



Volume 4  
Winter 1978

Number 3

## I.T. RESEARCH EFFORTS TO SHINE ON SUN DAY

As a part of the preparation for the University of Minnesota's participation in the coming "Sun Day" that will be observed on Wednesday, May 3, William Kell of the Graduate School Research Development Center, and Mary Trigg of the All-University Council on Environmental Quality, conducted a University-wide inventory of all current solar and solar-related research projects that revealed a total of 34 separate efforts ranging over a wide spectrum of inquiry into varied facets of the area.

As might be anticipated, the Institute of Technology figures prominently in the total effort with 18 separate enquires in progress. These projects, along with every aspect of the topics under investigation at the University, will be the subject of a publication now in preparation by the Graduate School Research Development Center and the Center for Urban and Regional Affairs.

Listed below are the Institute of Technology researchers, their departments, and the questions their areas of research are addressed to answering or adding new, factual information to.

Harold Cloud and Vance Morey, Agricultural Engineering. How can the sun be used to supplement conventional systems for drying grain?

Arthur Erdman and Darrell Frohrib, Mechanical Engineering. Can a lightweight wood flywheel be developed as an energy storage system to accommodate the uneven flow of energy caused by shifting winds collected by a windmill?

Charles Fairhurst, Civil & Mineral Engineering. Is it possible to construct a large building with heat provided by solar panels, air conditioning by an underground ice tank, and electricity by its own solar electrical generator? What factors—site selection, architecture and design, energy use, structure, waterproofing, insulation, and public policy, for example—govern overall feasibility of earth sheltered residential housing, and how should these factors be addressed?

Edward Fletcher, Mechanical Engineering. How can the separation of water into Hydrogen and Oxygen contribute to solar energy storage technology?

SUN DAY—Continued on page 2

## Maybe You Might Like to be a "Mole"

The winter edition of the newsletter that Minnesota's Fourth District Congressman, Bruce F. Vento, sent his constituents contains a reference to an article by Dr. Charles Fairhurst, Head of the Department of Civil and Mineral Engineering, titled, "Going Under to Stay on Top," an examination of what the author considers to be the correct utilization of underground space resources.

Rep. Vento initiates the subject by asking, in connection with energy use, "What problems? The skyrocketing costs of traditional housing. The combined expense and scarcity of energy supplies like natural gas and oil. The growing concern with environmental quality."

He then turns to the Fairhurst article and its references to lower underground building costs, less need of insulating materials and lower energy requirements to heat underground buildings as well as significant energy savings in summer cooling.

MOLE—Continued on page 6

## I.T. Society Offers "Survival" Seminars

"Can You Survive Company Politics?" will be the topic to be dealt with at a series of three lunch hour seminars sponsored by the Institute of Technology Alumni Society starting on Wednesday, March 29. The seminars will focus on such realistic business life situations as awareness that someone may, "be sticking it to you", and, "your waking up some morning and asking, 'what happened?'".

Actually, the high-content, time-intensive seminars, conducted by University of Minnesota faculty members who have first-hand experience in business and industry, will concentrate on many of the aspects of the political realities of business life and survival in them.

On Wednesday, March 29, Blaine Cook, Professor of Business Administration, will present, "Company Politics—The Way It Is". Wednesday, April 26, he will move to the topic that logically follows his first one, "Now That I'm Aware, What Can I Do?".

SURVIVAL—Continued on page 4



SUN DAY—*from page 1*

William Garrard, Aerospace Engineering. Can home storage of solar energy be lengthened from less than a week (the current limit) to more than three months using a system of small, low cost solar panels and large pebble bed or water tank storage units? How much might this approach to solar collection save in home construction costs?

Richard Goldstein, Mechanical Engineering. How might heat transfer and thermal storage devices in solar energy systems be improved?

Phillip Goodrich, Agricultural Engineering. Can animal manures be economically recycled as an energy source? What are the environmental and energy advantages of converting animal wastes to methane gas?

Michael Hoffmann, Civil & Mineral Engineering. What low cost collector designs are best suited to Minnesota's climate? How much solar energy can Minnesotans expect from low cost solar collectors? What factors affect their economic attractiveness?

Herbert Isbin, Chemical Engineering. How do variations in heat intensity and water flow inside collector tubes affect steam generation for electrical power in solar boilers? How do these factors affect the overall performance of large solar thermal power systems?

Kenneth Jordan, Agricultural Engineering. Can low cost solar collectors provide additional heat necessary for proper ventilation in turkey houses? Can solar energy improve air quality in other livestock dwellings?

Richard Jordan, Thomas Bligh, Ernst Eckert, Emil Pfender, James Ramsey, Mechanical Engineering. What is the most efficient solar collector design for heating and cooling a medium-sized underground building?

David Kittleson, Mechanical Engineering. Can crop residues be efficiently converted to usable fuels through intense heating processes (pyrolysis or combustion)?

Walter Maier, Civil & Mineral Engineering. Can methane gas be produced from crop residues? Can sewage be processed into methane gas and fertilizer without incurring public health hazards? Are solid wastes (garbage, for example) an economical source of energy?

## THREE RECEIVE OUTSTANDING ACHIEVEMENT AWARD ON SCIENCE & TECHNOLOGY DAY

A luncheon honoring the three men awarded the University's Outstanding Achievement Award and their wives opened the activities of Science and Technology Day Friday, Nov. 4, at the Alumni Club in the IDS Tower.

Following this event nearly 200 engineers, scientists, and students were present at an excellent seminar on the topic, "Materials for Today and Tomorrow," held in the Coffman Union Theater. The same evening more than 500 alumni, friends, and guests of the University attended the banquet at the Radisson South Hotel.

Guest speaker for the dinner was Dr. J. Herbert Holloman, Director, Center for Policy Alternatives, Massachusetts Institute of Technology. His subject, "Materials and the Economy," continued the theme of the entire day.

The three who received the Outstanding Achievement Awards at the banquet from Regent David M. Lebedoff were Richard F. Hammel, '44 BArch, '54, MArch. (Harvard), Malcolm M. Renfrew, '38 PhD. Chem., and Quentin F. Soper, '40 BChem., '43 PhD. Chem. (Illinois).

Also honored by Dr. M. Elizabeth Craig, President of the Minnesota Alumni Association, was Everett H. Dale, for faithful service to the Alumni Association and for his competent leadership as president of the I. T. Alumni Society.



**Dr. J. Herbert Holloman, Director of M. I. T.'s Center for Policy Alternatives, was the evening's guest speaker.**

The reverse illustration on the front page of this issue of *ITems* shows a portion of the pilot plant equipment now being used by the Mineral Resources Research Center to test ore samples taken from the Copper-Nickel deposits found in Northeastern Minnesota.

## ITEMS

*ITems* is a quarterly publication of the Institute of Technology at the University of Minnesota, with special support from the I.T. Alumni Association. Material from this publication may be reproduced without cost, but credit to *ITems* will be appreciated. Requests to be placed on the mailing list or other inquiries may be directed to Clarence A. Berg, 107 Lind Hall, University of Minnesota, Minneapolis, Minn. 55455. Phone (612) 373-4838.

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Send your changes of address to:  
ITEMS, 322 Aeronautical Engineering Bldg., University of Minnesota, 110 Union St., SE, Minneapolis, MN 55455.



Shown receiving his Outstanding Achievement Award from Regent Lebedoff is Richard F. Hammel who has served as an assistant professor and assistant advisory architect for the University of Minnesota, consulting architect for the St. Paul Public Schools and, since 1951, a partner in the St. Paul architectural firm of Hammel, Green and Abrahamson.



Minnesota Alumni Association National President, Dr. M. Elizabeth Craig, here presents Everett H. Dale with a Certificate of Appreciation for his faithful service to the Alumni Association and for his competent leadership as president of the I. T. Alumni Society.



Regent Lebedoff here presents the Outstanding Achievement Award to Dr. Malcolm M. Renfrew, Professor Emeritus, University of Idaho. He served as head of the Department of Chemistry at the Idaho school from 1968 to 1973. Dr. Renfrew has also held positions with E. I. duPont de Nemours and Co., General Mills, Inc., and Spencer Kellogg and Sons.



Dr. Quentin F. Soper, research advisor at the Greenfield Laboratories of Eli Lilly and Company, receives his Outstanding Achievement Award and congratulations from Regent Lebedoff. Soper joined Lilly at its Indianapolis headquarters in 1944 and transferred to its Greenfield Laboratories in 1975 where he has subsequently directed agricultural organic research since 1967.



SUN DAY—*from page 2*

Narendra Mohan, Electrical Engineering. Is it possible to use wind energy to provide electric heating by means of low cost devices (specifically, capacitor-excited squirrel-cage induction machines)?

Mahmoud Riaz, and Vernon Albertson, Electrical Engineering. Perry Blackshear, Thomas Bligh, and Rashad Abdel-Wahed, Mechanical Engineering. Michael Hardy, Mineral Resource Research Center. Hans-Olaf Pfannkuch, Geology and Geophysics. Is it possible to construct a large-scale system for storing thermal energy at high temperatures in natural rock formations, and later retrieving it to supply thermal and/or electrical needs?

E. M. Sparrow, Mechanical Engineering. How does the shifting direction of the wind affect storage of heat collected by solar panels? How can we allow for the wind when designing solar collectors? How can heat be stored by the process of melting solids?

Raymond Sterling, Civil & Mineral Engineering. Can earth-sheltered homes—those constructed partially underground—be made realistically energy-independent in Minnesota? What are the best designs and sites for earth sheltered homes?

Raymond Warner, Jr., Electrical Engineering. Can solar batteries be developed that will boost the efficiency of solar concentrator systems by increasing the ratio of output voltage to current?

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SURVIVAL—*from page 1*

William Weitzel, Associate Professor, Industrial Relations, will present, "A Key to Your Survival", at the final session of the series on Wednesday, May 24.

All three luncheon-seminars will be held at the Sheraton Airport Inn, Highway 494 and 24th Ave., South, Bloomington. They will start at 12:00 noon and will cost \$5.00 per program and luncheon.

## The Way Things Are Going To Be

Daily, with the exception of Thursdays, 45 Architecture is the location of a sixth hour class that a chemical engineer who graduated a few years ago, and now works for a Wisconsin-based company, says furnished him with a valuable look ahead to exactly how things happen in the professional world after graduation.

Called "Energy Conversion Systems," the course had its inception in 1973, the year the OPEC nations gave the rest of the world an opportunity to assess its dependency upon the oceans of petroleum that rests within the sovereignty of their mideastern borders.

According to Dr. Lorne M. Chanin, the originator of the course, it has for its aim, "...giving the students an opportunity to examine all aspects of present energy conversion methods and reporting back to the class what their investigations revealed to them."

Actually, the course has additional goals. Dr. Chanin says, "Now they solve problems that have rather exact answers. This is the nature of the present learning process. This course aims to give them the chance to confront problems that do not have unique answers." The observations of the graduate working in Wisconsin confirms Chanin's contention that in their future professional careers graduates will be continually confronted with problems of this nature and that they will have to be able to give their opinions and views upon them—even those bordering on the classical definition of the word conundrum—when working in industrial capacities.

The course opens with class discussions of ways of planning for and dealing with energy problems that have become extremely important as far as the future of our society is concerned. The next step is for the students to select a topic for their personal investigations from a list provided by Dr. Chanin. He is also amenable to student suggestions for topics they have discussed with him prior to a final selection.

Next comes a step Chanin feels is of much importance, that of giving the student, "The experience of going to the literature and finding out what is known, 'What can I report on?'" At this point many of the students have

not previously realized the dimensions of their problem. Chanin puts it that they do not realize the complexity of advanced engineering.

Once the topic is selected and the student has begun to look in earnest at the mountain of material available to him, the question that naturally follows is, "How do I shrink it down?"

Shrink it he must. The time allotted for his verbal presentation to the class is 18 minutes. He then has the opportunity to field the questions his classmates have developed for four or five minutes.

When asked beforehand what kind of a report is being looked for Chanin tells them to aim for one that can be presented with pride to graduate groups.

Dr. Chanin, a member of the Electrical Engineering faculty who received his degrees in physics, sums up his hopes for the course with a statement that could well serve as an aim for the entire educational process, "We're trying to educate them so that they can provide better answers than my generation of scientists have."

For the students, a part of the grade is based upon their oral presentations. Another part is earned by a written document and, a small part by the questions they ask.

A visit to EE5332 can leave one with the opinion that Chanin's hopes for the next generation of scientists and engineers may well be entirely justified.

## Richard C. Jordan Receives Honor

Acting Associate Dean of the Institute of Technology Richard C. Jordan was recently notified of his election by the Council of the American Association for the Advancement of Science, as a Fellow of the Association. The letter informing Jordan of the honor defined a Fellow as one "who has produced a body of work on behalf of the advancement of science that is scientifically distinguished or socially highly significant or both."

Dr. Jordan's name was presented to the Council with the following citation, "Richard C. Jordan, for his fundamental contributions to heating, refrigeration, and air-conditioning engineering and to the education of engineers in this area."

## A MESSAGE FROM THE I.T. ALUMNI SOCIETY PRESIDENT

It's useful, at the start of a new term in office, to look over where we've been as an organization, what we've accomplished, and where we've fallen short. The next step is to assess our needs as an organization together with the needs of those we hope to serve, namely, the Institute of Technology, the alumni, and the students. At the end of the line, this will permit us to establish a really meaningful set of goals and organize ourselves to reach them.

Looking back, a great deal of work has been done. The I. T. Alumni Society is certainly an active, responsive organization. There are some big shoes to fill, even to continue momentum at the present level. To date, working with this year's executive board and current board members, it is obvious that we have a vast resource of talent from which to draw. The year ahead looks exciting.

Our first board meeting was held with both its members and the heads of the schools and departments within I. T. This was a stimulating meeting. A number of ideas emerged to facilitate increased cooperative effort between the alumni and the departments in a number of areas.

These contacts need to continue on a regular basis and need to be reinforced by positive action taken on the suggestions and ideas raised at this meeting.

At an executive board meeting held late in November a number of goals for the next two years were set. They include:

1. Science and Technology Day.
2. A program for alumni covering a variety of current subjects on a regular basis.
3. A program for I. T. students that will offer an opportunity for them to come into contact with the industrial community.
4. Conduct a review and determine if a teacher recognition program is underway within the Institute of Technology and whether it would be appropriate for the I. T. Alumni Society to sponsor such an activity.

I would like to hear from you, both as the year progresses and as ideas occur to you as to how and where you would like to see your alumni

organization function. I encourage you to take part in your organization. Your input, and especially your help, will be sincerely appreciated. You may contact me through the Alumni Office at 2610 University Ave., St. Paul, MN 55114.

Dave Hagford,  
President,

*I. T. Alumni Society.*

## ITems of Alumni Happenings

One of the continuing features in ITEMS is the news of happenings among the alumni. Please send your contributions to this department to Richard Baker, Secy.-Treas., I. T. Alumni Society, 2610 University Avenue., St. Paul, MN, 55114.

Thomas Moodie, BSEE '49, MSEE '65, has joined Toltz, King, Duvall, Anderson and Associates, Inc., St. Paul as the head of the electrical engineering department. He is the former head of the corporate engineering department and has served as a consultant for the Pillsbury Company in Minneapolis. He also has been in the power distribution division of Northern States Power Co.

During his twenty-five years with Pillsbury, he has had responsibilities for designing electrical control systems and the management of construction in this country and abroad. He will continue these duties while giving technical direction and managing the electrical projects at TKDA.

Tom and his wife, Doris, have one child. The family lives in Golden Valley.

The member of the alumni board representing chemistry is Albert C. Holler, a native of Erie, Pa., who started his undergraduate work at the University of Pittsburg. After World War II, he came to Minnesota to study analytical chemistry under I. M. Kolthoff and received his B. Chem. degree. He was awarded the Thomas F. Andrews prize for his undergraduate research in analytical. After graduation he was a research fellow in chemistry with Dr. Bryce M. Crawford's group at the Oak Street Laboratory.

Since 1948 he has been with the Twin Cities Testing and Engineering Laboratory in St. Paul. He is now vice-president in charge of the chemistry division. His specialties are corrosion,

marine chemistry activities, marine cargo surveys and inorganic analytical chemistry. He is a certified corrosion specialist and marine chemist and has published numerous articles in journals.

For his services in the Boy Scout program he has been honored with both the Silver Beaver and Silver Antelope awards. The Camp Fire Girls have also presented him with the Luther Halsey Gulick award. He is a member of many technical societies and is the past national chairman of the Marine Chemists Association.

Russell C. Heinselman was appointed to the I. T. Board in November, 1977 as representative of the School of Mathematics. Russ was granted the B. Math. degree from the University in 1968. After military service he returned to the campus as a NEDA IV Fellow in Computer Science and received his M. S. in 1972. He joined Sperry Univac in 1973 to participate in simulation and systems analysis projects related to the development of large-scale computer systems. Russ is now senior design engineer concentrating on simulation studies of distributed computer systems.

The representative for Agricultural Engineering on the Alumni Board is Phillip W. Manson, the recipient of his B. S. in Civil Engineering and M. S. in Agricultural Engineering from the University. From 1926 to 1970, he was a member of the teaching and research staff of the U. of M.'s. Department of Agricultural Engineering. Concerned with the field of soil and water conservation, his major publications range from consumer articles to highly technical research reports. Manson has been chairman and active on many A.S.T.M. committees and is a registered professional civil and agricultural engineer.

The new second vice-president of the alumni board is George Champine, holder of B. S. and M. S. degrees from the University of Minnesota, and a Ph.D. in management information systems, also from Minnesota. He is director, advanced systems, for commercial computer systems at Sperry Univac and an Adjunct Professor in the Institute of Technology.

Dr. Champine has been in the Defense Systems Division of Sperry Univac and was responsible for the design and development of software



Morris E. Nicholson, Director, Continuing Education in Engineering and Science

systems for computer control of high performance radar systems. Prior to his present position, he was supervisor of defense missile systems. Dr. Champagne served on special assignment at the Bell Telephone Laboratories in 1953 as a systems analyst for radar. He has authored a number of technical papers and has made a large number of presentations on computer technology and economics.

The student representative on the board is John Mehaffy, an electrical engineering senior studying digital computer design. He is involved in the I. T. tutorial program and is employed by the Consulting Group on Instructional Design. John is a member of the academic standards and student affairs committee of the Institute of Technology and an I. T. honor student.

Charles J. Purcell who received his B.E.E. from the University in 1949, is the Computer Science representative on the alumni board. He went to work for IBM as a customer engineer for electronic and electric accounting machines after his graduation and, in 1952, joined the General Mills research division where he was primarily an electrical engineer working on the design of various analog computing devices, both electronic and electro-mechanical. He joined Control Data as a senior engineer in 1962 and worked on various digital computer systems for military applications. Since 1964, Charles has served as a principal consultant in the design and application of a very large, general purpose digital computer for Control Data in Arden Hills.

Mr. Purcell is married and is the father of six children. The two oldest are I. T. graduates (ChEn and MinE), and two are now enrolled in I. T. (EE and ChEn).

## SEARCH COMMITTEE SEEKS NEW I.T. DEAN

A search committee has been named by President C. Peter Magrath to find a successor to Dean Richard A. Swalin. The twelve member committee is headed by A. O. C. Nier. Other committee members are; Rutherford Aris, John R. Borchert, Margaret B. Davis, John N. Dempsey (Chairman of the I. T. Advisory Council), Richard J. Goldstein, Donna C. Green

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## Continuing Education Course Needs Polled

During the past fall quarter the Department of Continuing Education in Engineering and Science invited forty-two firms with home offices in the State of Minnesota to participate in a study of the educational needs of the engineers and scientists employed by them. The purpose of the study is to determine the needs of professional employees in firms of an "intermediate" size, particularly ones that do not have an extensive "in-house" program.

The first study asked middle management personnel to indicate the areas in which their scientists and engineers would need additional study to improve their professional performance. Their response showed a major need for further study in managerial, communication and economic skills. In the technical area the major needs appear to be a better understanding of materials science, energy conservation and the environmental impact of technology.

Surprisingly low on the list for a region having such a large electronics based industry was the need indicated for courses in electronics and solid state physics.

Plans to supplement programs to meet the needs of the technical personnel, based upon the study, will be developed in collaboration with the cooperating companies.

Listed below are the six categorical questions used to elicit information in the survey: 1) What courses do you recommend to assist newly-hired engineers in becoming effective more quickly in the work of your organization? 2) What courses do you recommend to assist engineers in making effective use of new technology important to your organization? 3) What courses do you recommend to assist engineers in relating to disciplines other than their own? 4) What courses do you recommend to assist you and other technical managers and leaders in the technical aspects of your work. 5) What courses do you recommend to improve the effectiveness of your technical support personnel?

A complete summary of the survey may be obtained by writing or calling Dr. Morris Nicholson, Director of Continuing Education in Engineering and Science, Room 320, Aeronautical Engineering Bldg., 110 Union Street, SE, University of Minnesota, Minneapolis, MN 55455.

### MOLE—from page 1

This aroused an interest, on the part of the I.Tem's editor, to read Dr. Fairhurst's article, first printed in *Underground Space*. Vol 1, pp. 71-86. © Pergamon Press, 1976.

Beginning with a quotation from J. R. R. Tolkien's, *The Hobbit*, that might well, when translated into the requirements for human habitation, furnish specifications for a far more than satisfactory home for *Homo sapiens*, the author sums up the reaction many give to a hasty consideration of the idea of living underground, "But, I don't want to be a mole!"

Establishing a rationale for below surface building, he points out that the idea is hardly new. As evidence he refers to Leonardo da Vinci's sixteenth century outline of a multi-level city design. Fairhurst also provides evidence that, "Development of underground space is far from synonymous with living underground . . . Where it is desirable, underground

space can be designed to include windows, natural lighting and, even, as visitors to the hobbit's home will discover, views of attractive landscape!"

From the family dwelling the author proceeds on to examine the utilization of underground space by large buildings and the emergence of major "undercover" complexes such as Place Villa-Marie and Place Bonaventure in Montreal as well as the underground development of the site of the famed Les Halles market place in Paris into an arterial network including the metro rail subway, highways, parking facilities, office, commercial and recreational complexes.

An even more ambitious project, now in the planning stage, referred to by Fairhurst is one announced in *Tass*, the official USSR news agency, that envisions the saving of 18,000 of Moscow's surface acres by the construction of tunnels for one-way streets through the center of the city, along with an extension of the subway



from its present 90 mile length (serving 5,000,000 riders daily) to 198 miles. The heart of this transportation network would consist of restaurants, movie theaters, stores, exhibition halls, swimming pools, markets, warehouses, repair shops and other public services, all underground. Tentative plans call for the project's completion within the next 15 to 20 years.

In addition to exploring other means of utilizing underground space, "Going Under to Stay on Top" contains data that analyzes comparative construction costs as well as energy costs for heating and cooling underground structures contrasted with those for conventional surface buildings.

The title for Dr. Fairhurst's article was also used to identify a conference held in the Twin Cities last October 14-15, sponsored by the American Underground-Space Association, staged by the Science Museum of Minnesota. Other IT faculty involved in the event, in addition to Fairhurst who gave the keynote address, include Tom Atchison, visiting professor in CME, Tom Bligh, assistant professor in ME and CME, who outlined the overall implications of underground building, while Ray Sterling, assistant professor in CME, and David Bennett, associate professor of Architecture, described specific examples of residential and commercial design. Charles Nelson, assistant professor in CME, covered a variety of local examples of underground space use. Jerry Allen, lecturer in Architecture, and president of Criteria, Inc. served as moderator and made a presentation of his firm's underground office park now under construction in downtown St. Paul.

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(undergraduate student), David E. Hagford (President, I. T. Alumni Society), K. S. P. Kumar, Carol L. Lemche (graduate student), V. Rama Murthy, and James B. Serrin.

His letter also notes that it is anticipated that many suggestions for prospects will come from, "friends of the Institute of Technology". This sector most certainly includes many I.T. alumni and it is hoped that it can be looked to as a source of suggestions.

The address is: Professor A. O. C. Nier, Chairman, Search Committee, School of Physics and Astronomy, University of Minnesota, 116 Church St., S. E., Minneapolis, MN 55455.

## FROM DEAN JOHNSON'S DESK

One of the major concerns that has occupied the thoughts of the faculty in recent months is the preparation of the next budget for consideration by the next Minnesota State Legislature which will convene in January, 1979. Although the convening is a year away, the beginnings of the preparations of the 1979-80 budget proposal have already begun. When one starts to think about the justification of a budget proposal for a University program, one is compelled to consider what the "bottom line" is for a college such as I.T. Unfortunately the product produced by I. T. is often less easy to measure than the product of a corporation. Even though one cannot determine the profit margin in dollars, there are a number of obvious benefits to the state that result from I.T. programs. I would like to enumerate a few of the significant benefits in the following paragraphs.

Primary, of course, in the list of benefits is the education of young men and women to become professional scientists, engineers or architects. The benefit to the state from these young persons is direct. In recent years, more than two-thirds of our B. S. graduates have held their first full-time positions in Minnesota. In some fields such as computer science the number of graduates staying in Minnesota approaches 100%. The importance of these graduates to the state economy is certainly significant.

This year the I. T. Advisory Council with a membership of twenty-eight executives from business and government have been looking into the benefits of the Institute of Technology to Minnesota. In particular, they have been considering the secondary effect of job creation when a technical professional is employed. Their data show that the addition of one engineer in a high technology industry will create about 15 additional jobs within the company. The benefit to Minnesota of I. T. graduates is thus clear and concrete in terms of job creation.

Another area considered by the Advisory Council involves the direct interaction between technology intensive industries and University programs. University programs in technology appear to be a very important ingredient in the development of a neighboring high technology industry. The provision for continuing technology education for company employees as well as close consultation with engineering and science faculty has been shown to be crucial to that development. An employee's ability to continue his or her education while employed in high technology business appears to be necessary for both the individual and the company. The UNITE television network which was begun in 1971 as a joint project between a number of Minnesota industries and I. T., transmits live classes from the Institute of Technology to Twin Cities companies as well as to the IBM installation in Rochester. By use of this system, company employees may attend classes without ever leaving their place of business. I am sure that this is recognized as a significant advantage to any of you who have recently tried to drive to the Minneapolis campus.

More and more, the technical expertise of the I. T. faculty is being employed for the solution of specific problems in government and industry. I view consulting of this sort to be important to the vitality of the educational programs of I. T. as well as providing aid to the development of high technology in Minnesota. The interactions with state government have expanded significantly in the past few years. These interactions provide expertise to state agencies and local governmental bodies which would probably be impossible to provide in any other way.

In summary, although the "bottom line" is not measured in dollars, there are a number of benefits to the state that are being demonstrated. By working together, I. T., government and business can have a significant effect on the Minnesota economy.



## Coming Continuing Education Programs . . .

### WRITING EFFECTIVE REPORTS

A One-Day Seminar  
Friday, April 28.  
THUNDERBIRD MOTEL, 2201 E. 78th  
St., Bloomington. Fee: \$95.00.

Shows the "how to" of focusing on audience awareness as a basic approach to writing; compares approaches used by professional writers; identifies standard plans and formats as an aid to writing high-quality, high-impact reports that will have a positive outcome. Thomas Pearsall will lead the seminar. (Mail to 334 Business Administration, University of Minnesota, Minneapolis, MN 55455.) Contact: Dick Grefe. Dial 373-3680.

### TELEPHONE INTERFERENCE

A Four-Day Conference  
Monday, May 8, through  
Thursday, May 11.  
SHERATON INN-NORTHWEST, I-494 &  
U. S. 52, Brooklyn Park. Fee: \$360.

A course designed for engineers working for power and telephone companies. It will deal with the principles, problems and solutions of telephone interference. The instructor will be Barna Szabados, U. of New Brunswick. (Mail inquiries to 222 Nolte Center, University of Minnesota, Minneapolis, MN 55455.) Contact: Leslie Denny. Dial 373-5444.

### MINICOMPUTER SYSTEMS FOR WAREHOUSING/DISTRIBUTION SYSTEMS

A Three-Day Conference.  
Monday, May 8, through  
Wednesday, May 10.  
SHERATON INN-NORTHWEST, I-494  
and U. S. 52, Brooklyn Park. Fee;  
\$395.

The program demonstrates why minicomputers have been called the "new way of life in Distribution/Warehousing." It will tell managers what a minicomputer system can and cannot do, how to analyze cost versus benefit, and how to select the best systems for his purposes. No background in computer programming or hardware is needed. (Mail inquiries to 222 Nolte Center, University of Minnesota, Minneapolis 55455.) Contact: Leslie Denny. Dial 373-5444.

### ENERGY CONSERVATION IN EARTH SHELTERED STRUCTURES

Case Study Results for U of M's  
Williamson Hall  
A Two-Day Conference  
Tuesday, May 16 Through  
Wednesday, May 17.  
Mayo Memorial Auditorium, East Bank  
Campus.  
Fee: \$36.00 per person. Registration  
starts at 7:45 a. m. First session 8:15  
a.m. Parking reservations available.

Topics include: Underground Construction as Viewed by the Department of Energy. Underground Construction as Viewed by the Minnesota Energy Agency. Overview of Earth-Sheltered Structures. Heat Transfer in Earth-Sheltered Structures. Structural Aspects of Earth-Sheltered Structures. An Overview of the Research Project Associated with Williamson Hall. Thermographic Studies of Williamson Hall. Panel Discussion and Question Session. Thermal Studies of Soils. Instrumentation and Data Acquisition. A Novel Design. Guided Tours of Williamson Hall. Of interest primarily to engineers, architects, builders and contractors. For brochure, registration form and information: David Chittenden, 219 Nolte Center, 315 Pillsbury Drive S.E., University of Minnesota, Minneapolis, MN 55455. Dial (612) 376-2578.

### INTRODUCTION TO COMPUTERS

A One-Day Seminar  
Wednesday, May 24.  
8:30 a.m. to 4:30 p.m.  
HOLIDAY INN—2540 N. Cleveland  
Ave., Roseville. Fee; \$95.00.

This seminar provides an understanding of the basics of computers and the skills required of those people who work with them. The seminar leader will be Kim Helseth. (Mail inquiries to 334 Business Administration, University of Minnesota, Minneapolis, MN 55455.) Contact: Dick Grefe, Dial 373-3680.



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