# Engineers' Forum

VIRGINIA TECH FEBRUARY 1989

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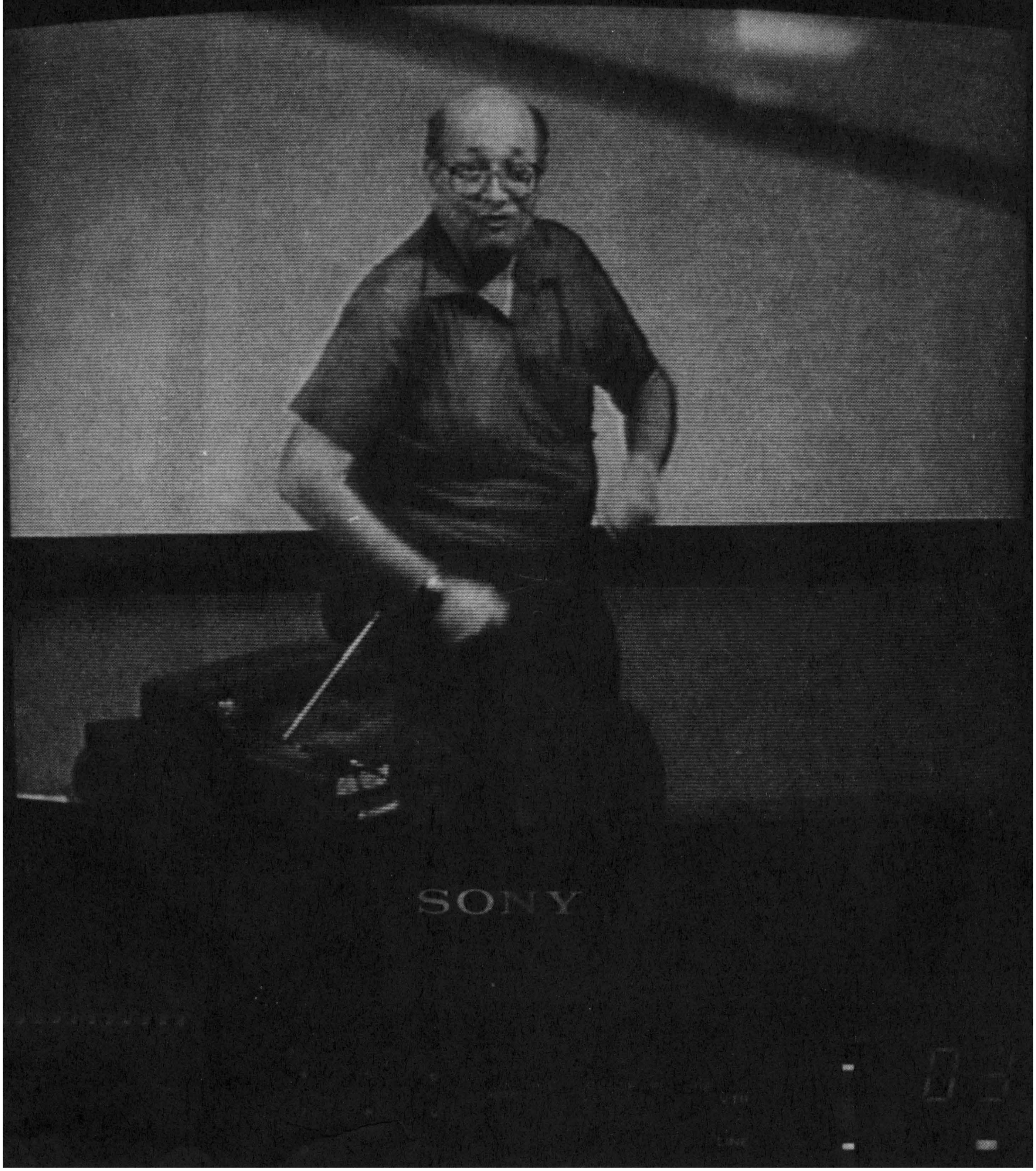

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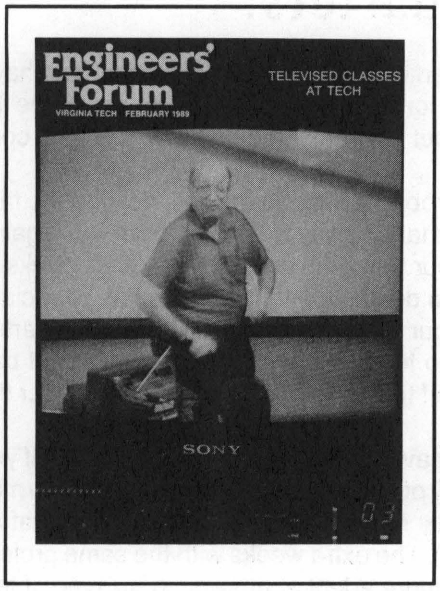


Tom Glaab

On the Cover: Economics professor Allan Mandelstamm on campus cable television.

Darkroom facilities donated by Virginia Tech Communications Department.

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# Engineers' Forum

Volume 7, Number 3
February, 1989

# Editor's Page



## No Quarters?

Now that we've all survived sixteen weeks of the same classes, and have comfortably (?) settled into the next long and laborious semester, maybe it's time we settled this small matter about the quarter-to-semester-system conversion: are we really better off?

The most obvious change you probably noticed this fall, despite the fact that it was still summer and Tech had taken away two weeks from you (again), was the length of the syllabuses your teachers gave you. Sixteen weeks of one course will definitely bore me to death, you think to yourself; especially considering that you were tired of your classes six weeks into spring quarter. More material will be covered, more tests will be given, and if you get bad grades they will count one and a half times more than they would under the quarter system.

And yet, there are advantages to having such long academic terms. If you get behind, you definitely have plenty of time to pull yourself back up. You may also have some time to take it easy if you are so inclined (if that is at all possible in an engineering program). The extra weeks with the same professor also may allow you to become more adept at answering his type of test questions before the final.

Yet the pros and cons stated in the past two paragraphs are really not that significant. What's important here is to get the best education possible, and to get the most out of four years at Virginia Tech. The foundations for our engineering expertise are laid in the first three years; the last year, aside from adding to that foundation and preparing graduates for industry, should be one in which students can examine specific areas of interest, areas of potential specialization.

Herein lies the problem with the semester system: less academic terms means, according to the graduation flow charts of most departments, less opportunity for technical electives. In an academic curriculum as strict as engineering, the opportunity for any courses different from those required, particularly with the Core Curriculum and College of Engineering requirements for electives, is seldom seen. So why take away even more opportunity for intellectual exploration by switching to semesters?

Someone who would know told me that a large factor in switching to the semester system was the reduced paperwork for the staff. Give me a break. What are you going to tell the guy who has waited three years to take a course in CAD/CAM, but will miss out because this semester (the only one it's offered) he has to take Music Appreciation to fulfill a Core Curriculum requirement? I don't care if there's more paperwork for the staff on the quarter system — what difference does it make how much work there is, since they are compensated for it? (Assuming, of course, that they work at the same rate whether there is a lot of work or a little — or am I being naive in assuming this?) The University should not take away such an important learning opportunity for such a petty reason.

Andrew E. Stalder
Editor

*Editor's Note:* The *Engineers' Forum* is now accepting entries for its 6th annual Technical Writing contest. Interested students should contact the Forum at 112 Femoyer Hall, or at 231-7738. All entries must be received by April 28, 1989.

# Letter From The Dean

# The Real World ... The World of Politics

*by Dean Paul Torgersen*

As engineers, we are generally comfortable with the world of technology. In our educational process we may not spend as much time as we should in preparing engineering graduates for the world of business, e.g., profit and loss statements, labor contracts, and so forth, but many engineering graduates successfully acclimate to business through experience and/or additional coursework after graduation. Politics is yet another world altogether. I would like to share a story with you. In the late 1970's, our College of Engineering hoped to persuade the Virginia General Assembly of the need to complete the top three floors of Whittemore Hall. The space was obviously needed but we were competing against a number of other Virginia Tech projects, as well as requests from the other state-supported institutions in Virginia for capital projects.

We were successful, as you know, and we were able to expand the facilities for the electrical and industrial engineering departments. Much of the credit for this success belongs to the Virginia Society of Professional Engineers, which at the time was presided over by one of our civil engineering alumni, Ray Martin of Richmond. Through his efforts, VSPE became a lobbying group with the Virginia General Assembly.

As a college, we had realized that we needed a political support group, comprised of Virginia taxpayers and professionals. The efforts of the VSPE on behalf of our college made us realize how very important our professional engineering body is within the Commonwealth.

On a national level, this situation also holds true. Professional groups such as physicians and lawyers have always maintained a very strong influence in the American political system. Historically, engineers have not. Legislation has not always furthered obvious technological advances. Nor have technological developments fared well in some of the major funding decisions. As an example, the National Science Foundation, in existence for more than a century and charged with engineering responsibility, only recently added engineering as a separate budget item, ensuring belatedly that the profession be included in this funding process.

This decade marks the first attempts by the National Academy of Engineering to take a leading role in the political activities of Washington, D.C., placing itself in a complementary role to the National Academy of Sciences. As the NAE plans to celebrate its 25th anniversary (NAS is 125 years old), President Bob White is striving to make the engineering academy a more visible entity.

As an aside, one of White's efforts was to commission a veteran technical writer, Lee Edson, to write the history of the group. Mr. Edson happened to be a writer-in-residence at our own College of Engineering several years ago, the first time an engineering college in the U.S. hosted a writer-in-residence. At that time we were interested in the assistance Mr. Edson could provide to our engineering students who were attempting to improve their communications skills. This special program was funded by a company chaired by one of our alumni. Today, our bond with Mr. Edson will be reflected in the historical piece on the NAE — he makes reference to several of the Virginia Tech faculty who are members of the National Academy of Engineering.

An element of luck often plays a role in the successes we have in life. We were lucky Ray Martin was at the helm when we needed the VSPE's assistance, and we were lucky that the NAE chose Lee Edson to write its biography. But it is more than luck — we had to reach out to these people, and persuade them to take an active role on our behalf. In Mr. Martin's case, we asked him to use his spare moments campaigning for our building; in Mr. Edson's case, we persuaded him to take a sabbatical and work in our college for an academic year.

Our college prides itself in the establishment of novel programs, such as the hosting of Mr. Edson, and in its close association with our alumni, and these efforts make a substantial difference in the education you receive as a Virginia Tech student. In addition to Ray Martin's close affiliation with the college, we have a strong relationship with a number of engineering alumni who serve on advisory boards to the college as a whole, and to several departments in particular.

We maintain a Committee of 100, engineering graduates who have become corporate leaders, government chiefs, and prominent educators. Within this Committee, we have an Advisory Board that meets on campus annually to discuss the accomplishments and goals of the College of Engineering. The civil and industrial engineering departments maintain separate advisory boards, yet all of these groups function similarly. They advise us on such matters as: the needs of industry and the types of engineering students they hope to employ in the future; educational issues such as whether engineering should be a four or five year curriculum; any shortcomings they may have found in their education after living in the 'real world' for a period of time; and technological directions for the future.

This advice and concern from our alumni have direct effects on the future generations of engineers who graduate from Virginia Tech.

As engineering students at Virginia Tech, you have a most common bond. You will all become engineering alumni, whether it is in a few months or a few years. It is important for you to know of the respect we have for our alumni and the debt we owe to you for the help you provide us. This assistance comes in many forms — political lobbying, program funding and advice are just a few of the important ways of helping your alma mater.

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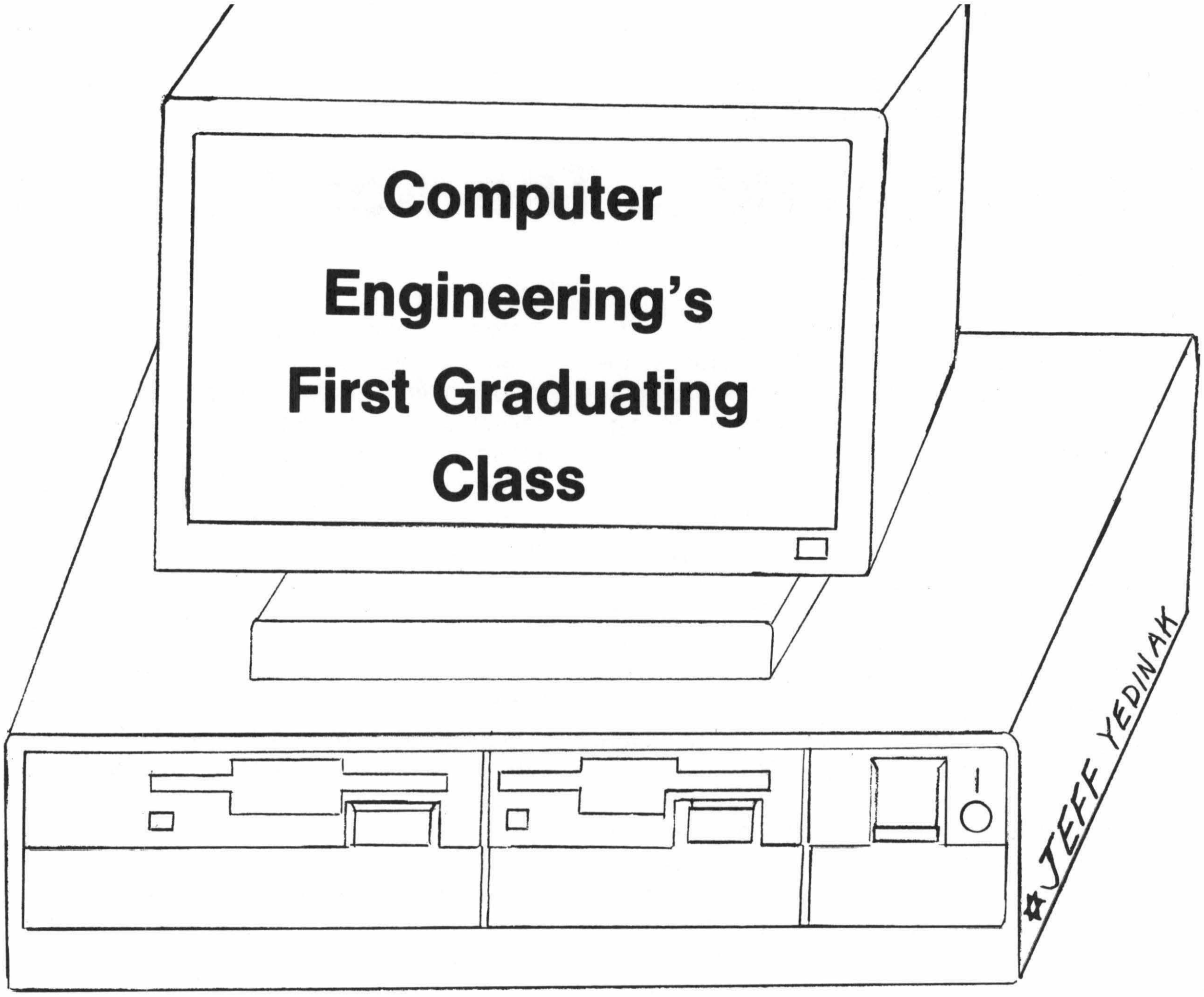
**Dean Torgerson** is an Industrial Engineer who plays tennis and runs the College of Engineering. He also enjoyed a brief stint as President of the University.

# Computer Engineering's First Graduating Class




*by Andrew Predoehl*

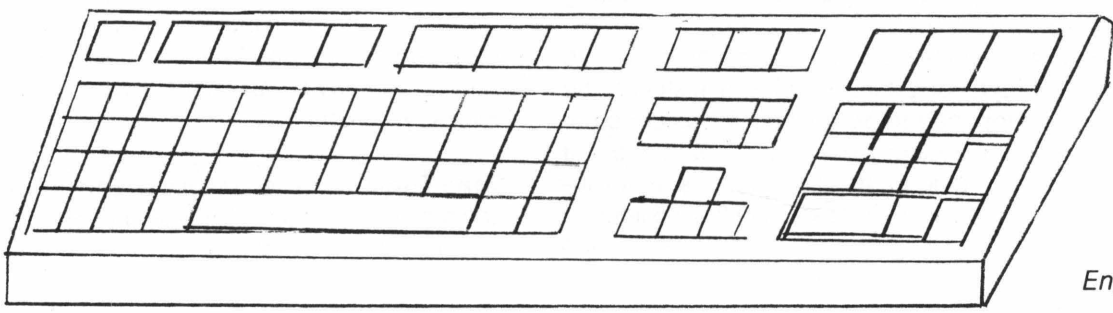
This spring, yet another class of engineering seniors will graduate, earning degrees representing all of Virginia Tech's diverse fields of study; unlike previous years, though, fifteen of these graduates will be earning a B.S. in Computer Engineering, a degree recently added to the Bradley Department of Electrical Engineering.

A computer engineering (CpE) major is much like an electrical engineering (EE) major who takes a complement of courses in computer science (CS). Dr. James Armstrong, a professor of electrical engineering, describes computer engineering as "a firm grounding in the engineering foundations that are a part EE," such as networks, electronics courses, electronics labs, and heat transfer, as well as "the core CS courses, like compilers and operating systems, without the many electives that computer science students take." The result, according to Dr. Daniel Hodge, head of the electrical engineering department, is "a more focused program" than a standard EE degree, bridging the gap between the hardware of the EE department and the software of the CS department.

The result of such a course of study is a degree providing a strong preparation in the field of computer engineering, but lacking the wide breadth of an EE degree. "The EE degree is broader-based" than the computer engineering degree, says Hodge, "and allows more career options." However, "there is great interest in computer engineering around the country," according to Armstrong, and "the electrical engineering department gets frequent requests [from companies] for computer engineers." The engineering industries are receptive to computer engineers; a quarter of Tech's computer engineers are also co-op students, working for companies such as Goddard Space Flight Center, Langley Research Center, Digital Equipment Corporation, Ford, General Electric, and IBM.

**In The Beginning...**

In fact, corporate requests for electrical engineers also trained in software were partially responsible for the creation of a computer engineering degree. For years before the computer engineering degree option began, many students



expressed interest in the computer area of the EE department, over other areas of specialization, such as communications, electronics, power, and controls. Further, according to Dr. Armstrong, "[Dean] Torgersen was very interested in having a computer engineering program." So, in 1985, the computer faculty of the electrical engineering department began working on a curriculum for a computer engineering degree, using the IEEE (Institute of Electrical and Electronics Engineers) model for an ideal computer engineering program, and the ABET (Accreditation Board of Engineering and Technology) minimum requirements for a computer engineering degree program, which described not only technical requirements, but also requirements for courses in the sciences and humanities.

The proposal for the computer engineering degree program was completed in December 1985, in order to begin taking sophomore engineers in the fall quarter of 1986. This particular year was planned specifically because these sophomores would be graduating seniors in this spring of 1989, which is the year for the normally scheduled ABET accreditation team to come to Tech to examine the engineering programs. The ABET team would then be able to accredit the computer engineering degree; ABET will not accredit a program before at least one class has already graduated from it, but the accreditation then extends to that class which has just graduated. The timing was planned so that no senior would earn a computer engineering degree without ABET accreditation.

After the proposal was approved, it became time to announce the new degree program. In the fall of 1985, the electrical engineering department sent a memo to the freshmen in engineering fundamentals, informing them of the new degree option of computer engineering. The film about electrical engineering that freshmen saw in class at the time did not discuss the CpE degree; in fact, that film is only now being updated. When the freshmen engineers chose their majors in the spring of 1986, 40 students were selected to make up the first class of computer engineers. The competition to get in the program was stiff; although the number of applicants is not available, according to Dr. Armstrong, none of those selected to be computer engineers had a QCA lower than 3.0.

The freshmen selected in spring 1986, in due course, turned into the sophomores of fall 1986, when the computer engineering curriculum began. Unlike previous engineering programs, the computer engineer's course of studies includes a large amount of computer science courses, which, in the past, consisted almost exclusively of computer science majors. Initially, the professors teaching the first CS classes required for computer engineers were shocked to learn that they had some students present who were not computer science majors. Sarah Cole, a computer engineering senior, remarked that some of those professors "felt that since we were not CS majors, we didn't belong in [their] class[es]," and some of them said as much. In addition, computer science students own Macintoshes, and all freshman and sophomore engineers own IBM computers; "the professors seemed unhappy about taking programs done on the IBM's." Not all the hostility came from the college of arts and sciences, though: "some of the EE professors seemed to think that since we weren't pure EE students, we shouldn't be in their classes either," even though computer engineering students belong to the electrical engineering department.

**Communication Breakdown**

Many sophomore computer engineers descended upon the electrical engineering undergraduate counselor, Virginia MacWhorter, and about three weeks into the fall quarter, they attended a meeting where representatives from the EE department as well as the CS department fielded questions and complaints. "We foresaw an identity crisis," explains MacWhorter. "The meeting was planned in advance. [The students] said they felt like the EE department didn't love them anymore." They reassured the engineers that the EE department would try to work out the problems that were occurring, and indeed they were mostly successful. Nevertheless, although the CS professors did not cause any further trouble, "no matter what they are told, professors are going to think what they want to think," said Cole. Explains MacWhorter, "after the first few weeks, there were no comments," and no major problems.

Similar incidents still occur occasionally between the computer science and electrical engineering departments. This past fall semester, the professor teaching EE 4504, Computer Organization, informed the class that EE majors did not have the proper computer science background and could not take the course. Many disconcerted electrical engineers complained immediately; the problem was that EE 4504 is cross-listed as CS 4504, and the professor teaching the class happened to be from the computer science department, and was in fact relatively new at Tech. A few phone calls quickly resolved the misunderstanding.

Once the initial friction was smoothed over, the students got down to working, and they have not had much opportunity to slow down since. Cole explains, "the program is rough. You're taking the cores of two different majors. You had better like the computer, since you spend not only the hours in front of it for CS, but for the EE classes as well; you'd better like math, too." As the program stands now, a computer engineer takes an average of 17 credit hours per semester, with a high of 19 credit hours in the first semester. The sophomore year of computer engineering is nearly identical to that of electrical engineering, with the difference that computer engineers take a two-semester computer science class plus a course in discrete mathematics, whereas electrical engineers take electronics a year before the computer engineers, as well as dynamics and a free elective.

The benefits clearly outweigh the disadvantages for those who have decided to stay with the program. "I considered transferring several times" explains Cole, but obviously did not. "The program offers great depth." For example, when talking recently to a company representative, Cole was asked how she could have covered such a large number of courses: "I explained that my curriculum covers most of CS and EE," teaching the better part of both. "Many companies have been especially interested in computer engineers," such as Westinghouse and IBM, in addition to their normal demands for regular electrical engineers.

The computer engineering program offers a great deal to its students. Opportunities for research abound. Some of the research currently being done at Tech includes the following:

- Design automation — The study of how computer aided design (CAD) software and hardware can be used and developed, along with other design techniques, to allow one to design a computer in a systematic way, using a computer.

- Digital communication — The study of overcoming the problems involved in making computers "talk" to each other, encompassing such topics as modems, used in computer communication via telephone lines; communication protocols, or standards for computer communication and error-checking during communication; and computer networks, arrangements of interconnecting computers which transmit and receive information among each other.

- Pattern recognition and speech processing — Research concerning the growing areas of artificial intelligence and machine vision, with applications to robotics, in which hardware components and sophisticated algorithms combine to attempt to give computers "eyes" and "ears."

- VLSI design and systems architecture — The developing and improving of systematic methods for designing microprocessors at the most detailed level, planning how a logic design is to be implemented in the actual semiconductor on a microchip, and how the microprocessor will need to interact with computer memories, hardware peripherals, and so on, as a part of a complete computer system.

**The Future of Computer Engineering**

Computer engineering is a new degree program at Tech, but it does not represent a particularly new field of study. "We've had students getting the equivalent [education] of CpE students for years," MacWhorter explains. Thus, the academic curriculum for computer engineering is not particularly protototypical; according to Dr. Hodge, "I don't see any specific changes planned." Cole states, "the courses are what we need to have." A few changes may occur when the ABET team examines the computer engineering program. "They will make suggestions" for improvement, explains Hodge, and the department board surely "will look pretty closely" at ABET's recommendations.

One feature of the computer engineering program that will not be changing soon is the size of the incoming class, which has been fixed at 40 students for the past three years. This relatively low number is due to inherent limitations in the facilities of both the electrical engineering and computer science departments, in terms of faculty and classroom space. Before now, the program has not accepted any transfers; however, since the curriculum has been available now for three years, there are spaces for a maximum of 120 students; currently there are about 100 students, since several have transferred into a different majors. Because of these available spaces, and due to student interest, "for fall '89," according to MacWhorter, "we will accept four transfers who have completed their sophomore year in computer engineering, having a QCA of 3.0 or better, with preference given to EE's, other engineering [curricula], and CS." "Sophomore level external transfers may be considered after completing a sophomore year and establishing a QCA at Virginia Tech. Applicants for [external] transfer must go through the enrollment coordinator in the dean's office to ascertain the criteria for proper transfer."

The computer engineering program at Virginia Tech is a relatively new degree option which gives determined students the opportunity to prepare for careers in the computer industry, concentrating on the link between hardware and software. The program has had its snags untangled over the past three years, and ultimate test of the curriculum, has been passed: the first class of computer engineers will soon be entering the professional world for which they have been preparing over the last four years.

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**Andrew Predoehl** has a vested interest in computer engineering since he is a sophomore in CpE.

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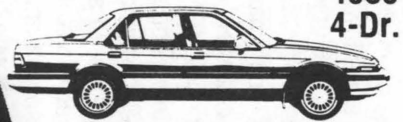

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# Blacksburg's Newest Cable TV System: Virginia Tech

*by Tom Glaab*

Students have always been able to watch television in the dorms. You turned on the TV and pointed the rabbit ears toward Roanoke until the picture was reasonably clear. There were six channels to choose from, all of which went off the air by 3 a.m. Now, students have over 40 channels to choose from, including MTV, CNN, Spanish and French language networks, and student-produced television, as well as four local channels.

These additional channels are the product of Communication Network Services' (CNS) latest project, a quarter-million dollar cable television system.

The new TV system consists of several C-band satellite receivers and two off-the-air antennas connected to a fiber optic and coaxial cable distribution system which goes to virtually every room on campus. There are two basic components to the system: one brings TV to campus, and the other is used for teleconferencing and teaching.

The first, cable TV, is based around a multi-satellite antenna located on Tech Center Drive behind the Corporate Research Center. This antenna is visible from the 460 bypass, and is capable of receiving signals from up to 17 satellites at once. Currently it only uses eight: Galaxy 1 and 3; Satcom 3R and F4; Westar 4 and 5; Anik D1; and Telestar 303. The signals from these satellites are descrambled, modulated, and fed along broadband coaxial cable to the main switch room in Cassell Coliseum.

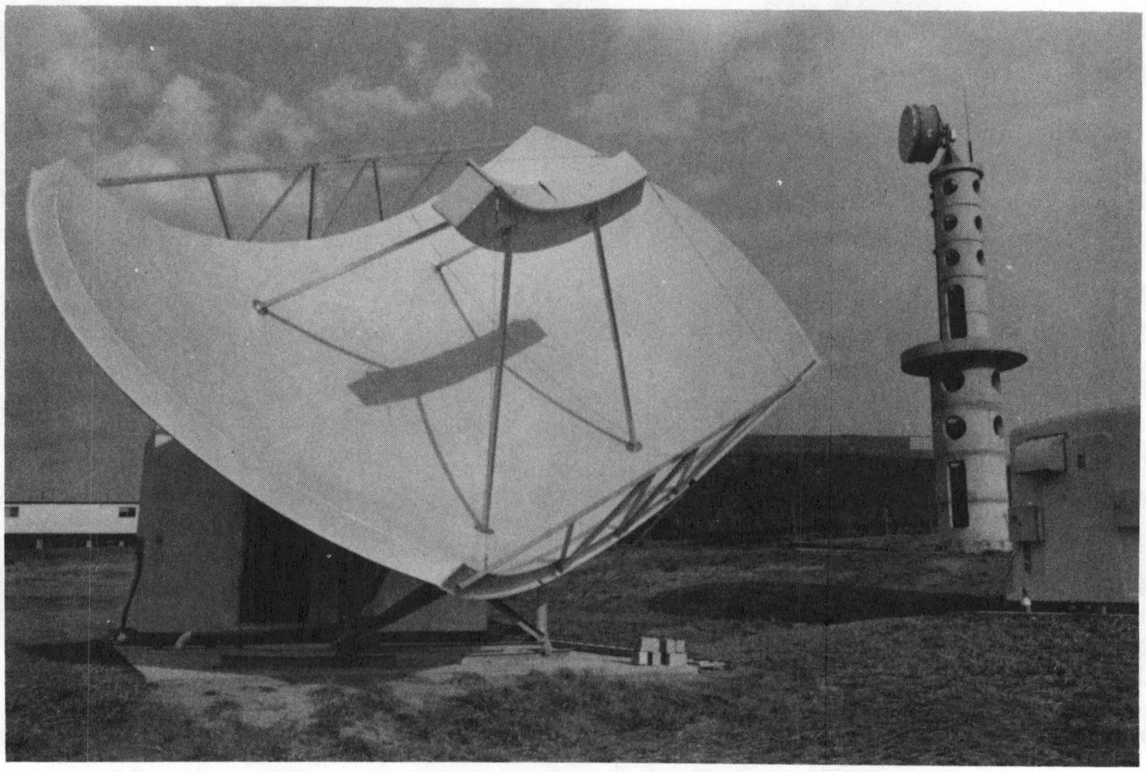
In the switch room, Tech-produced programming, such as televised classes and pre-recorded programs, is put onto the system. The University Planning Calendar is also fed into Blacksburg Cable's system from here.

The Planning channel, which primarily shows scrolling calendars with upcoming events, is sent along fiber optic cable to the top of Slusher Tower, where it is transmitted over a microwave link to Blacksburg Cable's downlink on Yellow Sulphur Road. It can be viewed on Blacksburg Cable channel 30.

From the switch room, programming travels along copper cable to different buildings across campus, where it enters Building Distribution Frames (BDFs). The BDFs split a signal for distribution to Intermediate Distribution Frames (IDFs), which are generally located on different floors of a building. From there individual rooms are wired. The programs can be viewed on any cable ready TV, or by buying a cable tuner. Tuners range from about $20 to $200, depending on features, and at least one model is available at the University Bookstore for about $25.

The second part of the system involves sending TV signals from Tech to other locations around campus and around the state. The bulk of the 1,000 mile fiber optic network is used here, because signal quality has to be kept at the highest level possible.

Programming that originates at Tech includes graduate



Tom Glaab

*The main antenna used by Tech. In the back is the microwave link to Slusher Tower.*

classes, sporting events, and economics classes. Classes are generally filmed in Whittemore Hall and transmitted to Cassell Coliseum via Burruss Hall. Graduate classes are often linked to locations around the state by satellite, so students in places like Richmond and Northern Virginia can take classes at Tech. There is a two-way voice link, so students can ask questions from the remote classrooms.

Other classes, primarily classes which are only broadcast on campus, do not have this interactive ability, but many of them are recorded and played back continuously. One example is channel 34, which replays Professor Allan Mandelstamm's economics lectures.

CNS has the ability to televise sporting events, but only events held in Cassell Coliseum can be broadcast live. CNS is considering buying a portable microwave link, similar to a TV news van, to be able to cover other events. Signals would be transmitted from the van to Slusher Tower, and then carried down to Cassell Coliseum.

*Many students are still 17 years old, so a legal problem arises with "R" rated movies broadcast on premium channels.*

Coverage of sporting events and many other types of programming is actually done by Tech students. Students use CNS equipment and facilities to plan, film, and edit their productions, which are played on channel 33, the student channel. CNS would like to become a "phone company" and only broadcast programs, instead of also having to do production work, according to Kim Pollard, Communications Engineer for CNS and unofficial video manager. The communications department has started to help in that way, but so many students wanted to work with video that only students in Valerie Ostroth's communications class may participate.

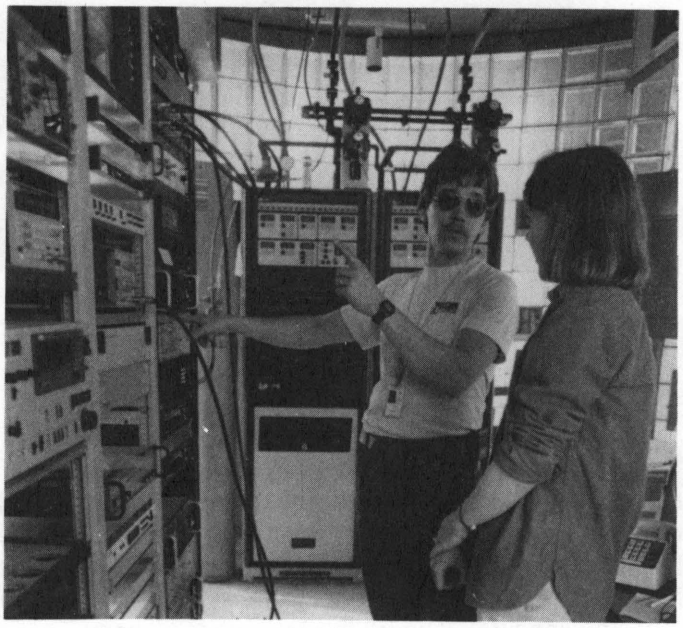
The system has a capacity for 62 channels, with five "T," or reverse channels. The "T" channels are used for sending programming backwards to the head end of the system. One of the first uses for the "T" channels will probably be to broadcast SGA meetings. A signal would be sent from the meeting room up one of the five "T" channels to Cassell where it would be distributed across campus on channel 9.

Forty of the 62 channels are now in use, with the obvious exception of channels 14 and 15. The reason for this is the frequencies for channels 14 and 15 are also aeronautical distress frequencies. A cable system can use those channels if it can prove that its system is free of leakage. Because it is a new system, CNS decided not to use those channels. There is too much chance that somebody on the top floors of Slusher will leave her antenna disconnected, effectively radiating garbage onto the distress frequencies.

Of the 40 channels being used, 10 are strictly for instructional use. The rest of the channels were selected based on a survey distributed last year. Another survey, this one written with the help of students, will be distributed sometime in the spring so CNS can determine whether or not to add more channels next year.

The problem with adding more channels is not financial as much as it is a problem with hardware. Each channel requires its own modulators and amplifiers, and since CNS is a cable TV system in the eyes of the industry, everything must be licensed. This licensing requires CNS to report the details of its operation right down to serial numbers, so ordering and installing spare equipment is not easy. Three modulators ordered in August still have not arrived, so when modulators being used now break down, there are no replacements.

Premium TV is a real sticky point, said Pollard. Students want a pay channel, but there is no consensus about which one to get. CNS has to charge by the room, so if one roommate wants it and the other does not, problems arise. Many students are still 17 years old, so a legal problem arises with "R" rated movies broadcast on premium channels. On a technical level, the cable system is a combination of a home-run, or parallel, system and a series system. This would make installing descramblers very difficult. The descramblers would be easily accessible to students, and while theft of services is not a big (technical) concern, students tampering with the descramblers would probably damage them, and possibly throw the whole system out of alignment.

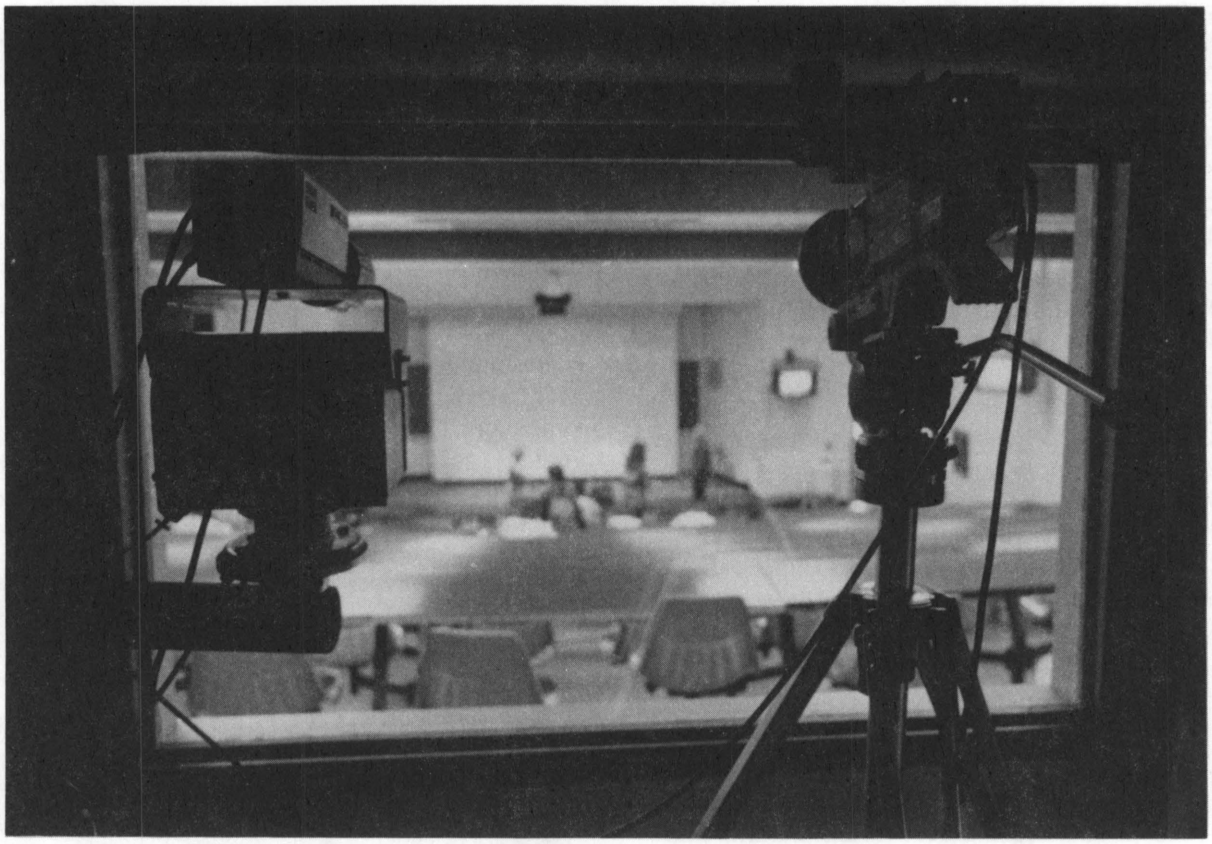


Tom Glaab

*Dave Shantz of CNS shows the difference between the microwave and fiber optic transmissions from campus to the uplink. Behind him are the twin 3 kW amplifiers used to amplify the signal to the satellite.*

When asked about plans for Squires Student Center, Pollard admitted that nobody had approached CNS about wiring the renovated building. She said that there was certainly enough signal strength on the line at Squires, and this would be the perfect time to custom wire the new theaters, but until CNS was approached, they had enough other things to work on.

What's in the future? Pollard said that radio could be coming. Since there are no full time classical or jazz radio




*TV cameras used to film classes in Whittemore 300.*

stations in the area CNS is considering broadcasting FM radio signals from other cities over the cable. To receive these signals, students would simply hook their TV cables into the antenna jacks on their stereos, and tune in to a predetermined frequency in the FM broadcast band.

Unlike the new phone system, video does not extend to the Northern Virginia Graduate School. CNS will be looking into compressed video techniques to run televised classes in Northern Virginia. The major drawback to this technology is cost. Pollard estimates that it would cost about $60,000 to run one compressed video channel.

The biggest "problem" with the system, says Pollard, is that students will probably become spoiled because the quality of the new system. "We were told not to install it ourselves because we wouldn't be able to do it right, but now we're a model system and we saved a lot of money." As a result of CNS's work, Virginia Tech has a cable TV system that would make many cities jealous.

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**Tom Glaab** is a junior in Electrical Engineering. He is also the only one who can take files from various word processors at three in the morning and put them together in a form the typesetter can understand.

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# Tech Engineering Attracts Students from Around the Globe

## for the Engineers' Forum.

# Engineering Societies at Virginia Tech

*by Karen Koger*

**Student Engineers' Council (SEC)**

The SEC is open to all engineering students. Meetings are held every other Wednesday at 5:00 in Norris 200. Information is posted in the display case in the Norris tunnel and on the bulletin board next to the SEC Office in Femoyer 110.

SEC's biggest project this semester is Engineers' Week, February 20-24. SEC also sponsors Superstars, an athletic competition for all the engineering societies. SEC awards the $1000 Paul E. Torgersen Leadership Scholarship to a rising senior engineering student every year, as well as the Sporn Award, which goes to an outstanding engineering professor. A special project for SEC this year is the petitions to the Virginia General Assembly for funding for a new engineering building at Tech. Some SEC members will be attending the Regional Meeting at Penn State on March 31-April 2.

The faculty advisor for SEC is Lynn Nystrom, Norris 333, 231-6641. For more information, call Julie Feil at 231-6036.

**Engineers' Forum**

The *Engineers' Forum* staff is open to all students. Meetings are held every Wednesday at 4:00 in the Dean's Conference Room next to the Dean's Office. Information is posted on the *Engineers' Forum* office door at Femoyer 112.

The staff will be attending the Engineering College Magazine Association (ECMA) National Conference at Howard University on April 13-16. The *Forum* is also sponsoring a technical writing contest with cash prizes. The deadline for contest entries is April 28.

The faculty advisor for *Engineers' Forum* is Lynn Nystrom, Norris 333, 231-6641. For more information, call Karen Koger at 951-5134.

**American Institute of Chemical Engineers (AIChE)**

Information about AIChE can be found on the bulletin board of the AIChE lounge in Randolph Hall.

Members of AIChE will be attending the Southern Regional Conference and the Mid-Atlantic Research Conference. A plant trip to Hoechst Celenese in Narrows, Virginia, is planned. Guest speakers to Tech include industry representatives from Dow, Exxon, Milliken, and Westvaco.

The faculty advisor for AIChE is Dr. Michelsen, Randolph 142, 231-6631. For more information, call Sean Pluckter at 953-1546.

**American Society of Mechanical Engineers (ASME)**

Information about ASME is posted on the triboard and on banners in Randolph lobby.

The main project of ASME this semester is hosting the Regional Student Conference.

The faculty advisor for ASME is Charles Reinholtz, Randolph 104.

**Institute of Industrial Engineers (IIE)**

Information about IIE is posted outside Whittemore 271.

IIE members will be attending the International Conference in Toronto on May 14-17. IIE also hosts Happy Hours and a Spring Picnic.

The faculty advisor for IIE is Paul Kemmerling, Whittemore 271A, 231-5439. For more information, call Christian Farls, 232-1453.

**National Society of Black Engineers (NSBE)**

NSBE meetings are held on the first and third Tuesdays of each month at 7:00. Information is posted on signs around campus.

NSBE members will be attending the National Conference at the University of Cincinnati on March 29-April 2. NSBE's service projects include Toys for Tots and Mentor Internships for New River Valley.

The faculty advisor for NSBE is Charles Yates, Randolph 130, 231-4351. For more information, call Terri Jones at 552-0826.

**Professional Society of Asian Engineers (PSAE)**

PSAE meetings are held every Thursday at 8:00 in the Whittemore Student Lounge.

The faculty advisor for PSAE is Dr. Wing Ng, Randolph 201. For more information, call Daniel Niguidula at 2326171.

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**Karen Koger** is a senior in Mechanical Engineering. What else can we say?

# Solar Motivation:
# GM's Sunraycer

*by Andy Stalder*

What looks like a giant insect, is faster than your average Chevette and yet uses less horsepower than your lawn mower? General Motors' Sunraycer solar-powered car, that's what. A prototype of the car that won the 1,950-mile World Solar Challenge race in Australia in November, 1987 was on campus for two days in January. The *Engineers' Forum* was there to take a closer look.

Perhaps the most striking feature of the Sunraycer is its overall aerodynamic shape. In pictures, the length of the car looks somewhat proportional to its small height (3.3 ft.); in actuality the vehicle is 19.7 ft. long! The design, conceived by engineers from AeroVironment, Inc., and General Motors, is based around the always aerodynamically-desirable teardrop shape. Besides desiring such a shape to minimize straight-line aerodynamic drag, the team also strived for a shape which would prove stable in cross wind situations, and yet still provide adequate surface contours for both solar cells and driver compartment.

Initial designing utilized an advanced computer program, VSAERO, developed by the National Aeronautics and Space Administration. The final design achieves a virtually neutral attitude at high speeds (negligible tendency to lift or plow), according to Sunraycer Team Manager George Ettenheim. Wind tunnel tests at the 10-foot GALCIT wind tunnel in California Institute of Technology revealed the Sunraycer's drag coefficient to be .13, the lowest ever measured at Caltech for a road vehicle.

The overall body shape was not the only area of attention in the team's quest for the best possible aerodynamics. The wheels (mounted with bicycle tires to minimize rolling resistance) are covered with plastic disks to reduce drag. Initial design wind tunnel tests indicated a need to somehow reduce upward lift in a crosswind. Also, the driver needed a 'rear-view mirror' that could provide adequate rearward vision without adding drag. Both of these seemingly inconsistent problems were solved with the addition of two small vertical fins (strakes) to the top of the driver compartment. The strakes channel and direct crosswinds along the body to the rear of the car, thereby reducing lift.

The rearward vision problem was solved by shrouding an objective lens and prism in the right strake (aimed at the rear, of course). Connected to this, inside the cockpit, is a cord containing 200,000 fiber optic bundles. The fiber optics carry the image to a small screen easily viewed by the driver, and do not consume any valuable electric power.

The Sunraycer's chassis is lightweight yet surprisingly strong. Utilizing a welded aluminum tube spaceframe — the same type of construction used by many race cars — the Sunraycer weighs only 15 pounds, yet it amply supports the total vehicle weight (with driver) of 547 pounds. The body is constructed of a sandwich of Kevlar/Nomex/Kevlar, with the center portion (Nomex) having a honeycomb structure. This structure contributes to great strength and rigidity, while only weighing 3 ounces per square foot.

Naturally, the majority of the body is covered with solar cells. The car brought to Virginia Tech used K7 silicon solar cells (produced by the Hughes Aircraft Company's Spectrolab subsidiary) exclusively, but on the actual race car 80% of the solar cells were gallium arsenide. The gallium arsenide cells have a nominal efficiency in converting the sun's rays to electricity of 20 percent; the K7 cells are 16.5 percent efficient. Why weren't gallium arsenide cells used exclusively? Apparently, this was due to their limited availability in the world market at the time. All in all, some 5200 solar cells cover the Sunraycer's canopy.

The recipient of all this solar-turned-electrical energy is the Sunraycer's powerplant, the Magnequench Motor. The Magnequench was designed by General Motors Research Laboratories (GMRL), and named for the special process (designed by GMRL and GM's Delco Remy Division) by which molten metal is instantly cooled (quenched) in an oxygen-free environment. This process has allowed GM to develop the Magnequench into a 92 percent efficient motor; by contrast, conventional motors of similar size are only 75 to 85 percent efficient. As a complete package, the motor weighs only 8.1 pounds, and has a continuous power output of 2 hp. at 4,000 rpm. The drivetrain down from the engine is simple and lightweight: a chain drive transmits power to the lone drive wheel, the left rear.

Batteries provide an indirect source of power to the car. The Sunraycer uses 68 rechargeable silver zinc cells for supplemental power early and late in the day. The batteries — each providing 1.5 volts and 25 ampere-hours — are charged using the solar panel in the two hour periods just after sunrise and before sunset.

GM's Sunraycer solar car indeed proved to be an effective competition car in the World Solar Challenge, winning by an over 600-mile, two and one-half day margin. Additionally, the car established seven national and international speed records for electric-powered land vehicles. And with a recorded average speed of 80.2 mph over 5 miles, not too many average Chevettes are going to catch it!

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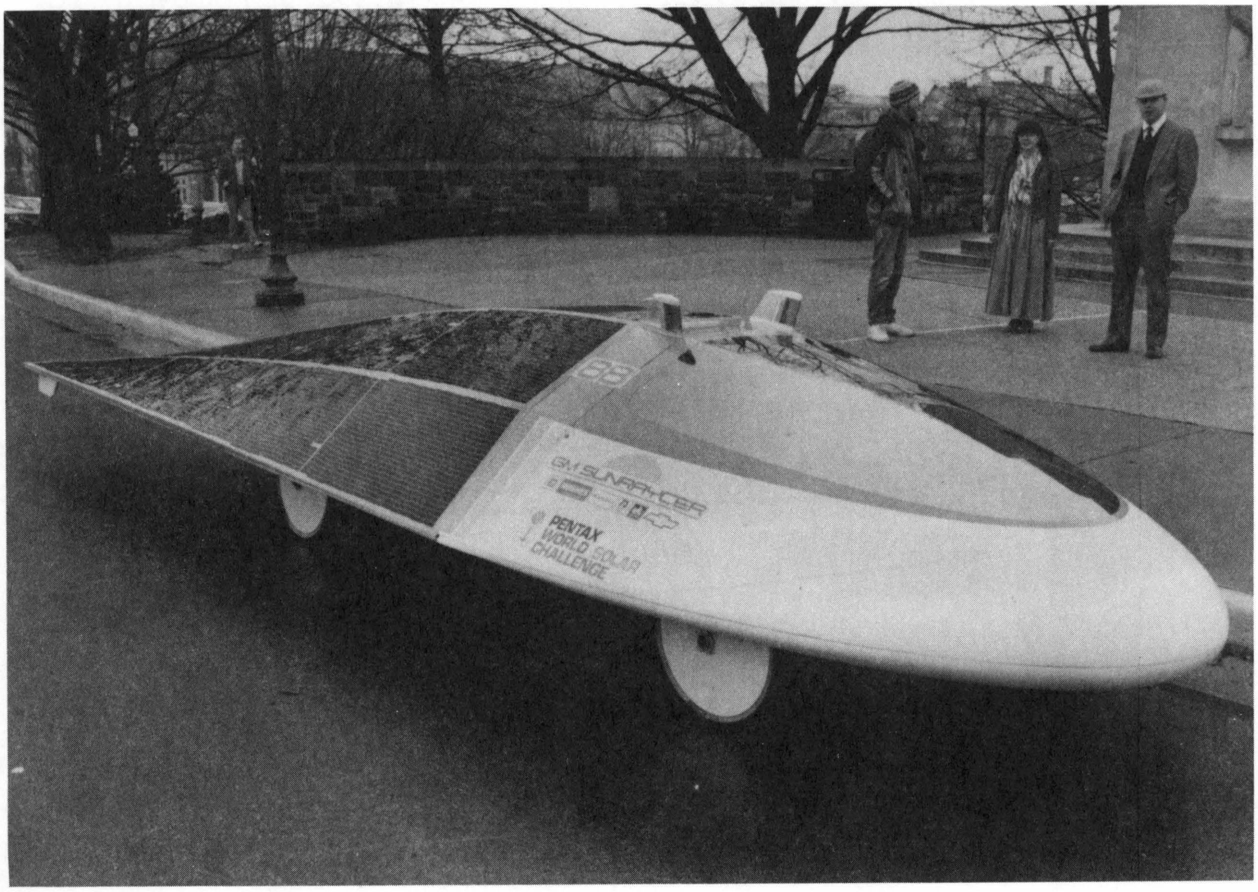
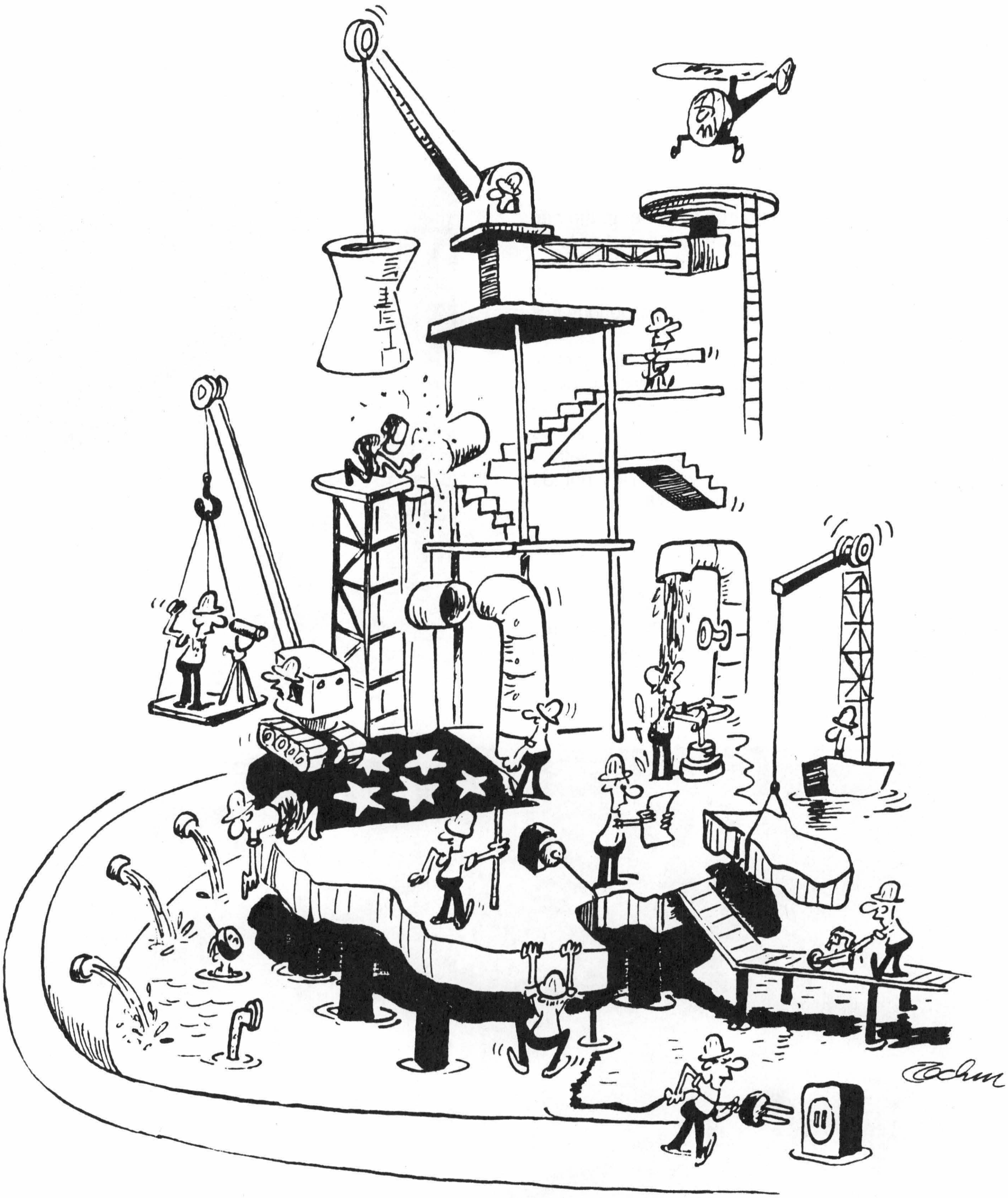
**Andy Stalder** is a junior in Mechanical Engineering. He put this issue together while dying of the flu. Hopefully he'll still be around for the April issue.





# Turning Ideas Into Reality
# Virginia Tech

## National Engineers Week - February 19-25, 1989

# E-Week at Virginia Tech

National Engineers Week, February 19-25, 1989, is a week dedicated to honoring all the nation's engineers. The week helps to promote recognition and appreciation of the creative engineers who are building America by "turning ideas into reality." Engineers Week was first founded by the National Society of Professional Engineers in 1951 in honor of George Washington, who was a military and agricultural engineer. In conjunction with the national event, the Student Engineers' Council (SEC) at Virginia Tech is sponsoring many engineering-related events.

So what motivates the students to want to participate in these activities? We want to show that engineers are not only studious, but involved. A new event for this year is the Volleyball Tournament. This sports event promotes friendly competition and interaction among the engineering societies. Over 25 teams have signed up, with trophy prizes going to 1st, 2nd, and 3rd place winners.

In addition to getting to know fellow students better, the Faculty-Student Talent Show provides a fun and relaxing way for students and professors to interact outside of the classroom. Groups compete with each other for 1st, 2nd, and 3rd place monetary prizes. Acts usually consist of singing, skits, musical instruments, etc. All students not participating in the talent show are encouraged to come out and watch.

On a more formal level, the students and faculty are given another chance to become better acquainted at the annual Engineers Week Luncheon. Selected faculty members and society presidents are invited, including the winner of the Paul E. Torgersen scholarship. The guest speaker for this year's luncheon is Don Morris, a professor in Engineering Science and Mechanics, who is the winner of last year's Sporn Award.

Since most of these activities are centered around the faculty and the upperclassmen, we did not want to exclude the freshmen from our celebrations. In order to integrate the freshmen into the engineering departments, we have planned Engineering Choice, an information night in which freshmen will be able to talk to upperclassmen about their respective engineering disciplines. The event is held before the freshmen must choose their majors, in hopes of helping to reinforce enthusiasm in a certain discipline or clear up some confusion as to which major to choose. All engineering departments will be represented by their respective societies.

SEC is not the only organization sponsoring events throughout the week. Tau Beta Pi, the engineering honor society, is sponsoring its 2nd Annual College of Engineering Open House on February 24, 1989. Instructional and research facilities in each of the different branches of engineering will be open for public tours. Tau Beta Pi has invited university faculty and staff, university students, high school students, and the local community to attend. Open House has high potential to become an important public relations medium for the College of Engineering and its various departments. Virginia Tech is now known as one of the few universities to host both an Expo and an Open House.

The American Institute of Aeronautics and Astronautics is hosting a speaker, Scott Crossfield, a former test pilot and fighter pilot who is now a technical consultant to the U.S. House of Representatives. Crossfield is the first pilot to fly successfully at Mach 2 and Mach 3. His talk, "Onward and Upward," covers topics from the X-15 to the proposed National Aerospace Plane.

Other events going on during the week are the Toothpick Bridge-Building Contest, sponsored by the Society of American Military Engineers; the Paper Airplane Contest, sponsored by the American Institute of Aeronautics and Astronautics; and the Virginia Tech Engineering T-shirt sale, sponsored by the Society of Women Engineers.

Finally, to thank all societies and engineers who participated in Engineers Week, the Student Engineers' Council is throwing a happy hour party at the end of the week. The celebration is a great conclusion to a fun and busy week!

The following is a schedule of events during Engineers Week:

Sat., Feb. 18: Volleyball Tournament
War Memorial Gymnasium
Mon., Feb. 20: AIAA Speaker-Scott Crossfield
Donaldson Brown Auditorium 8:00 p.m.
Tue., Feb. 21: SAME Toothpick Bridge-Building Contest
McBryde 5:00 p.m.
Engineering Choice: Owens Banquet Room
7:00-8:30 p.m.
SWE T-shirt sale at Engineering Choice and
throughout the week
Wed., Feb. 22: AIAA Paper Airplane Contest
War Memorial Gymnasium 7:30 p.m.
Thur.,Feb. 23: Faculty-Student Talent Show
146 Smythe 6:30 p.m.
Fri., Feb. 24: Tau Beta Pi Open House 9:00 a.m.-7:00 p.m.

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**Elizabeth Soong** is a senior in Aerospace Engineering. She is also the treasurer of the Student Engineers Council.

# The Full Circle of Computer Technology, or Late Night Thoughts about IBM vs. DEC.

*by Tom Glaab*

Late one night while running up my phone bill downloading files from a computer in Pennsylvania one of my roommates wandered into my room and sat down on my couch.

He watched for a few minutes, then commented on the inefficiency of modems. I agreed, watching the data lights on the modem flash at (only) 1200 baud. The conversation gradually turned to thoughts of wiring our house with a local area network (LAN), and I joked that we might as well buy a minicomputer and turn all our PCs into dumb terminals.

"You're right," Dave said.

Realizing that I was, our conversation immediately went off on a tangent about the developments of computer technology since the 1940's. Computers started as room-filling monstrosities which served several dumb terminals. As technology improved the computers grew smaller, but were still mainframes. Technology went further, and the minicomputer was born. These computers served several users, but were smaller, less elaborate, and less expensive than mainframes. Eventually the PC became the standard, because it was small, cheap, and one user's crash wouldn't shut down the whole office.

Now, computer users realize that they need to share software and data, and shuffling floppy disks is not the answer. As a result, LANs have become the latest craze in the computer industry. However, since these are essentially systems of stand-alone computers with one computer dedicated to maintaining the communications link, any upgrade of the system involves replacing several computers, a rather expensive proposition.

Dave and I figured that the next logical step is to return to minicomputers, completing a full circle in computer technology. Existing computers on a network would simply be converted to dumb terminals at little to no expense, and upgrades would be limited to one machine.

There would also be significant savings in terms of software. Instead of having to buy many copies of a program for use in an office, a company would only have to buy one. There may be an additional licensing fee due to its use on a multi-user system but this would probably be less than the cost of buying many copies of the program. By using one central copy of a program, everyone on the mini would be using the same version, which would eliminate compatibility problems faced in a situation where several different versions of a program are used.

Perhaps this sounds a lot like a LAN. It is, in its own way. But the difference is that the server computer would be dedicated to its job from the start, instead of being a PC which was converted to act as a server.

There are also many economic implications to this trend. IBM always has been the king of the mainframe world. It also has become a leader in the PC world. Digital Electronics Corporation (DEC) has always led the minicomputer market. But IBM has attempted to encroach upon DEC's market, and vice versa.

Due to its own bumbling around, IBM has lost much ground in the PC market. Its new line of PCs has fallen flat on its face because IBM's subcontractors have been unable to deliver hardware on schedule and because IBM hasn't been able to deliver OS/2. The first version of OS/2 was rushed onto the market and is far from being complete. This inability to deliver has become an embarrassment to IBM and a boon to other computer manufacturers who have leapt at the opportunity to make XT and AT clones.

DEC, meanwhile, continues to hold onto the mini market with its VAX line of computers, and has not ventured into the PC world since its Rainbow PCs flopped several years ago.

We decided that a logical path for the computer industry to follow would be for IBM and DEC each to do what they do best and to leave each other alone.

IBM should continue to lead the mainframe/supercomputer market and develop new PC technology while allowing outside manufacturers to actually build and market it. DEC should continue in the minicomputer market and prepare for the next step in the circle: replacing LANs minis.

Computer technology has almost come the full circle, but for it to succeed there must be an element of cooperation. Attempting to steal a market or dominate one with archaic technology is not the way to do this.

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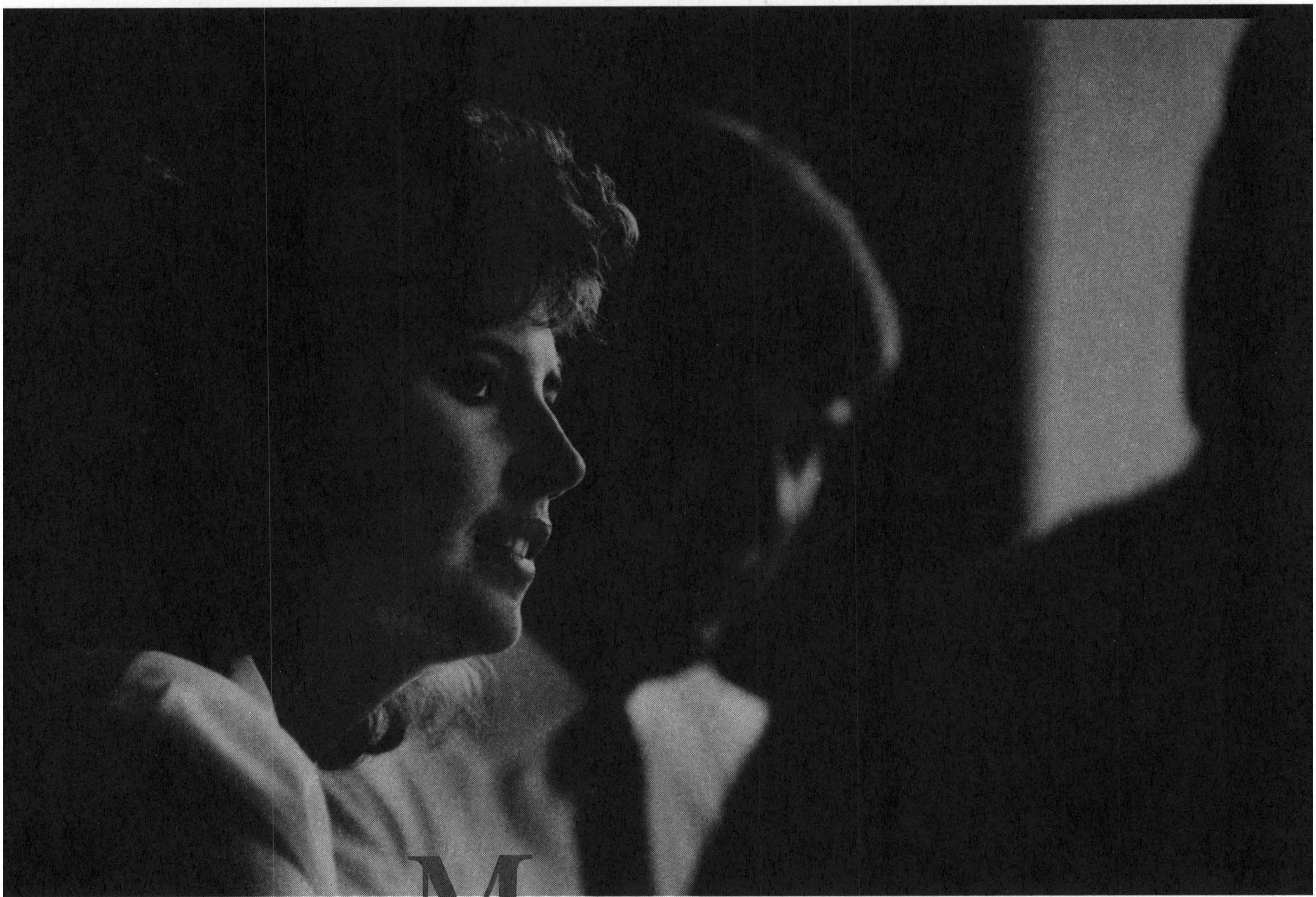
**Tom Glaab** is a junior in Electrical Engineering who is thinking about graduating sometime before the turn of the century.

*Mary Blue doesn't rest until every part is perfect.*



Mary Blue expects a lot from herself. A software engineer at GE Aircraft Engines, she helps develop new manufacturing methods for the engine parts that power commercial and military aircraft. Quality is her absolute top priority.

Mary also expects a lot from the company she works for. As a member of GE's Manufacturing Management Program, she's found the environment that lets her achieve, and excel. Her support system includes CAD/CAM, robotics, new materials, and all the leading-edge technologies. Plus interaction with the best minds in her field.

Talented engineers like Mary Blue are handed real responsibility on high priority projects from the day they join GE. Which is why only the most demanding, self-motivated people can be selected.

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