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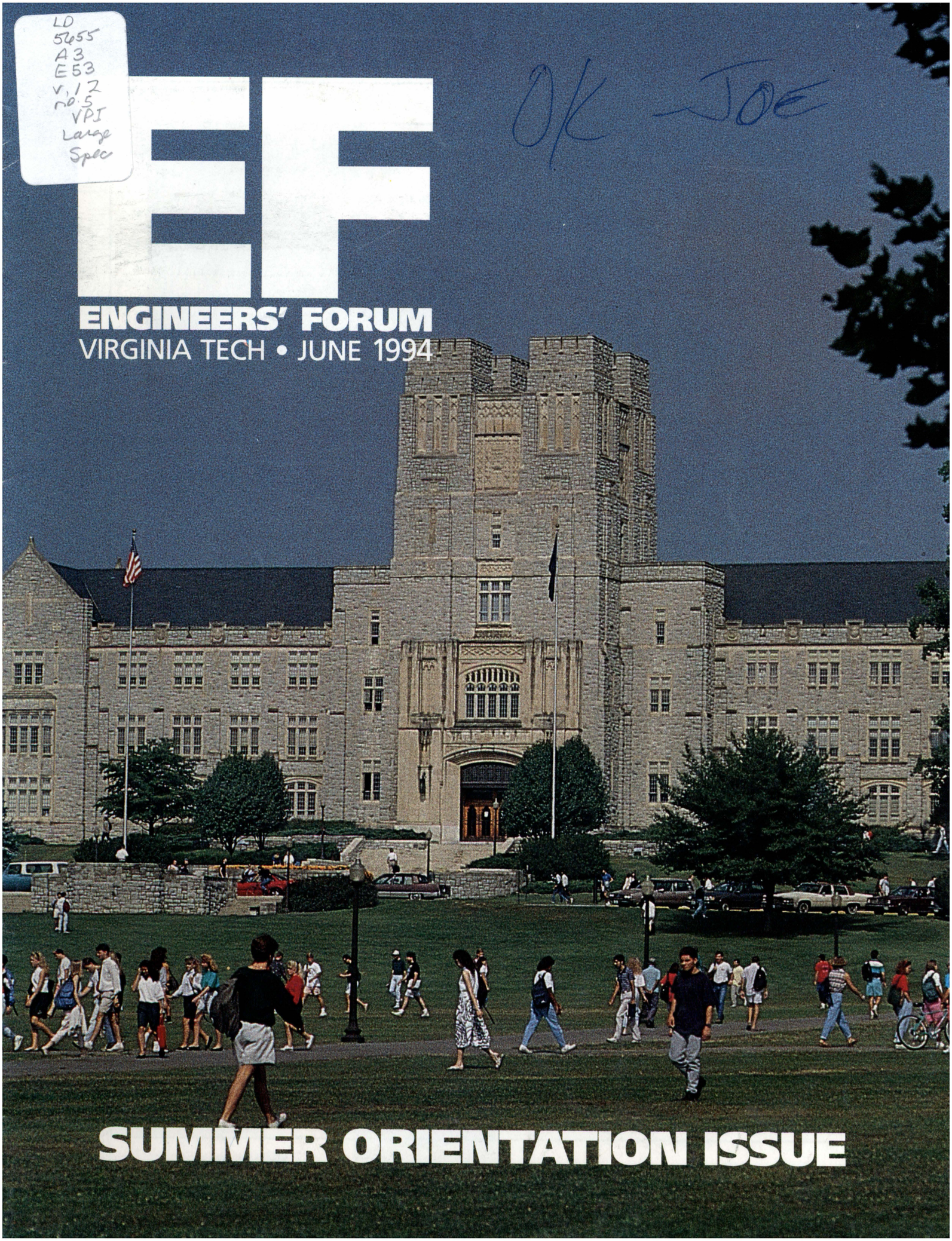
ENGINEERS' FORUM

VIRGINIA TECH • JUNE 1994



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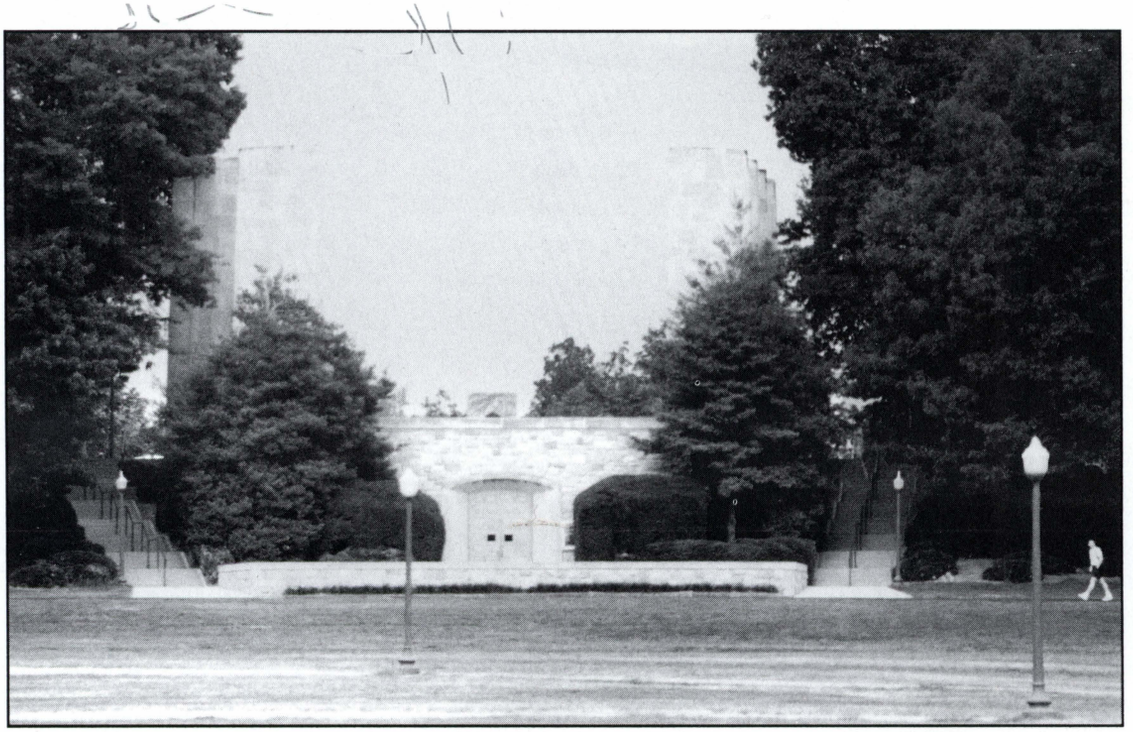
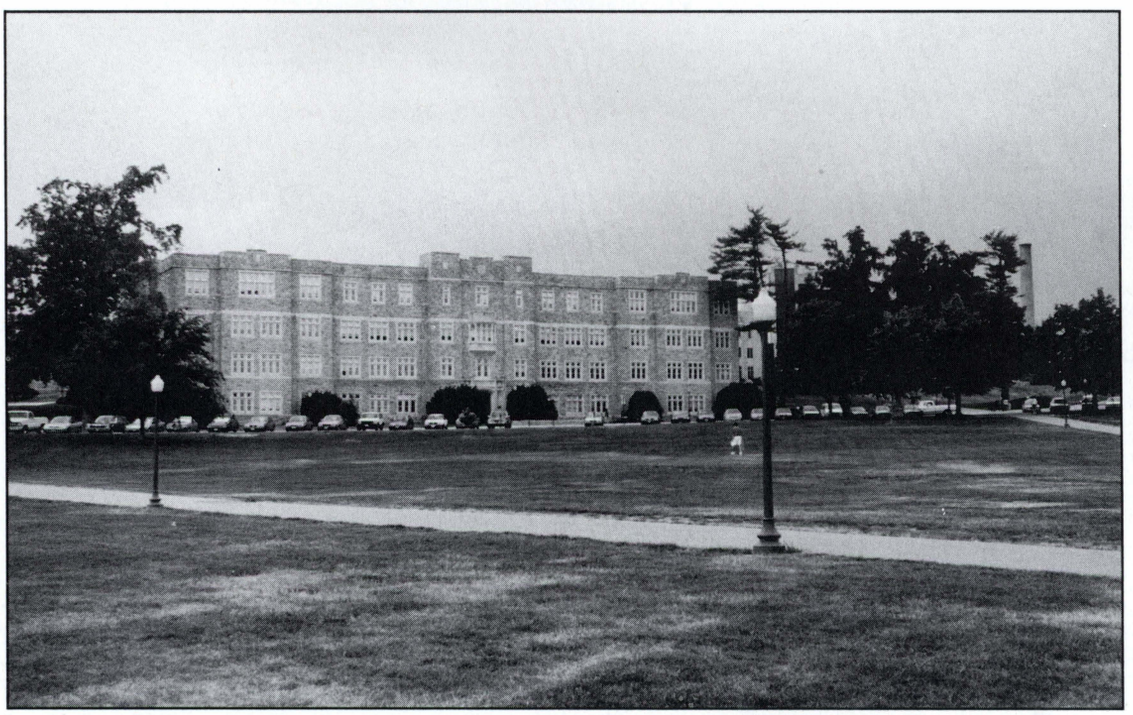


War Memorial Chapel *Photo by Rich Parish*



Patton Hall *Photo by Rich Parish*

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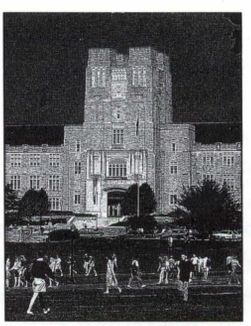


ON THE COVER

Virginia Tech's Burruss Hall is one of the most recognizable and memorable landmarks on campus. It has overseen generations of students wending their way to and from their classes. Photo by Bob Veltri.

Blacksburg Electronic Village

A Community for the Future

by Mike Reese

The town of Blacksburg is slowly undergoing change which may make it one of the most futuristic societies in the world. Many people who pass through Blacksburg, Virginia, associate the rural setting with a simple community. Few realize that Blacksburg is emerging into one of the most futuristic communities on the globe if a current feasibility study shows promise.

This will be accomplished through the Blacksburg Electronic Village project. There are many areas of business and individual life which will be affected by this project; primarily, life will be simpler due to the advanced technology being developed through the joint efforts of Virginia Tech, C&P Telephone, IBM, and obviously the town of Blacksburg. C&P is taking the lead in the six-month study of the idea. Final recommendations are expected in late summer.

If implemented, the electronic village will revolutionize the role of computers in local schools. In development is a National Research and Educational Network (NREN) which local schools will tie into through a Local Research and Educational Network (LREN). As more cities create LRENs, the national network will grow stronger. Joseph Wiencko, manager at Communications Network Service (CNS), likens it to "tributaries contributing to a river." Each LREN would be developed with "personal" attributes to better suit the community it serves.

This network will access data bases and other computers. Teachers will be able to call upon experts in various fields to give lectures and answer students' questions. Field trips can be taken without leaving the classroom. These are only a few of the in-school activities which will be made possible.

At home, children will be able to access library material and other references. A sick pupil won't have to miss assignments or turn in homework late. In an optimum situation the student won't even have to miss school. A computer could connect the child to the teacher and the rest of the class.

The quality of local libraries will not be a limiting factor when children gather resources for projects. Material from leading universities and distant cities will be available to them.

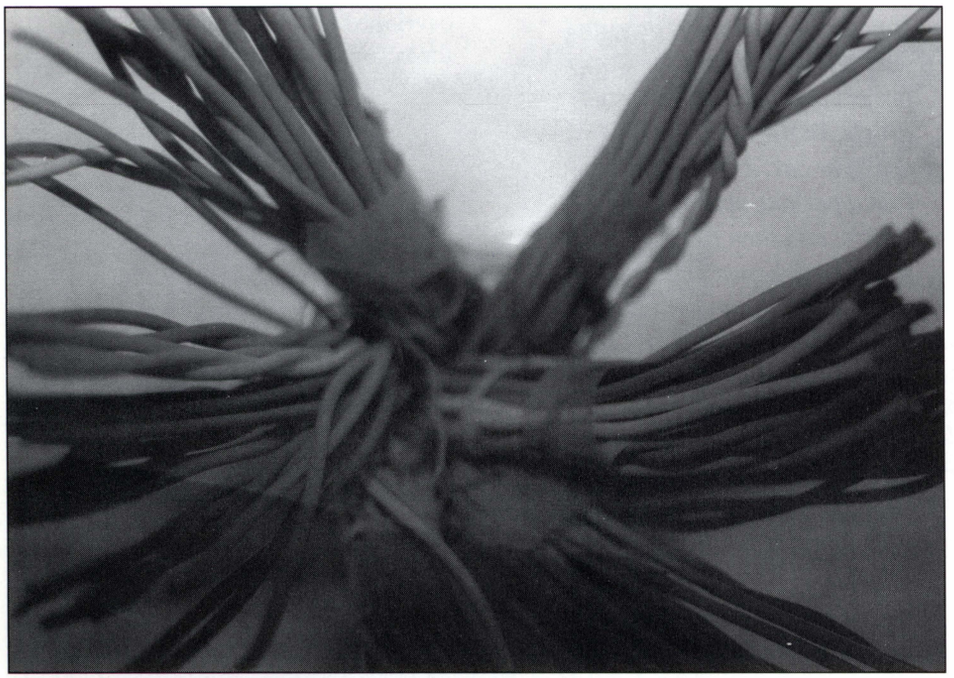
The power of the computer and access to a multitude of software will enable children to work at their own pace while the teacher easily monitors and evaluates their work. The students of Blacksburg will be given the first opportunity to take advantage of the most efficient and productive educational program in the country, while their parents utilize a different function of the electronic village.

The accessibility of different social events and the interaction of people on a network open up new dimensions for socializing. Anyone with a computer will be able to attain information on social gatherings of their peer or ethnic groups. Information that needs to be dispersed quickly, such as cancellation of class or team practice, can be sent through a network. Instead of letting your fingers do the walking across the yellow pages, a consumer's fingers can walk across the keyboard and explore a more in depth directory of businesses, sign up for sports facilities, or answer general questions about different restaurants.

The keyboard can also help a customer order information more quickly than placing the order across the phone or through the mail. Every day, a businessperson will have the opportunity to order a different newspaper to best suit their needs. Reading the news can be done at their desk. This is convenient for the consumer and beneficial for the environment. Large amounts of paper will not be wasted in the production of newspaper, information will be instead saved electronically. Our own library is in the midst of transferring to this type of system. CD-ROM now holds current information on disk instead of paper.

Electronically saving information not only saves paper, but also space and time. One can easily save time referencing information on a disk from a remote area; space is saved because a disk takes up considerably less space than a book. Presently, there is a group which is converting classic novels and other works into electronic editions.

POSSIBILITIES



Fiber optic wire: The basis for communicating in the future.

The entertainment side of this small town will be completely revolutionized. It does not stop at getting information on events; the events can be brought into the home. A family can preview a movie before renting it, and then view the movie without leaving the house.

For the more serious user, information on town meetings or important dates for community activities can be accessed through an electronic telephone tree. The community members can interact informally with their elected leaders and bring important information to their legislators attention.

Banking from home would put an end to dealing with large lines at the bank. Managing one's money with quick access to the bank's record of withdraws and deposits, while concurrently viewing one's own registered cash flows, makes for easy budget balancing. The dream of home-banking will now be made a reality.

Business in Blacksburg will also benefit from the advancements of the electronic village. As mentioned before, ordering will be simplified and a broader market will be reachable. Customers would be allowed to view the schedule of various services — such as the barber — and be able to choose a time which is most convenient.

Blacksburg could benefit by having remote offices of large firms brought into the area. This would be possible because communications to the central office would be simplified. Dr. Ira Jacobs, professor of electrical engineering, pointed out, "We are in an information age where businesses need to be in close contact with one another; the electronic village is a viable option for close communicating." Large cities with a large population will not be a necessity for branching a firm into new locations in the future.

In the medical field, patients would be able to ask doctors for advice and order prescription medicine all in one step. Doctors will be able to update patients by electronic phonemail about a new epidemic or about changes in results of a test. The problems of inefficiency and large costs would be brought back under control with electronic transmission of information.

Patients who live in a rural setting, such as Blacksburg, will not have to suffer because of the lack of medical knowledge concentrated in the area. A general practitioner could consult a specialist about the unusual symptoms of a certain patient.

Life in Blacksburg will be made simpler because of the advanced technical networking systems being developed. Time will be conserved because one will not have to leave the house to attend to tedious daily chores. The analogy is wasting time going to the library compared to accessing the library from home. People who are isolated from society due to physical disabilities will not be alienated; a network pen pal will connect them to new friends. Everyone will benefit from the electronic village.

With all the benefits residents of Blacksburg will be able to take advantage of, one simple question is easily overlooked. Why was Blacksburg given the opportunity to become the model for new communities to appear in the next century? The answer is multifaceted. The majority of residents in the area have a high technical literacy rate, as can be expected in a college town. Also, many students and professors have their own personal computers, an important basis for an electronic village. Blacksburg also has the advantage of harboring one of the leading engineering schools in the country. Tech has a strong background in communications networks, fiber optics, and computer software development; these are the needed elements to develop and integrate various systems into an electronic village.

Blacksburg can also boast a diverse ethnic community. Citizens of various

Continued on next page

POSSIBILITIES

countries will help to open up informal communications with people from around the world. Rural settings, as stated earlier, usually discourage large businesses from establishing branches in the area. This project will investigate if big businesses will branch into small towns, and if so, will it be profitable?

Finally, this project has the political support it needs. Rick Boucher, Chairman of the House Science Subcommittee, is working to direct attention towards this project. This attention is important to help attain needed funding and support. His diligent efforts led to a recent press conference about the Blacksburg Electronic Village on January 20, of this year. Here Boucher, James McComas, president of Virginia Tech, Mayor of Blacksburg Roger Hedgepeth, and the president of C&P Telephone voiced their support. These four participants' endorsement brought the recognition the project deserved.

Now that the project has started, how will this project be undertaken in the labs across Virginia Tech? The real answer is they won't. Besides the hardware and the fiber optic wire put into service, the expansion of the project will be left to the people and local businesses.

"Virginia Tech will help facilitate many applications and help integrate software for specific companies," explained WienckoTech will be in a consultant position, helping groups enter into this complex system smoothly, and giving advice on how their needs will be best satisfied.

Joseph Wiencko asks you to "imagine a cold rainy day, and you're finishing up your research project and you need one more article. In the time it takes you to go to the car, drive to the library, find a parking space, find the article, and then reverse the order to get back home; you will have wasted at least an hour. Compare this to looking up the article on your personal computer which would take at most five minutes." This project is being accomplished through the joint efforts of Virginia Tech, C&P Telephone, and the town of blacksburg.

Dr. Jacobs stated, "This is not a research project, but an operational one. Here the applications are the driving force and the technology is secondary." He went on to explain that traditional research projects operate in the opposite fashion. Usually the push is on advancing the technical aspects of the design. Here the driving force is how the Blacksburg Electronic Village will best be utilized.

Though the project is more of an application design, technical research will be cdone. Fiber optic research and other wiring components will be investigated to support a large load, and still pass information swiftly. Software will be developed to operate different aspects of the network, and other smaller areas will also be researched.

This is definately a large project. A well developed system will hopefully be in operation early in the next century. The general consensus is that graduates will come back in ten years and be astonished at how the town operates. This will hopefully put the United States in front of the Japanese by a few years. Japan is developing an electronic village which they plan to have in general use by 2015. A major goal which will very possibly be realized is the financial self-sufficiency of the system within five years. This means that the end-user will not have to pay for many of the services made available.

Lifestyles in Blacksburg are about to be radically changed. The Blacksburg Electronic Village is a revolutionary idea, analogous to the telephone. As the telephone became part of every household, communicating became a quick and simple task, now second nature. The results of the electronic village will be similar, the only difference is that more communication services will be affected. Education will be more proficient. Businesses will expand into new territories, and more people will be able to recieve high-quality medical attention. The definition of community and how people interact in the future lies in the hands of the townspeople of Blacksburg and the researchers of Virginia Tech. **EF**

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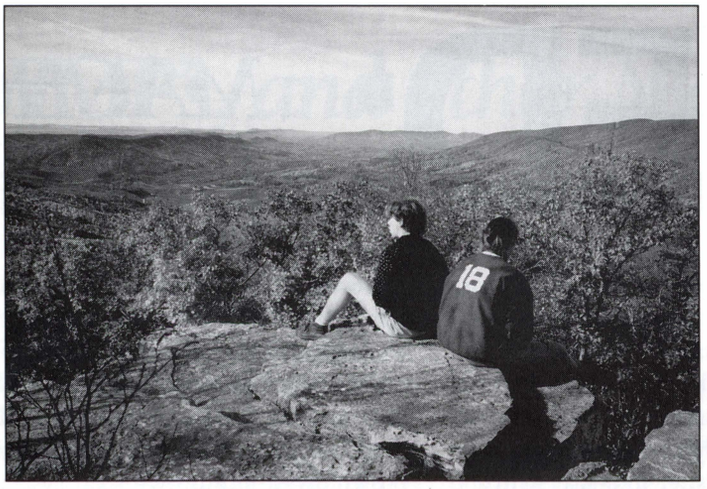
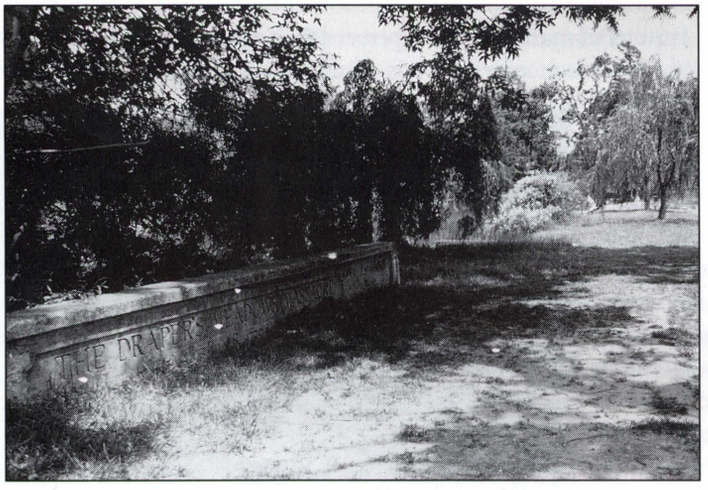


Hiking



Walking

Sightseeing

Who says there's nothing to do around here?

by Rich Parish and John Cole

Even though it may not seem like it now, the town of Blacksburg has many interesting things to do and a lot of unique social opportunities.

This area of the Blue Ridge mountains offers some of the most beautiful countryside anywhere. The mountains and the Appalalachian Trail, which runs very near to Blacksburg, provide for some of the best hiking available in Virginia. Jefferson National Forest is close by as are the Cascades waterfalls and Mountain Lake, where "Dirty Dancing" was filmed. Some of the best hiking trails include Dragon's Tooth, Brush Mountain, McAfee's Knob, and Kelley's Knob. All of these locations are just a short drive from campus.

There are also many opportunities for mountain biking or rock climbing. Stores in and around town such as East Coasters, Hokie Spokes, or Blue Ridge Outdoors have information and products concerning outdoor recreational activities.

An activity that is less strenous and more relaxing would be tubing down the New River, a popular summer pastime.

There are many good restaurants and bars in and around town, including Macado's, Pargo's, and the Hokie House. A little farther away from town and you can go to the Farmhouse or the Homeplace.

For those into the bar scene, many places won't even let you in unless you're 21. However, you can still get in plenty of places, including Arnold's and Sharkey's. As you will probably find out soon, Thursday's have evolved into a big night in town, which also leads to somewhat diminished attendance in Friday classes.

Another way many students spend their free time is to get involved in organizations such as fraternities, the Student Union, or engineering societies. They boost resumes and are a great social outlet (and you usually learn a thing or two). Tech has some excellent design opportunities such as the cars (baja, formula, solar) in Mechanical Engineering, the concrete canoe in Civil Engineering, or the AIAA aircraft projects in Aerospace Engineering.

Other students choose to go the route of involvement in clubs or activities such as intramural sports, the ski club, or the mountain biking club.

There are a lot of activities and things to do in and around Virginia Tech. Getting out and experiencing them will help to broaden your education and your college experience. EF

WANTED: *MACHO's for key rol*

by Jessica Smothers

Okay. So, you've heard it all before, how the universe was created in a massive explosion called the Big Bang and has been expanding ever since. What happens next is the big question now. Will the universe continue to expand forever, or will it eventually collapse in on itself in a great Cosmic Crunch?

The answer to this question depends on the mass of the universe. Scientists have calculated the "critical mass" of the universe, which is the amount of mass needed to create a strong enough gravitational force to stop the expansion of the universe. If the total mass of the universe is less than the critical mass, the universe will continue to expand forever. If the total mass is greater than the critical mass, the universe will eventually reverse the expansion. The total mass of the observed universe, including all of the galaxies and quasars, is, at most, ten percent of the critical mass.

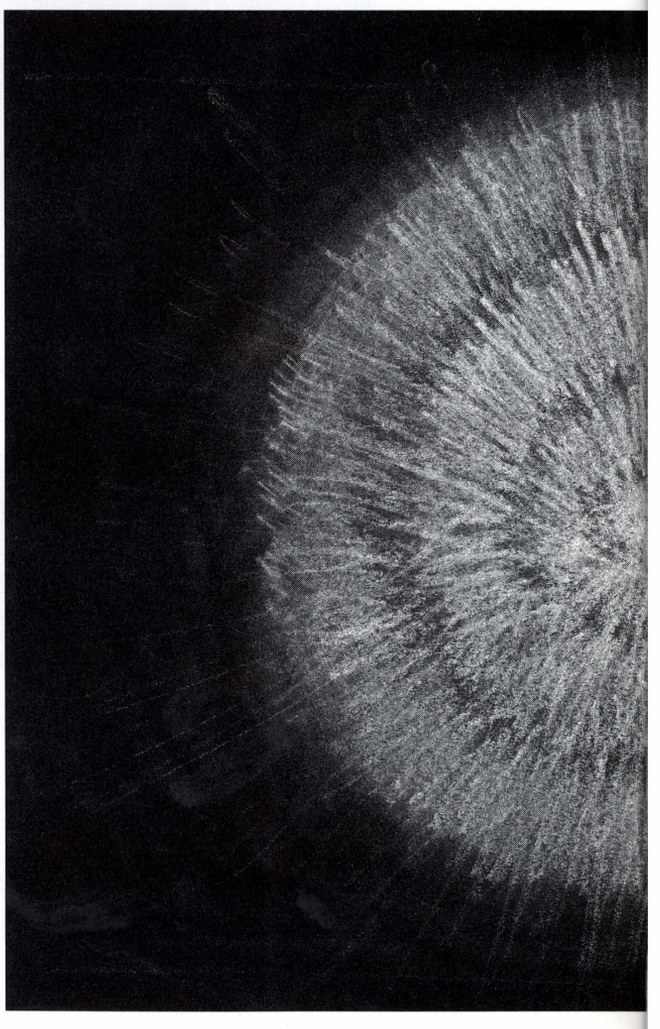
The problem is that the formation and behavior of the galaxies and the large galactic clusters cannot be explained with the amount of observed matter. The gravitational forces aren't strong enough to have formed such large structures as the Great Wall, a gigantic galactic cluster, in the amount of time since the Big Bang (approximately 10 to 20 billion years). This is where dark matter comes in.

Dark matter is a catch-all term used to describe any matter that cannot be detected in normal astronomical observations. It may make up to 99 percent of the mass in the universe. But dark matter is not a single type of matter. Scientists are looking for many types of particles and bodies that are all classified under the heading "dark matter."

Perhaps the most spectacular example of dark matter is a black hole. Black holes result when massive stars, at least 3.2 times as massive as our own sun, collapse in on themselves. What remains is a concentration of matter so dense, with a gravitational field so strong, that not even light can escape its pull. Black holes are believed to be at the centers of many galaxies, feeding on the dense concentrations of gas and dust located there.

There is no way to physically "see" a black hole since they don't emit any light, but the gas and dust being drawn toward the hole can be seen. That's just what the Hubble Space Telescope saw in a photo of galaxy NGC 4261 located in the Virgo Cluster. A black hole is believed to be sucking in the swirling cloud of gas and dust. Definitive proof of the black hole's existence won't be found until after the repairs to Hubble's main mirror. Opposing viewpoints are provided by astronomers who believe it is not a black hole but some other phenomenon, such as the remnant of a second galaxy swallowed by NGC 4261, that is causing the cloud.

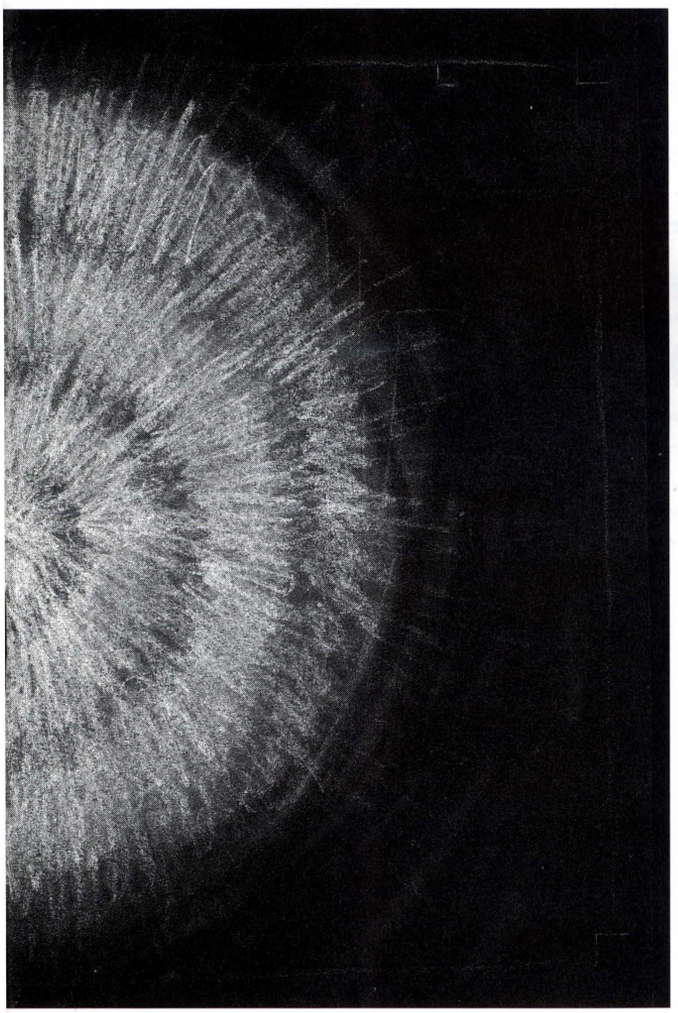
MACHO's are another class of large bodies that are believed to make up part of the missing matter. MACHO's (Massively Compact Halo Objects), also called brown dwarfs, are stars that didn't quite make it. Their mass is too small to ignite the nuclear fires that would make them shine. There could be millions of these in the Milky Way alone, but they would be so dim as to be nearly impossible to detect. Some scientists would say that we have a brown dwarf in our own solar system, the large gaseous planet Jupiter. Jupiter's composition is very similar to a star's, about 90 percent hydrogen and 10 percent helium. It is much larger than all the other planets



, WIMP's, and other Massive Unseen Bodies es in universal creation theory

combined, and it produces about twice as much heat as it receives from the sun. If Jupiter was just sixty times more massive it would have ignited and our solar system would be a binary system.

Even including the MACHO's and black holes there would still be a lot of missing matter. Scientists believe most of the missing matter will be found in the vast reaches of "empty" space in the billions of subatomic particles, insignificant by themselves, but adding up to an enormous amount of mass. Scientists are looking for several types of this subatomic matter. The search is difficult because these particles have nearly no individual mass and give off no light or other radiation. They can only be detected when they collide with other particles or indirectly, by observing the effects of their combined mass and gravitational force.



Hot dark matter, its particles called neutrinos, is one type of this subatomic dark matter. Neutrinos travel at or near the speed of light. Most probably have no mass, but recent experiments suggest that one type does have some slight mass. Even if it has only one ten-thousandth of the mass of an electron, the combined mass would be considerable.

However the light, fast neutrinos would not form the dense clumps of matter necessary to form galaxies. So another type of dark matter, cold dark matter, is needed. These particles are called axions and WIMP's (Weakly Interacting Massive Particles). WIMP's should be roughly the size of a neutrino, but the axion should be much smaller, perhaps one-trillionth of the mass of an electron.

The cold dark matter theory suffered a serious setback with the discovery of the "great walls." It didn't seem possible for such large structures to have been built by cold dark matter in the time since the creation of the universe. Then came the discovery of density ripples in the background radiation, the radiation left over from the Big Bang, by COBE (Cosmic Background Explorer). These "ripples" are areas with a slightly larger mass, thus a larger gravitational field. This field could then attract the matter that would eventually form stars and galaxies. The cold dark matter theory was revived immediately.

A recent observation by ROSAT seems to offer definitive proof for the existence of cold dark matter. ROSAT is short for Roentgen Satellite, a joint U.S., British, and German X-ray satellite. When ROSAT took pictures of three small galaxies in the NGC 2300 group, located about 150 million miles from Earth, there appeared to be a slight distortion of the image. The distortion turned out to be caused by a huge, hot gas cloud about 8 trillion miles in diameter that surrounds the three galaxies. The mass needed to hold on to the gas cloud is about 25 times greater than the mass of the three galaxies. The only answer is the presence of large amounts of dark matter that hold the cloud together.

The stars and galaxies may be more spectacular, but dark matter is the true motivator in the universe. At the very beginning of time, it was dark matter that instigated the birth of the galaxies. Between the galaxies, in their great clusters, are vast amounts of dark matter that hold everything together. After years of theorizing and searching, scientists are finally getting a glimpse at the composition of the universe. EF

Editor's Note: Artwork by Aaron Golub

SOCIETIES

Directory of Societies

Society of American Military Engineers (SAME)
Advisor: Major Gary H. Jackson
Society Information: SAME is a student society for engineers wishing to pursue a career in the Military.

American Society of Materials (ASM)
Advisor: Dr. William T. Reynolds, Jr.
Society Information: ASM is a society that focuses on the latest developments and news in the field of materials.

American Institute of Aeronautics and Astronautics (AIAA)
Advisor: Dr. Fred Lutze
Society Information: AIAA arranges programs which include speakers, films, and field trips. AIAA members also participate in the annual national design competition sponsored by AIAA and Lockheed. Last year, the two teams they entered placed first and third.

Tau Beta Pi Association
Advisors: Dr. James F. Marchman, Dr. Robert W. Hendicks, Dr. Curtis H. Stern, Dr. William L. Conger
Society Information: Tau Beta Pi is the national engineering honor society. Activities include a free tutoring service, an open house program during Engineers' Week, graduate school information sessions, and special events in celebration of faculty appreciation day.

Society of Naval Architects and Marine Engineers (SNAME)
Advisor: Dr. Wayne Neu
Society Information: SNAME is a national professional society dedicated to advancing the art, science, and practice of naval architecture and marine engineering. Activities include hosting speakers and field trips.

National Society of Professional Engineers (NSPE)
Advisor: Daniel D. Ludwig
Society Information: The NSPE is a forum for dealing with the social, ethical, economic, and professional dimensions of engineering. It hopes to aid in the professional development of engineering students, and to help their understanding of what it means to be a professional engineer.

Biomedical Engineering Society (BMES)
Advisor: Dr. Wallace Grant
Society Information: BMES is a national organization with members from many fields that helps to provide awareness of biomedical engineering while promoting student interaction. Activities include field trips, speakers, and conferences.

Institute of Industrial Engineers (IIE)
Advisor: Dr. Jeffrey Woldstad
Society Information: IIE is the student society for Industrial Engineering students. Activities include socials, speakers, and conferences.

American Society of Civil Engineers (ASCE)
Advisor: Dr. Al-Qadi
Society Information: ASCE is the student society for Civil Engineers. Activities include speakers, conferences, and projects such as the concrete canoe competition.

Institute of Electrical and Electronics Engineers (IEEE)
Advisors: Dr. Kwa-Sur Tam, Dr. William T. Baumann
Society Information: IEEE is the student society for electrical engineers. Activities include design projects, speakers, and conferences.

American Institute of Chemical Engineers (AIChE)
Advisor: Dr. David Cox
Society Information: The purpose of AIChE is to enhance the education of chemical engineering students socially, professionally, and academically. Activities include plant trips, regional conferences, guest speakers, a mentorship program, parties, and a spring banquet.

American Society of Safety Engineers (ASSE)
Advisor: Dr. Dennis Price
Society Information: The purpose of the ASSE is to expose members to safety programs, ideas, and methods used by industry, government, and product development. Activities include speakers, industry tours, social events, and regional conferences.

Human Factors and Ergonomics Society (HFES)
Advisor: Dr. Williges
Society Information: HFES studies the design of man-machine interfaces. Activities include speakers, industry tours, sports, and social events. The Virginia Tech chapter of HFES is the largest in the U.S.

Eta Kappa Nu
Advisor: Scott Midkiff
Society Information: Eta Kappa Nu is the Electrical Engineering honor society. Activities include a career forum, a senior electives forum, and tutoring.

Omega Chi Epsilon
Advisor: Dr. William Conger
Society Information: Omega Chi Epsilon is the chemical engineering honor society, providing services such as tutoring to chemical engineering undergraduates.

SOCIETIES

Directory of Societies

Nationally Society of Black Engineers (NSBE)
Advisor: Dr. Bevlee Watford
Society Information: The mission of the NSBE is to increase the number of culturally responsible Black engineers to excel professionally. Activities include tutoring, career fairs, plant tours, conferences, and a pre-college initiative program.

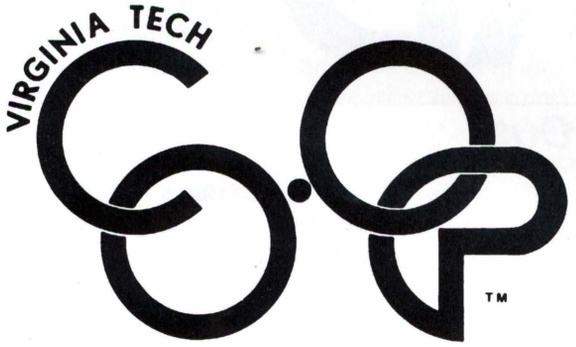
Society of Automotive Engineers (SAE)
Advisor: Kevin Kochersberger
Society Information: SAE provides practical design experience through Formula car and Baja cart racing competitions. SAE also sponsors plant trips and speakers.

American Society of Mechanical Engineers (ASME)
Advisor: Dr. Charles F. Reinholtz
Society Information: ASME aims to produce more knowledgeable and professional mechanical engineers by sponsoring industrial, academic, and social activities.

Chi Epsilon
Advisor: Dr. Michael Vorster
Society Information: Chi Epsilon is the national civil engineering honor society, honoring students who exemplify scholarship, character, practicality, and sociability. Activities include peer advising, graduate composite pictures and the annual t-shirt contest.

Alpha Pi Mu
Advisor: R.D. Dryden
Society Information: Alpha Pi Mu is the Industrial Engineering honor society. Alpha Pi Mu works with faculty and students, they sponsor presentations and social activities. Membership is open to juniors in the top 1/5 of the class and seniors in the top 1/3.

Pi Tau Sigma
Advisor: Dr. A.L. Wicks
Society Information: Pi Tau Sigma is the Mechanical Engineering honor society.



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Rethinking the SMART ROAD

by Cheryl E. Duty

One of the most controversial local issues in the New River Valley over the last few years has been the proposed construction of the smart road bypass linking Blacksburg and I-81. Alternative 6, one of the proposed routes for the smart road, has been approved and awaits further funding before construction begins. The route for Alternative 6 goes from Blacksburg, near the point where 460 bypass joins 460 business on the southern end of town, across Ellett Valley, and enters I-81 about two and a half miles north of exit 118 in Christiansburg.

The goal of Alternative 6 is to alleviate traffic congestion on 460, save travel time between the New River Valley and the Roanoke Valley, and serve as a testbed for smart road technology. This technology includes self-driving cars, variable roadside signs, and navigation systems built into the cars.

Alternative 6 is controversial because some groups believe it unnecessary and harmful to the ecosystem of the area. A larger ethical dilemma has centered on the actual smart road technology and its potential to provide economic growth and better travel conditions versus its tendency to increase single-person transportation, a major source of pollution in this country.

The issue of whether or not to construct Alternative 6 was debated among local residents, environmental groups, and highway officials. Residents were concerned that the new highway would destroy the beauty and rural atmosphere of the areas in its path by going through prime farmland and forests. Ellett Valley, for example, had been designated as an agricultural, forestal area by Montgomery County's comprehensive plan in 1990. Proponents of Alternative 6 touted its ability to provide jobs and research opportunities related to smart road technology to Southwest Virginia. They cited development along the new highway as a drawing card for businesses to the region. Those against the new highway saw it as redundant to an already-planned bypass. Those for the highway argued that traffic projections indicated that both roads would become necessary in the future.

Those who considered the new highway unnecessary pointed out that a bypass, Alternative 3A, had already been approved and will be constructed. Alternative 3A will begin on the southern end of Blacksburg where 460 bypass joins business 460, travel behind WalMart and come out at the second 460 bypass which heads towards exit 118 in Christiansburg. A further section of 3A will be added at the end of this stretch of 460 bypass to join with I-81 just south of exit 118. The Virginia Department of Transportation (VDOT) acknowledged that 3A would be sufficient to address current traffic congestion on 460. Studies of projected traffic, however, indicate that traffic volume will increase. This projected increase warranted the proposal of the additional link, Alternative 6. 3A was originally slated to become a six-lane highway to compensate for additional traffic, but the approval of Alternative 6 will most likely cancel the need for this expansion. Alternative 6 will save time traveling between Roanoke and Blacksburg, about six minutes by the year 2015, according to VDOT's traf-fic projections.

Opponents of the smart road, including residents of areas in the highway's path and environmental groups, claim the smart road is an unnecessary step in the wrong direction. Because 3A was already approved and its route passes close to an already developed tract of land, 3A was not controversial. Alternative 6 seems redundant because it is not needed to alleviate immediate traffic problems, only projected traffic increases which could possibly have been handled by an expansion to six lanes on 3A. Opponents are con-vinced that saving six minutes on a trip to Roanoke in 22 years does not justify the construction of a road through undeveloped land.

In addition, many people don't want to see places like rural Ellett Valley developed into a high-tech research and industrial area as envisioned by those who support the smart road as an economic boost for the region.

Other environmental concerns center on possible ground water contamination because the karst terrain (characterized by limestone laced with caves, sinkholes, etc.) of the area would allow pollution from construction of the highway and other development to rapidly enter the ground water, creating a health hazard for residents of the area.

Rebuttals for these arguments centered on two issues — human convenience and the economy. Smart road

officials and some commuters argued that saving even six minutes by the year 2015 was a significant improvement over options now available. They pointed out that any travel-time savings were quite valuable to those who had to travel the route each day.

The primary argument for the adoption of the smart road centered around its economic strengths. With economic hard times prevalent in Southwest Virginia, an $80 million dollar contract to build the highway was too tempting to pass up. This coupled with additional funding grants for smart technology research was promoted as an opportunity to provide a much-needed boost to the job market in the area. The smart road technology was said to offer short term opportunities based on construction as well as the potential to develop Montgomery County and Virginia Tech into one of the first and foremost leaders in smart road research. Possible spin-off technologies and manufacturing opportunities also sweetened this aspect of the project.

Although Alternative 6 has already been approved, the controversy is far from dead. The Federal Highway Administration (FHA) awarded $1.37 million towards the $80 million dollar construction cost of the highway. An additional $5.9 million from the federal government and $2 million from the state has been designated for smart road research. Because the FHA accepted VDOT's environmental impact statement for the road, part of VDOT's general operations budget may now also be used for construction of the highway. Opponents are focusing on blocking additional research funding in an effort stop the road.

A number of the opponents of the smart road are not against development of the technology itself or its application in this area. They focused instead on the redundancy of an additional road. They felt the technology could be implemented just as easily on 3A or some other needed highway in the area. Occasionally, the more fundamental premises of the smart road were questioned. Why focus on making driving a more comfortable and attractive option when the roads are glutted with cars already? Is the smart road really a project of the future, or is it contributing to the problem? Isn't building more and better roads like giving more drugs to a drug addict? Does smart technology really provide the solutions to our transportation problems? The discussion and resolution of these philosophical, ethical issues will have a significant impact on this region and on the nation as a whole. These questions transcend the local environmental and economic arguments and focus instead on the comprehensive transportation, environmental, and economic issues the whole country must face.

On one hand, smart road technology will provide a safer, faster, and more convenient way to travel. It also has the futuristic appeal of self-driving cars and customized navigation plans.

On the other hand, the attitude it encourages towards transportation has created far more traffic problems than it has solved. The fact is that traffic congestion problems, delays, and

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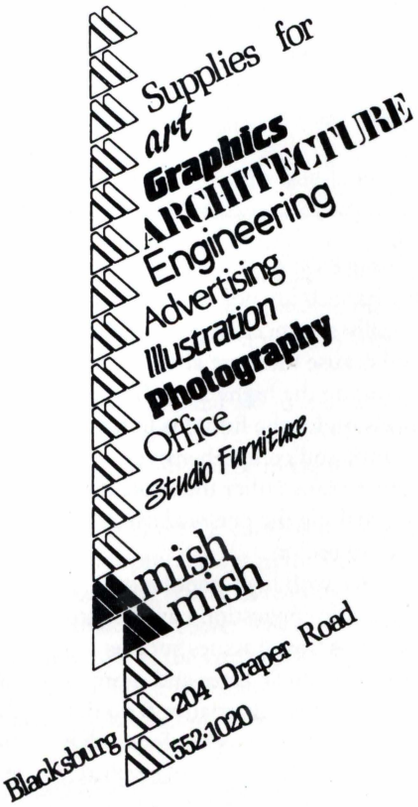
Engineers' Forum would like to thank the Virginia Tech College of Engineering for its cooperation and support in making this issue possible.



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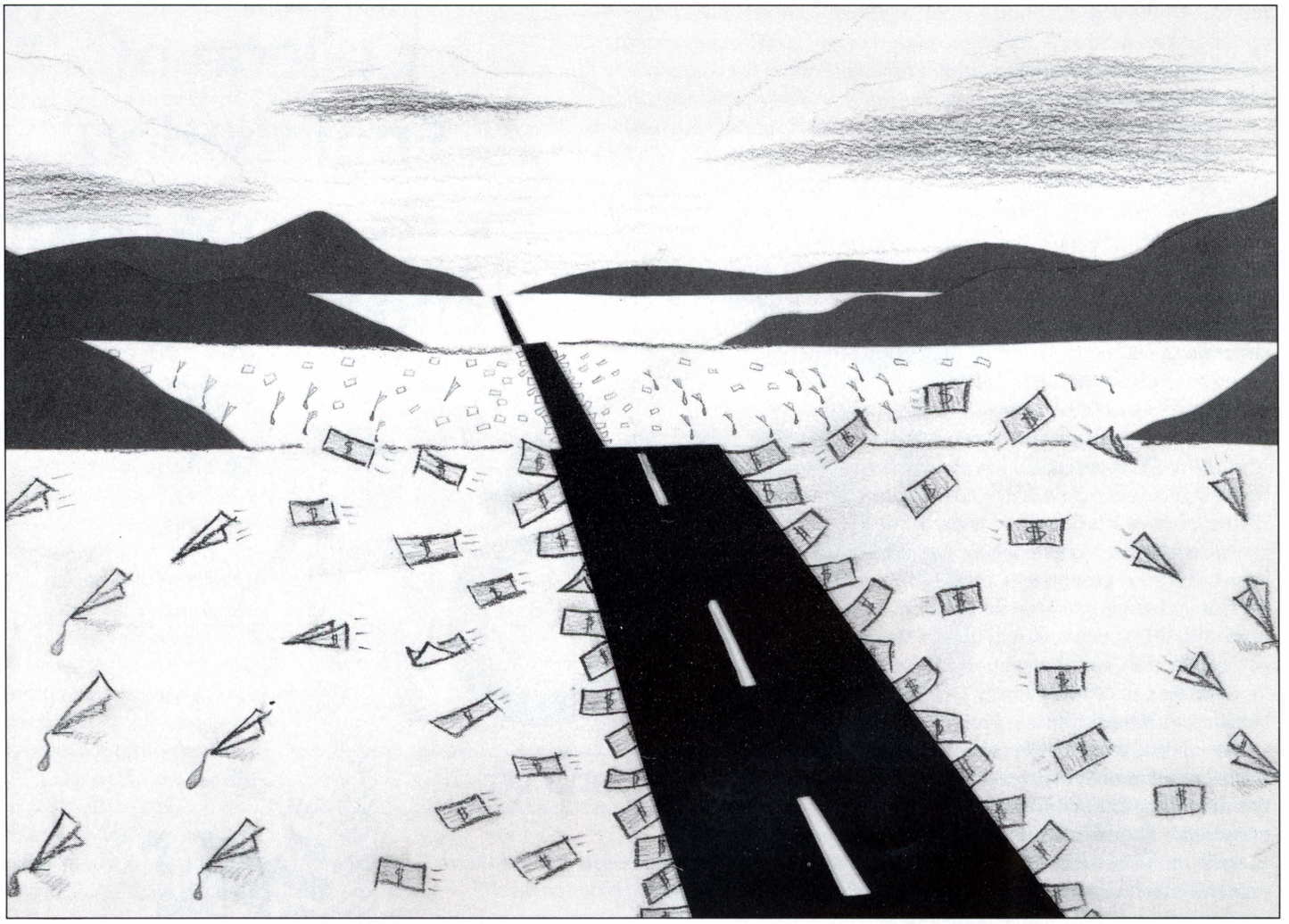

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even safety hazards are not caused by lack of a technically-advanced highway system. They exist because there are already too many cars out on the highways. The truly "smart" decision for the future is to focus on mass transit and comprehensive transportation plans rather than spending millions on making the personal car a more attractive option.

Some cities with high populations and greater traffic congestion have begun to focus on mass transit issues such as high occupancy vehicle lanes and more efficient bus systems. Alternative 6 on the other hand will focus on technologies that can apply to this area, which largely deal with privately-owned, single-passenger cars. A rural setting for smart road research is promoted as more effective because heavy traffic will not impede research, data collection, or modifications to the highway system. However, mass transit smart technology is already being tested in areas of high congestion such as Los Angeles, where it is most effective.

In the race to develop and bring new technology to market, the long-term effects of the technology on people's behaviors, habits, and attitudes are rarely considered. Perhaps smart road technology is necessary to make transportation safer, faster, and more convenient for future traffic challenges. On the other hand, perhaps the perceived need for smart road technology is based on the intriguing possibilities of more automated, customized travel without concern for the environment and land resources. The promised time savings, safer travel, jobs, research opportunities, and economic benefits of Alternative 6 are all very attractive. However, the necessity and wisdom of building a new road through undeveloped territory just to test smart road technology is uncertain at best. Even so, the fundamental question remains centered around the smart road technology itself. How will it lead us into the future, and at what cost? In the end we must recognize the implications of our decisions for future generations, and base our actions on long-term effects rather than short-term gains. **EF**

What's a "Coofer?"

The mysterious origins of the word Tech students are all too familiar with is finally revealed in an Engineers' Forum *exclusive.*

Rumored to be tucked away in almost every fraternity and sorority house and supposedly hidden in a Corps of Cadets vault are vast collections of old tests, quizzes, homework solutions, and class notes for almost every course that has been taught at this university. These sources of information are commonly referred to as "coofers." Why is it that Virginia Tech students use this term when students form other universities use unimaginative names such as "old tests?" In an effort to uncover this mystery, *Engineers' Forum* staff members embarked on an exhaustive search which ultimately lead us to our own magazine archives. The following article is reprinted from the February, 1944 issue of the *Virginia Tech Engineer* magazine, which was the predecessor to the *Engineers' Forum.* EF

The Origin of the "Coofer"

by William Smith

Once upon a time there lived in Bluefield, West Virginia, or Virginia, as the case may be, a group of boys who attended Bluefield College — one of Tech's extension schools. They were, as a group, exemplary embryo engineers whose faults are common to all of us, but whose imagination has served to enrich the vocabulary of this campus by one word, that euphonious and vitally important morsel of slang, "coofer," and its various and multitudinous derivatives.

Their sophomore mechanism problem, one afternoon, was a difficult one and one of uncertain answer, even to this group of near geniuses. Ah, me, they wondered, what could be the right answer?

At this juncture, one of the more consecutive thinkers in the crowd recalled that a junior down the hall had completed the course. Could he help them? Down the hall they all streamed and into the junior's room.

"Sure, help yourself. There's a file of all those old problems of mine over there in that old coffer," and the junior indicated a trunk standing in the corner. The sophomores, after a reassuring glance at its concrete correctness, trouped back to their problem and a successful finishing of it.

As the days passed and the course became more difficult, frequent and still more frequent became these raids on the old coffer and its store of answers. Eventually, through constant reference to it, the coffer came to mean the problems referred to and not the old box they were kept in, and colloquialism changed the harsh sounding coffer to the more harmonious and beloved form, coofer.

The word was transferred to this campus along with several of the group of its originators, and it swept the campus like wildfire, for it exactly suited a long-felt need for a word of such definition. It soon began to appear in forms other than the noun, and is now used as a verb in such constructions as "to coofer a problem" — or the abbreviated form, "to coof and answer" — and as a very descriptive adjective as in "the coofer king" or "the coofer kid."

Its spelling, we believe, should be standardized in the form used herein, as this construction indicates the etymological derivation of the word from its worthy and deserving origin, the old Bluefield College coffer. Such transitory spellings as keuffer (from the slide rule of the same name) and koofer are frowned upon by modern reputable usage.

Today, cooferism is a popular aid to course passing, and the gathering of any and all old problems is held by some as a prerequisite for advancing in engineering work.

An eminent authority on the campus has stated: "The answer to all your problems is in the literature." A number of people rank the coofer as reference literature in its most useful form. The coofer will never replace brains and the slide rule as the engineer's greatest aids in gaining an education, but it will remain as the best short cut now available for faking one.

MUSICAL ENGINEERS

by Mike Reese

There are three basic values which are essential to surviving in an engineering curriculum: creativity, discipline, and intelligence. Mark Cooper and Aaron Snyder not only display these characteristics by their success in class, but also in their extra-curricular activities.

Mark Cooper is an electrical engineer who fills his free time with band practice, organizing and heading technical projects for the International Society for Hybrid Microelectronics (ISHM), and working as a chef in a local restaurant. His good friend, and fellow electrical engineer, Aaron Snyder deals with an equally busy schedule. Aaron drives a bus for the Blacksburg Transit, is co-section leader of the drum section in the Marching Virginians, participates in music department ensembles, and is the first vice-president of the professional music fraternity Delta Omnicron. On top of managing his time, his responsibility as treasurer of ISHM is to manage the society's finances.

When first looking at this long list of activities, one may lose the quality in the quantity. Mark and Aaron are the epitome of renaissance men. They exhibit their technical and scientific knowledge through their involvement in ISHM and success in school. Their prowess in the field of science is mirrored by their experience in the band and in music in general. For Aaron, choosing between music and engineering was difficult. "When I first came to Tech I spent many hours in Henderson Hall talking to advisors on which path I should take. It was a very tough decision, and made my beginnings at Tech very difficult," he comments. The compromise was to supplement his engineering degree with a minor in music.

photo by Mark Cherbaka

Drummer Aaron Snyder at a basketball game in Cassell Coliseum.

Neither have had regrets about pursuing an engineering degree and say they enjoy their classes, but when asked what is their favorite activity the immediate reply was "the band." Mark gave this reason, "I'm close to my classmates, but my section in the Marching Virginians is like a second family." They pointed out that after spending over one hour every day during the week, and all day on game days, it is inevitable that a close bond forms between two band members.

There are also the bus trips. Long hours on the road with eight buses full of college students are bound to result in stories and tradition. Mark plays alto sax and his peers can be identified on the road with the words "group sax" taped in the windows. Another tradition is for the sax section to sing a modified version of the song "Feel Like Makin' Love," which mentions a graduate of this tight group.

Once off the bus, the care-free attitudes are brought onto the field. One of the major advantages of being in the band is the seating. Not only do they get great seats for the game, they are placed behind the opposing team. Heckling the players has become as much of an art as playing their instruments. "The rookies get especially charged up, and the more fired up they get, the louder we yell," joked Aaron. This part of game day is only a small part of their reward.

An audience of fifty to eighty thousand can easily become an emotional experience. Said Aaron, "When you're standing on the fifty-yard line, all you can see is people. They're screaming, and they enjoy your performance; its tough to match that with a calculator."

Mark added, "We've played at two NFL games..., this gives you the chance to be on national television. That's an

One of the major advantages of being in the band is the seating. Not only do they get great seats for the game, they are placed behind the opposing team. Heckling... has become as much of an art as playing their instruments.

experience you probably won't get as an engineer."

After graduation, the two plan to continue playing, although in different forms. Mark said he would join a community jazz band or some other music group if the chance arose. Aaron said the same and added that he might even help teach a high school band. Mark explained that they had both talked about teaching. "Helping others learn is another way I gain satisfaction," Mark said, although he would lean more towards teaching a science or math class.

Both have a great love for music, but they do not allow it hinder their success in engineering. Mark, as stated earlier, is the technical chair for ISHM. This position calls on him to create in a new way. He is responsible for coming up with new ideas for projects, and he utilizes leadership skills in their organization and production.

Aaron's work in his major was rewarded when he won the Power Research Scholarship in 1992. These two students have not only succeeded artistically, but also scientifically. They have pushed themselves to greater boundaries, but not to their limits. They are living proof of what Virginia Tech students can do. Mark gave a four-word description of the band, which is also an apt definition for himself and Aaron. The words are simply "The Spirit of Tech." EF

photo by Mark Cherbaka

Mark Cooper demonstrates his musical talent.

Most engineers are not known for their artistic ability. Mark and Aaron are two engineers who disprove this common misconception.

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A concrete canoe?

by Mike Reese

To the informed person, the idea of a concrete canoe is almost laughable. But seeing the team practice at the Duck Pond and seeing the canoe building process is enough to make a believer out of any skeptic.

In 1992, students not only were involved in the building of a canoe but also in the construction of a house to be used as the center of operation. On several slabs of concrete planted in the ground a few miles from campus, the team built their lab and shelter. Members proceeded to put up walls, floors, and a desperately-needed roof. This project took most of the fall semester to complete while other members concentrated on other projects.

Most people think of concrete as a sturdy, man-made mixture which is used to erect large skyscrapers and to support houses and other massive structures. The students of the American Society of Civil Engineers (ASCE) think of it as the key to winning a canoe race.

There are many varieties of concrete — and the right com bination is needed to get the best results. In 1991, the concrete had not been cooperative when members tried to spread it onto the frame. The concrete for 1992's design was tested in a lab by making two-inch cubes from different mixtures and then performing compression tests on the cubes. A force is applied to the cube and information is gathered on haw and when it fails.

The group did not mix just any concrete combination; they asked faculty members for advice and also consulted the *American Concrete Manual* for tips. They chose a type of concrete similar to the hydraulic cement found in a sidewalk that utilizes metallic reinforcement and does not contain fiberglass — the use of which would have violated contest regulations.

The concrete was also augmented with silica fume which has the consistency of a fine powder. This silica has cementitious properties which means that it fills in small voids such as particle-size bubbles and gaps. Glass beads were also used in the concrete. "They are very light hollow balls that help to take up space," said John Holda. The beads have a texture similar to that of powdered sugar.

While the concrete design was under research, another group dealt with an equally-important problem concerning the shape of the vessel. The group studied the published designs of top finishers in past competitions. Preliminary ideas were taken to the drawing board, or in this case, to a CAD system.

By February, the crew had plotted the cross-sections of the canoe. After much discussion, they decided the sweep angle of the canoe when viewed from the bottom could be modeled by the function $y=x^4$. Next, they separated the plots into 12 points and connected them with a spline function to create a smooth finish. Then, full-size cross-sections were plotted out. These paper models were then traced onto pieces of plywood, creating what is known as a "form."

The project was now beginning to look like a canoe. The form had a one-eighth inch bending board attached to its exterior with glue and nails. This bending board was the spine of the canoe. Then, two layers of duct tape were applied. The first was at 45° to horizontal and the other was perpendicular to the first layer. This gave the model a smooth fin-ish. Placed over the duct tape was a layer of packaging tape to keep the concrete from sticking to the mold.

The design was complete and the desired cement mix was chosen. Then came the next crucial step — the placement of the concrete. Once the cement was mixed and made ready for placement, the crew had to place the mixture within three hours into a wire mesh surrounding the mold in order to achieve the best results.

Then the concrete was moistened and covered in burlap as it underwent the hydration process. Hydration determines the durability of the concrete. If the concrete dries too quickly, the cement will crack or crumble — not a desired result in the middle of a lake. The covering keeps the concrete moist for a longer period of time. For this project, the concrete was left to hydrate for almost three weeks.

Final touches were made to improve the canoe's performance in the water and to give it some Virginia Tech charm. The canoe was sanded down to smooth out the surface and the name "Wild Turkey" was painted on the side.

ASCE members placed first in the regional competition. In the national competition, the team earned an eighth-place finish overall. **EF**

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