was held at the Memorial Union.

Other events for the year, including a centennial summer forum, an engineers day celebration, and a high school outreach program, are tentatively scheduled. ■

by Nancy Hromadka

LET THE CELEBRATION BEGIN!



Alumni, students and professors laughing with Comedy Sportz

Today's celebration . . . tomorrow's history. On Saturday, February 25, 1989, the University of Wisconsin - College of Engineering's Centennial Birthday Party was celebrated. Alumni, professors, and students gathered for an evening of festivities.

The celebration began at 5:00 p.m. in Union South with a social hour. Friendly faces greeted one another. Stories of the ole ' steam engines, slide rules, and curriculum were shared between the alumni and students. 6:00 p.m. soon approached and it was time for the buffet dinner. Dean Bollinger began the dinner with opening remarks that reminisced about the past, recited financial figures, and left in everyone's heart a sense of pride in being an engineering student at the University of Wisconsin-Madison. Dean Bollinger said,

> " . . . I feel about birthdays as I feel about commencement. It is the beginning, not the end. Rather than dwell on the past, I would like us to look into the future. Tonight, we are celebrating the next 100 years, and it is in our hands to get it off to a proper start . . ."

University President Shaw spoke a few words, and awards were presented. Mr. Ron Pluim, representing the American Society of Civil Engineers (ASCE), presented the "Madison Branch Most Valuable Member-1989" award to Professor Charles Salmon. Mr. Rick Satherlee representing the Wisconsin Association of Consulting Engineers (WACE) presented three scholarships of $250 to high school seniors. Recipients were Steven Decabooter, Kurt Frehner, and Daniel Haung. In addition, Ms. Judy Whalen, Wisconsin Society of Professional Engineers (WSPE) Executive director, read the proclamation by Governor Tommy G. Thompson declaring February 19 through 25 as "Engineer's Week."

A special thank you was extended to Professor William Dries who was the chief co-organizer, the Polygon Council for their organization and financial support, Mr. Steve Bishop for his help as co-organizer of the evening's festivities, the Society of Women Engineers for decorating, and all alumni, faculty members, and students who attended the celebration.

At 7:00 p.m., guests gathered in the Red Oak Grill to laugh with and at the infamous "Comedy Sportz." At 9:00 p.m., people fought furiously for the first piece of five cakes that were served. The evening ended with dancing to the Riverboat Ramblers in the Dag Hammarskjold room or to DJ entertainment at Diversions. ■

by Kim Fish

College Deans "cutting the cake" – from left to right: Dean William Wuerger - Associate Dean for Operations, George M. Maxwell - Associate Dearn for Pre-Engineering, John G. Bollinger - Dean, College of Engineering, John D. Wiley - Associate Dean for Research, and Donald D. Dietmeyer - Associate Dean for Academic Affairs.

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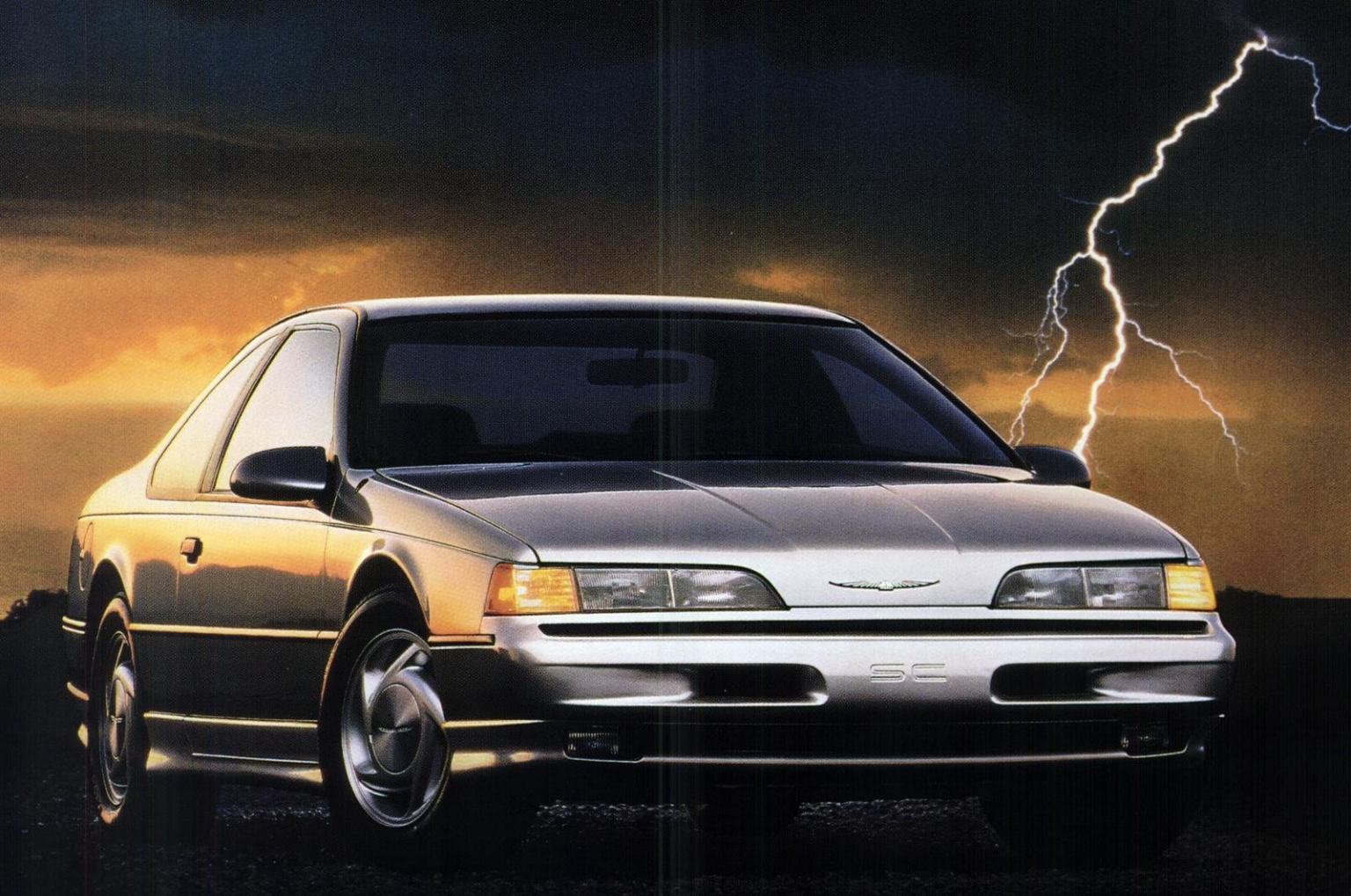

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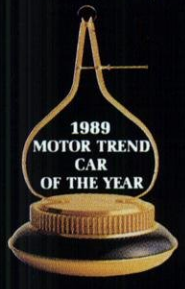

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Georgette Dixon likes to push the odds.

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