missouri SHAMROCK

October/November 1982

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UMC computing: life after engineering 5

missouri

SHAMROCK

The UMC College of Engineering Magazine

On the cover:
One aisle of the vast library of magnetic tapes maintained by the UMC Computer Network.
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Photo by Greg Gorman

October/November, 1982
Vol. 76 No. 1

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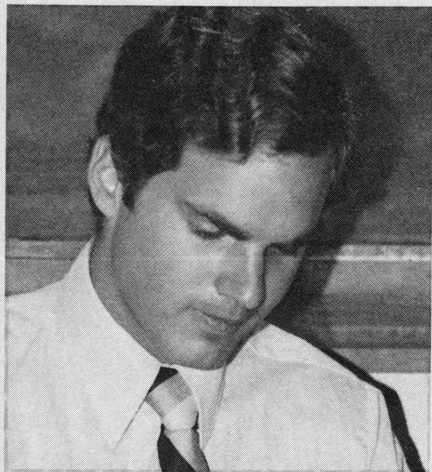
The Missouri **Shamrock** is published quarterly (October, December/January, February, and April) by the engineering students of the UMC College of Engineering. Opinions stated herein do not necessarily reflect the views of the College of Engineering.
Subscription rate is $4.00 per year. Inquiries concerning subscriptions or advertising should be directed to Missouri **Shamrock,** College of Engineering, University of Missouri-Columbia, Columbia, Missouri 65211.
Foremost, the Missouri **Shamrock** gratefully acknowledges its advisor, Ms. Margaret Kraeuchi, Director, Engineering Communications.

EDITORIAL



making decisions

The **Shamrock** revives the long-lost Editorial page with this issue. In it, I will voice my opinions on subjects important to engineering students. Readers wishing to respond to anything in the magazine are encouraged to write to the **Shamrock.**

EDITOR MIKE

by Michael Wroble

Being a Senior in the College of Engineering is a thrilling time of life for me. As I thumb through the College Placement Annual, companies from across the country and world entice me with their job opportunities. So many decisions have to be made in the next year. I wonder what I'll be doing a year from now. Who will I work for? What will I do? Where will I live—St. Louis, Texas, California, or Saudi Arabia? What about Graduate School? Is there a wife and family for me somewhere down the road?

I originally wanted to call this article "Life Planning". Americans are such compulsive planners, and it sickens me. Although I am not opposed to sensible planning, too many people go overboard. The healthy, spontaneous present moment is gone and so is the adventure. Brian Vachon of Vermont questions rushing into a career so soon. He suggests having a midlife crisis now, while you're still young enough to enjoy it.

If I had gone through with my original plans at age four, I'd be driving a milk truck right now. It would be nice, I guess, but my point is that as our interests change, our decisions should change right along with them. As Doctor Wayne W. Dyer points out in his terrific **Your Erroneous Zones** book, there is no such thing as right or wrong decisions; just different ones. Choice A will most likely bring about these consequences, while B brings these. If I choose A now, I can still probably choose B, C, or Z later on if I want.

We have the incredible freedom in this country to do just about anything we please. Unfortunately, most people don't take advantage of this freedom. They choose instead to feel trapped, depressed, and sorry for themselves. A visit to three Communist countries this Summer put all of those ideas out of my head for good. An East German girl confided in my friend that she wanted to leave, but couldn't. She followed him to the Berlin Wall and watched emotionlessly as he legally crossed over to freedom. Another one of her countrymen was shot dead trying to escape there a day earlier.

Yes, this is an **Engineering** magazine. The subject is decision-making and I offer what I've learned. Be open-minded and never discount any possibilities. Albert Einstein said to explore the unknown. He said, "The most beautiful thing we can experience is the mysterious. It is the true source of all art and science."

If you still insist on planning your entire life right now, decide to follow Brother Jeremiah's advice. He said, "If I had my life to live over again, I'd try to make more mistakes next time. I would relax. I would limber up. I would be sillier than I have been this trip. I know of a very few things that I would take seriously. I would take more trips. I would climb more mountains, swim more rivers, and watch more sunsets. I would do more walking and looking. I would have more actual troubles and fewer imaginery ones."

NEWS BRIEFS

by Michael Wroble

get ugly

Ugly men get better jobs and smarter wives, according to a recent survey. The survey covered 601 men and 745 women and was made J. Richard Udry and Bruce Eckland, both of the University of North Carolina. A woman's attractiveness was unrelated to education, occupation, or personal income, but not so with men. "First, the least-attractive males have the most education," the researchers said. "Second, their occupational status is higher on the job classification score." The more attractive the woman, the more highly educated her husband. The opposite was true for men. Only "outstandingly" good-looking men attain jobs as prestigious as those of the least attractive. Well, we can only hope, then.

1981 engineering degrees

The 1981 survey of degrees awarded to engineering and engineering technology graduates conducted by the Engineering Manpower Commission of the American Association of Engineering Societies (gulp!) is out. The E.M.C. recorded a total of 62,935 baccalaureate degrees, 17,914 master's degrees (including 271 professional degrees), and 2,841 doctoral degrees. All represent increases over the preceding year. Electrical engineering at 23.2 percent, closely followed by mechanical engineering 21.4 percent, were the most popular disciplines. They were followed by civil engineering with 16.8 percent, and chemical engineering with 10.9 percent of the B.S. degrees awarded. Mizzou recorded 381 baccalaureate degrees, 96 master's degrees, and 24 doctoral degrees in 1981.

video . . . addicts

Talking about video games, 20 billion quarters were fed to video machines in 1981! A total of 75,000 man-years were spent in front of video machines. Although there is no official monitoring agency to keep track of video game records, here are the unofficial record-holders to date: Defender, Darren McCreadie, 32,445,0000; Tempest, Steve Kramer, 906,000; Battle Zone, Steve Kramer, 9,005,000; Asteroids, Leo Daniels, 40,101,910; Asteroids Deluxe, Kevin Sentry, 2,117,570; Centipede, Frank Lanzinger, 2,999,999; Missile Command, Tim Vargo, 51,957,175.

record industry hurting

Industry experts believe the record business could be losing as much as $1 billion a year to video games. Robert Summer, president of RCA, says, "a very measurable percentage of dollars going into video games are former record dollars." Another $1 billion annually is being lost in home taping. "When the economy isn't good," says Walter Yetnikoff, president of CBS Records, "people look to cut corners."

"The hits still hit very high," according to Ahmat Ertegun, chairman of the Atlantic Records label at Warner Communications. "There are plenty of albums that sell from three to four million copies. Where we're suffering is in the middle range," meaning albums made by largely new, or developing artists.

The industry hopes that Congress will follow the example of several European countries and permit blank cassettes to be taxed, with the proceeds going to artists as royalties.

poetry contest

A $1,000 grand prize will be awarded in the upcoming poetry competition sponsored by the World of Poetry, a quarterly newsletter for poets. Rules and official entry forms are available from the World of Poetry, 2431 Stockton Blvd., Dept. D. Sacramento, California, 95817. What is this information doing in this magazine? Well, they sent me the information so I printed it. Maybe you who can't hack it in engineering can try going into poetry instead of business like everybody else. I've heard that shepherding is also very good right now.

cover story

UMC computing: life

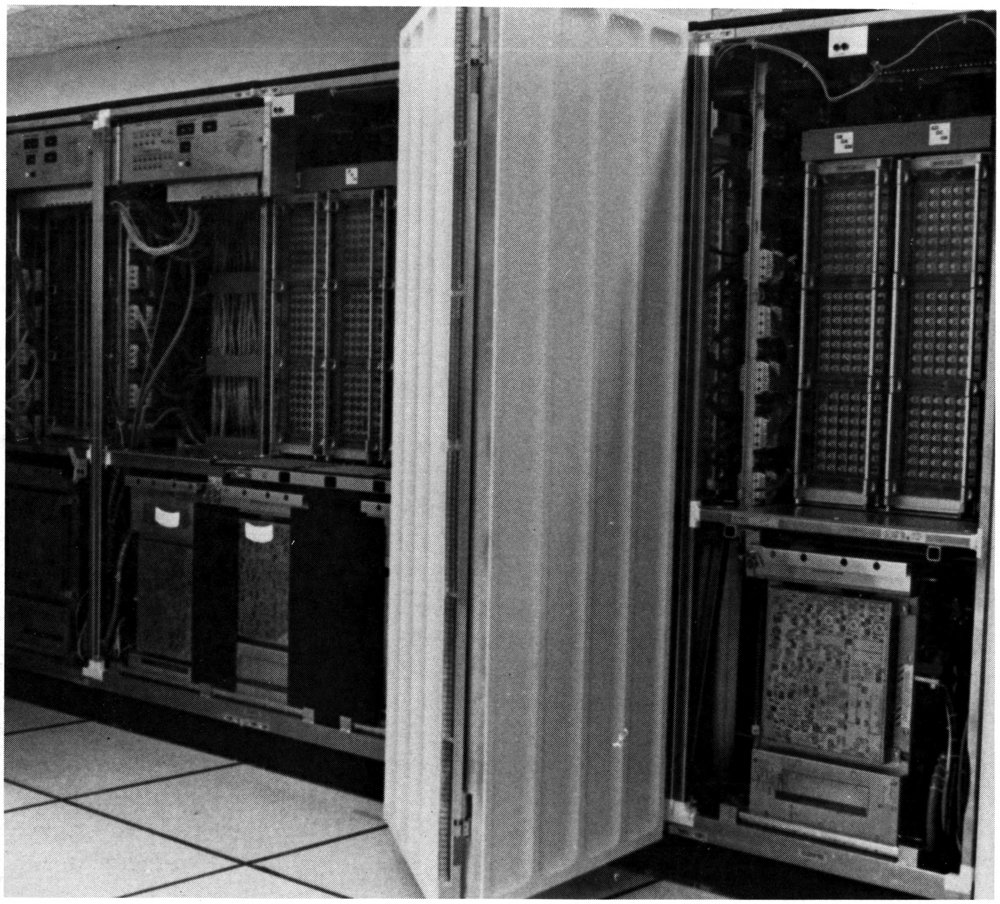


Photo by Greg Gorman

Here's a look at the insides of the Amdahl 470 Central Processing Unit. The CPU is the controlling unit for the entire computer system.

by Scott Courtney

The University of Missouri's Academic Computing Center (ACC) provides a vast array of computing services to students and faculty of UMC. Unfortunately, many students are not aware of all the facilities ACC has to offer—let alone how to use them. This is the first of two-part article on using the facilities of the Academic Computing Center. Part One is an introduction to the ACC's facilities and to computing in general. Part Two will give practical information on how to use the ACC services most often needed by students. The purpose of this article is not to teach programming, but to explain in understandable terms WHAT the computer is and HOW to make it do what you want. For more information, talk to your professor or check out the computing library in Room 100 of LeFevre Hall.

so what is that thing?!

First, let's talk for just a moment about what is meant by the words "computer" and "program". A computer is a piece of electrical equipment or hardware which is capable of performing arithmetic and data handling operations. "Data" is nothing more than information—numbers, words, or whatever. A modern computer may perform millions of operations or calculations per second; nevertheless, the computer is abysmally stupid! In fact, it is so dumb that it cannot perform even a simple task (like finding the average of a group of numbers) without an explicit set of step-by-step instructions. This set of instructions is called a program.

Programs come in many varieties. There are tiny programs that do nothing more complex than add up a

after engineering S

bunch of numbers. There are enormous programs that analyze laboratory data, print invoices for a business, or draw stunning graphics displays on a video screen (remember "TRON"?). One of the largest programs in existence is the so-called Operating System, or OS. This is a master program that in effect tells the computer how to run all the other programs.

Knowing that the computer must be told EXACTLY what to do and how to do it, we have to figure how to tell it. The computer doesn't understand English, or German, or any other human language. The only "words" it can comprehend are numbers in the base-2, or binary, system. For example, the command for

"The computer is abysmally stupid!"

the computer to add two numbers together might look like "1000110110111000" or something equally incomprehensible (at least to humans). While it IS possible to program the computer in binary codes, you can see that it would be extremely cumbersome and error-prone. To avoid the drudgery of binary programming, Mankind in his wisdom has created programs that translate human-readable words like READ, WRITE, and PRINT into these numbers that the computer itself can understand. The translator programs are called compilers, and the set of words that a particular compiler can undertand is called a language. There are many languages, each having advantages and flaws for particular applications. For example, FORTRAN (which stands for FORmula TRANSlation) is a terrific number-crunching language—which is why most engineers need to learn it. COBOL (COmmon Business Oriented Language), on the other hand, is woefully inadequate for arithmetic, but excels in business applications. BASIC is designed as an easy-to-learn beginners' language, and LOGO is a language developed for use in teaching programming to young children.

The University's computer system

cont. on page 16

the nuts and bolts

by Scott Courtney

The principle hardware of the Computer Network (featured in the photos with this article) is located in the basement of the Math Sciences building on the UMC campus. The Network maintains two Amdahl 470 central processing units—one for VM and the other for MVS. The MVS processor is an Amdahl 470/V8, and has 12 megabytes of memory. The VM machine is a 470/V7, and it has "only" 8 megabytes of memory. Each system has considerable storage capacity on IBM 3350 and similar disk drives; there are about 100 drives total, each of which can store over 400 million bytes of data.

In addition to these primary disks, the MVS system has several drum storage units, which provide low-volume data access at very high speed. The system has multiple magnetic tape drives, and the tape library contains over 15,000 tapes—each of which is capable of storing 151 million bytes. Several card readers and a punch are located at MS, as is the famed 3800 printer system. There are several large cabinets which house the equipment that links the CPU's in Math Science to the various remote nodes at LeFevre, EE, Middlebush, GCB, and so on. The Network also includes the UMSL, UMR, and UMKC campuses, as well as facilities at Jefferson City's Lincoln University and several other colleges in Missouri.

In an adjacent room is a large air conditioning unit, which removes the heat generated by all the electronic equipment. In case of power failure, two motor-generators provide a backup source of electricity to the central node only. One of the generators runs continuously, and is switched in automatically as needed; the other is a backup and must be started manually.

The primary remote node, located in Room 107 of LeFevre Hall, is the site of the ACC's graphics output equipment. Two plotters are available—a Benson-Varian and a Calcomp 763. LeFevre also has two card readers (one also punches), and three printers (600, 1100, and 1200 lines per minute). Ten IBM 3270-series terminals, two dial-up terminals, and one model LA36 Decwriter hardcopy terminal round out this important site. It is interesting to note that the LeFevre site is controlled by an IBM 4331, which is capable of functioning as an independent CPU.

More information about hardware is available in the User's Brochure, which can normally be obtained from LeFevre Hall. Thanks goes to the ACC for permission to photograph the Math Sciences facility.

IE survives scare

by Michael Wroble

"We're completely lost to understand the logic." That is how Dean Kimel reacted on April 1 to Provost Ron Bunn's proposed $7 million cuts for the University. The move was suggested primarily to improve employee salaries and bolster surviving programs. Among the programs slated for elimination was the Industrial Engineering Department. The IE Department consists of ten faculty members, all of whom hold doctoral degrees. Eight of these are Registered Professional Engineers and six are tenured.

Bunn said he tried to find "the least indispensable colleges to the mission of this campus." UMC's IE program is the only one in the state. "Most of our students are Missouri students, and most who go to work stay in Missouri. Cutting us would hurt Missouri industry," IE Chairman Jay Goldman said. "It is ridiculous to do this when the governor is flying all over the world trying to attract industry to Missouri."

Kimel added that "the major problem is the loss of a fine program which is unique in the state and produces highly employable graduates." Because it is integrated with the entire College of Engineering, "its loss would destroy the vitality of the entire college."

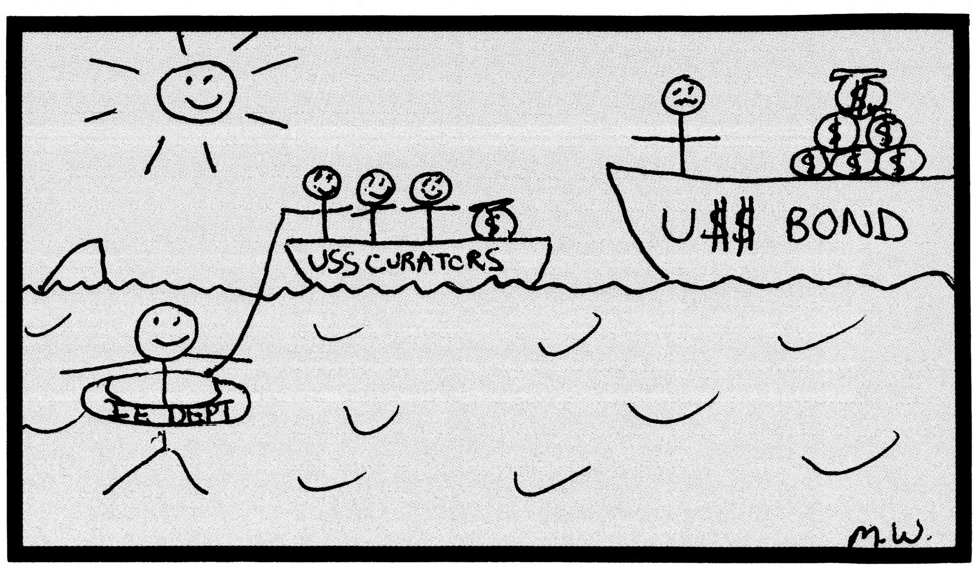
After the shock had lifted, a massive effort was made by the entire Engineering Department to save IE. A week after Bunn's announcement, he supplied "very basic" data to Goldman in support of his recommendation. The IE department responded with a carefully prepared response to the review committee. Students began a letter-writing campaign to legislators, UMC officials, engineering alumni, professional industrial engineers, and newspapers statewide. The mailings were funded by a sponsored car wash and raffle.

Kimel presented an alternate plan he called the Engineering Futures Action Plan. It combined some programs already present with a fund-raising and equipment loans campaign and a proposed supplemental fee for engineering students. The surcharge, similar to one already at the University of Minnesota, would cost engineering students about $213 extra per semester. Kimel said the fee would help restrict enrollment which is moving ahead of the ability to hire faculty. Nevertheless, his plan was quickly rejected by Bunn.

By June, it appeared that the proposed budget cuts would die. UMC chancellor Barbara S. Uehling sent a letter to UM President James C. Olson recommending a halt to efforts for the cuts. She suggested that broad-based statewide and intercampus committees be established to review principles for any reallocation of money.

On June 18, the University Board of Curators, meeting in Kansas City, passed a resolution stating that no programs would be eliminated solely because of money problems. The resolution, resented by Curator Marian Oldham of St. Louis, called for the creation of a curator's committee to develop a long-range to deal with the University's financial problems. Oldham said the resolution was passed because of the thousands of letters board members received in opposition of Bunn's massive retrenchment plan. resolution assures the previously targeted departments that they are no longer in danger of elimination.

It is still early to tell what kind of effect the events of the past half year will have on the College of Engineering. Back in April, Engineering Alumni Association president Bob Gerard said that "even if we come out of this, the College of Engineering will be damaged." Kimel said, "Engineering faculty is a vanishing breed. We will lose some faculty as a result of the action already taken."



job market slows

by Doug McCullough

The traditionally strong market for graduating engineers declined last year, leaving some seniors looking for jobs. Some 60% of the May 1982 graduates who were seeking industrial employment had obtained employment by the time of graduation. This was a decline from the report for the previous year and also the fall semester 1981. Jack Morgan, Assistant Dean of Engineering and Placement Director, blames the current recession for the weak job market.

Although all disciplines of engineering felt the decline, chemical engineers were hardest hit. Cutbacks in the chemical and petroleum industries have been blamed for the chemical engineers' poor showing last May. On the other hand, mechanical engineers were only modestly affected by the current decline. Morgan attributes this to the mechanical engineers' flexibility, allowing them to fit into a variety of industries.

Chemical engineers who did find jobs last May found that their salaries continued to be the highest among UMC engineers, averaging over 2200 dollars per month. Starting salaries for electrical, industrial and mechanical engineers remained very close to the top, while salaries for agricultural and civil engineers lagged.

Looking ahead, Morgan predicts another "lean" year, at least for December graduates. A return to the previously strong demand for young engineers can only come with a healthy economy and an expandng industrial picture.

File Photo

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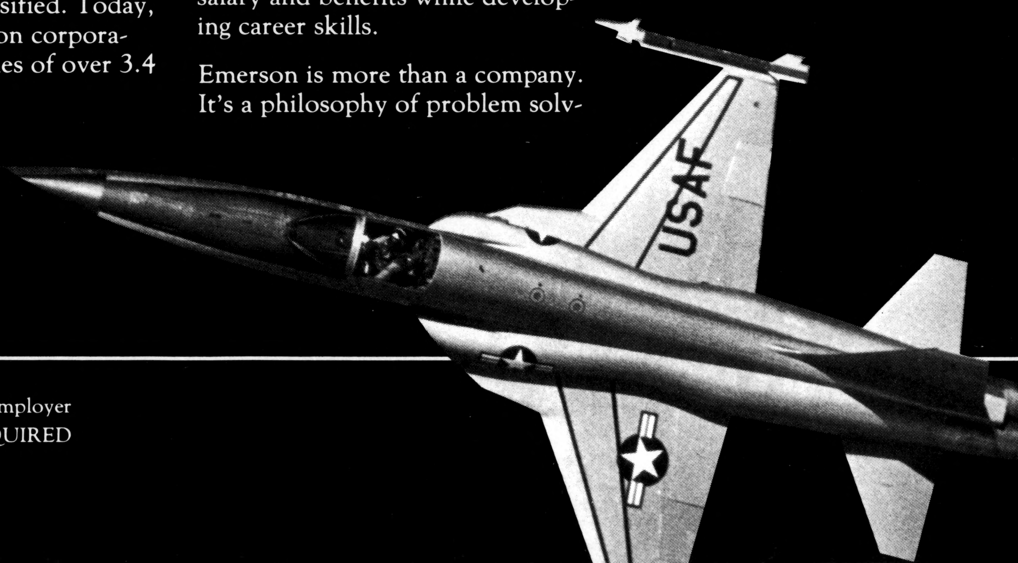

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conversation

Dr. Robert Eastman, a member of UMC faculty since 1955, talks with Conversation about his job as professor in Industrial Engineering and about his various summer experiences.

by Carla Koelling

Conversation: Where were you before you came to UMC?
Dr. Eastman: I was a professor at Georgia Tech for four years. My Ph.d is from Penn State and I taught there for a year.
Conversation: How long have you been at UMC?
Dr. Eastman: I joined the faculty in September of 1955. This is my 28th year.
Conversation: Why did you decide to become a professor?
Dr. Eastman: I did some co-op teaching at Antioch College.

"I worked . . . on robots for the space shuttle."

I liked it and decided to go into it.
Conversation: What did you do this summer?
Dr. Eastman: This summer I was in Annapolis, Maryland, at the David W. Taylor Naval Ship Research and Development Center. This is the R & D center for topics connected with the ship part of the Navy. The project I was working on was automating plasma flame spray coating.

On the Navy ship they were using it for corrosion resistance on steam valves and other parts. It's simply not practical to make the parts out of anything but steel, and the steel corrodes. Another application is rebuilding parts, like shafts and valve stems that get corroded or worn. They cut them down, then spray the metal on. Another application is non-skid coatings on decks and other things.
Conversation: Is that where you worked last summer?
Dr. Eastman: No, a year ago my research was on manufacturing photovoltaic cells for solar energy at the Jet Propulsion Lab in California. I worked there two summers.

A year before that I worked in Huntsville, Alabama on robots for the space shuttle. They use the robots to interchange modules or for maintenance. It's safer and cheaper than sending an astronaut out to do it.

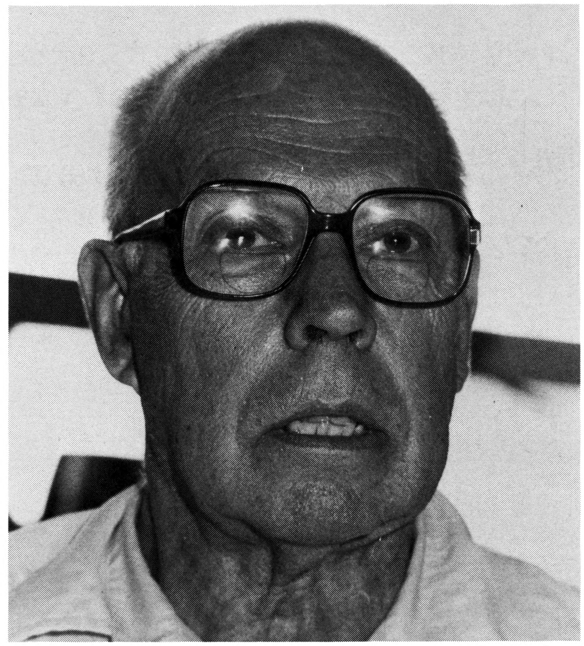


photo by Rich Steanach

I was a Fullbright lecturer at the Industrial University of Santander in Bucaramanga, Colombia, for one year. That was twenty years ago in 1962-63.

I was a visiting professor at Middle East Technical University at Ankora, Turkey, for a year and a half in 1969-71.
Conversation: What do you teach here?
Dr. Eastman: I teach Manufacturing Processes, Engineering Economics, Scientific Management, and Iterial Handling and Factory Layout.
Conversation: What professional societies do you belong to?
Dr. Eastman: I belong to the American Society of Engineering Education, I'm a fellow of the American Association for the Advancement of Science, and I'm registered in Ohio and Missouri as a professional engineer.

". . . I was working on . . . automating plasma flame spray coating."

Conversation: Anything to add?
Dr. Eastman: If you're interested in children, my oldest daughter, Caroline, is a faculty member in the Department of Computer Science and Engineering at Southern Methodist University. My second daughter, Parmelee, is an account executive for Digital Equipment in New York, and my son Roger is now doing graduate work at the University of Maryland in Computer Science.

The Surface Contingent

A recent finding at the General Motors Research Laboratories has changed scientific thinking about the behavior of electrons in metal surfaces. This discovery provides a greater understanding of the fundamental physical processes involved in such surface events as adhesion, corrosion and catalysis.

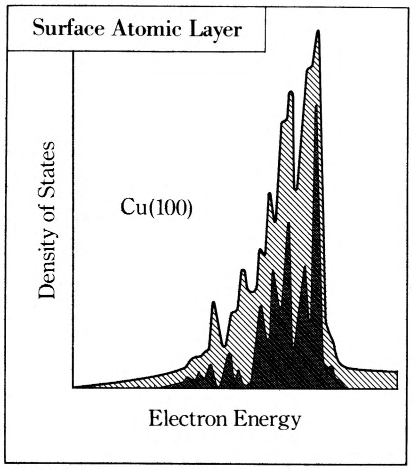
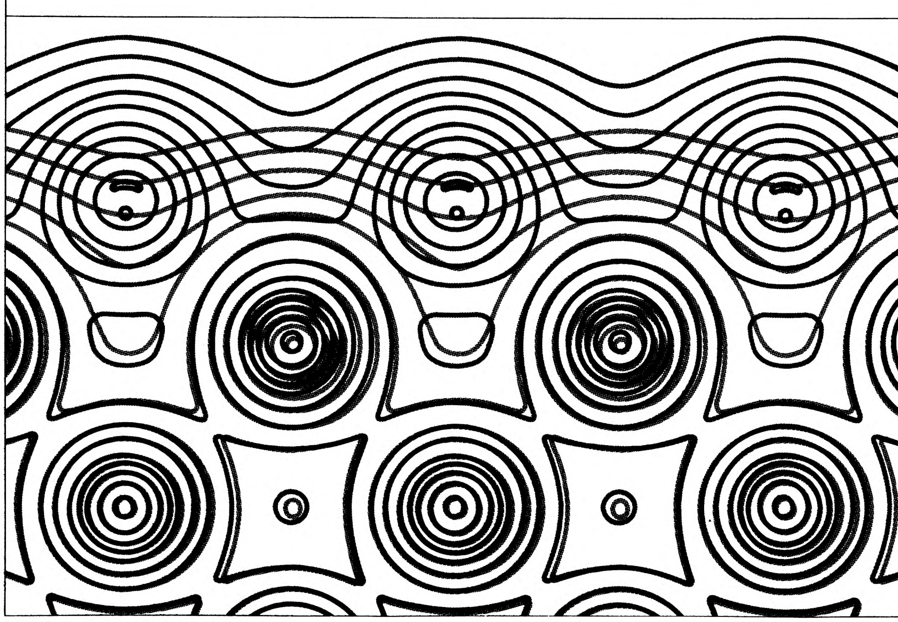


Figure 1: Energy distribution of electrons in outermost atomic layer. Shaded area indicates electrons in surface states.

Figure 2: Two electron density contour maps of the cross-section of a Cu(100) surface. One map shows a clean copper surface (lt. gray); the other shows a nitrogen-covered copper surface (dk. gray).



CONVENTIONAL scientific thought treats virtually all of the valence electrons found in the surface atomic layer of a metal as if they are free to roam throughout the metal's interior. The work of three physicists at the General Motors Research Laboratories suggests otherwise. Through calculations confirmed by experimental data, the theorists have shown that more than a quarter of the valence electrons in the top atomic layer of some metals are effectively trapped in the surface. The presence of so many "surface state" electrons must be considered when analyzing physical and chemical surface phenomena, including such surface events as oxidation leading to corrosion.

Drs. John Smith, Jack Gay and Frank Arlinghaus applied their theoretical analysis to the (100) surface of five metals: copper, nickel, silver, rhodium and palladium. They made bold predictions concerning the percentage of electrons in the surface atomic layer to be found in surface states: Cu(36%), Ni(23%), Ag(23%), Rh(23%) and Pd(19%). The ratio of the shaded area to the hatched area of figure 1 gives the percentage for copper.

Electrons in surface states are not only abundant, but also highly localized on the surface. Chemisorption on a metal is also confined to the surface region. Figure 2 shows what happens in the case of nitrogen chemisorbed on copper. The two contour maps coincide except in the surface layer, where the interaction is largely exhibited. Localization of the interaction holds for the chemisorption of other gases, including oxygen in the initial stage of metal oxidation. These observations led the physicists to conclude that surface states are important in chemisorption.

One way to probe electrons in surfaces is to chemisorb atoms on a clean metal surface and look for changes in photoemission spectra. Such an experiment was performed at GM for fractional monolayers of nitrogen, oxygen and sulfur on Cu(100). The dominant change in the photoemission spectrum was the disappearance of a large peak whose shape and energy location was independent of the chemisorbed atom. It was of special interest that the shape and energy location of this peak was nearly identical to the envelope around the surface state peaks in figure 1. This suggests that surface state electrons play a major role in the chemisorption process.

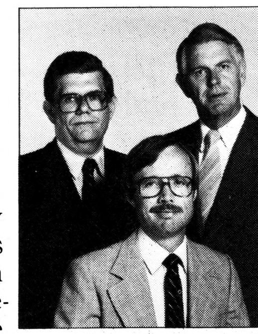
THE THEORETICAL advance at the heart of the discovery is the "Self-Consistent Local Orbital (SCLO) Method" for solving the Schrödinger equation. This new mathematical method was devised by the GM theorists to handle the classic dilemma posed by the self-consistency requirement. The characterization of electron behavior used to complete the equation must be consistent with the behavior predicted by the equation. In other words, one almost needs to know the answer in order to make the calculation.

Self-consistent solution of the equation for a metal surface is made exceedingly difficult by the three-dimensional nature of the electron density distribution. The theorists dealt with this challenge successfully by dividing the electron density distribution into two parts—the first part due to overlapping atomic density distributions; the second part equaling the difference between this atomic contribution and the exact density distribution.

One of the more stringent tests of the accuracy of the SCLO method was an angular photoemission experiment conducted by Heimann et al., at the University of Munich subsequent to publication of the GM research. The German research team confirmed a prominent surface state band predicted by the three GM physicists. This was the first time a surface state band on a solid had been calculated prior to its being seen experimentally. The SCLO method makes possible something that could not be done before—accurate prediction of the actual behavior of electrons whirling around nuclei at the surface of a metal.

"The large body of surface states we found on metal surfaces," says Dr. Smith, "may be a controlling factor in many physical and chemical surface phenomena. By replacing conjecture with calculation, the new surface theoretical methods give us the means to make major steps forward in the analysis of surface and interface properties."

THE MEN BEHIND THE WORK



Drs. Smith, Gay and Arlinghaus are theorists in the Physics Department at the General Motors Research Laboratories.

John Smith (center) and Jack Gay (right) received doctorates in physics; Smith from Ohio State University and Gay from the University of Florida. Frank Arlinghaus received his Ph.D. in physical chemistry from the Massachusetts Institute of Technology.

John Smith, leader of the GM solid state physics group, did postdoctoral work at the University of California in La Jolla. He joined General Motors in 1972. Frank Arlinghaus and Jack Gay joined the corporation in 1964 and 1965, respectively.

Each member of the team brings to the project a different expertise: Smith in surface physics, Gay in solid state theory, and Arlinghaus in bulk band structure calculations.

west of the columns

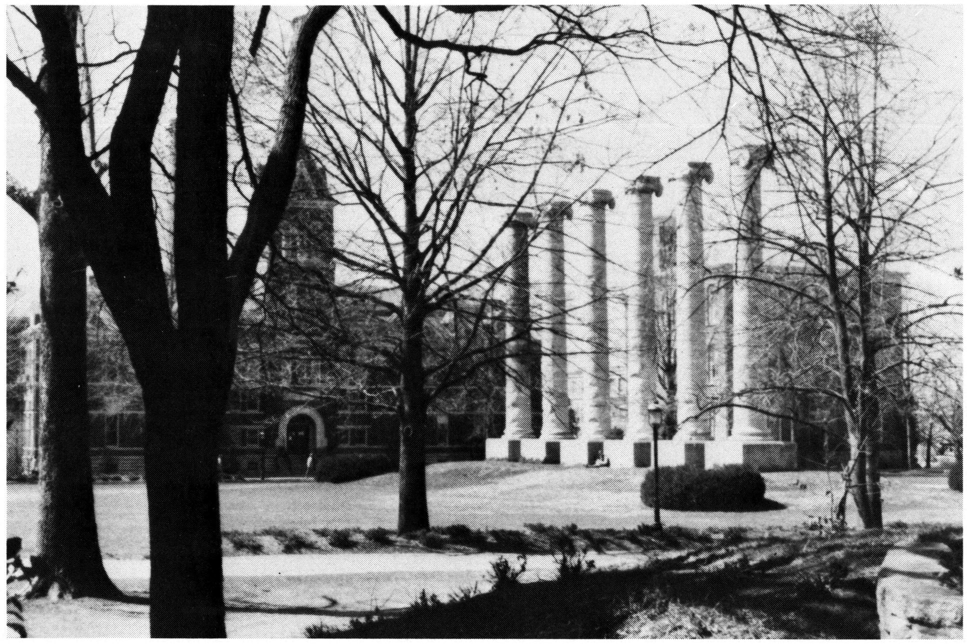
by Jackie Fallert

Charles Slivinsky, professor of electrical engineering at the University of Missouri-Columbia, has been named chairman of the UMC electrical engineering department. He had been interim chairman of the department since August 1981 and prior to that served as director of graduate studies for the EE department.

Slivinsky has been a member of the UMC faculty since 1968, with research and teaching interests in the applications of computers to aircraft flight control industrial processes. Slivinsky is active in the Institute of Electrical and Electronics Engineers as technical editor of IEEE's journal "Potentials", as a member of IEEE's Student Activities Committee and as national coordinator of student activities for IEEE's Computer Society.

Dr. Slivinsky received his bachelor's degree in electrical engineering from Princeton in 1963 and a Ph.D. in electical engineering from the University of Arizona. He has been a consultant to Wright-Patterson Air Force Base, Ohio, since 1975.

A new degree program in computer engineering has been approved within the College of Engineering. The first student to receive the B.S. in Computer Engineering graduated in May 1982. The program trains students in the design and application of computers in manufacturing, communication, transportation and other areas of society. The new program is the only one of its type in Missouri public higher education and one of very few such programs in the U.S.



The City of Columbia now has an early-warning weather monitoring system with computerized instruments placed at McBaine's water treatment plant. The instruments will continuously transmit weather information to the City-County Joint Communications Center in Columbia's Police/Fire Building.

Columbia is probably the only small municipality in the country to have such an automated remote warning system, says Jim Patty, director of Columbia's communications center. Following last summer's severe storms Patty sought help from Dr. William McFarland, professor of electrical engineering at the University of Missouri-Columbia, and some of his students who modified a commercially available weather computer into a remote, attached it to a special telephone line, and developed computer equipment from the Communications Center to receive the data. At the Center, personnel can watch a television screen which updates the weather information every four to eleven seconds.

Women now represent nearly 15% of the engineering undergraduates, as compared to 10% five years go. In addition, the women engineering freshmen tend to have a slightly higher high school standing and they score a little better on the freshman placement tests, giving them a slight edge over their male peers.

Starting salaries for new graduates with a B.S. in engineering rose again. Salaries averaged nearly $25,000 this June compared to $23,000 last June.

west of the columns

July 1 marked the retirement of Prof. James Beauchamp, who served as director of Continuing Engineering education since 1963. Dr. Cyrus Harbourt, UMC electrical engineering, has assumed the duties of Prof. Beauchamp's position.

Prof. Harbourt received his Ph.D. from Syracuse University in 1961. He served as chairman of the electrical engineering department from 1967-1977. For the past three years he has coordinated the Engineering graduate program in Kansas City. Prof. Harbourt has recently received his Professional Engineering certification.

The nuclear engineering program at the University of Missouri-Columbia received proof of its strength and quality in the form of fellowships and traineeships from two different sources.

The Office of Energy Research at the Department of Energy has awarded the program two energy graduate traineeships starting the Fall 1982 semester and running through the Summer 1984 and totaling $56, 000. The University will decide which students will receive the fellowship.

In addition, the Oak Ridge Associated Universities selected UMC Nuclear Engineering as a participant in the Nuclear Science and Engineering Fellowship Program, which offers generous fellowships ($12,000, tuition and fees) for the next four years. The ORAU Fellowships will place UMC students in tough competition with students from the other 24 eligible universities in the nation, with the ORAU staff making the final decisions as to who will receive the awards.

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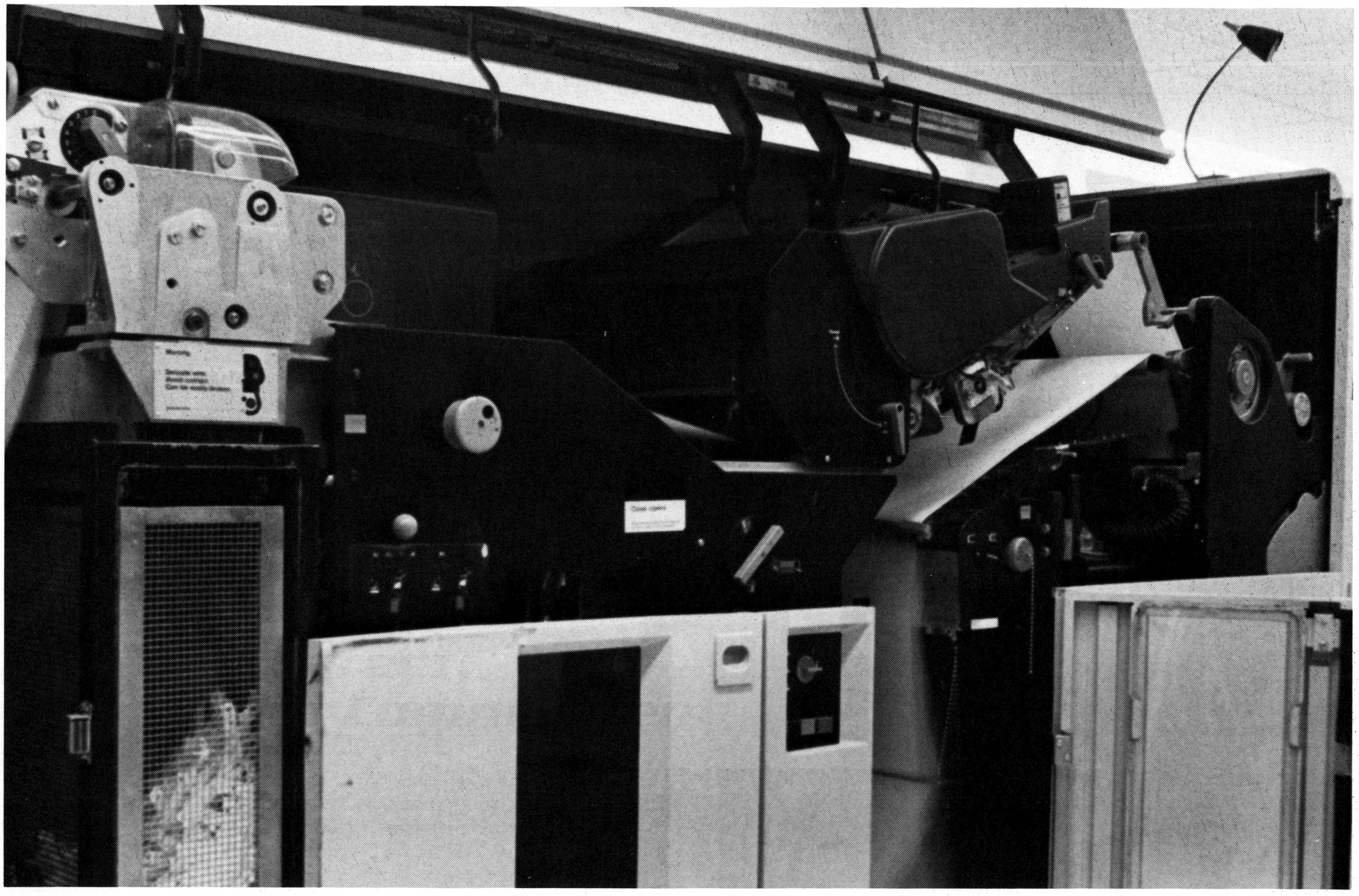
UMC computing



cont. from Pg. 7

provides compilers for a number of languages, including FORTRAN, COBOL, BASIC, WATFIV, PASCAL, PL/1, and WATBOL. In addition, there are various special-purpose "packages" available on the ACC. These include SAS (Statistical Analysis System), SPIRES (Stanford Public Information Retrieval System), SCRIPT (a text-processing system), and a host of others. The packages are simply widely-used programs that are written by IBM or other reknowned institutions to enable users to perform specific tasks without having to write their own program. For example, many researchers need to statistically analyze data—hence the SAS package.

Interactive Computing

Although most student users access the computer using card decks that range in size from miniscule to astronomical (with proportional weight!), a great many powerful functions are available from the interactive terminals. To use the terminals, however, requires a different account number and password from the one used with card, or "batch" computing. However, the University is presently phasing out its antiquated keypunch machines; soon nearly all computer assignments will be entered and run from the terminals.

A brief explanation of exactly what is meant by "interactive" and "batch" is in order. Batch, the kind of computing with which most students are familiar, simply means that the user prepares a job setup containing all the instructions and data (or location where the computer is to find the data in a file) that the computer will need to perform its computations. The user starts the job, then simply waits for the computer to finish. Interactive processing, on the other

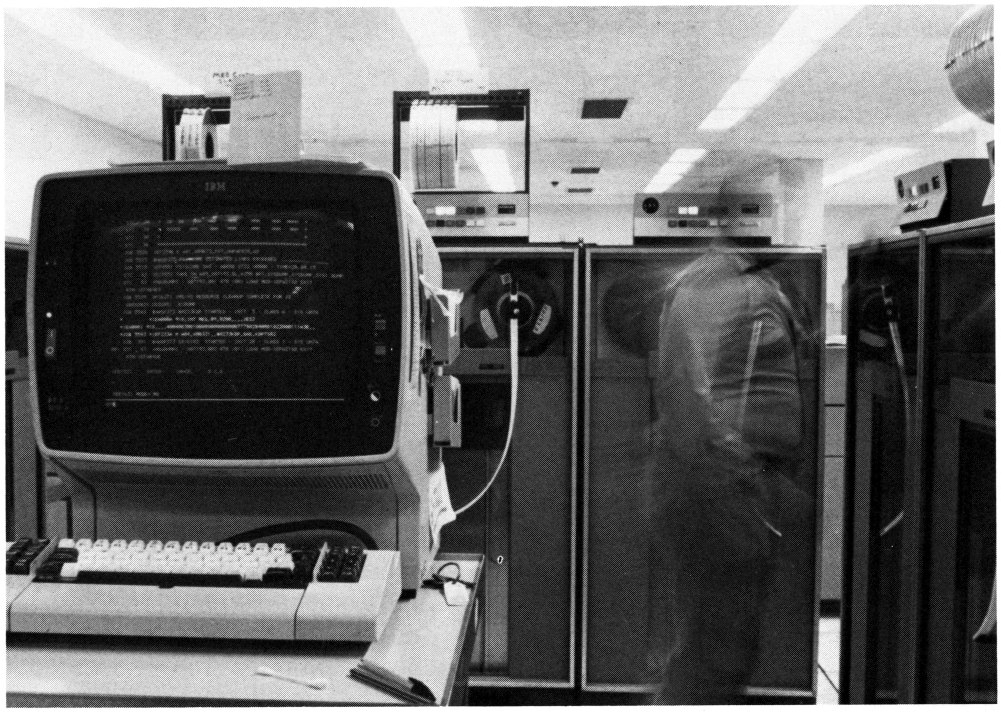
cont. on Pg. 18

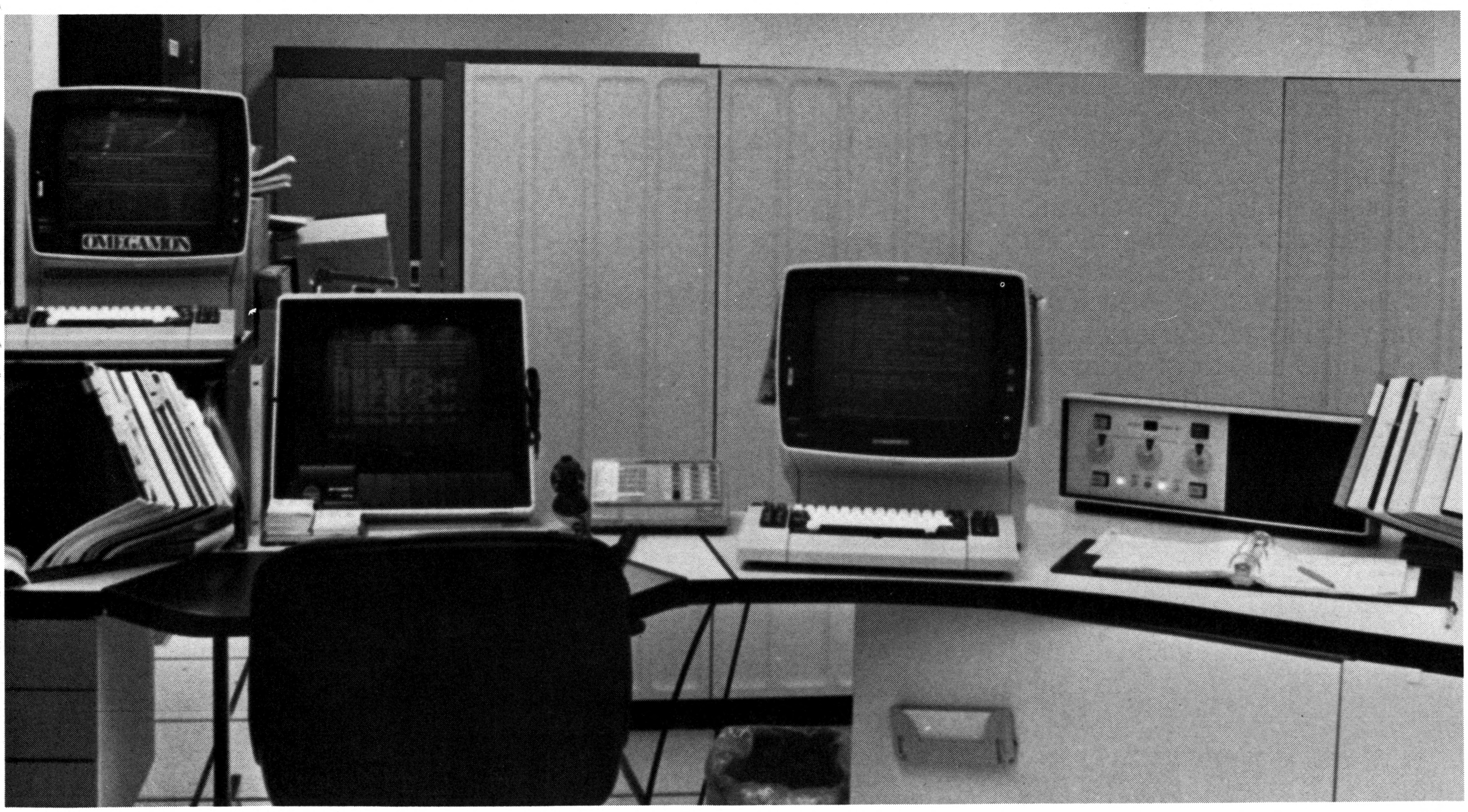
photos by Greg Gorman
opposite page

The operator's console in Math Sciences is where Man tells Computer what to do, where to put it, and whose output to lose.

No, it's not a printing press. This is the 3800 Laser Printer, which prints at over 20,000 lines per minute.

"The Invisible Operator", caught next to the tape drive units by our sharp-eyed photographer. The console in the foreground displays messages to the tape operators.





life after engineering S

Cont. from Pg. 17

hand, implies that the user has a degree of control over the program while it is running (for example, the program might ask the user to input certain data items).

There are two types of interactive accounts: TSO and CMS. TSO, or Time Sharing Option, is a high-performance system which allows access to all facilities which can be accessed from cards, plus numerous other functions which can only work in an interactive environment. For example, TSO allows the user to perform in a few seconds data manipulations that would take at least several minutes if a card deck had to be punched. Another interactive feature is text

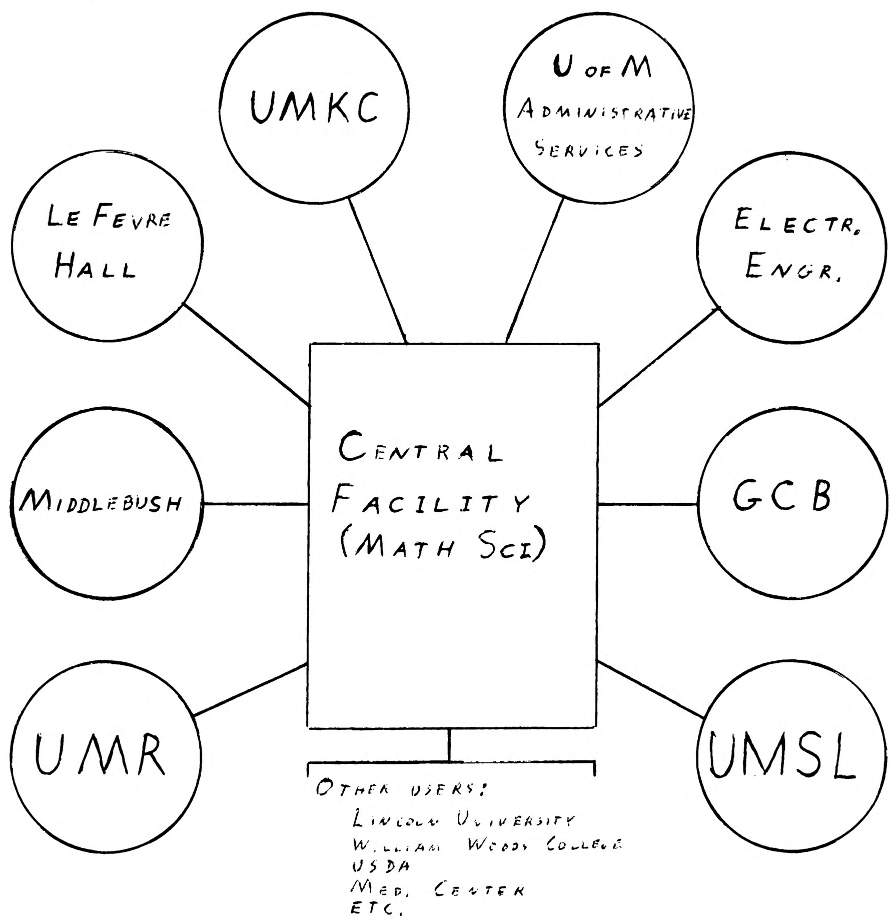
"CMS is easy to use and versatile."

processing. It is a fairly simple matter to compose term papers, theses, and so on using a system-supplied program called a text editor. The advantage of the text editor is that text may be typed in, examined, changed, added to, and deleted from — all without producing a single page of typing! This is much faster than typing a rough draft, proofreading, editing, and retyping a final copy. And correcting typographical errors is as easy as backspacing to the error and typing over it. When the user decides that the text is ready for "final copy", a simple command will direct the computer to print the text on any printer in the system — including the 3800 laser printer (which produces superb quality print at phenomenal speed). Most users print draft copies occasionally (sometimes it's nice to be able to skim the whole paper) on the standard line printer, then send the final copy to the 3800. Laser printer.

In addition to the standard TSO editor, a powerful and exceptionally easy-to-use system called SPF (System Productivity Facility) is available. SPF is so easy to use that it really needs no instructions. But if the user runs into problems, he or she need only press a special key on the terminal to receive helpful hints from the system. At first, only a brief prompt is given, but pressing the same key again gets you several pages of instructions. Finished reading the directions? Just press another key, and SPF puts you back exactly where you were, ready to continue what you were doing! SPF also provides an editor that is much more powerful than the usual TSO editor, as well as some often-needed utility functions.

The second interactive system, CMS (Conversational Monitor System), runs on a separate computer from TSO and batch. CMS is slightly less powerful than TSO, but it is much less expensive to use. Most students

(Cont. from Pg. 19



This diagram shows the relatlionship of the principle remote nodes of the Computer Network.

who have interactive accounts will have access only to CMS. Although some of TSO's super-features are not found in CMS, the CMS user can use his choice of three different text editors (EDIT, XEDIT, EZEDIT), or he an use the same SPF available under TSO. The CMS computer (which is called the VM System) is connected to the main (MVS) system, so the CMS user can use any of the printers or card punches available to TSO. In addition, a CMS user can prepare a batch "deck" using the text editor (each screen line equals one card), and then submit the job to run on the MVS machine. CMS is very easy to use, and very versatile. In fact, this article was written on the computer using SPF under CMS.

Both interactive systems offer the ability to write and run programs, edit reports and papers, copy, rename, move, delete, and create data files, and transfer data from VM to MVS and vice versa. Both systems allow full use of printers and card punches (which are actually on the MVS machine). CMS, however, lacks SCRIPT/VS (a special text processor useful for producing documents and theses; it automatically generates a table of contents, glossary, page numbers, etc., etc., etc. . .). CMS also does not allow direct access to magnetic tape, nor can the user monitor the status of his batch jobs. But CMS costs about only about half as much per hour of use as TSO; therefore, most classes use either batch or CMS.

Fastest Printer in the West

The 3800 laser printer mentioned above deserves a little more detail, for it is without question one of the most useful and powerful devices the ACC has to offer. The 3800 can prints with excellent quality on plain white paper, which may be either standard "printout size" or a more convinient 9 1/2 by 11 inch size. The number of characters per line and number of lines per page may be selected by the user, as may the type fonts (there are about 30 to choose from, and you may use up to four at once!) and paper size. Type fonts include standard gothic type, large "block" letters for headings and such, scientific and math symbols, and a special graphics font for printing lines and boxed text. In addition, the user may specify that his output be burst, stacked, and trimmed (perforations separated and side holes trimmed off). Output may be bound (a manual operation performed by the operator at Math Sciences) at a cost of about $1.00 per binder. All these features are amazing enough, but that's not all. The 3800 handles all those paper sizes, character fonts, and graphics at the staggering speed of 20,000 lines per minute! Pretty good, huh?

There is one more facility of the ACC that is worth some discussion. This is the so-called "$DOCUMENT" feature, which allows any user to print off all kinds of manuals and user's guides at no charge. Although $DOCUMENT has special printing features that can only be used with a "Class A") account (ENGR 5 students do not have this), the basic facility can be accessed by any user.

I've listed below some information sources you may want to try:

** User's Guide to WATFIV. This free pamphlet is available in any of the computer centers. It's a bright yellow book (very easy to spot), and I consider it indespensible for anyone who uses WATFIV.

** User's Guide to JCL. Another freebie (this one is brown), the JCL Guide is quite a bit more advanced than the WATFIV manual. I recommend it for those who have some experience with computers and want to learn more about this versatile control language. JCL may seem cryptic (it is!!), but knowing about it can prove extremely useful when you get an error like "IEF450I".

"the 3800 is powerful and FAST!"

** $DOCUMENT manuals. Directions for using $DOCUMENTS are posted in LeFevre Hall. Maybe none of the manuals will interest you, but you'll never know unless you look over the table of contents! (It's called (Content).

** The ACC library. Located in Room 100 of LeFevre Hall, the ACC Library has all the available manuals on UMC's computing services. They also have current computer magazines, like BYTE, '80 Microcomputing, Interface Age, and so on. Also available is a computer network newsletter.

The ACC has many facilites and services that can't be covered in a single article. The 3800 laser printer, video terminals, tape use, and graphics hardware are all extremely powerful and useful tools. But whether you want to be a casual user or a real "computer jock", take the time to learn what ACC has to offer. I guarantee it's time well spent.

a page from the past

October 1961

SHAMROCK

Sez

MUCHO DRYLABBING, B.S. '99

Greetings and salutations fellow whips! It looks as if we are off on another year of sleeping in class, cribbing, drylabbing (that's me!), goofing-off, etc. I sincerely hope that I may accomplish something this year as it is about my last one (I hope), my sociable security is supposed to start shortly. My father, bless him, always wanted to know what I was going to be when, and if, I ever got out of college, well now I can tell him, I am going to be senile.

Seems like the grass on ye olde Quadrangle survived the summer. After the great masses had trampled it at the last lawn partly I was sure that it was gone forever. But then we must realize that the Ags have been hard at work, growing grass is one thing that they are good at.

A word to the frosh now—which two of the columns are the furtherest apart? Give up? Ask an upperclassman. Also, don't call 9-9414 and ask for Elmer. These preceding pearls are older than some of the ME's steam engines.

I really don't have much to report of my summer vacation as I must resort to the fifth Amendment whenever I start to tell of some of my exploits. It was a great summer though. One part of it was a little bad news however, the Gestapo just didn't understand me all the time. Speaking of the Gestapo, have you noticed that neat little white car mit ye neat little high-speed rotating red light upon the top? The campus gendarmery has purchased a new road-runner. If they should 1. stick the toe in the carburetor, 2. have a downhill run, and 3. incorporate some luck, they might be able to catch a cold or something.

Your pore old buddy (namely me) just about got trampled in the registration rush, all I wanted to do was change about 5 courses that I had to repeat and you know what, the hierachy done thought that I was some sort of a nut or something. I was only there for 8¼ hours.

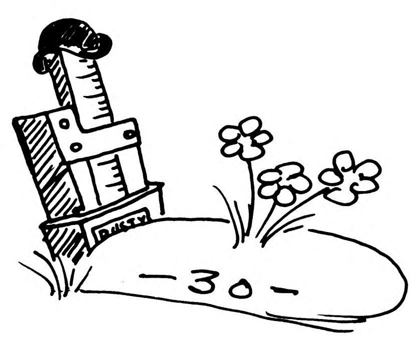
I hear that the Editor is in need of some help for his staff. I would volunteer but you know me, more harm than good. Why don't you lend him a helping hand? A few hours every month would help greatly. The SHAMROCK is a representative of your school and you should be proud of it.

Out of the great benevolence of my black heart I have decided to be nice to youse guys and try to advise you in yore troubles, say your girl left you and went out with an Art major last week, you lost your crib for 243, your department chairman doesn't know who you are, you can't find a parking place, etc.? Cheer up friend, MD the great is with you, just write your problem down and send it to MUCHO DRYLABBING, c/o The SHAMROCK, 233 Engineering Building. We will do our best to answer.

Watch this column next month for great revelations and a presentation of the word. I have a whole month in which to nose around.

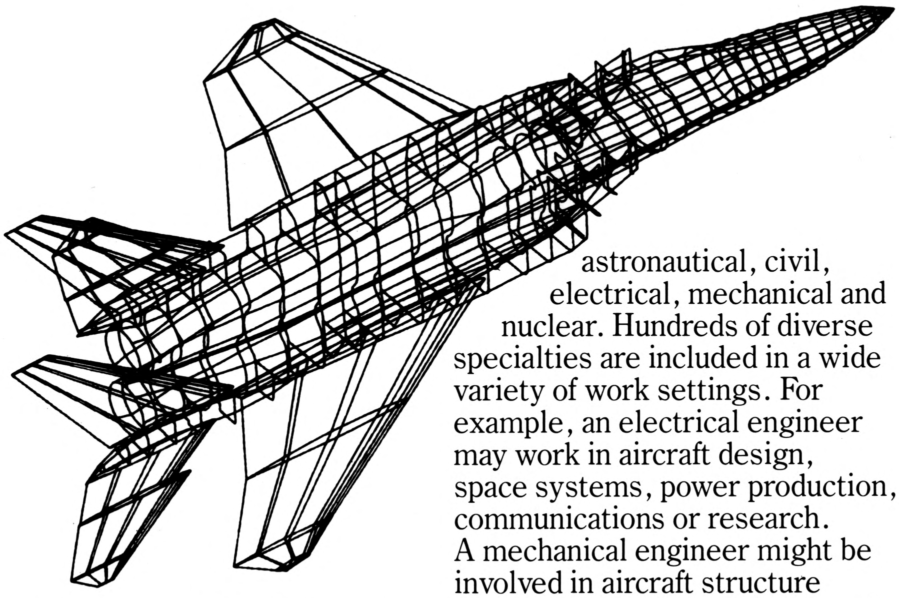
So long peasants—

MD



THE MISSOURI SHAMROCK

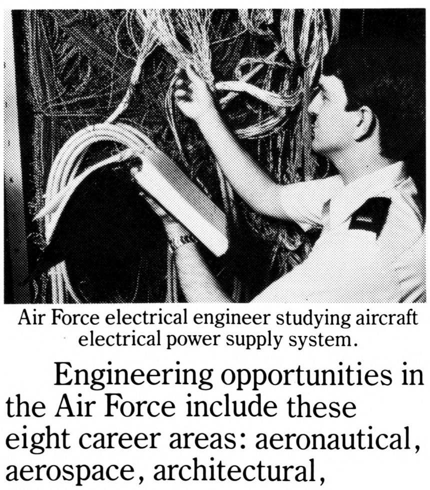
ENGINEERING TAKES ON EXCITING NEW DIMENSIONS IN THE AIR FORCE.



Computer-generated design for investigating structural strengths and weaknesses.

Developing and managing Air Force engineering projects could be the most important, exciting challenge of your life. The projects extend to virtually every engineering frontier.

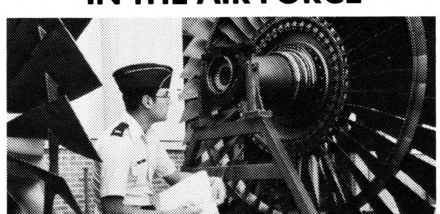
8 CAREER FIELDS FOR ENGINEERS



Air Force electrical engineer studying aircraft electrical power supply system.

Engineering opportunities in the Air Force include these eight career areas: aeronautical, aerospace, architectural, astronautical, civil, electrical, mechanical and nuclear. Hundreds of diverse specialties are included in a wide variety of work settings. For example, an electrical engineer may work in aircraft design, space systems, power production, communications or research. A mechanical engineer might be involved in aircraft structure design, space vehicle launch pad construction, or research.

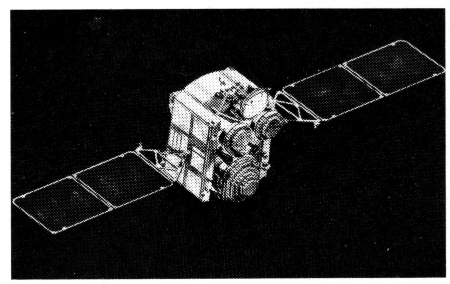
PROJECT RESPONSIBILITY COMES EARLY IN THE AIR FORCE



Air Force mechanical engineer inspecting aircraft jet engine turbine.

Most Air Force engineers have complete project responsibility early in their careers. For example, a first lieutenant directed work on a new airborne electronic system to pinpoint radiating targets. Another engineer tested the jet engines for advanced tanker and cargo aircraft.

OPPORTUNITIES IN THE NEW USAF SPACE COMMAND



Artist's concept of the DSCS III Defense Satellite Communications System satellite. (USAF photo.)

Recently, the Air Force formed a new Space Command. Its role is to pull together space operations and research and development efforts, focusing on the unique technological needs of space systems. This can be your opportunity to join the team that develops superior space systems as the Air Force moves into the twenty-first century.

To learn more about how you can be part of the team, see your Air Force recruiter or call our Engineer Hotline toll free 1-800-531-5826 (in Texas call 1-800-292-5366). There's no obligation.

AIM HIGH AIR FORCE

thought gallery

by Curtis Cannell

1) In the multiplication below, each letter represents a different digit. Which one of the ten digits does M represent.

ABCDEF HINT: $M \times A \triangleleft 10$

X M

BCDEFA

2) What is the remainder after subtravting 7 furlongs, 39 rods, 5 yards, 1 foot and 5 inches from 1 mile?

3) A young man was brought into court to be judged. The judge, however, dismissed himself from hearing the case. When asked why he had done so, the judge replied "brothers or sisters have I none, but this man's father is my father's son". What relation is the judge to the defendant?

ANSWERS

1) M=3

2) One inch

3) The judge is the father

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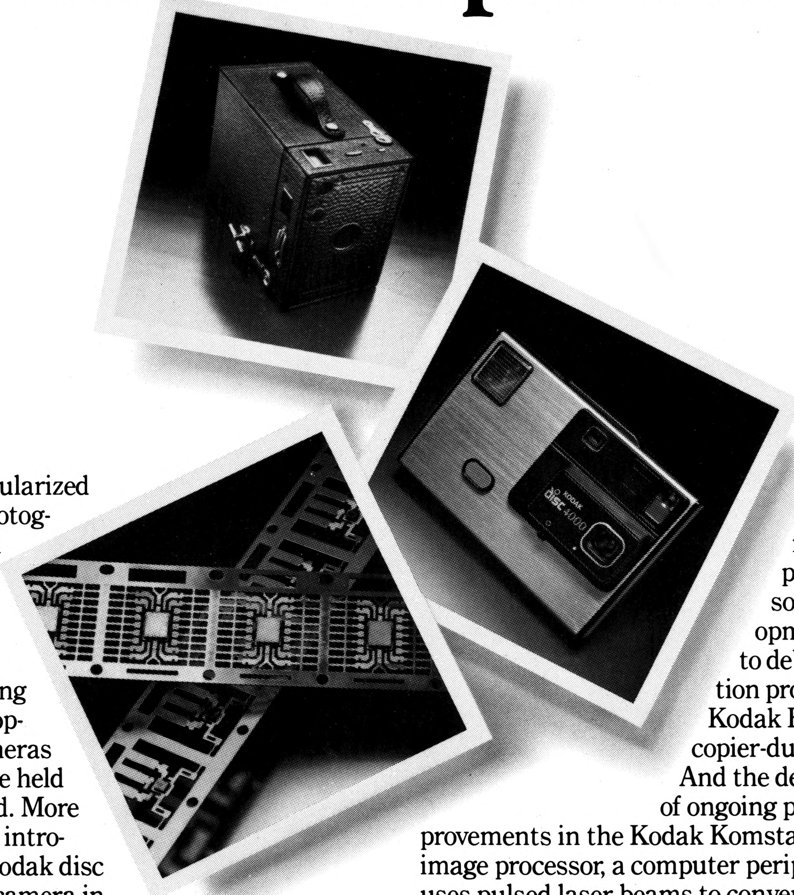

Kodak popularized amateur photography when we mass-produced photographic dry plates, leading to the development of cameras that could be held in your hand. More recently, we introduced the Kodak disc camera—a camera in which integrated circuits make the decisions, automatically, at the touch of the shutter release.

Today, integrated electronic components designed and fabricated at Kodak are built into a wide variety of our cameras. But it takes more than the electronics in our cameras to place us among the nation's top companies in sales of electronics-related equipment.

It takes innovative engineers working on projects that use a microcomputer-based software development system to debug application programs for Kodak Ektaprint copier-duplicators. And the development of ongoing product improvements in the Kodak Komstar 300 micro-image processor, a computer peripheral which uses pulsed laser beams to convert digital data to alphanumeric images on microfilm, at speeds up to 20 times faster than many ink-jet paper printers.

If you're ready for the challenges in electronics you'll find at Kodak, see a Kodak recruiter on your campus.
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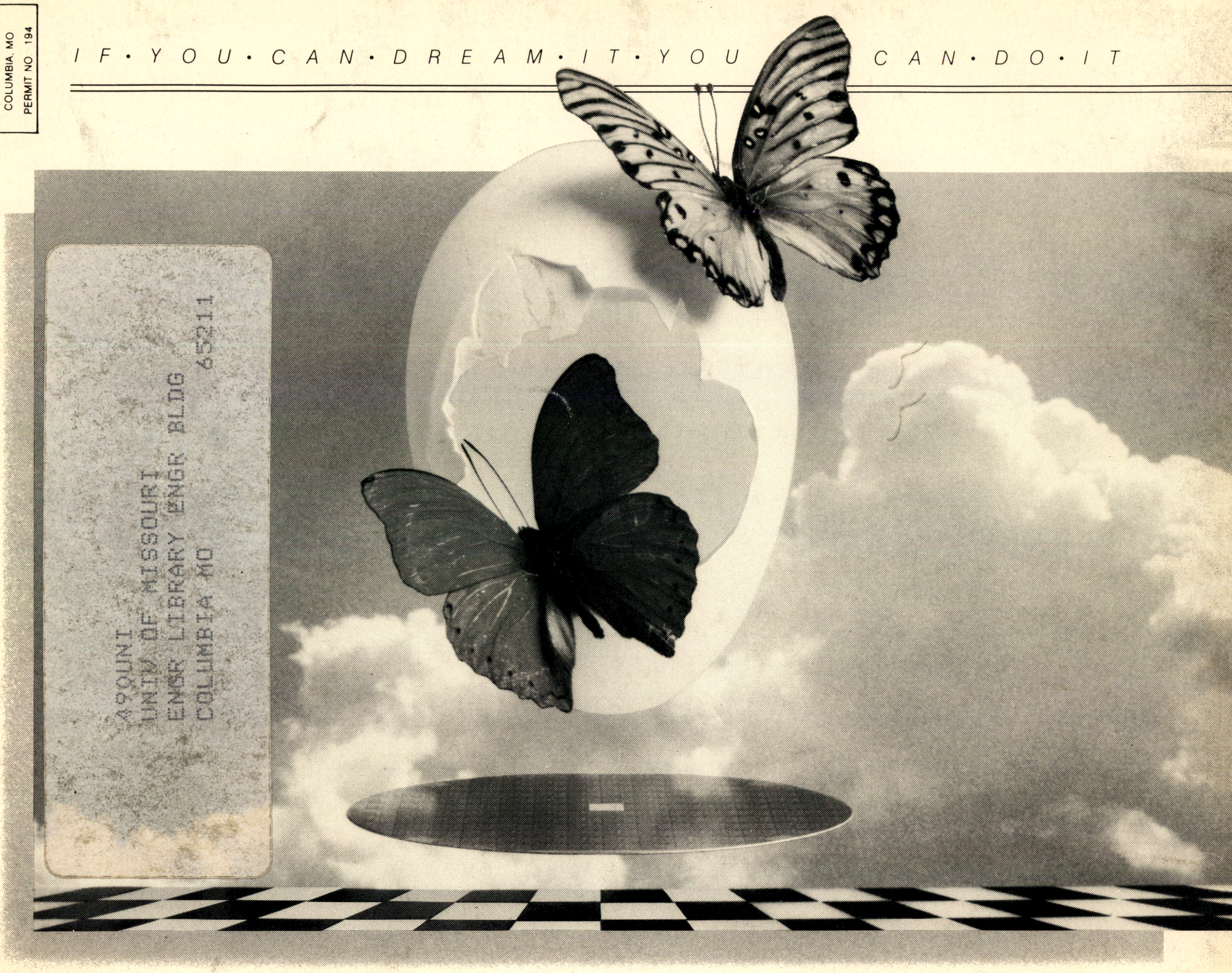

Expand the mind of the microchip.

Remember when electronic calculators were considered a luxury? Well, consider this sign seen recently outside a gasoline station in Schenectady, New York: "Free calculator with an oil change."

That's just one sign of the enormous impact microchips have had on the way we do everything – from banking to game-playing.

But how will we use microchips that are smarter, faster, more reliable, and less expensive to design? How will these new microchips be used to improve systems, products, and processes? As one GE engineer puts it, "The sky's the limit!"

That sky is replete with a number of integrated circuit concepts that GE is applying right now.

There's the custom IC, a chip that performs highly specialized functions. Traditionally, creating this chip has been an expensive, time-consuming job. So we're working on ways to cut design time and cost.

We're using computer-aided design (CAD) to design and simulate chips right on computer screens. We're also developing gate arrays, a system that allows you to build inexpensive prototype chips that can be "played" in systems before the final design is fixed.

Another area that GE is developing is VLSI (Very Large Scale Integrated) circuits. These ICs will eventually squeeze one million transistors onto a single chip.

Where will all this super electronic power be applied? GE engineering manager Don Paterson sees it this way:

"At GE you can innovate from the system down to the chip to create...whatever ignites your imagination."

In other words, you can dream it...and do it.

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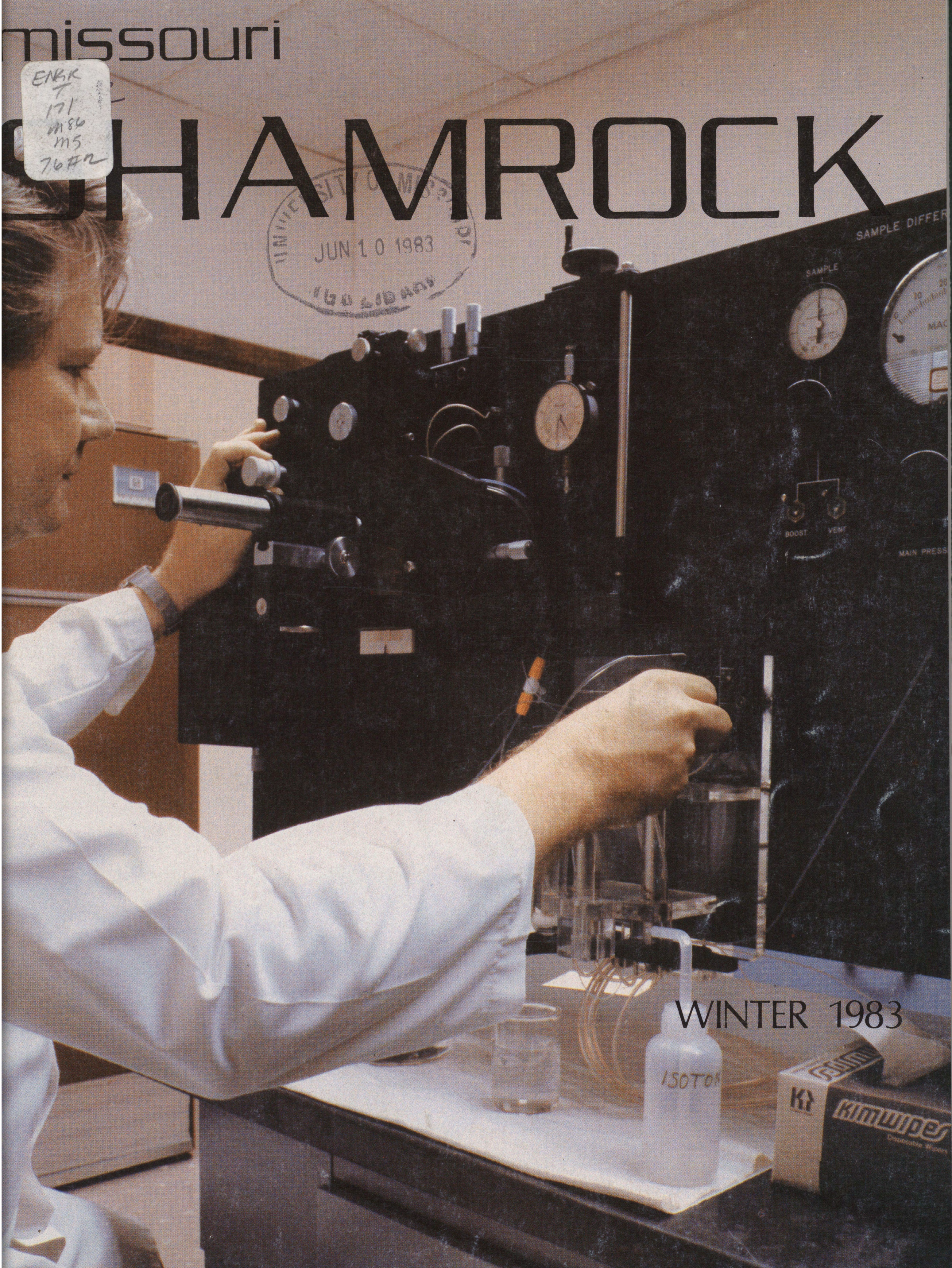

WINTER 1983

Luis Castellanos mines copper with software.

Most copper is found deep underground. But the Bell System's 995 million miles of copper cable have tons of it above and below ground. That copper provides vital circuit paths to transmit customer voice, data and video signals for today's Information Age needs.

And Luis Castellanos, seven years out of undergraduate school, supervises one of the groups that helps Bell System companies "mine" all that copper. He works with one of the largest computer hardware and software systems in the world—the Trunks Integrated Record Keeping System (TIRKS). Every day it "mines" the vast Bell network for available circuits and equipment. As a result of efficient use of network facilities, the Bell System saves millions by eliminating the need for certain capital expenditures.

Plus, there's more to TIRKS than "mining copper." It also configures circuits and assigns components needed for each circuit path. That allows Bell companies to respond faster to customer requests for complex services like video and data transmission. Employees are more productive too, because TIRKS helps them set up circuits and forecast facility needs.

Before TIRKS was available, keeping track of communications circuits and facilities required enormous amounts of paperwork and manual calculation. Every day, the average Bell System company handles orders involving 1500 circuits and up to 7500 individual components associated with them. Each detail has to be specified and accounted for.

Now, thanks to people like Luis, TIRKS keeps track of all that information instantaneously using computers. Information is up-to-date. It's instantly available. And it's more accurate.

According to computer scientists like Luis, the benefits from TIRKS are just beginning. He believes that, as more computer hardware and software systems like TIRKS interact, new benefits for customers may be possible, as well as additional productivity increases for employees.

Luis joined Bell Labs with a B.S. in computer science from Pratt Institute. Under a company-sponsored graduate study program, he attended Stevens Institute of Technology for his M.S. in computer science. At the same time, he worked part-time assuming responsibility for a large piece of TIRKS software. Working with design teams, he gained valuable insight from experienced members. Now, his technical performance has earned him a promotion to supervisor.

If you're interested in similar challenging employment opportunities at Bell Labs, write:

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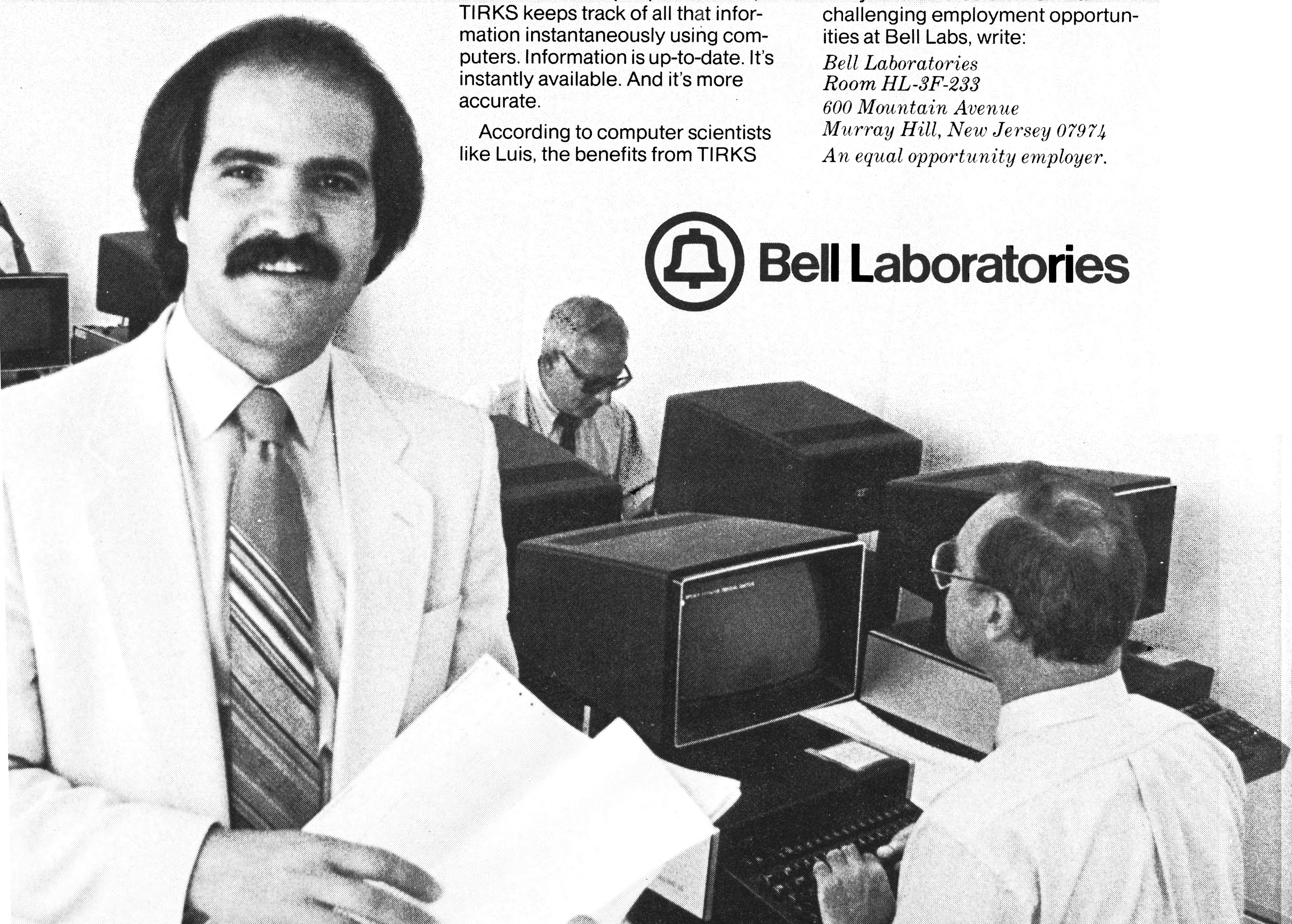

missouri
SHAMROCK
The UMC College of Engineering Magazine

On the Cover:
A demonstration of the sampling machinery at the Ellis Fischel Cancer Hospital
Cover Story page 6
Photo by Greg Gorman

WINTER
1983
Vol. 76 No. 2

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The Missouri **Shamrock** is published quarterly (October, December/January, February, and April) by the engineering students of the UMC College of Engineering. Opinions stated herein do not necessarily reflect the views of the College of Engineering.

Subscription rate is $4.00 per year. Inquiries concerning subscriptions or advertising should be directed to Missouri **Shamrock,** College of Engineering, University of Missouri-Columbia, Columbia, Missouri 65211.

Foremost, the Missouri **Shamrock** gratefully acknowledges its advisor, Ms. Margaret Kraeuchi, Director, Engineering Communications.

Visualization

photo by Ken Summers

by Michael Wroble

Last issue, my editorial dealt with making decisions. This time I'll go one step further and show you how to make these decisions work for you. The method I subscribe to is visualization, the process by which an individual forms and concentrates upon vivid mental images.

As an example of how visualization might work in everyday life, let's suppose that you decide that you want to improve your tennis game. After an afternoon spent on the court, it looks hopeless. It seems that Zeno's paradox has set in, that any more practice will only bring you minutely closer to Wimbleton calibre. Now suppose that you take a break and go inside to watch Jimmy Connors play on television. Stroke after perfect stroke of his is recorded in your brain. You can actually picture yourself doing the things that Jimbo does in his game. Back to the tennis court, the "ideal" you have imprinted in your brain has branched out and started controlling your muscles in a more desired way. Your game improves!

This same method of visualization has been successful in helping man achieve miraculous results. Michelangelo, for example, used it to help him create masterworks like the Pieta, David, and ceiling of the Sistine Chapel. "What I desire, I must first sense. What I sense, I create," he said. Bruce Jenner used visualization to help him win the 1976 Olympic decathlon. Under different names ("The Power of Positive Thinking", "Psycho-Cybernetics", etc.), visualization has helped people quit smoking, lose weight, overcome cancer, and realize just about any life goal.

Recently, Steven DeVore, a northern California educational consultant, completed a five-year study into brain functioning and human performance. The brain, he learned, has at least 10-to-the-2,783,000th power possible connections for receiving, storing, and correlating data. No one uses nearly this much brain potential.

DeVore adheres to the holographic theory of brain functioning. Within the brain, visual and sensory information is imprinted in waveforms and distributed throughout the brain, not simply in one part of it. When images are so vivid they seem all but real, the information they carry may actually be transferred to the body's motor system.

"In effect, what you're doing with visualization is flooding the brain and nervous system with a pure sensory vision of, say, a particular goal you desire," explains DeVore. "If you can create not only an intense visual image, but also get in touch with the sounds associated with your objective, as well as the smells and even the tastes and the feel, you will have taken a giant leap forward toward achieving your goal."

After studying the personal qualities of a cross section of business executives, engineers, doctors, lawyers, and athletes, DeVore narrowed down the characteristics of success to 21 distinct attitudes and behaviors. "I noticed an almost universal trait among high achievers," says DeVore, "and it was what I call Sensory Goal Vision. These people knew precisely what they wanted out of life, and they could sense it multidimensionally before they ever had it. That sharp, sensory vision became a

Cont. on page 5

News Briefs

Compiled by Michael Wroble

the road to nuclear sanity

The nuclear arms race can be stopped, asserts the Union of Concerned Scientists in their new book, **Beyond the Freeze: The Road to Nuclear Sanity** (Beacon Press, $4.95), but the U.S. and the U.S.S.R. face what may be their "last chance" to do so. "The arms race is really accelerating," M.I.T. professor Henry Kendall, the chairman of the group, said. "If we don't apply the brakes soon, the superweapons now under development are going to spark a runaway technological competition that may never be arrested." "It's time, though, to stop just talking about the problem," he added. "We've got to discuss realistic solutions."

In **Beyond the Freeze,** Kendall and colleagues Daniel Ford and Steven Nadis outline a step-by-step strategy for reducing the risk of nuclear war. "Our main purpose," Kendall said, "is to try to give the growing peace movement some guidance on the next phase of its campaign." A bilateral U.S.-Soviet freeze was the "obvious first step," Kendall said, and he emphasized that such a measure should include a comprehensive ban on all missile and warhead testing. "A halt to the deployment of new weapons is not enough," he noted. "You've got to cut the technological developments off at their roots. If you can't test new weapons, you can't develop or deploy them."

Other equally important follow-up measures are necessary, he continued, if the risk of nuclear war is to be diminished. "it's not just limiting the number of missiles and warheads that's vital. We have to prevent potential conflicts from developing into nuclear war, and to do so we have to make sweeping changes in official policy relating to the use of nuclear weapons." For that reason, he explained, a policy of "no first use" of nuclear weapons was a key element in the nation's future security. Reductions in the swollen U.S. and Soviet nuclear arsenals were also a key priority, Kendall continued, but he said that making small cutbacks, which might be negotiated quickly, were better than waiting for some "miracle solution" to be negotiated.

faculty shortage

A review of the 1981 AAES/ASEE survey of 284 schools offering B.S. or higher degrees in engineering shows a serious faculty shortage. The ECFSP Survey reported 18,000 authorized full-time engineering faculty positions. Of these positions, 9.0 percent were vacant. Between 1969 and 1981, full-time undergraduate enrollment has increased 66 percent. During that same period, faculty has only increased by 11 percent. The student/faculty ratio went from about 14 to over 21, an increase that indicates a serious overload in our schools. As a result, the survey reported that 32.5 percent of the respondents reported a reduction in research. In addition, 70.8 percent reported an increase in teaching load, 71.7 percent reported greater reliance on teaching assistants or part-time faculty, and 47.8 percent reported an increase in courses **not** being offered as of the fall of 1981. A full summary of the survey is in the November 1982 issue of the **Engineering Education** magazine.

am stereo

AM STEREO is now being broadcast in more than a dozen U.S. cities, including New York, Chicago, San Francisco, Los Angeles, Kansas City, and Philadelphia. Quite a few more cities are expected to enjoy AM stereo in the near future. Of the two systems currently being used, the system developed by Kahn Communications requires only that you use two separate analog AM radios. The other system, developed by the Harris Corporation, needs a specially equipped AM radio by the listener in order to receive broadcasts in stereo.

editorial—visualization

cont. from page 4

powerful driving force in their lives."

It was found that visualization's full potential is best attained while in a serene, restful state. Not bothered by anxiety or commotion, the mind is more easily adaptable to a state of consciousness like visualization.

Whether your goal is to bench press 200 pounds, be a top executive in the Fortune 500, or become dictator of a country and oppress the masses, it can better be achieved with the help of visualization. If you will excuse me now, I think I'm going to take a nap and dream about graduating from this place and getting a fantastic job. Remember, nothing is impossible with visualization!

help spot cancer

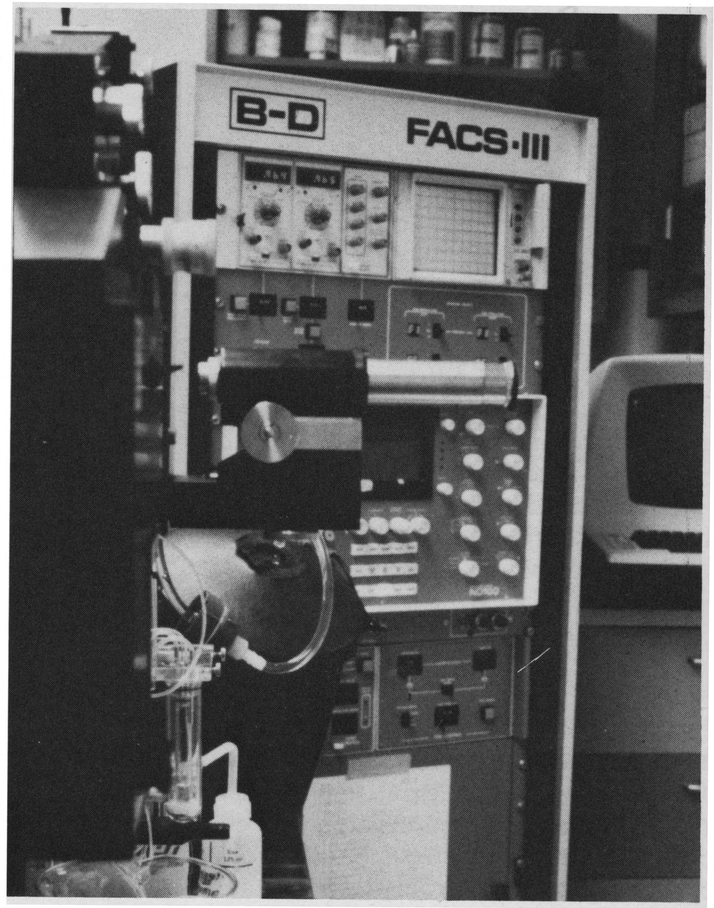
Dr. Harry Tyrer does not have a cure for cancer. But at the Cancer Research Center here in Columbia, Dr. Tyrer and his colleagues are developing a technique which may be of great value in diagnosing various types of cancer, and could be immensely helpful to researchers in dozens of biological fields.

Way back in 1965, a man named Mack J. Fulwyler wrote a paper which resulted in a system to allow cells to be analyzed by the way they interact with light from a laser beam. The cells are stained with a dye which causes them to fluoresce when exposed to laser light. The nuclei emit a greenish light; the cytoplasm (i.e., the part of the cell outside the nucleus) produces light of a red-orange tint. By monitoring the amount of light of each color which is emitted, the researchers may determine the relative amounts of nuclear (cells, not reactors!) material present in the cell. This is important because it has been discovered that cancerous cells tend to have abnormally high levels of deoxyribonucleic acid (DNA)—and DNA is found primarily in the nucleus. Thus, cells which possess cancerous properties may be identified by the proportion of green light they emit.

Enter Dr. Harry Tyrer, an electrical engineering professor at UMC. In 1973, Dr. Tyrer began looking for new ways to use the Fulwyler apparatus. Today, the system has been made infinitely more versatile by the addition of a computer. Here's how it works:

Entering a cylindrical chamber is a continuous flow of a special isotonic fluid. Near the chamber's egress, a miniscule tubule injects stained cells, which are suspended in the isotonic fluid. The mixture is released through a tiny hole, and the stream of cells (now in single-file) is directed into the path of a laser beam.

The laser excites the fluorescent stains in the cells, producing the characteristic red and green light discussed above. This emission, as well as any scattered reflections from the laser itself, are directed to a bank of sensitive photodetectors. The detectors produce a voltage in direct proportion to the amount of each color light present; this data is then fed to the computer. The computer assigns a numeric value to each of the light measurements for each cell; these values are used as coordinates to generate a histogram on a two-dimensional plane. For example, if cell A has light levels of 22 and 38, B has 21 and 15, and C has 22 and 38, the plane position (22,38) will contain a count of 2, and position (21,15) will count 1.

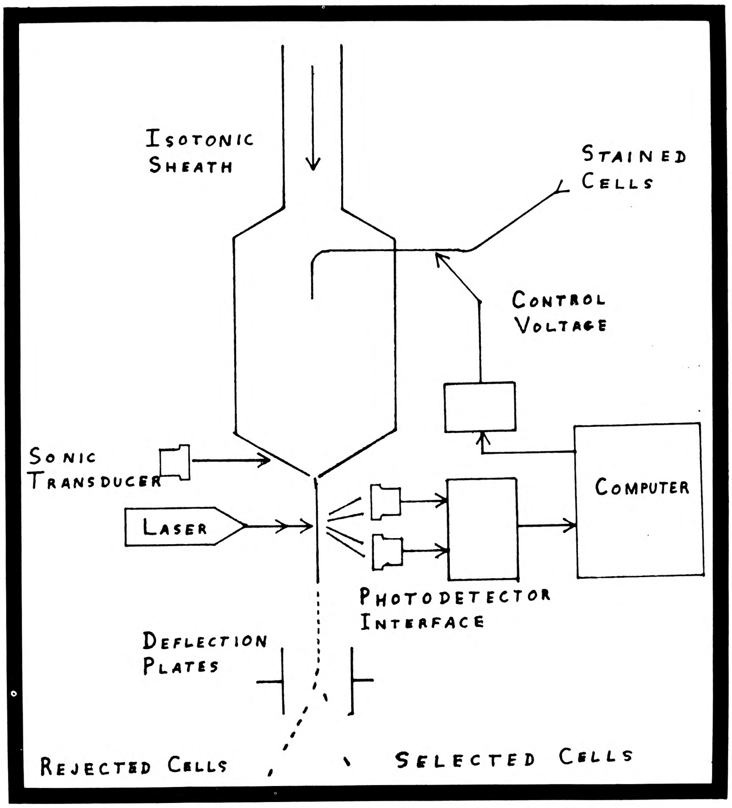


above: Part of the photodetector-to-computer interface.
opposite left: This photo shows a closeup of the peak measurement circuitry.

This histogram is extremely useful by itself, for it allows exact counts to be made of the number of cells having any particular level of nuclear or cytoplasmic material. But Dr. Tyrer didn't stop there. Instead, the power of the computer has been used to extend the analysis to allow the cells to be physically sorted based on their positions on the histogram.

Sorting cells one-by-one at rates of up to a thousand per second sounds complex, but the method used by Dr. Tyrer and his colleagues is surprisingly simple. First, the cells which emerge from the streaming chamber do so at a uniform speed. Thus, when any particular cell passes the laser beam

cover story



This diagram is a schematic representation of Dr. Tyrer's cell sorting process. The deflection plates carry a constant potential; the charge on the cell droplets varies under control of the computer.

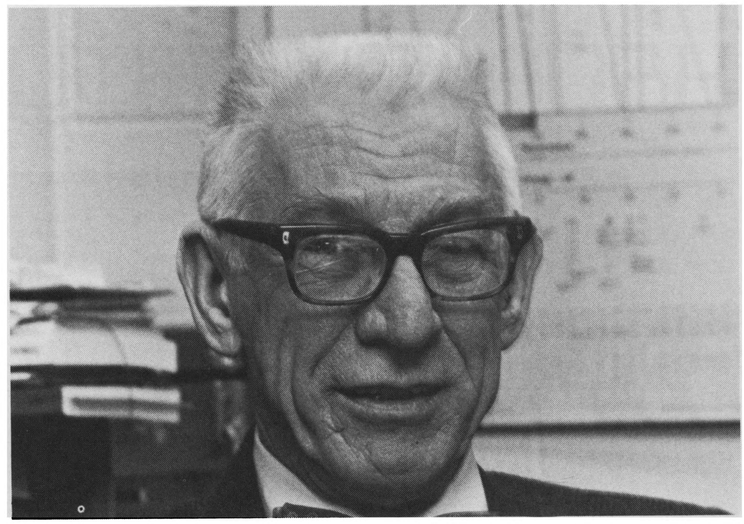
(and the computer receives its coordinate values), the position of that cell at any subsequent time is simply a function of the elapsed time since it was sampled. The mixing chamber is vibrated using a sonic transducer; this causes the cell stream to break (just below the laser beam) into droplets which contain one cell each. Also, the stream has been electrically charged. Thus, we have what amounts to a charged stream of individual cells, and one can easily determine the trajectory of any cell droplet using electrostatic deflection plates.

Now, the charge on the stream is varied by a voltage which is controlled by the computer. Using ordinary electrostatic attraction and repulsion, the computer can change the control voltage fast enough to cause any desired cell to separate from the main path. These cells can be collected on a microscope slide for further analysis. Best of all, the whole process is controlled by the computer's programmer. This means that the user may define almost any desired sorting criterion. Also, no law of nature says that the laser sorter is the only allowable input device, or that DNA content is the only thing the laser can detect.

This flexibility is the reason Dr. Tyrer's project is of such significance. For we now have a method for sorting cells at high speed, excellent accuracy, and in an amazing variety of ways. Although the present focus of Dr. Tyrer's research is the use of this technique in detecting cancerous cells in tissue samples, there is no reason to suppose that its value will end there. Other branches of the biological sciences have similar needs for analyzing cells; Dr. Tyrer's research should be of use to many scientists.

It is encouraging to note that much of this important work has been done not by professors like Dr. Tyrer, but by "mere" students. For example, Chris Kunkel, who received her B.S.E.E. from Mizzou and is now enrolled in medical school, did research toward her Master's degree on the theoretical aspects of positioning the cell droplets correctly. A senior in the EE department, John Miramonti, was responsible for all the electronic construction for the project, and contributed a great deal of effort to the programming and interfacing of the computer. Currently, Gene Kelly, Faramarz Saberian, and Chang Chang-I are working to add additional electronic hardware to enhance several aspects of the system, particularly the graphics display. We "mere" students have the opportunity, in this and other projects, to contribute not only to our own educational process, but also to ongoing efforts addressing problems that have to be solved.

conversation



Students who wish to receive a degree in any type of engineering must, at one time or another, take Physics 80. When they do take it, chances are good that they will have Dr. E.B. Hensley, the Associate Chairman of the Physics Department.

by Doug McCullough

CONVERSATION: Where did you receive your Ph.D. from, Dr. Hensley?
DR. HENSLEY: I received it from the University of Missouri-Columbia in 1951.
CONVERSATION: Can you tell us a little bit about what you did after you got your degree?
DR. HENSLEY: I joined the research staff at the Massachusetts Institute of Technology. This was from 1951 to 1953.
CONVERSATION: Did you enjoy that?
DR. HENSLEY: Yes, but when the opportunity presented itself, I returned to the Midwest and UMC.
CONVERSATION: When did you decide to go into physics?
DR. HENSLEY: My bachelor's degree was in mathematics. During World War II, I taught classes in radar. After the war, I decided to take up physics.
CONVERSATION: How long have you taught Physics 80?
DR. HENSLEY: I have taught it since 1977. Before that, I taught Physics 123, the course that follows Physics 80. I taught that course from 1974 to 1977.
CONVERSATION: You do not have to teach these courses. Why do you choose to?
DR. HENSLEY: After having taught graduate courses for over 20 years, I felt it was better for the younger faculty to have a chance at those courses. Besides, I enjoy teaching these courses.
CONVERSATION: Can you tell us about some of the differences between teaching a high level course and Physics 80?
DR. HENSLEY: The number of students in Physics 80 makes quite a bit of difference. I handle between 400 and 500 students every semester. The Physics 80 course is much more structured.
CONVERSATION: You mean that the lectures and tests are more standardized?
DR. HENSLEY: That's right.
CONVERSATION: Do you consider Physics 80 a "tough" course?
DR. HENSLEY: A lot depends on your aptitude in math and the physical sciences. People who did well in these courses before, and who are willing to study, should have no problem.
CONVERSATION: Do many people actually fail your course?
DR. HENSLEY: Yes, of course, but more people tend to drop out rather than fail.
CONVERSATION: Can you tell us about the relationship between physics and engineering?
DR. HENSLEY: Physicists are primarily concerned with the basic laws of nature, while engineers are concerned with developing and producing useful products. For example, the men that invented the transistor were physicists. At the time, they were trying to understand what was going on inside point contact rectifiers. Since that time, both physicists and engineers have contributed to the development of the vast transistor-based technology. Engineers tend to be more involved with developing new transistor devices and applications, while physicists tend to be more involved with the physical properties of the materials from which these devices are fabricated.
CONVERSATION: What type of student would be better off in physics as opposed to engineering?
DR. HENSLEY: Students who choose to study physics tend to be more curious as to why things happen as they do. They have a greater degree of independence to pursue their own ideas, a characteristic of academic research. Many of these students continue on to graduate school for more advanced degrees.
CONVERSATION: Isn't graduate school costly?
DR. HENSLEY: Most graduate students in physics receive teaching or research fellowships.
CONVERSATION: How would you rate the programs here at UMC?
DR. HENSLEY: I feel that the education you receive here is comparable to anywhere.

UNIVERSITY OF

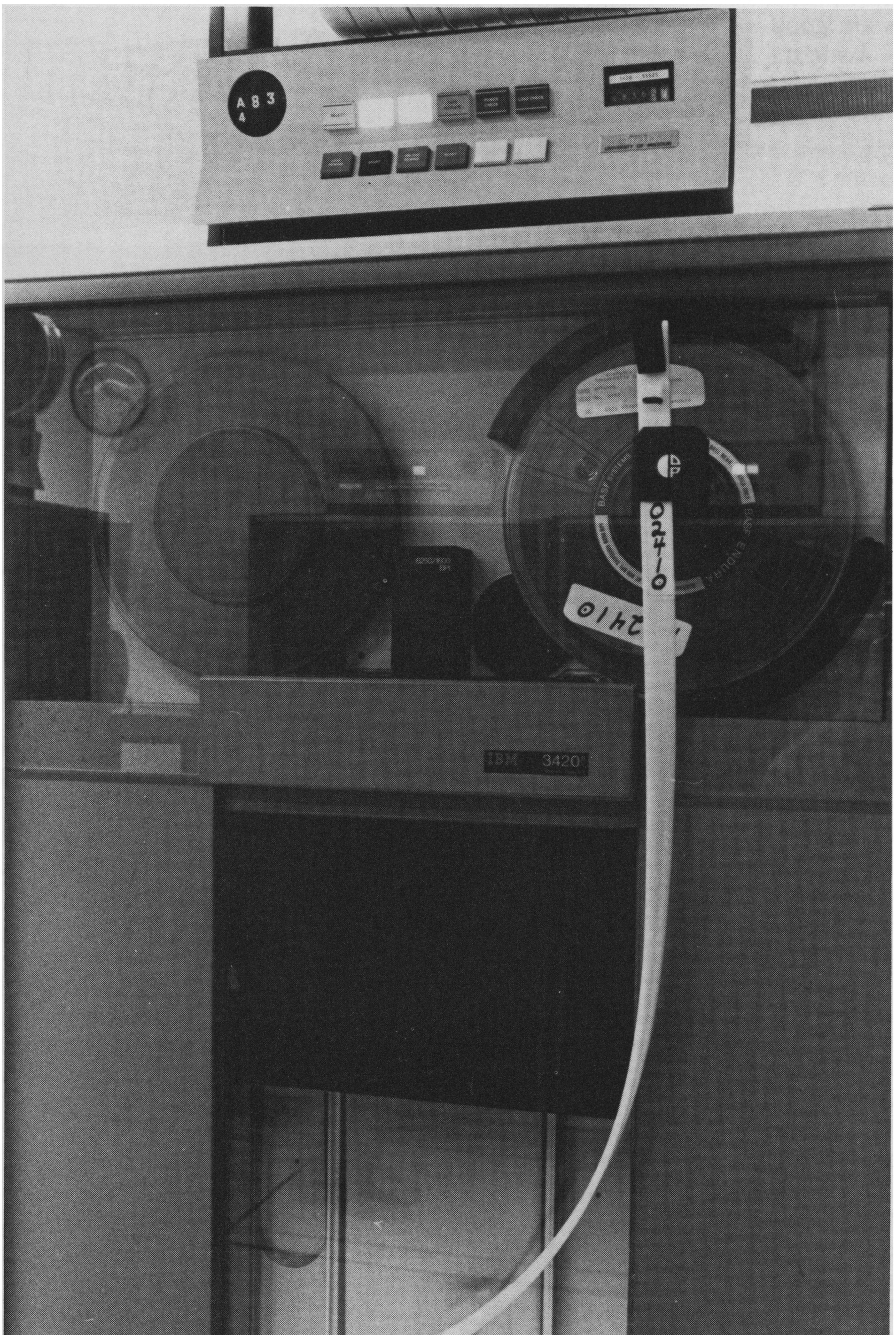


Photo 1: "A close view of one of the Network's magnetic tape drives. Each tape reel can store 6250 characters of data per inch of tape."

by Scott Courtney

For quite a few engineering students, the single FORTRAN course that is required is one course too many. "The Computer" is a vast, unfathomably complex monster that eats cards and coughs out green and white paper with ERROR and WARNING written all over it. The irstructor says, "Here are your account number and password. This is how you type a JOB card, and your TA will show you how to use the keypunches. Go forth and program!" Having to face The Computer armed only with this meager introduction, it's not surprising that a lot of freshmen who have never been exposed to computers before are soon totally lost. Others manage to grope their way through more or less by rote, not understanding what a compiler is or what JCL is for, and usually not caring. In either case, the result is all too often a future engineer who has been totally turned off to computers. And that's a shame, because computers are becoming more and more a part of our lives—and it is nearly impossible to find an engineering career that doesn't involve computing in one way or another.

This is the second part of a two-article series on the UMC Academic Computing Center (ACC). Part One discussed some of the basics of what computing is all about, and covered the major hardware (equipment) available for student use on the Network. In Part Two, we will get down to the "nuts and bolts" of how to actually use some of the more interesting software provided by the ACC for students.

MISSOURI COMPUTER NETWORK

Most of the facilities covered in this article are available to any UMC student who has a valid batch (punch card) account. However, some features may only be used by those students who have access to a class A account. A class A account differs from the usual monitor-class account in that the monitor-class account may only use computing facilities that are part of the Execution Batch Monitor (XBM). XBM jobs include WATFIV, WATBOL, $DOCUMENT, ASSIST, and $REPRO. Each of these may also be run from a class A account; however, most users of the above will have monitor-class accounts. If you are in doubt as to what kind of account you have, ask your instructor. Those portions of this article which apply only to class A accounts will be noted as they occur.

using WATFIV

Since almost all engineering students have taken ENGR 5 or CompSci 104, let's take a look at WATFIV. This language has more features and capabilities than many students realize. For example, consider the case in which a student has three programs to run for his assignment. Since he is an expert at programming and KNOWS his program will run first time through, the student wants to save time by running all three programs at once. He can do just that with the setup in Figure 1

Any number of separate WATFIV programs may be "stacked" in this manner. If a program doesn't need any data cards, just go on to the next $JOB card. Remember to put $STOP after the last $ENTRY card.

figure 1

```
//MYJOB JOB (xxxxEB,pwrd),
        'your name here',CLASS=W
$JOB
        (program number 1
        goes here)
$ENTRY
        (data cards for program 1,
        if any)
$JOB
        (program number 2)
$ENTRY
        (data cards for program 2)
$JOB
        (program number 3)
$ENTRY
        (data cards for program 3)
$STOP
//
```

While on the subject of those "$watchacallit" cards in WATFIV, let's digress for a moment to see how these control cards may be put to good use. The most useful card is the $JOB card, for this is where we can tell the compiler to do all sorts of neat things with the program. These special instructions to the compiler are called "options". WATFIV options are specified on the $JOB card as shown below:

```
$JOB      ,option1,option2,option3 . . .
```

The dollar sign is in column 1, and the first comma is in column 16. Option1, option2, and so on may be any of the following:

TIME=(minutes,seconds) Maximum time you wish to allow your program to run. If this is not specified by the programmer, the system assumes a "default" value of three seconds.

PAGES=lines Maximum number of lines of printout (in thousands of lines). Note that the computer will have a maximum value established for this field, depending on where you run the program.

NOLIST Causes WATFIV to print only your program's run-time output, with no listing of the program itself.

S=statements Maximum number of statements you wish your program to execute. If the program exceeds this limit, an error message will be printed.

DEC=f.d This option allows you to specify how the computer will print REAL numbers when no FORMAT statement is used. "f" is the total number of spaces for each number, including the decimal point, and "d" is the number of decimal places to print. For example, DEC=7.2 will cause the number 123.4567 to print as " 123.46". Refer to the User's Guide to WATFIV for a complete explanation of this option.

There are other options which may be placed on the $JOB card. The WATFIV User's Guide contains a complete listing.

The $JOB options may also be placed on another card, called the C$OPTIONS card. The only function of this card is to allow the programmer to code options. Its format is identical to the $JOB card, except that C$OPTIONS replaces $JOB and there is no comma before the first option field.

Other useful control cards for WATFIV include:

C$EJECT Placing this card in your program deck will cause the printer to skip to a new page in your listing.

C$SPACE n Skips "n" lines (blank) in your listing. Useful for improving readability of long program listings. Neither this card nor C$EJECT has any effect on the operation of your program.

(cont. on page 14.)

The Dispersion Analysis

Exhaust dispersion near a roadway is influenced by the turbulence and heat generated by moving vehicles. Findings at the General Motors Research Laboratories have provided a new understanding of the dispersion process.

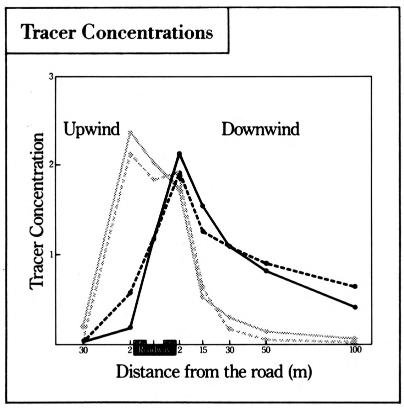


Figure 1: Observed (solid lines) and predicted (dashed lines) tracer concentrations near ground level as a function of distance from the edge of the road. Black lines indicate the case in which the wind is perpendicular to the road; gray lines, when the wind is nearly parallel to the road and opposing the upwind-lane traffic.

Figure 2: This representation of a roadway viewed from above shows the location of large vortices formed by local wind shear when the wind opposes the upwind-lane traffic.

BY USING the conservation-of-mass equation, one can describe the dispersion of gaseous molecules in the atmosphere. The equation includes terms for advection, diffusion, sources and sinks. Advection is the transport of air parcels by the mean wind; diffusion is due mainly to turbulent mixing. But the equation is useful only if we have information about the wind and temperature fields in the atmosphere. Specifically, our ability to predict vehicular exhaust concentrations near a road depends on knowledge of the effects of vehicles on these fields.

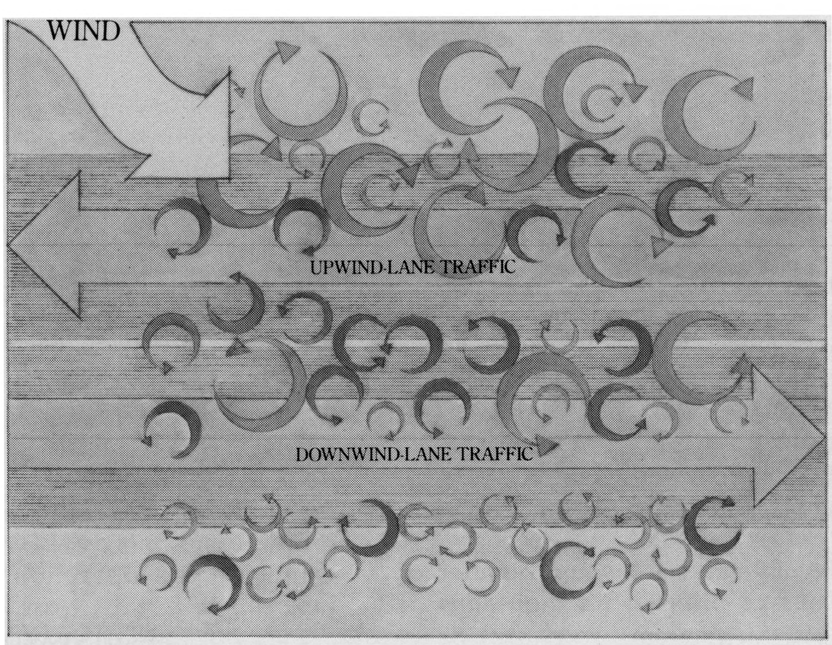
The conservation-of-mass equation for the mean concentration of any species, C, is

$$\underbrace{\frac{\partial C}{\partial t}}_{\text{Local rate of change}} + \underbrace{\sum_i \frac{\partial (U_i C)}{\partial x_i}}_{\text{Advection}} = \underbrace{\sum_{i,j} \frac{\partial}{\partial x_i}\left(K_{ij}\frac{\partial C}{\partial x_j}\right)}_{\text{Diffusion}} + \underbrace{So}_{\text{Sources}} + \underbrace{Si}_{\text{Sinks}}$$

where U_i is the mean wind velocity and K_{ij} is the eddy diffusivity tensor. This equation applies when the length scale of mixing is small compared to that of the variation of the mean concentration. Near a road, this condition is met if the averaging time for the concentration and wind velocity is much longer than the time interval of vehicular passage. For a straight roadway, a long averaging time allows one to assume spatial uniformity in the direction parallel to the road, and to ignore the spatial derivatives in that direction.

The input information for K_{ij} and the mean crossroad and vertical wind components near a roadway became available as a result of a large-scale experiment conducted by the General Motors Research Laboratories. The experiment has provided an understanding of the influence of moving vehicles on mechanical turbulence and buoyancy near a roadway. Dr. David Chock was responsible for the design of the experiment and the analysis of the data. The experiment, which duplicated a heavily traveled, level roadway, was conducted under meterological conditions minimizing dispersion.

Moving vehicles affect the mean crossroad and vertical wind components in the following ways. Vehicles act as an obstacle to the mean wind, causing it to slow and move upward as it approaches the vehicles and downward as it leaves the road. In addition, vehicles release heat, which causes a net upward motion. It was established that the increase in the mean vertical wind component due to the exhaust heat was $(B/U)^{1/2}$, where U is the crossroad wind component.



The buoyancy flux, B, is proportional to the heat emission rate of the vehicles.

Moving vehicles also enhance both turbulence intensity and mixing. To determine how this modifies the eddy diffusivity tensor, K_{ij}, Dr. Chock invoked a "second-order closure" assumption, which relates eddy diffusivity to Reynolds stresses and the gradients of mean wind velocity and mean temperature. Eddy diffusivity was assumed to be the sum of ambient and traffic contributions. To determine the traffic contribution, the length scale of the traffic-induced turbulence was assumed to be comparable to vehicle height—1.5 m.

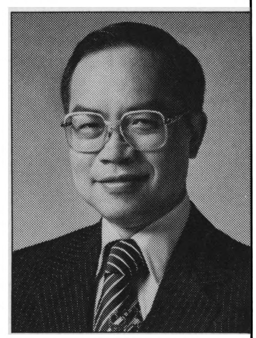
USING THE vast data base compiled during the experiment, Dr. Chock was able to specify K_{ij} and the mean crossroad and vertical wind components, and solve the equation numerically. To test the model, half-hour measurements of a tracer gas were used to map out experimentally the exhaust dispersion under various meteorological conditions. The case where the wind speed is low and the wind direction is nearly perpendicular to the roadway is represented by the black lines in Figure 1. Both the model and the experiment show the same dispersion pattern. The peak concentration is on the downwind roadside.

When the wind is nearly parallel to the road, the situation is much more complicated. Figure 2 shows that when the wind and traffic flow on the upwind lanes oppose each other, a high shear region occurs immediately upwind of the first traffic lane. When the wind and traffic are in the same direction, the high shear region occurs in the median of the road. In these high shear regions, large eddies are generated and turbulent mixing is intense. The gray lines in Figure 1 show a comparison of the model's predictions with the tracer data for the case illustrated by Figure 2. Notice that the peak concentration can actually occur on the upwind roadside, due to the exhaust transport by these large eddies. Dr. Chock's model is the first to predict this occurrence.

Under all combinations of wind speeds and directions, the predictions based on the model compare favorably with the measured tracer concentrations. There is little systematic bias with respect to wind direction.

"In light of this new model, exhaust dispersion near a roadway can now be predicted with reliability," says Dr. Chock. "This is of importance for environmentally sound road planning, and opens the door to the investigation of dispersion on city streets, where the presence of tall structures introduces even further complexity."

THE MAN BEHIND THE WORK



Dr. David Chock is a Senior Staff Research Scientist in the Environmental Science Department at the General Motors Research Laboratories.

Dr. Chock received his Ph.D. in Chemical Physics from the University of Chicago. His thesis concerned the quantum mechanics of molecules and molecular crystals. As a Postdoctoral Fellow at the Free University of Brussels, he did research work on the dynamics of critical phenomena. He did additional postdoctoral work in the fields of solid-state physics and fluid dynamics.

Dr. Chock joined the corporation in 1972. He is leader of the GM atmospheric modeling group. His current research interests include the phenomena of atmospheric transport and reactions, and the statistical study of time-series data.

General Motors

GM

MARK OF EXCELLENCE

UMC computing

cont. from page 11

In addition to these compiler control statements that are used outside the actual program, WATFIV has a number of time-saving features that are used within the program itself. The so-called structured programming statements are useful for making the logic of your program clear and easy to follow.

Structured statements in WATFIV include IF . . . THEN . . . ELSE DO WHILE, DO UNTIL, LOOP . . . ENDLOOP, DO CASE, AT END, and several others. As with the control cards, you should check the WATFIV User's Guide for complete details. Here is a look at some of the most versatile structured statements: IF . . . THEN . . . ELSE

This is probably the most useful of all the structured statements. It is set up as shown in Figure 2.

figure 2

```
IF (condition) THEN DO
   line1
   line2
   line3 . . .
ELSE DO
   line4
   line5
   line6 . . .
ENDIF
```

figure 3

```
   IF (.NOT.condition) GO TO 10
      line1
      line2
      line3 . . .
      GO TO 20
10    line 4
      line 5
      line6 . . .
20    CONTINUE
```

"Condition" is a standard IF statement clause, like "A.LE.B" or "ITEM.NE.6". If the specified condition is true, then line1 line2, and line3 (and so on) are executed. If the condition is false, then the program skips to the statement following the ELSE DO line. In either case, when the correct group of statements has been executed, control passes to the next line after the ENDIF statement. In other words, IF . . . THEN . . . ELSE will replace the following sequence of "standard" lines. (See Figure 3.)

This statement allows a lot of messy GOTO's to be replaced by a single set of clearly readable statements. By the way, lin1, lin2, and so on may be any valid WATFIV statements, including GO TO, a DO loop, or even another IF statement (of any kind).

figure 4

```
DO CASE index
CASE
   line 1
   line 2
CASE
   line3
   line4 . . .
CASE
   line5
   line6 . . .
CASE . . .
IF NONE DO
   line 9998
   line 9999
   line 10000 . . .
END CASE
```

The only catch is that this statement shares the DO loop's rules about nesting (i.e., no crossed paths) and jumping inside (you can not jump into the middle of IF . . . THEN . . ELSE).

DO CASE

Suppose we want to execute a different block of code depending on the value of a variable. We could use a computed GOTO, but that can get messy. Instead, we use the simple structure. (See Figure 4)

This series of statements will do line1 and line2 if the index (any integer expression) is 1, line3 and line4 if index is 2, and so on. If index is bigger than the number of CASE statements specified, the lines under IF NONE DO are executed. Of course, each CASE may contain any number of lines, and the DO CASE statement may be nested with other statements, provided the usual rules are observed.

One of the most useful facilities available from the ACC is the so-called $DOCUMENT function. $DOCUMENT allows any user to print off manuals on everything from APL to XEDIT, simply by requesting the desired manuals by name.

There are two ways to use $DOCUMENT. The first method, using the XBM, may be accessed by any user. The second method offers much greater versatility and produces nicer output, but it requires a class A account. In either case, the user need only supply a basic job setup, followed by a one-per-card listing of the names of the documents to be printed. Output may be sent to the standard printer for quick turnaround, or to the 3800 laser printer for best appearance and durability (for permanent reference).

The standard setup for MONITOR class $DOCUMENT jobs is:

//DOCUMENT JOB (xxxxrr,pwrd), 'name',CLASS=Y
$DOCUMENT

Cont. on page 15

Cont. from previous page
name1
name2
name3
etc.
Notice that no slash-slash (/) card is used. xxxx is the user's account number, rr is a route code (EB, LH, etc.), and name1, name2, and name3 are names of documents to print. As many may be printed at once as desired, up to the maximum line limit of the installation where the output is printed.

Many documents are longer than 3000 lines. To print one or more of these, change the job card to:
//DOCUMENT JOB (xxxxrr,pwrd,,lines),'name',CLASS=Y
The two consecutive commas are NOT a misprint; they indicate a field between pwrd and lines that is being skipped. Lines is the total number of lines (in thousands) to be printed. For example, if you are printing one document that is 3500 lines long and two more at 4000 lines apiece, you should code a lines value of at least 12. Note that the value is rounded up to the next thousand lines.

A good document to print first is called CCONTENT (for Columbia CONTENT). This is about 3000 lines long, and it is a list of all UMC documents, listing their names, subjects, and how many lines each contains.

An improved form of $DOCUMENT may be run with a class A account. The setup for the class A version is:
//DOCUMENT JOB (xxxxrr),'name',
// PASSWORD=pwrd
/*JOBPARM L=lines,K=0
// EXEC DOCUMENT
//GO.SYSIN DD *
name1
name2
name3
etc.
To print a document on the 3800 printer, use the setup above, but replace the // EXEC DOCUMENT card with:

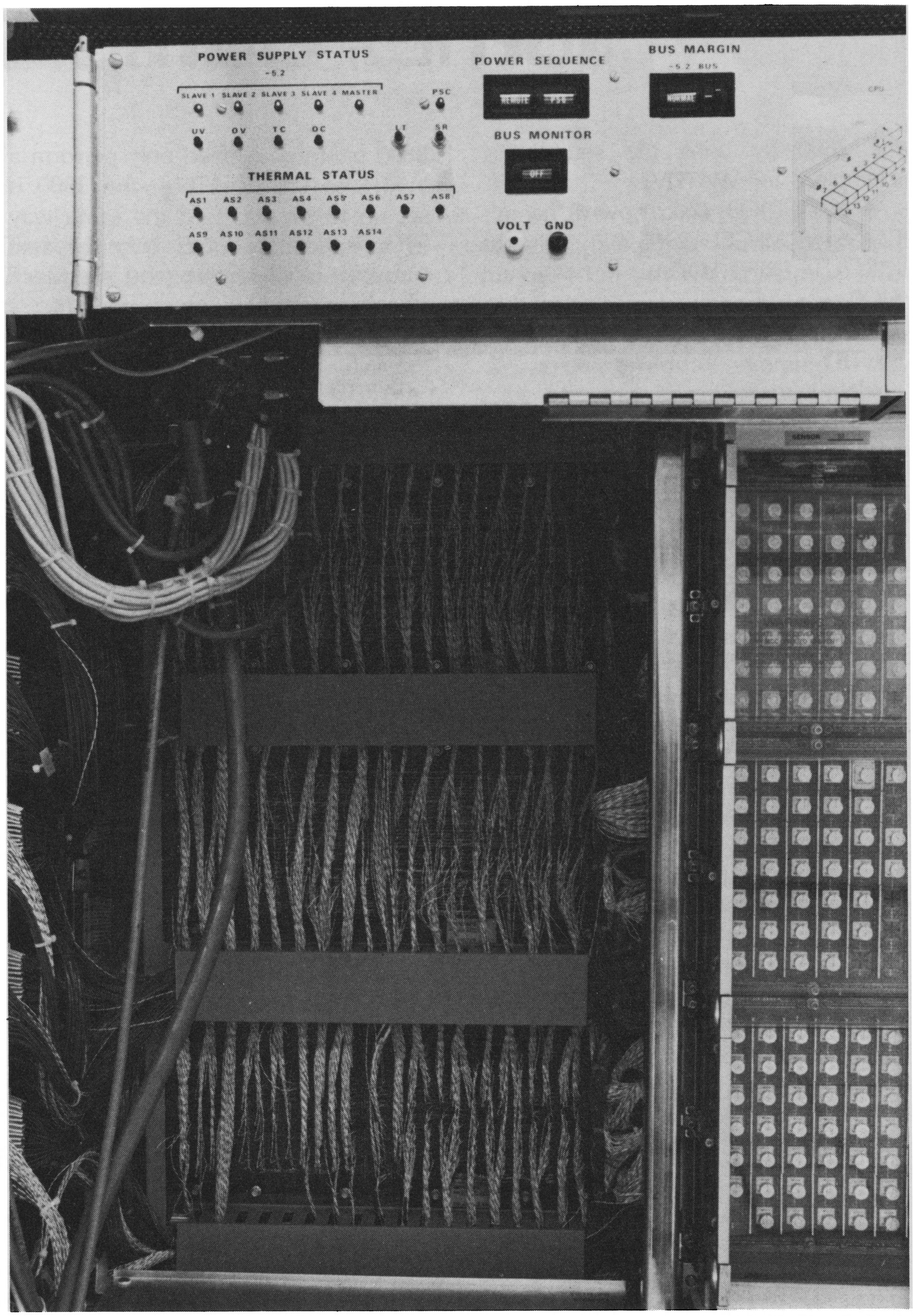


Photo 2: "This view shows the interior circuitry of one of the ACC's Amdahl 470 processors".

// EXEC D3800N6,CLASS=1
The CLASS=1 parameter will request that the output be softcover bound for permanent reference. Note that some documents are designed to use D3800N8 instead of D3800N6. These are noted in the CCONTENT document.

Using the 3800 Printer

Part One of this article mentioned some of the outstanding features of the ACC'S 3800 Laser Printing Subsystem. Now we will begin to look at how to access this powerful device. Any user may print a job on feature

UMC computing

the 3800 by using this setup (this example is for WATFIV):

```
//ALLMINE JOB (xxxxrr,pwrd),'name',
CLASS=W,MSGCLASS=S
/*ROUTE PRINT LOCAL
$JOB
  (program deck)
$ENTRY
  (data cards)
$STOP
//
```

The setup shown above will cause the user's entire output to be printed at Math Sciences on the 3800. The ACC's courier will then deliver the output to the site specified by the rr code, usually the next morning. Note that NO OUTPUT is printed where the job is run, so it's best to debug your program on regular printed output, then send the final copy to the 3800.

If you have a class A account, then you can do all sorts of nifty things with the 3800 printer. For example, suppose you have a program which produces lots of output. You want the listing to come back to standard printout, but you wish to send the program output to the 3800. This may be accomplished using the following job setup:

```
//GARBAGE JOB (xxxxrr,pwrd,,lines),
'name'
// EXEC WATFIV
//GO.FT33F001 DD SYSOUT=S,
DEST=LOCAL,
//        DCB=(RECFM=FA,LRECL=133,
BLKSIZE=133)
//GO.SYSIN DD *
$JOB
  (program)
$ENTRY
  (data)
$STOP
//
```

With this job setup, to print on the 3800 printer you need only perform a WRITE to unit 33. Thus, the 3800 is set up to be accessed the same way as a standard printer; only the unit number is different (the standard printer is unit 6). An example of a write to the 3800 might be:

```
WRITE(33,100) X, Y, Z, (A(N),N=1,5)
100 FORMAT(' ',3F10.3,5F6.1).
```

These relatively simple applications of the Laser Printer only scratch the surface of its capabilities. To learn more, you may wish to consult the following $DOCUMENT manuals:

CJCL3800 Examples of JCL to print on the 3800.
UMN3800 User's manual for the 3800 printer.

As you can see, the University of Missouri boasts a computer network with a vast array of features and capabilities. Though the average student will never use more than a small fraction of the Network's facilities, it is important to be aware of what is avilable, and if not HOW to use it, at least WHERE to find out. The ACC has much to offer; take the time to find out what your card-gobbling slave can do to help you.

engineer's week, 1983

by Mark Schwendeman
Chairman St. Pat's Board 1983

Engineer's Week 1983 will fall a bit earlier this year, running from Saturday, February 26 to Saturday March 5. The week kicks off with the annual parade on Saturday the 26th, with the Road Rally closing out that day. Rumors have it that this year's course will be more challenging than ever. Dependent upon the weather, Sunday's activities will consist of either a coed football tourney or the second annual softball tournament. A break from the usual classroom doldrums will be available Monday and Tuesday with Professor for a day. These are two days set aside for representatives from industry to speak with your classes on the latest technological developments within the engineering field. Encourage your professors to participate in this educational experience.

The Coronation of the Queen takes place at precisely 10:30

Monday evening's activity is the Student-Faculty Fun and Frolics, somewhat of a variety show where everyone can join in the fun. The Queen skits on Wednesday night offer every engineer an opportunity to preview the final five Queen candidates and make their final decision. The Barbeque, a social happening no one will want to miss, takes place Thursday evening. Friday evening is set aside for the Knighting ceremonies. Also, students, faculty, and friends will have a chance to see this year's lab exhibits both Friday and Saturday. The Green Tea at the Chancellor's residence gives everyone an opportunity to meet with both alumni and fellow students on Saturday afternoon. The week's activities are capped off Saturday evening with the annual St. Pat's Ball. The coronation of the new queen takes place at precisely 10:30 p.m.

This has been a brief overview of the 80th annual Engineers' Week. The tentative schedule included here is subject to changes, so stay tuned. If you have any questions, comments, or would just like to help out, please contact Mark Schwendeman (442-5506) or Mark Moorhouse (874-4930).

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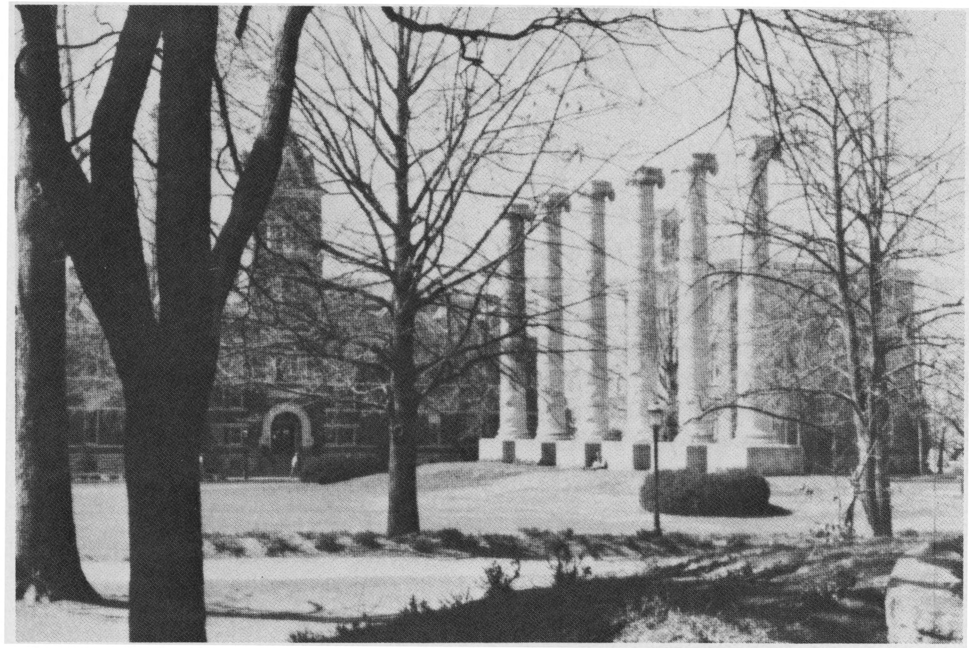
west of the columns

by Jackie Fallert



fee increase

Engineering students may have to pay an additional fee beginning next fall. Although the exact amount of the new supplemental fee has not yet been determined, University administrators are planning to recommend a $10 per hour fee at a meeting of the Board of Curators. The additional money raised through the supplemental fee will be applied to salary increases for the engineering faculty and to equipment purchases.

SHAMROCK award

The Engineering College Magazines Associated has awarded first place to the MISSOURI SHAMROCK for the "Best Single Issue" in the Association's annual competition. The award-winning issue was the February 1980 issue of the SHAMROCK. For those of you who weren't around, or have forgotten, that issue featured an article on "The Edison Connection". The cover and cover story are in a framed display on the second floor of the electrical engineering building.

dean is honored

William R. Kimel, dean of engineering, has been selected for the Bliss Award of the Society of American Military Engineers. This prestigious award is given annually to an engineering professor from a college that has an established ROTC program, and who has made an outstanding contribution to military engineering education and has promoted recognition of the importance of technical leadership to the national defense.

Dean Kimel has also been named as an honorary member of Alpha Nu Sigma, the national nuclear engineering honorary society.

outstanding research

Dr. Sudarshan Loyalka, UMC professor of nuclear engineering, recently received the Chancellor's Award for Outstanding Research in the Physical and Mathematical Sciences and the Sigma Xi Faculty Award for research excellence.

Dr. Loyalka's research concerns the development of theories to explain particle behavior. By his research, he is enhancing the understanding of the motion of neutrons, molecules and aerosols and the principles of heat-mass-momentum transfer in solids and gases.

In addition to his research, he has published many papers and serves as a reviewer for several technical journals.

neutron tomography

Applications involving a new nuclear process, called neutron tomography, were first demonstrated at the University of Missouri Research Reactor. Dr. William Kennedy and Dr. K. William Logan, assistant and associate professors of nuclear engineering and radiology, are working to develop the system which may be used to assist in cancer treatment.

The neutron tomography process directs a narrow beam of neutrons and gamma rays at a body part to produce a 3-dimensional image of it and any possible tumor.

Testing in neutron therapy as a treatment for tumors has already begun. However, with this new process the neutrons may become an important diagnostic tool as well.

what's what

Thirty-six engineering students of the University of Missouri-Columbia have been named to "Who's Who Among Students in American Universities and Colleges". "Who's Who" is one of the most highly regarded and long-standing honor programs in the nation, having served higher education for 46 years.

In selecting the nominated students, scholarship was the foremost consideration, followed closely by participation in academic and extra-curricular activities. The following is a

cont. on next page

engineer's week

tentative schedule

cont. from page 17

Saturday February 26

Road Rally
Parade

Sunday Febrary 27

Softball/Football Tourney

Monday February 28

Professor for a day
Student-Faculty Fun and Frolics
Ping Pong Ball Drop

Tuesday March 1

Professor for a day

Wednesday March 2

Queen Skits

Thursday March 3

Barbeque

Friday March 4

Knighting Ceremony
Lab Exhibits

Saturday March 5

Lab Exhibits
Green Tea
St. Pat's Ball
pg 20

west of the columns

cont. from page 18

list of students who will represent UMC's College of Engineering in "Who's Who".

Jan Anderson, Rebecca Besseken, Scott Boyd, D. Matthews Bond, Gregg Burke, June Chalquist, Christopher Cox, Lynne Erselius, Steven Foppe, Ronald French, Daniel Fritts, Michael Gerke, John Gilman, James Hartzfeld, Mark Hulshot, Paul Johnson, Anita Katti, Dewaine Kautsch, Douglas Kothe, Gregory Larsen.

Patricia Leonard, John Lewis, Dilys Liu, Russell Mallow, Laura May, Bernard Miller, Douglas Mueller, Mary Myers, Giovindarajan Natarajan, Mark Niederschulte, Joseph Payne, Keith Piontek, James Stiles, James Towler, Robert Whitaker and Michael Wroble.

IEEE happenings

The UMC student branch of IEEE is sponsoring a Student Professional Awareness Conference on February 18, 1983. The SPAC will be an informative workshop addressing the complex decisions that young engineers must deal with. Invitations will be extended to all of the student branches in IEEE's St. Louis section, including UMR, Washington University and SIU-Carbondale. IEEE encourages everyone to participate in this ma:jor event.

In addition, IEEE will sponsor a Student Paper Contest on January 25, 1982. This contest is open to all IEEE members and is the qualifying contest for the St. Louis section competition. Papers may cover technical, engineering, management and societal aspects of electrical engineering topics.

a page from the past

BULLARNEY

February 1969

This issue we reprint a page from the past representing the wry and often bawdy humor of the engineers of the 60's.

The engineer was out with a flirt, and when his buddy left the table to buy a paper she pursed her lips invitingly and leaned across the table toward her date and, putting her face against his, whispered, "Now is your chance, darling." Glancing around hastily, the engineer muttered, "So it is!" and quickly leaned over and drank his buddy's beer.

♣

What's the hurry?

I bought a new textbook and I'm trying to get to class before the next edition.

♣

Definition of a college man: One who can't count up to 70 without cracking a smile.

♣

Coed: "Where did you learn to kiss like that?"

C.E.: "Siphoning gas."

♣

The dictionary is the only place where success comes before work.

♣

Two junior EE's who had just completed a stiff Thermo exam were discussing it.

First EE: "How far were you out from the right answer on the second problem?"

Second EE: "Two Seats."

♣

A doctor can bury his mistakes; a lawyer's mistakes are hung; but an engineer has lasting monuments built to his mistakes.

♣

Student: "But professor, isn't this the same exam you gave last year?"

Professor: "Yes, but I've changed the answers."

♣

Guest: "Why does your dog keep watching me like that?"

Host: "I guess it's because you've got the plate he usually eats from!"

♣

"You can't beat the system," moaned a student after looking at his semester grades. "I took a course in basket weaving for a snap elective and then two Navahos enrolled and raised the curve so I flunked."

♣

"How did you find the ladies at the dance?"

"Oh, I just opened the door marked Ladies and shore enough there they were."

♣

Answer to question on a Physics test: A meter is the distance between two bars in Paris.

♣

It's remarkable how much fun you can have laughing at the picture on your I. D. card before realizing that's what you really look like.

♣

Have you heard about Bruno, the brown nose reindeer? He's second in line, just as fast as Rudolph, but can't stop quite as quick.

♣

There are only two kinds of parking left on the campus—illegal and no.

♣

Engineer on the telephone: "Doctor, come quick, my little boy just swallowed my slide rule."

Doctor: "Good heavens, man, I'll be right over. What are you doing in the meantime?"

Engineer: "Using log tables."

♣

EE: "Thought you were going to visit that blond in her apartment tonight."

Aggie : "I did."

EE: "How come then you're home so early?"

Aggie: "Well we sat awhile and chatted. Then suddenly she turned out the lights. I can take a hint."

♣

"What are you putting in your vest pocket there, Brent?"

"That's a stick of dynamite. Every time Davis sees me he slaps me on the chest and breaks all my cigars. The next time he does it, he's going to blow his hand off."

♣

Professor: "Well, what did you think of the course?"

C.E.: "I thought it was very well covered. Everything that wasn't covered during the semester was covered on the final."

♣

ME Prof: "If you were at the top of a tall building, how could you measure the height, using a barometer?"

Student: "I would tie a rope on the barometer, lower it to the ground, and then measure the rope."

♣

Rumor has it that the prerequisite for ME 302 is a previous course in ME 302.

♣

ME: "I hear the administration is trying to stop drinking."

CE: "That so? First thing you know they will be trying to make the students stop too."

♣

thought gallery

by Curtis Cannell

1) For chemical engineers, what is Kg-H_2O?

2) What is this?

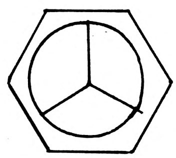
Fe^{3+}

Fe^{3+} Fe^{3+}

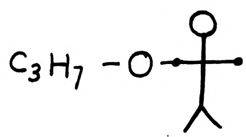
Fe^{3+} Fe^{3+}

Fe^{3+}

3) What is this?

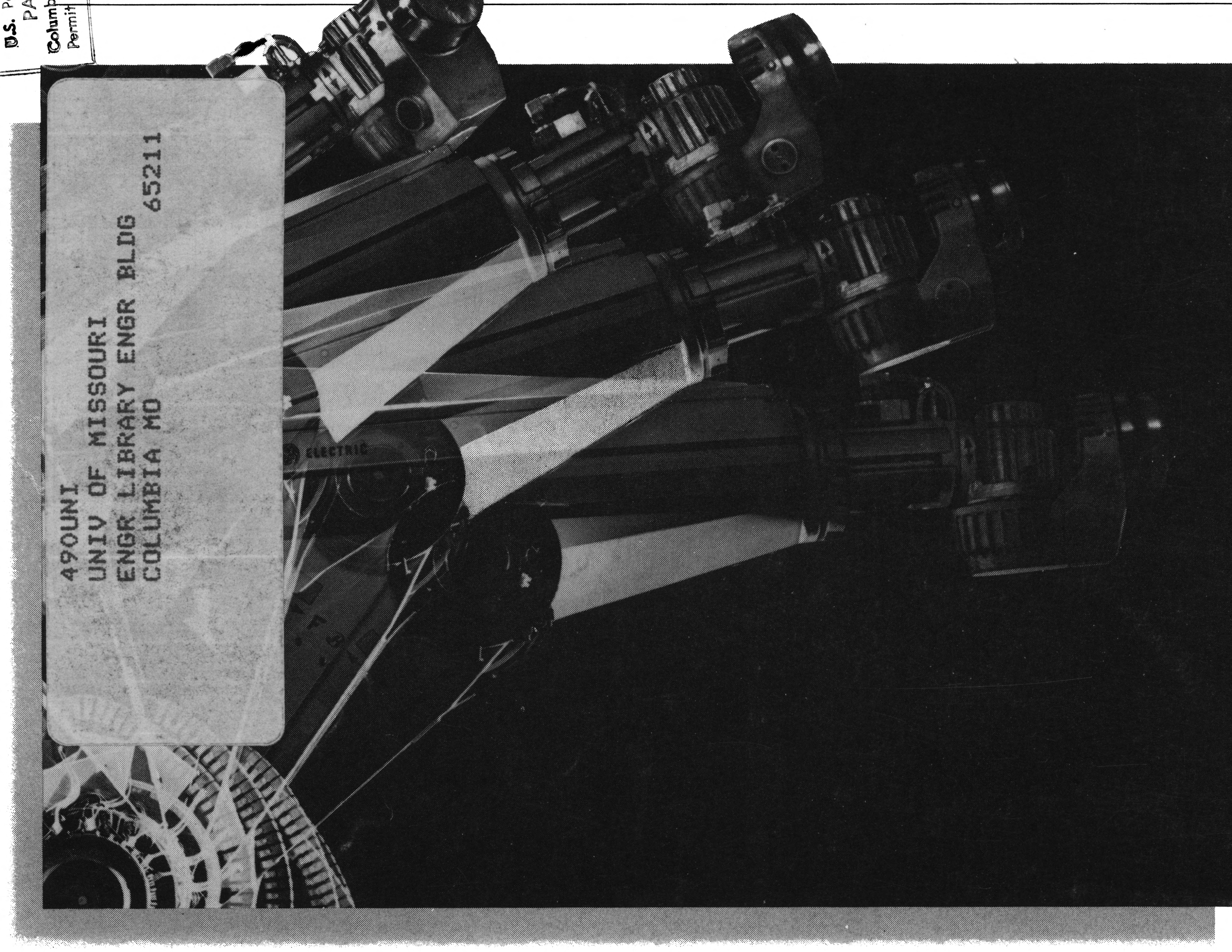


4.) What is this?



ANSWERS
10 Water for dogs (canine water)
2) Ferrous wheel
3) Mercedes Cenzene
4) Propyl-People-ether

F · Y O U · C A N · D R E A M · I T · Y O U · C A N · D O · I T



Teach a robot the facts of life.

There was a time when most robots earned their livelihoods in comic books and science fiction films.

Today, they're spraying, welding, painting, and processing parts at manufacturing plants around the world.

Necessity has caused this amazing leap from fantasy to factory.

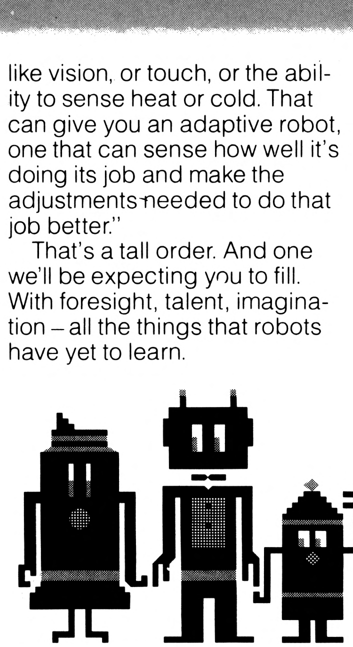
The world wants long-lasting, high quality products, now. And robots fit perfectly into this scheme of things: They can make those products – quickly, easily and accurately.

What kinds of robots? There is GE's Allegro,™ for one. It can position a part to within 1/1000th of an inch – or about ¼ the thickness of the paper this article is printed on. Or there's GP 132 (shown here). This loader, unloader, packer, stacker and welder – can lift and maneuver 132 pounds with no trouble at all.

So what's left for me to teach robots? You might ask. Consider this glimpse into the future by Dr. Roland W. Schmitt, head of GE corporate research and development:

"One of the big frontiers ahead of us is putting the robot's nervous system together with some senses – like vision, or touch, or the ability to sense heat or cold. That can give you an adaptive robot, one that can sense how well it's doing its job and make the adjustments needed to do that job better."

That's a tall order. And one we'll be expecting you to fill. With foresight, talent, imagination – all the things that robots have yet to learn.



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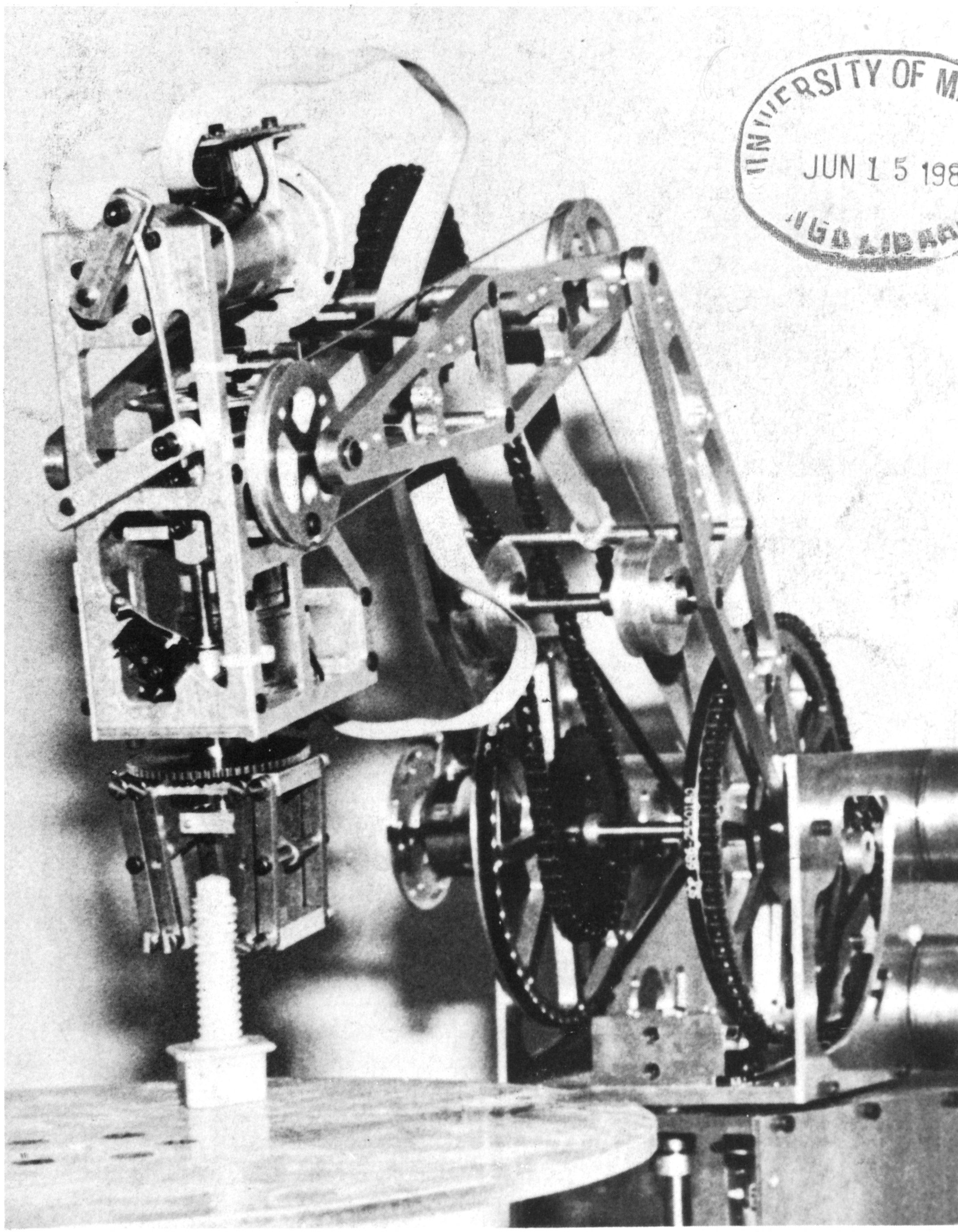
missouri SHAMROCK

76 #3

spring 1983



missouri
SHAMROCK
The UMC College of Engineering Magazine

Spring 1983 Vol. 76 No. 3

On the cover:
Futurists proclaim the dawn of a Robotics Age, when mechanical valets will cater to our whims. Yet that magic age seems always to be just ahead, just out of reach. Now a major electronics firm has introduced what some are calling the first home robot. How near are we to this Golden Age of Robots? Our cover story looks at UMC's efforts in this emerging industry.

contents

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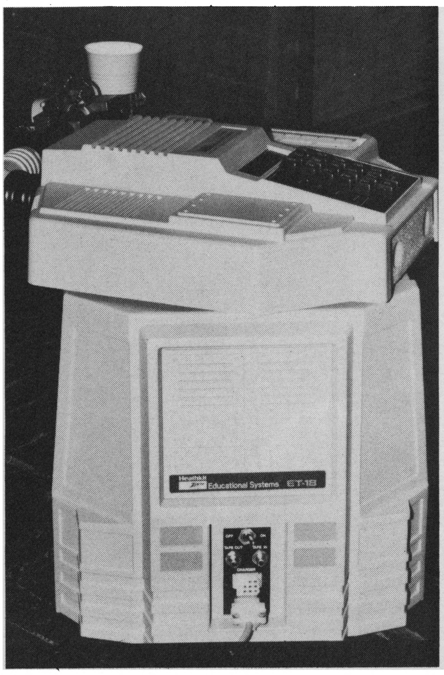
The Missouri **Shamrock** is published quarterly (October, December/January, February, and April) by the engineering students of the UMC College of Engineering. Opinions stated herein do not necessarily reflect the views of the College of Engineering.

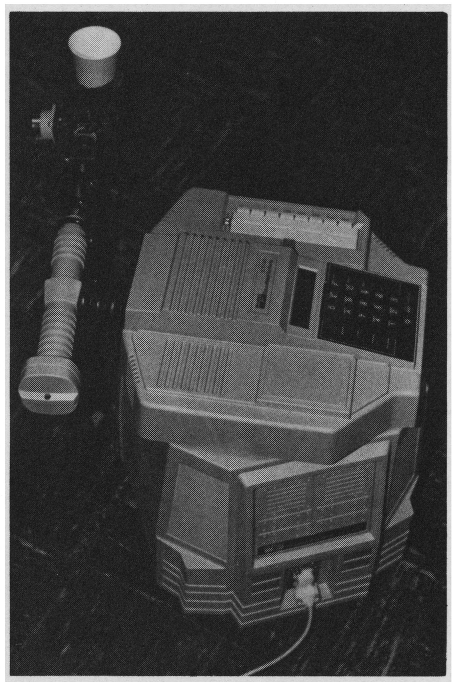
Subscription rate is $4.00 per year. Inquiries concerning subscriptions or advertising should be directed to Missouri **Shamrock,** College of Engineering, University of Missouri-Columbia, Columbia, Missouri 65211.

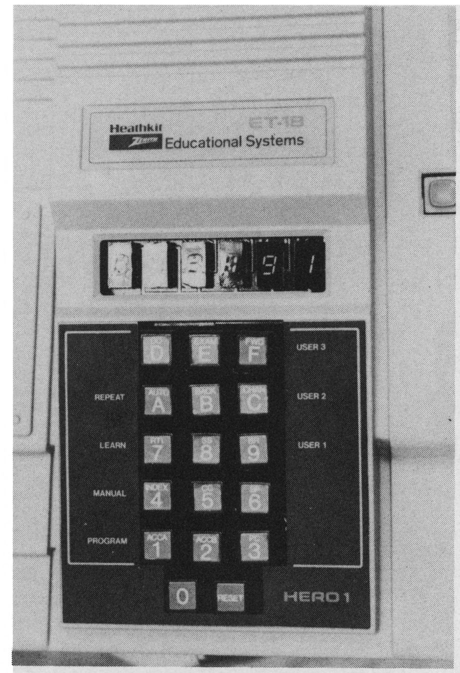
Foremost, the Missouri **Shamrock** gratefully acknowledges its advisor, Ms. Margaret Kraeuchi, Director, Engineering Communications.

cover story

robotics: coming of age







Anyone care for a cold drink? The Hero 1 Robot from Heath Company has a versatile arm, which may be used to manipulate small objects. Hero can be programmed from its keyboard or from a special "teaching pendant."

by Jeff Mild

For over 50 years the robot has lived inside the books and films of science fiction. That is, until now. With the recent recognition of industrialized robotics as a working, functioning system, and the maturing of the home and business computer boom, interest in the development of the robot (as science fiction has known it) has bloomed in the minds of men.

Present technology has enabled the hobbyist to create robots in the sense that they do what they are told through computer programs, but with many limitations. They lack the human aspect in terms of decision making and sensitivity.

Heathkit, a subsidiary of Zenith Radio, has come out with a marketable version of the home robot. They call it "Hero I". Built around a 16 bit microprocessor, it stands 20 inches high, weighs 40 pounds, and can manipulate small objects with its single arm. It has sonar for scanning a clear path on which to travel, a light sensor, a synthesized voice and more. Yet however sophisticated it may sound, its only function is to further education.

The University owns two Hero I robots, one in electrical engineering and the other in industrial engineering. Dr. Robert McLaren, Professor of Electrical Engineering at UMC, who is in charge of the EE Department's Hero I robot (now fully assembled and operational) feels Hero I will play a major role in teaching students what robotics is all about.

Robots like Hero I and those built by hobbyists are functional only in terms of experimental research and hastening the age of robotics. There are, however, hundreds of robot arms presently operating in industry performing a variety of jobs,

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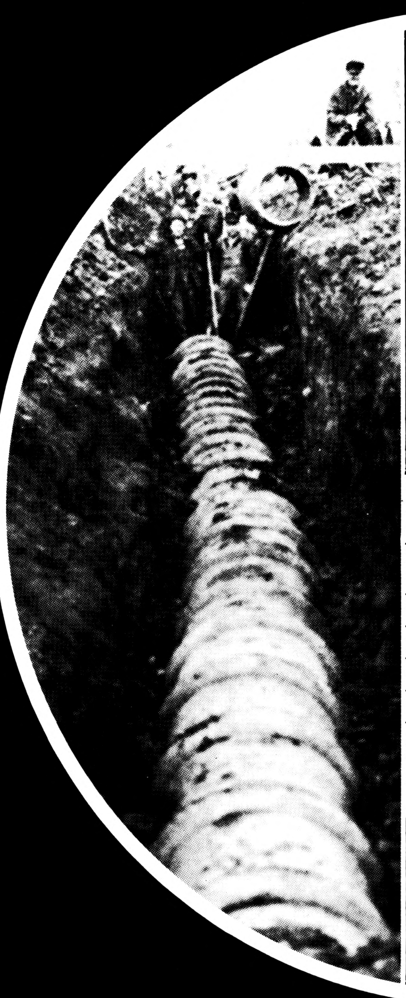
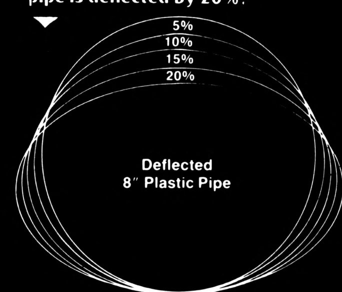
CLAY STRUCTURAL STRENGTH



Velocity of flow and quantity of flow are reduced as much as 13% when the cross-section of flexible plastic pipe is deflected by 20%.



Loss of Carrying Capacity of 8" Flexible Pipe Due To Deflection Under Load

Pipe Deflection	Reduction in Velocity from 0% Deflection	Reduction in Quantity of Flow from 0% Deflection
0%	0.0%	0.0%
5%	1.0%	2.9%
10%	2.0%	5.8%
15%	4.5%	10.1%
20%*	6.1%	13.6%

*Flexible pipe deflections greater than 20% have been measured in the field.

In 1964, this Vitrified Clay Pipe sewer was taken up after 52 years to make room for a new roadway. It was relocated and is in use today.

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Contrast flexible plastic limited life pipe. It starts its downhill course toward failure the day it's installed. Deterioration is slow—but sure. First, flexible plastic deflects and flattens from trench load. With time, creep or cold flow can bring more deflection. Whenever deflection reaches 20%—and deflections greater than 20% have been measured in the field—velocity and quantity of flow is cut to less than 87%. Severely deflected pipe must be replaced. Replacement, expensive as it is today, will cost even more tomorrow.

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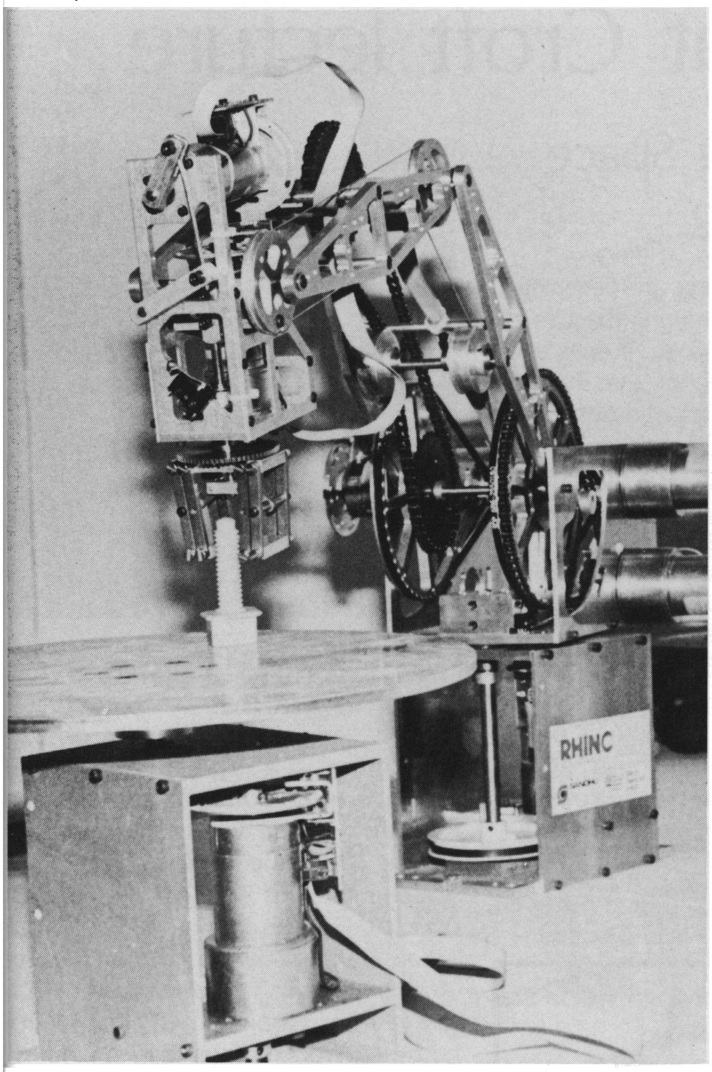


photo by Julie Baucom

This is the Rhino robot arm, designed for use in teaching robotics principles.

continued from page 4

such as assembling cars or launching satellites into orbit from the Space Shuttle. This aspect of the robot—the arm—has been developed successfully due to the easily described job applied to a computer program. But when decisions need to be made or the robot needs to see or feel—become more human; that's where todays technology leaves off.

There is, however, an obvious problem hindering technological advancement in robotics. How can one person specialize in robotics? It would require vast knowledge in the mechanical, industrial, electrical, and computer engineering fields—not to mention new fields born from robotics such as sensor technology and robot languages.

Realistically, in order to maintain the expertise of these specialized fields and apply them all to robotics, there must be a team effort.

Dr. Alec Chang, Professor of industrial engineering at UMC, feels there would be many problems in forming a new department in robotics. If the university were to open a department of robotics engineering, it would require sub-departments such as industrial robotics engineering and electrical robotics engineering. One can imagine the problems arising from such a move. Teamwork and compromise between the specialized fields are two examples. Hopefully, everyone will be willing to share the credit.

The robot has waited patiently for science to catch up with its technological demands. We are close, but not quite there yet. Some specialized fields are more expandable than others in terms of robotics applications. The computer field is the heart and brains of robotics and still has a long way to go in developing artificial intelligence suitable for the robot.

Sensor technology as applied to robotics is a relatively new field. Video, ultrasonic, infra-red, sonar, radar and others are all possible technologies for robot senses. The trick is getting the computer to interpret the sensors correctly. Voice recognition and synthesis through digitization are big research fields in computer today. The trick is teaching a computer how to interact through the use of spoken language. We are in a very early stage in the age of robotics. It seems inevitable now that soon new fields will open and new departments at the University will be formed.

Some day, a robot will be born that will live up to our expectations. And when that happens, there will be a robot in every home and business, doing what we've always wanted them to do—act human.

However, one basic question arises: "When robots are acting human, what will we be doing?"

Lousma speaks at Croft lecture

Astronaut shows film shot during Space Shuttle Columbia mission of 1982

Col. Jack Lousma, astronaut for the NASA space program, was on the UMC campus on Thursday, Feb 24, to deliver the 1983 Croft Lecture. His presentation, taking place in the Electrical Engineering Auditorium, centered around a film shot during his mission on board the Space Shuttle Columbia.

The subject of the film was primarily centered around the phenomena of life in space—to be orbiting the earth in a state of weightlessness. Scenes of one-handed push-ups and the trials of attempting the evening meal provided humor during the film.

The film also contained scenes of the lift-off and landing of the shuttle flight. As a commentary, Lousma explained some of the details involved in the maneuvers that were portrayed in the film. A question and answer session followed the film.

Lousma's career with NASA as an astronaut began in 1966 when he was chosen along with nineteen others. He worked on the astronaut support crews for the Apollo 9, 10 and 13 missions. He was also a pilot for Skylab 3 for two months in 1973. For the Apollo-Soyuz Test Project, Lousma served as backup docking module pilot for the United States flight crew.

On the mission portrayed in the film shown in the Croft Lecture, Lousma acted as commander of the third orbital test flight of the space shuttle Columbia. Launched from the Kennedy Space Center, Florida in March, 1982, the mission completed 129.9 orbits of the earth in eight days.

Lousma has spent a total of nearly 1620 hours in his two missions in his role as an astronaut. Of that 1620 hours, he spent more than 11 hours outside Skylab during a space walk on his first mission.

engineers week 1983

A perplexed English major observing the annual rites of spring saw many beautiful and interesting events: the daffodils blooming, young men's hearts turning to love, and ping-pong balls dropping from 1000 feet. Upon seeing this unusual occurence, he wandered forward and asked a young, bearded lad clutching a calculator, "Excuse me, sir, but can you tell me why all these people are gazing toward the sky?"

"It's Engineers' Week!" replied the bearded lad.

"Engineers' Week, you say! What is involved in this Engineers' Week?" queried the English major.

At this, the young engineering student commenced an excited babble about Engineers' Week: "It's a time when we have road rallies, yummy barbecues, beards, ping-pong balls, and LOTS of beer! Dr. Combs sings barbershop songs, and the students have calculator contests, put on lab exhibits and build concrete canoes. The highlight of the week is when we crown the King and Queen of Engineering and honor the Knights of St. Pat."

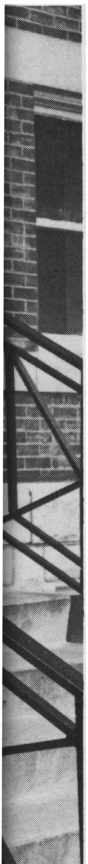
"I see!" quipped the English major. "It's a medieval festival of spring."

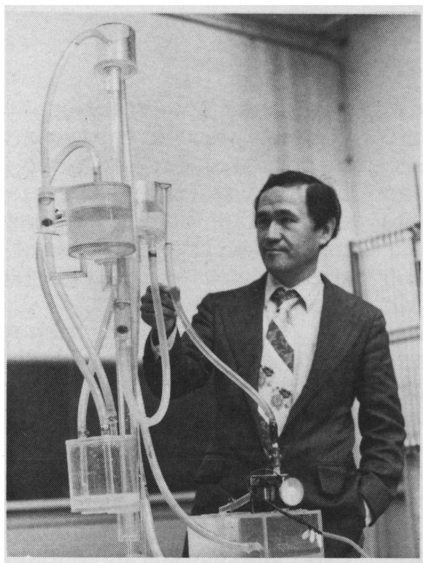
"No," corrected our hero, "Engineers' Week celebrates St. Patrick's Day."

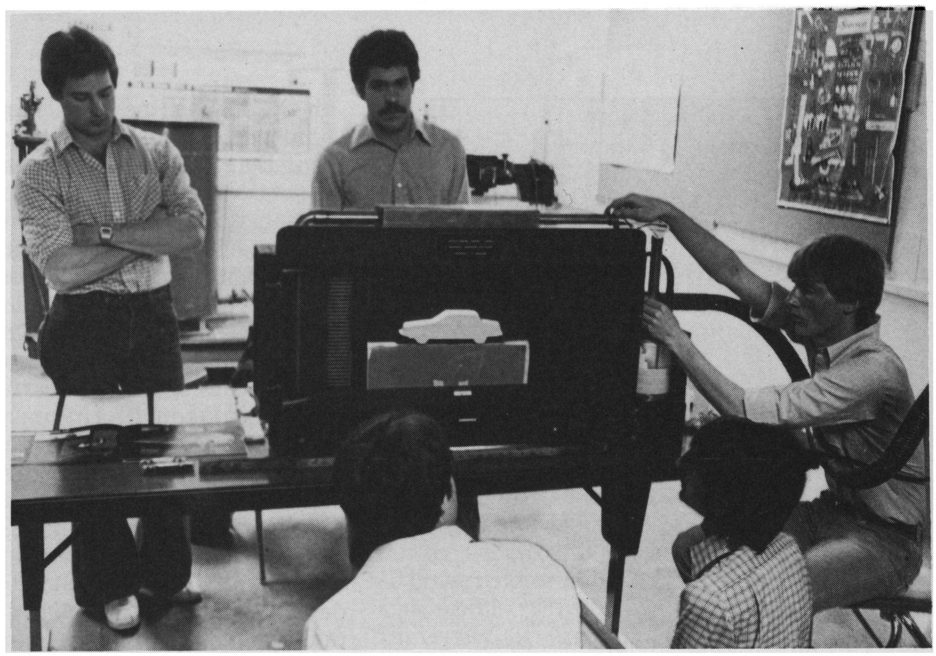
"Why St. Patrick?" the English major inquired.

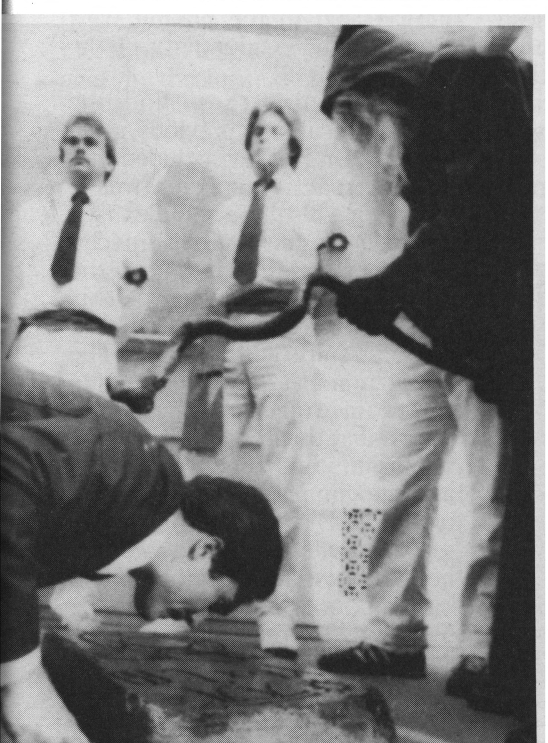
"Yes, St.Pat was the first Engineer because he drove all the snakes out of Ireland."

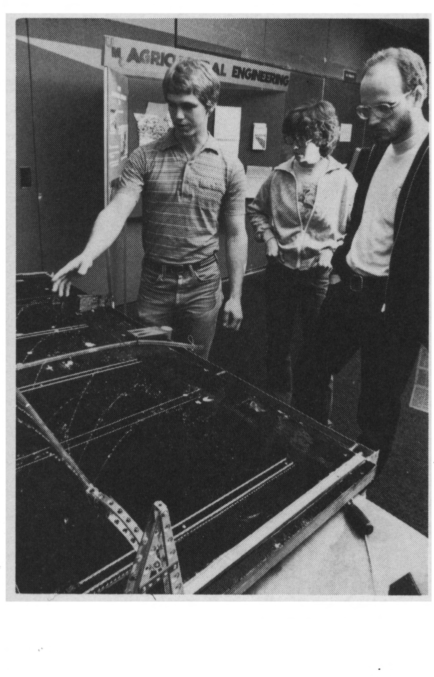
At this point that poor, forlorn English major became thoroughly confused. Snakes, concrete canoes, knights, St. Patrick—he wondered how this all fit together. He departed, leaving the engineers looking skyward in search of falling ping-pong balls.











Russ Rauba and Katie Viehmann, pictured on the opposite page, were selected as this year's Engineering King and Queen. Russ, a senior in Agricultural Engineering, was sponsored by the American Society of Ag Engineers. Katie was sponsored by Pi Beta Phi sorority, and is enrolled in the new Electrical/Computer Engineering dual degree program. The Shamrock congratulates both of these outstanding engineers. On the far left side of the opposite page, two of the queen candidates wave to crowds lining Broadway. Meanwhile, in the EE building, a certain professor and his dedicated students showed that playing with choo-choos can be educational. Other lab exhibits are shown in the accompanying photos.

The Chromium Mechanism

The first comprehensive explanation of electrochemical activity during the plating of chromium has recently been formulated at the General Motors Research Laboratories. This understanding has aided in transforming chromium plating into a highly efficient, high-speed operation.

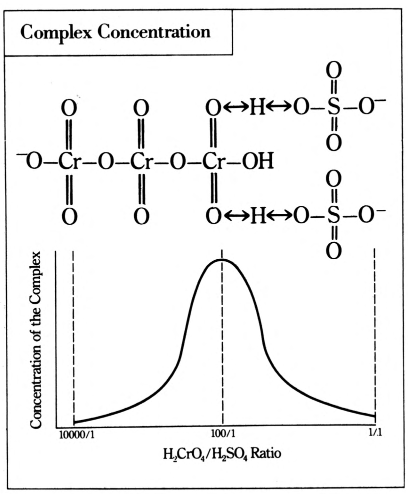
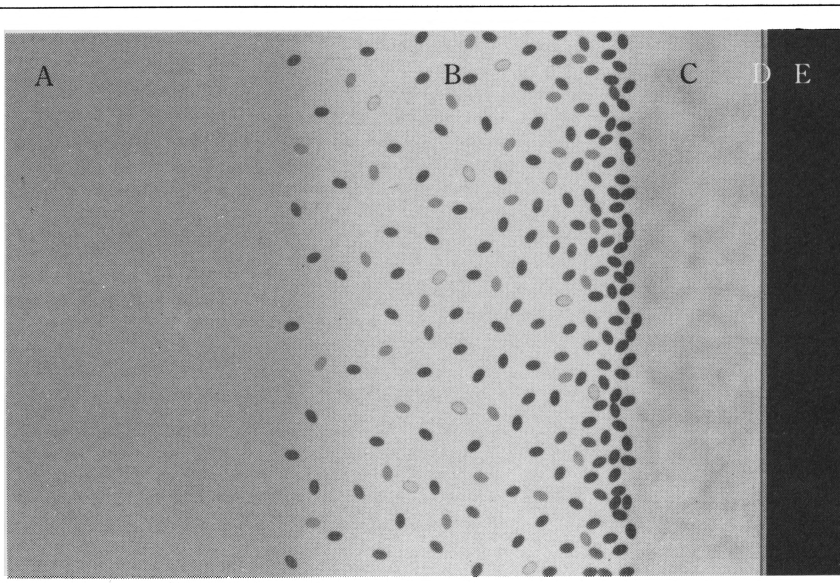


Figure 1: The electroactive complex and a theoretical plot of its concentration as a function of chromic acid to sulfuric acid ratio.

Figure 2: The electroactive complex diffuses from the bulk electrolyte solution (A) through the diffusion layer (B) to the Helmholtz double layer (C) to be discharged as metallic chromium (D) on the cathode (E) surface.



FOR MANY industrial applications, chromium coatings of more than 0.2 mil thickness are required for wear and corrosion resistance. But the conventional method of plating chromium is neither fast nor efficient. Nor, until the recent work of a GM researcher, had the steps involved in the century-old plating process been explained in detail. Through a combination of theory and experiment, Dr. James Hoare has devised the first comprehensive mechanism for chromium plating. This increased understanding has helped electrochemists at the General Motors Research Laboratories develop a system that plates chromium sixty times faster than the conventional method, while improving energy-efficiency by a factor of three.

The electrolyte for plating is a chromic acid solution which contains various chromate ions: chromate, dichromate and trichromate. From a series of steady-state polarization experiments, Dr. Hoare concluded that trichromate is the ion important in chromium deposition.

Sulfuric acid has been recognized as essential to chromium plating and has been assumed by some to be a catalyst for the process. In this strongly acidic solution, sulfate should be mostly present as the bisulfate ion $(HSO_4)^-$. Dr. Hoare found, contrary to expectations, that the addition of sulfuric acid to the plating bath decreased the conductivity of the solution.

Combining these findings with the results of previous investigations, Dr. Hoare concluded that the electroactive species was a trichromate-bisulfate complex (see Figure 1). From equilibrium considerations, he theorized that the maximum concentration of this species occurred at a 100-to-1 chromic acid/sulfuric acid ratio. The observation that the maximum rate of chromium deposition also occurred at this ratio supports the conclusion that this trichromate-bisulfate complex is the electroactive species.

During the plating process, the complex diffuses from the bulk solution toward the cathode (see Figure 2). Electron transport takes place by quantum mechanical tunneling through the potential energy barrier of the Helmholtz double layer and the unprotected chromium in the complex (Cr atom on the left in Figure 1) loses electons by successive steps, going from Cr^{+6} to Cr^{+2}. Decomposition of the resulting chromous dichromate complex takes place by acid hydrolysis to form a chromous-oxybisulfate complex:

$$^{+}Cr{-}O{\leftrightarrow}H{\leftrightarrow}O{-}\overset{\overset{\displaystyle O}{\|}}{\underset{\underset{\displaystyle O}{\|}}{S}}{-}O^{-}$$

The positive end of this complex is adsorbed onto the cathode surface. Electrons are transferred from the cathode to the adsorbed chromium ion, forming metallic chromium and regenerating the $(HSO_4)^-$ ion. Thus, Dr. Hoare's mechanism explains how sulfuric acid, in the form of the bisulfate ion, participates in the plating process.

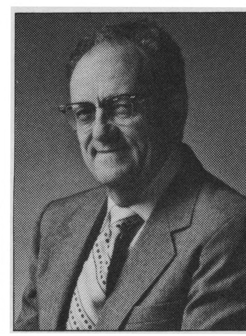
IT HAS long been known that chromium cannot be plated from a solution when initially present as Cr^{+3} because of the formation of the stable aquo complex, $[Cr(H_2O)_6]^{+3}$. Yet chromium can be plated when initially present as Cr^{+6} even though it must pass through the Cr^{+3} state before being deposited. Dr. Hoare's mechanism handles this paradox by explaining that the chromium ion being deposited (on the left in Figure 1) is protected by the rest of the complex as it passes through the Cr^{+3} state, so that the stable aquo complex cannot form.

The diffusion of the electroactive complex apparently controls the rate of the process, so that shortening the diffusion path increases the speed of chromium deposition. A high rate of relative motion between the electrolyte and the cathode will shorten the path. This can be accomplished by rapid flow or by agitation of the electrolyte.

Dr. Hoare found that the rate of chromium deposition increased with electrolyte flow until the process was no longer diffusion-controlled. He also found that the use of dilute electrolyte significantly increased plating efficiency.

"This project is an excellent example," says Dr. Hoare, "of how basic research and engineering principles can be combined to develop a new, successful process. Now, we'd like to take on the challenge of plating successfully from Cr^{+3}, which would be an even more efficient way to provide corrosion and wear resistance."

THE MAN BEHIND THE WORK



Dr. James Hoare is a Research Fellow at the General Motors Research Laboratories. He is a member of the Electrochemistry Department.

Dr. Hoare served as an electronics technician in the U.S. Navy during the Second World War. In 1949, he received his Ph.D. in physical chemistry from the Catholic University of America. After an assistant professorship at Trinity College in Washington, D.C., he joined the US Naval Research Laboratory as a physical chemist. He became a staff member at General Motors in 1960.

Dr. Hoare's sustaining interest has been in electrochemical kinetics and the mechanisms of electrode processes. He is best known to the scientific community for his basic studies of hydrogen and oxygen electrode mechanisms. His book, *The Electrochemistry of Oxygen,* published in 1968, is considered a work of primary importance to the field. In addition to his work on chromium plating, he is responsible for the fundamental research that helped make electrochemical machining a precision process.

Carter for Communications with Public

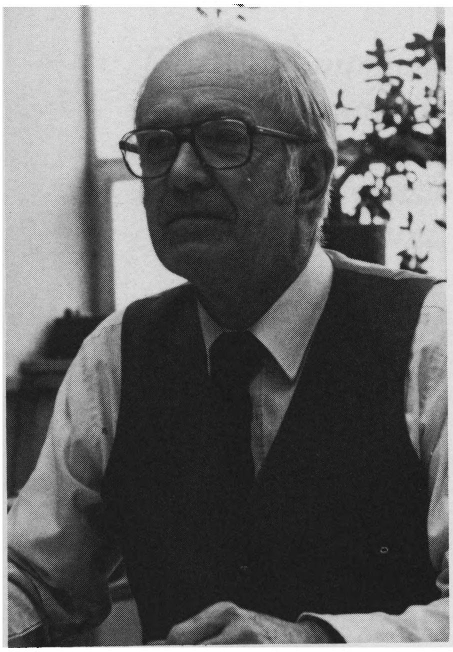


photo by Andy Fischer

Dr. Robert L. Carter

Almost every day, one reads or hears misleading news media statements bearing on technical issues. Made by political leaders, editorial writers, consumer advocates or businessmen, these are the result of misinformation, ignorance or deliberate prevarication.

Those who are teachers of engineering courses endeavor, first of all, to insure that each student becomes proficient not only in his own profession, but also in the art of communication with employer, customer and the lay public. Active involvement with one or more current public concerns having technical components is an important extra-professional social responsibility for each engineering graduate.

Experience shows that exchanges among professional peers, while gratifying, accomplish relatively little in advancing understanding of the lay public. On the other hand, while appearances before consumer or environmental advocacy groups can sometimes become distressing when an outspoken critic baits a speaker from the floor, they almost always enlighten other members of the audience.

Opportunities sometimes appear for engineers to instruct community groups on technical aspects of some current issue. Stimulated by experience of colleagues at other universities, I taught a course in "Introduction to Nuclear Energy and its Applications for Non-Engineers" between fall 1970 and spring 1978. The course was directed toward journalism students preparing for careers in science newswriting. It was intended that the background provided by the course would improve the accuracy of media stories dealing with applications of radioisotopes and nuclear energy. The work of eight of the students has come to my attention and appears to be technically accurate.

Another area of great importance is the need for volunteer technical expertise by local legislative bodies. "Technology Transfer" to legislative staff in state governments was deliberately addressed during the summer of 1975.

Working with the Technology Transfer Office at Argonne National Laboratories near Chicago, I was successful in establishing useful communication with legislative staff members in Wisconsin, Illinois, Iowa, Michigan, Indiana and Ohio. An effort to extend this exchange to Missouri following return to the University in the fall of 1975 met with the problem of a perceived conflict of interest.

The concern of the university-wide Radiation Safety Committee was focused in the fall of 1979 on the serious problem posed by temporary closing of all commercial disposal sites for low-level radioactive waste.

Along with many other institutions and industries in Missouri, the University's research and service work generates radioactive waste material which must be safely disposed of in a manner prescribed by law. If such channel for disposal were long closed off, research would have to cease. As chairman of the committee, I had an opportunity to work with the National Low-Level Radioactive Waste Management Program at Oak Ridge, Tennessee during the summer of 1980. Immediately following this, a survey of needs and practices of the 300 licensed Missouri users of radioactive material was undertaken.

The passage of the Federal Low-Level Radioactive Waste Policy Act made particularly timely the resulting report summarizing the problem in Missouri, proposing the appointment of a committee to review the State's needs and to submit a recommendation for action.

In July 1981, Governor Bond ap pointed me to the newly-formed Missouri Low-Level Radioactive Task Force, along with eleven other members representing a range of professional, political, and geographical perspectives.

Our variety of insights were drawn upon to make many significant contributions to the formulation of both the Midwest States and the Central States Regional Compact Agreements. After detailed study and discussion the Task Force submitted a unanimous recommendation to the Governor and to the Legislature, which is presently embodied in bills pending before the Missouri General Assembly.

The Task Force activity proved to be an excellent vehicle for communication with public opinion leaders in non-technical fields who would have been difficult to approach otherwise. Such an approach has an advantage over working through the news media in that the communication is two-way.

Opportunities to serve on committees addressing issues having technical components will appear in churches, schools, towns and other local jurisdictions, as well as at state and national level. Individuals with the engineer's background and quantitative grasp of physical reality are needed to lend balance to the deliberations of these important groups. Make this a part of your professional responsibility!

feature

nutritious pizza via computer

by David Cook

In some research that has enjoyed a great deal of national publicity, two U.M.C. professors have combined some insight, a little bit of Mount St. Helens, and a computer to take a bite out of the junk in junk food. This research is being carried out by the husband and wife team of Doctors Ken and Nan Unklesbay; members of the faculty in electrical engineering and in food science and nutrition, respectively.

The Unklesbays' objective is to improve the nutritional qualities of that gooey delight, pizza. Pizza is already somewhat nutritious, but by adding soy flour to the wheat crust the protein content of the pizza can be increased by as much as thirty percent. This is achieved without a noticeable difference in the taste or texture of that which is hidden under layers of zesty spiced sauce and melted mozzarella.

There is of course, a trade-off involved. Soy flour is more expensive than wheat. This is slightly diminished by the fact that soy flour absorbs more water than wheat and therefore results in a better yield. A slight reduction in the amount of topping can completely offset the increased cost.

Lysine, an amino acid necessary for the human synthesis of protein is destroyed in a browning reaction which occurs during baking. This affects not only the surface of the crust, but the interior as well. In the past, tasting of the lysine content of the pizza crust was performed by chemical anaylsis of a random sample of those baked. The Unklesbays have incorporated an optical sensor and a computer in the Advanced Computer Engineering Services Center to perform a nondestructive analysis which is complete in minutes. They envision this as a source of real time feedback for the bakers of pizza and crackers. The Unklesbays are using this system to find the most effective method of producing pizzas in which protein content is of primary importance.

photo by Andy Fischer

In the determination of the most cost effective mixture of wheat and soy the factors of consideration are ratio, baking temperature, and baking time. The Unklesbays are very concerned with energy usage in the kitchen. In fact, they have recently co-authored a book entitled **Energy Management in Foodservices.**

One novel energy saver employed in their research is the use of bentonite clay, which is the product of volcanic action. The clay is used to simulate toppings on the pizza. This prevents the top of the pizza from browning and the subsequent destruction of lysine. The clay also reduces the amount of energy required to produce the pizzas, thereby reducing the cost of the research.

Consumers are demanding better quality food for their dollars and the food industry is keenly aware of this. For example, one business in Columbia claims that their pizzas are nutritious and delicious. Soy enhanced dough and computer aided quality control are two methods the Unklesbays are hoping will improve the diets of millions of people. They are not trying to commercialize their thick and chewy volcano pizza, but they are seeking to deliver an improved quality of life.

a final salute to M*A*S*H

On February 28, CBS aired the final episode of the long-running and popular hit series "M*A*S*H". The A.C. Nielsen Company, which monitors the viewing habits of television audiences, said that 72 percent of the television sets in the New York Metropolitan area were tuned to the show. Evidently, many of those viewers stayed glued to their seats for the whole two and a half hours, for at 11 p.m. EST (the time at which the program ended) the flow rate in two of the city's water mains increased by 320 million gallons. Engineers for the New York City Department of Environmental Protection estimate that for this to occur 1 million people would have to flush their toilets at the same time.

engineering building proposals

by David Griese

The University of Missouri at Columbia School of Engineering is badly in need of new facilities, according to Engineering Dean W. R. Kimel. That is the reason for the proposed new agricultural engineering building and the proposed new engineering laboratories/classroom building.

The proposed agricultural engineer ing building is to stand on the site of the old agricultural engineering building, necessitating the razing of the old structure, Dean Kimel said. He said that the old building, T-12, an old World War II barracks, has been inadequate for years.

The proposed structure is in the planning stage now. Dean Kimel said that the building is projected to cost approximately $6.97 million.

"The most recent structure for the College of Engineering (at UMC), the electrical engineering building, was built in 1957," Dean Kimel stated, "Every college of engineering in the U. S. of which I am aware has had at least one new building since that time; and many colleges have added several buildings for their programs."

Currently, the Board of Curators and Coordinating Board for Higher Education have both approved the proposed new building and are now seeking an appropriation from the Missouri General Assembly to begin construction. Dean Kimel projected that it would be at least a year before actual construction could begin.

Another proposed building project for the UMC College of Engineering is a new engineering laboratories/classroom building to be added to the already existing engineering building. Dean Kimel stated that the proposed addition is to be constructed in the place of the parking lots to the west of the engineering building. Furthermore, a connection between the new wing and the electrical engineering building is also included in the proposal.

Dean Kimel said that the connection is to be in one of two forms—an enclosed bridge over South Sixth street or a tunnel underneath it. He also added that there is a possibility of closing South Sixth Street to traffic, thus providing easy access between the two buildings. When asked why such a structure would be needed, Dean Kimel stated that there is a large amount of traffic of both people and information between the two engineering buildings. If the new wing is built, it will exit directly onto South Sixth Street. He said that the connection between the buildings is a necessary safety precaution.

Also included in the plans for the engineering building is the razing of the portions of the civil engineering labs that were built in 1922. Originally the plan was to have the labs renovated, according to Dean Kimel. However, he said that the consulting architectural engineers recommended that the labs are "so bad that (they aren't) worth spending a dime on."

Presently, the Board of Curators and the Coordinating Board for Higher Education are seeking an appropriation of $177,000 for the planning of the proposed new structure and the demolition of the old civil engineering labs from the Missouri General Assembly, according to Dean Kimel.

After the planning money is appropriated, which should take about a year, the next step is to plan out the details of the proposed addition and then to seek an appropriation for the new wing, Dean Kimel said. He stated that the projected cost for the new building and connections comes to approximately $10.4 million.

According to the Dean, a date for the beginning of construction cannot be projected at this time because of all of the measures that must be taken in the meantime.

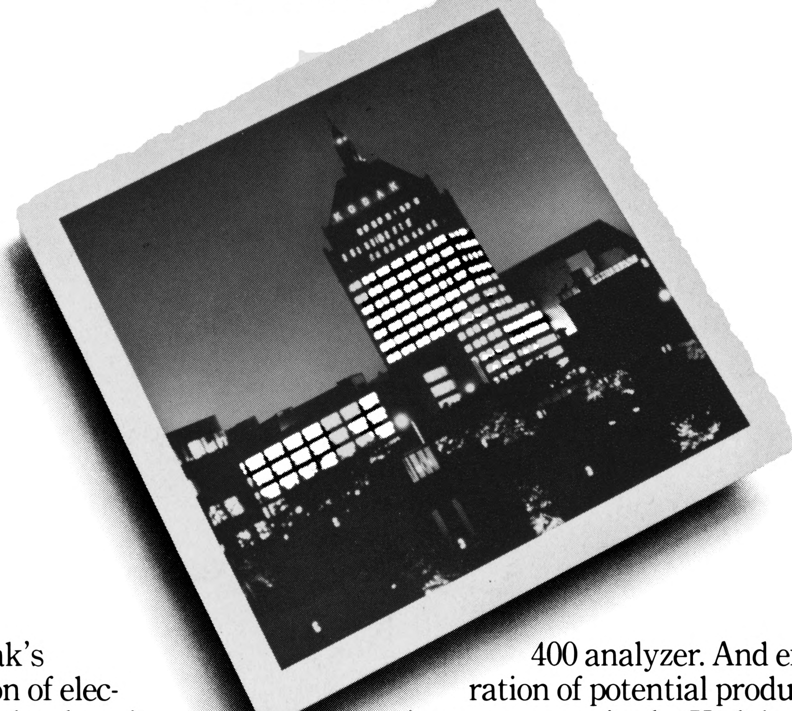
Again, Dean Kimel reports that there is an urgent need for the requested facilities. He stated, "In 1958 after completion of the electrical engineering building, then Dean Huber O. Croft stated that additional space would be necessary when enrolllment of the College of Engineering reached 1500 students."

The official enrollment for the fall 1982 semester in the college of engineering was 2779 students on the Univeristy of Columbia campus.

In a recent report, the Accreditation Board for Engineering and Technology stated, "Overall, however, the building and equipment for the college are old and do not offer the kind of environment needed for a modern engineering program. Increased enrollments have created a more crowded situation in an already facility."

Dean Kimel said, "Our need is very great and we are hopeful that the Missouri General Assembly will heed these priorities of the University of Missouri (and the) Coordinating Board for Higher Education by appropriating the required funds."

One of the nation's top companies in sales of electronics-related equipment is Kodak.



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