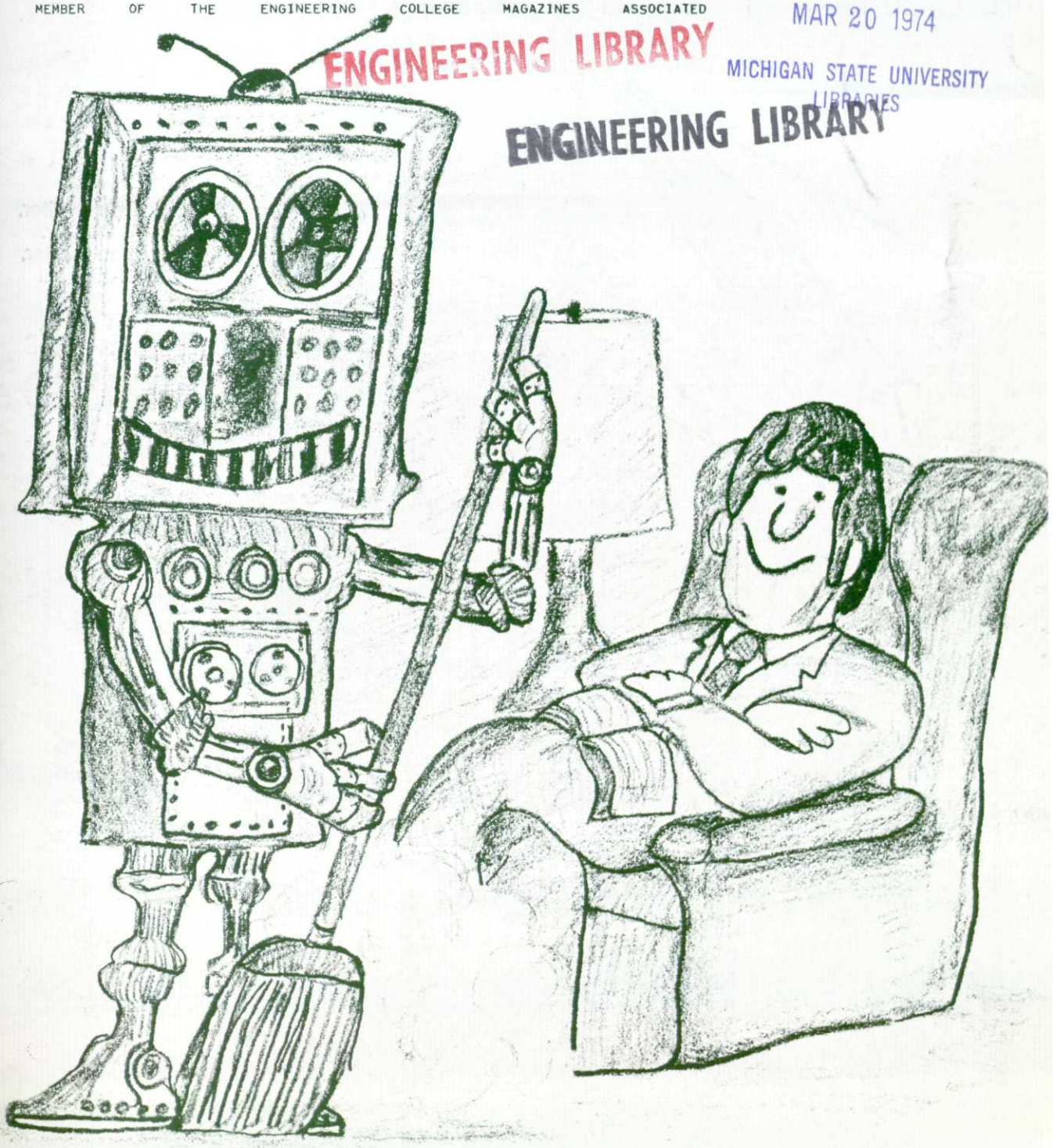
```
 SSSSSS   PPPPPPP      AA     RRRRRRR   TTTTTTTT     AA     N     NN
SSSSSSSS  PPPPPPPP    AAAA    RRRRRRRR  TTTTTTTT    AAAA    NN    NN
SS    S   PP    PP   AAAA     RR    RR     TT      AAAA    NNN   NN
SS        PP    PP  AA  AA    RR    RR     TT     AA  AA   NNNN  NN
SSSSSSS   PPPPPPPP  AA  AA    RRRRRRRR     TT     AA  AA   NNNNN NN
 SSSSSSS  PPPPPPP   AAAAAAAA  RRRRRRR      TT     AAAAAAAA NN NNNNN
      SS  PP        AAAAAAAA  RRRRR        TT     AAAAAAAA NN  NNNN
S     SS  PP        AA    AA  RR RRR       TT     AA    AA NN   NNN
SSSSSSSS  PP        AA    AA  RR  RRR      TT     AA    AA NN    NN
 SSSSSS   PP        AA    AA  RR   RRR     TT     AA    AA NN     N
```

THE SCIENTIFIC OPEN MINDED MAGAZINE

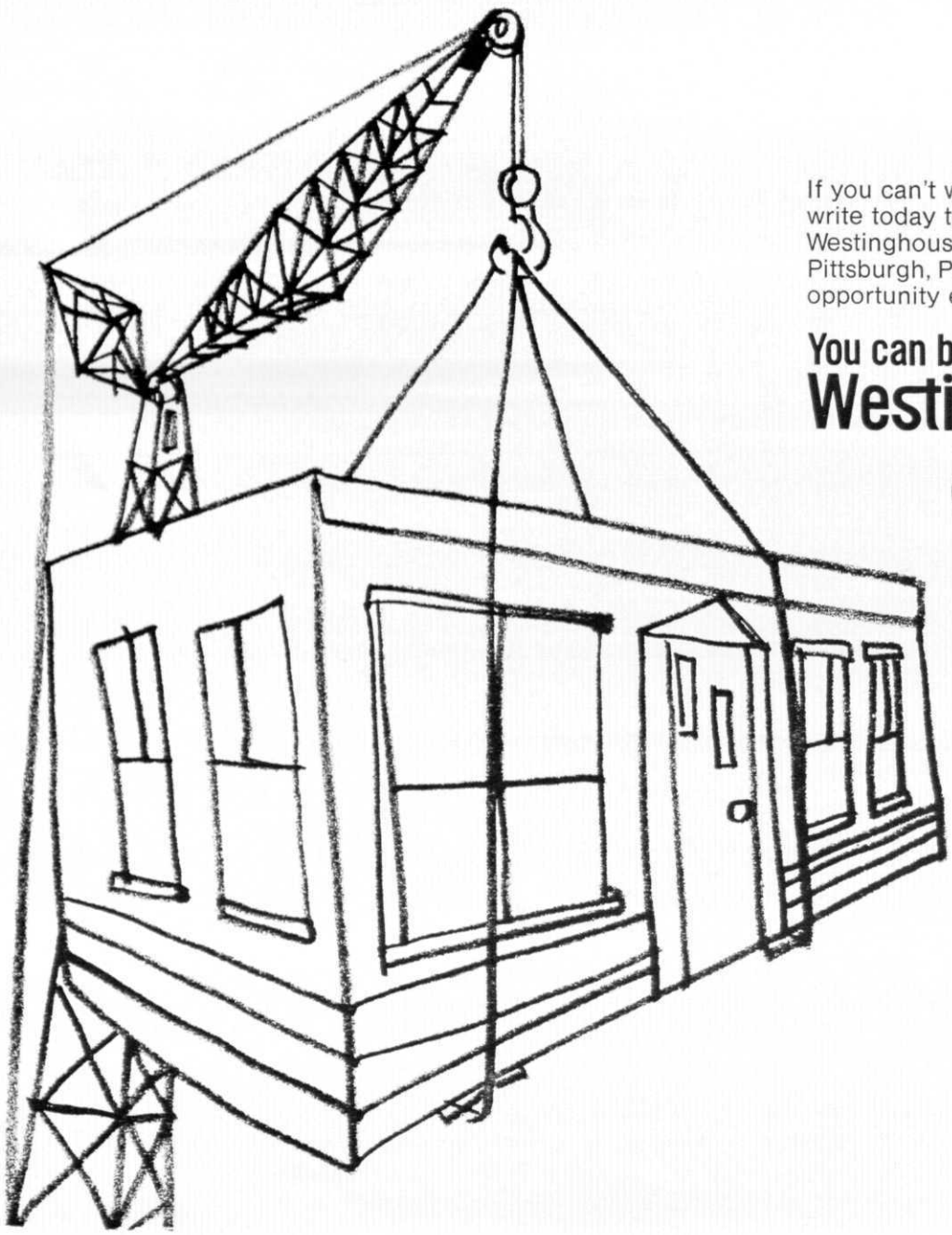
```
EEEEEEEE  N      NN   GGGGGG    II  N      NN  EEEEEEEE  EEEEEEEE  RRRRRRR
EEEEEEEE  NN     NN  GGGGGGGG   II  NN     NN  EEEEEEEE  EEEEEEEE  RRRRRRRR
EE        NNN    NN  GG         II  NNN    NN  EE        EE        RR    RR
EE        NNNN   NN  GG         II  NNNN   NN  EE        EE        RR    RR
EEEEEEE   NNNNN  NN  GG  GGGG   II  NNNNN  NN  EEEEEEE   EEEEEEE   RRRRRRRR
EEEEEEE   NN NNNNN  GG  GGGG   II  NN NNNNN  EEEEEEE   EEEEEEE   RRRRRRR
EE        NN  NNNN  GG    GG   II  NN  NNNN  EE        EE        RRRRR
EE        NN   NNN  GG    GG   II  NN   NNN  EE        EE        RR RRR
EEEEEEEE  NN    NN  GGGGGGGG   II  NN    NN  EEEEEEEE  EEEEEEEE  RR  RRR
EEEEEEEE  NN     N   GGGGGG    II  NN     N  EEEEEEEE  EEEEEEEE  RR   RRR
```

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

MICHIGAN STATE UNIVERSITY
VOLUME 25
NUMBER 3
FEB./MARCH, 1972



Whose factory made this house?
Westinghouse.
You bet we're hiring.



If you can't wait for the recruiter, write today to George Garvey, Westinghouse Education Center, Pittsburgh, Pa. 15221. An equal opportunity employer.

You can be sure... if it's Westinghouse

SPARTAN ENGINEER

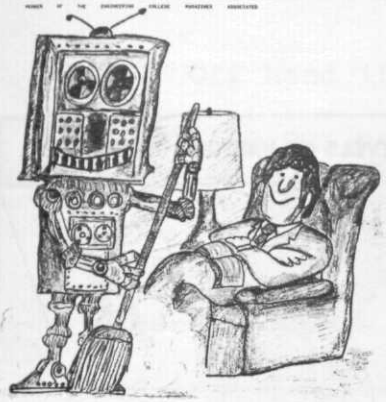
spartan engineer

The Scientific Ecologically Open Minded Magazine

Member of the Engineering College Magazines Associated

MICHIGAN STATE UNIVERSITY

VOLUME 25
NUMBER 3
FEB./MARCH, 1972



This months cover design symbolizes the growth of computerization and automation in our society. The art work is by Pat Sharp and the letterhead is by Bob Norby with some assistance from the CDC 6500. (The computer is an obsolete RCA model.)

FEATURES

DEPARTMENTS

Member, Engineering College Magazine Associated / Chairman: Daniel L. Griffer, Jr. Iowa State University, Ames, Iowa / Publisher's Representative: Littell-Murray-Barnhill, Inc., 60 East 42nd St., New York, New York 10017. / 737 N. Michigan Ave., Chicago, Ill. / Published four times yearly by the students of the COLLEGE OF ENGINEERING, MICHIGAN STATE UNIVERSITY / East Lansing, Michigan 48823. / The office is on the first floor of the Engineering Building / Room 144, Phone 517 355-3520. / Subscription rate by mail $2.00 per year / Single copies 40 cents / Printed by Millbrook Printing Company/.

A statement of policy:

The objective of the magazine is to communicate the exchange of ideas between: students and professors, professors and professors, departments, and colleges within the university. The Spartan Engineer believes that the engineering world can no longer neglect the social interactions of the outside world and is dedicated to initiating programs within its bounds that not only seek to relate the latest discoveries of pure science, but also show a genuine concern for the questions troubling our environment. The Spartan Engineer also identifies with the American ideal of free enterprise and its attempt to perfect the efforts of mankind in constructing a new world through human engineering.

STAFF

ENGINEERS GUIDE TO COMPARATIVE VALUES IN ZINC vs. PLASTICS

Unreinforced Plastic vs. Die Cast ZINC* Material	RATIO OF COSTS FOR EQUIVALENT LEVELS OF VARIOUS PROPERTIES					
	Tensile Strength at 24°C	Tensile Strength at 80°C	Flexural Strength at 24°C	Tensile Creep (100 hrs.) at 24°C	Un-notched Tensile Impact Strength at 24°C	Flexural Fatigue Strength at 24°C
ABS	2.54	3.46	1.37	12.3	2.78	0.91
Nylon 6/6	4.72	5.40	2.70	85.6	1.64	1.91
Polyacetal	3.09	5.00	2.40	29.0	3.60	1.42
Polycarbonate	3.82	3.60	2.33	20.0	1.70	3.40
Polypropylene	2.00	3.13	1.10	37.7	1.09	0.52

*SAE 903 Die Cast ZINC = 1.0 **Costs as of January 1970, (carload lots or maximum quantity bracket). All calculations are based on these figures.

Glass Reinforced Plastic vs. Die Cast ZINC* Material	RATIO OF COSTS FOR EQUIVALENT LEVELS OF VARIOUS PROPERTIES										
	Tensile Strength at 24°C	Tensile Strength at 80°C	Tensile Stiffness at 24°C	Tensile Stiffness at 80°C	Flexural Strength at 24°C	Flexural Strength at 80°C	Flexural Stiffness at 24°C	Flexural Stiffness at 80°C	Tensile Creep (1000 hr.) at 24°C	Notched Tensile Impact Strength at 24°C	Flexural Fatigue Strength at 24°C
Gl. Re. Nylon 6/6	1.91	2.68	8.42	8.90	1.82	1.91	20.5	16.7	7.85	3.83	1.96
Gl. Re. Polycarbonate	3.36	2.68	10.0	5.27	2.56	2.05	20.4	3.05	5.46	9.24	2.88
Gl. Re. Polyacetal	4.73	5.40	12.7	11.1	4.20	3.78	26.4	5.04	9.45	20.9	2.81
Gl. Re. Polypropylene	2.83	2.74	5.26	11.4	2.48	2.39	13.1	6.30	6.51	13.2	1.69
Gl. Re. Polysulfone	4.00	3.21	12.7	6.66	3.39	2.78	23.7	5.44	4.83	16.5	3.76
Gl. Re. SAN	1.63	2.14	4.37	2.78	1.70	1.49	9.70	1.84	1.90	10.1	1.14

*SAE 903 Die Cast ZINC = 1.0 **Costs as of January 1971, (carload lots or maximum quantity bracket). All calculations are based on these figures.

ZN-495

These charts are based on information from two extensive engineering evaluations conducted by U.S. Testing Co., for the International Lead Zinc Research Organization Inc. These studies showed that in almost every instance die cast zinc gives you more performance for your money than any of the plastics tested. ☐ For example, the results showed that an unreinforced Polycarbonate rod would cost 3.82 times more than a SAE 903 rod to withstand the same tensile load. Glass reinforced Polycarbonate would cost 3.36 times more than zinc. ☐ Reprints of this "Engineers Guide" are available. Just let us know the quantity you would like.

ST. JOE MINERALS CORPORATION

250 Park Avenue, New York, New York 10017, Tel. (212) 986-7474

The 8 Hour Work Week????

Off hand it may seem an impossibility, but if we can stabilize our population growth and solve the pollution problem, it is an almost certainty; however, fusion power is an absolute prerequisite for this to occur. Fusion is clean, produces far fewer radioactive wastes than fission and is a virtually unlimited power source. Five cents can extract all the deuterium in one gallon of water. This amount of deuterium has the energy potential of 300 gallons of gasoline. Three hundred times x-many gallons of water in the ocean equals an enormous amount of power.

Fusion power combined with continued cybernetic advances could easily free man from much repetitive toil. Eight hours of work per week per person may be sufficient due to the vastly increased productivity such a combination would bring. An almost utopian society could be ours by the early part of the next century, but just hypothesizing won't make it so. Congress must appropriate more money to fusion research in this country if we are to have fusion power by the end of the century. More people must be made aware of the necessity for greater spending in this area. The 8 hour work week can be ours but only increased cybernetic and fusion technology can make it possible.

Vincent Rybicki

energy

The energy to keep straining toward your chosen goal—and even as you attain it, look forward to the ones beyond.

The energy to explore, evaluate, create, bring needed changes.

Energy to burn, figuratively—that wealth possessed by the young, in mind no less than body.

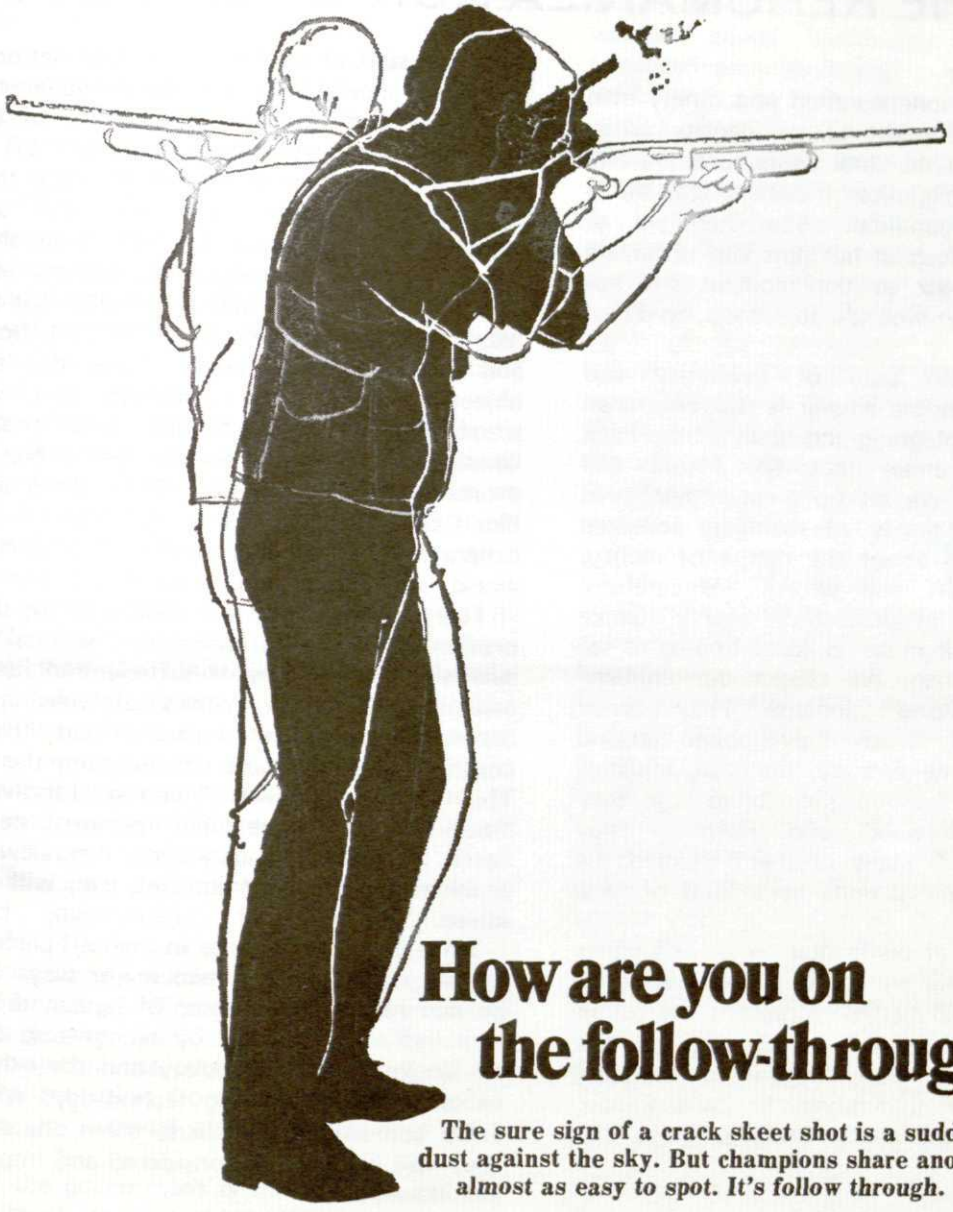
Energy to burn, literally, because ideas—freedom, equality, well-being, conservation of our natural environment—must be turned into realities—food, shelter, warmth, access, economic independence and the physical means to accomplish our goals. Atlantic Richfield is an energy company—in all these ways. One of the nation's thirty leading industrial corporations, and one of the ten companies producing most of our energy needs, with a strong position in diversified chemical products as well as in oil and gas.

A young company still extending its boundaries as it joins the efforts and resources of the Atlantic, the Richfield and now the Sinclair Oil Companies. Aggressive and imaginative in management. Flexible in organization and operation. Open to fresh thinking. Responsible in outlook. Offering new opportunities to financial and systems analysts, accountants, auditors, engineers, geologists, geophysicists, sales representatives, agronomists and programmers.

We invite your interest. See our representative on campus or your Placement Director.

AtlanticRichfieldCompany

An equal opportunity employer M/F.



How are you on the follow-through?

The sure sign of a crack skeet shot is a sudden puff of clay dust against the sky. But champions share another mark that's *almost as easy to spot. It's follow through.*

Like the top-flight skeet shooter illustrated here, our tapered roller bearing and steel engineers get results because they follow through, too.

How about you? Do you want a company that involves your interest and keeps you involved till the finish? That promotes from within? Are you up to the demands thrown our way by the automotive, construction, aerospace and chemical industries? Do you have your sight set on the future—on a company like ours that has a $221 million expansion and modernization program?

Then write to our Manager of College Relations. And tell him you'd like to take a shot at it. The Timken Company, Canton, Ohio 44706. Timken® bearings are sold all over the world. Manufacturing in Australia, Brazil, Canada, England, France, South Africa and the U.S.A.

An Equal Opportunity Employer (m/f).

TIMKEN®
REGISTERED TRADEMARK

THE TIMKEN COMPANY MANUFACTURES TAPERED ROLLER BEARINGS, SPECIALTY ALLOY STEEL AND REMOVABLE ROCK BITS.

ON THE REHUMANIZATION OF SOCIETY

A BRIEF HISTORY

America, on her one hundred and ninety-fifth birthday is in the midst of an identity crisis. After an infancy in the rural agricultural era and puberty in the metropolitan industrial era, she is entering the megalopolitan cybernated era of adolescence—suspicious of her past and uncertain of her future. Right at the moment she has retreated to lick her wounds, to recoup, to digest and to introspect.

Why the sudden pain of insecurity and confusion? One possible answer is that almost all of our study and planning and actions have been based on the premise that the future will resemble the past. We set up a social system in which the vast majority of members accepted certain assumptions about the nature of reality, of events, of right and wrong. We carefully planted the values of democracy, liberty, justice and freedom for all in our children hoping to see those values flourish. We taught our children science and reason and rationalism. They learned their lessons well. When they looked around themselves they saw tyranny, bondage, injustice and freedom for few. In their blind rage they burned Watts, Newark, and Detroit. They bombed and rioted. Many of them rejected the materialism of their parents as a kind of false security.

After a decade of confrontation politics, there are many confused, uprooted people wandering aimlessly about the battlefield amidst the rubble of former values, and America has not been the same. Her people have begun to seriously question the belief that money brings happiness, war brings peace, and change brings progress.

THE PROBLEMS

This brief history is, of course, a grossly oversimplified explanation of our inability to decide what our future should be and how we should get there. You cannot say what our collective future should be anymore than I can. But if I suggest a thesis and you propose an antithesis, perhaps we can arrive at a synthesis of what should constitute our national priorities and what kind of society can act on these priorities.

It is impossible to even define national priorities unless there is a national goal. For without a goal, everything is equally important—or for that matter, equally meaningless. And a collective national goal is hard to agree upon because as individuals, we disagree about the facts and the interpretation of facts, trends and the interpretation of trends, the constraints imposed by the environment, the nature of man, and what constitutes a desirable world to live in.[1]

So we start at the beginning: Our national goal is to enhance/affirm the dignity/value of each individual and improve the quality of life for each individual in the society as a whole.

Although it is easy enough to state this as a platitude there are immediate and ominous rumblings on the horizon. Right away there are those who would analyze our society assuming the existence of an objective reality—the systems men, the game strategists at Rand Laboratories and the like. They assume that this external objective reality is something that can be understood and controlled and that their consequent task is to develop better methods of measurement and control. Then there are men like Carl Rogers, ee cummings, Paolo Soleri and others who believe that reality is subjective—the world tends to become what it is believed to be.

The magnitude and the nature of the obstacles preventing us from attaining our national goal are such that neither view is sufficient in itself. It is essential that both modes of viewing reality remain in constant tension, and that both contribute to the task of designing the future.[2] This is a crucial point; if we regard individuals as "black boxes" alone, their personal needs will never be met. Yet if we do not view certain problems in a societal context, they will never be solved.

While I do not believe in the self-perfectibility of man, I see at least two major ways in which we can reach for this goal of human dignity for each individual. One is by recognizing the need for flexibility in our society and the other is the necessity of controlling technology. While it is more convenient to discuss them one at a time, they will have to be considered and implemented simultaneously.

THE FIRST PRIORITY

The first great priority—flexibility—is unfortunately too general to be practical. What are some of the specific ways we can increase the resilience of society? Most of these seem to boil down to political changes. This does not come as too great a surprise if you consider politics as a glue that holds society together.

In this age of technology it is especially important that the government be able to respond to changes in society at least as rapidly as those changes occur. To a large extent, this is one of the shortcomings of our government that today's college students find hardest to accept. "The present generation of undergraduate students has not experienced a major scientific breakthrough which significantly altered their lives. They have experienced or caused social changes galore, but radio and television seem

eternal to them, always were and always will be. Jet airplanes, electric kitchens and computers were 'ancient' when they woke to the use of reason . . . The days before Alan Shepard soared into space (no irony intended—my note) are as foggy to today's undergraduates as the feats of Buck Rogers were unreal to their parents. Nothing seems impossible in the world they have known. No wonder they are impatient in a world where millions are starving, where wars continue without clear purpose, where racism is winked at and government slowly strangles the freedom of an uninvolved electorate. They see no reason for misery or any delay: America abounds in money and talent."[3]

If government does truly exist to serve the people rather than its own perpetuation it must allow dissent. Without dissent there can be no hope of government being responsive to the needs of society given the time scale our society is geared to.

French critic Jean-Francois Revel, author of *Ni Marx Ni Jesus* (Neither Marx Nor Jesus) maintains that the United States is to be the birthplace of the second world revolution. The first was the advent of egalitarian societies and the second will have as its goal the establishment of "economic and social equality by and through cultural and personal liberty; the guarantee of security through the participation of all in political decisions and eventually the creation of a world government." He credits this to America's revolutionary method of change—dissent. As evidence he cites the case of the Vietnam War; "For the first time in world history, a foreign war . . . is meeting with strong opposition within the country that is waging the war . . . the transition from internal democracy to democracy in external affairs represents a giant step."[4]

And if the government is to act upon and not against dissent, then it must allow a free press. The recent attempts of government to gain a noose to hang over the press through its wiretap and right-to-subpoena-journalists'-notes cases are ominous signs that it is not willing to allow dissent a totally free voice.

Not only must dissent be allowed, but a truly representative government must be maintained. Somehow the checks and balances which were carefully designed into the Constitution to prevent concentration of power have fallen into disrepair. Congress must insist on its Constitutional right to declare war and refuse to let quasi-legal executive orders negate that role.

Within Congress itself a new look must be taken at the seniority system and the distribution of power. If two senators are elected—a freshman and one with "tenure"—legally they each represent the same number of people. Yet the power wielded by the senior senator's constituents may be far greater than that of the junior senator's constituents by virtue of the unequal power distribution between senators. Legalized gerrymandering?

We must also take a look at the role the lobby system plays in American politics. The seniority system and lobbies seem to exist in a symbiotic relationship—each helping each other. Yet neither is particularly representative. Supporting an effective lobby takes money and a great deal of it. Where does this money come from? Somehow I find it a difficult notion to accept that the rights of the corporation are inherently more valuable than the rights of the individual because corporations can pay to safeguard those rights. While a total ban on lobbying would not be desirable or enforceable, an equal distribution of congressional power might go a long way toward restoring a semblance of equal representation and a balance between corporate and public interests.

One of the duties the government has traditionally shirked since the advent of big business is trust-busting. There are discouragingly few anti-trust lawyers and indictments considering the effect corporations have upon the individual. It is just as possible for the rights of an individual to be denied by an act of corporate disregard or exploitation as it is for those rights to be denied by an invading enemy. We maintain an elaborate military organization to protect us from the latter, but virtually deny the possibility of the former.

Another massive obstacle to flexibility within the government is the elaborate system of overlapping bureaucratic jurisdictions that has evolved. In a Cooley essay paper last year, Brad Behrman reported that America has a "hodgepodge of 80,000 local governments—villages, townships, counties, port authorities, sewer districts, and special purpose agencies."[5] Incredible amounts of waste, duplication, and friction result from such a system. Add to this the multitude of federal and state agencies and it is more than mildly surprising that our country runs at all.

It is hard to suggest a realistic alternative because of the magnitude of the problem. But perhaps a move toward greater political ecumenicalism between local governments could lead to consolidation and eventually toward regional authorities based on local needs. For instance, a single Great Lakes Authority (with authority, of course) would be able to respond far more effectively to the total social, ecological, and economic needs of the Great Lakes Region than the hundreds of local municipalities dotting the shoreline or the mammoth bureaucracy centered in Washington.

Admittedly there are severe problems here, too. It is a very real objection that individuals and municipalities would get trampled on in the

(continued on page 18)

Artificial Intellegence

What's It All About?

By Jack Howes

This article will be a brief summary of the state of the art and come previews of future attractions. Computers have been becoming more and more a part of our life but we haven't seen anything yet . . . computers are going to have a very profound effect upon us.

Let us now look at some of the things being done to increase the intelligence of automata. One major step forward was the development of high level language, i.e. computer input that resembles English. Building on the higher languages (Fortran, Algol, Cobol, etc.) can produce specialized languages that are extremely readable; however, all of these special languages have a singular purpose of developing programs that contribute to the intelligence of a computer in a particular complex problem. Here we see one of the main problems faced in developing artificial intelligence in automata. We can place contributions into two categories, general programs with ability to perform tasks in a wide variety of areas and programs which exhibit expertise in particular problem areas. At present both of these goals haven't been accomplished in one computer program.

We are seeing specialized programs that have great amounts of skill and sophistication coming closer and closer to individual use. This is what technicians call time sharing and programmers call interactive or responsive modes of usage. Large numbers of terminals can be accomodated by one computer without the person at the terminal realizing he doesn't have the full attention of the computer. Advances in this area are limited only to the developing of more convenient means of intercommunication.

Cathode ray scopes are a good step forward but are certainly not the ultimate in man/machine interaction. In the near future we should see some really exotic devices for communicating with computers. For example, already in use are terminals that give stock quotations (found in all brokerage houses), devices to convert analog information (voltages, currents, temperatures, stresses, weights, etc.) to digital information, and all the graphical terminals being experimented with today.

In the background of these various user oriented devices are the programs that make our computers appear to be intelligent. Unfortunately, these programs can achieve skill in only very limited problems domains.

There are game playing programs which are probably the most popular and recognized area of artificial intelligence. Game programs also present some of the most difficult problem areas to achieve skill in. There is an extremely good checker program that was written by A. L. Samuel who works for I.B.M. which is probably the most skillful of all present artificial intelligence programs. There are only a few grandmasters who can beat this checkers program. Chess programs have not been as successful, most are rated as beginners.

Some of the more exotic research deals with robots. There are working models at a few research centers such as M.I.T. and Stanford, They have progressed far enough so that the machine can roll down a hall lined with rooms and find particular objects in a room. There is also a great amount of research being done toward digitizing and then interpreting voice patterns; however, there is still a long way to go in this area . . . but you haven't seen anything yet!

Puzzle Page

A five dollar prize will be awarded to the first undergraduate engineering student to turn in the correct solutions in Rm. 144, E.B.

1. Two similar triangles with integeral sides have two of their sides the same. The third side differs by 387. What are the lengths of the sides?

* * *

2. A book was found missing some of its pages. The sum of the page numbers of the consecutive missing pages in 8,656. What are the missing pages?

* * *

3. A spider eats three flies a day. Until he fills his quota, he has an even chance of catching any fly that attempts to pass. A fly is about to make the attempt. What are the chances of survival, given that five flies have already made the attempt today?

* * *

4. There are N points on a circle. A straight line segment is drawn between each pair of points. How many intersections are there within the circle if no three lines are concurrect? Into how many sections will the circle be divided?

* * *

5. In Byzantine basketball there are 35 scores which are impossible for a team to total, one of them being 58. Naturally a free throw is worth less than a field goal. What is the point value of each?

LAST ISSUE'S WINNER: Fred Larner, CPS Sen.

Last issue's answers.

1. (4/64) (27/63) + (12/63) (25/63) + (20/64) (23/63) + (28/64) (21/630) = **13/36**

* * *

2. **31. The terms of the sequence are representations of 16 in different bases, from 16 to 2.**

* * *

3. Let x be the radius of the larger circle, then $x(x-9) = (x-5)(x-5)$. $x = 25$
The diameters of the circles are 50 and 41 inches.

* * *

4. All of the triangular fields are the same area, 9 acres. The area of the center triangle is $\sqrt{s(s-1)(s-b)(s-c)}$ where $a = \sqrt{26}$, $b = \sqrt{20}$, $c = \sqrt{18}$, and $s = (a + b + c)/2$. **The farmer owned 100 acres.**

Dear Don,

I want to take this opportunity to congratulate you on the outstanding latest issue of the Spartan Engineer. I particularly liked the editorial, "Why Interview?", and believe you have provided students in the College of Engineering with some information that will be very helpful to them in their career planning. Keep up the good work.

Very truly yours,

John D. Shingleton
Director of Placement

Revolutionary Engineering

We are interested in the (still embryonic) "Counter-Technology" branch of the "Counter-Culture movement. We feel that the present movement needs people from scientific, mathematical and technical backgrounds just as badly as scientists, engineers, and technicians need the social consciousness which this movement reflects. It is our belief that communes, from the point of view of their own survival, must begin with the most advanced technologies evolved by the present capitalist society and begin to remold them to congruence with a different totality of social relations.

We are presently working with several groups planning to form communities and we are actively exploring possible ecologically compatible, etc. technologies which could be utilized by such communities.

Contact: AQUARIUS PROJECT
P.O. Box 4013
Berkeley, California 94704

IF IT WORKS ON THE MOON, IT SHOULD WORK IN THE POST OFFICE.

That cylinder, the size of a pea, is a building block of all space-age electronics gear. Soon millions will put more zip in your mail. And nickel's helping make it happen.

The U.S. Postal Service is busily streamlining itself with some of the most sophisticated electronic hardware in—or out of—this world.

Optical scanners to decipher addresses in over 9 different type fonts. Computers. Coders. High-speed printers. Giant, 15-ton electro-mechanical sorters.

By 1975, this equipment should begin to slash postal operating expenses as much as $500 million a year. And make a whopping improvement in service.

At the core of the new machines—and of business, medical, aerospace, and other advanced electronic hardware—are millions of spidery gadgets like the one in our photo. Anywhere from 29 to 100 percent nickel, they're hermetically sealed *packages* for miniaturized components. Most house tiny chips of silicon covered with transistors, resistors, diodes, and complex circuitry—complete *systems* for storing, amplifying, or otherwise harnessing faint electronic impulses.

The nickel in the packages helps because it has good thermal and chemical compatibility with silicon. Because it enhances formability, bonding, and electrical conductivity. And because corrosive humidity won't faze it. (Nor snow, nor rain, nor heat, nor gloom of night, for that matter.)

Insignificant as the little cylinder looks, it took over 4,000,000 pounds of nickel to make enough of them for the electronics industry last year.

Just as our metal is a helper, so International Nickel is a helper. We assist dozens of different industries all over the world in the use of metals. We offer technical information. And the benefit of our experience. Often, Inco metallurgists are actually able to *anticipate* alloys that will be needed in the future, and to set about creating them.

This kind of helpfulness, we figure, will encourage our customers to keep coming back to us.

And that helps all around.

The International Nickel Company, Inc., New York, N.Y. The International Nickel Company of Canada, Limited, Toronto. International Nickel Limited, London, England.

INTERNATIONAL NICKEL HELPS

The small space big sound.

About the only thing missing in the average guy's pad is space. And good stereo.

That's because it's hard to pack a big stereo sound in a small space. And big jobs take up so much room you have to throw out half your library or pile it on the floor.

Which is why you should check out the new Sylvania ACS 12WH. Big sound. Small size.

Big sound from two globe speakers you can swivel and turn to get the best stereo balance for your room. Each one has a four-inch extended-range air suspension speaker that sounds as good as conventional ones two sizes larger. Yet they're small enough to fit on the shelf right next to "War and Peace."

The solid state AM/FM/FM Stereo receiver fits on a shelf, too. It's less than a foot deep and only five inches high. But it's still big on features. Like a Field Effect Transistor FM front end. Ceramic Filter I.F. Strip. Fifty watts of peak music power.

If space is really tight, just stack the turntable right on top of the receiver. It'll work great any place you put it because it's a BSR Micro-mini with a diamond stylus.

Put it all together and it'll fit on one two-foot shelf. For about $200.*

How's that for no-space age living?

*Manufacturer's suggested retail price for Model ACS12WH is $199.95.

GTE SYLVANIA

Dr. J. D. Ryder

AN INTERVIEW
WITH
DR. J. D. RYDER

by Don Willemsen

Computer Technology in the USSR

In the summer of 1970 Dr. J. D. Ryder was part of a team of U.S. scientists and engineers sponsored by the State Department and I.E.E.E. He visited the USSR and some of its electronics and computer factories and institutes as part of a scientific exchange program. Here are some of the views Dr. Ryder brought back on computer technology in the USSR.

Don: Who is ahead in computer technology, the US or the USSR and by how much?

Dr. Ryder: We are definitely ahead of the Russians in computer technology. We are ahead by at least several years to a computer generation; although, the Russians claim to have two very capable computers hidden somewhere underground.

Don: What are the Russian computers like?

Dr. Ryder: Their best, the BECM-6 which is comparable in arithmetic ability to our CDC 3600 is slow and very bulky. For example, their keypunchers appear to have a large typewriter mounted on a high metal table which is filled with hardware. There is no automatic verifier on their keypunches and the operator must read what is printed on every card leading to many errors. While we were there, the Russians were only beginning to decide what type of system to devise to have multiple access to their computers. Their consoles had nixytube readout which is limited to only a few specific characters and is not as versatile as our cathode ray readout.

The BECM-6 had six to eight storage drums which were 18" in diameter running at approximately 850 rpm which is comparable to our technology on the ILLIAD-1 in 1954. This also indicated the computers low storage capabilities. The printer was very inefficient, printing only six lines per minute. The Russians were also just installing a plotter they purchased from France.

Don: Do you think the Russians could gain from our technology, or would it upset their system by selling them computers manufactured in the US?

Dr. Ryder: First of all, the Russians say, "There is nothing to learn from the West." Until recently they would not use any of our technology made available to them due to loss of face with their own people. Now, however, they are beginning to buy magnetic tape and tape units from the West. The inability of the Russian chemists to produce good magnetic tape is one of the main reasons for their low storage in computers. As a matter of fact, the computer institute of Novo Sibirsk used almost all paper punch tape.

Don: Do the Russians use semiconductors and integrated circuits in their computers?

Dr. Ryder: The Russians are 1 - 3 years behind the US in semiconductor technology. Their diode and transistor facilities are not as good as ours and therefore their semiconductors are not as good.

Don: Are computers used in factories or for accounting or for stock purposes?

Dr. Ryder: Not very often. The only computer we saw in use while in Russia was at a semiconductor factory. The main reason many places do not have computers or are slow in getting them is the great deal of bureaucracy in the Soviet Union.

Don: Do you think computer technology in the US made it possible for us to reach the moon before the Russians.

Dr. Ryder: Yes, they have no backup computers like the US and, being able to look at a spacecraft, their instruments were very sparse. It looked like they didn't have any computers on board.

Marginal land: the same area raises 30 chickens or 1 ton of catfish

The farmers at a "Kombinat" (collective farm) in Nasice Breznica, Yugoslavia are really making their acreage pay off.

They flooded it, and are raising good old American channel catfish.

About three years ago, FMC visited the Kombinat as part of a state department-approved agricultural development program. At the time, the Yugoslavians were raising carp in huge man-made ponds covering marginal land—land not best suited for crops. "Why not switch to farming catfish?" we asked. "They yield twice the harvest. And they bring a premium price in the marketplace."

The Yugoslavians said, "Good idea—where do we get the fish?"

That's when our work began. We contracted to ship them 21,000 fingerlings, 110 brood stock, and 120,000 newly hatched "fry," knowing live fish shipment mortality rates often reached 50%.

To do this job, special FMC containers were developed to fit into the baggage compartment of a Pan Am 707. They maintained precise life support levels of oxygen, carbon dioxide, ammonium, and controlled thermal levels, too. During four 50 hour trips from St. Louis to Yugoslavia we lost just six fish. A record.

More importantly, Yugoslavia has more productive "farmland."

Fish farming, or aquaculture, is an extension of FMC agricultural programs. The company is capable of building ponds, supplying pond cleaning and pond operating equipment, building fish processing and canning plants, as well as containers for shipping fish by air.

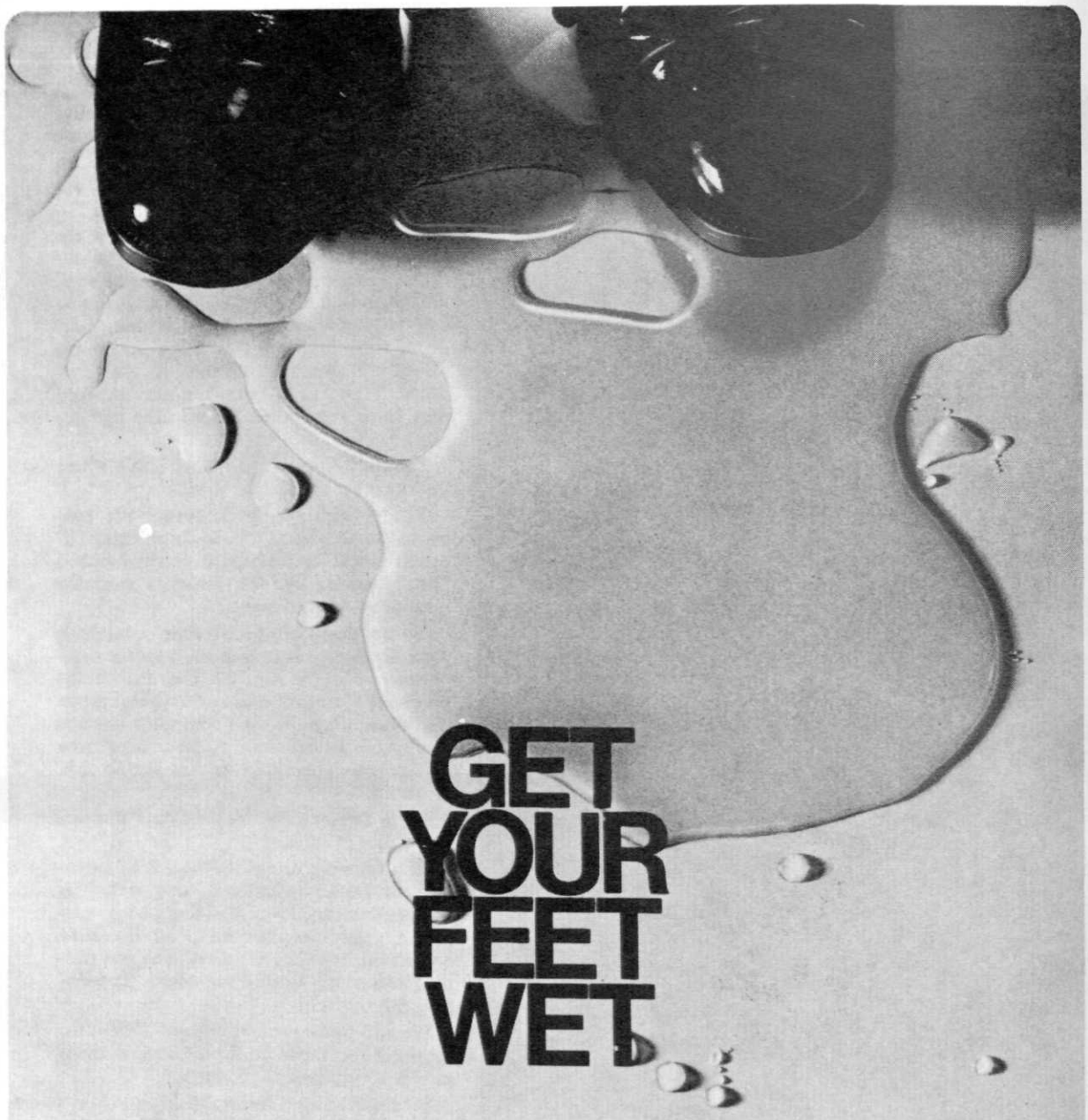
We also make printing presses, chemicals, snowmobiles, rayon cord, and several thousand other diversified products.

To discover what else we're doing to make life livable, see your placement director for our publication, "Careers with FMC." Or write FMC Corporation, P. O. Box 760, San Jose, California 95106. We are an equal opportunity employer.

fmc CORPORATION ®

FMC CORPORATION

You'd be surprised at all the things we do.



Water makes many things grow and flourish. Including your career. That's why engineers, landscape architects, environmentalist/ecologists, economists, planners and many other modern professionals have a chance to do big things—in every sense—by launching careers with the Corps of Engineers.

The Corps is responsible for overall planning and management of our nation's principal water resources. The question you will confront is no less than: "How can we improve the quality of life in these United States as it relates to water?"

When you find the answers, we'll help you put them to work. This unique challenge involves both your own technical education and talents and a total commitment on *our* part that the development and management of water resources must be balanced with protection of the natural environment.

Our career opportunities are not concerned with water resources alone, however. Modern construction, engineering design, systems analysis, computer technology, R&D, topography—these are just a few of the other areas where you can build a career of total involvement, achievement and satisfaction with the world's largest engineering/construction organization.

Eager to share a real challenge? This is the opportunity you're looking for. Write today for full information. CORPS OF ENGINEERS, Department of the Army, Washington, D.C. 20314 • An equal opportunity employer m/f

CORPS OF ENGINEERS

CISSR

by Dave Klingman

The Computer Institute for Social Science Research of Michigan State University was established in 1963 with two major functions. First, it is a research institute designed to provide research opportunities for social science faculty. There are usually about ten faculty in the research section all of whom hold joint appointments between CISSR and their home departments. Second, CISSR has a technical section designed to provide computer services for the MSU academic community, primarily developing and maintaining programs for social science data processing, and consulting in their use.

At first CISSR began hiring faculty and graduate students to perform these technical functions. But with the establishment of the Federal Work-Study Program in 1966 CISSR began hiring talented undergraduates. Initially there were about five programmer-consultants supervised by a staff member who also trained them. However, as more were hired it became evident that a formal training program was necessary. Such a program was set up with two sub-programs.

The Undergraduate Apprenticeship Program was designed not only to supply CISSR with technical personnel, but also to provide research assistants for computer oriented faculty, government agencies, and business concerns. The apprentices were supervised by upper-division undergraduates who also taught informal classes in fortran programming, assembly language, mathematical logic, statistics, social science research methods, and computer data processing. They also worked in teams of three or four members on projects and problems provided by social science faculty and the CISSR technical staff. The program grew to be quite large in the late 1960's and early 1970's, with as many as 90 undergraduates employed at one time. In 1970 the Center for Urban Affairs at MSU began granting funds to CISSR to train minority students, which helped swell the ranks. The Apprenticeship Program produced many competent programmers and consultants.

The other sub-program was the Graduate Intern Program, designed to train social science graduate students in computer research methods. They received much the same training as the undergraduates and after one year they were returned to their departments.

Recently tighter budgets have begun to have an effect on CISSR's training program. First, the Graduate Intern Program is no longer in effect due to departmental reductions in graduate assistants. Second, the Federal Work-Study Program has become more stringent in its requirements for financial need. Third, employment opportunities in computer-related fields have suffered along with other fields. In view of these developments CISSR is currently upgrading the quality of the training program while reducing its size. Hiring is becoming more selective and training is being oriented toward CISSR's own technical functions. At present there are 33 apprentices and 11 programmers and consultants. The Training Supervisor is now a faculty position in the technical section. The curriculum is concentrated in fewer courses taking a longer period of time and in CISSR-related projects being done individually.

Many CISSR projects are being completed in an undergraduate four credit course sponsored by the Computer Science Department, CPS490, taught by the staff of the technical section. The course involves a lecture covering the design and techniques of social science data processing program libraries, and a CISSR-related project assigned to each student. Thus, the student's work for CISSR is being rewarded with academic credit rather than pay. Finally in the area of graduate training, the College of Social Science is now requiring graduate students to have a minimum level of training or experience in computer usage before they will be authorized to use the university's computers. To help provide this training the CISSR technical section is conducting a non-credit course in computer data processing for social scientists.

 (continued from page 7)

ruthless quest for efficiency. And yet if dissent and other forms of public feedback such as hearings and referendums were encouraged it might be a workable alternative to the present bureaucratic inefficiency.

It is becoming more and more obvious that government, like any other complex problem, is a complicated series of trade-offs. Sooner or later we have to admit that no government can meet all of our needs. It is the classic enigma of the conservative and the liberal—how far should government go? Ideally, a government should be capable of guaranteeing the rights of the individual without specifying how the individual is to use his rights.

It is also a sad but true reflection that a government of men and women mirrors the faults of those men and women. Our press has coined a phrase to describe one of those faults—the "credibility gap." Even this euphemism does not obscure the fact that the government has lied, is lying, and will probably continue to lie. Recall last spring how the present administration stoutly maintained that absolutely no United States forces were operating in Laos. That took on a rather hollow sound when an American newsman brought back a tape recording of a U.S. forward air controller directing air strikes deep inside Laos. Then recall how the claim was changed to say that no U.S. ground troops were operating in Laos. And yet pictures were published in the newspapers of American civilians (allegedly CIA men) on Laotian air bases. There is no real evidence available to us one way or the other—only nagging doubts. It is these nagging doubts that are fed by half-truths from Washington; they corrode any respect one might have for the integrity of the government. If government is to be a resilient body capable of responding to change and dissent, it must be able to admit mistakes and reflect greater honesty in its dealings.

Finally, in a flexible government there is room for political un-solutions. When asked what he would do about the "racial problem" during the 1965 New York Mayoralty campaign, William Buckley replied: "Nothing—except promise justice."[6]

THE OTHER PRIORITY

Dawn, July, 1945. New Mexico—The new Tower of Babel stands in the desert. The high priests have gathered to make a burnt offering to the god of reason. It is the celebration of the triumph of the technology of man.

As the time of the lighting of the altar grows near men dare speak only in hushed voices. And then the tower is consumed in a flash as bright as a thousand suns. Hideous fireball and mushroom clouds slowly rise in the sky, and the heavens reply with a giant shock wave. This triumph of technology symbolically blinded us, and we have been blinded by its power ever since.

Technology equals power. Man discovered that he could unlease vast amounts of power—far more than the individual imagination can cope with. Enamoured with technology we have exploited nature, each other and ourselves.

What have we lost? Or gained? Does our individuality mean anything? Can technology be controlled? Do we want to control it? These are the kinds of serious questions people are asking themselves—or are being confronted with today. Take the case of one James Driver, upper-middle class, suburban-dwelling, tax-paying member of our high-pressure society: "One winter morning last year James Driver pulled away from his Bloomfield Hills home, looked at the slush and the traffic, made a U-turn, pulled back into his driveway, turned off the motor . . . After twenty years worth of rides on the suburban whirligig, Driver decided that morning that it was time to get off." Why? "Now I'll be controlling my own life . . . (referring to his plans to move to Gaylord, Michigan.)"[7] In fact it is only recently that large numbers of people are becoming aware of the relationship between technology and the quality of life. For somewhere along the line we were lulled into believing that quality of life and convenience in life were the same thing and that no good thing would come of questioning the assumptions of our technological society.

In order to gain insight into the assumptions of modern technology it is necessary to step back to the dawn of the age of reason. It was Galileo who said "where the senses fail, reason steps in." Newton's concept of the world was that of a large machine, governed by certain natural laws. This thinking not only persisted but found its way into the world of human affairs where humans are believed to be governed by the "laws" of sociology, psychology, and statistics. The outcome of all this has been the gradual reduction of man to a mere cog in the wheels of history and the correspondent feelings of uselessness, anonymity, alienation and the view that life is absurd. And in one modern sense it is. "Our error (in technological society) has been in constructing so much superstructure to encourage productive performance that man has become identified by his productive function. Cybernation then threatens man's identity by offering non-human ways of executing technique."[8] Take an example: Golf is a game in which the object is to move a small ball of finite mass sequentially from one predetermined location to another with a minimum amount of expended energy. It is certainly within the scope of present-day technology to build a "golf-machine" that could take wind velocity, distance, trajectories, (etc., etc.) into account and

shoot the ball from one hole to the next. I have no doubt that with practice it could reduce the game to a series of eighteen "holes-in-one." Or better still, how about a system of pipes between holes with air pressure driving the ball from place to place controlled by a computer to remove any possibility of human error. Absurd? Of course! Yet that is exactly what we have done with the jobs and lives of more than a few in our society. We have taken away their chance to make mistakes, to learn and to be human. In other words, we have stripped their purpose from their function. Going to work each morning on the suburban whirligig was a function without meaning for James Driver.

The demands of our technological society have taken something away from us—that elusive quality of life or the joy of living. As the Book of Ecclesiastes so eloquently put it: "To everything there is a season and a time to every purpose under heaven . . . a time to break down and a time to build up . . . a time to keep and a time to cast away . . . a time to keep silence and a time to speak . . . What profit hath he that worketh in that wherein he laboureth?" (Ecclesiastes chapter 3).

Toynbee, the great historian, argues that civilizations are cyclic in nature. This seems to be a reflection on the cyclic nature of individuals. We need challenges and activity and schedules. Yet we need times of privacy and retreat and times to think. There even seems to be a certain sense of frustration and tension that builds up if we are isolated from frequent encounters with nature. Nature here refers not only to grass and trees and wide open spaces, but to the nature of man as expressed through his art and his music.

Last year CBS did an interesting documentary study for their program "60 Minutes." The study was a comparison of murder rates in Houston—a city of immense technological progress—and her sister city in Mexico. At the time of the study, Houston had the highest murder rate of any U.S. city, but the rate of her sister city was far lower. One of the commentators noted that the homicide rates were roughly inversely proportional to the number of public fountains in each city. Now one does not have to be very bright to see that there is no magical connection between homicide rates and public fountains. And yet, doesn't the number of fountains a city has say something about its concern for the well-being of the individual? It is an attempt to keep the joy in life that technology can so easily rob us of.

A view that is becoming more widely accepted today is that "the order of the universe is not just passively observed but is imposed, at least partially, by man's mind."[9] We believe that we can invent the future. And inventing the future means gaining mastery over technology.

Specifically, how can our American society begin to exercise control over the pervasive grasp of technology? This is not an easy question and it certainly does not beg an easy answer.

The very first step is to *want* to control technology. The newspapers are filled with reports of influential people proposing purely technical solutions to socio-technological problems. This is tantamount to saying that technological skill—if only we carry it far enough—is the final answer. And in the end it means imposing a technical solution on somebody, i.e., making them submit to its mastery. So the cycle continues.

In our society we can force change to occur in three main ways—voluntary self-control, public pressure, and government control. Two of these are ways of imposing solutions on people and may not fundamentally change their nature or their outlook. In fact, imposed changes often have a way of being transient and easily disregarded. But when the change comes from within a person, it is far more permanent. Another way to look at this is to observe that change can be effected at any level in the strata of society, but the deeper the level, the more pervasive and permanent the change. So the real question becomes, "How can we change the nature of people so they in turn can change the nature of technology?"

We must educate. Granted that education is a slow process where progress is measured by the change over generations of students; it is still a way to effect deep changes. But it will mean altering the fabric of our educational systems away from job training and toward development of the total person. These are not easy changes and are much more long-term in nature than the political changes suggested earlier.

REFERENCES

[1] *Dialogue on Technology*, edited by Robert Theobald, Bobbs-Merril Company, Inc., Indianapolis, 1967, p. 7 introduction.

[2] Op. Cit., Theobald, p. 16.

[3] *The Grim Generation*, Robert Kavanaugh, Trident Press, New York, 1970, p. 139.

[4] "A Foreign Vision of the Coming American Revolution," TIME magazine, February 22, 1971, p. 18.

[5] "The Engineer and the Environment," Brad Behrman, A Cooley essay paper published in the *Michigan Technic*, October, 1970, p. 17.

[6] *Up From Liberalism*, William Buckley, Bantam Books, New York, 1968, p. xx introduction.

[7] A Feature Article in the Detroit Free Press, March 14, 1971, p. 1.

[8] "The Admiration of Technique," Edward McIrvine, An essay published in *Dialogue on Technology*, p. 41.

[9] "Human Imagination in the Age of Space," William R. Cozart, An essay published in *Dialogue on Technology*, p. 48.

ENGRINEERS

"All right, you idiots, fall in—on the double!" barked the sergeant as he strode into the barracks. Each soldier grabbed his hat and jumped to his feet, except one—a private who lay in his bunk reading a book. "Well?" roared the sergeant.

"Well," observed the private. "There certainly were a lot of them, weren't there?"

"It must be terrible to be lame," the woman remarked, dropping a quarter into the beggar's hat.

"It sure is, lady," he agreed.

"But wouldn't it be worse to be blind?" she asked.

"Much worse," replied the beggar. "People kept giving me slugs when I was blind."

"I was married twice." explained the Civil Engineer to a newly graduated Electrical Engineer, "and I'll never marry again. My first wife died after eating poison mushrooms and my second died of a fractured skull."

"That's a shame," offered the friend. "How did that happen?"

"She wouldn't eat her mushrooms."

A drunk fell on his pocket flask and smashed it, naturally lacerating his rear end. Upon arriving home, he was afraid to awaken his wife, so he procured band-aids and a mirror and proceeded to apply first-aid. Came dawn, his wife shook him and shouted, "Were you drunk last night?"

"Why, no!" reassured her soggy spouse.

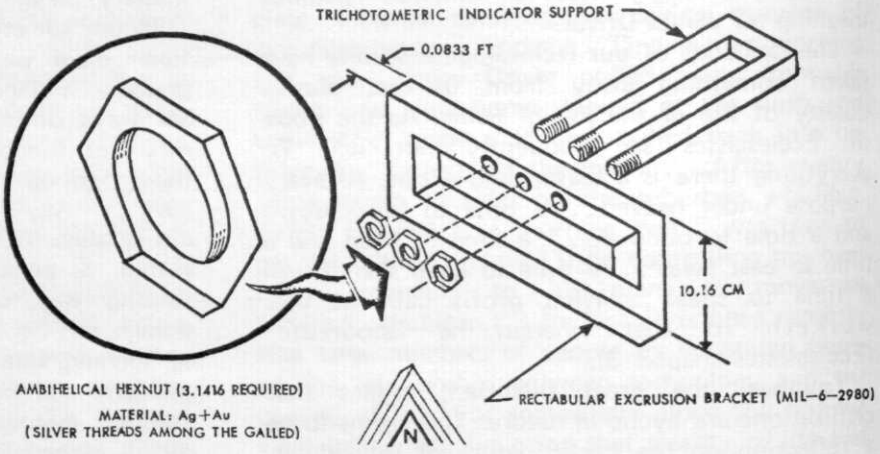
"Oh, yeah?" yelled his wife. Then what are all those band-aids doing on the mirror?"

A certain brewer sent a sample of his beer to a lab to be analyzed.

A few days later he received a report from the chemist:

"Dear Sir:

"Your horse had diabetes."



Courtesy of NAA "Operations and Service News"

Two old friends, both prosperous Industrial Engineers, hadn't seen each other in some time and happened to meet on the beach at Miami. "What brings you here Jack?" asked one.

"Actually, Fred, a tragedy. My business was burned to the ground, and I'm taking a vacation on part of the $250,000 insurance money."

"What a coincidence," responded Fred. "My business was destroyed by a flood and I got almost a million in insurance."

After a moment of thoughtful silence, Jack leaned close to his friend and whispered: "Tell me, Fred—how do you start a flood?"

Freshman: I think your girl is spoiled.

Senior: No, it's just the perfume she's wearing.

Three Indian squaws of the Al-jabr tribe were seated in their wigwams with their families. One, seated on a deer hide, had one child. The second, seated on an elk hide, also had one child. The third seated on a hippopotamus hide, had twins.

That proved that the squaw of the hippopotamus was equal to the sum of the squaws of the other two hides.

Civil Engineer: "You know something, honey? I'm going to call you jello because you're so easy to make."

Coed: "That's all right, dear. I'll call you oatmeal because you're done in three minutes."

"Do you believe in clubs for women?" a friend asked W.C. Fields.

"Yes," replied Fields, "if every other form of persuasion fails."

A young lady, with a touch of hay fever, took with her to a dinner party two handkerchiefs, one of which she stuck in her bosom. At dinner she began rummaging to the right and the left in her bosom for the fresh handkerchief. Engrossed in her search, she suddenly realized the conversation had ceased and people were watching her, fascinated.

In confusion, she murmered, "I know I had two when I came in."

M.E.: "Going out with girls a lot keeps you young."

C.E. "How come?"

M.E. "I started going out with girls when I was a freshman two years ago and I'm still a freshman."

Stereotype

Many who use the word wouldn't know one when they see one. Those who recognize it as a metal casting of a newspaper page, curved for the press, may be deriving a livelihood from this and everything else they know about printing. The more people who depend on the printing industry for a living and the more they know, the better for Kodak. The intricate complex of businesses and crafts centered on the art of printing and packaging is more than a principal market for specialized Kodak products. One way or another, it provides a life role for a not inconsiderable segment of mankind. **Finding a role *in life does seem to be a common problem.***

So you picture an executive conference. Sweeping generalities uttered, fine details worried over, a strong voice takes command: "Products alone can't sustain the growth we look for. The key is people—people to man our customer industries, to want growth in them as much as we do. Wouldn't we really be accomplishing more with a campaign to attract more kids to printing?"

Not quite.

We can't and shouldn't mount a campaign powerful enough to lure large numbers of kids into printing and the graphic arts, but we have collaborated with new-style academics, the printing and allied industries, and their unions in a measurement just completed of 1) manpower needs in these fields (not just ambitions), 2) how changes in technology promise to affect the needs. Interest in the findings should be made known to W. F. Flack, Dept. 942, Kodak, Rochester, N.Y. 14650.

Kodak

Recruiting should run on more than enthusiasm

HOW CAN A SHEET OF SILICONE RUBBER HELP TURN A TEN-YEAR-OLD INVALID INTO A TEN-YEAR-OLD ATHLETE?

A few years ago, General Electric engineers developed a silicone copolymer rubber with some remarkable properties.

It's a membrane that permits the rapid exchange of oxygen and carbon-dioxide molecules.

So it's made a revolutionary new artificial lung possible. The GE Peirce lung™ oxygenates blood in much the same way the human lung does.

That's a major engineering accomplishment. But that's not the reason it's important.

The GE Peirce lung works with a minimum of disturbance to blood cells. So it can be used safely much longer than conventional lung machines. Days instead of hours.

That extra time may be what a doctor needs to repair the defective heart of a child. To open the clogged arteries of an adult. Or to save the life of an accident victim whose lungs give out.

That extra time may be all it takes to help put thousands of those invalids back on their feet.

It's a pretty clear example of how a technological innovation can help solve a social problem. A lot of times, the effect of technology on society is rather direct.

That's why at General Electric, we judge innovations more by the impact they'll have on people's lives than by their sheer technical wizardry.

Maybe that's a standard you should apply to the work you'll be doing. Whether or not you ever work at General Electric.

Because, as our engineers will tell you, it's not so much what you do that counts. It's what it means.

GENERAL ELECTRIC