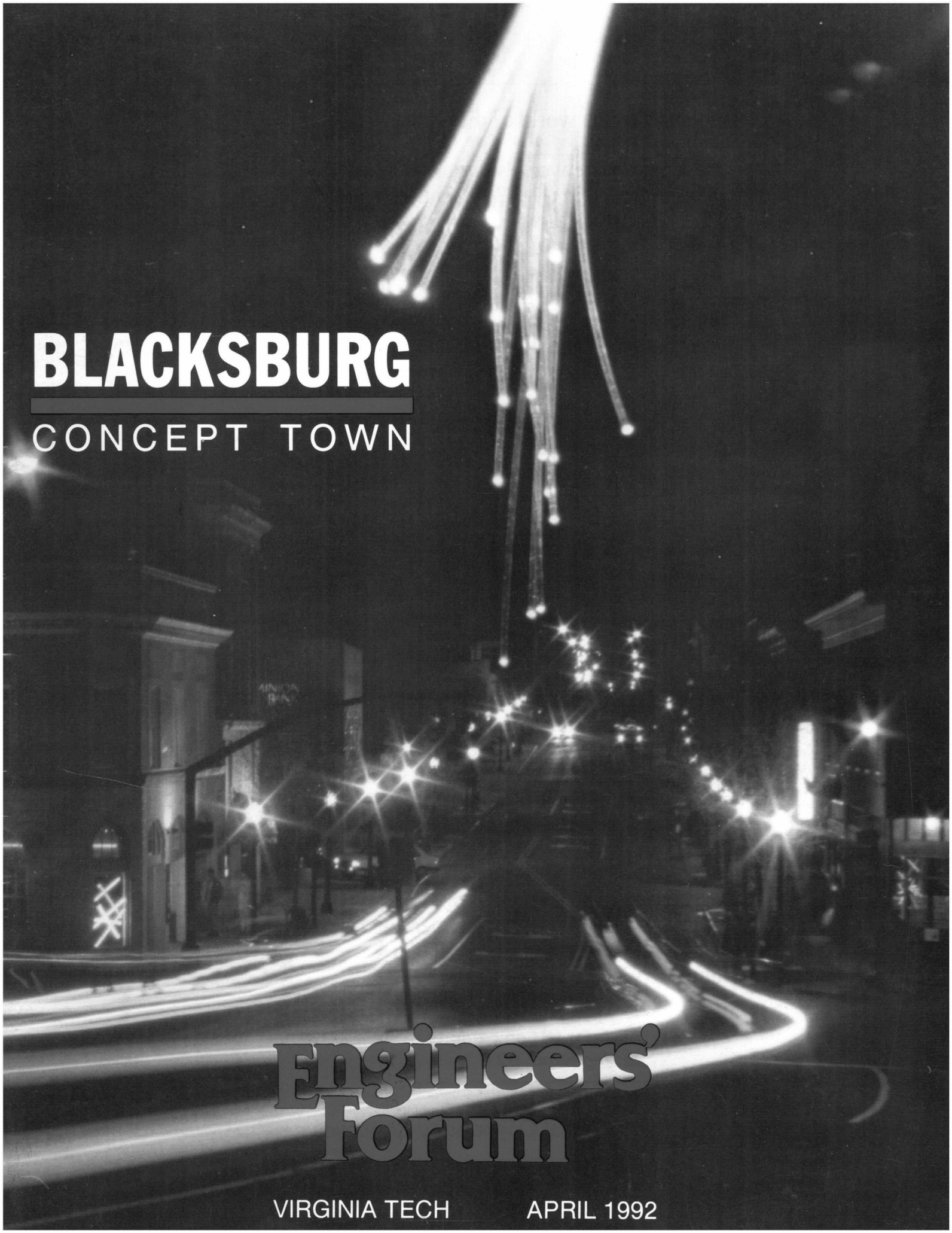
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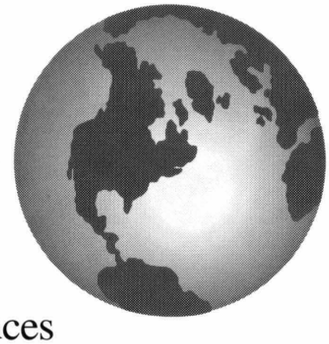

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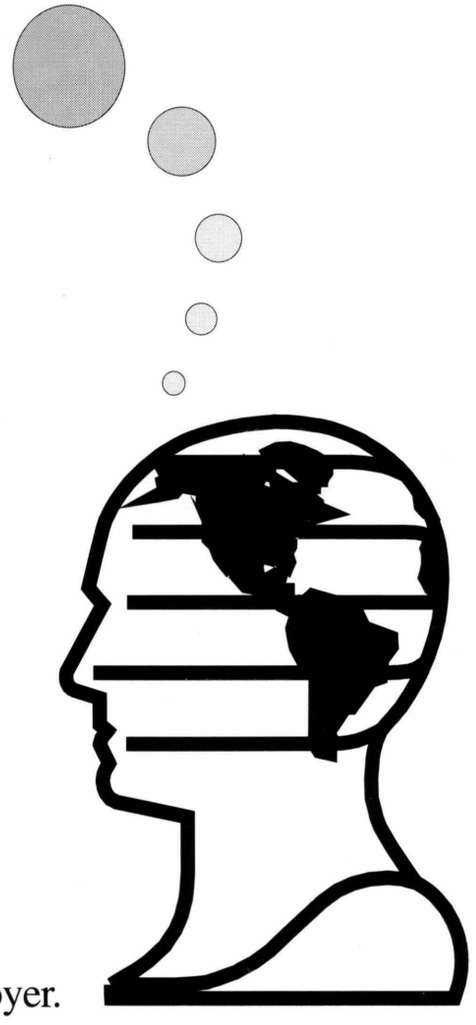

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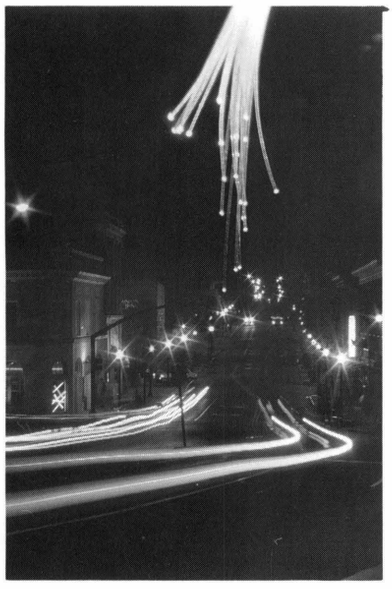

ON THE COVER

A photographic montage depicting fiber optic lines illuminating downtown Blacksburg. The proposed fiber optic network would interconnect students, the University, and many local businesses via computer. Photo and artwork by Mark Cherbaka.

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Darkroom facilities donated by Virginia Tech Communications Department.

EDITOR'S PAGE

SUCCEEDing with multimedia

With a $15 million grant from the National Science Foundation, Virginia Tech and eight other universities recently formed the Southeastern University and College Coalition for Engineering EDucation (SUCCEED). Two of the objectives of this coalition are to improve the quality of engineering education and to increase the number of students who enter engineering and eventually graduate with an engineering degree.

In addition to Virginia Tech, the coalition is comprised of the University of North Carolina at Charlotte, North Carolina State University, North Carolina A&T, Clemson, Georgia Tech, Florida A&M University, Florida State University, and the University of Florida. Combined, these schools encompass 7.5 percent of the undergraduate engineering student in the United States.

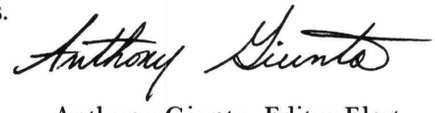
Each school in the coalition was given a particular facet of engineering education on which to focus. Virginia Tech has been assigned to the development of multimedia technology. What is multimedia? It is a combination of computer, television, and laser disk technology packaged into one system which performs the functions of all three.

Multimedia makes use of the massive storage capabilities of the laser disk to store video images, voice recordings and computer program files which can be accessed through the on-screen display menu. Surprisingly enough, early systems with this technology are already available and are as close as the new multimedia lab in Hancock Hall, and a few select professors' offices.

Multimedia is envisioned as both a supplement and a replacement for many courses in engineering and other disciplines. As an example, a student studying physics could access the files on gravitational attraction. With a click of the mouse button, equations would be displayed on part of the screen while the recorded voice of a professor explains their meaning. Another click calls up a visual animation showing the gravitational attraction between two celestial bodies. The advantages of this type of learning are that the student can proceed at his or her own pace and can review material which was not readily understood. Further, the use of multimedia can be applied to almost any subject, from French to physiology.

Multimedia is designed to compete for and win the attention of students who are accustomed to the visual and audio bombardment of video games and television. By providing a more stimulating method for learning as compared to more conventional teaching techniques, the proponents of multimedia hope to foster a greater aptitude for learning in students of all academic levels.

Because of the computer requirement for students in the College of Engineering, we are in a unique position to demonstrate the usefulness of this technology in a variety of engineering and nonengineering courses. We have the opportunity to advance multimedia in ways that will provide new, innovative learning techniques for students in engineering and in all disciplines.



Anthony Giunta, Editor-Elect

Hats Off to Jonathan Hess!

Jonathan has managed to keep the magazine out of bankruptcy court, while steadily improving the quality and appearance of the Engineers' Forum

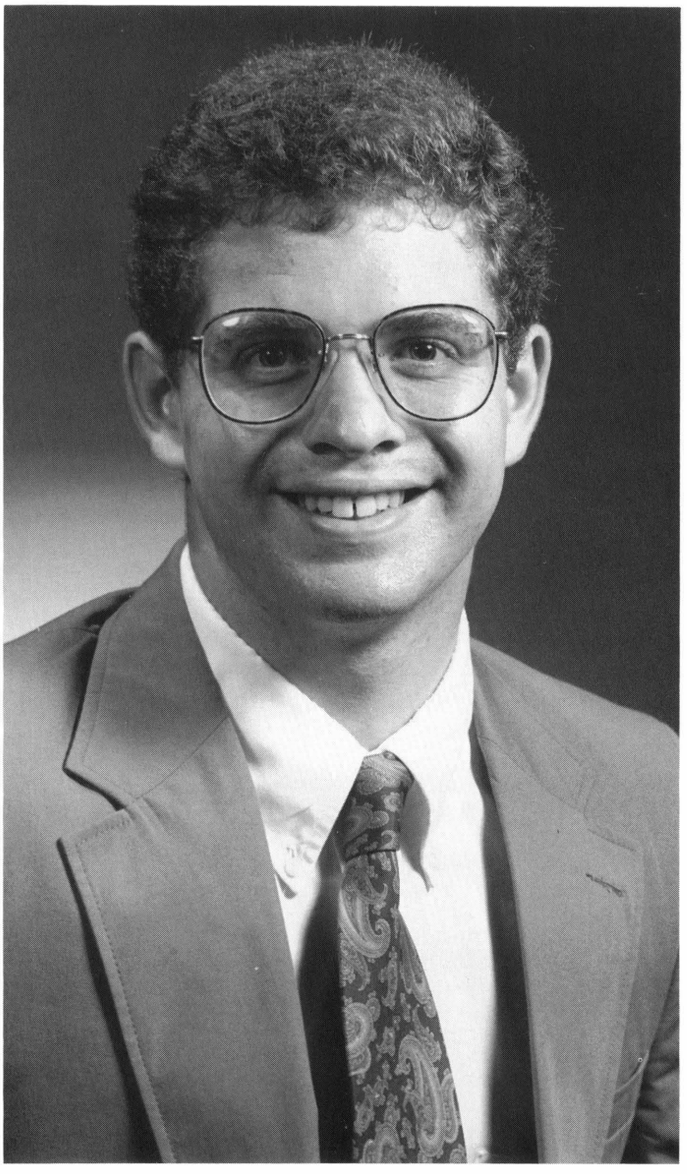
by Anthony Giunta

With the end of the 1991-92 year approaching, the staff of the *Engineers' Forum* bids farewell to our editor-in-chief, Jonathan S. Hess. Jonathan first joined the *Engineers' Forum* staff during the spring semester of his freshman year. With a natural business inclination, Jonathan quickly moved from the position of staff writer to advertising manager during his second year with the magazine. At the end of his sophomore year, Jonathan was elected as editor-in-chief, a position which he has held for the past two years.

In that time Jonathan has managed to keep the magazine out of bankruptcy court, while steadily improving the quality and appearance of the *Engineers' Forum.* Under Jonathan's direction, the magazine has received several awards for technical and design merit and now boasts a staff of many talented writers and artists.

In addition to his involvement with the *Engineers' Forum,* Jonathan managed to juggle his ISE classwork, activities in the German Club and President's Roundtable, his position as Chairman of the Senior Engineering Class Gift, and his standing as an executive member of the Student Engineering Council. When not running around campus or studying late into the night, Jonathan also found time to squeeze in a few rounds of golf.

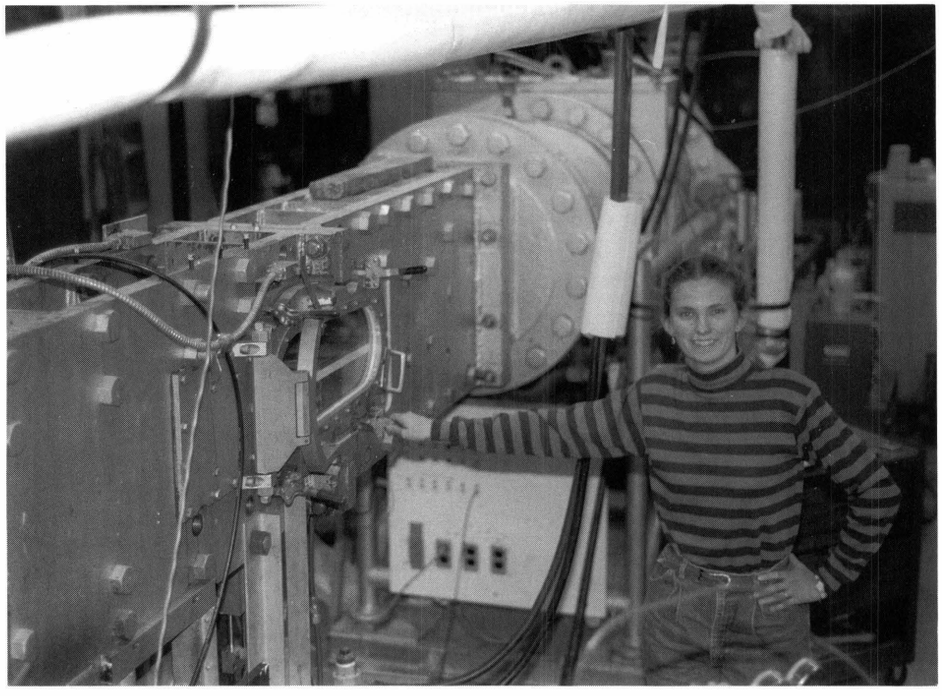
As we say good-bye to Jonathan, we wish him the very best of luck for a rewarding career and a future filled with high performance sports cars, sailboats, a date with the fashion model of his choice, and a set of magical golf clubs.



Editor Jonathan Hess is ready to graduate and enter the "real world."

Virginia Tech student named to 1992 All U.S.A. Academic First Team

Susan Cox, a senior in aerospace engineering, has been recognized for her achievements by *USA Today.*



Susan Cox alongside the Virginia Tech Supersonic Wind Tunnel in Randolph Hall.

by Christine Curran

A few months ago, Virginia Tech aerospace engineering student Susan Cox achieved quasi-celebrity status when she was featured in the January 31, 1992 issue of *USA Today*. The reason for this sudden fame was that Susan had been named by the newspaper to the 1992 All U.S.A. Academic First Team.

Cox was nominated for this award through the Virginia Tech Honors Program Office and was chosen by *USA Today* from over 1200 undergraduates across the country who were nominated in a similar way. Twenty finalists of diversified curricula were named to the team. Along with the newspaper article, finalists received a trophy, a $2500 scholarship and a trip to Washington D.C. that included tours of the White House and the *USA Today* facilities.

The application process for the award included an essay on what each applicant perceived to be his or her most significant contribution to society. Susan wrote her essay about one of her outstanding achievements during a co-op term at NASA Wallops Island Flight Facility. She was asked to look at a payload designed for upper atmospheric testing that was thought to be aeroelastically unstable. After close inspection and careful research, Susan was able to redesign the payload in a way that proved to be stable. In fact, she reports that her redesign has since been manufactured and will be launched sometime this spring.

Of the other finalists, Susan says they are by far the most interesting group of people with whom she has ever come in contact. The goal of the "All U.S.A. Academic First Team" is to honor a group of outstanding undergraduate students across all curricula who have the potential to make significant contributions to society. Only two of the finalists were in engineering disciplines. Three were Rhodes Scholars. One finalist had taken a year off from school to do volunteer work with Mother Theresa of Calcutta. One was a Vietnamese boat person who has had to struggle to get where he is, but still has found the time to do volunteer work with sick children in hospitals. These people did not fit the profile of your average college student. In fact, one of the winners was a sixty-six year old grandmother who triumphantly reached her long-time goal of earning a bachelor's degree this past December.

Like these other finalists, Susan Cox is an above-average student who does more than just go to class, do homework, and take tests. One of the things that sets her apart is the experience she has gained through the co-operative education program at Tech. Through her work at Wallops Island, Susan has gained considerable experience with real-world aerospace engineering applications. During her first term at the NASA facility, Susan worked in the Flight Vehicles and Systems Section. Here, her tasks included conducting ground-fixed tests of sounding rockets and testing parachutes with wired transmitters. Her second work term was with the Performance and Analysis Section, also doing tests with sounding rockets. During her third and final term, Susan worked with the Balloon Projects Branch doing various studies on weather and other balloons.

Susan says she recommends the co-op program to up-and-coming engineering students because she has found it to be a pleasant and educational experience that prepares you for the engineering profession in a way that classroom study simply cannot.

Susan is also very active during her school terms here at Tech. In addition to taking a full load of classes each semester she participates in professional and honor socie-

See Cox, page 13

Virginia's budget and bond turmoil

House and Senate face-off over alternate plans

by Keith Wieber

Recently, budget cuts in everything from the arts to public libraries have been proposed by Governor Douglas Wilder as a method to bridge the $567 million gap between state tax revenues and state needs. The problem that Virginia's lawmakers face is that there is little agreement on the state's most crucial needs and even less consensus on how to raise the money to meet them.

Two major tax plans have been introduced to the assembly by House Finance Committee Chairman, Richard Cranwell, and Hunter Andrews, Vinton and Senate Finance Committee Chief. Many other senators and delegates have proposed smaller tax bills of their own. Presently, legislators are challenging Wilder's proposal which calls for employee layoffs, cutbacks, and new taxes on hospitals and nursing homes to close the ever so burdensome gap in the $28 billion budget.

When college students from several universities learned of the proposed cutbacks they decided to voice their concern to the legislature. Approximately 75 college students traveled to Richmond to attend a meeting of the General Assembly. A few spoke before the House Appropriations Committee, while still others talked with representatives about the problems in higher education. The rest of the students from Radford University, Virginia Tech, the University of Virginia, William and Mary, and other institutions, were in attendance to support their fellow schoolmates. Many of the students of these universities complained that there is an increase in tuition and a decrease in services, and higher education is not the priority it should be.

The Senate passed a $594 million bond issue for colleges, mental hospitals, and parks which is over half the size of the bond issue approved by the House. Governor Wilder supports the Senate's package which demands repayment of the bonds without new taxes. The House's version, under Richard Cranwell, would borrow $1 billion and increase the sales tax by one-half cent in order to repay it. After voting for and passing the necessary tax increases, the House decided to partially rewrite the state's $28 billion budget when it was discovered that there was a $1 billion surplus in the state retirement system.

Governor Wilder had promised to veto any bond proposal which uses higher taxes to finance new state facilities. Even though the Wilder package was passed unanimously in the Senate it was defeated by successive votes in the House. The House's package failed to be voted on by the deadline in the Senate, thus eliminating its passage. This set the stage for a stalemate between the House and Senate. Virginia Tech and other state institutions are apprehensive about the possibility of the General Assembly abandoning a bill to borrow money for building projects.

Many of the students of these universities complained that there is an increase in tuition and a decrease in services, and higher education is not the priority it should be.

With the House and Senate deadlocked, Governor Wilder submitted three new borrow and build plans for state facilities to the General Assembly, that were virtually unchanged from those originally rejected by the House. House Speaker Thomas Moss of Norfolk, a 26 year veteran, stated "This is the most contentious session I've seen since I've been in the General Assembly."

With the introduction of the new plans by Governor Wilder, the House and Senate finally approved a package that will be submitted to voters for approval in November. All three issues in the school, park, and mental health package were readily approved with the closest vote for park bonds, which passed the House 58-41.

Under the approved bond Virginia Tech would acquire a new engineering and architecture building, and renovations would be made to Preston library and barracks at Virginia Military Institute.

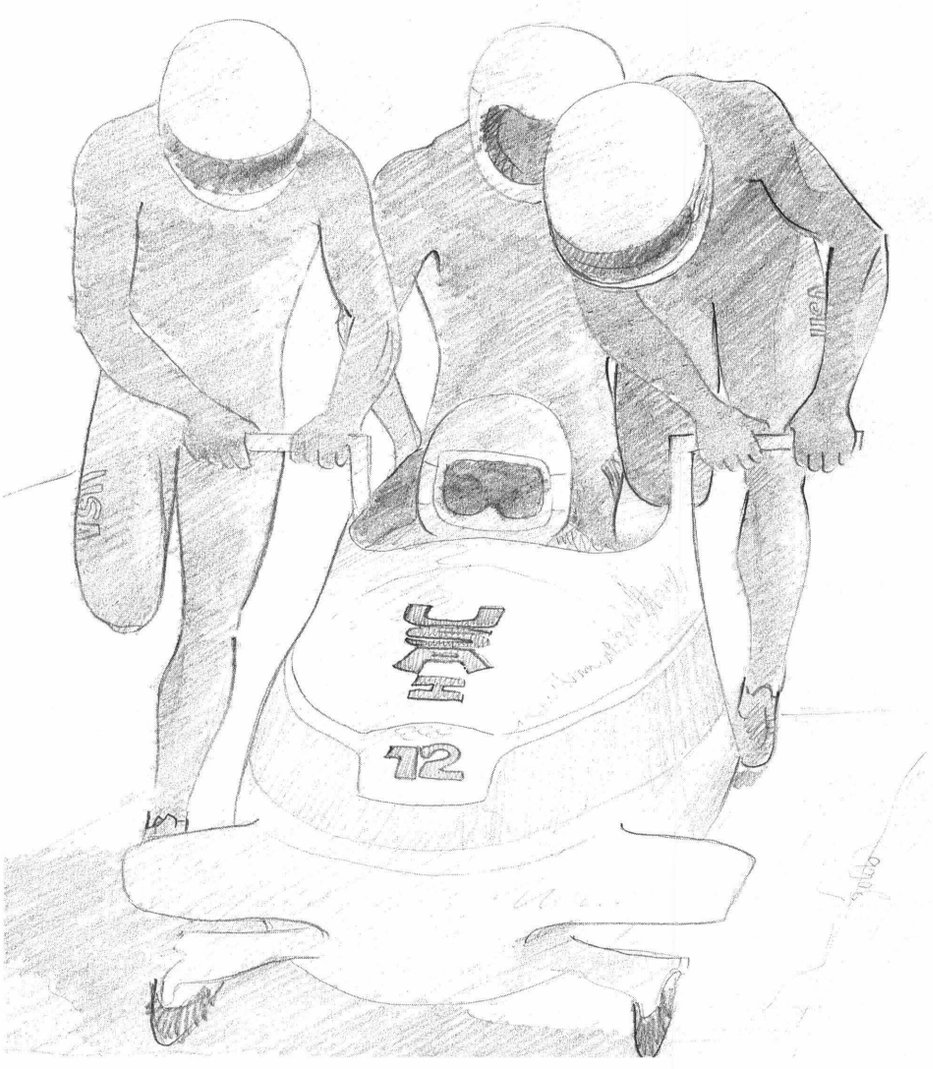
U.S. bobsled team given push by students

by John Cole

Three Virginia Tech students have been involved in a hands-on engineering experience since high school, working on improvements and modifications to bobsleds used by the U.S Olympic team. One of the most captivating sports this year in the Olympics, and one that garnered a lot of attention, was the bobsled race. The addition of Herschel Walker to the team, competing alongside people who had been in the sport for years gave bobsledding a lot of publicity, and raised people's hopes for the team in this year's Olympics.

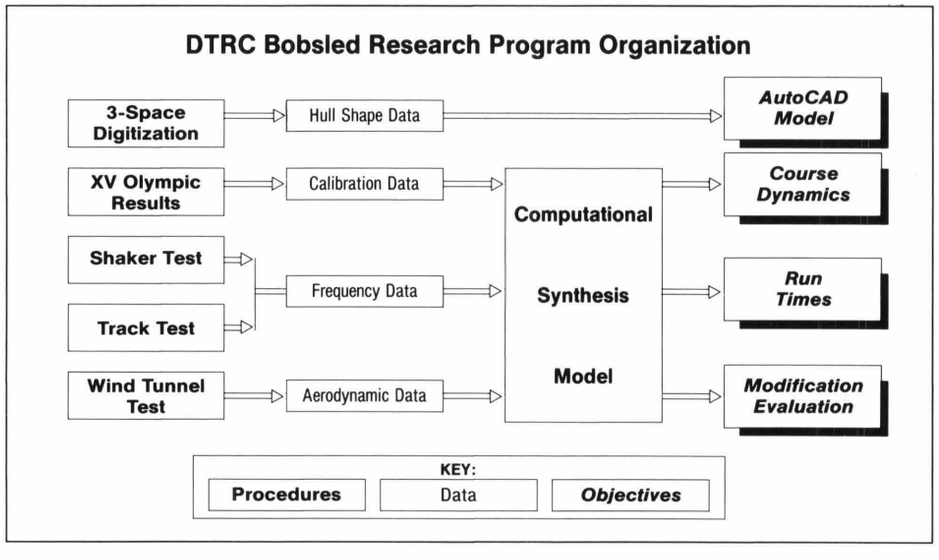
However, the two-man bobsled team finished a disappointing seventh in the standings and Walker was kicked off the four-man bobsled team, which also had a disappointing finish, placing ninth.

Now we must look forward to 1994 in Lillehammer, Norway, and focus on improvements. Three students here have been actively involved in changes to the bobsled itself that were used a little this year, and will be mostly used in 1994.



USA 1 sledders Randy Will, Joe Sawyer, Karlos Kirby, and Chris Coleman take off at the start.

They are freshmen Dan Ancona and Dan Sheridan, and sophomore Steve Chandler. During high school, they worked on the design of the bobsled at the David Taylor Research Center in Bethesda, Maryland, studying such things as how to reduce friction on the sleds and lowering drag and resistance of the sleds. They worked with the president of the bobsled club, Kevin Lynaugh, and Bob Ames. Both men are Naval Architects.



The George Washington University/ Department of Defense Science and Engineering Apprenticeship Program, as it was called, began in the summer of 1990. Four two-man Olympic bobsleds were brought to the research center for testing. After seven weeks of data collection, a computational model of the system was developed. The program was used to analyze the run times and what factors could help improve sleds, such as the drag coefficient, or the push time to get the sled started. One of the sleds was equipped with accelerometers and an onboard computer but was only used a little

See Bobsled, page 13

AND THE WINNER IS...

The Sporn Award is the latest award in a long history of awards and accomplishments for Dr. Paul E. Torgersen.

by Lee Fuglestad

The Sporn Award is an honor bestowed annually on a professor who has exhibited teaching excellence in the College of Engineering. Teachers are nominated by their students. The award is for a professor that goes the extra mile to ensure that their students really do understand.

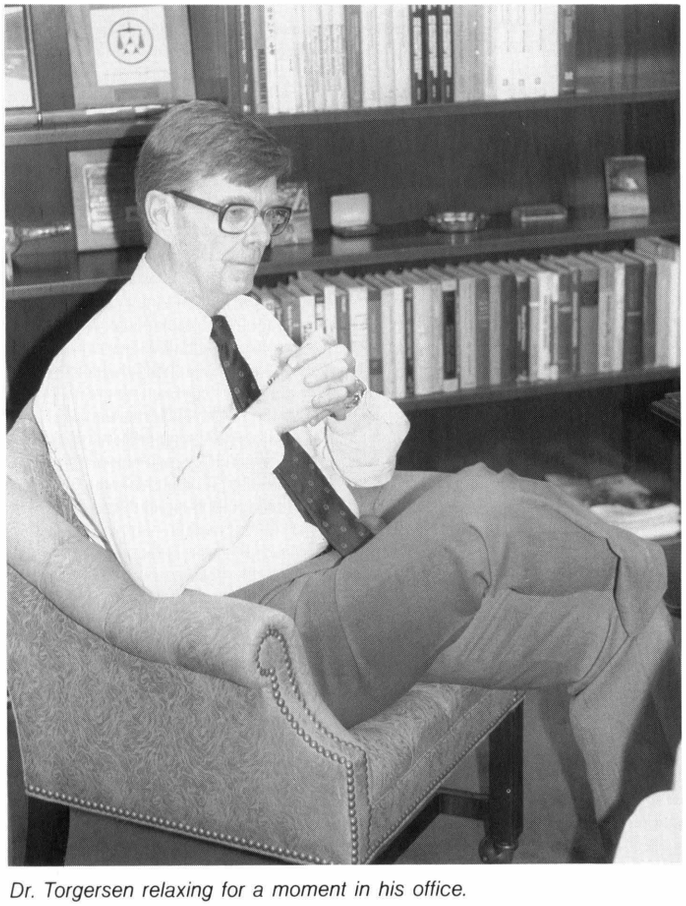
This year's recipient is Dr. Paul E. Torgersen, who is the John W. Hancock, Jr. chaired professor of industrial and systems engineering. He received a B.S. in industrial engineering from Lehigh University, and went on to receive a M.S. and a Ph.D. from Ohio State University. He has taught at three universities since his teaching career began in 1959. He first taught at Ohio State, then Oklahoma State. In 1967 he moved to Tech as the head of the ISE department.

Besides winning the Sporn Award, Dr. Torgersen also received the Oklahoma State College of Engineering Outstanding Teacher Award in 1963 — two teaching excellence awards to a man that "backed into teaching." He has won countless other awards for his work, in and out of the classroom.

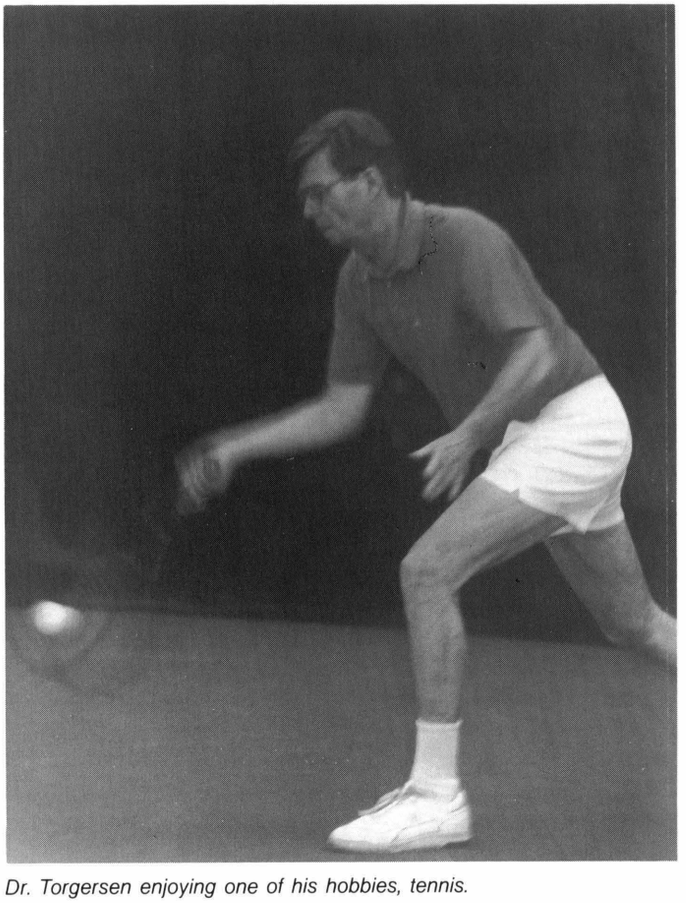
Teaching is not the only active roll that Dr. Torgersen has had at Tech. For 20 years he was Dean of the College of Engineering. In those 20 years he gave out more than half of all of the engineering degrees awarded at VPI. As if Dean of Engineering wasn't enough he served as Interim President for eight months in 1988 before President McComas became president of the university.

Throughout his busy career, Dr. Torgersen always found time to teach. Even now, while he is the director of two major companies and president of Tech's Research Center, he continues to teach. He is teaching a senior level course on organizations. Teaching is the profession he has held longer than any other. He considers the greatest reward to be helping a student learn a subject that the student once thought insurmountable. This is an accomplishment that has no monetary value, only a personal reward.

In his free time Dr. Torgersen enjoys playing tennis; he began his college education with a tennis scholarship to Lehigh University. Dr. Torgersen has given many contributions to the College of Engineering and his students, and he rightfully deserves this token of appreciation from his pupils.



Dr. Torgersen relaxing for a moment in his office.



Dr. Torgersen enjoying one of his hobbies, tennis.

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 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 net-

work. 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 then a book. Presently there is a group which is converting classic novels and other works into electronic editions.

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.

Researchers at CNS look over routes of fiber optic wire to be laid for the Electronic Village.

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 communication 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 phone-mail about a new epidemic or about changes in results of a test. The problems of inefficiency and large costs would be brought back under

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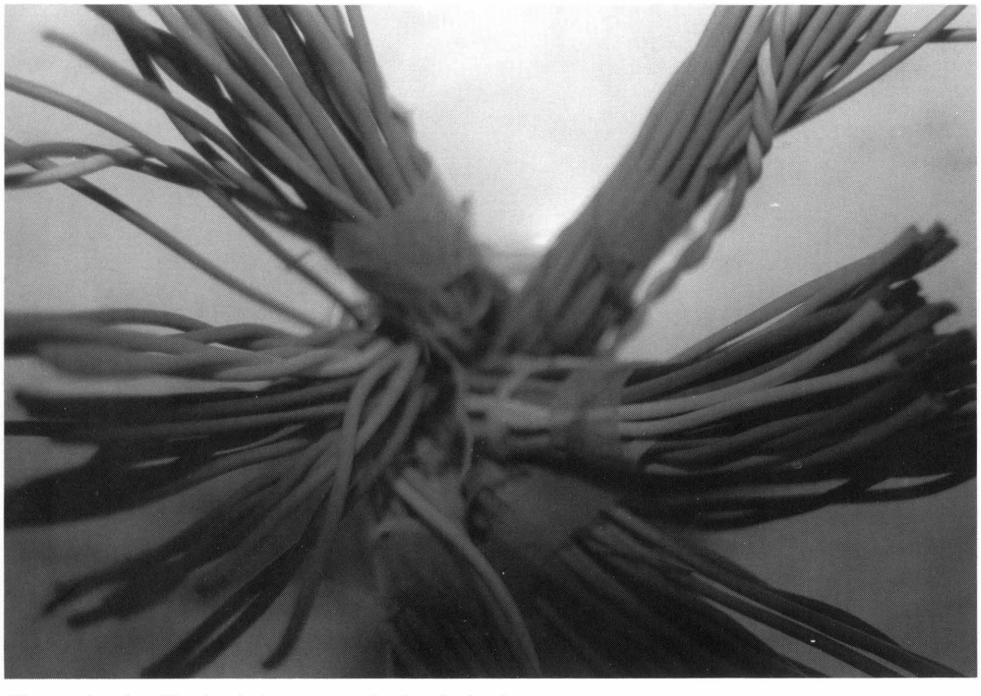


Fiber optic wire: The basis for communicating in the future.

Continued from previous page
control with electronic transmission of information.

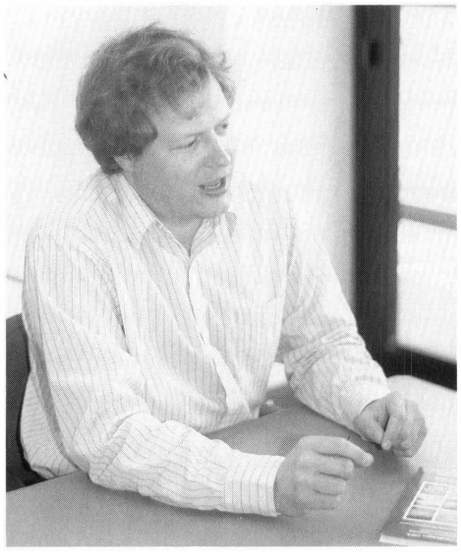
Patients who live in a rural setting, such as Blacksburg, will not have to suffer because of the lack of medical knowledge concentrated in the area. A general practitioner could consult a specialist about the unusual symptoms of a certain patient.

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 communication 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 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.



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, copy the literature, 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.

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 Wiencko. Tech 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. 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 the 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 be best utilized.

Though the project is more of an application design, technical research will be done. 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 definitely 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 will 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 a 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 than communication services will be affected. Education will be more proficient. Businesses will expand into new territories, and more people will be able to receive 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.

The route of the professional engineer

The road to becoming a professional engineer is fraught with many perils, such as the numerous engineering classes and the difficult Engineer In Training exam.

by Omar Khan

The professional engineer, commonly abbreviated as P.E., truly must exemplify their profession to become classified as "professional." A professional engineer is defined by the Commonwealth of Virginia State Board of Architects, Professional Engineers, Land Surveyors, and Certified Landscape Architects as "a person who is qualified to practice engineering by reason of his special knowledge and use of mathematical, physical and engineering sciences, and the principles and methods of engineering analysis and design acquired by engineering education and experience.

That person must also comply with the requirements for licensing as determined by the board. The board consists of three architects, three professional engineers, three land surveyors and two certified landscape architects. In addition, the board members must have practiced or taught their professions for at least ten years before they serve their four year term.

First of all, the "engineer in training" must have passed "approved engineering curriculum." Approved engineering curriculum is classified as four years or more of engineering curricula recognized by the board of the state you are applying for license.

Second, the engineer must obtain at least one reference from a professional engineer or departmental professors indicating that the engineer in training is approved to take the "engineer in training exam," abbreviated as the E.I.T. The E.I.T exam takes eight hours in one day to complete. The E.I.T covers, in depth, the fundamentals of engineering. A review of about three months or more is recommended for these exams. In addition, there is a nominal fee to take the exams.

Third, the engineer must then intern for at least four years or more before they can take the "principles and practice of engineering" examination. The examination gives specific problems of applications of engineering principles.

After the tests and internship then the "engineer in training" becomes a "Professional Engineer." However, the new P.E. has new duties and ethics by which he or she must abide. The fundamental cannons of professional engineers are the following:

1. **HOLD PARAMOUNT THE SAFETY, HEALTH AND WELFARE OF THE PUBLIC IN THE PERFORMANCE OF THEIR PROFESSIONAL DUTIES.**
2. **PERFORM SERVICES ONLY IN AREAS OF THEIR COMPETENCE.**
3. **ISSUE PUBLIC STATEMENTS ONLY IN AN OBJECTIVE AND TRUTHFUL MANNER.**
4. **ACT IN PROFESSIONAL MATTERS FOR EACH EMPLOYER OR CLIENT AS FAITHFUL AGENTS OR TRUSTEES.**
5. **AVOID IMPROPER SOLICITATION OF PROFESSIONAL EMPLOYMENT.**

The ethics are strongly enforced by National Society of Professional Engineers Code of Ethics for Engineers.

To become an engineer is a difficult task; to be a professional engineer is to go two tasks farther.

Editor's Note: *Professor Cevat Kardan, a professional engineer of mechanical engineering, of Virginia State University provided sources for this article.*

Expert systems use computers to simulate human experts

Expert systems represent an advancement in computer systems, in that they incorporate such human aspects as opinions, rules of thumb, and decision processes.

by Grady Koch

A knowledge based expert system is a form of artificial intelligence that allows specific expertise to be programmed into a computer. Expert systems in a computer represent some of the expert opinions, rules of thumb, and decision processes that an expert uses to solve problems. The goal of an expert system is to produce a computer program that can solve problems just as well as a human expert could.

Expert systems are useful for solving problems with complex social or physical constraints. These complex problems can't be solved easily using traditional programming methods. Tasks such as planning, legal resoning, medical diagnosis, computer configuration, and military planning often demand the knowledge of an expert.

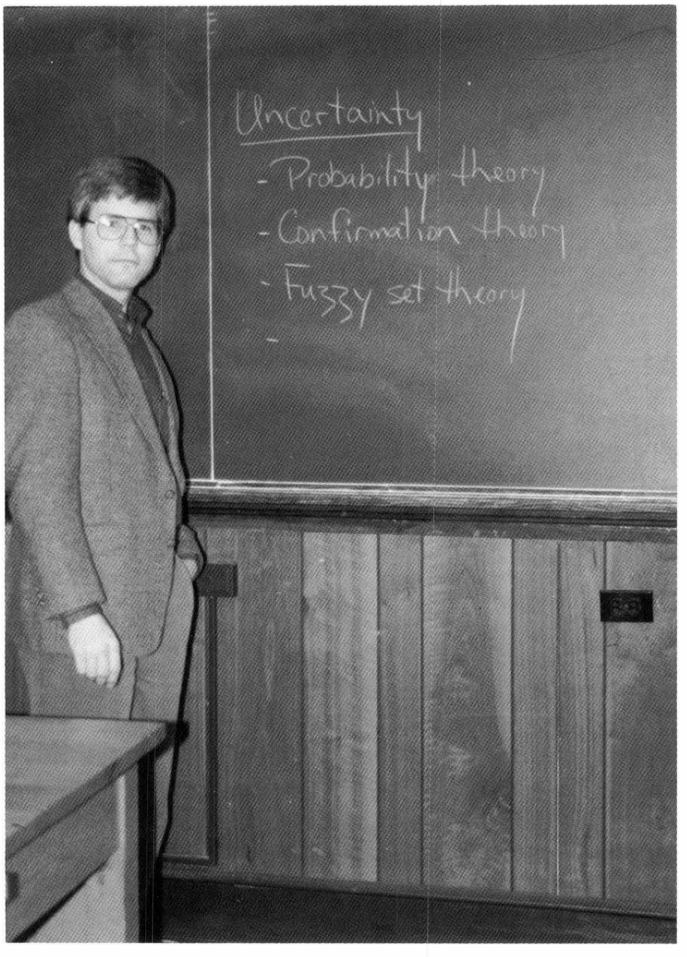
Expertise consists of knowledge about a particular field, understanding of problems in the field, and skill at solving these problems. There are two types of expert knowledge: public and private. Public knowledge consists of definitions, facts, and theories that are published in textbooks and reference books. Private knowledge consists mainly of heuristics (rules of thumb). Heuristics allow the expert to make educated guesses and to deal with incomplete or erroneous data.

The difference between a database, in which information is simply stored, and an expert system is that the expert system can put the information into a form that allows the computer to perform algorithms. The methods or algorithms that an expert uses are hard to define and don't follow a strict procedure. Expertise includes the ability to look at the overall picture and recognize patterns and relationships that may not be obvious to non-experts.

An expert system contains at least two components. First is the knowledge base, in which specific knowledge is stored as facts and rules. Second is an inference procedure which performs logical inferences and applies rules to facts until the given problem is solved. Expert systems are often made by beginning with a program called a system shell.

System shells provide an array of background tools to build the program. An expert system shell is similar to a spreadsheet in that the shell is the framework into which the user inserts information for a specific problem.

Specific expert systems are then created by entering specific information into the knowledge base. Dr. Conrad Heatwole, a Professor of Agricultural Engineering at Virginia Tech, teaches a graduate course in expert systems entitled Knowledge-Based Systems. Students in Dr. Heatwole's class learn principles of knowledge aquisition and knowledge engineering. Each student is required to develop an actual expert system.



Dr. Heatwole discusses the theory behind expert systems.

Expert systems are quite useful in agricultural engineering. Agricultural engineering addresses many problems in nature such as natural resources, environmental issues, and biological systems. Natural systems involve many variables and conflicts and therefore often require the capabilities that an expert system can provide.

A Virginia Tech graduate student has developed an expert system for selecting rice varieties to be grown in Sri Lanka. The user simply responds to a series of questions asked by the program about management processes and field questions. In return, the user is told the most appropriate rice variety. About 25 improved rice varieties have been developed with this program for Sri Lankan farmers.

Cox

Continued from page 4

ties such as AIAA (American Institute of Aeronautics and Astronautics) and Sigma Gamma Tau, which is the aerospace national honor society. Her most prized activities over the years, though, has been her involvement with the Wesley Foundation, Tech's Methodist student group. She is currently serving as student secretary and has, in the past, chaired committies on admissions, publicity and newsletter and participated in activities such as traveling with the singing group and doing volunteer work in conjunction with the Montgomery County Christmas Store.

Susan reveals that her experience with engineering so far has been quite positive. From an early age she knew she was headed toward engineering due to her interest in the areas of math and science. She delighted in science fiction fantasy but also enjoyed learning about things that were tangible and hardware-oriented. The thing that "propelled" Susan towards aerospace engineering was some volunteer work that she did in conjunction with the State of Virginia Governor's School at NASA Langley while she was in high school. There she had an opportunity to work on a conceptual design of a third generation aerospace plane. She has been aerospace-oriented ever since. Being a woman in engineering has not brought special treatment of any kind for Susan, positive or negative. She feels well accepted by all of her classmates and has not had any significant problems in dealing with the teaching staff. She appreciates the fact that she is treated as an equal at school and on the job. In fact, being a woman in engineering simply means to Susan that "there's just a shorter line for the bathroom."

Being a woman in engineering has not brought special treatment of any kind for Susan, positive or negative.

What's next for Susan Cox? Well, after graduation this spring she plans to go on to earn a master's degree in aerospace engineering with concentrations in fluids and propulsion. The graduate schools she is considering include Virginia Tech, M.I.T., and Cal Tech. But for this summer, she'll go back to Fort Blackmore, Virginia, to be with her family on their 200-year-old farm. She says she needs a break and for the next three months all she wants to do is work in the garden, milk cows, and drive tractors. More power to her — she deserves the break.

Bobsled

Continued from page 6

before it was rendered undriveable due to an unrelated malfunction in the sled's steering.

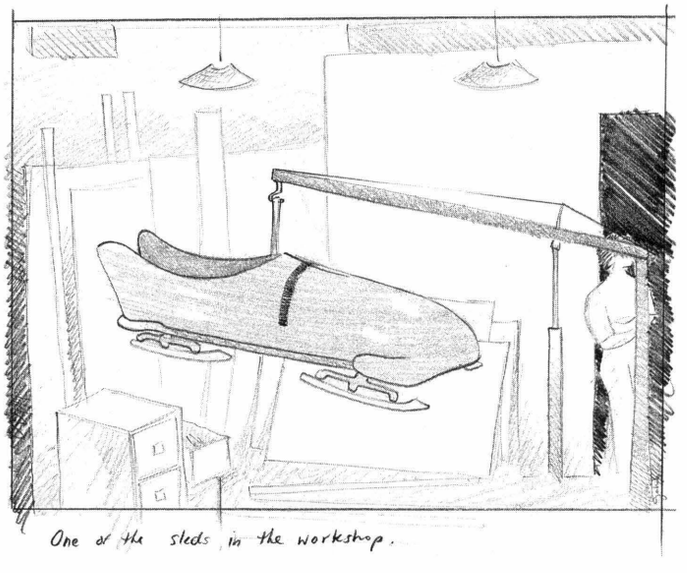
In September 1990, work began in the Research Center on a synthesis model. Data about the track at Utah and data on the track at Lake Placid where the U.S. bobsled team practices was obtained. In addition, information about the sleds' performances at the 1988 Olympics, in Calgary, was obtained from videotape and transcribed. An AutoCAD model was set up using the data about the hull shape. The calibration data from the Calgary Olympics, along with frequency data from tests in the lab, and aerodynamic data from the wind tunnel test made up the computational synthesis model. The computational model was used in analyzing course dynamics, run times, and modifications to be made to the sleds. Wind tunnel testing was also done that summer to find drag, pitch and lift for the sleds. Work was also done with the moments of the sleds.

Four two-man bobsleds were brought to the research center for testing.

Using the data and the computer programs, possible modifications were analyzed and formulated. An example of an important finding is that a .01 reduction in the co-efficient of kinetic friction could theoretically cause a two- to three-second improvement in speed. That is especially important when you consider that the seventh place U.S. two-man bobsled finished .69 seconds behind the winning Swiss sled over four runs.

The data also proved how critical the start is, with optimum speed coming through a faster initial speed combined with a shorter push time than had been achieved on previous runs. They even analyzed the best paths through the turns of the courses.

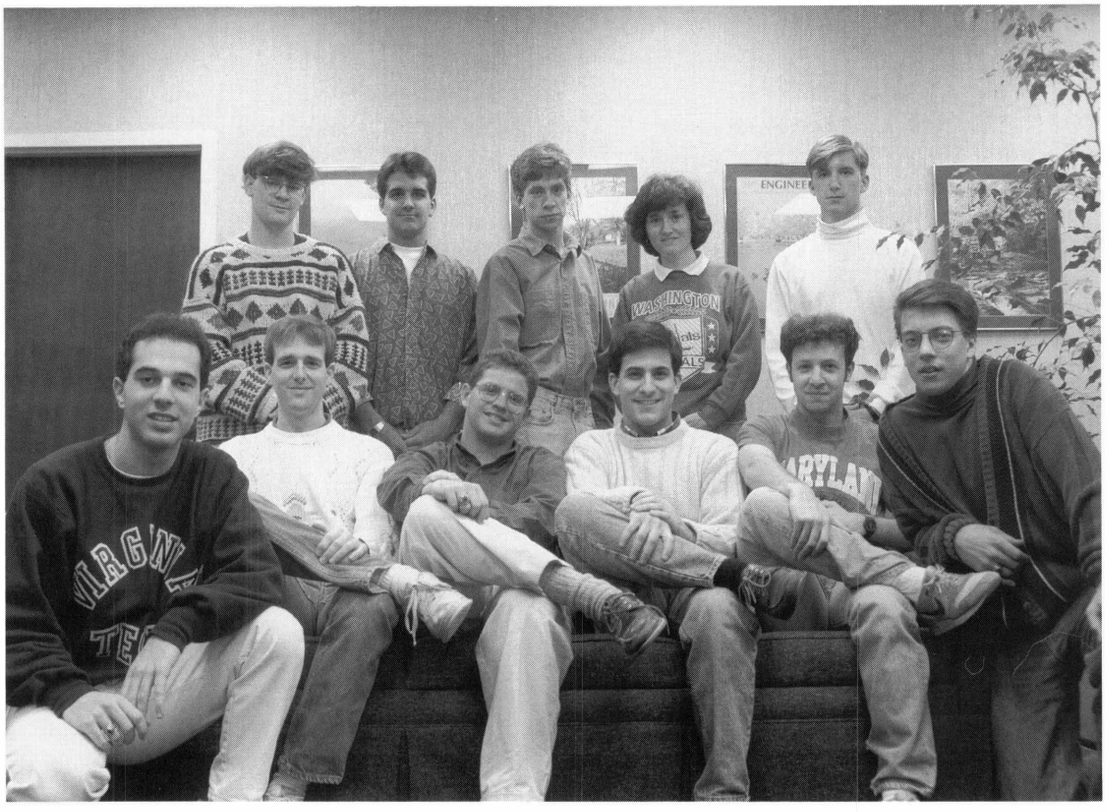
A few minor changes were used in the sleds in Albertville, but the main changes will come in time for the bobsled races in Lillehammer, Norway in 1994 and the Olympics in Utah in 1996. Although the students' future involvement in the project is unclear, their contributions have already been utilized.



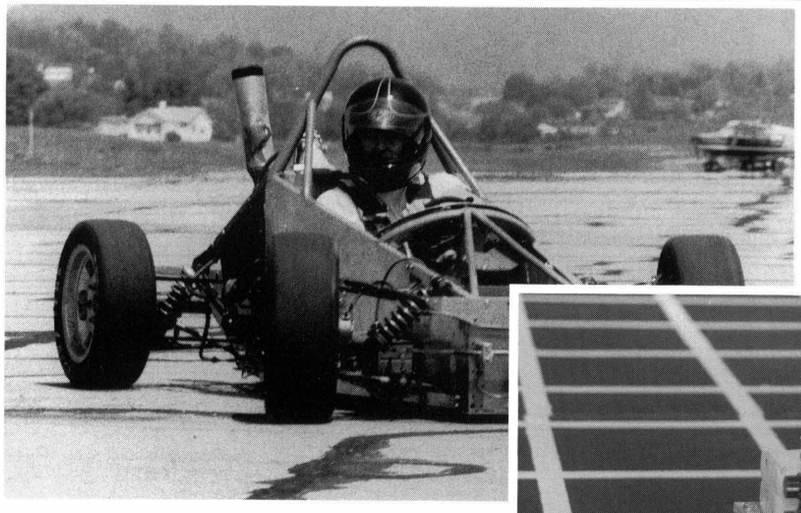
One of the sleds in the workshop.

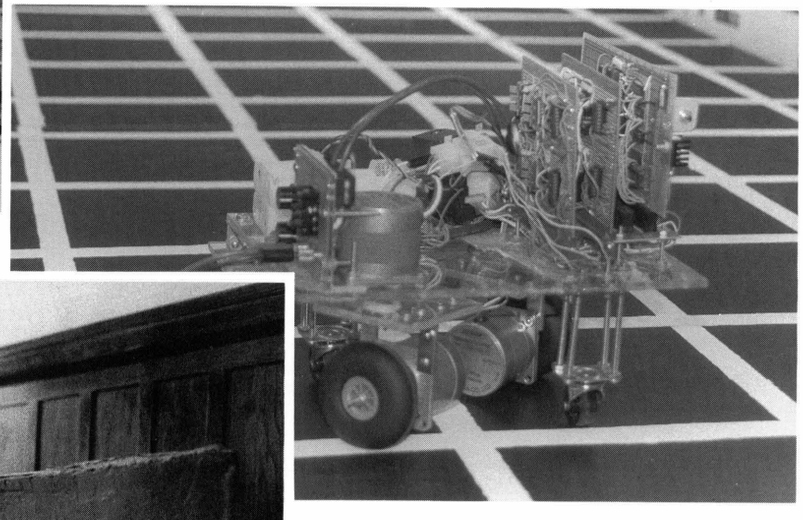
1991-92 Engineers' Forum staff

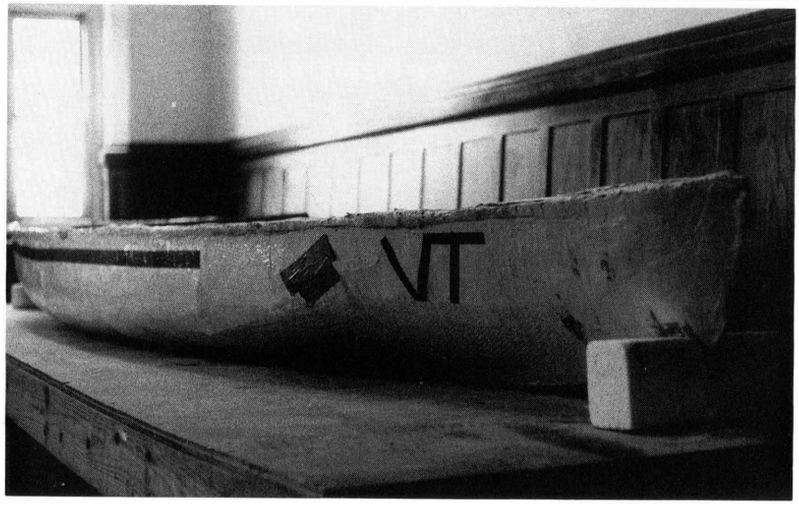
Seated, l-r: Mark Cherbaka, Howard Kash, Jonathan Hess, Tony Giunta, Aaron Golub, and Brian Pritham. Standing, l-r: John Cole, Steve Payne, Mike Reese, Christine Curran, and Keith Wieber. Not shown are Andrew Predoehl, Omar Khan, Lee Fuglestad, and Lynn Nystrom.



Coming this fall...







Design and Conquer

A Bit Of Tech Trivia

by Stephen Payne

1. Where is the Virginia Tech Fog Research Center?
2. One lap around the drillfield is what fraction of a mile?
3. What is the exact acreage of the drillfield?
4. What are the names of the two creeks flowing underneath the drillfield?
5. Which major on campus has given out the most BS degrees in Virginia Tech's history?
6. Who is the President Emeritus of Virginia Tech?
7. Exactly how many seats are there in Cassell Coliseum?
8. The drillfield sinks how many inches every 10 years?
9. Which department at Virginia Tech is the only one in existence in the country?
10. When was the Virginia Tech Honor System established?
11. When was the first female admitted into the Corps Of Cadets?
12. How many Tech Alumni have won the Congressional Medal Of Honor?

ANSWERS:

1. Mountain Lake 2. 8/10 of a mile 3. 22.3 acres 4. Stroubles and Goose creeks 5. Mechanical Engineering 6. T. Marshall Hahn, Jr. 7. 9,876 seats 8. 3 inches every 10 years 9. Anaerobic Microbiology 10. 1908 11. 1973 12. 6 (two were brothers — the only blood brothers ever to win the medal)

ENGINEERS

It might be a nuclear sub or a billion dollar aircraft carrier, at the Norfolk Naval Shipyard you can provide engineering support for the maintenance and testing of the most sophisticated technology in the world. Hands-on experience will challenge your personal creativity, stimulate and enhance your engineering knowledge, and accord you a good measure of responsibility on important projects.

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