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Volume 92, No. 5

July 1988

wisconsin engineer

In This Issue:

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wisconsin engineer

PUBLISHED BY THE STUDENTS OF THE UNIVERSITY OF WISCONSIN-MADISON, JULY 1988

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The staff of the *Wisconsin Engineer* would like to thank Tom Murray and Kelly Krueger of Engineering Publications for their generosity, Dean Wiley for his knowledge, the Career Planning and Placement Office and the Pre-engineering Office for their hardware, and Bob Perras for his software. We appreciate their contributions; without them this issue would not have been conceivable, let alone possible.

The *Wisconsin Engineer* magazine is published by and for engineering students at UW-Madison, and is a charter member of the Engineering College Magazines Association. 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

My New Friend

While most of us enjoy a work-filled summer away from classes, a new class of engineering students awaits the unknown—college. I extend an early welcome to these students. This is an exciting time, but it can also be a frightening time.

I remember too well how I felt one long year ago when I faced my freshman year of college. The excitement overwhelmed me, yet I had an incredible fear of what lay ahead. I worried about registration (but who doesn't?) and dorm life and homework and exams and...the list is endless. My greatest fear, though, was of not being accepted. As a woman engineering student, I wondered how male classmates and professors would react to me. I hoped that we, as a society, had progressed enough that a woman engineer was no longer so out of the ordinary that I would be the subject of discrimination. I would merely have to prove to the men that I belonged. But how easy could that be? After all, college is the big time, or so I thought. Wasn't college the time when old ideas changed, new opinions formed, and life began? I was scared to death.

I do want to thank the guys in my first engineering class for accepting me as an engineer and not looking down on me for being a little different. They reassured me that, if I worked hard enough, everyone would accept me.

With my fear resolved and a desire to be involved with the college of engineering, I accompanied six colleagues from the *Wisconsin Engineer* to the annual Engineering College Magazines Association convention at Virginia Tech. I met many wonderful people from many other schools. I learned an awful lot about this magazine and the ECMA organization also. But an astonishing thing happened and it has nearly destroyed my newfound trust in engineering.

One of the wonderful people from another school possessed a totally different and somewhat obscure view of one aspect of the engineering profession. I call him wonderful, though, because he showed me a new point of view, even if he did disillusion me a little.

My new friend was proud that his school's magazine is the only ECMA magazine to consistently feature a column about women engineering students. He believed that he (his magazine) was doing women a huge favor. I would have agreed, except that I knew what his column was all about, and I didn't like it one bit.

First, the title of the column ends with "-mate." To me, it does not create the image of a chess game, but rather that of a playmate. I don't speak out against playmates or the magazines in which they appear. I do, however, feel that such a connotation is not necessary for an engineering student.

I inquired about the criteria that establish who the -mate will be each issue. He explained that a decent GPA is

the first requirement, and added that there has never been a -mate with a GPA lower than 2.0. Photo judging is the second phase of the selection process. Five magazine staff members (there are no women on staff) look at photos of each entrant. The prettiest one wins. It sounds simple to me but I can imagine that getting five guys to agree on one girl could be painstaking. Activities, engineering qualifications, and work experience make up the third criterion in the event of a tie (with five votes?!). All decision of the judges are final.

With doubt in mind, I asked why they didn't feature a student who deserved to be noticed for her engineering skills. He retorted that a pretty woman gets noticed, and when a recruiter is paging through the magazine, he will see the picture before he sees any title or headline. He will automatically be impressed (because of her beauty) and offer her an interview. He may even hire her because beauty sells a product (I still wonder what product my friend is trying to sell). So, in a way, the column and photograph have done this woman a favor.

Still not convinced, I asked why the staff didn't give the space used by -mate to the SWE chapter on campus.

"Sweet?" My new friend wasn't sure of what I meant.

"SWE! The Society of Women Engineers," I explained.

"The Society of Women Engineers?! So they discriminate against men?" My new friend seemed rather confused. A kind man from Rensselaer explained that the president of that school's chapter is a man, and the group merely promotes women in engineering. My new friend didn't understand the need for the "women" in the title. I said that it is people like him who make the "women" in the title necessary.

What bothered me most about my new friend was that he seemed so set on his opinion that to be successful, a woman engineer must be beautiful. If beauty is in the eye of the beholder, his eyes are very critical. I thought (and still do) that an intelligent woman who dressed smart, spoke clearly, and appeared generally confident would fit the description of an attractive woman. He did not agree. She must be beautiful. Her features must be pleasing *to men*. He believes that attractive won't cut it in a man's profession.

Nothing I said changed his mind, not that I thought his narrow mind was even slightly changeable. Now I realize that people like him exist and I have been fortunate to be accepted by my classmates. I look forward to the future with caution. Will I face a professor, recruiter, or employer who possesses the same backward attitude, that a female engineer must be beautiful? Equally unfortunate is the young woman from Iowa who wondered why I made such a big deal about the issue. Was I an ERA freak? No. I am not an ERA freak. But I refuse to be made into an object for men to look at. I have nothing against men, unless they have something against me and my desire to be accepted as a qualified engineer.

During a time when engineering is a most important profession, when we need to accept qualified and only qualified engineers, a one step forward, two steps backward attitude like that of my new friend will only send our technology and society into turmoil.

In a few years, I will face another exciting time. The professional world, where I will use my engineering abilities in yet undetermined fields, is waiting for me. But I wonder if my male colleagues and employers will accept me for who I am, an engineer. I now understand that some people have a very unprofessional opinion of women engineers, and I am scared to death. ■

Shelly Hoffland

DEAN'S CORNER

I would like to welcome our freshmen to the great University of Wisconsin-Madison and an outstanding College of Engineering. You are embarking on one of the most exciting adventures of your lifetime. You have an opportunity to build a foundation on which you will build a professional career as a practicing engineer. This will be a challenge. You will have to work hard, and you will have to make sacrifices. I suspect that many of you have already done considerable planning for your education, but if you haven't, now is the time to formulate a mission for your self and to set goals, and in the course of the next several months, develop strategies and tactics to see to it that in the allotted time you have given yourself, and within the allotted budget that you have to work with, you will be able to accomplish your goals and achieve your mission.

As a student in engineering I would hope that your mission would encompass acquiring an outstanding, in-depth, and well-rounded education which will prepare you to contribute to our nation's economy and the betterment of mankind through the application of science and mathematics and understanding of human nature to place products and technical services in the hands of consumers.

Goals can differ greatly depending on the individual but there are some common elements which you all can share. For example, it is important to do very well in your studies. It is not for grades' sake that it is desirable to have high grades. Rather, it is the recognition that you have achieved a high level of understanding of the subject. Each morsel of understanding can be looked upon as an element on a structure on which you will build further understanding and, most important, will draw upon that knowledge to synthesize solutions to complex problems.

Everyone should have a goal of becoming an effective communicator. In the real world you will find that it is not only what you know, what you have conceived, or how well your thought processes function, but how well you can communicate what you have to offer to others. Communication involves speaking, writing and your physical gestures. There are opportunities here on campus to cultivate all of these dimensions of your personal communication skills.

Learning to participate is another goal that you might consider. Some of you have been active in community organizations and high school organizations. Here at the Madison campus you will find an incredibly diverse opportunity to participate in professional, social, recreational, political, cultural, and artistic organizations. Being involved is part of being at the University of Wisconsin-Madison.

Being informed is another goal that all of you should consider. I am sure you have been told many times that being a good citizen in a democracy involves being informed. Similarly, being informed is essential to being a good student here at the University. Read the publications, study the rules, listen to the professor, talk to your fellow students, read the bulletin boards, and read the *Wisconsin Engineer*.

Being well known is a goal that I have been surprised to find many students have overlooked. Some day, if and when you graduate from this University, you will want to call upon faculty and staff as professional references. In fact, it is not uncommon to look back over an undergraduate educational experience and return to a campus for advice and counsel from those whom you learned from while in school. Faculty like to know their students and faculty like to feel that their students want to know them. I hope you will work hard at learning how to know those who help you learn.

I have often heard the opinion expressed that a university like ours is big and indifferent. I can assure you that it is not indifferent. All of us on the faculty and staff are eager for you to succeed, and we want you to feel that you are an important part of our program. Our campus is only as big as you wish to view it. As a pre-engineering student you are a part of the total campus. We form a scientific/technical community. Each organization you participate in is a small community of individuals with interests very similar to yours. If you join the American Society of Mechanical Engineering student section, for example, you will be introduced to a sub-section of the College. If you join the Hoofer Sailing Club you will be among sailers. If you are a musician, try out for the University marching band. It is one of the best in the country and an excellent example of a smaller, personal community. The point that I am making is that in taking part in any of the many subsets of this great campus you will experience the smallness and intimacy of those with common goals and aspirations and talents, and you will be part of that great big larger set—the University.

Enjoy yourself while you are here, but don't wait too long to get down to work, and if we can help, don't hesitate to ask. Good luck. ■

John G. Bollinger
Dean, College of Engineering

SEMATECH
CENTER OF EXCELLENCE

Sematech, a national consortium of microelectronics companies, announced on May 31, 1988 that the University of Wisconsin-Madison has been named one of ten Sematech Centers of Excellence.

Research here will focus on X-ray lithography, a technology for making electronic chips that are smaller and have greater computing power and speed than those in use today, according to John D. Wiley, Associate Dean for Engineering Research and one of the developers of the University's Sematech proposal.

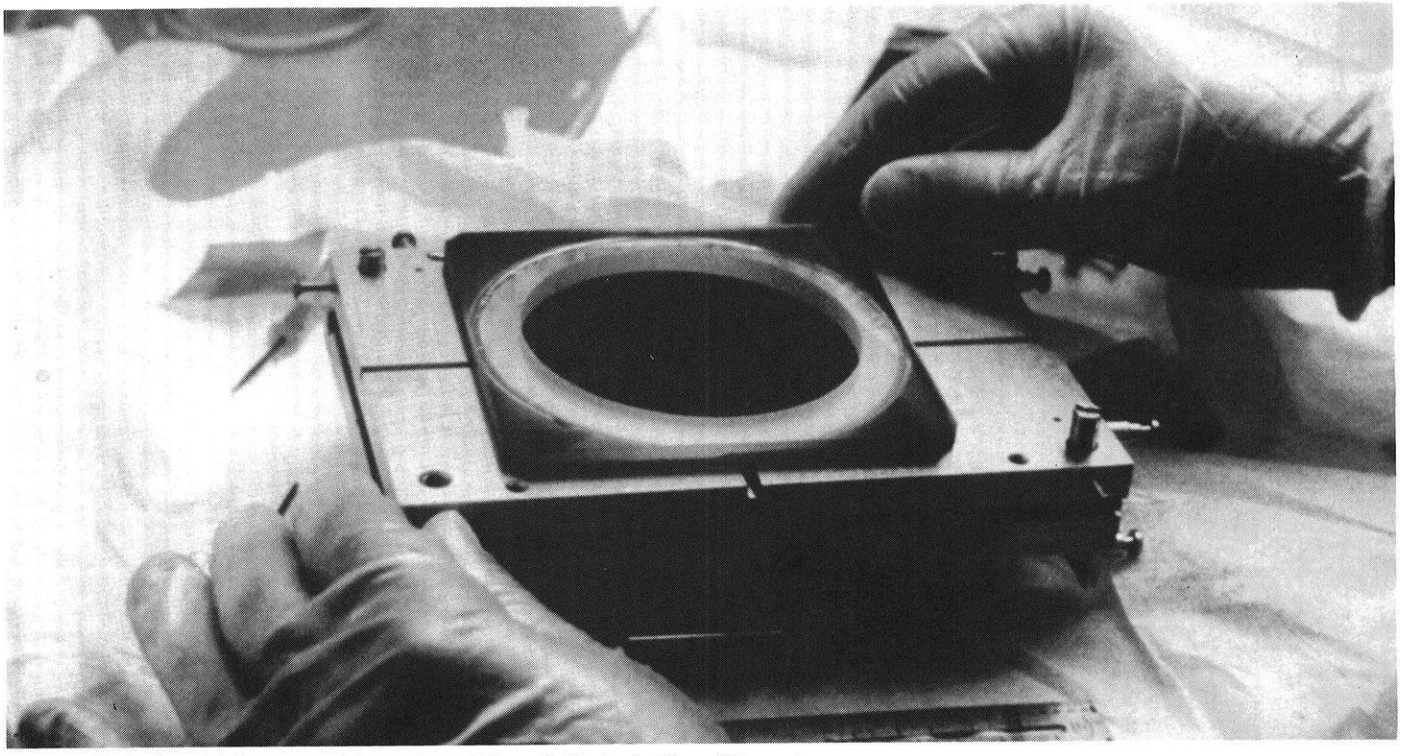
UW-Madison Chancellor Donna E. Shalala said the selection of UW-Madison by Sematech is noteworthy recognition of the skill, vision and potential of a large group of talented people. She praised the cooperative efforts of the University, state and community leaders and the state's Congressional representatives.

"There are many people who worked long hours to ensure the success of this proposal. The selection of UW-Madison by Sematech reflects that and it bodes well for the entire state," she said.

Word of the Sematech decision was passed to University officials by U.S. Representative Robert Kastenmeier who, along with Representative Les Aspin, assisted in contacts with the electronics consortium.

Wisconsin was a finalist last year in the competition for Sematech's national headquarters. Austin, Texas was ultimately chosen by the consortium.

Several U.S. microelectronics companies formed Sematech last year citing the need to pool their efforts in

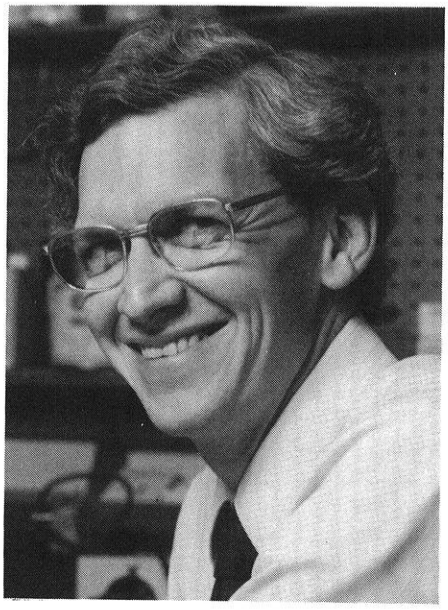


Hewlett-Packard mask being mounted for testing at Wisconsin Center for X-ray lithography

some areas to compete with Japanese and other foreign chipmakers. Members of the consortium have contributed about $100 million to the organization and the present federal budget provides a similar amount through the Department of Defense.

In its announcement on May 31, Sematech named ten Centers of Excellence around the country. Designated funding, ranging from $500,000 to $1.5 million, was announced for five centers. The centers and their areas of research are:

- University of Arizona for contamination/defect control
- University of CA Berkeley for optical lithography
- New Jersey consortium of universities for plasma etching
- University of New Mexico for metrology
- Massachusetts Microelectronics Center for single wafer processing.



John D. Wiley, Professor of Electrical Engineering and Associate Dean for Engineering Research

In addition to the Texas University consortium, which had previously been selected as a Center of Excellence as part of the site selection process, four universities have been named for future Center of Excellence development. The universities are:

- University of South Florida for inprocess testing
- Rensselaer Polytechnic Institute for multilevel metalization
- North Carolina State for advanced processing
- University of Wisconsin-Madison for X-ray lithography

Sematech officials visited the UW-Madison campus again on July 19 to develop a timetable for research but specific funding still has not been determined.

"One reason Sematech is moving more slowly on this center and some others may be that the consortium has not yet settled on what priority to place on promising but advanced technologies like X-ray lithography, a technology that may not pay off for several years," said Wiley. "They also are concerned about

X-ray Lithography

Microelectronics technology is at the heart of modern devices ranging from pocket calculators to television sets and computers to advanced military weapons.

Integrated circuits, also called electronic chips, that measure one quarter inch square may contain thousands or millions of transistors and other electronic components.

X-ray lithography, a technique under study at Wisconsin for nearly a decade, promises to shrink features of these circuits to one-half or less the size of today's chips. This would create more components within a given area and speed up the transfer of information around the chip. Common X-ray sources do not produce the radiation needed for this work.

Wisconsin's research makes use of Aladdin, a storage ring device about 80 feet in diameter. It is located at a UW-Madison facility near Stoughton and is one of two such devices available for this research in the U.S. Several other rings are in use or under construction in Japan and Germany.

John D. Wiley, associate dean in the UW-Madison College of Engineering, said companies from both of those countries have visited the UW-Madison's X-ray lithography facility in the past, and about half a dozen U.S. companies have visited recently.

improvement of existing technologies that will affect near-term profits." Wiley said Sematech is waiting for the federal officials to define a national X-ray lithography program before setting the consortium's own direction.

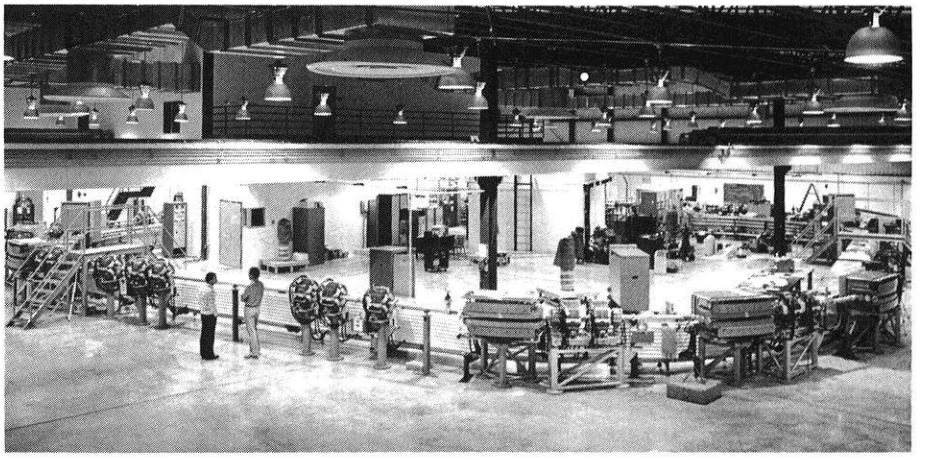
UW System President Kenneth Shaw praised state government involvement in the effort to attract Sematech. "We had great cooperation between Gov. Thompson and state agencies, the University and the Madison community," he said.

When Sematech announced its search for a location a year ago, Wisconsin did not appear to be a serious candidate, according to observers in the electronics industry.

However, a written proposal and other efforts by the Wisconsin Department of Development, UW-Madison and the private sector here won the state one of 13 site visits by Sematech representatives.

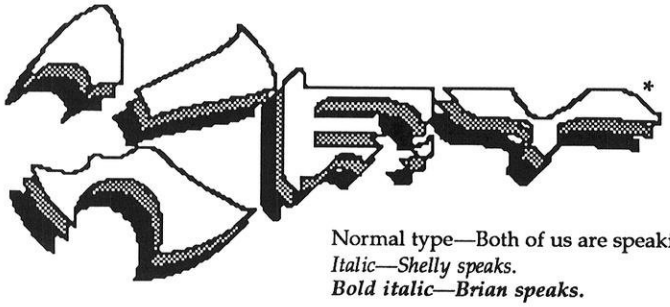
When Sematech announced its selection of Austin in January, Gov. Thompson said he believed the state was one of three finalists. At that time the UW-Madison College of Engineering received a $50,000 Sematech grant to prepare the proposal that led to the naming of the University as a Sematech Center of Excellence. ■■

—Compiled with information from Engineering Publications.



The Aladdin storage ring in 1983, prior to installation of beamlines

A Word to Freshmen



Normal type—Both of us are speaking.
Italic—Shelly speaks.
Bold italic—Brian speaks.

Hello. Welcome to Madison and the UW campus. ***I am Brian Lindahl, co-editor of this magazine. I am also a senior in Mechanical Engineering on the all too common five-year plan.*** *And my name is Shelly Hoffland. I am the other co-editor of the Wisconsin Engineer. Because I am only a sophomore (in ME) I can remember clearly my freshman year.* As older students, more familiar with this campus, we are writing to let you know what lies in your very near future. We realize that you may be fairly uncertain about many aspects of college, and we want to familiarize you with the university and college life.

Registration

You have heard all of the nasty rumors about registration at Madison. Based on our experiences, those rumors are more fact than myth. Though the horrors of registration are often exaggerated, it is difficult if you are unprepared.

The clue here is to BE PREPARED. Look at your timetable (BEFORE you register) and make up tentative schedules. Expect to encounter closed classes and sections. Move around the popular classes, like chemistry and calculus.

Last year, I walked through registration the day before my turn, just to find the assignment committees and to see which classes were filling fast. This way, I could more easily schedule the classes that would probably be open for me.

When I registered as a second semester freshman, I made up a few schedules and picked out two or three of the best (you know, late mornings, a lunch break, and absolutely no late classes). I used these to sign up for the lectures I needed, leaving any labs or discussions open. This way, each of the schedules I brought with me was more versatile. When I did sign up for the lab or discussion for a lecture I looked at the labs or discussions for my other lectures in the timetable and "X"ed off all that conflicted.

Hey Brian, your "best schedules" may not work for everyone. Try to be versatile. It might take a while to see what is best for you.

Do you like to sleep late? Would you rather go to classes and get them over with? When is lunch? Do you have a job? How about that exam schedule? These are all things that need to be considered. But realize too, that you may not get an ideal schedule your freshman year.

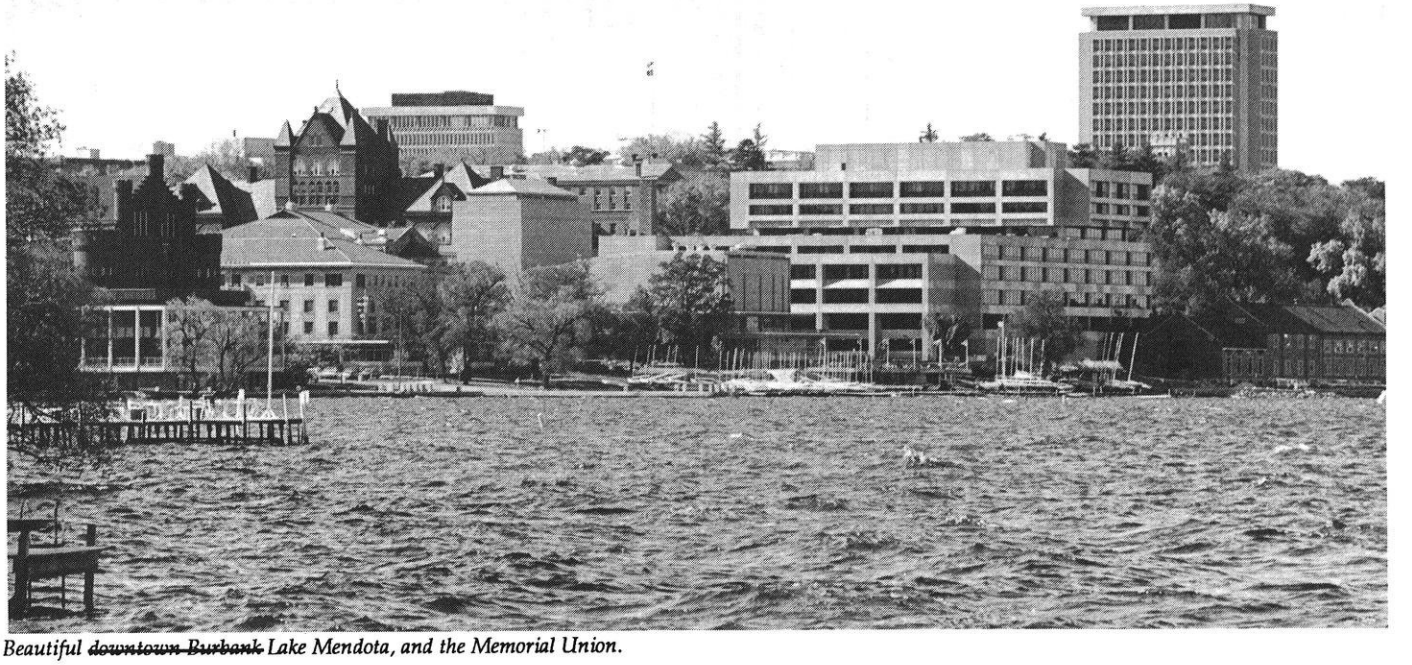
Let someone walk through registration with you. You will not be a wimp. If anything, they can keep you calm and suggest alternative classes (as well as prevent you from getting lost). If you don't know of anyone off hand, ask around. Maybe a friend knows someone. Heck, call us (262-3494), we might know of someone who is free.

Don't let this system frighten you. Be prepared and remain calm. Sooner or later, you will get the classes you need.

Common Classes

The average freshman in engineering takes chemistry and trig or calculus his or her first year. You can talk to upperclassmen about the professors and teaching assistants. The names will be familiar to upperclassmen who may

* *Things aren't usually made so obvious around here, so don't get used to such clear explanations.*



Beautiful ~~downtown Burbank~~ Lake Mendota, and the Memorial Union.

remember which were liked or disliked.

When asking about professors for these kinds of classes, it is not necessary to limit yourself to engineering students. Everyone has to take a science class and some sort of math class before they get a degree. So anyone can give an opinion about a professor.

Remember though, opinions are often biased and if you are stuck with a prof who someone else did not like, you may not have the same bad experience.

The required courses for pre-engineering students offer a great way to meet many of the students you will see for the next few years. At a school this huge it is common to think you will never see the same people over and over again. Meet people, and you'll be surprised.

It's hard to get to know anyone in particular in a lecture of two to three hundred people. But its not so hard to get to know eight or ten of the people from the lecture that have the same discussion you have. These are the ones that you get to know first, then as you start to hang out with them, they introduce you to their friends, and so on, and so on....

I met an incredible number of pre-engineers in my chem 103 class first semester. I was shocked to find most of them in my calc 222 lecture second semester. You start to recognize people more often, and suddenly you have tons of new friends, even if you only see them in that class.

Get Involved!!

Avoid the stress of homework and studies by involving yourself in one ***(or more)*** of the many recreational activities on campus. Your Wheat & Chaff has information about clubs and organizations all over campus. For more information, contact the Campus Assistance Center (263-2400). They can give you telephone numbers for just about any organization. The Wisconsin Unions offer quite a few activities, as well as mini-courses. Don't say that you will never have time for fun—you will miss out on so much!

For information on engineering student organizations look at *Getting Around* (you should have received one at SOAR, otherwise, get one at the pre-engineering office). We have many fraternal and social groups, as well as professional departmental groups.

Many of these groups are open to pre-engineers. Just watch bulletin boards in the ME lobby. This is a great way to find students with similar interests and still learn about engineering.

One of the best ways to find out what's really happening on the engineering campus is to read about it. The single best way to find out about things on the engineering campus is to write about it as a member of the Wisconsin Engineer news staff *(we even have T-shirts).*

College can be really boring and stressful if you ignore the opportunities to be involved. When you efficiently manage your time you can easily include many extracurricular activities.

Where To Go, Who To See

If and when you encounter problems with school or life in general, go see someone who knows how to help you. These people exist everywhere. Don't be afraid to call on them.

You met your engineering advisors at SOAR. They will discuss problems with academics and schedules. If you

Historic Bascom Hall sits on Bascom Hill. Abe sits on his throne.

personal problems, free counseling is available at the University Counseling Service. They can refer you to others if the need arises.

Academic and tutorial services are right under your nose. The GUTS/HASH is a "student helping student" program that can assist you on a short-term or long-term basis. Some departments also offer tutoring. Your TAs will have more information.

At the start of the semester, you will hear all sorts of telephone numbers and room numbers from your TAs where these services are available. Write them down, because classes change; chem is not all electron configurations or stoichiometry, and calc is not all natural logarithms or geometric curves. The point is, just because you don't need these numbers right away, you may be able to get a lot of use out of them later.

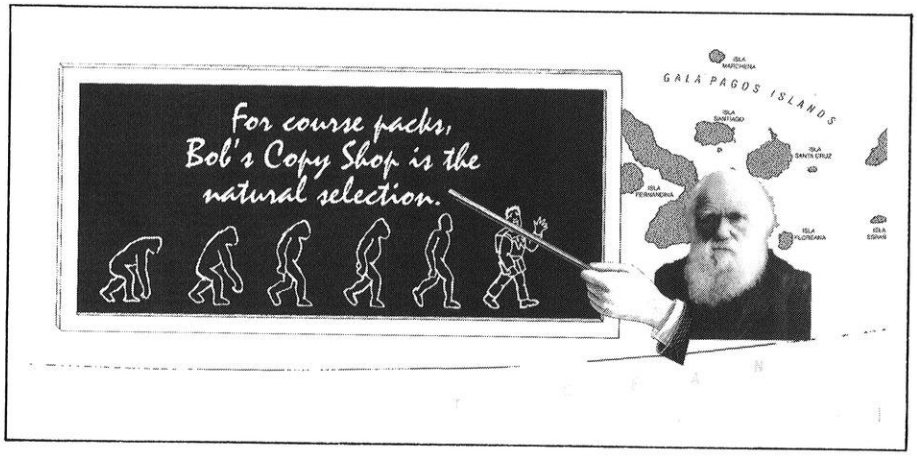
College is tough and challenging. No one can breeze through with total ease. PLEASE don't sit on your butt and wait for help to come to you. If you have a problem, any problem, someone on this campus can help, but you need to contact them. Again, Wheat & Chaff is a great source for information.

Last Words

Naturally, we can't tell you everything you want to know. By no means have we told you everything you need to know. We just thought that some free advice from older students could come in handy. Our suggestions may not work for everyone, but we hope we have helped in some way.

Make the University treat you as a person. Don't let it treat you as a number. It can go both ways—which way is your decision.

Really—that is so true. Take advantage of the opportunities here and you will have an absolutely wonderful experience in college.



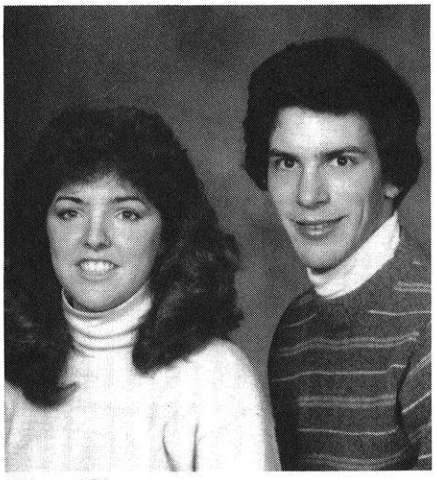
A Tribute to

Mike Van Dyke

by Don Woolston

Every Madison engineering freshman hears this advice: "Get involved with student organizations. It looks good on your resume." To the typical freshman who takes the advice, that involvement means sitting, arms folded, at a sparsely attended professional society meeting trying at all costs to avoid extra work.

Mike Van Dyke probably heard that advice in 1984, but sitting with his arms



Mike and Lisa

folded is not Mike's style. I have found that out because I am the advisor to the student organization (the *Wisconsin Engineer*) with which Mike chose to get "involved." I am writing this little tribute because I will always be grateful that he made that choice. He redefined the word "involved," and in the process impressed me as few other students ever have. My hat's off to you, Mike.

You see, Mike is what you call a hands-on guy. He is also a worker. I found that out the first day I met him. I was helping my students set up two new IBM PCs and a new printer that we had just bought with grant money from General Motors. Actually, it was more like *trying* to help since I'm not that much of a hands-on guy myself. As we got to the part where we had to drill holes in the computer case and the table to install a security device, things started to get sticky. Gradually, it occurred to me that the only things that were being done right were being done by the tall skinny kid from Neenah named Mike. A couple ECEs were talking a good game, especially about the innards of the computers, but they had placed the holes so carelessly that the security lock couldn't possibly fit. I distracted them long enough for Mike to pick up the tools and do the job right—and fast.

That's Mike's special talent. He can size up a problem and do the job fast—before some other people even figure out what needs to be done and whether they want to do it.

He's applied that talent to the production of the *Wisconsin Engineer* magazine over the last four years, and made an impact in the process. He organized the office. He balanced the books. He launched an ad campaign. He figured out the computer typesetting system.

In the summer of 1986, when I was gone for the summer, he produced (nearly single handedly) the entire summer issue—the first one to be typeset by the students instead of by a commercial printer, I recall. That fall, Mike saw another opportunity for action. An enthusiastic, artistically talented pre-journalism student named Lisa had shown up at the magazine office, and Mike liked what he saw. Lisa became a major force on the staff—and in Mike's everyday life. Mike and Lisa were married in 1987.

To put these accomplishments in perspective, you have to know more about Mike, especially what he is not. First of all, he is not a journalistic genius. He is smart and has an eye for a good layout, but he is no threat to win a Pulitzer. If they ever hold an all-university spelling bee, the smart money won't be on Mike. I guess I said it best already; Mike is a hands-on guy. Give him a deadline and stand back. He will get the job done—and fast.

Mike graduates this August. He and Lisa are off to Arkansas, where Mike will work as a maintenance engineer for Kimberly-Clark, an appropriate career choice because K-C has been a faithful *Wisconsin Engineer* sponsor. Stand back, Kimberly-Clark. Just give Mike a job and stand back. It will get done—and fast.

Now I've got to find another Mike. Anybody out there want to get involved in a student organization? ■

ENGINEERING BRIEFS

wisconsin engineer

NSF Young Investigator Award Goes to DeMarco

Christopher DeMarco, an assistant professor of electrical and computer engineering, was among three UW-Madison researchers to win National Science Foundation (NSF) Presidential Young Investigator Awards this spring.

The award provides an annual base grant of $25,000. NSF will provide an additional $37,500 per year to match grants from industry, raising the total research support possible to $100,000 per year for five years.

The awards are intended to help universities attract and keep qualified faculty in science and engineering. Only faculty members who began tenure track jobs within the last four years are eligible. They are based on excellence in both teaching and research.

DeMarco, who came to the college in 1985 after earning his PhD from the University of California, Berkeley, studies power systems, control theory, and robotics. In his short tenure as a university professor, he has achieved a national reputation and is described by colleagues as a rigorous and productive researcher.

This brings to 11 the total number of PYI award recipients in the college since 1984.

$2 Million Gift From Grainer

The College of Engineering has received a gift of $2 million from The Grainer Foundation in Skokie, Illinois.

The gift fulfills a requirement for the private funding portion of a $16.5 million addition to the Engineering Building. The Wisconsin budget bill last July committed $14.5 million in state funding to the project on the condition that the college raise $2 million in private funds. Construction could begin in 1989.

More than 65,000 square feet of space in the new addition will provide laboratories and offices for electrical and computer engineering, chemical engineering and other departments and programs.

The additions centerpiece will be a 500-seat Technology Transfer Auditorium that can be partitioned for use by two or three smaller groups. This and a large student study lounge will be built with private funds.

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College Centennial

The college will be 100 years old in 1989. As part of its centennial celebration, the college will host seminars, lectures, and other special events marking a century of engineering education, research, and public service.

Departments will hold open houses for students, parents and alumni; special programs for high school students and teachers and for women and minorities are planned.

The staff of the the *Wisconsin Engineer* plans a special spring issue to highlight the celebration of the college centenial.

Mink, Mork Scholarships Established

John F. Mink (BSME '64) and his wife have created the John F. and Roberta Mink Fund to support scholarships and capital acquisitions in the Manufacturing Systems Engineering Program and the Mechanical Engineering Department. Mink is vice president of Barber-Colman Co., Rockford, Ill.

The George Mork Scholarship Fund has been created in honor of Mork by his son, co-workers, and the Bucyrus-Erie Foundation. The scholarship will be awarded to undergraduates in the college with preference given to qualified Black students with financial need.

Mork's son, Philip W. Mork, is president of Bucyrus-Erie Co., Milwaukee.

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College Students Win Die-Casting Scholarships

Metallurgical and Mineral Engineering graduate student Chris Misorski and Mike Van Dyke, a senior in mechanical engineering, were among four students nationwide to receive David Laine Memorial Scholarships from the American Die Casting Institute at the institute's meeting in Chicago, October 19. Professor Carl Loper Jr., metallurgical and mineral engineering, nominated the two. Each received a $1,000 scholarship.

Ominous Trends In Engineering Enrollment

In the same way that market watchers keep a close eye on the supply and demand for soy beans, wheat, and pork bellies, government statisticians have been tracking the U.S. supply and demand for engineers. What do these statistics tell us? How rosy is the future for today's engineering students? Will the jobs be there? How well will this country be able to provide the technical know-how necessary to maintain economic health?

Statisticians' crystal balls are notoriously cloudy, but an increasingly clear picture seems to be developing. It's a seller's market. Those that have technical talents for sale (e.g., UW-Madison engineering graduates) should have no trouble finding buyers in the form of employers. In fact, the clouds in an otherwise sunny forecast would have to be the problem that the U.S. faces in coming up with enough well schooled high school students to feed into the engineering-degree pipeline.

This article takes a look at the trends in engineering enrollments and job projections from a student's point of view. It shows how a combination of demographic factors may decrease the number of engineering graduates, and how these trends likely will benefit individual students but will cause worries for U.S. leaders interested in maintaining technological superiority.

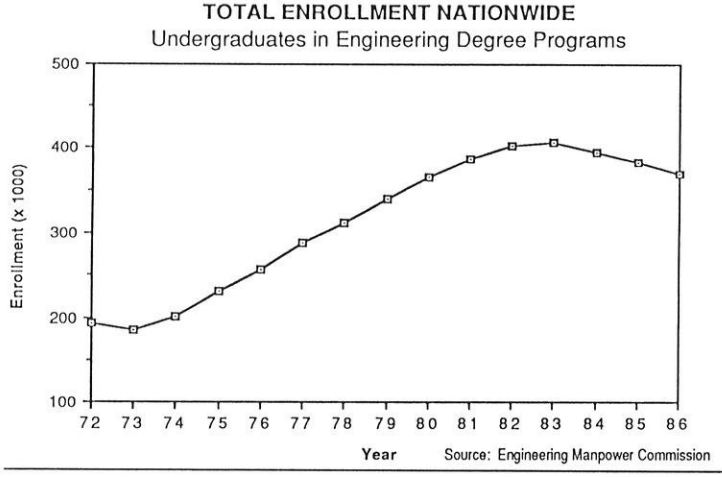


Figure 1

The Supply

The Engineering Manpower Commission reports show that U.S. engineering enrollment peaked in 1983 (see Figure 1); enrollment patterns here at UW-Madison reflect that national trend (see box). Even though the decline has been gradual, it has caught the attention of engineering educators nationwide. Recently, an entire issue of *Engineering Education* magazine was devoted to the topic of declining enrollment. As the issue points out, declining enrollments are closely linked to shifts in the age distribution of the U.S. population.

Now that the Baby Boom is just a distant echo, the average age of Americans is increasing rapidly. A result of that demographic shift can be seen all around us in the changing nature of advertising. While today we see advertising pitched mainly at Baby Boomers (30 to 40-year-olds), more and more Madison Avenue is out to mine gold from the silver-haired: laxative, health insurance and aspirin ads pollute the air waves with increasing frequency. The demographic changes behind the shift in advertising have clear implications for engineering education as well.

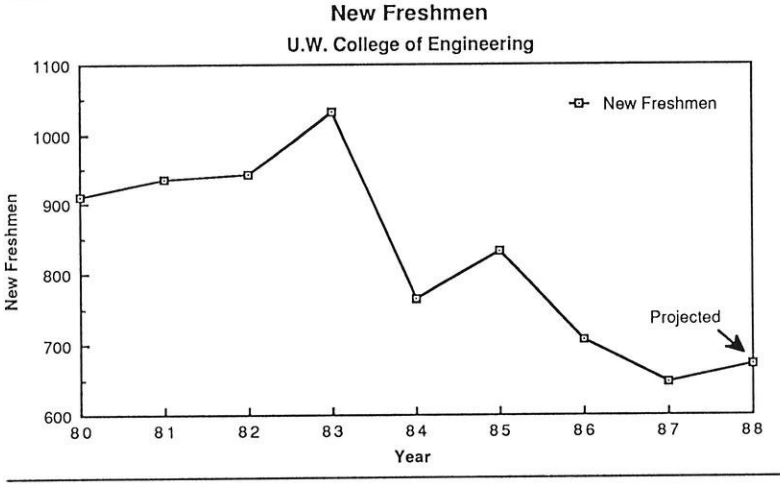
Figure 2 shows the declining number of 22-year-olds in the U.S. population.

box 1

UW-Madison College of Engineering Enrollment

Engineers who graduated from UW-Madison in 1987 and 1988 represent their own demographic miniboom. As the graph below shows, freshman enrollment hit a sharp peak in 1983. Recent graduates who have gone through four or five years of standing in long registration lines, sweating out waiting lists, and praying for extra sections of required courses will attest to the fact that the UW-Madison College of Engineering did not have the capacity to teach quite so many undergraduate students. The College of Engineering administration and the individual departments recognized the same fact; they took action to remedy the logjam by placing new limits on admittance to degree granting departments. These limits took the form of high GPAs, which in the case of especially over-taxed department such as Electrical and Computer Engineering and Mechanical Engineering, were indeed high (3.5).

Thus, the subsequent downturn in freshman enrollment shown below was not totally induced by demographic changes alluded to before; it was in part a conscious effort to improve education by limiting enrollment to a manageable figure.



Now enrollment has returned to manageable levels, and 3.5 GPA requirements for admittance to a department are behind us. In fact, today the UW-Madison is concentrating more on attracting outstanding students than on limiting enrollment. For example, Polygon and the Society for Women Engineers (SWE) student chapter have conducted hometown recruiting activities. A newly formed Pre-Engineering Society hosted a Day on Campus for prospective freshmen last spring. The last two years, the Pre-Engineering Office has hosted a Madison-area middle school Mathematics Meet, during which students participated in engineering-related activities. Professor Lois Greenfield of General Engineering, long-time SWE advisor, has helped coordinate several special program for women in engineering, including a yearly "retooling" conference for women interested in changing to non traditional careers. These recruiting activities should help the UW attract good students, but even more effort may be planned for the future to ensure steady enrollment in the face of changing demographics.

The pool of individuals from whom future engineering graduates will be developed will lessen by 25 percent by the end of the century.

Is this trend as serious as it looks? As with other statistics, many factors might mitigate what looks to be a rather steep downward trend. Perhaps statisticians haven't considered the context. Maybe tomorrow's 22-year-old will be more likely to enroll in engineering. Perhaps engineering graduates tend traditionally to be older return-to school-and-finish-years-later types. And just perhaps the drop in the number of 22-year-olds is in parts of the population that aren't attracted to engineering careers any way.

But it so happens that statisticians have looked at all these possibilities, and in all cases they found that the decline may be even more drastic than it appears in Figure 2.

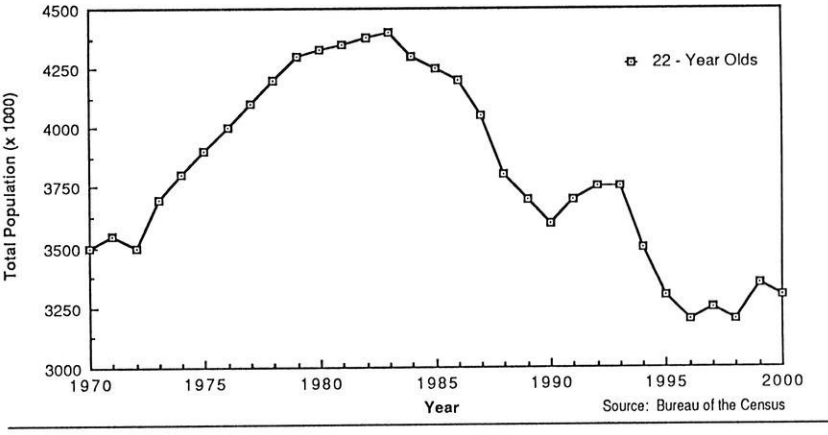


Figure 2

First, engineering is not as popular a career choice with freshmen as it once was. As Figure 3 shows, today's freshmen, as compared to 1983 freshmen, are less likely to choose engineering as a career and more likely to choose business. According to J. Ray Bowen, dean of engineering at the University of Washington in Seattle, "The decline in freshmen choosing engineering majors could conceivably persist until the middle of the 1990s." So from the smaller pool of potential college graduates, fewer and fewer are choosing engineering.

Secondly, it turns out that graduates in engineering are more likely than graduates of other field to finish their degree right after high school. According to Dean Bowen, "Most engineering bachelor's degrees are awarded to students who proceed directly, without interruption, from high school to collegiate studies."

Finally, background statistics show that the subpopulation of 22-year-olds most likely to enter engineering—white males—is a group whose numbers will drop particularly sharply over the next two decades. In 1975, 14 percent of the 22-year-old population in the U. S. was composed of racial minorities. Projections show that proportion will rise to 20 percent in the year 2005. Thus, the drop in the 22-year-old population is right where it counts in terms of engineering enrollment projections: in white males, who currently account for 75 percent of all engineering graduates.

These demographic figures have obvious implications for today's high school graduates. Over the next decade, engineering colleges will be out recruiting so that they can find enough new freshmen—especially those proficient in math & science, who, according to another government report, are all too scarce (see box at right). They will be looking especially hard for minority and women students. If this recruiting effort is successful in maintaining the current level of engineering graduates, will the jobs be available? Let's peer into the statisticians' crystal ball for the answer.

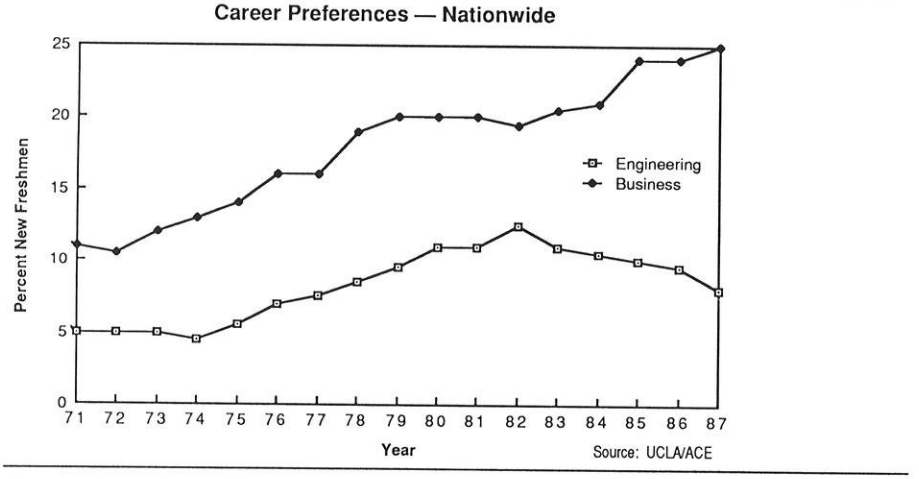


Figure 3

The Demand

The Division of Science Resources Studies of the National Science Foundation has the job of tracking engineering employment trends. Publications from that agency show that over the last five years, engineering has surged ahead of other professional fields in growth of job opportunities. While the Gross National Product grew 3 percent from 1980-1986, the number of engineers employed grew 7 percent. Growth was especially strong in research and development: the number of scientists and engineers employed in industrial R & D almost doubled between 1975 and 1985.

Will this trend continue? Probably so, according to at least one government publication ("Nurturing Science and Engineering Talent: A Discussion Paper," by the Government-University-Industry Research Roundtable of the National Academy of Sciences).

The important question, however, is what will happen into the next century, and the signs point to significantly higher demand. The number of white collar jobs will soon exceed the number of blue collar jobs. This implies increasing competition among professions for educated personnel. Moreover, employment in science and engineering is expected to continue to rise at rates higher than the average employment rate. The Bureau of Labor Statistics forecasts that over the next decade, civilian employment of scientists and engineers may grow by 40 percent.

box 2

A Leak in the Engineering Pipeline?

Ever since Sputnik in the 1950's U.S. educators have been self-conscious about the quality of American science education at the precollege level. The Soviet Union's success in space spurred two decades of big budgets and intense effort by the National Science Foundation (NSF) to bolster high school science, especially physical science.

But the Reagan administration's domestic austerity brought an end to federally funded intervention in science education. Funding for the Science and Engineering Education directorate of NSF went from about $110 million per year in the 1960's to virtually zero in 1982.

Lately, Congress has voted more money for NSF's education branch, but the damage may have already been done, according to a recent government report that compares U.S. students performance on standardized science achievement tests with that of students from 16 other countries.

To put it bluntly, the tests made American students look bad. If high school science were an Olympic sport, the U.S. wouldn't make it to the medal round. In fact, we might have trouble fielding a team.

According to "Science Achievement in Seventeen Countries: A Preliminary Report," U.S. high school students ranked next to last on chemistry and physics tests, and dead last on a biology exam. Countries who fared better include Hong Kong, Hungary, England and Singapore. At the bottom of the heap with Americans were Italy and Canada. Japan was at near the top in the physical sciences, but near the bottom in biology.

Obviously, those results are not good news for engineering educators, who rely on U.S. high schools to provide students who excel in the physical sciences. Some of the new NSF money is going into programs to give U.S. science teachers a boost. One of those NSF-sponsored activities, the Academic/Industrial Teachers' Internship Program (AITIP), is an enrichment program for math and science teachers at minority schools that is being conducted right here in the UW Madison College of Engineering.

Co-sponsored by the Pre-Engineering Office and the Minorities Engineering Office, AITIP is in its third year. This summer, 19 teachers from eight states came to Madison for two weeks of instruction in engineering fundamentals and computer technology. These teachers then left for a six-week technical internship with companies such as IBM, Whirlpool, 3M, and Oscar Mayer. The idea behind the program is to give these teachers first-hand experience in engineering so that they can add practical examples to their teaching and give better advice to students interested in technical careers.

So far the program seems to be working. One of this year's teachers said, "The AITIP program is an excellent idea for recruiting minority students. The staff was extremely professional and cooperative." Another volunteered, "The AITIP program...provided the opportunity for me to immerse myself in the engineering field. I now feel that I can be a very effective teacher when advising and instructing students about the requirements for pursuing an engineering degree." If NSF gets continued funding for this and similar programs to enhance science teaching, the pipeline of talent to engineering colleges may be running and at full capacity again.

Conclusion

Declining engineering enrollments, problems with precollege math and science instruction, and an increase in demand for engineers may mean headaches for the government, but these trends all make engineering an attractive career choice for the next few decades. These figures should turn the heads of today's high school student interested in a sure-fire career; they should also encourage the undergraduate engineering student wondering if the pain is worth the gain. It certainly looks like it, at least in terms of career opportunities. ■■

—The information in this article was compiled from sources in the Pre-engineering Office.

Complementing an Education

by Brian Lindahl

We've all filled out a job application at one time or another. The questions on all the forms are very similar: first your name, address, and other personal stuff that will never change, i.e. your birth date, social security number, etc. Then comes a little excitement—your education, job experience, and references. As students, we come to the University to do as much as we can to improve the education part of the form. At least this was my excuse to come to Madison.

After all, I feel we get an education to get a job, and to get a job, an application must be completed. But is that all we can do as far as improving these applications while in Madison?

I feel that by working hard in class to get a good grade and to really learn the material is the most I can do to improve the education part. I've taken, in my opinion, not the easiest classes, not the easiest professors, and not the easiest schedules. But then, I must admit, I

I've taken...not the easiest classes, not the easiest professors,not the easiest schedules...

avoid the worst of these categories with at least as much vigor. In one class I had, I really never knew how bad I was blown away by the subject until I got my grades back. Then it was plain to see I really needed to take the class over again. I didn't flunk the class, but I knew I didn't learn too much the first time through. The second time through, the class was just as much work as the first, but because of the combination of a new text, a different professor and brand new determination, I learned a thousand times more.

So I guess I'm doing my part to get the best education I can get here; I'm not going to settle for anything less at the end of a semester than I expected at the beginning of it. Can I really do much better than my own expectations?

But classes cannot teach me everything, and believe it or not, nobody can learn everything from a professor with a hunk of chalk in his or her hand. This means that education needs to be

Education needs to be complemented by something, anything.

complemented by something, anything.

In my case, I chose to find a job that was at least somewhat related to my major. A factory job? Well, I hoped to get some hands-on experience, to become familiar with the shop processes and see the results of an engineers' work. Any other experience I might get would be above and beyond my expectations of the job. Well, after I became familiar with the company, I began to want to move up through the ranks and secure a better position than a machine operator. After about nine months, the first opportunity presented itself: a job offering supervising experience was being offered to the part-time employees in the shop. The position was a "team-leader" job. My actual job didn't change; I did all the same jobs, but I also had the authority to assign work to other employees, and help with the training process.

I thought about what I really wanted out of my job. I thought about what I wanted out of my education. And I thought about my career...

Well, things were not going that bad. I had worked every type of machine in the shop short of the programmable lathe, and I had a job title I could use on a resume some day. But what I really wanted to do was work closer with the engineering department.

After another six months or so, another opportunity presented itself—a drafting position was opening up for someone who knew a lot about a particular machine the company made, and because I had been working longer than

many of the part-timers in the shop and also because I had used nearly all the machines, I had also made, at one time or another, most of the parts that made up the machine. I was offered the job nearly right away, but there was a catch to the job: you see, the drafting department had a pay ceiling, and because I had been working for the company for over a year, plus I had the team-leader job (which came with a raise) I had already passed the pay ceiling, and in order to take the job, I also had the honor of taking a pay cut.

So I went home. I thought about what I really wanted out of my job. I thought about what I wanted out of my education. And I thought about my career. I also thought about my checking account, the car I was driving to work,

I couldn't pass up the opportunity to work on a CADD station...

and the next six or so semesters of tuition that had to be paid some day.

Weighing all the facts, and taking into consideration my career plans, I opted to accept the job. I couldn't pass up the opportunity to work on a CADD station for a growing industrial company for a couple of years before graduating from college.

After a few months on the job, it started to bother me that I would have to be satisfied with the same pay the rest of my college career. I began to wonder if maybe I would be better off getting the training on CADD from this company, then moving on to another company willing to pay me what I was really worth. But then, back to job applications, I wondered what would look better on the form—the fact that I held a job with one company for so long while in school, or working at different places and getting more and different experience... would they think I dumped on this first company by letting them train me, then leaving simply for money?

As of yet, I guess I have not decided, because I'm still working for the same company and still wondering what to do. And that's not all bad. The pay scales are being reconsidered, and I may well get some of the money I think I deserve for

Would they think I dumped on this first company by letting them train me, then leaving simply for money?

working an eight hour day behind a ten or fifteen thousand dollar CADD machine.

This entire episode makes me wonder what would have been the best decision and when should it have been made. Is what I've done the best for my career, or just best for the company I'm working for? Should I have stayed in the shop to get the supervising experience, however little it was, or is now the time to move on to another company?

Believe me, right now it's hard to tell if what I'm doing about my employment is good only now or if it's for the good of my entire career. Hopefully, a recruiter will see what has gone down as dedication to a company, and offer me all that much more money some day. Heck, I'd strongly consider working for the same company for a career if the price is right; I mean, my God, look at the money and time they have invested in me already as a part-timer with that CADD station, plus all the time the company would save if they gave a job to me rather than an engineer who knows nothing about the company other than what you learn

I'd strongly consider working for the same company...look at the money and time they have invested in me....

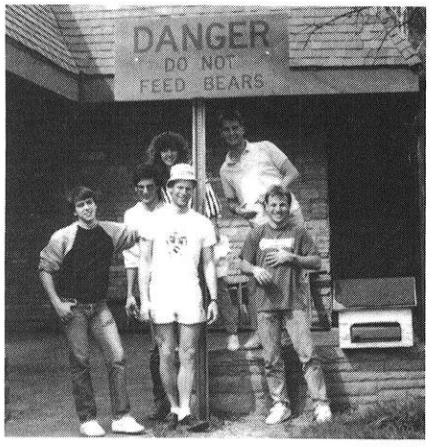
from researching them in a library. Maybe in a year or so I'll write about my interviewing and what really does come of my past job experience; then I can say for sure how important it is. ■

Just one more...

by Shelly and Brian

Our jovial staff set out on an adventure to the East Coast. We had a great time and met some great people.

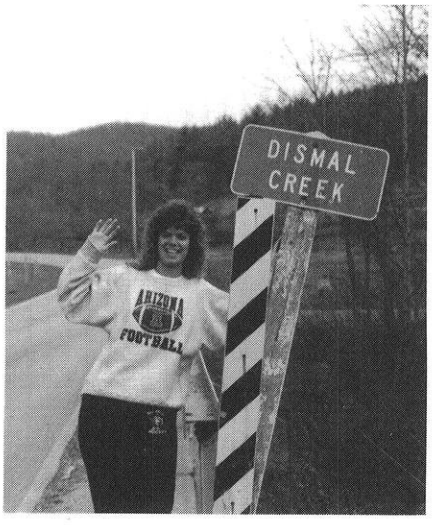
But on the way...



...we stopped at a zoo in West Virginia to take pictures of the animals.

Then...

...we got lost in downtown Dismal Creek. Then we took the wrong highway out of town.

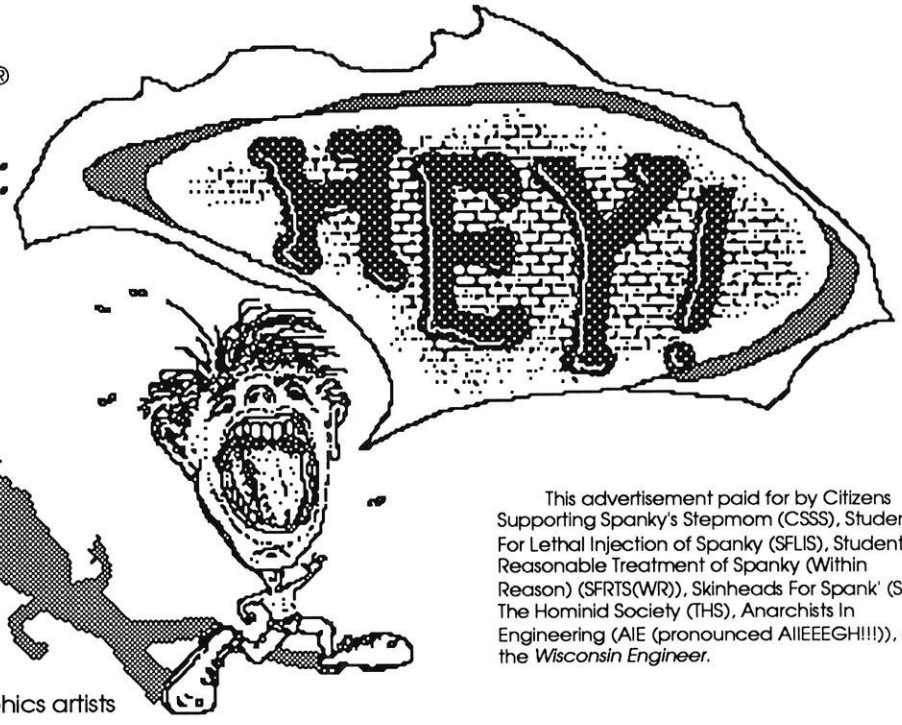


So...

...we stopped at the nicest looking home in Mahon to ask for directions.

They were having a party and invited us in for some drinks.

Spanky® Says:



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