Engineers' Forum

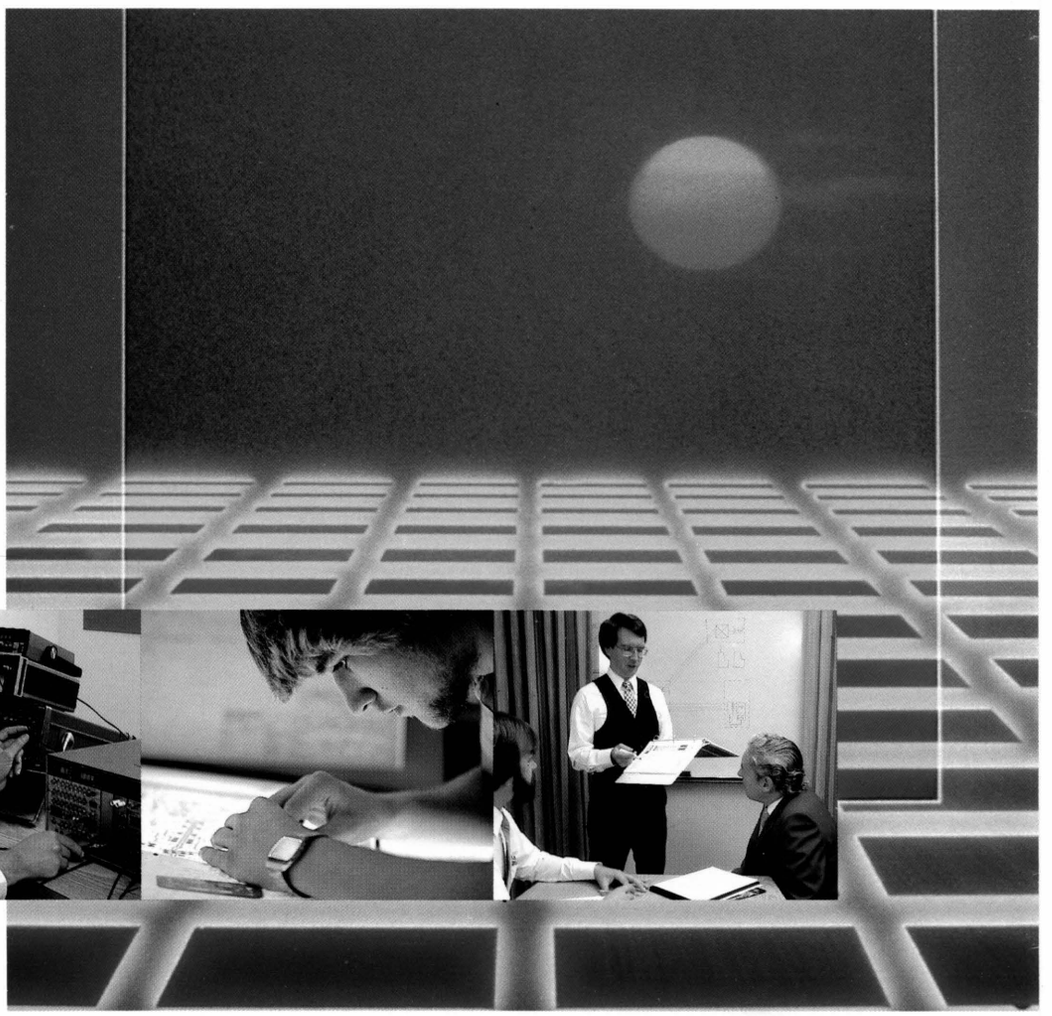
VIRGINIA TECH APRIL 1985

Perspectives on Engineering

YOUR FUTURE IS AS LIMITLESS AS YOUR IMAGINATION

As the innovator in telecommunications testing systems, Hekimian Laboratories, Inc. (HLI) is seeking Communications Engineers and Computer Scientists who would like to put their talents to the test. Join us and be involved in hands-on approaches in research, development, design and manufacturing.

Since the AT&T divestiture, the need for quality telecommunications testing has increased at AT&T, the Other Common Carriers, and the Fortune 500 companies. Our professionals are meeting this challenge. We are maintaining a tradition of consistent innovation that has pioneered the industry for more than 16 years.



Members of the Hardware Design Engineering Team may be involved with:

- **Development of new measurement techniques**
- **Design of analog and digital filters**
- **Interfacing analog and digital measurement techniques with microprocessors**
- **Design of microprocessor systems and test fixtures**
- **Development of electrical and mechanical design considerations for manufacturability**

As a member of the Software Engineering Group, you may be involved in:

- **Integrating equipment into a complete access and test system**
- **Implementing instrument control software**
- **Measurement control and data manipulation within test instruments**
- **Test fixture programming**
- **Algorithm design**

At Hekimian Laboratories, it isn't enough for your ideas to look good on paper; they have to be put to the test. You will work side-by-side with other professionals who are committed to being the best in their area of specialization, and follow a project through from inception to production.

HLI offers excellent salaries, a comprehensive benefits package and a superb location in the Washington, D.C. area, adjacent to the I-270 corridor in what is now called "Little Silicon Valley."

If you would like to meet the testing requirements of today . . . and tomorrow . . . while building a challenging career, we invite your inquiry. For more information about a career with Hekimian Laboratories, contact Tom Kruzic, Hekimian Laboratories, Inc., 9298 Gaither Road, Gaithersburg, MD 20877 (301) 840-1217. An equal opportunity employer.

HLI®

Hekimian Laboratories, Inc.

On the cover:
Charles Bostian, Professor of Electrical Engineering, at the Satellite Tracking Station of Electrical Engineering Department.

Photograph by Bob Veltri

Engineers' Forum is Virginia Tech's student engineering magazine. *Engineers' Forum* magazine is published four times during the academic year. Editorial and business office is located at 112 Femoyer Hall, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. Phone: (703) 961-7738. Advertising by Littel-Murray-Barnhill, Inc., 1328 Broadway, New York, NY 10001. Member Engineering College Magazine Association, John N. Clausen, Chairperson.

The opinions expressed in the *Engineer's Forum* do not necessarily reflect those of the administration, faculty, or student body of Virginia Tech.

Printed by Southern Printing Co., Inc., Blacksburg, VA 24060.

Engineers' Forum

Volume 3, Number 4
April, 1985

Perspectives on Engineering

STAFF

Will Student Discontent Elicit Changes?

Earlier this quarter, a committee of the Student Engineers' Council completed and submitted a report to the Colleges of Engineering and Arts and Sciences concerning the reactions of engineering students to the physics sequence required of all sophomores. The report consolidates information gathered by the committee in a survey of engineering students; for more specifics on the survey, see Brian Arundel's article that appears later in the magazine. At the time of this writing, however, no action has been taken by any administrator on the results of the physics survey with the exception of the Dean of the College of Engineering, Paul Torgersen.

During meetings with the committee, Torgersen mentioned some of the possible uses of this information and assured the committee that its results would be used by the College of Engineering to gauge student opinion concerning Physics 2171-3. As an example, according to Torgersen, the survey's ranking of instructors will enable the College of Engineering to request that teachers with lower ratings not be allowed to teach physics to engineers, and likewise to request that teachers with the higher ratings be assigned to those same sections. The College of Engineering, however, does not have jurisdiction over physics coursework and faculty. The Physics Department and the College of Arts and Sciences are going to have to take action if anything significant is to result from the survey.

Copies of the report have been sent to the Physics Department and the College of Arts and Sciences; with the advent of the semester systems, now is the perfect time for changes to be incorporated into the engineering physics sequence. This could be the opportunity for the Physics Department to upgrade their engineering physics program; they have been supplied with a reliable indicator of student opinion, they are already in the process of course revisions, and their program sorely needs improvement.

Of course, the possibility also exists that the physics report will get lost in the shuffle. Hopefully, however, action will be taken by the Physics Department, but if it is not there are still alternatives available for the concerned student. The Engineers' Forum, the Student Engineers' Council, and the Dean's Office have agreed to make copies of the report of the engineering physics survey available as a reference for concerned or interested students. If you stop by any one of the following locations, copies of the physics report will be available for you to read and to note which professors were rated the highest, which professors used what kind of testing, etc.:

Engineers' Forum
112 Femoyer Hall

Student Engineers' Council
110 Femoyer Hall

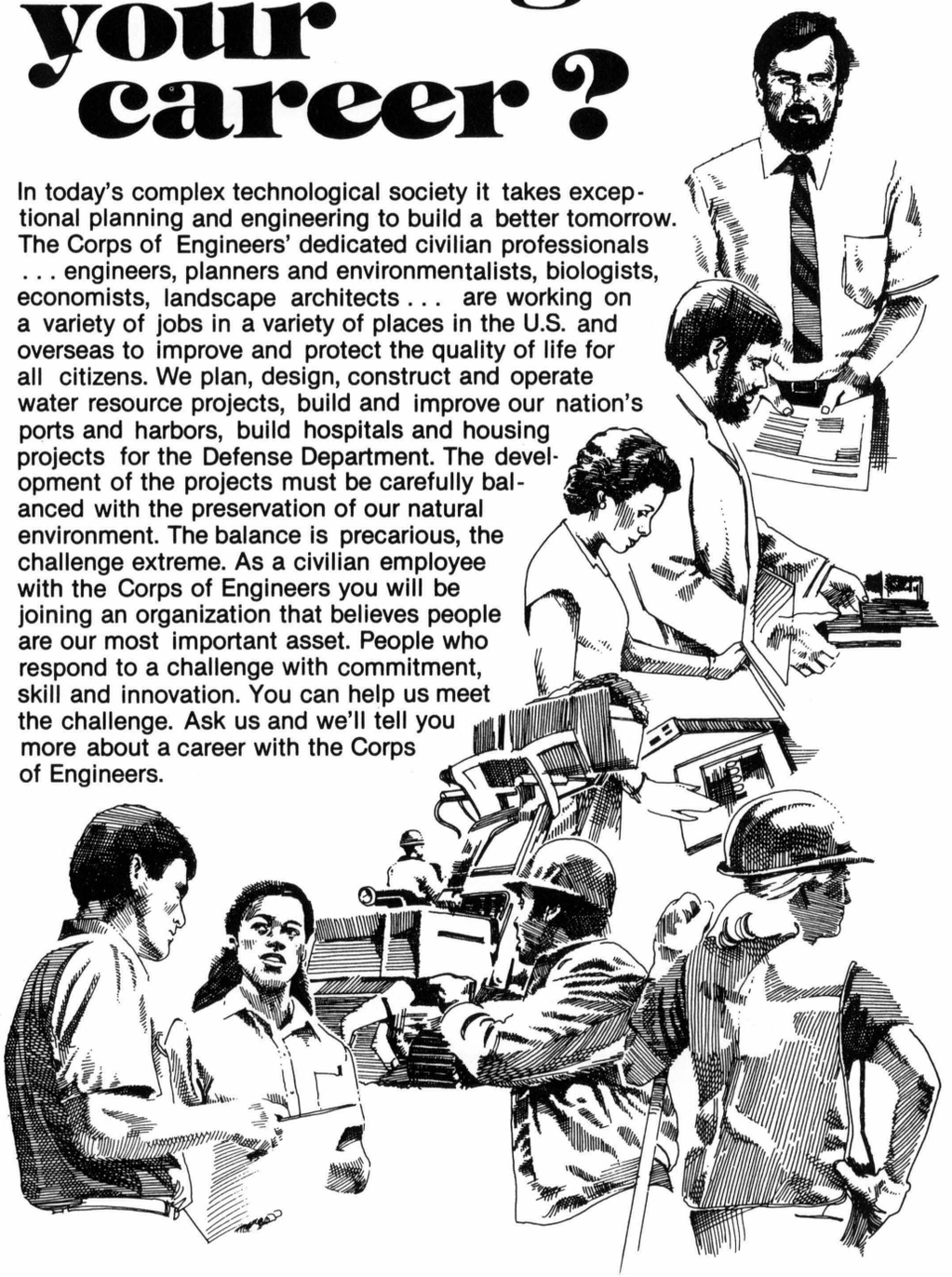
Dean's Office
337 Norris Hall.

Michael R. Dietrich

US Army Corps
of Engineers

Building your career?

In today's complex technological society it takes exceptional planning and engineering to build a better tomorrow. The Corps of Engineers' dedicated civilian professionals . . . engineers, planners and environmentalists, biologists, economists, landscape architects . . . are working on a variety of jobs in a variety of places in the U.S. and overseas to improve and protect the quality of life for all citizens. We plan, design, construct and operate water resource projects, build and improve our nation's ports and harbors, build hospitals and housing projects for the Defense Department. The development of the projects must be carefully balanced with the preservation of our natural environment. The balance is precarious, the challenge extreme. As a civilian employee with the Corps of Engineers you will be joining an organization that believes people are our most important asset. People who respond to a challenge with commitment, skill and innovation. You can help us meet the challenge. Ask us and we'll tell you more about a career with the Corps of Engineers.



Office of Personnel Army Corps of Engineers Washington, DC 20314

An Affirmative Action Equal Opportunity Employer

Keeping Abreast of Change: An Interview with Provost Roselle

by Bill Duncan

Engineering education faces many challenges during the 1980s, primarily due to the speed at which technology is advancing. As technology grows at a rapid rate, industries are hiring more and more engineers thus creating a shortage of qualified faculty. The technology revolution causes engineering equipment to become quickly outdated, and by doing so, it makes state-of-the-art research in the university laboratories difficult to perform. Also, the technology revolution has forced engineering educators to read constantly about their field so they can keep up with the escalating changes and convey these advances to students in the classroom.

The Virginia Tech College of Engineering, along with the Provost's Office, has been working to keep pace with the change. Recently, plans have been made to: 1) expand the Engineering faculty staff; 2) update inadequate equipment in senior and graduate engineering level laboratories; 3) change from an academic quarter to a semester year, and 4) broaden engineering education.

Faculty Expansion

In the midst of a nation-wide shortage of engineering faculty, Va. Tech is making plans to increase its College of Engineering's faculty staff. University Provost David Roselle said, "The Commonwealth of Virginia just gave us positions that we are going to give to the College of Engineering." Roselle admits Tech doesn't have as much of an engineering faculty problem as other institutions. He attributes its relative success in luring qualified engineering faculty to staying competitive in salaries and eliminating space problems. "I don't think six positions will solve America's engineering shortage, but every little bit helps," Roselle said. Tech has other advantages in attracting engineering faculty. The College of Engineering has gained the reputation of being one of the leading engineering colleges in the nation for its academic excellence. Also, Tech ranks first among all other universities in the percentage of private industry research dollars awarded to the faculty. Roselle said that bright engineering students and Blacksburg's scenic qualities are also factors in bringing engineering faculty here.

Equipment Update

In this era of escalating technological changes, educational equipment almost appears to be obsolete by the time it rolls off the assembly line. Roselle said that outdated equipment is "a very large problem." He added that there will never be a solution to the problem and "no alternative but to try to keep up." The Virginia state legislature awards Va. Tech $2 million annually for the purchase of new equipment. Roselle said that the $2 million a year was becoming inadequate for the rapidly growing engineering need for updated equipment. So, Tech has borrowed $10 million from the state to be paid back within ten years for the purchase of new scientific equipment. The bulk of this new equipment will be awarded to the College of Engineering. Roselle said that $9.2 million worth of the new equipment is being delivered presently. In addition to the extra equipment money, the state legislature has appropriated more funds for Tech for the purchase of equipment.

Roselle said, "We have done a lot to solve this problem." As well as giving credit to the state legislature, Roselle points to other key people who work very hard to solve equipment problems. He commends the engineering faculty for their successes in securing equipment. Also, private industry donates a major portion of Va. Tech's research equipment. Futhermore, the federal government has stepped in and is taking an active role in solving the College of Engineering's equipment problems.

Compared with other institutions, Tech's College of Engineering is making headway in solving inadequate equipment problems. Roselle said that the key ingredients to the success are hard work and "just keep cheering our successes." Indeed Va. Tech is experiencing noticeable short-term success with updating equipment. However, long-term success proposes questions. The difficulty lies in how to measure long-term success. Roselle does not plan to expend a lot of effort trying to measure the College of Engineering's long-term success in solving outdated

equipment problems. Instead, he plans to work very hard just to keep the equipment updated. "Whether we're successful or not, let others decide that," Roselle said.

Transition to Semesters

Va. Tech plans to switch to the semester system in August of 1988 pending approval by the Board of Visitors. Roselle said that "the reason we're not making the change until Fall 1988, is that it's a big job." He said the university expends a lot of money and effort each year just revising, reviewing, and approving courses in the curriculum. The semester system transition will concentrate that process into a shorter period of time. The entire curriculum will be reviewed and revised within the period beginning April 1985 and ending December 1986.

Advisors will start counseling students for the transition beginning April 1987. In July 1987 the university will begin converting student records and issuing credit summaries.

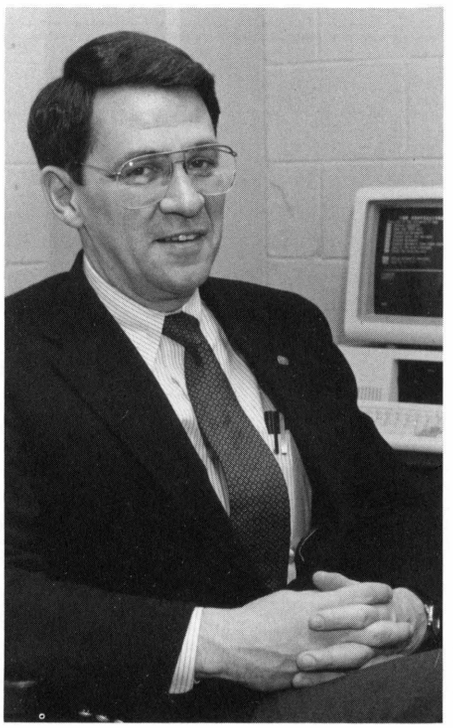
Roselle explained the key issue of the need for a change to semesters is not that Va. Tech's present calendar is inferior to other academic calendars. It's just different. Roselle said he thinks the students want the present calendar changed. "Incidentally, there are a lot of faculty who want the change," Roselle said.

The faculty will find the change advantageous because they can develop more in-depth subject matter in a semester than in a quarter. The faculty also can assign more serious research papers. Roselle cites a complete curriculum review as the foremost advantage of the change to the semester system.

The change will entail a marked reduction in the length of the present academic catalogue. "About one third of the courses will drop out of the catalogue," Roselle said. Engineering students need not worry that the change will impair the quality of their education. "We'll get the same information to students," Roselle said. "It'll just be packaged differently."

Broadening Engineering Education

Educators are concerned that engineers may not have enough education in non-engineering disciplines. Roselle said the "University has been concerned with the question of humanities for engineers." This concern prompted the proposal of a core curriculum in 1981 that would require engineers to take more humanities courses. "This fall we plan to implement the core curriculum for all students," Roselle said.



M. Hill

Provost Roselle

The problem is that extra humanities courses will place a burden on entering engineering students. They will face a time dilemma of trying to fulfill engineering requirements along with the added humanities course load. However, Roselle said engineering students haven't resisted the additional humanities requirements. He attributes this mood to an engineering student body having a wide range of interests. "The engineers that come to us are very diverse in their interests," Roselle said. "You can point to several manifestations of this such as there being more freshmen from the College of Engineering enrolled in honors English classes than from any other college."

Because of today's engineering students' diversity, Roselle said, "the day of the one-dimensional engineer is dead." He believes engineering students are far too bright and interested in too many things to seclude themselves from the non-engineering world. He also said the faculty want engineering students to gain a broad education.

The College of Engineering faculty also works hard to keep Va. Tech engineering students abreast of change. The faculty constantly updates its information via its findings in research. Va. Tech is noted for outstanding research which has gained it the number one rank in the percentage of private industry research dollars.

Yet, emphasis on research recently has become a controversial issue among the critics of higher education. In a February 25 letter to the *Roanoke Times & World-News* editor, Va. Tech Professor Emeritus Dan H. Pletta asserts that extensive research can lead to poor education. He writes, "over-emphasis on research, under-emphasis on good teaching, and disregard for educational objectives is one facet of the problem."

However, Roselle disagrees that overemphasis on research hinders engineering education. "Good researchers tend to be good teachers," Roselle said. "I don't think there needs to be a competition. Indeed, teaching and research go hand in hand."

Roselle said that staying abreast of research keeps information current. "Imagine what it would be like if we were teaching ten-year-old chemistry," Roselle said. Research is one of the three missions of an institution for higher learning. The other two are instruction and public services.

While these three missions remain constant, all factors affecting them change continuously and grow more complex. The Va. Tech College of Engineering and Provost's Office strive to meet their three missions. Roselle said, "the problem is getting people too busy."

The Engineer's Destiny

by Daniel H. Pletta, P.E.*

Whether or not the engineer's destiny is manageable or inevitable, it has apparently changed over the past 5000 years. I believe that it is poised now to enter a third phase, in which the engineer must participate effectively in societal leadership whenever technological missions are determined by legislative means, if serious hazards are to be minimized. The first phase spanned his practice in the builder's art and in the artisan's craft. The second phase evolved after both the renaissance of knowledge in the 14th century and the industrial revolution in the 18th century established a scientific foundation to replace the trial-and-error method of engineering practice.

During the first phase, which lasted until about 1750, builders designed and constructed the public facilities civilizations needed to function, and craftsmen invented and created the consumer products people needed to live. Originally, the facilities included irrigation, water supply and transportation systems as well as fortresses, monuments and buildings. Egyptian pyramids, Greek temples, Roman aqueducts and roads, China's Great Wall, Medieval cathedrals and royal palaces are examples. Early consumer products encompassed utensils, clothing, furniture, shelters, jewelry and weapons.

The second phase began to emerge after 1716, when the French engineer, Jean Rodolphe Perronet, was authorized to instruct "designers in science and practice needful to ... bridges and highways" for the French Corps des Ponts et Chaussees. Many other military and civilian engineering schools were founded shortly thereafter. Their number today probably exceeds 1000. Since 1716 the builder's and the artisan's functions have been transformed into a myriad of engineering specialties. These could be consolidated into those of facility engineers who designed and built what is now called the infrastructure which serves the public on a collective basis, and the product engineers who created and produced the consumer items which are used by the people on an individual basis.

Unfortunately, the tremendous production of material wealth and increase in living standards engineers generated, especially since about 1900 when electrical power and mass production were introduced, gradually altered environmental response and human reaction to engineering activity. Side-effects like atmospheric smog, acid rain, soil erosion, pesticide accidents, inflammable fabrics, carcinogenic additives, and instant communication were generated to pollute, poison or saturate man's habitat, body and mind.

In some cases the side-effects were remedied by retrofitting, but its ineffectiveness soon became apparent. As an example, consider the way existing oil and coal-burning electric generating stations were retrofitted so as to reduce air pollution locally. Electrostatic precipitators were installed to remove the alkaline flyash, and chimney heights were raised to disperse gases like sulphur dioxide (SO_2)and nitrous and nitric oxide (NO_x). Hindsight now shows how solving an irritating local nuisance created a far more serious global one.

About ten years ago, acid rain began to damage trees and aquatic life in forests and lakes in northern latitudes worldwide. The removal of the flyash by the precipitators prevented it from neutralizing the acidic gases in the stack as it had done formerly. The sad fact is that this *technological failure* was as predictable as was the recent Teton dam failure in Idaho.

Other failures were more interdisciplinary. The Pruitt-Igoe high-rise apartment slum clearance project in St. Louis failed because family congestion and illiteracy created a social environnment too dangerous for human occupancy. The complex was abandoned and dynamited after a few years of service. It was a *sociological failure.*

So, in a like sense, is the Aswan dam in Egypt a *biological failure.* It changed the ecology of the Nile River basin by controlling the previous annual flooding, and eliminated the fallow season downstream. This had previously killed infected snails. Now they spread the modern plague, bilharzia.

Typical *legislative failures* occur when lawmakers legislate engineering and ignore design limitations. For instance, the continual increase in allowable truck weights and lengths beyond the standards used to design road slabs and bridges results in their premature deterioration or failure, or mismatch of turning radii and roadway curves. Motorists are then taxed unfairly for the system's extra maintenance, or subjected to costly detours. Worse yet, they are frequently killed when bridges collapse, or trucks cannot stay in their lanes on sharp turns. Strangely enough, no legislator has ever been charged with manslaughter for these preventable accidents. However, public concern arising from both legislated engineering and technological change is growing.

Avoidable accidents and side-effects can be minimized only if engineers, as they enter the third phase of their destiny, become the public's advocate on technological matters. They must stop engineering design from being

legislated and insist on risk assessment studies for all major interdisciplinary projects. They should participate actively whenever technological policies are being formulated democratically or autocratically.

Engineers and scientists are able to see potentials and pitfalls of technological issues better than most other professionals. Both must begin to assume a leadership role in our technological civilization as population increases, deserts spread and resources dwindle so as to prevent civilization from becoming critically unstable.

A leadership role can be developed by engineering practitioners only if engineering novices are groomed for it, and if both unite into a politically effective global force. First, however, it may be necessary to use the same title for engineers worldwide which the public accepts as describing the engineer's professional ingenuity and public dedication. Unfortunately, the American title of "engineer" is also associated with locomotive drivers and motel maintenance employees. Foreign titles like the European "ingenieur," the Italian "ingeniere," the South American "ingeniero," and the Danish "ingenior" do not have this double meaning. The Danish form resembles its roots of ingenious and ingenuity most closely and is the one I would favor. Its truncated form of "genior" could be used to address professional colleagues, as is "senor" in Spanish, and the abbreviation "Gn." employed worldwide by the public as is "Dr." everywhere for physicians.

A distinctive title and the formation of a united global association might provide the esprit de corps needed for these ingeniors to begin applying their training as generalists-first-and-specialists-second toward the process of assuming leadership. The engineering profession will, in the future, have to broaden its public purpose to include societal leadership, and to participate in the formulation of national technological policies. To do that, it will have to increase curricula lengths, not only to provide for the greater breadth needed for interdisciplinary designs and an appreciation of civilization's cultural heritage, but also to cover the study of management and leadership.

Frederick Mavis conclusively expressed these thoughts for engineers in 1954, when he was Dean of Engineering at the University of Maryland. He said, "Has not the time come when professionals may have to study the laws of politics—and harness the overgrown giant of governing machinery which has become America's master, rather than its servant? Would professionals bungle the job more than politicians have done? . . . The job of harnessing politics for the use and convenience of man has yet to be done." When that is done, engineers may finally be fulfilling the third phase of their ever broadening and changing destiny.

---

*University Distinguished Professor Emeritus, VPI & SU

Student Views on Engineering Education

by James Lisk

Engineering is a difficult discipline in which success demands motivation, skill and sacrifice. The idea of success varies with each person; three engineering students and one former engineering student who seem to be successful share their ideas here.

Sue Reller, the first of these, is a junior in Industrial Engineering and Operations Research. She is doing well in her classes and also serves as an Associate Justice of the Virginia Tech Honor System. "If anything else, then you're just a person who sits in the library"; she believes being a successful student means more than making good grades.

J. Lisk

Sue Reller, Junior, IEOR, "If I thought I was really making a sacrifice (for engineering), then I would really be upset about it. But I've chosen to become an engineer and I can't just do that half way."

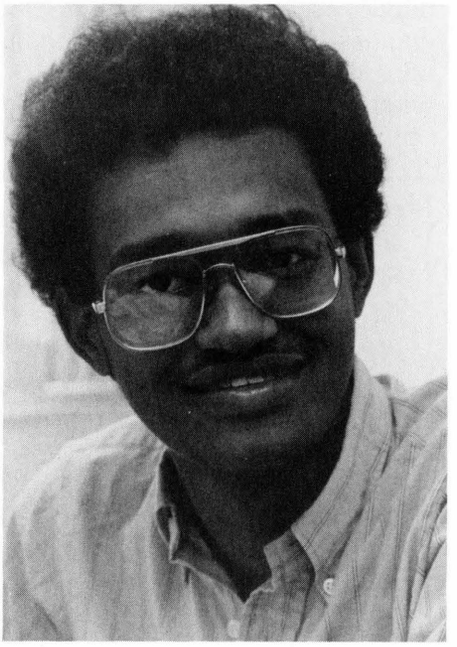
Scott Suko is a senior in Electrical Engineering and is president of the Virginia Tech chapter of the International Society of Hybrid Microelectronics (ISHM). He too has done very well academically. Of successful engineering students he says, "The best off engineering students are the ones who do well in their classes and still have time for themselves.

"I actually enjoy studying. I don't really think of it as a burden. If you don't like what you're studying, you won't be able to get through engineering."

Jerry Bradshaw is a senior in Economics, planning to begin graduate school in the fall. However, he started as an engineering student. Why did he change? Several factors were involved. "I had been doing a lot of work, not getting much accomplished. I did not have time to take philosophy and history classes that I'd never have a chance to take again. I did not think that the professors in the Engineering Fundamentals Department were very helpful in making this decision. I wasn't doing poorly, but when I went to talk to my advisor about possibly changing majors, his reply was 'Well, if you're not going to be an engineer what are you going to do? Dig ditches?' At that point I wasn't exposed to any other pursuits where I could get a good job."

"The whole first quarter it was drilled into me that engineering is the only thing you can graduate in and be assured of getting a job. And so I decided to stay in it, but finally I came to my senses."

Nathnael Gebreyes a senior in Industrial Engineering and Operations Research (IEOR) and president of the Student Engineers' Council (SEC), gives a different idea. "The hard reality of college is that *you* are responsible for seeing what's out there, which is a switch from high school. If you're not convinced that engineering is it (for you personally), then I would say that it is worth any student's time to go ahead and take a class or two in other majors even if it doesn't count (towards your degree) . . . because you're talking about the rest of your life."



B. Robertson

Nathnael Gerbreyes, senior, IEOR, president of SEC, "More than time to do, you need time to think. I have to manage my thinking in order to concentrate on SEC now and the next hour on my studies."

Sue also considered changing out of engineering. "All I had to do was move my records from one building to the next. I stayed in - why did I stay in? I don't know, I just decided to stick it out another quarter. And that other quarter, I

had some I.E. (IEOR) classes that I really liked."

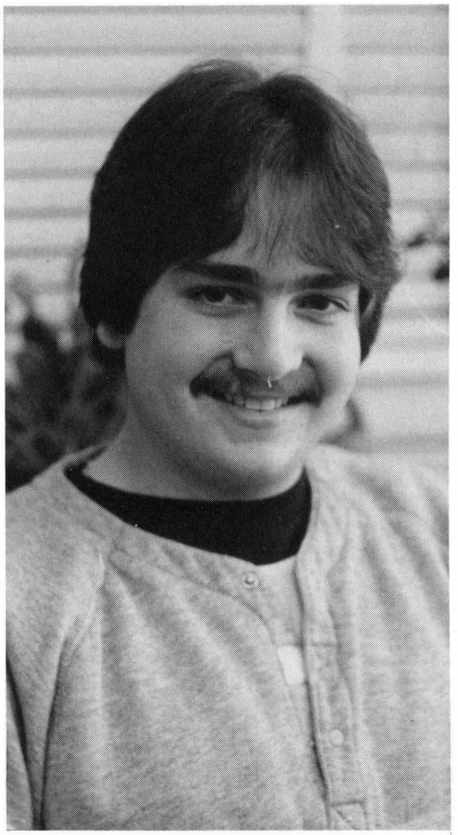
Scott never considered changing majors. "I like math, science and that type of thing. I thought I'd combine those interests in engineering. But if it weren't for the difference in the job market, there's a chance I'd have ended up in physics instead of engineering."

Jerry had a different view on this. "It seems to me that college shouldn't be a trade school. It should be a place to get an education and getting an education means reading 'terrible' books like the *Iliad* and the *Odyssey,* and taking some economics courses and some business management courses."

Scott would like to be able to take more classes but admits "I'd never be able to satisfy my curiosity in other areas . . . But the way that it (the engineering program) is set up is probably the best it could possibly be."

Nathnael believes that the Virginia Tech engineering program is more rigid than most other engineering programs. At an SEC conference at Purdue, he had the chance to examine engineering degree requirements of other colleges and discovered that most are not as stringent as Virginia Tech. "The fact that ours is tighter is an asset now, because we are looked upon as highly qualified graduates." He feels that some sort of medium should exist between being able to select classes and taking required classes exists, "I'm not sure we've reached that balance yet."

Jerry Bradshaw was not satisfied with the current balance. ''Freshman year, the E.F. department said 'Don't get involved in extracurriculars, you won't have time; you should concentrate on engineering classes.' " Now he has more time to do other things. "I am in the Economics Club and have time to go and see lectures and speakers who come here to teach, things I think are important to getting an education, but aren't in any curriculum anywhere . . . I have time to enjoy college and education without feeling like I'm just trying to get through."



J. Lisk

Jerry Bradsaw, senior, economics, "I know a lot of people whose parents would be shocked and abhorred to find out their children didn't want to be engineers. Smart people don't necessarily have to become engineers."

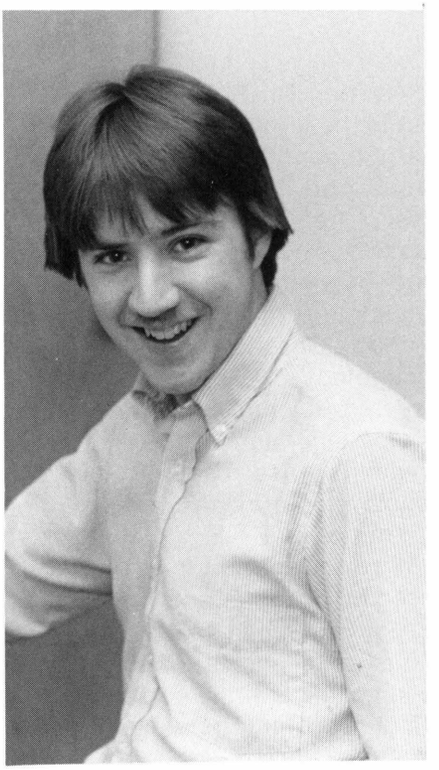
Sue was also caught up in classes her freshman year. "I wish I could have done more. My freshman year, I did nothing in the way of extracurriculars. My sophomore year I did a little with the honor system . . . I organize around my classes . . . It's just being able to see what's important."

Nathnael said, "At times, some of the things I've done out of class have been just as important, or more important than some of the classes. It's been a balance, a hard balance.

"Freshman year, I wasn't doing much of anything outside classes - that bothered me. Beginning second quarter as a sophomore, I began to get involved and really began to enjoy school a bit."

Scott believes that being president of ISHM "has affected by academic performance, but not that much. There is not much time left over to go out with friends, but I've always preferred a small number of close friends. Interviewing and plant trips are taking up so much of my time this quarter that it's really hard to keep up with all my school work."

As for the future, Scott hopes "to have a successful career as an engineer, make a lot of money, develop new things, and feel like I've contributed something."



J. Lisk

Scott Suko, senior, electrical engineering, "If you don't like what you're studying, you won't be able to get through engineering."

Sue still has a year before graduation but plans to complete a master's degree. "I might like a consulting role or maybe I'll come back and teach."

Nathnael is planning to start work. Jerry Bradshaw hopes to get his Ph.D. in economics. All of these people look forward to what the future holds for them and are happy in what they have chosen. And after all, isn't happiness what success is all about?

A New Initiative: The Center for Innovative Technology

by Dave Hernson

During Dr. Robert Pry's recent visit to the Virginia Tech campus for the Student Engineers' Council sponsored National Engineers' Week, he was inundated with questions and concerns from students and faculty on the functioning of Virginia's newly formed Center for Innovative Technology (CIT). Dr. Pry, a research scientist, recently retired as vice-chairman of technology at Gould, Inc., has accepted Governor Robb's appointment as president of the Center.

In answering the questions posed by both students and faculty, Dr. Pry explained the organization of the Center and its goals. To begin, he indicated that the purpose of the CIT is to bring the resources of Virginia's universities together to bear on the task of stimulating the high-tech industry in the state. This effort includes setting up a telecommunication network and statewide database system. The Center has the charge of attracting venture capital and awarding industrial revenue bonds in order to create incubator space in industrial parks for emerging high-tech companies. Finally, the CIT has the charge of coordinating and helping to build continuing education in the state.

The CIT is a not-for-profit corporation, separate from the state government and outside of the universities' administrations. The CIT was set up in this way for two main reasons. First, in order to give the Center the required leverage as a change-agent, it would not feasibly be created within one of the state's existing large organizations. Since the CIT is a separate organization, it will be able to catalyze new ideas and new activities within the larger organizations. Second, recognizing the fact that research and development is only one part of gaining a high-tech industrial base here in Virginia, the state's legislature made CIT's charter broad enough to operate in the whole gambit of economic incentives needed to create high-tech jobs here in Virginia.

Both students and faculty were concerned with how the CIT was to begin to achieve its goals. Dr. Pry said the first initiatives are to be started at the state's universities. The four new research institutes in the CIT plan are to be based at three of Virginia's universities with affiliate schools as indicated:

- The Institute of Information Technology at Virginia Tech in affiliation with George Mason University
- The Institute of Materials, Science and Engineering at Virginia Tech
- The Institute of Computer-Aided Engineering at University of Virginia in affiliation with Old Dominion University
- The Institute of Biotechnology at Virginia Commonwealth University

B. Robertson

Dean Torgersen, (left) and Dr. Pry.

Though these are based at the universities, their operations are to have state-wide responsibility. They will fund research with industry matching grants at schools throughout Virginia. These institutes are meant to bring all the state's universities together in a more coordinated research effort. In addition, the CIT's institutes will help coordinate and foster continuing education programs throughout the state.

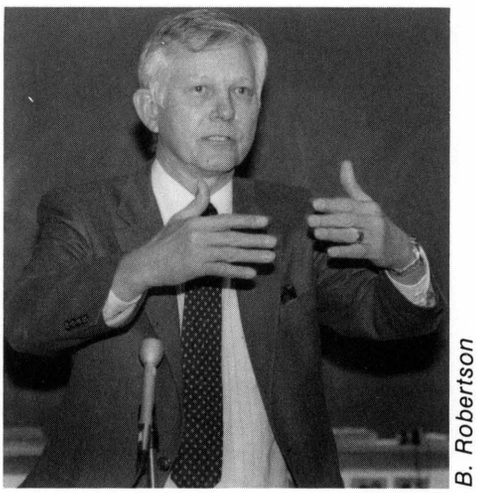
Dr. Pry said that in the high-tech industry, continuing education is no longer a perk that companies offer its employees, but has become a condition of employment. Industrialists can no longer be unconcerned if employees become out of date in their education, as there simply is not the pool of replacements that existed even ten years ago. Industry can no longer waste the intellectual capital in this way, as young replacements are scarce, leaving only the option of stealing from competitors. Therefore intellectual capital must be viewed as such and the same maintenance must be provided for it as is for the equipment on the shop floor.

CIT is developing a site near Dulles in northern Virginia. The building will be equipped with computer terminals, telecommunications and networking capabilities. This will enable the CIT to sell Virginia's resources effectively to candidate companies. Though this may seem to be simply image creation, Dr. Pry envisions it fulfilling the three reasons a corporation would move to a new locality,

1. Quality of life and worker climate
2. Top management wants to live there
3. Community wants the company there.

Looking back at the progression of economic development in the U.S., there has been a long tradition of non-involvement of government with the commercial industrial sector. Government attitude towards non-defense industry has been to leave it alone except to regulate it. Though that has worked for a long period of time, occurrences over the last 20 years have necessitated a change in that strategy. The result is that 2/3 of the states have initiatives of one kind or another like the CIT; however, the CIT is unique in the breadth of its approach outside the state-university system.

In an effort to explain to students and faculty the reason for a multi-million dollar program such as the CIT, Dr. Pry explained the historical events that led to the creation of the Center. Since World War II, the amount of money that has been allocated by the federal government to university research has come from the National Science Foundation, but to a very large extent, the monies have come from the defense establishment. The premise for this has been that all the research that defense generates has a spillover into the civilian sector. As a consequence, little attention has been given to developing those technologies in the civilian sector as industrial laboratories were assumed to take that responsibility.



B. Robertson

What was overlooked was the fact that research minds were the limiting factor, not just the research dollars. The majority of those minds outside the strictly applied research and development activities of most industries is directed towards defense (DOD) objectives. This leaves a gap in research and development relative to the entire economy, in that companies with less than 500 employees comprise about half of the "added value of manufacturing" in the U.S. These are companies lacking in both the capital and mind power required for research and development. The other half of the "added value of manufacturing" is provided by the Fortune 500 companies or less than 1% of the other smaller companies.

Another problem of technological advancement with respect to the economy is the long periods of inflation during the 50s, 60s, and 70s. These decades of relatively high inflation caused the capital intensive companies to appear very profitable with respect to their return on assets. Those assets were in 1950 dollars and though return on investment appeared good the company can no longer replace the capital with current dollars. As a consequence, productivity suffered and the door opened for foreign competition to debase those capital intensive industries such as auto and steel manufacturers. In addition, the tremendous success of the Marshall plan created commercially superior peers with respect to competition. Because those countries the U.S. helped to rebuild after the second world war do not need to make the magnitude of investments in defense which the U.S. does, their governments can invest in industrial research and development. This has led the U.S. to the realization that foreign competition is fighting those foreign competitors in our home markets rather than viewing foreign competition simply as export sales.

For those reasons, the industrial community has begun to examine ways in which to increase their economic leverage with respect to technology in order to enable the U.S. to compete in the international market. Currently about 2/3 of the states have some sort of initiative to attract existing business and to encourage research programs aimed at gaining this commercial and industrial conomic commercial and industrial economic leverage. The result in the long run is to raise the economic climate so that U.S. companies can continue to compete in the world market.

E-Week 1985

by Kevin M. Loney

Engineers' Week 1985, sponsored by the Student Engineers' Council, was held this past February with the theme "Turning Ideas into Reality." The week's activities included contests sponsored by campus engineering societies, an orientation program for high school juniors, a faculty-society luncheon, and a party at the end of the week.

Each day featured a different contest. On Monday, the American Institute of Chemical Engineers held a Society Feud, modelled after "Family Feud," in which the students on the teams were asked questions about Tech. The winning team, representing the American Society of Metals, won 150 dollars.

Tuesday featured one of the more popular contests, the Egg Car Nationals, in Randolph lobby. More than twenty entrants submitted vehicles that could carry an egg 15 feet and then accurately throw it at a target. While most of the models used devices that were triggered when the vehicle struck the target, the winning entry did not. Designed by Dave Rusillo, it used a slingshot-like action to throw the egg at the bull's-eye. First prize was an HP-41CV calculator, donated by Hewlett-Packard. This event was sponsored by the American Society of Mechanical Engineers.

On Wednesday, nineteen entrants competed in the Egg Drop contest, sponsored by the Student Engineers' Council. This event drew a large crowd to watch the eggs, wrapped in individually-designed containers, being tossed out of Pritchard Hall. Two containers survived the drop from the seventh floor of Pritchard before being taken to Slusher Tower to decide the winner. The winner, Mark Hall, used a basic design very similar to that of other contestants, but he used rubber bands to stress the egg prior to wrapping it. He was awarded 50 dollars, for his second annual win in this event.

The feature event for Thursday was a paper airplane competition held in the Old Dominion Ballroom of Squires' Student Center. The object was to design a plane that would fly the longest distance, with a first prize of a round trip airline ticket to Florida for spring break, donated by the World Travel Service. This event was sponsored by the Engineering Science and Mechanics Department. The winner was Frank Kovach, whose plane flew from one end of the ballroom to the other, an estimated distance of 112 feet. In addition to the ticket, he was also entered in the Second Great International Paper Airplane Contest to be held in May.

The American Society of Civil Engineers sponsored a toothpick bridge contest that was held on Friday. The object was to take a given number of toothpicks, and, using glue as an adhesive, construct a bridge that would support the greatest amount of force applied. The winning bridge, built by Brad

S. Talbot

One of nineteen eggs entered in Wednesday's egg drop contest sails to its fate from Pritchard Hall.

N. Gebreyes

Jean Skomarucha, newly elected president of the SEC, publicizes E-Week

Bruchman, supported a load of 1,075 pounds. He was awarded 50 dollars.

The final competition of the week, a rocket competition, was held by the American Institute of Aeronautics and Astronautics. Rockets were judged on the basis of design and distance flown. Each entrant was given a kit from which to construct the model. First prize, an HP-11C, was awarded to Dr. Wayne Leu of the Aerospace and Ocean Engineering Department, whose rocket flew over one-quarter of a mile. The award for the most creative design went to Lloyd Eldred, whose "boost" glider featured tails at the front of the rocket.

Besides the daily contests, there were other events during Engineers' Week. The orientation program for Montgomery County high school juniors was held on Monday. They were treated to a tour of several research areas on campus and a chemistry "magic" show put on by Professor L. K. Brice of the Chemistry department. They later met with Pamela Kurstedt, Assistant Dean of the College of Engineering.

The faculty-society luncheon was attended by the heads of each of the student sections of the university engineering societies in addition to a majority of the department heads. The keynote speaker for the event was Robert H. Pry, a representative of the Virginia Center for Innovative Technology. he emphasized the theme of Engineers' Week 1985 by stressing the need for the academic community to interact with the professional community and government in order to accomplish the goal of turning engineering ideas into reality.

The Results of the Engineering Physics Survey

by Brian Arundel

In the Spring of 1984, the Dean's Committee distributed a questionnaire among Engineering students. The survey was designed to analyze the effectiveness of Physics 2171, 2172, 2173. Slightly over 1000 students responded to a total of forty-five questions, which included such topics as professor proficiency, exam adequacy, and laboratory relevance. The primary objective of this study was to clearly identify the strengths and weaknesses of the Physics sequence and to determine possible alterations which could be made in order to improve the quality of the courses.

One question students were requested to answer was "how do you rate the professor?" The choices ranged from "excellent" to "very poor," including "very good," "good," "fair," and "poor." The majority of the instructors received ratings between "fair" and "poor," while professors R. Arndt and J. Ficenec recorded the most support.

Students comments accompanying the completed questionnaires varied widely. Some positive remarks regarded one instructor as "very good in teaching the material," and another "explains things clearly and answers any questions that you might have thoroughly." Some negative comments described one professor who "showed movies and slides that were worthless" and whose "explanations and theory were lacking." One student complained of a teacher who "had a bad accent and never explained anything he threw up on the board," while another "failed to teach the material properly."

Remarks such as those previously mentioned deal with lecture criticisms as well as professor evaluations. One survey question asked students to rate the lecture itself. This received a mediocre rating and therefore somewhat inconclusive responses, although a prevalent complaint was noted regarding the amount of class time spent on derivations. Three out of four students claimed that most of the lecture time was spent deriving formulas, and two of three students considered this time as "not helpful." Specifically, students commented: "book derivations repeated in class are a waste of time"; "go over examples in class instead of derivations"; "many derivations were haphazard and lacked the formalism engineers are used to; too much time is spent on deriving formulas—more application and problem solving would be beneficial."

Another influential aspect of professor evaluations is the subject of exams. Students were evenly divided as to whether problems or multiple choice tests are more beneficial, although 74% of the responding student population encountered multiple choice tests more often. Some students indicated a desire to "work out problems and get partial credit," while others expressed an interest in seeing tests combine both multiple choice and problems. Regardless of the format, however, a major problem within the physics sequence (although not specific to the department) concerns the availability of "koofers" [sic], or previous tests. Students commented that "the tests turned out to be a measure of which of the previous tests from the years before you got your hands on," and "koofers allowed a person who has never gone to class to get an 'A' by memorizing answers." One solution to this dilemma is to require professors to collect all copies of the tests, but this could seriously hinder students when studying for the final exam; they would not have the tests from earlier in the quarter to study from. A more viable alternative would be to require professors to create new tests each quarter, perhaps with more problems represented.

A similar situation is caused by data base tests. Representative student comments on the matter included the following: "I feel that

when teachers use data bases, that class has an unfair advantage over the classes that have problem tests"; "Professors who used data bases are not fair to students without old tests"; and "I feel that data base tests should be used by all teachers or none." As indicated by these responses, it would appear that data base tests are unfair unless all professors use them. Consistency among exams would give each student an equal chance, such as the departmental tests present within the Engineering Fundamentals program.

One issue causing complaints is course duplication. This deals mostly with Physics 2171 and 2172. ESM 1000 and ESM 2000 are cited by students as duplications of Physics 2171, and Electrical Engineers claim Physics 2172 duplicates EE 3101. Most students offering comments on this matter believed the ESM sequence covered the material more effectively than did Physics 2171, and EE majors expressed a desire to eliminate Physics 2172 all together. Out of 27 written responses, only two claimed that Physics 2172 provided an adequate background for EE 3101.

At present, physics labs are controversial additions to the course. Some students believe that "scheduled recitations and labs would be beneficial," while others disagree: "the course does not need a lab; the sophomore engineer would not have enough time to devote to it." The survey question "would a physics lab help you understand the material?" was little help in solving the dilemma; the students' answers failed to cite a decisive majority in either direction.

Responses to this questionnaire have led to a number of possible alterations in the opinions of the students. Changes can be made to improve the effectiveness in the areas of lecture proficiency, exam adequacy, and course duplication. Reactions to this survey, however, will not be known until sometime in Spring quarter, and a follow-up report concerning the repercussions will be published in the Fall issue of *Engineers' Forum.*

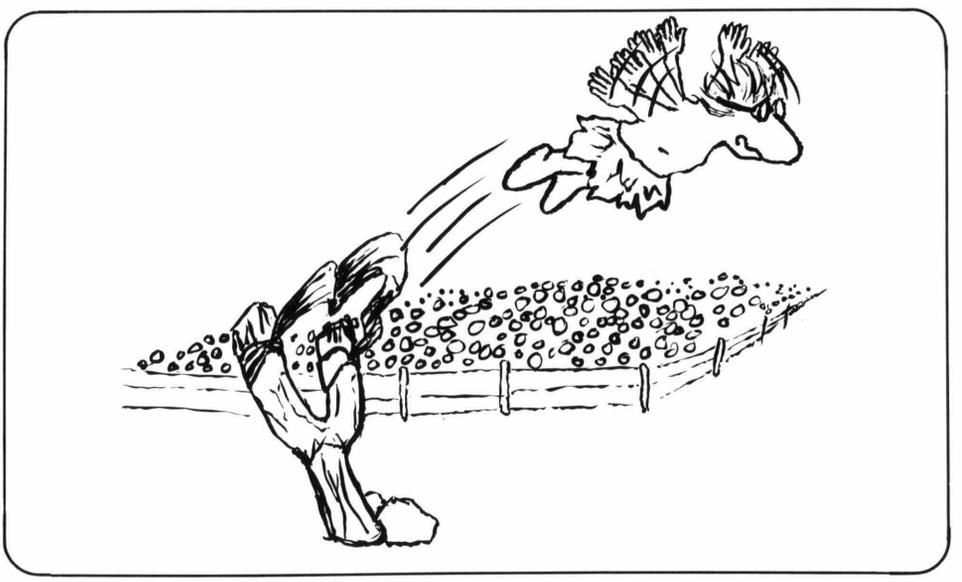
For Your Entertainment

Test your little grey cells by attempting to answer this trivial quiz.

1) First, an easy one to get you warmed up: what do these acronyms stand for? - LASER, BASIC, and SONAR.
2) What is the theoretical life-span of human beings?
3) What is the simplest gem in chemical composition?
4) In 1938, a 27 year old DuPont chemist discovered a substance with the lowest then-known coefficient of friction. What is its tradename? What is its chemical name?
5) Along the same lines, what was the tradename of the first instant coffee?
6) Who won the first Nobel Prize in Physics and for what (hint: it was in 1901).
7) The name of what particle comes from James Joyce's novel, *Finnegans Wake?*
8) What connection, if any, is there between artificial satellites and the Mayan civilization?
9) Another easy one, to (almost) finish on a positive note: what are the names of the five space shuttles?
10) And finally, for you SF fans: what college did Dr. Who attend, and what was his school color?

And now for the answers—but don't worry, this will probably be your only ungraded quiz of the quarter.

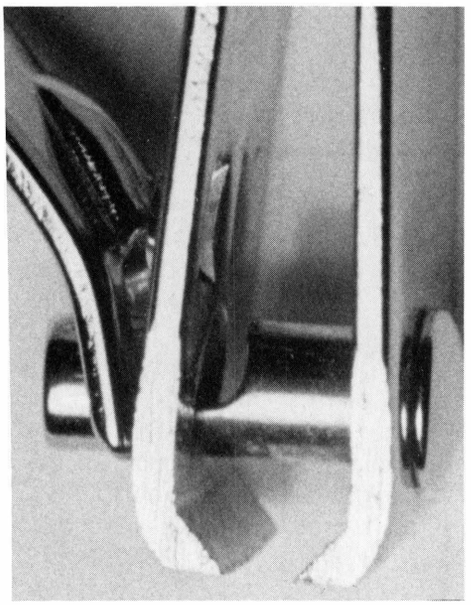
1) Light Amplification by Stimulated Emission of Radiation; Beginner's All-purpose Symbolic Instruction Code; Sound NAvigation Ranging
2) About 140 years.
3) The diamond.
4) Teflon, or polytetrafluoroethylene (PTFE).
5) Nescafe.
6) Wilhelm Konrad Roentgen, for the discovery of Roentgen rays, or X-rays.
7) The quark.
8) The study of satellite photos led to the discovery of prehistoric Mayan cities in the Yucatan jungle.
9) The Enterprise, Columbia, Challenger, Discovery, and Atlantis.
10) Prydonian, and scarlet.



Before thousands of spectators, Zog Jones proves conclusively that escape velocity cannot be achieved with a slingshot.

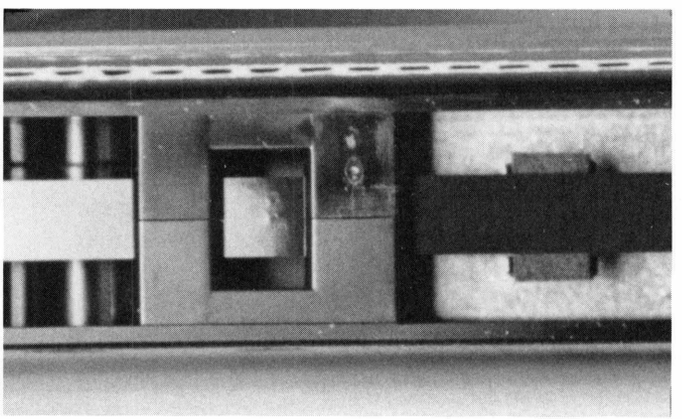
PICTURE QUIZ

Can you identify these familiar objects?

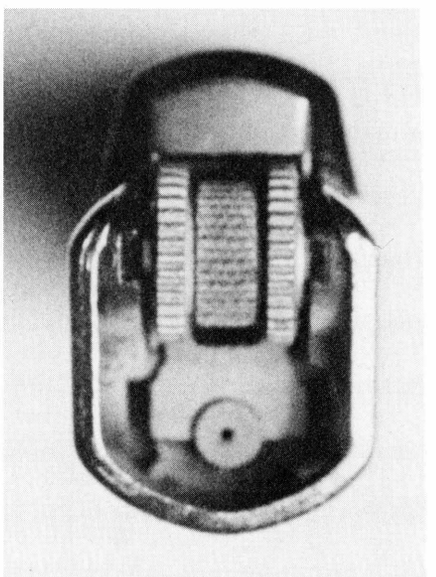


1

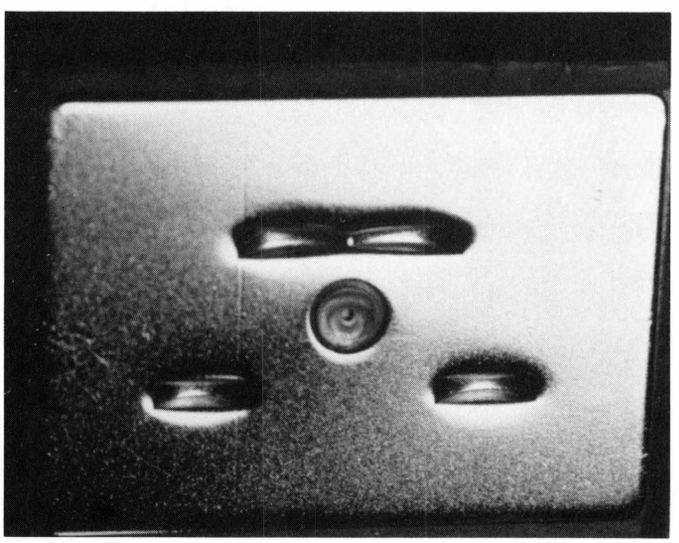
2



3



4



5

ANSWERS:

1) Nail Clippers; 2) Bottles;
3) Casette Tape; 4) Lighter;
5) Stapler plate

by Mark Hill and Bruce Robertson

Your mind has been stretched by education, your skills sharpened by training. Now your imagination is ready to fly.

It's the magic in your mind that turns dreams into reality.

It's time to dream, to reach out, to dare. And to do it you need the space for achievement. You will find it in companies that challenge you to fulfill the potential of your mind.

One of them is General Electric.

There you will find a sense of urgency that demands your very best, and stresses the individual's contribution to the success of the enterprise. At GE there is a climate for excellence where excellence means rewarding you when you win—*and rewarding you when you try:* the fuel for entrepreneurship in a large corporation.

Your kind of company. One that extends the boundaries of technology, creating opportunities on which minds like yours thrive.

Aerospace and aircraft engines. Medical diagnostic systems and robotics. Factory automation and microelectronics. CAD/CAM and consumer electronics. Information systems, plastics, and engineered materials. Plus future technologies still in your imagination.

A diversity you could not find anywhere else.

Today your future is in your imagination, and at General Electric. Reach for it.

If you can dream it, you can do it.