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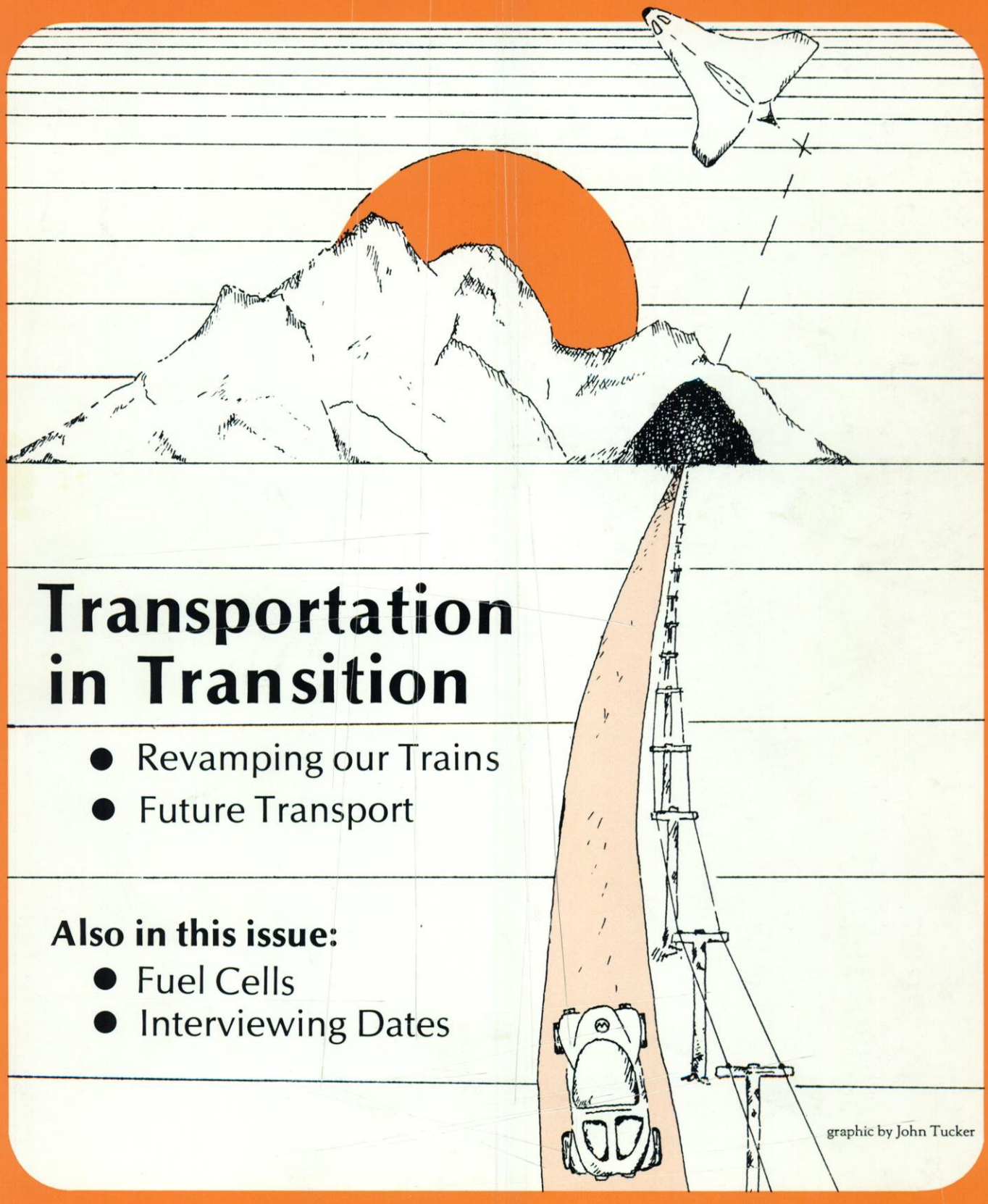
Volume 90 No. 1

OCTOBER 1985

wisconsin engineer



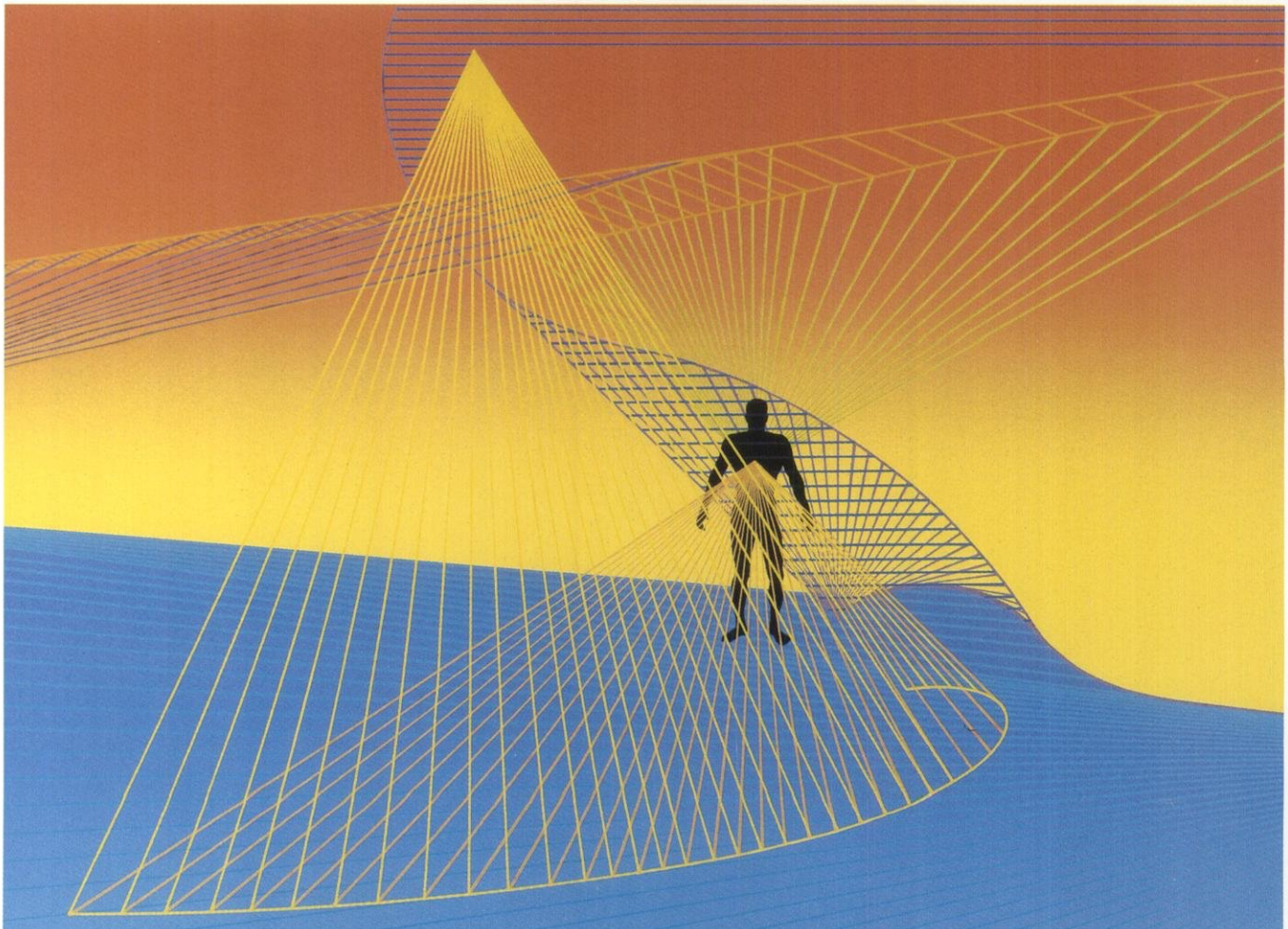
Transportation in Transition

- Revamping our Trains
- Future Transport

Also in this issue:

- Fuel Cells
- Interviewing Dates

graphic by John Tucker



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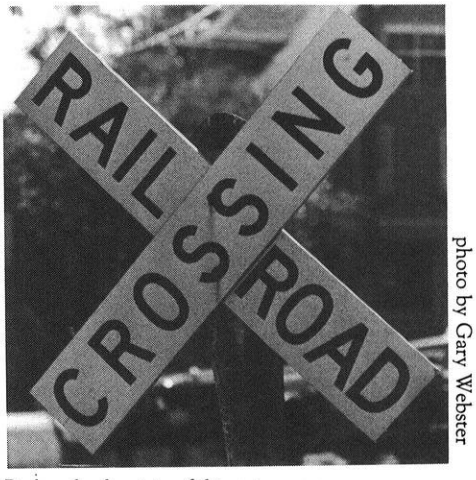

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The **Wisconsin Engineer Magazine** is published by and for engineering students at UW-Madison. Philosophies and opinions expressed in this magazine do not necessarily reflect those of the College of Engineering. All interested students have an equal opportunity to contribute to this publication. **Charter Member of the Engineeing College Magazines Associated. Chairperson:** John N. Clausen, Mechanical Engineering Building, University of Minnesota, Minneapolis, MN 55455. **Publisher's Representatives:** Littell-Murrary-Barnhill, Inc., 1328 Broadway, New York, NY 10001 and 221 North LaSelle Street, Chicago, IL 60601.

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Lake Water

US, THEM and Opportunity

by Paul A. Stone

Despite the diversity of the student body at UW-Madison, there have always been two broad classifications of students: those of the technically orientated College of Engineering (ie, US), and those of the (nonorientated ?) College of Letters and Science (ie, THEM). Although the distinction is not black and white, it exists nonetheless in various shades of gray.

From THEIR point of view, the typical engineer:

a) wears straight leg Levis and a flannel shirt.

b) has pencils and pens in a pocket holster and a calculator on belt.

c) spends free time doing mass and energy balances.

d) has no concept of the outside world.

From OUR point of view, those "Bascom Hill people":

a) wear funky, nonfitting, mismatched clothes with gucci shoes and tons of jewelery.

b) can't even turn a calculator on, much less use it.

c) spend free time discussing the relevence of whether a zebras stripes are black on white or white on black.

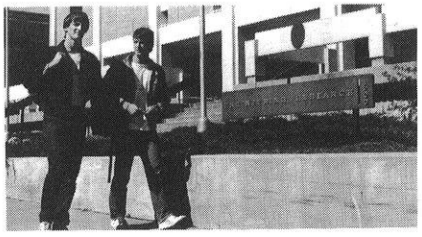
d) have no concept of anything mechanical or concrete.

Consideration of the location and terrain of these two factions of campus life suggests a subtle analogy. While THEY have Bascom Hall and State Street, WE have the Engineering Research Building (ERB) and Randall Avenue. Memorial Union's terrace overlooks beautiful, carefree Lake Mendota, whereas Union South's terrace overlooks (beautiful, carefree ?) Kurt F. Wendt library.

Although it's often enjoyable to "take the mickey out of THEM", WE in engineering could learn a bit from them. UW-Madison can offer US a great deal more than an outstanding technical education: opportunities for social, cultural, and political experiences abound on campus and cannot be learned in a classroom.

Most engineering students (at least those with any personality at all) do participate in many of the social activities: partying, badger games, sports, etc... . Some are even fondly familiar with some of the cultrual opportunities available: university theater and concert recitals, Elevjem Musuem of Art, study abroad programs, etc... .

However, few students in the College of Engineering take advantage of the many opportunities for political involvement. This is unfortunate for two reasons. First and foremost, we are neglecting an important opportunity for education which is unique to college in general and UW-Madison in particular. Secondly, as technically educated people, engineers can offer different insights into many political issues; our lack of political participation deprives the whole community of our potential contributions.



Us.

Them. photo by Gary Webster

There are currently several issues, both national and local in scope, which do affect US and to which OUR awareness and involvement could make a difference. Some of these include for example:

-Faculty Pay: Salaries of UW professors are not competitive with those offered by institutions of comparable quality in education. As a result, we are losing many of our top educators. The most recent example from the College of Engineering : Professor Frank is taking a good deal of his motor vehicle research with him to another university.

-CIA Recruitment: Demonstrations by THEM against the CIA recruiting on campus has intensified due to the CIA's covert operations in Nicaragua. The official Engineering Placement Office stand on the issue is that "no potential employers will be deprived access to students seeking employment."College of Engineering students have virtually ignored the issue by not expressing an opinion either way.

-South African Divestment: Although the university has divested all assets from South African companies because of their apartheid policy, the State of Wisconsin has not. Class boycotts and a sit-in at the Capitol last semester helped bring the issue into political focus. How many engineering students participated in either the boycotts or the sit-in?

-Environmental: Concerns regarding safety in industrial settings have been highlighted by disasters in Bophal, India, chemical waste sights, transportation of hazardous chemicals (including nuclear wastes), etc.. WE can and should contribute to these environmental issues as knowledgable, technical people.

Other issues such as Reagan's Strategic Defense Initiative (SDI), selling nuclear and other high technology to other countries such as China, legal drinking age, the farmer's plight, etc., etc., ... The list could continue indefinitely.

I am not advocating an abandonment of all classroom responsibility for political radicalness. However, I am suggesting WE get involved in the political issues: Be informed about the issues. Participate in some demonstrations, boycotts and rallies. Express your opinions in letters to the media or the party of concern. WE would all benefit quite a bit from it!

Don't surpass the unique opportunities offered by UW-Madison. After all, what do THEY up on Bascom Hill know about chemical kinetics in a nuclear reactor.

Paul A. Stone, Editor

Written response is welcome.

Editorial

Bike Cops: Megalomaniacs or Necessary Regulation?

by Matthew Piette

Anyone who has spent time on campus has seen the bike cops -- those uniformed bicyclists whose duty it is to enforce the rules of the road as they pertain to bikers. Many of us have had an unpleasant experience dealing with one. Does such a bicycle problem exist that warrants this solution or is it another example of governmental interference into the everyday lives of the people?

This past summer I was stopped by a bike cop. I was asked to dismount my bicycle and was lectured about the hazards of disobeying road signs (allegedly I ran the stop sign on the corner of State and Lake but wasn't stopped until I was at University and Orchard). She told me that not only was I endangering myself but also those around me and therefore she was going to write a ticket, presumably to encourage my feelings towards self-preservation. Being late for a class already and not particularly wanting to pay $38.00 for officious advice, I informed her of such and left. This incident left me with a personal distaste for bike cops, not only for the arrogance of the one I dealt with but also her lack of ability to enforce the law.

Madison currently has eight bike cops, down from fourteen this May. They are described as "uniformed civilian members of the police department" and have jurisdiction all over the city of Madison, although they concentrate on the campus area. Their main responsibility is to get bicyclists to comply with the law. To enforce this responsibility, they write tickets. Fines are either $26.50 or $38.00 depending on the violation. In the event that someone is stopped for a violation, the officer will check to see that the bicycle is registered with the city of Madison and that the bike has the required reflectors. If not, fines can be levied for these offenses as well. A disobeyed stop sign can therefore become an expensive event. Often, however, only a warning is given.

The leniency of the bike cop depends on how blatant the violation is and which officer witnessed the crime. I saw a person get only a warning for riding the wrong way on the Johnson Street bike path, while I saw another get a ticket just for not stopping before turning on to it. One would think that the Madison "left" would have a field day with their selective prosecution.

The leniency of the bike cop depends upon how blatant the violation is and which officer witnessed it.

Most bicyclists in Madison have the attitude that since they are on bikes and not cars, they do not have to obey traffic regulations. Since bikes are small, slow and maneuverable, they can't cause much harm and are therefore above the law. This obviously puts them in direct conflict with the bike cops. Bicycles can and do cause traffic problems and some control is necessary. Anyone who has driven on East Johnson at 4:30 PM with a bike in the right lane will agree with that.

A compromise must be reached, however. Not signalling or stopping when making a right turn from Gorham onto State Street hardly warrants a $38.00 ticket. A bicycle stoplight trap, located at the corner of Regent and Breese (I have seen cops hiding in the bushes there.), is another example of unnecessary persecution of otherwise innocent people. On the other hand, bike lanes are lanes and not streets; they are made for one-way traffic flow. Anyone who rides counter to the flow of traffic not only causes problems for other cyclists but also has a real chance of getting hit since cars are not looking for bikes coming from this direction. These people deserve as large a fine as possible. Likewise, not using a bike lane when one is available is a very real threat to traffic safety and should not be allowed.

Bikers should realize that because they are a part of the traffic flow, they must recognize certain laws designed for their own safety. Bike cops, however, should allow bicyclists to be human, and they should shed any holier-and-thou attitudes that they may have. If everyone acts a little more reasonably, Madison will not only be a better place to be, but it will also be a better place to bike.

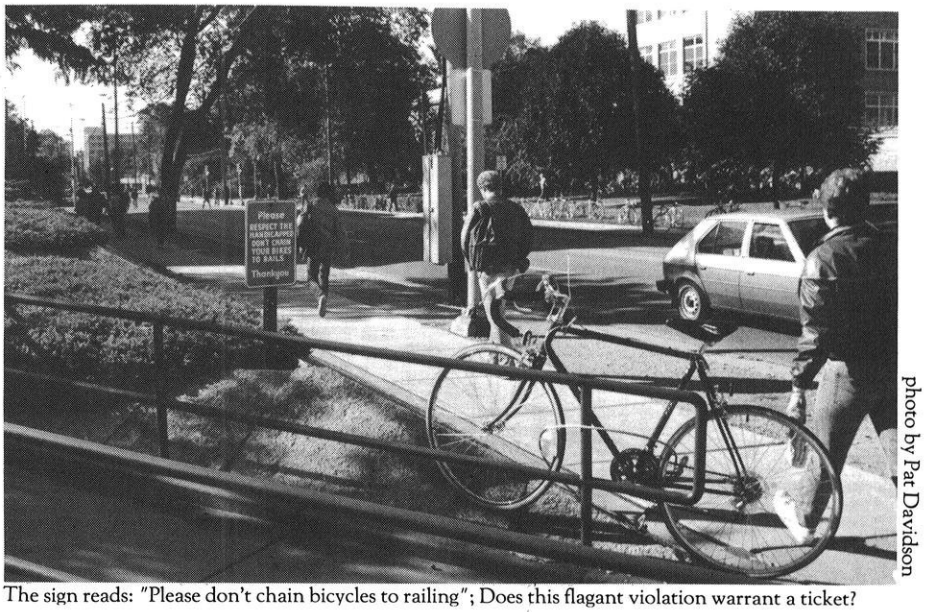


photo by Pat Davidson

The sign reads: "Please don't chain bicycles to railing"; Does this flagant violation warrant a ticket?

A New Age for Railroads

by Todd W. Wallinger

For years railroads have carried the stigma of being a dying industry - an idea whose time has come and gone. New hope, however, can be found in the latest developments offered by high technology. Experts throughout the world are now predicting that railroads are on the verge of a new age.

Some of the most exciting developments are occuring in the area of high-speed trains. The first of these, the "Bullet" trains originated in Japan in 1964. They have since found success in Japan and in Europe. Bullet trains differ from conventional trains in that they run on their own specially designed rail network which enables them to travel between 250 and 300 kilometers per hour (150 and 180 mph). Thus, while requiring a large initial capital investment, they can provide substantial long term savings.

Several studies are currently being made on the practicality of implementing Bullet train systems in the United States. In particular, plans are under way for such a system between Los Angelos and San Diego. This would reduce the driving time from the current 2.5 hours to 1 hour.

Perhaps the most fascinating technology on the horizon is the magnetically levitated train, or "Maglev". This train uses the interaction between magnetic fields on the track and the cars to levitate and propel the train. The only contact between the track and the cars is a sliding electrical connection which provides power for the train from a conducting rail in the track.

Since there is virtually no contact required between the Maglev and the tracks, it does not experience the friction losses which conventional trains do at high speeds. Derailment is not possible because the sides of the cars "wrap around"the tracks. Additional advantages are that the Maglev is quiet and has few moving parts. This makes it very dependable, virtually eliminating track maintenance. Furthermore, the Maglev does not require a driver as it is fully programed. An additional advantage is its efficiency. It consumes one fourth the energy of an airplane trip of equal distance. The major disadvantage of the train is that it reqires an initial investment even larger than the Bullet train.

A developmental Maglev system is already in operation in Birmingham, England. Although small in scale, the system has been very successful and has shown that the technology holds much promise for the future. At present, it consists of a double track 625 meters long and is used to transport passengers between the city's airport and railway station. A 1.6 kilometer system will be completed later this year in West Berlin, Germany. Several countries, especially West Germany and Japan, are conducting research on the application of Maglev technology to intercity transportation. The U.S. Department of Transportation believes a connection between Los Angelos and Las Vegas can be put into place by the early 1990's. Eventually intercity Maglev trains should be able to travel between 300 and 555 kph (180 and 300 mph).

"For years, railroads have carried the stigma of being a dying industry. Now, high technology is providing new hope."

The "People-Movers" of Disney World and Houston International Airport are hybrids of conventional and Maglev systems. Although propelled by magnetic forces like Maglev, these cars are supported on their tracks by passive wheels. The technology is much simpler, and hence, the implementation costs are much lower.

Another approach being considered for the future is to run the Maglev trains through underground vacuum tunnels. Since there would be no air resistance the trains would be able to travel up to an incredible 15,000 kph (9,000 mph). This is well into the supersonic region! Coast to coast trips in a half hour would be possible. However, these realizations would be limited by passenger comfort. At 10,000 kph (6,000 mph) the centripetal force on the passengers due to the train following the curvature of the earth would begin to induce weightlessness.

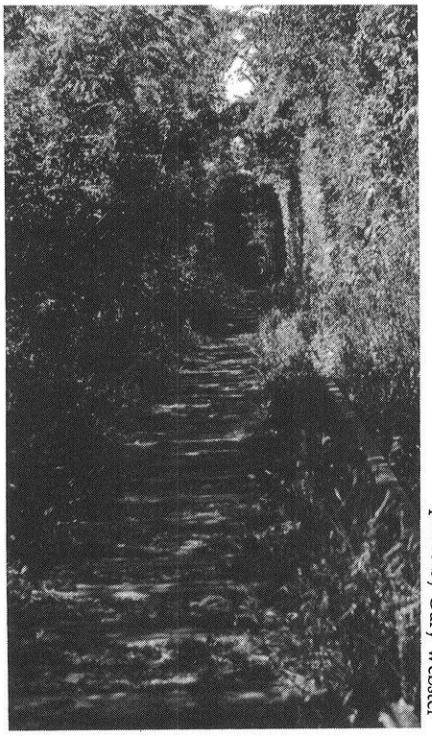


photo by Gary Webster

Is there any hope for our obsolete train system?

Just as in other industries, electronics holds the key to further improvements in railroad technology. Because railroad transportation is heavily dependent on schedules involving extensive communications and control networks, it is well suited to microprocessor technology.

Over the next three years, California's Bay Area Rapid Transport (BART) expects to put 280 cars with advanced microprocessors into operation. Present microprocessors are used to regulate speed, communicate train identification with track equipment, open and close doors, and make automatic announcements to passengers. The new microprocessors will be able to maintain safe braking distances, display status information to the operator, and perform simple diagnosis of operating malfunctions. Also, having fewer electronic components, the new microprocessors will be more reliable.

General Motors' Electro-Motive Division and General Electric are each developing their own microprocessor systems for freight locomotives: General Motors' "60 Series" and General Electric's "Dash 8". Both systems will provide improvements in fuel efficiency and reliability. The 60 Series will also be able to detect and record operating problems and take corrective action for certain malfunctions.

Whereas locomotives for freight transport must be able to pull heavy loads, those for passenger transport need to be fast. These two requirements produce a difficult design problem. However, with the advent of microprocessor technology, dual-purpose ("smart") locomotives may soon be commonplace. By changing the electrical characteristics of the motor in a manner analagous to changing gears in a car, locomotives could be used for either purpose at the flick of a switch.

Another microprocessor application is an active suspension system presently being tested by British Rail. In this system transducers near the wheels would measure the amount of bumps and displacements and send a signal to a microprocessor, It would respond by causing the car to move so as to minimize these displacements. A 50% reduction in bumps is expected. This would enable the train to travel at a higher speed while maintaining comfort for the passengers.

"Perhaps the most fascinating technology on the horizon is the magnetically levitated train."

Communications is another area where electronics may bring improvements to railroads. Trains being controlled remotely from a central location without a driver have been used on a small scale since the 1970's. However, the early technology required communication by radio, which made it expensive and unreliable. New developements are making it possible to inductively couple signals from a cable along the track to receivers on the train. Signals from the train would be sent to passive transponders located every kilometer along the track. The train would tell the control system its position and speed, and the system would communicate to the train whether it was allowed to continue, based upon the locations of other trains on the network. Driverless freight trains could result in better control of traffic flow, eliminating injuries to the crew from derailments.

Although not as glamorous perhaps as some of the other technologies discussed, track technology has so far provided the most significant improvements in the railroad industry. New rail materials and new techniques for rail production have made railroad travel safer and contstruction and maintenance less expensive. One particular developement that has been very successful is the use of concrete rather than the old wood ties to support the rails. Concrete is cheaper, more durable and results in fewer derailments due to improved track alignment.

"Microprocessor technology holds the key to further improvements in railroad technology."

Other technological developments are affecting every aspect of the railroad industry. The BiModal Corporation is developing a transport facility called the "Road-Railer". It may be hauled by both train on railroad tracks and by truck cab on the highways. Safer tank cars are also in the future: special couplers and end shields which would prevent puncture during derailment are under developement. In addition, a paint is being developed which would expand into a layer of insulation upon contact with fire. These are just a few of the many advances which are improving the railroad industries.

One hundred years ago, the railroads were the workhorses that made our modern industrial society possible. With the help of advanced technology, railroads may also become the way of the future.

REFERENCES:

1. *IEEE Spectrum*, Alscher, Boldea, Eastham and Iguchi; "Propelling Passengers Faster than a Speeding Bullet"; August, 1985
2. *Engineering*, "The Future", August, 1983
3. *IEEE Spectrum*, "Transportation"; January 1984, January 1985

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Getting Around in Style

by Ann Conklin

Despite the diversity among college students today, most share one common characteristic - being on a budget. This often means finding the cheapest ways to eat, to be entertained, and even to get from place to place. Consequently, for the majority of students, transportation is limited to walking, riding a bicycle, or taking an occasional ride on the "Big Grey Dog." Although these ways of getting around do have their merits, many students dream of the exotic and luxurious ways they will be able to travel when they are finally finished with college.

Even if your graduation date is still some time away, don't despair! Plenty of exciting opportunities for travel are available right on the University of Wisconsin campus. One of the most adventurous ways to get from one place to another is by hot air balloon. According to Joyce Barlow of Token Creek Balloons, Inc., one of the most common misconceptions about ballooning is that the pilot can direct the balloon to some specific location. Although it is possible to steer vertically and, to a certain extent, horizontally, a pilot must rely chiefly on wind direction to guide the balloon. Balloon launches, like landings, can also be difficult to predict.

Plenty of exciting opportunities for travel are available right on campus.

Because of Federal Aviation Administration safety regulations, a balloon can only be flown when no threatening weather is predicted and when the wind is less than ten knots. As a result, most balloons are launched at either dawn or sunset, when the air is calmer, and they travel a distance of five to seven miles. If you're thinking of buying a balloon, be prepared to spend between $5000 and $8000 for a used craft, and at least $12,000 for a new one. A more affordable way to learn about the sport is to enroll in the Wisconsin Union Mini Course on hot air ballooning. The class, which begins November 4th, includes three hours of instruction about aspects of ballooning such as the history behind the sport and the duties of the crew that follows the balloon. Then, students wait patiently for a call from the pilot saying that the conditions are right and it is their turn to go for a ride. You can find out more about the course, which is a great opportunity and a bargain at $115, by calling 262-3156. Hoofers also has an enthusiastic ballooning club. In addition to contracting pilots and balloons for frequent outings, the club is raising money to purchase their own balloon. Anyone interested is encouraged to contact Hoofers.

Perhaps the sometimes snow-covered hills of Wisconsin have ceased to be a challenge and instead you picture yourself skiing the mountains of Colorado. This January, Hoofers Ski Club will be tackling the deep powder at Steamboat Springs and Winter Park, Colorado. It is still not too late to get involved. Just wax up your skis and give Hoofers a call.

To some people, though, the thought of spending winter break in a place that has even more snow than Wisconsin is downright depressing. For approximately $400, you could be smelling the ocean air and basking in the sunshine of the Bahamas with Hoofers Sailing Club. If your dream transportation isn't a cruise in the Bahamas, the Club is also planning trips to such exotic places as Belize and the Virgin Islands this winter. Best of all, everyone, regardless of their previous sailing experience, is welcome. For specific prices and dates, contact Tom Kaaret (262-7536) or Dave Pearson (873-6651) as soon as possible.

Outside of campus, the Madison area has an abundance of luxurious transportation. What better way to impress a date than to pick him or her up in a chauffeured limousine? Several companies, including Nedrebo's, Touch of Class, and Allen Siehr Limousine Service will provide such a service for about $30 to $45 an hour. Your refreshments together with their limousine would make one of the classiest tailgate parties Camp Randall has ever seen. For a view of the stadium from a little higher up, you could rent or charter a small plane. These planes can take you just about anywhere, including your hide-away vacation spot or even to New York for dinner and a play. Without waiting around in any airports, you would be back to work in the real world the next day. Prices range from $34 to $400 an hour at Four Lakes Aviation. At the higher end of the price range, you would enjoy such luxuries as on-board telephones or perhaps a catered meal.

If you're looking for the perfect gift for the man who has everything, or for yourself, why not buy a helicopter ride? Beginning at $150 an hour, Blackhawk Helicopters, for example, will provide a pilot and a helicopter to take you places where even small airplanes cannot land, such as an out of the way fishing hole or a magnificent skiing spot. If you wish to throw a cocktail party on board, the $450 an hour model comes with a bar and air conditioning for your comfort. People wanting to arrive at a concert in high style have even enlisted the services of Blackhawk Helicopters.

One of the most adventurous ways to get from one place to another is by hot air balloon.

Although not everyone is an ardent viewer of the "Love Boat," an exotic ocean cruise is still the idea of luxury transportation for many people. The Mexican Riviera, Hawaii, and the Greek Islands are some of the most popular cruise destinations. A typical seven-day Hawaiian cruise offers island sightseeing during the day and on-board entertainment in the evening. Many types of accommodations are available, from about $995 per person for a budget cabin to over $2000 per person for an outside suite. Besides the usual romantic sunsets at sea, elegant dining, and warm temperatures that attract thousands of seafarers every year, some of the cruises are boasting an additional feature for early next spring: a prime view of Halley's Comet away from smog and city lights.

Well, maybe your piggy bank isn't quite ready for such a large expenditure of funds right now, but don't worry, you still have your bicycle, and even the biggest dreams can start out small.

Flywheels, CVT's and the Car of the Future

by Joel Stannelle

When hearing "car of the future", many are immediately struck with graphic visions of hovercrafts traveling at supersonic speeds, self-navigating computer controlled vehicles, and other hi-tech forms of transportation even more advanced. Given the strength of American innovation, these inventions could become a reality. The passenger car, in its present state, is rapidly becoming an endangered species. As our supplies of oil and other natural resources are threatened, it becomes necessary to find more inexpensive and efficient ways to get from point A to point B. This has been the main effort of the engineers in the T-27 Motor Vehicle Lab.

Professers Andrew Frank and Norm Beachley began research in the mid 70's by continuing a 3 year study conducted by the U.S. Department of Transportation on increased fuel economy in transportation systems through energy management. Two innovations have resulted from UW's research: flywheel cars and continuously variable transmissions (CVT's). The first flywheel driven car to be completed by the professors was a 1976 Pinto. A flywheel driven Pontiac Pheonix, just completed, is the subject of this article. All operational specifics mentioned are in reference to this car.

The first step in creating a more energy efficient automobile lies in finding out in what modes the engine runs most efficiently. This technique, known as "engine mapping", consists of running an engine over a full RPM range at different throttle settings (through attachment of different loads). Power output and fuel consumption are then measured, and the brake specific fuel consumption (measured in lbs. of fuel/horsepower/hr) is calculated for each of these points. A curve is then drawn through the points with minimum BSFC values for each given RPM. The engine of the flywheel powered vehicle is then allowed to run only along this "ideal operating line" by an on-board computer which controls the throttle.

Regenerative braking also plays a major role in the cars fuel savings.

After finding the ideal operating line, it becomes necessary to devise a way in which a car can function normally and still operate in its most efficient modes. This is done through the introduction of a large energy-storage flywheel into the drivetrain (see Figure 1). In contrast to a conventional flywheel, it isn't used to smooth engine output and isn't connected directly to the crankshaft (as shown in the diagram). When clutches A and B are engaged, the engine accelerates the flywheel to about 10,000 RPM and then shuts off (clutch A is opened). The torque of the spinning flywheel is then directed to the CVT through a bevel gear.

The hydrostatic continuously variable transmission, or CVT, is composed basically of two parts: a variable displacement hydraulic pump and a fixed displacement hydraulic motor. The pump, which is always geared to the drivetrain, can accelerate or decelerate with the gas pedal. It pumps a variable amount of oil to the hydraulic motor (controlling the motor's speed). This motor is attached to the differential which drives the axle. In this manner, the car is propelled. Note that in this type of vehicle, the computer, not the driver, is in control of the engine throttle. The gas and brake pedal are both connected to the CVT ratio controls (i.e. to the hydraulic motor and pump).

There are many advantages to this type of power plant. It is expected to give twice the standard fuel economy for city driving. This is due to the engine running only at a higher, more efficient load (when accelerating the flywheel), and then shutting off until more power is needed. Consequently, the car never has to idle. While spinning above a minimum rate, the flywheel can be the

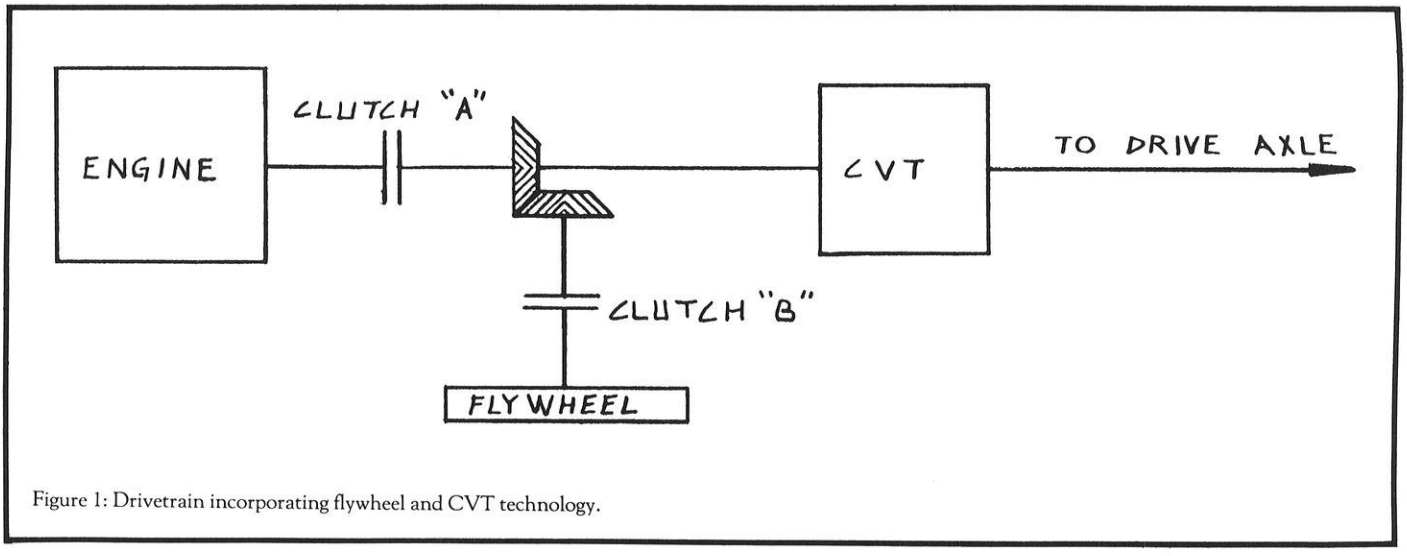


Figure 1: Drivetrain incorporating flywheel and CVT technology.

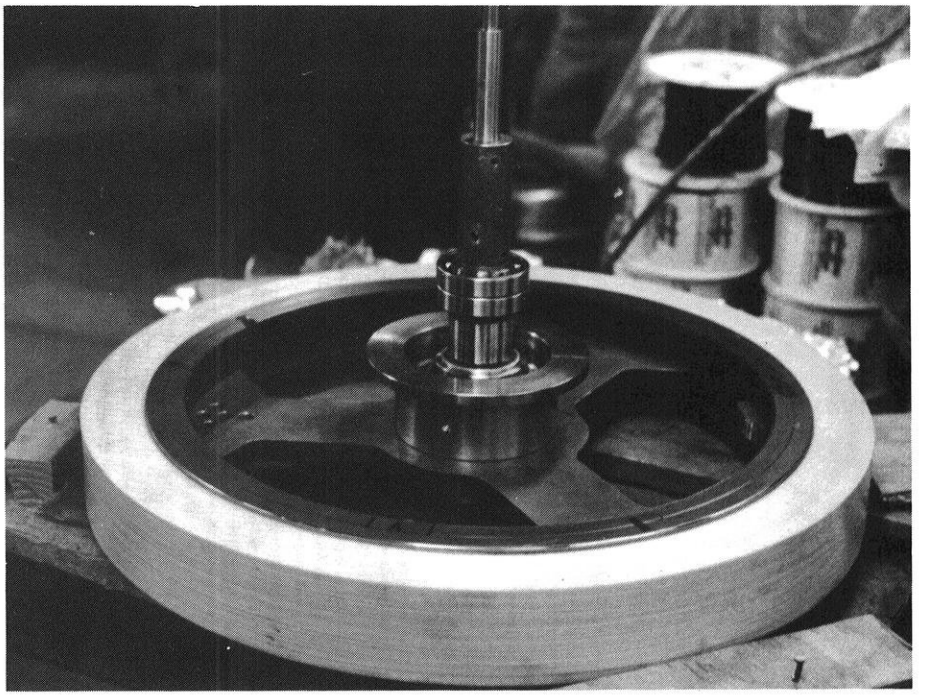
sole power source. When the car is cruising at a high velocity, the flywheel is de-clutched and the engine is run alone to save flywheel bearing and windage loss. In addition, a smaller, lighter engine can be used (a 1.6 litre engine in the just completed Pontiac Pheonix vs. the 2.5 litre standard engine). In spite of the smaller engine, performance is quite adequate. The engine can store a greater amount of energy in the highly inertial flywheel than it could deliver itself at any instant (as mentioned the flywheel peaks at about 10,000 rpm).

Lastly, regenerative braking also plays a major role in the car's fuel savings. Usually, all energy is lost during braking as heat against the brake shoes. This is especially true of large, heavy vehicles that wear out brakes quite often. In the flywheel car the CVT is downshifted during braking to a minimum ratio, forcing the flywheel to rotate faster and the car to come to a slow stop. In this manner wear is saved on the brakes, and the kinetic energy of the wheels are stored in the flywheel. The flywheel stores energy quite well since it operates in a near vacuum which greatly reduces spin loss due to air friction.

The flywheel and CVT power plant is expected to double the standard fuel economy.

One disadvantage of the flywheel engine is its inability to give performance while traveling up long hills. Since hill climbing ability usually dictates minimum engine size, the downsized engine just doesn't have the power to maintain an acceptable speed during this period. An additional disadvantage at the present time is the cost and complexity of the flywheel technology. In other words, this system is not an option for the amateur mechanic who wants to increase his car's gas mileage. In spite of these drawbacks, the quick acceleration and regenerative braking abilities of the flywheel system would be ideally suited to the poor performing, very heavy, electrically powered vehicle.

The CVT, on the other hand, has more direct applications suitable for the standard passenger car. Even without a flywheel, a CVT is highly benificial. Since you want to keep the engine at peak efficiency constantly, it is desirable to have an infinite number of "drive ratios" between the maximum and minimum power transfer from the engine to the wheels. Industry has realized this, and cars with CVT's are expected to appear soon on the market. In addition, research assistant Tom Volz is continuing CVT research in T-27 through the development of a V-belt system. This system creates different drive ratios by running a V-belt over variable diameter pulleys which could be hooked up to the drive train. His main effort will be toward improving the efficiency of the belts, which are often less then 90% efficient (as opposed to a 95% efficiency for standard gears). Even so, a CVT equipped car is expected to have the mileage of the same model equipped with a 5-speed manual transmission. Hence, it is definitely a worthwhile project.



Professor Frank's flywheel research may soon become commercial.

Technology producing research such as this is necessary if the passenger car as we know it is to survive past the foreseeable future. This is why places like the T-27 Motor Vehicle Lab, and the work of professors Frank and Beachley, along with Tom Volz and other contributing UW students, is of vital importance. Our future progress is dependent upon an ongoing effort to improve current technologies. We must support this effort if the "car of the future" is ever to become a reality.

The Scooters are Here!

by Jerome Holbus

You see them all over the campus these days - the shiny plastic machines putting down the busy streets and hogging the bicycle racks, while looking sleek, simple, and very fashionable. Resembling the "Air Cars" our heroes rode in George Lucas' *Return of the Jedi*, the new motor scooters are the latest way to get there without walking.

The Honda Motor Company has been especially successful with their three models : the Spree, the Aero, and (the Cadillac of them all) the Elite. It is estimated that Honda controls 80% of the scooter market. Its only active competition comes from Yamaha's Riva series.

In a time with falling motorcycle sales and the withdrawal of Italy's Piaggio Vespa from the American market (due to pollution control standards), Honda struck back with a new and virtually unmatched product line. Of these Honda scooters, the Spree has some striking features that not only makes it the market leader, but also a sorority girl's best friend. These scooters have been more than just a big hit with the student-age crowd. People of all ages can be seen zooming around the city in these red and black Sprees.

One reason for this great success on the market is due to the scooter's striking features in design and engineering. Gone is the kick-start ignition. These new scooters sport a solid-state ignition with a 12-volt electrical system. In addition, the Spree has a 49cc forced-air cooled engine and a single speed transmission. What this means is the Spree is a low maintenance transport system that requires very simple driving techniques since no gears need to be shifted. The only controls are the throttle and the front and rear drum brakes. The compact instrumentation panel displays just the basics: a speedometer, odometer, fuel guage, and a low-oil warning light. For security, it features a parking brake and ignition switch steering lock. What all this boils down to is that the Spree is very simple to own and operate.

The Spree's simplicity is certainly appealing to the younger crowd, but Honda's unique marketing scheme also warrants some attention. Many of us have seen photographs of model-turned-new wave rock star-turned-actress, Grace Jones, looking very mod on her Honda elite in such "hip" and "with it" magazines as *Rolling Stone*, *People*, *US*, or *Teen*. She can also be seen promoting the Honda line by breaking baby rattles on late night television commercials. Also on her team are such non-mainstream personalities as new wave rock group DEVO, cult rock hero Lou Reed, and new wave heart throb Adam Ant. They all carry the same kind of message, which is --if you want to be a trend setter like us, you'll get a scooter. Although these commercials are a bit off the wall, they deserve some respect since they evidently were well worth the $8 million Honda spent in their 1985 TV advertising campaign.

But despite Honda's strategy to target the trendy and highly impressionable 14-22 age group,*Isthmus* magazine's September 16, 1985 issue reported that 15% of Honda's total sales this year have gone to older folks, i.e. retirees. Although Honda is making no concessions to the older crowd, they feel their target customer's elders will fall into the scooter market much like they did when designer jeans were very popular with the young some years back.

photo by Gary Webster

Moped Madness: I wish I knew which one was mine.

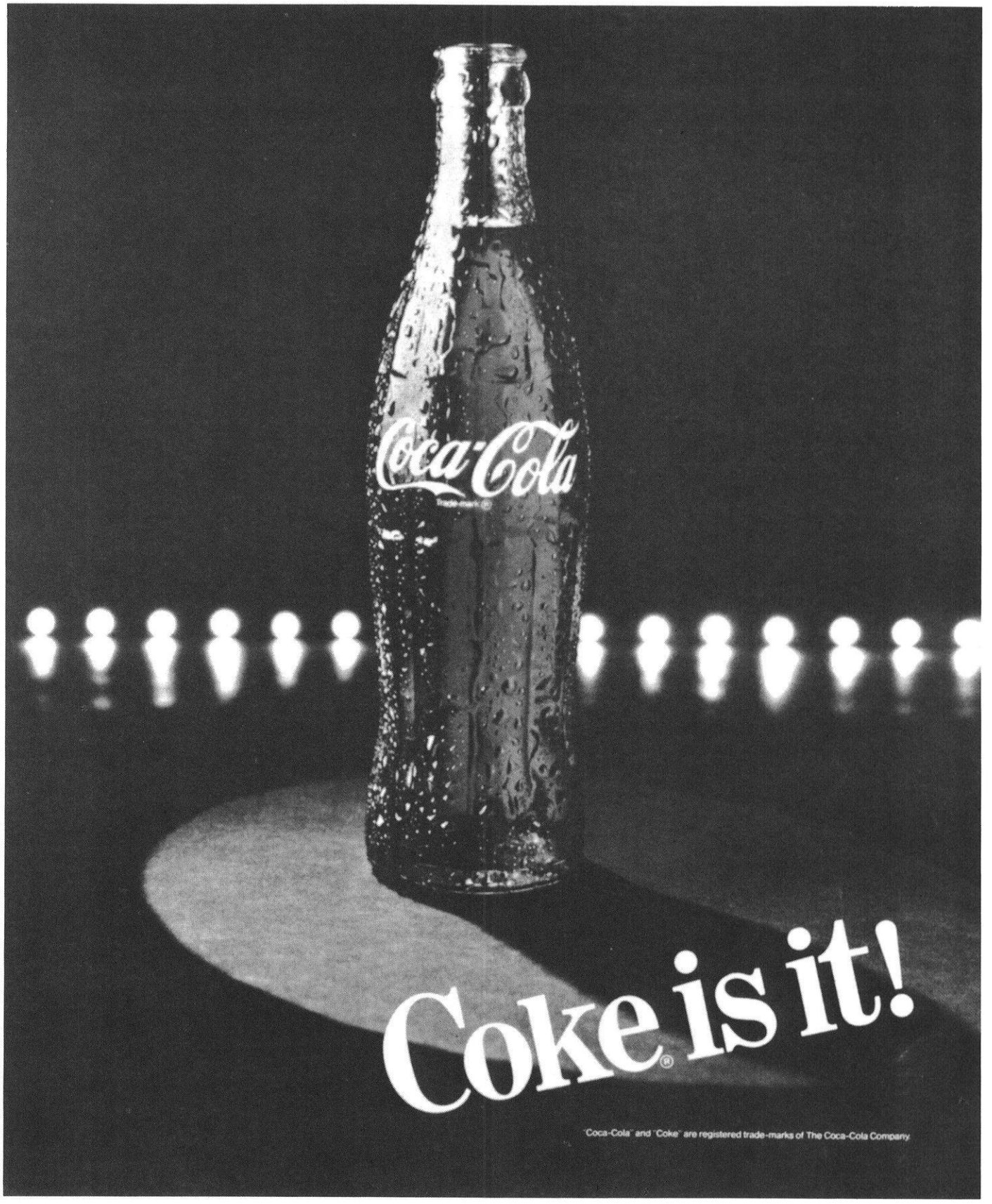
But probably the most interesting marketing strategy has been to disassociate the scooter from regular motorcycles. By doing this, these scooters appeal to a much sought after client: the female. According to a July 16, 1984 article in *Business Weekly*, only 8% of motorcycle sales have gone to women. But nearly one-half of scooter owners today are women. This is partly due to the simplicity of owning and operating one, and partly due to the scooter's clever design.

The Honda scooters feature a step-board which eliminates straddling and enables women to ride comfortably even in skirts. In addition, its engine is quiet and fully enclosed so there is no worry of staining clothes with engine grease. Moreover, these scooters display a wide aero-dynamic apron over the front wheel and steering bar which protect the riders from mud and other unpleasant things. Better still, these scooters have had a low accident rate--the only reported problem, according to Mona Erickson of Engelhart Honda in Madison, WI, has been the scooter's obscurity from view due to the car driver's blind spot.

Besides the Spree's simplicity, driving ease, and well-engineered design, its price and efficiency are equally impressive. The Spree lists for $398.00, but because demand has been so high, the Iowa Spree model has been known to sell for as low as $325.00. (The Iowa model was produced due to the State of Iowa law which permits the use of motorized cycles to 14 year-olds if the vechicle's top speed is 27 m.p.h. or less. Since Honda could not sell the Spree to that age group, its top speed being 30 m.p.h., they now market the Iowa model for this purpose).

The Spree's efficiency is evident in tis 100-plus miles per gallon of gasoline ratio, and its low maintenance, single cylinder engine system. And because the Spree is classified as a moped, it can be parked in any bicycle rack. The only question now is, how long will the fantastic sales last? In other words, is the Honda scooter line just another fad with sales soon to dwindle like the mopeds of the 70's? Mona Erickson doesn't think so. She looks forward to sales of next year's model even though the new styles have yet to be released. But one thing she does expect is a higher price for all the scooter models.

Whatever the future holds for these scooters, the Honda company will surely play an integral part of it. Just a look down any busy metropolitan street this time of year will tell you that these scooters are the latest in a quality and well-received mode of transportation.

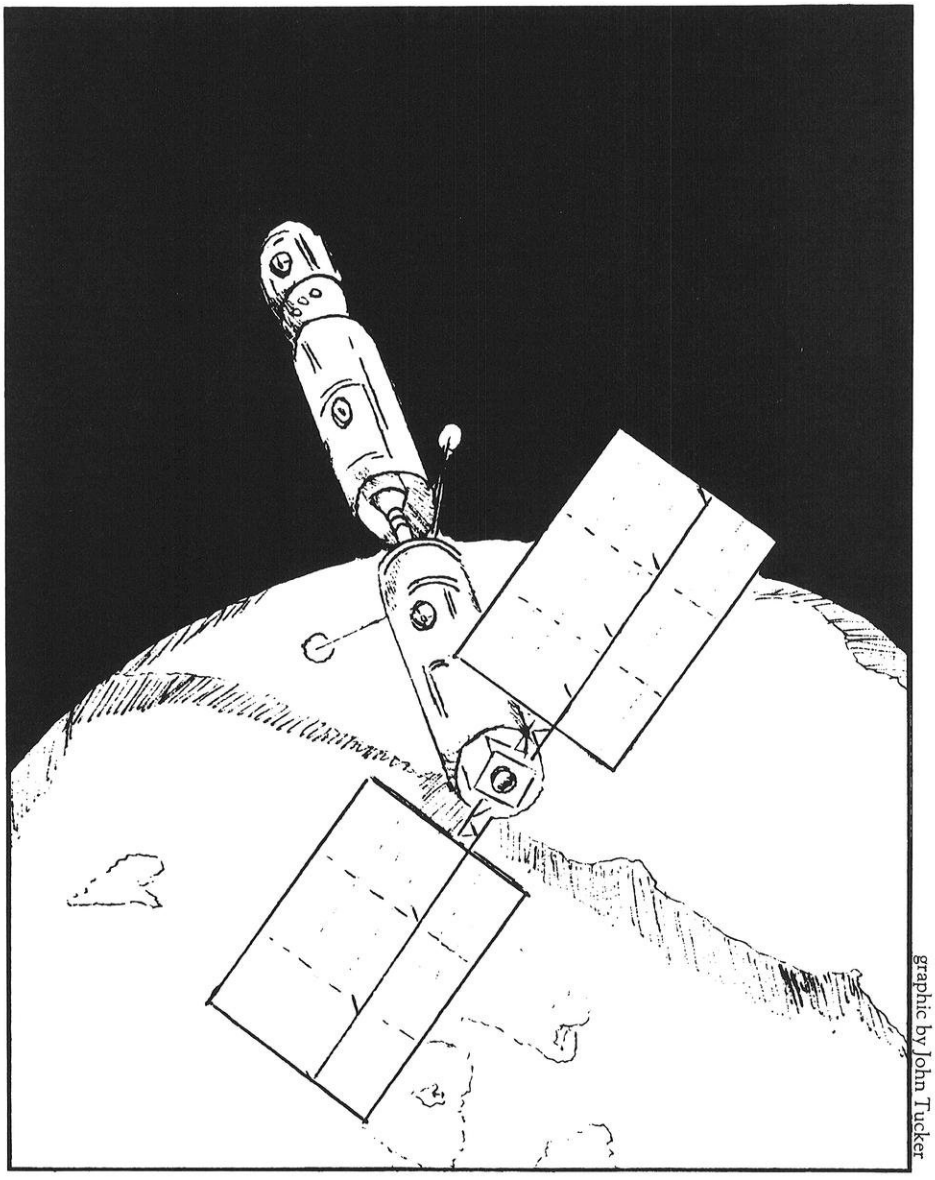

Coca-Cola
Coke is it!
"Coca-Cola" and "Coke" are registered trade-marks of The Coca-Cola Company

Pushing Ahead in Transporatation Technology

by Thomas Nikolai

The fast-paced society in which we live is tremendously dependent on a quick, efficient transportation system. Industry must have the raw materials needed for production processes, business leaders have to meet to discuss marketing strategies, and large civilian populations depend on the importation of agricultural products from rural areas in order to survive. Besides the obvious needs of agriculture, industry, and business, the demand for personal transportation far exceeds that expected from a practical point of view; the automobile is a reflection of personal taste and lifestyle.

Technical advances in any field of engineering are quickly incorporated into the transportation field.



graphic by John Tucker

A technological advance in almost any branch of engineering is quickly incorporated into the transportation field to keep up with the desires of the public and private sectors. The elements of our present transportation system can evolve quite rapidly because of these changes, and although it is impossible to predict exactly where the future will lead, here is a preview of where we are headed:

Automobiles

Although John DeLorean is planning to design and produce cars again, don't hold your breath if you are waiting to ride one of his stainless-steel DMV's "back to the future". Future changes in the automobile will continue to be in areas that were improved upon in the last decade: fuel efficiency, safety and personal comfort. Car engines will continue to be smaller in size, utilizing turbocharging and electronic control systems to enhance performance and fuel economy. Microprocessors will monitor almost every variable the engine has, controlling intake airflow, pressure and temperature, throttle position, engine rpm, ignition timing, and exhaust gas oxygen. Electronics will also control suspension, steering, and braking (to prevent wheel locking and skidding).

The options and accessories ava ilable for future automobiles will be limited only by their expense and popularity. Most cars will be equipped with four-wheel drive, which will automatically switch on under hard acceleration, braking or adverse weather conditions. Navigation systems will be available in the form of electronic maps, showing the vehicle's position at the center of a viewscreen. Such systems will indicate optimal travel routes, taking into account any detours or construction. Sonar devices may warn of objects behind the car when it is moving in reverse, or interrupt a cruise-control system when the distance separating cars is too small. Color TV

displays and compact disc players will be available for in-dash mounting, allowing one to "go mobile" in style.

Trucks

At highway speeds, over half of a vehicle's fuel is burned to overcome air resistance. The only aerodynamic improvements in heavy trucks to date have come in the form of add-on devices, such as cab-top wind deflectors. Most of the air resistance comes from the box-like tractor, which is shaped as such to accommodate the huge radiator needed to cool the engine. Future rigs will be powered by "adiabatic" engines that eliminate the need for air cooling. This will allow cab design to become much more aerodynamic. Several other innovations will help eliminate air drag as well. Pneumatically actuated gap sealers will cover the space between the tractor and trailer at speeds over 25 mph, reducing drag by 16%, and aluminum side skirts will lower at 45 mph to reduce turbulent air flow beneath the rig, cutting drag by another 18%. Trailers will be tapered at the end to create a high-pressure pocket behind the moving vehicle, instead of low-pressure cells characteristic of square-bodied trailers.

Electronic control will also help to make trucks more efficient and safe. Computer-controlled transmissions will improve the shifting performance of even the best drivers. Sensors will prevent brake lockups and help truckers avoid jackknifing, one of the most common accident causes. Trip recorders, similar to those used in airplanes,

Efficiency and safety will be the guidelines for advances in commercial aircraft technology.

will monitor truck performance and help anticipate mechanical wear and breakdowns. A nationwide voice and data communication system will transmit signals via satellite to help coordinate truck fleets and ensure prompt delivery schedules.

Air Travel

Efficiency and safety will be the guidelines for advances in commercial aircraft technology. New aircraft engines, called unducted fans (UDF), will use two counter-rotating sets of blades that are externally mounted (like conventional propellors, although they will point backwards). The UDF's will be almost 65% more efficient than current jet engines. Sophisticated flight control systems will help a pilot keep his craft in the air after the loss of an engine or damage to a wing by a reconfiguration of the control surface (in effect, a "self-repair" system). Airborne "threat alert" systems will monitor nearby planes, prescribe evasive action, and even implement this action if a crisis arises.

A permanently manned space station should be operational as early as 1992.

It is believed that military aircraft will increasingly dependent on STOL (stationary take-off or landing) technology. Such aircraft are not physically limited by runways, which are usually damaged during a battle. Furthermore, they may be positioned at the front line so that individual squads may use them immediately instead of waiting in uncertainty for air support.

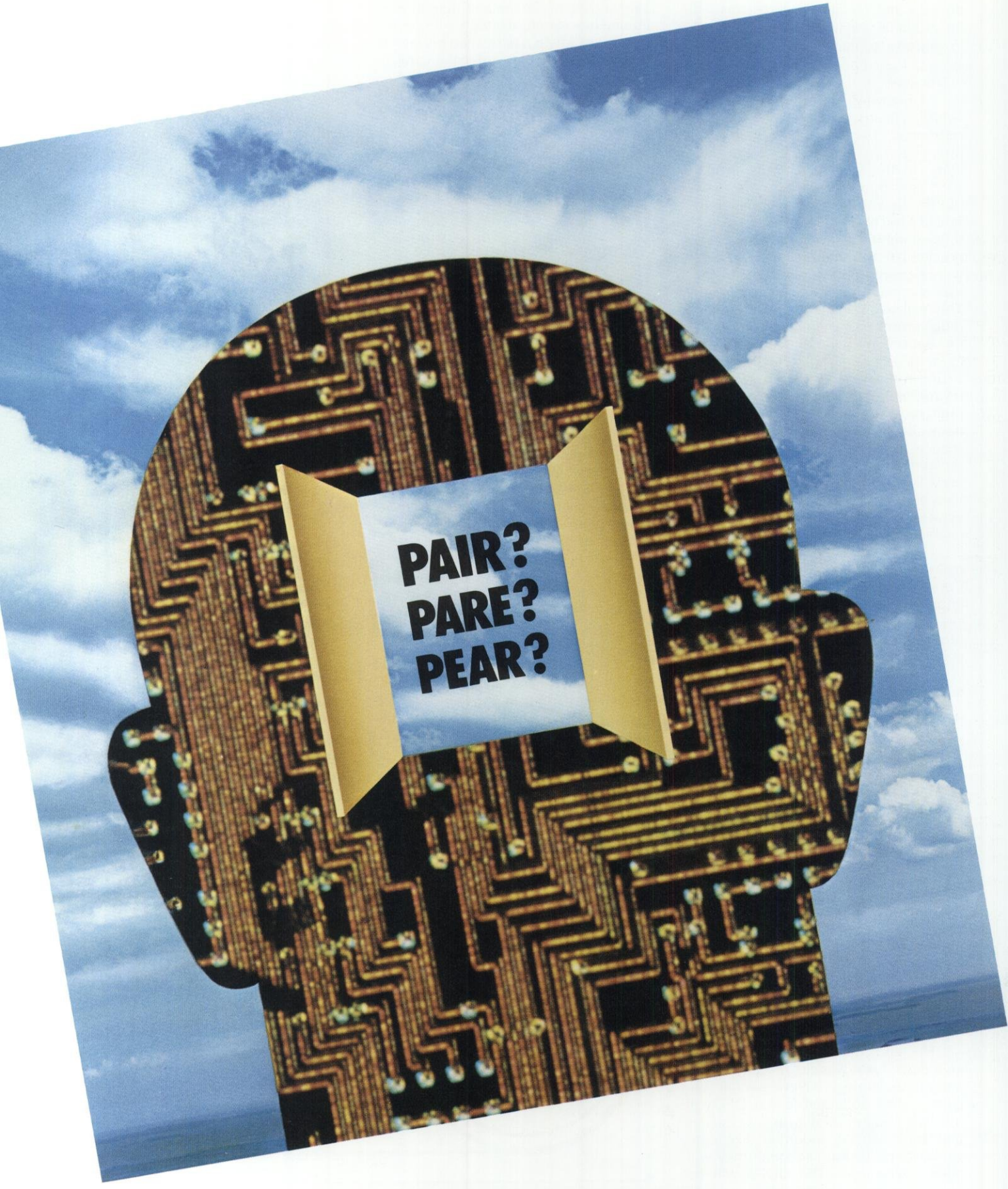
Space Travel

The decision to launch a permanently manned space station was announced by President Reagan in his 1984 State of the Union Address, and current plans envision it operational as early as 1992. This station would orbit at altitudes of only a few hundred miles, allowing its construction and maintainence to be accomplished using the Space Shuttle. However, the Shuttle cannot carry large enough payloads for projects of greater magnitudes (notably the expansion of the space station), nor can it carry cargo to higher orbits. Many communication satellites must be boosted to an altitude of 22,300 miles where they will be in geosynchronous orbit. The shuttle currently performs this task by firing upper stages out of it's cargo bay to loft satellites into the proper position. This upper stage system has had many problems to date, resulting in the loss of a few satellites. It has two other drawbacks as well: (1) large or bulky cargos cannot be lofted from the shuttle bay ,and (2) it is incompatable with the space station design. Clearly another mode of payload transportation would be needed to support our movement into space.

NASA is therefore designing a reusable orbital transfer vehicle (OTV) to boost larger cargos into space. A reusable booster-rocket-and-fuel-tank assembly, similar to that used to launch the shuttle, will put these "space tugs" into orbit. The tugs themselves will be propelled by tanks of liquified gases (hydrogen or oxygen), enabling these vehicles to reach very distant orbits. The tugs will also be reusable, since they may either dock themselves in the space station, or return to earth by falling through the atmosphere and touching down in an ocean. Deacceleration in the atmosphere will occur through the use of an umbrella-shaped aerobrake permanently mounted to the orbital vehicle. This novel structure will create enough drag to allow a controlled re-entry, and shield the tug from the enormous amount of heat generated.

The reusable UTV's, if used only to launch satellites and other forms of cargo, might well be regarded as a waste of money. However, NASA has much greater plans for the UTV's in the near future; they envision pairs of these space tugs hauling 80,000 lb payloads of materials and people into lunar orbit! Included in these loads will be the landing rockets that will carry components for a moon base to the surface!

Make your reservations early: construction begins in the year 2006.


PAIR?
PARE?
PEAR?

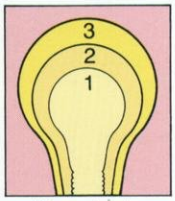
Would you like to know how computers can tell the difference between a pair in a poker game and a pear on a plate?

How they can understand a variety of speakers with a diverse variety of accents—and reply in pear-shaped tones, using normally connected speech?

Then read on to learn more about computers that recognize words, comprehend meaning from context, even synthesize human speech from a mere shadow of itself.

It's All In The Algorithms

Utilizing three levels of speech-processing algorithms, AT&T is giving the computer a more 'robust' understanding—the capacity to comprehend connected speech from different speakers.



Three levels to understanding

Acoustic pattern matching (1) identifies the spoken words.

Grammatical processing (2) figures out how the words are put together.

And semantic processing (3) extracts meaning from the context. With each successive step, the computer moves closer to accurate understanding.

Acoustic pattern matching determines how much latitude the waveform (pronunciation) of a word can have before it becomes unintelligible to the computer.

By isolating the specific characteristics the waveform of a word contains—independent of the accent of a speaker—we increase the probability that it will be correctly matched to a pattern stored in a computer's memory. But, correct recognition of words is only the beginning of computer understanding.

Computer Grammar 101

Grammatical processing further increases the probability of recognizing words. It analyzes them within the constraints imposed by language—the allowable sequences of syllables in a word or words in a sentence.

For a specific vocabulary and situation, it is possible to define every sequence the computer can recognize. Based on probabilities assigned to each word it recognizes—and where that word falls—the computer determines which of its possible sequences is the most likely. This process gains two advantages: It allows words that might not otherwise be recognized to be correctly accepted; and it speeds up processing time by using sequence position to limit the number of words it looks at for a pattern match.

A Meaningful Relationship

Semantic processing is the point where the computer crosses the line between recognition and understanding—the point where words are given meaning within a specific context. This endows a system with one of its most human qualities: knowing when a request isn't understood, and asking for appropriate clarification.

Talk Isn't Cheap

Making a computer listen intelligently is one thing; making it respond intelligibly, however, is another.

Enabling a computer to talk, reproducing the subtleties of human speech, has required large amounts of memory—a high cost item. Therefore, an 85 percent reduction in the amount of information needed to store and generate high-quality speech can mean significant cost reductions.

That's just what a new AT&T speech synthesis technique, called multi-pulse linear predictive coding (MP-LPC), provides. It reduces the 64 thousand bits per second previously needed to 96 hundred.

Speech signals mimic the human vocal tract—they have redundancies built in. MP-LPC codes speech to remove these redundancies, then tells the computer how to reconstitute the original speech from the mini-version in its memory. This coding eliminates unnecessary bits from being stored and transmitted.

Getting Down To Business

At AT&T, our goal is to make computers listen and understand as fast as people speak—and speak to and understand as many people as possible. Speech-processing algorithms, developed by AT&T Bell Laboratories, have moved us several steps closer to that ideal.

For example, most speech recognition systems make the speaker pause between words. But AT&T, using advanced recognition algorithms, has developed a Stock Quotation System, now in field trial, that allows callers to enter and retrieve current market information in natural, normally-connected speech. Users simply speak the number codes for any of over 6,000 stocks, and the service provides current quotes—delivered in computer-generated speech.

Numbers are nice, but make for limited conversation. Closer to our goal of a conversational computer is the Flight Information System. It uses the Official Airline Guide as its data base. In its limited environment, this laboratory system converses with the user in natural speech in response to normal flight information queries.

One Of Our First Callings

AT&T has been deeply involved in speech technology since the genesis of the telephone. From the beginning, our goal was to make mechanical communications fast, foolproof and economical.

Today, with the advent of the computer, we're moving toward the ultimate ideal: creating machines that serve our needs and save our energy in the most natural manner—by voice command.

AT&T
The right choice.

Fuel Cells: An Energy Alternative

by Paul A. Stone

The development of alternatives to conventional energy sources is the greatest technical challenge facing our generation. Thermal energy produced by the combustion of coal, gas and oil is limited by the availability of the fuels, environmental concerns and the low efficiency of thermal energy generation. Geothermal, nuclear and solar-thermal sources are also restricted by low (Carnot) efficiencies and have other problems associated with them. A viable alternative to these energy sources is an electrochemical one: the fuel cell.

The basic fuel cell has existed since the early 1800's. However, few applications of it were used until the National Aeronautics and Space Administration (NASA) selected it as the power source for the Gemini and Appollo space programs. Its use continues today in space shuttle flights. The fuel cell's success in these missions brought fuel cell technology to the interest of private industry for commercial applications.

The unique aspct of the electrochemical cell is the direct conversion of chemical energy into electrical energy.

Electrochemical concepts provide a basis for understanding how a fuel cell operates. An electrochemical cell is a system where chemical reactions occur in an orderly manner and either generate or consume electrical energy. Cells that consume electricity are known as electrolytic cells, while those that generate electricity are refered to as galvanic (or voltaic) cells. Examples of the most common galvanic cells are ordinary flashlight and car batteries. The fuel cell is also a galvanic cell. All galvanic cells convert the energy associated with a chemical reaction directly into electricity.

Although fuel cells and batteries both generate electricity, there are some fundamental differences between them. Fuel cells differ from flashlight and car batteries in their basic purpose: batteries are used for energy storage, whereas fuel cells are used for energy conversion. The mode of operation is also different. A nonrechargable battery (ie, a primary cell) such as used that in a flashlight is operated until all of the active material inside it is reacted. A lead acid car battery is an example of a secondary cell. When being recharged, the electricity supplied to it converts the products of the electrochemical reaction back into reactants. Hence, the battery may be used again as a power source. In contrast to both primary and secondary cells, the reactants in fuel cell operation are continuously fed to the electrodes where the reactions take place, and the products are generally discarded.

A fuel cell is an electrochemical cell that takes energy from the reaction of a fuel with oxygen and converts it directly into D.C. current. An oxidation reaction occurs at one electrode of the cell at the same time that a reduction reaction occurs at the other. The electrodes where oxidation and reduction occur are called the anode and cathode, respectively. These electrodes are physically separated by the electrolyte, most often a liquid, but can also be a solid or gas.

A schematic representation of a fuel cell is shown in Figure 1. The oxidation and reduction reactions occurring simultaneously at the anode and cathode create a potential difference across these electrodes. This potential drives electrons through an external circuit. The circuit is completed within the cell by ion transfer in the electrolyte.

Consider the hydrogen-oxygen (H2-O2) fuel cell represented in the schematic. In operation, hydrogen is

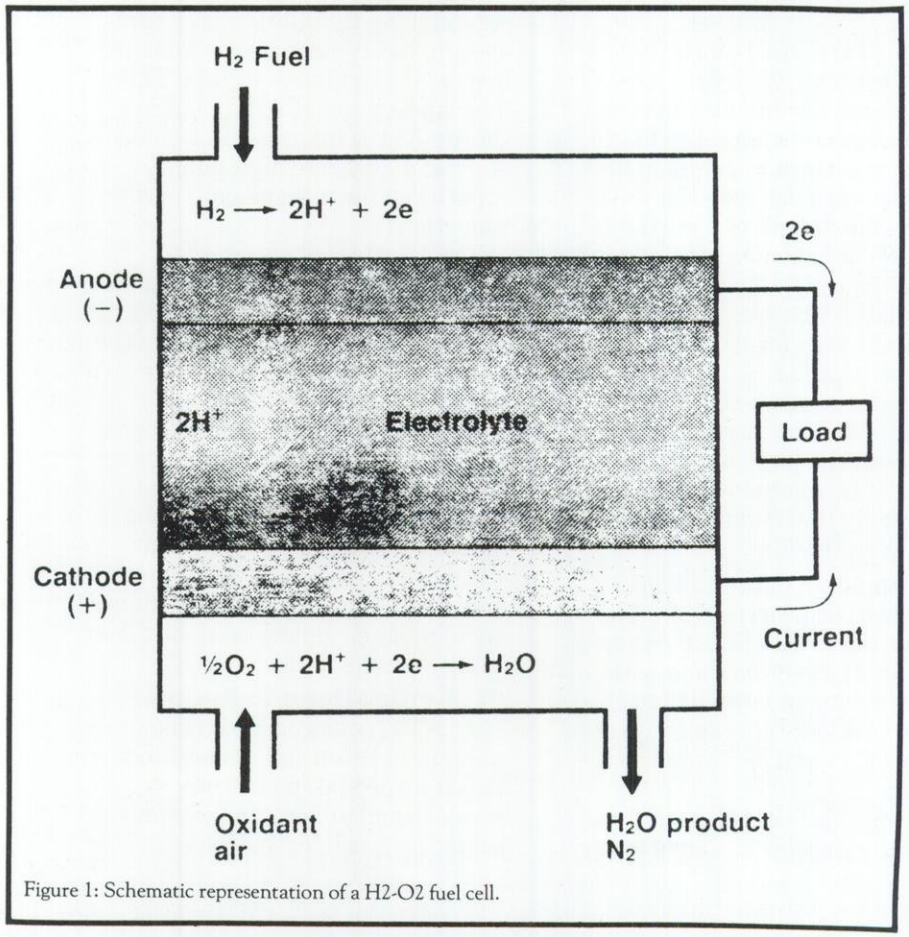


Figure 1: Schematic representation of a H2-O2 fuel cell.

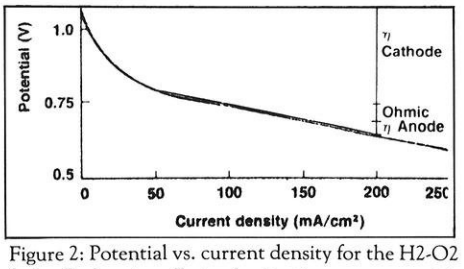


Figure 2: Potential vs. current density for the H2-O2 fuel cell, showing effects of activation overpotential.

oxidized at the anode and oxygen is simultaneously reduced at the cathode. If an acidic electrolyte is used, the corresponding reactions are:

anode: H2 = 2H+ + 2e-
cathode: 1/2 O2 + 2H+ + 2e- = H2O
overall: 1/2 O2 + H2 = H2O

These reactions create a thermodynamic potential of 1.23 volts between the two electrodes, which generates a usable current in the external circuit. The actual voltage obtained during operation is somewhat less than the thermodynamic predicted voltage because of cell inefficiencies. For the H2-O2 fuel cell, the actual open circuit voltage is about 1.0 volts. Figure 2 shows the relationship between the current density and the cell voltage of an H2-O2 fuel cell.

The unique aspect of the electrochemical cell is its ability for direct conversion of chemical to electrical energy; it is not limited by the Carnot efficiency. The Carnot heat engine absorbs heat from a high temperature reservoir and rejects it into a low temperature reservoir, and has a maximum efficiency given by: E = Th - Tl/Th

Although typical values for the Carnot efficiency are 60-70%, actual thermal energy sources operate at about 35% efficiency.

A fuel cell does not depend upon the flow of heat from sources to sinks. In theory, it could convert all of its chemical energy into useful work: 100 percent efficiency could be obtained. In addition, the efficiency of a fuel cell is independent of its size. Hence, efficient operation could be obtained even at less than peak loads.

Unfortunately, the theoretical 100% efficiency is not realized in actual fuel cell operation. The effective energy conversion is limited by sluggish reaction kinetics, ohmic losses, and mass transfer effects.

Reaction kinetic limitations arise from the slow chemical processes occuring at an electrode. These limitations are known as activation overpotential, and they account for the drop in potential near open circuit (low current density). As seen in Figure 2, activation overpotential in the H2-O2 fuel cell results in a loss of approximately 0.35 volts.

Ohmic losses are due to the resistance of the electrolyte solution through which charge is transfered. They are exactly analagous to the IR voltage drop across an electrical resistor. As observed in Figure 2, the voltage decreases linearly with increasing current because of the resistance of the electrolyte solution.

Mass transfer constraints (or concentration overpotential) deal with the transport of ions in the electrolyte to and from the electrode surfaces. If the charge carrying ions cannot diffuse fast enough to the electrode surface (where the reaction takes place), then the current in the external circuit is limited by the rate of diffusion of the ions. Such a limiting current is accompanied by a large drop in observed potential. For the H2-O2 cell represented in Figure 2, no limiting current is observed up to 250 mA/cm*2. Hence, concentration overpotential does not contribute significantly to inefficiencies in this cell.

The combined effect of slow reaction kinetics, ohmic losses and mass tranfer limitations is a reduction of the theoretical efficiency to about 40%. Figure 3 compares the efficiencies of fuel cells, coal fired steam and gas turbine sources for converting fuel to AC power. Although they are only somewhat more efficient than conventional sources at the present time, fuel cells offer the theoretical capability of greatly increased efficiency.

As conventional energy sources become less available, we must seek out new, innovative alternatives to replace them: the fuel cell is one such alternative.

Using a fuel cell for power production has other advantages as well. Because of their high energy-output to weight ratio, fuel cells are particularly well suited to transportation applications. Fuel cells contain no moving parts: they operate noiselessly and without frictional wear. Furthermore, fuel cells emit negligible amounts of atmospheric pollutants (an order of magnitude less than federal standards) as a result of their electrochemical nature.

With all of these advantages a fuel cell seems to be a likely candidate for applications where themal energy sources predominate at the present time, in particular for utility electric power and transportation. However, its commercial application is restricted by its actual efficiency, reliability and overall cost. To be commercially competitive with present heat engine power plants, a fuel cell lifetime should approach at least 5 years of operation. Current protypes operate continuously for only about a half of one year. In addition, the cost of cell components and developing production processes for these components is also inhibitive to widespread application.

Nonetheless, the fuel cell is not without hope! There is a great deal of both academic and commercial research aimed at reducing inefficiencies and costs and increasing reliability. Reaction kinetics are being improved through the development of more effective and less expensive catalysts. High temperature cells using a molten carbonate electrolyte and cells using solid

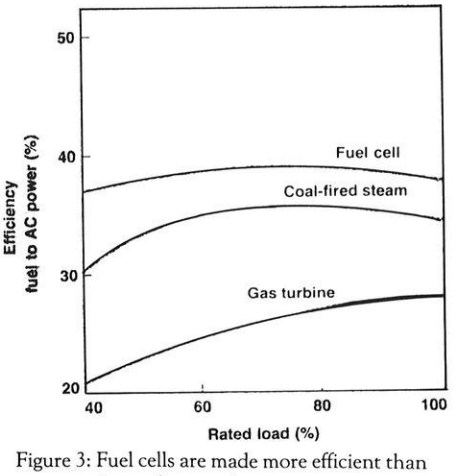


Figure 3: Fuel cells are made more efficient than common thermal generation sources.

electrolytes are being considered to reduce ohmic losses. Several prototype fuel cell units are in operation and have demonstrated their capacity for sucess in energy generation.

As conventional energy sources become less available, we must seek out new, innovative alternatives to replace them. Through its potential for high efficiency, high energy output to weight ratio and silent, pollution free operation, the fuel cell stands out as one such alternative.

REFERENCES:

1. Fuel cells: *Principles and Prospects*, Geoffrey Prentice, Chemtech, Nov. 1984
2. Fuel cells, Ken K. Ushiba, *Chemtech*, May 1984
3. Notes from ChE 507: Electrochemical Energy Generation

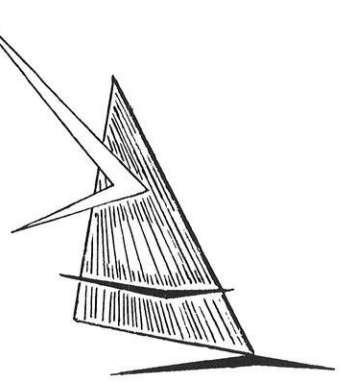
Life's a Beach!

"Evening champagne of the beer variety,
Black morning coffee to hasten sobriety.
Live in a house miles from sea or sand,
Stuck in the middle of our roving land."

"Make love in the morning but let him/her make the bed,
No time for shower: windsurfing instead!
Wind solid at thirty (school's a lost cause),
Jumping waves, breaking gravity's laws."

"Thirty-seven degree water, here comes the ice,
New wetsuit's fine, but booties would be nice.
Reaching so fast, when the spray hits it stings,
These are a few of my favorite things!!!"

HI-HO!



About WE

The *WISCONSIN ENGINEER* is produced five times yearly by students of the University of Wisconsin - Madison College of Engineering. 3000 copies of each issue are printed and distributed to Wisconsin high schools, paid subscribers, and other universities across the country. In addition, issues are distributed free of charge around the College of Engineering and the campus in general. The *WISCONSIN ENGINEER* is a self sufficient, non-profit organization funded through the sales of local and national advertisements.

In addition to the one General Engineering credit received by each staff member, the WE offers experience in all aspects of magazine production: writing, editing, photography, graphic design, advertisement, sales, business management,layout, typesetting,... (not to mention a lot of fun!) Each staff member is encouraged to participate in his\her areas of interest to the best of their ability.

If you are interested in developing and using your communication skills, management skills and creativity, then join US at WE! Stop by the office in Room 101 of the T-21 bldg. (next to General Engineering bldg. on the corner of Breeze and University) for more information. You'll be glad you did!

THE FACTS:

The **Wisconsin Engineer** is a self-supporting, non-profit engineering magazine published five times annually on the campus of the University of Wisconsin-Madison. The magazine is a charter member of the Engineering College Magazines Associated, and is written and produced by UW College of Engineering students.

The **Wisconsin Engineer** has been an important channel of communication for the Wisconsin engineering community since 1896. The magazine provides students and faculty members with up-to-date information pertaining to engineering developments at the university and around the world. Our journal focuses on science but, includes engineering views on political, social, and economic issues and social life at the University. Of particular importance is the magazine's emphasis on news about research projects within the College of Engineering and the departments of physics and math.

The **Wisconsin Engineer** is available to all students and faculty members of the UW-Madison College of Engineering. The magazine is sent to fifty universities across the country and around the world, to all Wisconsin high schools, and to many UW alumni and other subscribers.

Your advertisement in the **Wisconsin Engineer** is the best investment you can make if you are interested in contacting the more than 4000 engineering students at the University of Wisconsin-Madison. Whether you are looking for potential engineering students or selling products suited to engineers' needs, **WE** can provide the most direct means of communication with the engineering community at UW-Madison.

The **Wisconsin Engineer** consistantly ranks among the best engineering college magazines in the country. Each year at the ECMA National convention, the **Wisconsin Engineer** is recognized for its outstanding journalism, layout, and photography. We are producing a quality publication that is worthy of your advertising, and we look forward to doing business with you.

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3 issues 4%
2 issues 2%
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Phone: **(608) 262-3494**

Our Engineering Future

by Nick Dennison

It is the beginning of another semester, and along with the new courses come new expectations about the coming year. What is in store for us in the near future? A lot of people are asking this question. Engineering freshmen are eagerly trying to achieve the minimum G.P.A. requirements for their chosen branch of engineering, while students coming close to their graduation are wondering what will happen to them once they venture out into the real world. The answer to the freshmen is study. If you attain the grades needed for the respective engineering department of your choice, you are in. That was easy enough to answer! The other question is a little more difficult to answer because all you have to base it on is current statistics, which do not always tend to accurately predict the future. However, once you see what they predict, you will hope they come to pass.

Statistically we are all set. Job market predictions state that if the GNP continues its present growth rate, by 1987 there will be 242,800 more jobs than engineers. However, even if growth does not continue at this rate, there still will be a large need for engineers. Engineers perform jobs that are vital to the functioning of a civilized world: there will always be a need for them especially in petroleum petroleum extraction and refining, electronic design and manufacture and in electric, gas, and sanitation services. The need

What does the future hold for graduating engineers?

for them in government financed areas will, however, decrease if the GNP rate decreases. For example, if the government's budget does not allow for new roads or other construction, then the demand for civil engineers will wane. That does not mean that other fields of engineering related to government support will be affected in a negative way. For example, the job market in electrical and computer engineering will never look that grim. By 1987 there are expected to be 84,256 ECE graduates. There will be 197,662 jobs waiting for them if the government continues its high military spending. Without the current staggeringly high defense budget there will still be 166,036 job openings. Regardless of how the future economy moves, there will be plenty of jobs.

When the future engineers graduate, a lot of nice things will await them. Engineers who have graduated from the University of Wisconsin - Madison have told about life in the real world. Most of those out of the graduating class of 1984, for example, work for Fortune 500 companies. They live in various places

Where will I be ten years from now?

all over the United States. On the average they commute 17 minutes to work. 72% of them have flexible hours. 90% of them will eventually be able to move into a managerial position without a business degree. 86% of the class of 1984 might take the opportunity of furthering their education at their company's expense. Only 68% are working in their chosen field. Although only 68% of them are doing what they intended to do, most of them are probably enjoying what they do.

As Brian Ottum, a ChE major who graduated in 1983 and now works for Procter and Gamble in Cinncinati, Ohio, said in an interview with the Wisconsin Engineer, "The degree you receive at graduation is only your passport (to the working world)." He said that the skills pertinent to one's job are taught by the company, and managerial skills are often picked up through everyday job experience. The last comment he made was "not to worry" because the University of Wisconsin - Madison prepares its graduates well.

Those of us still trying to earn that sheepskin can only wait for our expectations to be filled. Freshmen have to work hard and make sure they gain acceptance into the department of their choice. Other engineers, with degree granting classifications, should aim for a swift graduation. If we are able to attain these goals, we never need to ask, "What is in store for us in the future?"

Some statistics found in:
Landis, F., and J. A. Svenstka, "The Demand for Engineers-Projection Through 1987," *Managment Science*, April 1983, Vol. 29, No. 4, pp. 455-465.

Engineer's Library: Leapin' Lasers, Batman!

by John Hilgers

If you enjoy doing do-it-yourself projects and have a keen interest in science and electronics then *Build Your Own Laser, Phaser, Ion Ray Gun & Other Working Space Age Projects* may be just the book you're interested in.

Build Your Own Working Laser, Phaser, Ion Ray Gun & Other Working Space Age Projects (Tab Books 1983) was written by Robert E. Iannini to describe several projects involving lasers and other "gadgets" developed by modern technology. Some of the projects are not intended for inexperienced hobbyists because they involve the handling of high voltages or possibly dangerous emissions. The book presents this disclaimer on the second page:

"This book deals with subjects, and may involve the use of materials and substances, that are hazardous to health and life. Do not attempt to implement or utilize the information contained herein unless you are experienced. Although all possible measures have been taken to ensure the accuracy of the information presented, neither the author nor TAB BOOKS, Inc. is liable for damages or injuries, misinterpretation of directions, or misapplication of information."

The general principles of laser theory are explained briefly, and five laser projects are presented.

The first section of the book deals with lasers. There is a brief section which explains the general principals of laser theory followed by five laser projects. The first is a harmless simulated laser project which utilizes a red LED and collimating lens to produce a thin beam of red light.

A true laser which produces a visible red beam is outlined in the next section. The laser is constructed in a self contained pistol or rifle configuration for easy aiming and carrying. At night the laser should be able to produce a bright red spot on a reflecting target at ranges of one mile or more. The batteries inside should be good for at least thirty minutes. This project, like most of the others, is available as a kit from the author's company. This may be helpful if the rounding up of the necessary parts is difficult. Each of the true lasers needs a laser bar or tube complete with mirrors to operate, but those are available at scientific supply houses.

The third project is an infrared pulsed laser utilizing a laser diode. This project, like the previous one is assembled in a rifle configuration. Both projects can be dangerous if someone's eyes are directly exposed to the laser. Hence, some caution is advisable. The infrared laser produces an invisible beam of laser light which can be detected by using either of two later projects: an infrared viewer or a laser light detector.

The fourth project is a pulsed red ruby laser gun which is powered by a portable power pack. The laser is capable of punching holes through thin metal sheets, creating small fires and can cause burns to anyone struck by it. The project uses very high voltages which are extremely dangerous. This should be regarded as an advanced project only.

The laser is capable of punching holes through thin metal sheets, creating small fires and burning anyone struck by it.

The last project is a high power continuous Infrared CO2 laser. This is a stationary laser using carbon dioxide as the laser medium. This project involves either making or purchasing a glass tube and properly installing an outer tube filled with water for cooling. The laser can be used to cut and weld a large number of substances including sheet metal and plastic. It could also be used to cut and shape wood.

The next topic of the book is ultrasonics. There is a brief section providing information on ultrasonics and then several working devices are presented. Most of these devices are applications of the pain and irritation caused on certain animals (and some humans, too). Devices such as the pocket pain field generator used to prevent dog attacks, an ultrasonic shock wave gun (phaser) , and some used to discourage unauthorized intruders and even rodents are described.

Another interesting project is the Ultrasonic translator listening device. This unit takes ultrasonic sound and

translates it into the audible range. This enables you to listen to moving water, insects, leaking gasses, lightning and electrical devices, and high frequency devices.

For those of you who like physics demonstrations, there is a whole chapter of them with complete schematics. They include a Tesla coil, a magnetic field distortion detector, light beam communicators, and even a device which converts infrared light into visible light, allowing you to see in the dark.

There are also a few projects for those interested in radio transmission. There are plans for a small voice transmitter and a transmitter which broadcasts the output from a tape recorder.

The ultrasonic translator device translates ultrasonic sound into the audible range, enabling one to listen to moving water, insects, leaking gasses, lightning and much more!

The last chapter is full of devices which no one should be without. A telephone recorder, a device for listening to all noise in a room over the telephone, a parabolic microphone, an invisible beam alarm system, and even schematics for a "self protection device" using electric current to either burn or to paralyze the target.

If you are searching for the perfect gift for that physics orientated hobbyist this Christmas season, *Build Your Own Laser, Phaser, Ion Ray Gun & Other Working Space Age Projects* could be just what you're looking for.

Crosswords of Engineering

by Charles Spengler

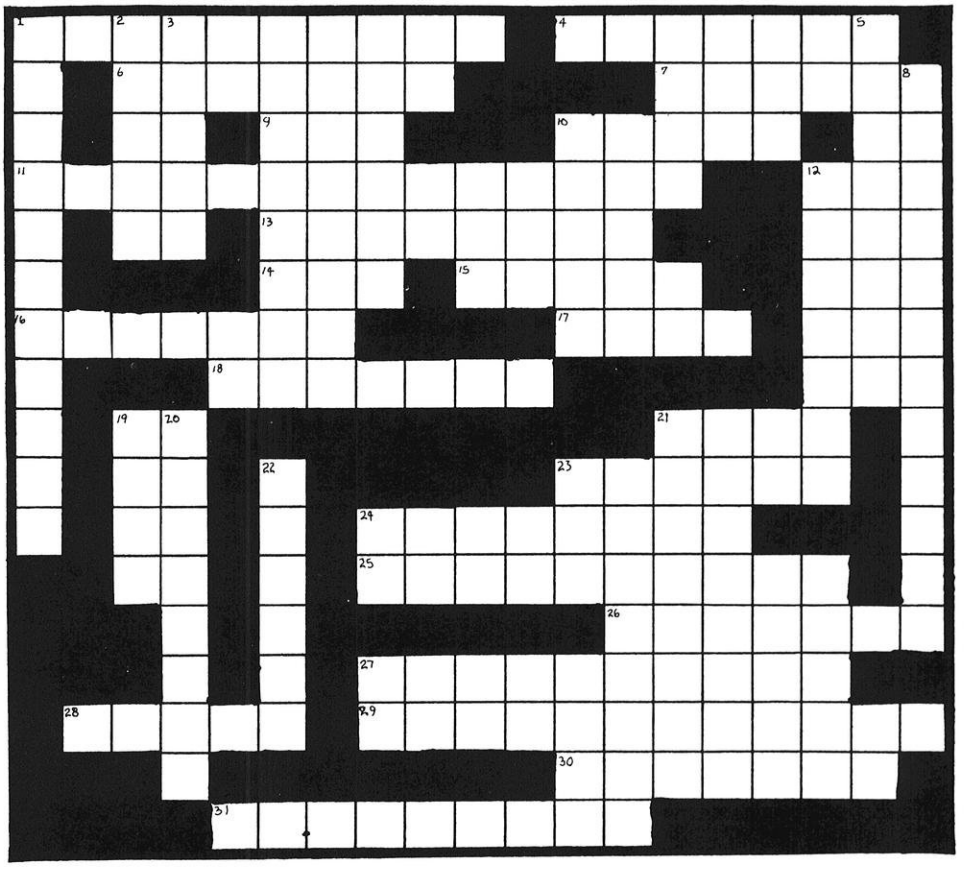
ACROSS:

1) An engineer's best friend.
4) 1,2,3,4,5,6,7,8,9,10,11,12,13,14.
6) What you get if you reduce an aldehyde (hint - causes hangovers)
7) Was responsible for several laws of motion and liked to drop things off the leaning tower of Pisa.
9) Commonly found in computer programs or in your garden.
10) Comander in chief of the WISCONSIN ENGINEER.
11) The Carnot efficiency is a subject of this science field.
13) Uncle Albert
14) A computer that wound up on the losing end of Dave Bowman's screwdriver.
15) If you are in the wrong you are in __ __ __ __ __.
16) An inter engineering organization run by students.
17) A beverage that most parents wish there kids wouldn't consume.
18) As opposed to synthetic.
21) Engineering fair held at UW-Madison every two years.
23) H + H = He + Bang < this process.
24) Can be calculated by parts, partial fractions or trigonometric substitution.
25) Opposite of #24.
26) Zion __ __ __ __ __ __ __ power plant, in Zion, IL.
27) There are thousands of them in your home computers.
28) Something that nobody on campus does enough of.
29) As opposed to qualitative.
30) The space-going version of High Noon with the old 007. Not a Bond movie.
31) The Dairy state.

DOWN:

1) The force towards the center of a revolving object.
2) Often found in physics labs or rock concerts. Red, Green, Blue.
3) 2001 and 2010 were written by this man.
5) Magic equivalent of an engineer.
8) Small, fuzzy, blue comic book charicter with prehencile tail that leaves a brimstone trail.
12) When a nucleus is struck by a neutron and splits into two nuclei.
19) Happens 3-4 times a semester per class and is usually cause for panic.
20) #24 and #25 are its major tools.

Answers provided on page 28



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Engineering Briefs

complied by Paula Grgurich

Nuclear Engineering

During the spring and summer of 1985, Phaedrus, a large experimental facility located under the patio of the Engineering Research Building, has been undergoing a transformation into Phaedrus Upgrade. Phaedrus is one of only five devices in the world whose purpose is to study the confinement and heating of a hot fully ionized gas, a plasma, in a magnetic field configuration called a tandem mirror. If the experiments confirm the theoretical predictions of how the plasma behaves, then Tandem Mirrors become a viable option to serve as a basis for Fusion reactors in the 21st century. Phaedrus has already done pioneering work in the study of plasma stability and heating using radio frequency (rf) oscillating electro-magnetic fields. Phaedrus Upgrade will allow University of Wisconsin researchers to extend their into a configuration that has a "thermal barrier". This new "wrinkle" in the concept was concieved at Lawrence Livermore National Laboratory and enhances the economical viability of the concept considerably. However, it also strains the ability of the scientists to predict the plasma behavior. Phaedrus Upgrade will uniquely undertake the task of studying a solely rf maintained thermal barrier tandem mirror. Specifically, Phaedrus Upgrade is 35 feet long, 4 feet longer than Phaedrus, with two new 1 Tesla magnetic field coils. The coils were wound at the U.W.'s Physical Sciences Laboratory. It also sports a new and roomier control room with more diagnostic handling capability. Twelve new rf antennas have been installed as well as a new high power microwave heating sources. Initial operations start in October.

Mechanical Engineering

The Department of Mechanical Engineering has hired five new faculty menmbers in the past year. They are: Robert Lorenz, Ph.D. UW-Madison who specializes in high performance system design, optics and sensor technology, computer control and manufacturing automation; Slawomir Spiewak, Ph.D. University of Warsaw, Poland who works in the areas of control engineering, microcomputers and optimizing manufacturing processes; Janet Ellzey, Ph.D. University of California-Berkeley whose areas of interest are fluid mechanics, combustion and numerical modeling; David Turic, Ph.D. Penn State who studies vibrations in mechanical systems, kinematics, computer-aided design and computer graphics; and Jay Martin, Ph.D. Michigan whose areas of expertise are combustion, fluid mechanics and diagnostic development.

Industrial Engineering

To celebrate its 15 year anniversary, the Department of Industrial Engineering is holding an Alumni Institute and Reunion, October 18-20, 1985. Both alumni and faculty speakers will discuss recent advances in the field of Industrial Engineering and the future of the Industrial Engineer. The speakers will address the Industrial Engineer's role in many areas including health, manufacturing, nutrition, office systems and natural resources. Participants will have the opportunity to tour the department laboratories, meet faculty, meet alumni in their area of interest and discuss professional issues of concern. The Institute won't be all work however. On October 19, participants will attend the Wisconsin/Northwestern Football Game after a big tailgate party at Union South.

Electrical and Computer Engineering

The Department of Electical and Computer Engineering have hired three new faculty members in the past year. They are: Deepakraj Divan, Ph.D. University of Calvary, Canada whose specialty is power electronics; Christopher DeMarco, Ph.D University of California-Berkeley who works in the areas of large-scale power systems, non-linear systems and control theory; and W.N.G.Hitchon whose areas of interest are simulation of plasmas and their interactions with solid materials and mathematical modeling. There are countless ECE research projects currently in progress. Here's a small sampling: McCaughan's optical switch, an optical analogue of integrated circuits; Birkmeier's astronautics radar, an ongoing experiment in air turbulence and windsheer; Chin's pattern recognition, a project dealing with industrial automation;Geisler's hearing aid, another application of integrated circuits; and Milenkovic's experiments with the voice track and speech.

Engineering Mechanics

A new and rapidly expanding specialty in the Engineering Mechanics Department is Computational Mechanics. Two new faculty members have been hired in this area over the past two years. The subjects of Finite element

(continued on 24)

New in the WE!

This is the first time our new column, "Engineering Briefs", is appearing in the *WISCONSIN ENGINEER*. Engineering briefs will focus on what's happening in various departments of the College of Engineering. Topics such as current research, faculty news and special events (conventions, retirements, etc.) will be reviewed. News which concerns all of the College of Engineering collectively will also be included.

If you are participating in or know of any hot research, news, or events happening in your department, why don't you share it with the rest of the College of Engineering and subscribers to the *WISCONSIN ENGINEER*? You may contact the WE at 262-3494 in this regard. Thanks for help making our new column a success!

Engineering Recruiting Dates

complied by
Michael Van Dyke

The following is a list of the company interview dates. This schedule is subject to change. Please check the Placement Office and bulletin boards for updates.

Monday, October 14

Allen Bradley
Bell Northern Research
Borg Watner Chemicals
General Instruments
Giddings & Lewis
Miller Electric Manufacturing
Modine Manufacturing
Wis. Dept. of Trans.

Tuesday, October 15

Appleton Papers
Control Data Corp.
Eastman Kodak
Englehard Corp.
Exxon Corp.
3M
Madison Gas & Electric
Oscar Mayer Foods
Owens Corning Fiberglas
Texas Instruments

Wednesday, October 16

Exxon
International Paper
Kimberly-Clark
3M
Northern Illinois Gas
Texas Instruments
Naval Avionics Center

Thursday, October 17

Battelle Northwest
Exxon
Factory Mutual Engineering
Ingersoll Milling Machine
Kimberly-Clark
3M
Texas Instrumnets
Union Oil Co.

Friday, October 18

Amdahl Corp.
Battelle Northwest
Inland Steel
National Semiconductor
Pillsbury Co. R&D
Union Oil Co.

Monday, October 21

Bell Research
Data General
Fisher Controls
Lockheed
Lutron Electronics
Minnesota Power & Light
Northrop
Xerox
C.I.A.

Tuesday, October 22

DuPont
GTE Corp.
Wisc Dept. Employee Rels.
C.I.A.

Wednesday, October 23

Commonwealth Edison
DuPont
Ford Motor
Olin Corp.
Quaker Oats
Standard Oil
Peace Corps

Thursday, October 24
DuPont

(continued on 25)

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analysis include Non-Newtonian Fluid Mechanics, Fracture Mechanics of Nonlinear Elastic Solids, Members of Discontinuous Media, and the more traditional Linear Problems in Structural Mechanics and Stress Analysis. The Engineering Mechanics Department provides an ideal setting in which to carry out coordinated numerical and laboratory experiments. Current Engineering Mechanics research is also aimed at the development of efficient time integration schemes for large-scale problems in structural dynamics. Research funding in these areas have been obtained from the National Science Foundation, The U.S. Air Force and the U.W. Graduate School. The Engineering Mechanics finite element group (Professors Cook, Malkus and Plesha) is designing a new sequence of courses in the area of Discrete Methods in Applied Mechanics and are collaborating in the updating and revision of Professor Cook's textbook-the primary text used in finite element courses.

Civil and Environmental Engineering

Two of CEE's faculty members are engaged in research on one of man's oldest building materials-wood. In each case the research is being supported by the U.S. Forest Products Laboratory. Assistant Professor Steven Cramer, CEE's newest faculty member, is focusing on improved safety and economy in the structural utilization of wood. His research strongly depends on innovative computing, utilizing both micro- and super-computers. To assure that the company analyses are realistic and accurate, his research incorporates a program of experimental testing, which will be conducted in the newly constructed College of Engineering's Structure and Material's Testing Laboratory. Application of his research include the development of design guidelines for residental roof systems. Assistant Professor Michael Oliva is exploring promising new techniques for the design and construction of timber bridges. Currently he is testing a fifty-foot span timber bridge deck. The results of his research will help to alleviate the problem posed by the deterioration of thousands of our nation's bridges.

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Ford Motor
Pillsbury Co.
Shell Oil
Sandia Nat'l Labs

Friday, October 25

DuPont
EDS
Shell Oil
Sandia Nat'l Labs

Monday, October 28

Eastman Kodak
Johnson Cntls - Control Prods.
Johnson Cntls - Globe Battery
Johnson Cntls - Sys & Svc.
Oak Ridge Natl Labs
PPG
Rockwell Int'l
U.S. Navy

Tuesday, October 29

Eastman Kodak
Impell Corp.
Johnson Cntls - Control Prods
Johnson Cntls - Globe Battery
Johnson Cntls - Sys & Svc.
PPG
Rockwell Int'l
U.S. Navy

Wednesday, October 30

Atlantic Richfield
Brown Printing Co.
Eastman Kodak
General Mills Research
Rosemount, Inc.
Union Carbide
NOAA

Thursday, October 31

Amoco Research Ctr.
Boeing
Dow Corning
Northern States Power
Pfizer, Inc. Research
Rosemount, Inc.
Union Camp

Friday, November 1

Amoco Research Ctr.
Boeing
Dow Corning
MIT Lincoln Labs
Northern States Power
Oster
Stauffer Chemicals
Uarco, Inc.

Monday, November 4

Ethyl Corp.
Hercules Research Ctr.
LOF Glass
Radian Corp.
Seaquist Valve
A. E. Staley Co.
Standard Microsystems
Travenol Labs
Westvaco
Naval Weapons Station

Tuesday, November 5

American Electric Power
Ethyl Corp.
General Motors
Liebert Corp.
Torrington Co.
U.S. Gypsum Research Ctr.
Marathon Electric Mfg. Corp.

Wednesday, November 6

General Motors
Interstate Power
Omaha Public Power District
Residuals Management Technology
Tektronix

Thursday, November 7

Air Products
American Cyanamid
Application Engineering
Cincinnati Milacron/Semiconductor
General Motors
Lawrence Liverrmore Labs
McDonnell Douglas
Texaco
Upjohn

Friday, November 8

City of Los Angeles/Water & Power
Harris Corp.
McDonnell Douglas
RTE Corp. Distribution

Monday, November 9

Lincoln Electric
Sperry Semiconductor
Union Carbide
VTC Inc.
Naval Ordnance Station

Tuesday, November 12

Cummins Engine
Polaroid Corp.
Prime Computer
Shell Development
System Planning Corp.
Union Carbide
U.S. Navy

Wednesday, November 13

Amsted Industries
Aqua Chem
Norplex
TRW
UOP/Process & Catalytic Sys.
Whirlpool Corp.
F.B.I.
Naval Sea Systems Command
U.S. Navy
W.R. Grace

Thursday, November 14

AT&T Bell Labs
Amoco Corp.
Hercules
Honeywell
Raytheon Corp.
Natonal Security Agency

Friday, November 15

Amoco Corp.
Honeywell
Xerox
Darcon
NASA/Goddard Space Flight Ctr

Monday, November 18

General Dynamics/Elec.
Tellabs, Inc.
Mobil Oil Corp

Tuesday, November 19

Air Products/Chemicals
BOC Tech Ctr
Boise-Cascade
General Dynamics/Elec
Pacific Gas & Electric
Southwest Research Institute
Timkin Co.
USAF

Wednesday, November 20

Inmont
Litton I.S.T.
Merck & Co.
Mobil Oil
Ralston Purina
Stepan Co.

Thursday, November 21

Digital Equipment
Litton I.S.T.
Mead Corp.
Mobil Oil
NASA Marshall Space Flight Ctr

Friday, November 22

R.R. Donnelly & Sons
Howmet Turbine Component Corp.

Engineering Abroad

by Laurie Ulman

Did you ever, in your wildest dreams, consider engineering in a foreign country? Have you wondered what it would be like to speak a different language in everyday life? Well, these dreams can become a reality as they have for many students at the University of Wisconsin - Madison.

One chemical engineering student, Paul Stone, pursued his dreams of studying abroad. He studied this past summer in England, and three years ago in Germany. The German trip was through the University of Wisconsin at Stevens Point. Programs at other U.W. systems are possible - and these credits will transfer to Madison. He was required to know German for this excursion. The classes he studied in Germany were non-technical ones such as History, Art History, German Culture, and a foreign language.

Schools in Europe operate on a different basis than schools in the United States.

Studying in Germany was an enlightening experience for Paul. A German professor of his described how the United States and Germany dealt with their own drastic financial depressions differently. The United States elected Franklin D. Roosevelt, who enacted his "New Deal" to set up many public service programs. Germany, however, had a rapidly rising leader by the name of Adolf Hitler. There was much euphoria with the new patriotic spirit that spread throughout the country. Germany put all of their efforts toward war machinery, and the economy responded. Paul's professor was even in a "Hitler Youth Group", which was similar to our "Boy Scouts". Paul also gained a new perspective of the United States in relation to world affairs. European newspapers have a greater international scope than newspapers here in America. Europeans appear to be better politically informed, and more politically aware than their U.S. counterparts.

Germans also seem to be surprisingly receptive to American tourists, and they are quite friendly to hitchhikers. Paul met a family at Oktoberfest with whom he became well acquainted. He visited them for a week during his study in England three years later! Paul had another experience in which he had hitchhiked to a town on a Sunday night, and found the Youth Hostel closed. He asked a German woman where he could find a boarding house. She replied that they were all "too expensive", and she took him around town until she found a friend of her's home where he could stay for the night. The only reason he could not stay with the German woman's family was because they had relatives over visiting.

Schools in Germany operate on a different basis than schools here. The language requirement is more stringent there: English and one other language of choice, besides the native German is required. There is also more pressure in grade schools to excel. Accomplishments in grade school determine which high school a student would be enrolled in. One of the high schools is more college-preparatory oriented than the other. The tuition for the Universities in Germany is free- the government pays for it. However, the placement tests are very difficult and require many months of study. Only 5-10% of the student population pass the tests and may enroll in the University.

The University of Germany is also different in its approach to studying for exams. Classes are held for a semester with no midterm exams. Then, at the end of each semester a comprehensive final determines the grade for the course. They do have 1-2 months to study for this final, but the pressure is monumental. After four years in the University, students must pass one large encompassing comprehensive final of the past four years.

England is similar to Germany in their University system, as are many Europeanl school systems. These systems differ from the school system here in the United States, where a larger percentage of students are able to receive a college eduction. However, here they must also finance it.

Cambridge University

Paul spent this past summer in England. This time he did take an engineering class: a chemical engineering Unit Operations Lab. This lab was condensed into five weeks of study. During the third week, they toured a nuclear power plant, a chemical plant, a petroleum refinery, and various other plants. Sightseeing and experiencing England was a major part of Paul's memories of his trip. Visits were paid to Stonehenge, the city of Bath, and many theatres. Wimbledon also happened to be going on at the time. But none of these exceeded Paul's favorite memory: the LIVE AID concert. The concert was an all day event filled with a lot of spirit and life!

Stydying Abroad is both a learning and a broadening experience which is nearly imppssible to obtain in ones native country.

Studying abroad is both a learning and a broadening experience which is nearly impossible to obtain in ones native country. It provides an opportunity to learn and grow within ones self. Many important decisions must be made quickly. It also offers a unique viewpoint in which to see the United States in relation to the world. Paul summed up his most startling discovery

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Engineering... More than Just Studying

by Fred Byars

In the eyes of the Letters and Science majors of this campus, engineering may apprear to be nothing more than long hours of study, lots of numbers, long equations, and little time for socialization. Well, while the engineering students of UW do indulge in a lot of studying, they also budget thier time well enough so that they can have a number of outstanding student organizations. This enables them to get out and learn more about campus living, So, whenever you have some time, get out and check into some of the following organizations. Perhaps you'll find a home away from home in a UW student organization. Who knows, maybe some day you'll even write for the *WISCONSIN ENGINEER*.

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS
Open to all science and engineering students interested in aerospace and related topics.
Prof. T.C. Haung
3350 Engr. Bldg.
262-0434

AMERICAN INSTITUE OF CHEMICAL ENGINEERS
Open to any chemical engineering student.
Prof. Dale F. Rudd
3006 Engr. Bldg.
262-1520

AMERICAN NUCLEAR SOCIETY
Open to all engineering and science students interested in nuclear energy and nuclear engineering.
Prof. M.L. Corradini
145 ERB
263-2196

AMERICAN SOCIETY FOR METALS AMERICAN INSTITUTE OF METALLURGICAL ENGINEERS
Open to all undergraduate and graduate engineering students interested in metallurgical engineering and related sciences.
Prof.F.Worzala
246 MME Bldg.
262-0389

AMERICAN FOUNDRYMAN'S SOCIETY
Open to all engineering students interested in the metal casting industry.
Prof. J.A. Koutsky
3016 Engr. Bldg.
262-3507

INSTITUE OF ELECTRCAL AND ELECTRONICS ENGINEERS
Open to all students interested in electrical engineering and allied fields.
Prof. K. E. Oughstun
3423 Engr. Bldg.
262-6249

INSTITUTE OF INDUSTRIAL ENGINEERS
Open to any industrial engineering student or prospective student.
Prof. C.H. Falkner
451 Mech. Engr.
262-0861

WISCONSIN BLACK ENGINEERING STUDENT SOCIETY
Open to any engineering student. Emphasizes academic and professional development of black students at U.W.
Alfred Hampton
23 Gen. Engr. Bldg.

(continued from 26)

and what he gained from studying overseas: "Awareness of different cultures and different attitudes towards world events. The U.S. isn't the only country in the world."

If you have studied a foreign language, you may have the option to study in a foreign country. The Office of International Engineering Programs coordinates study abroad opportunities in several countries. Student exchanges are possible in Germany, Norway, France, Spain, Scotland and Japan. To be eligible for this program, students should have a B or better GPA and the language background to spend their third year abroad. Study in Japan also

(continued from 27)

MINING CLUB
Open to any mining engineering undergraduate student.
Prof. R. de la Cruz
M171 MME Bldg.
262-5760

SOCIETY OF AUTOMOTIVE ENGINEERS
Open to all engineering students interested in automotive engineering; land, sea, and air.
Prof. G. Borman
Bldg. T-27
263-7871

SOCIETY OF WOMEN ENGINEERS
Promotes professional development, encourages interaction among women engineering students, and acts as a resource for female high school students interested in engineering.
Prof. Geenfield
24 Gen. Engr.
262-3507

ALPHA CHI SIGMA
A professional society for chemical engineers, and other students of chemical related fields.
Prof. E.J. Crosby
2006 Engr. Bldg.
262-8932

KAPPA ETA KAPPA
A professional electrcal engineering society.
Prof. R.A. Greiner
3535 Engr. Bldg.
262-9655

THETA TAU
A professional engineering society.
Prof. G. Robinsson
387 Mech. Engr.
262-3768

WISCONSIN SOCIETY OF PROFESSIONALS
Open to any engineering student.
Prof. W.W. Wuerger
266 Mech. Engr.
262-3484

WOMEN IN ENGINEERING
All women engineering students belong automatically.
Prof. Greenfield
24 Gen. Engr.
262-3507

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS
Open to all engineering students interested in agricultural engineering.
Prof. G.Barrington
227 Ag. Engr. Bldg.
262-1019

AMERICAN SOCIETY OF CIVIL ENGINEERS
Open to all engineering students interested in civil engineering.
Prof. E.J. Kuipers
2258 Engr. Bldg.
262-7244

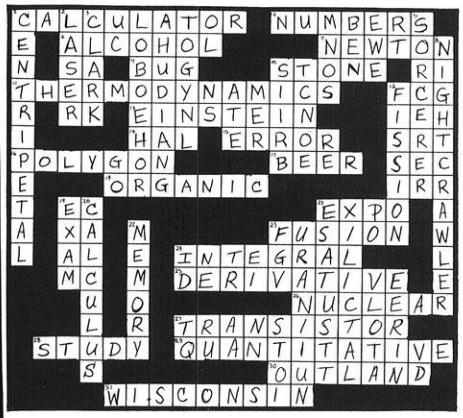
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Open to all engineering students.
Chris Myhre
231-2551

AUDIO ENGINEERING SOCIETY
A professional engineering society for persons interested in audio and elecrtoacoustics.
Prof. R.A. Greiner
3535 Engr. Bldg.
262-0511

INSTITUE OF TRANSPORTATION ENGINEERS
Open to all students interested in the field of transportation engineering.
Prof. R.L. Smith
2204 Engr.Bldg.
262-3649

Crossword Puzzle Answers

(continued from 21)



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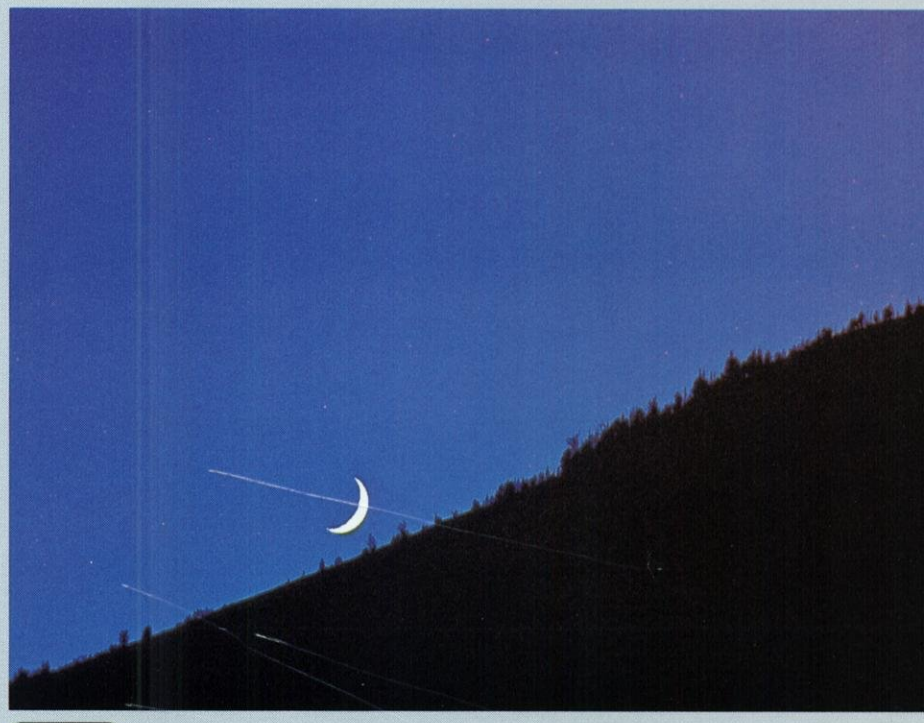

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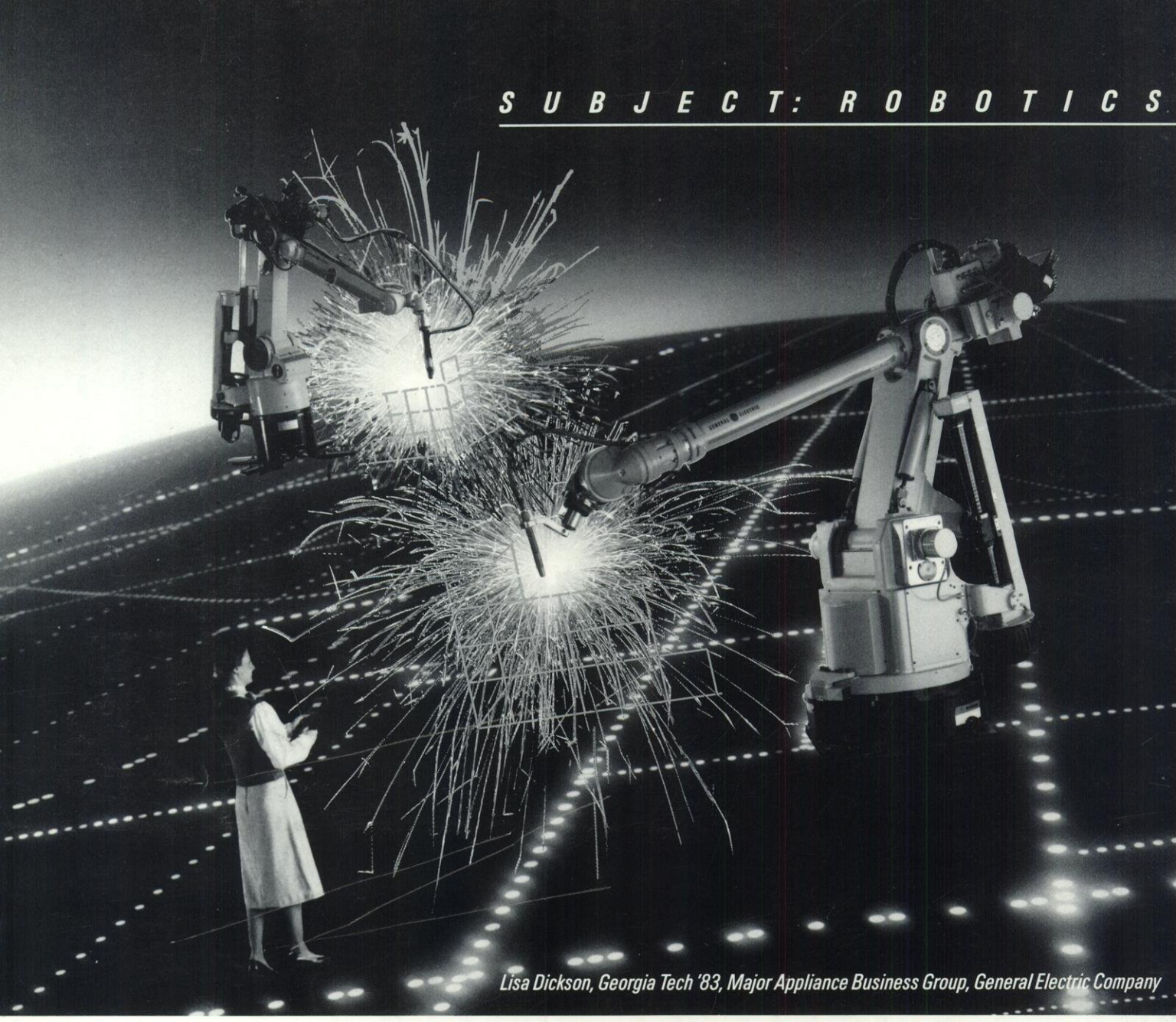

Lisa Dickson, Georgia Tech '83, Major Appliance Business Group, General Electric Company

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