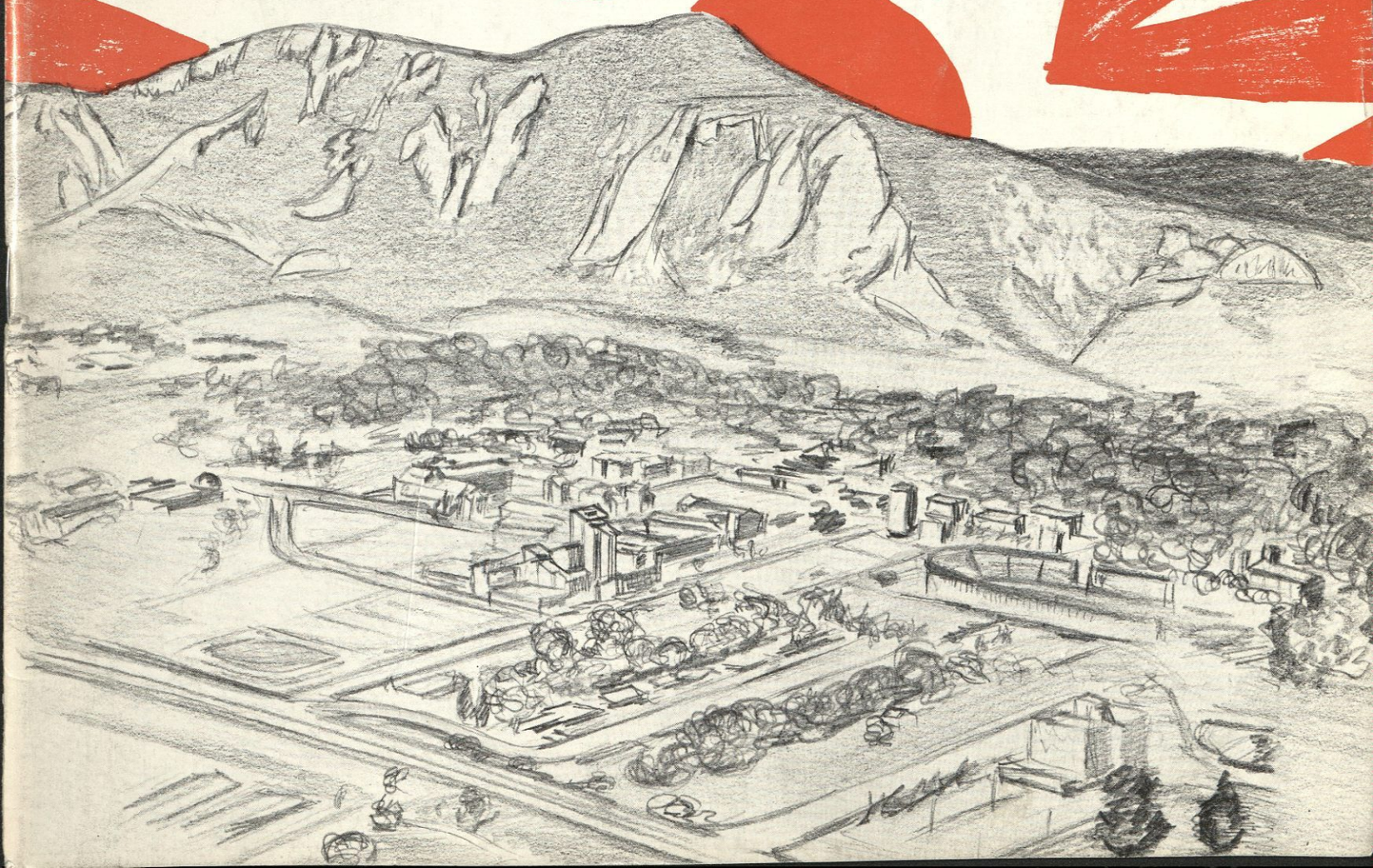
MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

The COLORADO Engineer

December 1972



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A buff will probably tell you you've got to drop a bundle to get a really great stereo system.

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But don't tell him.

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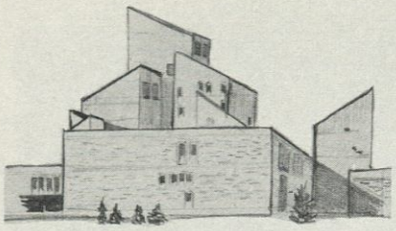

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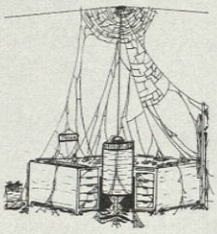

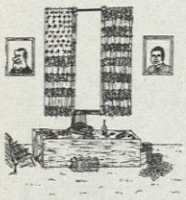

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Colorado Engineer

COLLEGE OF ENGINEERING • UNIVERSITY OF COLORADO

VOLUME SIXTY-NINE NUMBER 2 DECEMBER 1972

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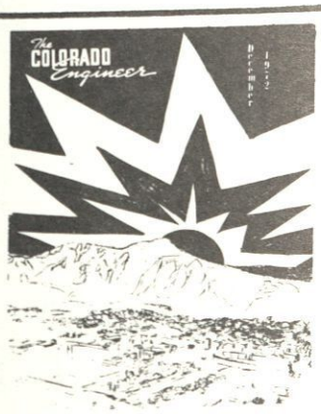
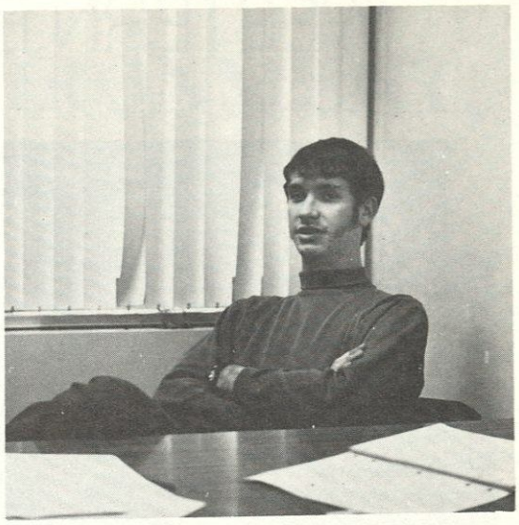
ABOUT THE COVER: This months cover is by Dick Sauer and Dave Slusher. It depicts a sunset over Boulder, Colorado.



From the Editor's Desk



DO SOMETHING ABOUT IT

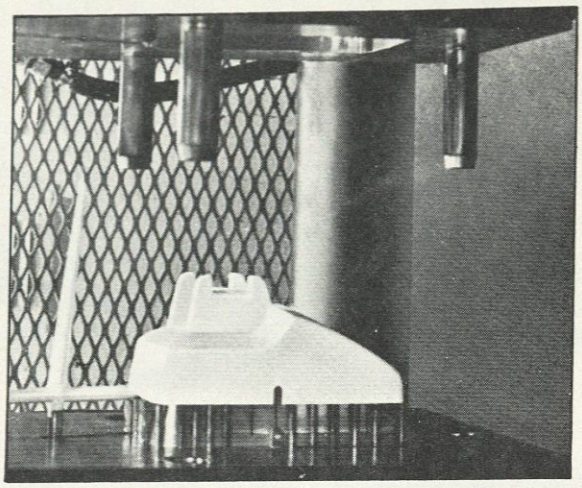
For the last several years, the strongest movement in the United States has been that of Ecology. There has been many an outcry against poluters, those people who foul up the water and air in the great quest for profit. The members of this movement, whether officially or not, each consider themselves as the "great protectors" of the environment, pointing and shaking their fingers at the wrongdoers. Although some of this "action" does stimulate some results, most of it has been taken for granted. An ecology protest or parade is an everyday affair in the news. Someone is always talking (or writing) about this subject. But somehow, not enough ever seems to be done about it. Why?

To use a trite but very true phrase, "actions speak louder than words." If the amount of energy consumed in talking and writing and debating and protesting about the rpe of the environment, were put to use in actual work in the same direction, then there would be no environmental problem. If everyone now protesting about the poluters of the environment would go out and plant a few trees, or start taking the bus to work, or pick up a little trash that happens mo be around, then they would soon see that this terrible problem is of dimensions with which they can personally cope.

It is true that we must keep an eye out for those who would spoil this land of ours for their own advancement, but a majority of the problems lies within ourselves. We must not only sound the herald's trumpet, but carry the flag as well. There is too much to do to just sit around and protest (adding a little noise pollution). Our actions will always start chain reactions among those around us. Example is the way. Pull, don't push.

Dave Slusher

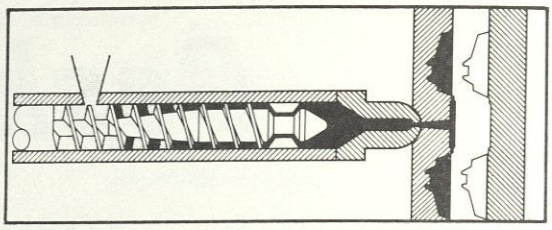
WESTERN ELECTRIC REPORTS



Molding by the millions. Western Electric people produce some 8 million phones a year. Molded plastic is used for housings and many other parts. So there is a constant investigation into the most effective way to use these materials.

$$A^*(z,t) = A_e^*(z) - [(A_f^* - A_i^*)/(1 - e^{-\beta N t_r})]\, e^{-\beta N t}$$

In developing the model at Western Electric's Engineering Research Center, it was found that melting behavior can be described by this formula which includes terms for shear heating and conduction heating effects. Other models were developed for temperature and pressure profiles.



End of molding cycle. At this point, the screw is stationary and heat is conducted into the plastic on the screw. After the plastic solidifies, the mold is opened as shown. The parts can then be ejected.

Solving the mysteries of molding with mathematics.

Even though plastics have been around for many years, there's still a lot to be learned about these versatile materials and their processing. So they are the subject for continuing studies by our engineers.

Some of their recent investigations have brought forth new and highly useful information about a relatively unexplored area: the melting behavior of plastics in the injection molding process.

One result of these studies is the mathematical formula, or model, above.

The model helps us predict melting behavior along the length of the injection screw molding machine used to mold telephone housings and other parts. Melting behavior is extremely important, because plastic pellets should be completely melted but not thermally decomposed before injection into the mold.

This information on melting is then used to investigate screw designs, operating conditions, machine sizes and plastic properties. All of which is aimed at obtaining optimum processing techniques.

Predictions obtained from the mathematical model have checked out closely with experimental observations. So the resulting screw designs are now undergoing evaluation by engineers at our plants in Indianapolis and Shreveport.

Conclusion: For new designs and materials, the model can help reduce the development cost for new molded parts and materials. For manufacturing current products, operating costs can be reduced.

Perhaps most significant is that we're getting information about molding temperatures not available experimentally. And many other types of information can be obtained without the use of costly, time-consuming experimental work.

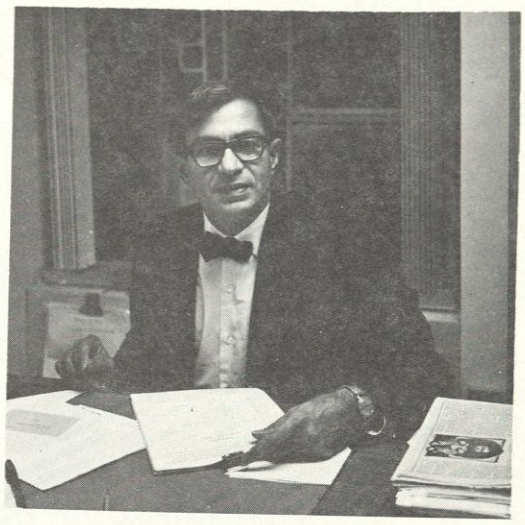
The end result will be more efficient plastic molding and therefore a better product for the lowest possible cost.

Western Electric

We make things that bring people closer.

ENGINEER, ENVIRONMENT, AND PUBLIC POLICY

Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind. (Engineers' Council for Professional Development)



By the very nature of their work, engineers are intimately involved with environment. Until recently, the side effects of industrialization were local and small enough to be neglected. Great industrial progress in this century has produced proportionately large side effects over extended areas. We have the basic knowledge to solve most of the problems of the environment, but the implementation of basic knowledge into technology and the use of this technology involves not only large costs but public policy in many areas. These are concentration of population in urban areas, public transpormation versus private vehicle use, greater and greater use of energy, population increase, and finally land use. The last is the most critical factor affecting environment.

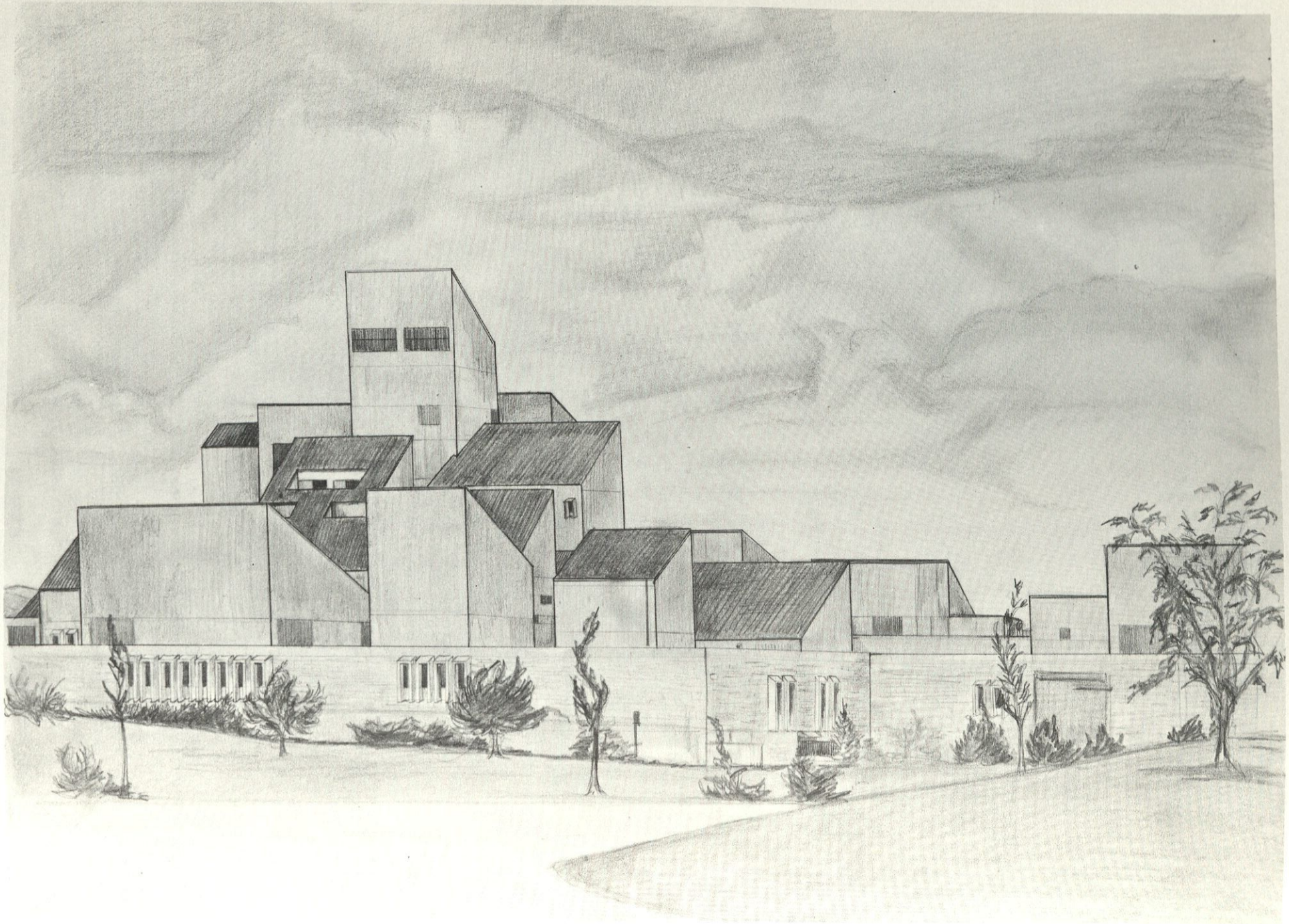
Public awareness of the environmental problem has been extended by great engineering and industrial progress. When the side effects were small, nature more or less took care of them. We were willing to suffer some inconveniences to achieve a greater material progress. The increase in the general welfare means that people want more than material things. Engineering progress has also a profound effect on social thought. When man was able to travel away from the earth in a space ship or a closed ecological system and see our planet as a sphere with a thin atmosphere, or biosphere, he was then able to state the concept of "Space Ship Earth" as a closed ecological system. It also focuses our attention on limits to our natural resources. In a steady state and in the long run nearly everything on this earth must be recycled. Engineers will rise to new challenges and continue to provide material benefits to mankind and will thereby stimulate great social thought on the new problems.

Until now, every country has measured its progress in terms of the Gross National Product, which is the sum total of goods produced and services rendered. Almost everyone seemed to feel that these two things represented the good life, but in addition there are other things such as clean air, clean water, noiseless and natural environment, which also contribute to material and spiritual well-being of man. There is considerable research activity on the Measurement of the Quality of Life. There are some widely used indicators of the quality of life in addition to income. These are, for example, the number of years of formal education, the availability of health care, social mobility, retirement and welfare benefits. These measures still leave out the environment, particularly the natural environment, in which man has evolved genetically for millions of years and socially in the last five thousand years. While our immediate environment in which we live and work is changing, man hasn't changed genetically and he desires contact with a natural environment.

Many of the environmental problems involve engineering and public policy. All engineers are not expected to become social scientists, but a knowledge of the humanities and social sciences and the ability to work with the social scientists are essential. Five years ago we started an All-University Seminar on The Environment and Public Policy, involving 10-20 departments from all over the University. The subjects chosen in the last four years were: World Food and Population Crisis; Ecology; Energy; and Transportation Problems of the Front Range. This Spring the Seminar will cover the all-important subject of Land Use.

The universities have always been concerned with current social issues and man's well-being. Harvard University, founded in 1636, was one of the first institutions of higher learning. The entire first graduating class went into the clergy, which was as important then as auto mechanics are now for the functioning of the society. Today we are concerned with the problems of environment. It is worthy of interdisciplinary scholarship. At the university we pursue environmental studies with the *aim of intellectual excitement, discovery, and the satisfaction of accomplishment.*

As the demands on the engineering profession have increased, the engineers have broadened their formal education, research and interests. In the past, we had two types of engineers, civil and military. Incidentally, West Point Military Academy is the oldest engineering school in the country. Today every branch of engineering has broadened its scope. Aerospace engineering practice requires classical engineers, physicists, chemists, meteorologists, biologists, physicians, and psychologists. These people have to share their knowledge and cooperate more than ever before. The formal training, and the teaching and research interests of aerospace faculty reflects this diversity of interests.



Art by Dick Sauer

THE ENGINEERING CENTER

The Colorado Engineer recently held an interview with William C. Muchow, the chief architect in the design of the Engineering Center. Questions regarding the design of the building and the problems involved were answered by him at that time. We would like to take this space to thank Mr. Muchow for the time he gave us from his busy schedule to enable us to complete this article.

BY DAVE SLUSHER

It goes clearly without hesitation, that the Engineering Center is a unique structure. It causes various, different reactions from all those who first look at it. Yet, the recurring question is, why it was built in the design which it was. Many people, including myself, assumed, because of its "odd" shape that some architect must have sat down and simply drew up a set of drawings with his main purpose being a work of art with pure uniqueness. This picture, it is assumed, was then transformed into detailed plans, and constructed. Hence, a work of art. However, this is not at all what happened. It is true that an architect is indeed an artist. But like an painter or literary artist or sculptor, an architect must thoroughly plan and reason out what he is about to do. His final product is the result of much logic. When we speak of talent ar artistic ability, we mean the ability to take the problems involved and to logically solve them and arrange the results into something attractive. This is true of any art.

The plans for the Engineering Center took many months to complete. To do the job, it took many architectural and engineering firms combined together under the title of "Architectural Associates of Colorado".

To understand the How's and Why's of the Engineering Center, let us look at the various problems and considerations involved in the actual planning. It is impossible to isolate separate steps in the evolving plan, but I have grouped certain aspects together to assimilate a step by step evolution.

THE PROBLEM

The main thing which had to be considered was that a building must be built with a tremendous floor space, but on a piece of land that was not that large. They wanted about 10 acres of floor space, to include about 250 laboratories, 250 offices, and 30 classrooms, all of various sizes. Some professors wanted their offices near the labs, and some wanted theirs and the offices of the various engineering departments to be centralized so that information could flow better. Then, of course, some simplified method of circulation between all of these labs and classrooms· and offices must be established. Another consideration was that the building must have some overall engineering "flavor" to it. It also had to be utilitarian in many, many respects. The design must include some method of enabling large equipment to be brought in and out of the laboratories. The placement of windows for light, and exits for safety, and a myriad of other, smaller necessities were all taken into consideration. The grand problem was large, but it was all solved.

BASIC DESIGN FORMATION

The architects considered all of the problems, and selected two as the most important: circulation, and identity of departments. A way of breaking up such a huge building was immediately apparent, and actually necessary. To give each department in the College of Engineering its own separate area, apart from the others would be highly desirable and convenient to the individual departments. But a method circulation from one to the other without spending a large amount of time was necessary. This appeared as quite a problem at first, considering the tremendous overall size of the building. But a simple design was conceived: the ring. Each department would be placed on the edge of a long ring (or rectangle). Each department would then have its separate identity, and a fast way of getting from one to the other would exist. This is now very evident. A person can walk entirely around the building, inside, on the first floor, and visit each department in exactly two minutes and fifteen seconds. (I tried it!) A person can go from one department to any other in less than a minute and a half, without leaving the building! Hence, a good solution was found for this problem. This is perhaps one of the best features of the Center. (Certainly it is the most convenient.)

This idea of the construction of departments about a ring-type center formed the first crude idea on which the rest of the center was planned. Courtyards came as a logical consequence of this, and were part of the original idea.

PLANNING THE DEPARTMENTS

Separating the building into departments was good, not only for identity readons, but also it greatly simplified the design of the building as a whole. Each department had a set of requirements it needed. Each had to have a certain number of laboratories of certain floor space and height. Also needed were certain numbers of offices, storage rooms, lounges, etc. Each set of requirements was taken and designed into a complete individual "container." Hence, all the workings of a particular department would be close together for convenience. This worked well with the desirability of identity.

Another "byproduct" of this was the capability of breaking the huge structure up into smaller entities. This gives a desirable "small building" affect. Space is always more interesting in smaller areas. The entire university uses this idea. Breaking large areas up into smaller ones gives a humanistic touch, and indeed, allows the eye to grasp the overall beauty in design. It would have very much been an eyesore to have designed the Engineering Center under one large roof as a big barn or warehouse. It would have been a monstrosity! And would not have served its function nearly as well.

The final decision as to where each was to be placed, came as a matter of pure logic. Certain departments had greater access and maintenance requirements. These were placed in back of the center, where these requirements could be easily met. Those facilities which would be most often used, were placed up front, closest to the students; this includes the classrooms, lecture rooms, and offices. The location of the administrative offices again was deduced from reason. Easy access, central location, and availability were necessary. Hence, it was placed on the first floor, immediately opposite the front doors. Placing the offices all on the first floor left a big hole underneath on the zero level. This became the back entrance.

OFFICES AND CLASSROOMS

The next problem was that of the centralization of offices. It was possible to simply cluster them all together in a big mass, but this would have certain undesirable features. Windows became an important factor at this point. They were not so important in the designing of

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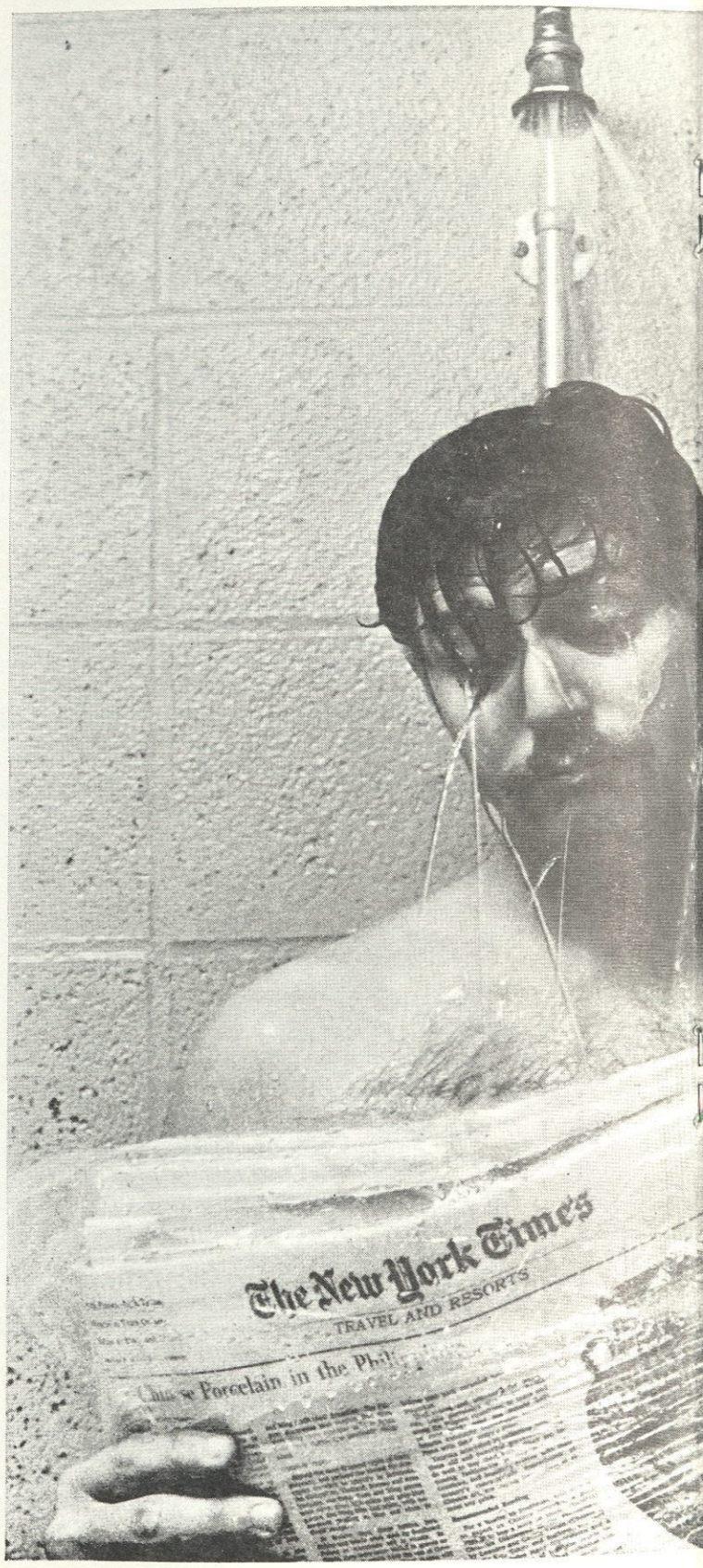
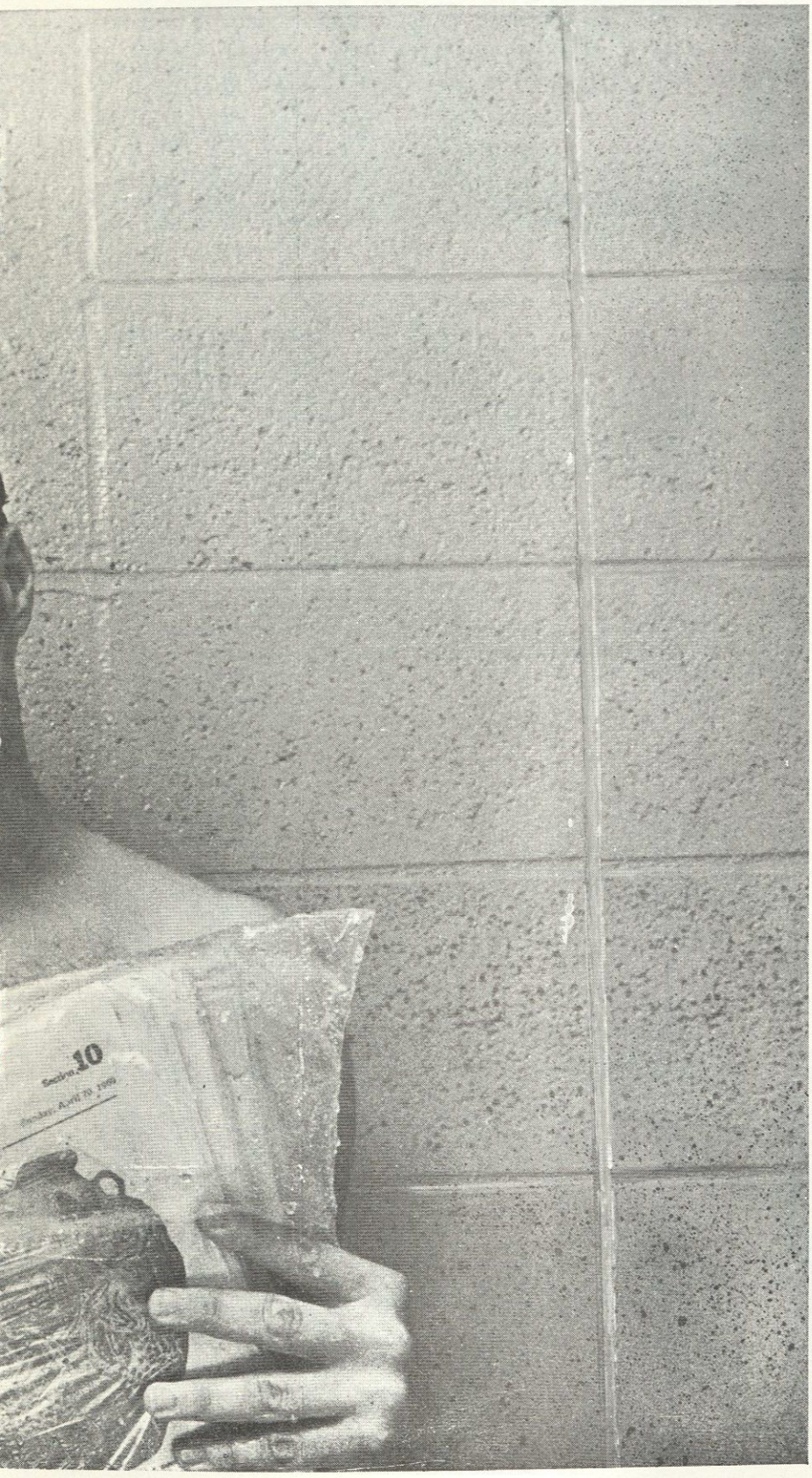
We keep the news fit to read.





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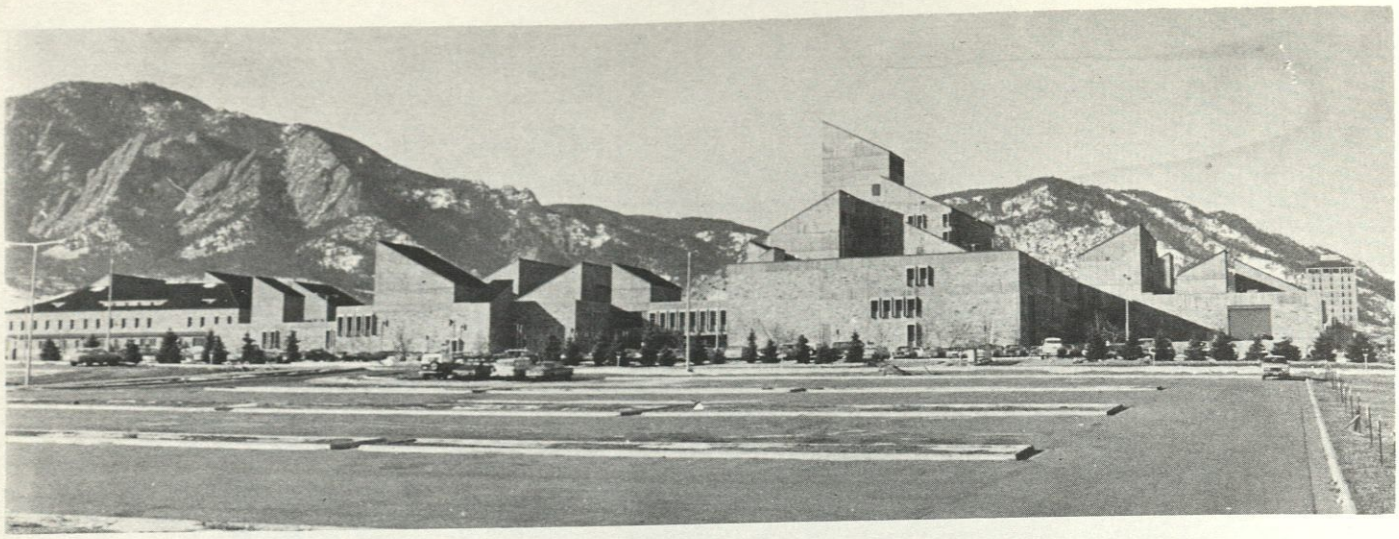
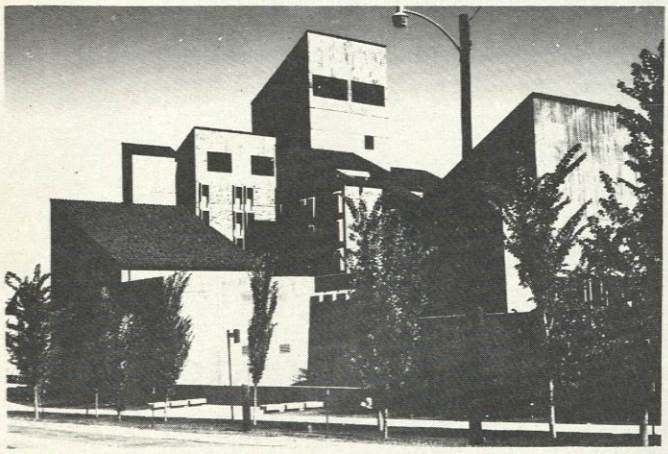


Continued from page 7

laboratories or classrooms, but were necessary for offices. Hence, the idea of a tower came into being. Several problems still stood in the way. It would have to be a ver wide tower in order to assure offices with window space. Again, this would prove very bulky, and unattractive. Another design was needed. Returning to the concept of the small building affect, the tower was broken up into four "wings", each centering around an elevator shaft. These wings gave the tower a larger outside area around which to place the large number of offices. Hence, all the problems were solved with this design.

The administration offices posed a similar problem. However, they were not so numerous. It was desirable to keep them on a single level for this reason. A design called for inner and outer offices. The problem was that the inner offices would not have windows, creating a rather ill psychological affect. So, a hole was "cut" into the middle of this plan, allowing the inner offices to have a piece of sky. This large hole gave way to the fountain area which sits below on the zero level.

In the design of the classroom wing of the Center, windows were not a problem. In fact, they were purposely excluded from the classrooms for several reasons. Windows would cause distractions in the classrooms. They were therefore placed in the corridors, so that the students could make use of them upon leaving a class. This absence of windows in the classrooms, allowed the rooms to be clustered together in the middle, or anywhere that was convenient. This led to great saving of space, and hence, cost.



ROOF DESIGN, AND MATERIALS

The designers took what they now had, and saw this big office tower sticking up. They didn't want to put a big shed type roof over it, or on any other part of the building. This would take away from the small building affect. Also, it wouldn't look good to just chop it off flat, especially against the backdrop of the flatirons. The concept of a sloping roof came as a result of all this. Any place where there was a protrusion, if it didn't waste space, they put a sloping roof on it. This included over machinery and mechanical equipment, over high storage areas, and over lecture halls. The sloping roof was found to be both in taste with the architecture, and very functional as well. Hence it was adopted. It was also decided to place the roofs arbitrarily, and slanting in north and south directions. The actual placement of the large laboratories and lecture halls was based on this roof design. They were scattered about, so as to scatter the placement of the roofs over the entire building. The staggered wings of the office tower were designed this way to give maximum value to this concept. The roofs were finished with the traditional red tile found in all the buildings on campus.

The Engineering Center is a structure supported building rather than a wall supported one. The main purpose of this is to enable future needs to be met by being able to add on to it. Since the walls are not supporting anything, it is no great problem to knock one out to add on additional space. And space can be added onto any wing or department in the building. This ability to adapt to possible future needs is one of the best features in the overall design of the Center.

The basic materials in the construction of the center were concrete and stone. The concrete was selected not only for its strength, but also for its high resistance to fire. It does not require fireproofing as do other structural materials. Stone was used as a fill-in for many of the walls. It, too, is a strong material, though it wasn't used for structural purposes. It was used to keep the Engineering Center in the same style as the buildings on the rest of the campus. Walls where potential future add-ons are planned were done in concrete.

In the use of the red stone and tile, the designers were attempting to carry on an impressive tradition at the University of Colorado. The Campus has what is called a "regional character." The stone and tile are characteristic of this. Most campuses are a conglomeration of various styles of architecture with various types of building materials. Whenever a new building is designed and built, it is done in the current style or fad. Hence, rather than maintaining a particular character of identity, the cluster of buildings on a given university campus can usually be

considered as a museum of architectural history. C.U. has maintained its identity with the red stone, tile roof, small building type of campus.

At the same time, the more modern architectural designs and techniques can be employed. Concrete becomes a major building material, blending in with the traditional red stone. None of this detracts from the regional character which the Boulder campus can proudly claim to possess.

The inside of the building was left fairlu much in a very rough form. This was done for very obvious reasons. Engineers working in the laboratories need not be afraid of accidentally ruining some fancy finish or woodwork, or paint. Very little of this is present. It is with considerable ease that the student can work in this environment, not having to worry about messing something up. Hence, the rough feeling provides the right feeling. It's easy to work in.

REACTIONS AND OPINIONS

There are both positive and negative reactions from those who see the Engineering Center. Some are critical and accuse it of looking like a collection of mine shafts. They falsely point out its conflict (?) with the beauty of the mountains facing it. Conversely, there are those who recognize architectural grandeur when they see it.

The Engineering Center was the first major building to use a sloping roof as an integral part of its design. Since then, this concept has been used by many other designers. It is now commonplace to see this type of roofloon apartment houses and condominiums.

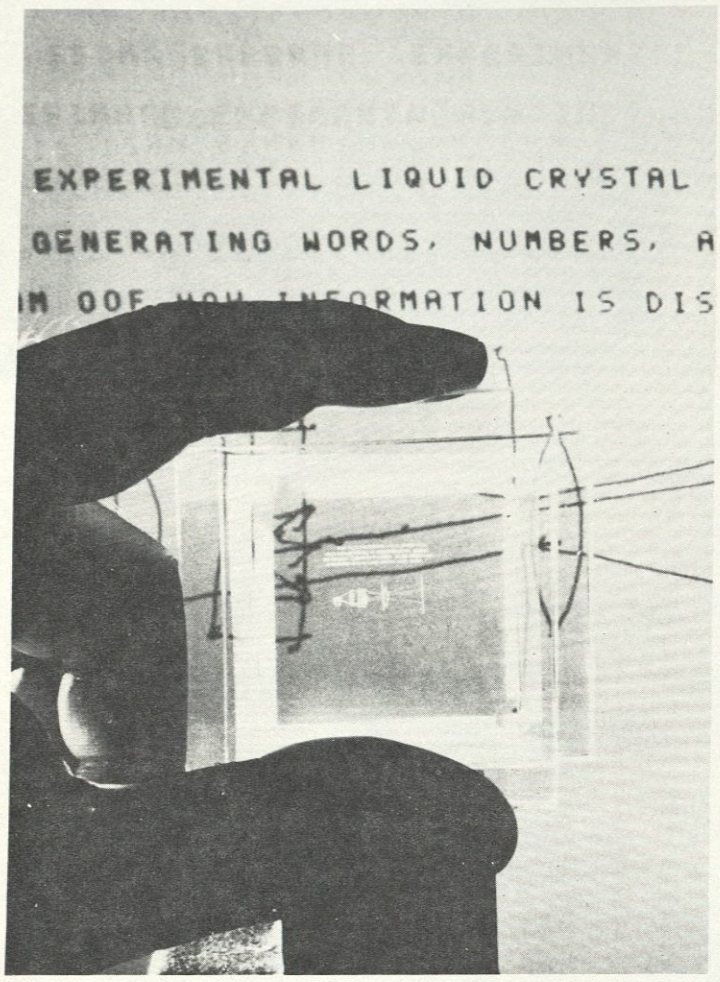
The Center has won several awards for its design and practicality. Its ability to adapt to future needs while fully meeting those of today stands out as its main resource. Though strictly utilitarian in design, it has become a landmark for the University of Colorado.

Photos by Dave Slusher

ENGINEERING CENTER STATISTICS

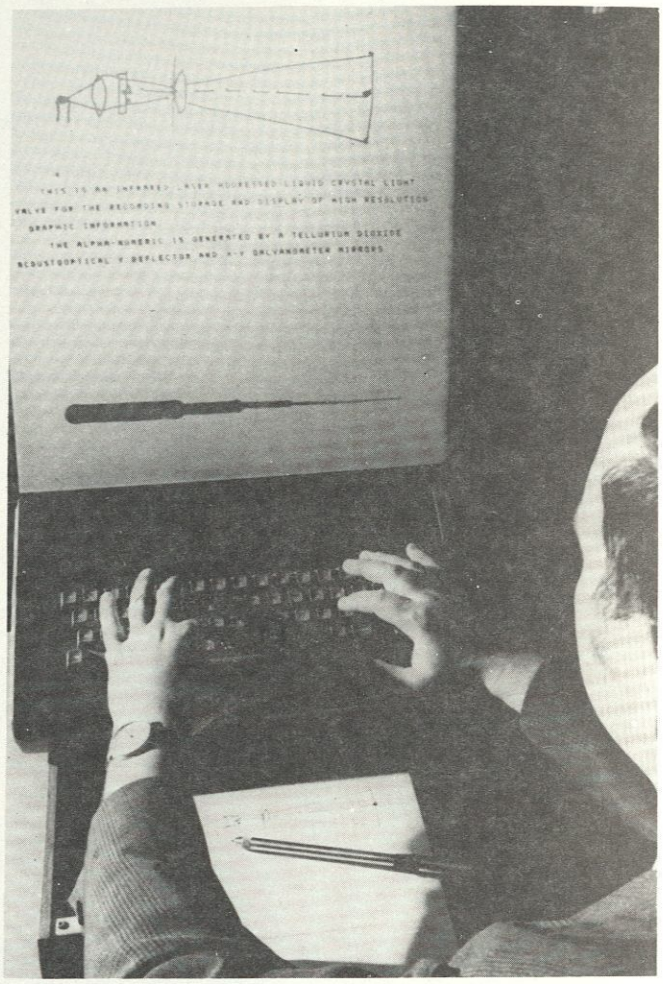
Cost	$8,525,000
Funds	$1,325,000 from National Science Foundation, $7,200,000 from state legislature (including $1,248,000 from the Higher Education Facilities Act)
Size	440,000 gross square feet (10 acres). 279,487 square feet assignable. 31 classrooms, 250 laboratories, 247 faculty and administrative offices. Cost: $16.00 per gross-square-foot unequipped. $19.25 per gross-square foot, equipped.
Materials	Concrete, stone and steel.
Architect	*Architectural Associates of Colorado,* a combine of firms of: William C. Muchow Associates, Denver; Hobart D. Wagner, Boulder; Fisher and Davis, architects, Denver; Ketchum and Konkel, structural engineers, Denver. *Special consultants:* McFall and Konkel, mechanical engineers, Denver; Swanson, Rink and Associates, electrical engineers, Denver.
Contractors	Dan R. Ponder Co., Ltd., El Paso Texas (general); Louis Cook Plumbing and Heating Co., Denver (mechanical); Collier Electric Co., Denver (electrical).
Dedication	May 5-7, 1966

LASER WRITING ON LIQUID CRYSTALS PROVIDES UNIQUE NEW DISPLAY DEVICE



Above is a liquid crystal slide containing information written by laser light. Molecules of the liquid crystal sandwiched between the glass plates of the slide have been rearranged by heat from the laser light to form letters, numbers and drawings. Light from an ordinary slide projector can display this information on a wall or screen as shown at the rear. To erase information, a small voltage applied to the glass plates restores transparency to the light slide.

No. 8.19–2 October, 1972 Bell Laboratories



Bell Labs scientist, Dan Maydan, demonstrates how words and drawings can be projected through a glass slide filled with a liquid crystal chemical compound. Information generated from the scientist's keyboard position directs laser light over the surface of the liquid crystal slide. As the laser writes on the cell, light from an ordinary slide projector displays the information on the viewing screen.

No. 8.19–1 October, 1972 Bell Laboratories

Computer and other display terminals may someday be all wet! A light-sensitive liquid could do the same job as conventional electronics needed to display letters and numbers in these devices.

Words, numbers and drawings can now be written by laser light on a new kind of large screen black and white display demonstrated by Bell Labs scientists. The new display uses a laser beam to write information, which can be transmitted over ordinary telephone lines, on a liquid crystal contained in a small glass slide.

The liquid crystal used is a transparent chemical fluid that becomes frosted when momentarily exposed to concentrated doses of heat.

Laser-driven liquid crystal displays are now being considered for use at Bell Labs in an experimental "remote blackboard" system for transmitting and receiving handwritten information over the Bell System telephone network.

A liquid crystal cell could be used at the receiving end of such a system, where coded pulses of information are used to direct a laser beam over a light sensitive medium. Laser "writing" in this system can then be projected on a wall or screen.

Sandwiched between two glass plates, the liquid crystal molecules of the Bell Labs device can be rearranged selectively by heat from a D D low-powered infrared laser beam to form numbers, letters and drawings. Information stored in the liquid crystal can be erased by applying an ac voltage to electrodes on the glass plates. This voltage forces the liquid crystal (LC) molecules back to their original well-aligned positions and restores cell transparency.

Bell Labs scientists Hans Melchior, Fred Kahn, Dan Maydan and Dave Fraser point out that liquid crystal displays could serve the same function as cathode ray tubes and other similar "read-out" devices in computers and graphic viewing terminals. Because laser-driven LCs can retain an image almost indefinitely, they do not have to be continuously replenished to avoid flicker problems, as with conventioonal cathode ray tube displays.

ENGINEERS GUIDE TO COMPARATIVE VALUES

IN ZINC vs. PLASTICS

Unreinforced Plastic vs. Die Cast ZINC*

RATIO OF COSTS FOR EQUIVALENT LEVELS OF VARIOUS PROPERTIES

Material	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*

RATIO OF COSTS FOR EQUIVALENT LEVELS OF VARIOUS PROPERTIES

Material	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,

notes & news

We never stop learning

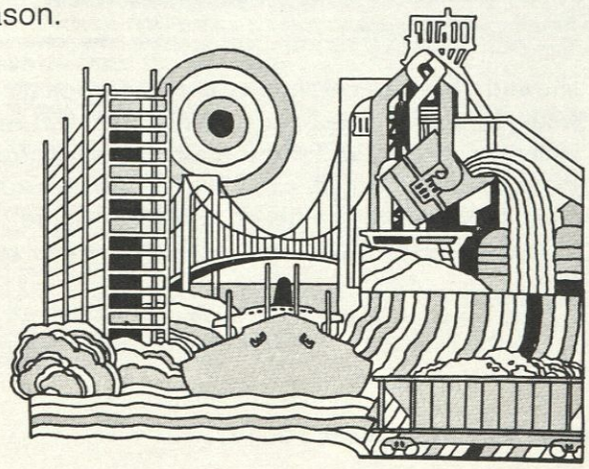
Since 1922, all college graduates employed through Bethlehem's Loop Course have participated in an orientation program at corporate headquarters. As they progress in their careers, they benefit from other management training activities. Another new program has recently been added: an advanced orientation course for experienced supervisory and management personnel to further educate and broaden their understanding of our company and their role in the company's future growth and development. These programs are all part of our corporation's continuing education and development.

Our new corporate home

Martin Tower is the new address of our corporate headquarters. Located in northwest Bethlehem, Pa., the Tower brings together many departments that have been scattered in various locations around the city. The structure is 21 stories of steel and glass.

New ore boat on the Lakes

The *Stewart J. Cort* is Bethlehem's newest ore carrier on the Great Lakes. She is 1,000 feet long, longer than any other Great Lakes ore carrier. Another investment to help cut the cost of steelmaking, the Cort carries 54,000 gross tons of ore pellets from Erie Mining's loading facility at Taconite Harbor on Lake Superior to our steel plant on Lake Michigan at Burns Harbor, Ind. She makes a round trip about every 5½ days throughout the shipping season.



Computerization continues

Our data processing experts continue to develop new systems. For example, consider our fasteners plant at Lebanon, Pa.—largest of its type in the nation. A new computer-oriented control system has made possible a 20% reduction in product inventories. Order entry and production scheduling are computerized for speed, accuracy and efficiency. Computers constantly monitor product inventories and the status of orders in production. It all pays off in better productivity and faster customer service.

R&D wins another award

The American Iron and Steel Institute recently presented an award to F. M. Temmel, a member of Bethlehem's Research Department, for his paper on a method of treating steel processing and mining wastewaters. It's another example of public and professional recognition of our programs for a quality environment. The paper outlines the development of a high-density sludge (HDS) process for neutralizing acid wastewaters. The process reduces the volume of the resulting sludge to as little as 1/50 of that produced by conventional neutralization.

Want to learn more?

We urge you to read our booklet, "Bethlehem Steel's Loop Course." If copies are not available in your placement office, drop us a line. Write: Director—College Relations, Bethlehem Steel Corporation, Bethlehem, PA 18016.

BETHLEHEM STEEL

an equal opportunity employer

No lecture. No preaching. No, none of that.

Here are facts about drug laws & the system of justice overseas.

If you're traveling to Europe, the Middle East or south of our own border, here are some facts. Because a lot of people have funny ideas about foreign drug laws and justice.

Maybe you've heard possession is okay in some countries. That's wrong. Or maybe you've heard the laws aren't enforced like they are here. That's wrong, too. Really wrong.

The truth is their drug laws are tough. And they enforce them. To the letter.

Mexico, for example, demands a two to nine year sentence for possession of anything. Carrying stuff in or out of the country will put you in jail for six to fifteen years.

There's a 24 year old girl from the United States sitting in a jail outside of Rome right now. She'll be there for six to ten months waiting for a trial. And after that she can get up to eight years.

In Spain, after you've been sentenced, you can't take your case to a higher court. You're all through. And nobody can get you out.

Those are facts. And there's no way around them. That's why over 900 Americans are doing time in foreign jails.

Check the countries you'll be visiting. One fact will come through. Loud and clear.

When you're busted for drugs over there, you're in for the hassle of your life.

Mexico.

Possession, 2 to 9 years plus fine. Trafficking, 3 to 10 years plus fine. Illegal import or export of drugs, 6 to 15 years plus fine. Persons arrested on drug charges can expect a minimum of 6 to 12 months pre-trial confinement.

U. S. Embassy:
Cor. Danubio and Paseo de la Reforma
305 Colonia Cuauhtemoc
Mexico City, Mexico
Tel. 511-7991

Sweden.

Possession or sale, up to 19 months and permanent expulsion from the country.

U. S. Embassy:
Strandvagen 101
Stockholm, Sweden
Tel. 63/05/20

Japan.

Possession, pre-trial detention, suspended sentence and expulsion. Trafficking, maximum 5 years.

U. S. Embassy:
10-5 Akasaka 1-Chrome
Minato-Ku, Tokyo
Tel. 583-7141

Denmark.

Possession, fine and detention up to 2 years.

U. S. Embassy:
Dag Hammarskjolds Alle 24
Copenhagen, Denmark
Tel. TR 4505

Bahamas.

Possession, 3 months to 1 year.

U. S. Embassy:
Adderly Building
Nassau, Bahamas
Tel. 21181

Spain.

Penalty depends on quantity of drugs involved. Less than 500 grams cannabis, fine and expulsion. More than 500 grams, minimum of 6 years in jail.

U. S. Embassy:
Serrano 75
Madrid, Spain
Tel. 276-3400

Greece.

Possession, minimum 2 years in jail. Trafficking, maximum 10 years plus fine.

U. S. Embassy:
91 Vasilissis Sophia's Blvd.
Athens, Greece
Tel. 712951

Lebanon.

Possession, 1 to 3 years in prison. Trafficking, 3 to 15 years.

U. S. Embassy:
Corniche at Rue Aiv
Mreisseh, Beirut, Lebanon
Tel. 240-800

Turkey.

Possession, 3 to 5 years. Trafficking, 10 years to life.

U. S. Embassy:
110 Ataturk Blvd.
Ankara, Turkey
Tel. 18-62-00

Canada.

Possession, jail sentence and expulsion. Trafficking, minimum 7 years, maximum life.

U. S. Embassy:
100 Wellington Street
Ottawa, Canada
Tel. 236-2341

Italy.

Possession: Minimum: 3 years and 30,000 lire fine. Maximum: 8 years and 4,000,000 lire fine.

U. S. Embassy:
Via V. Veneto
119 Rome, Italy
Tel. 4674

Germany.

Possession, jail sentence or fine. Trafficking, maximum 3 years plus fine.

U. S. Embassy:
Mehlemer Avenue
53 Bonn-Bad Godeberg
Bonn, Germany
Tel. 02229-1955

Jamaica.

Possession, prison sentence and fine. Trafficking, maximum 3 years at hard labor.

U. S. Embassy:
43 Duke Street
Kingston, Jamaica
Tel. 26341

United Kingdom.

Possession, use, trafficking: maximum 10 years and heavy fine. Possession of small amount for personal use usually punished by a fine or light imprisonment and expulsion.

U. S. Embassy:
24/31 Grosvenor Square
W.1., London, England
Tel. 499-9000

France.

Possession, use or trafficking; prison term of 3 months to 5 years and fine. Customs Court will also levy heavy fine. Minimum 3 to 4 months pre-trial confinement.

U. S. Embassy:
19, Rue de Franqueville
Paris, France
Tel. Anjou 6440

Iran.

Possession, 6 months to 3 years. Trafficking 5 years to death and fine of 3,000 rials per gram.

U. S. Embassy:
250 Ave. Takti Jamshid
Tehran, Iran
Tel. 820091, 825091

Morocco.

Possession, 3 months to 5 years and fine.

U. S. Embassy:
43 Ave. Allal Ben Abdellah
Rabat, Morocco
Tel. 30361/62

Israel.

Possession, heavy fine and expulsion. Trafficking, maximum 10 years and 5,000 Israeli pounds fine.

U. S. Embassy:
71 Hayarkon Street
Tel Aviv, Israel
Tel. 56171

Netherlands.

Possession, fine or 6 months in prison. Trafficking, maximum 4 years.

U. S. Embassy:
102 Lange Voorhout
The Hague, Netherlands
Tel. 62-49-11

Switzerland.

Possession, maximum 2 years or fine up to 30,000 francs. Trafficking, maximum 5 years.

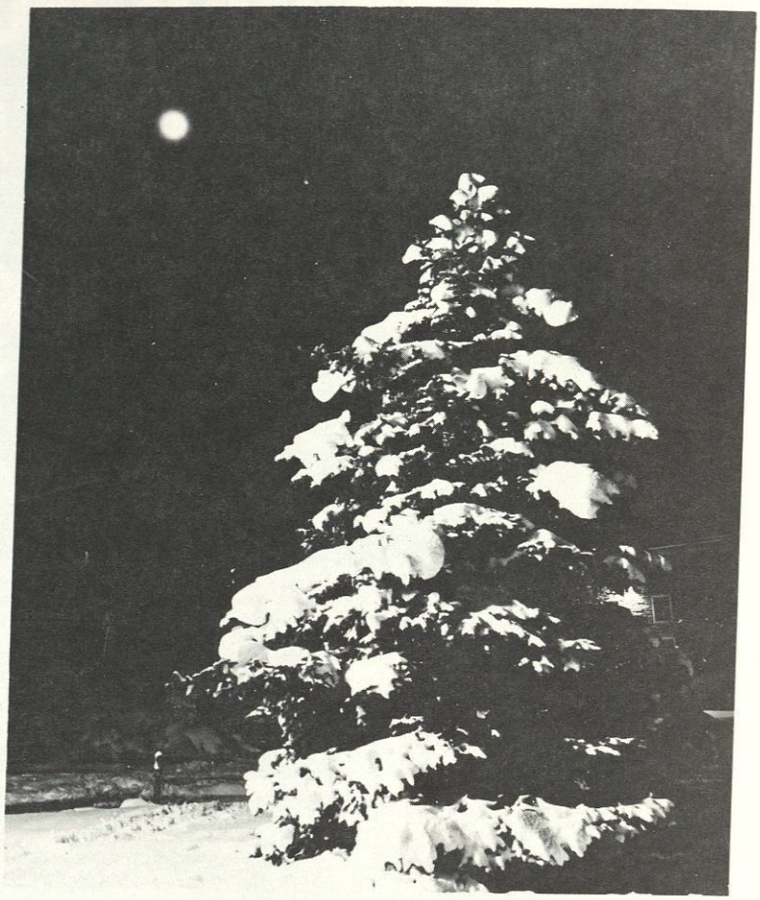
U. S. Embassy:
93/95 Jubilaumsstrasse
Bern, Switzerland
Tel. 43 00 11

National Clearinghouse for Drug Abuse Information.

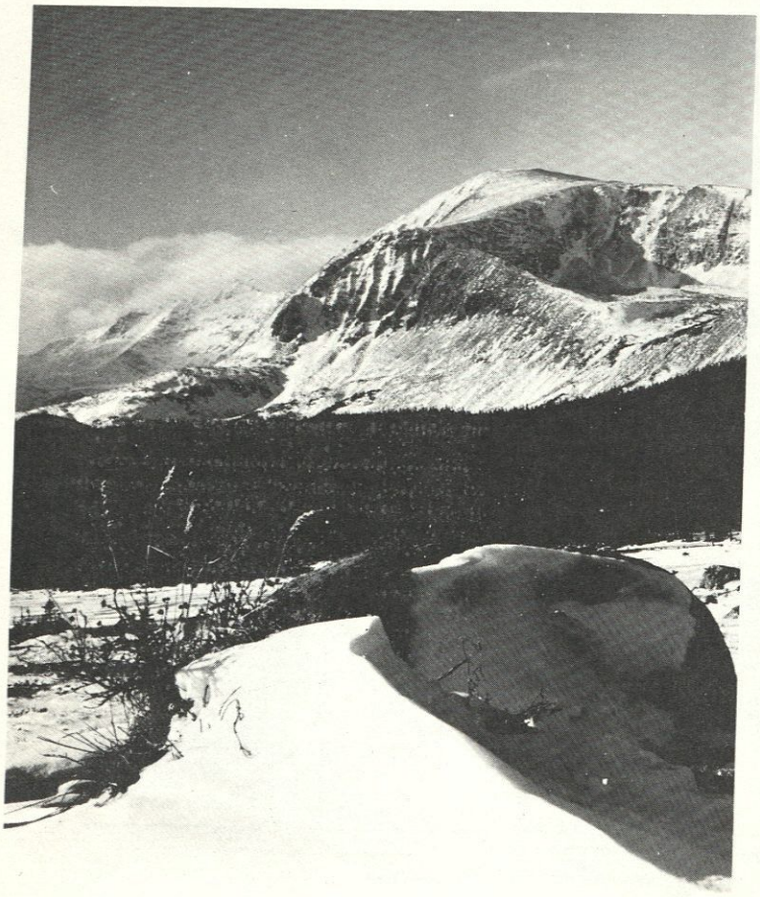
advertising contributed for the public good

Merry

Christmas



Dave Slusher



Robert M. Lemon

Fred Sprague

Douglas C. Colindy

Wayne R Sauer

Paul C. Perkins

Ron A. Fattor

...and thanks an awful lot for visiting us!

Five years ago companies were hungry for graduating engineers. Last year graduating engineers were hungry for jobs.

Now it's easier both ways. You have choice. We have choice. Honesty can prevail. We can part friends if we see we weren't meant for each other. Maybe a little self-description here would save time:

- Only very rarely does Kodak hire a manager. We hire workers, and some of them grow into managers. We consider engineers workers. A young engineer who lets on that his engineering is only temporary until he becomes a manager makes us uncomfortable. Yet we have some surprisingly young managers.
- We prefer engineers who know the difference between engineering and science. An engineer is a person who has learned a lot of science, not for the purpose of creating still more science, but for getting things done. (We also happen to need scientists.)
- Take, for example, a newly minted E.E. who shines in circuit design. Impressive talent. Hired. Could be put to work in that specialty but is lured instead into manufacturing engineering, a real action area. Expected there to be happy and productive spending 15% of time designing circuits and the rest on a tool design project befitting a mechanical engineer. At the same time we have mechanical engineers doing some chemical engineering. Also vice versa.
- Engineers tell the factory what to do. How can you tell somebody what to do if you've never done it yourself? Since our factories do things nobody else knows how to do, it would be a while before you really earn your keep.

But we're interested in *you*. If you are interested in us, you can write us something about *your* hangups, but tell us more about your strengths. **Eastman Kodak Company, Business and Technical Personnel, Rochester, N.Y. 14650.**

Kodak

An equal-opportunity employer m/f

HOW CAN A SHINY PIECE OF CRYSTAL HELP GIVE LIFE TO A DYING MAN?

That's no ordinary crystal. It's ultra-pure germanium. The purest substance on earth.

General Electric researchers and engineers first figured out how to refine germanium to such a pure level. (Less than one atom of impurity in a trillion.)

That was a major technical achievement. But that's not the reason it's important.

Ultra-pure germanium is very sensitive to certain radioisotopes. So it's making possible a revolutionary new sensing device for studying the brain. Conceived at the NYU Medical Center's Institute of Rehabilitation Medicine, this system is intended to give doctors their first 3-dimensional look at the entire brain.

A patient, wearing a helmet containing germanium sensors, will be given a radioisotope. As the isotope flows through the brain, the sensors will feed signals to a computer, resulting in a complete mathematical picture of the brain's blood-flow rates.

That information could be invaluable in treating hundreds of thousands of people with brain damage resulting from strokes or accidents.

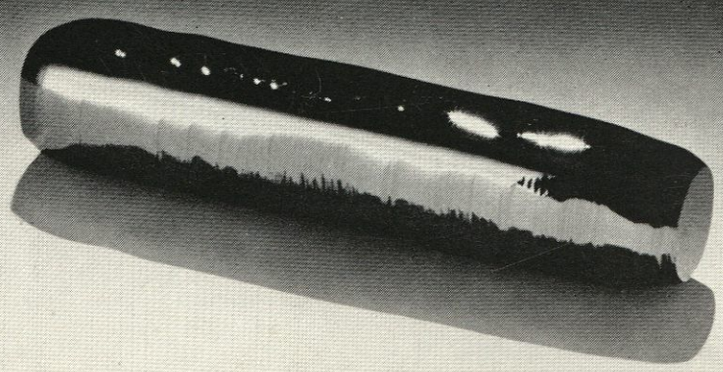
For example, take an auto-accident victim with critical head injuries. Without fast treatment he could easily be a dead man.

Within 15 minutes this new system could pinpoint the size and location of trauma in his brain. That's something no existing system can do in any amount of time.

It's a pretty clear example of how a technological innovation can help solve a human problem.

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