missouri SHAMROCK

October 1981

contents

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The UMC College of Engineering Student Magazine

Editor	Kathy Ziaja	Layout	Carla Koelling
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	Michelle Morris		Kathy Murray
			Ann Wamser
Photo Editor	Therese Gurski	Photographer	Phil Greene
Advertising Director	Mike Wroble	Artist	Elsa Johnson
		Writers	Curtis Cannell
Circulation	Rene Chouteau		Don Massey
Business Manager	Tom Ziaja		Ann Boman

photos by Tress Krushie Cover and pages 4 and 5

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

catching the sun at u.m.c.

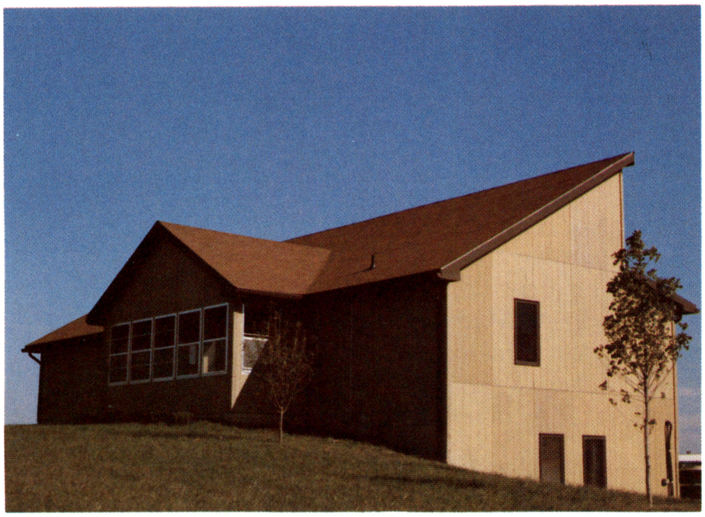
by Don Massey

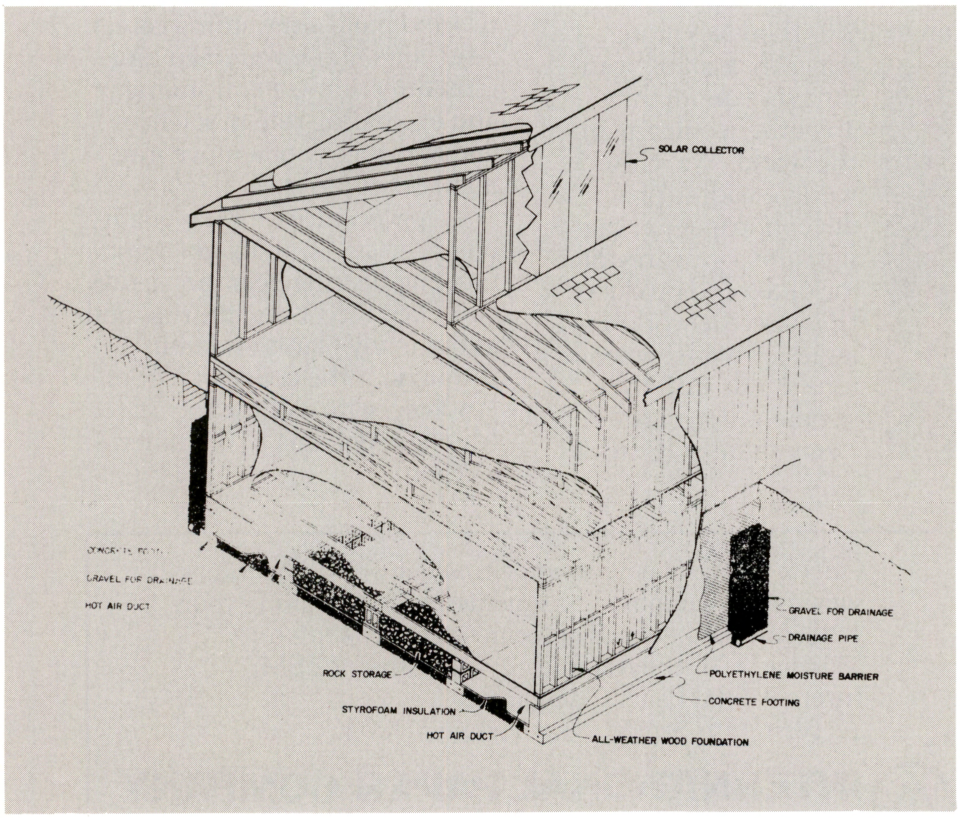
As with most major universities, research and development of the latest technology and its applications to today's problems is a standard goal. The University of Missouri-Columbia is no exception. Funded by the College of Agriculture, a professor of Agricultural Engineering, Dr. Neil Meador, has designed and overseen the construction of a new technology house on a University research farm near the Columbia campus. The house was built to help show the latest technology that is now available to anyone for residential construction. The main areas that were to be emphasized in the house were those of energy conservation and the use of solar energy. All types of new technology were considered in building the house.

The house plan decided on was one that would help to reduce the requirements for heating. The house is two stories with one-half of the lower floor below the ground level. The house is 100% usable, the lower floor construction was built with a wood foundation and wood floor. By building with wood, the lower floor will be as livable and comfortable as the second floor. The insulation chosen for the walls was 6 inch fiberglass insulation and 12 inch fiberglass insulation for the ceiling. Most of the windows are located on the south side of the house, they have an area roughly 5% of the floor area. The windows used have the shades built in between two of the pieces of glass to help prevent heat buildup in the house during summer months. An average R value for the new technology house that includes the windows, roof, walls and doors is close to 29.

Dr. Meador determined that 2/3 of the heat loss from the house could be related to air infiltration. To help reduce the amount of air infiltration, all but one of the outside doors enters into a protected area like the garage or greenhouse. Another way that airflow was reduced was by placing most of the windows on one side of the house, this helped to reduce draft-like conditions. The electrical wiring was mounted on outside walls rather than cutting into them, providing additional resistance to air infiltration.

In the attic of the house is a 430 square foot solar collector. The collector heats the attic air; if needed the heated air is circulated into the house. If the heated air is not needed, then it is passed through a rock bed underneath the house. The bed is 30 tons of 2 inch rock





and is used to provide warm air on cloudy days or during the night. If additional heat is needed, there is a heat pump and electrical heating. Basically, the type of operation is employed during summer months except the process is reversed. The fans pull cool, outside air into the rocks during the nighttime and then the house is cooled from the rock storage during daytime.

Work on the house was completed in January 1980. Dr. Meador began gathering data and has published results up to February 1981. He calculated the cost of heating the home from December to April to be $93.15 and cooling costs of $132.15 from May through November. The rate used to figure costs was 5¢ per kwh. Dr. Meador found the water heater to be the highest energy using utensil in the home.

Meador also concluded from his research that, if given a sunny day, enough heat could usually be stored to heat the house until the next day. "The house was not built as a superinsulated home but does display some of the characteristics," admitted Dr. Meador, when asked whether that was part of the design.

A model of the new technology house is located in Building T-12 of the Agricultural Engineering Department. More information about the model or the house may be obtained by contacting the Agricultural Engineering Department.

FAR LEFT: The House as seen from the front. UPPER LEFT: These 15 solor collectors are used to heat air in the attic of the house. LEFT: Diagram showing a cut-away view of the solor home.

conversation

Dr. Larry David, professor of Industrial Engineering, talks with CONVERSATION about himself, his courses, activities, and students.

by Ann Boman

CONVERSATION: Dr. David, could you first explain a little about yourself and how you became a professor?
DR. DAVID: I'm from Arkansas, and went to the University of Arkansas where I obtained my Bachelor's in Industrial Engineering, and my Master's degree as well. While I was there I taught a physics lab, believe it or not. I enjoyed teaching and thought I might do it for a couple of years. I happened to write the University of Missouri and they wanted me to teach for them. I taught as an instructor from 1961 to 1964. Back then each instructor taught four courses each, so, of course, I taught four courses.

I then went to Purdue University for three and one half years where I obtained my Ph.D. and did some more teaching.

When I left Missouri, I didn't intend to come back, but once I was gone I realized that I liked Missouri so I decided to return. That was back in January of 1968 and I've been teaching here since. That's a long time!

CONVERSATION: Would you describe your teaching responsibilities?
DR. DAVID: I teach IE 339 which is the second of a two sequence Statistics class. The first is Engineering 132 which I have also taught. I've taught Engineering 17, an experimental lab course for undecided engineers as well and I generally coordinate this class in the fall. In the summer I have taught Engineering Econ. and the other class I teach is Engineering 5—Fortran. I have super teaching assistants for this class. They're graduate students and I pick them myself. I don't have many mechanical engineers because they are mainly involved with Engineering 30.

Engineering 5 used to be a straight lecture class. Jay McGarraugh and I participated in a summer program to change this. The main reason we wanted a change was because with the straight lectures the students were being left on their own to debug their programs. Now, they have a lab as well as access to a tutor Monday through Thursday.

CONVERSATION: What is your advice to freshmen engineering students?
DR. DAVID: I advise about twenty-five to thirty freshmen a semester. I always tell them to spend more time in the math, physics, and engineering classes because these are the important ones. I also tell them to get help when they have a problem and not wait until it is too late.

by Phil Green

The key thing I believe is that they should attend class. Some freshmen get discouraged and start skipping classes. I would rather they came and fell asleep than not come at all. They may learn more.

Another important point is to keep up with the homework. A way I help my junior and senior students stay caught up is to give a test a week. This does not allow them the chance to get behind. I was a student once and I know how easy it is to get behind.

CONVERSATION: What activities are you involved with now?
DR. DAVID: Jay McGarraugh and I coordinate a summer institute for high school juniors and seniors. We have about 230 kids for two weeks. They start at 8:00 a.m. and go until 4:30 p.m. They mainly learn Engineering 5, but we also teach some Engineering 17 to show them a little of what the different engineering disciplines involve.

The students are mostly from Missouri but I have had one from as far away as Minnesota. They must be recommended by a math or science teacher in order to qualify. I really enjoy this program.

I'm also in charge of the Engineer In Training (EIT) refresher course. The EIT is the first exam a professional engineer takes. I teach engineering economics, as well as statistics. The program takes place in Kansas City and lasts two months. I don't go for the whole time

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writing—told like it is

Ernest S. Robson, Jr., Vice President-Corporate Marketing for Monsanto, was guest speaker at the 1981 SHAMROCK banquet held in April. Mr. Robson graduated from UMC with a degree in Chemical Engineering. His speech is reprinted here with his kind permission.

Let's get on to our subject—written communications. I'm going to talk about three things: the importance of communication, the five sins of communication, and five suggestions to improve communications.

The first thing we should recognize is that at a place like Monsanto, everyone is an expert on communications—if you describe expertise in terms of having an opinion. We all like what we write. And we all know that we can improve on what someone else has written.

But over the years, I've also learned that there's a lot more to written communications than putting my words on a piece of paper. And I thought it might be beneficial to share with you some of those personal experiences and observations.

First observation: in business, written words carry much of the load of communications.

They have to.

There are five "Sins of Writing."

I'm not an English teacher—so I can't tell you how to cross your "t's" and dot your "i's." You should know the basics of writing by now. If you do not, let me seriously suggest that you go to work on developing those basics. It could be a potentially serious problem for you in your career.

But let's assume you know the basics.

Let me offer a few suggestions.

Suggestion Number One is to organize your thoughts.

Before you ever begin to write, think through what you're trying to say. Then figure out what the reader has to know in support of that. Then just sketch an outline—either on paper or in your head. And only then proceed to write.

Suggestion Number Two: Write like you talk. Normally, we talk in short sentences and short words. And most people prefer to read that way as well. So when you've finished your writing, go back over it. Where you can, cut the length of your sentences in half. And substitute simpler words if you can. Read your letter out loud—does it sound like you?

"You should know the basics of writing by now."

Suggestion Number Three: Know your audience. What does the reader want or need to know?

Certainly, if you're writing a memo or report to a Research person with whom you've been intimately involved on a project, you'll want a great deal of technical detail. If you're writing a report to people in other functions or disciplines, think first about how much they'll need to know.

Know what your audience wants—and give it to them in writing.

Suggestion Number Four: Be Flexible.

One of the greatest sins of writing is "pride of authorship." Samuel Johnson instructed students to "read over your compositions and when you meet a passage which you think is particularly fine, strike it out."

When you have a particularly important piece of writing, try it out first on a few people before you send it. You may not like what they tell you—but it's better than having the ultimate readers telling you the same thing.

And one final suggestion: Develop your skills. At Monsanto, our Corporate Engineering Department provides training programs and seminars for our engineers to improve their writing skills. These are always well attended. And I would encourage you—whenever you have the chance—to do the same.

These are some of my ideas on written communications in Engineering—or for that matter, in any discipline or function. I hope I have at least piqued your interest in the subject—and demonstrated that it is important to you personally.

Good writing takes discipline. It takes time. It takes judgment. But it can also be a tremendous help to you—in your job and in your career.

"Good writing doesn't come naturally . . . We have to work at it."

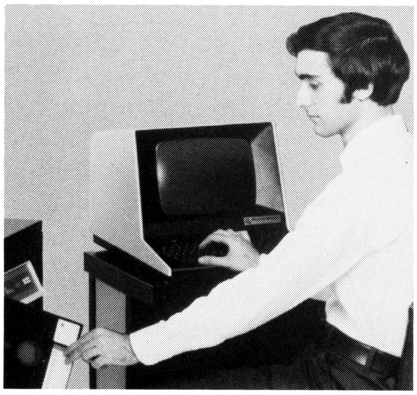
There are 60,000 Monsanto people scattered all over the world. We have to communicate with these people. We have to communicate with customers, with government officials with the public, with contractors. And we can't do it all—or even most of it—face to face.

So the written traffic is thick and varied at Monsanto—memos, reports, policies, manuals, brochures, guidelines, and on and on.

If written communications is im-

Continued on Page 20

TRW may be the answer to questions you haven't asked yet.



In engineering, as in other areas of knowledge, one new question often leads to countless others.

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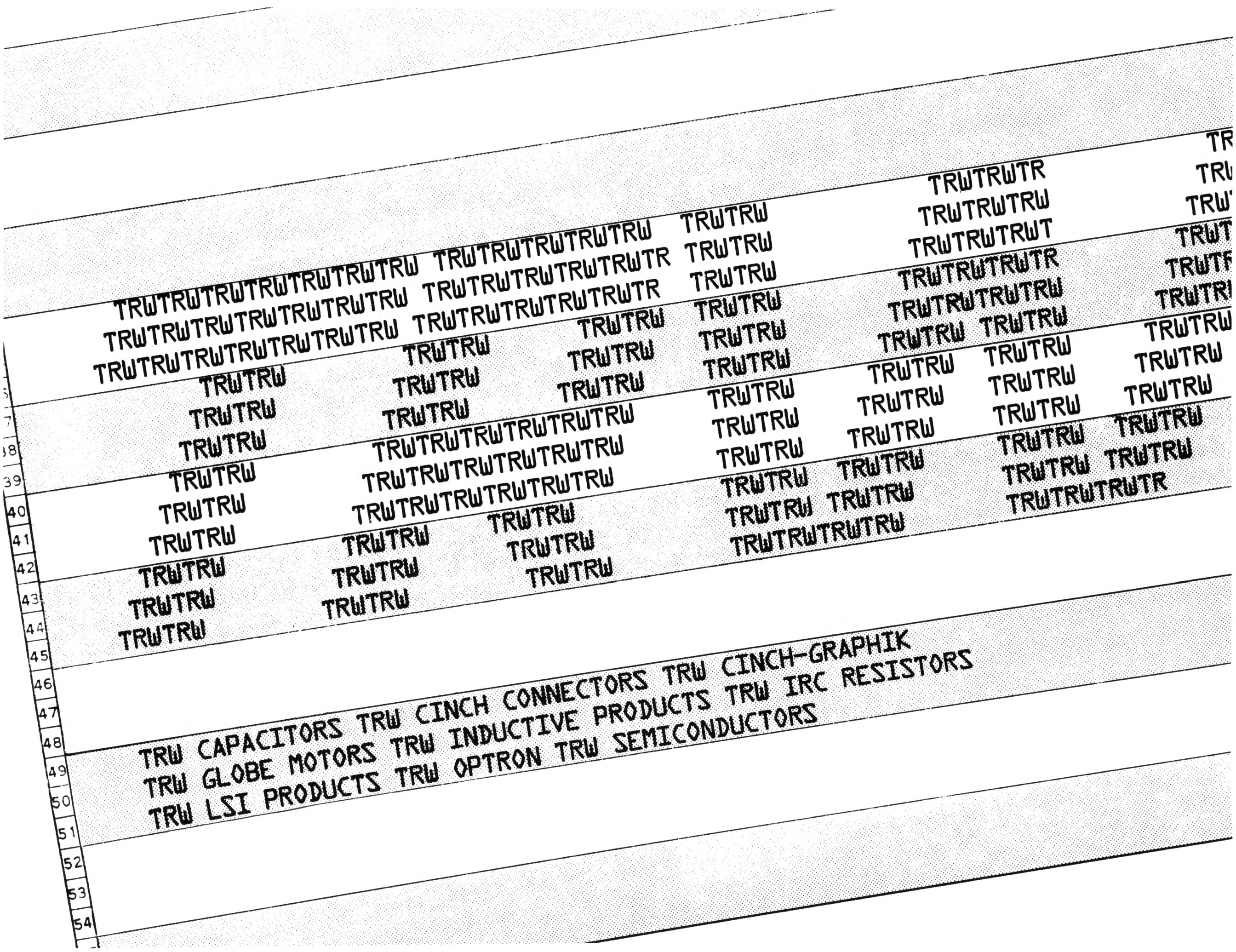

THE '06 SHAMROCK

Civil, Electrical Engineers!

Mechanical, Chemical Engineers!

Armatures, Fly Wheels, Stresses and Shears!

Engineers!

PREFACE

An Engineer's reputation in the use of the English is anything but enviable, and we are not rushing into print to refute impressions too certainly borne out by a long line of C's in our "Senior Course." Our only defense for the preparation of this pamphlet lies in the conviction of its need. With the passing of this senior class the only remaining original members of the Guard of St. Patrick leave the University. Decided misconceptions as to the origin and purpose of the day have crept in among the underclassmen, and it is in the hope of correcting certain tendencies and of keeping alive the true spirit of the day that this information is volunteered.

Thanks are due to Robinson, Maupin, Eitzen, and Smothers for their personal interest, and to last year's Savitar for its faithful history of the events of that year, which we have largely reproduced.

HISTORY OF 1903

It all took place up in the old library, now Prof. Spaulding's office. The seniors were straggling in, awaiting the ringing of the 11:30 bell, when Prof. Spaulding would lecture to them. The conversation drifted to the same old subject, for this is the time when Professors seem bent on working Engineers to death. They had appealed, shunned, threatened, growled, in vain. Still there was no respite. If they only had some higher power to appeal to, a Something, a Somebody, that could either step in and relieve them outright, or that by a superhuman influence could persuade their oppressors that it was time to call a halt. The season suggested the remedy. Was not the next day St. Patrick's day? And was not St. Patrick an Engineer. What else could "Erin go Bragh" mean? And would not the dear old Saint come to the rescue if they appealed to him? The tho't carried with it its own reward and his presence was felt by all.

This issue, SHAMROCK celebrates its 75th year as UMC's College of Engineering student magazine. The following stories are excerpts from the 1906 issue, the first "Shamrock." The 1981 staff gratefully dedicates this October issue to the people who have made the Missouri SHAMROCK possible—all 75 years of it.

The details were easily arranged. The Senior and Junior class presidents posted notices at once calling the attention of their classmates to the revelation, and declaring a holiday in honor of their patron saint. Conviction and conversation to the idea swept the department. At one o'clock a sophomore notice boldly announced that "whereas, in the ranks of the Engineering Department there are many of noble birth and Irish blood, and whereas, the ancesters of many of our most illustrious students came from Erin's Isle, and whereas, St. Patrick was an Engineer, therefore, be it resolved, that the Engineering Department take a holiday on St. Patrick's Day, cut all classes, and attend the morning prayer-meeting in a body."

Even the Freshmen took courage, called a class meeting and decided to stand firmly by the new order of things. Resolutions were adopted providing summary punishment for anyone who failed to cut and their spirit was shown when they marched in a body to wait upon the luckless youngster who had declared himself in favor of attending classes. It is needless to add that his conversion was speedy and thoro.

On the morning of the Saint's day a large body attended the "prayer meeting," then held in the general library and solemnly dedicated themselves to the service of their Saint. It was an impressive scene and the inspiration there imbibed has sustained the faithful in many a later struggle.

After prayer meeting the boys took to the quadrangle where the band cheered them with "The Wearing of the Green," "Dixie," and similar stirring airs, only to be stopped in the midst of their pleasure by Uncle Dick. He plead with them to give up the "foolish notion" and to return to their classes, and suggested in his characteristic way that the rowdies follow the band, past the law building, toward town, receiving as his blessing, the remark, "There they go, there they go. It is the murder of college spirit." Except for this there was no demonstration and the fellows spent their holiday quietly and enjoyed the rest it provided.

It was only natural that such a declaration of rights and such utter disregard for university regulations should be followed by some form of punishment. Various members of the faculty not yet converted to the new faith, expressed opinions on the day's proceedings. Artie tho't the boys had acted very ungentlemanly and told them so. Freddie, also, is said to have expressed himself. Of course the boys felt so sorry.

And then the discipline committee took a hand in the affair and as a result of its mysterious workings Nappy Morehead was "canned" for two weeks. So, also, was Sal Walker, a Medic, who butted into the band. Some say Sal had no business "buttin' in."

Be that as it may, the day was looked upon as a huge success, and the department settled down for another year of work, happy and contented in its new faith.

HISTORY OF 1904

In the second year of his dispensation St. Patrick simply inspired the loyal to a unanimous cut. Such, indeed, it was in spirit. His Immanence was felt by all and at the various class meetings never a nay was heard to the proposition to cut all exercises.

There was one feature, however, that tended to mar the day's celebration. Artie, in the first throes of conversion, had assumed a defiant air. He would not believe what men had failed to prove mathematically "neither," he added, with an air of finality, "has St. Patrick's name ever appeared in a pump catalog." Guillible Freshies and Sophs might easily swallow such a myth whole, but for the sake of their good judgment, for the sake of their dignity, for the sake of the university, and if for no other, for his own sake, he insisted the seniors should not cut. Guided by the Saint's omniscient presence the seniors acquiesed, feeling in their love for the cause that they could better deprive themselves of one day's pleasure than thwart a conversion that was certain to come with the years.

It was in accord with this spirit that the day was kept. The decorations on the cupola of Engineering Hall were and an air of quiet and rest pervaded the building. The Engineers practically avoided the campus. Even Professor Louis, for whom Jack plead so eloquently, wore a look of serene contentment.

The notable feature of the day's celebration was the Senior banquet that evening at the Gordon. Freddie and Artie were there, and it is rumored that Freddie said something caustic about Universities vs. Kindergartens. But Freddie was converted long ago and now sees the folly of his way.

HISTORY OF 1905

This year a slight departure was made from the celebration of other years. Committees were appointed from each class to form the Committee on Arrangements.

"About nine o'clock on the evening of the sixteenth the Engineers gathered at the Engineering Building, each man ready, if need be to guard his building, or the posters all night. About eleven o'clock the building would have seemed the headquarters of an army to the uninitiated. Every drawing table, every bench, every corner, had its man asleep on his arms. Upstairs, in a close-curtained room, the gas flickered on bobtailed flushes and broken straights while the subdued rattle of chips and the muffled roll of bones punctuated the silence. A little past midnight the sound of hammering and whistling and singing on the tower of the

ST. PATRICK WAS AN ENGINEER

St. Patrick was an engineer, he was, he was!
For he surveyed the Emerald Isle,
And made its map and a profile.
Erin Go Bragh. Rah! For the Engineers.

St. Patrick was an Engineer he was, he was!
For he was the gun with the monkey wrench,
That screwed the lawyers to the bench,
Erin Go Bragh. Rah! For the Engineers.

St. Patrick was an Engineer, he was, he was!
For he invented the Calculus,
And handed it down direct to us.
Erin Go Bragh. Rah! For the Engineers.

St. Patrick was an Engineer, he was, he was!
For he was "conned" in Chemistry,
And in senior English got a "C".
Erin Go Bragh. Rah! For the Engineers.

Runaway engine down the track, she flew, she flew!
Runaway engine down the track
The son of a gun she'll never come back:
Erin Go Bragh. Rah! For the Engineers.

(Repeat first line in each verse.)

Engineering Building interrupted these pleasure seekers. They, in turn, pulled the drowsy ones out from under the drawing tables and the building was a humming bee-hive. The noise-makers aloft proved to be Sophs busy at decoration. They were stretching the wire from the Engineering Building to the dome of Academic Hall. From the wire was to hang the Engineers' banner high over the quad. Soon little squads of men, each squad with a roll of bills, a brush, and a bucket of paste, could be seen starting out in every direction. These were the Juniors starting out to placard the town with big green-lettered posters. Other squads followed, scattered on along the routes covered by the bill posters, guarding them from molestation.

"A number of mules fearing that their building would be desecrated had, in the early part of the evening, gathered in their barn with a plentiful supply of fodder and the juice of the corn. As they seemed so confident that they had us bluffed we locked them in, posted their doors full of posters and sang Engineering songs on their front steps till seven-thirty in the morning. As the sun was high in the heavens and the juniors were beginning to arrive, we turned the mules out to graze and went home to breakfast.

"At nine-fifteen the bodyguard of St. Patrick was formed on Broadway—at Booche's corner. From this starting point the battalion of four companies, composed of the four classes in the department, and dubbed the "Guards of St. Patrick", departed for the campus marching to the majestic and inspiring strains of "The Wearing of the Green". Williams and Eby made up the musical feature and to say that they did their part up green is putting it lightly. After attending the exercises at convocation the "Guards" repaired to the Engineering Building where the grand "Kow-Tow" was held. This formed, probably, the most impressive and imposing spectacle of the occasion. At the signal the "Guards" assumed an attitude of profound reverence—hats off, kneeling down, with noses deep in the sod—while St. Patrick, holding his improvised transit as if in a solemn benediction, dedicated and forever consecrated St. Patrick's Day as a holiday to be set aside by the Engineering Department for the observance of the ceremonies enacted and established on this occasion. The battalion was next reviewed on Broadway by St. Patrick and after a few department yells led by Wray Dudley in his inimitable way, the "Noble" Guards were dismissed and St. Patrick's Ball in the evening closed the festivities. If the anniversaries of this innovation are as successful as the initial one, its perpetuation is assured."

We look back over the four years of St. Patrick's dispensation with great pleasure and satisfaction. The Saint and the Engineers are mutually in love. He has never disappointed nor deserted us; neither can he point to a single back slider in our ranks. We have only one regret—Artie is still obdurate. Let us all unite in earnest supplication that he, too, may be brought into the full light where he shall see the Saint in his true Irish beauty, and be filled with glad surprise.

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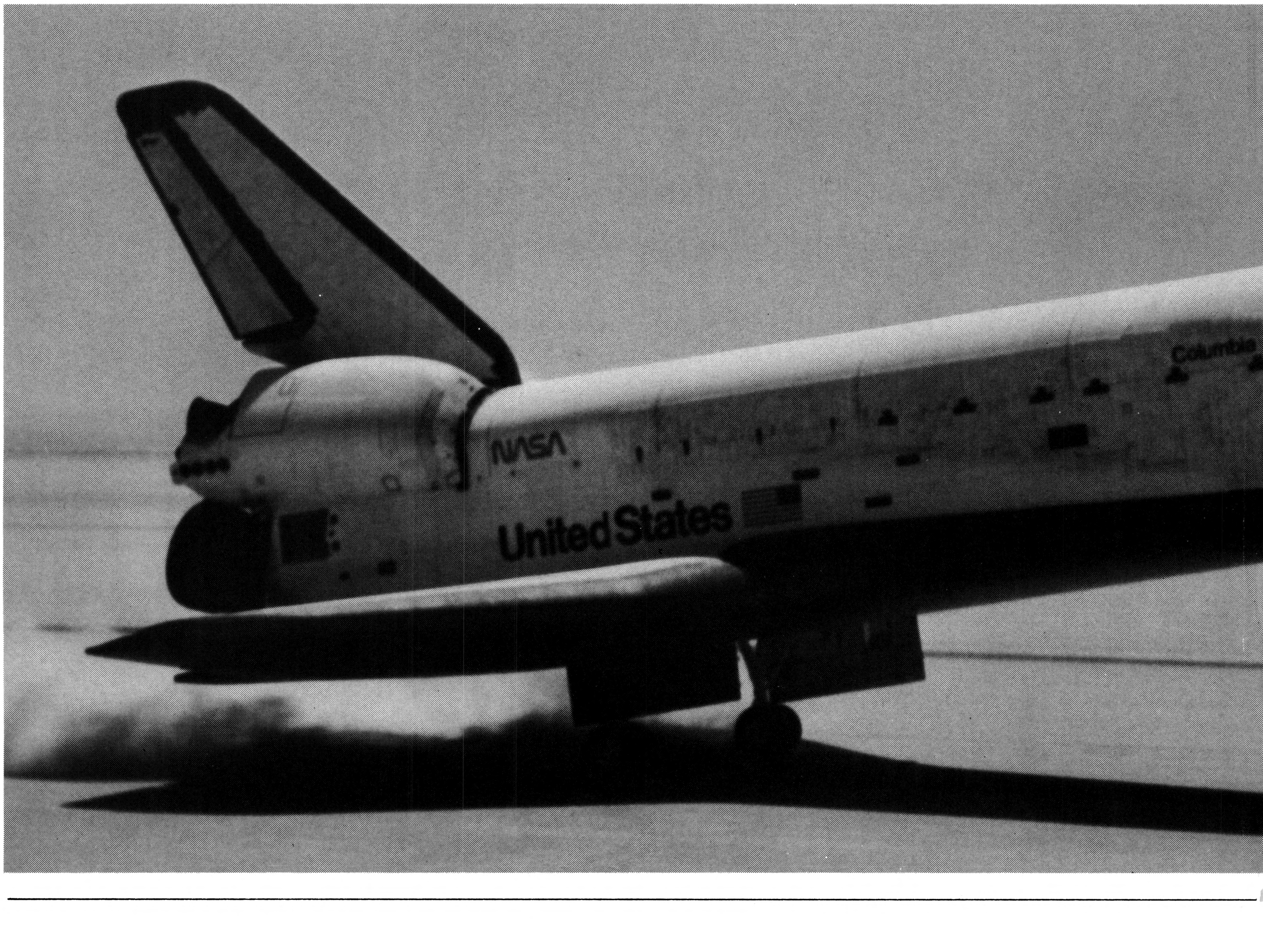

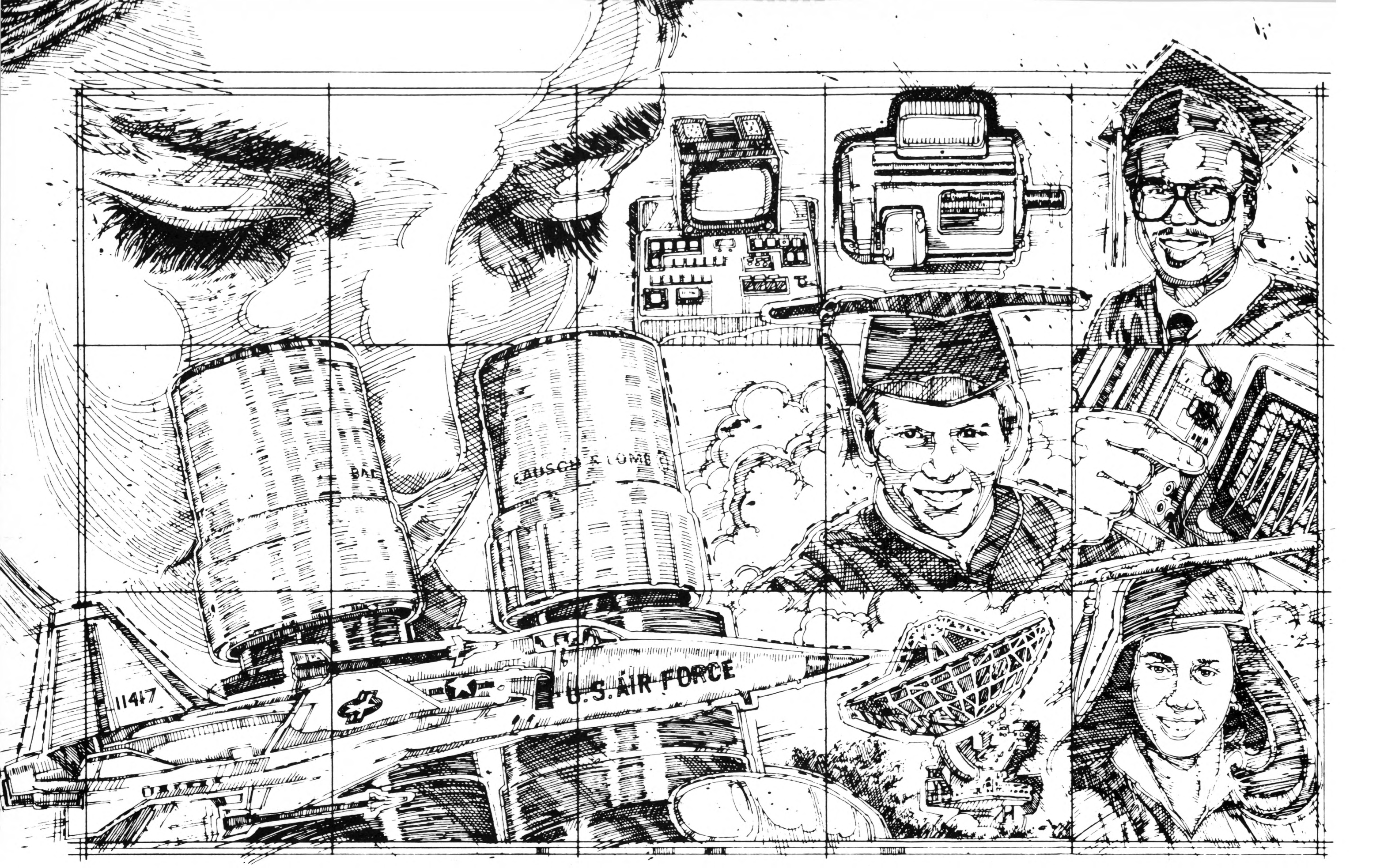

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Failure Analysis		●						
Optics	●			●	●			
Electronic Systems	●							
Product Assurance	●	●						
Logistics			●				●	
Computer Applications	●							●
Finance						●	●	
Planning		●	●				●	
Administration							●	
Quality Assurance	●	●						
Manufacturing		●	●					
Procurement							●	
Cost Estimating						●	●	
Contracts							●	
Plant Engineering		●	●					
Program Management	●	●		●			●	
Marketing	●	●		●				

DISCIPLINE

engineering funds:

a cut under the rest

by Linda Kral

There is a crisis in engineering education today. Since the mid-1970's, the demand for engineering graduates has increased sharply. Yet, the demand exceeds the supply, driving up starting salaries and increasing engineering enrollments.

The higher industrial salaries have caused fewer graduates to pursue graduate work, particularly at the Ph.D. level. The pool of Ph.D.s for engineering faculty is being depleted. The demand far exceeds the supply. Some 2,500 engineering faculty positions of a total of 20,000 faculty positions went unfilled in the nation's colleges of engineering during 1980-81 and the number is expected to be higher in 1981-82. (Only 24 graduated from UMC's College of Engineering with Ph.D.s in 1980-81.)

"UMC's College of Engineering . . . is facing serious problems in faculty recruitment and retention."

In addition to the short supply of faculty, a university engineering professor is no longer an attractive career. University salaries are substantially non-competitive with industry salaries. Students can earn more than their professors their first year out of school. Classes have become too large for personal interaction with students, course loads are too heavy for significant research, graduate assistants aren't available, and laboratory equipment needs to be updated.

The University of Missouri's College of Engineering, like other engineering schools across the nation, is facing serious problems in faculty recruitment and retention. Missouri is the lowest of the Big 8 in salaries for engineering professors. There are 100 faculty in the UMC engineering system which are responsible for 3800 students on the Columbia and Kansas City campuses. Many faculty at

Columbia commute to the UMKC campus for teaching night classes. Dean William Kimel feels he has a committed faculty working very hard to provide a quality engineering education to the 3800 students. The faculty brought in \$2.1 million from external sources to the College last year. However, the workload is becoming increasingly more difficult to handle with non-competitive salaries. Enrollment in the College of Engineering is 2.4 times that of 1973 with approximately the same number of faculty. Many faculty have quit to take job offers of 2½ times their current salary.

In view of the problems of faculty recruitment and retention stemming from too small a budget for the College of Engineering, the University received a 10 percent across-the-board tax cut. Last June, engineering faculty learned there would be no salary increase this year. According to Dean Kimel, the UMC College of Engineering met the budget cuts "through giving up 5.5 full-time em-

". . . a supplemental fee is currently under consideration for engineering undergraduates."

ployee unfilled faculty positions and 3.5 full-time employee non-academic positions, for which we are recruiting."

The budget cuts have served a harsh blow to the College of Engineering. The faculty, understandably, reacted very negatively to the cuts. The 1981-82 academic year will be a time of great concern for the College. Dean Kimel is left with no mechanics to help department heads.

The situation for the College of Engineering is a very serious one. Dean Kimel feels we have a very great financial problem that "I think has to be solved through more revenues from the General Assembly, supplemental fees for engineering students, or continued support from industry."

The state of Missouri has not provided the necessary resources in the past. Industry has been supportive and realizes its support is necessary to insure quality engineering graduates, but their resources still fall short of the needed revenue for the College. To provide adequate funding for the University's engineering programs, a supplemental fee for en-

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but I do participate in it. We're trying to coordinate one in Columbia. When it occurs, it will last two weekends.

Another activity I'm involved in is the Engineering Extension Program. This involves two-day seminars directed to the industrial community and occur in Kansas City and St. Louis. Owen Miller and I teach such things as statistic quality control, methods improvement for both supervision and clerical staff, and inventory control.

When I'm not teaching or involved here at the University I enjoy officiating sports. I'm now licensed to officiate high school baseball, football, and basketball. I used to officiate little league baseball. This semester I'm going to help officiate some of the intramural games to gain some experience.

CONVERSATION: Do you have a unique teaching style?

DR. DAVID: I like students and I like to try to get them interested in what they are studying. One such example is a T-shirt I wear to my Engineering 5 class. It was given to me by the computer institute. It says "Computer Jocks Do It With a Do." This usually gets the students attention and they seem to enjoy it.

gineering students is necessary.

Medical and law schools, which are separate from undergraduate departments, have met similar problems of professors' salaries through supplemental fees. But because the engineering faculty is part of the overall undergraduate schools, it is politically untenable to raise their pay significantly above that of others teaching undergraduates. Therefore, a supplemental fee is currently under consideration for engineering undergraduates. This fee is justified on the basis of required faculty salary improvement and badly needed funds for purchase of new laboratory equipment.

Since costs of engineering programs are similar to those of other professional programs, for which a supplemental fee is already in effect, Dean Kimel and Dean Robert Davis (Dean of Engineering at UMR) have proposed a supplemental fee of $213 per semester per full-time undergraduate engineering student be instituted.

Dean Kimel feels that this solution is necessary to tackle the problems facing the College today. The success of engineering schools have caused their own downfall. The system is not completely elastic. The presence of a high market for engineers doesn't assure that engineering schools will always be around. This assumes engineering professors will always be willing to work for low salaries or it presumes someone will pay the salaries.

continued from page 8

portant to a complex company, it is also important to the individuals in that company.

And this, of course, is where the challenge of good writing hits home. Because how your words are presented on paper will be a reflection of you—of your knowledge, your thinking process, your judgment.

Now—based on a great deal of personal experience, let me review some of the traps you might get yourself into in preparing your report. I call these traps the "Sins of Writing."

The first sin I call the "Ego" sin.

You've decided that you're going to tell me and my boss all we ever wanted to know about what you're doing—and more. You're going to demonstrate that you're the world's expert on the subject—so you write—and write—and write.

And when I get the report at 5:00, I find twenty single-spaced pages to read.

The first problem was mine. I didn't tell you I only wanted a two-page summary. But the second problem is yours. You let your ego get in the way. You assumed that I would be interested in reading all that you were interested in writing. And you wanted to make an impression.

Then there's the sin of "Omission."

In this case, your report has taken me from Point A—to Point B—to Point C. But then you skip over Point D. And you pick up with Point E.

And as I'm reading the report, I'm saying—where the heck is Point D? That's the one the boss really wants to know about.

And then I ask myself: is he trying to cover up on Point D? Did he forget about it? Or does he really understand how important that particular part of the program is.

By your omission, you've created doubts in my mind that you really know what you're doing.

My next sinful category I call the "Big Word" sin. When you write that you found yourself "in prevailing precipitant climactic conditions"—I think what you're telling me is that you got caught in the rain. I'll be tempted to write you a note like Churchill did about the memos he was receiving: "Most of these woolly phrases are mere padding, which can be left out altogether or replaced by a single word."

Next is the sin of "Emotion." In this case, your report points out that if management had listened to you six months ago, then they wouldn't have the problems they have today. You then go on to list your recommendations of six months ago—which at that time were turned down.

So you're going to have to learn to control your emotions in your communications. There are ways of being critical in writing—without being insulting. There are ways of making a point—without saying, "I told you so." And you're going to have to learn these ways.

A final sin I'd like to mention is that of "Loss of Logic." This is perhaps the most serious of all.

In this case, what is written just doesn't make sense. There's no organization to the report —it roams all over the map—it brings in points completely outside the scope of the report—and the main point of your memo is buried in the middle of the fourth paragraph on page 5.

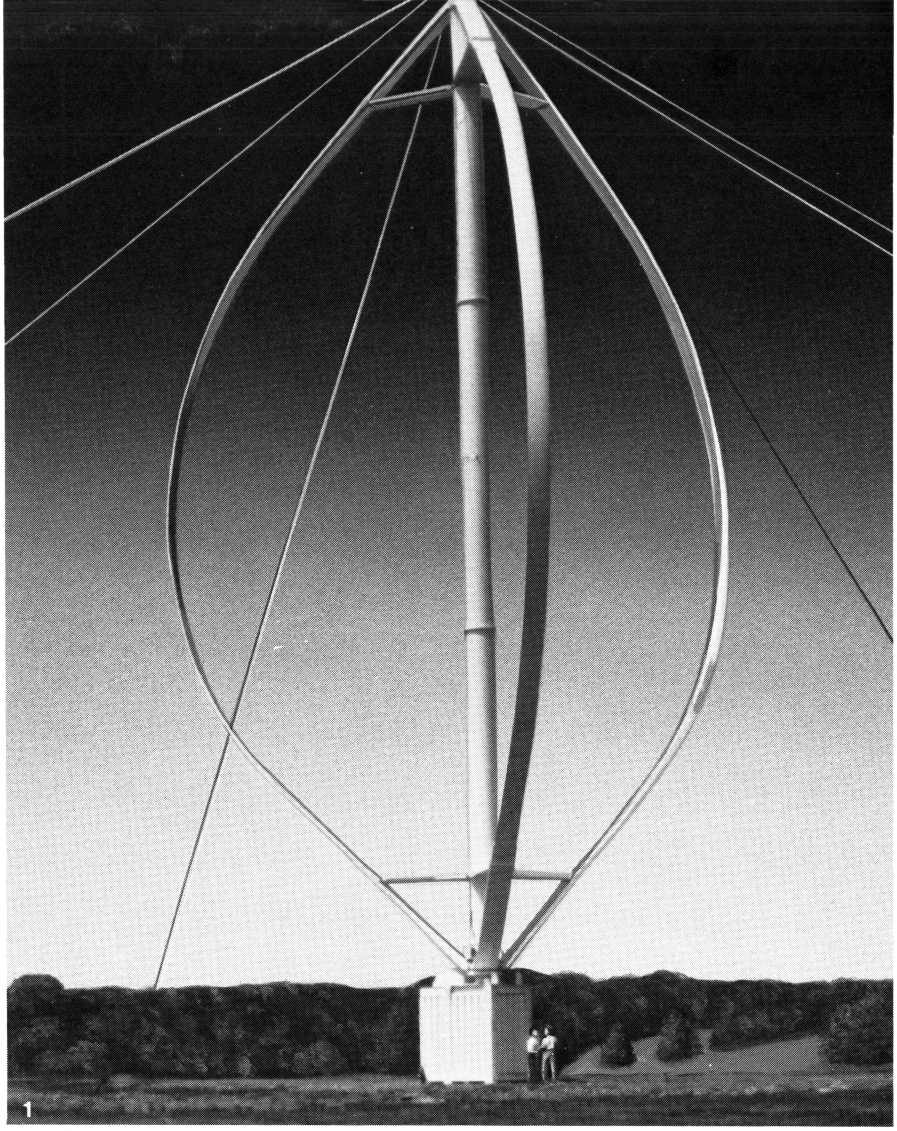
Your writing has to make sense if you are to make sense.

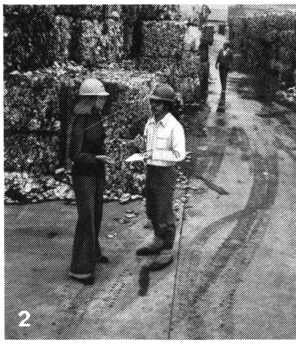
When you fall into the trap of any of the sins I've mentioned—Ego—Omission—Big Word—Emotion—or Loss of Logic—the reader is going to have problems with your writing—and with you.

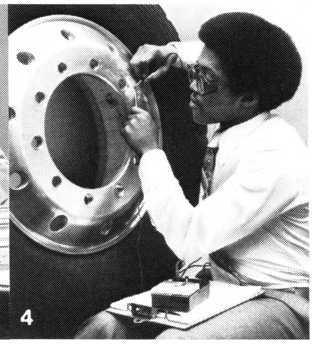
I hope I've managed to raise your attention level about the need for better writing.

Alcoa in vital energy conservation

(It's your future, too.)







(1) TOMORROW: Among Alcoa energy research projects is the Vertical Wind Turbine with aluminum blades that convert wind energy to electrical energy as the unit rotates. The total wind potential of one site in California is assessed by that state's energy commission at 5,000 megawatts... tomorrow's equivalent of *five* nuclear plants.

(2) TODAY: Imagine saving 3.3 *million barrels of oil* a year! That's what energy-conscious Americans did in 1980 by responding to the Alcoa call for used cans to be recycled and reprocessed into aluminum products. More than 330 million pounds of cans were turned into reclamation centers which helped Alcoa conserve the equivalent of 3.3 million barrels of oil. And Americans were paid $90 million by Alcoa for doing it.

(3) ANOTHER: Oil conservation measure is the increased use of aluminum to lighten automobiles. Theoretically, if the entire U.S. auto and light truck fleet averaged 40 mpg, the U.S. could eliminate the need for OPEC oil. Automobiles redesigned to achieve maximum benefits of aluminum's light weight can significantly increase the average mpg performance.

(4) SPECIFIC EXAMPLE— Today's truck owners are using more and more strong, attractive Alcoa forged wheels. Reduced weight and added fuel economy make aluminum wheels an essential product for economy minded truckers.

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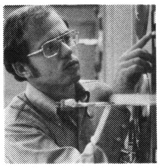

For years you've been proving to your professors just how good you are. Now it's time to prove it to yourself.

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Prove yourself where innovation's the rule, not the exception.

As a matter of corporate policy, TI has built-in budgets for new, innovative ideas. If you have a revolutionary concept that deserves to be put to the test, the money's there.

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No technology is hotter, or more fantastic, than microelectronics. And no company is hotter in it than TI.

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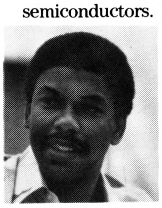

- The inventor of the integrated circuit.
- The inventor of the microprocessor.
- The inventor of the microcomputer.
- The inventor of the handheld electronic calculator.
- The inventor of the LCD digital watch.
- The designer and producer of the most complex MOS chip.
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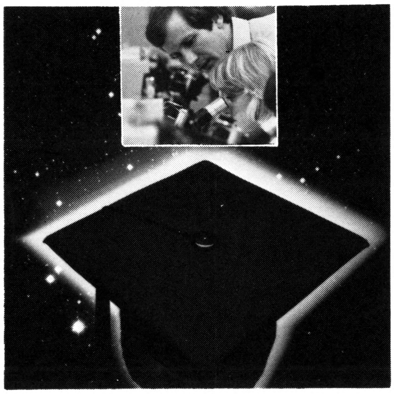
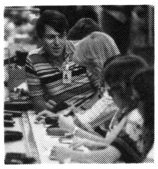


Prove yourself where you have the freedom to grow.



Because TI is like many companies in one, you have the opportunity to move laterally from one specialty to another as well as move up. Without changing jobs.

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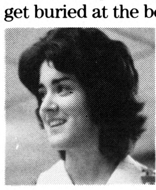

if you get a good idea your first week on the job, it gets heard. And you get rewarded.

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- Chemistry
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Campus Interviews

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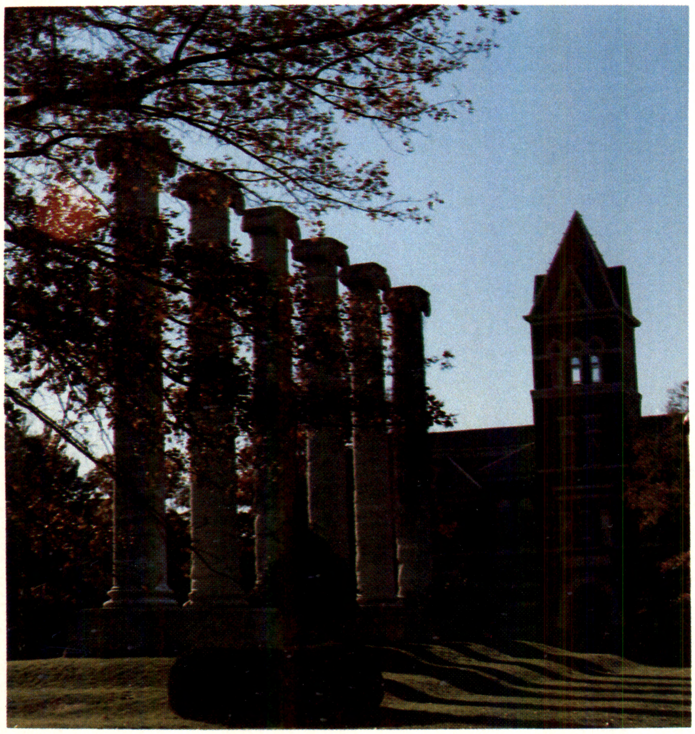


by Carla Koelling

Last August Dr. John Rouse left UMC to assume his new duties as Dean of Engineering at the University of Texas at Arlington. Dr. Rouse was Chairman of the Department of Electrical Engineering at UMC for 3½ years.

The former Miss Susan Sims has also left her position at the university as Administrative Associate to Professor Lysen. She and Dr. Rouse were married in May.

Dr. Charles Slivinsky is interim chairman of the EE department.

Salaries for University of Missouri-Columbia engineering graduates rose again this year. May 1981 B.S. graduates accepted jobs with salaries averaging $23,112 per year. This was an increase of $2,532 per year over May 1980 graduates who averaged $20,580 per year.

Three students reported acceptance of salaries in the $27-30,000 range. All had prior work experience. Most students received multiple job offers. Six offers were common with some students receiving as high as nine or ten offers of employment.

Chemical engineers, as a group, recorded the highest starting salaries this Spring followed in close succession by mechanical, industrial, and electrical engineers. UMC graduates received average starting salaries higher than those reported in a national survey of all U.S. graduating engineers by the College Placement Council.

Employer visits were up three percent over Winter 1980. Aerospace, electronics, and instrument industries, petroleum and allied products industries, and public transportation utilities recorded the highest number of interviews followed by automotive and mechanical equipment industries and chemicals, drugs, and allied products industries.

Jack Morgan, assistant dean of the UMC College of Engineering and director of placement, said, "The number of opportunities available to 1981 graduates were excellent and were a continuation of the engineering employment pattern seen for the last several years. Looking ahead, we expect the job market to be strong and healthy for many years to come."

St. Louis University High School and Wentzville High School took first and second place, respectively, while Park Hill High School, Kansas City, captured third in the statewide TEAMS competition sponsored for the first time February 25, 1981, by the College of Engineering here at UMC.

TEAMS stands for Tests of Engineering Aptitude, Mathematics and Science and is sponsored by JETS, a national organization encouraging youth interest in science and engineering. UMC Engineering Dean William R. Kimel is national president of JETS this year.

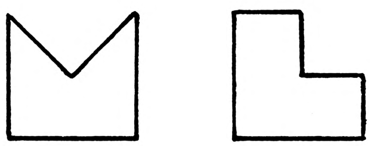
Nearly 400 students from 62 Missouri high schools participated in the event. Students could compete as members of school teams as well as individuals. Trophies were awarded to winning teams as well as to first, second and third place winners in each of the test areas of mathematics, chemistry, physics, English, biology and engineering graphics. Top individual winners (if also on the winning teams) could carry away as much as $200 in cash prizes. An additional prize for winners was the offer of a freshman engineering scholarship if they meet the basic criteria required of all UMC engineering scholarship applicants.

Industry and individual contributions helped support the activities of the event. The TEAMS competition will be an annual event at UMC.

Thought Gallery

by Curtis Cannell

Pictured below are squares with quarter portions removed. Divide each figure into four equal areas each having the same shape.



Answers to graphic puzzles will be in the next issue.

A blacksmith had a 40 lb. weight for his balance scale. One day a customer accidentally broke the block into four different sized pieces. He was surprised when the blacksmith thanked him for breaking the block because he could now measure every weight from 1 to 40 lb. What were the weights of the four pieces?

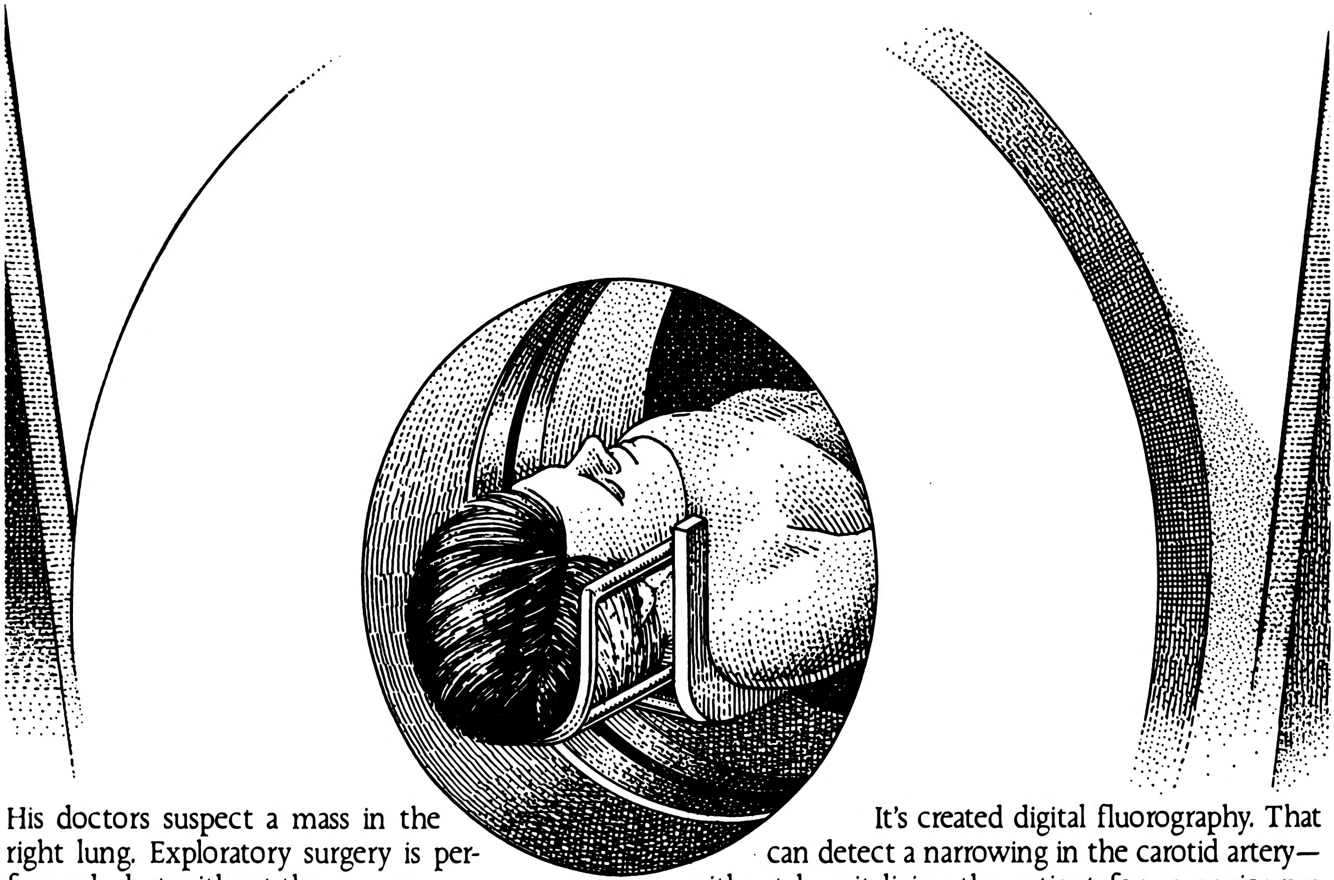
ANSWERS
The weights are 1, 3, 9, and 27 lb. To weigh a five pound weight put 9 on one side, 1, 3, and 5 on the other side.

Below are six lines. Add five more to make nine.

FOOD FOR THOUGHT

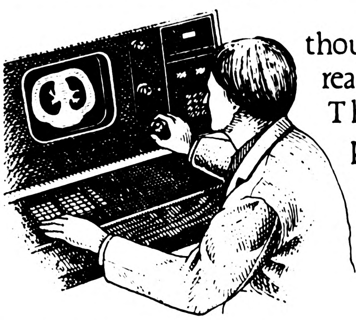
Everyone is a prisoner of his own experiences.

The silicon chip. It's replacing the scalpel.



His doctors suspect a mass in the right lung. Exploratory surgery is performed—but without the surgery.

This is made possible because of a major advance in radiology called the CT Scan (short for computed tomography).



The CT Scan provides thousands of digitized X-ray readings of a patient's body. Then, using a computer, it synthesizes the data into a series of cross-sectional or tomographic images—all within seconds.

The detail is incredible. Often a diagnosis can be arrived at immediately—so the patient is spared the knife.

But it's the heart of the computer that's the real miracle. The silicon chip.

The silicon chip is responsible for a new wave in microelectronics and a remarkable revolution in medical diagnostics.

It's created the digital ultrasound imager. That helps doctors visualize the womb of a pregnant woman with sound waves to monitor fetal development.

It's created digital fluorography. That can detect a narrowing in the carotid artery—without hospitalizing the patient for an angiogram.

General Electric is committed to finding new ways to make the computer chip serve. In medicine. And in other industries.

For instance, we're investing 100 million dollars in our new GE Microelectronics Center.

We've acquired INTERSIL, one of the leading designers of specialized computer chips. We've also acquired CALMA, a company which is using CAD/CAM technology to revitalize the American factory.

GE is even exploring new uses for microelectronics in satellite communications, radar and robotics.

Microelectronics is where the future is. A future that will need talent. Engineering talent.

If you'd like to know more about engineering opportunities at GE, check your Placement Office or write to: Engineering, Building 36-504, Schenectady, NY 12345.

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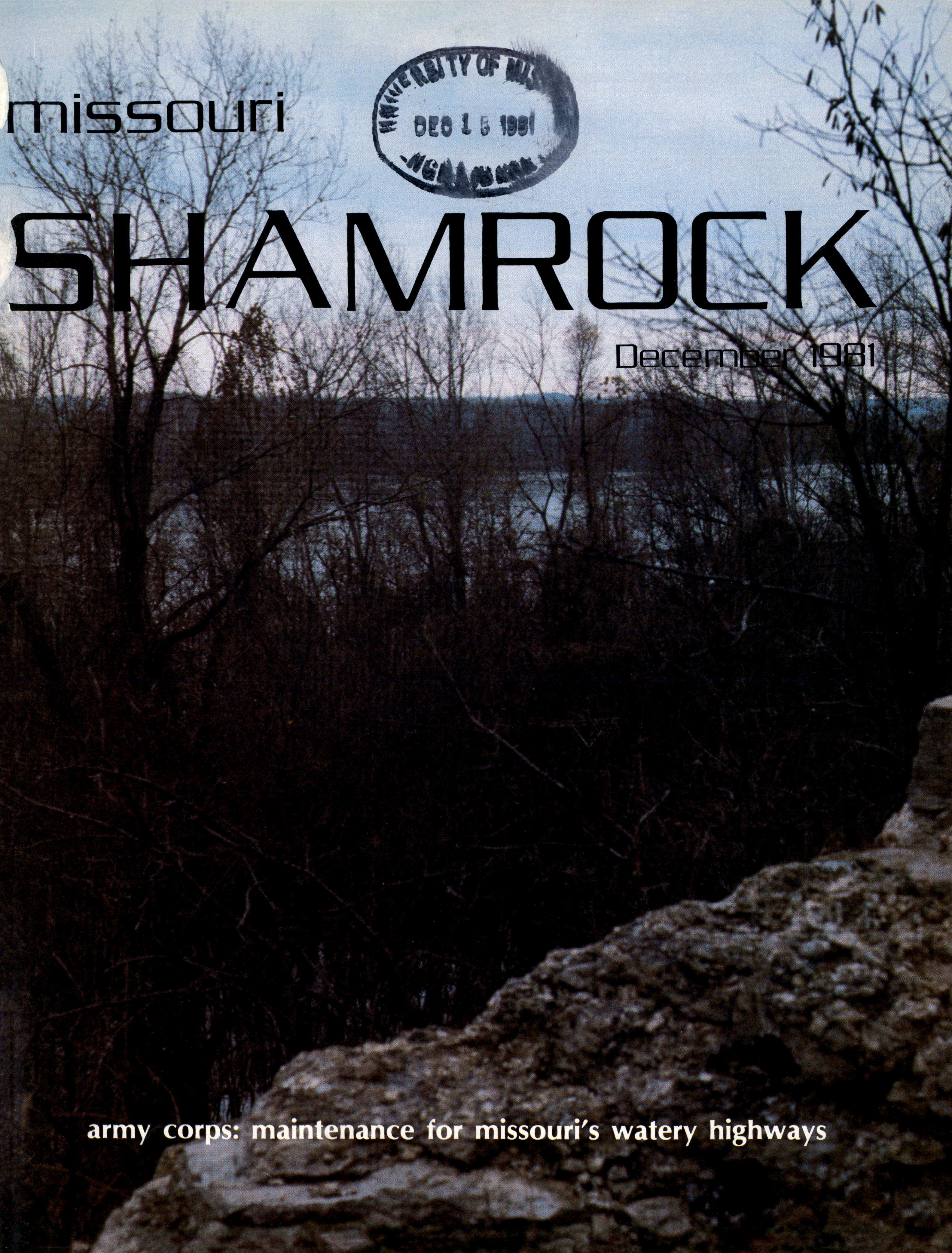
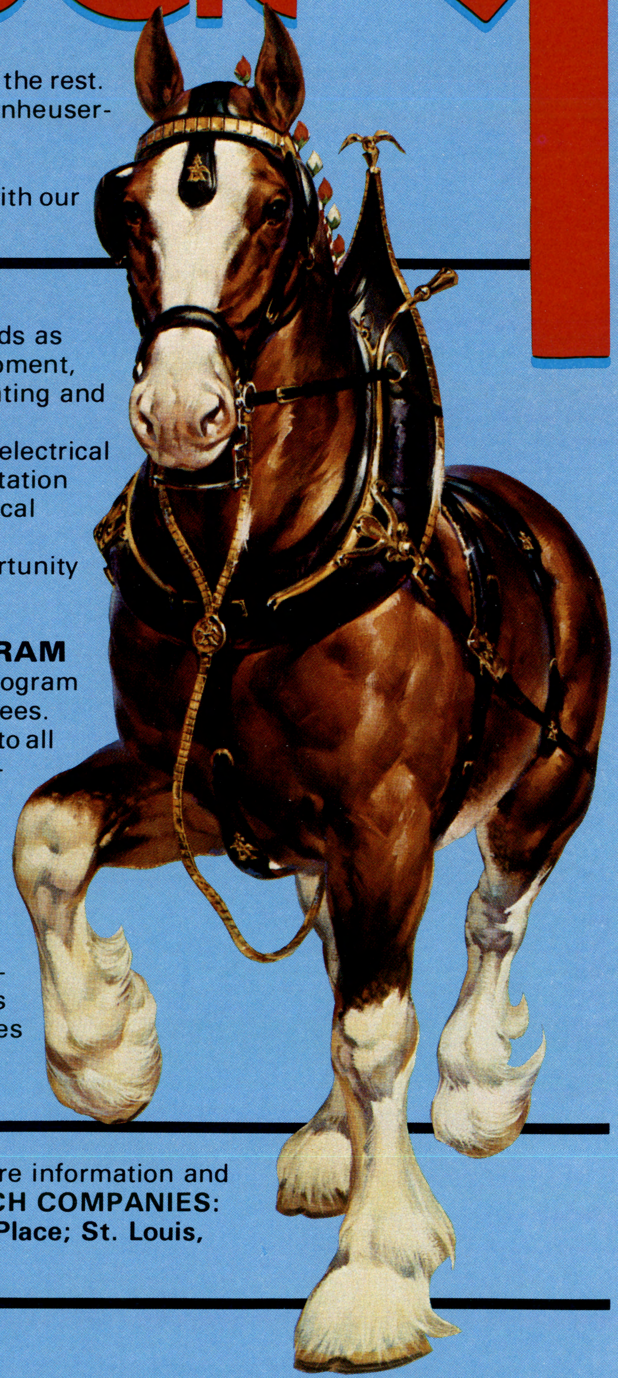
December 1981



army corps: maintenance for missouri's watery highways

STEP OUT WITH NUMBER #1



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SHAMROCK

The UMC College of Engineering Magazine

December, 1981

Vol. 75 No. 2

On the cover:
The Missouri River as seen from Highway 40 near Chesterfield MO. Cover Story page 4
Photo by Therese Gurski

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

cover story

army corps: maintenance for

by Amy Werner

In Missouri, the beauty of the landscape is accented by its rivers. These rivers provide recreation, energy and a highway for the movement of goods. The movement of these bulk commodities would not be possible if the flow and navigation of the river was not maintained. The United States Army Corps of Engineers in St. Louis provides this maintenance. With the use of different techniques, the Corps keeps traffic on the rivers flowing. Dredging and building of stone dikes help to keep the river like a superhighway. The Corps also maintains the lock and dam system found on the upper Mississippi, north of St. Louis. Other projects associated with

The Corps of Engineers maintains the river for the benefit of all.

the Corps are the Cannon Multipurpose Dam. Flood control, recreation, water supply, and hydropower are all provided by the Cannon Dam. If not for the engineers of the Corps, our waterways in Missouri would not be maintained to provide us with the energy, recreation and water supply needed for our society.

The St. Louis district of the Corps of Engineers is responsible for navigation on the Mississippi. The Mississippi is divided into two sections: The upper Mississippi is that part of the river above or north of St. Louis, and the lower Mississippi is that part of the river below or south of St. Louis. The difference between the upper and lower Mississippi is that the lower is a flowing river, while the upper is like a set of stair steps through twenty-nine locks and dams.

The Army Corps of Engineers maintains the lower Mississippi by two different methods; one is the building of stone dikes and the other is by dredging.

Stone dikes are about 1500 feet wide and protrude into the river. The purpose of the dikes is to confine the river and increase its velocity. If the velocity of the river is increased, the rushing water will help to scour out

The channel must be kept clear.

the river's bottom. The second method used by the Corps to keep the lower Mississippi flowing is dredging. With the use of a huge crane, usually found on a barge or on the shore, the debris in the river can be lifted out and moved. Although dredging is a good way to move material out of the river, with the increased construction of stone dikes the need for dredging has decreased. Twenty years ago there were twelve dredges in use. Today, there are only two.

The upper Mississippi is a like set of stairs a barges must climb while carrying goods. These stairs are formed by the locks and dams along the upper Mississippi. The Corps usually keep the locks open twelve months a year except for those past Lock and Dam 26 in Alton, Illinois. Once the barges are north of this lock, 60% of the traffic goes to the Illinois River and north to the Upper Great Lakes region. The other 40% proceed north along the upper Mississippi. This area is usually closed during the winter due to weather. The problems of ice in the locks is easily solved. It's usually flushed out or passed through the locks. The men responsible for keeping the traffic on the river moving are the bargemen.

photo by Therese Gurski

Above: The Missouri River at Highway 40. Right: Lock and Dam No. 26 on the Mississippi River near Alton, Ill.

missouri's watery highways

The barges found on the rivers carry many bulk commodities needed for everyday life such as grain and coal. Fifty-four percent of all goods moved along the river is grain. This grain is for the world market. Japan is a leading importer of U.S. grain. If something happens along the Mississippi to slow down traffic, the Corps will hear from Japanese importers stationed in New York who are worried about the world grain market.

With the price of transporting goods around the world increasing, the movement of bulk commodities by water is by far the most economical. In 1979, **Transportation Facts** stated, "to move one ton of goods for one dollar by air it would equal 2.7 miles, by truck it would equal 8.9 miles, by rail it would equal 42.2 miles and by barge it would equal 181.8 miles." The amount of goods moved by barge is much more economical than any other type of transportation. One barge is equivalent to 15 railcars, and an average tow is fifteen barges. This is equivalent to 225 rail cars or 900 through Lock and Dam 26 in 1980 was 96 million tons, and the amount of goods transported through Lock and Dam 27 was 74 million tons. The amount moved through these locks increases by 3 million tons each year. If it was not for the Corps maintaining navigation on the Mississippi, water transport would not be as economically feasible as it is today.

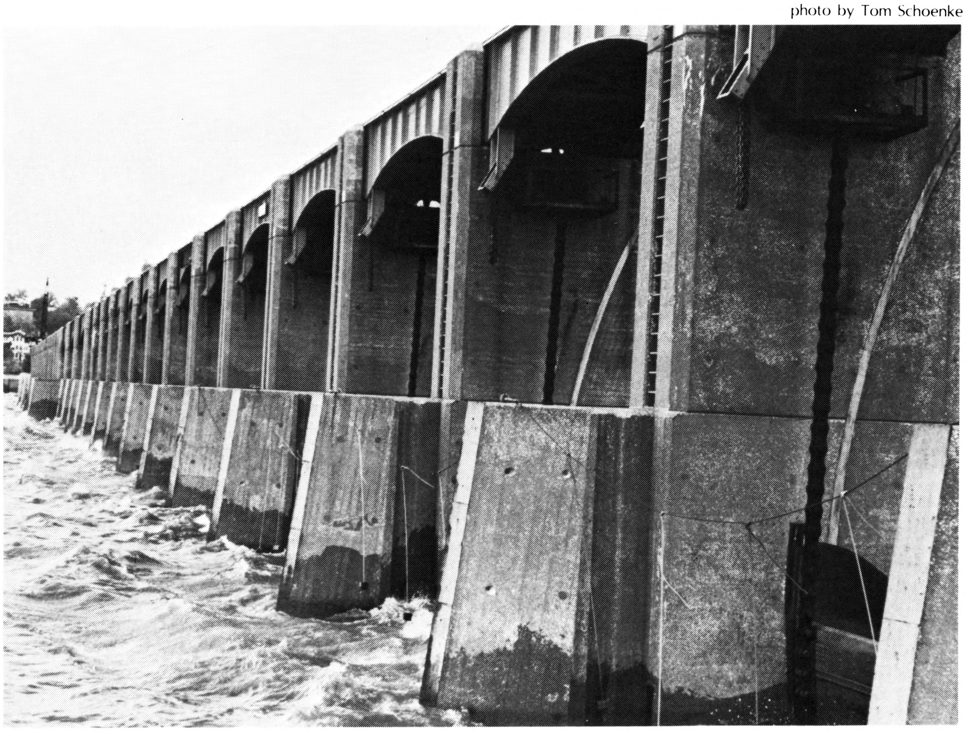
One barge is equivalent to 15 railcars.

The Cannon Dam is another example of what the Corps maintains to benefit the public. The Cannon Dam is a multipurpose dam. It provides flood control, a source of recreation, an increased water supply, hydropower, and a suitable environment for fish and wildlife. With energy costs the way they are today, hydropower is a good source of reusable energy. The Cannon Dam, and others like it, provide this energy.

The Corps never partakes in a project unless it meets three standards which they have set up. The first is that the project must be economically feasible. This means the project must produce more than its original cost. The second is a sociological reason. The project must benefit society. Third is the environmental impacts or benefits. With this criteria, the St. Louis Engineers District and the other 39 U.S. Army Corps of Engineers located throughout the continental United States try to provide the public with the best possible service and benefits while controlling our rivers and tributaries.

photo by Therese Gurski

photo by Tom Schoenke



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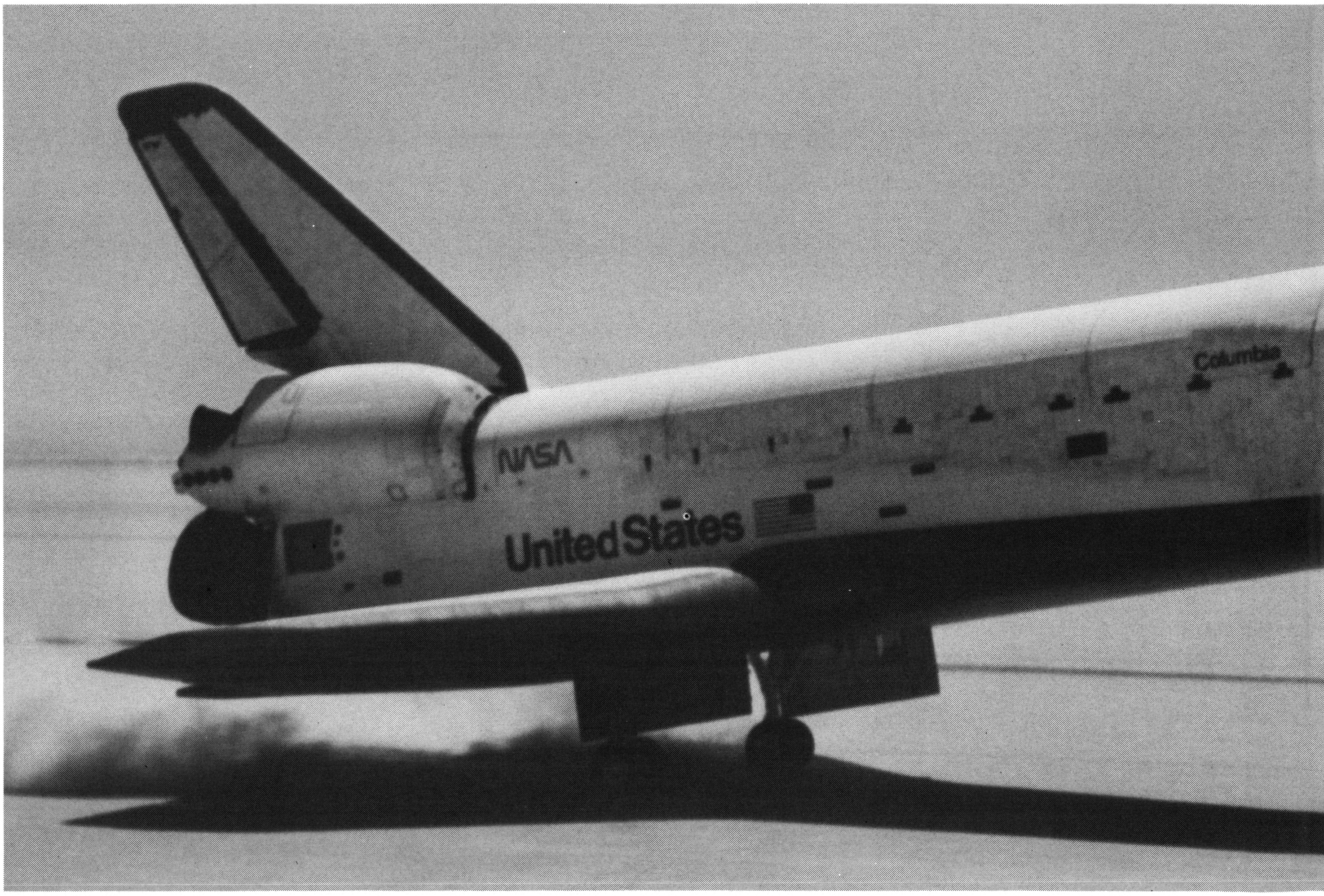

The Space Shuttle orbiter and main engines.

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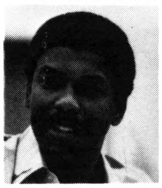

- The inventor of the integrated circuit.
- The inventor of the microprocessor.
- The inventor of the microcomputer.
- The inventor of the handheld electronic calculator.
- The inventor of the LCD digital watch.
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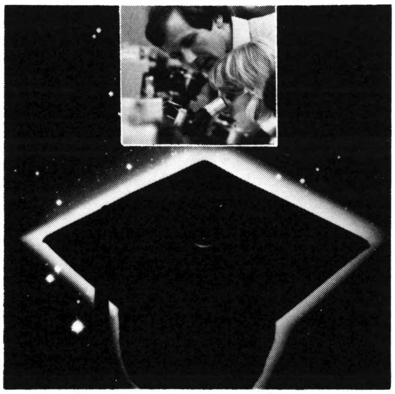
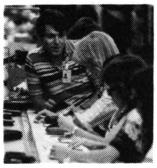


Prove yourself where you have the freedom to grow.



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TI has been acclaimed as one of America's best-managed companies because we've stayed young and vital while growing big.

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if you get a good idea your first week on the job, it gets heard. And you get rewarded.

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TI has hometowns in 19 countries on six continents. You'll find manufacturing in Singapore. Dallas. Tokyo. Nice. Buenos Aires. And many other cities around the globe.

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Texas Instruments is interested in graduates from the following specialties:

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Campus Interviews

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An equal opportunity employer M/F

conversation


photo by Kent Luetkemeyer

The Dean of Engineering is an important cog in the machinery of UMC's College of Engineering. This month, Dean William R. Kimel talks with Conversation about himself and the responsibilities of his job.

by Carla Koelling

CONVERSATION: First of all, Dean Kimel, where did you earn your degrees?
Dean Kimel: My Bachelor's and Master's degrees are in Mechanical Engineering from the University of Kansas. My Ph.D. is in Mechanics from the University of Wisconsin.

I worked in industry for a few years, then I got into higher education and that's where I've been ever since. I started the Nuclear Engineering Department at Kansas State University. At one time I was president of the American Nuclear Society.

CONVERSATION: What are some of your duties as Dean of Engineering?
Dean Kimel: I'm responsible for the programs of engineering on the Columbia and the Kansas City campuses.

The chairmen and the directors of the departments report to me. Then I report to Ron Bunn, the Provost.

They look to me as the person responsible for the College of Engineering's activities and accomplishments—it's teaching, research, and services.

My job is that of facilitating and coordinating the activities of the College of Engineering for the University of Missouri, Columbia.

One of the major jobs of my office is to meet with external groups and agencies related to engineering, including alumni.

We have 14,000 living alums and we have an awful lot of programs dealing with our alumni. We have to coordinate all of that, and I have a principal role in it.

If there are any problems around here, they always come to me. I have stacks of problems; believe me, I get 'em all. If the chairmen can't solve them, then I get 'em. I do my best to grapple with them with the resources available.

CONVERSATION: Do you have any major projects for the future of Engineering at UMC?
Dean Kimel: We plan to expand our externally funded research program. Also, we have been authorized by the Board of Curators to offer a Bachelor of Science degree in Computer Engineering; although it has not yet been approved by the Coordinating Board for Higher Education. We will probably have a limited scope program. We don't have the money to open it up to all students, therefore students will be enrolled on a selective basis. It will be part of the Electrical Engineering Department.

We are also planning to build a new building if, and when, the legislature funds it. It has been approved by the Coordinating Board of Higher Education and the Board of Curators. It will be located on Sixth Street and will house Industrial, Chemical, and Nuclear Engineering. That is something we can look forward to.

CONVERSATION: Do you have anything else to add?
Dean Kimel: I am delighted with the current job market for our graduates. Our major goal is, of course, to provide career opportunities for our graduates and I think we're accomplishing that very well.

We have an excellent, dedicated faculty here and, in addition, the non-academic personnel do excellent work—they are all indispensable.

feature

satellite tv signals

by Scott Courtney

The long-time dreams of many TV viewers have included such things as:

-being able to receive more than just two or three channels;

-watching sports events that are "blanked out" to certain localities;

-seeing first-run "cable TV" movies—without paying for cable TV;

-viewing European movies which are banned from broadcast in the U.S.; or,

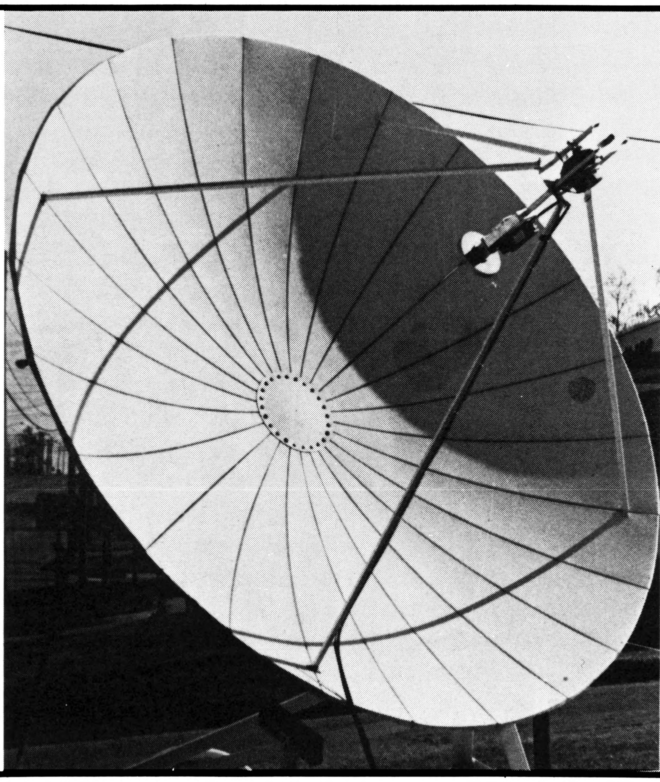
-enjoying a wide selection of educational and news programs.

It would be nice to be able to do all of these things, but alas, 'tis a happy dream—or at least it was. Suddenly a new technological development has made the TV viewers' dreams come true. This answer to many prayers is called satellite TV.

For several years, television networks, news services, and other program sources have been using satellites to relay their signals across continents and around the world. An "earth station" at the source (New York, for example) sends a television signal up to a satellite orbiting in space. The satellite picks up the signal, amplifies it, and sends it back to earth on a different frequency, perhaps to an earth station in California. From there, the signal is relayed to local television stations, cable TV distributors, and so on, for broadcast to the general public.

Satelitte signals used to be "out of reach"

This is all fine for the networks, but until recently it didn't mean much to the average, home TV viewer. True, anybody could receive satellite signals—anybody, that is, who had a hundred grand or so to spend on some fancy converters and a big dish antenna. Besides, even the people who could afford such a system still had to go through the hassle of getting a station license from the FCC, which was no easy task. In other words, the home viewer was simply out of luck.



photos by Phil Greene

All of this has ended with the advent of TVRO systems. TVRO stands for TeleVision Receive Only, and it means an earth station can receive satellite signals but can't transmit its own to the satellites. With the dawn of TVRO, the $100,000-plus "broadcast quality" system was no longer needed by the home viewer who only wanted to catch the satellite signals for his own use. Now, a no-frills receiving system, including a small dish antenna and a converter (to change the satellites' microwave signals into standard TV signals), can be purchased for under $3000—or built for even less. In addition, the FCC has relaxed its licensing requirements for non-commercial TVRO installations.

Satellite television is a relatively new field. The space age started in 1957 with the Soviet Union's launching of Sputnik I. But Sputnik didn't do much; it did, however, scare the United States into launching its own satellite, SCORE, in December of 1958. Neither of these satellites had enough onboard equipment to be practical for communications purposes, and their low orbits meant that ground stations had to have tracking antennae, which further complicated the situation.

Satellites have greatly increased ability to communicate

The real "satellite revolution" didn't start until 1963. That was the year in which the United States launched SYNCOM, the first geosynchronous communications satellite. "Geosynchronous" means that the satellite's altitude above the earth is such that the period of its orbit is exactly the same as the period of the earth's rotation (this happens at

new video era

an altitude of about 22,300 miles). The geosynchronous orbit means that the satellite appears to hang stationary above a particular point on the earth's equator. Thus, modern communications satellites do not require that the ground stations have expensive tracking antennae. Without geosynchronous satellites, today's low-cost TVRO systems might not have been possible.

Corporations use satellites for Teleconferencing

Since the invention of the geosynchronous satellite, satellite technology has grown almost exponentially. In the short space of sixteen years, we have progressed from SYNCOM's modest capacity of fifty telephone links or one television channel, to a modern satellite system which could handle 228 simultaneous television signals, or more than 200,000 telephone conversations. Such was our system in 1979—several more satellites have gone into service since that time. This trend is likely to continue, as more and more local broadcasters, networks, and cable TV companies rush to jump on the satellite bandwagon.

Telephone companies and television networks are by no means the only users of satellite TV links. Besides the Big Three networks, satellite users include several news services, Public Broadcasting Service (PBS) networks, and cable and pay-TV systems such as HBO, Nickelodeon, and Showtime. Some of the larger broadcast stations use satellite links for remote news pick-ups. Corporations use the satellites for Teleconferencing (i.e., meetings via closed-circuit television), and various religious and governmental organizations make use of satellites for a variety of functions.

Recently the satellite revolution came to the Central Missouri area in a big way when KRCG TV-13, a local broadcaster, installed a seven-meter dish for reception of signals from one of the WESTAR satellites. The system is used to receive syndicated shows such as **The Waltons, Entertainment Tonight,** and **Solid Gold.** This saves the cost of shipping videotape reels or films, and allows better picture quality. At present, TV 13 is the only broadcaster in this area to have satellite capabilities, but it is likely that other stations will follow.

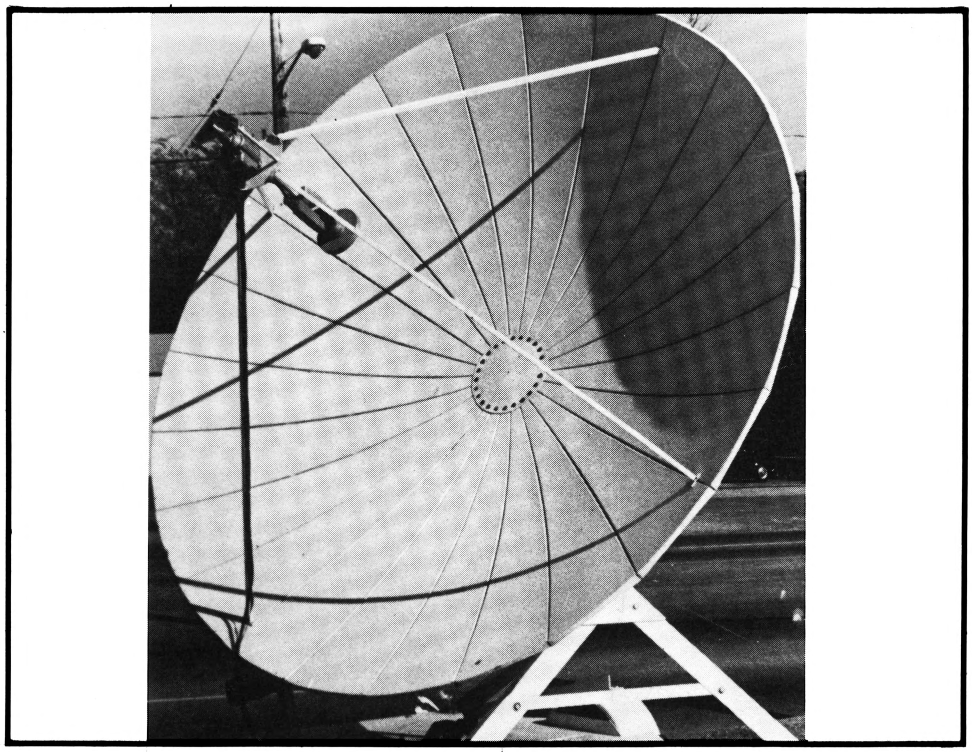
Individuals, too, can get in on the satellite boom, but there are still a few legal hassles which need to be cleared up. The virtual explosion of satellite technology has left the FCC's archaic regulation books far behind.

One of the most controversial issues is that of "video piracy." The FCC has traditionally held that the airwaves are "public property." But many of the programs sent over satellite networks are copyrighted, or are the property of cable TV companies or broadcast networks. These companies claim that unauthorized viewing of their programs by people who don't pay for them is theft of services, and so far the FCC has tended to agree. Although licensing requirements for non-commercial TVRO installations have been all but eliminated, the FCC still holds that no one may legally receive satellite programming without permission from the owners of the programs.

Individuals, too, can get in on the satellite boom

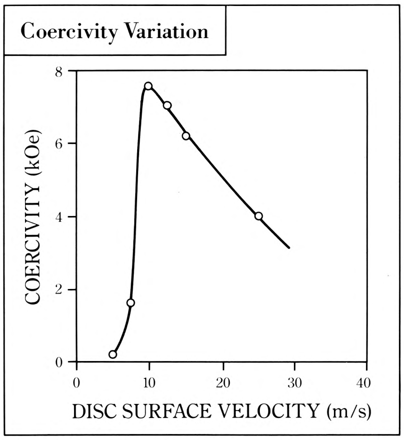
Although enforcement of this regulation is next to impossible, many of the satellite users are trying to prevent "piracy" by electronically scrambling or encoding their signals so that they can be viewed only by someone who has a special decoder. Unfortunately for the companies, most of

(cont. on page 14)



The Critical Interval

There has long been a need in the industrial world for low-cost, high-performance permanent magnets. Recent discoveries at the General Motors Research Laboratories show promise of meeting this challenge by the application of new preparation techniques to new materials.



Coercivity of $Pr_{0.4}Fe_{0.6}$ plotted as a function of disc surface velocity.

Color-enhanced transmission electron micrograph of melt-spun $Nd_{0.4}Fe_{0.6}$ having 7.5 kOe coercivity.

TWO properties characterize desirable permanent magnets: large coercivity (magnetic hardness or resistance to demagnetization) and high remanence (magnetic strength). Higher-performance magnets are required to reduce further the size and weight of a wide variety of electrical devices, including d.c. motors. Such magnets are available, but the cost of the materials necessary to produce them severely limits their use. The research challenge is to select, synthesize, and magnetically harden economically attractive materials of comparable quality.

Prominent among alternative materials candidates are alloys composed of iron and the abundant light rare earths (lanthanum, cerium, praseodymium, neodymium). Investigations conducted by Drs. John Croat and Jan Herbst at the General Motors Research Laboratories have led to the discovery of a method for magnetically hardening these alloys. By means of a rapid-quench technique, the researchers have achieved coercivities in Pr-Fe and Nd-Fe that are the largest ever reported for any rare earth-iron material.

Drs. Croat and Herbst selected praseodymium-iron and neodymium-iron based upon fundamental considerations which indicate that these alloys would exhibit properties conducive to permanent magnet development. These properties include ferromagnetic alignment of the rare earth and iron magnetic moments, which would foster high remanence, and significant magnetic anisotropy, a crucial prerequisite for large coercivity.

That these materials do not form suitable crystalline compounds, an essential requirement for magnetic hardening by traditional methods, presents a major obstacle. Drs. Croat and Herbst hypothesized that a metastable phase having the necessary properties could be formed by cooling a molten alloy at a sufficiently rapid rate. They tested this idea by means of the melt-spinning technique, in which a molten alloy is directed onto a cold, rotating disc. The cooling rate, which can be varied by changing the surface velocity of the disc, can easily approach 100,000°C per second. The alloy emerges in the form of a ribbon.

THE researchers found that variations of the cooling rate can dramatically affect the magnetic properties of the solidified alloys. In particular, appreciable coercivity is achieved within a narrow interval of quench rate.

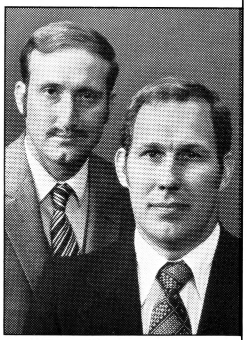
Equally remarkable, synthesis and magnetic hardening, two steps in conventional processing, can be achieved simultaneously.

"X-ray analysis and electron microscopy of the high coercivity alloys reveal an unexpected mixed microstructure," states Dr. Croat. "We observe elongated amorphous regions interspersed with a crystalline rare earth-iron compound."

Understanding the relationship between the coercivity and the microstructure is essential. The two scientists are now studying the extent to which the coercivity is controlled by the shape and composition of the amorphous and crystalline structures.

"The development of significant coercivity is an important and encouraging step," says Dr. Herbst, "but practical application of these materials requires improvement of the remanence. Greater knowledge of the physics governing both properties is the key to meeting the commercial need for permanent magnets."

THE MEN BEHIND THE WORK



Drs. Croat and Herbst are Staff Research Scientists in the Physics Department at the General Motors Research Laboratories.

Dr. Croat (right) received his Ph.D. in metallurgy from Iowa State University. His research interests include the magnetic, magneto-elastic and catalytic properties of pure rare earth metals and their alloys and compounds.

Dr. Herbst (left) received his Ph.D. in physics from Cornell University. In addition to the magnetism of rare earth materials, his research interests include the theory of photo-emission and the physics of fluctuating valence compounds.

Dr. Croat joined General Motors in 1972; Dr. Herbst, in 1977.

(cont. from pg. 11)

these decoders can be duplicated by do-it-yourselfers and electronics hobbyists, some of whom are probably making a small fortune selling decoders on the black market.

Rather than fighting the video pirates, some companies want to take advantage of the TVRO boom by offering commercial programs which are intended specifically for viewing by the general public on TVRO equipment. However, direct broadcast satellites (DBS) are currently the subject of much controversy. The FCC is in the midst of a formal study to formulate a policy regarding DBS. This policy is expected to be presented in 1983 at the Regional Administrative Radio Conference (RARC), the results of which will determine if, when, and how DBS is to be implemented in the Western Hemisphere. The present policy of the FCC is to "foster, not stifle" the DBS system, although no such system can actually go into service until after the RARC. In the meantime, the existing TV networks are lobbying heavily against this potential source of competition. Also, several minor technical problems stand in the way of a practical DBS system, although these should be cleared up in the near future.

In spite of the legal entanglements involving video piracy and DBS, today's satellite TV has a lot to offer. The mere fact that satellite signals are of a better quality than most standard broadcast signals is enough to make TVRO attractive to the true "videophile." Sports fans appreciate being able to tune in on a fantastic variety of sports events, including those which are blanked out to a particular geographical region. The excellent selection of movies and educational programming available on satellite channels also makes TVRO appealing to viewers who are tired of the rather narrow spectrum of shows offered by the national TV networks.

With the demand for satellite TV services growing so rapidly, it is certain that the satellite systems will offer even more and better services in the near future. For instance, experiments are being carried out in hopes of developing a system for high-resolution TV, which offers a substantially better picture than our familiar NTSC color signal. High-resolution video is not technically feasible for standard broadcast stations because their bandwidth is limited to 6 MHz; a high resolution system might require several times that bandwidth. This kind of spectrum space is available only in the microwave frequencies—which is where the satellites operate. Another possibility is digital high-resolution TV, in which the video signals are converted to pulse-type (binary) data. This method requires an extremely wide bandwidth, but offers the advantages of a virtually noise-free signal and better dynamic range than conventional analog systems.

One recent development, which is already in at least limited use, is called Teletext. Satellites that can relay video, can just as easily relay video text to be viewed on a standard TV receiver. Sometimes the data is sent during the vertical retrace interval of a regular television signal; in this case, a decoder is required to display the test. The Teletext system opens the way for transmitting such things as "video newspapers," stock market reports, and sports scores over television links. In addition, the marriage of Teletext with a large computer could eventually lead to information services which would carry up-to-the-minute reports on world news, weather, sports, and business statistics. These services would be available to anyone owning a TVRO system and a standard television receiver.

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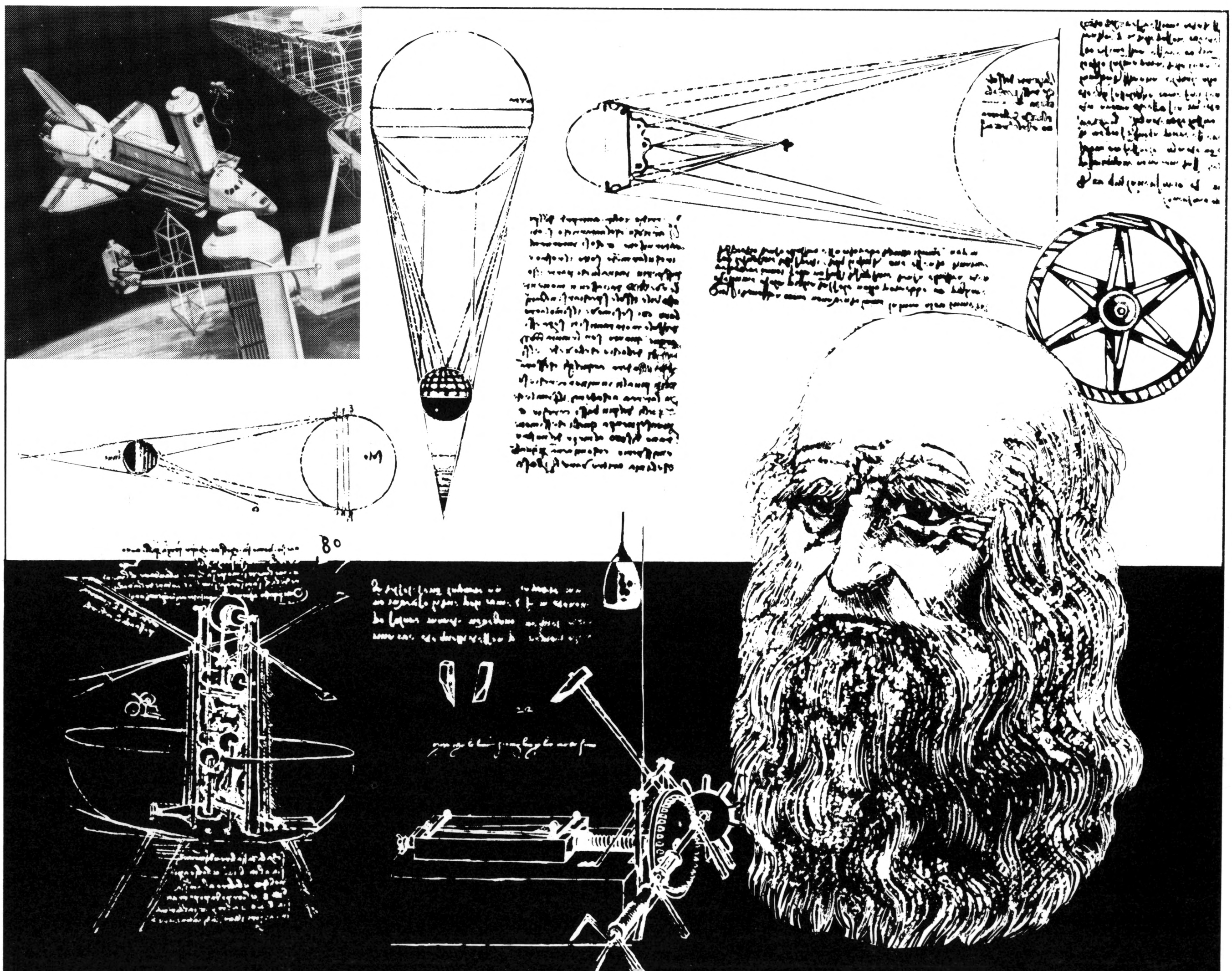


BS Computer Engineering: The New Kid on the Block

by Mike Foster

It has become increasingly evident that we are on the verge of a Computer Revolution. The effects on our society are sure to be as profound as those of the Industrial Revolution. The catalyst of this revolution is the microprocessor, an incredibly minute computer that is finding virtually unlimited application. Its ability to process vast amounts of information in mere nanoseconds, and at a low cost, continues to astound even those intimately involved with its development.

This revolution has been closely watched by the Electrical Engineering department at the University of Missouri-Columbia, and it is with cognizance of its importance that the idea of a Bachelor's program in Computer Engineering was formulated.

It was during the 78-79 school year that the decision to devise such a degree program was made. This decision was made in response to:

1) The high demand by society for engineers with computer training.

2) The strong interest shown by current engineering students.

3) The national trend to offer degrees in this specialty area.

UMC's program will be the first in the state and one of the few in the country. This decision necessitated meetings on curriculum planning, program objectives, and, last but not least, budget considerations. Now, over two years later, it has finally been approved.

Those two years have seen a concerted effort on the part of former EE department Chairman John Rouse, Interim Chairman Charles Slivinsky, and the department's Computer Engineering Division. Most notably, leadership came from William McFarland, Huber Graham, and currently, Michael Devaney; each of whom has served as the EE department's Coordinator for computer activities.

The program, which will be an expansion of the current emphasis area within the EE program, is planned to start with the Winter '82 semester. There is one complicating factor, however. The program cannot receive accreditation until at least one student is graduated and the degree program is examined and approved by the National Accrediting Board for Engineering and Technology. The earliest date the Department expects accreditation is Fall '83. Accreditation is

(cont. from pg. 16)

vitally important to graduating engineers because Professional Registration is only available to those who graduate from accredited programs. All programs currently offered in the College of Engineering are accredited.

Until accreditation is granted, graduates of the Computer Engineering program will also be asked to complete the Electrical Engineering program. This will require 12 hours (with careful scheduling and selection of electives) beyond the 126 required for the BSEE degree. The end result will be a joint BSEE/BS CompE. This dual degree will take approximately nine semesters to complete. Tentative schedules may be picked up in the EE Undergraduate office.

Graduates of this program can expect to find careers in design and application of computer systems with many of the over 200 firms who interview at UMC each year.

tv signals

(cont. from pg. 14)

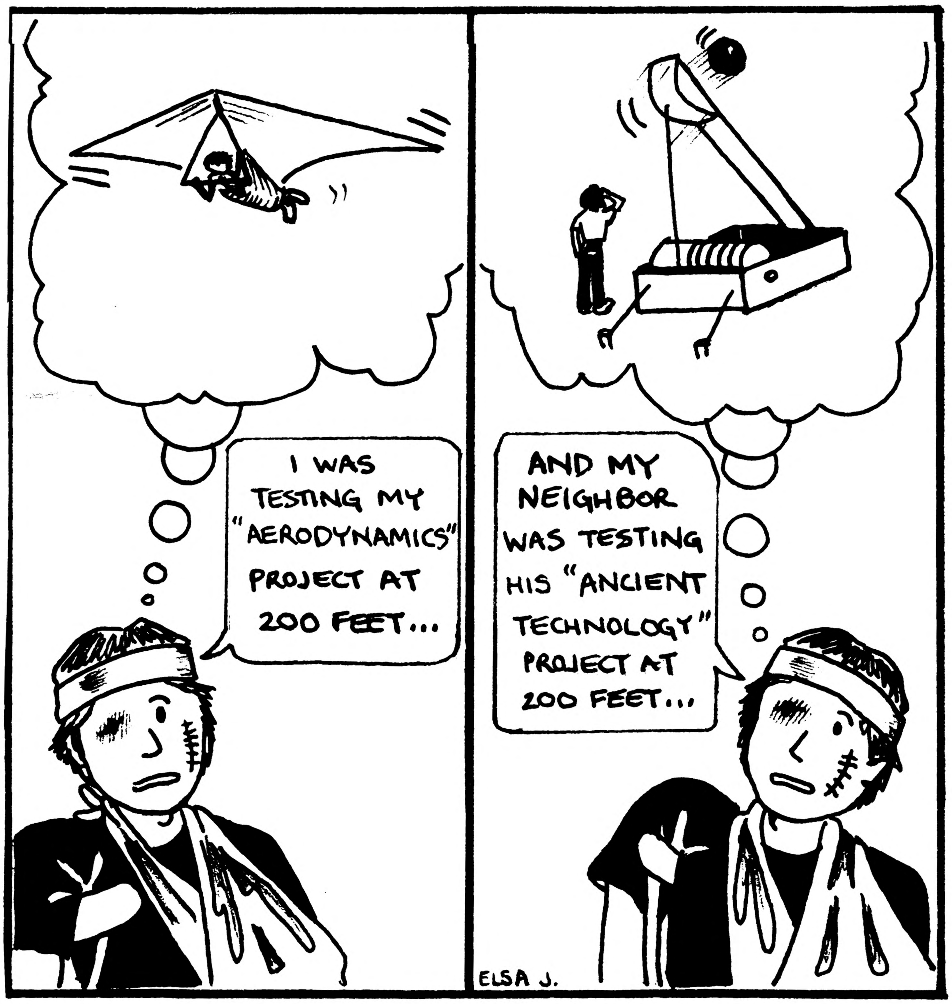
Another development, not to be overlooked, is the DBS system discussed earlier. DBS offers the ability to reach more viewers in outlying and fringe areas than traditional TV, as well as attracting more viewers because of its greater variety of programming. There may come a day when even the Big Three will make programming available on DBS. At the rate which things are going, that may be their only way to stay competitive!

Those who desire more information about satellite TV in general, or specific information on how to set up a home TVRO system, may wish to consult the sources listed below. Satellite TV is certainly here to stay, and what the future holds only time will tell.

Radio-Electronics magazine – news about new developments in satellite technology, as well as practical how-to information.

SPACE – the Society for Private and Commerical Earth Stations. A trade association open to both individuals and commercial satellite users. (SPACE, 1527 O Street NW, Washington, D.C. 20005)

Satellite Television Technology, Inc. – publishers of several detailed technical books on satellite TVRO equipment. (P.O. Box 2476, Napa, Calif. 94558)



a UMC degree the kansas city way

by Jeffrey L. Scruggs

In the fall of 1964, the University of Missouri-Columbia began offering graduate courses in electrical engineering as an extension service with UMKC. The program has expanded since 1964, and now a student can earn a master's degree from UMC in civil, electrical, industrial, and mechanical engineering while attending classes in Kansas City. In addition, a bachelor's degree can be earned in civil, electrical, and mechanical engineering.

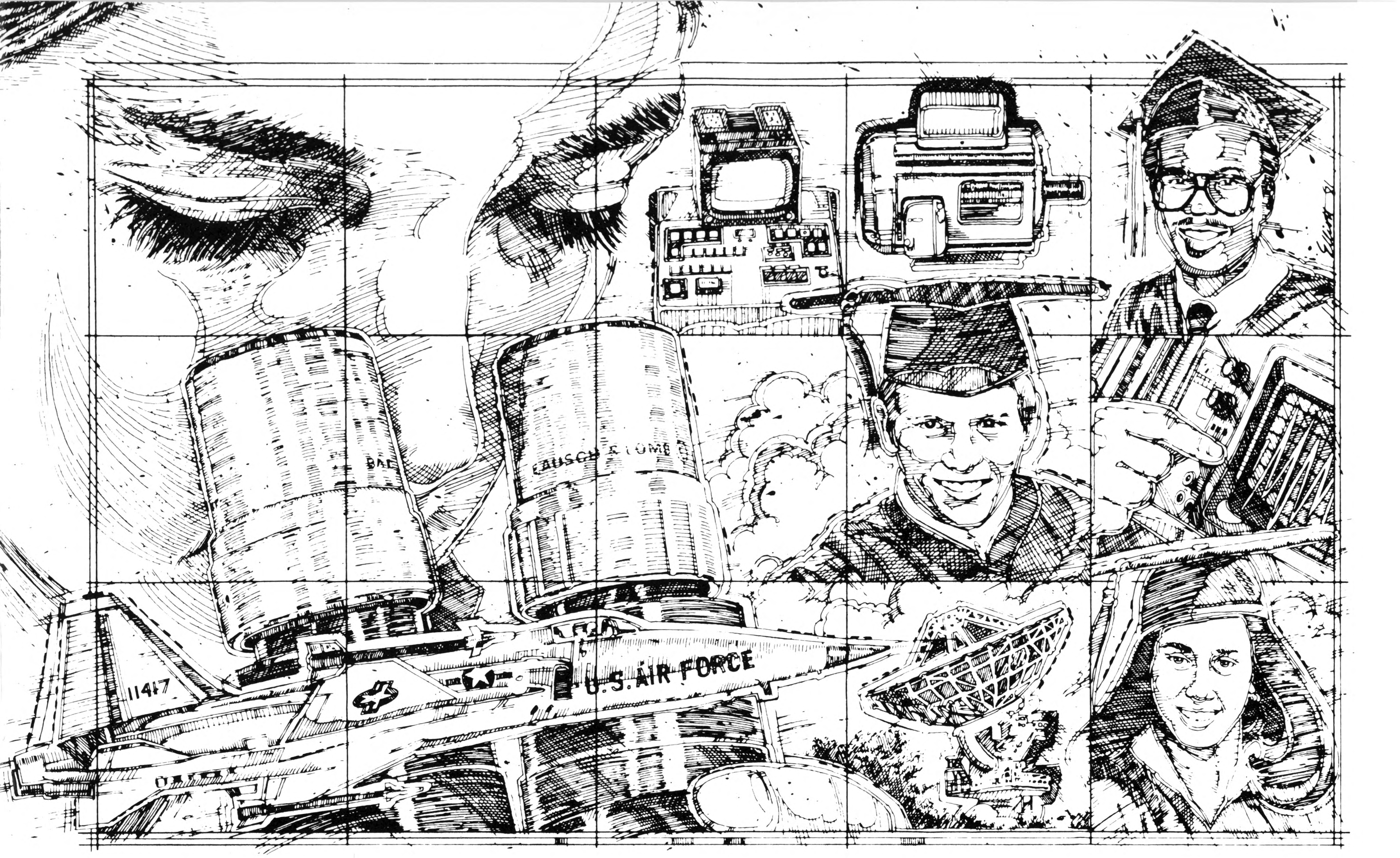
According to Prof. James Beauchamp, Director of UMC Continuing Engineering Education, the graduate program in Kansas City was started because industry in the Kansas City area felt that there was a need for an engineering school where their employees could continue their education. Since 1964, the graduate program has been geared toward meeting the needs of engineers who are employed in and around Kansas City.

For the past three semesters, the enrollment has been stable at approximately 225 graduate students per semester. The majority of these students are in the electrical engineering and civil engineering degree programs. In the seventeen years since the graduate program was started in Kansas City, more than 400 students have received their master's degrees from UMC's Kansas City extension program.

Each semester approximately twenty graduate courses are offered. These courses are divided between the four disciplines taught in Kansas City. The classes meet once a week for three hours in the evening. This makes it easier for the working engineer to attend. The professors who teach these courses come from three different sources: 1. UMC faculty who travel to Kansas City; 2. fifteen faculty members who live in Kansas City; and 3. adjunct faculty from companies in the Kansas City area. The adjunct faculty members work for companies in the area and are also hired by UMC to teach part time. Although they make up only a small part of the faculty, their practical experience makes them very valuable, and qualified, instructors.

By taking two courses per semester, an engineer can complete the thirty hour master's program in five semesters. Most students, however, take three to four years to complete the program.

Because the graduate program in Kansas City is an extension program of UMC, student fees are expected to cover most of the costs of the program, according to Prof. Beauchamp. Thus, the recent budget cuts that have affected UMC have had less of an impact on the Kansas City program. However, student fees are scheduled to increase in the fall of 1982 from the present $70 per credit hour to $82 per credit hour. Most employers reimburse their employees for at least part of these fees, thus continuing the tradition of industry support for the graduate program. As long as this support continues, UMC's Kansas City graduate engineering program will continue to serve the needs of engineers and industry in the Kansas City area.


U.S. AIR FORCE
11417

thought gallery

by Curtis Cannell

DECIPHER THIS
CURIOUS LETTER

Friends Sir, friends

stand your disposition;

'I bearing

a man the world

is whilst the

contempt,

ridicule

are

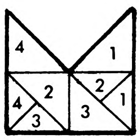
ambitious

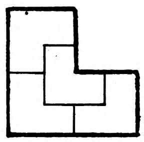
Using eight 8's, arrange them so that their sum equals 1000.

Given: A) Three cans of 8, 5, and 3 pints.
B) The 8 pint can is full of beer.

By filling, emptying, and refilling the three cans, accurately divide the 8 pints into two equal portions.

ANSWERS to previous issue's graphical problems.





ANSWERS
A curious letter:
"Sir, between friends, I understand your overbearing disposition; a man even with the world is above contempt, whilst the ambitious are beneath ridicule."

ANSWERS
888+88+8+8+8=1,000

BEER PROBLEM SEQUENCE

8-pt	5-pt	3-pt
8	0	0
3	5	0
3	2	3
6	2	0
6	0	2
1	5	2
1	4	3
4	4	0

Frustration Cubed

Rubic's Cube is an innocent-looking, three-dimensional puzzle that has taken the world by storm. It was invented by the Hungarian sculptor, designer, and architectural engineer, Professor Erno Rubik of the School for Commercial Artists in Budapest. Once one starts playing with this grown-up toy, unexpected things begin to happen. The player becomes entranced by the small cube, the palms become sweaty, anger and confusion set in, and within a couple of hours ego loss and resignation are complete.

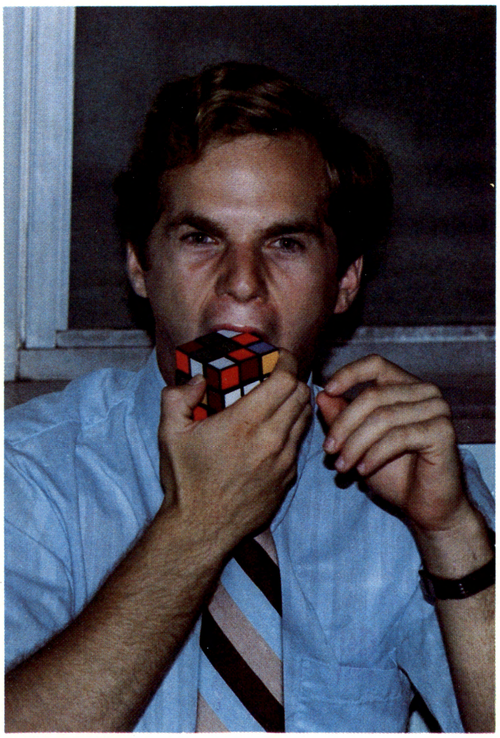
The Cube looks like a solid block of twenty-seven small cubes ingeniously linked so that each layer of nine cubes can be rotated about its center without the whole thing falling apart. Developing an internal mechanism to accomplish this task was a feat in itself. The six center pieces are attached to the middle by spring-loaded spindles, and the eight corner pieces and twelve edge pieces have plastic flanges which allow the layers to turn but prevent them from coming apart.

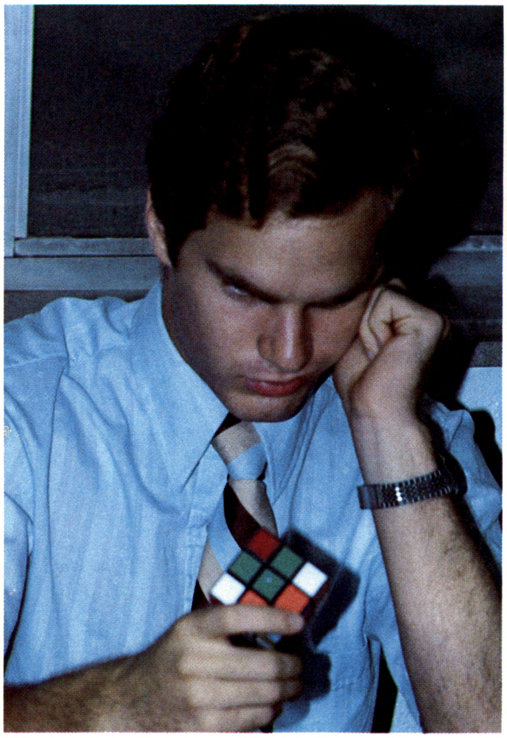
Initially, each side of the Cube contains a different color with that color being on all nine smaller squares which comprise a side. After a few turns, the Cube becomes a colorful mess that only a handful of bright people will ever be able to solve unaided. To come to the solution by mere guesswork is all but impossible. The total number of different patterns that this incredible little object is capable of producing is precisely 43,252,003,274,489,856,000. Even if one could look at the thousand patterns every second it will still take over a thousand million years to see them all.

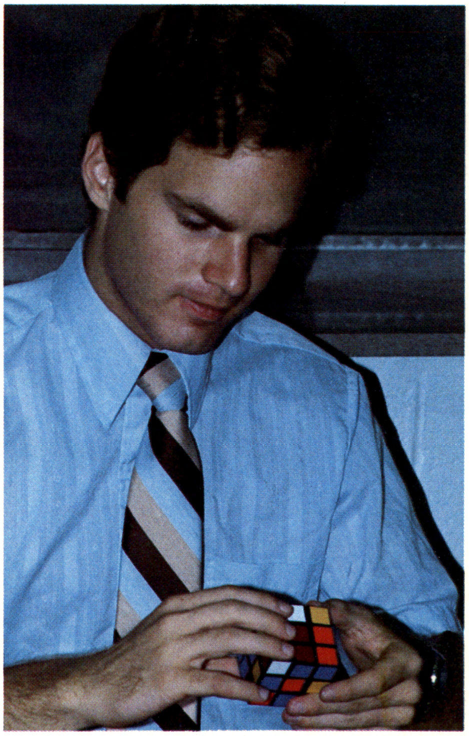
Solution booklets are available now with recipe-like instructions on how to solve the Cube. This, of course, defeats the challenging purpose of the puzzle. Some people memorize certain strings of moves and are able to solve the puzzle in less than two minutes.

It is also possible to take the Cube apart using just a screwdriver. If the Cube is taken apart and put back together so that just one piece is backwards, it will be impossible to solve the puzzle. An unsolvable puzzle should be given to every person who solves the puzzle by cheating. The **Shamrock** would like everyone to do their part in keeping cheaters off the streets.

photos by Greg Gorman







by Deann Yotter

Minorities in Engineering

The College of Engineering at UMC has an active program which is geared toward seeking out and educating competent minority engineers. This program, which was formally initiated in 1974, has been developed with considerable assistance from engineering industries.

Undergraduate minority enrollment has increased from 38 students in the Fall of 1974 to over 100 in the Fall of 1981. The program activities are designed to assist the minority student in successfully completing the engineering curriculum. Some of the program components include: financial aid, free tutoring and counseling, activities to assist in adjusting to campus life, seminars and workshops designed to improve study skills, and motivational activities.

Scholarships are awarded each year to outstanding freshmen and upperclass minority students. Freshmen scholarships are based upon high school performance and national test scores, and upperclass awards are based upon successful academic performance in the engineering program. Funds for these scholarship awards come entirely from industrial contributions. Minority engineering scholarships totaling approximately $64,000 have been awarded to 45 students, 15 freshmen and 30 upperclassmen, during the 1981-82 year.

A more detailed annual report for the Minority Engineering Program may be obtained from the minority Engineering Program Director, College of Engineering, University of Missouri-Columbia 65211.

Fellowship available to CE and AE grads.

The American Institute of Steel Construction, the national organization representing the structural steel fabricating industry, will be awarding, in 1982, a maximum of eight graduate study Fellowships of $4,750 each. The grants will be awarded to graduate civil or architectural engineering students proposing a course of study, toward an advance degree, related to fabricated structural steel.

A.O. Wilson, Jr., President of A.O. Wilson Structural Company, Inc. and Chairman of the AISC Committee on Education, said that, "The purpose of the 1982 Fellowship Award Competition is to encourage expertise in the imaginative use of structural steel for bridges and buildings and to motivate students toward the pursuit of new ideas which will improve the technology of steel construction and benefit the nation through lower construction costs which will provide more funds for vital projects."

To be eligible for the Fellowship Awards applicants must be: senior or graduate civil or architectural engineering students, accepted by an ABET accredited college or university offering a graduate structural engineering degree program, and United States citizens.

Fellowships will be awarded on the basis of the candidate's proposed course of graduate study, scholastic achievement, and the recommendation by the engineering college faculty.

Applications for fellowships are available at the Civil Engineering Department and from the AISC Education Foundation, 400 N. Michigan Ave., Chicago, Illinois 60611. The deadline for receiving applications is February 1, 1982. The names of the winners will be announced by February 15, 1982.

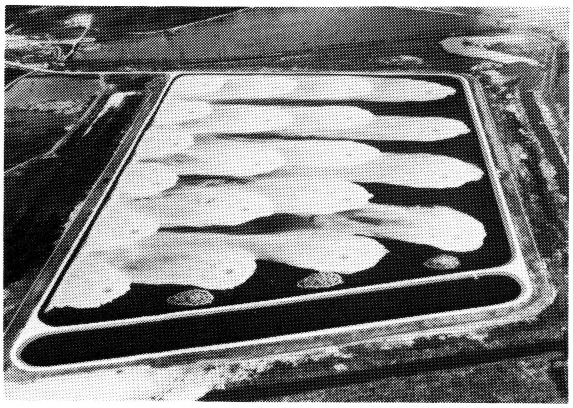
How to pick a company

International Paper—a company that hires more graduating engineers than all other disciplines combined—offers some advice on one of the toughest decisions you'll ever make.

Look for a real challenge.

Engineers are most important to companies with real technical problems to solve.

At International Paper, engineers in every discipline... electrical, chemical, mechanical, industrial, civil, computer science, and more... face challenges like these in the 1980's: How to bring paper mills built fifty years ago into compliance with tough EPA standards... how to conserve energy in a process that's more energy-intensive than aluminum... how to design automated packaging systems to match the speed of today's production lines... how to reduce waste and squeeze maximum value out of an evermore-costly fiber resource.



Tougher clean air and water quality standards require innovative approaches.

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Try to join an industry leader.

A company's size and strength affects the resources you have to work with, the impact your work can have, and the range of opportunities available to you.

International Paper is near the top ten percent of Fortune's 500 list, with sales of over $5 billion in 1980. IP makes more paper than all of Scandinavia—more than any other company in the world. We're the world's leading producer of paper packaging, and a growing force in solid wood products. IP is also the world's largest private owner of forestland, with over seven million acres. Every share of IP stock

Engineers find important challenges at International Paper.

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A new Technical Career Program orients you to IP, exposes you to the many technical career paths available, and helps you select successive job assignments that match your talents, experience, and interests with the needs of the company. From the beginning, both on-the-job and formal classroom training help you to improve your own abilities and build a rewarding career. And you choose your own long-term direction—a continuing and expanding role in science and technology or a move into managerial ranks.

Opportunities for top quality engineers are available in corporate engineering operations, our two U.S. R&D laboratories, and at our many plants and mills throughout the country... from Androscoggin, Maine to Mobile, Alabama to Gardiner, Oregon.

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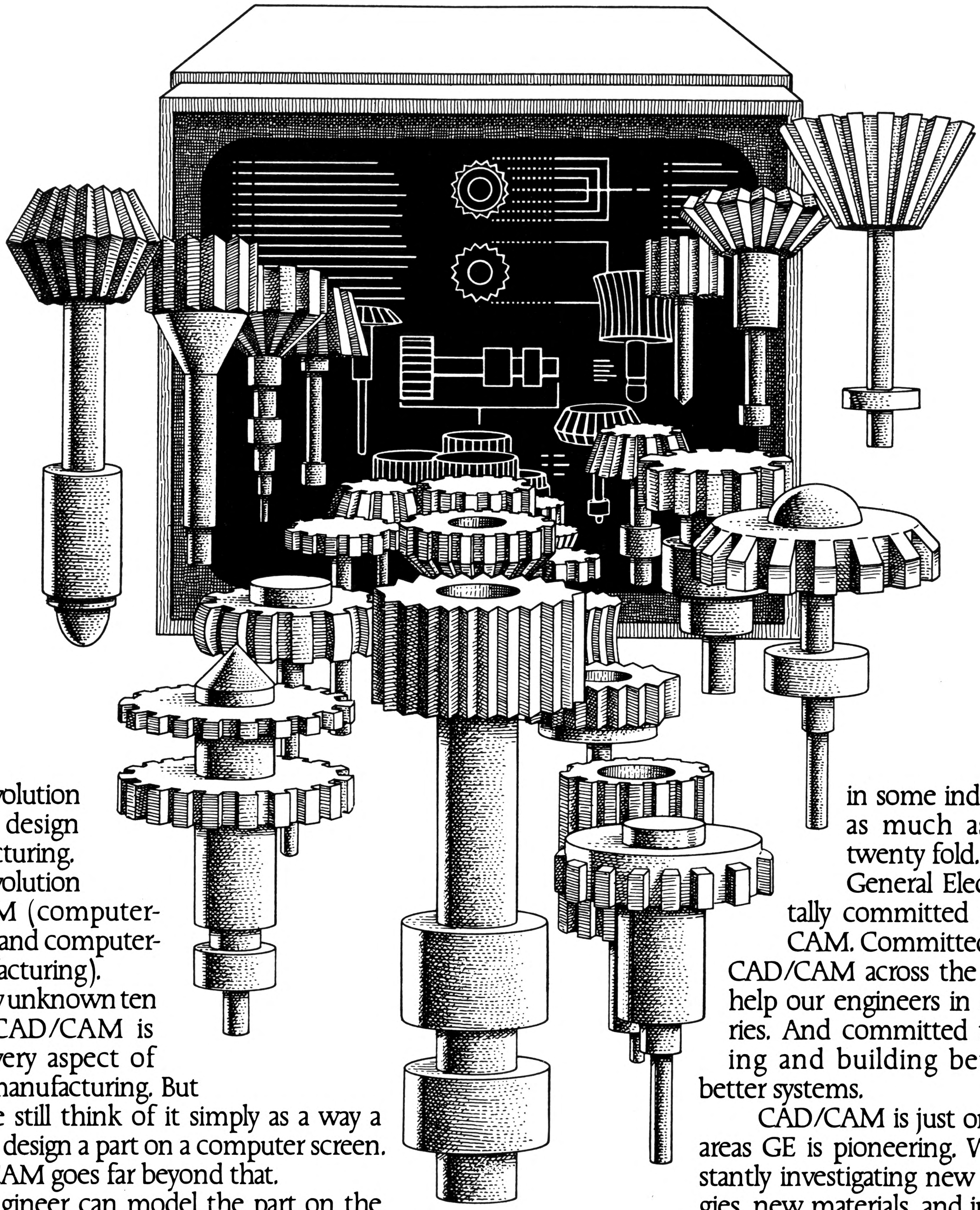

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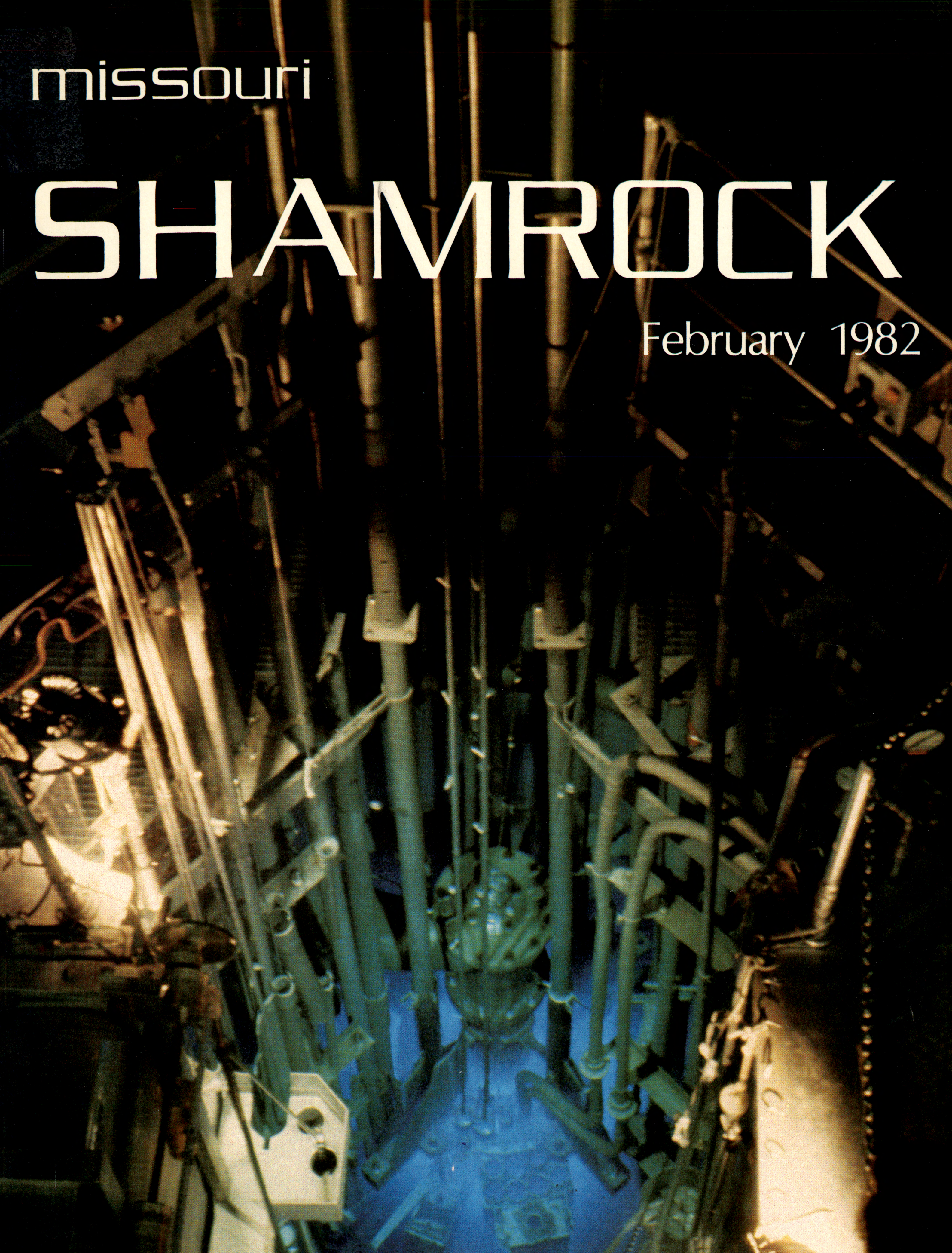
SHAMROCK

February 1982



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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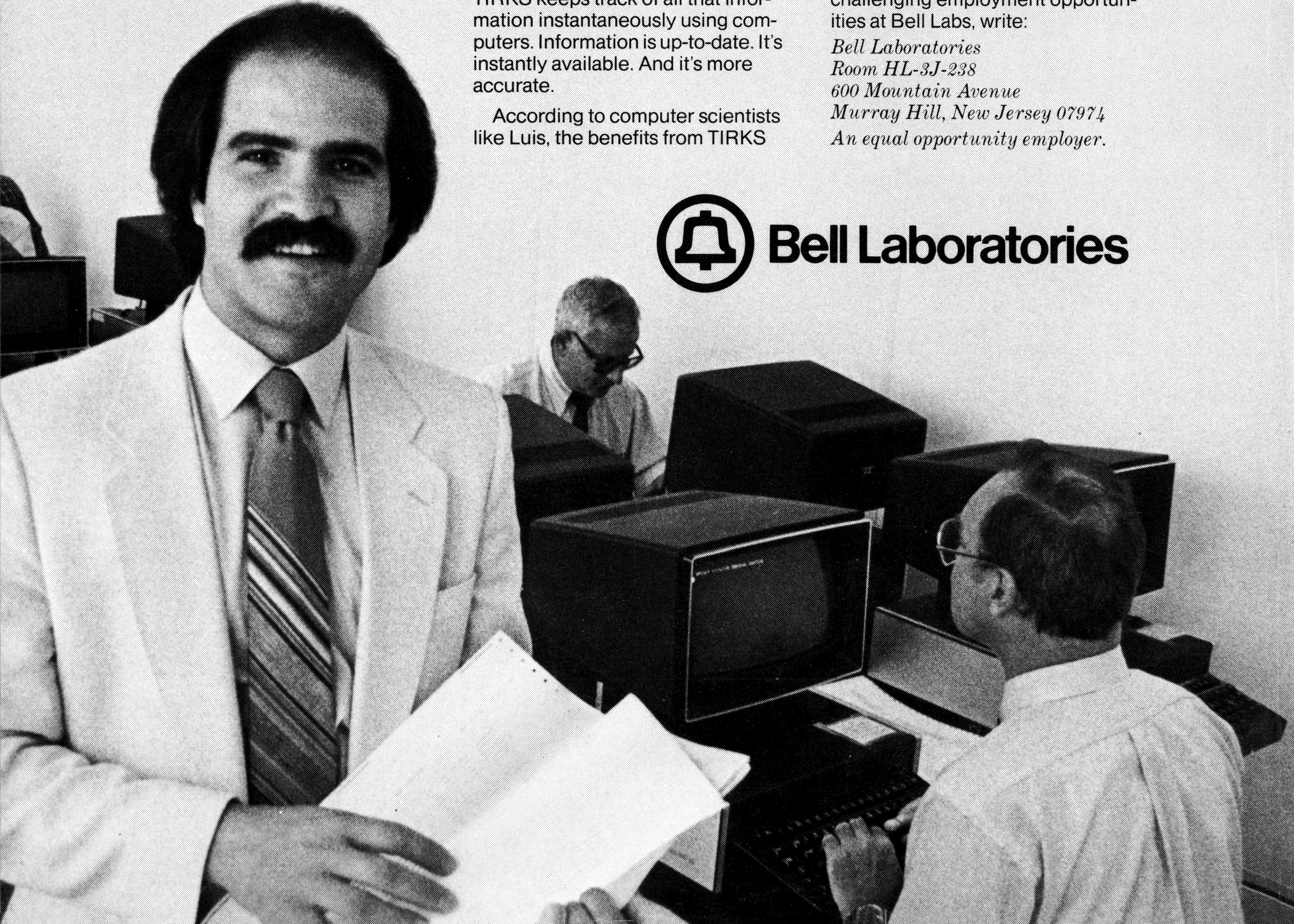

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SHAMROCK

UMC's Engineering Student Magazine

February, 1982

Vol. 75 No. 3

On the cover: The core of the Missouri University Research Reactor (MURR). Photo by Greg Gorman.

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staff

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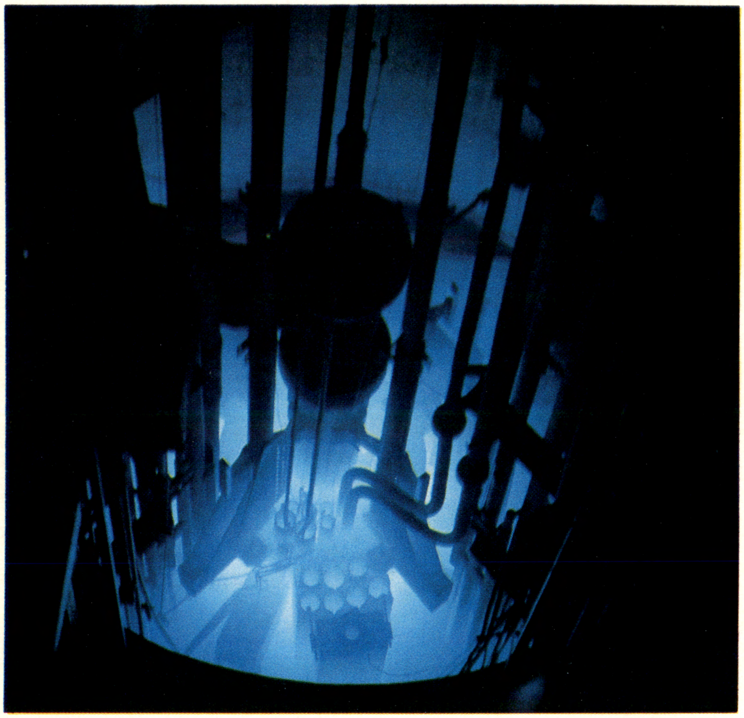


photos by Greg Gorman

MURR: More Than Just a Reactor

by Curt Cannell

The University of Missouri Research Reactor (MURR) was built in 1963 at a cost of $3.4 million. Since its beginning, it has proven invaluable and the University has had a first rate classroom for students. Students, however, are not the only people using the facility. The reactor assists researchers in all academic disciplines related to nuclear energy and its applications. Scientists are conducting numerous experiments day and night with the help of MURR's comprehensive support facilities.

MURR is the highest powered, highest flux university research reactor in the U.S. The facility provides intense sources of neutron and gamma radiation. Experimenters throughout the University system conduct research at the reactor. The facilities are also available to other universities, the government and industry.

Because MURR was intended for research, it was designed differently than power reactors. By using Callaway County nuclear power reactor as a comparison, the differences are obvious. The Callaway power reactor is rated at 3000 MW with a core measuring 12 feet high and 14 ft. in diameter, and operating at 600 degrees F. The research reactor is rated at 10 MW with a core measuring 2 ft. high and 1 ft. in diameter and operating at 120 degrees F. At Callaway the pressure of the primary system is 2250 psi. while MURR has only 70 psi. These differences are only because of the intended uses. Callaway needs to efficiently produce electricity and MURR needs only to produce radiation for experiments.

. . . the research continues 24 hours each day.

The fuels of the two reactors are also different. Because the research core is relatively small, it needs a higher density of Uranium-235. This is the substance from which the fission power is derived. However, Uranium-238 is what occurs most often in nature and U-235, an isotope, is found in amounts of 0.7% in this substance. Power reactors have U-235 enriched to 3%, but MURR has it enriched to 93%. This enrichment is necessary to sustain a critical reaction, otherwise the high surface to volume ratio of the small core would allow an excessive number of neutrons to escape, thus not sustaining a fission reaction.

Unlike power reactors, MURR has a Beryllium shield encircling the core to reflect neutrons inward. Because of their size, power reactors do not worry about neutrons lost out their sides.

The neutrons cause U-235 to fission, releasing a total of 10 MW of power in the research core. The core is cooled by water in the primary system and a secondary system dissipates the heat in a wet cooling tower outside. The pool also absorbs some heat (7%) but acts mainly as a radioactive shield.

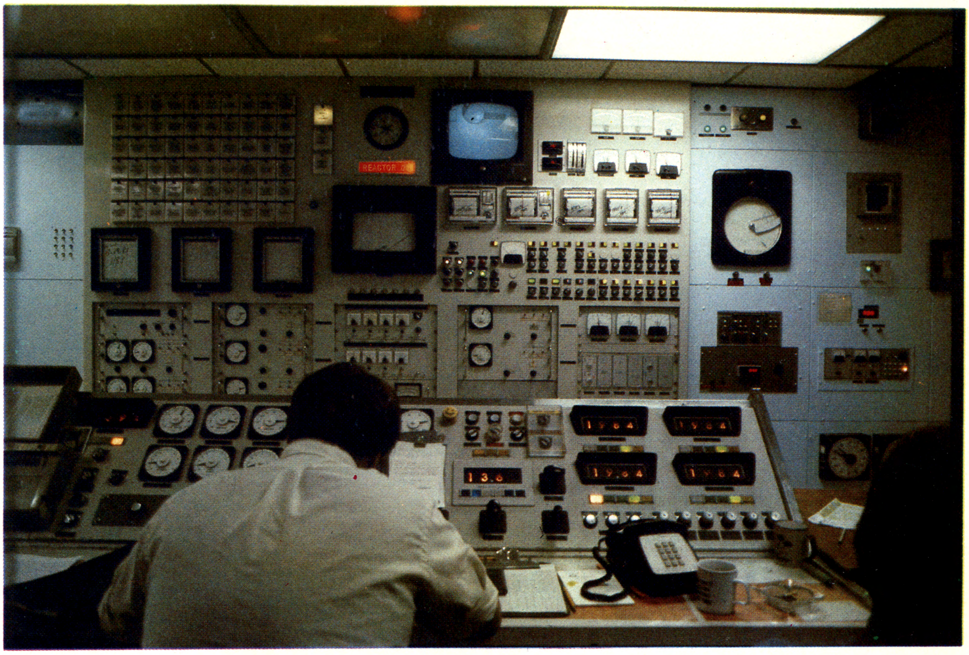
Cerenkov radiation is the blue glow observed around the core during operation. Free electrons, travelling faster than the speed of light (in water) collide with water molecules, causing photons to be released in the bluish-white wavelength.

Basically there are five methods of using the neutron radiation. These include a central thimble, a thermal column, six beam ports, twelve irradiation baskets, and four pneumatic tube (P-tube) systems.

The P-tubes accomodate specimens that are 1 inch in diameter and 4 inches long. The tubes carry the samples directly into one of four locations within the core. Each location has a different neutron flux. The highest flux in the core is $6x10^{14}$ neutrons per cm^2 per second.

The irradiation baskets are simply attached to the outside of the core where flux is less but still effective.

The beam ports are in the beryllium shield and are directed radially outward to experiment stations on the floor of the containment building. Beams are used in diffractometers, spectrometers, and other sophisticated devices.



The variety of research projects is amazing.

The thermal column is used for neutron radiographics. Neutrons enter the large graphite reflector surrounding the core, are slowed, and then directed towards a special photographic plate.

The central thimble allows specimens to be lowered into the center of the core via a vertical tube.

The five methods listed above are available because projects require varying types of neutron radiation. The variety of projects is amazing. In the past the facilities have even been used to analyze evidence from criminal trials. Listed in the following paragraphs are nine major areas of research at MURR. A few have commercial applications generating income supplying close to half the operating costs.

Radioisotopes made at the reactor are widely used in medicine and industry to examine internal organs, or for radiation treatment.

Neutron Activation Analysis (NAA) is a sensitive method of measuring trace amounts (10 micrograms and less) of many elements. This technique is quite often used in the life sciences, environmental technology and natural resources to follow chemicals in animals or the environment.

Nuclear Science, Inelastic Scattering and Neutron Diffraction all use neutrons to examine the nuclear and molecular structure of atoms in addition to their nuclear properties.

Neutron Properties simply studies and clarifies the basic properties of neutrons.

Radiation Effects Applications investigates the effects produced by irradiating living or non-living materials with neutrons, gamma rays, electrons or ions. Fatigue studies on radiation-damaged reactor metals was recently studied. Other applications include production of hybrid plants.

Students can become involved with MURR.

Neutron Radiography uses neutrons to take pictures, in a manner similar to the use of X-rays. Neutron radiography complements X-rays by imaging materials not contrasted by X-rays.

Nuclear Engineering uses the reactor facility for research and education.

Students can become involved with MURR in a variety of ways. Nuclear Engineering is a direct path, but for students wanting a less vigorous regimen there are classes and part time jobs available.

Nuclear Engineering offers NE301, NE305, NE315 and NE346 for students from other engineering fields interested in basic principles. Mechanical Engineering offers MAE300, a problems course. Students in this class gain practical experience and knowledge of real world engineering by designing support equipment for the reactor.

Experience is the best teacher, and many students are learning by holding full or part time jobs at the reactor. Last year, there were 33 graduates and 42 undergraduate students working with reactor services.

MURR is the highest powered university research reactor in the U.S. It is world renowned. It is productive. It provides vital services; and, although the doors close at night and the students return home, the research continues 24 hours each day.

FAR LEFT: The blue glow around the core is known as Ceren Kov radiation.
ABOVE: MURR's control room is staffed 24 hours each day by trained personnel.

Engineers Week—A 79

by Ron French

It has been recorded, "It all began in 1903. On a balmy spring day in March, a small group of Engineering students decided that the length of time between vacations was entirely too long; and since they had to attend classes six days a week while all other schools only had classes five days a week and their academic load was also much greater when compared to the other schools, they concluded that an impromptu vacation was definitely in order.

Grasping at this opportunity to escape their classroom boredom, this inspired, imaginative group discovered that St. Patrick's Day was fast approaching and decided that it would be an ideal day for a rest. So they declared St. Patrick to be the Patron Saint of Engineers through the following logic;

1. St. Patrick drove all the snakes out of Ireland.
2. A snake is nothing more than a big worm.
3. Chasing the snakes out of Ireland was, therefore, a "worm drive."
4. Engineers do indeed make worm drives.
5. St. Patrick was, therefore, the first Engineer.

On March 17, 1903, the entire Engineering student body cut classes and gathered in front of the Columns to celebrate St. Patrick's Day. St. Patrick, himself, made his first official visit in 1905 and set a precedent by knighting his loyal followers.

"St. Patrick is to engineers as St. Valentine is to lovers."

Today, that one original day has expanded into more than a week of activities for students, faculty and alumni. Many other colleges and universities across the nation, sensing a good thing, have since adopted the UMC tradition, making St. Patrick to Engineers what St. Valentine is to lovers."

The week will start off Saturday, March 28, 1982, with the second annual 5000 meter run. The afternoon will be highlighted by the ROAD RALLY. Queen candidates will be located at each of five check points giving directions and a poker card. Participants can win by obtaining the best time through the maze or by collecting the best poker hand.

"The length of time between vacations was too long."

Monday will be the day of the traditional Campus Stunt, judging of the beard contestants, and student-faculty fun and frolics.

Everyone looks toward the campus stunt committee to provide the mood for the week's activities. This year the committee will start off St. Pat's Week with the Ping-Pong Ball Drop. The ping pong balls can be redeemed for prizes.

The beard contest is divided into two divisions. The first division is for freshmen, sophomores, and juniors; the second division consists of seniors, graduates, faculty, and staff. Cash prizes will be awarded for first and second place respectively in each division.

The Student-Faculty Fun and Frolics is put on to allow both engineering students and faculty to display their talents. Participants in the past have performed as individual or group acts with no limit on size. Past acts have included barber shop quartets, vocal and instrumental solos, bands and various comedy acts.

As the days go by, Engineers' Week is getting closer and closer. Consequently, the Professor-for-a-Day activities are drawing closer also. These activities are held on Tuesday and Wednesday of Engineers' Week. During these two days, hopefully, all engineers will have the opportunity to listen to someone from industry lecture and answer questions about the field with which he is involved. This gives the students an opportunity to gain a better understanding of what engineering is all about through visitors' experience and advice. There will be a luncheon on each of these days to honor the guest lecturers.

The Calculator-Slide Rule Contest will be held Tuesday. The event consists of a calculator contest, nonprogrammable and programmable, followed by a slide rule contest. Each contest consists of a set of problems. The problems will emphasize application of common functions found on professional calculators along with speed and accuracy. The most correct answers at the end of 15 minutes wins.

The Queen and her attendants are chosen from the women's residences on the University campus. A few of the things the queen finalists will be doing are riding in the parade, helping judge the beard contests, and serving food at the barbeque. Perhaps the biggest event they are involved in is the Queen Skits held Wednesday evening. Each finalist will put on a skit, in conjunction with her living unit, which she has prepared.

"Each Queen' finalist will put on a skit."

This year's celebration will be climaxed with the coronation of the Engineering Queen at the St. Pat's Ball Saturday evening. The newly crowned queen will then represent the Engineers' Club for the following year.

The girls will be available for radio and TV interviews the week prior to and the week of Engineers' Week. Also, they will be spending their spare

Year Old Mizzou Tradition

time during Engineers' Week working with Engineers in the booths in Electrical Engineering and Engineering selling tickets to the Week's events, hats, shirts, buttons, etc.

The barbeque is traditionally one of the biggest events in Engineers' Week. The attendance, usually between 400 and 500, includes students, their dates, faculty, staff, friends of the College of Engineering, and, of course, the queen candidates.

The exact location of the barbeque is supposed to be a secret until the afternoon of the event, but rumors float for some time beforehand. Rumor has it that the event will be held at the "Road Apple" this year.

"The location of the barbeque is a secret."

The food is served by the queen candidates, and usually includes barbequed ham or beef on hamburger buns, baked beans, potato salad, potato chips, and plenty of the necessary liquid libation. After dinner, musical entertainment will be provided.

The Knighting Ceremony is the oldest and most colorful of all the engineering traditions, dating back to 1905. It is the time St. Pat appears to knight all engineers who have given an outstanding amount of their time to make Engineers' Week possible and also to knight those engineers who have been active in the school of engineering and have worked to better the school, be it as a club president, a member of a club, or just a student. It is truly an honor to become a Knight of St. Patrick because it shows that your colleagues respect you and have thought you worthy of the honor. The Knighting Ceremony is held in the early evening on Friday of Engineers' Week.

At present the requirements for knighthood are as follows:

MAGNA CUM LAUDE

Four years in Engineers' Club and/or technical society, at least one year on St. Pat's Board, and a minimum of 60 hours of service in engineering activities.

CUM LAUDE

Three years in Engineers' Club and/or technical society, at least one year on St. Pat's Board, and a minimum of 60 hours of service in engineering activities.

KNIGHT

A minimum of 40 hours of service in engineering activities.

LADY OF ST. PATRICK

A minimum of 40 hours of service in engineering activities.

HONORARY KNIGHT

Any senior who fills out the special petition.

The ceremony itself is both unique and impressive. It is held on a specially constructed platform set up beside the Engineering Building on the Francis Quadrangle. St. Pat arrives, ascends to the platform, and at the tap of his cane, causes the Blarney Stone to appear in a cloud of steam. The candidates for knighthood approach the platform one by one, kneeling to kiss the Blarney stone as St. Patrick

"It is an honor to become a Knight of St. Patrick."

Knights them with his cane. At the conclusion of the ceremony, the engineers present perform the Grand Kowtow by kneeling and touching their noses to the ground before St. Patrick and the Blarney Stone sublime in a cloud of steam.

The Honors Award Banquet should draw as many as one thousand people for an evening of good food, awards, and a speech afterwards. The banquet will be held Friday evening.

During Engineers' Week 1982, engineering units will present laboratory exhibits for the public to view. The units will be competing for the Dean's Trophy which is given for the best lab exhibits.

"The Dean's Trophy is given for the best lab exhibits."

The judges score the exhibits on such attributes as originality and innovativeness as well as on the quality and quantity of exhibits displayed by each unit.

This year the City of Columbia and the UMC College of Engineering are once again working together to coordinate a parade that promises to be bigger and better than ever. Aside from the usual bands and drill teams, the parade will include floats, decorated cars, motorcyclists, clowns, St. Patrick himself, the five Queen finalists, and several surprise stunts.

On the last Saturday of Engineers' Week, the annual Green Tea will be held in the Chancellor's home on the Francis Quadrangle from 2:00 to 4:00 p.m. The event is open to students, faculty, alumni, honor award guests, and friends of the College of Engineering. The Green Tea is sponsored by Engineers' Club and is given with the aid of the faculty wives, and engineering students. Usually attending the tea are the Queen Candidates, the Chancellor, the President of the University and his wife, Dean Kimel and his wife, and Dean Morgan and his wife in addition to many students and their dates or spouses.

Engineers' Week will climax with the crowning of the Queen at the St. Pat's Ball on Saturday night, April 3. The Ball will be held at the Tiger Hotel Ballroom. St. Patrick will appear for the crowning at 10:30 p.m. Tickets may be purchased the week before in the Engineering Building or at the door the night of the Ball. ERIN GO BRAGH!!!!!

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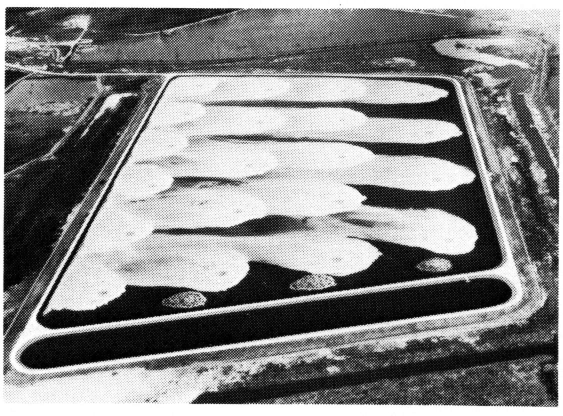

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Engineers find important challenges at International Paper.

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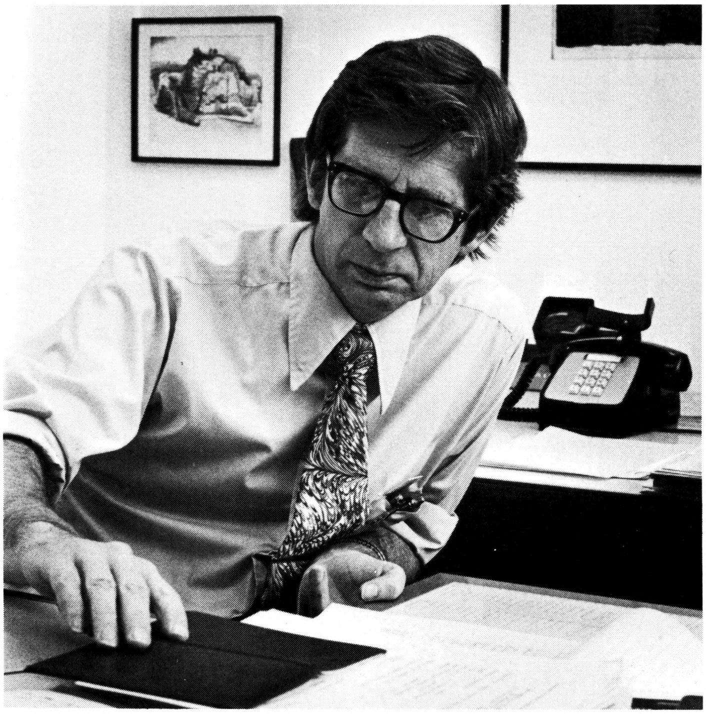
conversation

the SHAMROCK talks to Dr. Meyer

Dr. Walter Meyer has been a member of the UMC faculty since 1972. This month, he talks with Conversation about his job as a professor and chairman of the Nuclear Engineering Department.



by Linda Peterson

Conversation: Dr. Meyer, could you tell us your background and how you became a professor?
Dr. Meyer: I graduated in 1958 from Oregon State University with a degree in chemical engineering. After I received my Ph.d in 1964, I went to work in the nuclear engineering department at Kansas State University where Dean Kimel was the head of the department. I was made an associate professor in 1966 and a full professor in 1968. I came to the University of Missouri-Columbia in 1972 as a professor and chair of the nuclear engineering department.
Conversation: Would you tell us your teaching responsibilities?
Dr. Meyer: I teach Engineering 306 and 346. I also lecture in Engineering 17 and Physics 12.
Conversation: Would you explain to us about the graduate and undergraduate programs in nuclear engineering?
Dr. Meyer: The undergraduate emphasis areas are technical electives taken in the chemical, electrical, and mechanical engineering departments, and also in the physics, chemistry, and agriculture departments. The graduate program has several components including health physics and medical physics. There is also an option program which is a specific degree program approved by the state. Other degree areas are hospital equipment and development and power reactor.
Conversation: Would you describe your administrative and public relations work for the department?
Dr. Meyer: My work is mainly public information—letting the people know the realities of nuclear energy. I am a member of the American Nuclear Society, which provides education and research on peaceful uses of nuclear power. We have no relations with nuclear weapons.
Conversation: Could you tell us about the research going on now at UMC?
Dr. Meyer: We have received a grant from McDonnell-Douglas for fusion energy research. In the summer of 1980 we located three large, superconducting magnets. These magnets are unique because of their size. We are now constructing and testing a system for research. UMC is very fortunate to have this opportunity and the funds to carry on this research.

feature

SHAMROCK's Directory of

by Jackie Fallert

Engineer's Club

The Engineer's Club at the University of Missouri-Columbia was founded in 1903. It was the first Engineer's Club on any campus in the U.S. It is now in its 78th year and is continuing to grow as each year passes.

Throughout its history, the UMC Engineer's Club has sought to improve the quality of UMC engineers by providing speakers from industry, field trips, social events including raquetball parties, skating parties (roller and ice, when possible), Bar-B-Q's and picnics, and softball and football games. The Engineer's Club is predominantly a social organization and there is a $4 fee per academic year to cover party expenses.

The other major task of the Engineer's Club is to plan and coordinate the main engineering event of the year—St. Pat's Week. To do this, we enlist the help of fellow engineers and form a St. Pat's Board consisting of chairmen of various committees involved in making St. Pat's Week a success.

Engineering Graduate Student Association

The primary objective of the Engineering Graduate Student Association is to enhance communication among administrators, faculty, and graduate students within the College of Engineering, and to properly represent the interests of engineering graduate students from all disciplines in decision making processes. To facilitate the accomplishment of this objective, membership has been established on many key College of Engineering committees.

Membership in the EGSA is automatically available to every engineering graduate student. There are no membership fees. Anyone interested in participating in this organization may contact Steve Dunagan, Room 0030 Engr.

Engineering Student Council

The Engineering Student Council has been established as a means of promoting student identification with the College of Engineering, improving student faculty relationships, and evaluating matters related to the College of Engineering.

The student council recommends students for membership on divisional faculty committees. They also recommend the budgetary allocation of income from the student activity fee for purposes of programs and activities within the College of Engineering.

One such program is the Graduating Seniors Recognition Convocation which is held at the end of each Fall and Winter semester. The convocation was inaugurated several years ago by the engineering student body whose members felt that a more personal recognition of their achievements as graduating seniors was more desirable.

Missouri Shamrock

The Missouri SHAMROCK is the College of Engineering student magazine. It is published twice a semester and gives students the chance to write about something which interests them, not their teachers.

There are no regular meetings, though we try to meet once a month (watch for signs). Activities include photo assignments, selling ads to local businesses, working with layout, and, of course, writing. Anyone interested in participating in this exclusive organization may contact any of the staff members listed on page 3.

Society of Women Engineers

The Society of Women Engineers is a professional organization that is associated with a national chapter. It meets once a month, and the meetings usually consist of a short business meeting followed by a guest speaker.

SWE also sponsors a Christmas party every December. Last year it was held at Assistant Dean Morgan's house and proved to be a good time for all.

As a new project this year, SWE sponsored a Career Day where representatives from industry came in and participated on panels answering questions on such subjects as plant trips, resume writing, interviewing techniques, taking the EIT and PE exams, summer and CO-OP jobs, and career goals.

Elections for new officers will be held at the April meeting. It is very important that we have a good turnout for this meeting. Women interested in running for office will be asked to give a short speech stating why they would like the office they are petitioning for.

The SWE spring banquet will be held in April. Awards for the most active member and a $100 scholarship will be presented at that time.

Applications for membership are still being accepted—so stop by the Dean's office and pick one up—or call Susan Fleming at 875-4403 and get involved with SWE, it's a lot of fun! P.S.—Guys are welcome too!

American Society of Agricultural Engineers

The American Society of Agricultural Engineers is an organization of agricultural engineering majors. Its purpose is to promote interests, education, and fellowship among stu-

Engineering Organizations

dents of agricultural engineering.

Activities of recent past years include lab exhibits during Engineering Week, restoration of antique farm equipment, participation in antique tractor pulls, hayrides, parades, construction of a model bridge for the Missouri Highway Department, an annual banquet, and trips to state, regional, and national meetings.

Meetings are held on the second and fourth Tuesday of each month. The annual national dues are ten dollars. Two dollar local club dues are requested for all members after one year of membership. Anyone interested in more information about the club is encouraged to contact any of the Agricultural Engineering faculty or any of the club members.

Alpha Epsilon

The Alpha Epsilon Honor Society functions to give recognition to those agricultural engineers showing qualities of good character and scholarship, and to encourage and support improvements in the Agricultural Engineering profession. Members are elected from juniors whose cumulative GPA is in the upper quarter of their class in the College of Engineering and seniors whose GPA is in the upper third of their class in the College of Engineering. The initiation fee is $10.

American Society of Civil Engineers

ASCE is the student chapter of the American Society of Civil Engineers, the oldest professional engineering Society. Members are students and graduate students enrolled in the Department of Civil Engineering, but meetings are open and all faculty, students and interested persons are encouraged to attend.

The purpose of the organization is to promote a spirit of congeniality between its members, provide an opportunity for students and faculty to become aquainted on a social basis, and aquaint members with the civil engineering profession. Meetings are held the first Monday of each month where a program is presented on a topic of interest to civil engineers.

Dues to the society are four dollars per school year with freshmen and fifth year members being exempted. Any student joining after his or her sophomore year is required to pay back dues with the maximum paid by a member being twelve dollars.

Eta Kappa Nu

Eta Kappa Nu (HKN) is the electrical engineering honor society. The national organization exists primarily to confer honors upon outstanding electrical engineers and organizations, as well as to encourage and to improve the quality of electrical engineering students, teachers, and professionals. The university branch, Iota Chapter, also has as its goals to provide a setting for exceptional EE students to meet in a non-competitive atmosphere, to become better acquainted with the faculty, and to perform services for the department, college, and community.

Each year HKN selects the outstanding EE professor through a student vote, and the outstanding EE sophomore through an application and interview process. These awards are presented at the annual honors banquet during Engineers Week. The winning student receives a HP-41C calculator donated by Hewlitt-Packard.

Initial selection for membership is based on grade point average. The cutoffs are expected to be about 3.0 for seniors and 3.3 for juniors. Members of the chapter also consider a candidate's character and activities before electing him. Invitations will be sent out this year by early February; if you are not invited and think you may qualify, contact us at that time. Lifetime dues are currently $36, which includes national and local fees.

Officers are elected after initiation each semester. The vice-president becomes the president, and new officers are elected to fill the positions of vice-president, recording secretary, corresponding secretary, and treasurer.

Iota Chapter can be contacted through the mailbox in room 203 of the EE Building, or through our advisor, Dr. Robert Combs, 209 EE, 882-7382.

Alpha Pi Mu

Alpha Pi Mu is the industrial engineering honor society, whose main purpose is to recognize outstanding IE students. Applications for admission are sent to those IE students in the top one-third of the senior class and the top one-fifth of the junior class who have a GPA of 3.0 or better. There are no dues, but a one-time initiation fee is required. Meetings are held on the first Monday of every month.

American Institute of Industrial Engineers

The American Institute of Industrial Engineers (AIIE) is a professional organization open to any full-time student pursuing an engineering degree. The membership dues of $10, collected annually, makes a member eligible to receive the Industrial Engineering magazine.

(cont. on page 12)

(cont. from page 11)

The UMC Chapter meets monthly featuring guest speakers from either the faculty or industry. The exposure to industry is enhanced by at least one plant trip each year. In addition, two picnics each year are organized to promote the social interaction of students and faculty. The two main projects sponsored by AIIE are: student advisement during pre-registration and a booth set up in conjunction with Engineers' Week.

American Society of Mechanical Engineers

The American Society of Mechanical Engineers (ASME) student section is a technical organization open to all engineering students. The primary goals of the Society are the advancement of mechanical engineering and promotion of professional awareness and fellowship. Monthly meetings feature speakers from industry who discuss topics and applications in mechanical engineering. The Society also conducts design and paper competitions. Other activities of the student section include picnics and field trips. Currently, there are 124 student members. The yearly dues are eight dollars which include a subscription to Mechanical Engineering magazine and coupons that can be redeemed for technical papers.

American Society for Metals

American Society for Metals (ASM) is a professional organization with Dr. A. Krawitz as faculty advisor for the student chapter.

The Society is formed for the exclusive purpose of advancing scientific, engineering and technical knowledge with respect to the manufacture, processing, selection, understanding and use of metals and other engineering materials.

The student chapter sponsors field trips to producers and users of metals and also sponsors weekly materials seminars.

Student membership fees are $7 per year which includes monthly issues of Metal Progress magazine.

Pi Tau Sigma

Pi Tau Sigma is the National Honorary Mechanical Engineering Fraternity and is a member of the Association of College Honor Societies. The Missouri Epsilon chapter at the University of Missouri-Columbia received its charter in 1925.

The purpose of Pi Tau Sigma is to foster the high ideals of the engineering profession, to stimulate interest in departmental activities, to promote the mutual professional welfare of its members, and to develop in students of mechanical engineering the attributes necessary for effective leadership.

Criteria for membership is based on academic rank, year in school, and character. The top one fourth of the junior class and the top one third of the senior class are eligible for membership. New members are selected twice a year at the beginning of each semester. Lifetime membership dues are 35 dollars.

Activities of Pi Tau Sigma include smokers for new pledges, get-togethers with faculty members, and a spring banquet. Each pledge is also required to make a key which is the insignia of the fraternity. During Engineers' Week, the Missouri Epsilon chapter awards Mark's Handbook to the outstanding sophomore at the Honors Awards Banquet.

For further information, contact Dr. William L. Carson, faculty advisor, at 882-8268.

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feature
club plans

American Society of Mechanical Engineers

ASME Meeting Dates:

Tuesday, February 23
Wednesday, March 24
Wednesday, April 21

A field trip and spring picnic will be decided on by the members.

Society of Women Engineers

For Engineers Week SWE will sponsor the Engineering King contest. Any male engineering student interested in running can pick up a form from the SWE mailbox in the Dean's office. All nominees will be interviewed, and the remaining finalists will be asked to give a skit during Engineers Week. All engineers will then have the chance to vote for the candidate of their choice.

Eta Kappa Nu

Eta Kappa Nu (HKN) plans to conduct an election for the Outstanding EE Professor this semester. We will also be taking applications and interviewing candidates for the Outstanding EE Sophomore, who will receive a HP-41C calculator donated by Hewlitt-Packard. Both of these awards will be presented at the annual honors banquet during Engineers Week. An additional service project or social event is being planned for the semester.

American Society of Civil Engineers

Service project—surveying Little League baseball diamonds in Columbia.
Spring Picnic
Engineer's Week: model span contest
drafting contest
surveying competition

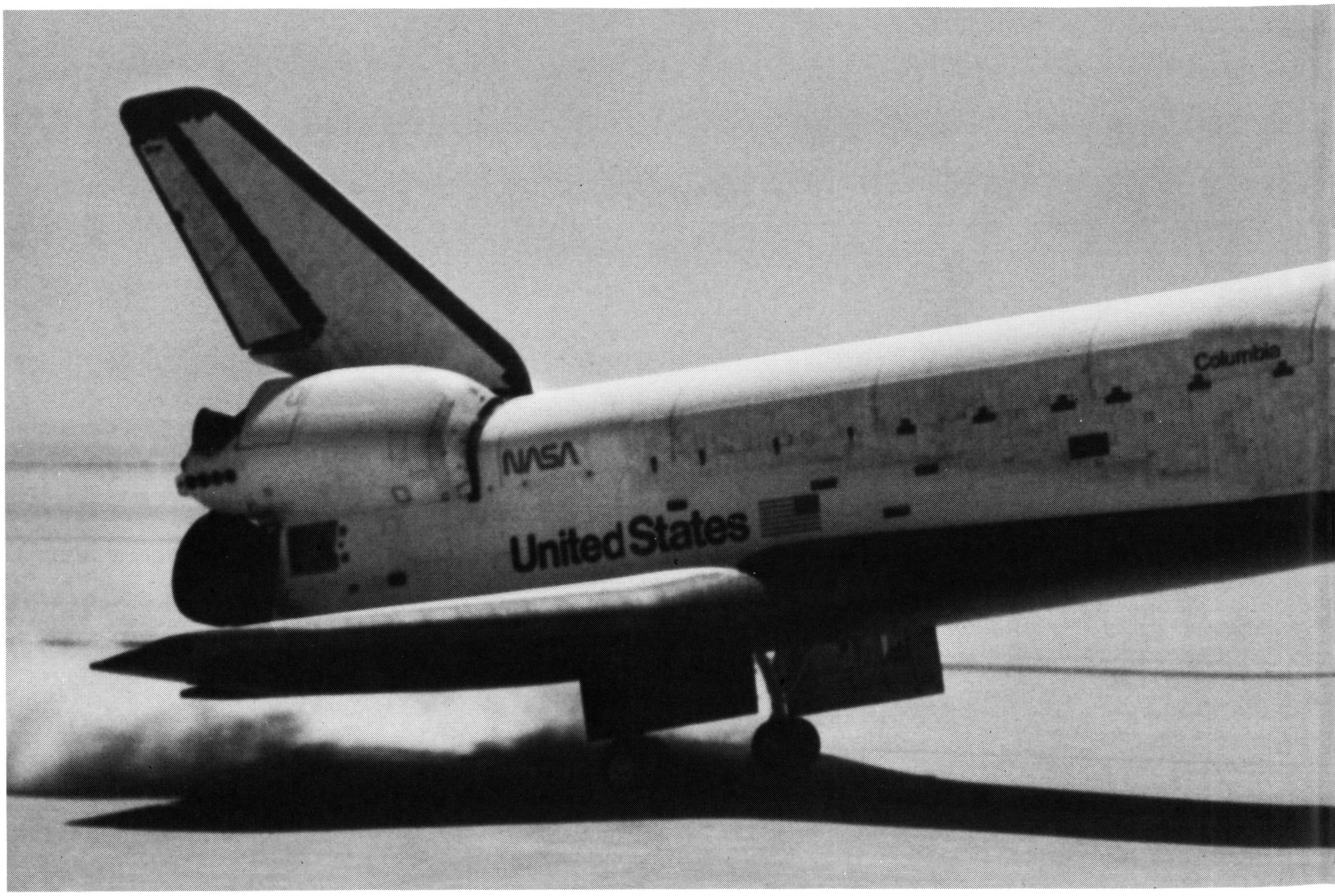
American Nuclear Society

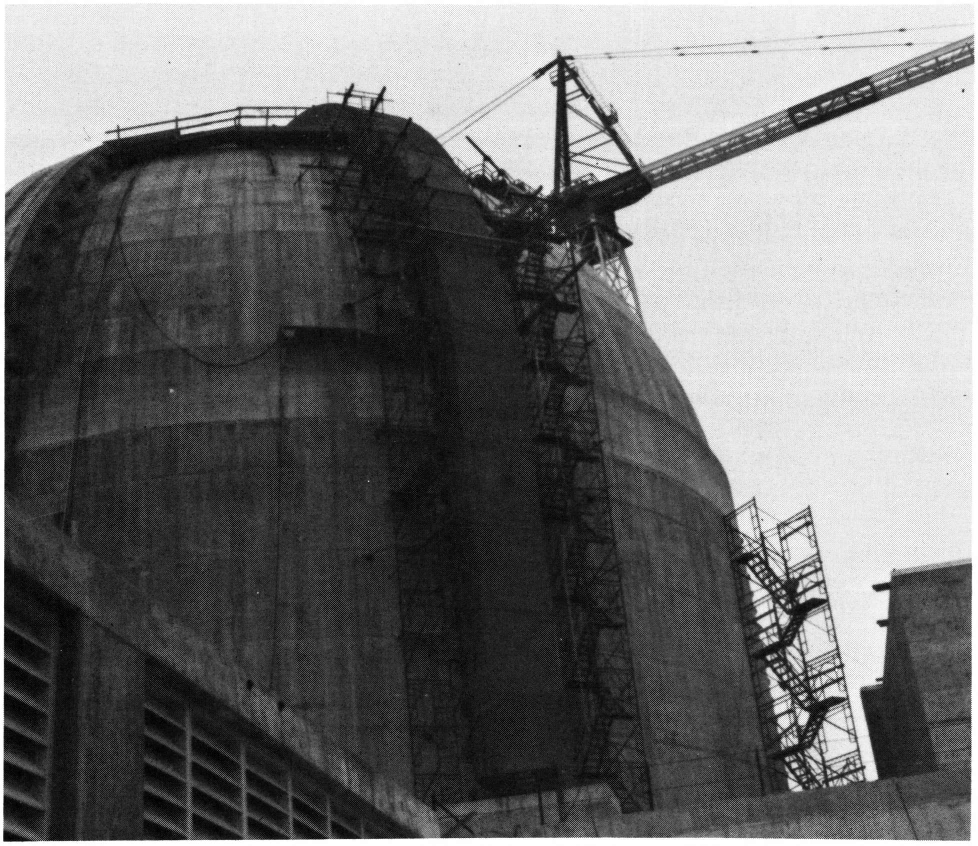
Every spring a student conference is held for the members of the Midwest Region of the American Nuclear Society. This year the UMC student Chapter will host that conference. The purpose of the meeting is to give undergraduate and graduate students from more than 20 midwestern schools the opportunity to present papers on their research topics in various areas of nuclear engineering. The conference is scheduled for Friday and Saturday, April 2nd & 3rd. There will be a mixer on Thursday, April 1st to acquaint the visiting students with MU and Columbia. Anyone interested in attending the conference may contact the Nuclear Engineering Department.

American Society of Agricultural Engineers

Activities currently planned for the winter semester include the annual banquet, club T-shirts, a trip to the regional meeting, and participation in Engineering Week lab exhibits and parade.

American know-how is alive and well... and creating career opportunities every day at Rockwell International.





UE's

by Mike Foster

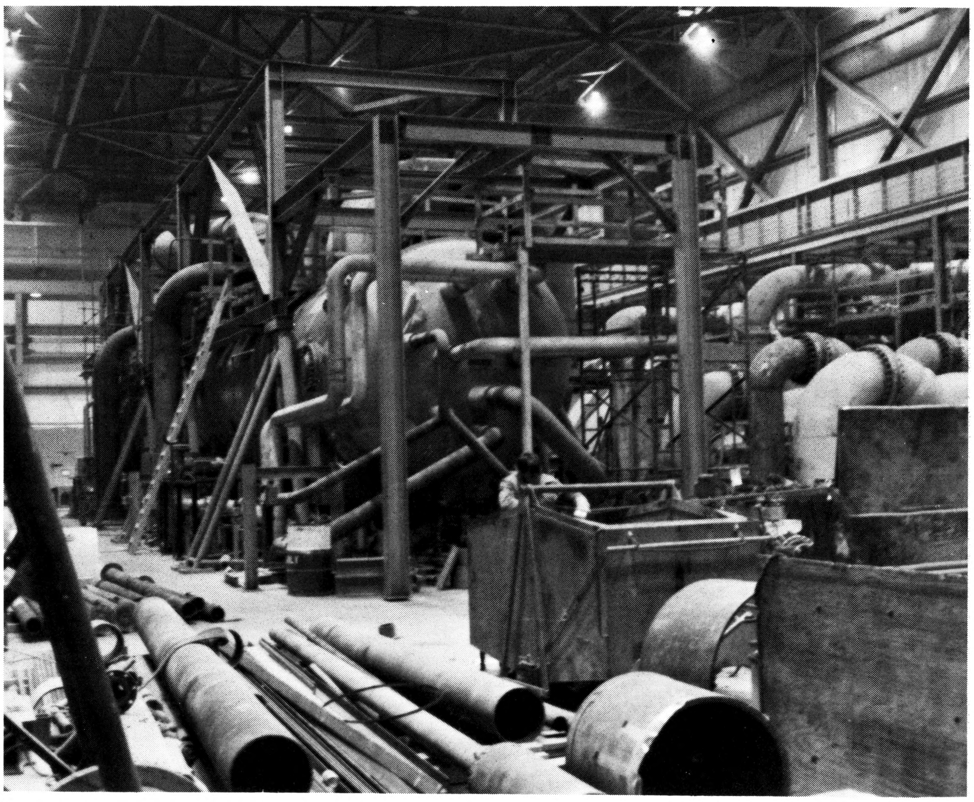
With warnings of the end of fossil fuel abundance coming with ever greater frequency, man has had to make plans for the future. One such plan is the use of nuclear means to generate electric power.

That plan is being implemented in Missouri by Union Electric Company of St. Louis. Construction progresses steadily at their Callaway Power Plant facility located approximately 30 miles east of Columbia near Fulton.

The plant consists of two identical generating units each capable of producing 1150 MW of power. Only one unit is being built at this time however, construction for the second unit has been suspended indefinitely.

The design of the generating units is shared with units in two other locations, southeastern Kansas and upstate New York. They are all termed SNUPPS, or Standardized Nuclear Unit Power Plant Systems. The units are designed to withstand the worst possible environmental conditions that could be encountered at any of the respective locations.

photos by Mike Foster



The site is located on a plateau near the Missouri River and is among seventy locations in four stated originally considered. It covers 7200 acres 5000 of which have been turned over to the Missouri Department of Conservation for development as a Wildlife Management Area.

The attention to detail in planning, design, and construction has, and continues to be, intense. The plant has been equipped with many redundant protective devices and systems designed to prevent or quickly harness possible problems that may arise during the operating life of the plant. This "defense-in-depth" concept employs extreme measures to ensure

(cont. on pg. 17)

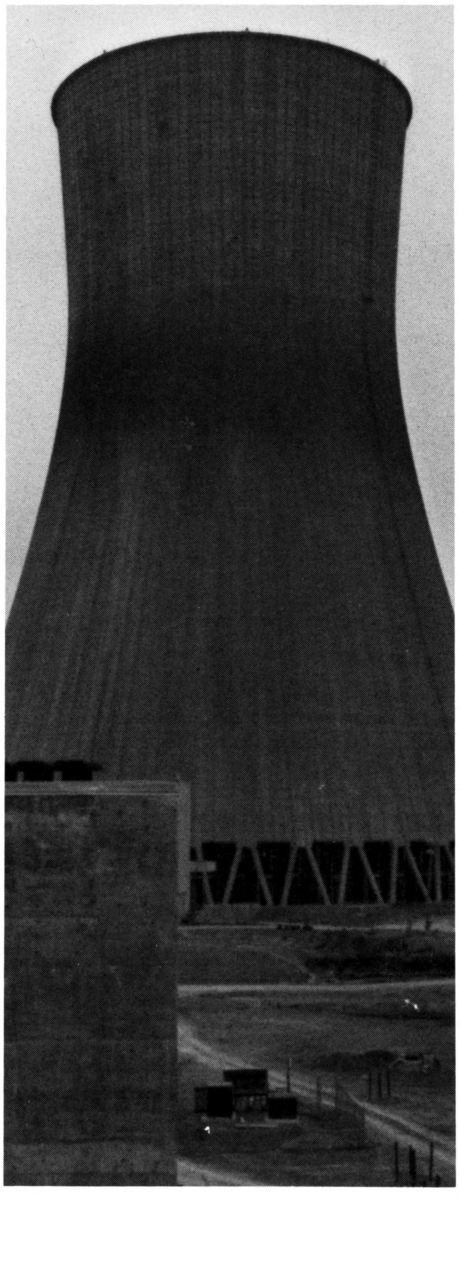
callaway power plant

that accidents don't have a chance to occur.

The plant generates electricity by first heating water and turning it into steam which is then expanded in a turbine which shares its shaft with a generator which turns and produces electric power. This in turn is then distributed to the consumer. All steam power plants operate in this fashion. The Callaway plant uses the controlled splitting of uranium atoms to heat water to make steam. The transfer of heat from the reactor vessel to the turbines is facilitated by three dis-

Only one unit is being built at this time

tinct piping loops. The transfer medium is water. The first of the three loops circulates around the reactor vessel itself gaining heat from the uranium-splitting or fission occuring inside. A tremendous amount of heat is being added to this primary loop but it does not turn to steam because it is being maintained at a pressure of 2250 pounds per square inch. This pressurizing allows the water to remain a fluid so that it can be pumped through the loop. The next, or secondary loop, receives heat from the first loop in heat exchangers called Steam Generators. The steam produced here is then directed to the first of four turbines. The first turbine is a high-pressure unit and the remaining three units are all low-pressure units. The steam performs useful work turning the bank of turbines which share their common shaft with an 1150 MW generator. This shaft is 210 feet long and had to be transferred to the site via the Missouri River on barges. Once the steam has been expanded, it is then pumped through a condenser where the third and final loop flows. This final loop removes heat from the turbine loop and allows the steam to become water so that it can be pumped through the loop once more. The heat removed is then carried by the final loop to the cooling tower, a 550-foot tall hyperbolic-shaped structure. Here, the water is



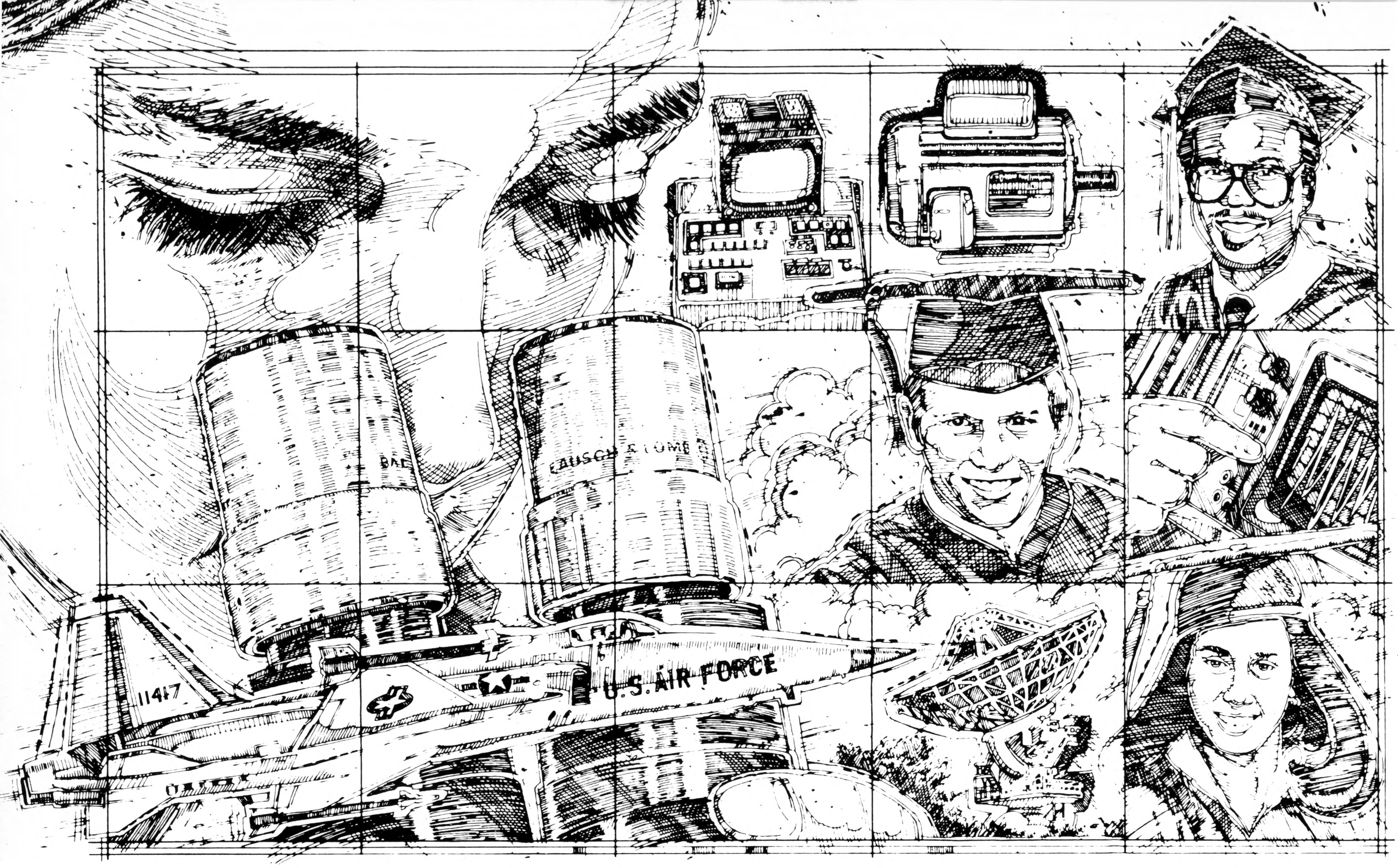
passed over a system of baffles and allowed to fall in a collecting pool at the bottom of the tower. The shape of the tower creates a natural draft which aids in the cooling process. This is the only point where fluid is allowed to escape in the entire cycle. It is estimated that approximately three per cent of the water in this final loop is lost through evaporation. Make-up water is purified at a plant at the nearby Missouri River and then pumped the 4½ mile distance to be added to the third loop. When the plant goes "on line", which is expected in October 1982, this process will proceed continuously. While all this activity is designed to churn the plant's turbines, the desired result is the turning of the generator. As the generator turns, the current produced is then conducted to the switchyard where it will branch into the plant's

The shape of the tower creates a natural draft

two main 345kV distribution lines. It becomes obvious that producing electricity for our modern society is a large and complicated process. Indeed, the construction itself has been a huge undertaking. On a typical day, 3500 people can be found at the site performing a variety of functions necessary for the smooth execution of the construction project.

The decision to build the Callaway Plant was made by Union Electric in response to projected electric power needs that will exist in Missouri in the near future.

OPPOSITE: Top—The reactor containment building. Bottom—Condensers which aid in the steam cycle. LEFT: The plant cooling tower.



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CAREER OPPORTUNITIES

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CAREER OPPORTUNITIES	Electrical Engineering	Mechanical Engineering	Industrial Engineering	Physics	Mathematics	Accounting	Business Administration	Computer Science
Design	●	●						
Structural Analysis		●						
Systems Analysis	●	●		●	●			●
Failure Analysis		●						
Optics	●			●	●			
Electronic Systems	●							
Product Assurance	●	●						
Logistics			●				●	
Computer Applications	●							●
Finance						●	●	
Planning		●	●				●	
Administration							●	
Quality Assurance	●	●						
Manufacturing		●	●					
Procurement							●	
Cost Estimating						●	●	
Contracts							●	
Plant Engineering		●	●					
Program Management	●	●		●			●	
Marketing	●	●		●				

accreditation team visits UMC

by Jeffrey L. Scruggs

Last semester, UMC's College of Engineering was visited by an accreditation team from the Accreditation Board for Engineering and Technology (ABET). The team from ABET spent a few days looking over the various departments in Engineering trying to determine if UMC met the standards for accreditation.

ABET was formed because the various professional societies, such as IEEE and ASME, felt that there was a need for a group which made sure that engineering colleges taught a minimum cirriculum. ABET periodically sends accreditation teams to all engineering colleges to see if they should be accredited. These teams are made up of a team leader, and a member from each discipline whose degree program is being evaluated. In other words, an eletrical engineer will be part of the team if the EE department is being examined.

ABET sends teams to all engineering colleges.

While the accreditation team is here, each member goes to his specific department and talks to all the faculty there, and as many students as he can. They also examine the physical equipment that each department has, whether it be the labs or the classroom. In addition, they look over the textbooks being used in classes, and examples of student work from those classes.

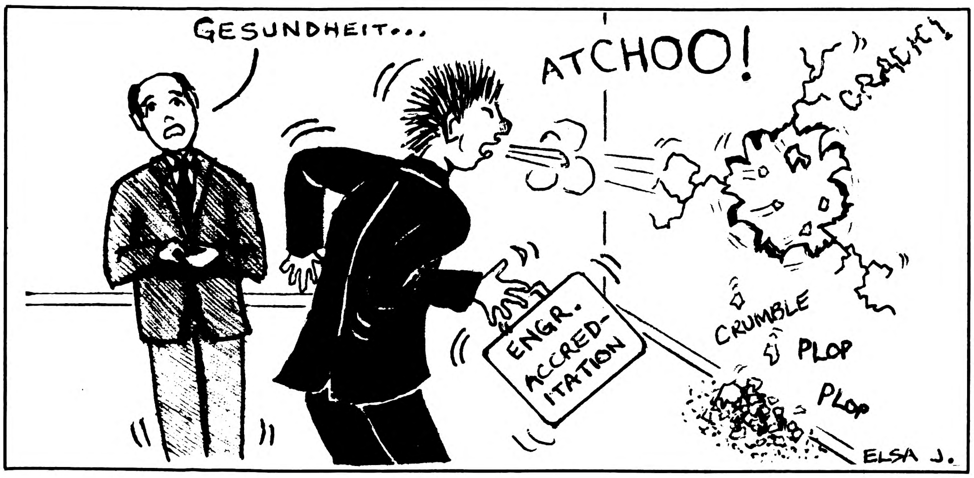
Each team member looks at a specific department.

The team leader does not look at a department, but most of the time roams the campus examining the support facilities such as the library and the computer facilities. He also will talk to the physics, math, chemistry, and arts and science departments. In order to be accredited not only must the engineering cirriculum be up to standards, but also the cirriculum of the various support groups.

The accreditation team normally spends about two days on campus, but lots of work was done before they got to campus. Each department had to submit prior to the visit two volumes of material on their programs. Volume I consists of statistical data on their program covering not only classes but also professors, and students. Volume II explains in detail the programs which are offered by the department. Also, each department must collect the textbooks and student work which will be examined during the visit.

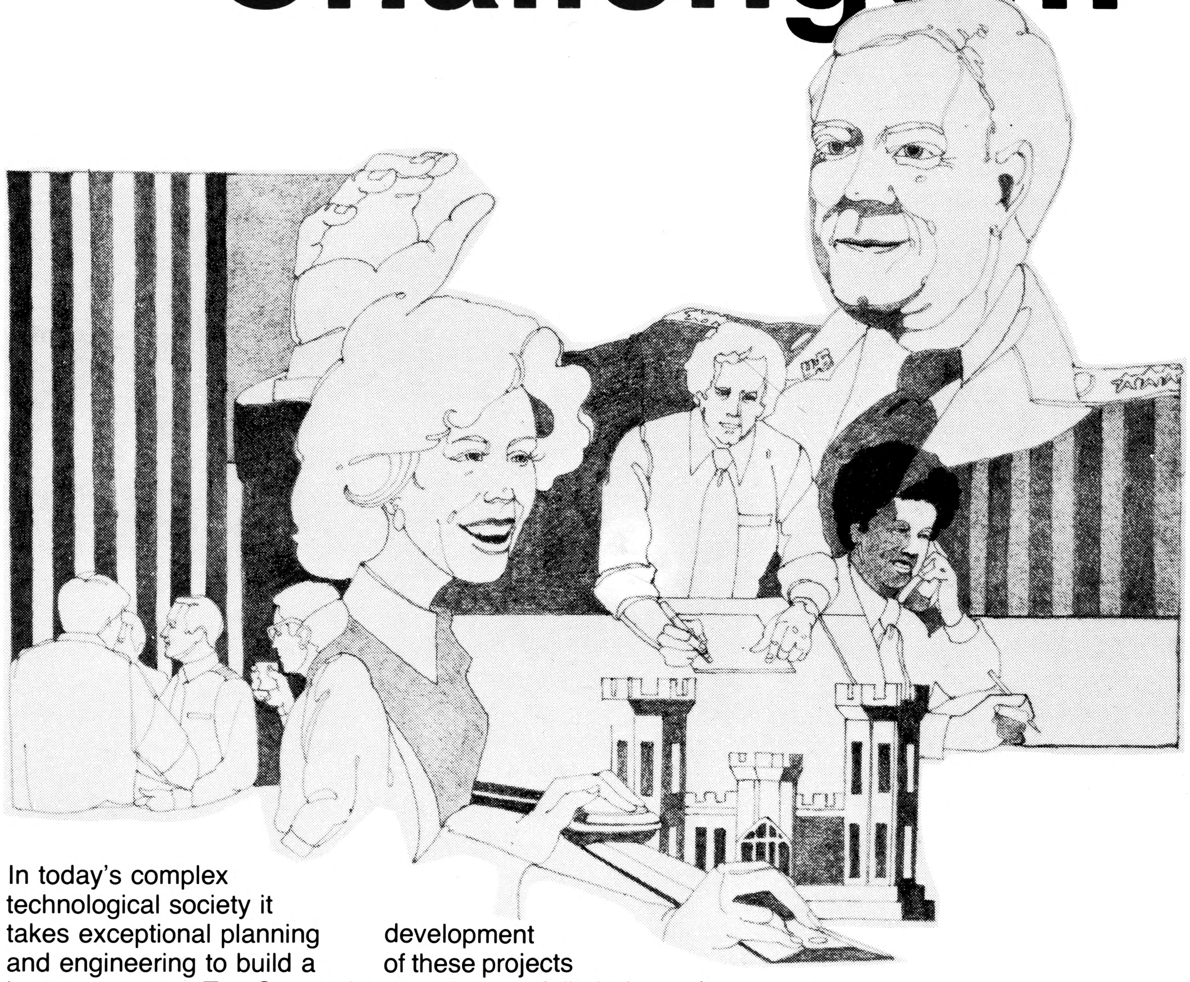
Accreditation is not meant to rank schools as to how good they are, instead it is a measure of whether the school met the minimum standards set by ABET. UMC is currently accredited for all its degree programs. This is very important in Missouri, because now to be a professional engineer you must be a graduate of an ABET accredited school.

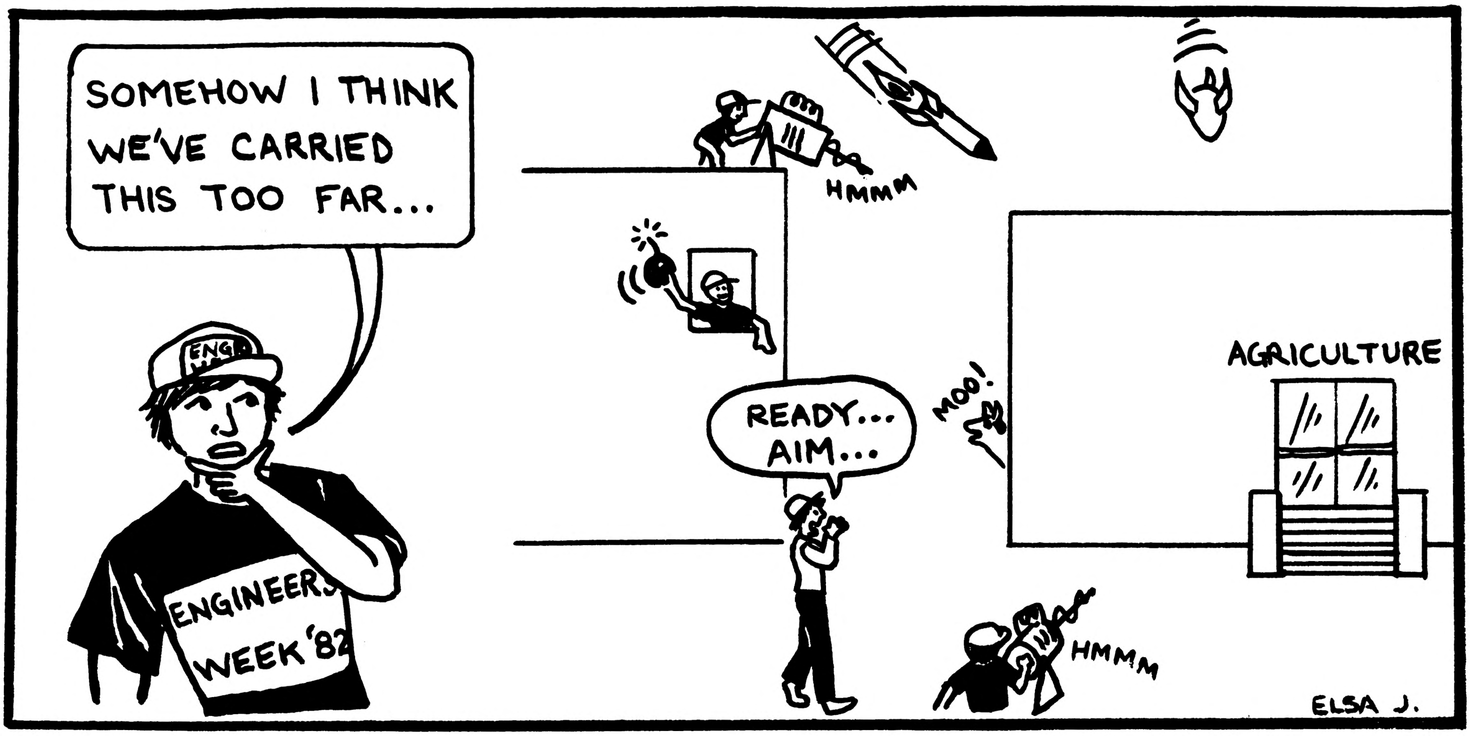
Accreditation is not meant to rank schools.



In March, UMC will get a copy of the official preliminary accreditation report. If UMC does not agree with the findings of this report, it can then appeal the report. Then next summer the ABET board meets and decides upon the accreditation of the schools visited that year, and Mizzou should be informed of their accreditation next fall.

The writer would like to thank Dr. John C. Lysen who provided much of the information which went into this story.





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American Nuclear Society

The American Nuclear Society's purpose is to make students and the public familiar with energy and nuclear power. All students in the Nuclear Engineering Department are affiliated with the ANS student branch and are encouraged to acquire membership in the national organization. Weekly seminars are scheduled throughout the school year. They provide an opportunity for students to present their research topic and results. In addition, speakers are frequently invited to seminars to address current interest issues and developments in nuclear engineering and related topics. Student conferences are held every spring in each of the regional divisions to offer students from different colleges the opportunity to meet and discuss research work. Other efforts include the dissemination of information about energy and/or nuclear power through presentations of the "Citizen's Workshop on Energy and the Environment", through information booths at fairs, etc. and other activities.

Organizations not listed: Society of Black Engineers,Tau Beta Pi, American Institute of Chemical Engineers, Chi Epsilon, Associated General Contractors, Institute of Electrical and Electronic Engineers, Society of Automotive Engineers.

the road to tenure

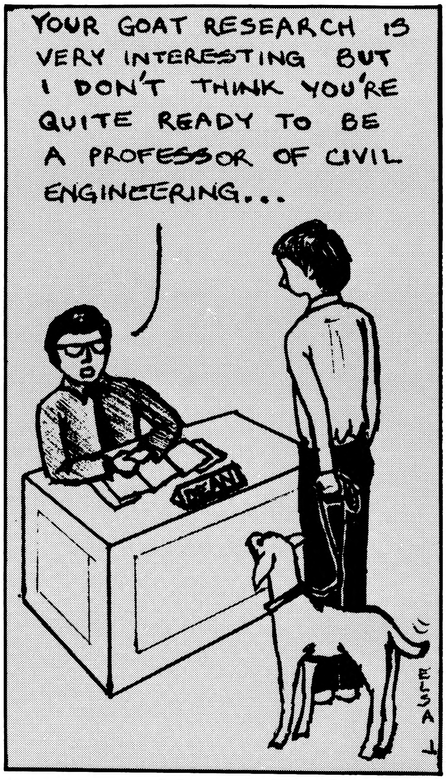
by Amy Werner

Most students attending a university want to improve their knowledge. The knowledge they seek is provided by the professors who have that special teaching quality. The professors here at UMC are very good at imparting knowledge, and they are very special. Each UMC professor had to go through a thorough selection and promotion procedure before receiving the title of "professor".

All professors started at the bottom like all of us. After receiving a B.S. or B.A. they continue· on for a M.S. or M.A., and then attain a Ph.D. Once an instructor has a Ph.D. he/she is usually hired as an Assistant Professor. Some general characteristics of an Assistant professors are that they must have the highest degree in their field or demonstrate equivalent professional competence. This will be demonstrated by outstanding academic work or recommendations from their professors or professional superiors. The Assistant Professors should be interested in teaching and working with students. Research should also be of great importance and be continually updated.

Professors should have a record of research accomplishments

The next step is Associate Professor. The Associate Professor must demonstrate his ability as a teacher to fellow professors and students. He should have a proven record of accomplishments in research with a definite promise of continued growth. This proof may be established through published articles in technical journals, research grants awarded to him by agencies and a desire by stu-



dents to work with him. He demonstrates an interest in student organizations within his particular field, and has served on departmental study committees and as a member of college or University committees.

The candidate for Professor must have established a deep interest in teaching. He must also have a consistent record of publication, demonstrating valuable aspects of his research. He should attract top graduate students, and have produced a number of M.S. and Ph.D. candidates whose research has been published. He must be recognized for his technical contributions. As a professor candidate, he should have organized and presented lectures to Universities and technical organizations. He must have served as an advisor for students and student organizations. In assuming the title of "Professor", he should have excelled in scholarly achievements, social and educational service and as a teacher.

For promotions, all candidates must meet three criteria. One is effectiveness as a teacher and activities connected with improvements of teaching are evaluated. Secondly, scholarly achievement, research publications, and external grant acquisition are reviewed; and thirdly, service to University, community, state and nation including committee assignments and extension activity are noted. After all three criteria are considered the most important consideration is by the department chairman, since he is responsible for assuring the quality of the department.

One other form of promotion is tenure. Tenure is permanent employment in a position as a professional. When tenure is to be granted at the rank of Assistant Professor the candidate must have served satisfactorily in departmental assignments, and should

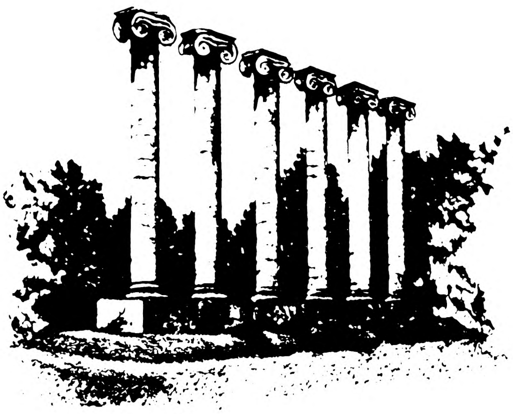
. . . administrators realize that competent instructors are indispensible

qualify for promotion to rank of Associate Professor within five years. His capabilities should place him on par with those of his rank. If tenure is to be granted to either an Associate Professor or Professor, there should be every assurance that their contributions will continue.

Without this promotion system, there would be few incentives for our teachers to improve our education system.

Although research is the primary purpose of a university, administrators realize that competent instructors are indispensible.

west of the columns



Rah! For the Engineers

PROCLAMATION
STATE OF MISSOURI

WHEREAS, the growth of modern civilization and its development to its present high state has been achieved through the knowledge and efforts of many groups and professions, but none has contributed more to this progress than has the engineering profession; and

WHEREAS, engineering has been the key to our progress, a vital factor in the development of our mighty industrial machines, our beautiful cities, our transportation and communication systems, and our better public health, and is playing a vital role in solving our energy and pollution problems; and

WHEREAS, it is desirable that all segments of the American community become informed of the contributions of the engineering profession to our well-being, in order to better understand the interrelation of the various professions, sciences, arts, and trades, and also in order to encourage young people to train for engineering careers; and

WHEREAS, it is fitting and proper that due recognition be given to the men and women of the engineering profession who, through their pioneering efforts, have brought these many benefits to our American way of life; and

WHEREAS, this being the seventy-ninth anniversary of St. Pat's Week, originally founded as Engineers' Week on the Columbia campus of the University of Missouri in the year 1903:

We proclaim the week of March 28th to be

ST. PAT'S WEEK

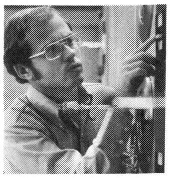
and call upon the residents of this community to acknowledge and give proper recognition and honor to the engineers of Missouri and of America who have earned the plaudits and everlasting thanks of this grateful nation.

Tentative Schedule
Engineers Week 1982

University of Missouri—Columbia

	Saturday, March 27
9:00 a.m.	5000 Meter Run
1:00 p.m.	Road Rally
	Monday, March 29
10:30 a.m.	Campus Stunt—Francis Quadrangle
7:00 p.m.	Beard Contest
7:30 p.m.	Student-Faculty Fun & Frolics
	Tuesday, March 30
All Day	Professor-for-a-Day
11:45 a.m.	Luncheon
3:30 p.m.	Calculator Contest
	Wednesday, March 31
All Day	Professor-for-a-Day
11:45 a.m.	Luncheon
8:00 p.m.	Queen Skits
	Thursday, April 1
4:00 p.m.	Engineers' Bar-B-Q—Road Apple
	Friday, April 2
1:00 p.m.	Alumni Registration
5:00 p.m.	Knighting Ceremony—Francis Quadrangle
6:00 p.m.	Honor Award Reception
6:45 p.m.	Honor Award Banquet
6:30-9:30 p.m.	Lab Exhibits—Electrical Engineering & Engineering Bldgs.
	Saturday, April 3
9:00-12:00 noon	Alumni registration
9:00-3:00 p.m.	Lab Exhibits
10:00 a.m.	Engineering Parade
10:30 a.m.	Alumni Business Meeting
10:30 a.m.	Alumni Wives Coffee and Tour
12:30 p.m.	Alumni Luncheon
2:00-4:00 p.m.	Green Tea—Chancellor's Residence
9:00 p.m.-1:00 a.m.	St. Pat's Ball—Tiger Hotel Ballroom (Coronation at 10:30 p.m.)

Graduate to a higher challenge. Texas Instruments.



For years you've been proving to your professors just how good you are. Now it's time to prove it to yourself.

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Prove yourself where innovation's the rule, not the exception.

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No technology is hotter, or more fantastic, than microelectronics. And no company is hotter in it than TI.

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And look at these credentials. TI is:

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- The designer and producer of the most complex MOS chip.
- The inventor of single-chip solid-state voice synthesis.
- The largest producer of microelectronic memory products.
- The world leader in Very Large Scale Integration.
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- The leading developer and producer of infrared and laser systems.
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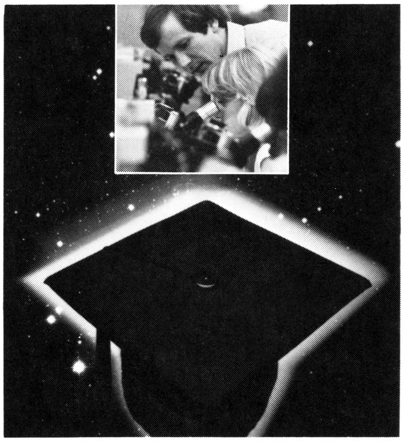
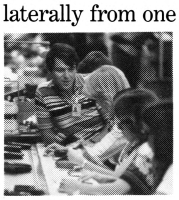
Prove to yourself where you have the freedom to grow.

Because TI is like many companies in one, you have the opportunity to move



laterally from one specialty to another as well as move up. Without changing jobs.



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Prove yourself where it counts.

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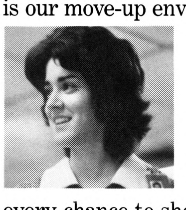

don't get buried at the bottom of a pecking order. So if you get a good idea your first week on the job, it gets heard. And you get rewarded.

At TI, you get every chance to show what you can do. And prove what you deserve.

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TI has hometowns to match your lifestyle. No matter where you call home. From New England to Texas to California.

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- Computer Science (Software/Hardware)
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- Engineering Physics
- Engineering Science
- Metallurgy
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- Chemistry
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Campus Interviews

TI Consumer Products Group
From calculators to home computers, electronic learning aids and more.

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Semiconductor components, materials and technology.

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One or more of these groups may be interviewing on your campus. Check with the Placement Office for interview dates:

Or send data sheet to: George Berryman, Texas Instruments, P.O. Box 225012 Corporate Staffing, M.S. 67, Dept. CJ4, Dallas, Texas 75265

TEXAS INSTRUMENTS
INCORPORATED

An equal opportunity employer M/F

thought gallery

by Curt Cannell

1)
By using four straight lines of equal length, divide a square so that the resulting pieces, when properly rearranged, will form five separate congruent squares.

2)
In the addition problem below, each letter represents a different digit. What number does each letter represent?

$$\begin{array}{r} AX \\ +\underline{XB} \\ ABX \end{array}$$

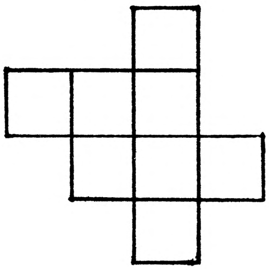
3)
In the multiplication problem below, each letter represents a different digit. What number does each letter represent?

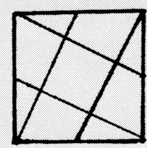
HINT: DDD=111xD
=37x3xD

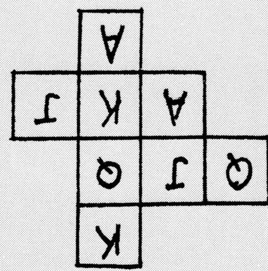
$$\begin{array}{r} A \\ \underline{\times\ CB} \\ ED \\ \underline{GF\ } \\ DDD \end{array}$$

4)
Eight cards are on a table in the relative positions shown below. Given the following conditions, what is their arrangement?

1) Every Ace borders on a King
2) Every King borders on a Queen
3) Every Queen borders on a Jack
4) No Queen borders on an Ace
5) There are 2 Aces (A)
2 Kings (K)
2 Queens (Q)
2 Jacks (J)

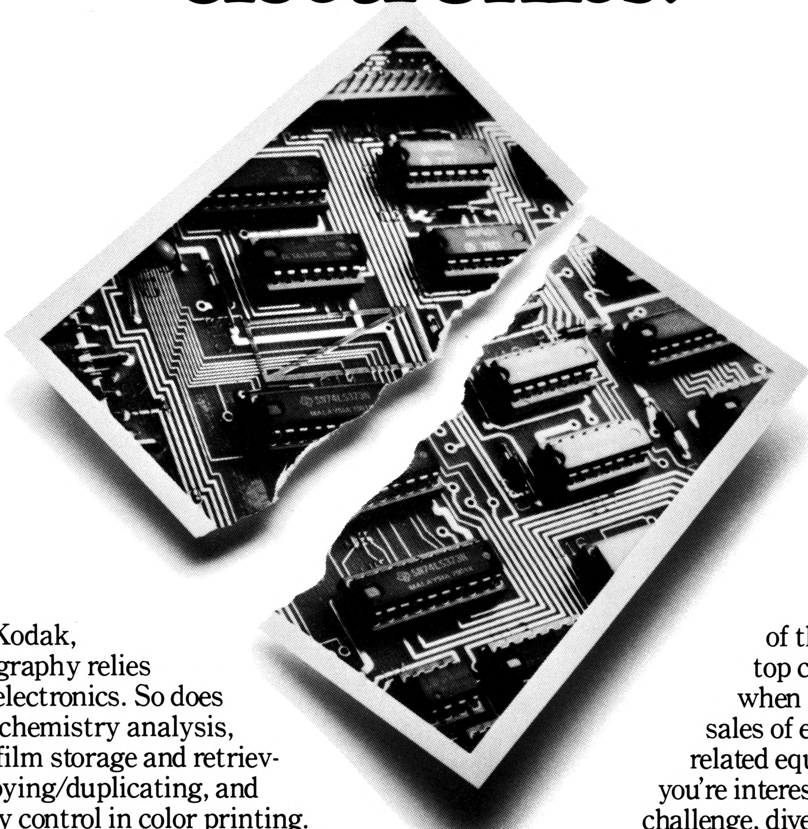






ANSWERS
2) A=1 B=0 X=9
3) A=6 B=7 C=3 D=2 E=4 F=8 G=1

If you stop reading now, you may short circuit your career in electronics.



At Kodak, photography relies upon electronics. So does blood-chemistry analysis, microfilm storage and retrieval, copying/duplicating, and quality control in color printing.

This diversity means we have a broad range of career opportunities for electrical/electronics engineers.

And, since Kodak introduces a new or improved product every three working days, our needs are growing rapidly. So rapidly that Kodak is already one of the nation's top companies when it comes to sales of electronics-related equipment. If you're interested in the challenge, diversity, and potential for steady career advancement you'll find at Kodak, see a Kodak recruiter on your campus.

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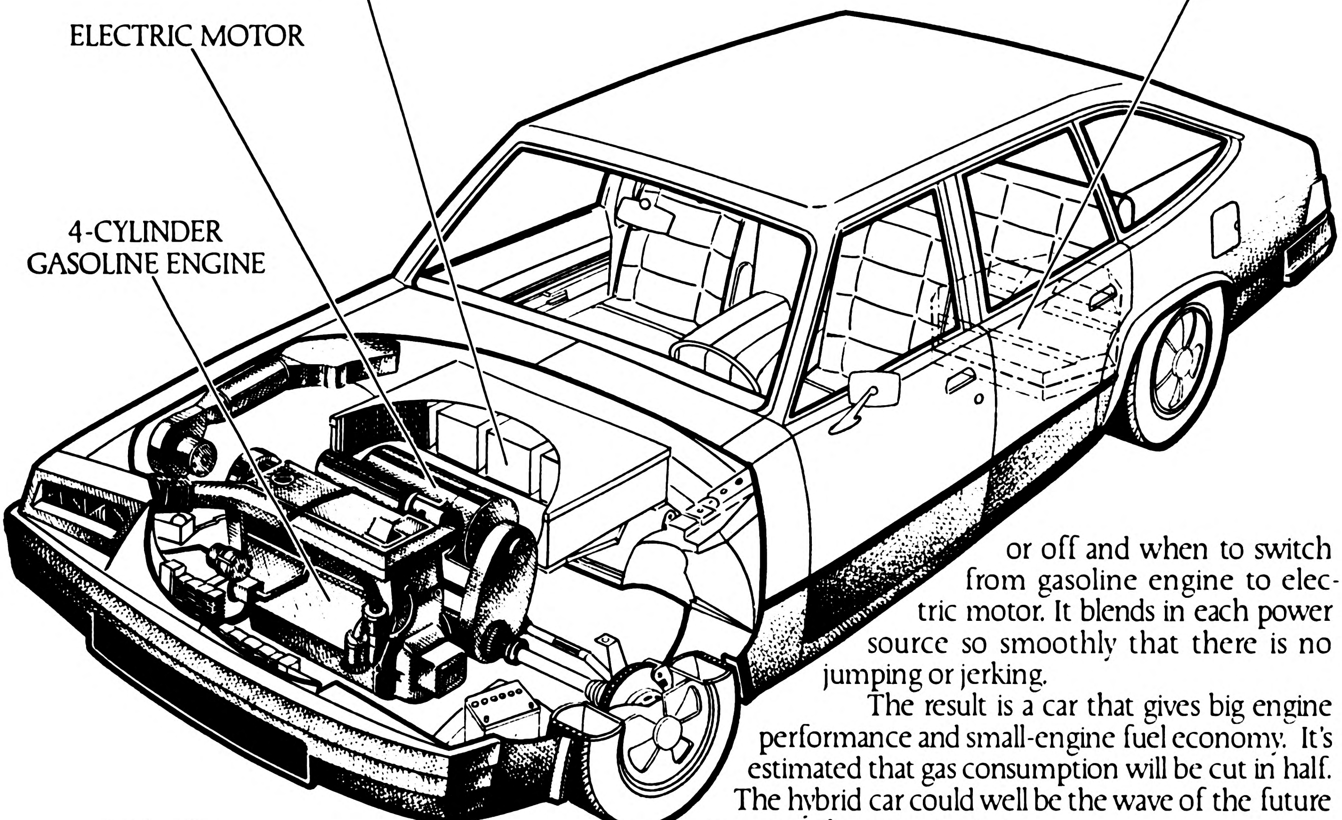
Is it an electric car that runs on gasoline, or a gasoline car that runs on electricity?



It's both.

It's a hybrid car being developed by General Electric for the Department of Energy. It's powered by both a gasoline engine and an electric motor.

This car runs part of the time on gasoline, part of the time on batteries, and combines both power sources when needed.

The electric motor will be used primarily for speeds from zero to 30 mph, and the gasoline engine for most highway driving. When you need extra power for passing, the electric motor automatically kicks in to boost the power.

The key to the operation of this vehicle is a GE-designed microcomputer. This computer, about the size of a cigar box, continually receives signals from more than three dozen sensors, measuring all the functions of the vehicle.

The microcomputer takes this information and determines the amount of power needed to meet the driver's command when he presses on the accelerator or brake pedal. It then decides when to turn power on or off and when to switch from gasoline engine to electric motor. It blends in each power source so smoothly that there is no jumping or jerking.

The result is a car that gives big engine performance and small-engine fuel economy. It's estimated that gas consumption will be cut in half. The hybrid car could well be the wave of the future in personal transportation.

Looking for new and practical solutions to transportation problems is just one example of research in progress at GE. We're constantly investigating new technologies, new materials, and innovative applications for existing technologies—in such areas as energy sources, motors and drives, aerospace systems.

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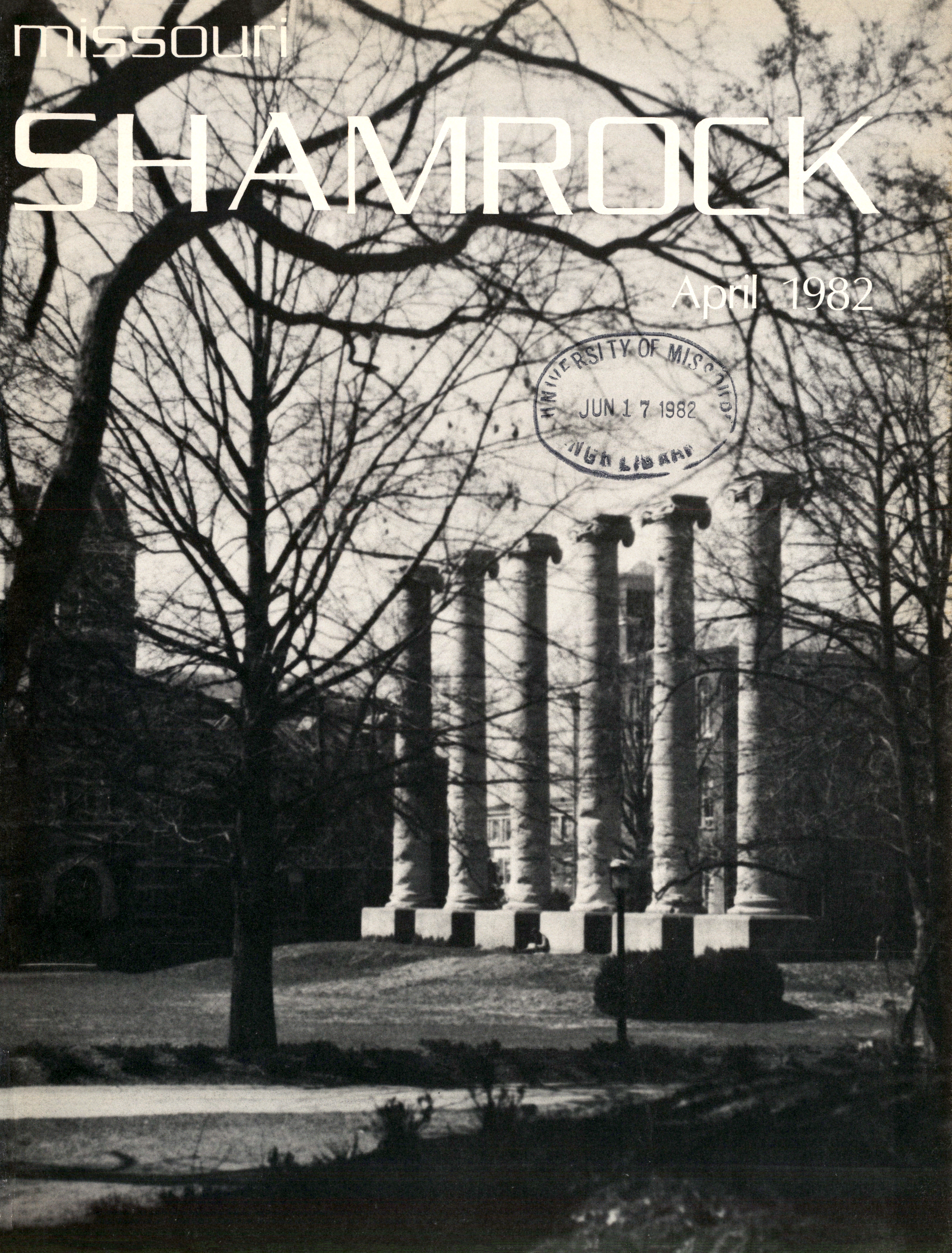
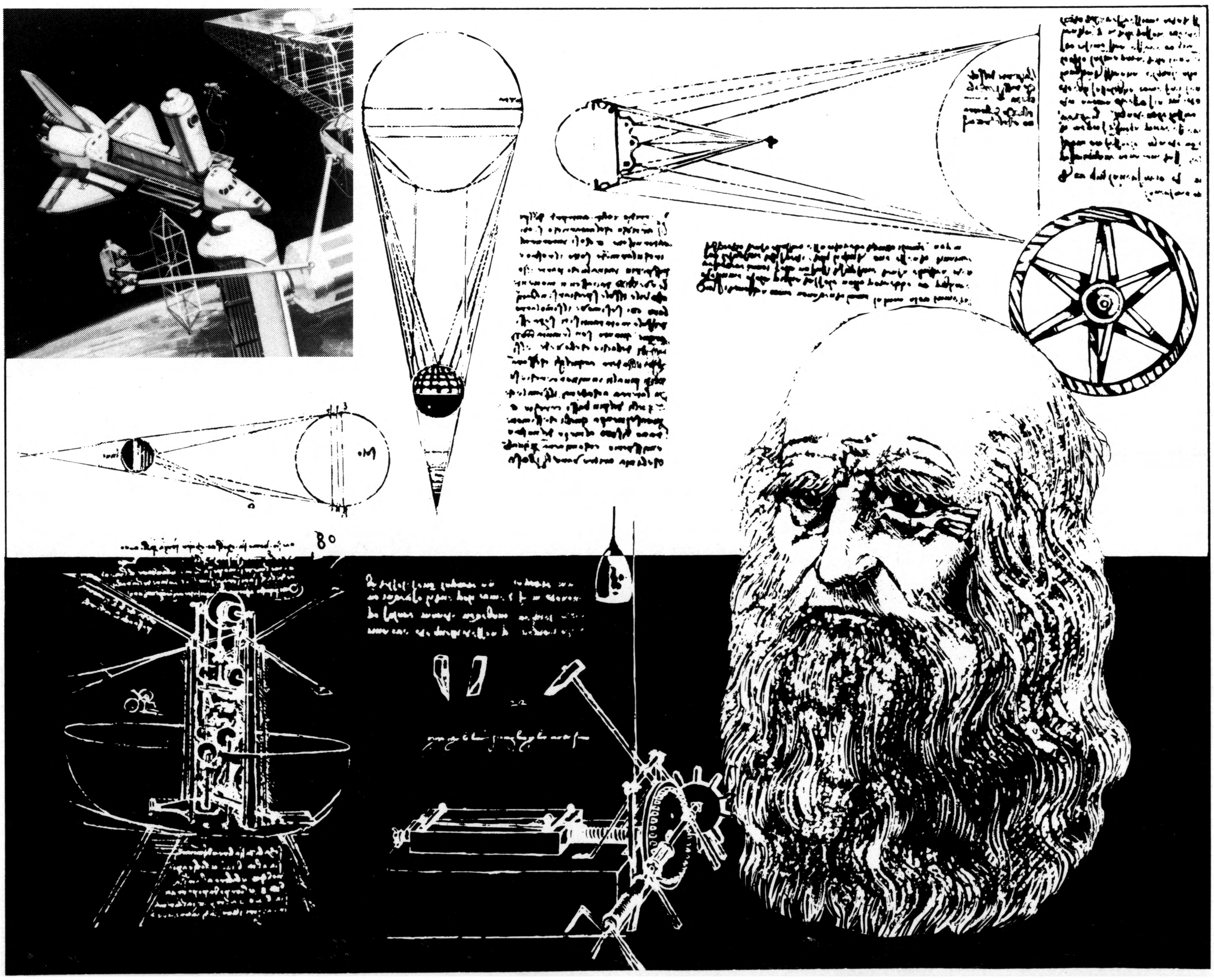
SHAMROCK

April 1982





missouri

SHAMROCK

UMC's Engineering Student Magazine

On the cover:
The Engineering Building and Columns on the UMC quadrangle. The area was alive with festivities during Engineers Week, March 26-April 3.
Photo by Therese Burski

April, 1982
Vol. 75 No. 4

contents

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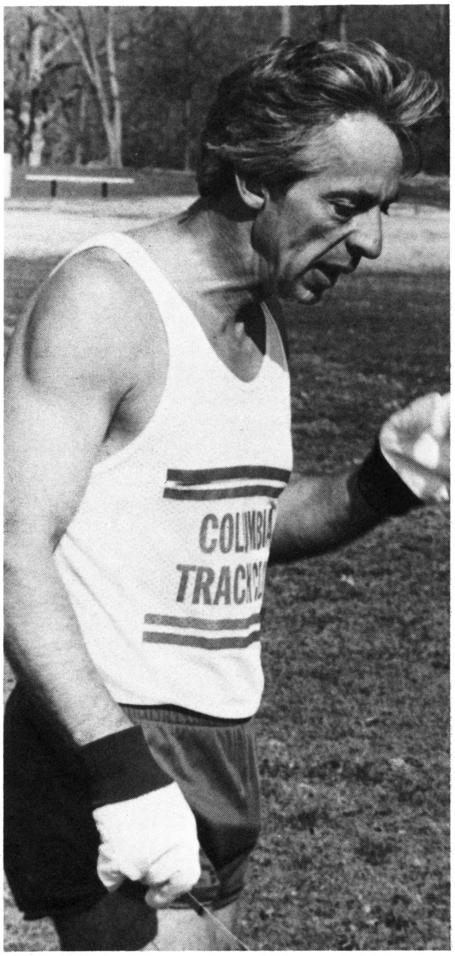
Foremost, the Missouri **Shamrock** gratefully acknowledges its advisor, Ms. Margaret Kraeuchi, Director, Engineering Communications.

cover story



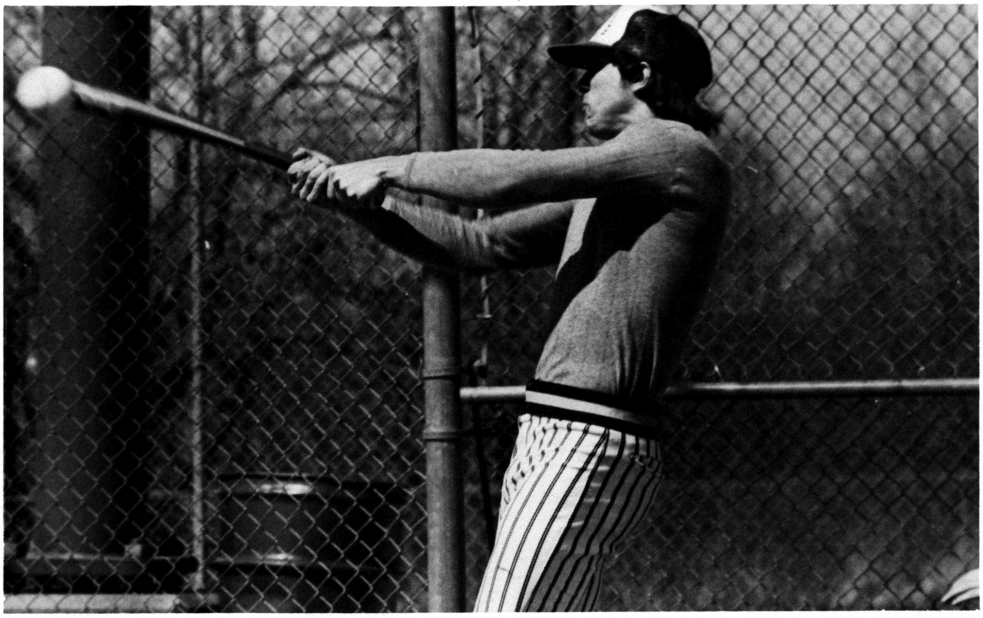
Engineers' Week 1982

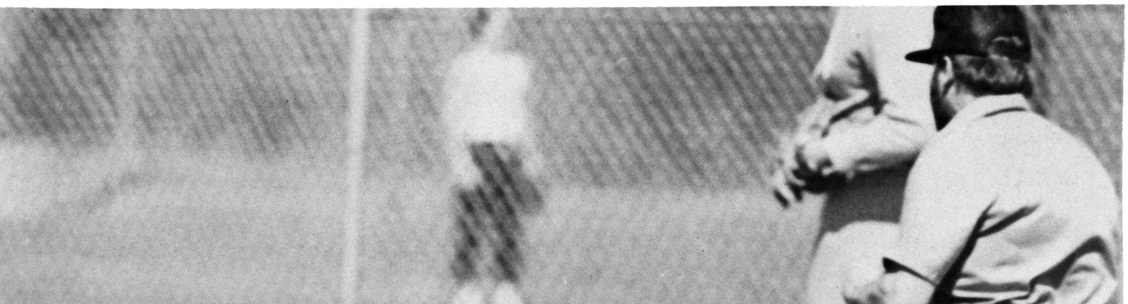
From March 26 through April 3, engineers proved that they could do much more than study. Starting with the 5000 meter run . . .

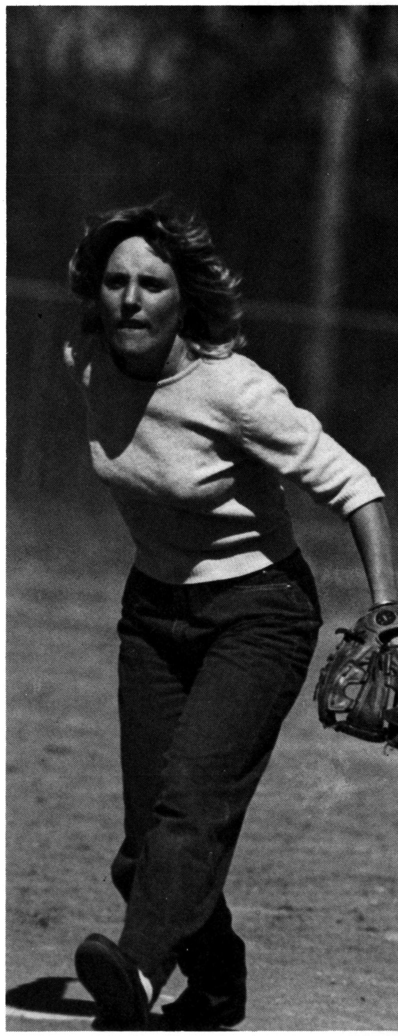
(Photo's by UMC College of Engineering)

. . . and, don't forget, the First Annual Softball Tournament — congratulations Mech. E's!

(Photo's by UMC College of Engineering)

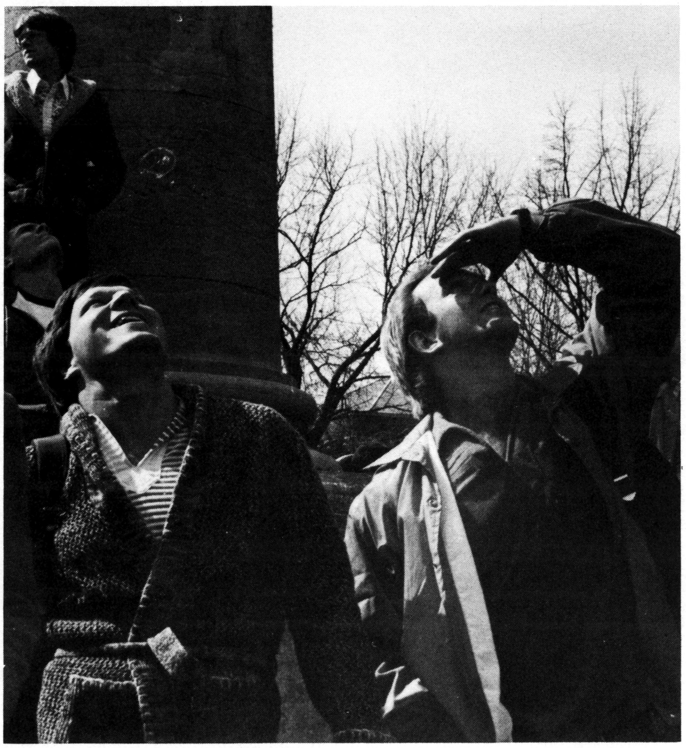






cover story

Photo by UMC of Engineering



Photos by Greg Gorman

Photos by UMC College of Engineering

Photo by Greg Gorman

From Booth sales, the infamous Ping-Pong Ball Drop, and Queen Julianne Koonse, to the Bar-B-Q, the Engineering Parade (ASCE's winning float), and the Queen Skits. It was a busy 10 days!

feature

Video Games: The inside story

by Scott Courtney

To say that video games are becoming popular these days would be the biggest understatement since Noah called the weather bureau and got a prediction of light drizzle! The enormous growth of the video arcade industry is nothing short of phenomenal. But what is perhaps even more amazing is what's inside the games themselves. What is it that makes them tick (and beep and hum and sometimes even talk)?

Although video games come in an astonishing variety of styles and game formats, nearly all are built around the same basic plan. The common denominator for all the games currently produced is that each contains what amounts to a small computer.

In fact, many video games are designed around the same microprocessors often found in personal computers (although some have special chips that are custom-made by or for the game company). As shown in Figure 1, the architecture of a microprocessor-controlled video game and that of a small personal computer are nearly identical. The primary difference between the two systems is the type of I/O (input/output) they perform. Computers have keyboards, disk drives, and printers, whereas games have joystick controllers, steering wheels, and sound synthesizers. Both systems use a video monitor to display information and pictures for the user, although the games' monitors are usually more sophisticated and of higher quality.

. . . each contains what amounts to a small computer.

As shown in the diagram, the principle components of a typical video game are the CPU, RAM, ROM, and I/O. The CPU, or Central Processing Unit, consists of a microprocessor and its associated timing and control circuitry. The CPU performs all necessary arithmetic operations, such as computing the angle of a blast from your laser or photon torpedo, and performs the data-transfer operations necessary for displaying the game's status and action on the video screen. Because of its importance, the CPU is often considered the "heart" of the system.

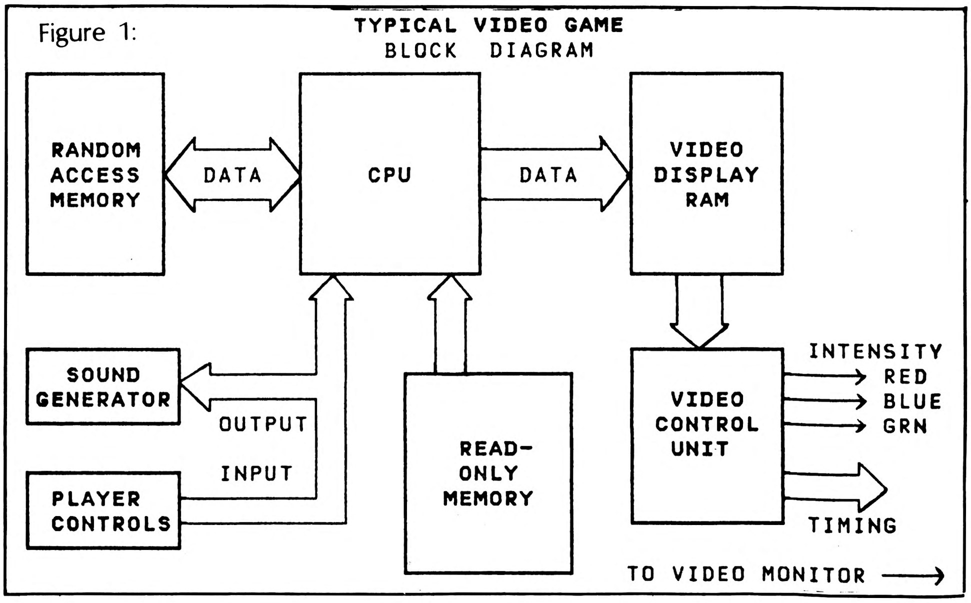
Input/output, or I/O, includes all of the circuits necessary for communication between the player and the game. Commands are received from the player through Input, interpreted and executed by the CPU, and the results communicated back to the player via the Output section. For example, suppose you are playing a spacewar game. You press a button marked "FIRE" to tell the CPU that you want to take a pot shot at an alien ship. The CPU then computes the angle, speed, and trajectory of your "missile"—Wham! You got him! Then the CPU sends to the video display circuitry the data necessary to display your missile's flight, and to make a suitable cloud of "space debris" where that nasty alien used to be. At the same time, the CPU adds points to your score, tells the sound generator to make an explosion noise, and goes to work figuring out what action the remaining aliens are going to take.

As you can see, the CPU is kept quite busy. In fact, many of the newer games actually have two microprocessors that share the work, each one being responsible for certain functions.

The CPU is often considered the "heart" of the system.

The other sections, RAM and ROM, make up the game's memory. ROM, short for Read-Only Memory, is the portion of memory that contains the master program for the game. If the

Figure 1:



CPU is the system's heart, then the program in ROM is undoubtedly its brain. ROM is so crucial to the system, in fact, that a given circuit can actually be made to play many different types of games just by changing the program ROM. This allows cheap production of foreign-language versions of popular games, and also permits a manufacturer to use one standard circuit board in several different games.

RAM, or Random Access Memory, is used by the CPU to store data of a more or less temporary nature, such as results of calculations and player's scores. Another section of RAM is used for storing the binary codes for the images that are displayed on the video screen. Unlike ROM, the RAM can be both read from and written to by the CPU. However, all the data in RAM is lost when the circuit's power is turned off; the program in ROM, on the other hand, is always retained whether the power is on or off.

One of the most important functions performed by the circuitry in a video game is the translation of screen-data (colors, brightness, and the like) stored in RAM into a form suitable for display on a color CRT (Cathode-Ray Tube). In order to understand this process, it is first necessary to know a little about how the video display itself works.

A typical video monitor uses a technique known as raster scanning to display pictures on a CRT. In raster scanning, the phosphor-coated face of the CRT is passed over or "scanned" by a narrow beam of electrons. The beam sweeps across the tube from left to right at high speed, while simultaneously scanning from top to bottom at a much lower speed. The net result of this process is that closely-spaced horizontal lines are traced over the entire face of the CRT, as shown in Figure 2. By varying the intensity of the electron beam and hence the brightness of each spot on the screen, any given image may be produced.

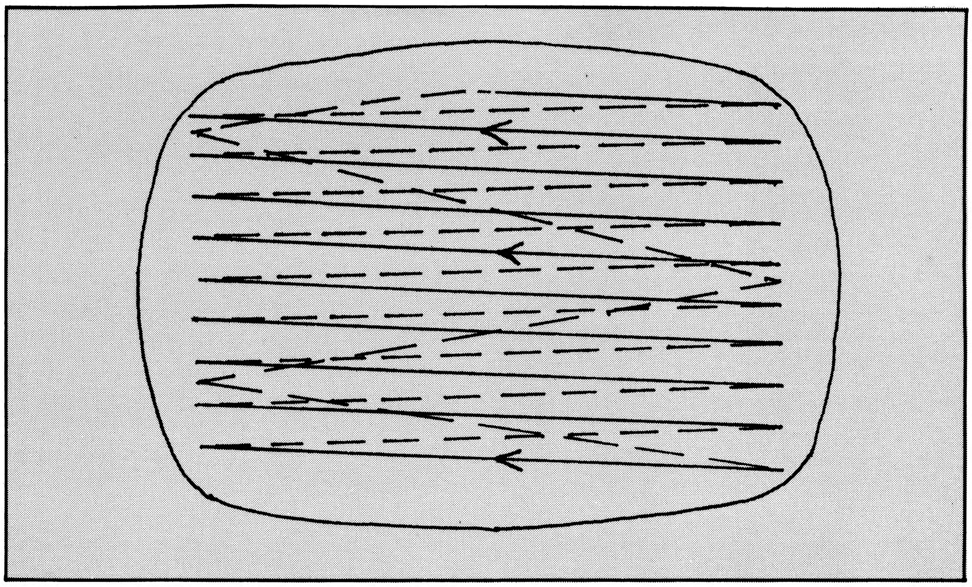


Figure 2: Diagram of the face of a CRT, showing scan lines (solid) and retrace lines (dashed). Size is exaggerated.

Color is added by using a CRT that has three electron beams. The face of the tube is specially constructed so that one beam produces red light, the second produces green, and the third beam creates blue. By varying the relative intensity of the three beams, an infinite variety of colors can be displayed, since our eyes blend the three discrete colors into one.

But the image on the screen is composed of analog, or continuously variable, data. How does the CPU store the data in RAM? The answer is that the screen is broken up into tiny

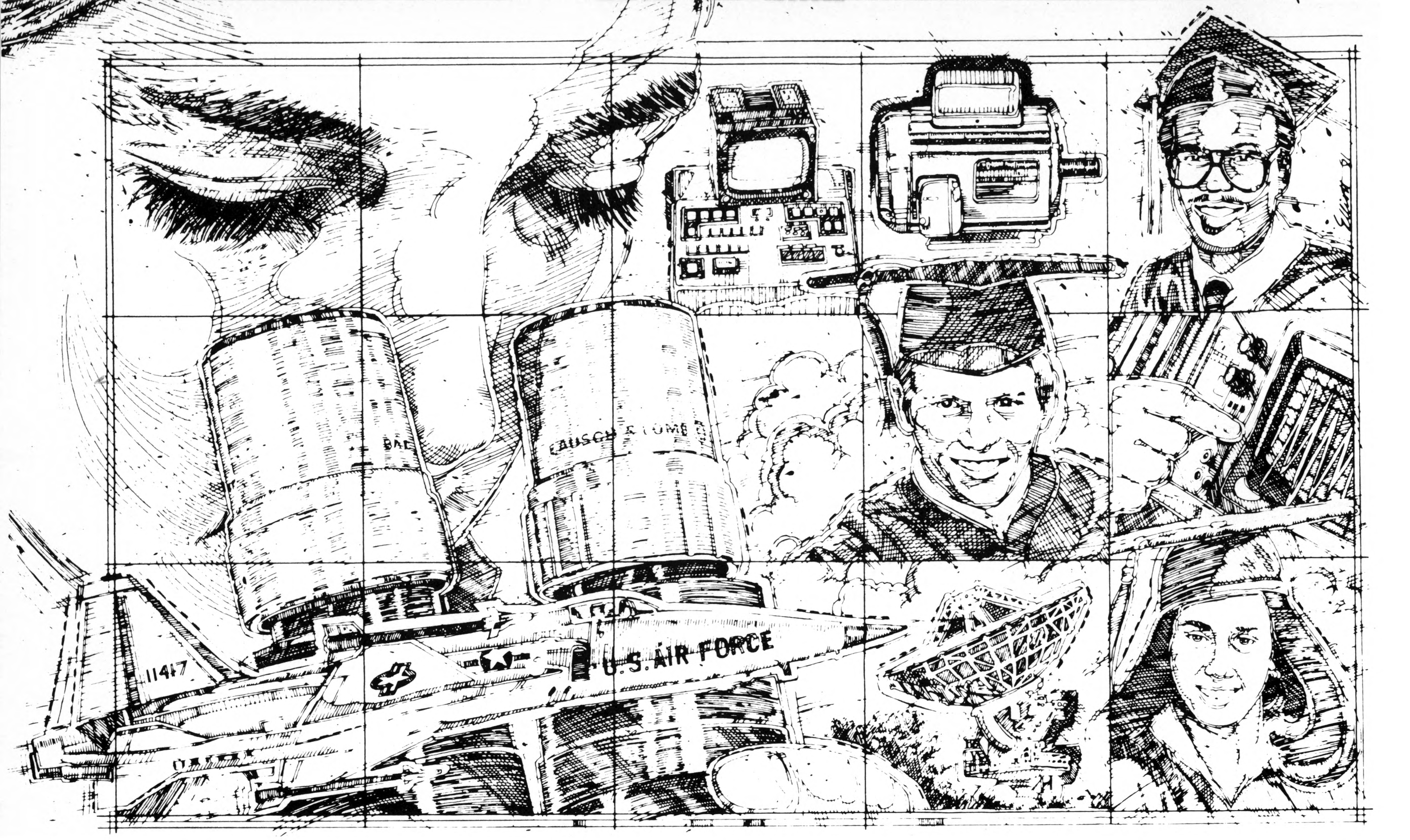
More bits can represent a greater variety of colors.

points of light called pixels. The entire screen is divided into lines, and each line consists of the same number of pixels. The total number of pixels is therefore equal to the number of pixels per line times the number of lines. The number of pixels determines how detailed an image on the screen can be—the more pixels, the better the quality of the image produced.

Since each pixel is scanned by three electron beams, the brightness levels of which can be varied independently, each pixel will require three binary numbers, representing its three brightness levels, to be stored in RAM. The number of binary digits (bits) needed for each pixel is determined by how many different brightness-color combinations we wish to allow. Obviously, more bits can represent a greater variety of colors, but only at the expense of needing extra storage space.

The relative intensity of the three beams of electrons determines the color of any given pixel, while their total magnitude determines the brightness of that pixel. To illustrate, let's assume that each of our beams is to have eight brightness levels, and that each level is assigned a number from 0 (beam off, or black) to 7 (beam fully on, or maximum intensity for this beam). Thus, one shade of blue-green might be represented by the code (Red, Blue, Green) = (0,3,3). Note that red is "off", while blue and green are assigned equal intensities. Now suppose we wish to increase the brightness of this pixel, without changing its color. We can do this by simply mul-

(cont. on Pg. 18)


U.S. AIR FORCE
11417

conversation

Dr. E.J. Charlson, a native Missourian, talks with conversation about his teaching and work experiences as professor in Electrical Engineering.

by Vicky Reinheimer

Conversation: Dr. Charlson, where did you attend college, and what was your specific field of study?

Dr. Charlson: I started college at the University of Missouri-Rolla in 1956, and I graduated with a B.S. in electrical engineering in 1960. Then, I went to Carnegie Melon University, where I received my M.S. in 1961 and my Ph.D. in 1964. I specialized in solid state electronics, or integrated circuits.

Conversation: Why did you decide to go into electrical engineering?

Dr. Charlson: I think the primary influence was my father. He was a superintendent of a power plant in Monroe City, and he was very interested in electronics. I had an interest in power until I learned about transistors, and I got hooked on them.

Conversation: Did you work in industry before you began teaching?

Dr. Charlson: Yes, my first job in industry was in the summer of 1959 for Westinghouse in Baltimore. We were still using germanium transistors, the early variety, so I basically started when this field was evolving. In fact, my first jobs included converting tube circuits to solid state circuits at Westinghouse.

Conversation: Why did you choose to teach in Columbia?

Dr. Charlson: Since I was born in Hannibal, Missouri and grew up in Monroe City, the area had some attraction because of location. Also, from a more practical point of view, my type of work relates to a large number of other disciplines, and Columbia offers more availability of this interdisciplinary work than Rolla.

Conversation: What kind of research do you do in the solid state labs?

Dr. Charlson: Most of the work that we have done in the past has been experimental. We spent most of our time trying to develop the technology associated with the fabrication of certain devices. More recently, however, we have been doing some theoretical work, mostly in the area of device modeling, trying to work out the mathematical details of certain device operations and trying to predict how devices can be improved.

Conversation: What courses do you teach at the University?

Dr. Charlson: Normally, I teach courses that are the backbone of solid state, like EE 235, Physical Electronics, and EE 333, Semiconductor Device Analysis. Also, I helped originate the 400 sequence, designing EE 444 and EE 446 when I first came here. When I started teaching the control course, EE 206, about three years ago, I hadn't done any formal control work in this area for about twenty years, so I had to dig quite a bit the first semester. Since then, I've really enjoyed it. I have had some interest in it, because I work with instruments, and feedback is a primary tool in instrumentation.

Conversation: Of all the classes you've taught, which is your favorite?

Dr. Charlson: That is a difficult question for me because I've taught many classes and many students in the past 18 years. I enjoy the type of class that requires me to use a little intuition in explaining rather complex phenomena, so I enjoy 235, especially the first part, which is modern physics. It's interesting to try to explain modern physics to engineers. Almost every time, I seem to teach it a little differently.

Conversation: Have you noticed a change in students and their interests over the years since you've been teaching?

Dr. Charlson: Yes, I have, but it's a subtle change. When I first arrived, students were very quiet and very easy to get to do things. You could almost go to the point of abusing them. Of course, you try to avoid that. But they seemed very flexible, and we worked them very hard. In the later 60's, an era of independence and people wanting to take control of their lives earlier, it was more difficult to communicate with the students. There was a degradation of purpose. The Vietnam War had something to do with that, no doubt. But in the last five years, it seems we're going back into that early era; students seem more serious and more industrious. They tend to have many jobs, which you didn't see ten years ago. Students seem more demanding of their teachers, which makes teaching a little more difficult, but more interesting. I really think it's a change in the right direction.

(Cont. on Pg. 16)

Future Possibilities:

Capt. Grace M. Hopper, USNR, computer pioneer and developer of the computer language COBOL, delivered the Croft Lecture in Engineering February 25 on the University of Missouri-Columbia campus.

A mathematician, Hopper began a teaching career at Vassar but volunteered for the Navy Reserves during World War II. Ordered to Harvard, she became a research fellow in engineering sciences at its Computation Laboratory where she helped develop the Navy's Mark II and Mark III computers. In 1949, while maintaining her Navy Reserve status, she went into private industry to help develop the UNIVAC I, the first commercial large-scale electronic computer. Since 1959 she has been an adjunct professor of engineering at the University of Pennsylvania.

In 1966 Hopper was retired from the Naval Reserves with the rank of Commander. But in 1967 she was recalled to active duty. In 1973 she was promoted to Captain and serves as special advisor to the Naval Data Automation Command.

Since 1952 she has published over 50 papers on software and computer languages. She has been elected to the National Academy of Engineering, is a Fellow of the Institute of Electrical and Electronic Engineers, and a Distinguished Fellow of the British Computer Society.

The Croft Lecture in Engineering annually marks National Engineers Week. The Lecture is made possible by a gift from Huber and Helen Croft. Dr. Huber Croft was dean of the UMC College of Engineering from 1941-61.

Captain Hopper "was the third programmer on the first national scale, digital computer in the United States, and she has been coping with them ever since." Introduction; Dean W. R. Kimel

"The reason I like that introduction is that it gives me an opportunity to remind you that the first large scale, digital computer in the United States was a Navy computer, operated by a Navy crew during World War II. And I find lately I have to remind people of that, because there's been a tendency on the part of a certain junior service to try and claim credit for those early computers. And just remember, they didn't exist yet.

"If you're wondering why I kept my cap on, I had a reason for that, too. This is my identifier. I hope all of you know that every record in a computer must have an identifier. That's so you know where to put it and how to find it again. But those identifiers have to be understood both by the person who originally puts it on the record, and the person who later looks at the record. And that's where I've been having trouble with my identitier. Because I go wandering around airports and people come up to me and say 'When's the next plane leave for Houston?'

"Until now, we've built hardware and put programs on it and we've totally failed to look at the underlying thing, which is the flow of information through any company, organization, activity or what have you. What we should be doing is looking at that information flow, the underlying thing, and then selecting the computers to implement that information flow. Now in order to do that, of course, one of the first things we'll need to know is something about the value of the information we're processing, because we'll want to put our best computers on the most valuable information.

"It's close to eight years now, I've been asking people how they valued their information. I've gotten the finest assortment of blank stares you ever saw in your life. I even thought that I might find out how they were assigning priorities on their computer systems. Boy, did that go flat fast. I found out how the priority is assigned. The top priority goes to the senior squeaky-wheel, not to the most valuable information. People even questioned that there was a difference in the value of information.

"Which is the more valuable piece of information? And what are our criteria? I've mentioned three possible criteria: The time in which you have to act, the number of lives affected, the number of dollars. I think there's a fourth one, and I don't know how to quantify it yet: The importance of that piece of information in making decisions. We've done no research on the value of information, not even comparative value within an organization.

"Leadership is not just the job of the top man, it's the job of everyone."

"We have failed to look at the value of the information we're processing. Now, it's going to make a tremendous difference in the future, because the amount of information we're processing and the amount of information in our information system is increasing steadily. At the same time everybody's demanding more rapid access to that information, they want it faster and faster. So we've got a pretty big job ahead of us, and those two concepts are in conflict. I

Hardware, software, people

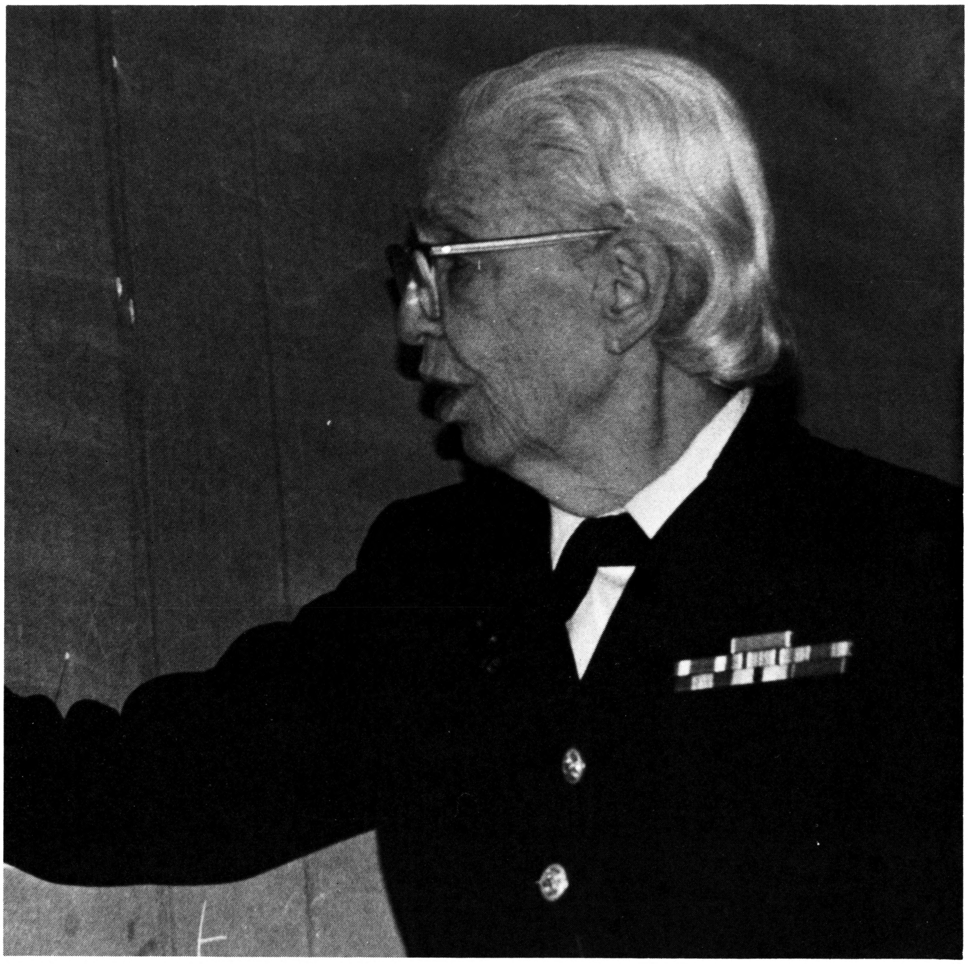


Photo by Greg Gorman

data. Yet we've talked for 30 years about data processing and all we've thought about was the processing, the hardware and the software, and its high time we took a look at the data. Part of its going to be the job of our engineers and programmers, but we're going to have to consult with other disciplines when it comes to the question of the value of the data we're processing, and its high time we began to do it.

"We haven't done the research on the value of information."

"Well, we ran the MARK computers all during World War II. I thought you might be interested to know that the first computer bug is still in existence. We were building MARK II the summer of 1945. It was a very hot summer in Cambridge, and naturally since it was World War II we were working in a World War I temporary building: No air conditioning, the screens weren't very good, MARK II stopped. We finally found the failing relay was one of the big signal relays, and inside the relay, beaten to death by the relay contact, was a moth. So the operator got a pair of tweezers and very carefully fished the moth out of the relay, put it in the log book and put Scotch tape over it, and below he wrote 'First actual case of bug being found.' "

There are "two reviews (which) must be made of any plan, computers or anthing else. Review the plan

(Cont. on Pg. 14)

finally made up a couple of curves. Now I have no numbers to put on these because the research has not been done yet. We haven't done the research on the value of information.

"The value of the information about an event goes up quite sharply immediately after the event. But the further you get away from the event in time, the more the value of that information levels off. Eventually, either you don't need it anymore or its replaced by a new piece of information.

"The cost of collecting information is very low at the time of the event. The further you get away from it in time the more it costs you to collect more information, and the more it costs you to store it and maintain it.

"Now, there's a crossover point. Beyond that point its costing us more to keep that information in the system than its worth to us. That's the point at which it should be gotten out of the system. But because we have not looked at the value of the information and the cost of the information we don't know where it is, and so we leave stuff in our files forever, and our systems are getting bogged down in dead information.

"We haven't even looked at the cost of having incorrect information in a system.

"We have not been looking at the

"review the plan in the

(Cont. from Pg. 13)

in the light of the future, all possible enemy actions, and then review the cost of not carrying out the plan. And yet I find again and again when we make our plans for computers we base the plans on the things we're doing now and the equipment we have in house, and totally forget to review those plans in the light of what we **will** be doing and the equipment that **will** be available. Probably the most dangerous phrase

"I think human beings are born with inertia."

that can be used in the world of computers is that perfectly dreadful one 'But we've always done it that way.' It's the most dangerous phrase you can use."

"One of our biggest jobs is going to be to change people's minds. Its one of the hardest things in this world to do. I think human beings are born with inertia, they get very comfortable in something, and then you come along and say well you're going to do everything differently. They're going to have to learn new things, they're going to have to change, and that's one of the hardest things you can get people to do.

"Just remember that everything must be reviewed in the light of all possible enemy actions. What is the cost of not doing this? What is the relationship between the cost of doing it and the cost of not doing it? Make those two reviews: All possible enemy actions and the cost of not doing it. I hope you'll apply that to all plans; they're extremely useful reviews.

"Well, there was something else that was driving me toward worrying about the future. I met MARK I, on July 2, 1944. MARK I was 51 feet long, 8 ft. high, 8 ft. deep, she was in a magnificent glass case, and she had 72 words of storage. 72 whole words, and each word consisted of 23 decimal digits in an algebraic sign, and what's more she could do 3 complete additions every single second. That sounds pitiful today, and yet if you go back and look at the newspapers and magazines of that time, you'll find that she was absolutely the most remarkable tool that man had ever built. Because she was the first tool that assisted his brain instead of the strength of his arm. So she has to stand out in our history for that reason."

"We didn't stop there. But we did not have a commercial computer until 1951, and that's when we had got our first commercial electronic computer called UNIVAC I. She did an addition in 282 micro-seconds; a complete addition, and we were going 1000 times faster."

"We didn't stop there. By 1964 out came the first of the CDC-6400's and it did an addition in 300 nano-seconds, and we were again going 1000 times faster."

"Now, if you're a nut about the future as I am, naturally you have to try and write the next line, see what its going to look like, what will happen.

Mark I had 72 whole words of storage.

"19?? Will we need an x,y,z system that adds in 300 pico-seconds, another thousand times faster? The answer is that we need it today, but we haven't got it.

"There are several reasons why we need it today. One of the reasons is that the population of the world is increasing. We're going to have to increase food supplies. And probably

"They're going to have to learn new things."

the biggest assist we could give to increasing food supplies would be better long-term weather forecasts. Yet we do not today have a computer which can run a full-scale model of the heat engine which consists of the atmosphere and the oceans. That didn't matter too much until a few years ago; we didn't have the data to feed into such models. But now we have the satellite photographs and those things are so good that when they're fully enhanced by computer we can actually tell how high the waves are out in the middle of the Pacific. We can tell what the temperature of the ocean is 20 feet below the surface. There's a catch, of course. To fully enhance one of those satellite photographs in our Navy systems requires 10 to the 15th power arithmetic operations and that's close to 3 days in our best computers, and the weather's already happened.

"There's another reason we're going to need tremendous systems of computers. It's a problem very few people have looked at, as yet. They keep pushing it off, they don't realize its going to be a problem. That's the problem known as water. Can you imagine the kind of computer power its going to take to insure that every resident in the United States has his fair share of pure water? It's going to be one of the biggest jobs we've ever tackled, and we've hardly started on it as yet, and it's an important one because it'll hit us sooner than we think.

light of the future."

"There's another area where we need greater computer power. The minute you get a shortage of something its price goes up, then after it delays it hits a couple of other things and their price goes up and then there's another delay and more prices go up. And the function is exactly like that for dropping a pebble in a pond: It ripples outward through the economy. Those are the third, fourth and fifth order functions, and we need higher order models. We need better computers to provide better information for management planning and we need it very badly.

Now of course I'm perfectly willing to admit that our bright young engineers are going to get beyond the velocity of light. They're going over to the anti-universe where they have white holes and talk to all the electrons and gluons and everybody else. But not in the next five years. And I

I think we've forgotten how bright and how good our young people are.

need that computer before then. So what am I going to do? Well I could use my common sense, except that seems to be last thing we ever use in connection with a computer. Well if I don't use common sense, back in '76 we got well accustomed to using past history, and to looking at it. Now back in the early days of this country when they moved heavy objects around, they didn't have any Caterpillar tractors, they didn't have any big cranes. They used oxen. And when they got a great big log down on the ground and one ox couldn't budge the darn thing, they did not try to grow a bigger ox. They used two oxen. And I think they're trying to tell us something. If we want greater computer power, the answer is not get a bigger computer, it's get another computer. Which is of course what common sense would have told

"You manage things, you lead people."

us. So our answer's going to have to be: We will build systems of computers. I think we've forgotten how bright and how good our young people are. And I hope we'll begin to recognize it. However, there's one way in which they do not differ from us. There's one thing they're looking for. They're looking for positive leadership. I don't know what happened to that word. We lost it somewhere in the last thirty years. I mean it in the old Navy sense—loyalty up and loyalty down. Respect for your superior and keeping him informed of what you're up to. And taking care of your crew. Leadership is not just the job of the top man, it's the job of everyone. Taking care of the people below them—providing leadership.

Be you engineer, scientist or whatever, you must be able to communicate in clear English. And that's one of our jobs—to see to it that our people can communicate. It's part of my job to bring up good young men and women for the Navy. Just so, it's your job to train and build good young men and women for the future of this country. Because the leadership they get today will be what they pass on to the next generation. We've gone all out for management. We've rested on the business school idea of this quarter's fitness reports. I think if I had a Marine standing here beside me what he would say would be, 'When the going gets rough, you cannot manage a man into combat, you must lead him.' And I think he would further say, 'You manage things, you lead people,' and I think we'd better remember that. And bring that word back into everything that we're doing. Good leadership—it's the one thing our young people want. For myself, I think you can see I have spent the busiest, most challenging, most fascinating, happiest 15 years I've ever spent in my entire life. And I've received most of the honors that are given to anyone in the computer industry. Each time I've received one, I've thanked them, and I've told them something I'd like to repeat to you. I have already received the highest award I will ever receive. No matter how long I live, no matter how many more jobs I may have. And that has been the privilege and the responsibility of serving very proudly in the United States Navy.

"What is the cost of not doing this? What is the relationship between the cost of doing it and the cost of not doing it?"

conversation

(Cont. from Pg. 11)

Conversation: Do you have any hobbies?

Dr. Charlson: I have found that the work I do involves a lot of lab work and requires a fair amount of time outside the normal work week. I come in quite a bit at night and on the weekend, mostly because I want to. It's very difficult to do the things I want to do on the budgets and with the equipment I have; it requires a large amount of effort to be effective. Whereas I would normally have several hobbies, I find that my work is now my hobby. I enjoy the lab work we do because it involves a variety of talents. We work in the areas of chemistry, metallurgy, and physics, as well as solid state engineering, so I never get bored. If I want something to do, I always have a project in the lab that I can work on. Over the years, my hobby has really been instruments and solid state instrumentation. Recently, I've been working with computers. They're becoming very dominant in technology because of the maturing of the solid state area. The primary reason I try to keep up in microcomputers is to understand what the applications are of some solid state devices we make.

Conversation: What is your wife's field of study, and how is it related to yours?

"I come in quite a bit at night and on the weekend, mostly because I want to."

Dr. Charlson: Her field of study is almost identical to mine. In fact, I met her when we worked together in a research lab at McDonnell-Douglas one summer. When we were married, she began helping me in the lab here, and over the years she came to spend more time here. She began to take a few courses, and finally, she had enough for a Masters. That developed into more interest, and she put together a program for a Ph.D., found an advisor, and finished her Ph.D. work. We were just playing it by ear and enjoying our work. We really didn't have the intention of both teaching. Then, about a year ago, when she was just about ready to finish her Ph.D., the chairman of electrical engineering, John Rouse, asked me if Elaine might want to teach. At the time, I said I didn't know and that I would ask her. We talked about it, she decided to interview, and she was offered a job. I think she enjoys it very much. Teaching is an area she hadn't considered very seriously. I thought we would end up with her working in industry and me teaching. We're satisfied with circumstances now except that we have very little time for leisure. Otherwise, it has worked out very well.

Conversation: Do you find time during the day to see your wife?

Dr. Charlson: Yes, she's right down the hall, and we work together in the solid state laboratory. We probably see each other much more than the average couple, and I never have to call home; if we need eggs, we get them together. We do not have children, so we're very free in that regard. If we make up our minds to do something or go somewhere, we can. This helps, as the schedules of faculty members are busy. It's good to have someone who understands the hours you have to put in. She's always been very understanding, but there is an added understanding because she does it herself and knows the demands.

Conversation: What do you like most about teaching?

Dr. Charlson: Teaching gives you some flexibility and freedom that you wouldn't otherwise have. Even though it doesn't bother me to work from 8 to 5, I prefer to select my own times. I also enjoy the ability to go away in the summer and see different parts of the country. It's nice to have three months off. For instance, when we go to the San Francisco area, we usually go into San Francisco every weekend. That's alot of fun. Oddly enough, we usually end up at technical bookstores. We've worn out three trunks. We've recently been going to Colorado to work for Hewlett Packard. We spent three summers there and five summers at the Lawrence Livermore Radiation Laboratory in Livermore, California, which is just outside of San Francisco. Livermore is a national laboratory with very good facilities. One of the reasons we go is to catch up on the latest technology. We bring those ideas back to the program to help Ph.D. students. They are always looking for topics. Many of the things I have done at Lawrence Livermore I've translated into Ph.D. theses here. Graduate students have been an emphasis area for me. I don't think I made a conscious effort to specialize in this area, it just happened. I

"She's always been very understanding . . ."

have been in an up and coming, or "hot" area, and young people recognize that. There is a tendency to have a large number of graduate students in this area, and I have a fair number. I produce about one Ph.D. a year. I do enjoy working with them. The only difficulty that I have, and almost every professor has, is too little money or equipment or space. Industry has been very helpful in that regard. They've contributed alot of what they would call obsolete equipment; it's still good, but it's not right on the cutting edge of technology. They donate it to us, and we refurbish it and use it in our labs. Elaine and I have learned to really appreciate such gifts from industry.

choosing the queen

by Amy Werner

Every Engineer's week ends with the crowning of the queen of love and beauty. The lucky girl who wears the crown is chosen from many. How are these girls selected? It is a very long process which requires a lot of hard work.

The work begins for the queen selection long before any Engineers begin thinking of green beer. Usually before Christmas break the queen committee sends out a letter. This letter contains an explanation and application for the girls who want to be queen candidates. The letter is sent to all the dorm floors, sororities, and Engineering Societies. Each of these organizations are to pick three girls, then send the application back.

Photo by Greg Gorman

The queen committee begins working when they receive the applications. All the applicants are contacted by phone and an interview is set up. The queen committee must interview about sixty-five girls. They break up into seven groups. Each group talks to about nine girls. These are personal interviews. Every candidate is asked about the same questions. Some examples of the questions asked are: Why did you come to the University of Missouri? Are you familiar with Engineer's week? After all interviews are completed the original sixty-five girls are cut down to thirty. Even though thirty-five girls are cut they are still encouraged to join in the festivities. There is usually an activity, after the girls are cut, where everyone is encouraged to come and meet the thirty girls. This years activities included a party at Motley's and a raquetball party. The girls are not required to attend but are encouraged. The idea of the activities is to promote interest for the coming Engineer's Week.

The second cut comes with round two of the interviews. It usually occurs after two weeks from the first cut. Once again the girls are interviewed, only this time they are open interviews. This means anyone who attends the interview can ask questions. This year it was held at Neff hall. The girls are kept separate before and after interviews so they will not have any idea what the candidate before them was asked. If a candidate is asked a bad question by the public, it is censored. Voting for the ten semi-finalists is held that night. Anyone attending can vote. Activities occur which give everyone a chance to meet the semi-finalists over the weekend. These are not required for the candidates. This year it was the Fifties party.

The five finalists are chosen about one and a half to two weeks after the semi-finalists are chosen. The candidates go through another set of interviews. These interviews are formal and more concentrated. Once again, anyone is welcome to attend and may vote. The voting occurs that night and the results are shown the next day.

Once the five finalists are chosen many activities are set up for publicity. The week preceding Engineer's week, the five finalists travel to Jefferson City to see the Governor, to Kansas City and St. Louis to see both cities mayors and they also meet with Columbia's mayor. During Engineer's Week there are many publicity campaigns to get to know the girls. Radio interviews (one each day for fifteen minutes) with each girl is set up. There are video tapes set up in the main Engineering building and the girls help with booth sales. Traditionally, Wednesday night of Engineer's week is set up for queen skits. These skits are put on by the queen candidates and their sponsors. Other activities that are not required for the girls are the road rally, scavenger hunt, parade, Fun and Frolics night, barbecue, the Green tea at Chancellor Uehling's house, and an awards banquet. The week concludes with the crowning of the queen. Traditionally, Dean Kimel announces the winner and Assistant Dean Morgan gets the first dance.

(Cont. from Pg. 9)

tiplying each individual intensity by a certain constant, such as 2. Doing this will give us (R,G.B) = (0,6,6). Notice that while the colors are still in the same proportions, the overall intensity has doubled.

How many different color-brightness combinations can this hypothetical system display? Since each beam has 8 levels, and there are three beams, the total number of combinations is 8 cubed, or 512—more than adequate to satisfy the most demanding video game addict.

How much RAM will it take to store the video screen data in a typical game? This depends upon three things: (1) the number of pixels per line of the screen, (2) the number of lines, and (3) the number of brightness-color combinations to be displayed.

Suppose, for the sake of example,

The video controller reads binary data out of the RAM.

that we want to design a Zap Your Professor video game. Let's say we want to have 128 pixels per line, 256 lines, and four intensity levels per pixel. Since this implies 4 cubed, or 64, color-brightness combinations, each pixel will need $\log_2 64$ or 6 bits of storage. A single location in memory typically contains 8 bits, so we can simply assign one storage location per pixel, and ignore the two extra bits. This does, of course, waste some storage, but CPU time is saved because of the simplified calculation of screen position.

Now, if each pixel takes one byte in RAM, and we have 128 per line, storage for each line will take 128 bytes. Multiplying this by the total number of lines yields 32,768 bytes needed to store data for the entire screen. In computer-jock lingo, this would be called "32K" of memory ($1K = 2^{10} = 1024$ bytes). This is about as much memory as many personal computers have.

Looking, once again, at the system diagram, notice that there is a previously unexplained block between "video display RAM" and "video monitor circuits." This unit, the video controller, is responsible for continuously reading binary data out of the RAM and converting it to the voltage levels needed to control the intensities of the electron beams in the CRT. The video controller also generates certain timing signals needed by the video monitor.

All that remains is for the CPU to store the appropriate binary values in RAM to display whatever is desired. However, as mentioned earlier, this can prove to be a rather complicated task. Many moving displays require the CPU to deal with nasty functions like logarithms and trigonometry. At the very least, extensive multiplication and division are needed, and these operations take a fairly long time (compared to addition and subtraction) on most microprocessors.

Time, of course, is a scarce commodity for the CPU. If, for example, the speed of the CRT's raster scanning is the same as that of a commercial television receiver, the screen will require updating every 33.3 milliseconds (with interlaced scanning). For a Z-80A microprocessor (a common CPU chip) running at its maximum frequency of 4 megahertz, this is enough time to execute about 16,600 instructions—not very many considering that the screen has over 32,000 pixels that need to be dealt with. As a result of this time-squeeze, most arcade-type video games have screens

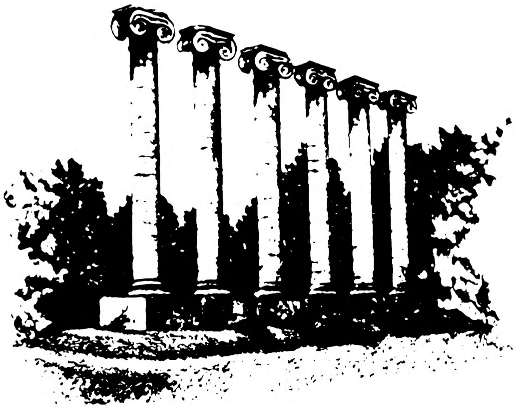
(Cont. from Pg. 18)

which are updated at a slower rate than a standard television set. Of course, there are certain factors that work in the CPU's favor. For instance, the human eye is a very low-speed device, at least when compared to a microprocessor, and it won't notice if a few points on the screen are thirty microseconds or so late in getting updated. Secondly, there won't normally be more than a few hundred points that need updating at one time; the others can just stay as they are. The only time that all 32,000 would have to be changed is when the whole screen is to be replaced with a new scenario (a simple data transfer operation), or when a large area is to be moved (like a planet as seen from the cockpit of a "spaceship"), in which case little computation is required. Further, once it has been calculated how far and in what direction an object on the screen is to be moved, all the points that make up that object can generally be moved the same way—again, a reduction in computation.

Despite the "favorable" factors mentioned above, the CPU is still kept busy nearly 100% of the time. To make the CPU perform all the complex actions required of it necessitates an extremely sophistacated master program in ROM. In fact, a typical video game may actually have more ROM (i.e., a bigger and more complex master program) than a home computer using the same microprocessor chip.

One final part of the system remains to be discussed—the parts of the I/O not associated with the video screen, such as the sound generator and joysticks. Most of these devices are fairly simple in operation. A joystick, for example, consists of nothing more than a pair of variable resistors mechanically linked to the joystick lever. Moving the joystick changes the resistance, which produces a voltage level that is directly related to the joystick's position. There are two such voltages produced—one for the horizontal, or X, position of the control lever, the other representing its vertical, or Y, position. These voltages are converted to binary numbers by a circuit called an ADC, or Analog-to-Digital Converter, which then passes the numeric information on to the CPU. A sound generator works in an opposite manner—the CPU sends to the generator a series of binary numbers telling the generator what kind of sound is to be made (i.e., the frequency, volume, and duration of the sound). The sound generator then uses the data to produce, or synthesize, the sound effect desired. The output of the sound generator is an analog voltage which is fed to a standard audio amplifier.

All in all, the internal operation of a video game can be a pretty complex subject. Although the basic principles of the game's inner workings are simple enough, the actual implementation of these principles involves a lot more than just deciding how many Pac-men must be eaten before a free game is awarded. In fact, what for the player is nothing more than a good way to kill a half hour may very well represent a design effort that took many man-years to complete. To the design engineer writing a 16,000 byte-long assembly language program, a video arcade is anything but fun and games.



prospective fusion facility at UMC

by Jackie Fallert

In these days of the energy crunch, everyone is searching for alternate sources of energy. The University of Missouri-Columbia will be joining in on the search through the studies which will soon begin using the newly acquired fusion research equipment. This equipment will allow UMC to do work in the fusion engineering area, particularly in the stability of plasmas.

You may ask, "Where does one pick up the equipment necessary for fusion research"? This particular setup is NASA surplus equipment which became available when a developmental space fuel project, involving fusion, was cut due to budget requirements.

How much will it cost to obtain this equipment that will provide UMC with a first class fusion facilty? The present market value of the equipment is approximately $13 million. However, UMC will be able to set up an operating facility for a mere $2 million. We were off to a running start in raising the necessary funds with a gift from McDonnell Douglas to the tune of $1 million, $400,000 up front, with another $600,000 to follow if UMC can come up with the additional $1 million. According to Dr. Walter Meyer, chairman of the Nuclear Engineering department, the additional money will come from other companies and there will be zero cost to the university. "We hope that continued operation will be supported by contracts and additional grants."

The fusion research program is being headed by Professor Mark Prelas of the Nuclear Engineering department. According to Prof. Prelas, the bulk of the equipment will be kept in temporary commercial storage until a permanent building to house the system can be constructed. At this time, a committee is deciding on a site for the new building.

Even though the new program and equipment will provide the opportunities for extensive research, fusion research is not completely new to the UMC campus. Small scale and theoretical research has been done through the years. For example, two students on a fellowship program with McDonnell Douglas recently completed studies in the areas of plasma engineering and fusion material.

The university has an old, water cooled magnet which was used in field effects studies, and is now in the engineering laboratories. This old magnet, although large in size, has a very small testing area (about 3.81 cm. bore), and relatively low field strengths (about 2 Telsa) that severely limits its research and testing capabilities. In contrast, the new equipment will consist, in part, of three large bore superconducting magnets weighing about 1½ tons each. Though smaller in size, these magnets have very high field strengths (about 5 Telsa) and large testing areas (48 cm. bore), which are desirable qualities for research.

What exactly is fusion? Fusion is the process of joining together atomic nuclei to form heavier nuclei. The union results in the release of large amounts of energy. (Fusion is the concept used in the hydrogen bomb.)

A heavy isotope of hydrogen, known as deuterium, is a common fuel for a fusion reaction. This hydrogen isotope is only a very small percentage (much less that 1%) of the naturally occuring hydrogen. But as Prof. Prelas pointed out, considering that water is a natural source of hydrogen it seems that, if properly developed, fusion could be a nearly "limitless source of energy."

Another "plus" for fusion reactions is that, unlike the more common fission reactions, the fusion process is much cleaner. If the proper shielding precautions are taken, fusion is an extremely safe nuclear reaction. Even though fusion will not replace fission, it could "definitely enhance our energy situation," according to Prof. Prelas.

Although a few other universities in the United States have ongoing programs in fusion-related studies, they don't have the advantages offered by the type of research facility that will soon be part of the University of Missouri.

The distinguishing characteristic of this research facility will be steady-state operation, with the high field superconducting magnets, which is important for plasma engineering studies. Other universities have pulsed type systems which place limitations on their testing and research capabilities. Not only is it felt that the fusion research facility will improve our stature as an engineering and science school, but it should also serve to at-

the university system

by Curt Cannell

Most students at large institutions are unaware of their school's administrative structure or the chain of command above the Dean of their college. Here is an explanation of the administrative structure at the University of Missouri — Columbia.

The Board of Curators are appointed by the Governor for terms of six years and are ultimately responsible for decisions regarding the University. The Board has 9 members that must have a ratio of Democrats to Republicans of 4 to 5 or visa versa. The Curators are prominent business persons, attorneys, bankers and even farmers who have extensive knowledge of laws, money, business and institutional management. The Board meets about once each month to discuss academic and administrative policies. The Board has a General Counsel, a Secretary and Treasurer for advice and assistance. There is no salary for a Curator.

James Olson is the President of the University. He was recommended by a four campus search committee, then approved and appointed by the Board of Curators. The President's salary is $72,000.

The President is responsible for the operation and decision making of the four campus system. The President has many support staff which include an Executive Assistant, a Director of University Information and a Governmental Relations Officer. There are also two Vice-Presidents. One is in charge of academic affairs while the other takes care of administrative affairs. Also responsible to the President are the Chancellors of each of the four campuses.

A Chancellor is recommended by a search committee consisting of faculty, staff, and students, and then approved by the Board of Curators. The Chancellor is the chief executive officer and she is responsible for all decision making and operations on the Columbia campus. The Chancellor's salary is $67,000 and there is no term of office.

Chancellor Barbara Uehling has eight staff members who provide her with information and advice. The staff includes the Provost, three Vice-Chancellors, a Hospital Director, and three supportive offices. The Intercollegiate Athletics Department also answers directly to the Chancellor, but it is a group by itself.

Students need not despair, because the system allows for faculty, staff, and student input.

The Provost is responsible for academic affairs of all students on the Columbia campus. Two Vice-Provosts take care of research, graduate students and extension services. The Provost is one step above the Deans.

Deans are recommended by a search committee to the Provost and the Chancellor, but appointed by the President. Just as the Chancellor is totally responsible for the Columbia campus, each Dean is responsible for everything in his/her division. This includes everything from physical maintainence to maintaining quality faculty. Deans also have no term of office.

There are many other offices not described here, each with their own requirements and duties. The University is large and may appear complex. It is complex, but students need not despair because fortunately the system allows for faculty, staff, and student input. This means that everyone can become involved and not feel alienated.

west of the columns

(Cont. from Pg. 20)

tract more high technology industry to Missouri.

Presently there are about 14 people, from the UMC campus as well as other campuses, involved with this project. In addition to faculty and students, there are several consultants, who worked with the system at NASA, interested in helping with the project. With their help, hopefully the predicted time table will be pushed forward.

As it stands now, the major components of the facility will be here by May 1982, and some offshoot research in superconductivity with a large coil test facility will be established by this summer. Unfortunately, it will take a while to get the entire system operational, and it is predicted that the more specialized research in fusion should begin in January 1984.

Once the research is initiated, it is expected that there will be both short and long term impacts. According to Prof. Prelas, "The technological aspects of the research will have immediate value. Specifically, information acquired in plasma engineering, superconductivity, health effects, corrosive chemistry, operational maintenance, etc., will be useful for the studies used to project plant designs and costs, and will help stimulate new research. Hence, 30 to 50 years from now when fusion plants come on line, research, such as that being done here, will assure that only the safest, most economical technology will be used."

Overall, as Dr. Meyer concluded, "It should be very advantageous to the university to have this type of forward-looking research."

thought gallery

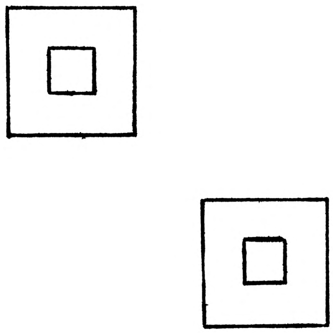
by Curt Cannell

Given a cube (one unit per side), what is the largest perfect hexagon that could be placed within the cube? Find the dimension of a side.

What is the largest sum of money—all in current coins and no silver dollars—that a person could have without being able to give change for a dollar, half dollar, quarter, dime, or nickel?

A man runs **n** times round a circular track whose radius is **t** miles. He drinks **s** quarts of beer for every mile that he runs. Prove that he will only need one quart (two pints).

Below are the top and right side views of an orthographic drawing. What is the front view? There are two general solutions.

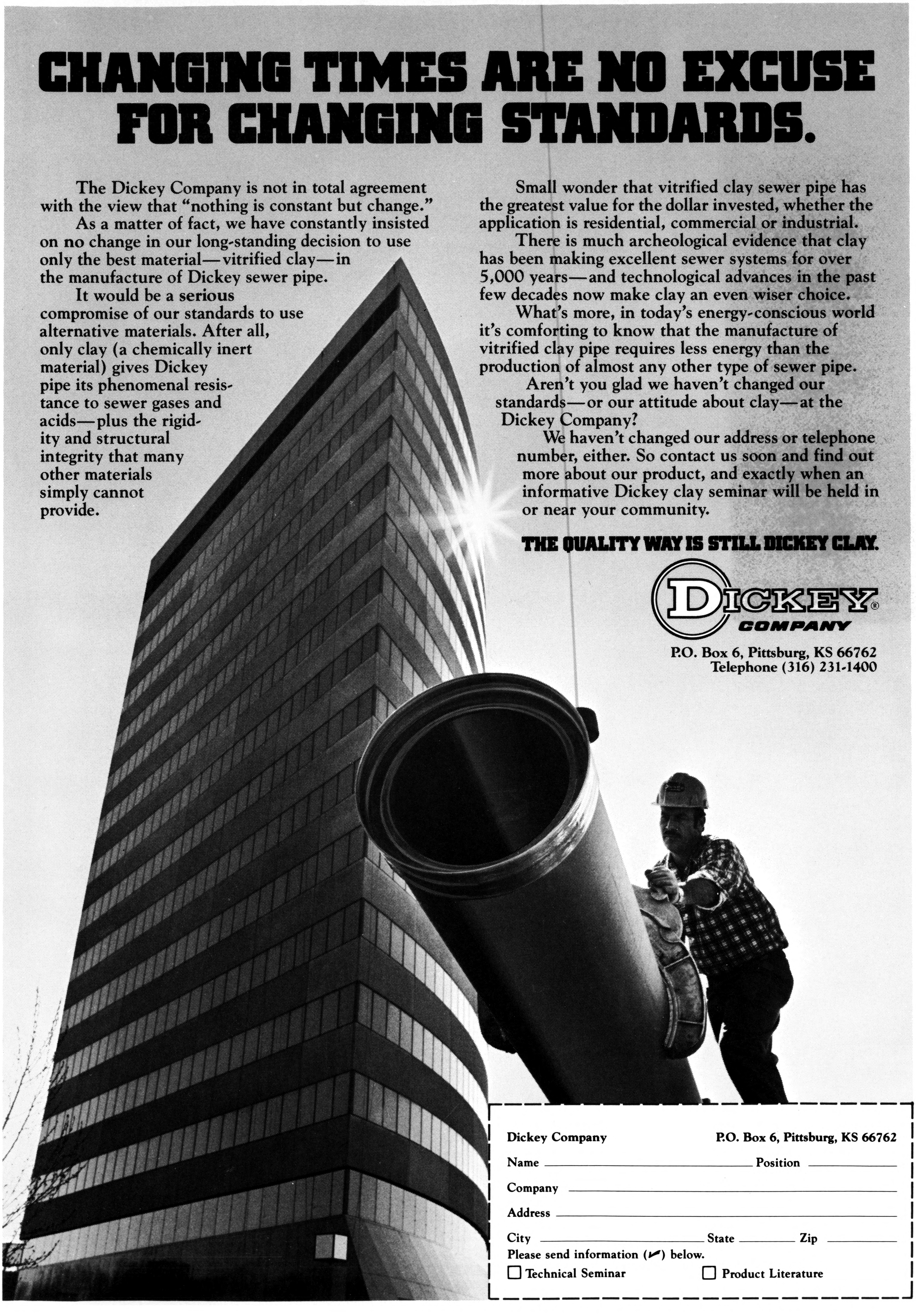


ANSWERS

Side= $\sqrt{1/2}$

$1.19, one half dollar
one quarter
four dimes
four pennies

Beer consumed $= 2\pi nts$
$= 2$ pints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Digitization Information Page

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Source information

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Source ID	010-010218855
Notes	Pages yellowed by age. Many of the issue covers have a University of Missouri stamp on them

Due to disbanding, some portions of text/images were cut off: pg. 13 of February 1981 issue

Capture information

Date captured	February 2021
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Derivatives - Access copy

Compression	Tiff: LZW compression
Editing software	Adobe Photoshop CC
Resolution	600 dpi
Color	color (for color images) & grayscale
File types	tiff
Notes	Images cropped, straightened, brightened