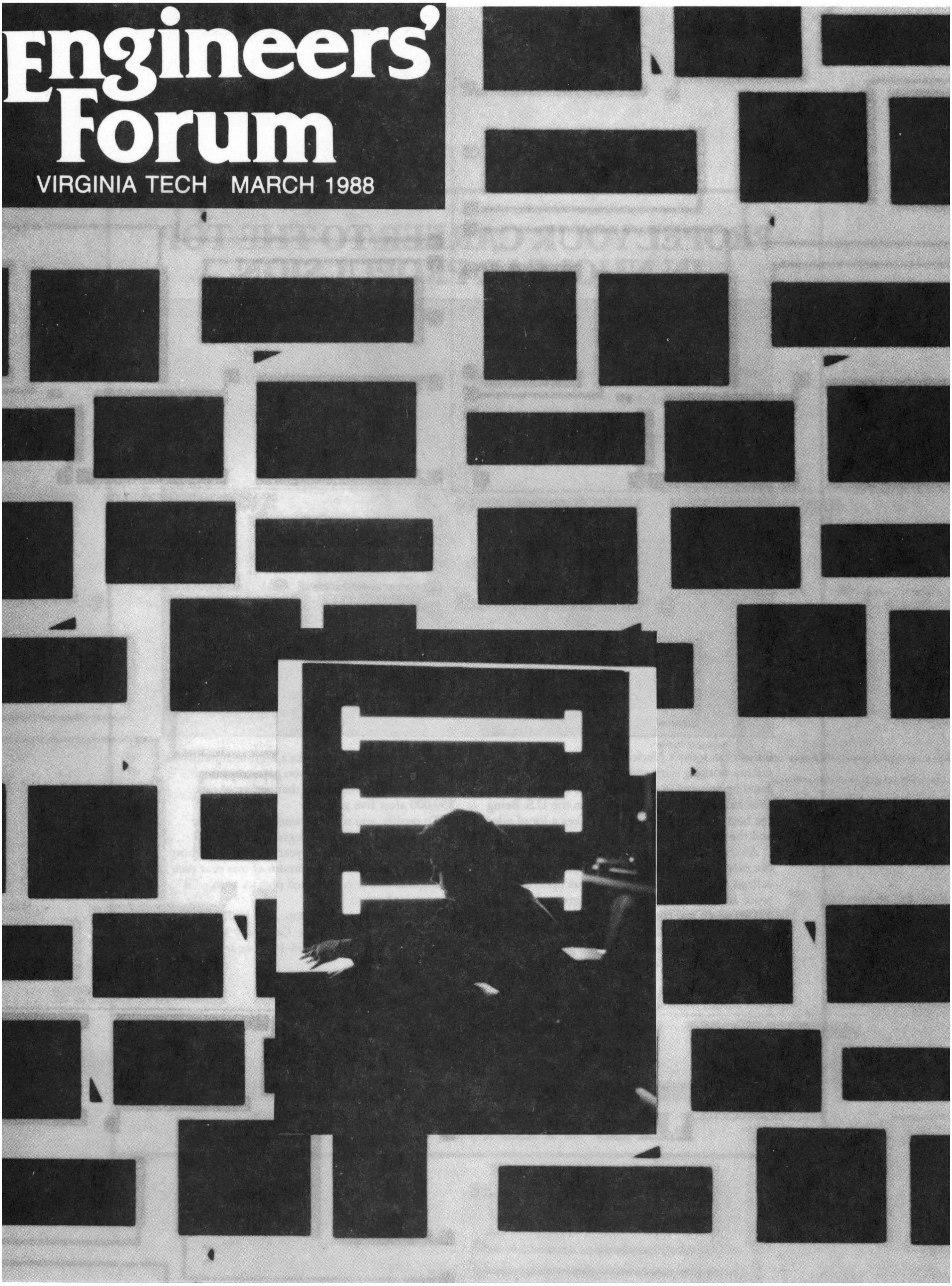
Engineers' Forum

VIRGINIA TECH MARCH 1988



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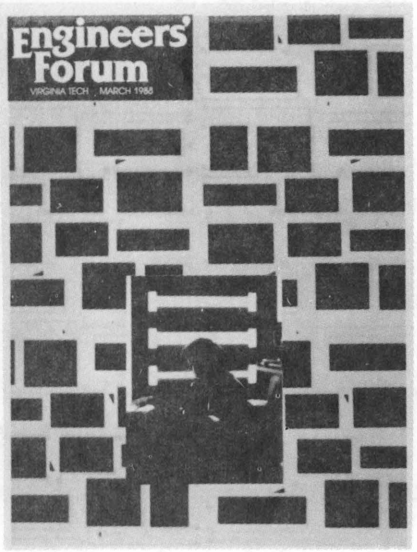

On the Cover:
Julie Feil, a junior in EE, is silhouetted in the hybrid microelectronics darkroom. The image behind her will be reduced to fit a 1 in. x 2 in. ceramic substrate like those in the background.
Photos by Theresa Gidley.

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Engineers' Forum

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March, 1988

Nodiplomaphobia

The night before graduation: You can't sleep. Three quarters of your extended family is sprawled out and snoring on the floor of your apartment. But that's not what's keeping you up.

You're taking this time to reflect on your four (okay, five) years in Blacksburg, the classes you barely passed, the ones you didn't, the friends you have made, the groups you've been in, the job offer you thought would never come through. But neither is this the cause of your insomnia.

It's not that you're afraid of standing in front of thousands of people while your name is called. It's not because you're going to miss Blacksburg, Greek's Cellar, or Pandapas Pond.

No, you suffer from nodiplomaphobia. Everyone gets at least a touch of it. We joke about it most of the time, but tonight it gnaws on your brain like two shots of cheap tequila. Even the curve-busters worry that inside their folder, instead of a diploma, will be a blank sheet of white Xerox paper. And a four dollar parking ticket.

It's a fear based on your suspicion that after residing in Blacksburg for four years and taking over sixty classes, you may have overlooked something. Maybe the incomplete you had to take one quarter wasn't properly completed. What if your advisor goofed? What if you owe the library 50 cents? Or what if that Sociology class wasn't approved the year you took it. It had been approved the year before, but...

"Go to sleep!" you startle yourself by speaking out loud. You've been through your graduation checklists hundreds of times, paid all your parking tickets, settled up library fines... Was there anything else? The gnawing starts again.

Alex Derr
Editor and Insomniac

Theresa Gidley

HENDERSON HALL OF HORRORS: An Introduction to Interviewing

by Lauri Benz

This is not a helpful advice column. If you need helpful advice, go to the Placement Office and pick up the current issue of *Careers* magazine. It has the same upbeat, warm-hearted advice as the last one did. And the one before that... It will have tips on dressing and foiling "trick" questions and so on. This is a column to give underclassmen, who haven't interviewed yet, some idea of what an on-campus interview is really like.

A student generally arrives at the interview waiting room about ten minutes before the interview is supposed to begin. This extra time gives interviewees a chance to visit the restroom several times to remind themselves that they do indeed look professional. But the real reason is that it takes ten minutes to get used to the Placement Office's tropical climate.

The waiting area is filled with students wearing dark suits and clutching imitation-leather folders with little brass corner-guards. These folders usually contain extra copies of the interviewee's Life Story, otherwise known as a resume. All folders are the same thickness — thick enough to look important but not so thick as to look cluttered. As the half-hour mark nears, older people dressed in dark suits (but without the ubiquitous imitation-leather folders) emerge from the hallways, and each one calls out an student's name. The chosen student rises and shakes hands with the interviewer who mumbles his or her name. The interviewee, concentrating fiercely on giving a firm handshake, often misses the interviewer's name entirely.

The next adventure is trying to find the interviewer's cubicle. Ideally, the interviewer will lead the way through the maze of narrow hallways, but an occasional interviewer will be courteous and allow the student to go first. This gives the interviewer a chance to see how the interviewee can handle working under a minimum of direction, and gives the interviewee a chance to worry about whether or not one's suit can still look professional with a few wrinkles in it.

Once the interviewer and interviewee are safely seated in the cubicle (which is about the size of a largish bathtub), the interviewer asks one of the Standard Icebreaker Questions: "So, why did you choose engineering?" (not too hard), "So, why did you come to Virginia Tech?" (medium), or "So, tell me about yourself..." (eep!). The trick to these questions is being able to candidly answer each of them in thirty seconds or less without hesitation.

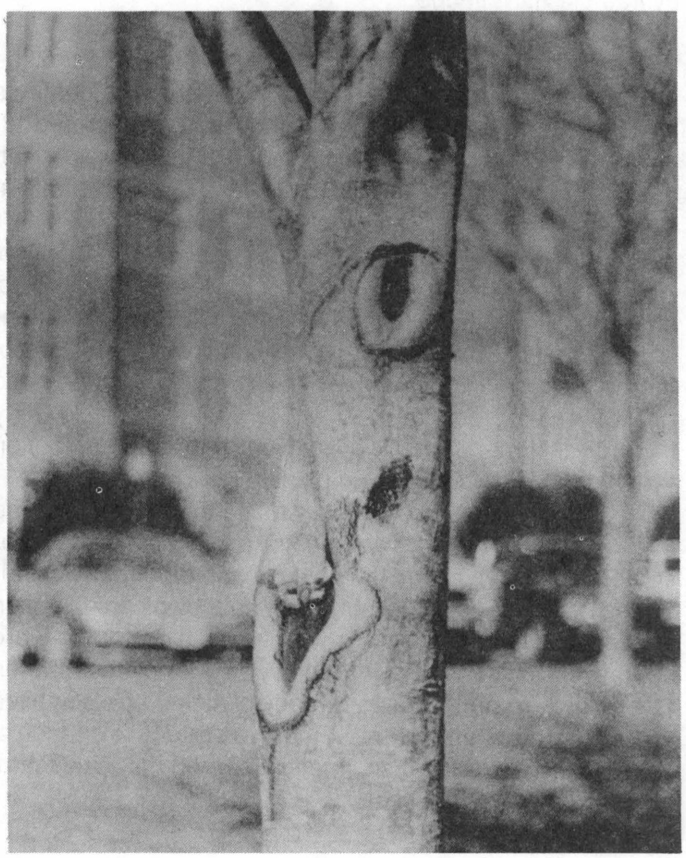
Most interviews last for about twenty-five minutes. The tone is usually conversational, but the interviewer is often interested in the form, not the substance, of the answer. An interviewer looks for composure, a straightforward problem-solving attitude, and plain old-fashioned common sense. Panic can obscure the presence of these qualities, but self-confidence can partially compensate for deficiencies. Interviewees must therefore be careful not to panic.

When the interview comes to a close, there is another handshake and a cordial goodbye. The interviewer spends the next five minutes writing like mad, in the human equivalent of a memory dump. The key word is "memory." An interviewer sees up to fifteen people in a day of interviews, and impressions begin to blend together after a while, so students must concentrate on being interesting. An animated conversation, punctuated with anecdotes and examples, is considerably easier for the interviewer to remember than a series of "foolproof" stock answers (lifted from the helpful advice columns) that the interviewer has already heard a hundred times.

That, in a nutshell, is an on-campus interview. Interviews are short; they may be a little scary; occasionally, one may even be a waste of time. However, interviewing is a fundamental part of the job search, and these screening interviews must not be taken lightly.

Interviewing is a learnable skill, and it gets easier after the first few times. As the helpful advice columns say: be flexible, be positive, but BE YOURSELF, and you'll do fine.

Good luck.



Theresa Gidley

COMPACT DISCS:
New Manufacturing Method Allows For Mass Production

Theresa Gidley

by Patricia A. Rutledge

If the high price and limited availability of compact discs still gets you down, good news is here. Recent developments in compact disc (CD) manufacturing have generated an economical method to mass produce CDs. As a result, ten new CD pressing plants will be producing CDs in the U.S. in 1988.

Included among the new manufacturers are JVC, Capitol /EMI, Denon, Discovery Systems, 3M, DuPont/Phillips, Shape Optimedia, Laser Video, and Warner/Elecktra/Atlantic. According to an article in the October 1986 issue of *Stereo Review,* the technology of CD manufacturing is so well developed that "anyone with a spare twenty to thirty million dollars — and a lot of patience and determination —can start up a CD pressing plant."

The compact disc resembles a "sandwich" containing three layers of different materials: a polycarbonate substrate, a reflective aluminum coating, and a protective sealing layer. The transparent polycarbonate discs are injection molded, and strings of binary numbers — 0's and 1's — are burned into the surface of the disc by a tightly-focused laser. The reflective coating, usually made of aluminum, is applied to the polycarbonate surface. Finally, a protective coating of acrylic resin seals the disc, and silk-screen machines print the label on top of the sealer.

Because the pits in a CD are smaller than most dirt particles, the entire process of CD manufacturing must take place in a special dust-free environment called a clean room. The process is completely automated but must be monitored continuously since timing and temperature control are crucial. The polycarbonate plastic arrives at the plant in the form of pellets. Care must be taken to keep dirt from entering the plant when the pellets are transferred to the supply bins. The pellets pass through a drying machine, since moisture can cause bubbles and blisters in the discs. A sealed conveyor belt carries the pellets to the pressing machines.

The pellets are heated until they melt, and the liquid polycarbonate is fed to the CD press. In the pressing machine (injection molder) the discs solidify, and the digitally-encoded data is transferred from the "master disc" mold to the CD in the form of tiny pits. The pressing machine completes one injection-molding cycle every 15 to 20 seconds. The mold is pulled apart and the disc removed. The freshly-pressed discs are scanned by laser for dust contamination.

Before the pits containing the binary data can be transferred from the master disc to the CD, the master disc must be prepared from a digital "pre-master" tape. The producer of a recording can supply the CD manufacturer with either an analog pre-master or a digital one. Both of these recording types can be converted to the digital CD sampling rate of

44.1 kHz. The engineer edits the tape, places silent segments (recorded as digital 0's) between the tracks, and adds the disc directory and subcodes, which tell the CD player which track the pick-up is reading.

The mastering machine burns the pits into the master disc while the pre-master tape is playing. This process is analogous to cutting lathes in an LP record stamper, but it is more precise. In addition, the mastering machine adds error-protection codes, scrambles the data, assembles the data, and converts the digital 0's and 1's to a laser-readable code on the disc surface. A CD player unscrambles the data and converts it to an analog signal to send to a receiver. The master disc is used as the mold for pressing the CDs, and each master disc is recycled after several weeks of use.

Since mastering is the most expensive step in CD manufacturing, additional techniques are being tested. One such method is the Teledec CD cutting process, which is 80 percent cheaper than the mastering method described above, and it does not require a clean room. Teledec uses "Direct Metal Mastering" (DMM) to electrolytically plate a blank disc with copper. A lathe is used to cut wedge-shaped pits in the disc. These pits are easy for the laser to read and provide improved error detection and disc molding. However, this process is still in the trial stage in the U.S.

After the discs are checked for contamination, robotic arms stack the discs on spindles so that technicians can collect them and take them to the reflective coating room. The aluminum coating is 50 to 100 nanometers thick and is applied by one of two methods. One method is vacuum deposition, in which a chunk of aluminum in a vacuum chamber containing racks of discs is heated until the aluminum vaporizes. The vapor condenses on the discs and forms an even coating. This process takes about 15 minutes. The second method is ion deposition. An ion gun in a vacuum chamber deposits the metal on the disc, virtually one atom at a time. Each disc is visually inspected for obvious defects before being sent to the automated testing devices. At this point, the discs are playable inside of the clean rooms.

Next, the acrylic seal is placed on top of the aluminum coating to protect the disc from scratches and oxidation. Ultraviolet light cures the acrylic to make the surface extremely tough and scratch-resistant. The disc is now complete and ready for labeling.

Each disc, not just a sample, must pass the final quality-control test. The CD is played at high speed in its entirety on a special purpose player. The machine looks for errors and checks the size, depth, and shape of each of over five billion pits. The final step is to package the discs in plastic cases which are often called "jewel boxes," or in blister packs, cardboard boxes, pull-tab plastic wrap, or other packaging as specified by the record company.

With the advent of this new manufacturing method as well as new developments in mastering, some manufacturers anticipate producing over 50 million CDs per year at a single location. Such an increase in CD production should be good news to CD fanatics as well as to those who are skeptical about the availability of their favorite music on CDs. As the new plants start up, competition among manufacturers should spark a decrease in CD prices. Overall, the ability to mass produce CDs has opened many doors for the CD market; meanwhile, the door for LP records is rapidly closing.

Answers to Picture Quiz:

Clockwise from top right:
Smyth
Williams
Cheatham
Saunders
Whittemore
Holden

THE LINN COVE VIADUCT: New Technology Saves an Old Mountain

by Alex Derr

On September 6 last fall, the final 7.5 miles of the Blue Ridge Parkway opened to the public. The highlight of this "missing link," by 25 years the last section to be completed, is a quarter mile viaduct whose serpentine concrete form winds its way up the side of Grandfather Mountain. From technological, economic, and scenic standpoints, the Linn Cove Viaduct is a grand finale for the Blue Ridge Parkway.

HISTORICAL BACKGROUND

The Blue Ridge Parkway was conceived in 1933. At that time, the Civilian Conservation Corps was building Skyline Drive in Shenandoah National Park as a make-work project. Virginia Senator Harry F. Byrd suggested that the road be continued down the Blue Ridge to connect Shenandoah National Park with Great Smoky Mountains National Park in North Carolina. President Franklin Delano Roosevelt liked Skyline Drive so much that he agreed immediately.

One reason this last section has taken so long to complete is that the land took a long time to appropriate. Normally, the National Park Service would decide the route it wished the road to follow, based on its criteria of aesthetics and utility. The state government would then secure a right-of-way on the land and construction could begin.

An eight mile long right-of-way for the Grandfather Mountain section, near Linville, North Carolina, was obtained in 1938. World War II halted construction, and when the war had ended, the National Park Service had become dissatisfied with the route. It wanted to build the road higher on the mountain. The owner of the land would not agree to this, and no compromise was reached for twenty years.

WHY A VIADUCT?

Environmental impact had become a matter to reckon with in this time. While the rest of the Parkway had been completed in low impact fashion, it was mostly due to the good sense of the Parkway's landscape architect. In this new era, integrity and experience had to give way to extensive studies. This is when a viaduct was dreamed up.

The slopes that the road must traverse are, in some places, very steep. In order to build a road on these sections, some of the mountainside must be blasted away. This encourages erosion which steep slopes with thin soil can not afford. One section of the missing link is particularly precipitous. To save its fragile ecology, the Park Service opted to elevate the road.

OTHER CONSTRAINTS

Following the aesthetic precedent of the Parkway, the Linn Cove Viaduct had to closely follow the contour of the mountain. Because of this, of the 153 eight foot long concrete sections making up the viaduct, no two are interchangeable, and only one is straight. Also, the viaduct maintains a steep (10%) grade.

Specially contoured supporting pillars were designed for the viaduct to enhance the aesthetics of the concrete piers. These eight-sided piers alternate concave and flat surfaces to capture shadows and sunlight in interesting patterns.

The toughest restriction, imposed by the Park Service, was that building the viaduct could not allow trampling the ground it was to span. In other words, it had to be built from the air. This presents some unique problems, most of which are due to gravity.

CREATIVE SOLUTIONS

Instead of building from the ground up, as is standard practice for bridge construction, the viaduct was built out from existing sections and then down to the next foundation.

First, pier foundations were set on the mountain. The Park Service conceded to let the contractors build a narrow timber work bridge to each pillar site so the foundations could be laid before the viaduct arrived.

Computer aided design was used to shape the roadway sections to conform to the shape of the mountain. The sections had to be match cast one at a time, at a facility off the mountain, to ensure that the curves would mate properly.- Then they were trucked up the mountain.

Construction proceeded as follows: A crane lifted a 50 ton section off the completed roadway, swiveled around, and positioned it on the open air end. After the new section was securely fastened to the previous one, the crane moved out and repeated the process.

When the span reached the next pillar location, the precast eight sided pier sections were lowered onto the foundation that had previously been built. In a typical week, only four or five roadway sections could be installed. It was a slow and expensive project.

THE PARKWAY TODAY: AMERICA'S MOST BEAUTIFUL HIGHWAY

21 million people visited the Blue Ridge Parkway in 1980 — as many people as visited Disney World. Tourist dollars now support hotels, restaurants, gift shops, and gas stations along the way.

The 470 mile Blue Ridge Parkway cost a total of $124 million. Although dollars were worth more when most of the road was constructed, the quarter mile Linn Cove Viaduct's $10 million final cost is still a disproportionate expense. What it represents, however, is state-of-the-art technology employed to protect a venerable old mountain.

Trivia Quiz

by Andrew E. Stalder

1. What is the weight of William 'The Refrigerator' Perry in stone?
2. Which current marque is credited with the construction of the first gasoline-driven automobile?
3. What is the Julian date for Christmas?
4. How long is Winter Quarter in femtoseconds?
5. In physics, a diagram describing the electromagnetic force between two charged particles is named for what Nobel-prize winning Cal Tech physicist?
6. FORTRAN was created by employees of what company?
7. Multiple Choice: Physicist James Clark Maxwell, who created four basic equations for electromagnetism, was of what descent? a) Croatian b) Scottish c) Latvian d) British e) Estonian
8. How many 24-hour libraries does Tech have (not counting exam weeks)?
9. If you were travelling 1.422 x 10^5 int'l leagues/year on route 81, would you be pulled over ?
10. What is the size of the center angle (in degrees) of a slice of pizza, assuming it was sliced correctly?
11. How many engineers were on the 1987 Super Bowl-champion New York Giants?
12. Leonard Nimoy, portraying science officer Spock on television's Star Trek, has formal training in what field?
13. What is the name of the spaceship which put the first man on the moon?
14. Where was the first atomic bomb exploded?
15. Multiple Choice: Tesla is a) a unit of magnetic flux b) Nikola Tesla, an early pioneer in the development of AC electricity c) a heavy metal band d) all of the above
16. What is 549 in hexadecimal?
17. Who invented the pneumatic automobile tire?
18. An automobile tire with a speed rating of 'Z' is capable of what speeds?

1. 22.14 stone
2. Daimler-Benz
3. 359; or 360 for a leap year
4. 4.67 x 10^{21} femtoseconds
5. Richard P. Feynman
6. IBM
7. b
8. 0
9. Yes; if not for speeding, for obstructing the rest of traffic travelling at 70 miles an hour!
10. 45 degrees
11. Three: kicker Raul Allegre (CE), offensive tackle Karl Nelson (EE), and nose tackle Jerome Sally (IE).
12. Physics
13. Apollo 11
14. Albuquerque, New Mexico
15. d
16. 225
17. John Dunlop
18. 149+ mph.

Theresa Gidley

VIRGINIA MOUNTAIN HOUSING: Building A Better Tomorrow For Montgomery County's Needy

By Patricia A. Rutledge

When the weekend rolls around, most of us look forward to a break from studying to enjoy our free time. Yet for some Virginia Tech students, the weekend is a time to reach out and lend a hand to the needy families in Montgomery County. These student volunteers participate in Virginia Mountain Housing's Volunteer Home Repair Program.

In 1974, students from the YMCA at Virginia Tech formed a volunteer program to help the elderly and low income families in the Blacksburg area repair their homes. The students spent their own time and money to fix homes that they saw were in need of repair. With the help of community leaders, organizations, and social service agencies, the students' efforts gave rise to a program called Project Home Repair.

Virginia Mountain Housing, Inc. (VMH), a private, non-profit corporation, was formed in 1979 by merging Project Home Repair with the Winterization Program sponsored by New River Community Action, Inc. In late 1980, when funding for the coordinator of the VMH program was cut, the home repair assistance came to a halt.

In October 1983, VMH was born again with the aid of the Montgomery County Ad Hoc Housing Committee, YMCA funding, Christiansburg Area United Way, Blacksburg United Fund Support, and other funding. The new housing program is called the Volunteer Home Repair Program, and its goal is to improve living conditions throughout Montgomery County. The Volunteer Home Repair Program provides free labor and assists in obtaining low or no interest loans and grants to home owners to pay for supplies. The program also accepts donations from individuals.

Student volunteers are needed to do the following types of work: patch roofs, repair and replace steps, build porches, build outhouses, scrape and paint interior and exterior walls, replace rotting floorboards, and sometimes cut fire wood. Workers are needed every weekend, and so are the tools, paint, and money for building supplies. Project Home Repair (sponsored by VMH and the Virginia Tech YMCA) had a Tool Drive on October 30-31 as part of the National Teach-in on Homelessness. The drive was a success, but basic hand tools and digging tools are still needed.

In addition, VHM completed a Housing Needs Assessment on November 7. The goals of the assessment were to collect information about the housing conditions in rural parts of Montgomery County, to identify those households

Tech Volunteers put the finishing touches on a home. They scraped and repainted the house for the elderly owner.

which are most in need of repair, and to give volunteers the opportunity to get first hand experience with people less advantaged than themselves. Support was also provided by the Virginia Office for the Rights for the Disabled.

During Fall Quarter, student groups such as Pi Lambda Phi, Pi Kappa Alpha, Sigma Phi Epsilon, Alpha Phi Omega, and the German Club worked with VMH on several different projects. One project was at the Pembroke School, which is an old elementary school that was converted into housing. The school is now known as S.A. Robinson Apartments and contains 27 apartments for low income elderly persons. The students scraped and painted a large part of the facility and cleaned out the old gym, among other jobs, in preparation for an Open House.

Other recent projects include building outhouses, shingling a roof, building new slopes to flat roofs, sheetrocking, putting in windows, cutting wood, repairing plumbing, and rebuilding a floor in a trailer. If your or your student organizations would like to help out, you should contact VMH at 930 Cambria St., Christiansburg, VA 24073. The phone number is 382-1935. For those who donate money and/or tools, all contributions are tax-deductible, and receipts are available.

So the next time a weekend rolls around, think about the needy families in the Blacksburg area and volunteer your time, money, and tools to help make Montgomery County a better place to live.

College-Wide Open House To Showcase Tech Engineering

by Ruth Bowman and Noel Schulz

The Virginia Tech chapter of Tau Beta Pi, the engineering honor society, is sponsoring the First Annual College of Engineering Open House on March 22, 1988 during Engineers Week. Instructional and research facilities in each of the different branches of engineering will be open for public tours. Tau Beta Pi is coordinating college wide events while student societies are working within each department.

Tau Beta Pi has invited university faculty, staff, and students, regional high school groups, local politicians, alumni, and our local community. Companies such as IBM, Hoover Color Corporation, Electro-Tech, Xaloy, Northern Telecom, and Hercules will be attending. Faculty members are also inviting their own industry representatives. Additionally, Tau Beta Pi will be host to over 150 public school children.

Students, faculty, and administrators have been working on this project for over six months. The organization of Open House is being accomplished by three committees: facilities, logistics, and publicity. The facilities committee is working with the departments on coordinating their individual presentations. The logistics committee is working with interdepartmental events such as registration, welcome booth, refreshments and campus maps. The publicity committee has mailed letters to industry representatives and area public schools. They will also work with radio, television, newspaper, and poster publicity.

In a recent memo to engineering faculty concerning Open House, Engineering Dean William Stephenson compared this project to Expo, sponsored by the Student Engineers Council. "Open House has similar potential and can be an important public relations vehicle for the college and its various departments," said Stephenson. During Open House, Dean Stephenson will open the hybrid microelectronics laboratory, which he directs.

Theresa Kennihan, President of the Student Engineers Council, reports that Virginia Tech will be the first university to have both an Expo and Open House. Tau Beta Pi hopes that Open House will help display the facilities that helped the Virginia Tech College of Engineering rank seventeenth among national engineering programs in a recent poll by USA Today.

This is a large undertaking for the College of Engineering and will require participation by many undergraduates, graduate students, and faculty. If you are interested in getting involved, please contact one of the following people:

Noel Schulz, Overall Chairperson, 953-0197
Ruth Bowman, Publicity Chairperson, 953-1892
Lane Hinkle, Facilities Chairperson, 951-1930
Elizabeth Walke, Logistics Chairperson, 552-7984

Chad Valentine

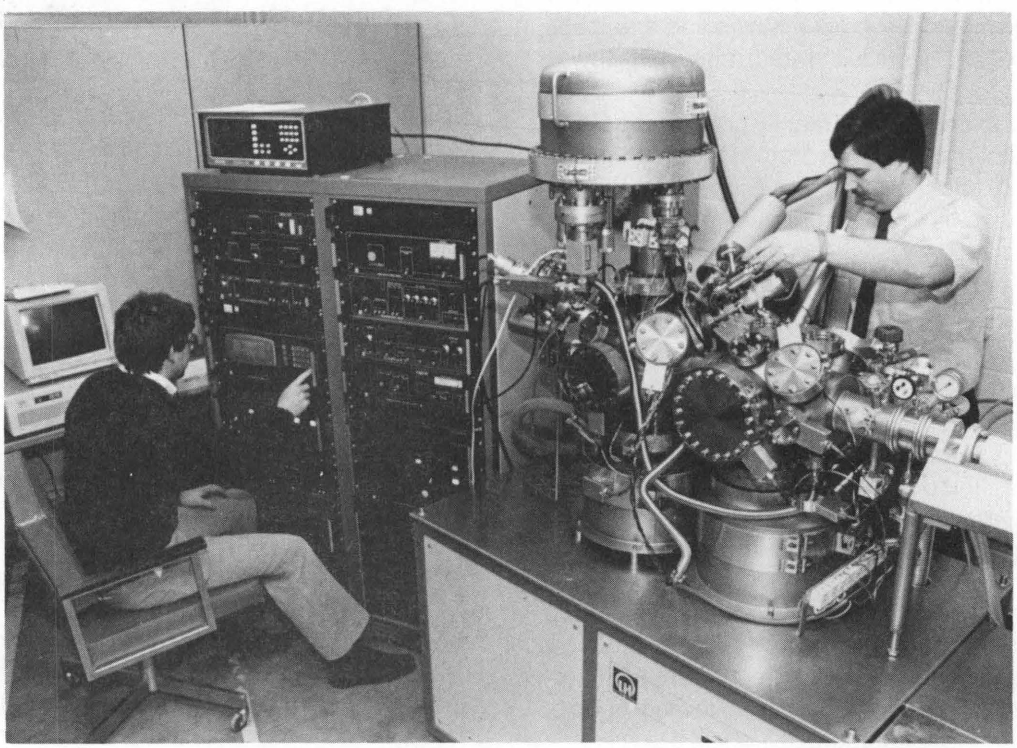
Acting Dean William Stephenson and Open House Chairperson Noel Schulz discuss the details of Open House. Stephenson, Director of the Microelectronics Lab, is showing his support for the event by giving tours of the microelectronics lab.

The following faculty members will be coordinating events in their respective departments:

Dr. Adel — Mining Engineering
Dr. Conger — Chemical Engineering
Dr. Crittenden — Engineering Fundamentals
Dr. Greene — Industrial Engineering and Operations Research
Dr. Heatwole — Agricultural Engineering
Dr. Hendricks — Materials Engineering
Dr. Marchman — Aerospace Engineering; Ocean Engineering
Ms. McWhorter — Electrical Engineering; Computer Engineering
Dr. Reinholtz — Mechanical Engineering
Dr. Sword — Engineering Science and Mechanics
Dr. Walker — Civil Engineering

Chad Valentine

Instructional facilities, such as the EE Microprocessors lab, will be open for public tours.



Chad Valentine

Dr. David Cox and graduate student Kirk Schulz of Chemical Engineering will be among the faculty and students displaying the research facilities during Open House.

THE RESULTS ARE IN... Summer 1987 Computer Survey

by Susan Jean Bazakus

Do you remember receiving a lengthy questionaire on your computer habits and an opscan form in the middle of the summer? The College of Engineering has mailed questionaires to a select number of its students each summer since the freshman PC program began to help determine its effectiveness. Questions range from "How many hours per week did you use your computer?" to asking your opinion on the quality of the issue of "Bits, Bites, and Nibbles" you received. The results of the survey have become available courtesy of Dr. Charles E. Nunnally, Assistant Dean for Engineering Computing.

Each entering freshman engineering student since the Fall of 1984 is required to have their own personal computer. Through an arrangement between the College of Engineering and IBM, engineering students can purchase a variety of PC'S and software at discount prices.

The software included in the packages varies from word processing to programming, and meet most of the requirements presented within the curriculum. Instructors and students alike have become familiar with the many applications of the PC at their disposal and many classes are structured to enable the student to use the computer to help solve complicated engineering problems as they may later do in the workplace.

Approximately 1,628 questionnaires were returned by students from the classes of 1987-1991. Of those with departmental assignments, responses consisted of 30 computer engineering students, 9 AGEC, 119 AE, 50 CHE, 98 CE, 38 ESM, 271 EE, 112 IEOR, 31 MATE, 213 ME, 15 MINE, and 12 ocean engineering students.

ENTERING FRESHMEN — CLASS OF 1991

870 entering freshmen responded. Most of them had had some experience with computer languages and usage. The majority of entering freshmen had worked on, in descending order, Apple, Tandy, and IBM computers at their high school. The majority had been exposed to computers between fifth and tenth grade.

Either at home or at school, almost all had used BASIC. PASCAL had been less popular, and FORTRAN was at the bottom of the list.

CLASSES OF 1988, 1989, AND 1990

Most of these students prefer BASIC to FORTRAN, but use FORTRAN the most. Over 70% hadn't used their Turbo PASCAL, but 80% had used their CAD KEY package. Only 5.3% admitted they had never used their Volkswriter.

GRADUATING SENIORS — CLASS OF 1987

Only 25% of the graduating seniors had owned a PC, but 84% recommended the computer requirement for future classes. The majority of this "PC-transition" group felt a definite trend toward utilizing computers in their courses.

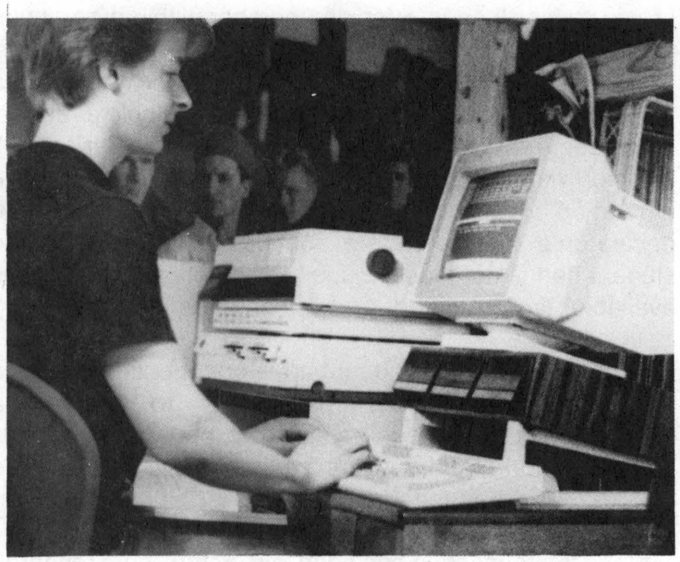
77% had used FORTRAN 77 to do the majority of their programming work related to class, and most of these students also preferred FORTRAN. Most graduating seniors used the free software available in the labs and spent less than $25 for software during the prior four years.

Most of the transition group members felt that "a general knowledge of personal computers" helped them in their job search.

In all the classes, computers were used mostly for word processing and for playing games. The Engineering Fundamentals classes were the most computer oriented.

SUMMARY

These aren't all of the results. As many of 67 questions were asked of each class. Most of your classmates have put their PCs to good use, but a few of you have not. One thing is certain:The computers are here for better or for worse, and if you don't learn how to use yours, it will probably be for the worse.



Theresa Gidley

Chris Modin, a freshman engineer, and a hacker by necessity.

UNDERGRADUATE RESEARCH: A Hidden Opportunity

by Ken Giles

Ask a typical engineer if he or she would like more work to do, and you will be physically and/or verbally abused. The engineer's goals are usually immediate: to get an 'A', maintain that QCA, or pass a burdensome course.

Unfortunately, in the pursuit of these ends, a student may miss a valuable opportunity outside the normal course of study. Undergraduate research provides such an opportunity. By researching a topic of interest within an engineering discipline, a student can increase his or her knowledge in depth and in breadth. Obviously, this will help both in the classroom and on the job. A researching student can be more than a "classroom engineer," and apply knowledge to more than just homework and tests.

So, then, just what is undergraduate research? As stated in the Virginia Tech General Catalog, it consists of "individual research projects carried out by students under faculty supervision." It can be counted as a senior level elective with variable credit of up to six hours. But you do not have to be a senior in order to do research. As the name implies, it is intended for all undergraduates. Even freshmen should be thinking about possible research that he or she might like to do in the engineering field.

Many students either are not aware of the research opportunities available or may be unsure of how to go about becoming involved. Usually a group of students with a common interest, or an individual student who desires to do study on his own, will go to a faculty member within a particular field of study who has openings for research by students. Most often, a student comes to the professor with an idea but, occasionally, a professor will make available a request for students who want to participate on a particular project.

Either way, once the student and the professor have agreed on doing some sort of research, the next step is to decide on a specific project. Sometimes, the idea that the student had is not feasible due to conflicts with resources available, time required, and acceptance by the hosting instructor.

If the idea that the student had is unacceptable, a topic agreeable to both parties is usually easy to find. Once a definite project has been established, many other details need to be worked out, such as credit available, approximate time required, frequency of meetings, and number of students required on a project (if applicable).

When the foundation has been laid, actual topic research begins . Many hours of work are required on even the simplest of projects and much time will be spent in the library and in the labs. This requires commitment, patience, and dedication on the part of the student.

The student must keep in mind that the host professor is simply the individual's mentor he or she is responsible for directing, guiding, supervising, and helping the student through rough waters, not to do the work. The load and responsibility rests on the shoulders of the student and the quality of the results is in direct proportion to the amount of hard work and enthusiasm that he or she invests towards the project.

Though much hard work, time, and effort is involved, the benefits of undergraduate research outweigh these minor inconveniences tremendously. First, the student will establish important ties to the engineering faculty and often to other professors and individuals outside of the engineering field as well. This allows him or her access to a great wealth of tutoring, advising, and counselling resources not accessible to the classroom engineer.

In doing research on a particular subject, one will gain first hand experience in the laboratory and will develop laboratory and data-gathering techniques that will be valuable for both during school and in one's career. Undergrad research also helps one to sample a potential major, allowing one to decide on a particular major before it becomes too costly.

Research is often done on topics at the forefront of technology; consequently, a student will be able to have a hand in unraveling and studying new and interesting developments within a particular field. Sadly, this type of experience is not possible in the classroom environment. Finally, research gives one a direction and a focus for his or her education. This focus can allow a student to appreciate more fully his or her academic experiences.

Here is a partial and in no way comprehensive list of faculty that currently have opportunities for research, along with their field of specialization. Please consult your academic counselor for additional references.

Dr. Richard Claus — Optics
Dr. John McKeeman — Computer
Dr. Charles Bostian — Communications
Dr. Fred Lee — Power Electronics
Dr. Kwa-sur Tam — Power
Dr. A. A. Riad — Hybrid Microelectronics
Dr. William Davis — Radio
Dr. Douglas Luse — Computing and Control Theory

The earlier on in your academic career that you become involved in such pursuits, the more of these advantages you will realize and reap. Research is a fundamental part of the successful engineer, and undergraduate research is a vital part of this engineering college (whose purpose is to cultivate successful engineers). It is an opportunity that can yield many positive and rewarding results; sadly, it is not utilized by the majority of Virginia Tech engineers.

The initiative rests with you, and your future depends on your willingness to take that initiative, surge ahead, and do something productive. Undergraduate research is an opportunity that can be passed up but, if taken, can only give benefits in return.

MIDI for the Masses

by Martin Gendell

For those who've seen the movie "Amadeus," you'll remember the scene towards the end where Mozart is ill and bed-ridden. Salieri, the man responsible for our hero's illness, is in the room with Mozart while the latter is spewing off the different parts of what will be his last piece of work. Salieri is astounded at how Mozart's mind can work so effortlessly as he struggles to comprehend and keep up, trying his best to transcribe every note leaving Mozart's mouth...

Of all the scenes in the long movie, this one is the one I remember best. While Mozart's body suffers from both mental and physical ailments, there seems to be a part of him that's still healthy. His timeless creativity and musical genius are unscathed by the mortal illnesses. If only we could've somehow captured his mind — his soul — in a machine. No, the electronic music industry hasn't yet found a way to capture a persons creative genius on a floppy disk, but it has some pretty powerful alternatives.

Now, try to imagine a similar scene where Mozart is sick in bed. But instead of Salieri transcribing the notes, Mozart has a Yamaha KX88 keyboard controlling a bank of digital sampling synthesizers, while an Apple Macintosh computer faithfully records the notes to a 30 megabyte hard disk. While recording the first violin part, Mozart decides he wants to hear what the flutes are playing at that point. With a few clicks on the Mac's mouse, the computer directs the synths to play the flute parts he recorded the day before. Satisfied, he returns to finish the violins. By the end of the day, the entire symphony is safely magnetically stored. Tomorrow, he will do a little editing, ask the computer to transcribe the parts to the correct key for each instrument, and print the entire score on a 300 dots-per-inch laser printer.

Sounds pretty absurd, huh? But think about it! What if Mozart's, Bach's or Gershwin's talent had lived with today's technology at their fingertips. Who knows how many more pieces of music each could have produced. It would be like Einstein growing up with the theory of relativity already discovered and having his whole life to expand on it.

Perhaps we should get back into reality. I'm not supposed to be writing fiction. I'm simply trying to show the technology that exists today each of us can exploit. Today's music making means are rapidly becoming more powerful than the "star wars" technology. Improvements in both hardware and software make it easier to compose, edit, record, and reproduce music, and every day the price goes down.

Okay, so maybe you can't afford even a fraction of the equipment my fictitious Mozart used. But at a price tag of roughly fifteen thousand dollars, compared to what was available even five years ago, that equipment performs fantastic tasks.

Fifteen grand is probably just out of reach for most of us, myself certainly included (*Engineers' Forum* doesn't pay that well). But you don't need to spend that much to capitalize on the electronic music industry boom. Whatever your budget, you can buy something today that you couldn't have five years ago.

An industry that once marketed their products exclusively for the pro or semi-pro musician, has turned them into department store goods. For example, Casio offers a huge line of synthesizers costing anywhere between $30 and $3000. If sampling is what you're interested in, you can get a Casio sampling keyboard for around 100 bucks. Or, if you've just finished a co-op assignment and feel rich, you can buy a top quality sampler made by a company called Ensonic,

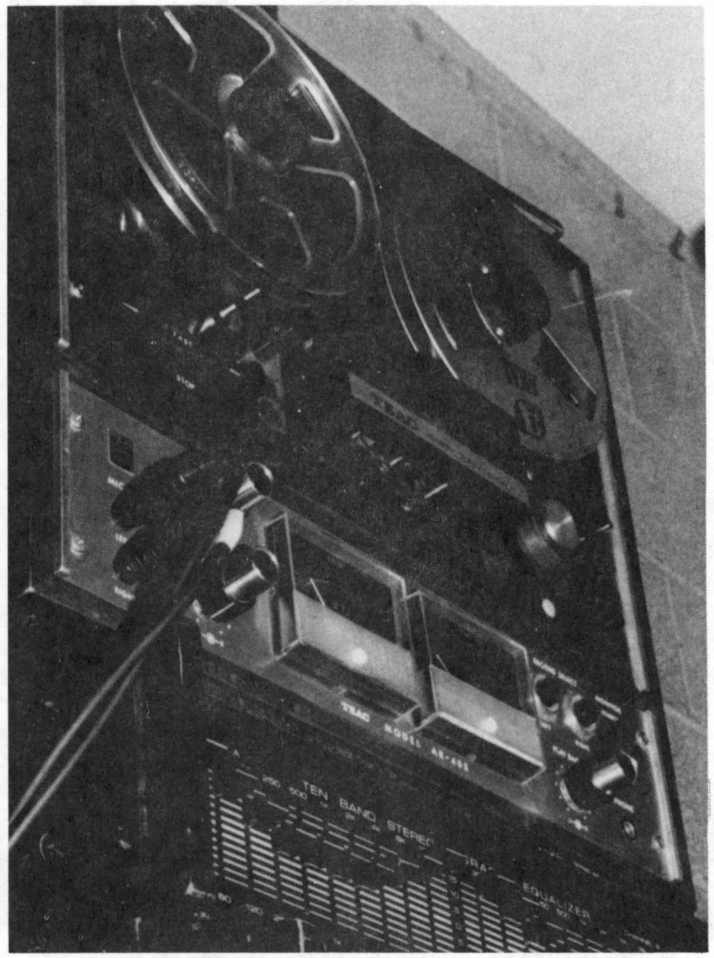
Theresa Gidley

starting in the $1400 price range. There are a whole range of companies manufacturing music making machines: Yamaha, Korg, Kurzweil, Roland, and many others, each offering a line of powerful instruments.

You say tickling the ivories isn't your thing? You play guitar or a wind instrument? No problem. Thanks to an industry standard called Musical Instrument Digital Interface, or MIDI (pronounced MID-EE) for short, that allows electronic instruments to talk to each other, companies have now come out with synthesized guitars, and wind instruments that hook straight into todays synths. Even xylophone players have specially designed intsruments that control synthesizers. All of these instruments play exactly like their conventional counterparts, so you don't have to make any drastic changes from the way you're playing now.

If you ever thought that the world of electronic instruments wasn't for you, or wasn't affordable, think again. There is a whole electronic world out there yet to be explored. With such a wide range of products and prices, all the barriers have been removed between you and the ones and zeros of digital music. I doubt even the great Mozart would pass up an opportunity like this.

Martin Gendell is a senior in Electrical Engineering who felt rich after a co-op assignment and bought a Korg DW-8000 synth. His other interests include graduating, driving a beat-up car, soccer refereeing, and wishing he had more money to buy stuff with.

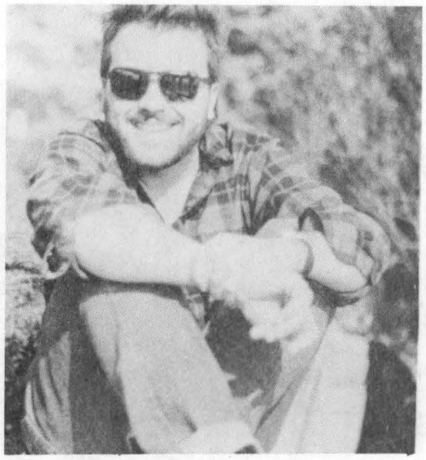


Theresa Gidley

Theresa Gidley

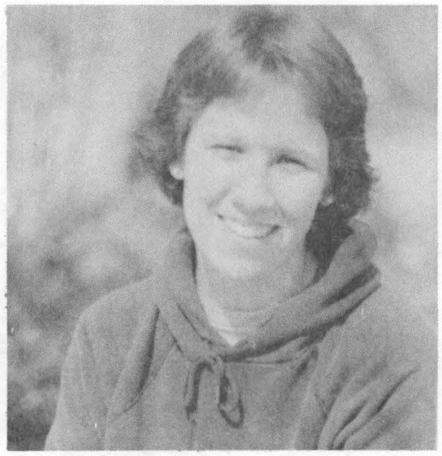
FORUM CARDS

Collect 'em all!
Trade with your friends!



Martin Gendell

"Up-beat music and beat-up cars."



Lauri Benz

"I'll get you for this."

Trish Rutledge

"Can't make the meeting — got another plant trip."

Theresa Gidley

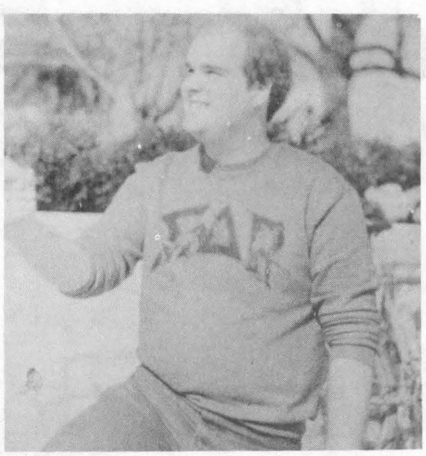
"Sometimes it's nice to be on the other side of the camera."

Susan Bazakus

"Today the Forum...Tomorrow the World."

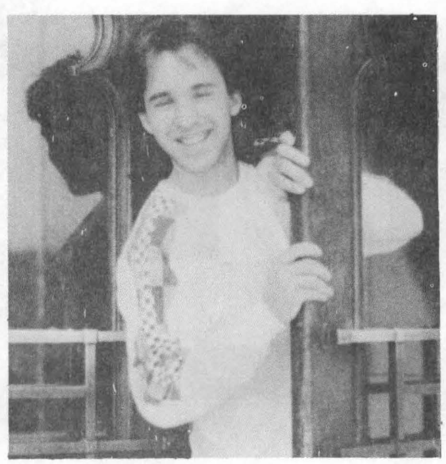
Alex Derr

"Don't let your kids grow up to be editors."



Chad Valentine

"Today, the Forum...Tomorrow, back ’o the Roanoke Times."



Andy Stalder

"This better not happen to me."

Karen Koger

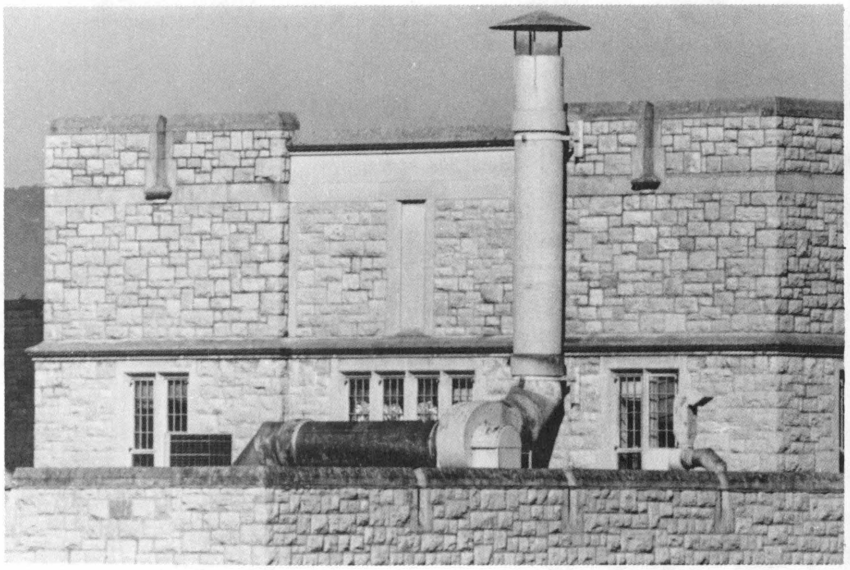
"Headlining Titleist."

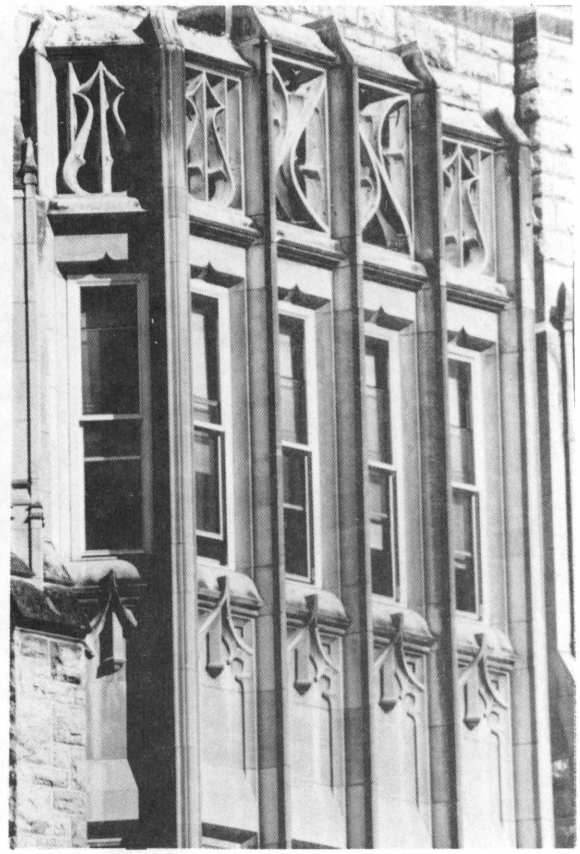
Photos by Theresa Gidley. Theresa's portrait by Chad Valentine.

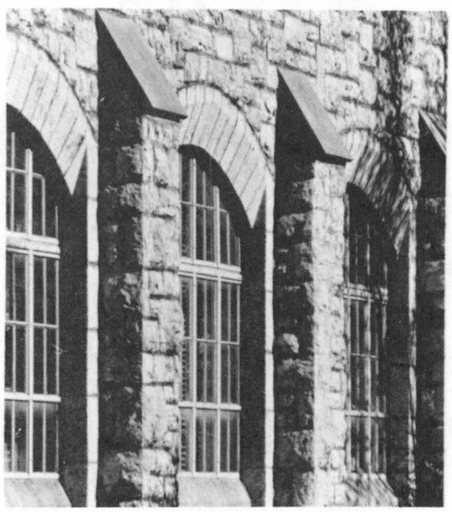
Picture Quiz

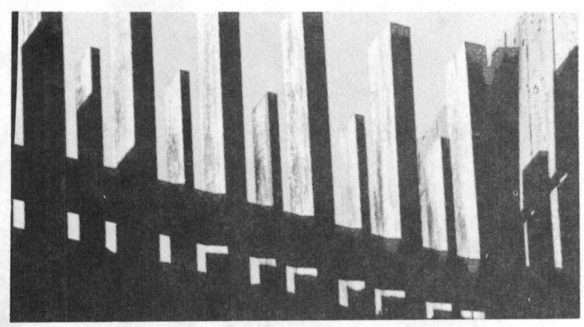
by Tom Glaab

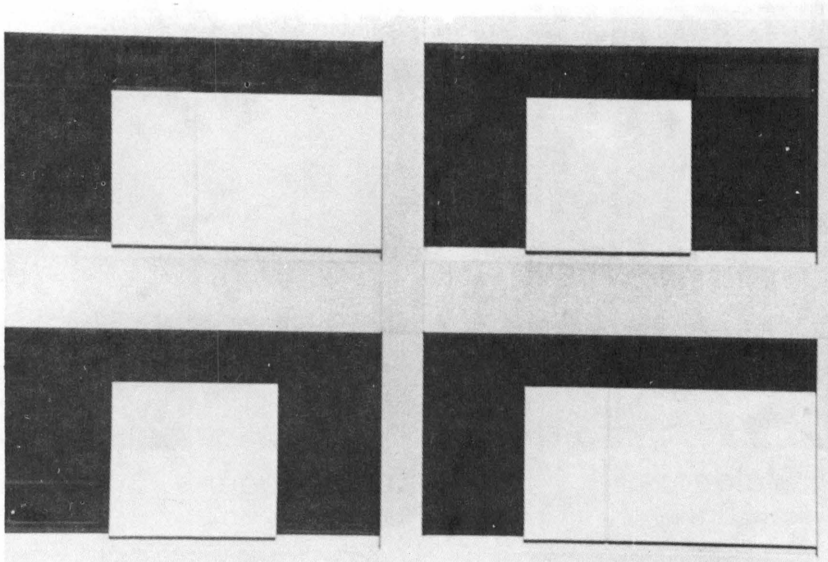
Can you identify these campus buildings?
Answers on page 7.

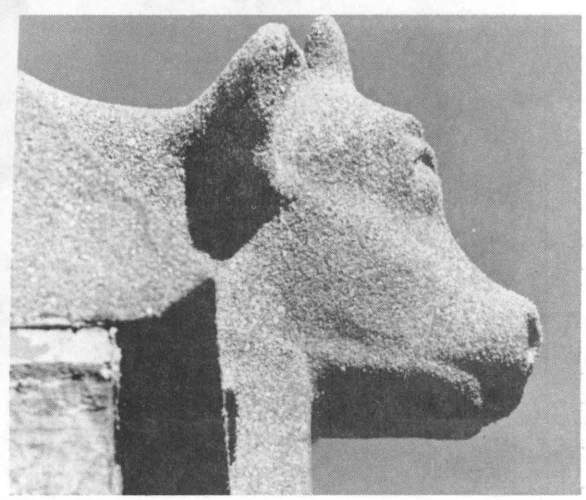












FUTURE TALK

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