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WISCONSIN ENGINEER

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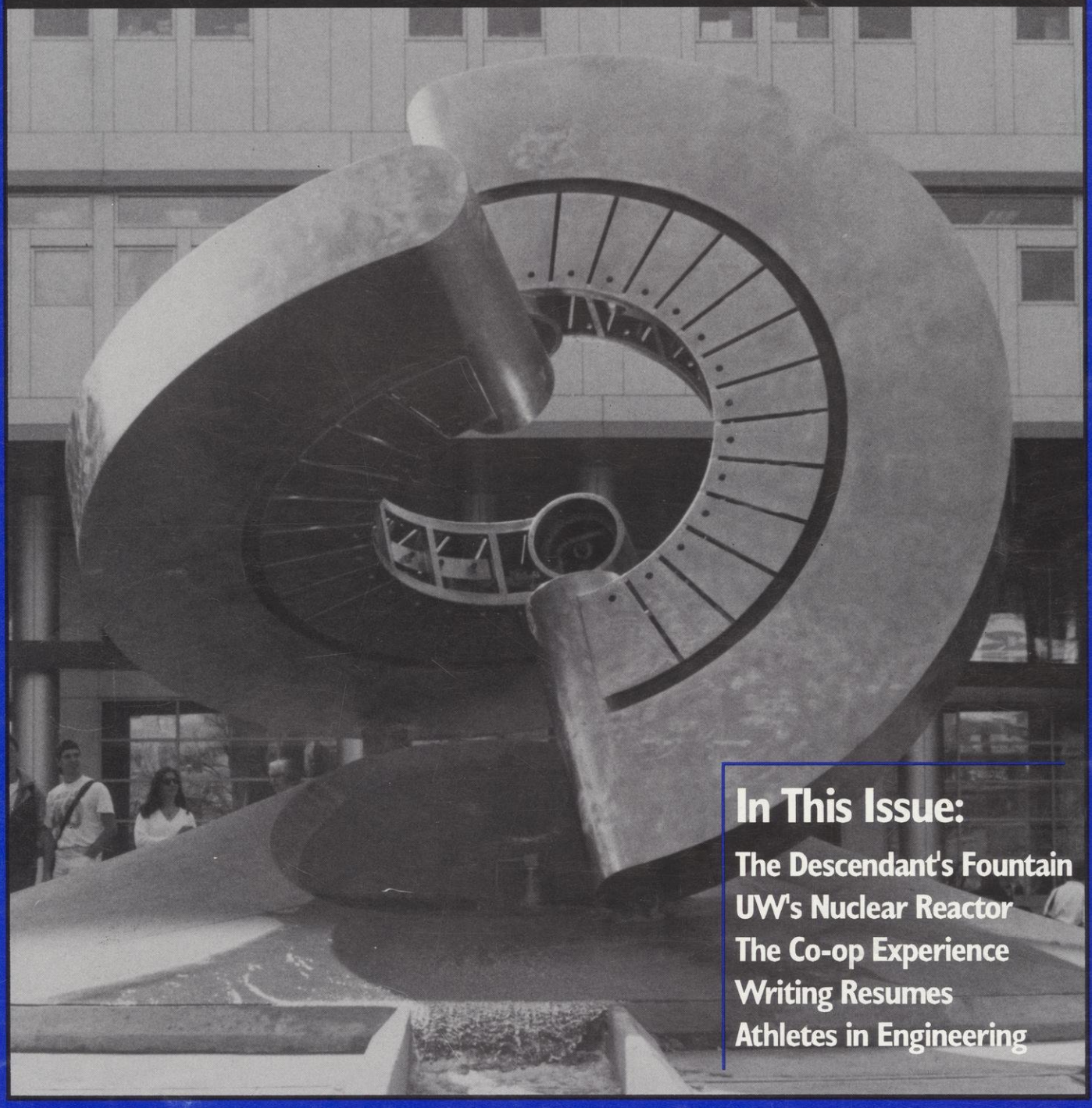

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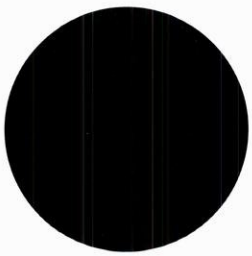

Ideas shape the course of history.

– John Maynard Keynes

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JOHN DEERE

WISCONSIN ENGINEER

Published by the Students of the University of Wisconsin-Madison

FEATURES

DEPARTMENTS

The **Wisconsin Engineer** magazine, a charter member of the Engineering College Magazines Associated, is published by and for engineering students at UW-Madison. Philosophies and opinions expressed in this magazine do not necessarily reflect those of the College of Engineering. All interested students have an equal opportunity to contribute to this publication.
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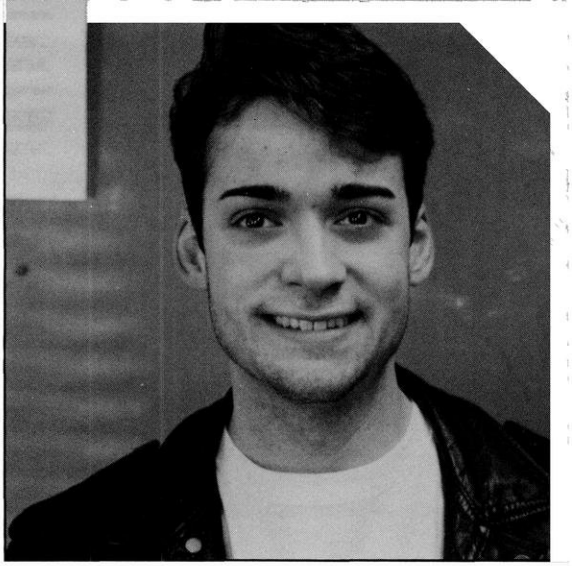
Editorial

Coming to Grips with Engineering



I have kept it a secret long enough. I cannot hide my feelings any longer. Some may shun me for it, but I have to come out and say who I really am. I am ...an *engineer*! Yes, I can say that now. I am an E-N-G-I-N-E-E-R. In fact, I am a junior in the Electrical and Computer Engineering department here at UW-Madison. That means I have been an engineer for some time now! I have finally accepted it, and now I feel I must proclaim it. Yes, declare it loud and bold across the Engineering campus, over Bascom Hill and down the halls of the Humanities Building in hopes that my words will encourage others to come forward and accept their engineering nature.

"What's wrong with me? Why am I so different?"

I first started having these feelings around fifth grade. While other kids were playing Atari (remember those days?), I was discovering the wonders of science, indeed physics. I found comfort in the orderly manner of its laws. "Ms. Pacman" and "Donkey Kong" simply did not bring that same sense of internal harmony. Sure it was "nerdy," but I was fascinated by science; I always wanted to know why, why, why. Why does our TV need to "warm up"? Why do Mom's eight-tracks make that hissing noise? Why can't Dad wear his polyester suit near open flames?

"Maybe these feelings will just go away."

At that age I was too young to understand my feelings. I just hoped that someday I would be like everyone else. But the feelings never went away. In high school I even found myself reading ahead in my science texts. "Particles are really waves?" I read in amazement. "Mass is really energy and time is relative?" These topics captivated me far more than the history of the Babylonian Empire or the study of the executive branch of the federal government. So every year my internal struggle worsened.

"Keep my options open."

When I came to the UW I quietly registered as a pre-engineer. I did so with the understanding that all my options were left open, that I could easily transfer to any other school. "Besides, everyone changes their major," I assured myself.

I took the usual chemistry and calculus courses, and I began to see how much work a technical major could involve. As the semesters passed by and I advanced in my degree program, I began to find that I interacted with fewer and fewer people. I started to feel trapped. Was I going to turn out to be a stereotypical "enginerd"? Would I cancel a date on a Friday night because I had to study for an exam on Monday?

"What's happening to me?"

I agonized over these thoughts. I searched for ways to meet new people and find out if I really belonged in engineering. I tried out various student organizations, went on a co-op and even took career interest surveys. Nothing helped, nothing gave me the answer I wanted to hear — that I really was not an engineer.

"There has to be more to life."

What could I do? Join Engineers Anonymous? Search for the meaning of life on State Street? I made an effort to study at Helen C. White Library rather than Wendt. I roomed with a History and a Psychology major. Yet I still found myself fascinated by technology, and worst of all I loved problem solving. I was sunk. My heart was low. Could it be that I really was an ... an engineer? My roommates told me I was not while my counselors told me I was. My parents chose not to influence my decision. My horoscope, well, it did not help either.

"On the other hand ..."

I mulled and thought and mulled some more. I began to accept the world as a competitive place in which a person needs to have an edge to get ahead. That edge seemed to be a technical degree. "As technology progresses, we must progress with it," I thought. I recognized that engineers do good for society by making safer and more reliable products, by eliminating waste from industrial processes, even by automating menial tasks. Furthermore, I saw that by studying engineering I might answer those "why" questions that had plagued me since childhood. I could unlock the mysteries of the

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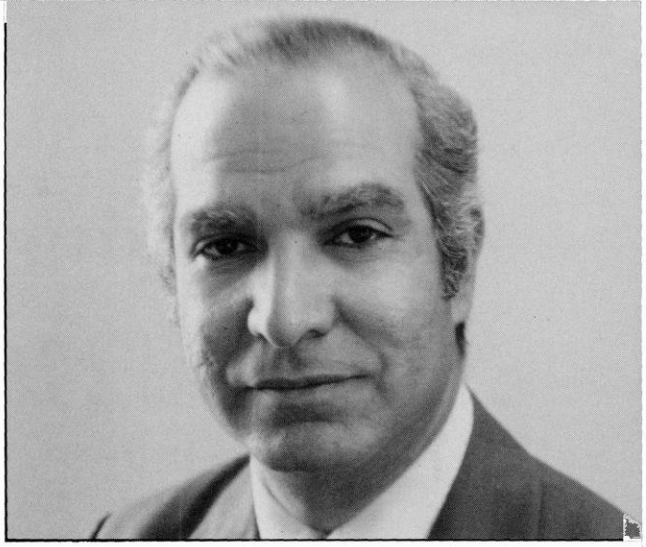


Faculty Profile

Ali Seireg: A Modern Leonardo

"Come in," said Dr. Ali Seireg, professor of mechanical engineering, greeting me with a smile. I moved into the office stuffed with papers and books to take a seat at one of the two empty chairs situated in the little clearing near the door. Gazing around at the stacks and piles of papers which covered everything except the few square feet where our chairs were, I could not help but wonder if Dr. Seireg could find anything in the seeming clutter. The few things he needed, such as the telephone, sat atop a pile of papers over a foot high which completely covered the desk like a burial mound. Noticing my stare and reading my mind, Dr. Seireg laughingly remarked that he has not used the desk for years, and yes, he knows where everything is and can find it.

Before we started the interview, Professor Seireg handed me a folder crammed with papers which he thought might be a helpful overview of what he does. "Here's sort of a resume," he commented, handing me a sheet of paper with what seemed to be enough resume material squashed onto it for all of the professors in the College of Engineering combined. I quickly scanned it. Ten lines of awards, honors and prizes such as the Kuwait Prize for Science. The list of honors included: Wisconsin Men of Achievement, Engineer of Distinction, Outstanding Educators in America,Who's Who in the World, Who's Who on the Frontiers of Science and Technology, and membership in the "Advisory Panel, NASA Technology application Team, 1987," and the National Science Foundation.

I could not believe my eyes, but before I could read even a fraction of this list, Seireg began to show a stack of letters he had kept. There were invitations requesting the "honor of his presence" at the opening of the Wellcome Museum of the History of Science in England, where he has an exhibit, and invitations to speak at the Chinese Mechanical Engineering Society, which had given him an honorary membership — the highest honor their society could bestow.

These were mixed in with commendations from people as diverse as the president of the U.S.S.R. Academy of Sciences, and Governor Tommy Thompson. After showing me one of the letters from Russia, Dr. Seireg explained that he had been instrumental in getting the United States and Russia to share technological information and encourage scientific cooperation. Seireg casually mentioned that he had met Gorbachev too.

When he caught me throwing a puzzled glance at the skeleton buried up to it's femur in papers at the back of the office, he told me a little about his interest in biomechanics. As he spoke he showed me letters from doctors at the Mayo Clinic and John Hopkins University asking for his help, and letters from doctors at the University of Bologna, Italy, thanking him for his wonderful biomechanics lectures.

When I finally got my jaw off the floor and asked him how he originally came to Madison, he laughed and told me that it was in one of the magazine articles he was giving me. He dug through a folder and pulled out an article entitled "Ali Seireg, a Modern Leonardo," and handed it to me.

Dr. Seireg's biomechanics research assistant.

see FACULTY, page 17

Engineers...Lawyers?? You Must Be Kidding!!

As students struggle through the trials of engineering curricula, somewhere in the back of everyone's mind is a vision of life after undergraduate school. If one asks an undergraduate engineering student where she or he would like to be five years from now, one may get a number of replies. The common responses are working in manufacturing , design, project engineering, or even management. Few engineers, however, even consider the option of law school after receiving their engineering degree. It may have something to do with the fact that there are are over seventeen pages of lawyer jokes on the Internet that continue to perpetuate less than pleasant lawyer stereotypes. And perhaps an occasional comment like "If I drop out of engineering I can always do pre-law," heard in the hallway of an engineering building may contribute to the relatively low numbers of students with a technical background entering law school. In any case, those that do enter are in great demand.

Many different prospects within the legal profession are ideal for people with science-related undergraduate degrees. The most well known of these is patent law, which is one of the fastest growing fields in law today. Patent lawyers deal with the legal questions that concern an inventor's claim to a new product, process, or discovery. They work more in a corporate capacity than in a court room, often researching past patents to determine if their client's claim differs enough from previously existing products to be considered original. Patent lawyers do see some trial work when patent disputes over new technology erupt between competing companies. As manufacturers race to be the first on the market with a better product, lawsuits over who can claim a discovery and the money that goes with it are on the rise. Consequently, the need for patent experts is continuously increasing.

Having an understanding of the technology behind a product enables a patent lawyer to make research and cooperation with the parties involved much easier because they can discuss the product at the same level

Engineers who pursue a career in patent law have a definite advantage over non-science majors in certain areas of industry and consulting. An engineering patent attorney can be of great benefit to a company dealing in mechanical, electrical, or chemical products and processes. Having an understanding of the technology behind a product enables a patent lawyer to make research and cooperation with the parties involved much easier because they can discuss the product at the same level. A lawyer with no technical background would lack the required technical knowledge and judgement, and put their side of the case at a serious disadvantage.

Jean Tibbetts, a senior in electrical engineering, plans to attend law school next fall after she graduates this December. "I'm very glad that I went into engineering, but after gaining some work experience on a co-op, I realized that I would like to utilize my engineering skills in a field where I have more of a chance to write and be in contact with people, " she explains. " I have always been interested in the legal system, and patent law is the perfect way for me to see both sides of the development of a product."

Products Liability Law is another growing field where engineers have an edge in the job market. Products liability deals with the question of holding manufacturers responsible for defective products whose failure causes injury, property damage or commercial loss. These types of cases quickly conjure up visions of ridiculous lawsuits and huge jury awards. In reality, however, only 25% of people who sue corporations actually win their case. The average award to such plaintiffs is around $8,000. Attorneys in this field tackle the legal issues of whether property damage or personal injury was caused by a lack of appropriate warnings and precautions from the manufacturer or by misuse on the part of the consumer.

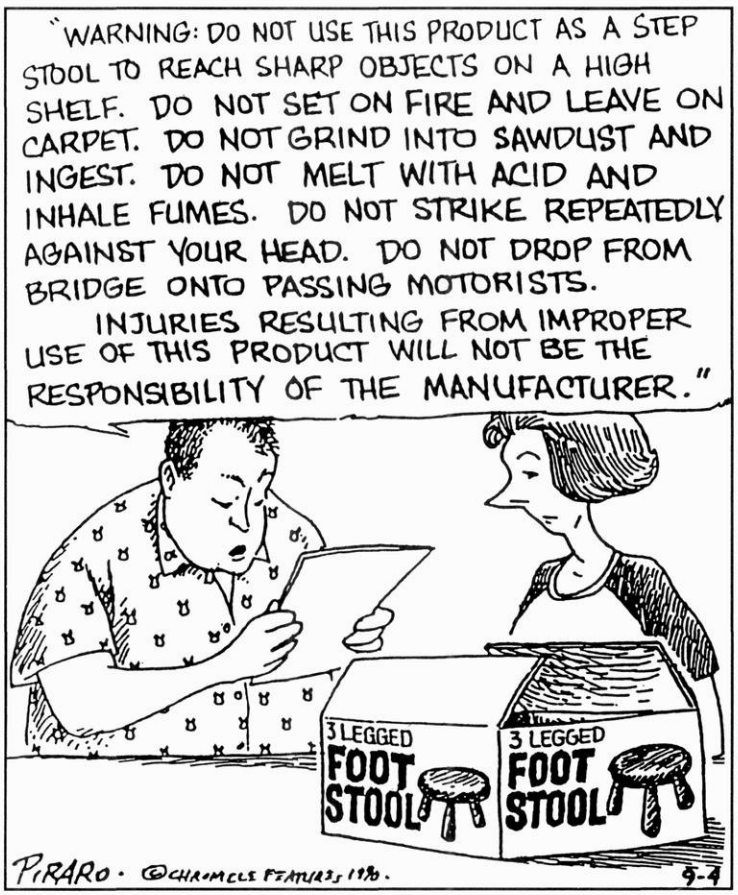
An excellent way to get more

information about opportunities in Products Liability is by taking MSE 469: Engineering Products Liability and the Law, a one-credit class designed specifically for engineers as an introduction to the field. Taught by Professor Richard Moll, Ph.D., P.E., MSE 469 gives students an overview of recent cases and the law behind them, as well as an understanding of how to design safer products and warning labels in order to better protect consumers from harm and companies from lawsuits.

Another way to look into the field of law before graduation is to take advantage of the University Pre-Law Society (PLS). This organization offers students numerous services on their route toward law school. It can give interested students the information they need to decide if a career in law is right for them. The group of approximately 125 members meets twice a month, with various speakers at each meeting. In the past their guests have been deans from the Law School, political figures such as Chuck Chvala, the defense attorney for Jeffrey Dahmer, and panels of current law students for question and answer sessions.

In addition to regular meetings, Pre-Law Society sponsors the Law School Caravan each fall at the Memorial Union. Representatives from over sixty law schools attend to help answer questions about specific programs or applications. PLS also holds mock Law School Aptitude Tests (LSAT) to give students a chance to practice one of the most important parts of getting into law school. Another service of the group is an annual tour of the Chicago law schools for people interested in attending school in the area. Interested students should contact PLS president, Mark Becker.

The best way to truly decide if law school is the right career choice is to gain practical experience in case preparation. At the undergraduate level, the Pre-Law Society's Intercollegiate Mock Trial Team is the best way to accomplish this. Each year PLS sponsors two or three teams of students that prepare a case for regional and national Mock Trial competitions.



"Our cases have ranged from elderly abuse to sexual harassment to freedom of religion," explains David, a junior in Political Science and Student Co-Coordinator of the Mock Trial teams. "We receive a packet of witness statements, evidence and related case law each fall, and have until February to get it ready for trial. We write every part of the case; openings, direct and cross-examinations, and objections — plus play the witness roles. We try to be as prepared as possible, but in competition you never know what surprises the other side will bring."

This year's case deals with Liability Law. It centers around a man who, after leaving a Halloween party late at night, drives his car over a railroad track and is hit by a train. He claims that he did not see any flashing lights before crossing the tracks. Police on the scene recorded his blood alcohol content at 0.09. However, witnesses called the train company that day to complain of broken lights at the intersection. Although the company sent someone to fix the flashers, the repair person went against company policy and used old parts that had not been tested in years. In arguing this case, products liability, company responsibility and the plaintiff's state of mind will be major factors. An engineering perspective on each of these issues will be a great help in developing the case.

Whether they use their strong technical skills or simply the skills of reasoning and logic acquired from an engineering education, engineering students have an edge in the law profession. The field offers a challenging and rewarding career option that is worth exploring.

Author Bio:
Marty Plein is a senior graduating in Engineering Mechanics. As she tackles the interviewing process, she is enjoying the last year of college life.

Engineering at the UW: The Foreign Perspective

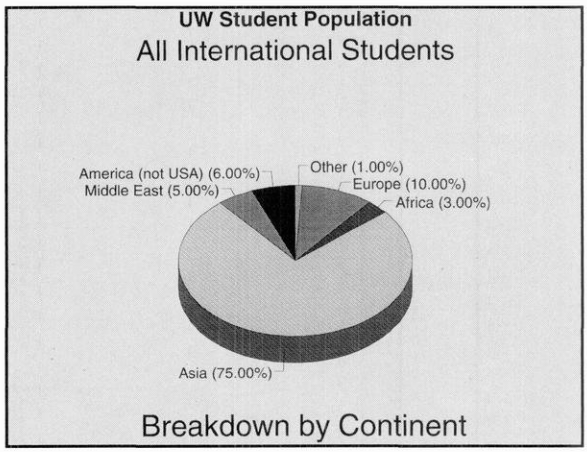
As an engineering student you are quite used to many aspects of life on the engineering campus. You might be familiar with the Computer Aided Engineering center, as well as the classic $2 burger baskets sold at Union South. Likewise, it is common to see your fellow students stressing over exams at Wendt Library. Still, there is one part of engineering life that you may not be aware of: meeting foreign students. Some foreign students are easy to recognize, while others are harder to distinguish. However, if you happen to strike up a conversation with one of them, their accents will tell you that they are not American.

"International students" is the official term used to describe non-immigrant foreign students. The UW-Madison ranks fourth among all U.S. universities in total international student enrollment. Throughout the entire university more than 4000 international students were enrolled in the 1993-94 term, about ten percent of the 40.000 UW students.

Have you ever wondered where all these students come from, who they are, and why they came here?

The UW-Madison ranks fourth among all U.S. universities in total international student enrollment

According to the International Student and Scholar Services, about 75 percent of all international students are Asian and the remaining quarter are from an array of countries around the world. While the male-to-female ratio is quite even throughout the UW, only one-third of the international students are female. Also, one-third of all foreign students attend the College of Letters and Science while one-fourth enroll in the College of Engineering.



Having all of this background information, you may still wonder why these young men and women came to Madison. There are as many different reasons as there are foreign students, but you would like to learn at least a few of them. So why not go on an imaginary trip around the engineering campus and see what you can find out.

To get your first bit of information, you choose to approach the guy next to you who is struggling to secure his bike with a kryptonite lock. You are not sure, yet something in his appearance looks foreign. Francisco, you learn, is from Santiago, Chile. He is in his first year as a graduate student in the Manufacturing Systems Engineering (MSE) program. He did his B.S. in Industrial Engineering in Santiago and started working right after he graduated. By chance, he met Professor Steudel from the IE Department, who gave several seminars in Santiago.

"He told me about the MSE program and I was simply fascinated!" Francisco says. He goes on to explain a little bit about the differences in the educational systems of Chile and the U.S. "We (in Chile) have a very good undergraduate level — more specific, more theoretical, more challenging — and I feel very well prepared to work in industry. But our graduate programs aren't as good."

Francisco probably would not been able to afford tuition at the UW, but he was fortunate enough to receive a scholarship. "I love it," he says. "All the facilities are well equipped, everything is so close and the courses are great, even if they are a lot of work."

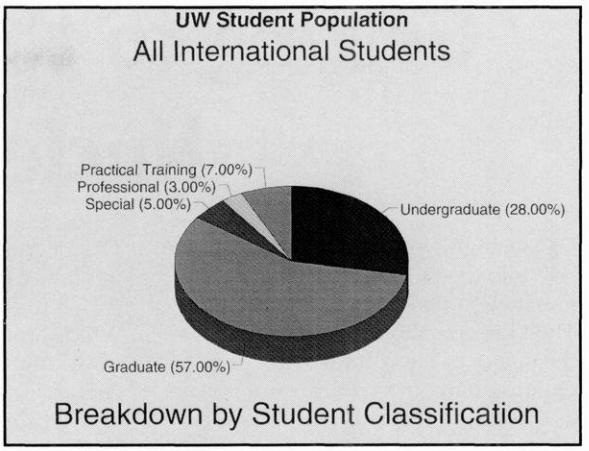
On your way to the CAE you run across a guy named Pakphum. He is from Thailand and just got his bachelor's degree in Industrial Engineering at the University of Miami last May. Pakphum is in a bit of a hurry because he has many homework assignments due tomorrow. When asked why he came, he replies, "I didn't like Thailand's university system that much." He explains that the engineering education there was too broad. Like Francisco, Pakphum received a scholarship to attend the UW-Madison.

You ask him what he likes about studying here. "Well, first of all, as a grad student you are very close to the faculty, which is highly qualified. So you learn not only in courses but

directly from working with your professor. And the programs are flexible and adjustable, so you can concentrate on what is most interesting for you."
Certainly, there are also things Pakphum does not like. For example, he believes that at the undergraduate level the UW sometimes seems to be too large. Before you ask him another question, Pakphum excuses himself and, heading towards the CAE, says with a smile, "You know, it's packed all the time!"

In search of more stories, you move on towards the Union. At the entrance a tall guy asks you what time it is. Recognizing his accent, you ask where he is from. Martin, you learn, is from Germany. He is a third year Ph.D. student in Chemical Engineering. Like most of the German students at the UW, Martin initially came over to Madison through an exchange program sponsored by a German organization. "After one-and-a-half years I finished my masters degree. I really liked studying here. (There are) a lot more courses, more interesting courses and a more organized system than in Germany." So Martin decided to work for his Ph.D. here. "In terms of computer integration, access and networking, German universities are five years behind," Martin comments.

In the Union you meet two guys talking to each other. Again, you recognize their accents. They tell you that they met each other as undergraduates and are both working towards a master's degree now. Fernando is from Spain and got his B.S. in Industrial Engineering. "Actually, my father wanted me to study in the States because he believes that to be the best education I could get. I was kind of reluctant in the very beginning, but eventually I really liked it." Fernando adds, "I appreciate the practical approach in most of the courses I took and I feel well prepared for practice." According to Fernando, some of the courses, however, do not teach enough theory. "I would like to have learned more basics in physics, math and mechanics," he says.

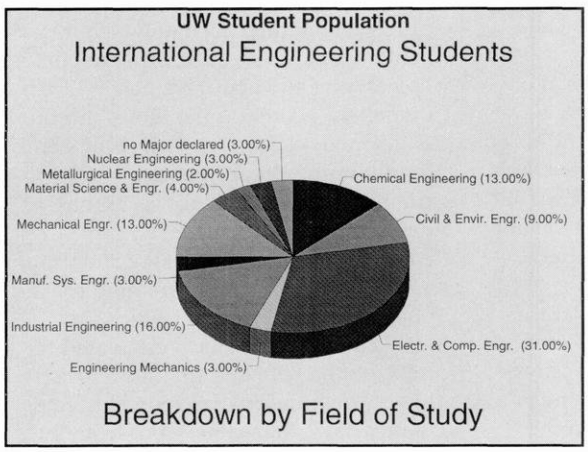


Thinking more about his general experiences living in the United States, he continues, "The lack of good and informative sources of news in this country bothers me once in a while." Smiling, he takes *El Pais*, a major Spanish newspaper, out of his backpack. "Also, I sometimes felt that most of the Americans — at least of those I met — somehow are too ambitious and too busy to really enjoy their lives."

Fernando's friend Boris is from Bulgaria. His parents moved to Austria when he was 14. There he finished high school and studied at a university for one year. "I disliked the Austrian universities," Boris remarks. "They are overcrowded and one is simply flooded with information and left alone finding one's way out." Since a lot of his friends moved to the U.S. to study, his attention also got directed to the States.

"I applied for a lot of schools, but the UW-Madison turned out to be the best deal for your money." Boris got his bachelor's degree in Electrical and Computer Engineering last December. He is now working for a master's degree in that field. "There are exceptions," Boris says, "but overall I would say that undergraduate level courses are too easy. They are not scientific and theoretical enough. But that all changes once you graduate." Boris says that graduate school is the right mixture of theory and practice. Further, Boris points out he likes the possibility of adjusting his graduate program to his personal interests by means of many elective courses.

After you leave Fernando and Boris, your imaginary journey comes to a close. You realize that you have only heard five out of the thousands of potential stories to be found on our campus. Though your perspective is limited, you now have some idea why international students come to Madison. This perspective might help you evaluate the weaknesses and strengths of your educational system. The large number of international students attending UW-Madison demonstrates the university's international reputation.



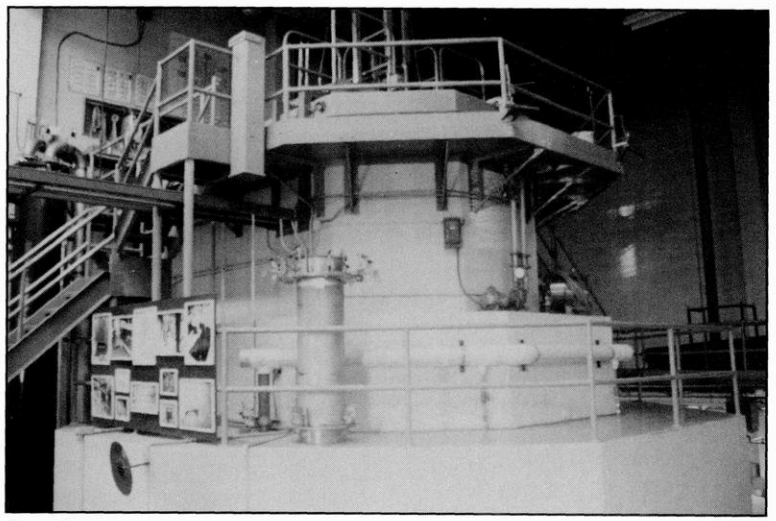
AUTHOR BIO:
Andreas Stinnes is a graduate student in his first year of the Manufacturing Systems Engineering program. As an international student from Stuttgart, Germany, he is currently enjoying the differences of both Madison and the UW and still struggling a bit to get his English straight.

Getting to the Core of the COE's Nuclear Reactor

Ten high school students look down into the twenty-foot pool of water. Fascination plays across their faces. Their interest abounds as they peer at the device at the bottom of the pool. Guides point out various features such as cooling systems, control rods and high voltage power lines.

Could this be a scene from a Frankenstein movie? No, it is just a tour of the nuclear reactor here on campus! Located near the back of the Mechanical Engineering Building, the College of Engineering's nuclear reactor has been operating for 32 years.

A nuclear reactor is a machine which produces energy by the fissioning of uranium-235 atoms. Uranium-235, an isotope of the element uranium, has 92 protons and 143 neutrons. Protons and neutrons are the subatomic particles which make up the nuclei of atoms. When a uranium atom is hit by a neutron, the atom breaks apart, giving off energy and fragments of the original atom. Among these fragments are neutrons which continue the reaction process. These free neutrons are regulated in a reactor by control rods that can be placed at different heights corresponding to what power level is desired. The control rods absorb the neutrons and prevent them from causing additional fissions. The control rods contain boron, an element that "eats" neutrons, slowing the nuclear reaction.



The nuclear reactor

The University of Wisconsin Nuclear Reactor Laboratory (UWNR) is a one-megawatt open pool reactor which can pulse up to about 1000 megawatts

In a commercial power plant, a reactor is housed in a metallic shell called the reactor vessel. Water flows into the vessel, and the fissioning of the uranium heats the water. Then the water is sent through a number of heat exchangers which turn it into steam. The steam turns turbines and produces electricity.

The University of Wisconsin Nuclear Reactor Laboratory (UWNR) is a one-megawatt open pool reactor which can pulse up to about 1000 megawatts. One megawatt is about 1400 horsepower, roughly the power necessary to run 10,000 light bulbs. At UWNR, the reactor simply sets near the bottom of a pool of water. The pool contains 18,000 gallons of very pure water, H_2O. It has to be pure because any impurities would become radioactive and contaminate the system. The hydrogen and oxygen do not absorb neutrons, but almost all of the metals found in the Madison's water supply would absorb the neutrons and become radioactive.

The best description of UWNR is a reactor with training wheels. It does not produce any electricity

The core of the reactor is made up of 23 fuel bundles, each of which contains four fuel rods. A fuel rod is 15 inches long and about an inch in diameter. It contains the fuel, a uranium oxide mixed with europium. One gram of uranium provides enough energy to run the reactor at full power for one day. The core is regulated by four control blades, long sheets of aluminum and boron placed between bundles, and one transient rod, a tube which fits inside a bundle. Water is circulated through the pool and up into cooling towers over the control room. On cold winter days, the water vapor from the cooling towers can be easily seen from

the parking lot behind the Mechanical Engineering Building.

The best description of UWNR is a reactor with training wheels. It does not produce any electricity because that would require the boiling of water to turn the steam turbines. Because the reactor is an open pool reactor, boiling would cause an enormous loss of coolant, which would cause the reactor to shut itself off. Still, the reactor provides many essential services to the department of Nuclear Engineering and Engineering Physics.

The most important of these applications is Neutron Activation Analysis or NAA. The idea behind NAA is a simple one, although NAA is complex to put into operation. An object placed next to the reactor absorbs neutrons and becomes radioactive. Radioactive elements give off specific energies of gamma rays, or high energy light. By comparing the number of gamma rays given off by the sample to the number of gamma rays given off by a control sample, researchers can determine the chemical composition of the sample to an accuracy of parts per trillion. Unfortunately, NAA does not work for every element because not all elements absorb neutrons.

NEEP classes also use the reactor to conduct experiments of their own. One such experiment run for a lab class is the pulsing experiment. The transient rod can be pneumatically expelled from the core by high pressure air, causing

Still, the reactor provides many essential services to the department of Nuclear Engineering and Engineering Physics

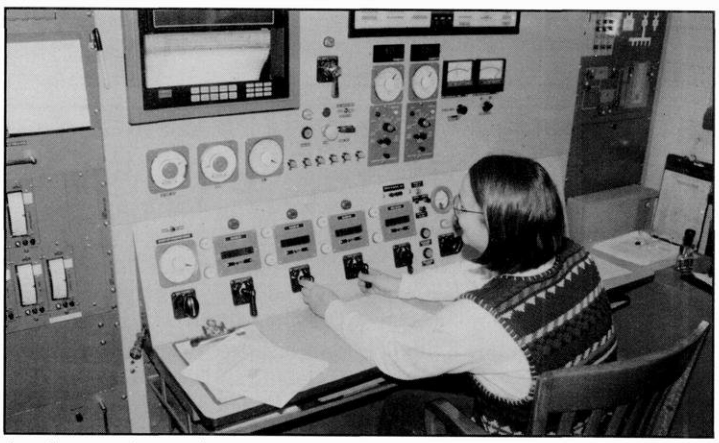
change from 300 watts to 1000 megawatts in a span of microseconds. The reactor immediately shuts itself off at this point, because the neutrons are the reactor to become supercritical and being absorbed by other parts of the fuel besides the uranium-235, and so the nuclear reactions stop. This allows the class to investigate the behavior of the uranium fuel at higher temperatures and energies than normally possible. It also produces a pulse of radiation that can be used in the other experimental facilities in the reactor laboratory. These facilities include: a pneumatic tube to put objects next to the reactor to be irradiated, long tubes called beamports to hold large experiments, and hydraulically powered experimental stations for irradiations.

The fuel that is currently being used has been in place since the late 1970s and could continue to function for another thirty-plus years without any appreciable loss in performance. No high level radioactive waste is produced by the facility, nor is any stored at the site

One of the most frequently asked questions is whether or not the reactor generates radioactive waste. The fuel that is currently being used has been in place since the late 1970s and could continue to function for another thirty-plus years without any appreciable loss in performance. No high level radioactive waste is produced by the facility, nor is any stored at the site.

UWNR is essentially student-run, with faculty supervision. A class is offered every two years in the principles of reactor operations. If a student is successful in the class, he or she is given an opportunity to take the Nuclear Regulatory Commission examination and become a licensed reactor operator. After two years as a reactor operator, the student can try to became a senior reactor operator, and thus be given more responsibilities and duties. Currently, the reactor employs seven students as reactor operators, and two as senior reactor operators. They are supervised by Mr. R.J. Cashwell and Mr. Steve Matusewic. Operators have a variety of tasks which include running the reactor, performing maintenance activities and giving tours to the public.

AUTHOR BIO:
Willie Keller is a very busy senior in Nuclear Engineering. He is also running the UW - Madison's College Bowl Team and is the president of Polygon.



A student operating a nuclear reactor.

Getting Physical: The Physical Plant

One Big Mr. Fixit

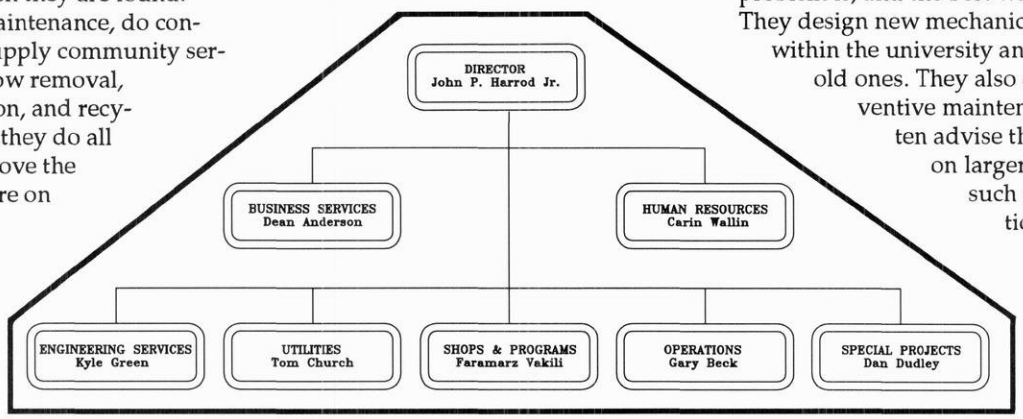
Have you ever been on campus and seen those green or white trucks with the words "Physical Plant" painted on the side? Did you ever stop to wonder what the Physical Plant is? Most people do not realize what the Physical Plant does, and fewer still understand the important role it plays to this university.

"I don't care what it is or what's wrong, there's someone here who can fix it." That is the response of Kevin Corcoran, Steamfitter Supervisor, when asked his opinion of the Physical Plant. It may be a little biased, but overall it is an accurate description. In the simplest terms, the Physical Plant, headed by John P. Harrod, is the division of this university that takes care of all the "physical" facilities of the campus. These facilities include the interior and exterior of all the buildings and the grounds on which they are found. They provide maintenance, do construction, and supply community services such as snow removal, rubbage collection, and recycling. Basically, they do all they can to improve the quality of life here on campus.

Obviously, this is a tremendous task and one that requires a lot of work. Therefore, the Physical Plant is not just some "shoestring operation," but instead is almost a separate entity outside the University. A part of Facilities Planning and Management (FP&M), the Physical Plant employs over 800 people and is divided into five different departments. Each department is responsible for a different aspect of the university, and they often have little to do with one another.

The largest and perhaps most visible of these departments is "Operations." With Gary Beck leading the way, about 500 people make up the operations division. This can further be broken into five different parts with perhaps the most commonly thought of being the Custodial department. Working three shifts, custodians are the unsung heroes that everyday attempt to clean up after 45,000 people. They can be found in every building, and their job is never done. Following these lines, the grounds crew, which is more visible in the summer than the winter, serves a similar purpose, only outside. They care for the lawns, trees, shrubs and sidewalks. During the winter they handle snow removal, and it is their job to make the campus look good. Equipment services handles the repair of any equipment used by the Physical Plant, including all university-owned vehicles and any other special equipment. Another important part of the "Operations" division is campus services. They handle all of the mail, on- or off-campus, provide delivery and pick up of people and equipment, and supply a moving crew for when departments change locations. Lastly, "Operations" is the home for the Pest Control department. Though a vital part of this school, it is one that needs little explanation.

"Shops and Programs" is another department within the Physical Plant. It includes all the skilled and highly trained craftsmen that the Physical Plant employs, such as steamfitters, electricians, masons, and carpenters, to name a few. They are all experts at what they do and each employee is certified by the state. Headed by Faramarz Vakili, they build and fix things that most people would not attempt to do. These people did not just order the Time/Life How-To-Do books, they wrote them. Working closely with the shops, the "Engineering Services" department often designs what the craftsmen do. Led by electrical engineer Kyle Green, it is often left up to the engineers to determine what a certain problem is, and the best way to fix it. They design new mechanical systems within the university and upgrade old ones. They also direct preventive maintenance and often advise the university on larger projects such as construction of new buildings. The last two departments that make up the Physical Plant are "Utilities" and "Special Projects." The Utilities department, headed by Tom Church, manages both power plants here on campus. They handle the steam and chilled water distribution for the campus and are in charge of strategic and long range plans. The Special Projects department is currently working on energy conservation. With mechanical engineer Dan Dudley at the



Breakdown of the University of Wisconsin-Madison Physical Plant.

helm, they attempt to curb energy waste and save money. They look into ways of improving or replacing old systems.

The cost of maintaining an establishment of this size is enormous. One may wonder what kind of budget the Physical Plant has and where the money comes from. To answer these questions one must first think of the university not as a whole, but instead as a group of separate "businesses." With this in mind, a lot of what the Physical Plant does gets "charged out" to the different departments. For example, if the Hygiene department needed air conditioning for a new lab, the Physical Plant would do the work and then charge the Hygiene department for the expenses. This is just like an outside contractor, only the Physical Plant is not out to make a profit. Therefore, their work is better, at a much lower price. But this system has its limitations. The Physical Plant does not have the resources or manpower to do any major construction, such as Grainger Hall. The plant only does construction projects under $30,000. Furthermore, not all things can be charged out. About $23.5 million dollars per year is budgeted from the university for the Physical Plant. Approximately 80 percent of the budget is for salaries and the other 20 percent for the purchasing of supplies. The budget can be further broken down into $8-9 million for general building maintenance, $8-9 million for custodial work, $3 million for the two power plants, $1 million for the grounds, and the rest for administrative needs.

Every employee is a highly skilled expert and together there is nothing they cannot accomplish

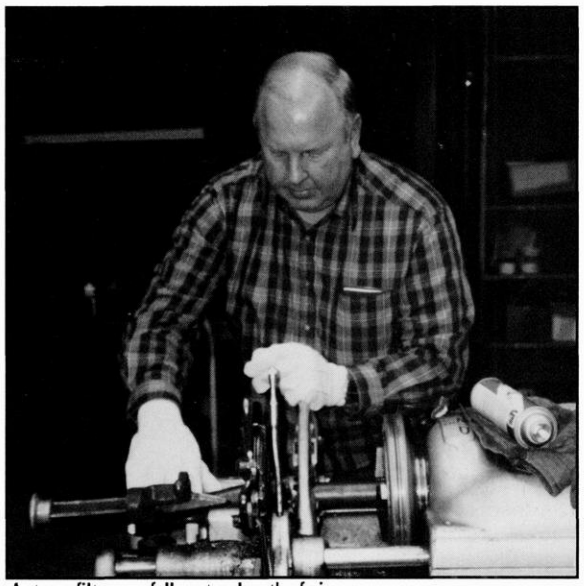


Photo by Shaun Burke

A steam filter carefully cuts a length of pipe.

With that kind of money it would seem that the university should be in beautiful shape. Unfortunately, this is not the case. According to Faramarz Vakili, Assistant to the Director of the Physical Plant, "The university has a big problem with deferred maintenance." It would cost, "in excess of a quarter billion dollars to get it all done." In other words, the Physical Plant cannot fix everything that needs fixing. There is simply too much work to do and not enough people to get it all done. The problem, according to Vakili, is that facilities are getting old and the Physical Plant needs to strike a balance between the customers' needs and the unseen problems. There are problems in places such as the steam tunnels that demand immediate attention, and therefore other problems that are much smaller and not as important must be put off. These small problems add up and create a big problem, deferred maintenance.

Photo by Shaun Burke

For some steam filters, welding is an everyday task.

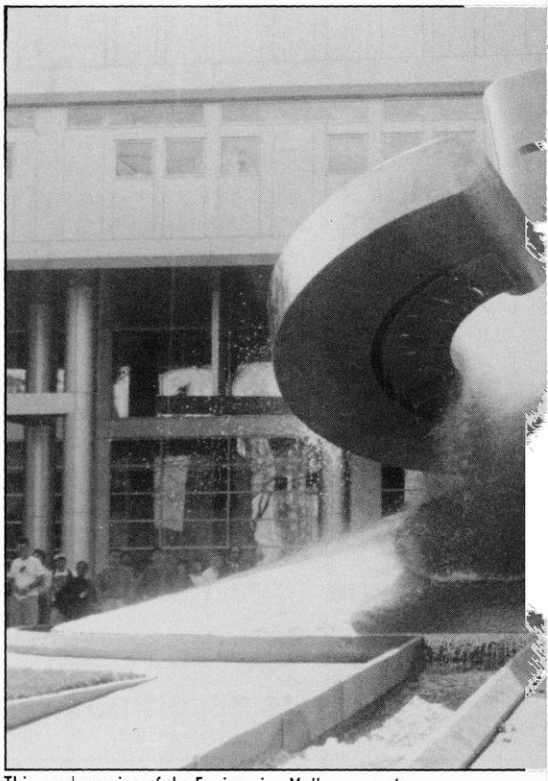
Aside from the problems, there are also many successes. Under the current administration, the Physical Plant is finally implementing computer systems that will integrate all the departments. This will help them to run more smoothly and efficiently. They will have integrated databases and CAD systems. Employees will learn the latest software and have the ability to work in a unified manner. Also, the recently established Concentrated Upgrade and Repair of Buildings project is successfully tackling the problem of deferred maintenance. It combats this problem by concentrating the efforts of a percentage of maintenance personnel to completely repair and upgrade a building. Currently ten buildings have gone through this program and one by one each building is being brought up to "a desired level of utility, efficiency and aesthetics, while maximizing energy conservation, occupants safety and comfort level."

Though far from perfect, the Physical Plant and its employees do the best they can. They work hard and take pride in what they do. In their own right, every employee is a highly skilled expert, and together there is nothing they cannot accomplish. They keep this university running, asking for almost nothing in return. They are the ultimate Mr. Fixit and they deserve all the credit they are given.

Author Bio

Jon Furniss is a mechanical engineering student working on his TCC certificate. He hopes to graduate, someday.

The Descendant's Fountain



This year's version of the Engineering Mall, seen at the dedication ceremony for the Descendant's Fountain.

As the fall semester began, rumors of a fountain were flying around. Following those rumors were leery comments about the space the fountain would take up and the money it would cost. No one was sure of any details, but every student seemed to know that a mysterious fountain was going to be built right in front of Engineering Hall. John Bollinger, Dean of the College of Engineering, helped set the facts straight. In an interview he explained that the fountain, known as the Máquina, would be the main attraction of Engineering Mall. To Bollinger, the mall had been only a vision for quite some time.

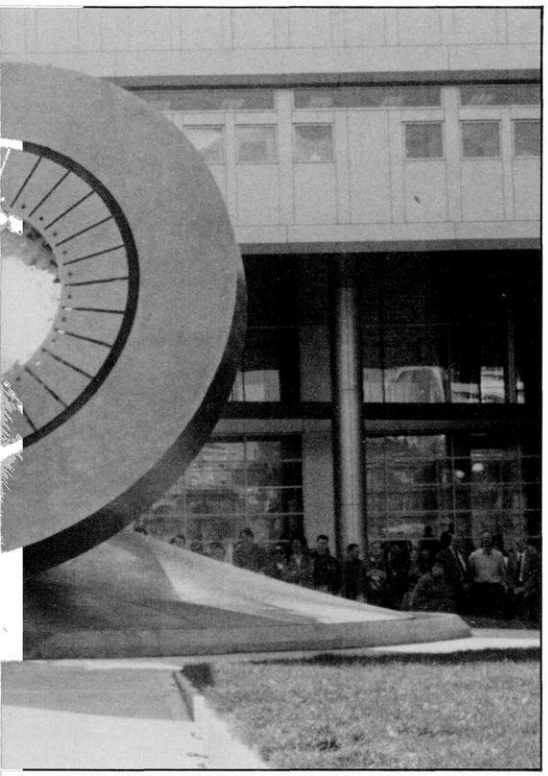
When Bollinger was a student, he and his fellow students petitioned to have a large mountain of coal removed from the engineering campus. He explains that this was the beginning of his vision for an "aesthetically pleasing College of Engineering campus." Now he smiles at the beautiful sight of his vision turned into reality.

The development of this vision was the result of a lot of hard work and a little bit of fate. In the process of calling alumni for donations, UW fundraisers contacted alumnus William Conrad Severson, a sculptor. Instead of offering money, Severson said that he wanted to contribute a piece of art to the University. Severson graduated in 1947 with a Bachelors of Science in Applied Art from UW-Madison and then went on to obtain his Masters of Fine Arts from Syracuse University. His work can be found in 28 states and around the world. Because the character of Severson's art is very technical, a place had to be found where he could "design to fit the environment and the setting of the people and their purpose." So the University contacted a number of people, including Bollinger, with this proposition.

A view of the Engineering Mall last year.

When Bollinger caught word of the artist, he immediately "seized the opportunity." Bollinger contacted Severson with the idea of turning a parking lot into a meaningful part of campus. Severson saw this as a great artistic opportunity. Wasting no time, Severson and Bollinger proceeded to "conceive and formulate the Engineering Mall." They soon generated the idea of a fountain. However, to Bollinger and Severson, a piece of art in itself would not suffice. In order to truly represent the engineering campus, the completed Descendant's Fountain had to be a translation of dynamic forces into a piece of art. Severson opted to include texture and movement in the form of water, compressed air, steam, sound and lights. Severson believes that his design for the Máquina "represents engineering tools and the engineer's role in creative problem solving."

The story, though, does not stop here. According to Bollinger, the Engineering Mall has been created by the alumni for



the students, and thus in some way it must include the students. The underground control lab for this mall is where the students will have the opportunity to participate wholeheartedly.

From the equipment lab, the students will have complete control of the mall. The capabilities include three clusters of nozzles on the Máquina sculpture which can be controlled independently. There are twenty smaller nozzles which can produce intersecting jets of water and compressed air can be introduced into the flow streams to give the water movement. The pool beneath the Máquina contains pool lights which can also be independently controlled. An open channel called a weir connects the Máquina to the reflecting pool. In the weir the flow rate can reach up to 820 gallons per minute. A hydraulic jump can be produced due to the geometry of the transition from the weir into the spillway and then into the reflecting pool.

Above the reflecting pool a 12-inch diameter clear column will rise 22 feet. Water will be pumped through the center of the column and cascade quietly around the sides. Compressed air can be introduced into the flow and a laser light can be controlled to coordinate the different effects of the column. In the winter the column will have the capability of producing enough ice to carve sculptures and may be used by Polygon to start an ice sculpture contest for the students.

Who will get the privilege of running the new Engineering Mall for the first time? The people with the best ideas, of course. A three phase student competition is currently taking place to determine how the fountain will be choreographed for Engineering Exposition 1995. Five student teams competed in **Phase I** which was the **Preliminary Proposal Competition**. In this phase multidisciplinary teams of students came up with a plan for choreography of the mall, which included with the feasibility studies and economic analyses. At the mall's dedication ceremony, the top two teams were given the honor of proceeding to Phase II of the competition. **Phase II** is the **Final Proposal Competition**. At this point the student teams must give a more detailed analysis of their choreographed plan for the mall. The team with the winning proposal will be given the rights to carry out their plan and the budget to fulfill it. Finally, **Phase III**, the **Final Implementation**, will be determined by how much of the actual plan is carried out in time for Engineering Expo. Bollinger hopes that this will be one of the main attractions at EXPO, but that it will not detract from any of the other student projects.

In order to truly represent the engineering campus, the completed Descendant's Fountain had to be a translation of dynamic forces into a piece of art

At 11:00 on the sunny morning of October 21, 1994, the Descendant's Fountain was officially dedicated to the College of Engineering. The dedication ceremony was held on the mall. All students and members of the College of Engineering were invited to attend. As a crowd gathered around the fountain, a number of well known figures spoke. Included in the line up were UW-Madison Chancellor David Ward and businessman David Grainger, who donated a large sum of money to the construction of the fountain. Melanie Vrettas, Chairman of the Polygon Fountain Competition, presented the awards for Phase I of the competition. The ceremony unveiled the fountain and its capabilities, along with two works of art that were donated to the COE. A bronze sculpture adorns the steps of Engineering Hall, while a colorful painting hangs inside.

The new Engineering Mall extends the beauty of Henry Mall and "takes it one step further." According to Bollinger, it also serves as a "learning playground for the students." The mall is a place where people can gather, both young and old.

"The whole mall talks about heritage and bringing art and engineering together," says Bollinger. He further explains that the turning wheel on the front of the fountain is Severson's tribute to his family. Severson donated the sculpture in special memory of his father, Olif Severson, who was the first of his immigrant family to come to the United States and to live in Madison. Severson's donation, along with a lot of other generous donations of time, money and experience from many of the UW-Madison alumni and local companies, have made this fountain possible. The inscription on the pyramid at the north end of the mall says it all: "From the Alumni to the Students."

Author Bio:
Gina Wagner is a senior in mechanical engineering. At the moment she is probably eating croissants while studying abroad for the semester in Nancy, France.

A Virtual Department? The Evolution of Engineering Mechanics

The past four years have been ones of great change within the College of Engineering. Graduation requirements are dropping toward 120 credits, Engineering Hall was redesigned into a state-of-the-art information station, and a $2 million laser-fountain complex has replaced our parking lot. On the surface this growth seems to show that the College of Engineering is prospering and changing for the better, but within the small Department of Engineering Mechanics and Astronautics, some big upcoming changes are being met with mixed emotions.

Engineering Mechanics and Astronautics (EMA) is one of the smaller departments in the college, with just 87 undergraduate students supported by 10 professors. It offers two undergraduate degrees: Engineering Mechanics, and Engineering Mechanics with Astronautics Option. Both degrees provide a strong background in mechanical engineering but add further skills in analysis by incorporating the following topics in their curriculum: finite elements, vibrations, experimental stress and mechanical testing laboratories, and fatigue of materials. The Astronautics Option also gears students toward fields in aerospace and aeronautics through a curriculum that includes aerodynamics, astrodynamics, satellite dynamics and propulsion systems. EMA also teaches many of the basic structural courses of statics, dynamics, and mechanics required by other engineering majors. Graduates from the program are employed in a wide variety of fields, doing work that ranges from aerodynamic car body design and engine analysis to fatigue testing of aging aircraft and space shuttle system controls. Although the EMA Department is not widely known here on campus, it is the largest of its kind in the United States. This status will be changing shortly, however.

Due to downsizing and budget cuts, the EMA Department will see a 40 percent reduction in faculty over the next three years. In fact, the department is already experiencing a shortage of instructors. Retired professors have been returning to teach classes in order to help out the current staff.

This policy cannot continue forever, though. Professor Lovell, chairman of the EMA Department, explains, "Things have just not been completely settled. ... All decisions have not been made." Therefore, the EMA Department will likely cease to exist here at Madison, possibly as early as Fall 1995. The disappearance of the department **does not**, however, mean that the degree is also leaving. The B.S. in EM/EMA will remain an accredited program, so currently enrolled students and entering freshman have **no reason** to panic. Both Geological and Metallurgical Engineering do not have their own separate departments, so Engineering Mechanics is not setting a precedent. The current challenge is to find the best way to deal with the change, and three options are being discussed.

The first of these options — and the easiest to implement quickly — is the creation of a "virtual department." This would put EMA into the same situation with Geological Engineering, which is currently "virtual." Under this idea, the degree and faculty would remain basically intact, but all office support and departmental activities would cease. Many questions are left open under this solution, however, such as how advising and career services would be

YEAR	EMA PROFESSORS	TECHNICIANS	LECTURERS	OFFICE STAFF
1992	15	2	2	3.5
1995	9	1	1.5	2.5 + 1 LTE

Figure 1. Reduction of EMA Staff

handled and how the changes would affect the statics-dynamics-mechanics sequence that is taken college-wide.

Both of the other options now on the table involve merging with existing departments, but in very different ways. One idea is to create a new department, with the title Engineering Sciences, that would offer degrees in Nuclear Engineering and Engineering Physics (NEEP), and Engineering Mechanics. According to Professor Lovell, this option has been entertained "because size is more of a driver than the natural fit of the department, and NEEP is in trouble too." The many differences between EMA and NEEP make this merger very complicated, and it greatly changes the identity of the Engineering Mechanics degree. For example, NEEP students take just four credits of EMA classes. On the other hand, Engineering Mechanics currently shares 60 common required credits with a degree in Mechanical Engineering, and electives make it possible to have as many as 87 common credits. These similarities make a merger with Mechanical Engineering the most logical choice.

With this merger, four future undergraduate degrees would be possible:

- BS in Mechanical Engineering only
- BS in Mechanical Engineering with an Engineering Mechanics Option
- BS in Mechanical Engineering with an Engineering Mechanics and Astronautics Option
- BS in Engineering Mechanics offered simultaneously with a BS in Mechanical Engineering

Although no decisions have been made as to which of these degrees would be offered, tentative plans to create a transition program have been discussed, along with possibilities for new courses, faculty and research.

This option seems to best accommodate the Engineering Mechanics Department, and students are enthusiastic about it. "EMs have had many problems with career placement in the past," said Bob Gustafson, a senior in EMA and president of the University of Wisconsin Chapter of the American Institute of Aeronautics and Astronautics. "Many employers are unfamiliar with our program and the skills that we can offer, so our interview opportunities are limited. An affiliation with the ME Department would certainly help in our job search."

The Engineering Mechanics and Astronautics program offers a unique combination of both design and analysis which can lead to a wide range of career opportunities

No time has yet been set for a decision about these options, but the current EMA Department budget will only last until June 1995. The only decision that has been made is that a change will take place in the near future. Many students have become frustrated about the minimal amount of information available to them regarding the decision. "I believe that the lack of student input in this decision-making process is a bit irresponsible," said Andrew Tillema, a senior in EMA. "We worked very hard to get the Astronautics Option added to our Department, and this decision to now do away with it seems a bit harsh." Other concerns are also being raised over the loss of identity that EMs will have after a merger with another major. The benefits of a smaller department, such as better advising, more personal contact with professors, and knowing the majority of students within the program could be lost. However, the added benefits of career placement and new course opportunities make these changes exciting for many.

No matter what decision is finally made, Engineering Mechanics and Astronautics will remain at Madison long enough so all current and future enrolling students can earn their degrees. New students should in no way turn away from the degree because of the changes; instead they should seriously consider it. The Engineering Mechanics and Astronautics program offers a unique combination of both design and analysis which can lead to a wide range of career opportunities. For more information about the EMA program, stop by the EMA office in Room 2348 Engineering Hall.

Author Bio:

Marty Plein is a senior graduating in Engineering Mechanics this May.

EDITORIAL from page 2

universe and do society some good in the process! "Maybe being an engineer is not so bad after all," I realized.

"I'm OK, you're OK."

So I gradually accepted my engineering nature. And now I offer a challenge to all the other "closet engineers" hiding out in libraries or behind computers around campus. Stand up! Put on your pocket protector, grab your graphing calculator and shout, "Hey, Madison! I'm an engineer and that's alright with me!"

by: Jason Och, editor

Shop Talk

Electronics Shop offers engineering students hands-on experience in electronic design and repair

You can see it in your mind's eye: the ultimate stereo amplifier — something like 500 watts. You have taken the basic electrical engineering courses here at the UW and you know how to design the amp. Only one problem remains. You do not know one end of a soldering iron from the other. What can you do? Where can you go for help?

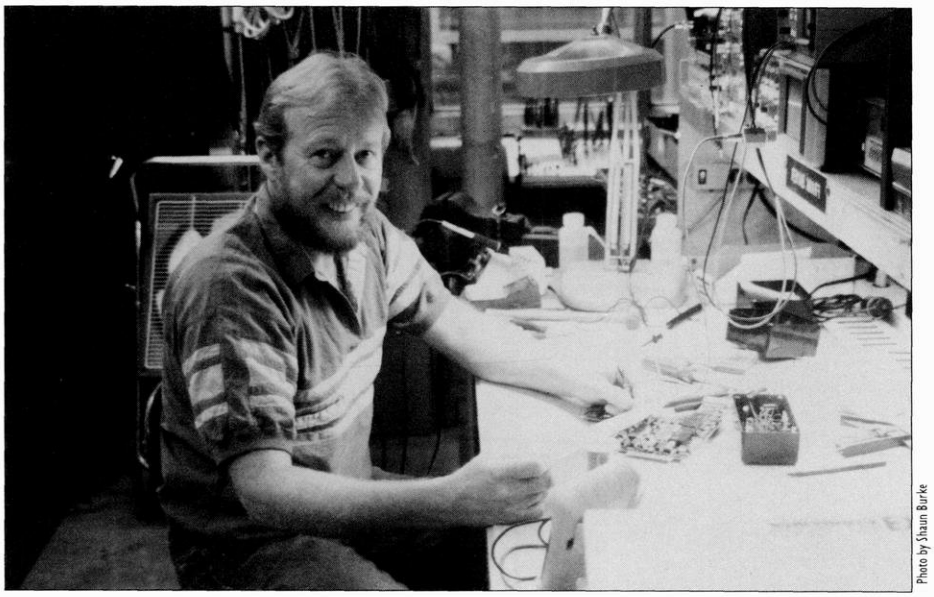


Photo by Shaun Burke

Need a helping hand? Frank Bayer, electronics technician at the UW-Madison Electronic Repair Shop, finds time to help ECE students when he is not designing or repairing lab equipment.

Frank Bayer, electronics technician at the UW-Madison ECE Electronic Repair Shop, may be just the person you need to see. Bayer's shop, on the first floor in the west wing of Engineering Hall, receives all the tortured lab equipment from ECE undergraduate, graduate and research labs. Next door is the Student Electronics Shop, which Bayer oversees. Open to all ECE students, staff, and faculty, the Student Shop is available for use on electronic lab design work, EXPO projects, even home projects like your ultimate stereo amplifier.

Bayer came to the ECE Department in July 1992. He started out in electronics in 1968 as a microwave radio equipment repairman in Vietnam. He later worked at IBM and eventually joined the UW's Biotron project as an electronics technician. Bayer helped maintain the environmentally controlled research rooms and chambers at the Biotron facility. After leaving the Biotron, Bayer took over the ECE Repair Shop. As soon as he stepped in, Bayer reorganized the Repair Shop to make it more efficient. He rearranged the Student Shop, separating it from the Student Mechanical Shop in the basement of Engineering Hall, and added a network connection to CAE.

Bayer repairs and calibrates the instructional and research equipment used in ECE labs. His repairs — often done on extremely complex equipment without the aid of a schematic diagram — save the ECE department a lot of money. For example, an oscilloscope probe alone may cost as much as $200 to replace. He also designs, develops and builds prototype boxes for student labs. These "black boxes" allow students to observe the effects of various circuits without having to spend time wiring those circuits.

Bayer enlists the help of several ECE student hourlies. These students assist Bayer in calibration and repair work. "We've prototyped a lot of the boxes that

Photo by Shaun Burke

Frank Bayer, electronics technician at the UW-Madison Electronic Repair Shop, looks on as student hourlies Ron Anderson (left) and Rudy Moore (right) perform final testing on their EXPO '95 project, a microprocessor-controlled milling machine.

are in the ECE labs that students use for experimental work," says Rudy Moore, an hourly at the Student Shop. When they have finished their calibration and repairs, the hourlies work on their Expo project, a microprocessor-controlled milling machine (see photo).

"The Shop can give you practical experience that you might not necessarily get in the ECE classes," comments Moore. "Combining working in the shop, taking a class like [ECE] 453 or 468 ... You gain a lot of practical experience."

Although his repair work keeps him very busy, Bayer finds time to help out students who come to the Shop. He explains that students sometimes come into the Shop without much practical experience in building and troubleshooting circuits. "You don't learn all that on day one either," he adds. "You pick that up over the years. That's what I'm here for, that's why we have the Student Shop — to get people in here and give them some hands-on experience."

Bayer hopes that the many resources of the Shop will attract more students. He points out that the Shop has wire wrap tools, soldering irons, power supplies, signal generators and oscilloscopes. Furthermore, he and the student hourlies are there to help out. "My door is open to students who need advice," Bayer offers.

Author Bio:
Jason Och is a junior in Electrical and Computer Engineering. He confesses, however, that he has yet to get his guitar amplifier working. His roommates are indeed thankful.

FACULTY from page 3

It turns out that the Egyptian born Seireg graduated from the Cairo University Royal School of Engineering at a time when it was legal to practice medicine without a license, but not engineering. He expounded, "Engineers are taught that they are leaders, planners, thinkers. I'm biased to mechanical engineering," he interjected, "because it covers everything." He explained that the prime ministers of Egypt have historically been engineers. To Seireg, "Engineering is not just number crunching ... it's a mixture of art, science and business." Such a statement sounds very believable coming from a man whose ancestors designed the great pyramids.

Seireg had wanted to be an engineer ever since he was four years old. After receiving his undergraduate degree, he stayed at the University of Cairo to teach for two years before coming to Madison to work on his doctorate. He picked Madison because of an article in Life magazine which showed a warm, friendly city with abundant greenery and numerous lakes. The pictures did not quite match up with reality, however. As he stepped off the train on the last day of January, the thermometer was pegged at 37 degrees below zero. Seireg was not deterred, though. He made it through the winters to finish his doctorate.

After receiving his Ph.D. in Mechanical Engineering, he returned to Cairo University to lecture for two years. He then returned to the United States to teach at Marquette University. After five years at Marquette, Seireg was

Offered an opportunity to teach at Madison, where he has been since 1965. Mostly at Madison, that is. His resume mentions the University of Florida, so I ask him about the details. "Well," he explained with a huge grin, "they asked me if I wanted to come down there and teach during the winters." So for ten years Seireg has been heading down to Florida for the winter while the rest of us stay here and freeze. He is fortunate to be tenured at both universities.

see FACULTY page 19

Time Management Masters

You finally arrive home after a long, stressful day- a few lectures, a meeting with a TA and a three hour physics lab. As dinner is in the workings you know that the worst is yet to come: all the homework. A disgruntled sigh escapes your lips after glancing down at your Bucky Book and discovering that there is a problem set due tomorrow that you completely forgot about. Will all the work ever end?

This scenario depicts a common day in the life of a busy engineering student. One must hold a certain amount of respect for the engineering student who adds the commitment and stress of participating on one of the UW athletic teams to an already hectic lifestyle. There are over 60 UW athletes who are also pursuing a career in engineering. They participate in a variety of sports ranging from football to golf and they are majoring in all fields of engineering.

Cameron Loos swims breaststroke and the individual medley for Wisconsin while he pursues his civil engineering degree. Heather Maclean, a nuclear engineering student, is the cockxswain for the women's crew team. Cheryl Torrence, a freshman starting the engineering program, runs track and cross country. John Hockers is a nuclear engineering student who also rows for the men's crew team. If that is not enough, John is also a housefellow in the lakeshore dorms.

These athletes spend about 20 hours a week in practice alone. This does not include travel or competition time. Naturally, they all carry a full load of credits. How do they do it? They are experts in time management. John said the first thing that he did was invest in a huge planner. "Practice is always at the same time, so you learn to work around it," says Heather. She does admit, however, that she is lucky to have a class schedule that leaves her with substantial blocks of studying time. Cameron admits that it took him two years to be able to manage his time effectively. "I look at my planner and see what is due a week in advance. I don't leave anything to the last minute anymore because you never know what will come up," says Cameron. However, when all the planning alone doesn't cut it, the athletes find other ways to get everything done. John says "In a pinch, sleep is the first thing to go. " In fact, that was a fairly unanimous feeling.

Another feeling shared by the athletes is that their education is their top priority. In fact, at one point or another, each of them has considered giving up their sport for their education. However, they believe that training motivates them to do better. "I do better when I'm so busy; it keeps me in line," explains Cameron.

With all the schoolwork and practice, these students are left limited time for social activities. This, however, does not bother them because their sport is too important to them. "I miss my social life a little, but I care about swimming. My coach says that between a social life, school and swimming, you can only do two successfully, and he's right," says Cameron. For Heather, the time crunch affects her in other ways. "One of the harder aspects of being so busy is that I

am never able to go home."

Each athlete has a unique story behind how they got involved in UW sports as well as the field of engineering. Heather knew in high school that she wanted to major in a science field. Engineering made science more applicable. She narrowed the choice to nuclear engineering because she sees it as a combination of the principals of a number of engineering fields, and she liked the fact that nuclear engineering is a small department. She got involved in crew after seeing a pamphlet at SOAR. Crew appealed to her because it was on the water, and it was a way she could meet people and stay active. Now it keeps her interest because she enjoys what she is doing. "It is challenging trying to motivate eight people to work together, but it is worth every minute involved."

There are over 60 UW athletes who are also pursuing a career in engineering

Cameron knew in High School that engineering was the career for him. He also started swimming in High School.

John also started out in the sciences. It was when he attended the Engineering EXPO that he was "sucked in." Engineering appealed to him because it gave him an actual reason to know calculus. John was approached by the crew coach at SOAR. He did not consider joining crew at first because he did not even know what crew was. When he came back for classes in August, he was called by the freshman crew coach. He was fairly indifferent about the whole situation, but decided to try it. After awhile he" just got hooked."

Cheryl wants to correlate both engineering and business. She has been running since fourth grade. She was simply following in the footsteps of her brother, who was active in a group called the Milwaukee Striders. Eventually, Cheryl would like to compete internationally. Being a Freshman, Cheryl realizes that it will get harder to manage time when her classes get harder. However she feels that she is "prepared for the challenge."

Each of these athletes feel that the benefits of participating in their sport far outweigh the hardships involved. "Rowing may be trying at times, but it gives me a huge sense of accomplishment," says Heather. Another benefit mentioned was the traveling involved. The men's swim team, for instance, has its intense training in Hawaii. Being involved in such a time consuming extracurricular activity is also a great plus when interviewing for jobs. The most important advantage of all is the strong friendships created while on the team. "We are all one big family," says Heather.

Author Bio:
Emily Erickson is pursuing a journalism degree with a major in Public Relations and Advertising with an emphasis in Marketing. She will be testing out of her marketing management skills next semester when she coops at a computer firm in Egypt.

FACULTY from page 17

"Do you have a secret for success?" I asked.

Dr. Seireg smiles and adjusts his grip of his coffee mug. "I just work and don't worry about success. I think beyond what I see, I look beyond what I hear and investigate. I always try to give more than I receive and do good as it's own reward. I just like to help students. I keep the door open, anyone can come in and I'll give them the same respect whether it's a freshman, a grad student, or a professor. Availability is the big thing."

I nod my head, knowing from personal experience that he will take time to help a struggling student who walks into his office.

"One last question," I assure Dr. Seireg. "What makes a successful engineer in your eyes?"

He thinks for a minute then responds, "It [engineering] is a natural talent. Most engineers are calculators, not engineers. You've got to be an innovator. Engineering is not just solving equations."

Seireg continues, "You've got to be proactive, not reactive. Be visible, tell people what you've done. You don't have to be famous, just do something useful. Put your sights high and don't be bashful. You have excellent people here at the university; use them."

He goes on, giving advice faster than I can hope to write it down. That is how Dr. Seireg is, filled with more ideas and knowledge than any normal individual

Author Bio:
R.J. Elsing is trying to patiently await May graduation and the outrageously exciting, unbelievable high paying job that will fall into his lap.

Resumes, Quick and Easy?

If you are reading this article with the intention of writing a resume soon, the first thing you should do is stop reading and make your way to the Engineering Career Services (ECS) center located in 1150 Engineering Hall. There you will find an entire organization devoted to helping you, the UW engineer, make a quality resume and land that elusive first job. Ask for the resume writing packet and check out any of the many books written on the subject, such as *Resumes for Engineering Careers*.

The sole purpose of a resume is to obtain a personal interview

There, now that you are back we will go through the basics of writing a good resume. The first thing you should know, and will see in any guide on the subject, is that *the sole purpose of a resume is to obtain a personal interview*. Your resume will not win you any jobs outright; that is up to you once it has performed its purpose. Your resume should emphasize what you believe are your strongest characteristics. These should be easily recognized by someone scanning it. It is a well known fact that potential employers will scan each resume for only 20-30 seconds, sometimes even less. Thus, your resume has about half a minute to convince a recruiter that you are worth interviewing. Finally, your resume must be grammatically correct and contain no spelling or typographic mistakes.

If you are making your first resume, there are a few things you can do in preparation to make it easier. First, write down every job, co-op, internship, summer job, work-study job, and any other form of employment you have ever experienced. Next, write down your educational history and degrees received. Once you have obtained a university degree, leave off all those accomplishments from high school because no one cares anymore. Finally, write down all the clubs, organizations and sports that you have participated in at the university level. Also include any special abilities or accomplishments you may possess, such as being a concert pianist.

As an engineering graduate, your major accomplishment to date is your engineering degree. List that first and only include your grade point if it is high, around a 3.0 or so. Now go on and list your work experiences along with a short, concise explanation of the work performed for each entry. List education and work experience in reverse chronological order beginning with the most recent experience. This type of resume is called a chronological resume and is generally the best choice for recent engineering graduates. The other general resume format is a **functional** resume. This type groups work and educational experiences into types or responsibilities.

If you do not have work experience yet, then list and describe any major engineering projects you have worked on as an undergraduate. These can be experiences from labs or classes. Also describe the task you performed and how you worked in a group or by yourself to produce the finished product. It is advisable to obtain some work experience in engineering before finishing your undergraduate career.

If you have been following along, you have now assembled all of the information on yourself and are ready to begin a rough draft of your resume. At first, do not worry about the length of your resume, but include all the items you

JOHN L. DOE
1318 St. James Ct.
Madison, WI 53715
(608) 251-5703

Education

UNIVERSITY OF WISCONSIN-MADISON
Master of Science in Nuclear Engineering and Engineering Physics May 1994
GPA: 3.4 on 4.0 scale

WASHINGTON UNIVERSITY IN ST. LOUIS
Bachelor of Science in Electrical Engineering May 1992
Minor in Chinese
GPA: 3.6 on 4.0 scale

BEIJING FOREIGN LANGUAGE NORMAL COLLEGE
Language study in Beijing, China Summer 1991

Work Experience

RESEARCH ASSISTANT Fall 1992-Present
University of Wisconsin-Madison
- Researched and developed a library of Deuterium-^{3}Helium fusion related journal articles. Located over 800 articles and created a computer database system for easy recovery of articles on particular topics. Major author on report "Fifty Years Research in Helium-3 Fusion and Helium-3 Resources."
- Performed CAD modeling of advanced fusion reactor design.

ENGINEERING RESEARCH INTERN Summer 1994
University of Tokyo Nuclear Engineering Laboratory in Japan
- Wrote a Fortran computer code using the finite element method to model eddy current induced heat transfer in fusion reactor first walls and new materials.

ENGINEERING INTERN Summer 1992
Wisconsin Power & Light, Integrated Electric Planning Dept.
- Performed an engineering and economic analysis of cogeneration power production. Wrote a Microsoft Excel Macro to evaluate the economics of cogeneration versus the entire Wisconsin Power & Light production system.

COMPUTER OPERATOR, WORK STUDY 1988-1992
Washington University in St. Louis
- Oversaw a data output facility.

Additional Information

- Highly knowledgeable of C, Fortran, Pascal, Excel, Lotus, and CAD.
- Proficiency in Unix, Macintosh, DOS, and Windows operating systems.
- Conversant in Chinese and moderate knowledge of French and Spanish.
- Member UW Curling Club since 1992. Vice-President in 1993, Treasurer 1994.
- Head Girls Soccer Coach, 1992-94.
- Member Tau Beta Pi since 1991.
- Member Eta Kappa Nu since 1990. Vice-President from 1991-1992.
- Annual Scholarship from Washington University in St. Louis, 1988-1992.
- Enjoy travel, soccer, windsurfing, curling, and biking.

Sample resume 1.

Jane L. Doe

1010 W. Johnson #2
Madison, WI 53711
(608) 255-5050

5454 Wydown Blvd.
St. Louis, MO 63130
(314) 868-2340

Career Goal: A challenging and intellectually satisfying position in automotive design or manufacture. Interest in low emission engines.

EDUCATION

University of Wisconsin-Madison
B.S. in Mechanical Engineering, May 1995
GPA: 3.2/4.0

Design Projects

- *Hybrid Gas/Electric Engine:* Computer design and analysis of a hybrid engine concept for a low emission automobile. Determination of most efficient mix of gas and electric power for varying driving conditions.
- *Natural Light Pipe:* Designed and built a natural light pipe to bring daylighting into offices or homes to promote better working conditions.

WORK EXPERIENCE

Engineering Co-op
General Motors, Inc., Detroit, MI, 1/93 - 5/93
- Designed and manufactured prototype catalytic converter for new model automobile.

Work Study Librarian
University of Wisconsin-Madison, 9/91-Present
- Staffed the circulation desk at Wendt Engineering Library.

HONORS / AWARDS

- University of Wisconsin Academic Scholarship, 1991-95
- Dean's List, 5 semesters
- President, Society of Automotive Engineers, 1994
- First Prize, Engineering Literature Contest, 1993

ACTIVITIES / INTERESTS

University of Wisconsin Baseball Team, 4 years
Society of Hispanic Engineers, Polygon
Basketball, weaving, fishing

Sample resume 2.

have listed about yourself. This exercise is purely for you to transfer your knowledge of yourself onto paper. Give a description of what you *accomplished* in your previous employment rather than what your job title and responsibilities were. Recruiters want to see someone who gets the job done and is not worried about titles. Write everything you can think of into this draft and then show it to friends and colleagues who can help you identify your strengths and may remind you of things you left off.

As an undergraduate, you must keep your resume under one page

Now that you have all your major accomplishments and strengths listed, you have to choose what will be on your final resume. As an undergraduate, you *must* keep your resume under one page. The only exception to this would be if you somehow managed twelve engineering internships, were president of five clubs, and lettered in three sports. However, figure out how to include all *relevant* information onto that page.

Format your resume so it is aesthetically pleasing as well as functional, highlighting your strongest characteristics. Look at the sample resumes that follow and try and observe what qualities or experiences you see first on the resume. These are the first things the recruiters see as well, and they catch that person's eye and motivate them to learn more about you.

Separate your resume into sections. Education and work experience will be on all engineers' resumes. Add additional sections depending on your unique qualifications. List your skills, honors, awards and activities, in either separate sections or one combined section. Use bullets (•) to emphasize exceptional points. Do not overuse though. Finally, it is assumed today that references are available upon request, so leave this off your resume.

Once you reduce your resume to one page and format it in the style you prefer, have it read by as many people as possible. The ECS office has a resume review service where a qualified staff member will read your resume and make suggestions on how to improve it. This will give you professional feedback on your resume.

The appearance of your resume is an important factor and reflects on you personally. Make *certain* that there are no spelling or grammar mistakes. Laser print (obviously) your final copy on good bond paper of white or off-white color. Then have it professionally reproduced or laser print it yourself.

Remember, your resume is never finished. It is an evolving document that grows as you grow. In the future you may decide to cut parts out of your resume as you add new portions. Depending on the job you are applying for you may want to include a statement of purpose. Or, you may rearrange your resume to best suit it towards a new career direction. It is a good idea to keep track of which resume is sent to which company. A work notebook is helpful for this purpose and to keep track of where, when and with whom you have interviewed.

Good luck!

Author bio:
Joel Crabb recently finished a master's degree in Nuclear Engineering. He spent last summer in Japan traveling and doing research at the University of Tokyo. This summer he plans to bicycle across the United States.

Cooperative Education:

A Glimpse into the Real World of Engineering

While venturing through Engineering Hall during the first half of every semester, one is sure to find a number of engineering students decked out in their best formal suits, sitting nervously on the couches before the interview rooms. Anxiously they wait for someone to come out of one of the tiny rooms and call their name. For many of those dressed-up students, within the interview rooms lies the chance at a full-time job after graduation. When beginning to interview, many wonder what separates the multitudes of graduating engineering students from one another. Anyone in the field will point out that extracurricular activities help, as do leadership positions. But according to an overwhelming number of graduating students and faculty advisors, work experience tops the list of criteria that employers prefer.

According to an overwhelming number of graduating students and faculty advisors, work experience tops the list of criteria that employers prefer

So how does one go about getting engineering job experience while in college? At the UW-Madison College of Engineering, the answer is simple: the Co-op program. The Cooperative Education program at the COE provides engineering students with the opportunity to work as co-ops or interns during their undergraduate college careers. An engineering co-op works for a number of semesters, ranging from one to four, interspersed with semesters of attending school. An intern, on the other hand, works only during the summer.

Ruth Janto-Walter (left) and Marion Beachley.

THE PROCESS

The process of applying for a co-op or intern position is very user-friendly. Marion Beachley, director of the Co-op program, explains that any qualified engineering student can walk into the Co-op Office, located on the first floor of Engineering Hall, and purchase a resume disk. The disk contains a handy software program that guides the user, step by step, through the process of constructing a resume. Once the student has produced such a resume, he or she returns it to the Co-op Office, and thus becomes an official co-op candidate. Then the industrious people at the Co-op office do the legwork for the students.

Engineering students who have co-oped or interned have a competitive edge over others in the job market

Once a student is registered with the office, her or his resume is entered into a database along with the resumes of all co-op candidates. Beachley downloads up to 500 resumes at a time onto disks which she sends to all companies that participate in the co-op program. Recruiters can sort the resumes by major, and select up to six students as "pre-selects," for whom they reserve interview slots when they come to campus.

Those who do not get pre-selected still have a fair shot at all of the available co-op positions. Several days before a company comes to campus, the Co-op Office puts an interview sign-up folder outside the office. Interested students can sign up on a first-come first-serve basis. The folders are brought out around 8:00 a.m., but lines to sign up begin to form as early as 5:00 a.m. since everyone wants to get one of the remaining interview slots.

Once students get interview slots, the rest is in their hands. On the prescribed day of their interview they too will be found in their interview duds, sitting anxiously on those couches right along with the graduating engineers, waiting for the chance to impress a potential employer.

THE ADVANTAGES

The advantages of co-oping are numerous, as anyone associated with the program will profess. The first is certainly that engineering students who have co-oped or interned have a

Engineering Coops: A Personal View

For Gina Wagner, a senior in Mechanical Engineering, the internship adventure began in the spring of 1994, when a representative from John Deere called her for a phone interview. The company had received her credentials from the database of the Co-op Office. The credentials, which already included three co-op terms with James River Corporation, were quite impressive. Though the idea of a phone interview was rather surprising to her, Wagner answered the questions quite well. She was asked very general questions about who she is and what she is involved in.

"The questions were so general," Wagner comments, "that I did not realize that it was an interview until it was done."

The success of this preliminary interview was evident when the company called her several weeks later to invite her for a second interview at their Harvester Works Product Development plant in Silvis, Illinois. The truly challenging part of the interview process was about to begin.

When Wagner arrived in Silvis she was greeted by the director of personnel. They spent the first hour of the day in a somewhat informal discussion in which she got to ask him questions about John Deere. "This part of the day put me more at ease," Wagner says, "since I got to ask the questions."

Then Wagner went to her first official interview of the day. She spent an hour speaking with the manager of the Seeder Test Division, who questioned her about her academic pursuits. He asked questions regarding the aspects of classwork that she enjoys and what parts of it bring her satisfaction. After the interview a John Deere retiree took her on a tour of the Seeder factory. She saw various kinds of planters, all of which were built at the plant. Though the conversation during the tour was informal, Wagner realized that she was being evaluated during every part of the day.

Her next activity was a second hour-long interview, this time with an engineering team leader, who questioned her on her extracurricular involvement and activities. This interview was followed by one more tour and a third and final interview. The last interview, which focused on Wagner's teamwork and supervisory skills, was conducted by her future team leader.

After a grueling first half of the day, lunch time finally came. A young female engineer treated Wagner to lunch at a nearby restaurant. Again, conversation was casual. "This part of the day felt really informal to me. It was a time to relax," says Wagner.

The second half of the day proved to be the most intense part. To test her problem solving and communication abilities, the company gave Wagner a case study. She had two hours in which to familiarize herself with a fictional situation and respond in writing to the problems that it involved. She was to play the role of a manager of a group of team leaders, who was about to leave town for a week. She was given about 25 memos from different people in her team who brought up issues and problems that had come up. Before leaving town, she as the manager had to answer each memo in writing, explaining how she wanted the problems to be handled.

"The exercise was really intense. After spending fifteen minutes reading all of the material, I wrote without stopping for the remainder of the two hours," Wagner explains. She points out that the case study was a way for the company to learn how she would perform in a real engineering situation.

Then at last the day was over. After such a long and thorough interview process, Wagner felt that "they definitely found out who I am because they questioned every part of my personality and involvement."

A number of weeks later John Deere offered Wagner a summer internship. She spent the summer in the test labs, working on liquid fertilizer systems for one of the current John Deere planters. The company liked her work so much that at the end of the summer she was guaranteed a full time job upon graduation.

After having worked at the John Deere Harvester Product Development plant, Wagner reflects on the experience: "I loved it! I would certainly consider a full time job with John Deere. The work and the people made it a fantastic experience!"

competitive edge over others in the job market. Students who co-op also reap financial rewards. During their terms, co-ops earn approximately three-fourths of the salary of an entry-level engineer. For such "starving college students" as us, this is a substantial amount of money. Most of all, the experience gives engineering students a chance to find out what working in engineering is really like. Having that kind of knowledge becomes a tremendous benefit when a student must decide what area of engineering to enter upon graduation.

NEW DEVELOPMENTS IN THE CO-OP PROGRAM

While keeping the Co-op program thriving it its present form, Marion Beachley and Ruth Janto-Wolter, Assistant Director of the Co-op program, are continually looking for ways to expand the opportunities that the program offers. One of their latest pursuits is implementing a software package called Jobline. The software, created by Academic Software Co., is a listing of all current co-op and intern opportunities available to all majors. It will be on-line at the CAE. Students will be able to log into the program and check the latest job news.

The experience gives engineering students a chance to find out what working in engineering is really like

"I hope that we will have more action from students in getting jobs on their own," says Beachley in regards to the Jobline software.

To keep students well informed, Beachley has started to send e-mail to all co-op candidates about current openings on interview schedules, as well as other opportunities that arise once campus interviews are over.

On top of it all, Beachley and Janto-Wolter often travel to companies that do not recruit co-ops from UW-Madison to convince them to do so. In this way the list of co-op and internship opportunities for engineering students keeps growing.

* * * *

So what are you waiting for? Go out and find yourself a Co-op!!

Author Bio:

Svetlana (Liz) Zilist is a senior in Mechanical Engineering. At the moment she is probably trying to understand an engineering lecture in Spanish as she spends the semester in Madrid, Spain.

Dave Clark, a senior in Mechanical Engineering, began his co-op search in the fall of 1993. After numerous interviews, Clark received three offers. He examined his options and chose to work at Burgess-Norton, a manufacturing company in Illinois. In explaining his choice, Clark says, "I took the job there rather than the other options because it would give me the broadest range of experience."

Burgess-Norton is a manufacturing corporation with a number of plants around the state of Illinois. Clark co-oped at their powder metal facility. Powder metal manufacturing is a process which uses high tonnage presses to compress powdered metal into nearly finished parts. "Any complex metal part that could otherwise be manufactured by casting or machining can be made by the powder metal method, often for less cost," Clark explains.

Clark spent the first month of his co-op in training. He was given the unique opportunity to work each type of machine on the shop floor for at least a day. By getting his hands dirty on the presses, lathes, grinders and similar equipment, Clark got a feel for how each machine functions.

After obtaining an understanding of shop floor machinery, Clark stepped into the Manufacturing Engineering Department. Immediately he was given a rather large list of projects to embark upon. The projects ranged from leadership activities to design. One such assignment that Clark remembers as quite a challenge was leading a Tool Control team.

"I was working with a nine person cross-funtional team, which I was to facilitate," recalls Clark. "Our job was to come up with a procedure for inventory tracking in the plant." The team met twice a week for the eight months that Clark was there, and has continued meeting since. For Clark, playing the role of a team facilitator was an extremely educational experience. It taught him to cooperate with his co-workers and encourage a positive attitude. When group members became skeptical about particular ideas, Clark often resorted to a well known phrase of encouragement: "Just because the people who tried it last time could not make it work does not mean that we can't make it work." This proved to be a successful counter to common cynicism. By the end of Clark's term the group developed a system of keeping careful files on all purchased equipment and updating them as new equipment was obtained. They presented their idea to a board of managers, who heartily applauded the project.

The most valuable aspect of the experience was finding out how things work in industry, because it is so vastly different than here at school

When looking back on his co-op, Clark says that the most valuable aspect of the experience was "finding out how things work in industry, because it is so vastly different than here at school."

Clark plans to return to Burgess-Norton in the spring to work in a piston pin manufacturing plant.

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