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December 1991

wisconsin engineer MAGAZINE

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High Speed Trains

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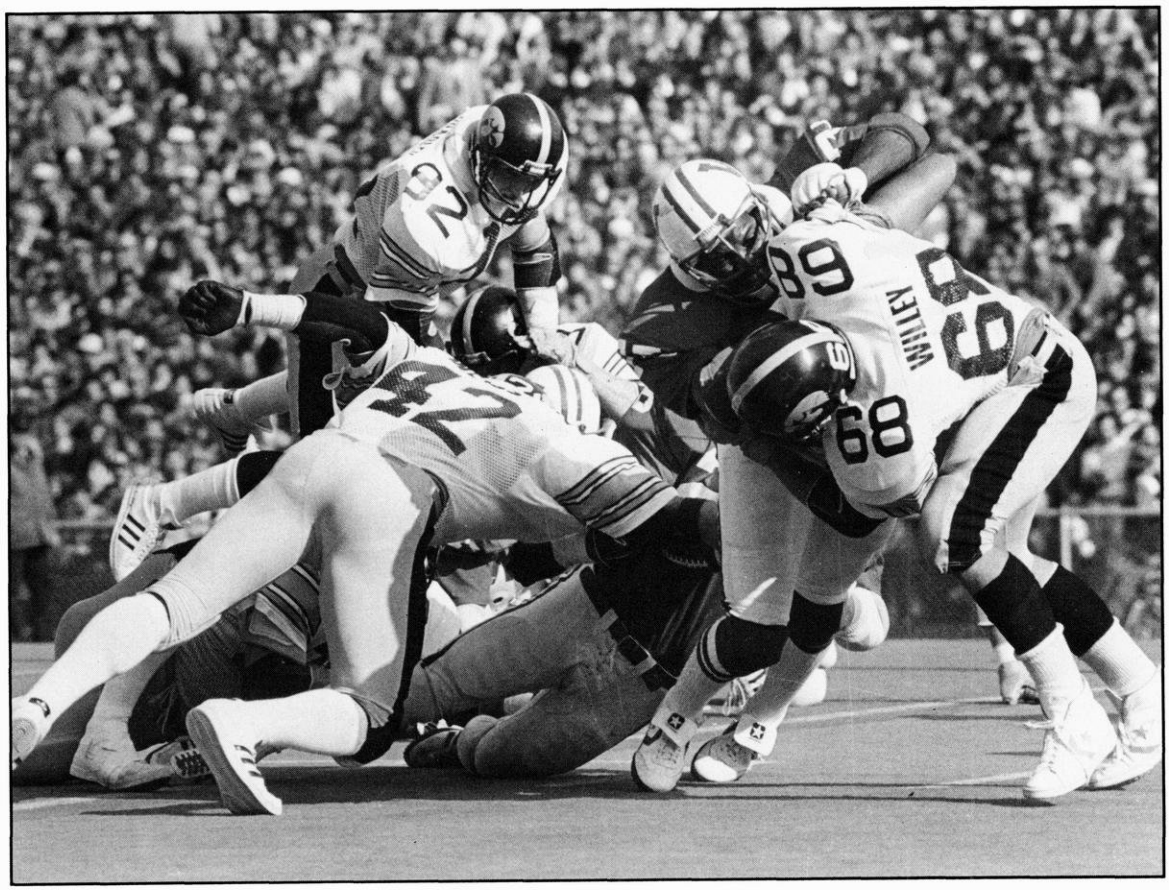

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wisconsin engineer

Published by the Students of the University of Wisconsin–Madison, December 1991

Cover
Disneyworld, the product of "imagineering," in Orlando, Florida. Photo by Cynthia Chang-Yit.

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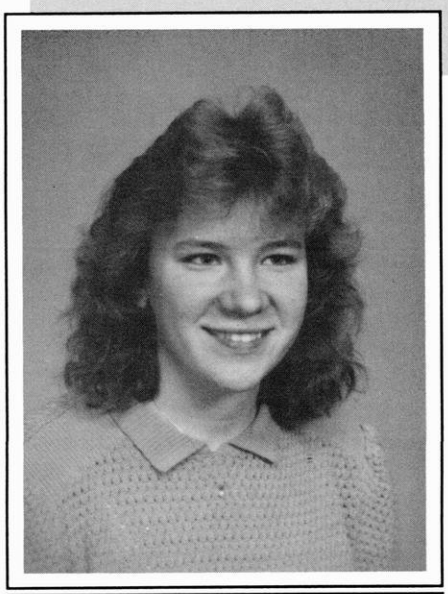
Benefits of Graduate School



Nancy Hromadka, co-editor

In May of 1991, of the 282 seniors registered with the UW-Madison College of Engineering Career Planning and Placement Office, only ten percent planned to pursue a graduate degree. This ratio has been the general trend for engineers at Madison for the past two years, with the percentage ranging between nine and 13 percent.

With similar results in many universities across the country, the National Science Foundation predicts a shortage of Ph.D. level scientists and engineers as the year 2000 approaches, and thus, a supply of researchers that will be unable to meet the expected demand.

But why are the numbers so low? In many cases, engineering students spend well over the traditional four years simply earning their bachelor's degrees. By the time they have completed that curriculum, they are ready to be finished with school and to begin earning money in the work place. However, another equally common reason for choosing not to go is simply never considering it. Studies have shown that students who come from families where one or both parents have earned advanced degrees are more likely to pursue the higher degree than those who do not. Unless students have been encouraged by an influential person in their lives, such as a parent, friend or professor, they do not even view graduate school as an option. Also, many students without this background often lack an understanding of what graduate school involves and what benefits it can provide.

Although several factors, with economic ones often being the most dominant, influence a student's decision to attend graduate school, there are other factors to consider. The following provides a brief glimpse of what benefits are available for an engineer with an additional degree.

Although salary differences are a quantitative measure of the worth of graduate school, a survey conducted by the *Engineering Education* magazine of college seniors and full-time graduate students revealed that students pursuing advanced degrees choose to do so because they are truly interested in learning more about their particular field of study. Higher salaries and plans to work someday as a professor are important, but the most dominant motivation lies in the simple fact that they enjoyed learning similar subject matter in their undergraduate curricula.

The economic drive to pursue an advanced degree is substantial. According to data collected by the CPC Salary Survey of September 1991, engineers starting with a master's degree earned on average 13 percent more per year than those engineers with just a bachelor's degree. Salaries increased by about $18,000 a year from a bachelor's degree to a doctorate degree.

Some people argue that the increased salary may take a number of years to pay off when weighing the cost of graduate school and income not earned while a student. However, many universities as well as the National Science Foundation and several other organizations designed to promote excellence in math and the sciences offer financial aid in the form of grants, fellowships, research assistantships and teaching positions. Many of these awards cover tuition and living expenses while the student is enrolled in a graduate program. In addition, students working toward their Ph.D. degrees welcome the experience as an opportunity to refine their teaching skills in preparation for eventual work as professors.

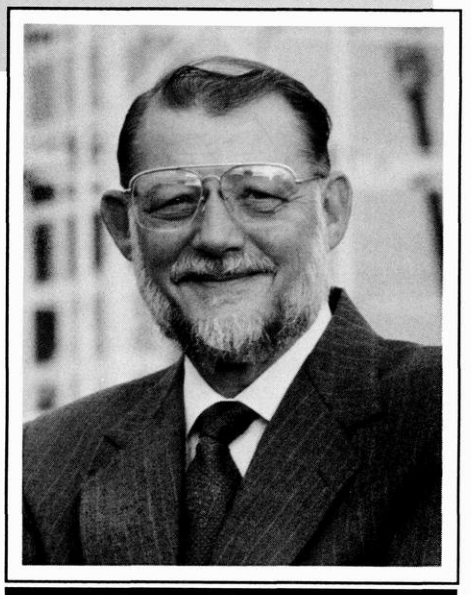
There is no hard and fast rule that says an engineer must attend graduate school immediately following graduation. Several companies who employ engineers provide paid time off and tuition reimbursement programs. These companies see an advanced degree as an asset to their competitiveness in the race for continually improving technology. It is in their best interest to help an employee earn an M.S. or Ph.D. degree. Sometimes, companies work with universities to provide correspondence courses through video tapes and satellite television. Night school is yet another option for students who cannot afford to attend school right after graduation.

Graduate school is a viable option for a good engineer. For the interested student, it is definitely worth checking into further. Some good sources of information include the Career Planning and Placement Office, *Peterson's Guide to Graduate Programs in Engineering and Applied Sciences*, the Graduate Admissions Office, friends and teaching assistants who are currently graduate students, a faculty advisor or a favorite professor.

Although graduate school may not be for everyone, it should not be completely ruled out without some serious consideration and an understanding of the growing need in this country for upper level science and engineering researchers. ■

Dean's Corner

The Key to a Quality Engineering Education



John G. Bollinger, Dean
College of Engineering

As students in the College of Engineering, I hope you realize that the quality of your education is our JOB #1. We are interested in your present and your future. We want to know how you feel about what we are doing for you. We welcome your input and will work with the data you provide us.

You are one of our primary customers. Last year, Polygon implemented a student survey to assess "customer satisfaction" in the college. It was a good beginning, and we learned a lot of interesting facts. We learned that we did not always do as well as you thought we should. We learned that we offered some things that you did not know about, but should have. We learned that there are times when you are saturated with information to the point that you may no longer wish to know more. We learned that you feel very positive about the college and your departments in many respects. We learned that we must do some things differently so that you can maximize the benefit of your experience while you are on our campus. Polygon has decided to make the student survey an annual event. This survey will provide valuable feedback to the faculty and administration to implement improvement.

The faculty in the college wants to provide you with the best education as a basis for a productive professional career. You, as our customer, are buying a knowledge base for lifelong learning and a tool kit for professional practice. In our quest for continuous improvement we have argued convincingly to improve our capital budgets so that we can invest in new laboratory facilities, remodel our physical plant and bring you the latest in computing facilities. Our faculty has been working hard to create new experimental experiences and to integrate not only computer literacy, but computer intimacy into our curriculum. As our new resources are deployed, we hope that you sense the opportunities that we and the tax payers of Wisconsin have made available to you.

As you complete your work here at school and move into the professional world, you will experience the broad impact of this nation's quest for continuous improvement. Industry's focus on quality in order to improve global competitiveness is dependent on continuous improvement.

To achieve new goals in quality and productivity improvement, industry has redefined the role of the employee in the work force. All employees in a business must concentrate on who their customers are, to the extent that everyone is obsessed with doing what is right for the customer. In the new quality movement, management has adopted a philosophy of employee empowerment. Empowerment means not only the right, but the responsibility to make job related decisions and implement changes in an effort to achieve continuous improvement. In our University, our faculty has inherited empowerment from their ancestors who founded this University. It is a way of life for us, and you can expect them to have the responsibility to do what it right.

Continuous improvement is a vector quantity. It has magnitude in the sense of how hard one works at trying to improve. It has direction in knowing what needs to be changed in what way to provide improvement. In order to manage improvement, it is important to have data. Engineers should be inherently good at collecting data and basing decisions on the analysis of that data. Because we have practiced this process, we have little excuse for not being good at continuous improvement.

Data for continuous improvement in our educational system can take on many forms. We collect data by observation in the classroom, in the laboratory and in the daily communication we have with students and each other and our colleagues elsewhere. We collect data by asking questions in the form of surveys, examinations and participation in meetings. We collect data by practicing as researchers, professional consultants and as contributors to scientific meetings. Your faculty have a wealth of data, and they use it in the classroom and in advising you in guiding your career. For many years we have used student course evaluations to judge the performance of teaching, and now we are using surveys to assess you reactions to our programs.

You too, can make the commitment to continuous improvement by becoming a better student and a more sophisticated professional. Continuous improvement only works if everyone participates and tries a little harder. You can improve by collecting data, assessing where you are, defining where you want to be and vectoring yourself to a higher level of achievement. You can benefit from the continuous improvement process in the college by taking part in the Polygon effort. Communicate, fill out your teaching evaluations and surveys effectively. You can improve by being a participant. ■

ALL ABOARD!

High Speed Rails

Photo by Stoller

The Paris-South East TGV in service .

Imagine traveling from downtown Chicago to the Twin Cities in two hours and 15 minutes, without leaving the ground! While not quite a reality yet, high speed ground transportation or supertrains are actively being developed as one possible solution to our growing transportation problems here in the Midwest and around the world. There are two basic forms of these supertrains. They are traditional steel-wheel-on-steel-rail technologies and magnetic levitation. Major advances have occurred with both technologies, and now they are being considered as feasible alternatives to airplanes and additional highways.

In October 1964, while the American passenger rail transportation system was in the midst of decline, Japan was quietly starting a new era in railroads. The Tokaido-Shinkansen, the rail line over which the famous "Bullet Trains" travel, was opened. This line has been described as the first true high speed rail route. High speed rail is defined as operation in excess of 125 miles per hour. Today, over 300 trains a day travel this route at speeds up to 140 mph. Its success has spurred the growth of a larger Shinkansen system, with three additional routes added in the past 20 years. The "Bullet Trains" achieve their high speed through the use of very powerful electric traction on tracks built and maintained to very high tolerances. In fact, every evening the system is shut down so the tracks may be serviced and aligned.

European High Speed Rail

High speed rail took another jump forward in 1981 with the start of *Train à Grande Vitesse* service on the specially constructed Paris South-East line between Paris and Lyon. The TGV, which translated means "very fast train," regularly travels this route at speeds up to 168 mph. Despite enormous construction costs, the Paris South-East line has been a great success. In 1988, the line carried 17 million people, with a daily average of over 50,000 people. Seventy-five percent of these people are estimated to be airline converts or people who would have otherwise driven the route.

The Paris South-East high speed rail line is very interesting in that it is designed for use only by TGV trains. All other passenger and freight trains still follow the old alignment. Since the line is used exclusively by the TGV trains with a high power to weight ratio, grades or hills up to 3.5% are allowed, much steeper than a normal railroad. The steeper grades allow the line to more closely follow the terrain and save some construction costs. There are also no trackside signals as all traffic control is displayed for the engineers on board the train. Trackside signals were considered unnecessary, since at that speed, trains would be passing them at a rate of one every 20 seconds anyway. Of course, with speeds of 168 mph, there are no highway grade crossings.

As in Japan, the success of the first line has prompted the construction of several new routes. In 1990 the TGV- Atlantique opened with service from Paris to the Southwest of France. Experience gained from the construction and operation of the first line was used to improve the TGV Atlantique. The curve radii were increased and grades were decreased. The trains were also constructed lighter, thus requiring fewer motors per car. All of these improvements translate to an estimated 10% energy usage savings over the original line and an increase in speed to just under 190 mph. Another line to connect Paris with the new Channel Tunnel is also planned, as well as routes to Brussels, to Cologne in the North and to Strausbourg in the East.

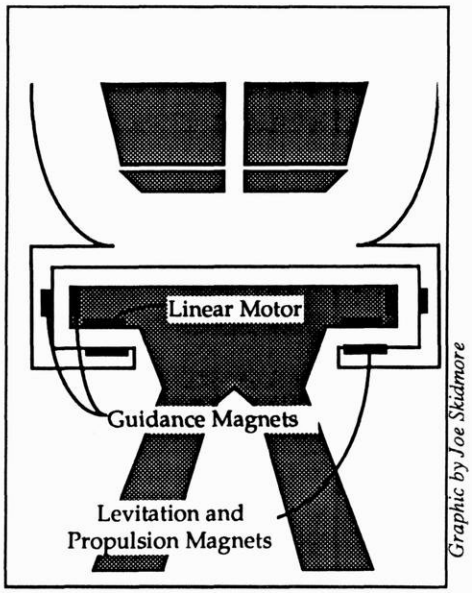
France is not the only country in Europe which has committed itself to high speed rail. The United Kingdom has been operating the HST 125, a high speed diesel-electric train, since 1976. The HST 125s require no overhead electrification, and as their name implies, travel at speeds of 125 mph. They travel over existing rail lines, which were upgraded for this

operation. Since 125 mph has been determined to be the practical upper limit for diesel-electric traction, rail lines must be electrified to travel faster. With the recent electrification of the East Coast Main Line all the way from London to Edinburgh, new electric locomotives have been introduced travelling at 150 mph.

Other nations currently operating or developing high speed rail service include Denmark, Sweden, Spain and Italy. The Italian and Swedish systems use trains which are capable of tilting as they travel through curves. This adjustment allows higher operating speeds and increased comfort on existing track. Amtrak also operates high speed service on the Northeast Corridor between New York and Washington, D.C., where Metroliners regularly travel at 125 mph.

Floating Trains

The developments with traditional high speed rail have been very impressive, but even they may be considered simply an improvement of nineteenth century technology railroads. Since the 1960s there has been research into the revolutionary new transportation system of Magnetic Levitation. Maglevs can be described as a hybrid between a train and an airplane, but in reality they are very different from both. Like trains, they follow a fixed guideway, yet maglevs also "fly", even if only a fraction of an inch above their guideway. Two countries lead the race towards commercial operation of high speed maglevs. Germany and Japan have been developing two different forms of this technology. They differ mainly in the way levitation is achieved. One type uses electromagnetic attraction, while the other utilizes electrodynamic repulsion.



Graphic by Joe Skidmore

Levitation and propulsion systems on the Transrapid Maglev.

German research has focused almost entirely on electromagnetic attraction. The research is being conducted by Transrapid, a consortium of German companies lead by Thyssen Henschel, Inc. Electromagnetic attraction is the force that draws magnets of opposite polarity together. When energized, the magnets mounted on the underside of the guideway attract the magnets mounted on the underside of the vehicle. The attraction lifts the bottom of the vehicle up towards the guideway. A one-half inch air gap is maintained between the two magnets by computers which continually adjust current to the magnets. Since the magnets are mounted beneath the guideway, no snow, ice or debris can collect. However, the clearance between the vehicle and the top of the guideway is about one foot.

Propulsion is achieved through the use of linear induction. Linear induction can be visualized as taking a traditional round motor stator magnet, flattening it out and laying these magnets flat in a line. While a traditional motor spins when powered, with linear induction the opposing magnets move along the line. When energized to 6000 volts the magnets fixed to the guideway work with those fixed to the underside of the train, to propel the maglev along the guideway. Since there are no moving parts like motors or transmissions there is nothing to wear out, and with no contact to the guideway, friction is greatly reduced. The maglevs can therefore float on a magnetic carpet at speeds up to 300 mph.

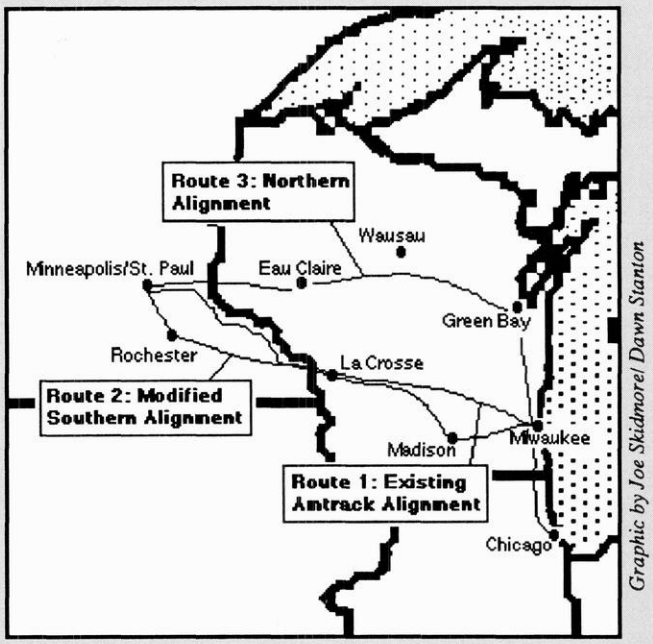
How do you stop something moving 300 mph without the aid of friction? That is easy; simply reverse the thrust, and let the magnets push the train in the other direction. If external power is lost, battery power is available for braking and levitation. Guidance magnets are also provided along the edges of the guideway to align the vehicle properly. Should all levitation systems fail, the maglev would simply slide to a rest along safety skids.

While Germany has concentrated its efforts behind one type of system, Japan has been developing both attractive and repulsive maglevs. Japan Air Lines has been developing a electromagnetic attractive maglev, similar to the Transrapid Maglev, while Japan National Railways has been developing a maglev that levitates through the use of electrodynamic repulsion, which is the force that drives magnets of the same polarity away from each other. The JAL Maglev sits in a U-Shaped guideway with levitation coils on the bottom and propulsion coils on the sides. On board the maglev is a superconducting magnet used to both propel and levitate the vehicle. Sophisticated refrigeration systems are used for liquid helium to chill the magnet wires to four Kelvin. As these wires are cooled they become superconductive and lose their resistance to flow of current. They then lift the vehicle off the bottom of the guideway. As with the German Maglev, linear induction is used for propulsion and braking. This technology is planned for service between Tokyo and Narita International Airport and eventually, between Tokyo and Osaka. As superconductive magnets become available at higher temperatures, this method of levitation promises to become more inexpensive.

American Supertrains

These technologies being developed around the world are not as foreign as they may seem. While it has taken some time, they are finally coming to the United States. In fact, there are currently many studies across the United States for potential high speed service. Currently, the route which is closest to actually being constructed is a link between

Supertrains in Wisconsin?



Graphic by Joe Skidmore/ Dawn Stanton

Proposed routes that may bring supertrain technology to Wisconsin.

Wisconsin has always had a strong connection to railroads. Even though many routes have been eliminated, there are still 15 railroads operating 4400 route miles in the Dairy State. In 1990, the Minnesota, Wisconsin and Illinois Departments of Transportation authorized a feasibility study for high speed service between Chicago, Milwaukee and the Twin Cities. The study by Transportation Management Systems/Benesch High Speed Rail Consultants was released in May 1991 and drew some interesting and exciting conclusions.

Three possible routes were considered and evaluated on the basis of costs and benefits. While the first route follows the existing Amtrak corridor, the second route diverges near Watertown to also serve Madison.

...maybe by the end of the decade it will be possible for a new *Hiawatha* to shatter the speed records of its predecessor

The last route travels north to Green Bay and crosses the northern part of the state. However, the southern routes are more favorable over the northern because they would serve a larger population.

Three different high speed technologies were also considered. The most conservative option involves the use of 125 mph diesel-electric trains, much like those used in England. The next option is a 185 mph technology using TGV type electric trains. The third and most ambitious option uses 300 mph maglevs. Construction of any of these technologies would not be cheap; the costs range from $0.9 billion to $5.7 billion. Despite the high construction costs, the economic benefits associated with a high speed rail line, $8 billion to $10 billion, are rather impressive. Surprisingly, the 125 mph and 185 mph option benefits are not much less than those of the the 300 mph option.

High speed passenger rail is nothing new to Wisconsin. In fact, during the late 1930s and early 1940s Wisconsin held the distinction of having the fastest passenger run in America. The Milwaukee Road Company's flagship passenger train the *Hiawatha* was scheduled to travel between Sparta and Portage at an average speed of 74 mph. It was normal for the *Hiawatha* to reach speeds in excess of 100 mph. The means of propulsion was state-of-the-art back then, a streamlined steam engine.

Wisconsin has taken the first step towards high speed rail, and there is a strong interest in this state for this project. This summer, Governor Tommy Thompson even traveled to Europe to ride some of the supertrains. The first study proved that high speed rail is quite feasible. Currently, more detailed economic and engineering analyses are suggested. Hopefully, Wisconsin will continue to pursue this technology, and maybe by the end of the decade it will be possible for a new *Hiawatha* to shatter the speed records of its predecessor. ■

Dallas and Houston, Texas. The "Texas TGV" is being promoted by GEC Alsthom, Inc., the builders of the French TGV system, and also by Morrison Knudsen, Inc., a mammoth construction firm headquartered in Boise, Idaho. MK already has a reputation for successfully undertaking big construction projects. They built the Hoover and Grand Coulee dams in the West. They are also the leading builder and rebuilder of passenger rail cars and locomotives in the United States. MK hopes this combination of expertise will help them lead the way in the race for high speed rail in the U. S.

Other routes under consideration include: Las Vegas-Los Angeles, Boston-New York-Washington, Philadelphia-Pittsburg, Miami-Orlando-Tampa, Los Angeles-San Diego, Cleveland-Columbus-Cincinnati and in our backyard, Chicago-Milwaukee-Twin Cities. In fact, a national maglev network, sharing much of the existing Interstate Highway right of way, has even been envisioned.

While it is not exactly clear which technology will dominate, the Age of the Train is one again upon us. All Aboard! ■

AUTHOR

Joe Skidmore is a Junior majoring in Civil and Environmental Engineering, and also studying Japanese. His interests include running, photography and, of course trains.

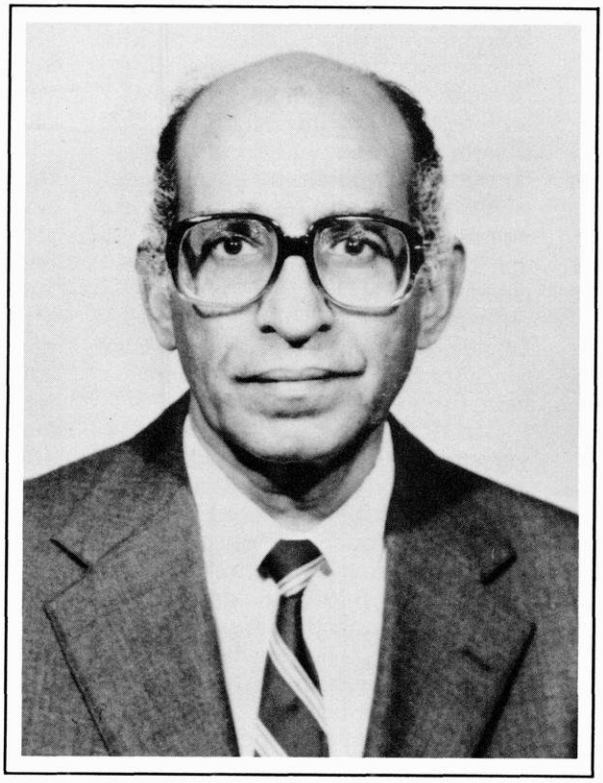
Jaafar Khalaf Al-Abdulla
A Dynamic Educator

Weightless bars, frictionless pins and motionless pulleys evolved into an immense structure of both known and unknown forces. Unfortunately, the false beauty of the festively colored diagram could not prevent the inevitable question.

"What do we do first?" demanded the speaker as he faced the class with an expecting stare. Although everyone knew the answer, no one muttered a word. Anxious anticipation permeated the desk-cluttered room, and then it was broken by three simple words.

"Free body diagram." The tone pierced the ears of even the sleepiest students, and Jaafar Khalaf Al-Abdulla plunged into his lesson for the day.

A member of the Engineering Mechanics Department at the University of Wisconsin-Madison, this man is known for his teaching intensity. Al-Abdulla is a professional teacher as well as a professional student. He has six degrees , five from the UW, ranging from mathematics to civil engineering. Finishing his education with a Ph.D. in structural engineering, Al-Abdulla worked for the Engineering-Graef-Anhalt-Schloemer Consulting Engineers. With a broad education, Al-Abdulla has had many work opportunities. Having worked in both Kuwait and Doha-Qatar, Al-Abdulla decided to return to Madison in 1985 and became Senior Lecturer in the EM Department, carrying the highest load in the department. He has taught 13 courses in three different countries, acquiring a distinct and unique teaching style. Al-Abdulla continues to contribute his abilities to the education of many engineering students.



Jaafar Khalaf Al-Abdulla, Engineering Mechanics Senior Lecturer

Al-Abdulla continues to contribute his abilities to the education of many engineering students

With many high level complex engineering courses, a student must be strong in the fundamentals of engineering. Teaching both Statics and Strengths of Materials this semester, Al-Abdulla provides the backbone of the engineering curriculum. "I try to set the foundation," states Al-Abdulla, "I like to teach Statics in order to better the student." Al-Abdulla says he is rewarded by contributing part of himself to the student. He explains, "It is motivating to see students come back after they have taken my classes." Students who take advantage of his contributions will gain an understanding not only of Statics but of engineering as a whole.

Al-Abdulla gives his students an opportunity to learn by teaching more than just the basics of engineering. He elaborates, "Three of us could not move a refrigerator into an apartment. One person came to help us and he moved it alone, because he had confidence." Confidence is always emphasized within the walls of

(Continued on page 11)

Walt Disney *Imagineering*

Imagine a place that combines childhood fantasies and state-of-the-art technology, a place where architects in three-piece suits interact with engineers in blue jeans and tennis shoes. Picture a place where artists and songwriters work hand-in-hand with sound specialists and sculptors, and everyone wears a Mickey Mouse name tag. Creativity and ingenuity fill the air as story boards, miniature models and high-powered computer systems rest on tables set up throughout the building. Colorful photos of beloved Disney characters adorn the walls.

In this amazing place where innovation flourishes and dreams abound, the ideas behind the mystical, magical attractions of the Disney theme parks are brought to life. In Glendale, California, amidst a conglomeration of scene shops, sculpture studios, carpentry rooms, film libraries and welding shops lies the home of Walt Disney Imagineering, the high-tech dreamers and masterminds behind the most popular tourist attraction in the world.

The WDI organization, a subsidiary of the Walt Disney Company, employs over 1200 men and women with over 130 different job descriptions. These positions range from show designers, artists, writers, project managers, engineers, architects and filmmakers to audio and visual specialists, animators, computer programmers, land planners, ride system designers, finance experts and researchers. These Imagineers, as they are called, are responsible for all stages of the development of a Disney idea, from the wild and impossible dream to the physical and structural realization of the theme park attraction itself.

Every Disney project is achieved through the combined efforts of several people. The Disney-Imagineering organization is divided into seven primary units consisting of creative development specialists, architects and facility engineers, ride system designers, project managers, corporate administrators, construction managers and research and development experts.

The Disneyland theme park located in Anaheim, California, originally began as a dream of Walt Disney who wanted a clean, pleasant place for parents and children to have fun together.

In 1952, Disney assembled a diverse group of animators, artists, engineers, naval officers and publicists into a group called Walter Elias Disney Enterprises. These creative geniuses were the very first Imagineers. In 1953, the group's name was changed to Walt Disney Imagineering. The year 1955 marked the opening of the first Disneyland theme park in southern California.

The standards Disney set for his Imagineers back in the early 50s proved to be the magic formula that would eventually bring Disneyland fame and fortune. Many of Walt's methods and ideals remain standards followed by Imagineers today — many of whom fell in love with Disneyland at an early age when they visited it for the first time as a child.

Explaining the Imagineering philosophy, Disney once said, "There's really no secret about our approach. We keep moving forward - opening up new doors and doing new things - because we're curious. And curiosity keeps leading us down new paths. We're always exploring and experimenting."

Disney always pushed his Imagineers to stretch their minds, their ideas and their imaginations. He was driven by the notion that "as long as there is imagination left in the world, Disneyland will never be completed."

In addition to the ideals behind the Imagineers, much of their success was due to the logical, well-planned structure of their approach. Disney believed strongly in research and consulting. Long before any serious construction on the first theme park began, Disney and his Imagineers spent countless hours searching for the right place to build Disneyland. They also attended various carnivals and amusement parks across the country, noting what aspects people enjoyed and what areas called for improvement. They researched solutions to the problems encountered and interviewed several carnival operators and patrons. Crowd control studies, ride evaluations, cost factors, weather fluctuations, employee evaluations and environmental aspects were all taken into consideration.

With the information they had gathered, the Imagineers returned to California and began plans for the new and better form of a family entertainment park. Small details which improved the entire 'Disney Experience' were Disney's passion. He insisted on small touches, from "Audio-Animatronics" characters wiggling their toes in a bathtub to friendly ride attendants ready with a polite greeting and a cheerful smile, to an immaculate park with every window polished sparkling clear and every street swept spotless each night. Minor conveniences such as several shaded places to rest, creative trees and bushes carved to resemble Disney characters, multi-staged rides designed to keep guests waiting in

line occupied and trash cans painted to blend with the scenery were all vital qualities that Disney believed made the distinction between a good theme park and a great one.

Many of the park's attractions were centered on Disney characters and story lines ranging from Snow White and the Seven Dwarfs to Sleeping Beauty and Cinderella to Mickey Mouse and Davy Crocket. The unique use of a combination of architecture, color, costuming and entertainment to tell a story through each attraction set Disneyland apart from most carnivals and amusement parks of the time.

A frustrating realization made by Disney and his Imagineers was that their original ideas were sometimes beyond the reach of modern technology. A long-time goal of Disney was to produce realistic three-dimensional animation. Unfortunately, in the early days of Disneyland, the electronic technology for this technique just did not exist. Finally, though, in the early 60s, Imagineers found a way to incorporate advancements in hydraulic and pneumatic hardware into three-dimensional movements. As computer systems advanced it became easier to synchronize words and music with mechanical body movements. And soon, the first Disney "Audio-Animatronics" figures were born. By combining technology from robotics, radio control, animation, digital audio and mechanical engineering, the figures quickly advanced from small, singing birds to life-size human models.

Even after Disneyland opened in 1955, Disney continued to search for ways to improve his park. He often traveled overseas to flea markets and junk shops on a quest for mechanical toys that his Imagineers could disassemble and study. Although Disney undertook great and wild projects, he always approached them in a systematic and methodical manner. His changes and inventions were carefully researched, and he often learned valuable lessons from his mistakes.

A vivid example of this method was his preparation to begin work on a second theme park in Florida. Before plunging into a large building project, he wanted to see if the East Coast would be as receptive to a Disney theme park as the West Coast had been. His golden opportunity to test his audience was the 1964 World's Fair where he agreed to provide four innovative exhibits. The "Great Moments with Mr. Lincoln" exhibit sponsored by the State of Illinois and featuring an "Audio-Animatronics" figure of America's sixteenth president was a big hit. With this positive feedback, plans for the next theme park were underway.

Disney's second theme park, Walt Disney World in Orlando, Florida, was Disney's chance to do his creating on a bigger and better scale, and to correct the mistakes made in the first Disney theme park. His major goal for the Florida park was to find a place with enough land "to hold all the ideas and plans we could possibly imagine." Indeed, he accomplished just that as he purchased a block of land in central Florida twice the size of Manhattan Island.

Although Disney died in 1966 shortly after ground-breaking for the new project had begun, his Imagineers continued to move forward in the Disney tradition and opened the Walt Disney World Resort in 1971. The Magic Kingdom was then joined by EPCOT Center in 1982. And, as recently as 1989, the Disney - MGM Studios Theme Park became the third gated attraction in Orlando.

As technology continued to expand, the Disney Imagineers continued to put it to use in increasingly creative and complex applications. Of course, with such a broad base of expertise, the Imagineers have actually produced some of their own technology along the way. Disneyland vaunts the United States' first daily operating monorail system, the first computer-controlled thrill ride and a highly advanced three-dimensional motion picture photography system.

The very nature of the Disney theme parks often called for high-tech systems and devices which had not yet been invented. The

Disney Looks to the Year 2000

The 1990s will see a multi-billion dollar expansion of the Disney theme parks around the world and the ten year interval will be known as the "Disney Decade" according to Chairman and Chief Executive Officer of Walt Disney Imagineering, Michael D. Eisner.

In addition to the Magic Kingdom, Epcot Center and the MGM Studios currently in Disney World, Eisner predicts the creation of a fourth theme park and an expansion doubling the present size of the MGM Studios theme park. He also foresees the construction of some residential areas, a cultural affairs institute and a regional shopping center.

As part of its facelift, Disney World will see 29 new attractions and a more technologically advanced Tomorrowland with a three-dimensional outer space alien adventure co-produced by George Lucas and slated to open in 1994.

Disneyland in Anaheim, California looks to the end of the decade, 1999, for the completion of Hollywoodland modeled after the Hollywood Boulevard of the 1930s and 40s. Hollywoodland promises a wild, 'hare-raising' trip though the cartoon world of Roger Rabbit on the Toontown Trolley, scheduled to open in 1996. The trolley ride will synchronize aerospace technology and an action-packed adventure film. In 1996, Dick Tracey's Crime Stoppers will make its home in Hollywoodland as well.

Commemorating the late Jim Henson, the three-dimensional presentation of Muppet Vision will debut in 1993. Also in store for Disneyland is an allnew Captain Eo space fiction film starring Michael Jackson and produced by George Lucas. Laser beams shooting across the theater, fiber optic stars twinkling on the ceiling and thick fog permeating the air distinguish this futuristic attraction.

On a larger scale, conceptual designs for a second park in California are currently under consideration. The two possible locations for the park are on the ocean in Long Beach or adjacent to the present park in Anaheim.

Imagineers are also working on ideas for new and exciting attractions in Tokyo and even in Paris, despite the fact that Euro Disneyland has not even opened yet. They are merely continuing with the tradition Walt Disney himself began, "The way I see it," he said, "Disneyland will never be finished. It's something we can keep developing and adding to... I've always wanted to work on something that's alive, something that keeps growing. We've got that at Disneyland."

transportation systems used in many of the park attractions were specially designed to move a high volume of people through them in a short amount of time, for example. Tomorrowland in Walt Disney World boasts motorless trains which transport 3600 passengers an hour and run quietly over a rail system containing magnetized field coils. Free of mechanical parts, these trains rely on a linear induction process to power their motion.

In the Universe of Energy pavilion in EPCOT Center is another set of vehicles which rely on an inductive coupling power system. These vehicles, called "traveling theater cars," hold 96 passengers and proceed along a thin guide wire embedded in the road beneath them. Fully automatic, they move in response to electronic signals transmitted through the guide wire and received through sensors on the bottom side of the vehicle.

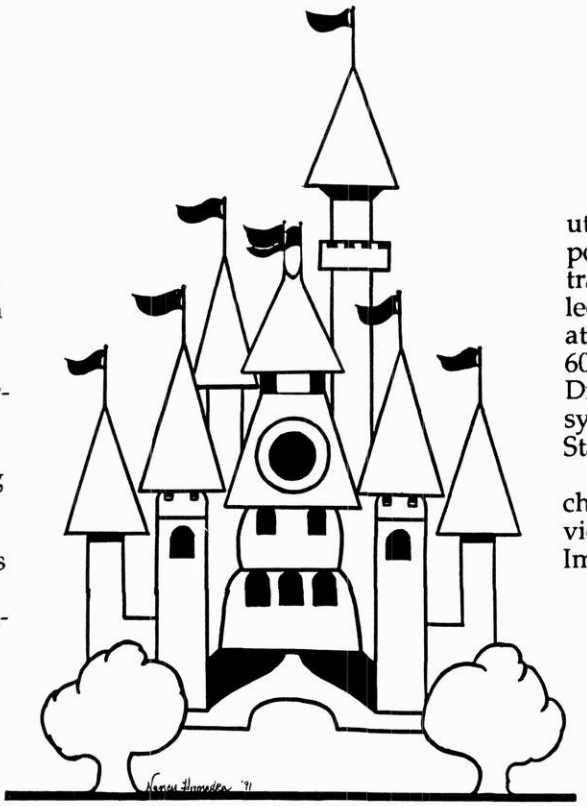
True to its name, the rooftop of the Universe of Energy pavilion contains more than 80,000 photo voltaic cells which collect photon energy and convert it to electrical energy used within the building.

Another amazing 'behind the scenes' innovation at Disney World is actually below the scenes. A one mile labyrinth of tunnels lies beneath the Magic Kingdom. Throughout these "utilidors," as they are called, can be found administrative offices, storage compartments, break lounges, employee cafeterias and wardrobe rooms as well as maintenance systems including heat and air conditioning ducts, compressed air and water pipes, and electrical controls. Within this network is also a specialized fire prevention system designed by the Imagineers.

Once again concentrating on the minor details to improved the park, the Imagineers implemented a unique vacuum-assisted garbage collection system that eliminates the need for conventional garbage trucks. A series of 24-inch pneumatic tubes located within the utilidors transport trash from 17 points throughout the park to a central collection site. The trash is collected every 15 minutes and travels at typical highway speeds of around 60 miles per hour. Although not a Disney creation, this Swedish built system was first used in the United States by Disney World.

The construction of EPCOT's characteristic geodesic dome provided another challenge for the Imagineers. Its structural design was a feat in itself, but conquering that obstacle opened the doors to even more challenges, for although Orlando seldom experiences the heavy snowfall of the northern states, it does suffer severe rains. Thus, weatherproofing the Spaceship Earth became another important consideration. But in true Disney style, the Imagineering team designed a novel fluid flow system to collect rain water at the sphere's midpoint and guide it internally through the structure to drain traps underground, preserving the attraction's architectural integrity.

Undoubtedly, the term "Imagineers" is a fitting title for a group of such talented and diverse people who have attained so many incredible artistic and technological achievements. Through the unrivaled coordination of childlike imagination and technological expertise, the Disney Imagineers have succeeded in creating a place where parents and children children can have fun together. But, just as Disney himself would have expected, his Imagineers continue to search for new and exciting ways to improve the original idea of a man who believed that dreams could be brought to life. ■



Bonjour, Mickey Mouse

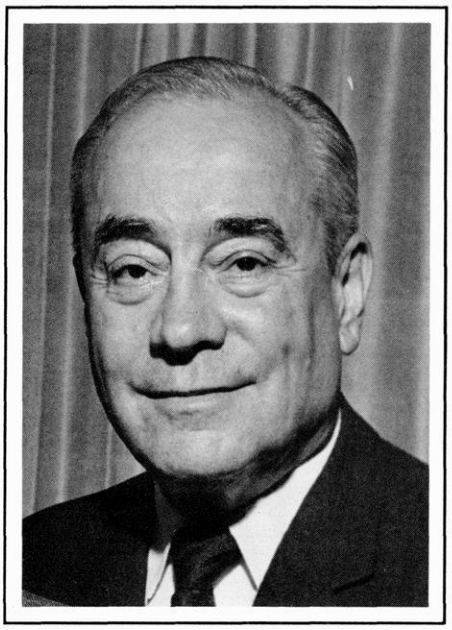
In 1983, after 28 years of success in California and 12 years of success in Florida, Disney went international, opening its first overseas theme park in Tokyo, Japan. Although the Tokyo Disneyland is currently owned and managed by a Japanese corporation, WDI was responsible for the park's design, construction and manufactured show equipment. The 200 acre, $750 million park generated over $1 billion in revenues in the last fiscal year.

Expecting equal success, Disney plans to open its second foreign theme park located in Marne-La-Vallee, an area just 20 miles east of Paris, France. The 5500 acre Euro Disneyland is scheduled to open April 12, 1992 and anticipates over 11 million visitors during its first year. After almost six years of planning, the $4.2 billion resort will tout a theme park with 29 attractions, six hotels with a total of 5200 rooms and a 138 acre camp site, in addition to several different shops, restaurants, tennis courts, and an 18 hole golf course. ■

AUTHOR

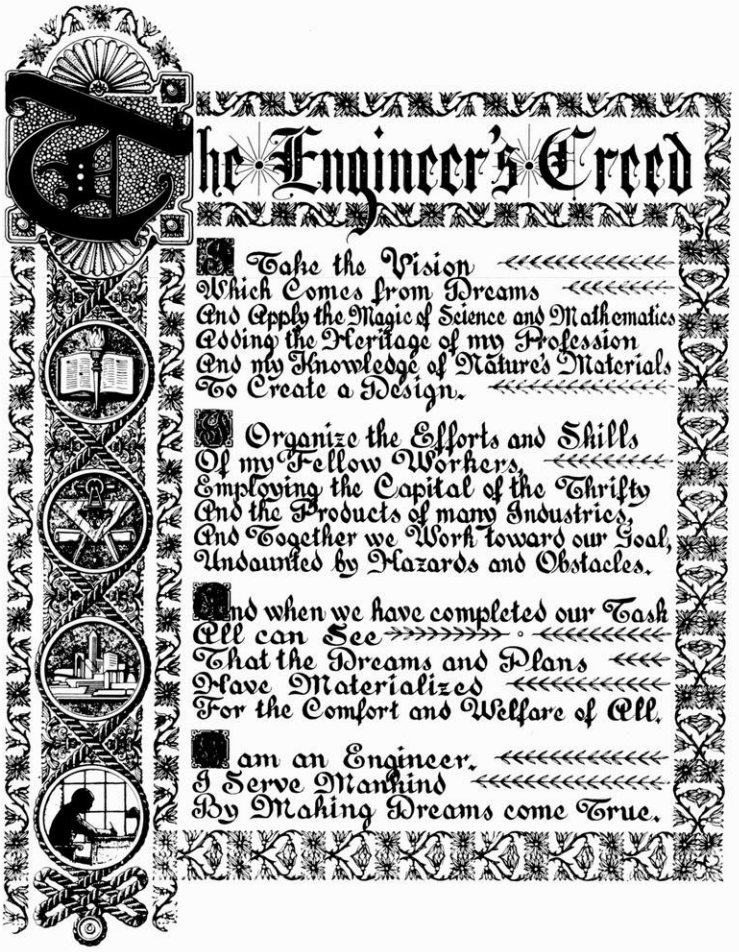
Nancy Hromadka, ECE 4, is a big fan of the Space Mountain Rollercoaster adventure at DisneyWorld in Orlando, Florida and wouldn't mind working as an Imagineer herself some day.

A Tribute to Adolf Ackerman



Adolf Ackerman (1901-1991)

The *Wisconsin Engineer* acknowledges the life accomplishments of UW-Madison engineering alumnus Adolph Ackerman, who died last spring just before his 90th birthday. Ackerman is best known as a vocal advocate of the need for engineers to dissent. Among other things, he spoke out against shoddy engineering in the nuclear power industry, and engineering education that lacked a foundation of social studies . The following poem, which Ackerman wrote early in his career, expresses ideals for engineers and engineering students. ■



Al-Abdulla

(continued from page 7)

the Statics classroom. In order to do well in Statics one needs more than just confidence; time management is also stressed. "Budget your time," is heard as often as "free body diagram" (a common problem solving technique used in Statics).

Al-Abdulla uses many examples while lecturing. By doing problems step by step and with different methods, Al-Abdulla provides an engineering background for the diverse student body. "Students come from different high schools and different teaching styles," states Al-Abdulla. It is important to give the students equal opportunity. His teaching diversity gives the students a new learning perspective. Al-Abdulla's advice for Statics problem solving can be applied to all areas of life.

The silver tray collected the last specs of chalk from the sweeping eraser. The students pushed out of the classroom hurrying to their next classes. Professor Al-Abdulla's job was not over; rather, it had just begun. Ten students waited outside the office at the end of the hall on the third floor of the Engineering Building. Office hours had just begun. As always, his goal had remained the same — "To be an excellent student and an excellent engineer." ■

AUTHOR

Jim Webb is a second year Mechanical Engineer. It was heard that the night before finals, all through the city, not a creature was stirring, not a single ME. As he was all cozy, and snug in his bed, visions of free-body diagrams danced in Jim's head.

Congratulations to Outstanding Seniors!

At the annual *POLYGON* Engineering Council Fall Luncheon on Friday, November 22, seven awards of $300 each were presented to this year's recipients of the Outstanding Senior Awards. The awards are based primary on leadership and service activities. This year's Outstanding Seniors are Susan Halverson (ChE), Bart Heldke (ME), Andrew 'Chip' Hogan (ECE), Brian Lofy (ECE), Rob Jewell (ME), Wendy Weinbrenner (ChE) and Tom Wuttke (ECE). Money for these awards comes from the College of Engineering Colbeck Scholarship Fund.

Engineering Briefs

by Mike Waters

Engineers' Float Takes Top Honors

The Engineers' Homecoming Float won first place among student organizations in the UW Homecoming Parade on Friday, October 25. The float, under the theme "UW Engineers *Gear Up* for a Win," consisted of an 8-foot-tall Bucky Badger, a Hoosier dummy and two large movable gears. The float was also adorned with signs of the organizations that participated in the construction. Construction of the float was funded by a $250 grant from the UW Homecoming Committee and donations from POLYGON Engineering Council and the Society of Women Engineers.

Oops!

The *Wisconsin Engineer* staff and advisor would like to apologize to Associate Dean C. Allen Wortley for distorting the meaning of his Dean's Corner (October, 1991) through editing changes we made. We regret bad judgments made in our efforts to meet publication deadlines.

CAE Finally Receives Money for New Computers

After weeks of uncertainty, university bureaucrats finally finished the paperwork to allocate money to CAE to buy new computers. The money, which had been budgeted for CAE to set up a new computer lab for students, had been held up in administrative red tape. CAE will now resume its search for a location to place the computers. Previous plans to establish a computer lab in the student study lounge on the second floor of the Mechanical Engineering Building were cancelled due to inadequate climatic control of the area.

Dean Bollinger Proposes Engineering Honors Program

Last issue, we alerted readers to a proposed Engineering Honors Program. Well, here is a proposal drafted by College of Engineering Dean, John Bollinger.

The proposal outlines a combined 120-credit B.S. degree/24-credit M.S. thesis degree program. Curricula for each department have not been formed and the proposal has not received approval on any level yet. The general requirements for the proposed program are the following:

1) Students may be admitted into department Honors programs as freshmen, as transfer students or anytime they apply with an acceptable program plan, an advisor (mentor) and at least a 3.0 GPA;
2) The Honors Program will require 120 course credits that guarantee an ABET accredited program;
3) At the completion of the 120 required credits, Honors students will be required to enroll in graduate school for an M.S. thesis degree of 24-credits (18 course credits from 400-700 level courses);
4) At the completion of the M.S. requirements, Honors students will receive both their B.S. and M.S. degrees;
5) Students who withdraw from the Honors Program will receive a B.S. degree when their standard requirements are fulfilled.

The dean hopes to have the Honors Program ready to implement next fall. Any comments or questions about the proposed program can be directed to POLYGON Engineering Council (265-2212).

100 Years of ECE

The Department of Electrical and Computer Engineering at the University of Wisconsin-Madison had its grand opening... 100 years ago.

From 1891 to 1991 this department has been serving the University with excellent research and instruction. Exciting developments have been made in the traditional electrical engineering fields as well as many new fields of study: biomedical engineering, computers, digital signal processing, electronics, feedback control, holography and lasers, integrated circuits, microwave and satellite communications, radar, sonar, superconductivity, transistors and many others.

On October 25th, 1991, the ECE Centennial Celebration took place, honoring the electrical and computer engineering graduates of the past century. Over 4,000 alumni were sent invitations and information on how to purchase memorabilia from the event including T-shirts, mugs, posters and a special history book , *The Department of Electrical and Computer Engineering 'Touching the Future' 1891-1991*, written to commemorate the Centennial. To further honor the graduates of the department, the book continues to be available free, for alumni only, upon request. (Simply write the department office for this commemorative gem.)

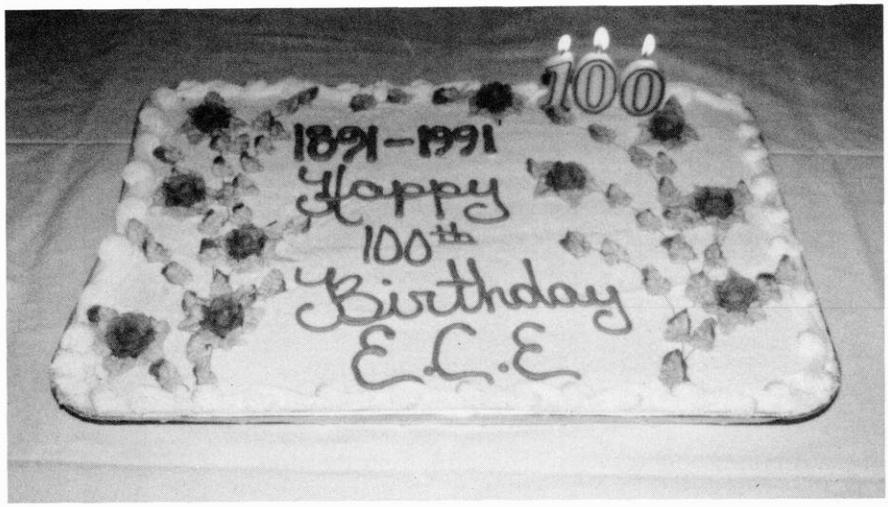


Photo by Shaun Burke

The ECE Centennial birthday cake.

The Centennial celebration began in the ECE Student Lounge with morning refreshments. A collection of historic pictures and antique equipment adorned the room. Available for purchase, the equipment consisted of ancient voltmeters, ammeters, wattmeters, decade resistance boxes and slide rules, to name a few. Much of the equipment dated back to the turn of the century.

Tours and demonstrations followed. The historic 1880 Edison generator, one of the first built by Thomas Edison, was fired up that day. The generator was donated to the department in 1893. Many interesting labs were visited, including the Computer Control Instrumentation Lab, the Wisconsin Electric Machines and Power Electronics Lab, the Torsatron- Stellarator Lab, the ECE Machine shop, the ECE Workstation Lab, the Optics Lab, the Engineering Research Center Lab and the Wisconsin Center for Applied Microelectronics.

A Centennial Lunch was held at Union South, and those people not attending the luncheon were invited to a Centennial Barbecue in the ECE courtyard, sponsored by the IEEE Student Organization. Following the luncheon, an address was given by Professor Bahaa Saleh, the Chairman of the Electrical & Computer Engineering Department, entitled "The ECE Department: One Hundred Years of Progress." A presentation of awards then took place in which approximately 50 outstanding alumni were honored for their achievements and contributions to the field. Citations and medals were awarded. Current undergraduate students also received special scholarships at the ceremony.

Laboratory tours and demonstrations continued after the presentation and were followed by an Engineers' Day Social Hour at the Memorial Union. Engineers' Day, also occuring that same Friday before the UW-Homecoming football game, provided an event filled day for ECE Centennial Celebration participants.

The day ended in an Engineers' Day banquet in the Great Hall of the Memorial Union. Here, Professor Harold Peterson was honored. He came to UW-Madison from General Electric in 1945 to be chairman of the department and served in that capacity for the next 20 years. Because of his outstanding contributions, he was awarded an ECE Centennial Citation and applauded by engineers of all disciplines. ■

AUTHOR

Amy Ricchio is a senior in Industrial Engineering. She has a co-op next semester with James River Corporation in Green Bay.

Society Spotlight: Institute of Electrical and Electronics Engineers

Over 320,000 people around the world are members of the Institute of Electrical and Electronics Engineers, making it the largest electrical engineering society in the world. The IEEE publishes 25 percent of the technical information for industries around the world. The organization was founded in 1884 and improved with the help of Thomas Edison and Alexander Graham Bell.

IEEE allows students to learn about the engineering opportunities available and also socialize with other students," says David Drenk, an IEEE member. All students in electrical engineering are eligible to join IEEE. There are many benefits to being a member of IEEE. Being a member gives students a chance to interact with each other and work with people in a professional manner in order to accomplish goals. A great deal of learning takes place when students work together to efficiently complete a project. Belonging to a group such as IEEE encourages students to work together.

According to member Aaron Judy, "IEEE tries to keep students in contact with industry and the real world." Taking part in IEEE's programs helps to accomplish this goal. In addition to the programs and activities, members receive the magazines *Potential* and *Spectrum*, which offer current information on advances in electrial engineering.

About 240 students belong to the UW-Madison student branch, which has meetings every two weeks. The advisor for IEEE is Professor Kewal Saluja. According to Dave Way, the chairman of IEEE, "We want to promote professionalism among students and stress the importance of working as a group." Each semester five to seven technical speakers from companies such as IBM, Hewlett Packard and Rockwell International lead technical presentations for IEEE. The speakers relay the most current information about engineering and technology to the students. A few topics covered by the recent speakers include new techniques in storage for computers, navigation with auto pilots and engineering in the 90s.

Plant tours are of interest to many members. Each semester, IEEE visits different plants. Two plants toured this semester were the General Electric plant in in Milwaukee and the Nicolet plant in Madison. By participating in the tours, the students can see how the real world of engineering operates and can learn that engineering is more than just classes.

There are various committees in the student branch, including outreach, social and fund raising. The outreach committee travels to different high schools in the Madison area and talks to students in math and physics classes. Familiarizing the students with engineering and recruiting new engineering students are the committee's primary goals. The outreach committee discusses engineering in general and does not just promote electrical engineering. This semester approximately 375 high school students will be contacted, and the goal for next semester is 500. For one of the social activities, IEEE and the Society of Women Engineers jointly sponsored a bowling night. The social committee is currently trying to find a sponsor for the "Save a Top" program, where soda can tops are saved and donated to a charity to help others. The fund raising committee is in charge of planning the various cookouts held throughout the year. A big money making event this year was selling T-shirts for the Electrical Engineering Centennial.

IEEE is also responsible for saving the student lounge in the Engineering Building. Recently, the members collected signatures on a petition and presented it to the Polygon Engineering Council to prevent the student lounge from being replaced by a computer lab.

IEEE is also active in the Engineering Expo. Last year the group won third place in the student division for their laser pool project. Judy notes, "Expo is a strong point. Working on a group project taught me a lot about group leadership."

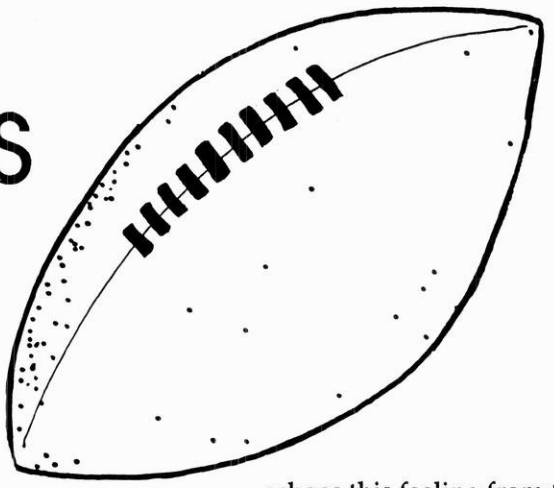
Anyone in electrical engineering may join IEEE. A bulletin board explaining the group's events is located on the first floor of the Engineering Building. Any questions about IEEE may be referred to Dave Way at 238-4736. ■

AUTHOR

Amy Erickson is a second year Electrical Engineer from Stillwater, Minnesota. For Christmas, she would like to be this year's Olympic gold medalist in circuit design. Unfortunately, The Olympic Committee recently announced that circuit design was being dropped from this year's Olympics. The *Wisconsin Engineer* believes that interest in the sport fizzled.

Football Fields

Grass vs. Artificial Turf



Traditional sports fans may wince at the sight of a domed sports stadium or the use of the three-point play in basketball. But what do these fans have to say about artificial turf?

Like it or not, synthetic turf is being installed in college and professional football stadiums nationwide. The University of Wisconsin's Camp Randall Stadium was groundcovered with artificial turf in July of 1990 by Astroturf Industries, Inc. The McClain Athletic Center also has a similar turf groundcover.

The UW Badger football team has mixed feelings about the new turf, according to Rob Ianello, on-campus recruiting coordinator for the Badgers. He says that the football team still practices on the grass field two times each week even though most games are played on artificial turf.

"Their legs get more weary on the turf than on the grass," explains Ianello. "We practice on the grass and then on Thursdays we go onto the turf to keep their legs tough."

So what exactly is the difference between artificial turf and natural grass, and what are the pros and cons of each? Astroturf Industries, Inc. offered some answers to those questions as well as a report on the composition of the turf.

One of the positive attributes of the synthetic turf is its consistency. Unlike natural grass, which may suffer more wear and tear, artificial turf better upholds its quality throughout a season of inclement weather and excessive use.

There are those coaches, players and sports writers who argue about the effect of artificial turf on the number and extent of injuries in a season. Several studies have been done on the subject, but one that is cited most often is a 1978 study called the National Athletic Injury/Illness Reporting System study conducted by Pennsylvania State University. The conclusion of that report showed that there was little difference in the number of "serious" injuries, or injuries that would cause a player to miss one game or a week of participation, between games played on grass and games played on synthetic turf.

The number of abrasions suffered by football players who play on artificial turf is higher than those suffered on natural grass

Other studies have shown that the number of abrasions suffered by football players who play on artificial turf is higher than those suffered by players on natural grass. Ianello echoes this feeling from the UW football team, saying that colder temperatures make the turf harder and thus, more painful to fall upon.

According to Astroturf Industries, the condition of artificial turf is comparable to the "ideal grass," or the first grass of the season. The difference is that grass loses its quality through weathering while the turf stays fairly consistent.

One of the reasons for this consistency can be seen in the components of the turf. The pile fibers of the AstroTurf used in Camp Randall are made of a nylon 6-6 (the size of the yarn used) ribbon which can absorb about 4% of its weight in moisture. This ability makes the turf seem more like natural grass. Three things happen when the turf becomes wet: The turf becomes softer and less abrasive, it becomes cooled, and it becomes slightly lubricated. All three conditions help assimilate the turf to grass and improve the playing conditions.

Natural grass, however, can become muddy and soggy during wet weather conditions, resulting in a more easily damaged football field.

Surface temperatures in natural grass and artificial turf are also different. A dry synthetic turf surface will be warmer than natural grass; whereas, a wet synthetic turf surface will be more equal to grass' natural state. While grass can be cooled naturally via the evaporation process

Astroturf Industries report that it takes 1500 gallons of water to cool an entire football field

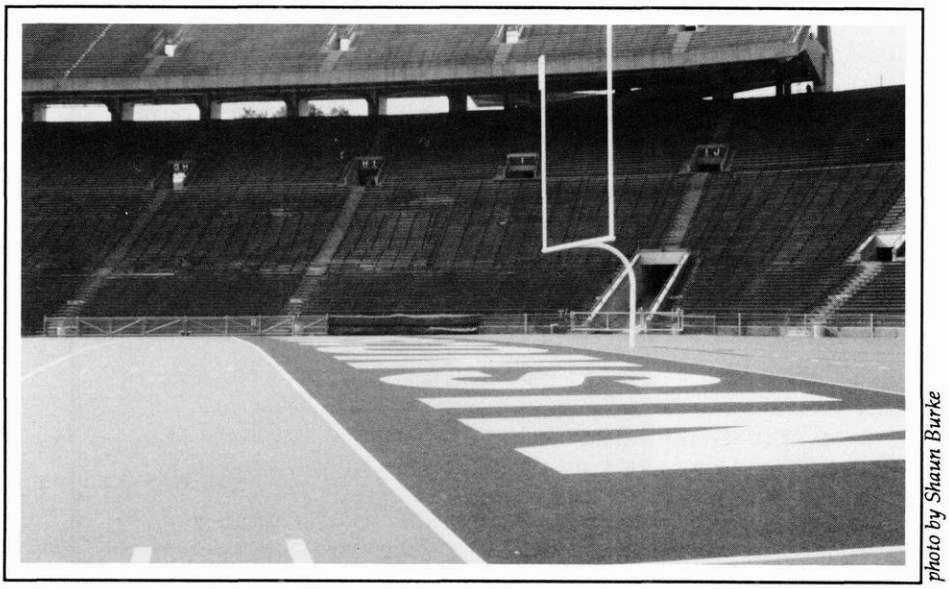


photo by Shaun Burke

Camp Randall Astroturf. Could it be responsible for Wisconsin's change in luck this year?

involved in its roots, turf must be cooled artificially. Astroturf Industries reports that it takes 1500 gallons of water to cool an entire football field. Camp Randall's football field is cooled off using hoses any time the conditions get too hot.

The drainage system underneath artificial turf is also a consideration. Camp Randall's "float-drain" system has holes within the padding beneath the turf. Water flows through these holes and then off to side drainage areas which extend around the perimeter of the field.

Shoe selection is another factor involved in the grass vs. artificial turf issue. On grass fields, the traction is a result of the cleats mechanically penetrating the roots of the natural grass. On turf, the cohesive friction between the shoe and the synthetic surface causes the traction. The ideal shoe for an artificial surface has a good support for the foot, is stiff enough to support the arch and the base of the toe joints and has moderate traction. Some football players wear basketball shoes on artificial turf, but some type of cleat is recommended to prevent hydroplaning.

Ianello says that some Badger football players have better footing on grass fields, noting that the cleats dig into the grass. He also points out that sometimes the turf becomes too slick when it is wet, more so than wet grass.

When weighing the pros and cons of artificial turf as compared to natural grass, Astroturf Industries concludes that turf is more economical and practical. For example, the maintenance cost of the Astroturf is $10,000-$15,000 annually, while the cost for natural grass upkeep is $40,000-$60,000 annually.

Replacement of Astroturf is required every ten years, while natural grass football fields must be re-sodded every two to three years.

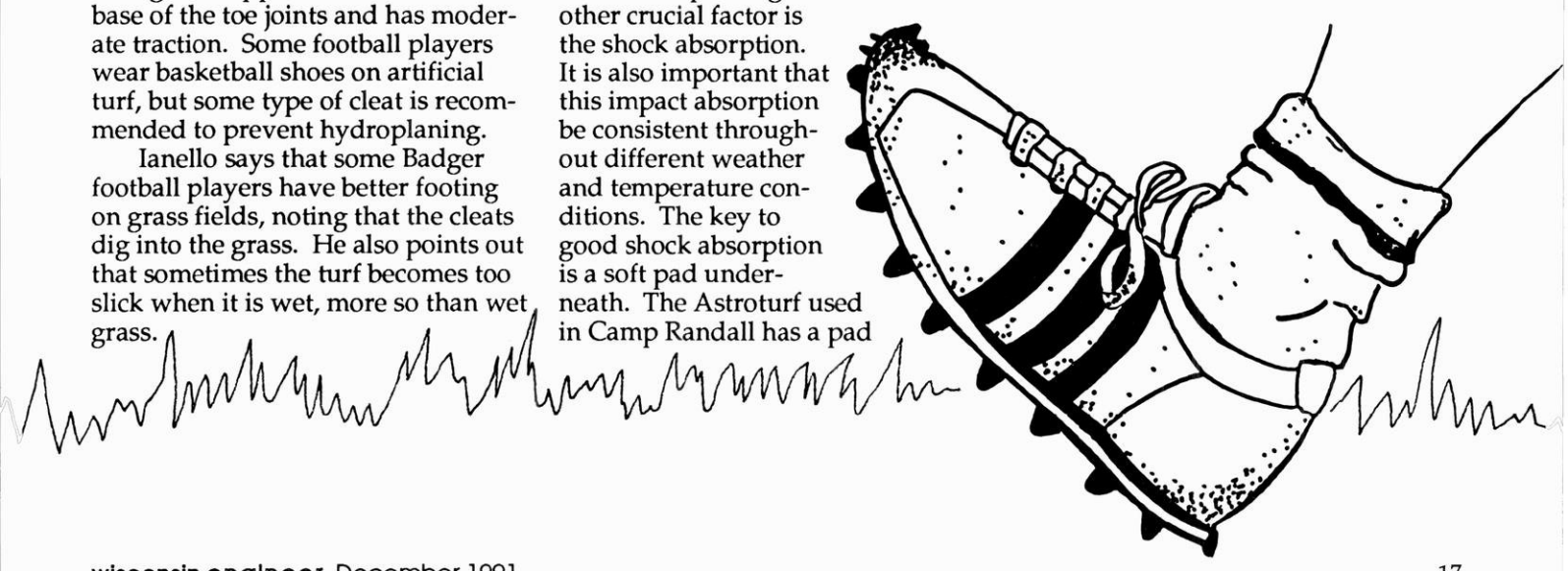
While stadiums with natural grass are limited to the number of games played on the field each year, artificial turf stadiums can enjoy unlimited usage.

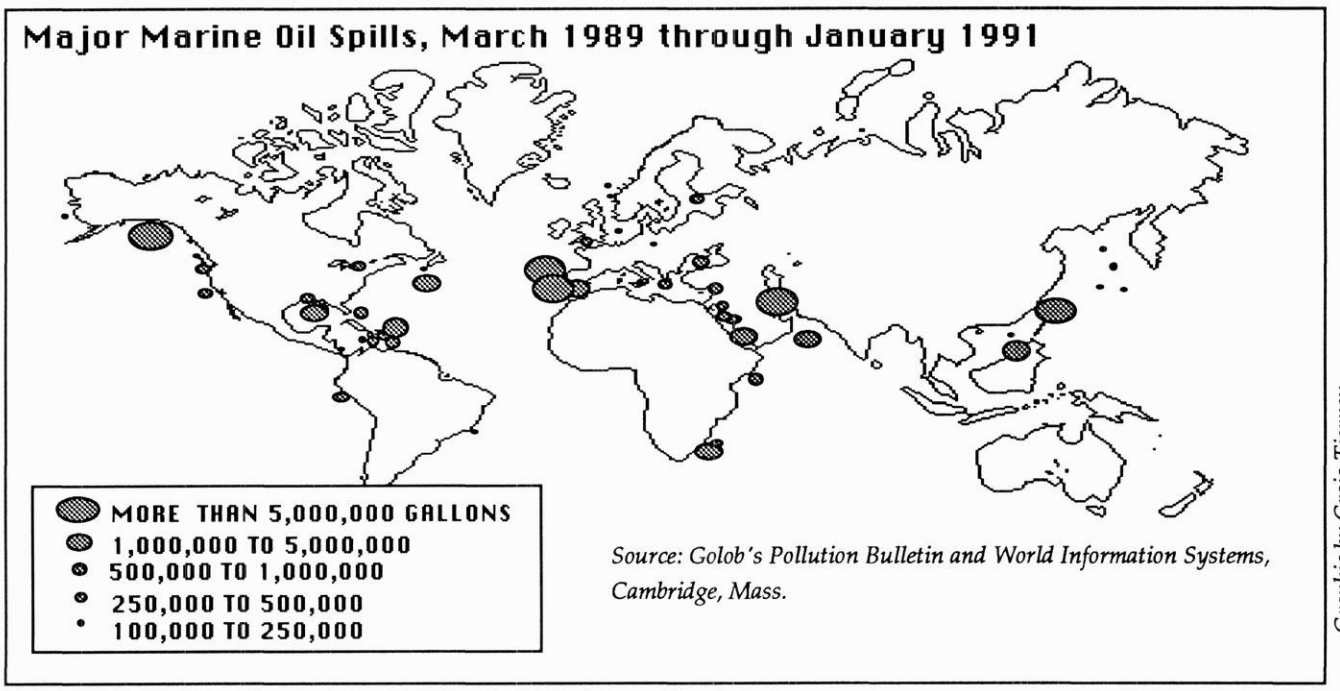
Turf experts agree that another crucial factor is the shock absorption. It is also important that this impact absorption be consistent throughout different weather and temperature conditions. The key to good shock absorption is a soft pad underneath. The Astroturf used in Camp Randall has a pad made of a closed-cell synthetic foam cushion, a material often chosen for excellent shock absorption.

The UW football team finds it is a "big deal" to play on artificial turf and something that requires getting used to, says Ianello. He explains, "Most of them played on natural grass in high school, so this is all new to them." ■

AUTHOR

Amy Nelson is a senior in Broadcast Journalism. She really hopes that Santa will be able to fit a forest green Jaguar into her stocking.





Source: Golob's Pollution Bulletin and World Information Systems, Cambridge, Mass.

Graphic by Craig Tierney

Oil Spills

A slick engineering issue

According to the U.S. Coast Guard an estimated 2.3 million tons of petroleum enter the seas each year, five percent as oil spills. This staggering figure symbolizes a definite problem that most would agree needs some new solutions. The crisis is definitely getting attention. Recent oil spills have fueled much public outrage and have also hit a few pocketbooks pretty hard. Exxon alone spent $2.5 billion on the cleanup of Alaska's Prince William Sound while the government added nearly $154 million. Although spills only account for five percent of oil entering the seas, down from 12.5% in 1985, a spill enters as a highly visible, concentrated shock to the environment. Prevention will have to play a major role, but the fact remains that oil spills will continue. In order to combat the environmental damage caused by oil spills we need effective cleanup technology.

Currently, several main oil spill clean-up technologies exist.

Dispersants can be sprayed onto a slick to reduce the cohesiveness of the oil so it can be broken up by wind and waves, diluted and better biodegraded. Dispersants are highly controversial due to concern over their impact to the environment. As a result, not much field data showing their actual effectiveness exists.

Sinking agents have successfully been used to sink spills of oil. They are generally regarded as ineffective. However, because of the impact onthe ocean floor and the tendency of oil to leach back to the surface.

Bioremediation has potential applications in petroleum cleanup ranging from oil spills on the water to beach cleanup to gasoline leaked from underground fuel tanks

In Situ Burning is simply the onsite burning of a spill. Although seemingly a simple solution, there are many limitations. For example, the oil must be at least three millimeters thick and relatively fresh. In addition, about one millimeter of oil residue will remain due to the quenching of the flame resulting from loss of heat to the water's surface. This method also involves a trade-off from the oil pollution to the air pollution resulting from the combustion of the oil.

Mechanical cleanup is the actual recovery of the oil. The U.S. now relies mainly on this mechanical solution for removing spills. This technique uses any of a range of devices suitable for oil removal. The method is also seriously hampered by present technology. The present mechanical oil recovery devices are relatively ineffective in waves greater than six feet

and winds greater than twenty knots. At best it has been unusual for more than 10 to 15 percent of the oil to be recovered off the water from a large spill.

The development and improvement of these technologies is presently the job of both the oil industry and various branches of the government, including the Environmental Protection Agency, the Coast Guard, the Department of Transportation and the Department of the Interior. One problem remains: The only two methods mentioned so far that actually remove the oil from the immediate ecosystem are in situ burning and mechanical recovery, and both leave significant amounts of petroleum. What happens to the rest?

Oil is a naturally occurring substance so it is only natural that organisms exist that feed on it or derive their energy from it. There are microorganisms that biodegrade and oxidize hydrocarbon molecules, ultimately converting them to carbon dioxide. These microorganisms have provided a point of much hope in the area of petroleum cleanup as potentially the most inexpensive and least damaging of cleanup techniques.

Bioremediation is a term describing any of several methods used which attempt to enhance, or speed up, the natural biodegradation of the oil. Bioremediation has potentially vast applications in petroleum cleanup, ranging from oil spills on the water to beach cleanup to gasoline leaked from underground fuel tanks found at the corner gas station. The new technique has recently seen some significant advances and encouraging successes, yet much of the field and its applications remain sorely in need of exploration and development.

The process of bioremediation presently includes three main categories of viable options: the use of genetically engineered microbes; the introduction of non-indigenous, naturally occurring microbes; and the stimulation of biodegradation by 'evening up' the other nutrients necessary for the microbes to survive.

The last of the processes just mentioned is by far the simplest approach and has recently had some success. In addition to hydrocarbons, other nutrients such as nitrogen, phosphorous, and oxygen are needed by the microorganisms in order to survive. When an unnaturally high volume of hydrocarbons is introduced into an ecosystem as in the instance of an oil spill, the other nutrients suddenly become limiting factors in the microbes' ability to eat well and prosper. Several ideas and methods for the 'evening up' of nutrients are under research and development in a variety of hydrocarbon cleanup applications. The application that has been used in the cleanup of oil spills consists of adding nitrogen- and phosphorous-bearing fertilizers to the spill or beach. This research has resulted in inconclusive results and little, if any, enhancement for spills still on the water. However, the method has recently met some success on the beaches of Prince William Sound. These Alaskan beaches are the site of the joint EPA/Exxon cleanup effort which constitutes the largest bioremediation attempt to date. The effort proved encouraging, with a two to threefold enhancement of natural biodegradation rates.

The introduction of non-indigenous bacteria is a method in which naturally occurring bacteria are brought into the spill. This method may provide a small jump in the rate of biodegradation, but the overall increase in the rate is fairly minimal. Most areas already contain a significant number of oil degrading microbes, and these native microbes will reproduce rapidly and eventually outnumber the introduced microbes. The net enhancement of the method of introducing non-indigenous bacteria over natural biodegradation rates tends to be small.

Genetic engineering could make all the difference in the field of bioremediation, or none at all. An alteration in the microbes' genetic makeup which helps them to withstand colder temperatures, consume more hydrocarbons, or reproduce faster could very well turn out useful.

Genetic engineering could make all the difference in the field of bioremediation, or none at all

Biodegradation is not a new process. In fact, man's use of biodegradation is surprisingly frequent as it is the basis of conventional engineering techniques for wastewater treatment. Increasing concern for pollution and its cleanup, as well as some insights into biodegradation have led to more research for its role in petroleum cleanup.

Bioremediation has had some success, but much of its possible ability has yet to be discovered. One of the main problems with the technique is the present inability to accurately measure its rate and effectiveness. However, bioremediation could well prove to be a relatively inexpensive, environmentally safe and effective solution to a very real problem. ■

AUTHOR

Jeremy Vesbach is in his first semester and is planning on majoring in Civil and Environmental Engineering. For Christmas he would like a pollution-free America and a winning lottery ticket.

All I Want for Christmas

A Guide to High-Tech Toys

It is that time of year again when people start thinking about what they want this holiday season. This year many gifts are electronic or computer-related. From a *Jet Fighter Simulator* to the newly released Super Nintendo, there is an extensive selection available reaching a diverse audience.

In the market of electronic toys and computer games, the new products are not overshadowing the old. Some old favorites still holding strong are Classic Nintendo, walkie talkies, electronic musical instruments, the *Advanced Dungeons and Dragons* gaming series, remote control cars and traditional train sets. The newly released Super Nintendo games, computer games based on movies or sequels to previously released computer games such as *Leisure Suit Larry 5* , are breaking new ground with spectacular graphics and sound.

The games being released are generally for entertainment purposes, but there are also games available for educational purposes. Business, tax and word processing programs are strong sellers.

Small stocking stuffer games are also available. These games range from pocket liquid crystal display games to miniature *Lite Brites* to *Game Gear* . The miniature *Lite Brites* are similar to the classic *Lite Brites*, but in a hand-held version. *Game Gear* similarly is a hand-held version of the larger Sega system, but it has better graphics and is in color.

Super Nintendo, which retailers expect to be a big seller this season, has the ability to entice the player with three dimensional graphics and digital stereo sound. High tech, eight-button controllers, compared to the old Nintendo's five button controllers, allow the player more control and options. A new Mario adventure is also included with the system. In Super Mario World, Mario and his friend Yoshi are on an island fighting to save the Princess.

The Super Nintendo is a specialized computer, playing games or programs strictly made for that system. Its cartridges consist of memory chips with programs stored in them. Technology has advanced so the new Nintendo system is smaller, faster

Photo by Margret Illemann and Robyn Ryan

Erica Vorsho is entranced by a battery operated dog.

Photo by Margret Illemann and Robyn Ryan

April Henry shows that Nintendo is for both young and old.

and more reliable. Unfortunately, the classic Nintendo cartridges are not compatible with the Super Nintendo System.

Computer games work slightly differently. One can purchase software and install it on the computer's hard drive or insert and load the program into the computer each time it is run. A new computer game on the market is *Kid Pix*. This program allows a person to draw pictures on the video screen with a unique twist. As one draws on the screen with the mouse, a distinct sound effect accompanies each line or shape. For example when one draws a squiggly line a *whoop-whoop* sound is heard. The sounds are imaginative and comical at the same time. Other computer games such as *Advanced Dungeons and Dragons* gaming series put one in a fantasy role playing situation in which one collects clues to stay alive and finally conquer the game.

What motivates consumers to purchase electronic games and toys? Many people answer this question with a response such as "they are challenging" or "they are fun." Motivation largely depends on the age group involved. Parents with younger children purchase toys that are safe, yet enjoyable, as opposed to teenagers who prefer a challenge over safety.

Recently, while at East Towne Mall we asked Erica Vorshco of DeForest, Wisconsin what she wanted for Christmas and why. "A Barbie jeep, because I love it!" was her matter-of-fact response. As the audience gets older, they tend to be drawn to computer or video games. Both young and old are inclined to want certain toys because of advertisements or because someone they know has one.

Ron Koci, manager of Walden Software at East Towne Mall, states, "Most of our computer programs and games interest people between the ages of 15 and 45."

Many of the games such as *Where in the World is Carmen Santiago?* are strategy games pitting the user's wits against the program's built-in intelligence. In the game the player must track down and bring in Carmen. The player uses supplied clues and an almanac in his or her search for Carmen. This series allows the player to learn geography and history, while being entertained.

April Henry, 18, from Marabou, Wisconsin enjoys playing Nintendo. She states, "It's challenging, different and fun." This holiday season, many college students are requesting televisions, stereos and even Nintendo Systems. Steve Baffico, a student here at the UW, states, "I'd really like a new answering machine."

Enjoyment and safety are important factors in the purchase of gifts, yet price remains equally important. The Super Nintendo System costs $200 while the cartridges cost around $60. Computer games, such as *Where in the World is Carmen?* and *Advanced Dungeons and Dragons* series, for the IBM, Macintosh or Amiga systems run around $40 to $55. The smaller stocking stuffers cost $10 to $15 while remote control cars run anywhere from $20 to $45.

One consumer stated that she never really thought about the price and bought a Super Nintendo System without hesitation since "it would give the kids something to do after school." A majority, however, opt for the "little as possible" philosophy when purchasing electronic games and toys.

Whether shopping for yourself or purchasing a gift for someone else, there is a wide variety of electronic games and toys available. As the Nintendo Company slogan states, "The power is in your hands."

AUTHORS

Margret Illemann and Robyn Ryan, both first year students, managed to whip together this article for your reading enjoyment. All Margret wants for Christmas is to pass her political science course. All Robyn wants is carpeting for her dorm room.

The Psychology of Shopping

A long, long time ago, before I became a freshman, I was much more accustomed to the outside world. By that I mean that I watched and understood the news regularly; I watched situation comedies daily, and, oh yes, I had complete freedom of transportation. That is, I had access to my parents' car. Ah, how I loved to waste gasoline as I tooled around my hometown, running errands and picking up various siblings from their extra-curricular activities.

I also did something that will shock and amaze those who have met me in college. I used to go to the mall.

In my year and a half at this university, I have learned that the mall and all that it stands for is unsophisticated and superficial. For example, a sweater bought at the mall is not nearly as cool as one found on the table of a street vendor on State Street or out of a J. Crew catalog. Heavy metal and pop music, the kind played by almost every boutique in a mall, is replaced by alternative music -- that which is not popular on the Top 40 music charts.

In my year and a half at this university, I have learned that the mall and all it stands for is unsophisticated and superficial

So, when I found myself in mid-December, with finals drawing near, and the consequential time crunch robbing me of all but my most necessary methods of procrastination, I was torn. I desperately needed to go Christmas shopping in a place where I could find gifts for everyone I knew in one trip. However, with two feet of snow on the ground and a raging blizzard outside, I did not feel up to trekking all over State Street. I decided to go to the mall.

I boarded the first east-west bus that I saw on a snowy Saturday morning. Then I settled in for a long ride. The bus took me far off of campus... past homes with small children playing in the front yard and gas stations and elementary schools. It occurred to me that in my "bubble" of college life I had forgotten about the rest of the world. We strive so hard for diversity here, but I live in a dorm with 74 other people who are very much like me —mostly sophomores in college looking to get a degree and a good job.

My thoughts were interrupted when, a half-hour through the ride, two giggling girls boarded the bus. They both chewed (or perhaps the correct term is smacked) gum and sported jean jackets bearing six inch diameter buttons with the likes of the New Kids on the Block and Nelson. I wondered if their mothers might have at least made them wear hats in this terribly cold weather, but hats certainly would not have fit over their bangs, which curled three inches into the air.

"Well," I thought to myself, "you can't judge a book by it's cover. Maybe those girls aren't on their way to the mall. Perhaps they're going to the library or to visit a sick friend..."

Before I could chide myself for using a cliché in my own thoughts, the girls stopped giggling and began to converse.

"Oh my gosh!" squealed one girl through lips slathered in frosty pink lipstick. "I wonder if Joey will be hanging out at the food court?"

"If he is, I'll die!" exclaimed the other in a voice that was reminiscent of fingernails on a chalkboard.

Now I wanted to chide these girls for being so incredibly cliché in their mall behavior. I was beginning to understand my peers' aversion to the mall.

However, now we had arrived, and I had work to do. The logical side of my brain took over and I decided to cover every store by first shopping in one side of each wing of the building, and then the other. The first store that I decided to enter was a large department store. I remembered a friend of mine complaining that her flannel nightshirt was getting very old. I headed to the pajama-slash-lingerie section of the store, and no sooner had I found and purchased the perfect kind of plaid when I heard, "Hey Annelies, what's up? Out underwear shopping, or what?"

My face became crimson as I turned around to greet an aquaintance from math discussion. "Uh, no, I'm just doing a little Christmas shopping. What brings you here?"

"The same," he said, looking at the floor. "You see, my little sister loves The New Kids on the Block, so

I figured that this was the place to shop."

"I think you're right," I said, watching the two giggly girls that I shared the bus ride with as they walked by.

"Sorry, but I've really got to be going," he said nervously.

I knew that he was a junior and therefore had had the benefit of two and a half years of college conditioning to become anxious in and around malls. It showed.

I left the department store and inadvertantly followed those giggling girls. I overheard more of their conversation.

"I really, re-eally think that Matthew Nelson is cuter than his twin brother Gunnar."

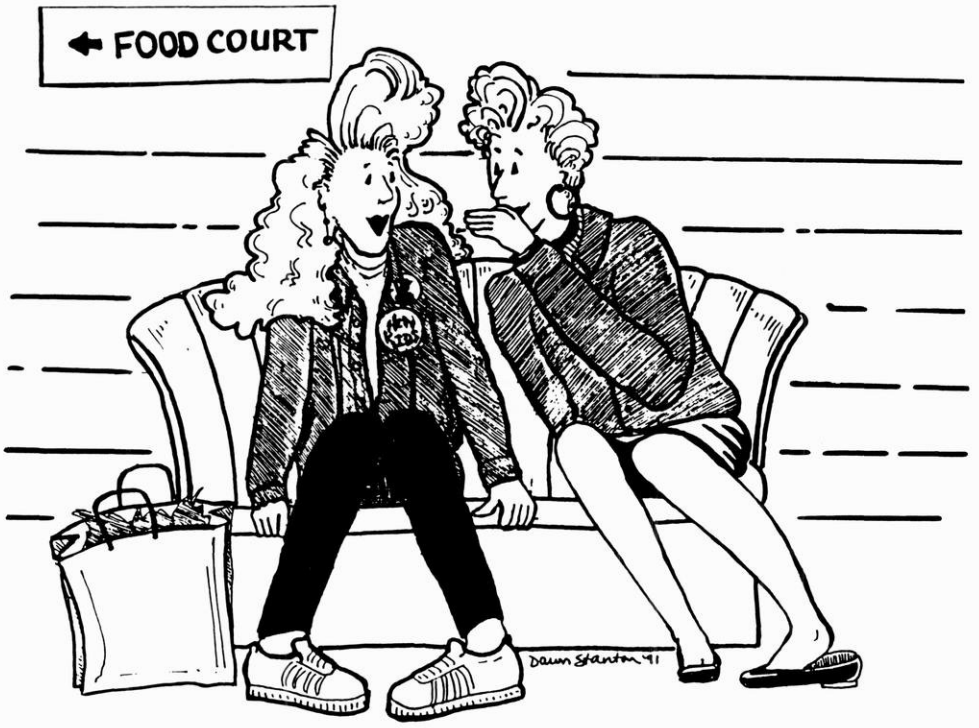
"Whatever happened to Shaun Cassidy?" I mumbled to myself. "Now there was a heartthrob."

I passed by stores of all sorts. Some sold clothing of only pink and lavender. Some sold incredibly tacky gag gifts and smelled strongly of bad plastic. Finally, I found a shop that suited my needs.

"Whatever happened to Shaun Cassidy?' I mumbled to myself. "Now there was a heartthrob."

"I'd like an order of fries and a Coke," I told the young worker at the fast food chain counter. It was obvious that I wouldn't be able to continue my journey without some carbohydrates, caffeine and rest.

I sat down and watched the people in the "Food Court" all around me. Senior citizens race-walked by several times. Mothers tried to quiet crying toddlers. For these people, it was just another day. But for the group of 20 teenagers buzzing around the Food Court, self-esteem, lives and and ego-centric worlds were being built up and shattered daily. A police officer watched them at least as intently as I did. He leaned up against a wall, puffing up his chest and resting his hand on his gun.



I was becoming more and more intrigued with the soap opera going on in my midst. However, the atmosphere conjured up memories of my earilier years... a time when, for me, talking to a boy was the most difficult thing in the world, the label on one's jeans helped to determine social status, and a "best friend" was a very temporary thing.

Once again, my mind found a tangent and decided to explore it. I decided that it was safe to assume that for most people, adolescence is the most difficult time in their lives. If that is true, then as college students, we are getting our first taste of adulthood. That signifies the beginning of self- sufficience and security. Could it be that going to the mall triggers deep-rooted insecurities in the mind of even the most stable college student?

I stood up with a start, egocentrically impressed by my own thoughts. My hands shook and my heart raced as I headed to the next department store.

A sweatshirt, a book, a box of stationery and a pair of socks later, I was finished. With my Christmas shopping out of the way, I could now bus home and return my energy to studying.

However, I could not wait to mention my mall anxiety theory to some of my friends, although I was pretty sure that they would just laugh at me and say that the only reason they never go to the mall is that it is annoying.

Never mind them — they would just be repressing old fears. Besides, I could not help looking forward to Christmas break at home. A whole *month* with nothing to do... except go to the mall. ■

AUTHOR

Annelies Howell is a second year student tentatively majoring in physics. She tries to avoid the malls as much as possible by spending her time skiing.

North Pole Faces Cutbacks

(North Pole) - We present to our readers the following letter and confidential memo sent to the **Wisconsin Engineer** magazine anonymously. Postmarks show the origin of these items to be between 89 and 90 degrees North latitude:

Dear Sirs:

A crisis of terrifying proportions is looming in the near future, and no humans seem to be aware of the impending end of Christmas as we know it. Severe budgetary constraints are forcing cutbacks in the once lavish expenditures here at The North Pole, Inc. (formerly the North Pole). Your children may never know the joys of the Yuletide if you miss the chance to rescue a tradition. I am sending you this information in order to promote awareness of the possible collapse of Christmas. Please encourage all of your readers to send letters to The North Pole, Inc. to implore them to rescue and restore Christmas.

~ a Concerned Terrified Elf

Confidential Memo
To: S. Claus, Distribution Division, TNP, Inc.
From: T. Grinch, CEO TNP, Inc. TG

You lose!

Being the company's only shareholder, I voted today and decided to prioritize the financial aspects of TNP, Inc. starting immediately. This redistribution of resources will entail eliminating all on-revenue services and replacing them with a "quid pro quo" type of transfer, similar to the payment techniques utilized by Amalgamated Tooth Fairies, Ltd. I can't imagine why even someone as dim as you didn't see this as the source of your financial troubles as you ran this company into the snow.

As your contract stipulates that I maintain you as an employee at your current salary, I have decided to promote you to a comfortable desk job informing children of the new policy concerning our products (they are no longer gifts; rather, they are purchases taxable at 43% of the list price). Your salary will remain the same, but you lose your health insurance, blizzard insurance, sleigh insurance, pension, company investment funds, life insurance, glacier insurance and doughnut privileges. In addition, we have moved you into a 96% tax bracket, channeling all company profits through you.

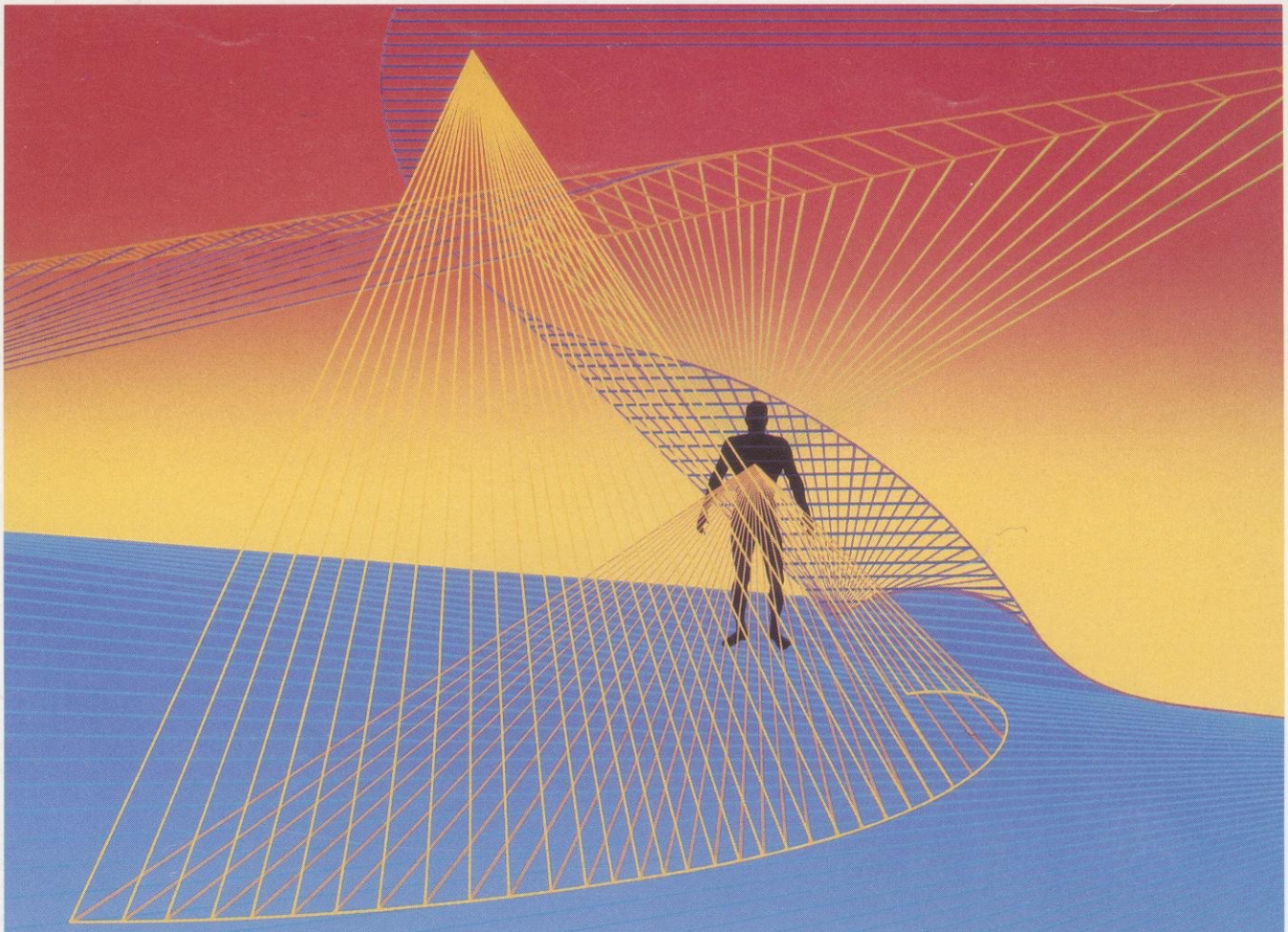
P.S. I hope you die of frostbite!

We have no further information on this matter. Our repeated attempts to send mail to the North Pole were defeated by the U.S. Postal Service. In addition, all attempts to charter aircraft (at extremely generous rates, on our part) were met with scorn and derision. **National Geographic** expressed interest in supporting an expedition in the summer, which is much too late. We can only hope that Santa will be able to regain control of the North Pole in time to provide a Merry Christmas.

We can only wait until December 25, when the success or cataclysm will present itself. So, we wish you a "Merry Christmas" or a "Never Surrender," based upon your Christmas. ■

AUTHOR

Alexander Dean is graduating this Christmas after 11 semesters of ECE and Spanish. In the eight months before starting graduate school, he would like to start two electronics companies, write the Great American Novel, read 200 books, bike around England, build a sailboat, record an album, and catch-up on *Star Trek* and *Cheers*.



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