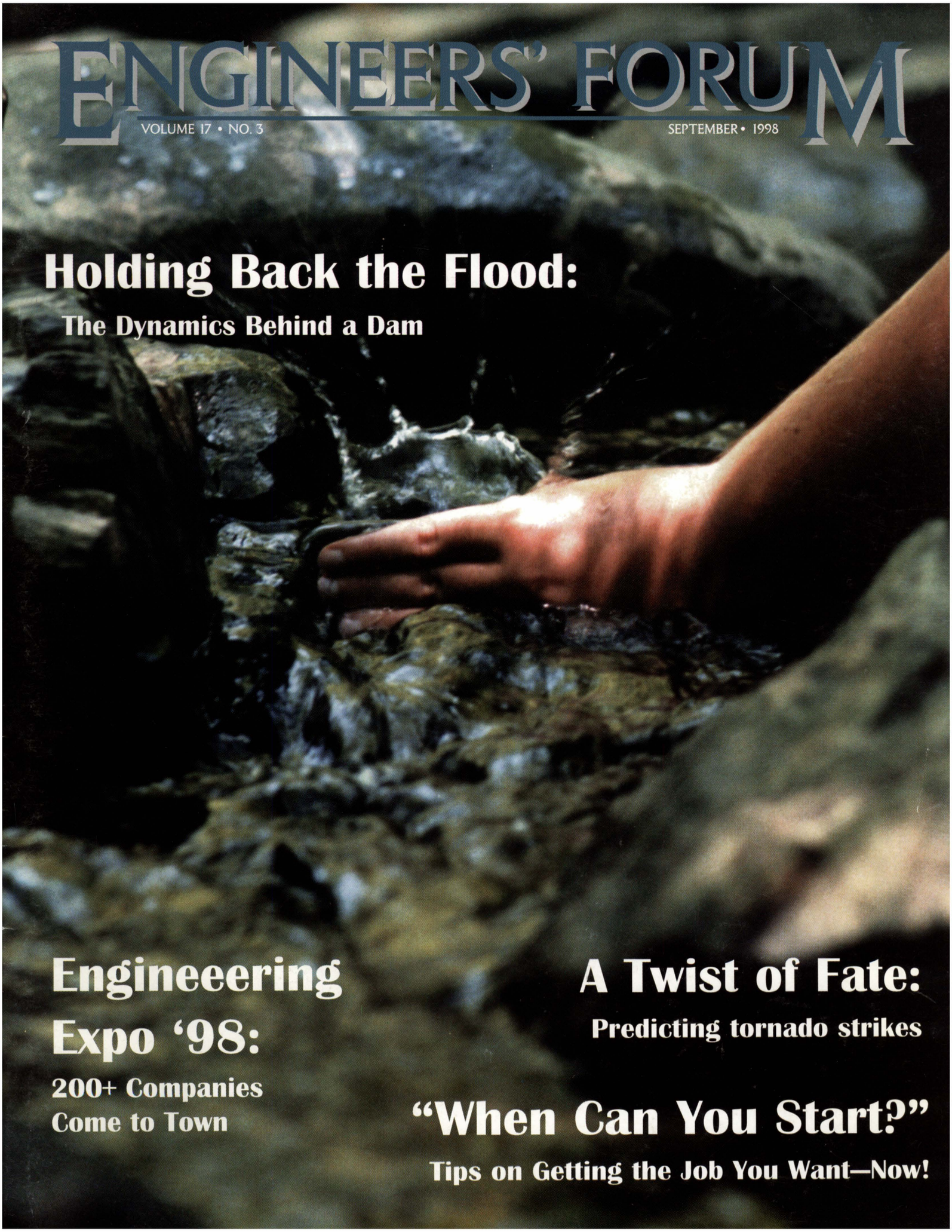
ENGINEERS' FORUM
VOLUME 17 • NO. 3
SEPTEMBER • 1998
Holding Back the Flood:
The Dynamics Behind a Dam
Engineeering Expo '98:
200+ Companies Come to Town
A Twist of Fate:
Predicting tornado strikes
"When Can You Start?"
Tips on Getting the Job You Want—Now!

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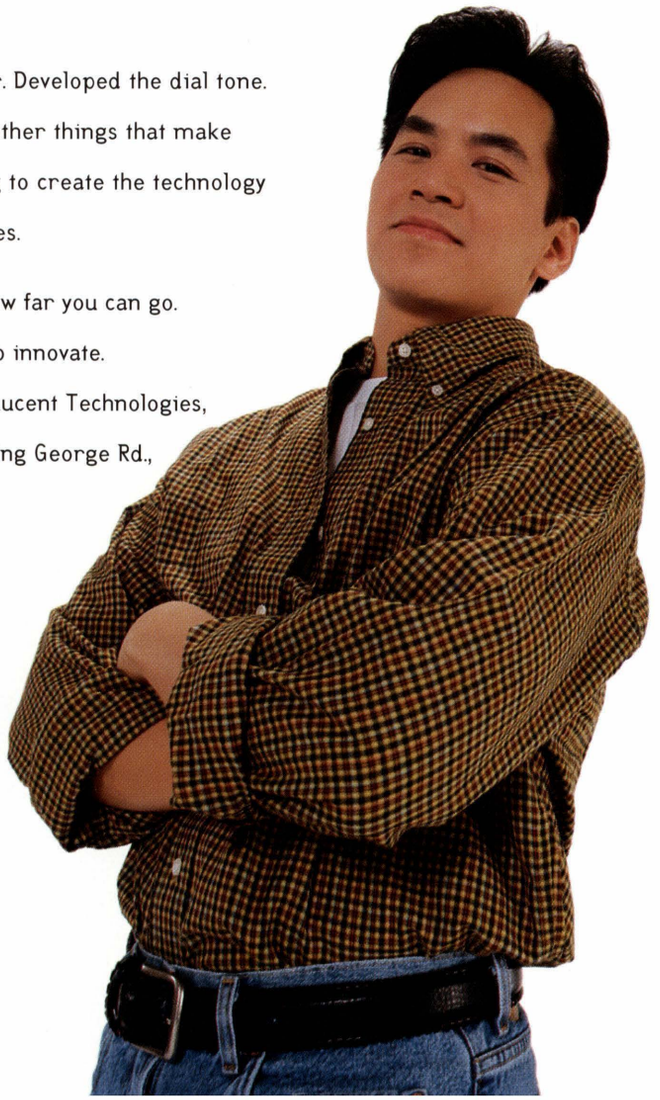

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The Student Engineering Magazine of Virginia Tech

ENGINEERS' FORUM

VOLUME 17, NUMBER 3 SEPTEMBER 1998

Table of Contents

On the Cover

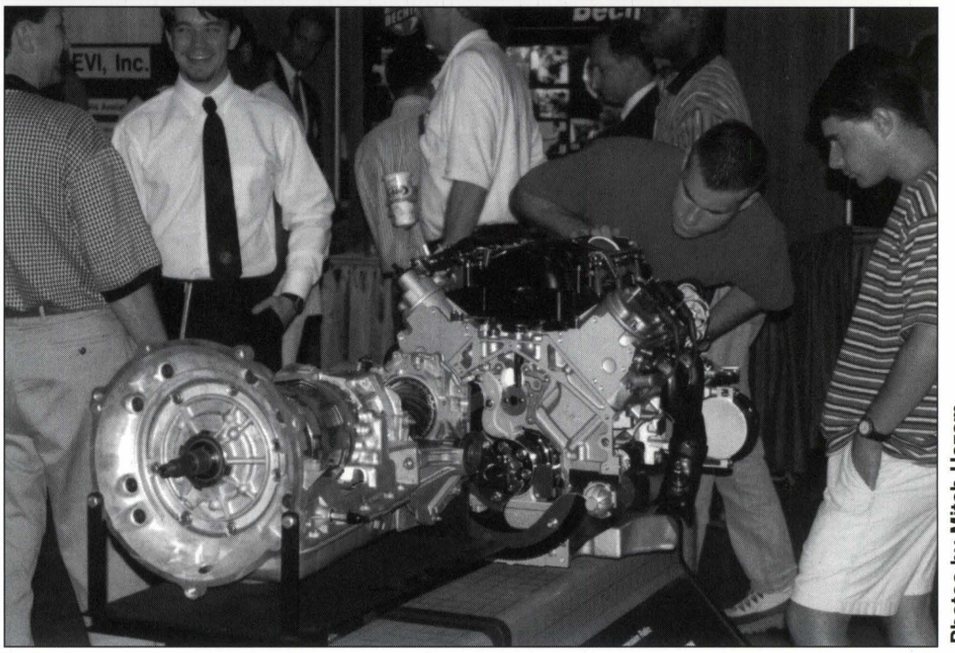
Controlling the water's flow: All of us take dams for granted, but how do they really work? And are they causing more problems than they solve? Photo by Jason Gibbs.

A Smorgasbord of Jobs

BY SHUVOM GHOSE

Are you looking for a job or internship in your major? Would knowing exactly which skills employers crave interest you? Do you want a truckload of free pens, frisbees, and mousepads with company logos on them? Then Engineering Expo '98 is for you!

The 19th annual career fair produced by the Student Engineer's Council, Engineering Expo '98 is the best chance for students to window-shop the engineering job market. On September 15th and 16th, rooms in both Squires and Owens will contain booths from over 200 businesses, each manned by representatives eagerly awaiting any questions or resumes students can throw at them. In attendance should be blue-chip engineering firms such as Lockheed Martin and National Semiconductor, government agencies like the U.S. Army Core of Engineers and the National Security Administration, and many other smaller companies.



Photos by Mitch Hazam

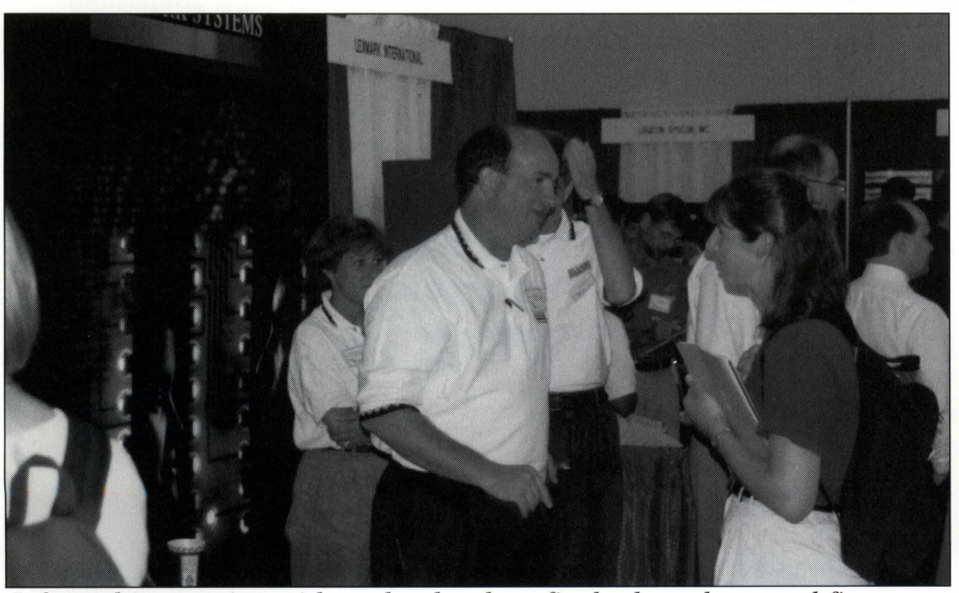
Students take interest in a technical display at last year's Expo.

Even if they are not hunting jobs, many students have gone to past Expos to find out what employers really look for in applicants, often to be surprised by the answers. While expected forerunners such as high QCA's and technical knowledge do make the top twenty on the list of most desired qualities, nearly all companies, even engineering-oriented ones, place the highest value on skills like emotional stability, the ability to relocate, and proficiency in working with other people.

Often, students have found out their dream job may reside at a company to which they had not even considered applying. For example, consider some random, arbitrarily-chosen major like aerospace engineering. Two years ago, AE's going to career fairs would have discovered that Lockheed Martin, one of the largest aeronautical companies in the world, had decided to accept applications from chemical engineers, computer engineers, electrical engineers and mechanical engineers only. On the flip side, the Central Intelligence Agency, a company not famous for hiring pocket-protector types, was looking to employ aerospace engineers to determine the threat foreign ballistic missiles posed to the United States.

One final reason to attend Expo '98 is the opportunity to collect armloads of the free plastic chaff companies seem determined to give away to college students. Whether you crave a mousepad, a frisbee, or a badge that lights up in the dark, if it is plastic and can display a corporate logo, you can be sure someone in a booth will be giving it away. And after handing over the trinket, the person behind the desk may offer some advice which will increase your knowledge of the business world. Or he may even accept your resume, interview you the next day, and offer you the job which will become your endeavor for the next thirty years.

So will it be a frisbee, a further insight, or a future? The choice awaits at Engineering Expo '98. EF



Informal interaction with each other benefits both students and firms.

Locations: Squires Commonwealth Ballroom and Owens Banquet Hall

Times and Dates: 11-5 Tuesday, September 15th and 9-2 Wednesday, September 16th

For a list of the companies attending Expo, see page 13.

original thinkers

idea with a focus people on the future

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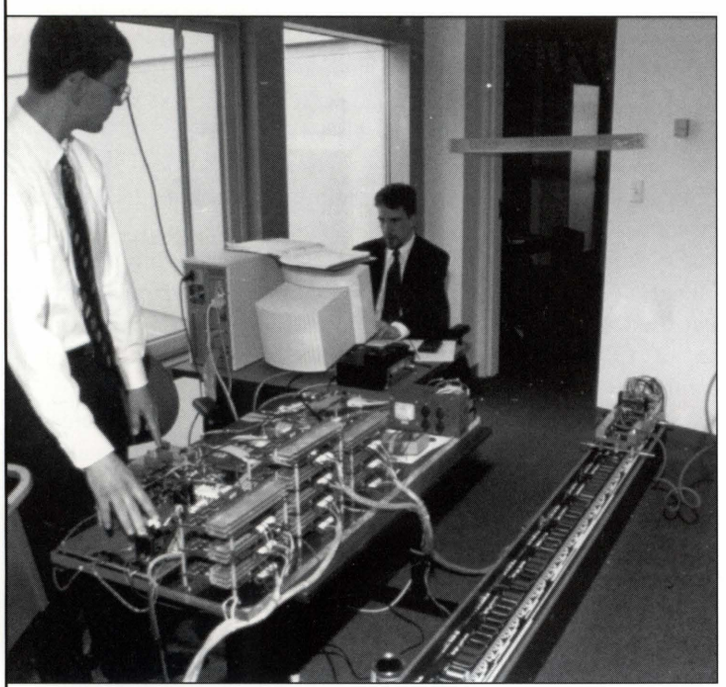
Virtual Corporation Produces Real Results

FROM STAFF REPORTS

Thirty-five Virginia Tech undergraduates, operating a virtual corporation they formed this year, have devised a way to shave $1-$2 million per mile off the costs of a rapid transit system, according to Krishnan Ramu, an adviser of the project.

The virtual corporation is the novel idea of Leonard Ferrari, electrical and computer engineering (ECpE) department head. He envisions the enrolled students as going beyond the conventional student project experience. In the virtual corporation, the aspiring professionals from various disciplines at the university will work together as would a team in a corporation, and they must develop commercially viable products or technologies. No other engineering college in the country offers a similar program.



Photos by Rick Griffiths

Testing a small-scale prototype.

During this first year, students from three of Virginia Tech's colleges, engineering, business, and arts and sciences, formed a virtual company, the Personal Electric Rapid Transit System (PERTS). Similar to a Fortune 500 company, PERTS divided itself into three main divisions: High Speed Ground Transit (HSGT), Rapid Cargo Transit (RCT), and National Park Transit (NPT).

Their goal was to prepare a feasibility study and develop a prototype of a personal rapid transit system that would combine the efficiency of mass transit with the flexibility of a personal automobile.

Students designed and tested a magnetic propulsion system that undercut the cost of today's technology by a third.

"We want the undergraduate students to think globally, to find out what it is like to work in the real world. And we want them to solve an economic development concern for Virginia," Ramu, an ECpE faculty member, says.

The students designed and built a working prototype of a track and an electrically propelled vehicle. Phase II of the project will build levitation into the system and will provide the technology needed to allow the vehicle to exit the track for driving on local roads.

Maglev vehicles are magnetically levitated and propelled, riding on a cushion of air, powered by electricity and magnets at speeds that can exceed 300 mph.

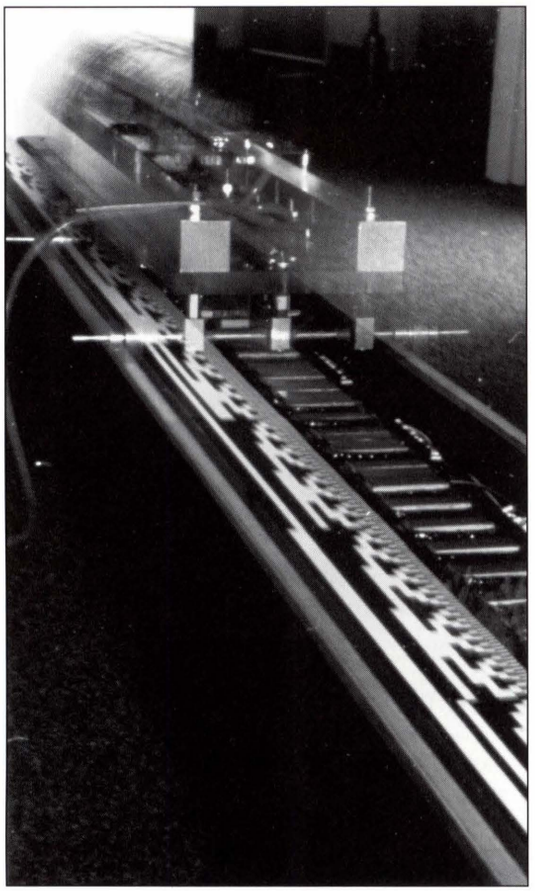
Maglev also can be used for cargo transportation at major ports, shipping terminals, and airports. However, the NPT division of PERTS determined that due to economic constraints, a transit system is not suitable for all national parks.

Ramu says the magnetic propulsion system devised by the students reflects a 30 percent reduction in costs over the current propulsion system on the market. The saving is derived from the simpler structure and construction of magnetic laminations and windings. The proposed system also has a higher reliability compared to other forms of propulsion systems.

The system would also be adaptable for conveyor systems, replacing belt-driven tracks used in various types of manufacturing assemblies.

An expert in motion control systems, Ramu explains that magnetic levitation and propulsion system may cost $20 to $40 million per mile, depending on the design and specifications. Typically, the infrastructure costs are 60 to 70 percent of the total cost and the remaining 20 to 30 percent accounts for the electronics, controls, and machines. With the students' design, the infrastructure costs would remain the same, but the electrical engineering costs would be reduced by six to seven percent of the total resulting

"Most magnetic levitation systems lose about 40 percent of their energy in the air. However, with our LSRM....There is almost no energy leakage,"



This electrically-propelled prototype is the predecessor to a true maglev train.

in a saving of about a $1.2 to $2.4 million dollars per mile.

The technology the students developed is proprietary. The prototype of the electric propulsion system is 20-feet long and microprocessor-controlled. The key to its success is they used a linear switched reluctance motor (LSRM). "Most magnetic levitation systems lose about 40 percent of their energy in the air. However, with our LSRM, that loss is at a minimum....There is almost no energy leakage," the students wrote in their final report.

A switched reluctance motor (SRM) has the ability for high speed switching as a vehicle is propelled down a track. The SRM also allows for the easy replacement of individual coils which contain the current that produces the magnetic field that propels the vehicle.

The linear part of the motor comes from the students' redesign of a round or rotary SRM. Essentially, they sliced the rotary arm radially and opened it, making the linear shape.

The students also used the patented fiber optic system of ECpE faculty member Kent Murphy to implement fiber optic sensors into their design. These sensors identify position data from the code strip on the rapid transit track.

The business students who were members of PERTS were advised by Ruth Ann Smith, a marketing professor. They formed teams for publicity, advertising, and promotions. The undergraduates also developed plans to host a conference on RCT with a goal of assisting the Norfolk harbor area to become the leading seaport on the Eastern shore.

Other Tech faculty who are associated with the project are: G.Q. Lu of materials science and engineering and Jan Bohn and Doug Nelson of mechanical engineering.

Shana Hawkins, the vice president of administration for the Virtual Corporation, claims her involvement in this project has been "the most rewarding, most satisfying academic pursuit" she's taken on "because of the diversity of the people involved." She plans to continue with PERTS next year as she enters the MBA program.

In Virginia, a consortium of industries, including Lockheed, Virginia Power, and American Maglev Technologies, is considering a maglev project in southwest Virginia. If it is agreed upon, the project would represent America's first full-scale maglev undertaking.

Ferrari is convinced the students in PERTS and other evolving virtual corporations will "help industry solve their short term design problems". He also hopes that industrial money will fund these virtual corporations. EF

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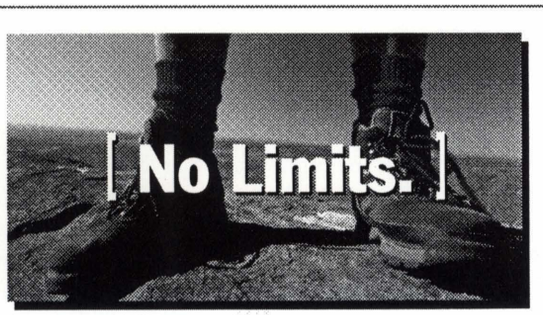

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A Twist of Fate

The Chancy Art of Predicting Tornadoes

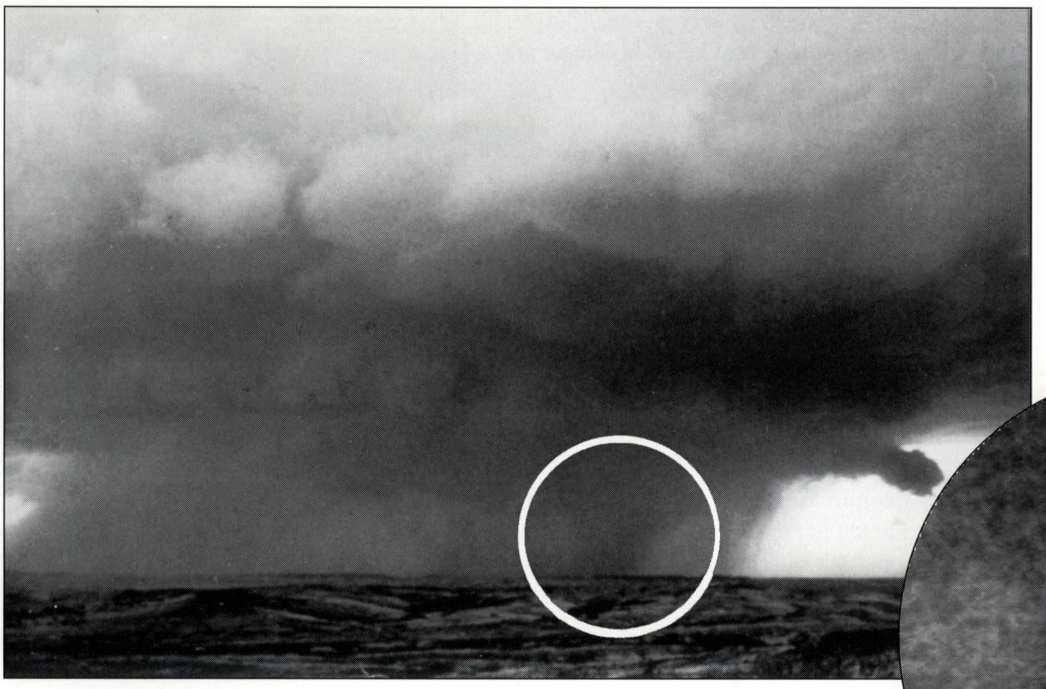
BY CHRIS THAISS

Imagine for just a moment that you are outside on a warm summer day, listening to the ballgame, while the barbecue is slowly cooking lunch. All of a sudden, the sky darkens and winds begin to gust, nearly blowing you out of your hammock. While you are thinking that your barbecue will be ruined because of the imminent rain, you see off in the distance a cloud stretching from the dark sheet above your head to the ground. Who cares about the rain ruining the barbecue, the entire house might be ripped off its foundation! Remembering the local news and its tornado safety tips, you go down to the basement, one of the safest places in a house. As the tornado gets closer, you begin to hear what sounds like a locomotive bearing down on your house. You begin to sweat knowing that anytime now your house might collapse, leaving you trapped inside. The sound is getting louder, and louder, and louder…CRASH! The windows just exploded because of the low pressure outside created by the vortex of the tornado! Wind fills the basement, papers and debris from the outside fly past you. You hold on for dear life. Then it all stops. The tornado has passed, and all that remains of the tornado is the sound fading into the distance.

This story, a very real one, happens every year to thousands of people. Sadly, it does not always turn out as this story did, as is the case with the tornado that touched down in the suburbs of Birmingham, Alabama, earlier this year, where 41 people were killed. The tornado that struck Birmingham packed 250 mph winds, an F4 on the Fujita Wind Damage Scale, strong enough to lift a pickup truck and throw it 100 yards. Because we live in the '90's, tornado forecasting has turned from crude science into an art, so the people of Alabama had time to get ready for the tornado. However, this was not the case in the early 1940's when the only forecast for a tornado was a phone call from the actual point of touch down. On March 25, 1948, this all changed when two men, Colonel Robert C. Miller and Major Ernest J. Fawbush, correctly forecasted that the atmospheric conditions were ripe for tornadoes in the vicinity of Tinker AFB, Oklahoma, heralding the beginning of tornado forecasting. The base had been hit by a tornado just four days prior, and the brilliant meteorologists were amazed to see that the weather pattern that day was exactly the same as it had been when the tornado hit four days previously. They called in Major General Fred S. Borum, who alerted the ground personnel on the base and the rest is history. The device used to view the storm up to 100 miles away was an older AN-PQ-13 radar that was used as a bomb-aiming radar on B-29 bombers during World War II. This was 50 years ago, but what do we have now to warn us of upcoming storms and the high winds that they produce?

"It does feel good to spot one, but....All the warnings in the world will not bring back someone's home once it is hit."

The main advance in the prediction of tornadoes is Doppler radar. It has the ability to substantially increase the time from a tornado's first detection to when it actually hits an area, improves the measurement of damaging winds, turbulence and wind shear associated with causing numerous plane crashes, and it increases the accuracy of identifying areas that may be threatened by the storm. The radar itself works by bouncing an electromagnetic signal off of an object and measuring the time that it takes for the signal to return. The objects, in the case of meteorology, are particles of ice, water or dust in the atmosphere. Doppler radar also measures the change in frequency related to the speed of an object in relation to a point. Doppler, therefore, gives vary accurate calculations when it comes to the size, intensity, speed and direction of a thunderstorm. By measuring wind patterns, Doppler radar can detect a tornado



Courtesy of Mike Emlaw, National Weather Service

Not all tornoadoes are easy to see—clouds and rain can often hide them. The picture above shows one such storm. Though it's hard to see, a tornado is located inside the white circle.

Inset: After enlargement and digital enhancement, the tornado becomes much more visible.

Fujita Wind Damage Scale

F0	*40-72 mph*	*Some damage to chimneys and signs, branches break off, shallow-rooted trees pushed over.*
F1	*73-112 mph*	*Surfaces peeled off roofs, mobile homes overturned, automobiles pushed off road.*
F2	*113-157 mph*	*Roofs torn from frame houses, mobile homes demolished, large trees uprooted.*
F3	*158-206 mph*	*Roofs and some walls torn off well-built houses, trains overturned, most trees uprooted, heavy cars lifted off ground and thrown.*
F4	*207-260 mph*	*Well-built houses leveled, structures with weak foundation blown some distance, cars thrown and large missiles generated.*
F5	*261-318 mph*	*Strong frame houses lifted off foundations and disintegrated, debris carried considerable distances, automobile-sized missiles (debris) fly through air in excess of 300 feet, trees debarked.*

COURTESY OF THE NATIONAL WEATHER SERVICE

forming miles above the Earth's surface, giving plenty of time for preparation against high winds. By the mid-1990's in a joint effort by the Federal Aviation Administration, Department of Defense and the National Weather Service, 164 radars have been installed throughout the United States. This network of weather tracking radars will greatly increase the time to prepare for severe thunderstorms that produce tornadoes throughout the country. Doppler has its plusses, but sometimes the radar system is unable to detect the presence of a tornado. This is the reason that the National Weather Service has SKYWARN, a collection of weather spotting groups from around the country, to spot severe weather and tornadoes when Doppler can't see it.

SKYWARN is entirely staffed by volunteers who have a passion for storms. Chris Knauer, a SKYWARN volunteer of six years, relates some of the reasons that he joined the team: "I used to live in the Midwest (Indiana, Michigan) and went through many tornado watches and warnings as a kid. When I got my amateur radio ticket back in the late eighties, SKYWARN was one of the more organized functions that occurred in ham radio – and still is to this day. It serves a real purpose to the community and keeps up the awareness of amateur radio."

He says that the best part of his job is "getting in the truck, turning on the GPS scanner and going on the road (better when paved)." Although Chris says it does feel good to spot a tornado and report it to the authorities, he adds, "But at the same time it is tempered with the fact that property and lives are endangered by these systems. All the warnings in the world will not bring back someone's home once it is hit."

SKYWARN works closely with their own communities to spot and relay information about approaching tornadoes to the National Weather Service, for the issuing of tornado warnings via television and radio.

With all of the technology that has been developed to detect and notify people of upcoming tornadoes, there is still an extraordinary amount of deaths that occur at the hand of the tornado. This just goes to show that without training people in the proper procedures to survive a tornado, there will still be death related to mother nature's most violent wind storm— the tornado.

Tornado Sizes

Weak Tornadoes

- *69% of all tornadoes*
- *Less than 5% of tornado deaths*
- *Lifetime of 1-10 minutes*
- *Wind speed < 110 mph*

Strong Tornadoes

- *29% of all tornadoes*
- *About 30% of all tornado deaths*
- *Lifetime can exceed 20 minutes*
- *Wind speed 110-205 mph*

Violent Tornadoes

- *Only 2% of all tornadoes*
- *70% of all tornado deaths*
- *Lifetime can exceed 1 hour*
- *Wind speed > 205 mph*

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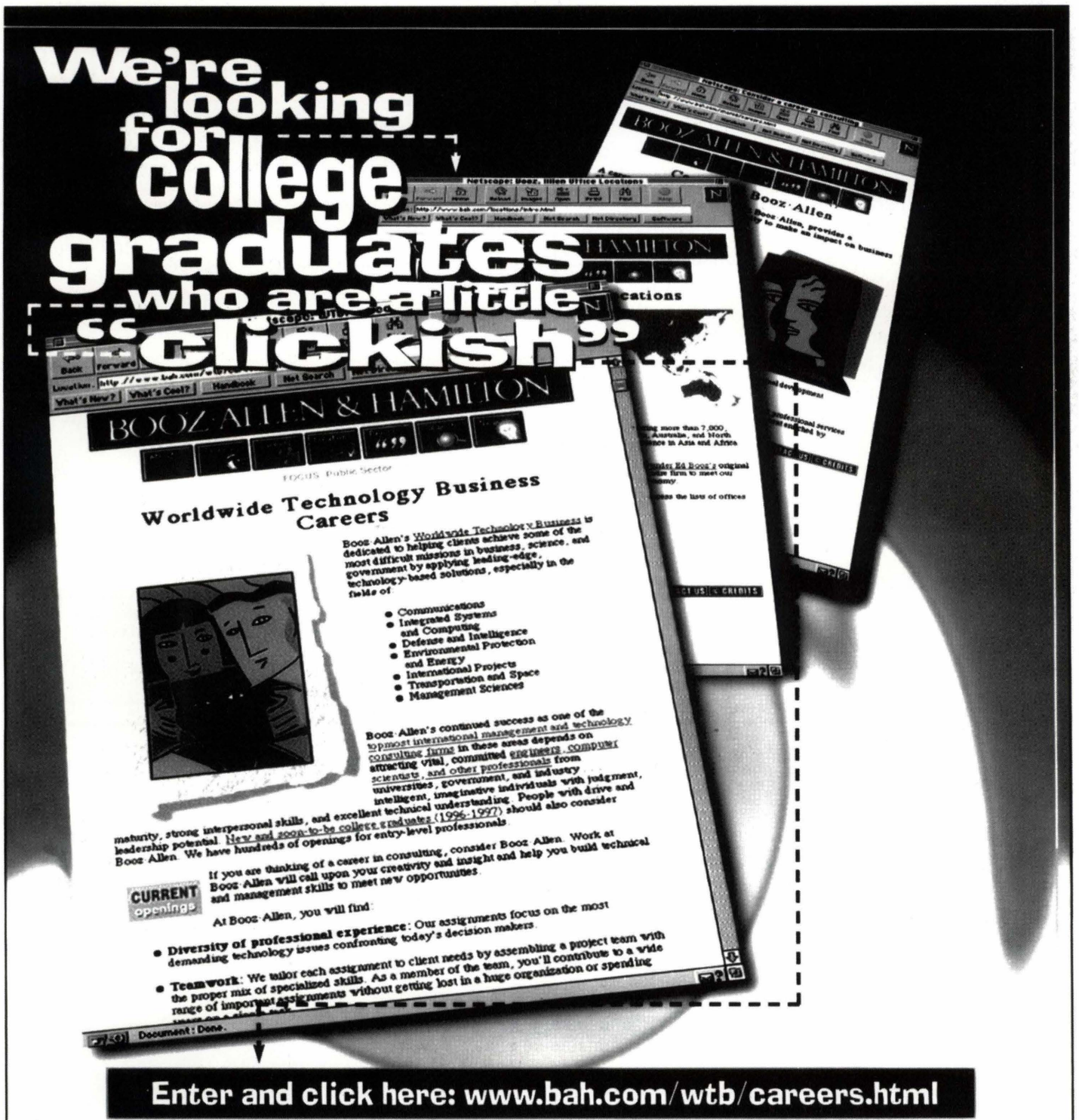

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US Army Medical Department
US Army Recruiting
USG Corporation
Veridian (Veda Inc.)
Viasystems
VSE Corporation
Westinghouse Electric Company
Westinghouse Power Generation
Westvaco Corporation
White Oak Semiconductor
WL Gore
York International Corporation

For a description of the Engineering Expo, see page 3.

ENGINEERING DAM-AGE

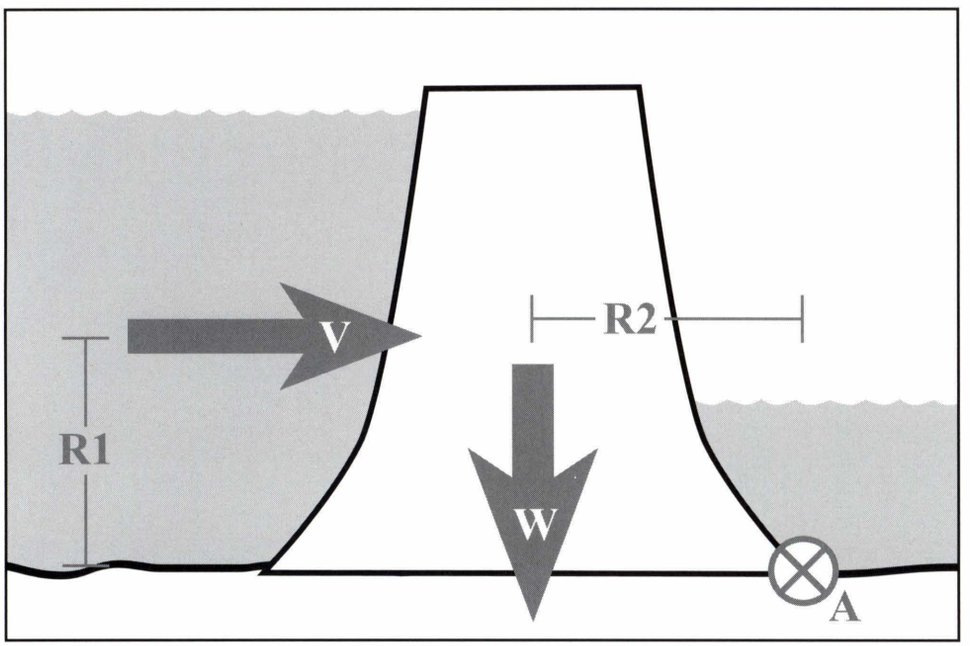
BY SHUVOM GHOSE

Floods have always been bad news. In ancient times, they came without warning and destroyed without restraint. Now, though we purport to know the true causes and habits of floods, we are not always more successful at containing their wrath than our predecessors. When the Mississippi River, the most monitored and controlled river in the world, began to surge over its banks in the summer of 1993, nearly 1400 dams and levees stood in its way to protect the people of the Midwest from flooding. Nonetheless, the Great Flood inundated over 10,300 square miles of previously dry land and caused $18.1 billion in damages, making it the second largest natural disaster in American history. Even though that amount of destruction staggers the imagination, the final count would have been much higher if humans had not used all the engineering at their disposal to fight the rising water.

One of the most often used solutions against floods is the dam. While the basic concept behind one seems simple enough, building a dam consists of more than pouring dirt and concrete in front of a river.

There are two basic types of dams: the earthfill and the concrete gravity. Earthfill dams are usually trapezoidal in shape and made of one material that is permeable to water and one that is not. They work under a simple principal: the impermeable layer keeps the water from soaking through and washing away the porous layer, while the porous layer provides a cheaper way to support the load of the water than making the whole dam impermeable. Earthfill dams are a relatively cheap and easy way to hold back small amounts of water, which is why they are the most prevalent design.

Concrete gravity dams, however, are where the engineering mechanics get applied. These dams of solid concrete are governed by the delicate balance struck between the moments around the downstream toe of the dam. (See Fig. 1.) Backed-up water creates a torque around point **A** by pushing against the dam with a force (**V**) and a moment arm starting below the waterline and descending vertically to ground level (**r-1**). Engineers counter that torque and stabilize the dam by relying on the dam's own weight **W** and a moment arm reaching horizontally from its center-of-mass to the downstream toe (**r-2**). Since water weighs 62.5 pounds per cubic foot and concrete weighs 150, the dam usually wins the battle. Concrete gravity dams can be expensive, complicated to construct, and utterly awe-inspiring. The Grand Coulee Dam, located 28 miles northeast of Coulee City, Washington, stretches 550 ft from top to bottom, 5,223 ft from side to side, and contains 11,975,520 cubic yards of concrete, enough to fill a football field 1.36 miles high.



Graphic by Doug Kelley

Figure 1: How the force of the water, V, and the dam's own weight, W, act on a concrete gravity dam.

One feature common to both types of dams is the outlet structure. Says Dr. David Kibler of the Civil Engineering department, "In addition to the core and the embankment slopes of the structure itself, the most important part from my standpoint would be the outlet structures, which really protect the dam and at the same time, allow it to satisfy its function."

"The first outlet is the principal spillway," Kibler continues. "And that's what lets the water out of the dam for everyday needs, like water supply downstream, or navigation downstream, or irrigation needs."

Principal spillways vary in size just as dams do. The Summersville dam on the Gauley river, a popular location for Virginia Tech rafting trips, has a main outlet consisting of four tubes each capable of delivering 1000 cubic feet of water per second, while the Grand Coulee dam's service spillway can move one million. Though the principal spillways are considerable in

size, they may not be able to pass enough water through the dam in times of crisis.

"That's where the emergency spillway comes in," Kibler says. "That's the second outlet type. The emergency outlet up on top of the dam only activates when you've got really severe flooding. It's designed usually to activate maybe once every twenty-five years, or once every fifty-years, or in some cases, once every one hundred years. You can think of that emergency structure as kind of a notch way up close to the top of the dam, and that notch, if it's wide enough and deep enough, will pass the so-called design flood without overtopping the crest of the structure."

Overtopping can spell death for an earthfill dam. "If it's an earthfill structure, overtopping is the main failure mode. The water goes over the top and peels away from the backside the soil and the grass liner, whatever there is there, and just tears it up from the back side. Once the breach opens, it just eats its way down through from the top. So then you lose the whole dam and the contents."

For gravity dams, the failure modes are no less spectacular. The most obvious way for one to fail is by overturning, where the sum of the moments trying to rotate the dam becomes larger than the moment due to the weight, and the structure tips over.

If the image of a two or three story high wall of water barreling downstream isn't terrifying enough, imagine if the dam came with it. Kibler says, "There's also the possibility that the gravity dam, the concrete dam, can be pushed downstream. I've never seen that happen, but we look at sliding resistance also." Just to quiet some pounding hearts, engineers usually design gravity dams where sliding would entail a loss of life to have a factor of safety of 4 under normal conditions, and 1.5 under extreme conditions. Perhaps that wasn't as reassuring as intended.

Along with these concerns, design engineers also look at a whole range of possible threats to their structure. Could ice sheets build up on the stagnant water behind the dam, and then push the dam over when they start to expand? Some gravity dams have heated intake gates, to prevent ice from forming against them. Could an earthquake move the dam downward or downstream relative to the stagnant water, and unbalance the moment equation? The Grand Coulee is designed to withstand a peak acceleration of 0.19 times the force of gravity.

To make sure none of these failure modes happen, all major dams are monitored 24 hours a day, from an operation control center right at the structure. "And every major dam will have a dam tender, so to speak, who lives right at the site of the dam," Kibler adds. "If it's an Army Core of Engineers dam for flood control, major navigation control, that sort of thing, there will be somebody maintaining, tending, watching the dam who lives practically on top of the dam. The army core does this deliberately, so that the individual responsible is immediately at hand. And those people do have a vested interest, they really do." Note that it is not *official* Army Core of Engineers policy to put the dam tender's house in the direct downstream path of a dam breach to increase their level of vested interest.

While the Core or other dam-building organizations would obviously not take deliberate steps to endanger people, this subject is kin to a question long-debated in the hydrological world. Namely, do big dams and far-reaching levees stifle floods, or actually increase their destructiveness? Sure, dams and levees provide the obvious solution: putting a solid structure between people and the water. Yet, if two cylindrical glasses, one having a smaller base than the other, are placed under identical flows of water, which will fill up faster, and which needs to be higher to contain the same amount of water? Since 1851, some engineers have theorized that, by restricted the Mississippi River to a smaller area by levees and dams, flood control engineering has actually caused more damaging floods. Since the water must go *somewhere*, each new levee necessitates that stronger and higher ones be built downstream.

For these reasons, many have proposed the whole philosophy of flood control be revised. "What we've got to do," Kibler says, "Is do a better job of controlling floods in the areas where they occur. In other words, we've got to go into the headwater areas, upstream, and try to control the releases at the upstream points, rather than wait till the water concentrates in the

IF THE IMAGE OF A TWO OR THREE STORY HIGH WALL OF WATER BARRELING DOWNSTREAM ISN'T TERRIFYING ENOUGH, IMAGINE IF THE DAM CAME WITH IT.

Photos by Jason Gibbs

Carter D. Martin Memorial Dam as reconstructed in 1996.

main channel." Another way to reduce the power of floods is to improve the way we use land. Natural forests absorb the most water per acre, cultivated land the second most, and paved, urban areas close to zero. "Urbanization is the biggest cause of flooding that we have, outside of ungodly rainfalls," Kibler states. "A real good example of that situation is right here on campus. The Drillfield is at the end of the drainage system. The whole town of Blacksburg comes right into and underneath our Drillfield. When the town of Blacksburg floods, we are the beneficiaries here on campus."

Thus, regressing paved areas to cultivated land and cultivated land to natural forests is a way we can increase the absorbing power of the land itself, and thus work with nature instead of against it. And truly, though multi-million dollar dams like the Grand Coulee are impressive testimonials to the quality and scope of our technical ability, would not a solution that lets nature do most of the work for us be an even greater job of engineering? *ET*

The Day the Dam Broke

In 1926, an earthen dam was built across Buffalo Creek near Lynchburg in Campbell County, Virginia. The thirty-foot-high dam, put there to form Timber Lake, met all government standards and passed its yearly structural inspections.

In 1991, Radford University Geology Professor Chester F. "Skip" Watts determined that the dam across Buffalo Creek was unsafe because of increased development of nearby land. Urban development is a major cause of flooding (see main article, p. 14). Watts reasoned that because concrete and asphalt absorb much less runoff than fields and forests, development in the Timber Lake community meant the dam needed to be stronger.

Watts's findings, hardly noticed in 1991, proved valid on the night of June 22, 1995. A torrential storm brought 10 inches of rain in less than a day and flooding throughout the area. Timber Lake rose enough to overtop the dam, and the earthen structure collapsed. A thirty-foot wall of water barreled down the creek bed, leveling everything in its path. Two were killed in the accident—a motorist named

Doris Stanley and a volunteer fireman named Carter Martin. Martin was on duty, attempting to rescue the occupants of a number of flooding cars stalled on U.S. 460, when the deluge came downstream and he lost his life.

The Timber Lake Homeowners Association gathered donations, took out loans, and rebuilt the dam the next year. The new structure nearly met the fate of its predecessor, though, during heavy rain halfway through its construction. At the builder's suggestion, Timber Lake residents dug a 12 foot emergency spillway to divert the waters. Five feet of water covered the dam, but it survived to be finished—with a concrete top—soon after.

The Carter D. Martin dam, with a view of its spillway.

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HELP WANTED

by Rebecca Gassler

With the Engineering Expo approaching this month, Virginia Tech's engineering students are frantically writing resumes, convincing parents they really do need $500 to buy clothes for an interview, and practicing answers to questions they will probably never be asked. Hopefully, this article will help you find the job of your dreams.

A resume could be the single most important tool in getting a job. Many jobhunters can tailor theirs to a specific job at a specific company. Those of us talking to the hundreds of companies at the Expo are not so lucky. We must present a generic resume explaining what we want and hope that at least one interviewer thinks that our resumes were written for him.

First, decide what format best fits your qualifications and experience. People who have several relevant job experiences may want to do a chronological or functional resume. Chronological resumes should be in reverse order and functional resumes should highlight those experiences that relate directly to your goals. Most of us will probably want to write a resume based on our skills. With this style, you can list all of those computer applications you learned but never thought would be useful. List skills learned in previous jobs, too. Your skills may be general, such as "Familiar with word processing," or specific, such as "Expert in the use of Microsoft® Word 97." Be careful not to overembellish. If you spent three weeks learning FORTRAN in Engineering Fundamentals and wrote one program, don't say that you are an expert; this will come back to bite you in the future. If you have many job experiences and a few useful skills, too, create a resume that is a combination of the chronological, functional, or skills format.

Now comes the important part—making sure that the content appeals to those that are hiring. First, provide adequate contact information. Most of us have a school and a permanent address; include both. Give a daytime phone number, and in these days of the electronic era, an e-mail address. Next present a clear, concise objective. Make sure that it adequately represents the work that you are looking for. Don't say "I want a job in the engineering field." Instead, say "I want a job that will allow me to use my engineering skills to design aircraft."

Photos by Jason Gibbs

The third thing that must be present is your educational background. Many of us will just have one degree that is not even completed. List the school, location (city and state), type of degree, majors and minors. Include academic awards, scholarships, and publications. Your educational background should also provide your GPA, both overall and in-major. Some companies may also request a transcript, so be prepared.

The most comprehensive section should be your skills and work experience. Take this space to show off and make yourself unique. Include all positions, paid and unpaid, in reverse chronological order. Under each position, take the time to compose several phrases that describe what you did, what you learned, and what your responsibilities were.

Finally, show those employers that you are well-rounded. List organizations and clubs in which you participate, making sure to include any leadership positions that you have held.

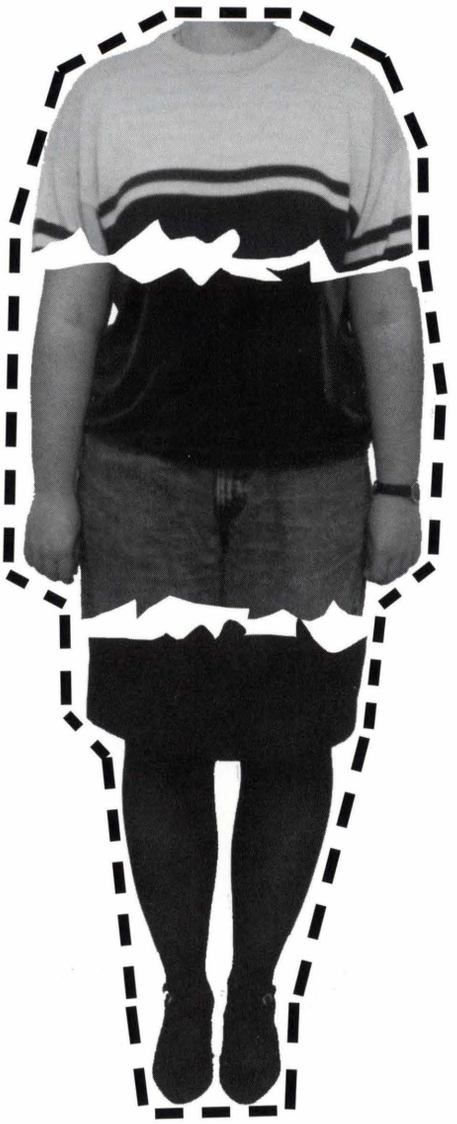
Content is not the only thing that is important in a resume, though. The way it looks can prove that you spent some time and effort to put it together. Invest in some high-quality resume paper, and if needed, matching envelopes. Choose a conservative color, like white, gray, or beige. Take it to a copy center to get it reproduced, or do it yourself with a laser printer. For the Expo, you probably will not need a cover letter because most employers simply ask for the resume itself.

In the job fair situation, both your resume and the way you present yourself are important. Don't throw together the suit you wore four years ago that is a little on the small side with a cartoon aharacter tie and walk out the door. Males should wear a suit or jacket and tie with nice dress slacks. There should be dress shoes on those feet, and some nice dress socks, too. The black hiking boots and white sports socks won't cut it, even if your pants cover them up. Women should wear a skirt and

blouse or a suit. They should avoid flashy colors, and the neckline should not be too low, nor the hemline too high. Jewelry, make-up, and perfume or cologne should be understated. All clothes should fit well and be neatly pressed, even if it means having to take it to the dry cleaners.

Now that you are dressed, it is time for the interview. This is probably the most nerve-wracking part of the job hunt. The first impression is important. Greet your interviewer, offer a strong handshake, and make eye-contact. Don't be afraid, they need you, too. Often the interviewer will ask questions about how school is going, if you like the campus, about where you are from, and so on, just to relax you. Typically he will have your resume in front of him and will have already reviewed it. The questions may be based on the characteristics of the job to be filled or on your resume. Be ready to draw parallels between your skills and experience and the duties of the job. The interviewer will also provide information on the company, allow you to ask questions, and explain the next step in the hiring process.

After all that, you just have to sit and wait. You should have an approximate date when the next contact will occur. If you do not hear from the company after that date, go ahead and follow up with a phone call. Hopefully it will be good news. Happy hunting! EF



WHAT TO WEAR?

MALES

•Shirt and Tie
•Slacks or a Suit
•Dress shoes and socks
•Little or no cologne

FEMALES

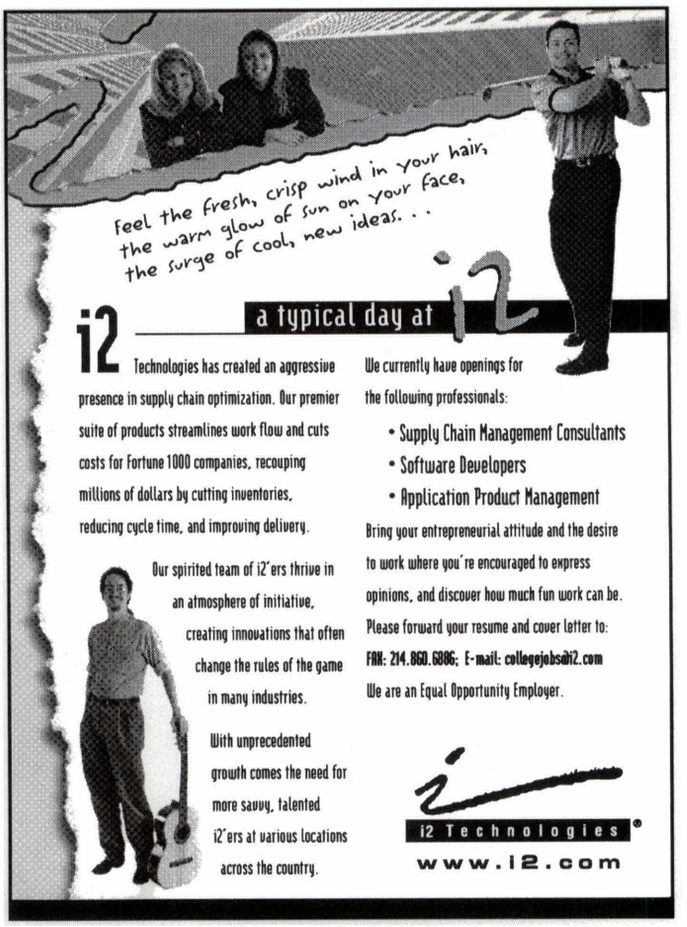
•Dressy, conservative blouse
•Nice skirt or a suit
•Dress shoes and pantyhose
•Understated makeup, perfume, and jewelry

EVERYONE

•Neatly pressed clothing
•Well-manicured appearance

TEN INTERVIEW QUESTIONS YOU WILL EVENTUALLY BE ASKED:

1. *What are your career goals or objectives?*
2. *Why did you choose those goals?*
3. *How do you expect to achieve them?*
4. *What do you have to offer our company?*
5. *What classes do you like best/least?*
6. *What leadership experiences have you had?*
7. *What is your ideal job?*
8. *How are your previous experiences relevant to your future?*
9. *What do you look for in a company?*
10. *Is there anything specific that you'd like to know about the company?*



From the e-mail bag . . .

WHAT IF DR. SEUSS WROTE COMPUTER TECH MANUALS?
If a packet hits a pocket on a socket on a port,
And the bus is interrupted as a very last resort,
And the address of the memory makes your floppy disk abort,
Then the socket packet pocket has an error to report!
If your cursor finds a menu item followed by a dash,
And the double-clicking icons put your window in the trash,
And your data is corrupted 'cause the index doesn't hash,
Then your situation's hopeless, and your system's gonna crash!
If the label on your cable on the gable at your house,
Says the network is connected to the button on your mouse,
But your packets want to tunnel to another protocol,
That's repeatedly rejected by the printer down the hall,
And your screen is all distorted by the side effects of Gauss,
So your icons in the window are as wavy as a souse,
Then you may as well reboot and go out with a bang,
'Cause as sure as I'm a poet, the sucker's gonna hang!
When the copy of your floppy's getting sloppy on the disk,
And the microcode instructions cause unnecessary RISC,
Then you have to flash your memory and you'll want to RAM your ROM—
Quickly turn off your computer and be sure to tell your mom!

A boy was crossing a road one day when a frog called out to him and said, "If you kiss me, I'll turn into a beautiful princess." He bent over, picked up the frog and put it in his pocket.

The frog spoke up again and said, "If you kiss me and turn me back into a beautiful princess, I will stay with you for one week." The boy took the frog out of his pocket, smiled at it and returned it to the pocket.

The frog then cried out, "If you kiss me and turn me back into a princess, I'll stay with you and do ANYTHING you want." Again the boy took the frog out, smiled at it and put it back into his pocket.

Finally, the frog asked, "What is the matter? I've told you I'm a beautiful princess, that I'll stay with you for a week and do anything you want. Why won't you kiss me?"

The boy said, "Look I'm an engineer. I don't have time for a girlfriend, but a talking frog is cool."

More on page 29

Technical Tidbits

Construction of the controversial Advanced Communication and Information Technology Center has finally begun in front of Brodie Hall. Scheduled for completion in June 2000, the Center will house programs in fiber optics, wireless and satellite communications, human-computer interaction, and parallel computation labs. The Center will also be home to a multimedia lab and the Cave Automatic Virtual Environment.

Opposition to this project has been active since the University first proposed it in 1994. The main bone of contention is the single span bridge slated to connect the Center to Newman Library. Many of the students, faculty, and alumni who have reviewed the building plans point out that the bridge blocks the view of the War Memorial from the Mall and is too large for a rural setting like Blacksburg. While the architects' sketch included in the 1995 master plan shows that the Memorial, trees, and sky are all visible though the underpass, "There is a tremendous difference between what we see and what we get," said Paul Tubach in 1996. Tubach, then an undergraduate student in the Landscape Architecture Department, led the coalition to oppose the construction of the bridge.

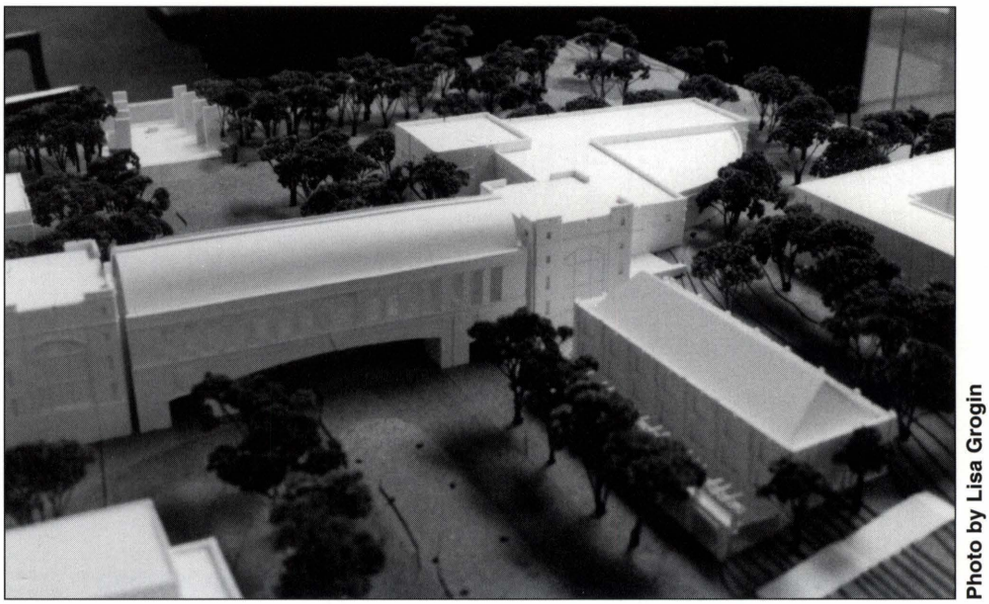


Photo by Lisa Grogin

An architect's model of the Center, showing the bridge across the Mall.

The National Science Foundation has pledged $12.35 million to create an Engineering Research Center (ERC) in power electronics centered at Virginia Tech. This pledge follows a $1.5 million commitment from Governor Jim Gilmore and support from over 100 companies in industry.

"Enormous prestige is associated with an ERC," said Tech's Dean of Engineering F. William Stephenson. "Some 80 percent of the top 25 engineering programs in the country are home to one of these select centers. Our program is clearly the premier power electronics curriculum in the country."

A recent survey conducted by the Insitute of Electrical and Electronic Engineers (IEEE) indicates that power electronic loads (motor drives for heat pumps, ventilation, air conditioners and other industrial and residential applications) account for more than 60 percent of the total electric power consumed in the U.S. This fact, coupled with the uncertainty of fossil fuel supplies and the increased priority placed on efficient conversion and control of electrical power, has led power electronics to emerge as a profession of major importance, said Fred Lee, a professor of electrical and computer engineering.

Lee is the director of Tech's Virginia Power Electronics Center, which submitted the proposal for the new ERC. He predicts the center's work in the next 10 years will result in a 30 percent savings in electric power consumption, and says the center's vision is to "make the U.S. the most efficient user of electrical energy in the world."

Hands-On Doesn't Mean Brains-Off

FROM STAFF REPORTS

Issuing a quiet hum, 60 freshmen in a lecture hall sit with heads bent over Kodak disposable cameras and carefully dissect the mechanisms, using only their hands and paper clips as tools.

Working in pairs, the 17- and 18-year-olds are focused seriously on their task; after they take the cameras apart they will have to reassemble the Kodaks to a working condition. Along the way, they must answer questions and draw sketches of the mechanisms. And they seem to be enjoying it.

This is the hands-on engineering lab, where freshmen learn by practicing "reverse engineering"—taking things apart and putting them back together.

"This exercise makes them think about the things engineers have to consider in designing mechanisms," says Steve Hughes, a graduate student in aerospace and ocean engineering who is helping instruct the lab. "For some of the freshmen, this is a first-time experience."

The cameras have 17 parts that have to be separated, studied and reassembled. In their lab reports, the students write answers to three pages of questions on everything from environmental factors of the camera's production to the cost-effectiveness of the design.

"I was a Lego freak as a kid," says freshman John Harris as he and partner Stephanie Gerke disassemble their camera. Harris, who plans to major in mechanical engineering, believes this type of hands-on work "helps us get inside the engineering process."

Engineering labs like this one were offered three nights a week during spring semester 1998, making it possible for the more than 1,000 freshmen in Engineering Fundamentals (EF) classes to go through a hands-on experience.

"One reason these labs are so important is that many of the students who come to Virginia Tech today are more computer literate than mechanically inclined," says EF Associate Professor Michael Gregg, who wrote a proposal that garnered funding from the Southeastern University and College Coalition for Engineering Education (SUCCEED) to establish the freshman lab program.

"Moving students from an attitude of 'What is the assignment and how can I get it done?' to 'Wow, this is interesting!' is the best approach to engaging them in their classes," says EF Assistant Professor Richard Goff, co-principal investigator with Gregg for the lab program.

SUCCEED is not the only sponsor Gregg and Goff have found for the program. Kodak donated 700 cameras for the lab and Lockheed-Martin awarded $80,000 over three years for materials and equipment.

Gregg, Goff and EF Assistant Professor Pat Devens also have made their own donations—they have worked voluntarily with the program to ensure its success. "The labs are not a required part of the EF curriculum," Gregg notes.

Gregg, Goff and a graduate teaching assistant are offering eight sections of the lab during the current fall semester. In addition to working with cameras, this year freshmen will analyze computer hard drives, internal combustion engines, and electric drills.

Thanks to the generosity of Ray and Violet Frith of Bassett, Virginia, engineering freshmen soon will have their own lab space. Mr. Frith, a 1951 agricultural engineering graduate of Virginia Tech, and his wife have donated $250,000 in support of the Frith Freshman Engineering Design Laboratory.

The new lab will be located in the basement of Randolph Hall, where the Car Factory and other student projects were housed (these projects now are in the recently completed Joseph F. Ware, Jr. Student Projects Laboratory in the Old Laundry Building).

The Friths' endowment is being used to renovate the Randolph basement space and to establish the Frith Practical Learning Endowment Fund, which will support the lab with resources for curriculum design, instruction tools, and maintenance. The College of Engineering plans for all of the

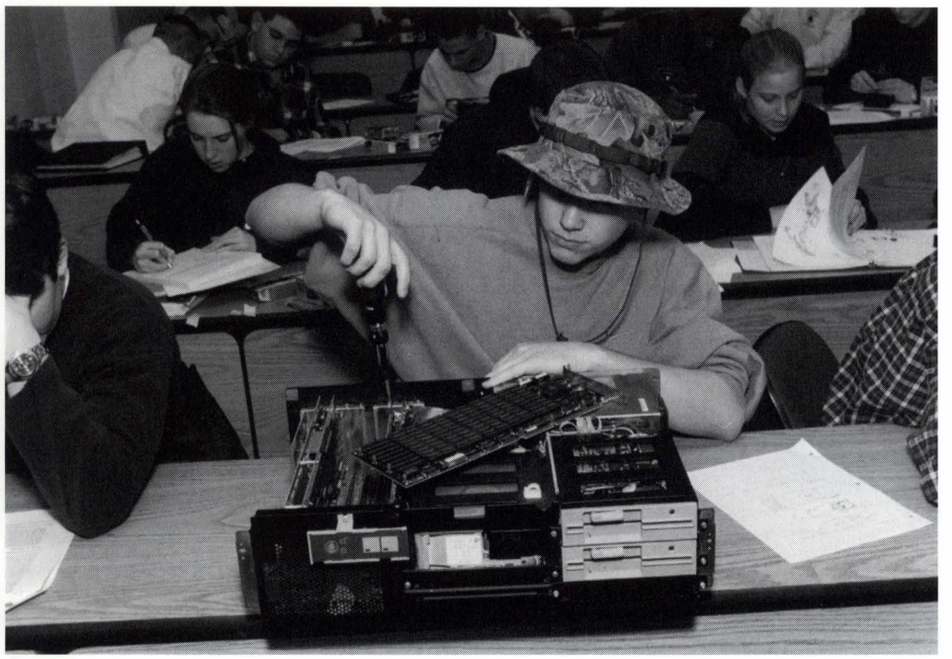
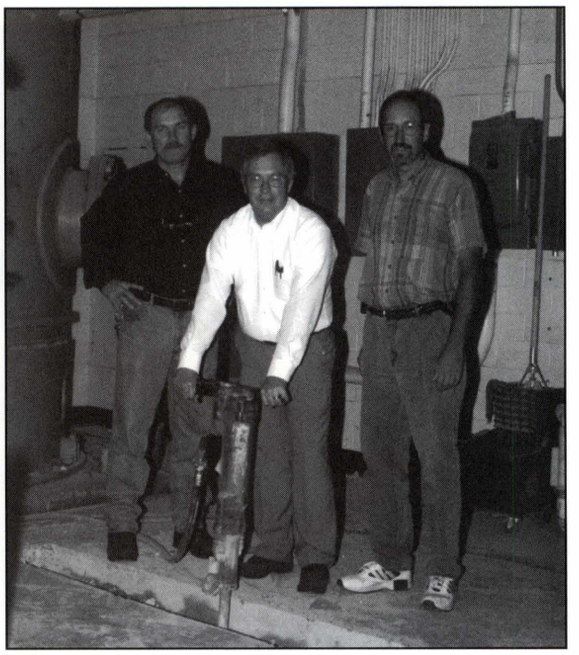


Photo courtesy of Richard Goff

Freshman will explore a range of devices in the Frith design lab.



Photos by Jason Gibbs

Left: The Frith Lab, under construction in Randolph Hall.
Right: Professor Gregg, Dean Griffin, and Professor Goff have led in the lab's construction.

1,400 to 1,500 freshmen who enroll each year to become involved in activities in the Frith design lab.

Gregg says the hands-on Practical Engineering Laboratory being offered this fall will be held in classrooms during the first part of this fall semester and will move into the Frith lab as soon as renovations are completed. Hayden Griffin, head of EF, expects the lab space will be ready by early November. "Our goal for the Frith lab is that every student in EF 1015 will have some hands-on experience," Griffin notes. In addition to the reverse engineering portion of that experience, he adds, the work undertaken by freshmen in the Frith lab will include projects involving computerized data acquisition and control and experiments related to engineering issues such as manufacturing and environmental problems. *EF*

Continued from page 23

You know you are an engineer if...
you have no life—and you can prove it mathematically.
you know vector calculus but you can't remember how to do long division.
you chuckle whenever anyone says “centrifugal force.”
you've actually used every single function on your graphing calculator.
it’s sunny and 70 degrees outside, and you are working on a computer.
you always do homework on Friday nights.
you know how to integrate a chicken and can take the derivative of water.
you think in math.
you've calculated that the World Series actually diverges.
you hesitate to look at something because you don't want to break down its wave function.
you have a pet named after a scientist.
you laugh at jokes about mathematicians.
the Humane society has you arrested because you actually performed the Schrodinger's Cat experiment.
you can translate English into Binary.
you can't remember what's behind the door in the science building marked EXIT.
you have to bring a jacket with you—in the middle of summer—because there's a wind-chill factor in the lab.
you are completely addicted to caffeine.
you avoid doing anything because you don't want to contribute to the eventual heat-death of the universe.
you consider ANY non-science course easy.
when your professor asks you where your homework is, you claim to have accidentally determined its momentum so precisely that according to Heisenberg, it could be anywhere in the universe.
the "fun" center of your brain has deteriorated from lack of use.
you'll assume that a horse is a sphere in order to make the math easier.
you understood more than five of these indicators.
you make a copy of this list and post it on your door.

A physicist and an engineer are sitting next to each other on a long flight from LA to NY. The physicist leans over to the engineer and asks if he would like to play a fun game. The engineer just wants to take a nap, so he politely declines and rolls over to the window to catch a few winks. The physicist persists and explains that the game is very easy and a lot of fun. He explains, “I ask you a question, and if you don’t know the answer, you pay me $5. Then you ask me a question, and if I don’t know the answer, I’ll pay you $5.”

Again, the engineer politely declines and tries to get to sleep.

The physicist, now somewhat agitated, says, “OK, if you don’t know the answer you pay me $5, and if I don’t know the answer, I’ll pay you $50!”

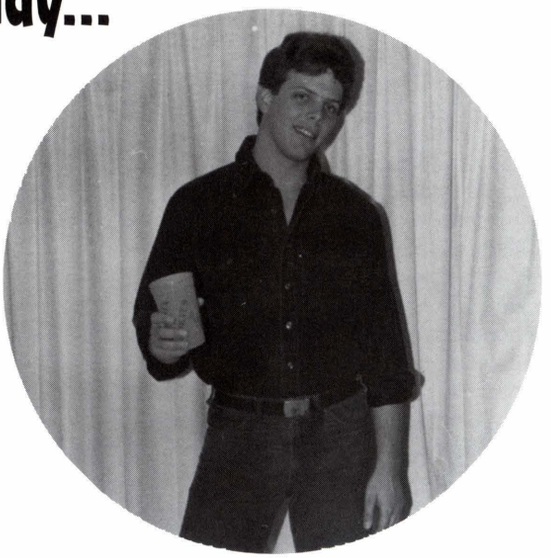
This catches the engineer’s attention, and he sees no end to this torment unless he plays, so he agrees to the game. The physicist asks the first question. “What’s the distance from the earth to the moon?”

The engineer doesn't say a word, but reaches into his wallet, pulls out a five dollar bill, and hands it to the physicist. Now, it’s the engineer’s turn. He asks the physicist, “What goes up a hill with three legs, and comes down on four?”

The physicist looks up at him with a puzzled look. He takes out his laptop computer and searches all of his references. He taps into the Airphone with his modem and searches the Net and the Library of Congress. Frustrated, he sends e-mail to his co-workers—all to no avail. After about an hour, he wakes the engineer and hands him $50. The engineer politely takes the $50 and turns away to try to get back to sleep.

The physicist, more than a little miffed, shakes the engineer and asks, “Well, so what's the answer?” Without a word, the engineer reaches into his wallet, hands the physicist $5, and turns away to get back to sleep.

If it seems like your life is filled with hours of endless study...



...or "swinging" parties...

...why not join a team with enough pull to get things done while having fun?

American Institute of Aeronautics and Astronautics

The AIAA aims to get students involved in aeronautical and aerospace activities above and beyond the classroom. The society has speakers from industry and sponsors the Design/Build/Fly Electric Unmanned Aerial Vehicle competition.
Contact: E-mail Dr. Fredrick Lutze at lutze@aoe.vt.edu

American Institute of Chemical Engineers

AIChE is for chemical engineers interested in meeting other chemical engineers and learning about the different types of companies that employ them. The club has a corporate speaker at every meeting, sponsors plant visits, and does service projects.
Contact: E-mail Diane Patty at dpatty@vt.edu

American Society of Mechanical Engineers

ASME is part of a national, professional organization for Mechanical Engineers whose activities include plant trips, corporate speakers, socials, and national/regional meetings. Freshman have free membership!
Contact: E-mail asme@vt.edu or call the ASME office at 231-4175

Student Engineers' Council

The SEC represents the student body of the college of engineering and unites all the engineering societies. They provide many leadership positions and organize events such as Engineers' Week, the Engineering Leadership Conference, and the Freshman Planner. Any engineering major is welcome!
Contact: E-mail sec@vt.edu

Society of Automotive Engineers

SAE's official objective is to enter student design competitions sponsored by the national branch of the Society of Automotive Engineers.
Contact: Visit their homepage at www.vt.edu:10021/org/sae

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Fumbling the Facts

While reading an article about a border dispute in *The Economist*, I came across the phrase, "…a strip of land, 'the Tin Bigha Corridor', 178 metres by 85—not much larger than a football field…" At the time, I continued through the article without a second thought. Later, I was scanning a piece about asteroid impacts in *Astronomy* magazine and found, "small Earth-crossers—objects smaller than 50 meters in diameter, half the size of a football field…" Though a little irked, I managed to restrain myself. Then, I read a blurb in *Time* that contained an inspired sentence: "For aerospace contractors, it is the prize of a decade: a $17 billion U.S. space station the size of a football field." In medical terms, I think my reaction could be best described as "a massive hissy fit."

Who told these people it was preferable, *or even acceptable* to use a football field as a unit of measurement? Like the Hokie Pokie, this is one of those things that seems to make a lot of sense until you think about it. When asked, I'm sure most people would be quick to reply that a football field is 100 yards long, but how many would know its width? I don't offhand, and I played for four years in high school. Furthermore, while the field of play is 100 by 53.3 yards, an actual football field, including the endzones, is 120 by 53.3 yards. Which are the writers using? And if the writer hails from north of the border, is he then using the 150 by 65 yard field of the Canadian Football League?

Who told these people they could use a football field as a unit of measurement?

Those inconsistencies aren't what bothered me most about the three pieces above. In the first article, the area of the Tin Bigha Corridor is almost three times that of a football field with endzones. If this print suddenly got three times larger,

it'd look like this.

Does that seem "not much larger" than before? As far removed as *The Economist*'s comparison is, the second and third pieces literally contain analogies from another dimension.

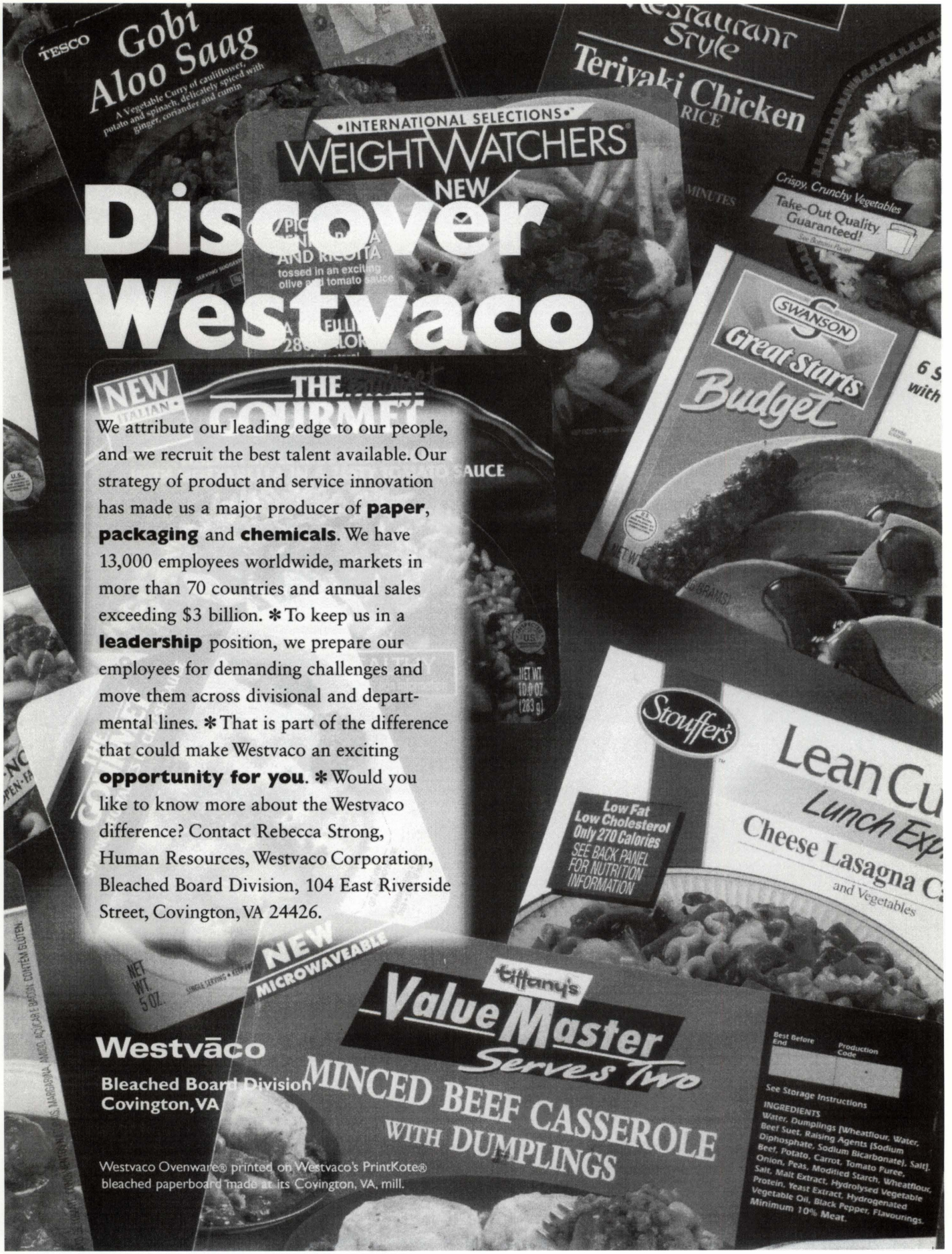
Like the acre, a football field has no height because it is a two-dimensional object. This means the size of a football field is really its area. In the second article, what exactly is half the area of a football field—the asteroid's diameter, which is a length, or its size, which is a volume? Neither make any sense at all.

Then there's the even more ambiguous sentence in *Time*. I almost wish NASA *would* build a space station as close to the size of a football field as they could approximate. Then, the whole planet could gawk upwards in awe at an object so flat and thin it could serve as nothing but an orbiting billboard to advertise our national fondness for using two dimensional analogies for three dimensional objects!

Unfortunately, not even the coming of the metric system will solve this analogous epidemic. When the American inch is replaced by the International centimeter, and the American pound by the International kilogram, the American football field will have a ready replacement. I can already see it coming: "In other news today, lightning in Washington State felled a Redwood tree the size of a soccer field..."

Shuvom Ghose

Executive Editor



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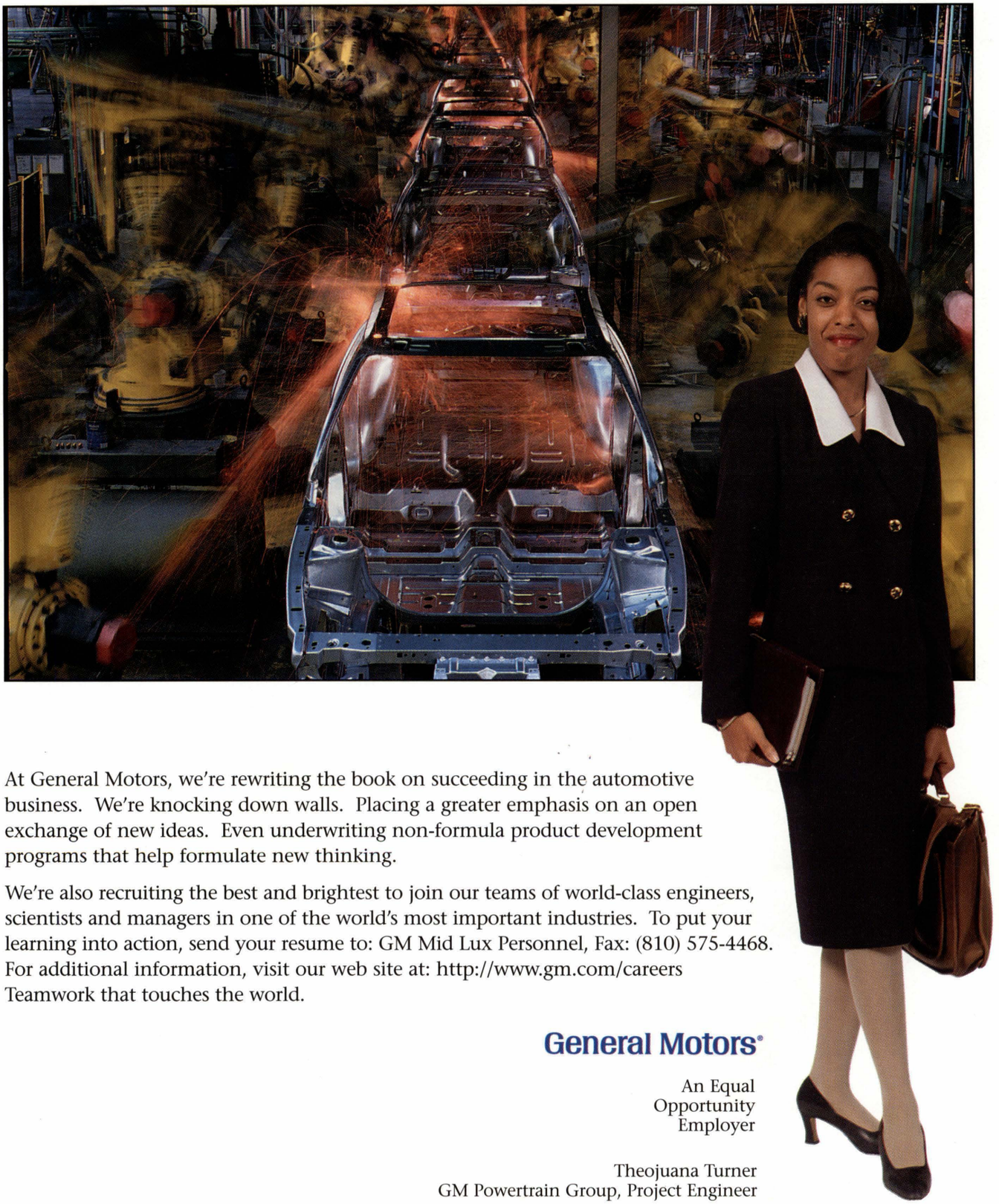

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