Engineers' Forum

VIRGINIA TECH

SEPTEMBER 1993

At The Leading Edge . . .

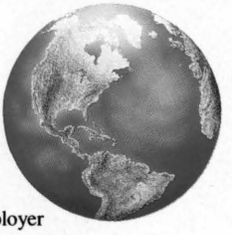
Delco is a world leader in automotive electronics. We produce 22,000 instrument clusters, 23,000 radios and 700,000 ICs, *every day.*

Through teamwork, our Delco engineers keep us at the leading edge of electronics . . . on the road, in the air and around the globe.

If you are interested in working on tomorrow's technology in Kokomo, Santa Barbara, Flint, Milwaukee, Luxembourg, Singapore, Liverpool, Matamoros or Reynosa . . .

Contact:
Tonya Goodier
Delco Electronics
Corporate Headquarters
One Corporate Center
M.S. CT-17-A
Kokomo, IN 46904-9005

A World of Opportunity



An Equal Opportunity Employer

Resumes may also be sent directly to the following Delco Electronics locations:

Flint, Michigan:
Human Relations Supervisor
2011 B
1300 North Dort Highway
Flint, MI 48556

Milwaukee, Wisconsin:
Personnel Manager
Delco Electronics Corporation
P.O. Box 471, M.S. 1A14
Milwaukee, WI 53201

Santa Barbara, California:
Personnel Manager
Delco Systems Operations
6767 Hollister Avenue
Goleta, CA 93017

Delco Electronics
WORLD LEADER IN AUTOMOTIVE ELECTRONICS™
Subsidiary of GM Hughes Electronics
It's who we are.

Engineers' Forum
VIRGINIA TECH
SEPTEMBER 1993

Engineers' Forum is Virginia Tech's student engineering magazine. *Engineers' Forum* is published four times during the academic year. The editorial and business office is located at 112 Femoyer Hall, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. Phone (703) 231-7738. Member of Engineering College Magazines Associated, Lee Edson, Chairperson.

Darkroom facilities donated by Virginia Tech Communications Department.

CONTENTS

EDITORIAL

The scheduling system: One major fault

As some of you may or may not know, the scheduling system at Virginia Tech is a little different. Once past freshman year, scheduling is done by filling out the OPSCAN forms, turning them in, and then receiving the finished schedule. Most schools make you stand in lines to directly register at the terminals. That process is a nuisance and a waste of time. Those schools have to make room for "scheduling days" in their calendar. The University of Virginia uses the first week after students return for scheduling; all they do for a whole week is schedule classes. (And they are supposed to be smart?) Our system is advanced and a timesaver, and it deserves a lot of credit. However, it has one major fault.

The need to "force-add" a class occurs when a student is required to take a class that specific semester and all sections of that class are filled. The force-add system is a major ordeal, and it causes a lot of unnecessary problems for students. Students are sent on a wild goose chase to obtain numerous signatures. Students are given the runaround as administrators and professors often refuse to sign the papers. Students are also told they can't get into any of the classes until after the first week. Instead they are to "sit in" on a few classes in the chance that an opening might occur.

Basically, the university to which we pay thousands of dollars a semester is telling us there is no room for us in the classes we need to graduate. In addition, we have to do all the work to get into those classes. Getting a schedule fixed can last until the second week of classes.

The need to "force-add" classes cannot be blamed on students, either. When we receive our schedules before the start of the semester, they will have classes missing. I've known people who have received schedules with no classes. And what do you do when the classes you signed up for aren't on your schedules? You have to "force-add" them.

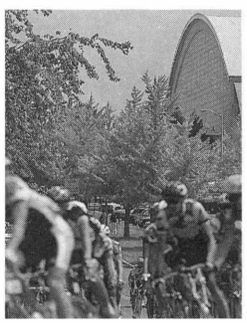
The university is making the students do the work to get the classes we need. One of my friends in Civil Engineering couldn't get a class he needed. He tried to "force-add" and administrators told him all the sections of that class were full. The student's dad drove down to Tech and threatened to organize a parent group to protest this treatment of students. The university was then quite helpful in signing the student up for the needed class (giving new meaning to the term "force"-add).

This situation is disrespectful. We pay tuition and then the university turns around and tells us there is no room in the classes we need. Maybe the university needs to rethink its definition of "full." General Chemistry classes have 500 students in them, but we are told there is no room for a 31st student in a Statics class. If the university is so overloaded with students, maybe it should cut back on admissions.

The problem becomes magnified for engineers. Students who try to finish the engineering curriculum in four years have a pre-planned, tight schedule. Almost every class has prerequisites and many classes are only offered in certain semesters. Students can also not afford to miss the first new days of classes as they try to figure out which classes they will end up in.

The "force-add" system stands out as the one major fault in a scheduling system that is otherwise very good. The administration must work on a solution to the "force-add" problem. To start, they just need to realize that the first and foremost reason students pay tuition is to attend classes to get a degree.

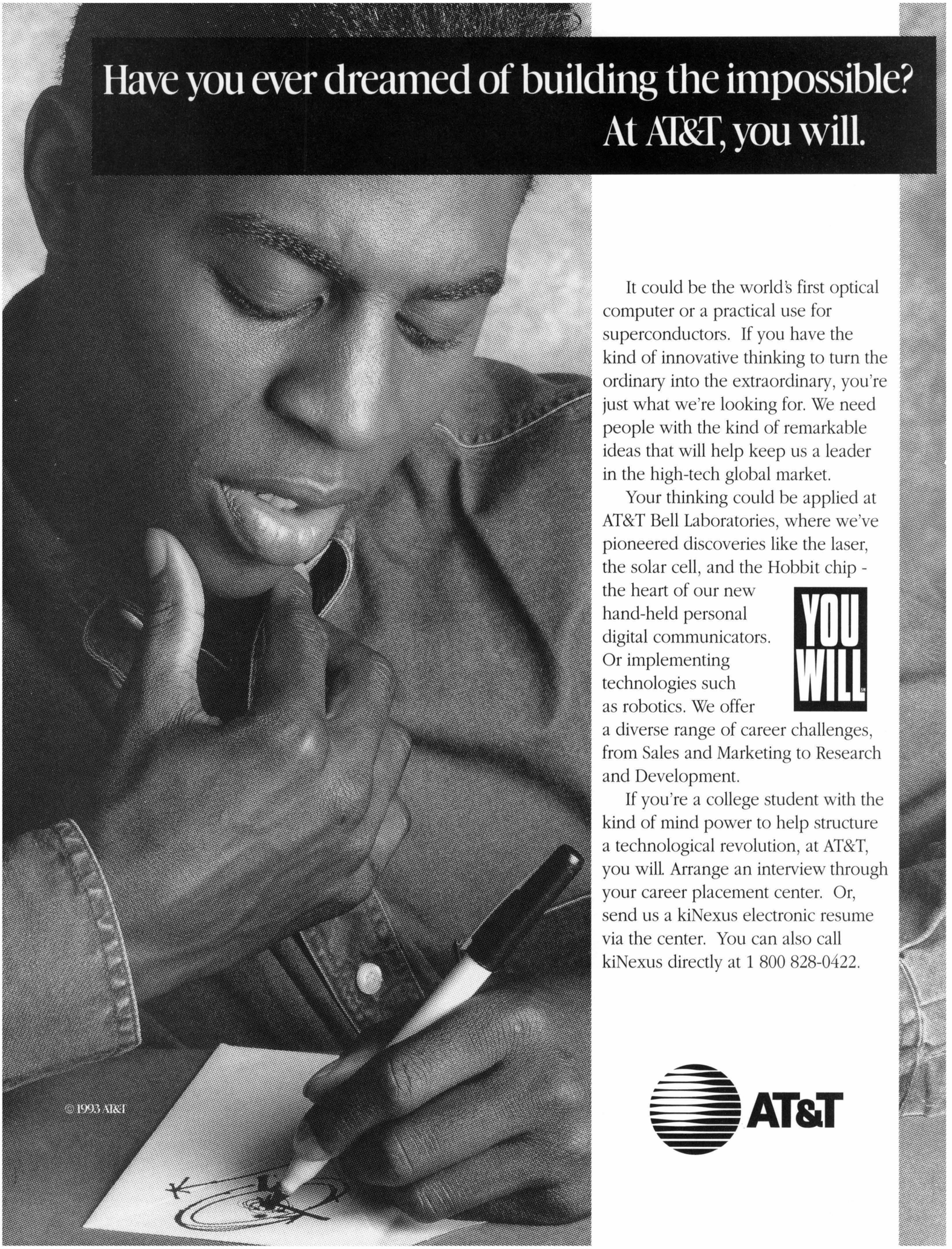
John Cole
Editor-In-Chief



ON THE COVER

Bikers begin the last leg of the Tour duPont in front of Cassell Coliseum.

Photo by Rick Griffiths.


Have you ever dreamed of building the impossible?
At AT&T, you will.
It could be the world's first optical computer or a practical use for superconductors. If you have the kind of innovative thinking to turn the ordinary into the extraordinary, you're just what we're looking for. We need people with the kind of remarkable ideas that will help keep us a leader in the high-tech global market.
Your thinking could be applied at AT&T Bell Laboratories, where we've pioneered discoveries like the laser, the solar cell, and the Hobbit chip - the heart of our new hand-held personal digital communicators. Or implementing technologies such as robotics. We offer a diverse range of career challenges, from Sales and Marketing to Research and Development.
YOU WILL
If you're a college student with the kind of mind power to help structure a technological revolution, at AT&T, you will. Arrange an interview through your career placement center. Or, send us a kiNexus electronic resume via the center. You can also call kiNexus directly at 1 800 828-0422.
AT&T
© 1993 AT&T

TEACHER FEATURE

DEAN CLOUGH SAYS GOODBYE

by Mike Reese

Four years ago, Dr. Wayne G. Clough made the decision to resign from his administrative duties as Department Head of the Charles Via Department of Civil Engineering. His decision was met with a request to replace Dr. Paul E. Torgerson as dean of the College of Engineering. This was an unexpected, but not unusual situation in his illustrious career. Clough has repeatedly found himself faced with unannounced opportunities, and just as often he has successfully faced the challenges.

The first of these opportunities occurred in his undergraduate days at Georgia Tech. Acting on a suggestion, Clough decided to stay in Atlanta, Georgia, to continue research. He stayed until he had received a M.S. degree and then went into industry. At the time he may not have realized he would return to school and eventually rise through the ranks of academia.

His return took him to the University of California, Berkeley, to pursue a doctorate degree. Clough described Berkeley as "exciting and unpredictable" and "one of the best schools in some measures." It seemed as if he was describing himself. He went on to excel in the field of geotechnical engineering. He has won National Science Foundation grants and headed the geotechnical department at Stanford. Why? Because he loves to chase earthquakes. What research could be more exciting and unpredictable?

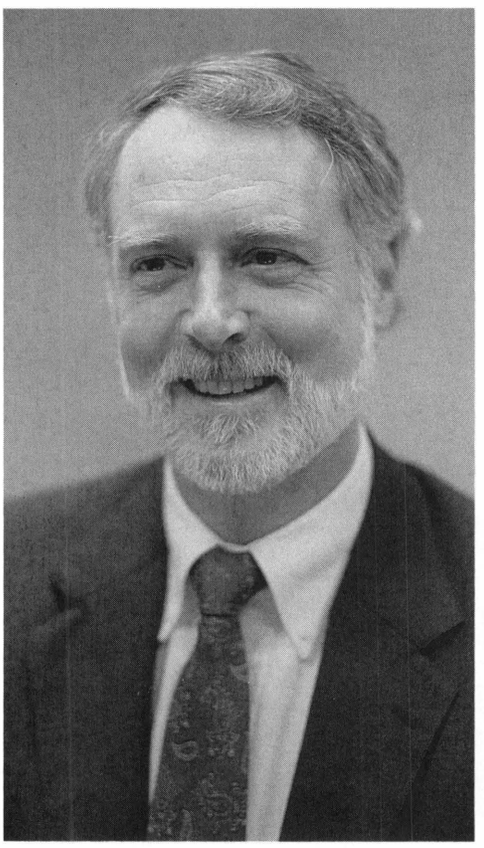
In 1982, he brought his research here to Virginia Tech. The next year he was named head of the Civil Engineering Department. He became dean of the college in 1990. In the last three years he has worked hard to continue the progress of the college despite devastating budget cuts. He has given new energy to old projects, and worked hard to bring new research to Blacksburg.

In the early '80's, Virginia Tech was one of the first engineering programs to require students to purchase a computer. The PC Initiative gave Tech national recognition as a program which extensively combines computers with engineering education. However, by the end of the decade the project's momentum had begun to slow. Dr. Clough was determined to maintain Tech as a leader. He said his goal "was to re-energize the project."

Seniors this year will appreciate how much the package has changed in the last three years. This year's package will include a 486-DX processor. Some of the software included is 3-D versions of AUTOCAD and CADKEY, Mathematica, and Word for Windows with bookshelves. Students will also have complete multimedia capabilities, a convenient addition to coincide with last year's opening of Hancock's Multimedia Lab.

Clough has been a driving force in bringing Tech to the forefront of multimedia research. Under Clough, Tech was named to the head of the Southeastern

As Dr. Wayne Clough moves on to his new position at the University of Washington, many of us are ready to acknowledge and thank him for his contributions to Virginia Tech. This article reflects on his career, including an area many may overlook — his devotion to the students.



TEACHER FEATURE

Clough has always been sensitive to student's needs. The classroom renovations were a result of listening to student's complaints. In addition, he worked personally with students to improve teacher evaluations to insure the student's voice is heard.

University and College Coalition for Engineering EDucation (SUCCEED) multimedia research group. Tech will be leading this group of eight southeastern universities toward integrating multimedia into the engineering curriculum. Students will begin to see the results in Engineering Fundamentals, Statics, and Dynamics classes this year.

Clough has worked with other colleges here at Tech so that multimedia will be used in subjects outside of engineering, such as Calculus, English, and Physics. This shows Clough's concern to better the university and not just the College of Engineering. This can also be seen in new renovations students will see take place over the next few years.

All engineering classrooms will be air-conditioned, they will have new computing facilities installed, and work will be done to improve the lighting. Since these classrooms are in reality used by the entire university, all students gain a better learning environment.

Clough has always been sensitive to student's needs. The classroom renovations were a result of listening to student's complaints. In addition, he worked personally with students to improve teacher evaluations to insure the student's voice is heard. This group is called the Dean's Committee.

On a more social level, Clough and his wife held cookouts for students who volunteered at EXPO, and for students who worked with the Student Engineers' Council. At the picnics there was a feeling of intimacy, not intimidation. This is a credit to his outgoing personality. Students felt relaxed enough to engage in casual conversation, without giving thought to Clough's daily dealings with congressman and leaders of industry. During volleyball, some even felt confident enough to spike against his team (but never at him!).

Clough has been an important part of this college. But once again a new opportunity has become available. Not surprisingly, he has accepted the challenge. It gives him a chance to return to the West Coast. He noted, "I seemed to be drawn to beautiful areas. First it was San Francisco, then Blacksburg, and now Seattle."

Clough is Provost at the University of Washington, Seattle. His responsibilities include making decisions on budgetary and academic issues, and insuring that academic quality and standards are met. His scope of work will now expand beyond one college, and spread over an entire university.

With his increased responsibilities, Clough's sensitivity to students has not diminished. He said, "I will be concerned with undergraduate education; more freshman involvement is one of my goals." He explained this will be difficult at a school with a combined campus enrollment of over 40,000 students. One must also remember that this institution is in an urban environment. It is easier for students to feel alienated when there is not the concentrated student community that exists here in Blacksburg.

The word opportunity may have been overused in this article, but it could not have been helped, for the word is synonymous with Dr. Clough. He has taken advantage of them all his life, and created them for those who have had the chance to work with him.

Opportunity has led him into a level of education that few engineers reach. He explained, "Few engineers make it to the level of Provost or President. We [engineers] are left out of the decision making process." Who better to represent us engineers than Dr. Wayne G. Clough.

Though his charisma, creativity, and leadership will be deeply missed, it should make us proud to know that his future colleagues will associate him with Virginia Tech. EF

Tour DuPont:

by Monta Elkins

Not as strange a combination as you might expect

"The contribution of engineers is written all over the bikes," says Davis Wildman of East Coasters bicycle shop, co-chairman of the local organizing committee for the 1993 Tour DuPont. Many different materials and technologies go into construction of the modern racing bike. Kevlar and computers. Titanium and carbon fiber. Gore-tex and Teflon. These are but of few of the high-tech items that come into play in competitive bicycle racing today.

Friday, May 14, 1993: Virginia Tech hosted the start of stage 9 of the 1993 Tour DuPont, America's premier cycling event. It was a very hard stage, the longest of the event. The riders traveled 151 miles and climbed over 3000 feet to Beech Mountain, North Carolina (elevation 5,058 feet), the highest elevation in the tour's history. Jorg Muller, the stage 9 winner, pedaled the distance in seven hours, for an average speed of over 21 miles per hour! Raul Alcala of the WordPerfect team was the overall race champion, traveling an estimated 1,085 miles in under 46 hours and 43 minutes. Before the race he called the section from Blacksburg to Beech Mountain "the most decisive stage." The amount of technology that goes with such performance is just as incredible as the performance itself.

Virginia Tech, The College of Engineering, and The Center for Intelligent Material Systems and Structures sponsored the Tour de Tech on the same day as the Tour DuPont. The Tour de Tech was a science and technology exposition showcasing technology related to bicycle racing and more. Local school students attended the event, designed to spark their interest in engineering.

Who says advanced technology never sees the light of day? There were an estimated 12,000 people at the events in Blacksburg and an overall audience of 92 million people in 93 different countries for the Tour DuPont.

Computers on bicycles

Computers have permeated every pore of our society. These bicycles are no exception. Riders in the Tour DuPont used bicycle-mounted computers that provided a variety of functions. "How far do I have to go?" "What is my average speed so far?" Just ask the computer. These computers monitored both average and maximum speed, elapsed time, and trip miles. Cyclists can use this information to pace themselves. The training regimen of these world class athletes is incredible, and so are the technologies they use. Computers help them monitor their ability. How about "What's my heart-rate?" or "How high have I climbed?" The more sophisticated bike-mounted computers monitor the rider's heart rate and the altitude. The fruits of engineers and scientists spring up in many places.

Imagine the incredulity of the computer pioneers as they are told that their room-sized devices will someday increase in power and shrink in size, to the point that they can be mounted unobtrusively on a bicycle. "Unbelievable?" Future innovations are equally unimaginable.

Bicycles have personalities

The bike's characteristics must be carefully matched to the task and the rider. Different bikes were used for different purposes. The Tour DuPont consists of eight road races, two time trials and one team time trial. The frame geometry of the time trial bike is different from that of a road race bike. High speeds and tight spaces increase the need for maneuverability. Light weight is more important for time trials, while durability takes precedence for the road races. In the long road races, the comfort of the rider becomes more important.

Frame geometry must also take into account the different sizes of human riders. (Don't you just hate when something as vague as "people" intrudes on a "perfect design.") Arm length, torso length, leg length, riding style and weight are some of the items that must be considered when fitting a bike. (And get this — weight, leg strength and stamina can *vary* for the same individual.) Bike frames can be ordered in many sizes for each of several styles. And, if that isn't good enough, some companies custom build bikes to fit a given rider.

Engineering and materials advances have led to lighter and stronger bikes. Advanced composite materials led to the aerodynamic DuPont tri-spoke wheels, costing about $700 each. Frames may be made from carbon fiber, steel, aramid fiber (like Kevlar, of bulletproof vest fame), other exotic materials, or some combination of these materials. Typical race bikes usually cost between $2,000 and $3,000, but in reality there is no upper limit.

Besides making the bikes lighter and more durable, new technologies make the bikes more comfortable. Frame geometry, material selection, and shock absorption systems reduce the wear and tear on the rider, thus making his job a little easier. Less fatigue means better times.

Looking high-tech

Colored jerseys are awarded to outstanding cyclists during the tour. These jerseys also showcase some of DuPont's

Engineering & Bicycles

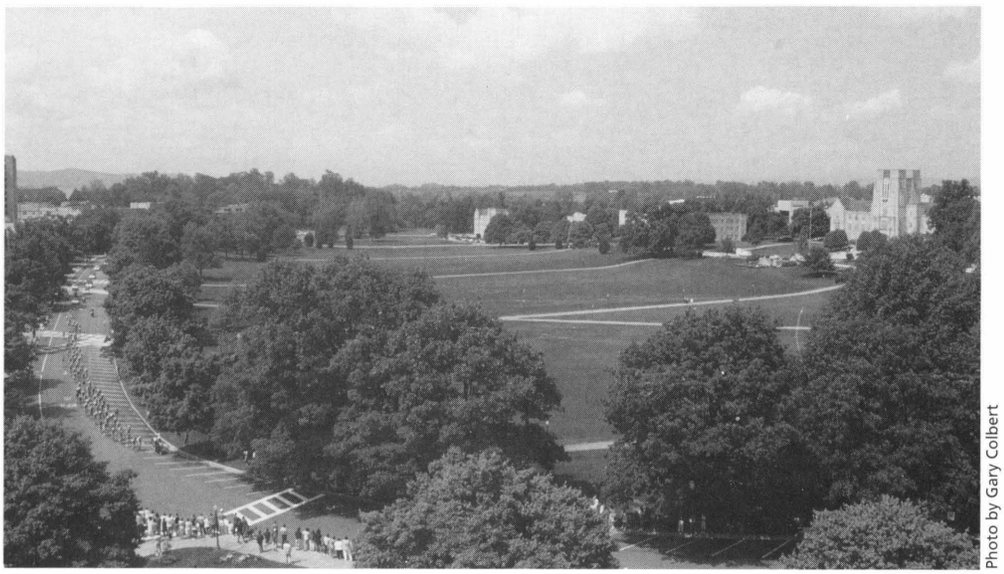


Photo by Gary Colbert

The Tour DuPont bicycle race is shown here as the racers circle the drillfield.

high-tech materials. The cheetah-spotted Sprint Leader jersey, awarded to Wiebren Veenstra, is made of Lycra spandex which is "form fitting for improved aerodynamics." The King of the Mountains jersey is made from Supplex nylon that is touted, ounce for ounce, as stronger than steel. It was awarded to Saturn's Scott Mercier. Selection of clothing material depends upon its characteristics. Riders need clothes that can help keep them cool and dry. Materials need to be both strong and light weight. Eye-catching colors and wrinkle resistance are additional features. Other DuPont materials used in bike racing are Coolmax and Cordura fabrics, Delrin, Hytrel, Rynite and Zytel plastics. Imron polyurethane enamel is used to paint the bikes and is resistant to the weather and abuse they see.

Many of the advanced materials for today's racing bikes have come from aerospace research and development. The advanced technology used in these race bikes tends to "trickle down" into the more common bikes as time goes by. Today's "high-tech, only-in-the- lab" materials are tomorrow's common ones. Because of the international flavor of the Tour DuPont, you can see examples of advanced materials from all over the world used in bike construction.

There are many more places where engineering plays an important role in the development of racing bikes. Tire design and manufacturing requires low weight and high puncture resistance.

Helmet designs must protect the head from injury, while being light in weight and cool to wear. Chain lubrication, shoe and cleat design, seat design, bearing efficiency, and aerodynamics are all concerns.

Tour DuPont takes more than bicycles

The high-technology requirements weren't limited to the race bikes. There were motorcycles specially equipped with cameras to take live action shots of the competitors during the race. These video images were transmitted to helicopters hovering overhead, or stored on tape to be edited in a mobile video production truck for same-day news coverage. There was a camera-equipped jet helicopter that provided aerial shots of the competition. Communication technologies of all types were necessary. The press transmitted voice, video, and electronic messages back to their employers for publication. Race officials and marshals had the own requirements, as did the riders and their support vehicles. The Motorola team had a radio headset for communication between the racers and the team support vehicle.

Many different engineers made all of this possible. In some cases high-tech companies were directly responsible for the cyclists attending the event. Motorola and WordPerfect, for example, sponsored teams.

Now it's your turn

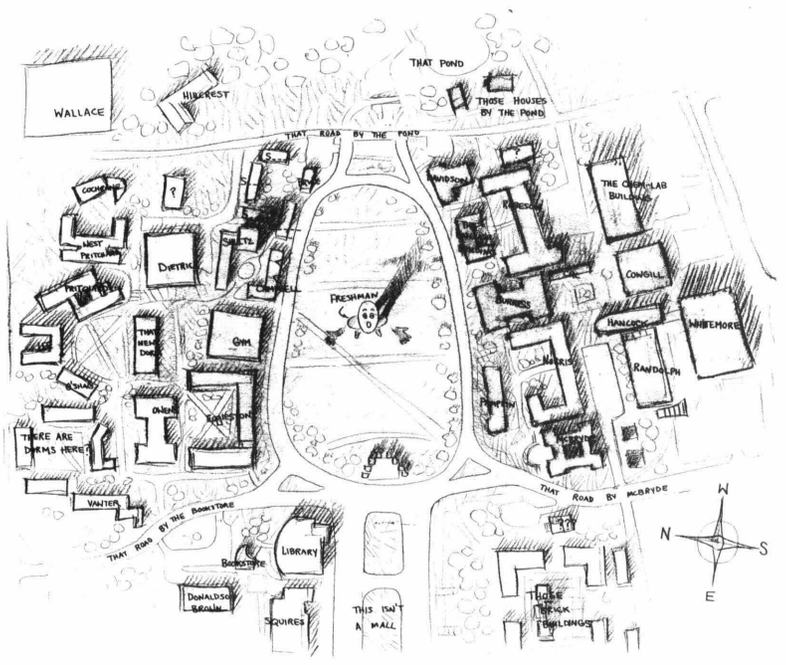
There are still many roads to travel with bicycle design. There are many things to consider. Derailleur controls for changing gears transmit primarily positional information, whereas handbrakes transmit force. There are many different approaches. Recumbent bikes may be more efficient with less air resistance and a lower center of gravity as well as providing a more comfortable riding position. There are different ideas to try. Biopace Chainrings are oval gears, instead the usual circular gear, which provide different gearing at different places in the pedal rotation to allow for the "weak spots" in the pedaling motion. Now what else might be a good idea . . . ? You may have the answer for tomorrow's bike. EF

PERSPECTIVES

The accumulated wisdom of a former freshman

by Jessica Smothers

Welcome to Virginia Tech! All through high school you were told horror stories about professors, classes, and course loads. Teachers told you things like, "In college, no one cares what you do. Go to class, don't go to class, you're just a faceless name and number to your professors." Tales of hideous term papers and impossible grading curves were enough to make you doubt the wisdom of going to college at all.



Artwork by Aaron Golub

In spite of all the stories and tales, you've decided to come here. Now for the big secret: College isn't as bad as the horror stories make it out to be. Granted, there are many differences between high school and college, but that doesn't mean college has to be a long series of all-nighters writing hundred-page papers for crazed professors who couldn't care less whether you live or die. Here is the accumulated wisdom of a year at Tech:

1: GO TO CLASS. This may sound like ridiculously basic advice, but it's easy to fall into a habit of skipping classes, especially those long, boring 8:00 a.m. classes. Although most professors don't take attendance (yes, there are a few who do), they do notice when the class size suddenly triples on a test date and your face is completely unfamiliar. Also, many professors test on the lectures as well as the book, and the material isn't necessarily the same. Reading the text may not be enough to learn the material, so going to the lectures is important for good grades.

2: MEET YOUR PROFESSORS. Make a point of meeting each of your professors, either after class or during their office hours. Introduce yourself and tell them how much you're interested in the class, even if it's Advanced Mating Rituals of the Slug or The Economic Impact of Underwater Basket Weaving. Don't be afraid to go to a professor for help, either. That's why they have office hours. Make yourself known to the professor so you won't be a faceless name and number.

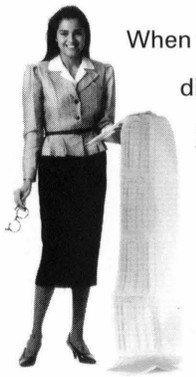
3: MAKE FRIENDS WITH YOUR CLASSMATES. Make a point of getting to know at least one person in each of your classes and exchange phone numbers. In the unlikely event that you should miss a class (yeah, right), it's good to have someone to get notes from. It's also good to work on homework assignments in a group. You can explain the material to each other and work out problems together, which can reduce the amount of time you spend on an assignment while increasing your understanding of the material.

4: DO YOUR HOMEWORK. This is another deceptively simple piece of advice. However, many professors neither collect nor grade homework assignments and it's easy to put off doing it until "later." Often "later" comes the night before the test and you find yourself pulling an all-nighter to study material you haven't learned. Also, test questions will frequently come from homework assignments, with just the numbers changed around. So avoid the all-nighters and keep up with the homework.

5: GET INVOLVED. While classes and homework are important, what goes on outside the classroom is also important. As engineers, your schedules will be tight, but choose several activities or organizations that interest you (like the Engineers' Forum) to get involved with. These activities not only give you a needed break from studying, they also provide social contact with many different people, not just engineers.

The year ahead of you will be exciting and frustrating. You will have many new freedoms, but also many new responsibilities. Don't fall prey to the tendency many freshmen have for partying too much, studying too little, and being amazed when their grades come back much lower than expected. Hopefully, these tips will help you to have a fun and rewarding time here at Virginia Tech. Welcome! EF

Team up with Amoco.

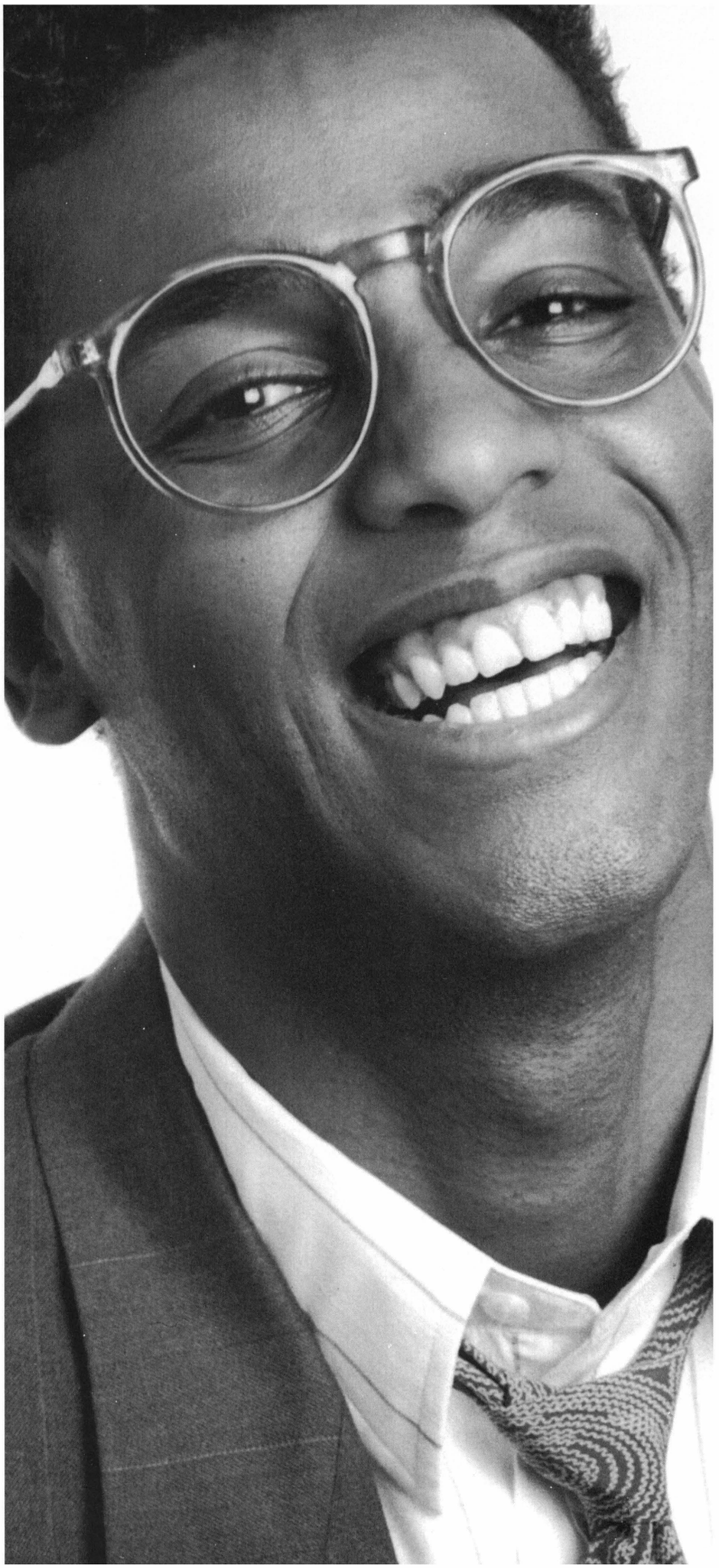


When you join Amoco, you'll discover that we don't just talk teamwork, we live it every day. We're the global energy and chemical company whose success is built on a diversity of talents–from engineers to geoscientists, MBAs and information technology specialists.

In these and other fields, we offer exciting career opportunities. Amoco people explore frontiers in energy, devise new technologies, manage challenging businesses, and help shape our nation's environmental policy. It all adds up to a stimulating, interdisciplinary workplace where people like you make the most of their talents. If you'd like to be part of a dynamic, well-managed company, whose environmental record you can be proud of, think Amoco. We're the team worth joining. Check your college placement center for more information.

Amoco Corporation
Explore the possibilities.

An equal opportunity employer.



Global Opportunities

"I love what I'm doing. I guess the bottom line is that BWNT gives me the freedom to try... almost anything."

— Lisa Petrusha, Supervisor, Fluence Analysis Group University of Michigan '87

"I chose nuclear engineering because it was different, challenging. I didn't want to get bored. I chose B&W Nuclear Technologies for the same reasons. At other places, one person works on a little piece of the puzzle without ever seeing the big picture. BWNT people are more team oriented and work on technical programs that achieve specific goals.

"They gave me significant work, right away — not a lengthy training period followed by limited responsibilities. I get to try new things, even go out into the field, to broaden my background. There are always new opportunities, and my achievements have given me the confidence — and the independence — to look forward to the next challenge."

The first step in joining the BWNT team is to forward your resume to: Program Manager, College Recruiting, B&W Nuclear Technologies, P.O. Box 10935, Lynchburg, VA 24506-0935; (804) 385-2628.
An equal opportunity employer, M/F/H/V.

BW B&W NUCLEAR TECHNOLOGIES

SENIOR YEAR SURVIVAL TIPS:

A guide to job hunting and graduate school

by Tony Giunta

You have rounded the final turn and are in the home stretch, but get ready — it's an all-out sprint to the finish line. It does not matter if you are planning to get a job after graduation or if graduate school is in your future (or you just don't know yet), your senior year will seem like the most hectic and frenzied of all your years at Virginia Tech.

Not to get you worried, but as you read this in mid-September, many employment and graduate school deadlines are already very close. If you have not started thinking about life after graduation, here are some tips to get you caught up to the rest of the senior pack.

The Job Search

If you are certain that you could not stand several more years of school at this point in your life, then getting a job should be your top priority as a senior. The place to start is the University Placement Office in Henderson Hall. The Placement Office offers a variety of job placement services and provides several introductory seminars at the start of the semester.

You should begin your job search by obtaining a copy of the Placement Office booklet, which contains many sample resumés and a variety of other job related form letters.

A good resumé is the first step in getting a job interview. Because employers receive thousands of resumés every year, a poor quality resumé buys a one-way ticket to the trash can.

If you are applying for an engineering or business related position, your resumé should look like the samples in the booklet. Many people use resumé typesetting services offered through various copy shops or bookstores. If you have word processing software that provides a variety of fonts and text sizes, then it is just as easy to make your own.

The University Bookstore has several Macintosh and IBM computers that are connected to laser printers. Also, there are several laser printers in the PC labs around campus. Printouts from the bookstore cost 35 cents per page, whereas the PC lab printouts are free. You must supply your own paper for both.

When purchasing resumé paper, buy high-quality, heavy-weight paper stock. Standard printer paper just does not look very professional and the monetary savings are insignificant when compared to the risk of having your resumé immediately trashed.

Once your resumé is ready, you must check the Placement Office schedule to find out when various companies will be conducting their on-campus interviews. Usually resumés must be submitted several weeks prior to the interview dates. Some students like to tailor their resumés to fit each different company. This is probably a good idea although it may require substantial research and planning beforehand. Another option is to have several copies of a standard resumé that is general enough to fit whatever type of position you are seeking.

The actual process of submitting a resumé and obtaining an interview is too involved to discuss here. Read the Placement Office booklet for general information on the next steps in your job search, or stop by Henderson Hall and talk to one of the Placement Office staff members.

On to Graduate School

"If you are going to graduate school in engineering and paying for it yourself, then you are doing something wrong." - Anonymous Virginia Tech Professor.

The key to graduate school is funding and, fortunately, there are a variety of sources for engineering students. However, there is growing competition for the fellowship and assistantship funds that are available.

> **"If you are going to graduate school in engineering and paying for it yourself, then you are doing something wrong."**
>
> *— Anonymous Virginia Tech Professor*

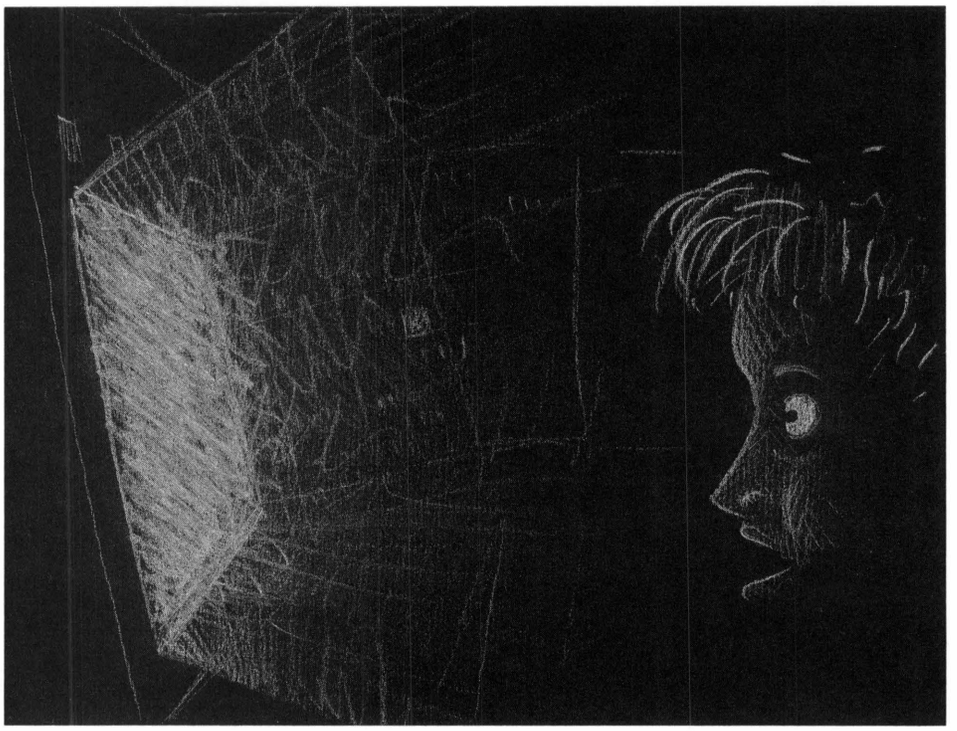
The general test of the Graduate Record Exam (GRE) is required by many, but not all, engineering graduate schools.

Some schools also require the engineering subject exam of the GRE. The general test is similar in format to the Scholastic Aptitude Test (SAT) while the engineering subject test is a fairly rigorous test on fundamental engineering subjects. Since many graduate schools use the GRE scores as one factor in determining financial assistance, it is a good idea to prepare for them. Just as for the SAT test, there are many GRE preparation books and classes available. The GRE tests are

See Senior, page 24

SCIENCE FICTION

SOLO FLIGHT



Artwork by Aaron Golub

by Shane Crofts

The tone from the ship's log brought Marin back to life. She had been up too late the night before and was not at all feeling up to making the six hour trip to the small outpost of Samal IV. Sighing, she looked back at her log screen so she could continue her pre-trip inspection.

Today, at least, she would be flying a CTS model. They were the newest addition to the fleet, and were much more powerful than the standard Fluyds. The only complaint she had about the CTS was that the steering was stiff. At least the seats were comfortable. The cargo consisted of one ton of medicine for the outpost, so in her mind this would be an uneventful journey.

After signaling to base that she was ready for departure, Marin gently steered the ship out of the bay. She proceeded on her designated route, then began looking for her portable music system; a must for all transport operators. The music systems were the only way to bear the boredom.

Marin checked the time and was disappointed to see that only four hours had passed. So far she had only seen a bulk freighter and one small military craft. However, there was something on her surveillance screen, coming in from the side. It took the computer a few moments to identify the object, and Marin was surprised when she read that it was a personal mobility unit. That was odd because that kind of spacecraft was only found traveling between space stations that were within a half-hour of each other. Samal IV was the closest space port around.

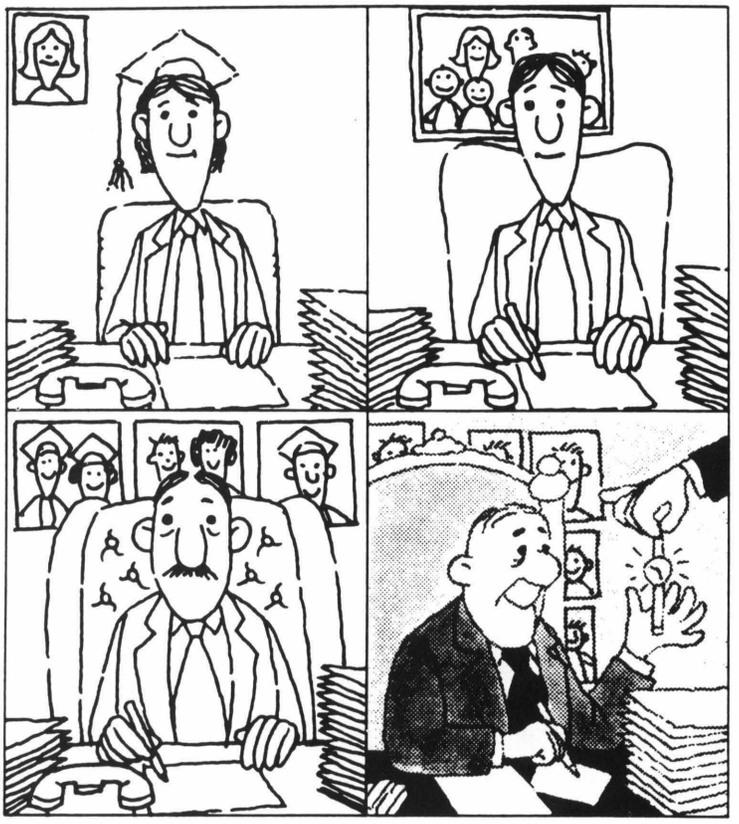
She was also amazed at how fast it was traveling. In fact, it seemed to be picking up speed. Marin hailed the ship on all channels in hopes that she could reach the pilot, but it was to no avail. By now it was quite obvious that the small craft was headed straight toward her. The CTS lurched as Marin tried to steer clear of the hurtling object, but her ship couldn't turn that fast.

The impact threw her against the padded walls and left her sprawled on the floor. The small cabin was filled with the sounds of alarms going off. Marin jumped up, her heart pounding in her chest. She had broken out in a cold sweat and salty tears streamed down her cheeks. The only thing that seemed to be working were the indicator lights, which were telling her of the damage inflicted to her ship.

She had lost eighty percent of her accelerating power, mostly due to her generator being knocked out when the two crafts hit. Now the ship was using most of its reserve power to keep the life support systems working. The radio was out along with all the power assist systems, which were needed for steering and auto-navigation.

Marin had never felt so alone and frightened, but she couldn't think about that. She needed to gather her courage so that she could come up with a plan. Obviously, she had been thrown off course, but how far? And where was that small ship that had caused so much trouble? Had anyone been aboard it? Without her navigation system working Marin had to fly by hand and by sight. Unfortunately, there were no directional signs out in space like there were on planetary surfaces. She located the old

See Science Fiction, page 24



There must be some way to avoid doing the same thing for the next forty years.

You'll be getting your degree from a top school. And you're ready to find a great job. The question is: which job? And can it interest you for your whole career?

At Andersen Consulting, it's our job to help clients do what they do. Only better. For you, that means opportunity and challenge.

Part of our business is anticipating the future. So come talk to us about yours. Find out more about a career with Andersen Consulting.

ANDERSEN CONSULTING
ARTHUR ANDERSEN & CO., S.C.

Where we go from here.™

Andersen Consulting is an equal opportunity employer.

INTERVIEWING ON CAMPUS OCTOBER 26TH, 27TH, AND 28TH
CONTACT YOUR PLACEMENT OFFICE FOR FURTHER DETAILS.

EYE ON INDUSTRY

Exotic Electrifying Engineering

by Michael Reese

It looks like they are here to stay. Over the last hundred years, interest in the possibility of an electric car as a means of marketable transportation has been renewed due to various factors: The environment, politics, and economics. Individually, these factors were not enough bring the electric car to the forefront of the automotive industry. Collectively, though, they have led to recent developments that will lead to modern and feasible electric vehicles.

The irony is that a hundred years ago, electric vehicles were the majority of automobiles sold in the country. At the turn of the century, the electric car's future looked promising. They were considered cleaner than petroleum or steam driven engines; the latter discharged odor and steam. Electric vehicles also did not need to be "cranked" to start the motor. However, problems arose quickly.

Electric cars were two to three times more expensive to run. To recharge a battery, one needed to be located near a city. Battery storage and efficiency limited vehicle range. These factors led to the lack of interest in the electric car. In 1905 production of internal combustion engine (ICE) automobiles surpassed the electric car.

The first comeback of the electric car came in the beginning of the next decade. The nickel-iron battery's storage increased by 35%. Life-span of the battery increased by 300%, and upkeep dropped by 63%. Industry looked to the electric car as a promise for cheap transportation. The price of gasoline was rising while electric cost was declining.

Economically, the electric car was gaining on the ICE automobiles. The problem was recharging. Charging stations were only reasonable for large businesses. Hope that the commercial market would revive the electric car industry faded.

The electric car idea was grounded until the late '60s when cities began to deal with the problems of air pollution. In 1967, the federal government set new emissions standards for ICE engines.

This led to new research in the area of electric cars. Marginal advances had been made in the previous decades. The electric car in the '60s was basically the same vehicle from the '20s. Range improvement increased from 20 to 50 miles. Still considered a backward technology, environmental pollution singularly could not revive the electric car.

The '70s brought long lines at gas stations. The oil embargo of 1973 crippled the country and made it realize how severely dependent it was on foreign oil. The electric car was now looked on as a political savior. The country needed to wean itself from the black gold of the Middle East. Once the embargo was lifted, and lines subsided, the push for electric vehicles consequently dwindled. This time, the Department of Energy (DOE) founded the Electric and Hybrid Vehicle Program to maintain strong research.

The government recognized the importance of electric vehicles. An established group was now supporting the development of these vehicles. During the '80s, steady progress was made in research since a group to give constant support had been created.

This progress mainly dealt with improving the battery. Success of the electric car had been prevented because of problems with the battery. The battery limits the vehicle's range. Once the battery is discharged, recharging time is lengthy. A battery also must be durable enough to undergo extensive charging and discharging cycles. Lastly, the battery is comprised of toxic chemicals which environmental groups worry about containing in an accident.

The problem of range is slowly diminishing. Electric cars in the last decade have reached distances close to three times their forerunners from two decades before, a little more than 120 miles. The Chesapeake Consortium (see blurb) hopes to see vehicles with ranges in excess of 200 miles. This range begins to approach that of ICE powered automobiles.

Charging times are not likely to be reduced, but the alternative is reasonable. Most families have multiple cars. A family might buy only one ICE car for long trips, and use the electric cars for local driving. Another idea was developed years ago to deal with the difficulty of recharging time. Cars could stop in auto stations not to receive gas but to exchange their discharged battery for a fresh one. This is highly unlikely since it would require all cars to use the same battery design. In addition if there are no stations at the present, who would buy a car where they can only receive a new battery in limited areas? The Catch 22 is that unless people purchase these cars, these stations will not be built.

Maintaining sufficient performance over the life of the battery is also important. An electric car can expect to have its battery recharged over a thousand times if it lasts as long as the car. This is a demanding goal and is another problem for battery operated vehicles.

Though electric cars are meant to help

EYE ON INDUSTRY

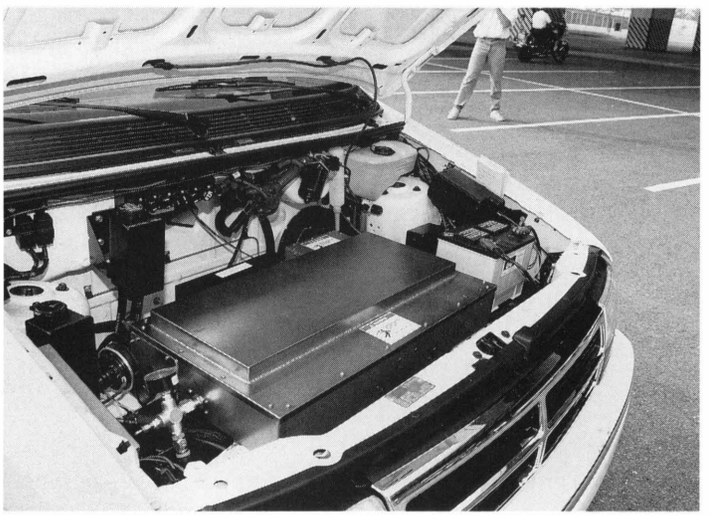
the environment, the battery is comprised of toxic chemicals such as sulphur, lead, and sodium. Some types, such as NiFe batteries, have been shown to be electrically and mechanically stable, and thus environmentally sound. Tim Winter, head of Westinghouse's electric vehicle research and graduate of Virginia Tech, gives this idea for thought: "If the internal combustion engine was introduced today, safety standards would not allow an individual to sit over an explosion in a box."

Batteries are the exotic energy alternative to the traditional fossil fuel for powering automobiles in the future. But is the latest look at electric vehicles just another fad? Most likely not — and for the same reasons which rejuvenated interest in the past. Politics, economics, and the environment have all stimulated interest, but never simultaneously or as intensely as the present.

Politics are a major force. With a large trade deficit, the government is looking to reduce the country's dependence on foreign oil. California recently passed a bill which requires car manufacturers to have at least 2% of their vehicles sold to be zero-

Continued on next page

The Baltimore Gas & Electric Co. has four of these vans already in use.



Photos courtesty of Balto. Gas & Electric Co.

Here's a look at the engine technology that will significantly decrease air pollution.

Consortium believes electric cars are the answer for future success

The Chesapeake Consortium is a coalition of four groups, Westinghouse Electric Corporation, Baltimore Gas & Electric Company, Chrysler Corporation, and the State of Maryland, with a common interest in electric vehicles. This group was awarded a $4 million grant for research in this area from the Department of Transportation. This group will also invest an additional $5.5 million to the project. This group is a microcosm of what is happening in the field to day.

The state government has political and environmental interests in this area. Maryland is located at the southern tip of the Northeast megalopolis and therefore, has air pollution problems. The government will play a political role by helping legislature pass laws favorable to electric cars.

The Baltimore Gas & Electric Co. (BG&E) is looking for economic benefits to come from electric cars. Tim Winter, graduate of the Bradley Dept. of Electrical Engineering, explains why:

Most electric cars will be used for local daily driving. These cars will need to be charged at night. This gives the power company a new market to supply during the off-peak hours. An increase an electric production can be accomplished without building new plants.

With the end of the Cold War, the defense industry has been cutback. Companies like Westinghouse in the past have relied on defense contracts and research as a large part of their business. Electric car research will help to fill the void the defense industry has created.

Chrysler has multiple reasons for interest in this field. States such as California are passing laws forcing companies to sell a percentage of their cars as zero-emission vehicles. Electric cars are the answer — and they provide a way for the American automotive industry to capture a profitable new market.

Collaborations, like the Chesapeake Consortium, bring groups with various interests together to commercialize the electric vehicle. All signs show that the electric car will succeed. With the environment and economy in its present state, we need it to succeed. **EF**

EYE ON INDUSTRY

"If the internal combustion engine was introduced today, safety standards would not allow an individual to sit over an explosion in a box."

Continued from previous page
emissions vehicles by 1998. This percentage will grow to 10% in 2003. Electric vehicles are the only realizable automobile to fit this standard in the immediate future.

Some European cities have taken a different twist on this idea. Urban areas will eventually only allow zero-emission vehicles to enter city limits. This has put considerable pressure on companies to produce electric cars at affordable prices.

These bills were originally developed due to environmental pollution. The world is acting more responsibly towards the environment. With this mentality, individuals may be more likely to pay a little extra for an electric vehicle. Combine this with politics again, the government may give tax breaks for these car owners, and the electric vehicle looks even more economical.

With the research being funded by the government, prices should become more affordable than the extremely expensive electric cars today (over $100,000). In addition, the electric engine technology is more basic, thus maintenance costs are smaller.

A gas engine automobile needs five minutes to replace its fuel. Electric cars would probably need to be charged overnight, but this is reasonable for someone to drive around the city, to work, and to complete daily chores.

This 19th century technology is the answer to our 21st century problems. As vehicles become more affordable — and the environment becomes more unmanageable — the electric car will find a permanent place in America's transportation system. EF

At W. L. Gore & Associates, Inc. no one will tell you what to do!

Freedom to choose

At W. L. Gore & Associates, Inc. no one will tell you what hat to wear. No one will predetermine your project list. No bosses will book your services for the next year. That's because Gore is not just a worldwide pioneer of innovative materials and products for the medical, electronic, industrial and fabric industries. We are also pioneers in motivating people. Our unique Lattice culture (see "The 100 Best Companies to Work for in America") is at work in Gore facilities in Japan, Europe and the U. S. It offers a supportive, nonhierarchical ("no bosses"- yay!) work environment. We give you the freedom to choose where you can best contribute to our goal of having fun and making money.

Our technical staff is fully empowered to research, develop and even market ideas that they originate or commit to. We encourage hands on, direct involvement, with a dedication to personal growth and not corporate ladder climbing.

A broad product range

Gore's products range from implantable medical devices such as heart patches and artificial arteries, to sophisticated signal management products for supercomputers and robotics. GORE-TEX® garments have worldwide recognition, and our environmental businesses are an excellent reflection of our dedication to improving the quality of life.

For these areas, we need creative chemical, mechanical, materials, and electrical engineers, as well as life scientists. We seek individuals who desire to work with active, forward thinking associates in a nonbureaucratic environment that promotes freedom, fairness and personal responsibility.

GORE
Creative Technologies Worldwide

An Equal Opportunity Employer

Responsibility based on talent, not endurance

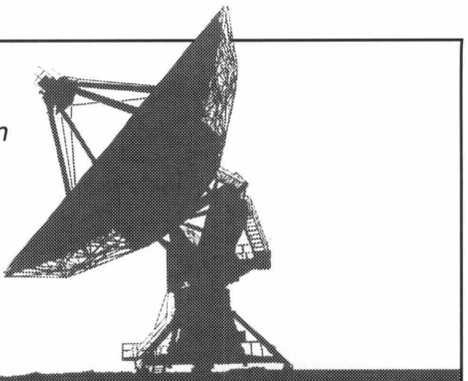
Extensive training is offered both in technical and business disciplines. This allows our associates to assume responsibilities that match their expanding skills, without the artificial restriction of time with the company.

Gore believes in rewarding according to contribution. Your compensation and growth are directly linked with what you do as an individual to improve the overall profits. We also offer a flexible benefits package and a profit sharing plan so that everyone can share in the success of the business.

If you are interested in a work environment that allows self determination, growth, and the freedom to implement your creative thinking, contact your placement office or write us at the address below.

W. L. Gore & Associates, Inc., P.O. Box 9206, Newark, DE 19714

Information systems and communications technology is uniquely dynamic. It continues to evolve at an accelerated pace, requiring constant innovation and uncommon expertise. In both the Government and Commercial marketplaces, GTE's Government Sector is meeting the information management, information movement and communications challenges of a changing world.



Software Engineers and Systems Engineers

Individuals interested in joining GTE can look forward to challenging careers in one of the following areas:

- **System Architecture**
- **Object Oriented Design**
- **Networking**
- **Real Time Software**
- **Communications Systems Software Development**
- **Simulation and Modeling**
- **Information Engineering**
- **Rapid Prototyping**
- **DBMS**
- **Expert Systems and ANN Designs**
- **Graphical User Interface**
- **Case Technology**

GTE Government Systems

the POWER of dual-use technology

CAREER FAIR
September 20-21, 1993

CAMPUS INTERVIEWS
November 9, 1993

Multi-media communications, virtual reality, artificial intelligence, and voice recognitions - these are technologies that GTE's Government Sector is associated with, unlike most government contractors. They are technologies being developed at GTE, one of the world's leading information systems and communications organizations. GTE's Government Sector is building a future based on the concept of Dual-Use Technology - we are developing and upgrading sophisticated information management, information movement and communications systems that can be used by both the government and commercial world.

As GTE continues to diversify, we require talented professionals with the ability to capture the power of dual-use technology. See your Placement Office for interview availability, more information, or the opportunity to review our video. If you are not available for an interview on the date listed, or cannot attend the job fair, send your resume to GTE Government Systems, 77 A Street, Needham Heights, MA 02194, Attn: Julie Bebo, College Relations Coordinator.

An equal opportunity employer, m/f.

TRW Systems

The only limitations you will have are the limits of your own imagination.

Located in the Northern Virginia area, TRW's Systems Division is at the forefront of state-of-the-art innovative systems engineering, delivering its expertise in support of many important government programs. We are also a leader in developing and integrating large intelligence software systems that process volumes of data for rapid decision making by government analysts.

We're looking for talented people like you to join our SD team of top-notch electrical engineers, computer scientists, mathematicians, systems engineers, physicists, industrial engineers, and mechanical engineers.

Consider a career with TRW and enjoy a competetive benefits package, including flexible work hours, a stock savings plan, and a year-end holiday week shutdown. Build a future at TRW. Exercise your imagination. Send your resume to: TRW Systems Division, Professional Placement, Dep**artment VA TECH, One Federal Systems Park Drive, FP1/6110, Fairfax, VA 22033-4411.**

Equal Opportunity Employer
U.S. Citizenship may be required for some positions.

TRW

IVHS:

The future of highway transportation is here

by Ann Steedly

You are on your way to Virginia Tech looking ahead to a long, boring trip on the highway. With traffic, it could take up to seven or eight hours to get to school. As you merge on to the expressway, do you worry about the lengthy trip? No, you simply press a few buttons, lean back and prepare for a nice long nap.

Sound unrealistic? This scenario may become a reality within the next few decades. And much of the testing of this new technology will occur right here in the New River Valley.

The new road linking Blacksburg with I-81 near Ironto will be a testbed for much of the Intelligent Vehicle Highway Systems (IVHS) technology. This "Smart Road" project will be carried out by a research group consisting of JHK and Associates, Hughes Aircraft, Bell Atlantic, and Virginia Tech's own Center for Transportation Research. Funding for the research was provided in the form of a $1.37 million award from the Federal Highway Administration.

One side of the six-mile road will be constructed by 1995 and upon completion will be used to carry a lane of traffic in each direction between US 460 and I-81. Planners hope that this will alleviate the congestion on the US 460 Christiansburg bypass between Tech and the interchange at I-81. The other side of the highway will be built in four sections over a 15- to 20-year period so that different IVHS technologies may be tested upon completion of each stage of the construction project.

Many technologies compose IVHS, and not all are as dramatic as those depicted in the first paragraph of this article. Many of the more affordable and less complicated technologies are currently being used in congested areas across the country. IVHS consists of four basic divisions: Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Advanced Vehicle Control Systems (AVCS), and Commercial Vehicle Operations (CVO).

Many big cities currently have in place or are implementing ATMS technologies. Boston's Central Artery/Third Harbor Tunnel project is a prime example of ATMS. The tunnel will have variable message signs which warn of upcoming congestions, accidents, and even weather conditions at the end of the tunnel. The tunnel will also collect tolls electronically so that cars do not have to stop. In order to facilitate this electronic toll collection, drivers must attach an electronic license plate to their cars. Sensors located in the tunnel will read the plate each time you pass through the tunnel. At the end of the month tunnel operators will send out a bill for the plate. Currently, 20 such AVI toll facilities are in place or planned for.

Continued on next page

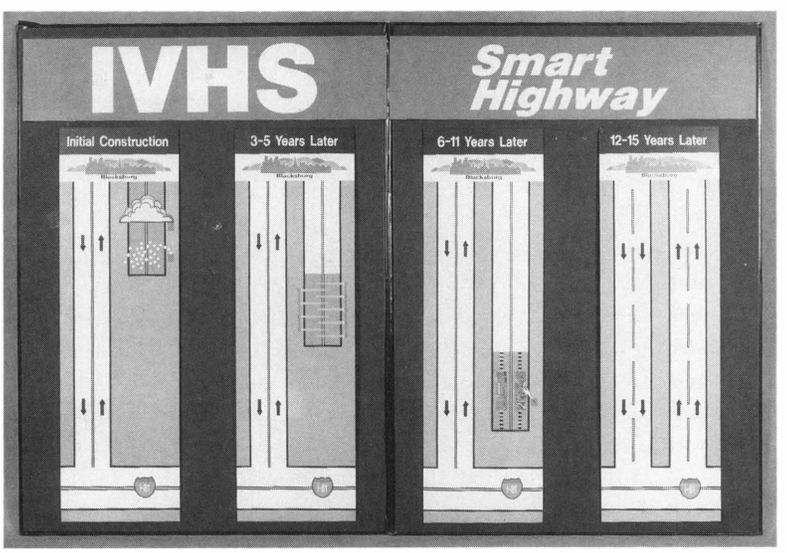


Photo courtesty Center for Transportation Research

A planned schedule for development of the Smart Road from I-81 to Blacksburg.

...single-car drivers cause most of the congestion problems in this country.

All of this technology is designed to allow people to drive in the most efficient and informed way possible, thus alleviating congestion problems.

Government support of IVHS currently focuses on improving mass transit systems and encouraging high-occupancy car travel. Lee Han, who works at the Center for Transportation Research, stresses the importance of this branch of IVHS because single-car drivers cause most of the congestion problems in this country. Currently many cities, including Washington D.C., operate high-occupancy vehicle (HOV) lanes during the busier hours of the day. These lanes encourage carpooling and thus reduce the number of cars on the road. Violation of HOV lane rules can lead to a hefty ticket. This discourages single car drivers from trying to use this lane to get ahead.

Mary Laurent, from the Center for Transportation Research, believes that making mass transit more efficient could also greatly alleviate traffic problems. Transit authorities will track buses in order to detect breakdowns and accidents, helping to prevent breaks and delays in schedules. Another bus can immediately be deployed to complete the route of a disabled bus. Buses equipped with antennas will send their position, heading, and speed through a radio transmitter to a traffic management center. The center will respond to breakdowns and accidents and also send information back to the bus concerning traffic problems and possible reroutings. When a bus breaks down, the center will dispatch another one to finish the route. The center can also send information regarding delays to people waiting at the bus stops. This technology is currently being tested in Los Angeles and in the Tidewater region of Virginia. In both areas, the system has significantly cut delays.

Some of the technologies that are most useful to travelers fall under the category of ATIS. In order for travelers to obtain ATIS, an in-vehicle navigation system must be installed in their car. The car could then transmit the position, heading, and speed to a traffic management center in the same manner as a bus. The information that the center will send back includes electronically displayed directions to other locations based on current location, and information on nearby gas stations, hotels, restaurants, hospitals, or any other relevant information. The center will also provide information on upcoming congestion, accidents and possible alternate routes. Researchers recently completed a one-year project called TravTek in Orlando, FL. For this demonstration, General Motors equipped 100 Oldsmobiles with the navigation systems and found that users responded positively to the system.

Producers of CVO technology gear their efforts towards benefiting emergency vehicles, trucks, and other vehicles. Weigh-in-motion (WIM), accomplished with the assistance of an electronic sensor located on the bottom of the truck, could be a boon for the trucking industry. Sensors in the road will read the information from the sensor and thus identify a truck. Other sensors will calculate the weight of the truck and send all the information to a control center. If the truck violates its weight requirements, the control center would notify a police officer. The HELP/Crescent program is currently testing this technology through California and several adjoining states.

The other major CVO technology is an antenna that will preempt traffic signals. Buses, ambulances and other emergency vehicles will have the antennas. The antenna will send a signal ahead to traffic lights and the lights will change accordingly in order to allow the vehicle to pass through the light quicker.

Researchers currently have limited testing and sketchy details on AVCS. AVCS will first be able to give the driver better information. Night vision, fog sensors, and sensors that identify adjacent cars will help the driver maneuver more capably and avoid accidents on his own. Eventually, researchers hope that a system that integrates more advanced AVCS with the other technologies will actually provide automatic vehicle operations. These operations would include automatic braking, which will decrease reaction time and thus help avoid many rear-end accidents. Cruise control will help drivers maintain a steady speed. Lateral control is perhaps the most difficult to accomplish, but could be the most valuable. It will keep the car in the lane when a driver falls asleep. There must be sensors in the car and in the pavement in order to accomplish this type of control. Automatic hazard detection and maneuvering will help drivers avoid unseen obstacles.

In addition to the radio tracking that connects with the onboard navigation systems in IVHS, AVCS vehicles will have antennas that send a signal through a satellite to a national control center. This Global Positioning System (GPS) will keep track of the position of all vehicles, and operators will be able to manage traffic in a comprehensive manner. Researchers hope that they will one day combine all of this technology so that your car will indeed be able to take you to your destination without any assistance. EF

ROUND & ABOUT

Mastering phone functions can be worthwhile endeavor

by Rich Parish

Throughout the history of man, one of the greatest modern achievements was the development of the telephone by Alexander Graham Bell in 1876. The first phone used by the public looked like a big box with a receiver and a crank on the side that was used to call the operator. Phones slowly developed from there, as did the possibilities that were available with the phone. As phones improved, service slowly spread until it now reaches almost every part of the world. That simple phone from over a hundred years ago has evolved to become a much more complicated piece of machinery than ever before.

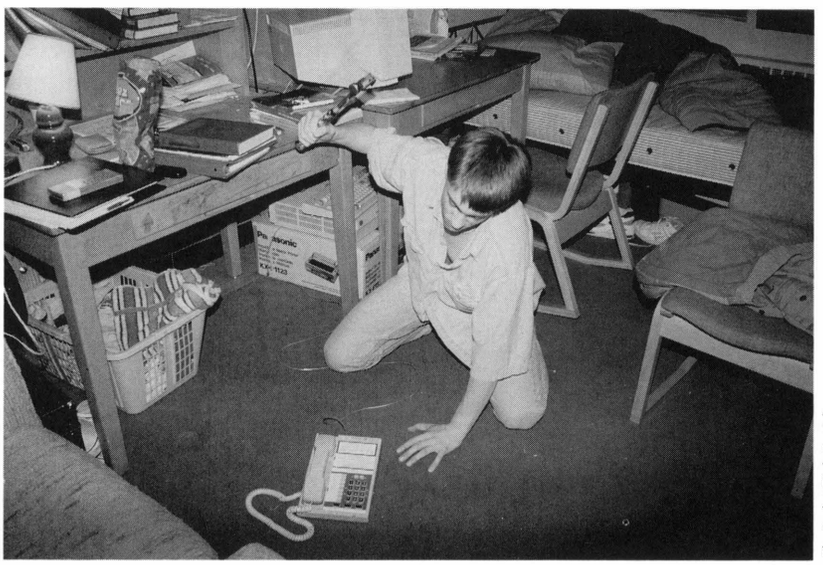


Photo by Rich Parish

A student prepares to take advantage of the numerous options the ROLMphone has to offer.

...and then again...

Technologies have advanced so far, in fact, that phones exist where you can see on a video screen the person you are talking to. Here at Virginia Tech, the phones are not quite that advanced, but they do offer many features that are luxurious but can also be a bit confusing for some people.

The phone system here was created by IBM; the telephones are called ROLMphones. New students spend weeks trying to figure them out, but once understood, the benefits of such an advanced system are rewarding. These special phones combine regular phones with a built-in data line that allows access to any modem anywhere in the world.

These phones also have many interesting features including automatic camp-on, call transferring, the ability to put calls on hold, Phonemail, programmable buttons, save and repeat, and many other features that can be adapted to your tastes.

Automatic camp-on is similiar to call waiting, a feature widely open to the public through local phone companies. The difference is that automatic camp-on is done on the part of the caller, whereas call waiting is done on the part of the receiver. Automatic camp-on is done when you call someone on campus and get a busy signal. If you wait for seven seconds, the "line busy" tone will stop, and the person on the other line will hear a beep to let them know that someone has "camped" onto their line. In addition to the beep, a light starts blinking on the phone to remind the receiver that someone is waiting on the other line. All the receiver has to do is press the button labeled "connect" and they will be connected to the second caller, putting the first on hold. They can then use the "connect" button to toggle back and forth between the two callers.

Sometimes if you are busy, or someone calls you and then wishes to speak to someone in another room, you can transfer that call to another phone. All you have to do is press the "transfer" button, dial the number of the phone that the call is being transferred to, announce to that person who the caller is, then hang up. The phone call has been effectively transferred to another phone on or off campus.

Putting a call on hold on the ROLMphone is very easy. You just press "hold" and then hang up. When you're ready to reconnect, you just press the button of the line that the call is being held on, then you pick up the receiver and continue the conversation.

Phonemail is a very unique program that is open to all phones at Virginia Tech. Phonemail is a voice message system, which is similiar but much more advanced than an answering machine. Any person on or off campus can leave a message on Phonemail. Each phone has access to a personal mailbox, where all the messages for that number are kept. You are notified that mail is waiting for you by the "msg wtg" (message waiting) light that will be blinking. To get these messages, you just follow the explicit instructions given to you at the beginning of the year.

Continued on next page

ROUND & ABOUT

That simple phone from over a hundred years ago has evolved to become a much more complicated piece of machinery than ever before.

Continued from previous page

Through Phonemail you can send and receive messages, but you can also forward messages you have received to other people. Phonemail also becomes useful late at night if you don't want to wake someone up with a call; all you have to do is enter Phonemail, record a message, and follow the instructions to send it. You can also change your greeting and your voice name (heard by someone receiving a message from you). There is a special booklet distributed at the beginning of the year that will tell you everything you need to know about Phonemail.

On every ROLMphone, there are special programmed buttons called repdial buttons. One of these buttons is for the data line, one is for the regular phone line, one is the "flash" button, one is programmed as a "save and repeat" button, and one is programmed to instantly call for the time and temperature. There is one button left that can be programmed to whatever you like. You can program a phone number, or you can program a sequence such as one to retreive your Phonemail messages by pressing a single button. All you have to do is get the dial tone, press * 5 6 6, press the repdial button you wish to program, press the number or sequence you wish to save, and then hang up. You have just programmed a repdial button.

One of the repdial buttons is a "save and repeat" button. This button allows you to redial a number that you "saved," much like a telephone which redials the last number called. All you have to do is press "save/repeat" before you hang up the phone. It can be done during a conversation, the busy signal, or the ring. To call the number after it has been saved, just press the "save/repeat" button again.

There ar other options on the ROLMphone, some of which are available for change. One thing that you can change is the ring tone. After getting the dial tone, just press * 5 7 2 and then any of the digits from 1 to 8. You can test all of them without hanging up. The last one that you press before hanging up is the one that will be used.

The ROLMphone also has a one-way speaker. You can use this feature to call someone and find out if they are home. Just make sure you pick up the receiver if you get an answer. The one-way speaker is also helpful when listening to Phonemail messages and when calling for the time and temperature.

All these luxuries of our phone system are nice, but there is another much more important purpose to these special phones. Every phone has a built-in modem, giving all students the ability to access online information from hundreds of thousands of Bulletin Board Systems (BBS) around the world. The data connection allows you to send electronic mail (E-mail) to millions of people from all walks of life. With the modem, you can even hold a one-on-one conversation with someone in China without ever having to pick up the phone.

The possibilities of this form of communication are endless. Many people believe that the future of communications lies in the combination of computers and phones because they offer such a multitude of opportunities.

To tap into these awesome information sources, just go to the telecommunications office in 128 Burruss Hall and ask for a data line and primer. EF

Career Objective: To utilize my technical and problem solving skills in an organization that will allow me to maximize my personal and professional growth.

Education: BS Engineering, Virginia Polytechnic Institute, Blacksburg, VA. May 1994. GPA 3.2

Affilliations: IEEE; NSBE; SWE; NTA

Work Experience:

AT BOOZ·ALLEN & HAMILTON, WE CAN HELP YOU FILL IN THIS BLANK.

You'll soon fill in one important blank on your resume: your college degree. The next blank to fill is even more significant: your work experience.

Fill in the work experience blank with a Booz·Allen & Hamilton career. Few companies can offer more. As part of one of the largest and most respected international management and technology consulting firms, you'll work on leading edge technologies with engineers and computer scientists who are among the best in their field. You'll also work with a diverse client base on some of the most intriguing problems of our time — in transportation, environmental protection, health care, space, information systems, communications, defense, manufacturing, and advanced technology.

Your degree will look good on your resume. For a professionally rewarding career as well, back it up with Booz·Allen & Hamilton work experience. If interested, contact: **Booz·Allen & Hamilton, Dept. 5081/DG, 4330 East West Highway, Bethesda, MD 20814.** Equal Opportunity Employer.

BOOZ·ALLEN & HAMILTON

SCIENCE FICTION

Continued from page 12

paper star maps that were buried in one of the panels along the cabin's wall. The only thing she could do was pray that she could find some sort of marker so that she could tell where she was. Finally, she identified two stars and from there she could pinpoint her location, and for the first time in the past hour Marin breathed. Now she had the difficult task of trying to fly her crippled ship to Samal IV, which was now seven hours away judging from her available power.

Slowly, she started out on her long journey. Every muscle in her body was tightened. Now, she was forced to scan ahead in fear of running into space debris which her navigational system would have avoided automatically. The steering was almost non-responsive and Marin had to use all her strength to turn the ship. Time passed slowly, but intently. Marin's head hurt from the collision, but she hardly noticed that. Her stomach felt like it had been ripped open from the extreme emotions she was experiencing. Several times she almost felt like she was on the verge of losing her beaten sanity, but she persevered. The small object that appeared in the distance made her grip her controls tighter. All her mind could think of was another crash approaching. She stared feverishly at that ship coming towards her knowing that it was up to her to identify it. Obviously, it was in a direct path with her, and all Marin could hope for was that it would recognize that she had been disabled.

Much to her delight she soon discovered that it was a shuttle craft sent out by the defense force of Samal IV. After losing radio contact with her they set out in search for her. The only thing Marin cared about was being off the ship and being with other people.

Marin sat on the cabin floor of the rescue ship sipping potassium tea, while the captain was softly talking to her.

"You know, if that had been me I seriously doubt I could have done anything, let alone try to fly a ship in that condition. Especially, if I were the only one on board," the captain said.

Marin looked up at the captain and for the first time all day she smiled. EF

Senior

Continued from page 11

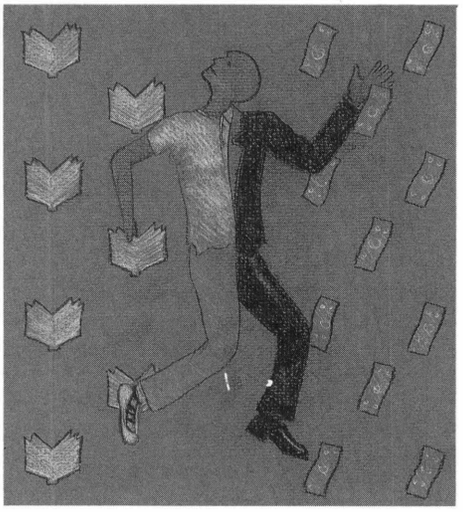
offered in October and December and require pre-registration, as with most other standardized tests.

In addition to the GRE, there are similar tests for students entering medical school, law school, and just about every other professional program. More information on these tests can be obtained from particular academic departments or through the Counseling Center in Henderson Hall.

One significant source of funding is through government sponsored or privately endowed fellowships. Competition for fellowship money is usually intense as many fellowships can be applied to tuition at any university. Also, fellowships normally do not require any teaching or research assistantship duties of the recipient.

Many of the fellowship applications require a plan of study and/or research along with letters of recommendation. Some also require a curriculum vitae, which is analogous to an extended resumé. Because of the time required to prepare a fellowship application, it is best to start as early as possible. Although many of the applications are due in January or early February, there are several which have deadlines in November and December.

As with fellowship applications, graduate school applications also may take considerable time to prepare. Often the same information requested for



Artwork by Aaron Golub

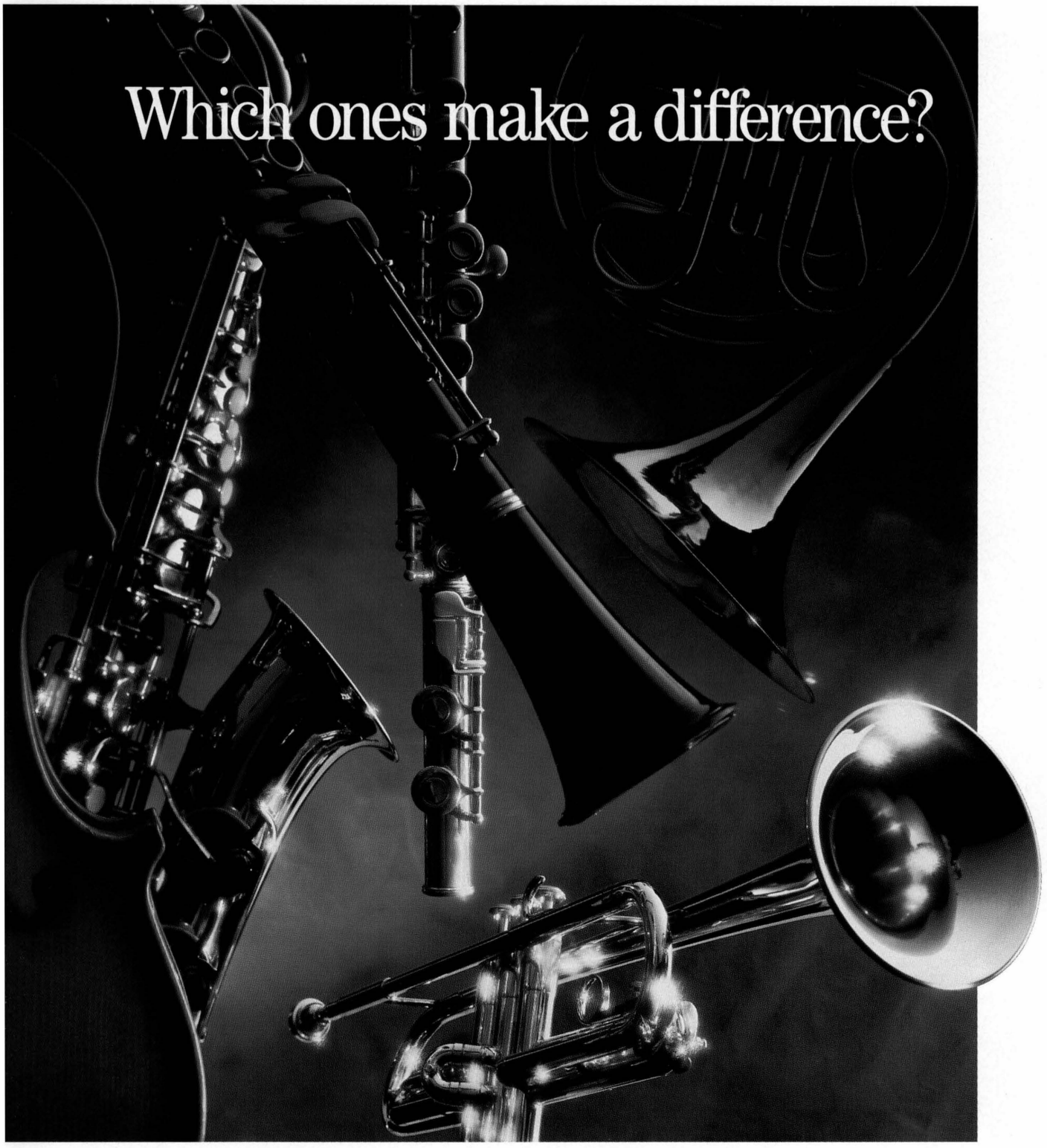
fellowships is required on the graduate school forms. Most graduate schools have a rolling admissions program, but to get any type of financial aid, applications must be submitted by February at the very latest.

Graduate schools provide several sources of financial support including teaching and research assistantships, tuition waivers, and fellowships. Either type of assistantship requires the student to work a certain number of hours for the academic department. If the student is lucky, this work will be in her/his field of interest. The self-explanatory tuition waiver may or may not require work of the recipient while the fellowship normally does not.

Although the application deadlines for both fellowships and graduate school financial assistance are fairly early, the notification time may seem unnecessarily late. For both fellowship and graduate school application it may be the end of March or early April before the student is informed as to the type and amount of financial aid.

Undecided?

If you cannot choose between the working world or graduate school, you are not alone. You best course of action is to try for both since, hopefully, while your are making up your mind, one of the two will provide an option. In addition to the staff of the Placement Office and Counseling Center, professors in your department can offer a variety of information on both the real world and graduate school. Good luck and happy hunting. EF



They all do. It takes many different instruments to make an orchestra. To make a great performance.

Just like companies.

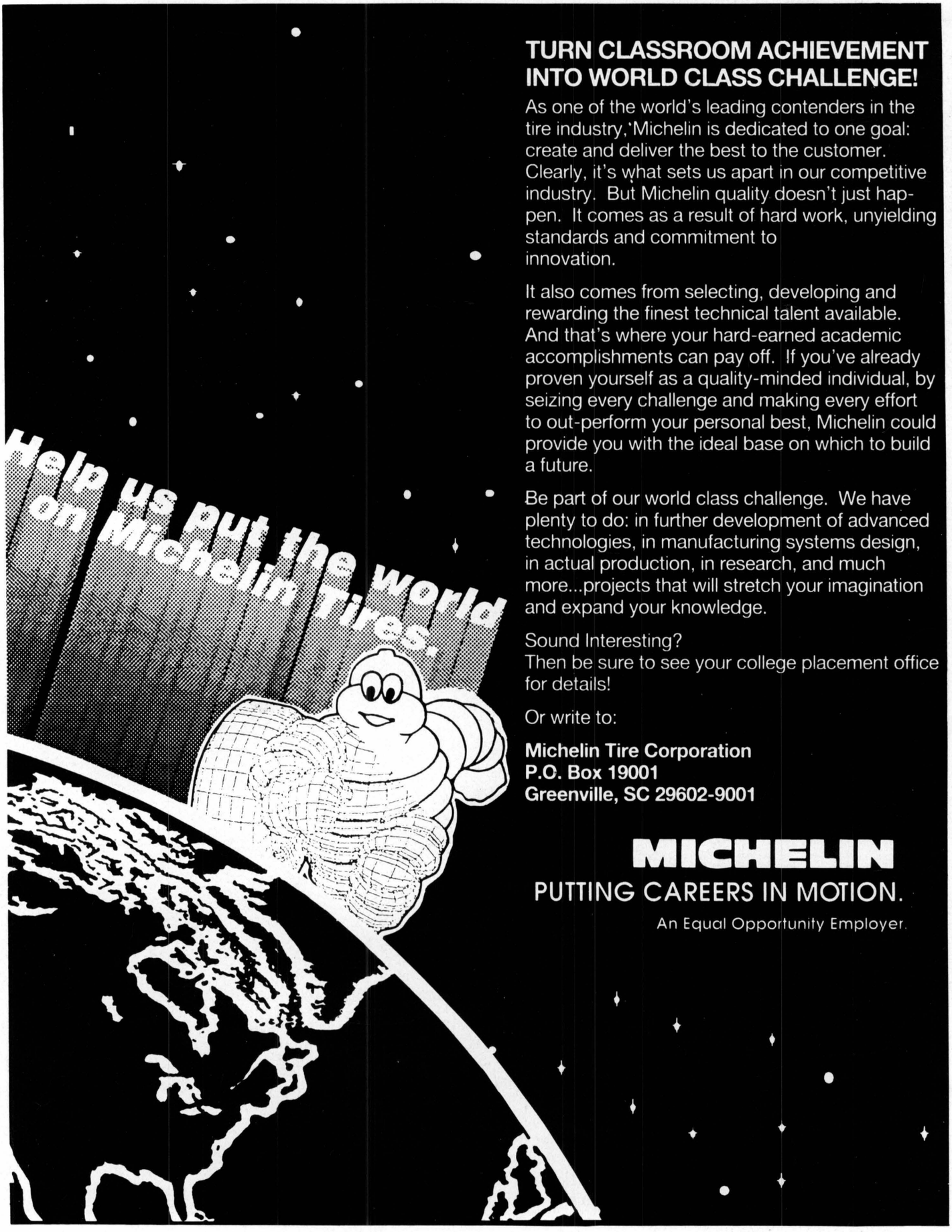
At Hewlett-Packard, we understand what it takes to create outstanding work. A diverse group of individuals, each with their own strengths, their own wealth of experiences, working together with a common purpose.

When it all comes together, the results can be spectacular. Play your part. If you have a BS, MS or PhD in EE, CS, CE, ME, or MBA, work with us and together we'll orchestrate an exciting career.

Send resume to:
Hewlett-Packard, Box: VA,
3404 E. Harmony Rd, Fort Collins, CO 80525.

Hewlett-Packard is an equal opportunity employer dedicated to affirmative action and workforce diversity.

HEWLETT PACKARD



TURN CLASSROOM ACHIEVEMENT INTO WORLD CLASS CHALLENGE!

As one of the world's leading contenders in the tire industry, Michelin is dedicated to one goal: create and deliver the best to the customer. Clearly, it's what sets us apart in our competitive industry. But Michelin quality doesn't just happen. It comes as a result of hard work, unyielding standards and commitment to innovation.

It also comes from selecting, developing and rewarding the finest technical talent available. And that's where your hard-earned academic accomplishments can pay off. If you've already proven yourself as a quality-minded individual, by seizing every challenge and making every effort to out-perform your personal best, Michelin could provide you with the ideal base on which to build a future.

Be part of our world class challenge. We have plenty to do: in further development of advanced technologies, in manufacturing systems design, in actual production, in research, and much more...projects that will stretch your imagination and expand your knowledge.

Sound Interesting?
Then be sure to see your college placement office for details!

Or write to:

Michelin Tire Corporation
P.O. Box 19001
Greenville, SC 29602-9001

MICHELIN

PUTTING CAREERS IN MOTION.

An Equal Opportunity Employer.